Каталог Beckhoff

Автоматизация

EtherCAT, Lightbus | **Fieldbus Box modules**

	EtherCAT Coupler Box	Lightbus Compact Box	Lightbus Coupler Box
Technical data	**IL230x-B110**	**IPxxxx-B200**	**IL230x-B200**
Extension modules	max. 78 with max. 512 byte input and 512 byte output data	–	max. 120 with max. 512 byte input and 512 byte output data
Data transfer rates	100 Mbaud	2.5 Mbaud	2.5 Mbaud
Configuration possibility	via KS2000	via KS2000 or the controller	via KS2000 or the controller
	 A station consists of an IL230x-B110 Coupler Box and any number of up to 78 Extension Box modules that are connected via IP-Link.	 Compact Box modules for Lightbus are available for all relevant industrial signals.	 The Lightbus Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.
Bus interface	2 x M12 socket, 4-pin (d-coded)	2 x fibre optic socket for plug ZS1020-0010	2 x fibre optic socket for plug ZS1020-0010
Digital peripheral signals	4 x digital input + 4 x digital output on-board + extension modules	according to I/O type, see page 728	4 x digital input + 4 x digital output on-board + extension modules
Analog peripheral signals	max. 127 inputs and 127 outputs	according to I/O type, see page 738	max. 124 inputs and 124 outputs
Approvals	CE, UL	CE, UL	CE, UL
Further information	www.beckhoff.com/IL230x-B110	www.beckhoff.com/IPxxxx-B200	www.beckhoff.com/IL230x-B200
Accessories			
Cordsets and connectors	see page 756	see page 756	see page 756
TwinCAT 2 PLC	–	–	–

PROFIBUS, Interbus | **Fieldbus Box modules**

	PROFIBUS Compact Box	PROFIBUS Compact Box with integrated tee-connector	PROFIBUS Coupler Box	PROFIBUS Coupler Box with integrated tee-connector
Technical data	**IPxxxx-B310**	**IPxxxx-B318**	**IL230x-B310**	**IL230x-B318**
Extension modules	–	–	max. 120 with max. 128 byte input and 128 byte output data	
Data transfer rates	automatic detection up to 12 Mbaud		automatic detection up to 12 Mbaud	
Configuration possibility	via KS2000 or the controller, DP-V1 extensions are supported		via KS2000 or the controller, DP-V1 extensions are supported	
	 Compact Box modules for PROFIBUS are available for all relevant industrial signals.	 In the Compact Box with integrated tee-connector, the PROFIBUS is relayed forward in the module.	 The PROFIBUS Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.	 In the Coupler Box with integrated tee-connector, the PROFIBUS is relayed forward in the module.
Bus connection	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, 1 x M12 plug, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, 1 x M12 plug, 5-pin, B-coded
Digital peripheral signals	according to I/O type, see page 728	according to I/O type, see page 728	4 x digital input + 4 x digital output on-board + extension modules	
Analog peripheral signals	according to I/O type, see page 738	according to I/O type, see page 738	max. 60 inputs and 60 outputs	max. 60 inputs and 60 outputs
Approvals	CE, UL	CE, UL	CE, UL	CE, UL
Further information	www.beckhoff.com/IPxxxx-B310	www.beckhoff.com/IPxxxx-B318	www.beckhoff.com/IL230x-B310	www.beckhoff.com/IL230x-B318
Accessories				
Cordsets and connectors	see page 756	see page 756	see page 756	see page 756
TwinCAT 2 PLC	–	–	–	–

	PROFIBUS PLC Box	PROFIBUS PLC Box with integrated tee-connector	Interbus Compact Box	Interbus Coupler Box
	IL230x-C310	**IL230x-C318**	**IPxxxx-B400**	**IL230x-B400**
	max. 120 with max. 128 byte input and 128 byte output data		–	max. 120 with max. 64 byte input and 64 byte output data
	automatic detection up to 12 Mbaud		500 kbaud	500 kbaud
	via KS2000 or the controller, DP-V1 extensions are supported		via KS2000	via KS2000
				
	The PLC Box is an intelligent PROFIBUS node that can perform decentralised processing of I/O data and execute control tasks independently of the function of the PROFIBUS network.	In the PLC Box with integrated tee-connector, the PROFIBUS is relayed forward in the module.	Compact Box modules for Interbus are available for all relevant industrial signals.	The Interbus Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.
	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, 1 x M12 plug, 5-pin, B-coded	1 x M23 socket, 9-pin, 1 x M23 plug, 9-pin	1 x M23 socket, 9-pin, 1 x M23 plug, 9-pin
	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules	according to I/O type, see page 728	4 x digital input + 4 x digital output on-board + extension modules
	max. 60 inputs and 60 outputs	max. 60 inputs and 60 outputs	according to I/O type, see page 738	max. 28 inputs and 28 outputs
	CE, UL	CE, UL	CE, UL	CE, UL
	www.beckhoff.com/ IL230x-C310	www.beckhoff.com/ IL230x-C318	www.beckhoff.com/ IPxxxx-B400	www.beckhoff.com/ IL230x-B400
	see page 756	see page 756	see page 756	see page 756
	see page 944	see page 944	–	–

CANopen, DeviceNet | **Fieldbus Box modules**

CANopen

	CANopen Compact Box	CANopen Compact Box with integrated tee-connector	CANopen Coupler Box	CANopen Coupler Box with integrated tee-connector
Technical data	**IPxxxx-B510**	**IPxxxx-B518**	**IL230x-B510**	**IL230x-B518**
Extension modules	–	–	max. 120 with max. 128 byte input and 128 byte output data	
Data transfer rates	automatic detection of 10 kbaud up to 1 Mbaud		automatic detection of 10 kbaud up to 1 Mbaud	
Configuration possibility	through KS2000 or the controller (service data objects)	through KS2000 or the controller (service data objects)	through KS2000 or the controller (service data objects)	through KS2000 or the controller (service data objects)
				
	Compact Box modules for CANopen are available for all relevant industrial signals.	In the Compact Box with integrated tee-connector, CANopen is relayed forward in the module.	The CANopen Coupler Box has four digital inputs and four digital outputs. Other kinds of signals are available in the Extension Box modules.	In the Coupler Box with integrated tee-connector, CANopen is relayed forward in the module.
Bus interface	1 x M12 plug, 5-pin	1 x M12 plug, 5-pin, 1 x M12 socket, 5-pin	1 x M12 plug, 5-pin	1 x M12 plug, 5-pin, 1 x M12 socket, 5-pin
Digital peripheral signals	according to I/O type, see page 728	according to I/O type, see page 728	4 x digital input + 4 x digital output on-board + extension modules	
Analog peripheral signals	according to I/O type, see page 738	according to I/O type, see page 738	max. 60 inputs and 60 outputs	max. 60 inputs and 60 outputs
Approvals	CE, UL	CE, UL	CE, UL	CE, UL
Further information	www.beckhoff.com/IPxxxx-B510	www.beckhoff.com/IPxxxx-B518	www.beckhoff.com/IL230x-B510	www.beckhoff.com/IL230x-B518
Accessories				
Cordsets and connectors	see page 756	see page 756	see page 756	see page 756
TwinCAT 2 PLC	–	–	–	–

DeviceNet

	DeviceNet Compact Box	DeviceNet Compact Box with integrated tee-connector	DeviceNet Coupler Box	DeviceNet Coupler Box with integrated tee-connector
	IPxxxx-B520	**IPxxxx-B528**	**IL230x-B520**	**IL230x-B528**
	–	–	max. 120 with max. 512 byte input and 512 byte output data	
	automatic detection up to 500 kbaud		automatic detection up to 500 kbaud	
	through KS2000 or the controller (explicit messaging)	through KS2000 or the controller (explicit messaging)	through KS2000 or the controller (explicit messaging)	through KS2000 or the controller (explicit messaging)
				
	Compact Box modules for DeviceNet are available for all relevant industrial signals.	In the Compact Box with integrated tee-connector, DeviceNet is relayed forward in the module.	The DeviceNet Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.	In the Coupler Box with integrated tee-connector, DeviceNet is relayed forward in the module.
	1 x M12 plug, 5-pin	1 x M12 plug, 5-pin, 1 x M12 socket, 5-pin	1 x M12 plug, 5-pin	1 x M12 plug, 5-pin, 1 x M12 socket, 5-pin
	according to I/O type, see page 728	according to I/O type, see page 728	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules
	according to I/O type, see page 738	according to I/O type, see page 738	max. 252 inputs and 252 outputs	max. 252 inputs and 252 outputs
	CE, UL	CE, UL	CE, UL	CE, UL
	www.beckhoff.com/IPxxxx-B520	www.beckhoff.com/IPxxxx-B528	www.beckhoff.com/IL230x-B520	www.beckhoff.com/IL230x-B528
	see page 756	see page 756	see page 756	see page 756
	–	–	–	–

Modbus, RS485/RS232 | **Fieldbus Box modules**

Modbus

RS232 / RS485

	Modbus Compact Box	Modbus Coupler Box	RS485 Compact Box
Technical data	**IPxxxx-B730**	**IL230x-B730**	**IPxxxx-B800**
Extension modules	–	max. 120 with max. 512 byte input and 512 byte output data	–
Data transfer rates	150 to 38,400 baud RTU/ASCII	150 to 38,400 baud RTU/ASCII	9.6 kbaud, 19.2 kbaud, 38.4 kbaud (default)
Configuration possibility	by means of address selection switch or KS2000	by means of address selection switch or KS2000	via KS2000
			
	Compact Box modules for Modbus are available for all relevant industrial signals.	The Modbus Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.	Compact Box modules for RS485 are available for all relevant industrial signals.
Bus interface	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded
Digital peripheral signals	according to I/O type, see page 728	4 x digital input + 4 x digital output on-board + extension modules	according to I/O type, see page 728
Analog peripheral signals	according to I/O type, see page 738	max. 255 inputs and 255 outputs	according to I/O type, see page 738
Approvals	CE, UL	CE, UL	CE, UL
Further information	www.beckhoff.com/IPxxxx-B730	www.beckhoff.com/IL230x-B730	www.beckhoff.com/IPxxxx-B800
Accessories			
Cordsets and connectors	see page 756	see page 756	see page 756
TwinCAT 2 PLC	–	–	–

	RS485 Coupler Box	RS232 Compact Box	RS232 Coupler Box	RS232 PLC Box
	IL230x-B800	**IPxxxx-B810**	**IL230x-B810**	**IL230x-C810**
	max. 120 with max. 512 byte input and 512 byte output data	–	max. 120 with max. 512 byte input and 512 byte output data	
	9.6 kbaud, 19.2 kbaud, 38.4 kbaud (default)		9.6 kbaud, 19.2 kbaud, 38.4 kbaud (default)	
	via KS2000	via KS2000	via KS2000	via KS2000
				
	The serial Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable. It detects the connected modules and automatically allocates the input and output data to the process image.	Compact Box modules for RS232 are available for all relevant industrial signals.	The serial Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable. It detects the connected modules and automatically allocates the input and output data to the process image.	The PLC Box is an intelligent RS232 coupler that can perform non-central decentralised processing of I/O data and execute control tasks. Like the Coupler Box, it has four digital inputs and four digital outputs.
	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded
	4 x digital input + 4 x digital output on-board + extension modules	according to I/O type, see page 728	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules
	max. 252 inputs and 252 outputs	according to I/O type, see page 738	max. 252 inputs and 252 outputs	max. 252 inputs and 252 outputs
	CE, UL	CE, UL	CE, UL	CE, UL
	www.beckhoff.com/IL230x-B800	www.beckhoff.com/IPxxxx-B810	www.beckhoff.com/IL230x-B810	www.beckhoff.com/IL230x-C810
	see page 756	see page 756	see page 756	see page 756
	–	–	–	see page 944

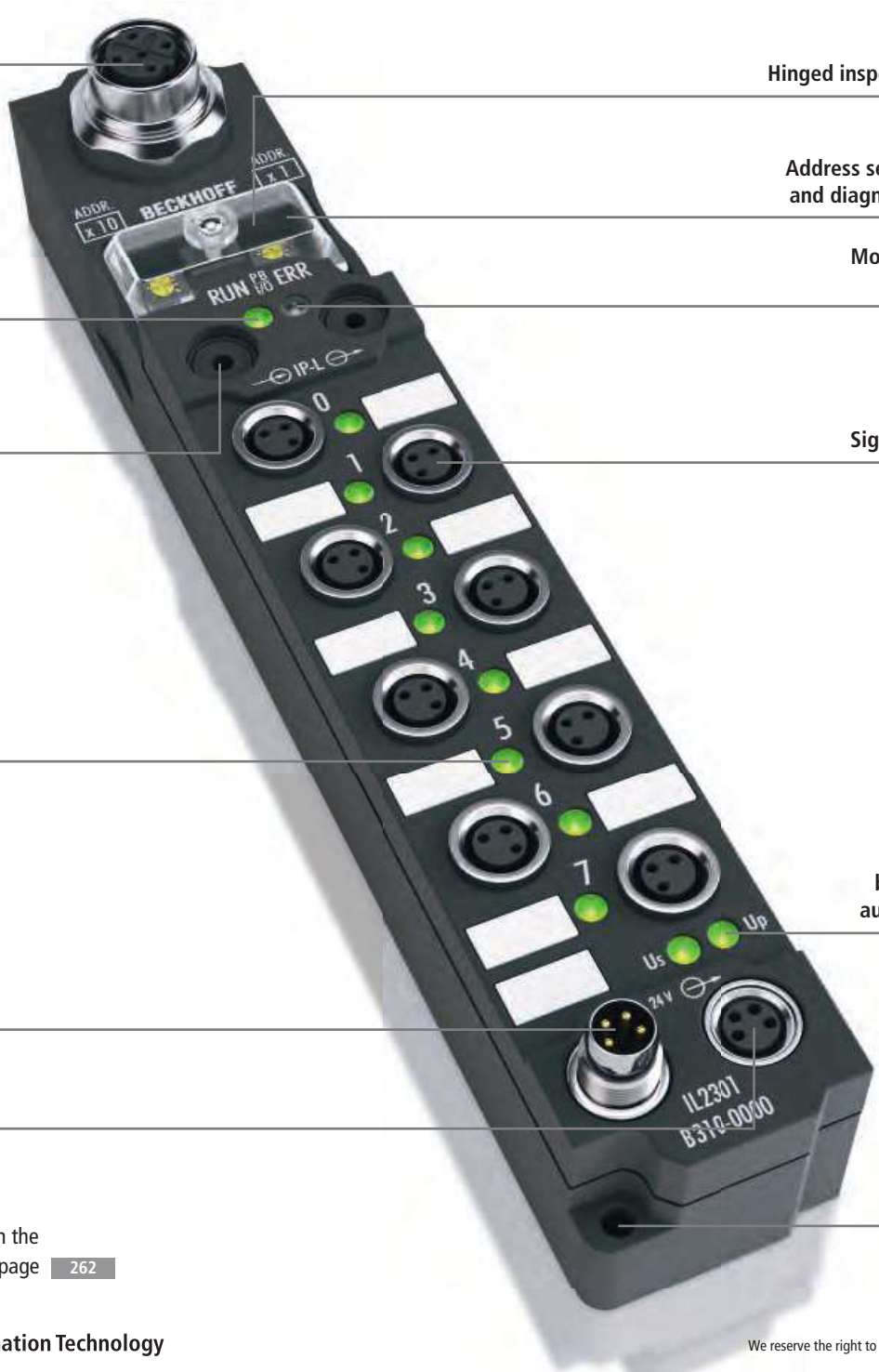
Ethernet, PROFINET, EtherNet/IP | **Fieldbus Box modules**

Ethernet

	Ethernet Coupler Box with RJ45 connection	Ethernet Coupler Box with M12 connection	Ethernet PLC Box with RJ45 connection
Technical data	**IL230x-B900**	**IL230x-B901**	**IL230x-C900**
Extension modules	max. 120 with max. 512 byte input and 512 byte output data		max. 120 with max. 512 byte input and 512 byte output data
Data transfer rates	10/100 Mbaud, automatic recognition of the transmission rate		10/100 Mbaud, automatic recognition of the transmission rate
Configuration possibility	via KS2000	via KS2000	via KS2000
			
	The Ethernet Coupler Box with RJ45 connection gathers the I/O data from the Extension Box modules over the interference-free IP-Link optical fibre cable. It detects the connected modules and automatically allocates the input and output data to the process image.	The Ethernet Coupler Box with M12 connection gathers the I/O data from the Extension Box modules over the interference-free IP-Link optical fibre cable. It detects the connected modules and automatically allocates the input and output data to the process image.	The PLC Box is an intelligent Ethernet node that can perform decentralised processing of I/O data and execute control tasks independently of the function of the Ethernet network. The PLC Box, like the Coupler Box, has four digital inputs and four digital outputs.
Bus interface	1 x RJ45 socket	1 x M12 socket, 4-pin (d-coded)	1 x RJ45 socket
Digital peripheral signals	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules
Analog peripheral signals	max. 127 inputs and 127 outputs	max. 127 inputs and 127 outputs	max. 127 inputs and 127 outputs
Approvals	CE, UL	CE, UL	CE, UL
Further information	www.beckhoff.com/IL230x-B900	www.beckhoff.com/IL230x-B901	www.beckhoff.com/IL230x-C900
Accessories			
Cordsets and connectors	see page 756	see page 756	see page 756
TwinCAT 2 PLC	–	–	see page 944

	PROFINET Coupler Box	EtherNet/IP Coupler Box
	IL230x-B903	**IL230x-B905**
	max. 120 with max. 512 byte input and 512 byte output data	max. 120 with max. 512 byte input and 512 byte output data
	10/100 Mbaud, automatic recognition of the transmission rate	10/100 Mbaud, automatic recognition of the transmission rate
	via KS2000	via KS2000
		
	The PROFINET Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link optical fibre cable. It detects the connected modules and automatically allocates the input and output data to the process image. The Coupler Box has four digital inputs and four digital outputs.	The EtherNet/IP Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link optical fibre cable. It detects the connected modules and automatically allocates the input and output data to the process image. The Coupler Box has four digital inputs and four digital outputs.
	1 x M12 socket, 4-pin (d-coded)	1 x M12 socket, 4-pin (d-coded)
	4 x digital input + 4 x digital output	4 x digital input + 4 x digital output
	on-board + extension modules	on-board + extension modules
	max. 127 inputs and 127 outputs	max. 127 inputs and 127 outputs
	CE, UL	CE, UL
	www.beckhoff.com/IL230x-B903	www.beckhoff.com/IL230x-B905
	see page 514	see page 514
	–	–

Signal types | Coupler Box and PLC Box



Fieldbus interface (connection depends on the particular fieldbus)

Hinged inspection window

Address selection switch and diagnostic interface

Fieldbus status display

Module or IP-Link status display

IP-Link interface for the connection of extension modules

Signal connection

Signal status display

Status display power supply: box supply and auxiliary voltage

Power supply input
– box supply
– auxiliary voltage

Power supply downstream connection

Mounting holes

For further information on the individual fieldbuses see page 262

Standard housing

XXL housing

Signal connections

Connector 8 mm, snap type, 3-pin

Connector M8, screw type, 3-pin

Connector M12, screw type, 5-pin

Coupler Box
Up to 120 extension modules, spaced up to 15 metres apart, can be connected to one Coupler Box. The Coupler Box modules are capable of automatically recognising the extension modules connected to them during start-up, and map the I/O data automatically into the fieldbus process image – it is not necessary to configure them. The coupler appears, from the fieldbus point of view, along with all of the networked extension modules, as a single participating bus device with a corresponding number of I/O signals.

The Coupler Box corresponds to the Bus Coupler in the Beckhoff Bus Terminal system. Beckhoff fieldbus devices with protection class IP 20 (Bus Terminals) and IP 67 (Fieldbus Box) can be combined without difficulty – the data is handled in the same way in either case.

Low-priced plug connectors with protection class IP 67 can be used for the rapid and simple preparation of the IP-Link fibre optic cable. The connection does not require special tools and can be performed quickly and simply. The IP-Link cables can also be obtained with prepared plugs if required.

PLC Box
Almost unlimited I/O application possibilities result from the extendable Coupler Box with PLC functionality and IP-Link. Up to 120 extension modules, with 960 I/Os, can be directly addressed from the PLC program. The programmable PLC Box modules are therefore particularly suitable as autonomous small PLCs for the control of parts of a plant or of small machines.

Programming is carried out with TwinCAT in accordance with IEC 61131-3. Five different manufacturer independent programming languages are available: Instruction List (IL), Function Block Diagram (FBD), Ladder Diagram (LD), Sequential Function Chart (SFC) and the high-level language Structured Text (ST). The program download occurs either via the fieldbus or via the programming interface. Extensive debugging functions (breakpoint, single step, monitoring, etc.) are also available.

▶ www.beckhoff.com/Coupler-Box
▶ www.beckhoff.com/PLC-Box

Coupler Box

IL230y-Bzzz

- 110 = EtherCAT
- 200 = Lightbus
- 310/318 = PROFIBUS
- 400 = Interbus
- 510/518 = CANopen
- 520/528 = DeviceNet
- 730 = Modbus
- 800 = RS485
- 810 = RS232
- 900/901 = Ethernet TCP/IP
- 903 = PROFINET
- 905 = Ethernet/IP

- 0 = connector 8 mm, snap type, 3-pin
- 1 = connector M8, screw type, 3-pin
- 2 = connector M12, screw type, 5-pin

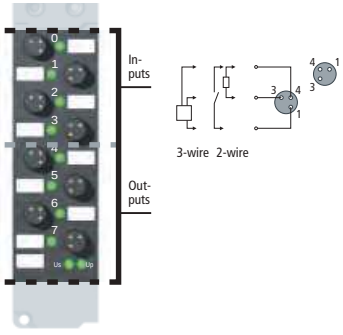
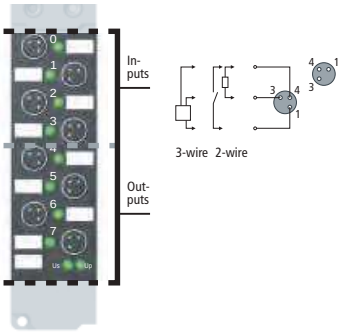
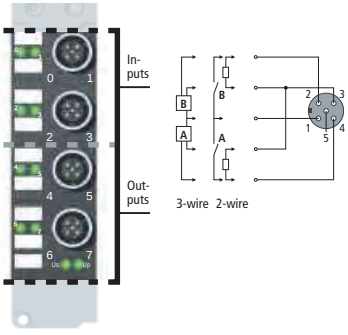
PLC Box

IL230y-Czzz

- 310/318 = PROFIBUS
- 810 = RS232
- 900 = Ethernet TCP/IP

- 0 = connector 8 mm, snap type, 3-pin
- 1 = connector M8, screw type, 3-pin
- 2 = connector M12, screw type, 5-pin

Coupler Box | **Digital combi, 24 V DC**

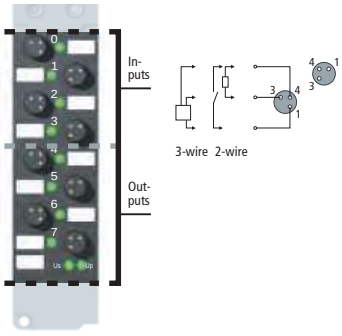
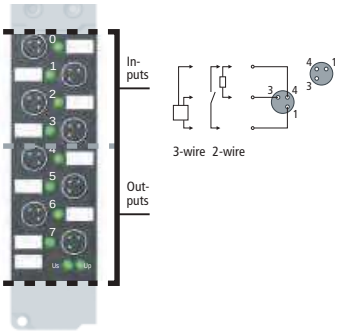
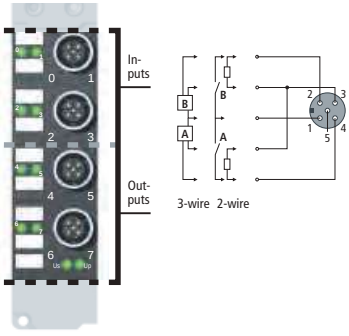
	4 x digital input + 4 x digital output, 24 V DC, 8 mm, I_{MAX} = 0.5 A	4 x digital input + 4 x digital output, 24 V DC, M8, I_{MAX} = 0.5 A	4 x digital input + 4 x digital output, 24 V DC, M12, I_{MAX} = 0.5 A
Technical data	**IL2300-Bxxx**	**IL2301-Bxxx**	**IL2302-Bxxx**
Connection technology	8 mm, snap type	M8, screw type	M12, screw type
Specification	EN 61131-2, type 2	EN 61131-2, type 2	EN 61131-2, type 2
Number of channels	4 inputs + 4 outputs	4 inputs + 4 outputs	4 inputs + 4 outputs
Input filter	3.0 ms	3.0 ms	3.0 ms
			
	The IL2300 Coupler Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. The signals are connected via 8 mm snap type connectors.	The IL2301 Coupler Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.	The IL2302 Coupler Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Sensor supply	derived from control voltage, max. 0.5 A total, short-circuit-proof	derived from control voltage, max. 0.5 A total, short-circuit-proof	derived from control voltage, max. 0.5 A total, short-circuit-proof
Max. output current	0.5 A on each channel, individually short-circuit-proof	0.5 A on each channel, individually short-circuit-proof	0.5 A on each channel, individually short-circuit-proof
Load type	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load
Short circuit current	typ. 1.5 A	typ. 1.5 A	typ. 1.5 A
Auxiliary power current	typ. 20 mA	typ. 20 mA	typ. 20 mA
Current consumption from U_S	see documentation	see documentation	see documentation
Special features	IP-Link coupler	IP-Link coupler	IP-Link coupler
Approvals	CE, UL	CE, UL	CE, UL
Further information	www.beckhoff.com/IL2300-Bxxx	www.beckhoff.com/IL2301-Bxxx	www.beckhoff.com/IL2302-Bxxx

Extension Box

Up to 120 Extension Box modules can be connected to the Coupler Box via the IP-Link communication facility. The Extension Box modules cover the full spectrum of I/O signals with various connection techniques. See page 726

IExxxx	Extension Box	Plug	Page
Digital input			
IE1000	Extension Box, 8 digital inputs 24 V DC, 3.0 ms filter	8 mm	728
IE1001	Extension Box, 8 digital inputs 24 V DC, 3.0 ms filter	M8	729
IE1002	Extension Box, 8 digital inputs 24 V DC, 3.0 ms filter	M12	729
IE1010	Extension Box, 8 digital inputs 24 V DC, 0.2 ms filter	8 mm	728
IE1011	Extension Box, 8 digital inputs 24 V DC, 0.2 ms filter	M8	729
IE1012	Extension Box, 8 digital inputs 24 V DC, 0.2 ms filter	M12	729
IE1502	Extension Box, up/down counter, 24 V DC, 100 kHz	M12	729
Digital output			
IE2000	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 0.5 A	8 mm	730
IE2001	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 0.5 A	M8	730
IE2002	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 0.5 A	M12	731
IE2020	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	8 mm	731
IE2021	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M8	731
IE2022	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M12	731
IE2040	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 12 A)	8 mm	732
IE2041	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 12 A)	M8	732
IE2042	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 12 A)	M12	732
IE2808	Extension Box, 16 digital outputs 24 V DC, I_{MAX} = 0.5 A ($\sum$ 4 A)	D-sub	733
IE2512	Extension Box, 2 digital pulse width outputs 24 V DC, I_{MAX} = 2.5 A	M12	733
Digital combi			
IE2300	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	8 mm	734
IE2301	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	M8	735
IE2302	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	M12	735
IE2310	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	8 mm	734
IE2311	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	M8	735
IE2312	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	M12	735
IE2320	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	8 mm	736
IE2321	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M8	736
IE2322	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M12	737
IE2330	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	8 mm	736
IE2331	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M8	736
IE2332	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M12	737
IE2400	Extension Box, 16 digital combination inputs/outputs 24 V DC, 3 ms filter, I_{MAX} = 0.5 A	8 mm	737
IE2401	Extension Box, 16 digital combination inputs/outputs 24 V DC, 3 ms filter, I_{MAX} = 0.5 A	M8	737
IE2403	Extension Box, 16 digital combination inputs/outputs 24 V DC, 3 ms filter, I_{MAX} = 0.5 A	IP 20 connector	735
Analog input			
IE3102	Extension Box, 4 differential analog inputs ±10 V, 16 bit	M12	738
IE3112	Extension Box, 4 differential analog inputs 0/4…20 mA, 16 bit	M12	739
IE3202	Extension Box, 4 analog inputs for resistance thermometer, PT100…1000, Ni100, 16 bit	M12	739
IE3312	Extension Box, 4 analog inputs for thermocouple, types J, K, L, B, E, N, R, S, T, U, 16 bit	M12	739
Analog output			
IE4112	Extension Box, 4 differential analog outputs 0/4…20 mA, 16 bit	M12	740
IE4132	Extension Box, 4 analog outputs ±10 V, 16 bit	M12	740
Special functions			
IE5009	Extension Box, 1 SSI encoder interface	M23	742
IE5109	Extension Box, 1 incremental encoder interface with complementary inputs, 1 MHz	M23	743
IE6002	Extension Box, 1 serial interface RS232C	M12	744
IE6012	Extension Box, 1 serial interface, 0…20 mA (TTY)	M12	745
IE6022	Extension Box, 1 serial interface, RS422, RS485	M12	745

PLC Box | **Digital combi, 24 V DC**

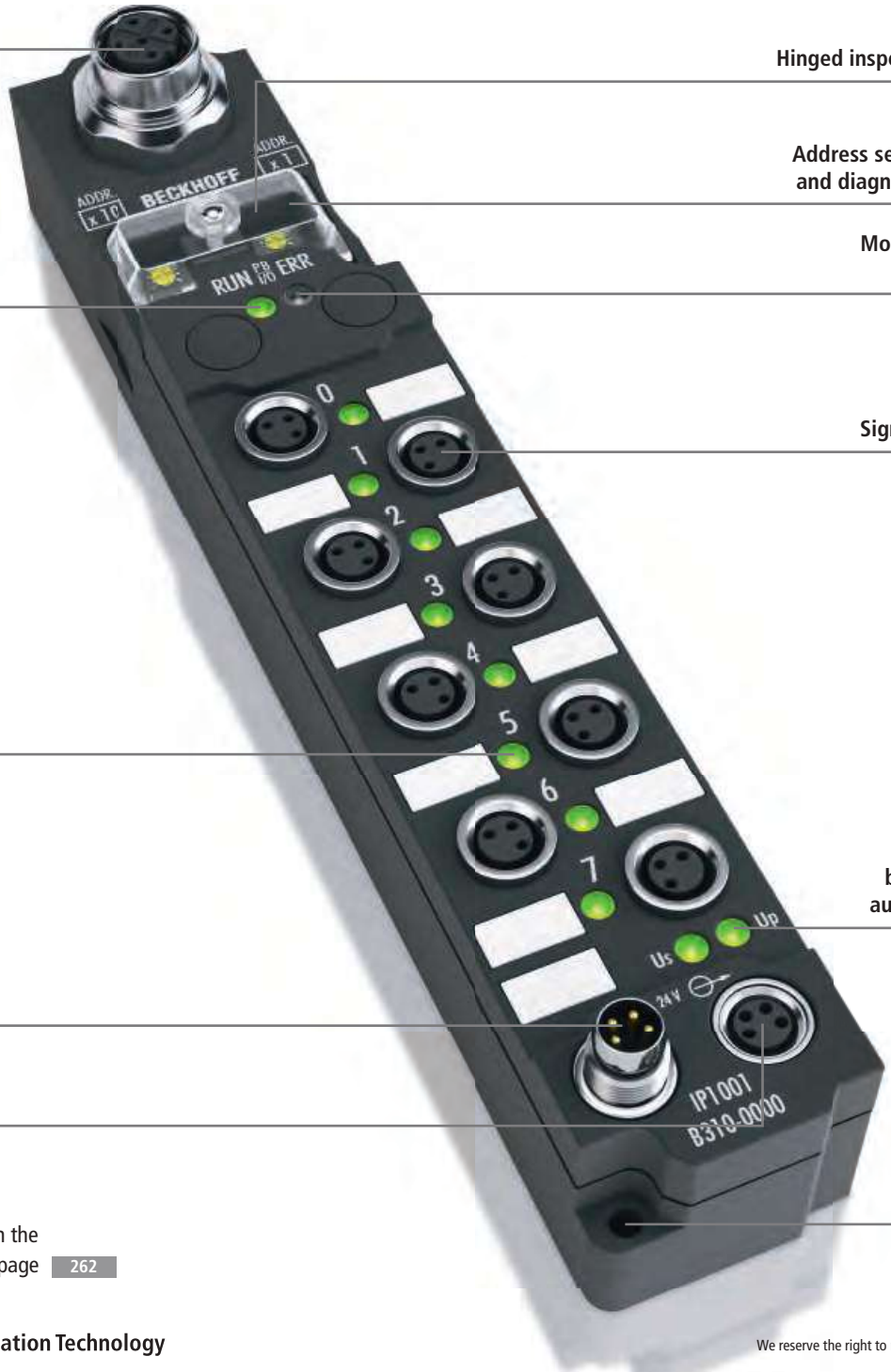
	4 x digital input + 4 x digital output, 24 V DC, 8 mm, I_{MAX} = 0.5 A	4 x digital input + 4 x digital output, 24 V DC, M8, I_{MAX} = 0.5 A	4 x digital input + 4 x digital output, 24 V DC, M12, I_{MAX} = 0.5 A
Technical data	**IL2300-Cxxx**	**IL2301-Cxxx**	**IL2302-Cxxx**
Connection technology	8 mm, snap type	M8, screw type	M12, screw type
Specification	EN 61131-2, type 2	EN 61131-2, type 2	EN 61131-2, type 2
Number of channels	4 inputs + 4 outputs	4 inputs + 4 outputs	4 inputs + 4 outputs
Input filter	3.0 ms	3.0 ms	3.0 ms
			
	The IL2300 PLC Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. The signals are connected via 8 mm snap type connectors. Unlike the Coupler Box, the PLC Box can be programmed via TwinCAT and thus used as a small controller.	The IL2301 PLC Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. The signals are connected via M8 screw type connectors. Unlike the Coupler Box, the PLC Box can be programmed via TwinCAT and thus used as a small controller.	The IL2302 PLC Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. The signals are connected via M12 screw type connectors. Unlike the Coupler Box, the PLC Box can be programmed via TwinCAT and thus used as a small controller.
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Sensor supply	derived from control voltage, max. 0.5 A total, short-circuit-proof	derived from control voltage, max. 0.5 A total, short-circuit-proof	derived from control voltage, max. 0.5 A total, short-circuit-proof
Max. output current	0.5 A on each channel, individually short-circuit-proof	0.5 A on each channel, individually short-circuit-proof	0.5 A on each channel, individually short-circuit-proof
Load type	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load
Short circuit current	typ. 1.5 A	typ. 1.5 A	typ. 1.5 A
Auxiliary power current	typ. 20 mA	typ. 20 mA	typ. 20 mA
Current consumption from U_S	see documentation	see documentation	see documentation
Special features	IP-Link coupler	IP-Link coupler	IP-Link coupler
Approvals	CE, UL	CE, UL	CE, UL
Further information	www.beckhoff.com/IL2300-Cxxx	www.beckhoff.com/IL2301-Cxxx	www.beckhoff.com/IL2302-Cxxx

Extension Box

Up to 120 Extension Box modules can be connected to the PLC Box via the IP-Link communication facility. The Extension Box modules cover the full spectrum of I/O signals with various connection techniques. See page 726

IExxxx	Extension Box	Plug	Page
Digital input			
IE1000	Extension Box, 8 digital inputs 24 V DC, 3.0 ms filter	8 mm	728
IE1001	Extension Box, 8 digital inputs 24 V DC, 3.0 ms filter	M8	729
IE1002	Extension Box, 8 digital inputs 24 V DC, 3.0 ms filter	M12	729
IE1010	Extension Box, 8 digital inputs 24 V DC, 0.2 ms filter	8 mm	728
IE1011	Extension Box, 8 digital inputs 24 V DC, 0.2 ms filter	M8	729
IE1012	Extension Box, 8 digital inputs 24 V DC, 0.2 ms filter	M12	729
IE1502	Extension Box, up/down counter, 24 V DC, 100 kHz	M12	729
Digital output			
IE2000	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 0.5 A	8 mm	730
IE2001	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 0.5 A	M8	730
IE2002	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 0.5 A	M12	731
IE2020	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	8 mm	731
IE2021	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M8	731
IE2022	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M12	731
IE2040	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 12 A)	8 mm	732
IE2041	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 12 A)	M8	732
IE2042	Extension Box, 8 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 12 A)	M12	732
IE2808	Extension Box, 16 digital outputs 24 V DC, I_{MAX} = 0.5 A ($\sum$ 4 A)	D-sub	733
IE2512	Extension Box, 2 digital pulse width outputs 24 V DC, I_{MAX} = 2.5 A	M12	733
Digital combi			
IE2300	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	8 mm	734
IE2301	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	M8	735
IE2302	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	M12	735
IE2310	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	8 mm	734
IE2311	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	M8	735
IE2312	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 0.5 A	M12	735
IE2320	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	8 mm	736
IE2321	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M8	736
IE2322	Extension Box, 4 digital inputs 24 V DC, 3 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M12	737
IE2330	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	8 mm	736
IE2331	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M8	736
IE2332	Extension Box, 4 digital inputs 24 V DC, 0.2 ms filter, 4 digital outputs 24 V DC, I_{MAX} = 2 A ($\sum$ 4 A)	M12	737
IE2400	Extension Box, 16 digital combination inputs/outputs 24 V DC, 3 ms filter, I_{MAX} = 0.5 A	8 mm	737
IE2401	Extension Box, 16 digital combination inputs/outputs 24 V DC, 3 ms filter, I_{MAX} = 0.5 A	M8	737
IE2403	Extension Box, 16 digital combination inputs/outputs 24 V DC, 3 ms filter, I_{MAX} = 0.5 A	IP 20 connector	735
Analog input			
IE3102	Extension Box, 4 differential analog inputs ±10 V, 16 bit	M12	738
IE3112	Extension Box, 4 differential analog inputs 0/4…20 mA, 16 bit	M12	739
IE3202	Extension Box, 4 analog inputs for resistance thermometer, PT100…1000, Ni100, 16 bit	M12	739
IE3312	Extension Box, 4 analog inputs for thermocouple, types J, K, L, B, E, N, R, S, T, U, 16 bit	M12	739
Analog output			
IE4112	Extension Box, 4 differential analog outputs 0/4…20 mA, 16 bit	M12	740
IE4132	Extension Box, 4 analog outputs ±10 V, 16 bit	M12	740
Special functions			
IE5009	Extension Box, 1 SSI encoder interface	M23	742
IE5109	Extension Box, 1 incremental encoder interface with complementary inputs, 1 MHz	M23	743
IE6002	Extension Box, 1 serial interface RS232C	M12	744
IE6012	Extension Box, 1 serial interface, 0…20 mA (TTY)	M12	745
IE6022	Extension Box, 1 serial interface, RS422, RS485	M12	745

Signal types | Compact Box



Fieldbus interface (connection depends on the particular fieldbus)

Hinged inspection window

Address selection switch and diagnostic interface

Fieldbus status display

Module or IP-Link status display

Signal connection

Signal status display

Status display power supply: box supply and auxiliary voltage

Power supply input
– box supply
– auxiliary voltage

Power supply downstream connection

Mounting holes

For further information on the individual fieldbuses see page 262

Standard housing

XXL housing

Signal connections

Connector 8 mm, snap type, 3-pin

Connector M8, screw type, 3-pin

Connector M12, screw type, 5-pin

Compact Box modules are robust fieldbus stations for different fieldbus systems. They offer a wide range of I/O functionality. All relevant industrial signals are supported. In addition to digital and analog inputs and outputs including thermocouple and RTD inputs, there are also incremental encoder interfaces available for displacement and angle measurement in addition to serial interfaces to solve a large number of communication tasks. The digital inputs and outputs can be connected with snap type 8 mm diameter plugs, screw type M8 connectors, or with screw type M12 pendants. The M12 version is provided for analog signals.

Special input and output channels on the combination I/O modules can be used for either input or output. It is not necessary to configure them, since the fieldbus provides both input and output data for each combination channel. The combination modules give the user all of the advantages of fine signal granularity.

The processor logic, the input circuitry and the sensor power supply are fed from the box supply voltage, the auxiliary power for the outputs can be routed separately. In this way it is possible to achieve cascadable emergency off concepts. In Fieldbus Box modules in which only inputs are available the auxiliary power supply U_P can optionally be connected in order to pass it on downstream.

The state of the fieldbus connection, the module status, the status of the power supply and of the signals is indicated by LEDs. The label strips can be machine printed elsewhere and then inserted.

IPxxxy-Bzzz

- xxx:
  - 200 = Lightbus
  - 310/318 = PROFIBUS
  - 400 = Interbus
  - 510/518 = CANopen
  - 520/528 = DeviceNet
  - 730 = Modbus
  - 800 = RS485
  - 810 = RS232
- y:
  - 0 = connector 8 mm, snap type, 3-pin
  - 1 = connector M8, screw type, 3-pin
  - 2 = connector M12, screw type, 5-pin
  - 8 = D-sub, 25-pin
- zzz:
  - Signals see page 728

▶ **www.beckhoff.com/Compact-Box**

Signal types | Extension Box

Fieldbus status display

Module or IP-Link status display

IP-Link interface for the connection of extension modules

Signal connection 8 mm, M8 or M12

Signal status display

Status display power supply: box supply and auxiliary voltage

Power supply input
– box supply
– auxiliary voltage

Power supply down-stream connection

Mounting holes

Digital input

Digital output

Analog input

Analog output

Special functions

The Extension Box modules cover the full spectrum of I/O signals: digital inputs with different filters, digital outputs with 0.5 and 2 A output currents, analog inputs and outputs with a 16 bit resolution, thermocoupler and RTD inputs, serial interfaces and encoder inputs.

Similarly to the Compact Box modules, the digital inputs and outputs can be connected either through 8 mm snap type connectors or screw type connectors (M8 and M12). Analog signal types are provided with the M12 version. The snap type connectors lock in place positively, forming a vibration-proof connection, while the screw type connectors offer the advantage of high resistance to being pulled out.

The extension modules are connected to the process level via the fieldbus coupler. Up to 120 extension modules can be connected at distances of 15 m from box to box via the IP-Link communication connection.

IExxxy

- 0 = connector 8 mm, snap type, 3-pin
- 1 = connector M8, screw type, 3-pin
- 2 = connector M12, screw type, 5-pin
- 3 = IP 20 connector
- 8 = D-sub, 25-pin
- 9 = connector M23, screw type, 12-pin

Signals see page 728

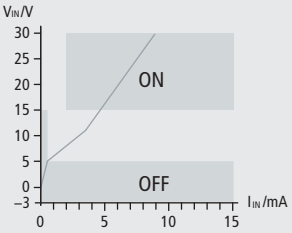
▶ **www.beckhoff.com/Extension-Box**

Digital input | 24 V DC, positive switching

The digital inputs on a 24 V supply are among the most frequently used signals. The EN 61131-2 standard describes the input characteristic and distinguishes three types. Type 1 has a small input current with low power dissipation. This input is optimised for mechanical switches and actively-switched electronic outputs. Type 2 has a significantly larger input current and is optimised for 2-wire sensors with a high quiescent current consumption. Type 3 is a combination between type 1, with low current in switched-on state, and a satisfactorily high quiescent current for the majority of modern 2-wire sensors. The type 3 input can be used in almost all applications as a replacement for type 1. The diagram shows the typical current/voltage curves of the module inputs and the allowable range of conformity in accordance with the standard.

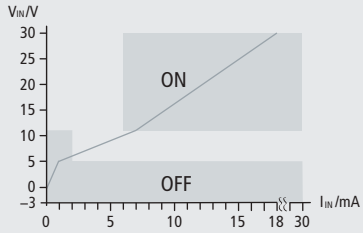
The input circuits differ in their filtering functions. The filtering has the task of suppressing electromagnetic interference. However, this does have the drawback of signal deceleration. The filter time of 3 ms is comparatively slow, but it can suppress the bouncing of a mechanical switch and delivers a stable signal for simple PLC applications. Filter times of 0.2 ms are suitable for applications with shortest possible reaction times and should be used for mechanical switches only in a restricted manner.

Type 1



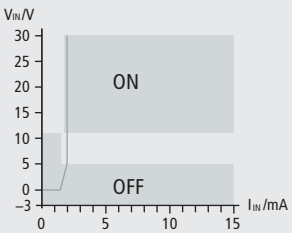
Signal voltage "0": -3…5 V DC
Signal voltage "1": 15…30 V DC

Type 2



Signal voltage "0": -3…5 V DC
Signal voltage "1": 11…30 V DC

Type 3



Signal voltage "0": -3…5 V DC
Signal voltage "1": 11…30 V DC

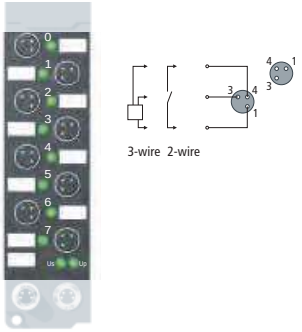
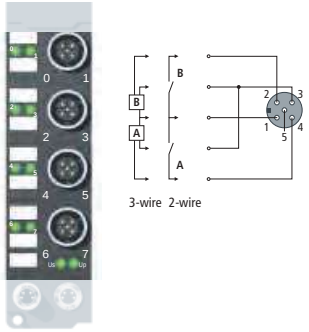
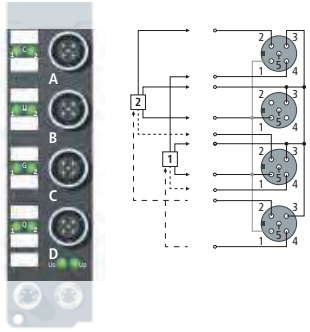
Characteristics of the 3 input types according to EN 61131-2 (24 V DC)

	8-channel digital input, 24 V DC, 8 mm, type 2	
Compact Box	**IP1000-Bxxx**	**IP1010-Bxxx**
Extension Box	**IE1000**	**IE1010**
Connection technology	8 mm, snap type	
"0" signal voltage	-3…+5 V (EN 61131-2, type 2)	
"1" signal voltage	11…30 V (EN 61131-2, type 2)	
Input filter	3.0 ms	0.2 ms
Number of inputs	8	
Nominal voltage	24 V DC (-15 %/+20 %)	

The IP10x0 and IE10x0 digital input modules acquire the binary control signals from the process level and transmit them to the higher-level automation unit. The signals are connected via 8 mm snap type connectors.

The sensors are supplied from the box supply voltage U_S.

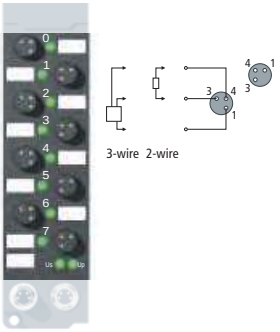
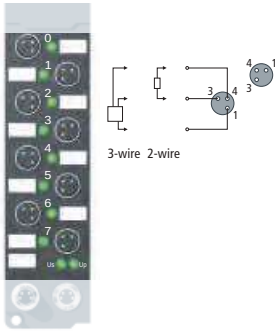
Number of counters	–
Counting frequency	–
Sensor supply	from control voltage, max. 0.5 A total, short-circuit-proof
Current consumption from U_S (without sensor current)	IP10x0-Bxxx: see document. IE10x0: 25 mA
Bit width in the process image	8 inputs
Electrical isolation	channel/U_S, channel/ch.: no, U_S/fieldbus: depend. on fieldb.
Approvals	CE, UL
Further information	www.beckhoff.com/IP1000 www.beckhoff.com/IE1000

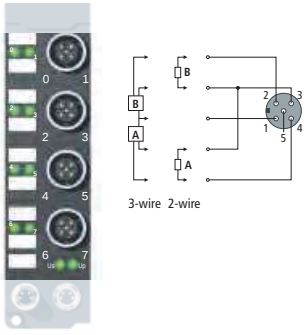
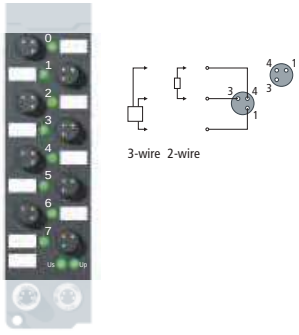
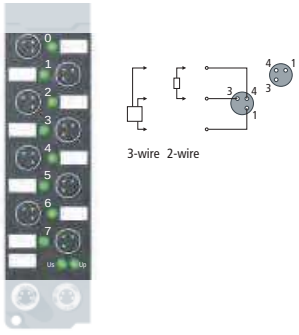
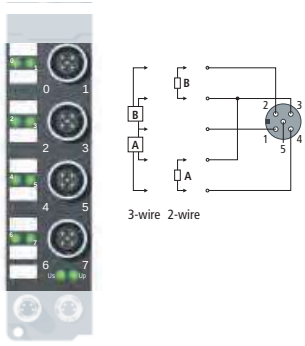
	8-channel digital input, 24 V DC, M8, type 2		8-channel digital input, 24 V DC, M12, type 2		2-channel up/down counter, 24 V DC, 100 kHz, type 2
	IP1001-Bxxx IE1001	**IP1011-Bxxx IE1011**	**IP1002-Bxxx IE1002**	**IP1012-Bxxx IE1012**	**IP1502-Bxxx IE1502**
	M8, screw type		M12, screw type		M12, screw type
	-3…+5 V (EN 61131-2, type 2)		-3…+5 V (EN 61131-2, type 2)		-3…+5 V (EN 61131-2, type 2)
	11…30 V (EN 61131-2, type 2)		11…30 V (EN 61131-2, type 2)		11…30 V (EN 61131-2, type 2)
	3.0 ms	0.2 ms	3.0 ms	0.2 ms	–
	8		8		2 counter inputs + 2 gate inputs + 2 up/down switches
	24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)
					
	The IP10x1 and IE10x1 digital input modules acquire the binary control signals from the process level and transmit them to the higher-level automation unit. The signals are connected via M8 screw type connectors. These versions are distinguished by input filters of different speeds. The sensors are supplied from the box supply voltage U_S. The auxiliary voltage U_P is not used in the input module, but may be connected in order to be relayed downstream.		The IP10x2 and IE10x2 digital input modules acquire the binary control signals from the process level and transmit them to the higher-level automation unit. The signals are connected via M12 screw type connectors. These versions are distinguished by input filters of different speeds. The sensors are supplied from the box supply voltage U_S. The auxiliary voltage U_P is not used in the input module, but may be connected in order to be relayed downstream.		The counter module has two fast counters running at up to 100 kHz. It counts binary pulses and transmits the counter state to the higher-level automation unit. The up/down input allows the counters to be switched between upwards and downwards counting (in 32 bits). The gate signals (gate inputs) allow the counters to be triggered: Depending on the level at the gate input, the counting function is halted or enabled. The outputs can be switched according to the counter state. From the controller it is possible to set the counter state, to start or halt the counter function, and to set the outputs.
	–		–		2, each with a depth of 32 bits
	–		–		100 kHz (2 kHz for switching between up and down)
	derived from control voltage, max. 0.5 A total, short-circuit-proof		derived from control voltage, max. 0.5 A total, short-circuit-proof		derived from control voltage, max. 0.5 A total, short-circuit-proof
	IP10x1-Bxxx: see documentation IE10x1: 25 mA		IP10x2-Bxxx: see documentation IE10x2: 25 mA		IP1502-Bxxx: see documentation IE1502: 25 mA
	8 inputs		8 inputs		2 x 32 bit input/2 x 8 bit control/status
	channel/U_S, channel/channel: no, U_S/fieldbus: depending on fieldbus		channel/U_S, channel/channel: no, U_S/fieldbus: depending on fieldbus		channel/U_S, channel/channel: no, U_S/fieldbus: depending on fieldbus
	CE, UL		CE, UL		CE, UL
	www.beckhoff.com/IP1001 www.beckhoff.com/IE1001		www.beckhoff.com/IP1002 www.beckhoff.com/IE1002		www.beckhoff.com/IP1502 www.beckhoff.com/IE1502

Digital output | 24 V DC, positive switching

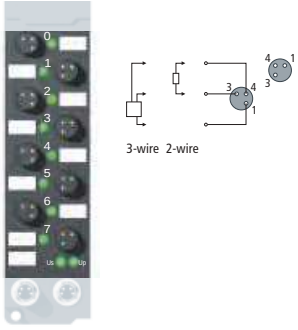
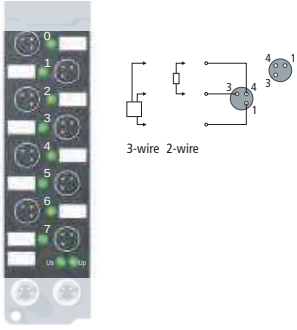
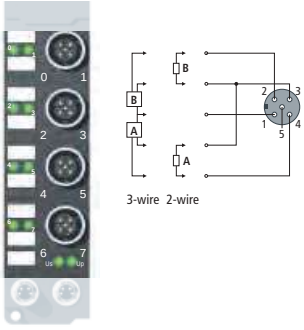
Many actuators are driven or controlled with 24 V DC. The Fieldbus Box modules in the category "positive switching" switch all output channels to 24 V DC. The output circuit offers further functions such as short-circuit-current limitation, short-circuit switch-off and the depletion of inductive energy from the coil.

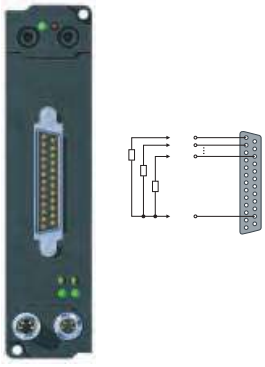
The most common output circuit delivers a maximum continuous current of 0.5 A. Special Fieldbus Box modules are available for higher currents. Any type of load (ohmic, capacitive, inductive) can be connected to an output module.

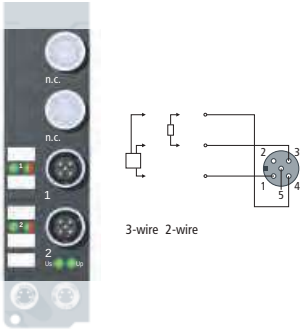
	8-channel digital output, 24 V DC, 8 mm, I_{MAX} = 0.5 A	8-channel digital output, 24 V DC, M8, I_{MAX} = 0.5 A
Compact Box Extension Box	**IP2000-Bxxx IE2000**	**IP2001-Bxxx IE2001**
Connection technology	8 mm, snap type	M8, screw type
Load type	ohmic, inductive, lamp load	ohmic, inductive, lamp load
Max. output current	max. 0.5 A on each channel, individually short-circuit safe	max. 0.5 A on each channel, individually short-circuit safe
Number of outputs	8	8
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	 The IP2000/IE2000 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit-proof and protected against inverse connection.	 The IP2001/IE2001 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit-proof and protected against inverse connection.
Current consumption from U_S (without sensor current)	IP2000-Bxxx: see documentation IE2000: 25 mA	IP2001-Bxxx: see documentation IE2001: 25 mA
Short circuit current	typ. 1.5 A	typ. 1.5 A
Auxiliary power current	typ. 20 mA per channel	typ. 20 mA per channel
Bit width in the process image	8 outputs	8 outputs
Electrical isolation	channel/U_S, channel/channel: no, U_S/fieldbus: depending on fieldbus	channel/U_S, channel/channel: no, U_S/fieldbus: depending on fieldbus
Approvals	CE, UL	CE, UL
Further information	www.beckhoff.com/IP2000 www.beckhoff.com/IE2000	www.beckhoff.com/IP2001 www.beckhoff.com/IE2001

	8-channel digital output, 24 V DC, M12, I_{MAX} = 0.5 A	8-channel digital output, 24 V DC, 8 mm, I_{MAX} = 2 A (∑ 4 A)	8-channel digital output, 24 V DC, M8, I_{MAX} = 2 A (∑ 4 A)	8-channel digital output, 24 V DC, M12, I_{MAX} = 2 A (∑ 4 A)
	IP2002-Bxxx IE2002	**IP2020-Bxxx IE2020**	**IP2021-Bxxx IE2021**	**IP2022-Bxxx IE2022**
	M12, screw type	8 mm, snap type	M8, screw type	M12, screw type
	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load
	max. 0.5 A on each channel, individually short-circuit safe	2 A each channel, individually short-circuit safe, total current max. 4 A	2 A each channel, individually short-circuit safe, total current max. 4 A	2 A each channel, individually short-circuit safe, total current max. 4 A
	8	8	8	8
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
				
	The IP2002/IE2002 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit-proof and protected against inverse connection.	The IP2020/IE2020 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit-proof and protected against inverse connection.	The IP2021/IE2021 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit-proof and protected against inverse connection.	The IP2022/IE2022 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit-proof and protected against inverse connection.
	IP2002-Bxxx: see documentation IE2002: 25 mA	IP2020-Bxxx: see documentation IE2020: 25 mA	IP2021-Bxxx: see documentation IE2021: 25 mA	IP2022-Bxxx: see documentation IE2022: 25 mA
	typ. 1.5 A	max. 4 A	max. 4 A	max. 4 A
	typ. 20 mA per channel	typ. 30 mA per channel	typ. 30 mA per channel	typ. 30 mA per channel
	8 outputs	8 outputs	8 outputs	8 outputs
	channel/U_s, channel/channel: no, U_s/fieldbus: depending on fieldbus	channel/U_s, channel/channel: no, U_s/fieldbus: depending on fieldbus	channel/U_s, channel/channel: no, U_s/fieldbus: depending on fieldbus	channel/U_s, channel/channel: no, U_s/fieldbus: depending on fieldbus
	CE, UL	CE, UL	CE, UL	CE, UL
	www.beckhoff.com/IP2002 www.beckhoff.com/IE2002	www.beckhoff.com/IP2020 www.beckhoff.com/IE2020	www.beckhoff.com/IP2021 www.beckhoff.com/IE2021	www.beckhoff.com/IP2022 www.beckhoff.com/IE2022

Digital output | 24 V DC, positive switching

	8-channel digital output, 24 V DC, 8 mm, I_{MAX} = 2 A (∑ 12 A)	8-channel digital output, 24 V DC, M8, I_{MAX} = 2 A (∑ 12 A)	8-channel digital output, 24 V DC, M12, I_{MAX} = 2 A (∑ 12 A)
Compact Box Extension Box	**IP2040-Bxxx IE2040**	**IP2041-Bxxx IE2041**	**IP2042-Bxxx IE2042**
Connection technology	8 mm, snap type	M8, screw type	M12, screw type
Load type	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load
Max. output current	2 A each channel, individ. short-circuit-proof, total current max. 12 A (channel 0…3: ∑ 4 A, 4+5: ∑ 4 A, 6+7: ∑ 4 A)	2 A each channel, individ. short-circuit-proof, total current max. 12 A (channel 0…3: ∑ 4 A, 4+5: ∑ 4 A, 6+7: ∑ 4 A)	2 A each channel, individ. short-circuit-proof, total current max. 12 A (channel 0…3: ∑ 4 A, 4+5: ∑ 4 A, 6+7: ∑ 4 A)
Number of outputs	8	8	8
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
			
	The IP2040/IE2040 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are supplied by three load circuits; for this reason these modules do not relay the supply voltage. The outputs are short-circuit-proof and protected against inverse connection.	The IP2041/IE2041 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are supplied by three load circuits; for this reason these modules do not relay the supply voltage. The outputs are short-circuit-proof and protected against inverse connection.	The IP2042/IE2042 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are supplied by three load circuits; for this reason these modules do not relay the supply voltage. The outputs are short-circuit-proof and protected against inverse connection.
Current consumption from U_S (without sensor current)	IP2040-Bxxx: see documentation IE2040: 25 mA	IP2041-Bxxx: see documentation IE2041: 25 mA	IP2042-Bxxx: see documentation IE2042: 25 mA
Short circuit current	typ. 4 A	typ. 4 A	typ. 4 A
Auxiliary power current	typ. 50 mA per channel	typ. 50 mA per channel	typ. 50 mA per channel
Bit width in the process image	8 outputs	8 outputs	8 outputs
Electrical isolation	channel/U_S, channel/channel: no, U_S/fieldbus: depending on fieldbus	channel/U_S, channel/channel: no, U_S/fieldbus: depending on fieldbus	channel/U_S, channel/channel: no, U_S/fieldbus: depending on fieldbus
Approvals	CE, UL	CE, UL	CE, UL
Further information	www.beckhoff.com/IP2040 www.beckhoff.com/IE2040	www.beckhoff.com/IP2041 www.beckhoff.com/IE2041	www.beckhoff.com/IP2042 www.beckhoff.com/IE2042

	16-channel digital output, 24 V DC, D-sub, I_{MAX} = 0.5 A (∑ 4 A)
	IE2808, IE2808-0001
	D-sub socket, 25-pin
	ohmic, inductive, lamp load
	0.5 A each channel, individually short-circuit-proof, total current max. 4 A
	16
	24 V DC (-15 %/+20 %)
	
	In the IE2808 digital output module an output short-circuit is recognised and passed on to the controller. After a fault, e.g. a short circuit at an output, the IE2808-0001 version starts up again automatically. The IE2808 version waits for the fault to be reset by the master (CTRL byte).
	25 mA
	max. 1.5 A
	typ. 30 mA
	16 outputs, 16 inputs (diagnostics) optional: control/status
	channel/U_s, channel/channel: no, U_s/fieldbus: depending on fieldbus
	CE, UL
	www.beckhoff.com/IE2808

	2-channel pulse width output, 24 V DC, M12, I_{MAX} = 2.5 A
Compact Box **Extension Box**	**IP2512-Bxxx** **IE2512**
Connection technology	M12, screw type
Load type	ohmic, inductive
Max. output current	2.5 A on each channel, individually short-circuit-proof
Number of outputs	2
Nominal voltage	24 V DC (-15 %/+20 %)
	
	The outputs of the IP2512/IE2512 module provide a pulse width modulated version of a binary signal. The keying ratio is prescribed by a 16 bit value from the automation unit. The output is protected against overload and short circuit.
Current consumption from U_s (without sensor current)	IP2512-Bxxx: see documentation IE2512: 25 mA
Up/down channel	24 V DC, 0.5 A, short-circuit-proof
Base frequency	8 Hz…40 kHz, default: 250 Hz
Duty factor	0…100 % (T_{ON} > 750 ns, T_{OFF} > 500 ns)
Resolution	max. 10 bit
Bit width in the process image	48 inputs/outputs: 2 x 16 bit data + 2 x 8 bit status
Electrical isolation	channel/U_s, channel/channel: no, U_s/fieldbus: depending on fieldbus
Approvals	CE, UL
Further information	www.beckhoff.com/IP2512 www.beckhoff.com/IE2512

Digital combi | 24 V DC, positive switching

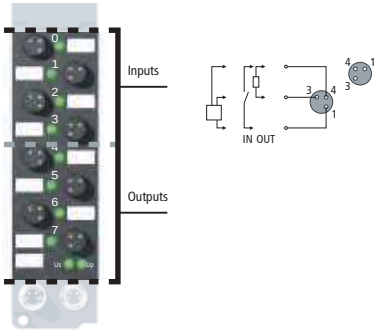
The digital combination modules combine inputs and outputs in one module. The input circuits differ in their filtering functions. The filtering has the task of suppressing electromagnetic interference. However, this does have the drawback of signal deceleration. The filter time of 3 ms is comparatively slow, but it can suppress the bouncing of a mechanical switch and delivers a stable signal for simple PLC applications. Filter times of 0.2 ms are suitable for applications with shortest possible reaction times and should be used for mechanical switches only in a restricted manner.

The output channels supply a max. continuous current of 0.5 A. Special output modules are available for higher currents. Any type of load (ohmic, capacitive, inductive) can be connected to an output module. As lamp and capacitive loads are critical due to their high starting currents, they are limited by the output circuits of the modules. This ensures that the upstream circuit-breaker is not triggered. Inductive loads are problematic at switch-off, as high induction voltages develop, if the current is interrupted too fast. An integrated freewheeling diode prevents this voltage peak. However, the current is reduced so slowly that it leads to faults in many technical control applications. A valve remains open for many milliseconds. The modules represent a compromise between prevention of overvoltage and switch-off. They suppress the induction voltage to about 24 V DC and realise switch-off times which approximately correspond to the switch-on time of the coil.

In the event of a short circuit, the module switches the corresponding output off and cyclically attempts to switch it on again. This continues until either the short circuit is eliminated or the controller resets the output. The clock frequency depends on the ambient temperature and the loads on the other channels. The total current specified should be observed.

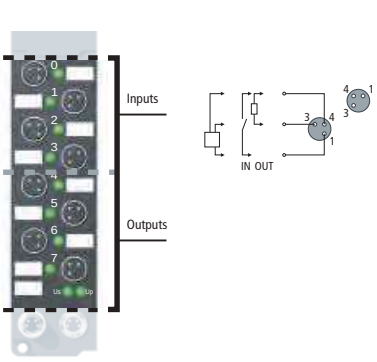
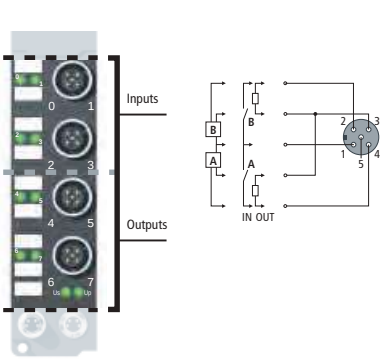
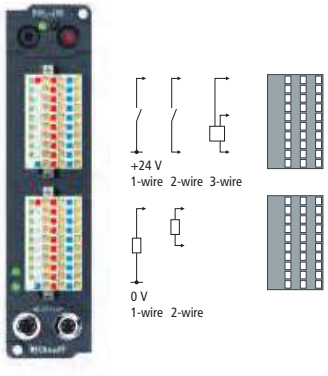
4 x digital input +
4 x digital output,
24 V DC, 8 mm, I_{MAX} = 0.5 A

Compact Box Extension Box	IP2300-Bxxx IE2300	IP2310-Bxxx IE2310
Connection technology	8 mm, snap type	
Number of channels	4 inputs + 4 outputs	
Nominal voltage	24 V DC (-15 %/+20 %)	
Input filter	3.0 ms	0.2 ms

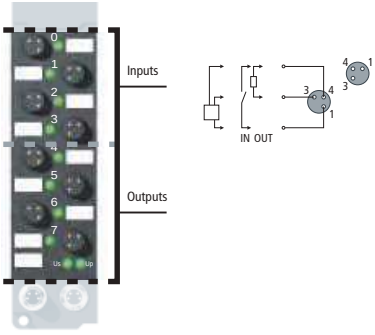
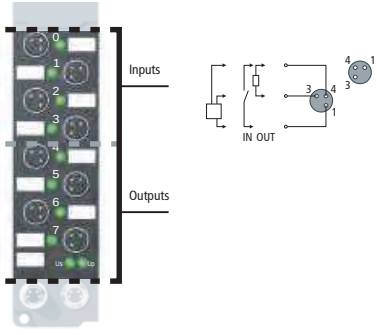


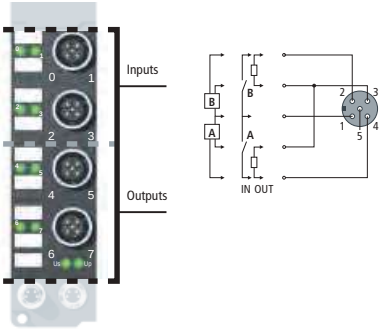
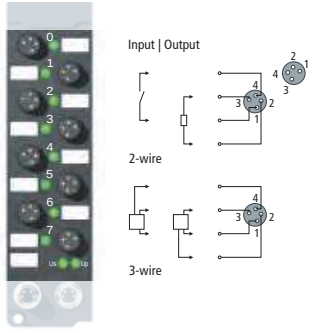
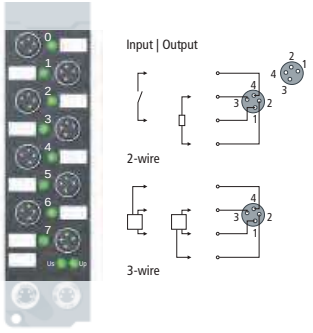
The IP23x0/IE23x0 digital I/O module combines four digital inputs and four digital outputs in one device. The outputs are short-circuit-proof and protected against inverse polarity. The signals are connected via 8 mm diameter snap type connectors.

"0" signal voltage	-3…+5 V
"1" signal voltage	11…30 V, 6 mA input current (EN 61131-2, type 2)
Sensor supply	derived from control voltage, max. 0.5 A total, short-circuit-proof
Max. output current	0.5 A on each channel, individually short-circuit-proof
Load type	ohmic, inductive, lamp load
Short circuit current	typ. 1.5 A
Current consumption from U_S (without sensor current)	IP23x0-Bxxx: see documentation IE23x0: 25 mA
Auxiliary power current	typ. 20 mA per channel
Approvals	CE, UL
Further information	www.beckhoff.com/IP2300 www.beckhoff.com/IE2300

	4 x digital input + 4 x digital output, 24 V DC, M8, I_{MAX} = 0.5 A		4 x digital input + 4 x digital output, 24 V DC, M12, I_{MAX} = 0.5 A		16-channel digital combi input/output, 24 V DC, IP 20 connector, I_{MAX} = 0.5 A
	IP2301-Bxxx IE2301	**IP2311-Bxxx IE2311**	**IP2302-Bxxx IE2302**	**IP2312-Bxxx IE2312**	**IE2403**
	M8, screw type		M12, screw type		connector with spring-loaded technique
	4 inputs + 4 outputs		4 inputs + 4 outputs		16 channels (8 inputs and 8 outputs)
	24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)
	3.0 ms	0.2 ms	3.0 ms	0.2 ms	3 ms
					
	The IP23x1/IE23x1 digital I/O module combines four digital inputs and four digital outputs in one device. The outputs are short-circuit-proof and protected against inverse polarity. The signals are connected via screw type M8 connectors.		The IP23x2/IE23x2 digital I/O module combines four digital inputs and four digital outputs in one device. The outputs are short-circuit-proof and protected against inverse polarity. The signals are connected via screw type M12 connectors.		The digital IE2403 I/O module has sixteen channels with eight inputs and eight outputs. The device can therefore be flexibly adapted to the requirements of the application. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. For the signal connection IP 20 connectors with a spring-loaded system are used, optionally available with 1 or 3 pins. The module is supplied without connectors. Accessories: – ZS2001-0001: connector, 1-pin, without LED – ZS2001-0002: connector, 1-pin, with LED – ZS2001-0004: connector, 3-pin, with LED
	-3…+5 V		-3…+5 V		-3…+5 V
	11…30 V, 6 mA input current (EN 61131-2, type 2)		11…30 V, 6 mA input current (EN 61131-2, type 2)		11…30 V, 6 mA input current (EN 61131-2, type 2)
	derived from control voltage, max. 0.5 A total, short-circuit-proof		derived from control voltage, max. 0.5 A total, short-circuit-proof		derived from control voltage, max. 0.5 A total, short-circuit-proof
	0.5 A on each channel, individually short-circuit-proof		0.5 A on each channel, individually short-circuit-proof		max. 0.5 A on each channel, individually short-circuit safe
	ohmic, inductive, lamp load		ohmic, inductive, lamp load		ohmic, inductive, lamp load
	typ. 1.5 A		typ. 1.5 A		typ. 1.5 A
	IP23x1-Bxxx: see documentation IE23x1: 25 mA		IP23x2-Bxxx: see documentation IE23x2: 25 mA		25 mA
	typ. 20 mA per channel		typ. 20 mA per channel		typ. 20 mA per channel
	CE, UL		CE, UL		CE
	www.beckhoff.com/IP2301 www.beckhoff.com/IE2301		www.beckhoff.com/IP2302 www.beckhoff.com/IE2302		www.beckhoff.com/IE2403

Digital combi | 24 V DC, positive switching

	4 x digital input + 4 x digital output, 24 V DC, 8 mm, I_{MAX} = 2 A (∑ 4 A)		4 x digital input + 4 x digital output, 24 V DC, M8, I_{MAX} = 2 A (∑ 4 A)	
Compact Box **Extension Box**	**IP2320-Bxxx** **IE2320**	**IP2330-Bxxx** **IE2330**	**IP2321-Bxxx** **IE2321**	**IP2331-Bxxx** **IE2331**
Connection technology	8 mm, snap type		M8, screw type	
Number of channels	4 inputs + 4 outputs		4 inputs + 4 outputs	
Nominal voltage	24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)	
Input filter	3.0 ms	0.2 ms	3.0 ms	0.2 ms
				
	The IP23x0/IE23x0 digital I/O modules combine four digital inputs and four digital outputs in one device. The outputs are short-circuit-proof and protected against inverse polarity. The signals are connected via 8 mm diameter snap type connectors.		The IP23x1/IE23x1 digital I/O modules combine four digital inputs and four digital outputs in one device. The outputs are short-circuit-proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.	
"0" signal voltage	-3…+5 V		-3…+5 V	
"1" signal voltage	11…30 V, 6 mA input current (EN 61131-2, type 2)		11…30 V, 6 mA input current (EN 61131-2, type 2)	
Sensor supply	derived from control voltage, max. 0.5 A total, short-circuit-proof		derived from control voltage, max. 0.5 A total, short-circuit-proof	
Max. output current	2 A each channel, individually short-circuit safe, total current max. 4 A		2 A each channel, individually short-circuit safe, total current max. 4 A	
Load type	ohmic, inductive, lamp load		ohmic, inductive, lamp load	
Short circuit current	typ. 4 A		typ. 4 A	
Current consumption from U_S (without sensor current)	IP23x0-Bxxx: see documentation IE23x0: 25 mA		IP23x1-Bxxx: see documentation IE23x1: 25 mA	
Auxiliary power current	typ. 30 mA per channel		typ. 30 mA per channel	
Approvals	CE, UL		CE, UL	
Further information	www.beckhoff.com/IP2320 www.beckhoff.com/IE2320		www.beckhoff.com/IP2321 www.beckhoff.com/IE2321	

	4 x digital input + 4 x digital output, 24 V DC, M12, I_{MAX} = 2 A (∑ 4 A)		16-channel digital combi input/output, 24 V DC, 8 mm, I_{MAX} = 0.5 A	16-channel digital combi input/output, 24 V DC, M8, I_{MAX} = 0.5 A
	IP2322-Bxxx **IE2322**	**IP2332-Bxxx** **IE2332**	**IP2400-Bxxx** **IE2400**	**IP2401-Bxxx** **IE2401**
	M12, screw type		8 mm, snap type	M8, screw type
	4 inputs + 4 outputs		16 channels, useable optionally as input and output	16 channels, useable optionally as input and output
	24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	3.0 ms	0.2 ms	3.0 ms	3.0 ms
				
	The IP23x2/IE23x2 digital I/O modules combine four digital inputs and four digital outputs in one device. The outputs are short-circuit-proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.		The IP2400/IE2400 digital I/O modules have sixteen channels that can be used as eight inputs and eight outputs. The signals are connected through snap type 8 mm diameter connectors, which have four pins (with separate input and output pins). This makes it possible to connect antivalent sensors. Adapter cables are available for use in input-only or output-only cases, as well as connectors for field wireable. It is also possible to use the power supply cable directly as the sensor cable. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity.	The IP2401/IE2401 digital I/O modules have sixteen channels that can be used as eight inputs and eight outputs. The signals are connected through M8 screw type connectors, which have four pins (with separate input and output pins). This makes it possible to connect antivalent sensors. Adapter cables are available for use in input-only or output-only cases, as well as connectors for field wireable. It is also possible to use the power supply cable directly as the sensor cable. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity.
	-3…+5 V		-3…+5 V	-3…+5 V
	11…30 V, 6 mA input current (EN 61131-2, type 2)		11…30 V, 6 mA input current (EN 61131-2, type 2)	11…30 V, 6 mA input current (EN 61131-2, type 2)
	derived from control voltage, max. 0.5 A total, short-circuit-proof		derived from control voltage, max. 0.5 A total, short-circuit-proof	derived from control voltage, max. 0.5 A total, short-circuit-proof
	2 A each channel, individually short-circuit safe, total current max. 4 A		0.5 A on each channel, individually short-circuit-proof	0.5 A on each channel, individually short-circuit-proof
	ohmic, inductive, lamp load		ohmic, inductive, lamp load	ohmic, inductive, lamp load
	typ. 4 A		typ. 1.5 A	typ. 1.5 A
	IP23x2-Bxxx: see documentation IE23x2: 25 mA		IP2400-Bxxx: see documentation IE2400: 25 mA	IP2401-Bxxx: see documentation IE2401: 25 mA
	typ. 30 mA per channel		typ. 20 mA per channel	typ. 20 mA per channel
	CE, UL		CE, UL	CE, UL
	www.beckhoff.com/IP2322 www.beckhoff.com/IE2322		www.beckhoff.com/IP2400 www.beckhoff.com/IE2400	www.beckhoff.com/IP2401 www.beckhoff.com/IE2401

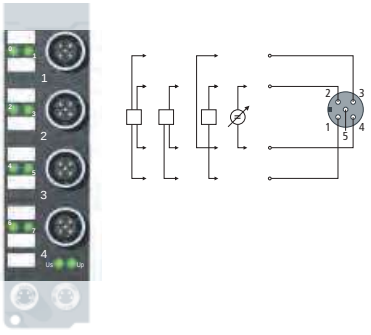
Analog input | -10…+10 V, 0/4…20 mA, PT100, temperature

The IP/IE3102 Fieldbus Box modules evaluate analogue standard signals in the range of -10/0 V to +10 V with 16-bit resolution and the IP/IE3112 modules in the range of 0/4 mA to 20 mA.

The IP/IE3202 analog input module is intended for the direct connection of resistance thermometers. The resistance is measured with a low signal current, linearised and represented in 0.1 °C. The module supports 2-, 3- and 4-wire measurement on all four channels. The measurements serve to eliminate or deduct the parasitic resistance of the sensor cable. All inputs are separately configurable for a wide range of sensors, for the three measurement procedures and for the direct measurement of resistance.

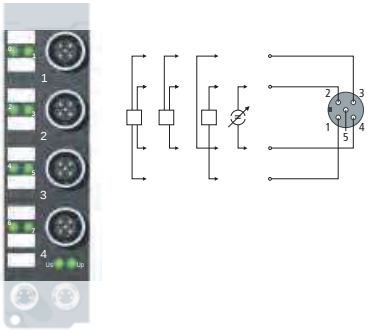
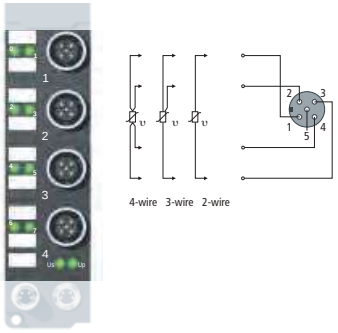
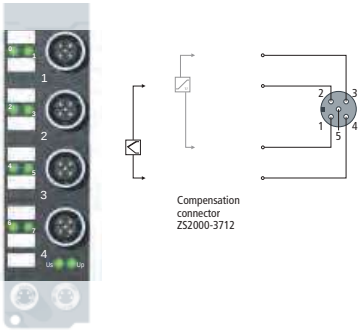
The IP/IE3312 Fieldbus Box enables the measurement of temperature using thermocouples. The measured thermovoltage is linearised in accordance with the characteristic of the respective type and transferred to the controller as a temperature value in 1/10 °C or 1/100 °C. The inputs are separately configurable for a wide range of different sensor types. Parasitic thermovoltages arise at the interface of the measuring cable and the module, significantly falsifying the measurement. This error is eliminated by the ZS2000-3712 compensation plug.

	4-channel analog input, -10…+10 V, M12, 16 bit
Compact Box **Extension Box**	**IP3102-Bxxx** **IE3102**
Connection technology	M12, screw type
Signal type	-10/0…+10 V
Resolution	16 bit (for 0…10 V range: resolution 15 bit)
Conversion time	250 ms, configurable to 5 ms
Number of inputs	4

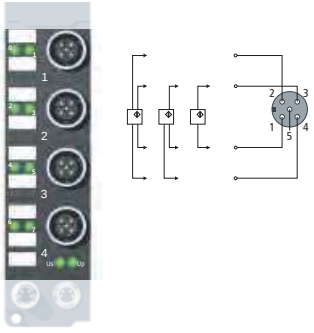
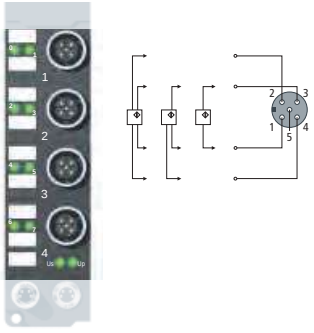


The IP3102/IE3102 analog input module handles signals in the range from -10 to +10 V. The voltage is digitised to a resolution of 16 bits and is transmitted, electrically isolated, to the higher-level automation device. The four input channels have differential inputs and possess a common, internal ground potential. The applied auxiliary voltage (which can be any value up to 30 V DC) is fed through to supply the sensor. It is thus possible, for instance, to supply a measuring potentiometer with 10 V DC from an external voltage source.

Nominal voltage	24 V DC (-15 %/+20 %)
Measuring accuracy	< ±0.3 % (relative to full scale value)
Sensor types	2-, 3-, 4-wire
Measuring range	-10…+10 V, 0…+10 V, user scale
Internal resistance	> 100 kΩ
Sensor supply	from load supply voltage U_P, DC, any value up to 30 V
Current consumption from U_S (without sensor current)	IP3102-Bxxx: see documentation IE3102: 55 mA
Approvals	CE, UL
Further information	www.beckhoff.com/IP3102 www.beckhoff.com/IE3102

	4-channel analog input, 0/4…20 mA, M12, 16 bit	4-channel analog input, PT100 (RTD), M12	4-channel analog input, thermocouple, M12
	IP3112-Bxxx **IE3112**	**IP3202-Bxxx** **IE3202**	**IP3312-Bxxx** **IE3312**
	M12, screw type	M12, screw type	M12, screw type
	0/4…20 mA	PT100, resistance	thermocouple, mV
	16 bit	0.1 °C per digit	0.1 °C per digit
	250 ms, configurable to 5 ms	approx. 250 ms (configurable up to 65 ms)	approx. 250 ms (configurable up to 70 ms)
	4	4	4
			
	The IP3112/IE3112 analog input module handles signals in the range from 0/4 to 20 mA. The input current is digitised to a resolution of 16 bits (the default is 15 bits), and is transmitted, electrically isolated, to the higher-level automation device. The four input channels have differential inputs and possess a common, internal ground potential. The applied load voltage (which can be any value up to 30 V DC) is fed through to supply the sensor.	The IP3202/IE3202 analog input module allows resistance sensors to be connected directly. The module's circuitry can operate the sensors using 2-, 3- or 4-wire connection techniques. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. The module can also be used for simple resistance measurement with the output in ohms. The module's standard settings are: resolution 0.1°C in the temperature range of PT100 sensors in 4-wire connection.	The IP3312/IE3312 analog input module permits four thermocouples to be directly connected. The module's circuit can operate thermocouple sensors using the 2-wire technique. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. Compensation for the cold junction is made through a temperature measurement in the connecting plugs. This means that standard extension leads can be connected. The IE3312 can also be used for mV measurement. Accessories: – ZS2000-3712: connector with temperature compensation
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	< ±0.3 % (relative to full scale value)	< ±1 °C	< ±0.5 % (relative to full scale value)
	2-, 3-, 4-wire	PT100, PT200, PT500, PT1000, Ni100, Ni120, Ni1000 resistance measurement (e.g. potentiometer)	types J, K, L, B, E, N, R, S, T, U (default setting type K), mV measurement
	0…20 mA, 4…20 mA, user scale	-200…+850 °C (PT sensors); -60…+250 °C (Ni sensors)	depending on sensor type; preset value is type K, -100…+1,370 °C
	80 Ω measuring shunt	–	–
	from load supply voltage U_P, DC, any value up to 30 V	–	–
	IP3112-Bxxx: see documentation IE3112: 55 mA	IP3202-Bxxx: see documentation IE3202: 40 mA	IP3312-Bxxx: see documentation IE3312: 40 mA
	CE, UL	CE, UL	CE, UL
	www.beckhoff.com/IP3112 www.beckhoff.com/IE3112	www.beckhoff.com/IP3202 www.beckhoff.com/IE3202	www.beckhoff.com/IP3312 www.beckhoff.com/IE3312

Analog output | 0/4…20 mA, -10…+10 V

	4-channel analog output, 0/4…20 mA, M12, 15/16 bit	4-channel analog output, -10…+10 V, M12, 16 bit
Compact Box **Extension Box**	**IP4112-Bxxx** **IE4112**	**IP4132-Bxxx** **IE4132**
Connection technology	M12, screw type	M12, screw type
Signal type	0/4…20 mA	-10/0…+10 V
Resolution	15 bit, configurable to 16 bit	16 bit
Conversion time	< 4 ms	< 4 ms
Number of outputs	4	4
		
	The IP4112/IE4112 analog output module generates analog output signals in the range from 0/4 to 20 mA. The power is supplied to the process level with a resolution of 15 bits (default), and is electrically isolated. If the input is transmitted without an arithmetical sign, 16 bit resolution may also be selected. If necessary, the output scaling can be altered. Ground potential for the four output channels is common with the 24 V DC supply. The analog actuators are powered by the load voltage. The applied load voltage (which can be any value up to 30 V DC) is fed through to supply the actuators.	The IP4132/IE4132 analog output module generates analog output signals in the range from -10 to +10 V. The voltage is supplied to the process level with a resolution of 16 bits, and is electrically isolated. If necessary, the output scaling can be altered. Ground potential for the four output channels is common with the 24 V DC supply. The analog actuators are powered by the control voltage. The applied load voltage (which can be any value up to 30 V DC) is available for supply of the actuators.
Nominal voltage	24 V DC	24 V DC
Load	< 500 Ω	> 5 kΩ
Measuring accuracy	< ±0.1 % (relative to full scale value)	< ±0.1 % (relative to full scale value)
Actuator supply	from the auxiliary voltage U_P	from the auxiliary voltage U_P
Current consumption from U_S (without sensor current)	IP4112-Bxxx: see documentation IE4112: 40 mA	IP4132-Bxxx: see documentation IE4132: 40 mA
Approvals	CE, UL	CE, UL
Further information	www.beckhoff.com/IP4112 www.beckhoff.com/IE4112	www.beckhoff.com/IP4132 www.beckhoff.com/IE4132

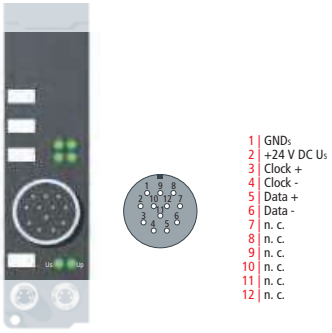

RUN I/O ERR
IF-L
0
1
2
3
4
5
6
7
Us
Up
24 V
IE1001-0000
BECKHOFF

Position measurement | **SSI encoder, incremental encoder**

The IP5009/IE5009 SSI encoder interface is used for the direct connection of an SSI encoder that is powered via the SSI interface. The interface circuit generates a pulse for reading the sensor, and makes the incoming data stream available to the controller as a data word in the process image. Various operating modes, transmission frequencies and bit widths can be permanently stored in a control register.

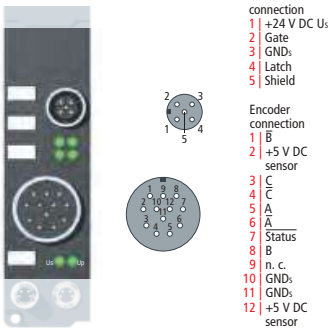
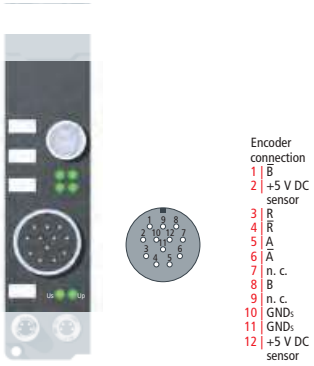
The IP5109/IE5109 Fieldbus Box processes differential signals according to the RS422/RS485 standard. This method of transmission is particularly resistant to interference and is suitable for high transmission frequencies. The incremental encoder interface uses a quadrature decoder. Gate and latch inputs enable pre-processing in the module in order to be able to transfer positional values to the controller exactly upon an external event and thus support the referencing of a drive.

	1-channel SSI encoder interface, M23
Compact Box **Extension Box**	**IP5009-Bxxx** **IE5009**
Connection technology	M23 connector with outer thread, 12-pin
Nominal voltage	24 V DC (-15 %/+20 %)
Number of channels	1



The IP5009/IE5009 SSI interface module allows an SSI encoder to be connected directly. The encoder is powered via the SSI interface. The interface circuit generates a pulse for reading the encoder and makes the incoming data stream available to the controller as a data word in the process image. The module can optionally provide the data as binary numbers or as a binary gray code. Adaptation for the direction of rotation can be configured. Various operating modes, transmission frequencies and bit widths can be permanently stored in a control register.

Signal input	difference signal (RS485)
Encoder supply	24 V DC, from load voltage
Data transfer rates	variable up to 1 MHz, 250 kHz default
Counter	–
Limit frequency	–
Resolution	32 bit counter value
Commands	–
Sensor supply	derived from control voltage, max. 0.5 A total, short-circuit-proof
Current consumption from U_s (without sensor current)	IP5009-Bxxx: see documentation IE5009: 55 mA
Approvals	CE, UL
Further information	www.beckhoff.com/IP5009 www.beckhoff.com/IE5009

	1-channel incremental encoder interface, 1 MHz, M23	1-channel SinCos encoder interface, M23	
	IP5109-Bxxx **IE5109**	**IP5209-Bxxx**	**IP5209-Bxxx-1000**
	encoder/sensor: M23 connector with outer thread, 12-pin, gate/latch: M12, screw type	M23 connector with outer thread, 12-pin	
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	
	1	1	
	 Gate/Latch connection 1 | +24 V DC U_S 2 | Gate 3 | GND_S 4 | Latch 5 | Shield Encoder connection 1 | $\overline{B}$ 2 | +5 V DC sensor 3 | C 4 | $\overline{C}$ 5 | A 6 | $\overline{A}$ 7 | Status 8 | B 9 | n. c. 10 | GND_S 11 | GND_S 12 | +5 V DC sensor		
	The IP5109/IE5109 module is an interface for the direct connection of incremental encoders with differential inputs (RS485) or with single inputs. A 16 bit counter with a quadrature decoder and a 16 bit latch for the zero pulse can be read, set or enabled. The inputs can optionally be used as complementary or as single inputs. Incremental encoders with alarm outputs can be connected at the interface's status input. Interval measurement with a resolution of 200 ns is possible. The gate input allows the counter to be halted (high = stop). The value is read with a rising edge at the latch input.	 Encoder connection 1 | $\overline{B}$ 2 | +5 V DC sensor 3 | R 4 | $\overline{R}$ 5 | A 6 | $\overline{A}$ 7 | n. c. 8 | B 9 | n. c. 10 | GND_S 11 | GND_S 12 | +5 V DC sensor The SinCos module IP5209-Bxxx serves as interface for the direct connection of a measuring sensor, for example a measuring probe with sinusoidal voltage output 1 V_{SS} to the higher-level fieldbus. In contrast to the standard version, instead of a voltage input the special IP5209-Bxxx-1000 version has a current input for 11 μA_{SS} measuring probes. The measuring signal is processed, interpolated and made available as a 32 bit value. The signal period resolution is 10 bits, i.e. 1,024 steps. The reference mark is also stored in a 32 bit value. The current count and the reference mark value can be read. The limit frequency for the measuring signal inputs is 100 kHz.	
	difference signal (RS485)	1 V_{SS}	11 μA_{SS}
	+5 V DC	+5 V DC	
	–	–	
	16 bit, binary	–	
	1 MHz (with 4-fold evaluation)	100 kHz (scanning of the input signals with 500 kHz)	
	16 bit binary value	10 bit, 1,024 steps per period	
	read, set, enable	set count, evaluate reference mark latch, change of direction, frequency control	
	derived from control voltage, max. 0.5 A total, short-circuit-proof	5 V DC from control voltage, max. 0.5 A	
	IP5109-Bxxx: see documentation IE5109: 55 mA	130 mA	
	CE, UL	CE, UL	
	www.beckhoff.com/IP5109 www.beckhoff.com/IE5109	www.beckhoff.com/IP5209	

Communication | **Serial interfaces**

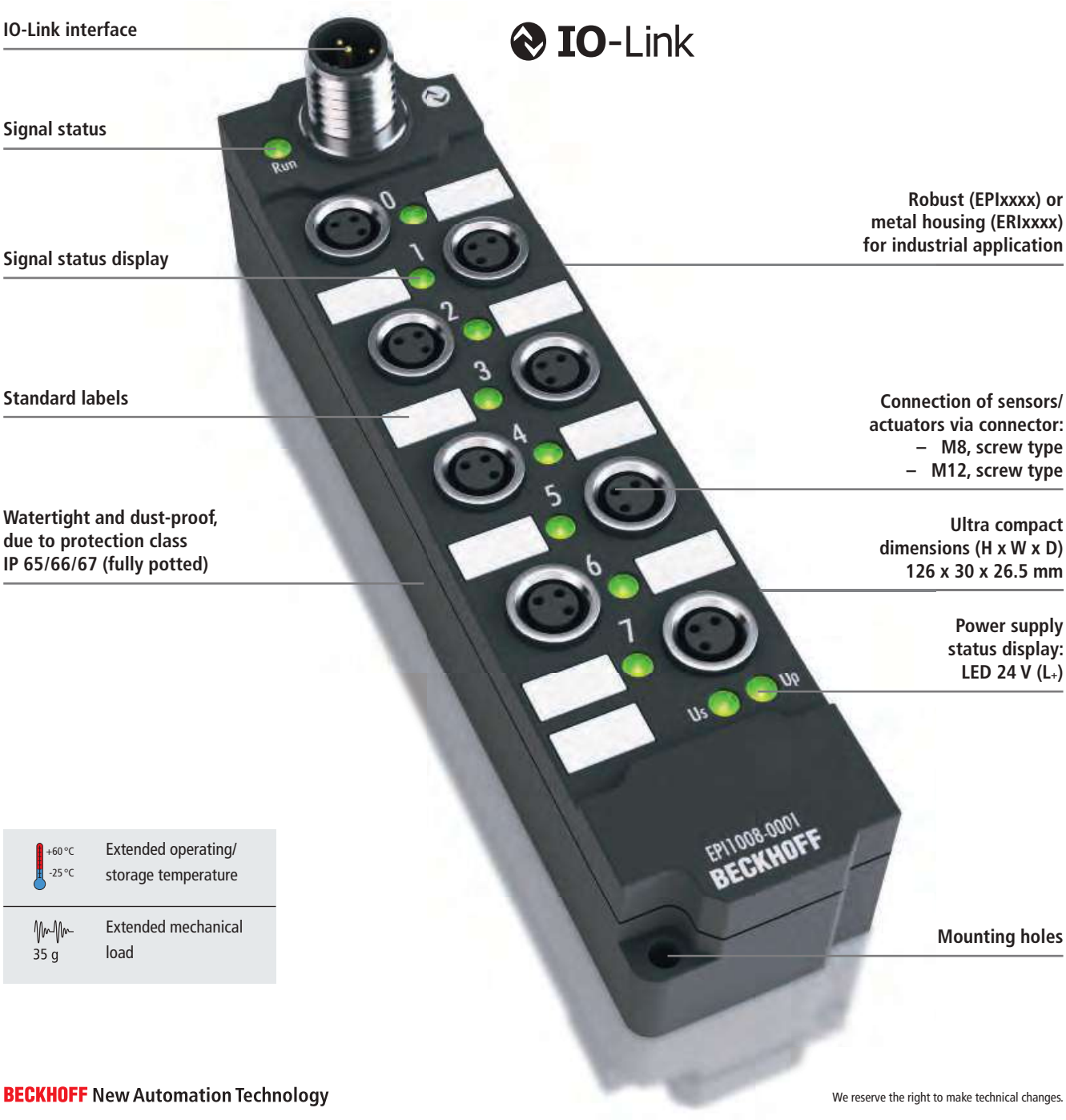
The IP60x2/IE60x2 serial interfaces enable the connection of devices with RS232 or RS422/RS485 interfaces to the control level. The active communication channel operates independently of the higher-level bus system in full duplex mode at up to 115.2 kbaud. This way, any desired number of serial interfaces can be used in the application without having to consider structural restrictions in the control device. The serial interface can be positioned close to the place of use, this way reducing the necessary cable lengths.

The RS232 interface enables high resistance to interference by means of electrically isolated signals, which in the case of the IP6022/IE6022 module is additionally supported by differential signal transmission according to RS422.

	1-channel serial interface, RS232, M12
Compact Box **Extension Box**	**IP6002-Bxxx** **IE6002**
Connection technology	M12, screw type
Data transfer rates	1,200…115,200 baud, 9,600 baud (8 bits, no parity, 1 stop bit) is preset
Data transfer channels	2 (1/1), TxD and RxD, full duplex
	 The IP6002/IE6002 serial interface module allows the connection of devices with an RS232 interface, which operates in conformity with the CCITT V.28/DIN 66 259-1 standards. The module transmits the data in a fully transparent manner to the higher-level automation device. The data is transferred via the fieldbus using a simple handshake protocol. This does not have any effect on the protocol of the serial interface. The RS232 interface guarantees high immunity to interference through electrically isolated signals.
Nominal voltage	24 V DC (-15 %/+20 %)
Bit transfer	RS232 (EIA-232)
Specification	“0”: -18…+3 V; “1”: 3…18 V
Cable length	max. 15 m
Data buffer	128 bytes receive buffer, 16 bytes transmit buffer
Bit width in the process image	input/output: 3 x 8 bit user data, 1 x 8 bit control/status (up to 5 x 8 bit user data are possible)
Current consumption from U_S (without sensor current)	IP6002-Bxxx: see documentation IE6002: 40 mA
Approvals	CE, UL
Further information	www.beckhoff.com/IP6002 www.beckhoff.com/IE6002

	1-channel serial interface TTY, 20 mA current loop, M12	1-channel serial interface, RS422/RS485, M12
	IP6012-Bxxx **IE6012**	**IP6022-Bxxx** **IE6022**
	M12, screw type	M12, screw type
	1,200…115,200 baud, 9,600 baud (8 bits, no parity, 1 stop bit) is preset	1,200…115,200 baud, 9,600 baud (8 bits, no parity, 1 stop bit) is preset
	2 (1/1), TxD and RxD	TxD and RxD, full/half duplex
		
	The IP6012/IE6012 serial interface module allows the connection of devices with a 20 mA current interface. The interface operates passively. The module transmits the data in a fully transparent manner to the higher-level automation device. The data is transferred via the fieldbus using a simple handshake protocol. This does not have any effect on the protocol of the serial interface. The current interface guarantees high immunity to interference through electrically isolated signals with injected current.	The IP6022/IE6022 serial interface module allows the connection of devices with a RS422 or RS485 interface. The module transmits the data in a fully transparent manner to the higher-level automation device. The data is transferred via the fieldbus using a simple handshake protocol. This does not have any effect on the protocol of the serial interface. The transmission of differential signals according to RS232 guarantees high immunity to interference through electrically isolated signals.
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	2 x 20 mA	RS422/RS485
	load: < 500 Ω	line impedance: 120 Ω
	max. 1,000 m twisted pair	max. 500 m twisted pair
	128 bytes receive buffer, 16 bytes transmit buffer	128 bytes receive buffer, 16 bytes transmit buffer
	input/output: 3 x 8 bit user data, 1 x 8 bit control/status (up to 5 x 8 bit user data are possible)	input/output: 3 x 8 bit user data, 1 x 8 bit control/status (up to 5 x 8 bit user data are possible)
	IP6012-Bxxx: see documentation IE6012: 40 mA	IP6022-Bxxx: see documentation IE6022: 40 mA
	CE, UL	CE, UL
	www.beckhoff.com/IP6012 www.beckhoff.com/IE6012	www.beckhoff.com/IP6022 www.beckhoff.com/IE6022

EPIxxxx, ERIxxxx | IO-Link box



+60 °C
-25 °C
Extended operating/ storage temperature

35 g
Extended mechanical load

Industrial housing (EPIxxxx)

Zinc die-cast housing (ERIxxxx)

I/O connections

Connector M8, screw type, 3-pin

Connector M12, screw type, 5-pin

Since 2013, the IO-Link communication system has been available worldwide as an international standard according to IEC 61131-9 and is thus the first globally standardised technology for communication with sensors and actuators below the fieldbus level. Based on this standard Beckhoff offers a new, extensive range of IO-Link box modules with IP 67 protection for the implementation of inexpensive point-to-point connections directly in the field.

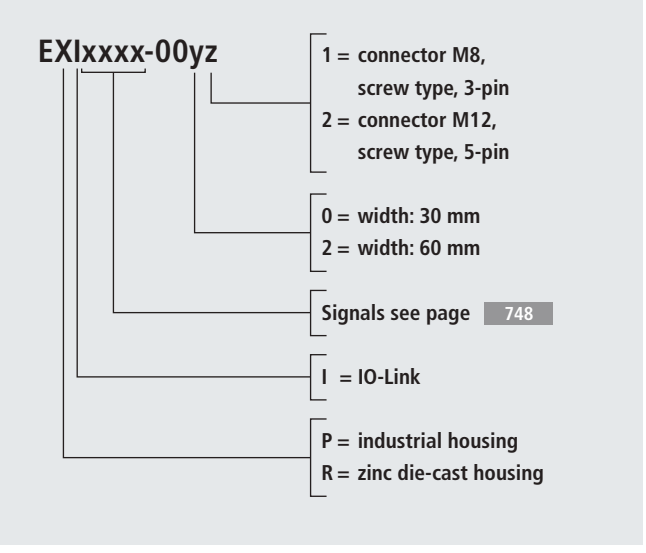
The EPIxxxx and ERIxxxx IO-Link box modules enable the connection of binary and complex sensors and actuators in the field. The connection between the modules and the respective IO-Link master is made via an M12 connecting line (port class A). In case of modules with increased power consumption, an additional voltage infeed is possible (port class B). Economical wiring is possible through the use of unshielded industrial cables. The modules are designed according to IO-Link specification V1.1; the range of the point-to-point connection is 20 m in accordance with the specification. All connected IO-Link devices can be identified, diagnosed and if necessary simply replaced without parameterisation having to be carried out again.

With their compact and space-saving design the IO-Link box modules are suitable for the most diverse applications. The IO-Link connections are integrated both in the proven plastic housings (EPI) and in the die-cast zinc housings (ERI) for additional protection in extremely harsh environments. Binary sensors can be connected to 8- or 16-channel modules with an M8 or M12 screw connection. The universal digital I/O modules with 8 or 16 freely usable input/output channels are particularly flexible in use. Analog signals can be acquired and output with the 4-channel analog input box or combi box with two analog inputs and two analog outputs. In combination with a V1.1 master this allows the sensor parameters to be saved in the master and reloaded.

Beckhoff offers IO-Link masters in IP 20 and IP 67 execution:

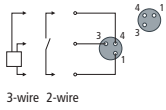
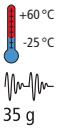
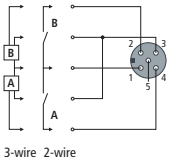
- EL6224 EtherCAT Terminal (IP 20)
- EP6224 EtherCAT Box (IP 67)
- KL6224 Bus Terminal (IP 20)

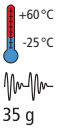
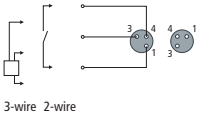
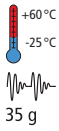
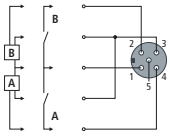
The IO-Link configuration tool is directly integrated into the TwinCAT software system. Apart from the programming of the control system, cyclic data from various fieldbuses are collected in process images in TwinCAT, including data from the IO-Link devices, and thus no separate configuration tool is required. With TwinCAT, higher-level fieldbuses such as EtherCAT can be conveniently connected to the sensor/actuator level and simply configured via one software platform. Moreover, the scan function of the IO-Link devices facilitates their integration.
In connection with the import of the device description file IODD (IO Device Description), parameters and diagnostic data can be accessed directly via the configuration tool. With the aid of the TwinCAT software system, IO-Link parameters and diagnostic data can also be accessed simply and conveniently from a user program.



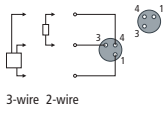
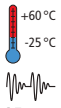
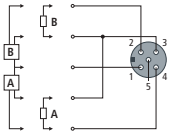
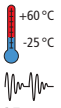
▶ **www.beckhoff.com/IO-Link-box**

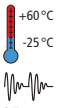
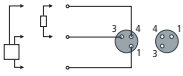
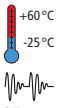
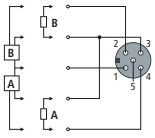
Digital input | 24 V DC, positive switching

	8-channel digital input, 24 V DC, M8, positive switching	8-channel digital input, 24 V DC, M12, positive switching
Industrial housing **Zinc die-cast housing**	**EPI1008-0001** **ERI1008-0001**	**EPI1008-0002** **ERI1008-0002**
Connection technology	M8, screw type	M12, screw type
Specification version	IO-Link V1.1, Class A	IO-Link V1.1, Class A
Input filter	3.0 ms (default), adjustable 0…20 ms	3.0 ms (default), adjustable 0…20 ms
Number of inputs	8	8
	 	  
	The EPI1008/ERI1008 IO-Link box with digital inputs acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the controller. The state of the signals is indicated by light emitting diodes. The signals are connected via M8 screw type connectors.	The EPI1008/ERI1008 IO-Link box with digital inputs acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the controller. The state of the signals is indicated by light emitting diodes. The signals are connected via M12 screw type connectors.
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Data transfer rates	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
Interfaces	1 x M12 plug, a-coded	1 x M12 plug, a-coded
Sensor supply	max. 0.5 A total, U_{S1} (derived from L_+), short-circuit-proof	max. 0.5 A total, U_{S1} (derived from L_+), short-circuit-proof
Current consumption	typ. 100 mA from L_+	typ. 100 mA from L_+
Electrical isolation	control voltage/communication: yes	control voltage/communication: yes
Operating temperature	-25…+60 °C	-25…+60 °C
Approvals	CE	CE
Protection class	IP 65/66/67 (according to EN 60529)	IP 65/66/67 (according to EN 60529)
Further information	www.beckhoff.com/EPI1008 www.beckhoff.com/ERI1008	www.beckhoff.com/EPI1008 www.beckhoff.com/ERI1008

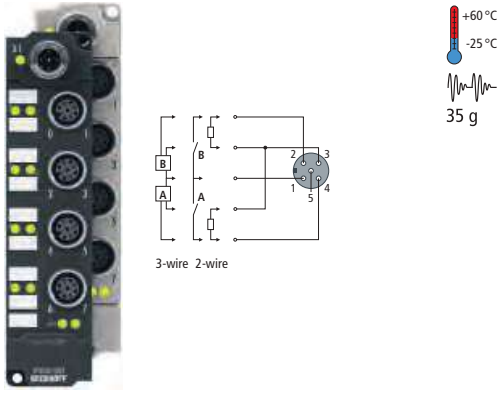
	16-channel digital input, 24 V DC, M8, positive switching	16-channel digital input, 24 V DC, M12, positive switching
	EPI1809-0021 **ERI1809-0021**	**EPI1809-0022** **ERI1809-0022**
	M8, screw type	M12, screw type
	IO-Link V1.1, Class A	IO-Link V1.1, Class A
	3.0 ms (default), adjustable 0…20 ms	3.0 ms (default), adjustable 0…20 ms
	16	16
	  35 g  3-wire 2-wire The EPI1809/ERI1809 IO-Link box with digital inputs acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the controller. The state of the signals is indicated by light emitting diodes. The signals are connected via M8 screw type connectors.	  35 g  3-wire 2-wire The EPI1809/ERI1809 IO-Link box with digital inputs acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the controller. The state of the signals is indicated by light emitting diodes. The signals are connected via M12 screw type connectors.
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
	1 x M12 plug, a-coded	1 x M12 plug, a-coded
	max. 0.5 A total, U_{S1} (derived from L_+), short-circuit-proof	max. 0.5 A total, U_{S1} (derived from L_+), short-circuit-proof
	typ. 100 mA from L_+	typ. 100 mA from L_+
	control voltage/communication: yes	control voltage/communication: yes
	-25…+60 °C	-25…+60 °C
	CE	CE
	IP 65/66/67 (according to EN 60529)	IP 65/66/67 (according to EN 60529)
	www.beckhoff.com/EPI1809 www.beckhoff.com/ERI1809	www.beckhoff.com/EPI1809 www.beckhoff.com/ERI1809

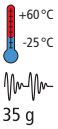
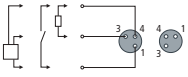
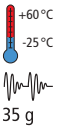
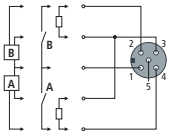
Digital output | 24 V DC, positive switching

	8-channel digital output, 24 V DC, M8, I_{MAX} = 0.5 A	8-channel digital output, 24 V DC, M12, I_{MAX} = 0.5 A
Industrial housing **Zinc die-cast housing**	**EPI2008-0001** **ERI2008-0001**	**EPI2008-0002** **ERI2008-0002**
Connection technology	M8, screw type	M12, screw type
Specification version	IO-Link V1.1, Class B	IO-Link V1.1, Class B
Load type	ohmic, inductive, lamp load	ohmic, inductive, lamp load
Max. output current	0.5 A per channel, individually short-circuit-proof	0.5 A per channel, individually short-circuit-proof
Number of outputs	8	8
	  3-wire 2-wire  +60 °C -25 °C 35 g	  3-wire 2-wire  +60 °C -25 °C 35 g
	The EPI2008/ERI2008 IO-Link box with digital outputs connects the binary control signals from the controller on to the actuators at the process level. The eight outputs handle load currents of up to 0.5 A each. The signals are optionally connected via M8 screw type connectors. All outputs are short-circuit-proof and protected against inverse connection.	The EPI2008/ERI2008 IO-Link box with digital outputs connects the binary control signals from the controller on to the actuators at the process level. The eight outputs handle load currents of up to 0.5 A each. The signals are optionally connected via M12 screw type connectors. All outputs are short-circuit-proof and protected against inverse connection.
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Data transfer rates	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
Short circuit current	typ. 1.5 A	typ. 1.5 A
Current consumption	typ. 100 mA from L_+	typ. 100 mA from L_+
Auxiliary power current	typ. 20 mA + load	typ. 20 mA + load
Interfaces	1 x M12 plug, a-coded	1 x M12 plug, a-coded
Electrical isolation	control voltage/communication: yes	control voltage/communication: yes
Operating temperature	-25…+60 °C	-25…+60 °C
Approvals	CE	CE
Further information	www.beckhoff.com/EPI2008 www.beckhoff.com/ERI2008	www.beckhoff.com/EPI2008 www.beckhoff.com/ERI2008

	16-channel digital output, 24 V DC, M8, I_{MAX} = 0.5 A (∑ 4 A)	16-channel digital output, 24 V DC, M12, I_{MAX} = 0.5 A (∑ 4 A)
	EPI2809-0021 **ERI2809-0021**	**EPI2809-0022** **ERI2809-0022**
	M8, screw type	M12, screw type
	IO-Link V1.1, Class B	IO-Link V1.1, Class B
	ohmic, inductive, lamp load	ohmic, inductive, lamp load
	0.5 A each channel, individually short-circuit-proof, total current max. 4 A	0.5 A each channel, individually short-circuit-proof, total current max. 4 A
	16	16
	  35 g  3-wire 2-wire	  35 g  3-wire 2-wire
	The EPI2809/ERI2809 IO-Link box with digital outputs connects the binary control signals from the controller on to the actuators at the process level. The 16 outputs handle load currents of up to 0.5 A each, although the total current is limited to 4 A. This makes these modules particularly suitable for applications in which not all of the outputs are active at the same time, or in which not all of the actuators draw 0.5 A current. The signals are optionally connected via M8 screw type connectors. All outputs are short-circuit-proof and protected against inverse connection.	The EPI2809/ERI2809 IO-Link box with digital outputs connects the binary control signals from the controller on to the actuators at the process level. The 16 outputs handle load currents of up to 0.5 A each, although the total current is limited to 4 A. This makes these modules particularly suitable for applications in which not all of the outputs are active at the same time, or in which not all of the actuators draw 0.5 A current. The signals are optionally connected via M12 screw type connectors. All outputs are short-circuit-proof and protected against inverse connection.
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
	typ. 1.5 A	typ. 1.5 A
	typ. 100 mA from L_+	typ. 100 mA from L_+
	typ. 20 mA + load	typ. 20 mA + load
	1 x M12 plug, a-coded	1 x M12 plug, a-coded
	control voltage/communication: yes	control voltage/communication: yes
	-25…+60 °C	-25…+60 °C
	CE	CE
	www.beckhoff.com/EPI2809 www.beckhoff.com/ERI2809	www.beckhoff.com/EPI2809 www.beckhoff.com/ERI2809

Digital combi | 24 V DC, positive switching

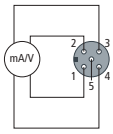
	8-channel digital input or output, 24 V DC, M8, I_{MAX} = 0.5 A	8-channel digital input or output, 24 V DC, M12, I_{MAX} = 0.5 A
Industrial housing **Zinc die-cast housing**	**EPI2338-0001** **ERI2338-0001**	**EPI2338-0002** **ERI2338-0002**
Connection technology	M8, screw type	M12, screw type
Specification version	IO-Link V1.1, Class B	IO-Link V1.1, Class B
Input filter	3.0 ms (default), adjustable 0…20 ms	3.0 ms (default), adjustable 0…20 ms
Number of channels	8 digital inputs or outputs	8 digital inputs or outputs
		
	The EPI2338/ERI2338 IO-Link box has eight digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.	The EPI2338/ERI2338 IO-Link box has eight digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image. The outputs handle load currents of up to 0.5 A, are short-circuit-proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Data transfer rates	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
Max. output current	0.5 A per channel, individually short-circuit-proof	0.5 A per channel, individually short-circuit-proof
Load type	ohmic, inductive, lamp load	ohmic, inductive, lamp load
Sensor supply	from load supply voltage, max. 0.5 A total, short-circuit-proof	from load supply voltage, max. 0.5 A total, short-circuit-proof
Short circuit current	max. 1.5 A	max. 1.5 A
Interfaces	1 x M12 plug, a-coded	1 x M12 plug, a-coded
Auxiliary power current	typ. 20 mA + load	typ. 20 mA + load
Current consumption	typ. 100 mA from L_+	typ. 100 mA from L_+
Electrical isolation	control voltage/communication: yes	control voltage/communication: yes
Operating temperature	-25…+60 °C	-25…+60 °C
Approvals	CE	CE
Further information	www.beckhoff.com/EPI2338 www.beckhoff.com/ERI2338	www.beckhoff.com/EPI2338 www.beckhoff.com/ERI2338

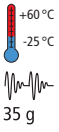
	16-channel digital input or output, 24 V DC, M8, I_{MAX} = 0.5 A (∑ 4 A)	16-channel digital input or output, 24 V DC, M12, I_{MAX} = 0.5 A (∑ 4 A)
	EPI2339-0021 **ERI2339-0021**	**EPI2339-0022** **ERI2339-0022**
	M8, screw type	M12, screw type
	IO-Link V1.1, Class B	IO-Link V1.1, Class B
	3.0 ms (default), adjustable 0…20 ms	3.0 ms (default), adjustable 0…20 ms
	16 digital inputs or outputs	16 digital inputs or outputs
	  35 g  3-wire 2-wire	  35 g  3-wire 2-wire
	The EPI2339/ERI2339 IO-Link box has 16 digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image. The outputs handle load currents of up to 0.5 A (the total current is limited to 4 A). They are short-circuit-proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.	The EPI2339/ERI2339 IO-Link box has 16 digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image. The outputs handle load currents of up to 0.5 A (the total current is limited to 4 A). They are short-circuit-proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
	0.5 A per channel, individually short-circuit-proof, total current max. 4 A	0.5 A per channel, individually short-circuit-proof, total current max. 4 A
	ohmic, inductive, lamp load	ohmic, inductive, lamp load
	from load supply voltage, max. 0.5 A total, short-circuit-proof	from load supply voltage, max. 0.5 A total, short-circuit-proof
	max. 1.5 A	max. 1.5 A
	1 x M12 plug, a-coded	1 x M12 plug, a-coded
	typ. 20 mA + load	typ. 20 mA + load
	typ. 100 mA from L_+	typ. 100 mA from L_+
	control voltage/communication: yes	control voltage/communication: yes
	-25…+60 °C	-25…+60 °C
	CE	CE
	www.beckhoff.com/EPI2339 www.beckhoff.com/ERI2339	www.beckhoff.com/EPI2339 www.beckhoff.com/ERI2339

Analog input | -10…+10 V, 0/4…20 mA

The EPI3174 and ERI3174 IO-Link box modules evaluate analog standard signals within the range of -10/0 V to +10 V or 0/4 mA to 20 mA with 16-bit resolution. The signal form is separately configurable for each channel. The EPI3174/ERI3174 evaluates the difference between the two input signals Input+ and Input-. These must be referred to the ground potential of the load voltage U_P. The DC component does not affect the measurement, as long as it is in the common mode range.

	4-channel analog input, -10/0…+10 V or 0/4…20 mA, parameterisable, 16 bit
Industrial housing	**EPI3174-0002**
Zinc die-cast housing	**ERI3174-0002**
Connection technology	M12, screw type
Specification version	IO-Link V1.1, Class B
Signal type	-10/0…+10 V | 0/4…20 mA
Resolution	16 bit (incl. sign)
Conversion time	~ 100 µs
Number of inputs	4





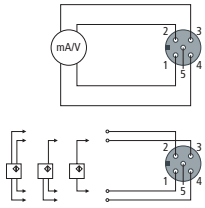
The IO-Link box EPI3174/ERI3174 has four analog inputs which can be individually parameterised, so that they process signals either in the -10…+10 V or the 0/4…20 mA range. The voltage or input current is digitised with a resolution of 16 bits, and is transmitted (electrically isolated) to the higher-level automation device. The four input channels have a common, internal ground potential. The input filter/conversion times are configurable in a wide range.

Measuring error	< ±0.3 % (relative to full scale value)
Data transfer rates	230.4 kbaud (COM 3)
Internal resistance	> 200 kΩ | 85 Ω typ. + diode voltage
Sensor supply	from additional power supply $2L_+$, DC, freely selectable up to 30 V
Current consumption	typ. 100 mA from L_+
Interfaces	1 x M12 plug, a-coded
Special features	current or voltage parameterisable (0/4…20 mA, -10/0…10 V)
Operating temperature	-25…+60 °C
Approvals	CE
Further information	www.beckhoff.com/EPI3174 www.beckhoff.com/ERI3174

Analog output | -10…+10 V, 0/4…20 mA

The EPI4374 and ERI4374 IO-Link box modules acquire/output analog standard signals within the range of -10/0 V to +10 V or 0/4 mA to 20 mA with 16-bit resolution. The type of signal is separately configurable for each channel. The output signals U_S, U_P and the fieldbus are electrically isolated from one another and have a common ground potential (Output-).

	2-channel analog input + 2-channel analog output, -10/0…+10 V or 0/4…20 mA, parameterisable, 16 bit
Industrial housing	**EPI4374-0002**
Zinc die-cast housing	**ERI4374-0002**
Connection technology	M12, screw type
Specification version	IO-Link V1.1, Class B
Signal type	-10/0…+10 V | 0/4…20 mA
Resolution	16 bit (incl. sign)
Conversion time	input: ~ 100 µs, output: ~ 40 µs
Number of outputs	2
Number of inputs	2



The EPI4374/ERI4374 IO-Link box combines two analog inputs and two analog outputs which can be individually parameterised, so that they process/generate signals either in the -10…+10 V or the 0/4…20 mA range. The resolution for the current and voltage signals is 16 bit (signed).

The voltage or output current is supplied to the process level with a resolution of 15 bit (default), and is electrically isolated. Ground potential for the two output channels is common with the 24 V DC supply.

Measuring error	< 0.1 % (relative to full scale value)
Data transfer rates	230.4 kbaud (COM 3)
Load	> 5 kΩ | < 500 Ω
Internal resistance	input: > 200 kΩ | 85 Ω typ. + diode voltage
Sensor supply	from load supply voltage U_P, DC, any value up to 30 V
Current consumption	typ. 100 mA from L_+
Interfaces	1 x M12 plug, a-coded
Special features	combi module, current or voltage parameterisable per channel
Operating temperature	-25…+60 °C
Approvals	CE
Further information	www.beckhoff.com/EPI4374 www.beckhoff.com/ERI4374

Accessories Fieldbus Box

Power cables, sensor cables, connection cables and further accessories

see the EtherCAT Box chapter from page 514

Pre-assembled cables
Accessories for fieldbus components include a wide range of cable assemblies. For clarity, the order numbers are listed without cable length information in the following tables. For detailed ordering information referencing the cable length please see the web pages or the price list.

For technical data sheets see ▶ www.beckhoff.com/datasheets

Accessories PROFIBUS, Modbus, RS232, RS485

Pre-assembled cables for flexible applications

Material characteristics		Pict.
ZK1031-6xxx-1xxx	PUR, 2-wire, (2 x 0.25 mm²), shielded, drag-chain suitable, purple	A

Electrical data	
Ratings	160 V (according to IEC 61076-2-101)
Material	outer cladding PUR, inner insulation polyethylene
Installation	drag-chain suitable
DC resistance	54.13 Ω/km
Line capacitance	28.5 nF/km
Nominal impedance	150 Ω at 1 MHz
Approval	UL style 119100 vol. 1 sec. 8, RoHS-compliant, halogen-free, flame-resistant

Ordering information	Cable, pre-assembled with M12 socket (5-pin/straight) to	Pict.
ZK1031-6200-1xxx	open end	B
ZK1031-6251-1xxx	M12 plug (4-pin/straight)	C

Ordering information	Cable, pre-assembled with M12 socket (5-pin/angled) to	Pict.
ZK1031-6400-1xxx	open end	D
ZK1031-6451-1xxx	M12 plug (4-pin/straight), reverse-keyed	E

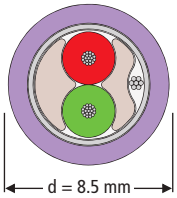
Ordering information	Cable, pre-assembled with M12 plug (5-pin/straight) to	Pict.
ZK1031-6100-1xxx	open end	F

Ordering information	Cable, pre-assembled with M12 plug (5-pin/angled) to	Pict.
ZK1031-6300-1xxx	open end	G
ZK1031-6354-1xxx	M12 plug (5-pin/angled)	H

Accessories

Ordering information		Pict.
ZS1031-2600	tee-connector, 12 Mbaud (blue ID ring)	I
ZS1031-2610	tee-connector, 12 Mbaud for the direct connection to the other tee-connectors (yellow ID ring)	J
ZS1000-2600	Y-connector, 12 Mbaud (plug, socket)	
ZS1000-1610	termination resistor (plug)	K
ZS1000-0610	plug for field assembly	L
ZS1000-0620	socket for field assembly	M
ZS1000-0630	plug for field assembly, angled	N
ZS1000-0640	socket for field assembly, angled	O
ZS1031-6610	control cabinet feed through M12, plug-coupling	P
ZB3200	PROFIBUS cable 12 Mbaud 1 x 2 x 0.64 mm²	
ZB3300	PROFIBUS cable 12 Mbaud 1 x 2 x 0.64 mm², 5-wires, drag-chain suitable	

A



Sectional view

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Illustrations similar

Accessories CANopen, DeviceNet

Pre-assembled cables for fixed installation

Material characteristics		Pict.
ZK1052-6xxx-3xxx	PVC, 4-wire, (4 x 0.32 mm²), shielded, fixed installation, grey	Q

Electrical data	
Ratings	300 V, 80 °C
Material	outer cladding PVC, inner insulation polyethylene
Supply cable	black, red
Data lead	blue, white
DC resistance	54.13 Ω/km
Line capacitance	37.17 pF/m
Nominal impedance	126 Ω at 1 MHz
Approval	UL approval, AWM 2476, 80 °C, 300 V; CSA AWM I/II A/B, 80 °C, 300 V, FT1

Ordering information	Cable, pre-assembled with M12 socket (5-pin/straight) to	Pict.
ZK1052-6200-3xxx	open end	R

Ordering information	Cable, pre-assembled with M12 socket (5-pin/angled) to	Pict.
ZK1052-6400-3xxx	open end	S

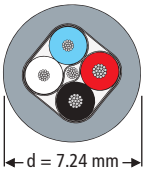
Ordering information	Cable, pre-assembled with M12 plug (5-pin/straight) to	Pict.
ZK1052-6100-3xxx	open end	T
ZK1052-6152-3xxx	M12 socket (5-pin/straight)	U
ZK1052-6154-3xxx	M12 socket (5-pin/angled)	V

Ordering information	Cable, pre-assembled with M12 plug (5-pin/angled) to	Pict.
ZK1052-6300-3xxx	open end	W
ZK1052-6354-3xxx	M12 socket (5-pin/angled)	X

Accessories

Ordering information		Pict.
ZS1052-2600	Y-connector (plug, socket)	
ZS1052-2602	Y-connector with stub, 1 m (plug, socket)	
ZS1052-1610	termination resistor (plug, 120 Ω pin 4–5)	Y
ZS1052-0620	straight socket, screw type connection	
ZS1052-0640	angled socket, screw type connection	
ZS1052-0610	straight plug, screw type connection	
ZS1052-0630	angled plug, screw type connection	
ZS1052-6610	control cabinet lead-in M12, plug-coupling	Z
ZS5052-4500	distribution box: 1 x 5-pin plug, 4 x 5-pin socket	a

Q



Sectional view

R

S

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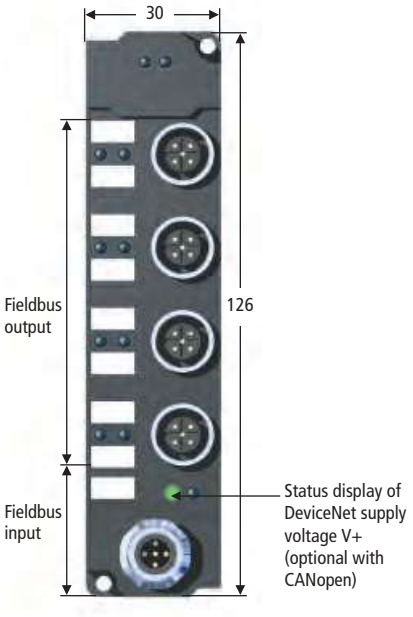
X

Y

Z

Illustrations similar

a



Distribution box

Technical data	
Fieldbus	CANopen or DeviceNet
Bus plug	M12 plug, 5-pin, screwed
Data transfer rates	up to 1 Mbaud (CANopen) or 500 kbaud (DeviceNet)
Protection class	IP 67
Temperature range	0…+55 °C

The following stub lines are not to be exceeded:

Baud rates	Max. stub length (multidrop)	Max. bus length with multidrop technology (without stubs)
1,000 kbaud	0.3 m	25 m
500 kBaud	1.2 m	60 m
250 kBaud	2.4 m	120 m
125 kBaud	4.8 m	310 m

Accessories IP-Link

Cordsets

Ordering information	
ZK1020-0101-0xxx	pre-assembled IP-Link cable, drag-chain suitable
Z1101	plastic fibre optic, single core, 1,000 µm with protective PU cladding and Kevlar strain relief, drag-chain suitable
Z1103	plastic fibre optics, 1,000 µm, PUR sheat ø 6 mm, heavy duty, drag-chain suitable

Accessories

Ordering information	Plug	Pict.
ZS1020-0010	plug, unit pack 1	b
ZS1021-0010	plug, unit pack 10	b
ZS1022-0010	IP-Link plug, unit pack 10, clip type	c
ZK1020-0101-1000	IP-Link jumper	d

Ordering information	IP-Link accessories
ZS5300-0003	mounting plate for Coupler Box, zinc-coated steel sheet, 270 mm
ZS5400-0001	sanding gauge for IP-Link connector
ZS5400-0010	abrasive paper P600, 10 sheets
ZS1022-0000	locking device IP-Link, stainless steel

b

c

d

Illustrations similar

KS2000

Configuration software KS2000

The KS2000 can be used for parametering modules, local diagnostics, forcing data, monitorig values, updating firmware and programming Beckhoff mini PLCs via TwinCAT. The connection between the fieldbus components and the PC is established via the serial or USB connection cable provided, or via the network and TCP/IP. The KS2000 configuration software for Windows NT/2000/XP/Vista or Windows 7 operating systems has a friendly user interface, making work comfortable and convenient.

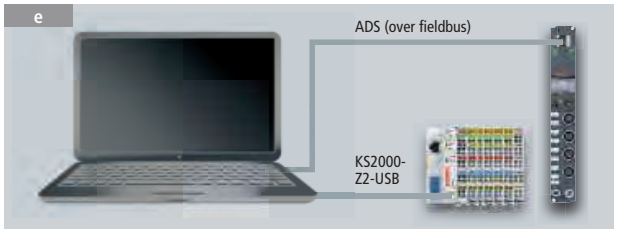
Ordering information		Pict.
KS2000	configuration software for project design, commissioning and parameterisation of Beckhoff Fieldbus Box modules and Bus Terminals	e

USB cable for KS2000

The KS2000 cable connects the Fieldbus Box modules with the PC. The USB cable features electrical isolation. Status LEDs indicate whether data are sent or received. On the connected PC the USB cable behaves like a COM port and can therefore be used for all Beckhoff tools using serial communication.

Ordering information		Pict.
KS2000-Z3-USB	connection cable for KS2000 or TwinCAT for serial conversion from USB for Fieldbus Box, length 3 m	f

e



f

Housing type A

Housing type B

FM33xx-B110 | **Thermocouple Fieldbus Modules with EtherCAT interface**

EtherCAT®

The FM33xx-B110 fieldbus modules allow 12 or 32 thermocouples to be connected to a module. The connecting circuitry for these multiple thermocouples is housed in a compact, splash-proof housing and has an EtherCAT IN and an EtherCAT OUT interface. The modules are supplied with power via separate M8 connections and are "daisy-chain"-capable on both the power supply and EtherCAT sides, i.e. several modules can be wired in series in a line topology.

The module's circuit can operate thermocouple sensors using a 2-wire connection. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. The error LEDs indicate a broken wire. Compensation for the cold junction is made through a temperature measurement in the connecting plugs. This means that standard extension leads can be connected. The Fieldbus Modules have back-voltage protection circuitry to protect against external voltages applied to the thermocouple inputs. Voltages of up to 230 V AC are withstood without damage to the module. Those thermocouple inputs that are not affected remain functionally operative or are only affected for a short time.

The extended parameterisation is carried out via EtherCAT. The parameters are stored in the module. The status of the Fieldbus Module is indicated via LEDs.

The different versions of the FM33xx Fieldbus Module differ in terms of the number of available thermocouple input channels (12 or 32 channels) and the housing type (clip-on housing A or add-on housing B). The add-on housing (type B) features two locking latches and a continuous rubber seal to provide an IP 65 connection to the socket element. In addition, housing type B features two cast brackets with holes for attaching the FM module to mounting plates (through-hole mounting).

Ordering information	FM33xx-B110
FM3312-B110-0010	Fieldbus Module, thermocouple, 12-channel, type J, EtherCAT IN/OUT interface, housing type A
FM3312-B110-1010	Fieldbus Module, thermocouple, 12-channel, type J, EtherCAT IN/OUT interface, housing type B
FM3332-B110-0010	Fieldbus Module, thermocouple, 32-channel, type J, EtherCAT IN/OUT interface, housing type A
FM3332-B110-1010	Fieldbus Module, thermocouple, 32-channel, type J, EtherCAT IN/OUT interface, housing type B

Technical data	FM3312-B110	FM3332-B110
Fieldbus	EtherCAT	
Data transfer rates	100 Mbaud	
Configuration possibility	via the controller	
Fieldbus connection method	2 x M12 socket, 4-pin (d-coded)	
Thermocouple channels	12	32
Thermocouple connections	industrial plug-in connection (Han24E, Han64D), 2-wire connection	
Cable length	max. 100 m	
Sensor types	type J, mV measurement (other types on request)	
Measuring range	type J: -10…+900 °C	
Resolution	0.1 °C per digit	
Conversion time	approx. 250 ms	
Measuring accuracy	< ±0.5 % (of the full scale value)	
Input filter	5 variations, configurable	
Power supply	24 V DC (-15 %/+20 %), feed: 1 x M8 plug, 4-pin; downstream connection: 1 x M8 socket, 4-pin	
Current consumption	typ. 120 mA/max. 150 mA	typ. 150 mA/max. 180 mA
Bit width in the process image	input: 1 x 16 bit data, 2 x 8 bit status (per channel), 1 bit WcState, 10 bytes InfoData	
Electrical isolation	channels/control voltage: 500 V, between the channels: no, control voltage/fieldbus: 500 V (EtherCAT)	
Housing type A	industrial plug-in connector, Han24B	
Housing type B	add-on housing AGG + locking bracket	
Housing pin insert	Han24E	Han64D
Contacts	hard gold plated	
Dimensions (L x W x H)	type A: 120 mm x 52 mm x 129 mm, type B: 150 mm x 52 mm x 129 mm	
Weight	type A: 950 g, type B: 1,030 g	
Operating/storage temperature	0…+55 °C/-25…+85 °C	
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27	
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4	
Protect. class/installation pos.	housing to IP 65 (EtherCAT connector: IP 67)/variable	
Further information	www.beckhoff.com/FM3312-B110	

Accessories

Ordering information	Accessories	
ZK1090-6xxx-xxxx	accessories EtherCAT/Ethernet M12	515
ZK2020-3xxx-xxxx	power cables	517

Housing type A

Housing type B

FM33xx-B310 | Thermocouple Fieldbus Modules with PROFIBUS interface

The FM33xx-B310 Fieldbus Modules allow 12 or 32 thermocouples to be connected to a module. The connecting circuitry for these multiple thermocouples is housed in a compact, splash-proof housing and has a PROFIBUS DP interface with a transmission rate of 12 Mbaud. Data are mainly exchanged cyclically, although acyclic services ("DP-V1") are also available for parameterisation and diagnosis.

The module's circuit can operate thermocouple sensors using a 2-wire connection. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. The error LEDs indicate a broken wire. Compensation for the cold junction is made through a temperature measurement in the connecting plugs. This means that standard extension leads can be connected. The Fieldbus Modules have back-voltage protection circuitry to protect against external voltages applied to the thermocouple inputs. Voltages of up to 230 V AC are withstood without damage to the module. Those thermocouple inputs that are not affected remain functionally operative or are only affected for a short time.

The extended parameterisation may be carried out either via the fieldbus or, using the KS2000 software tool, through the configuration interface. The parameters are stored in the module. The status of the Fieldbus Module is indicated via LEDs.

The different versions of the FM33xx-B310 Fieldbus Module differ in terms of the number of available thermocouple input channels (12 or 32 channels), the type of thermocouple that is implemented (type J or K), and the housing type (clip-on housing A or add-on housing B). The add-on housing (type B) features two locking latches and a continuous rubber seal to provide an IP 65 connection to the socket element. In addition, housing type B features two cast brackets with holes for attaching the FM module to mounting plates (through-hole mounting).

Ordering information	FM33xx-B310
FM3312-B310-0000	Fieldbus Module, thermocouple, 12-channel, type K, PROFIBUS interface, housing type A
FM3312-B310-0010	Fieldbus Module, thermocouple, 12-channel, type J, PROFIBUS interface, housing type A
FM3312-B310-1000	Fieldbus Module, thermocouple, 12-channel, type K, PROFIBUS interface, housing type B
FM3312-B310-1010	Fieldbus Module, thermocouple, 12-channel, type J, PROFIBUS interface, housing type B
FM3332-B310-0000	Fieldbus Module, thermocouple, 32-channel, type K, PROFIBUS interface, housing type A
FM3332-B310-0010	Fieldbus Module, thermocouple, 32-channel, type J, PROFIBUS interface, housing type A
FM3332-B310-1000	Fieldbus Module, thermocouple, 32-channel, type K, PROFIBUS interface, housing type B
FM3332-B310-1010	Fieldbus Module, thermocouple, 32-channel, type J, PROFIBUS interface, housing type B

Technical data	FM3312-B310	FM3332-B310
Fieldbus	PROFIBUS DP	
Data transfer rates	max. 12 Mbaud	
Configuration possibility	via KS2000 or the controller	
Fieldbus connection method	DIN 45322, 6-pin, screwed	
Thermocouple channels	12	32
Thermocouple connections	industrial plug-in connection (Han24E, Han64D), 2-wire connection	
Cable length	max. 10 m	
Sensor types	type J, K, mV measurement	
Temperature range	type J: -10…+900 °C; type K: -100…+1,370 °C	
Resolution	0.1 °C per digit	
Conversion time	approx. 250 ms	
Measuring error	< ±0.5 % (of the full scale value)	
Input filter	5 variations, configurable	
Power supply	24 V DC (-15 %/+20 %)	
Current consumption	typ. 90 mA/max. 120 mA	typ. 100 mA/max. 130 mA
Bit width in the process image	input: 4 x 16 bit data, optional: 4 x 8 bit control/status	
Electrical isolation	channels/control voltage: 500 V_{rms}, between the channels: no, control voltage/fieldbus: 100 V_{rms} (PROFIBUS)	
Housing type A	industrial plug-in connector, Han24B	
Housing type B	add-on housing AGG + locking bracket	
Housing pin insert	Han24E	Han64D
Contacts	hard gold plated	
Dimensions (L x W x H)	type A: 120 mm x 52 mm x 129 mm, type B: 150 mm x 52 mm x 129 mm	
Weight	type A: 950 g, type B: 1030 g	
Operating/storage temperature	0…+55 °C/-25…+85 °C	
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27	
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4	
Protect. class/installation pos.	housing to IP 65 (PROFIBUS connector: IP 67)/variable	
Further information	www.beckhoff.com/FM3312-B310	

Accessories

Ordering information	Accessories
ZS3100-0831	angled PROFIBUS plug, DIN 45322, 6-pin
ZS3100-0841	angled PROFIBUS socket, DIN 45322, 6-pin
ZS3100-1810	straight PROFIBUS plug terminating resistor, 6-pin
ZB3300	PROFIBUS cable 12 Mbaud 1 x 2 x 0.64 mm², 5-wires, drag-chain suitable
KS2000	configuration software for extended parameterisation 761


BECKHOFF
CU2008
Lnk
Act
X1
X2
X3
X4
X5
X6
X7
X8
100
Power
PE
X0
24V DC
NEC CLASS 2

Infrastructure Components

PC Fieldbus Cards, Switches, Media Converters

Infrastructure Components

PC Fieldbus Cards, Switches, Media Converters

Infrastructure Components

PCI/PCIe Fieldbus Cards
Beckhoff rounds off its range of fieldbus components with the PCI-based PC Fieldbus Cards for Lightbus, PROFIBUS, CANopen, DeviceNet, SERCOS interface, Ethernet and the PCI Express v1.1 cards for PROFIBUS, CANopen and Ethernet. The cards were specifically developed for fast controllers and real-time tasks such as drive position control. To enable universal application, the interface cards are fitted with either one or two fieldbus channels. The Ethernet cards offer a maximum of four channels. The fieldbus cards can optionally be equipped with non-volatile memory (NOVRAM), hence enabling the failsafe storage of data. Features:

- fast data exchange through short cycle times (e.g. EtherCAT: down to 12.5 µs)
- process data communication can either be free running, synchronised, synchronised with a delay, or equidistant
- powerful parameter and diagnostics interfaces
- freely configurable bus management for every device

Mini PCI Fieldbus Cards
The Mini PCI cards for PROFIBUS, CANopen, DeviceNet, SERCOS interface and Ethernet complement the PC fieldbus card range. Just like the standard PCI cards from Beckhoff, the interfaces are specifically optimised for fast controllers with compact size and real-time tasks. The bus interface is not implemented on the fieldbus card, but separately in the respective Industrial PC housing (device-specific).

Switches
The Ethernet switches in industrial design forward incoming Ethernet frames to the target ports and prevent collisions in full duplex mode. They can be used universally in automation and office networks. User-friendly installation via integrated DIN rail adapter.

Infrastructure Components
The real-time Ethernet port multiplier allows the connection of eight independent Ethernet networks.

The EtherCAT junction serves as 8-way network access junction for configuring star topologies.

The EtherCAT media converters (optical fibre to copper and vice versa) meet the requirements for a highly deterministic EtherCAT network. They are useful in applications where EtherCAT is to be transmitted over long distances or where increased electromagnetic interference is to be expected. The EtherCAT media converters can also be used for other Industrial Ethernet protocols.

FC2001, FC2002 | Lightbus PCI interface cards

LIGHTBUS

The PCI Fieldbus Cards from Beckhoff are characterised by outstanding features. They are tailor-made for TwinCAT, the software solution for PC-compatible control technology. The power of TwinCAT comes into its own with this interface generation:

- Cycle times up to 100 µs are possible.
- Process data communication can either be free running or synchronised.
- It is possible to select two parallel fieldbus channels on one card.
- powerful parameter and diagnostics interfaces (ADS)

TwinCAT I/O provides configuration tools and Windows NT/2000/XP/Vista or Windows 7 drivers for programs in any desired high-level language (DLLs) and for Visual Basic applications (ActiveX). Applications with OPC interface can access the cards via an OPC server.

Technical data	FC2001	FC2002
Fieldbus	Lightbus	
Number of fieldbus channels	1	2
Data transfer rates	2.5 Mbaud, 32 bits of process data in 25 µs	
Interface to the PC	plug-and-play PCI interface 32 bit with 4 kbyte DPRAM for 8 communication channels, data, control and status register	
Bus interface	2 x standard fibre optic connector Z1000 (plastic fibre), Z1010 (HCS fibre)	4 x standard fibre optic connector Z1000 (plastic fibre), Z1010 (HCS fibre)
Communication	8 priority controlled logical communication channels	
Bus device	max. 254 nodes with a max. of 65,280 I/O points per fieldbus connection	
Interrupt	initiation of 2 PC hardware interrupts is possible	
Hardware diagnosis	3 LEDs per channel	
Dimensions	approx. 106 mm x 187 mm	
Operating temperature	0…55 °C	
Further information	www.beckhoff.com/FC2001	www.beckhoff.com/FC2002

Ordering information	FC2001-0000	FC2002-0000
FC200x-0000	standard configuration	

Accessories		
TwinCAT I/O	I/O driver	947
Cordsets	cordsets and connectors	688

FC3101, FC3102 | **PCI PROFIBUS**
FC3151 | **Mini PCI PROFIBUS**

PROFIBUS DP, DP-V1 and DP-V2 (MC): the PROFIBUS PCI Fieldbus Cards from Beckhoff can master the PROFIBUS protocol with all its features. Thanks to the PROFIBUS chip developed in-house, the cards are equipped with the latest version of the PROFIBUS technology.

The FC3151 Mini PCI Card brings fieldbus functionalities to the Industrial PC in a compact construction. The bus interface is not implemented on the fieldbus card, but separately in the respective housing (device-specific).

Technical data	FC3101	FC3102	FC3151
Fieldbus	PROFIBUS DP (standard), PROFIBUS DP-V1 (Cl. 1+2: acyclic services, alarms), DP-V2, PROFIBUS MC (equidistant)		
Number of fieldbus channels	1	2	1
Data transfer rates	9.6 kbaud…12 Mbaud		
Interface to the PC	plug-and-play PCI interface 32 bit with 4 kbyte DPRAM per channel	plug-and-play PCI interface 32 bit with 4 kbyte DPRAM per channel	Mini PCI interface 32 bit with 4 kbyte DPRAM per channel
Bus interface	1 x D-sub socket, 9-pin, galvanically decoupled	2 x D-sub socket, 9-pin, galvanically decoupled	1 x D-sub socket, 9-pin, galvanically decoupled
Communication	master and slave functionality (also mixed)		
Bus device	per channel: max. 125 slaves with up to 244 bytes input, output, parameter, configuration or diagnostic data per slave		max. 125 slaves
Cycle time	differing DP cycle times per slave are possible using the CDL concept		
Hardware diagnosis	2 LEDs per channel		
Bit width in the process image	total max.: 3 kbyte input and output data		
Dimensions	approx. 106 mm x 175 mm	approx. 106 mm x 175 mm	59.75 mm x 50.95 mm (type III A)
Driver	TwinCAT I/O and higher levels		
Further information	www.beckhoff.com/FC3101	www.beckhoff.com/FC3102	www.beckhoff.com/FC3151

Ordering information	FC3101-000x	FC3102-000x	FC3151-000x
FC31xx-0000	standard configuration		
FC31xx-0002	configuration with 32 kbytes NOVRAM	configuration with 32 kbytes NOVRAM	configuration with 128 kbytes NOVRAM

FC3151-000x can only be ordered with a Beckhoff Industrial PC with Mini PCI option.

Accessories		
TwinCAT I/O	I/O driver	947
Cordsets	cordsets and connectors	688

FC3121, FC3122 | **PCIe PROFIBUS**

PROFIBUS DP and DP-V1: the PROFIBUS PCIe (PCI Express) Fieldbus Cards from Beckhoff can master the following PROFIBUS features:

- master, slave and PROFIBUS monitor up to 12 Mbit/s
- powerful parameter and diagnostics interfaces
- The error management for each bus user is freely configurable.
- It is possible to read the bus configuration and automatically assign the "GSE" files.

In TwinCAT, all functions are conveniently available. Other applications also benefit from the diverse features: general drivers for Windows NT/2000/XP/Vista or Windows 7 and convenient configuration tools are included in the TwinCAT I/O software package. High-level language programs use the DLL, Visual Basic applications the ActiveX interface. Applications with OPC interface can access process data and parameters via an OPC server.

The PCIe fieldbus cards offer the possibility of optionally adding a NOVRAM card (FC600x). The fieldbus cards automatically recognise the connection of these memory cards, which can also be plugged into the card later. The FC600x cards offer simple data backup on the NOVRAM memory and are available from 128 to 512 KB.

Technical data	FC3121	FC3122
Fieldbus	PROFIBUS DP (standard), PROFIBUS DP-V1	
Number of fieldbus channels	1	2
Data transfer rates	9.6 kbaud…12 Mbaud	
Bus interface	1 x D-sub socket, 9-pin, galvanically decoupled	2 x D-sub socket, 9-pin, galvanically decoupled
Communication	master and slave functionality	
Bus device	per channel: max. 125 slaves with up to 244 bytes input, output, parameter, configuration or diagnostic data per slave	
Bit width in the process image	total max.: 30.5 kbyte input and output data	
Dimensions	approx. 100 mm x 130 mm	
Operating temperature	0…+55 °C	
Driver	TwinCAT 2.11 R3 and higher	
Further information	www.beckhoff.com/FC3121	www.beckhoff.com/FC3122

FC5101, FC5102 | **PCI CANopen**
FC5151 | **Mini PCI CANopen**

CANopen

The FC510x PC plug-in cards link the PC to a CANopen network. They optionally act as network master or slave. In addition, general CAN messages can be sent or received – without having to bother with CAN frames in the application program. The cards provide a powerful implementation of the protocol.

The FC5151 Mini PCI Card brings fieldbus functionalities to the Industrial PC in a compact construction. The bus interface is not implemented on the fieldbus card, but separately in the respective housing (device-specific).

Technical data	FC5101	FC5102	FC5151
Fieldbus	CANopen		
Number of fieldbus channels	1	2	1
Data transfer rates	10, 20, 50, 100, 125, 250, 500, 800, 1,000 kbaud		
Interface to the PC	plug-and-play PCI interface 32 bit with 4 kbyte DPRAM per channel	plug-and-play PCI interface 32 bit with 4 kbyte DPRAM per channel	Mini PCI interface 32 bit with 4 kbyte DPRAM per channel
Bus interface	D-sub connector, 9-pin according to CANopen specification, galvanically decoupled		
Communication	CANopen network master and CANopen manager, optionally CANopen slave		
Bus device	per channel: max. 127 slaves	per channel: max. 127 slaves	max. 127 slaves
Termination resistor	switchable		
Hardware diagnosis	2 LEDs per channel		
Bit width in the process image	total max.: 3 kbyte input and output data		
Dimensions	approx. 106 mm x 175 mm	approx. 106 mm x 175 mm	59.75 mm x 50.95 mm (type III A)
Operating temperature	0…+55 °C		
Driver	TwinCAT I/O and higher levels		
Further information	www.beckhoff.com/FC5101	www.beckhoff.com/FC5102	www.beckhoff.com/FC5151

Ordering information	FC5101-000x	FC5102-000x	FC5151-000x
FC51xx-0000	standard configuration		
FC51xx-0002	configuration with 32 kbytes NOVRAM	configuration with 32 kbytes NOVRAM	configuration with 128 kbytes NOVRAM

FC5151-000x can only be ordered with a Beckhoff Industrial PC with Mini PCI option.

Accessories		
TwinCAT I/O	I/O driver	947
Cordsets	cordsets and connectors	688

FC5121, FC5122 | **PCIe CANopen**

CANopen

The FC512x PC plug-in cards link the PC (PCI Express) to a CANopen network. They optionally act as network master or slave. In addition, general CAN messages can be sent or received – without having to bother with CAN frames in the application program. The cards provide a powerful implementation of the protocol, offering many desirable features:

- All CANopen PDO communication types are supported: event driven, time driven (using an event timer), synchronous, polling.
- individual monitoring of the process data objects
- synchronisation with the PC controller's task cycle
- SDO parameter communication at start-up and runtime
- emergency message handling
- Guarding and Heartbeat
- boot-up according to DS302
- powerful parameter and diagnostics interfaces
- The error management for each bus user is freely configurable.
- It is possible to read the bus configuration and the node parameters.
- online bus load display

In TwinCAT, all functions are conveniently available.

The PCIe fieldbus cards offer the possibility of optionally adding a NOVRAM card (FC600x). The fieldbus cards automatically recognise the connection of these memory cards, which can also be plugged into the card later. The FC600x cards offer simple data backup on the NOVRAM memory and are available from 128 to 512 KB.

Technical data	FC5121	FC5122
Fieldbus	CANopen	
Number of fieldbus channels	1	2
Data transfer rates	10, 20, 50, 100, 125, 250, 500, 800, 1,000 kbaud	
Bus interface	1 x D-sub socket, 9-pin, galvanically decoupled	2 x D-sub socket, 9-pin, galvanically decoupled
Communication	CANopen network master and CANopen manager	
Bus device	per channel: max. 127 slaves	
Termination resistor	switchable	
Bit width in the process image	total max.: 4 kbyte input and output data	
Dimensions	approx. 100 mm x 130 mm	
Operating temperature	0…+55 °C	
Driver	TwinCAT 2.11 R3 and higher	
Further information	www.beckhoff.com/FC5121	www.beckhoff.com/FC5122

FC5201, FC5202 | **PCI DeviceNet**
FC5251 | **Mini PCI DeviceNet**

DeviceNet™

The FC520x PC plug-in cards link the PC to a DeviceNet network. They can act there as master or as slave modules. The PCI bus interface ensures both high transmission rates to the PC and fully automatic configuration of the cards in the PC hardware.

The FC5251 Mini PCI Card brings fieldbus functionalities to the Industrial PC in a compact construction. The bus interface is not implemented on the fieldbus card, but separately in the respective housing (device-specific).

Technical data	FC5201	FC5202	FC5251
Fieldbus	DeviceNet		
Number of fieldbus channels	1	2	1
Data transfer rates	125, 250, 500 kbaud		
Interface to the PC	plug-and-play PCI interface 32 bit with 4 kbyte DPRAM per channel	plug-and-play PCI interface 32 bit with 4 kbyte DPRAM per channel	Mini PCI interface 32 bit with 4 kbyte DPRAM per channel
Bus interface	open style connector, 5-pin, according to DeviceNet specification, galvanically decoupled (Connector is supplied.)		
Communication	DeviceNet network master (scanner), optionally DeviceNet slave		
Bus device	per channel: max. 63 slaves	per channel: max. 63 slaves	max. 63 slaves
Termination resistor	switchable		
Hardware diagnosis	2 LEDs per channel		
Bit width in the process image	total max.: 3 kbyte input and output data		
Dimensions	approx. 106 mm x 175 mm	approx. 106 mm x 175 mm	59.75 mm x 50.95 mm (type III A)
Operating temperature	0…+55 °C		
Driver	TwinCAT I/O and higher levels		
Further information	www.beckhoff.com/FC5201	www.beckhoff.com/FC5202	www.beckhoff.com/FC5251

Ordering information	FC5201-000x	FC5202-000x	FC5251-000x
FC52xx-0000	standard configuration		
FC52xx-0002	configuration with 32 kbytes NOVRAM	configuration with 32 kbytes NOVRAM	configuration with 128 kbytes NOVRAM

FC5251-000x can only be ordered with a Beckhoff Industrial PC with Mini PCI option.

Accessories		
TwinCAT I/O	I/O driver	947
Cordsets	cordsets and connectors	688

FC7501, FC7502 | **PCI SERCOS interface**
FC7551 | **Mini PCI SERCOS interface**

sercos
the automation bus

The SERCOS interface PCI Fieldbus Cards from Beckhoff allow direct access to the SERCON816-ASIC. The driver for these passive cards is incorporated into the TwinCAT software and allows optimum access to the SERCOS interface. There are no artificial limitations with regard to the number of bus devices and I/O data per device.

The FC7551 Mini PCI Cards brings fieldbus functionalities to the Industrial PC in a compact construction. The bus interface is not implemented on the fieldbus card, but separately in the respective housing (device-specific).

Technical data	FC7501	FC7502	FC7551
Fieldbus	SERCOS interface		
Number of fieldbus channels	1	2	1
Data transfer rates	2, 4, 8, 16 Mbaud		
Interface to the PC	plug-and-play PCI interface 32 bit, direct access to DPRAM and SERCON816 register		Mini PCI interface 32 bit with 4 kbyte DPRAM per channel
Bus interface	2 x connector F-SMA according to IEC 874-2	4 x connector F-SMA according to IEC 874-2	4 x connector F-SMA according to IEC 874-2
Communication	SERCON 816 chip		
Synchronisation	synchronisation of several cards via ribbon cable		–
Bus device	≤ 254		
Cycle time	all cycle times supported by SERCOS interface (down to 62.5 µs)		
Hardware diagnosis	1 LED per channel		
Dimensions	approx. 95 mm x 120 mm	approx. 95 mm x 120 mm	59.75 mm x 50.95 mm (type III A)
Driver	TwinCAT I/O and higher levels		
Further information	www.beckhoff.com/FC7501	www.beckhoff.com/FC7502	www.beckhoff.com/FC7551

Ordering information	FC7501-0000	FC7502-0000	FC7551-000x
FC75xx-0000	standard configuration		
FC75xx-0002	–	–	configuration with 128 kbytes NOVRAM

FC7551-000x can only be ordered with a Beckhoff Industrial PC with Mini PCI option.

Accessories		
TwinCAT I/O	I/O driver	947
Cordsets	cordsets and connectors	688

FC9001-0010, FC9011 | **PCI Ethernet**

Ethernet TCP/IP

The Ethernet PCI network cards can be used in office and automation networks and offer the following benefits:

- plug-and-play interface
- 10/100/1,000 Mbit/s (FC9011), 10/100 Mbit/s (FC9001-0010), full duplex
- automatic baud rate setting according to IEEE 802.3u
- maximum performance through hardware-integrated checksum creation and verification
- The hardware side supports Quality of Service (QoS) through prioritised multiple queues.
- Wake on LAN
- Boot from LAN (PXE) (only FC9011)

The cards (or individual channels) can also be operated with TwinCAT drivers – and therefore in real-time.

Technical data	FC9001-0010	FC9011
Fieldbus	all Ethernet (IEEE 802.3) based protocols	
Number of Ethernet channels	1	
Data transfer rates	10/100 Mbit/s, IEEE 802.3u auto-negotiation, full duplex at 10 and 100 Mbit/s	10/100/1,000 Mbit/s, IEEE 802.3ab auto-negotiation, full duplex at 10, 100 and 1,000 Mbit/s
Interface to the PC	plug-and-play PCI interface 32 bit	
Ethernet interface	10BASE-T/100BASE-TX Ethernet	10BASE-T/100BASE-TX/1,000BASE-TX Ethernet
Ethernet plug	1 x RJ45	
Cable length	100 m (up to switch or end device)	
Standard drivers	standard operating system drivers for Intel®-compatible NIC real-time driver or Beckhoff driver for Windows 2000/XP and Windows 7, 32 bit (available from Beckhoff website)	
Real-time drivers	TwinCAT drivers for EtherCAT/real-time Ethernet. Drivers can be selected separately for each channel.	
Hardware diagnosis	2 LEDs per channel (activity, link)	
Dimensions	approx. 51 mm x 120 mm	
Operating temperature	0…+55 °C	
Further information	www.beckhoff.com/FC9001	www.beckhoff.com/FC9011

Ordering information	FC9001-0010	FC9011-0000
FC90xx-00xx	standard configuration	

Accessories		
Cordsets	cordsets and connectors	688

FC9002, FC9004, FC9022, FC9024 | PCI/PCIe Ethernet

Ethernet TCP/IP

The Ethernet PCI network cards can be used in office and automation networks and offer the following benefits:

- plug-and-play interface
- 10/100/1,000 Mbit/s (FC9022, FC9024) or 10/100 Mbit/s (FC9002, FC9004), full duplex
- automatic baud rate setting according to IEEE 802.3u for each channel
- maximum performance through hardware-integrated checksum creation and verification
- The hardware side supports Quality of Service (QoS) through prioritised multiple queues.

The cards (or individual channels) can also be operated with TwinCAT drivers – and therefore in real-time.

Technical data	FC9002	FC9004	FC9022	FC9024
Fieldbus	all Ethernet (IEEE 802.3) based protocols			
Number of Ethernet channels	2	4	2	4
Data transfer rates	10/100 Mbit/s, IEEE 802.3u auto-negotiation, full duplex at 10 and 100 Mbit/s, separate settings for each channel		10/100/1,000 Mbit/s, IEEE 802.3ab auto-negotiation, full duplex at 10, 100 and 1,000 Mbit/s	
Interface to the PC	plug-and-play PCI interface 32 bit	plug-and-play PCI interface 32 bit	PCI Express x1	PCI Express 2.1 x1 (5.0 GT/s)
Ethernet interface	10BASE-T/100BASE-TX Ethernet	10BASE-T/100BASE-TX Ethernet	10BASE-T/100BASE-TX/1,000BASE-T Ethernet	10BASE-T/100BASE-TX/1,000BASE-T Ethernet
Ethernet plug	2 x RJ45	4 x RJ45	2 x RJ45	4 x RJ45
Cable length	100 m (up to hub, switch or end device)	100 m (up to hub, switch or end device)	100 m (up to switch or end device)	100 m (up to hub, switch or end device)
Standard drivers	standard drivers for Intel® 8255xER series or Beckhoff driver for Windows 2000/XP and Windows 7 (available from Beckhoff website)		standard operating system drivers for Intel®-compatible NIC real-time driver or Beckhoff driver for Windows 2000/XP and Windows 7 (available from Beckhoff website)	
Real-time drivers	TwinCAT drivers for EtherCAT/real-time Ethernet. Drivers can be selected separately for each channel.			
Hardware diagnosis	2 LEDs per channel (activity, link)		2 LEDs per channel (activity, link)	
Dimensions	approx. 95 mm x 125 mm	approx. 95 mm x 125 mm	approx. 62 mm x 100 mm	approx. 98 mm x 98 mm
Operating temperature	0…+55 °C			
Further information	www.beckhoff.com/FC9002	www.beckhoff.com/FC9004	www.beckhoff.com/FC9022	www.beckhoff.com/FC9024

Ordering information	FC9002-0000	FC9004-0000	FC9022-0000	FC9024-0000
FC90xx-0000	standard configuration			

Accessories	
Cordsets	cordsets and connectors 688

FC9051, FC9151 | Mini PCI Ethernet

Ethernet TCP/IP

The FC9x51 Mini PCI Card brings further Ethernet ports to the Industrial PC in a compact construction. The bus interface is not implemented on the fieldbus card, but separately in the respective housing (device-specific). The FC9x51 is available for Beckhoff Industrial PCs with Mini PCI option. Like the standard PCI cards, the Mini PCI variants are specifically optimised for fast controllers and real-time tasks:

- automatic baud rate setting according to IEEE 802.3u
- Ethernet and real-time Ethernet protocols, EtherCAT-ready
- full duplex at 10 and 100 Mbit/s

In combination with the Ethernet Mini PCI Cards, a third Ethernet port is available in the Industrial PC with 10 Mbit/s, 100 Mbit/s or 1,000 Mbit/s. While the 100 Mbit/s Ethernet port offers optimum performance for all EtherCAT control tasks, a gigabit port is available for connecting the higher-level network.

The power of the Fieldbus Cards can be most easily seen in combination with the TwinCAT software PLC and NC. But other applications also benefit from the intelligent PCI cards that handle the fieldbus protocol efficiently on their own processors.

Technical data	FC9051	FC9151
Bus system	Ethernet (all IEEE 802.3-based protocols), EtherCAT	
Number of Ethernet channels	1	
Data transfer rates	10/100 Mbit/s, IEEE 802.3u auto-negotiation, full duplex at 10 and 100 Mbit/s, separate settings for each channel	10/100/1,000 Mbit/s, IEEE 802.3u auto-negotiation, full duplex at 10 and 100 Mbit/s, separate settings for each channel
Interface to the PC	Mini PCI interface	
Communication	Ethernet and real-time Ethernet protocols, EtherCAT-ready	
Bus device	Ethernet standard	
Standard drivers	standard operating system drivers for Intel®-compatible NIC real-time driver	
Real-time drivers	TwinCAT drivers for real-time Ethernet. Drivers can be selected separately for each channel.	
Dimensions	59.75 mm x 44.60 mm (type III B)	
Operating temperature	0…+55 °C	
Further information	www.beckhoff.com/FC9051	www.beckhoff.com/FC9151

Ordering information	FC9051-0000	FC9151-0000
FC9x51-0000	standard configuration (can only be ordered with a Beckhoff Industrial PC with Mini PCI option)	

Accessories		
TwinCAT I/O	I/O driver	947

FC1100, FC1121 | PCI/PCIe EtherCAT slave card

EtherCAT

The FC1100 PCI EtherCAT card and the FC1121 PCIe (PCI Express) EtherCAT card can be used to integrate a PC as a slave in an EtherCAT network. The cards have an EtherCAT channel with two ports (IN/OUT). They can therefore also be used for the development of EtherCAT slave software on the PC.

The FC1121 PCIe card can optionally be retrofitted with the FC600x NOVRAM cards in order to backup data on the NOVRAM. Three NOVRAM sizes are available: 128, 256 and 512 KB.

Technical data	FC1100	FC1121
Fieldbus	EtherCAT (direct mode)	
EtherCAT plug	2 x RJ45, EtherCAT IN/OUT	
Data transfer rates	100 Mbit/s	
Interface to the PC	PCI 32 bit	PCIe (PCI Express) interface
EtherCAT Slave Controller	ET1100	
RAM	8 kbyte	
SYNC manager	8	4
FMMUs	8	3
Cable length	up to 100 m	
Hardware diagnosis	2 LEDs per channel (activity, link)	
Dimensions	approx. 65 mm x 125 mm	approx. 100 mm x 130 mm
Operating temperature	0…+55 °C	
Driver	TwinCAT driver for EtherCAT	
Further information	www.beckhoff.com/FC1100	www.beckhoff.com/FC1121

Accessories		
TwinCAT I/O	I/O driver	947
Cordsets	cordsets and connectors	688

CU20xx | **Ethernet Switches**

The Beckhoff Ethernet Switches offer five (CU2005), eight (CU2008) or 16 (CU2016) RJ45 Ethernet ports. Switches relay incoming Ethernet frames to the destination ports. In full duplex mode, they prevent collisions. They can be used universally in automation and office networks. User-friendly installation via integrated DIN rail adapter.

The switches meet the special requirements of real-time-capable Industrial Ethernet solutions through several outstanding features:

- compact design in full metal housing
- half or full duplex, with automatic baud rate detection
- 10/100 Mbits/s Ethernet
- cross-over detection: automatic detection and correction of crossover and straight-through Ethernet cables
- clear, quick diagnosis, two LEDs for each Ethernet port
- fast DIN rail mounting
- industrial design

Technical data	CU2005	CU2008	CU2016
Bus system	all Ethernet (IEEE 802.3)-based protocols, store and forward switching mode, unmanaged	all Ethernet (IEEE 802.3)-based protocols, store and forward switching mode	all Ethernet (IEEE 802.3)-based protocols, store and forward switching mode
Number of Ethernet ports	5	8	16
Ethernet interface	10BASE-T/100BASE-TX Ethernet with 5 x RJ45	10BASE-T/100BASE-TX Ethernet with 8 x RJ45	10BASE-T/100BASE-TX Ethernet with 16 x RJ45
Cable length	up to 100 m twisted pair		
Data transfer rates	IEEE 802.3u auto-negotiation, half or full duplex, automatic settings	10/100 Mbit/s, IEEE 802.3u auto-negotiation, half or full duplex at 10 and 100 Mbit/s possible, automatic settings	10/100 Mbit/s, IEEE 802.3u auto-negotiation, half or full duplex at 10 and 100 Mbit/s possible, automatic settings
Hardware diagnosis	2 LEDs per channel (activity, link)	2 LEDs per channel (activity, link, 10/100 Mbit)	2 LEDs per channel (activity, link, 10/100 Mbit)
Power supply	24 (18…30) V DC, 3-pin connection (+, -, PE)	24 (18…30) V DC, 100 mA, 3-pin connection (+, -, PE)	24 (18…30) V DC, 150 mA, 3-pin connection (+, -, PE)
Weight	approx. 260 g	320 g	400 g
Dimensions (W x H x D)	approx. 73 mm x 100 mm x 30 mm	approx. 85 mm x 100 mm x 30 mm	approx. 146 mm x 100 mm x 30 mm
Operating/storage temperature	0…+55 °C/-25…+85 °C		
Protect. class/installation pos.	IP 20/variable		
Further information	www.beckhoff.com/CU2005	www.beckhoff.com/CU2008	www.beckhoff.com/CU2016

Accessories		
Cordsets	cordsets and connectors	688

CU2208 | 8-port Gbit Ethernet Switch

The Beckhoff Ethernet Switch offers eight RJ45 Gbit Ethernet ports. Switches relay incoming Ethernet frames to the destination ports. In full duplex mode, they prevent collisions. They can be used universally in automation and office networks. User-friendly installation via integrated DIN rail adapter.

The switches meet the special requirements of real-time-capable Industrial Ethernet solutions through several outstanding features:

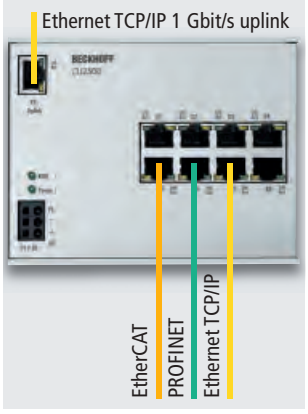
- compact design in full metal housing
- half or full duplex, with automatic baud rate detection
- 10/100/1,000 Mbits/s Ethernet
- cross-over detection: automatic detection and correction of crossover and straight-through Ethernet cables
- clear, quick diagnosis, two LEDs for each Ethernet port
- fast DIN rail mounting
- industrial design

Technical data	CU2208
Bus system	all Ethernet (IEEE 802.3)-based protocols, store and forward switching mode, unmanaged
Number of Ethernet ports	8
Ethernet interface	10BASE-T/100BASE-TX/1,000BASE-T Ethernet
Cable length	up to 100 m twisted pair
Data transfer rates	IEEE 802.3u auto-negotiation, half or full duplex, automatic settings
Hardware diagnosis	2 LEDs per channel (activity, link)
Power supply	24 (18…30) V DC, 3-pin connector (+, -, PE)
Weight	430 g
Dimensions (W x H x D)	approx. 122 mm x 100 mm x 30 mm
Operating/storage temperature	0…+55 °C/-25…+85 °C
Protect. class/installation pos.	IP 20/variable
Further information	www.beckhoff.com/CU2208

Accessories		
Cordsets	cordsets and connectors	688

CU2508 | Real-time Ethernet port multiplier

The real-time Ethernet port multiplier allows the connection of eight independent Ethernet networks. The CU2508 is connected to the PC via a gigabit uplink. The PC offers high-performance data transfer to the multiplier, which allocates the data to the relevant 100BASE-TX port based on an analysis of a frame prefix and sends them time-controlled with µs precision. Received frames are also allocated a prefix including a timestamp and sent to the PC. With the support of a driver, users have eight independent ports with full real-time characteristics available. The CU2508 is used in applications in which several Ethernet ports are required that need to be realised outside the PC. TwinCAT supports the CU2508 and makes further network ports at the PC unnecessary. For extremely high demands, an EtherCAT installation can, for example, be distributed or expanded to up to eight lines in order to multiply the performance. The distributed clocks of the EtherCAT lines are synchronised. An EtherCAT cable redundancy with simultaneous usage of distributed clocks can also be realised using two ports of the CU2508.



Technical data	CU2508
Protocol	Ethernet TCP/IP; real-time protocols: EtherCAT, PROFINET, EtherNet/IP and others (depending on driver)
Number of Ethernet ports	8 x 100 Mbit/s and 1 x 1 Gbit/s (uplink)
Ethernet interface	RJ45
Cable length	up to 100 m twisted pair
Data transfer rates	100BASE-TX and 1 Gbit/s
Hardware diagnosis	LEDs
Power supply	24 (18…30) V DC, 100 mA, 3-pin connection (+, -, PE)
Dimensions (W x H x D)	approx. 146 mm x 100 mm x 30 mm
Operating/storage temperature	0…+55 °C/-25…+85 °C
Protect. class/installation pos.	IP 20/variable
Further information	www.beckhoff.com/CU2508

Accessories		
Cordsets	cordsets and connectors	688

CU1128 | **EtherCAT junction**

Line, tree or star: EtherCAT supports almost any topology. If a star topology requires several branches at a particular point, the 8-way CU1128 EtherCAT junction can be used instead of several EK1122 devices. Port 1 is the input port for the network.

Further EK1100 or EtherCAT Box modules can be connected at ports 2 to 8. The EtherCAT junctions are connected via RJ45 sockets with direct display of link and activity status.

In conjunction with TwinCAT or other suitable EtherCAT masters the CU1128 also supports coupling and uncoupling of EtherCAT strands during operation (Hot Connect). The device cannot be used as a standard Ethernet switch.

Technical data	CU1128
Task within EtherCAT system	coupling of EtherCAT junctions
Data transfer medium	Ethernet/EtherCAT cable (min. CAT 5), shielded
Bus interface	8 x RJ45
Distance between stations	max. 100 m (100BASE-TX)
Protocol	EtherCAT
Delay	approx. 1 µs per port
Data transfer rates	100 Mbaud
Configuration	not required
Power supply	24 (18…30) V DC, 185 mA, 3-pin connection (+, -, PE)
Weight	approx. 430 g
Operating/storage temperature	0…+55 °C/-25…+85 °C
Relative humidity	95 %, no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Protect. class/installation pos.	IP 20/variable
Approvals	CE
Further information	www.beckhoff.com/CU1128

CU15xx | EtherCAT media converters fibre optic

The EtherCAT-capable CU1521, CU1521-0010 and CU1561 for Industrial Fast Ethernet/ 100 Mbaud serve as media converters from optical fibre to copper and vice versa. The CU1521 is suitable for multimode, the CU1521-0010 for singlemode optical fibre and therefore significantly longer transmission links. The CU1561 is suitable for POF (plastic optical fibre) cables, which are particularly easy to install in the field.

The media converters always operate bidirectionally and collision-free with constant delay. They can be diagnosed as a separate EtherCAT devices. In this way, unlike standard media converters, they enable fast link control and the safe closing of the EtherCAT strand even in the event of a fault. Since the transfer direction (copper to optical fibre | optical fibre to copper) is relevant for the bus, the devicse can be configured via a switch. Via this switch "Link Loss Forwarding" for normal Ethernet operation can also be selected. The CU15xx are useful in applications where higher EMC loads on the bus line are to be expected.

Technical data	CU1521-0000	CU1521-0010	CU1561
Task within EtherCAT system	media transition from RJ45 copper physics to multimode fibre optic and back	media transition from RJ45 copper physics to singlemode fibre optic and back	media transition from RJ45 copper physics to POF and back
Data transfer medium	multimode glass fibre 50/125 µm (MM); Ethernet/EtherCAT cable (min. CAT 5), shielded	singlemode glass fibre 9/125 µm (SM); Ethernet/EtherCAT cable (min. CAT 5), shielded	plastic optic fibre 980/1000 µm (POF); Ethernet/EtherCAT cable (min. CAT 5), shielded
Bus interface	1 x SC Duplex; 1 x RJ45		
Distance between stations	max. 2,000 m (100BASE-FX); max. 100 m (100BASE-TX)	max. 20,000 m (100BASE-FX); max. 100 m (100BASE-TX)	max. 50 m (POF); max. 100 m (100BASE-TX)
Protocol	EtherCAT		
Delay	approx. 1 µs		
Data transfer rates	100 Mbaud		
Configuration	per rotary switch		
Power supply	24 (18…30) V DC, 3-pin connector (+, -, PE)		
Current consumption 24 V DC	approx. 100 mA		
Dimensions (W x H x D)	34 mm x 98 mm x 77 mm		
Weight	approx. 120 g		
Operating/storage temperature	0…+55 °C/-25…+85 °C		
Relative humidity	95 %, no condensation		
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27		
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4		
Protect. class/installation pos.	IP 20/variable		
Approvals	CE		
Further information	www.beckhoff.com/CU1521	www.beckhoff.com/CU1521	www.beckhoff.com/CU1561

CU2608 | 8-port Ethernet Switch, IP 67

The CU2608 Ethernet Switch offers eight d-coded M12 Ethernet ports. Switches relay incoming Ethernet frames to the destination ports. In full duplex mode, they prevent collisions. They can be used universally in automation and office networks. Mounting can easily be carried out by the user with two central M4 fixings or alternatively via two offset M3 holes.

The CU2608 meets the special requirements of real-time-capable Industrial Ethernet solutions through several outstanding features:

- compact design in IP 67 plastic housing
- 8 d-coded M12 sockets
- 10/100 Mbaud, half or full duplex, with automatic baud rate detection
- cross-over detection: automatic detection and correction of crossover and straight-through Ethernet cables
- clear, quick diagnosis, 1 LED for each Ethernet port
- easy on-site installation

Technical data	CU2608
Bus system	all Ethernet (IEEE 802.3)-based protocols, store and forward switching mode
Number of Ethernet ports	8
Ethernet interface	10BASE-T/100BASE-TX Ethernet with 8 x M12 socket, d-coded, 4-pin
Cable length	up to 100 m twisted pair
Data transfer rates	10/100 Mbit/s, IEEE 802.3u auto-negotiation, half or full duplex at 10 and 100 Mbit/s possible, automatic settings
Hardware diagnosis	1 LED per channel (activity, link)
Power supply	24 V DC (-15 %/+20 %), feed/downstream connection: M8, 4-pin
Weight	approx. 300 g
Dimensions (W x H x D)	60 mm x 126 mm x 26.5 mm
Operating/storage temperature	-30…+70 °C/-40…+85 °C
Protect. class/installation pos.	IP 65/66/67 (conforms to EN 60529)/variable
Further information	www.beckhoff.com/CU2608

EP9128-0021 | EtherCAT junction, IP 67

Line, tree or star: EtherCAT supports virtually any topologies, which can also be directly branched in the field using the EtherCAT Box modules. If several junctions are required at one point in the star topology, an EtherCAT junction can be used to branch the topology further.

Analogous to the infrastructure components with IP 20 protection, the EP9128-0021 eight-way EtherCAT junction offers the possibility to construct the branches of the topology with the smallest possible number of components in the IP 67 world as well. The EtherCAT network is connected to the input port of the EP9128-0021 and can be extended at ports 2 to 8. EtherCAT topologies can be arranged even more flexibly with the multiple junctions with IP 67 protection, since connection to the IP 20 world is also possible via the ports. The EtherCAT junctions are connected via shielded M8 sockets with direct display of link and activity status. Suitable accessories (cables and connectors) are available.

In conjunction with TwinCAT or other suitable EtherCAT masters the EP9128-0021 also supports coupling and uncoupling of EtherCAT strands during operation (Hot Connect). The device cannot be used as a standard Ethernet switch.

Technical data	EP9128-0021
Connection method	M8, screw type, 4-pin
Nominal voltage	24 V DC (-15 %/+20 %)
Task within EtherCAT system	coupling of EtherCAT junctions
Data transfer medium	Ethernet/EtherCAT cable (min. CAT 5), shielded
Bus interface	8 x M8, shielded, screw type
Distance between stations	max. 100 m (100BASE-TX)
Protocol	EtherCAT
Delay	approx. 1 µs per port
Data transfer rates	100 Mbaud
Configuration	not required
Power supply	24 V DC (-15 %/+20 %)
Current consumption 24 V DC	approx. 150 mA
Dimensions (W x H x D)	60 mm x 126 mm x 26.5 mm
Operating/storage temperature	-25…+60 °C/-40…+85 °C
Protect. class/installation pos.	IP 65/66/67 (conforms to EN 60529)/variable
Approvals	CE, UL
Further information	www.beckhoff.com/EP9128

EP9521-, EP9522-0020 | **EtherCAT media converters fibre optic, IP 67**

The EtherCAT/Industrial Ethernet modules EP9521 and EP9522 for Industrial Fast Ethernet/ 100 Mbaud serve as media converters from optical fibre to copper and vice versa. Both media converters are suitable for multimode fibre-optic cables. In addition to the copper branch, the 2-channel EP9522 enables further optical fibre topologies to be configured via the second optical fibre port, while the single-channel EtherCAT Box EP9521 is used for direct transfers between the two media. The media converters operate bidirectionally and collision-free with constant delay. They can be diagnosed as separate EtherCAT devices. In this way, unlike standard media converters, they enable fast link control and the safe closing of the EtherCAT strand even in the event of a fault. Since the transfer direction (copper to optical fibre | optical fibre to copper) is relevant for the bus, the devices can be configured via a switch. Via this switch "Link Loss Forwarding" for normal Ethernet operation can also be selected.

The EP952x are useful in applications where EtherCAT transfers over large distances are required or where higher EMC loads on the bus line are to be expected.

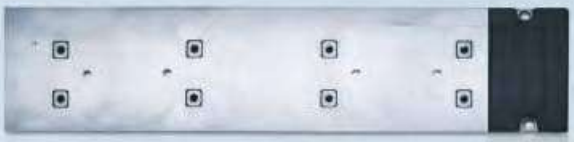
Technical data	EP9521-0020	EP9522-0020
Number of channels	1	2
Task within EtherCAT system	media transition from M8 copper physics to multimode fibre optic and back	
Data transfer medium	multimode glass fibre 50/125 µm; Ethernet/EtherCAT cable (min. CAT 5), shielded	
Bus interface	1 x LC Duplex; 2 x M8, shielded, screw type	2 x LC Duplex; 2 x M8, shielded, screw type
Distance between stations	max. 2,000 m (100BASE-FX); max. 100 m (100BASE-TX)	
Protocol	EtherCAT/Industrial Fast Ethernet	
Delay	approx. 1 µs	
Data transfer rates	100 Mbaud	
Configuration	per rotary switch	
Power supply	24 V DC (-15 %/+20 %)	
Current consumption 24 V DC	approx. 150 mA	
Dimensions (W x H x D)	85 mm x 126 mm x 26.5 mm	
Weight	approx. 250 g	
Operating/storage temperature	-25…+60 °C/-40…+85 °C	
Protect. class/installation pos.	IP 65/66/67 (conforms to EN 60529)/variable	
Approvals	CE, UL	
Further information	www.beckhoff.com/EP9521	www.beckhoff.com/EP9522

For availability status see Beckhoff website at: www.beckhoff.com/EP9522


BECKHOFF
X01
X02
X03
X04
X05
X06
DriveRdy
DriveRdy
link/act
link/act
Warning!
Up
Us
GND
X02
X03
L1
L2
L3N
PE
BECKHOFF
AX5203

Drive Technology

The drive system for highly dynamic positioning tasks



Drive Technology

Servo Drives, Servo and Linear Motors, Compact Drive Technology and XTS

Beckhoff Drive Technology

Servo Drives

The AX5000 impresses with great functional variety as well as high efficiency. With current control cycle times of up to 62.5 µs, the integrated control technology supports fast and highly dynamic positioning tasks. The compact AX8000 multi-axis servo system is a fast and easy to install high-performance drive system enabling simple commissioning. At the same time, it brings high performance in a compact design to every control cabinet: with maximum control speed, integrated mains filter and 17 drive-integrated safety functions (TwinSAFE).

AX5000 see page 798
AX8000 see page 808

▶ www.beckhoff.com/Servo-Drives

Servomotors

The Servomotors are characterised by high dynamics as well as energy and cost efficiency. They are available with stainless steel housings (AM8800), certified according to EHEDG is this execution particularly suitable for applications in the food and beverage industries. The AM8500 series is specially designed for applications with high load moments of inertia or high synchronism demands. To further enhance their performance the AM8000 and AM8500 series can be equipped with an external fan. All motors of the AM8000, AM8500 and AM8800 series are available with OCT. The AL2000 iron-core linear motors offer high continuous forces.

Synchronous Servomotors see page 816
Linear Servomotors see page 848
Connection cables see page 804

▶ www.beckhoff.com/Servomotors

Compact Drive Technology

In the low-voltage range up to 50 V, Beckhoff offers a wide range of components for compact drive solutions, particularly for stepper and servomotors. In conjunction with IP 20 stepper motor terminals or IP 67 EtherCAT Box modules, the AS1000 stepper series can be operated as an adjustable axis, either with or without feedback. The AM8100 servomotor series can be used in conjunction with the EL72xx servo terminal to configure a very compact drive axis.The AM8100 series supports One Cable Technology (OCT) and therefore offers the benefits of an electronic name plate and multi-turn absolute encoder function. Pre-assembled cables and specially adapted planetary gear units round off the product range of Compact Drive Technology.

See page 858

▶ **www.beckhoff.com/compact-drive-technology**

eXtended Transport System

The XTS linear transport system (eXtended Transport System) from Beckhoff combines all drive technology functions in a single mechatronic system: motor movement, power electronics and displacement measurement form a technical unit which can be used to implement a wide range of complex movements. A user-friendly programming interface enables different movements to be realised simultaneously directly from TwinCAT with little effort. The modular XTS system enables fast adaptation of a transport concept to different geometries and applications.

System description see page 872
Mechanical components see page 886
Software see page 888

▶ **www.beckhoff.com/XTS**

Servo Drives

AX5101–AX5112, AX52xx | **Digital Compact Servo Drives: 1-/2-channel up to 8.3 kW**

- 1- or 2-channel Servo Drives
- high-speed EtherCAT communication
- rated current up to 12 A or 2 x 6 A
- optimised for multi-axis applications
- variable motor output current for 2-channel Servo Drives
- TwinSAFE drive option card

See page 800

AX8000 | **Multi-axis EtherCAT drive: Compact control power with 1 µs current control update time**

- optimised, compact dimensions for control cabinet installation
- OCT integrated
- TwinSAFE integrated
- new, integrated AX-Bridge: toolless mounting
- powerful FPGA technology combined with multi-core ARM processors
- multi-channel current control technology

See page 808

EL7201 | **Ultra-compact servo terminal in 12 mm I/O housing up to 170 W**

- complete servo drive on 12 mm
- seamless integration into EtherCAT I/O system
- U_S 8…50 V DC, I_{MAX} 2.8 A_{RMS}
- field-oriented control for highly dynamic positioning tasks
- tailored to AM8100

See page 433

EL7211 | **Compact servo terminal in 24 mm I/O housing up to 245 W**

- complete servo drive on 24 mm
- seamless integration into EtherCAT I/O system
- U_S 8…50 V DC, I_{MAX} 4.5 A_{RMS}
- field-oriented control for highly dynamic positioning tasks
- tailored to AM8100

See page 433

AX5118–AX5140 | **Digital Compact Servo Drives: 1-channel up to 28 kW**

- high-speed EtherCAT communication
- rated current: 18/25/40 A
- flexible motor type selection
- TwinSAFE drive option card

See page 800

AX5160–AX5193 | **Digital Compact Servo Drives: 1-channel up to 118 kW**

- high-speed EtherCAT communication
- rated current: 60/72/90/110/143/170 A
- high performance with small dimensions
- flexible motor type selection
- TwinSAFE drive option card

See page 800

▶ www.beckhoff.com/Servo-Drives

AX5000 | Digital Compact Servo Drives

▶ www.beckhoff.com/AX5000

AX5101–AX5112 | 1-channel, up to 12 A

AX52xx | 2-channel, up to 2 x 6 A

AX5118–AX5140 | 1-channel, 18/25/40 A

AX5160, AX5172 | 1-channel, 60/72 A

AX5190, AX5191 | 1-channel, 90/110 A

AX5192, AX5193 | 1-channel, 143/170 A

The EtherCAT drives

The AX5000 Servo Drive product line from Beckhoff sets new standards in drive performance. The AX5000 series is available in single- or multi-channel form and is optimised for exceptional functionality and cost-effectiveness. Featuring integrated, high-speed control technology with a current control cycle of down to 62.5 µs, the AX5000 drives support fast and highly dynamic positioning tasks. The drives utilise EtherCAT as a high-performance communication system, providing an ideal interface with PC-based control technology while supporting coupling with other fieldbus systems. The 2-channel Servo Drives with variable motor output current optimise the packaging density and the cost per drive channel. The compact design and simple and safe installation through the "AX-Bridge" quick connection system significantly simplify control cabinet assembly.

Technical highlights

- **fast control algorithms**
  - current control: min. 62.5 µs
  - speed control: min. 62.5 µs
  - position control: min. 62.5 µs
- **variably adjustable current and speed filters**
- **high-speed EtherCAT system communication**
- **1- or 2-channel Servo Drive**
  - optimised for multi-axis applications
  - variable motor output current in 2-channel drives
  - active current sensing
- **active DC-Link and brake energy management via AX-Bridge**
- **variable motor interface with**
  - multi-feedback interface
  - flexible motor type selection
  - scalable, wide range motor current measurement
  - OCT (One Cable Technology)
  - electronic identification plate
- **high-speed capture inputs**
  - eight programmable digital I/Os, two with time stamp
- **mains connection**
  - wide voltage range 100…480 V AC
  - integrated mains filter
- **integration of safety functions (optional)**
  - STO, SS1
  - TwinSAFE: intelligent safety functions for Motion Control with AX58xx
- **compact design for simple control cabinet installation (300 mm depth)**
- **AX-Bridge – the quick connection system for power supply, DC-Link and control voltage**
- **variable cooling concept (fanless, forced cooling)**

Technical data	AX5000
Bus system	EtherCAT
Drive profile	SERCOS™ profile for servo drives according to IEC 61800 7 204 (SoE)
Rated supply voltage	100…480 V AC, 50/60Hz
DC-Link voltage	max. 890 V DC
Current control	62.5 µs
Design form	compact Servo Drive in 1- and 2-channel models, multi-axis systems with AX-Bridge
Protection class	IP 20
Operating/storage temperature	5…40 °C
Approvals	CE, cULus

AX51xx | 1-channel Servo Drives up to 40 A

Technical data	AX5101-0000-0200	AX5103-0000-0200	AX5106-0000-0200	AX5112-0000-0200
Function	servo drive for one drive axis			
Rated supply voltage	3 x 100…480 V AC ±10 % 1 x 100…240 V AC ±10 %	3 x 100…480 V AC ±10 % 1 x 100…240 V AC ±10 %	3 x 100…480 V AC ±10 % 1 x 100…240 V AC ±10 %	3 x 100…480 V AC ±10 %
Rated current	1~: 1.5 A 3~: 1.5 A	1~: 3 A 3~: 3 A	1~: 4.5 A 3~: 6 A	3~: 12 A
DC-Link voltage	max. 890 V DC			
Minimum rated channel current at full current resolution	0.35 A	1 A	1 A	6 A
Peak output current	4.5 A	7.5 A	13 A	26 A
Further information	www.beckhoff.com/AX51xx			

Technical data	AX5118-0000-0200	AX5125-0000-0200	AX5140-0000-0200
Function	servo drive for one drive axis		
Rated supply voltage	3 x 100…480 V AC ±10 %		
Rated current	3~: 18 A	3~: 25 A	3~: 40 A
DC-Link voltage	max. 890 V DC		
Minimum rated channel current at full current resolution	12 A	12 A	18 A
Peak output current	36 A	50 A	80 A
Further information	www.beckhoff.com/AX51xx		

AX51xx | 1-channel Servo Drives 60…170 A

Technical data	AX5160-0000-0200	AX5172-0000-0200	AX5190-0000-0200
Function	servo drive for one drive axis		
Rated supply voltage	3 x 400…480 V AC ±10 %		
Rated current	3~: 60 A	3~: 72 A	3~: 90 A
DC-Link voltage	max. 890 V DC		
Max. braking power (internal/external)	–/52 kW	–/52 kW	–/67 kW
Peak output current	120 A	144 A	180 A
Further information	www.beckhoff.com/AX5160		

Technical data	AX5191-0000-0200	AX5192-0000-0200	AX5193-0000-0200
Function	servo drive for one drive axis		
Rated supply voltage	3 x 400…480 V AC ±10 %		
Rated current	3~: 110 A	3~: 143 A	3~: 170 A
DC-Link voltage	max. 890 V DC		
Max. braking power (internal/external)	–/67 kW	–/103 kW	–/103 kW
Peak output current	180 A	215 A	221 A
Further information	www.beckhoff.com/AX5160		

AX52xx | 2-channel Servo Drives

Technical data	AX5201-0000-0200	AX5203-0000-0200	AX5206-0000-0200
Function	servo drive for two drive axes with flexible distribution of the total device current		
Rated supply voltage	3 x 100…480 V AC ±10 % 1 x 100…240 V AC ±10 %		
Rated current	1~: 2 x 1.5 A 3~: 2 x 1.5 A	1~: 2 x 3 A 3~: 2 x 3 A	1~: 2 x 4.5 A 3~: 2 x 6 A
DC-Link voltage	max. 890 V DC		
Minimum rated channel current at full current resolution	0.35 A	1 A	1 A
Peak output current	2 x 5 A	2 x 10 A	2 x 13 A
Further information	www.beckhoff.com/AX52xx		

Dimensions	Height without connectors	Width	Depth without connectors
AX5101	274 mm	92 mm	232 mm
AX5103	274 mm	92 mm	232 mm
AX5106	274 mm	92 mm	232 mm
AX5112	274 mm	92 mm	232 mm
AX5118	274 mm	185 mm	232 mm
AX5125	274 mm	185 mm	232 mm
AX5140	274 mm	185 mm	232 mm
AX5201	274 mm	92 mm	232 mm
AX5203	274 mm	92 mm	232 mm
AX5206	274 mm	92 mm	232 mm
AX5160	345 mm	190 mm	259 mm
AX5172	345 mm	190 mm	259 mm
AX5190	540 mm	280 mm	253 mm
AX5191	540 mm	280 mm	253 mm
AX5192	540 mm	280 mm	332 mm
AX5193	540 mm	280 mm	332 mm

Typical combinations AX5000	Mains choke	Mains filter	Braking resistor (x = 1, 3 or 6)
AX5160-0000-0200	AX2090-ND50-0060	integrated (C2 up to 10 m, C3 up to 25 m)	AX2090-BW52-x000
AX5172-0000-0200	AX2090-ND50-0072	integrated (C2 up to 10 m, C3 up to 25 m)	AX2090-BW52-x000
AX5190-0000-0200	AX2090-ND50-0090	AX2090-NF50-0100	AX2090-BW53-x000
AX5191-0000-0200	AX2090-ND50-0110	AX2090-NF50-0150	AX2090-BW53-x000
AX5192-0000-0200	AX2090-ND50-0143	AX2090-NF50-0150	AX2090-BW54-x000
AX5193-0000-0200	AX2090-ND50-0170	AX2090-NF50-0180	AX2090-BW54-x000

Braking resistor: x = power in kW

Options for AX5000 Servo Drives

AX57xx | Encoder option cards

The AX5000 Servo Drive series supports a large number of feedback interfaces via the multi-option interface:
- resolver (2-, 4-, 6- or 8-pole)
- SinCos encoder 1 V_{PP}
- single- and multi-turn encoder Hiperface 1 V_{PP}
- single- and multi-turn encoder BiSS 1 V_{PP}
- single- and multi-turn encoder 1 V_{PP}

From hardware revision 2 onwards, OCT (One Cable Technology) is also supported by the AX5000 and with it the "second encoder" function where the encoder inside the motor is used for commutation and a second high-resolution encoder is used for position control.

Encoder option cards
For the integration of further feedback systems the controllers can be equipped with encoder option cards from hardware revision 2 onwards. The option cards are inserted in the second option slot on top of the AX5000, offering the possibility to connect one or two further encoders, depending on the version.

Encoder option cards for AX51xx
- AX5701: one additional encoder input 1 V_{PP}, BiSS B, Hiperface, EnDat
- AX5721: one additional encoder input EnDat 2.2 or BiSS C
- AX5731: one additional encoder input HTL

Encoder option cards for AX52xx
- AX5702: two additional encoder inputs 1 V_{PP}, BiSS B, Hiperface, EnDat
- AX5722: two additional encoder inputs EnDat 2.2 or BiSS C
- AX5732: two additional encoder inputs HTL

Ordering information		Pict.
AX5701-0000	encoder option card for one additional encoder input 1 V_{PP}, BiSS B, Hiperface, EnDat	
AX5702-0000	encoder option card for two additional encoder inputs 1 V_{PP}, BiSS B, Hiperface, EnDat	A
AX5721-0000	encoder option card for one additional encoder input EnDat 2.2, BiSS C	
AX5722-0000	encoder option card for two additional encoder inputs EnDat 2.2, BiSS C	
AX5731-0000	encoder option card for one additional encoder input HTL	
AX5732-0000	encoder option card for two additional encoder inputs HTL	

AX58xx | TwinSAFE drive options cards

Significant hazards to persons arise from the dynamic movements of the electrical drive equipment of machines. With the AX58xx TwinSAFE drive option cards numerous safety functions can be easily implemented by the user. No further circuits are necessary for this, such as circuit breakers or contactors in the supply lines or special external encoder systems. Optional cards that are certified according to DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3) are available for different safety categories:

AX5801 | Personal protection against inadvertent restart of the drive axis (STO/SS1):
- Safe Torque Off (STO) according to IEC 61800-5-2
- control through safe 24 V DC outputs
- mains voltage and motor line remain connected

AX5805, AX5806 | Further drive-integrated safety functions according to IEC 61800-5-2. Control is performed via EtherCAT; no further wiring is required:
- stop functions (STO, SOS, SS1, SS2)
- speed functions (SLS, SSM, SSR, SMS) with up to 8 speeds
- position functions (SLP, SCA, SLI) with reference cams
- acceleration functions (SAR, SMA)
- rotating direction functions (SDIp, SDIn)

For further information on TwinSAFE and the TwinSAFE products see page 966

Ordering information		Pict.
AX5801-0200	TwinSAFE drive option card for AX5000 up to 40 A, HW 2.0: STO, SS1 (1)	B
AX5805-0000	TwinSAFE drive option card for AX5000 up to 40 A, HW 2.0: STO, SS1, SS2, SOS, SLS, SDI (1)	C
AX5806-0000	TwinSAFE drive option card for AX5000 from 60 A, HW 2.0: STO, SS1, SS2, SOS, SLS, SDI (2)	

(1) AX5000 up to 40 A: AX5x01-0000-0200, AX5x03-0000-0200, AX5x06-0000-0200, AX5112-0000-0200, AX5118-0000-0200, AX5125-0000-0200, AX5140-0000-0200

(2) AX5000 from 60 A up to 170 A: AX5160-0000-0200, AX5172-0000-0200, AX519x-0000-0200

AX59xx | **AX-Bridge quick connection system**

For Servo Drives up to a rated current of 40 A, the AX59xx AX bridge enables the simple and fast connection of several AX5000 units to form a multi-axis system by means of plug-in supply and connection modules.

The AX590x supply module is simply snapped onto the Servo Drive. The AX591x connection module with integrated busbars is suitable for multi-axis systems and combines mains input, intermediate circuit, 24 V DC control voltage and brake voltage. In combination, the AX590x and AX591x modules enable fast installation and commissioning.

– integration of power supply, DC-Link, 24 V DC control and braking voltage
– connection module with power rail system, current carrying capacity up to 85 A
– straightforward installation and disassembly without additional wiring
– visible and safe contacting

Active DC-Link and brake energy management

With the AX-Bridge the DC-Links are automatically through-connected: This enables an economic energy balancing between axes.

– short-circuit-proof
– intelligent utilisation of all available system ballast resistors
– elimination power loss

Ordering information		Pict.
AX5901-0000	AX-Bridge power supply module for connection of supply voltage and 24 V DC for control and brake energy (pluggable), for AX5x01…AX5125, 85 A	D
AX5902-0000	AX-Bridge power supply module for connection of supply voltage and 24 V DC for control and brake energy (pluggable), for AX5140, 85 A	
AX5911-0000	AX-Bridge power distribution module, quick connection system for power supply, DC-Link and control voltage (pluggable), for AX5x01…AX5112, 85 A	E
AX5912-0000	AX-Bridge power distribution module, quick connection system for power supply, DC-Link and control voltage (pluggable), for AX5118 and AX5125, 85 A	F

A

B

C

D

E

F

Motor supply cables for AX5000 Servo Drives at AM8xxx

Motor cables 1 mm² with iTec plug system for AM801x, AM802x, AM803x and AM853x at AX5000 (1.5…6 A)

Ordering information	Motor cable with 1 mm² wire gauge, highly flexible for drag-chain use
ZK4500-8022-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 81 mm (7 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 1 mm² + (2 x 0.75 mm²) + (2 x AWG22))
ZK4500-8022-0050	example for 5 m length
ZK4501-8022-xxxx	extension cable

For maximum cable lenghts please see the current documentation ▶ **www.beckhoff.com/documentations**

Motor cables 1.5 mm² with M23 speedtec® plug for AM883x and AM8x4x up to AM8x6x (up to winding code P) at AX5000 (1.5…12 A)

Ordering information	Motor cable with 1.5 mm² wire gauge, fixed installation
ZK4500-8003-xxxx	cables for fixed installation min. bending radius = 61 mm (5 x OD), (4 x 1.5 mm² + (2 x 0.75 mm²) + (2 x AWG22))
ZK4500-8003-0050	example for 5 m length
ZK4501-8003-xxxx	extension cable

For maximum cable lenghts please see the current documentation ▶ **www.beckhoff.com/documentations**

Ordering information	Motor cable with 1.5 mm² wire gauge, highly flexible for drag-chain use
ZK4500-8023-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 89 mm (7 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 1.5 mm² + (2 x 0.75 mm²) + (2 x AWG22))
ZK4500-8023-0050	example for 5 m length
ZK4501-8023-xxxx	extension cable

For maximum cable lenghts please see the current documentation ▶ **www.beckhoff.com/documentations**

Motor cables 2.5 mm² with M23 speedtec® plug for AM8x4x up to AM8x6x (up to winding code P) at AX5000 (18…25 A)

Ordering information	Motor cable with 2.5 mm² wire gauge, fixed installation
ZK4500-8004-xxxx	cables for fixed installation min. bending radius = 69 mm (5 x OD), (4 x 2.5 mm² + (2 x 1 mm²) + (2 x AWG22))
ZK4500-8004-0050	example for 5 m length
ZK4501-8004-xxxx	extension cable

For maximum cable lenghts please see the current documentation ▶ **www.beckhoff.com/documentations**

Ordering information	Motor cable with 2.5 mm² wire gauge, highly flexible for drag-chain use
ZK4500-8024-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 97 mm (7 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 2.5 mm² + (2 x 1 mm²) + (2 x AWG22))
ZK4500-8024-0050	example for 5 m length
ZK4501-8024-xxxx	extension cable

For maximum cable lenghts please see the current documentation ▶ **www.beckhoff.com/documentations**

Motor cables 4 mm² with M40 speedtec® plug for AM8x6x (from winding code Q) and AM807x at AX5000 (12…25 A)

Ordering information	Motor cable with 4 mm² wire gauge, highly flexible for drag-chain use
ZK4500-8025-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 111 mm (7 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 4 mm² + (2 x 1 mm²) + (2 x AWG22))
ZK4500-8025-0050	example for 5 m length
ZK4501-8025-xxxx	extension cable

For maximum cable lenghts please see the current documentation ▶ **www.beckhoff.com/documentations**

Motor cables 10 mm² with M40 speedtec® plug for AM8x6x (from winding code Q) and AM807x at AX5000 (40 A)

Ordering information	Motor cable with 10 mm² wire gauge, highly flexible for drag-chain use
ZK4500-8027-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 225 mm (10 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 10 mm² + (2 x 1.5 mm²) + (2 x AWG22))
ZK4500-8027-0050	example for 5 m length
ZK4501-8027-xxxx	extension cable

For maximum cable lenghts please see the current documentation ▶ **www.beckhoff.com/documentations**

Motor cables 10 mm² with M40 speedtec® plug for AM8x6x (from winding code Q) and AM807x at AX5000 (60 A)

Ordering information	Motor cable with 10 mm² wire gauge, highly flexible for drag-chain use
ZK4504-8027-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 255 mm (10 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 10 mm² + (2 x 1.5 mm²) + (2 x AWG22))
ZK4504-8027-0050	example for 5 m length
ZK4501-8027-xxxx	extension cable

For maximum cable lenghts please see the current documentation ▶ **www.beckhoff.com/documentations**
AX5000 (60 A) does not support OCT. With each unit, a resolver cable ZK4530-8010-xxxx must be ordered separately.

Feedback cables for AX5000 Servo Drives at AM8xxx

Resolver cables with iTec plug system for AM802x, AM803x, AM853x at AX5000

Ordering information	Resolver cable with 0.25 mm² wire gauge, flexible, for drag-chain use
ZK4530-8110-xxxx	flexible, drag-chain suitable cable with 5 million bending cycles, max. 120 m/min, max. 4 m/s², min. bending radius = 75 mm (10 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, 4 x 2 x 0.25 mm²
ZK4530-8110-0050	example for 5 m length
ZK4531-8110-xxxx	extension cable

Resolver cables with M23 speedtec® plug for AM883x, AM8x4x to AM8x6x, AM807x at AX5000

Ordering information	Resolver cable with 0.25 mm² wire gauge, flexible, for drag-chain use
ZK4530-8010-xxxx	flexible, drag-chain suitable cable with 5 million bending cycles, max. 120 m/min, max. 4 m/s², min. bending radius = 75 mm (10 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, 4 x 2 x 0.25 mm²
ZK4530-8010-0050	example for 5 m length
ZK4531-8010-xxxx	extension cable

Encoder cables with M23 speedtec® plug for AM8x6x, AM807x at AX5000

Ordering information	Encoder cable with 0.5 mm² wire gauge, highly flexible, suitable as trailing cable
ZK4510-8020-xxxx	Highly flexible, drag-chain suitable cable with 5 mio. bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 53 mm (7 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (7 x 2 x 0.14 mm² + 2 x 0.5 mm²). The cable is UL and CSA listed.
ZK4510-8020-0050	example for 5 m length
ZK4511-8020-xxxx	extension cable

Accessories

EtherCAT patch cables

Ordering information	ZK1090-9191-0xxx | EtherCAT patch cables
ZK1090-9191-0001	EtherCAT bridge AX5x01 to AX5112, length 0.17 m
ZK1090-9191-0002	EtherCAT bridge AX5118 to AX5140, length 0.26 m
ZK1090-9191-0xxx	EtherCAT patch cable, 0xxx = length in decimetres (-0020 = 2 m), available lengths 0.5 m, 1 m, 2 m, 3 m, 5 m and 10 m

Not assembled motor cables for higher performance, from AX5000 (25 A)

Ordering information	Motor cable, flexible, drag-chain suitable with 5 million bending cycles, for Servo Drives AX5000 from 25 A
ZK4509-0016-0zzz	6 mm², for AX5125, (4 x 6 mm² + (2 x 1 mm² + 2 x 1.5 mm²)) (1)
ZK4509-0017-0zzz	10 mm², for AX5140, (4 x 10 mm² + (2 x 1 mm² + 2 x 1.5 mm²)) (1)
ZK4509-0018-0zzz	16 mm², for AX5160, (4 x 16 mm² + 2 x (2 x 1.5 mm²)) (1)
ZK4509-0019-0zzz	25 mm², for AX5172, (4 x 25 mm² + 2 x (2 x 1.5 mm²)) (1)
ZK4509-0019-1zzz	35 mm², for AX5190, (4 x 35 mm² + 2 x (2 x 1.5 mm²)) (1)
ZK4509-0019-2zzz	50 mm², for AX5191/AX5192, (4 x 50 mm² + 2 x (2 x 2.5 mm²)) (1)

zzz = ordering indication of the length of material in decimetres, e.g. ZK4509-0016-0100 = 10 metres, (1) not suitable for OCT

Power supply | Mains filters for AX5000 (from 1.5 A)

Ordering information	AX2090-NF50-0xxx | Mains filters
AX2090-NF50-0014	mains filter C2 for AX5000 Servo Drives up to 14.6 A, 46.4 x 231 x 70 mm (W x H x D), 0.9 kg
AX2090-NF50-0032	mains filter C2 for AX5000 Servo Drives up to 32.8 A, 58 x 265 x 90 mm (W x H x D), 1.75 kg
AX2090-NF50-0063	mains filter C2/C3 for AX5160* Servo Drives up to 63 A, 62 x 305 x 180 mm (W x H x D), 5 kg
AX2090-NF50-0100	mains filter C2/C3 for AX5172*/AX5190 Servo Drives up to 100 A, 75 x 336 x 200 mm (W x H x D), 6 kg
AX2090-NF50-0150	mains filter C2/C3 for AX5191/AX5192 Servo Drives up to 150 A, 90 x 380 x 220 mm (W x H x D), 6.8 kg
AX2090-NF50-0180	mains filter C2/C3 for AX5193 Servo Drives up to 180 A, 200 x 410 x 120 mm (W x H x D), 7 kg

* AX5160, AX5172: mains filter already integrated. Additional mains filter for C2 and C3 only necessary if the cable lengths exceed 10 m (C2) and 25 m (C3).

Power supply | Mains chokes for AX5000 (from 60 A)

Ordering information	AX2090-ND50-0xxx | Mains chokes
AX2090-ND50-0060	mains choke for AX5160 Servo Drive, 60 A, 0.25 mH, U_K 2 %, 190 x 200 x 120 mm (W x H x D), 7 kg
AX2090-ND50-0072	mains choke for AX5172 Servo Drive, 72 A, 0.20 mH, U_K 2 %, 190 x 240 x 110 mm (W x H x D), 10 kg
AX2090-ND50-0090	mains choke for AX5190 Servo Drive, 90 A, 0.16 mH, U_K 2 %, 230 x 300 x 160 mm (W x H x D), 13 kg
AX2090-ND50-0110	mains choke for AX5191 Servo Drive, 110 A, 0.13 mH, U_K 2 %, 230 x 300 x 180 mm (W x H x D), 15 kg
AX2090-ND50-0143	mains choke for AX5192 Servo Drive, 143 A, 0.10 mH, U_K 2 %, 240 x 330 x 200 mm (W x H x D), 25 kg
AX2090-ND50-0170	mains choke for AX5193 Servo Drive, 170 A, 0.09 mH, U_K 2 %, 240 x 330 x 200 mm (W x H x D), 25 kg

Power supply | Transient voltage suppressor for AX5000 (1.5…25 A)

Ordering information	Transient voltage suppressor for Servo Drives AX5000
AX2090-TS50-3000	transient voltage suppressor for AX5000 Servo Drives, required if CSA certification necessary

EMC accessories | Shroud for AX5000 (from 60 A)

Ordering information	Shroud for connecting cable screens
AX2090-SB50-0001	shroud for AX5160/AX5172
AX2090-SB50-0002	shroud for AX5190/AX5191
AX2090-SB50-0003	shroud for AX5192/AX5193

Braking energy management

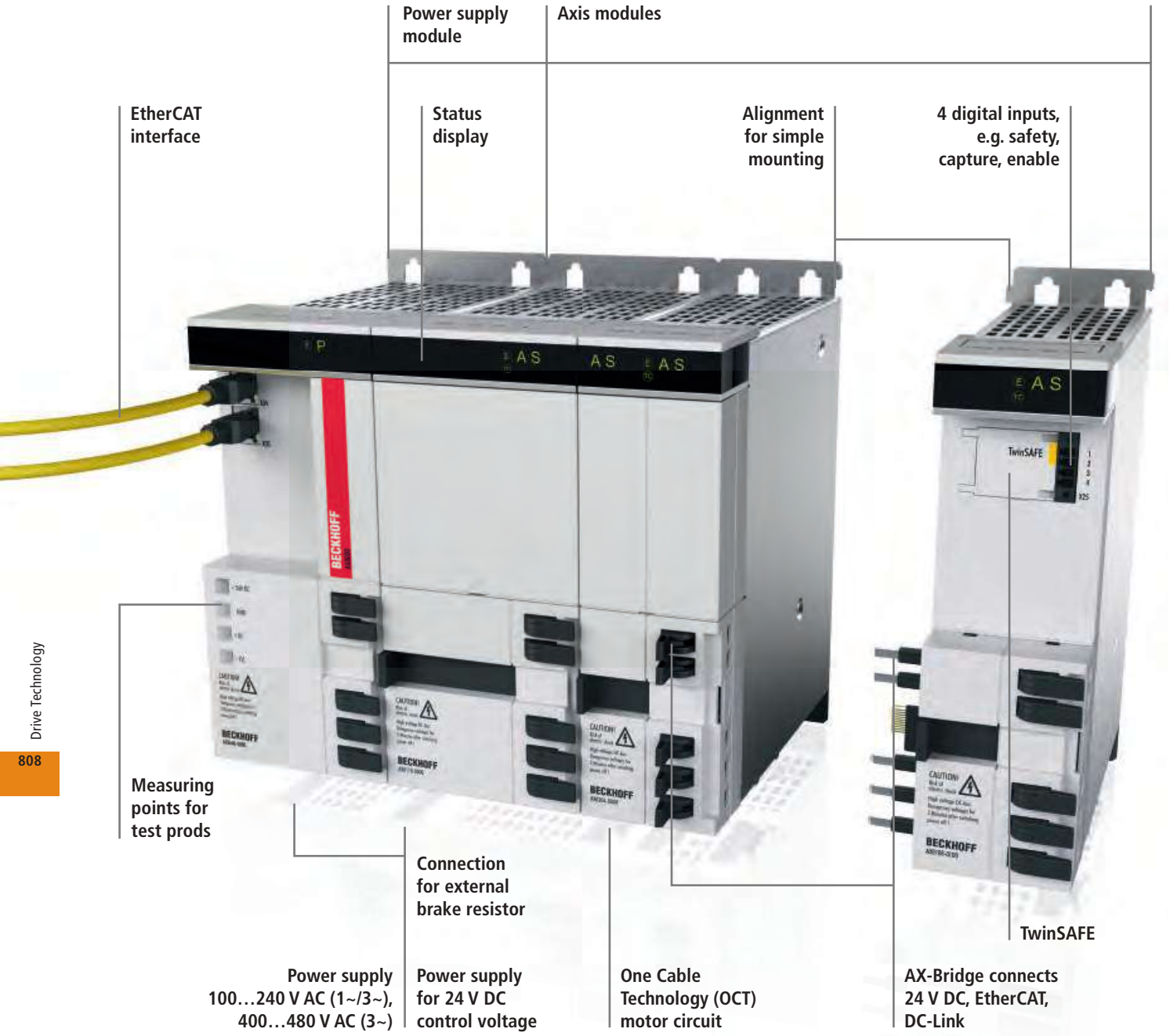
Ordering information	Components for DC-Link for AX5000
AX5021-0000-0000	ballast unit with internal braking resistor (250 W) and option for connecting an external ballast resistor (up to 6 kW) as well as an additional DC link expansion capacity for storing brake energy efficiently
AX2090-BW50-0300	external ballast resistor for AX5x01 to AX5112 (stand-alone), 0.3 kW/47 Ω, 92 x 120 x 349 mm (W x H x D), 2 kg [1]
AX2090-BW50-0600	external ballast resistor for AX5x01 to AX5112 (stand-alone), 0.6 kW/47 Ω, 92 x 120 x 549 mm (W x H x D), 3 kg [1]
AX2090-BW50-1600	external ballast resistor for AX5x01 to AX5112 (stand-alone), 1.6 kW/47 Ω, 185 x 120 x 649 mm (W x H x D), 5.8 kg [1]
AX2090-BW51-1000	external ballast resistor for AX5118 to AX5140 (stand-alone) and in combination with ballast unit AX5021, 1 kW/23 Ω, 92 x 120 x 749 mm (W x H x D), 4 kg [2]
AX2090-BW51-3000	external ballast resistor for AX5118 to AX5140 (stand-alone) and in combination with ballast unit AX5021, 3 kW/23 Ω, 355 x 255 x 490 mm (W x H xD), 8 kg [2]
AX2090-BW51-6000	external ballast resistor for AX5118 to AX5140 (stand-alone) and in combination with ballast unit AX5021, 6 kW/23 Ω, 455 x 255 x 490 mm (W x H x D), 12 kg [2]
AX2090-BW52-3000	external ballast resistor for AX5160 and AX5172 (stand-alone), 3 kW/13.2 Ω, 355 x 260 x 490 mm (W x H xD), 9.5 kg [3]
AX2090-BW52-6000	external ballast resistor for AX5160 and AX5172 (stand-alone), 6 kW/13 Ω, 455 x 260 x 490 mm (W x H x D), 13 kg [3]
AX2090-BW53-3000	external ballast resistor for AX5190 and AX5191 (stand-alone), 3 kW/10.2 Ω, 355 x 255 x 490 mm (W x H xD), 9.5 kg [4]
AX2090-BW53-6000	external ballast resistor for AX5190 and AX5191 (stand-alone), 6 kW/10 Ω, 455 x 260 x 490 mm (W x H x D), 13 kg [4]
AX2090-BW54-3000	external ballast resistor for AX5192 and AX5193 (stand-alone), 3 kW/6.6 Ω, 355 x 255 x 490 mm (W x H xD), 9.5 kg [4]
AX2090-BW54-6000	external ballast resistor for AX5192 and AX5193 (stand-alone), 6 kW/6.5 Ω, 455 x 260 x 490 mm (W x H x D), 13 kg [4]

Recommended interface cables: [1] ZK4000-2101-2xxx (1.5 mm²), [2] ZK4000-2102-2xxx (2.5 mm²), [3] ZK4509-8025-xxxx (4 mm²), [4] ZK4000-2104-2xxx (6 mm²)

AX5000 motor chokes

Ordering information	AX2090-MD50-00xx | Motor chokes
AX2090-MD50-0012	motor choke for AX5000 (1.5…12 A), up to 12 A rated current, necessary for motor cable ≥ 25 m, max. 100 m, with integrated connection cable (150 mm)
AX2090-MD50-0025	motor choke for AX5000 (18…25 A), up to 25 A rated current, necessary for motor cable ≥ 25 m, max. 50 m, with integrated connection cable (150 mm)

AX8000 | Multi-axis servo system



AX8620 | Power supply module, 20 A

AX8640 | Power supply module, 40 A

AX8108 | Axis module, 8 A

AX8118 | Axis module, 18 A

AX8206 | Double-axis module, 2 x 6 A

The AX8000 multi-axis servo system greatly simplifies the implementation of multi-channel drive solutions. The required number of 1-channel or 2-channel 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 1-axis and 2-axis modules can optionally be equipped with STO or TwinSAFE (drive-integrated safety functions).

eXtreme Fast Control in the drive

The EtherCAT-based AX8000 multi-axis servo system combines powerful FPGA technology with multi-core ARM processors. The new multi-channel current control technology enables extremely short sampling and response times. The entirely hardware-implemented current controller combines the advantages of analog and digital control technology: reaction to a current deviation from the setpoint value is possible within 1 µs; the velocity controller cycle time is around 16 µs at a switching frequency of 32 kHz. The processing of EtherCAT process data (actual and setpoint values) is carried out without a processor almost without delay in the hardware, so that the minimum EtherCAT cycle time is only 62.5 µs.

One Cable Technology (OCT)

The AX8000 multi-axis servo system supports OCT, the One Cable Technology for power and feedback. In connection with the servomotors from the AM8000 (standard), AM8500 (increased inertia) and AM8800 (stainless steel) series, the wiring is reduced to the standard motor cable, via which the feedback signals are also transmitted. As in sensorless control, the user no longer has to use an additional feedback cable. All information required for control purposes is transmitted reliably and interference-proof via a digital interface.

Drive-integrated safety functions

The AX8000 with TwinSAFE supports the typical drive-integrated safety functions and fulfills the requierements of DIN EN ISO 13849-1:2008 (Cat. 4, PL e).

- stop functions (STO, SOS, SS1, SS2)
- speed functions (SLS, SSM, SSR, SMS) with up to 8 speeds
- position functions (SLP, SCA, SLI) with reference cams
- acceleration functions (SAR, SMA)
- rotating direction functions (SDIp, SDIn)
- brake function (SBC)
- safely limited torque (SLT)

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…890 V DC
Current control	1 µs update time, 16 µs cycle time
Design form	modular system with 60 or 90 mm wide elements
Protection class	IP 20
Operating/storage temperature	5…40 °C
Approvals	CE, cULus (in preparation)

▶ www.beckhoff.com/AX8000

AX8620, AX8640 | **Power supply modules**

A power supply module generates the DC-Link voltage (DC) 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.

AX8000 supply modules can be used on 1- and 3-phase low-voltage mains supplies.

– 1-phase mains supplies 100…240 V AC, 50/60 Hz
– 3-phase mains supplies 3 x 200…3 x 480 V AC, 50/60 Hz

A separate 24 V DC power supply is required in each case.

Technical data 400…480 V	AX8620-0000	AX8640-0000
Rated supply voltage	3 x 400…480 V AC	
Rated input current at 40 °C	3~: 20 A	3~: 40 A
Rated output current	3~: 24.5 A DC	3~: 49.0 A DC
Rated output	3~: 13 kW	3~: 26 kW
DC-Link voltage	max. 890 V DC	
DC-Link capacitance	675 µF	405 µF
Max. braking power (internal/external)	52.1 kW/43.6 kW	21.8 kW/21.8 kW
Further information	www.beckhoff.com/AX8620	www.beckhoff.com/AX8640

Technical data 100…240 V	AX8620-1000	AX8640-1000
Rated supply voltage	3 x 200…240 V AC 1 x 100…240 V AC	3 x 200…240 V AC
Rated input current at 40 °C	1~: 10 A 3~: 20 A	3~: 40 A
Rated output current	1~: 5 A DC 3~: 24.5 A DC	3~: 49.0 A DC
Rated output	1~: 1.5 kW 3~: 7.5 kW	3~: 15 kW
DC-Link voltage	max. 440 V DC	
DC-Link capacitance	1020 µF	1700 µF
Max. braking power (internal/external)	5.4 kW/9.8 kW	10.7 kW/22 kW
Further information	www.beckhoff.com/AX8620	www.beckhoff.com/AX8640

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 optimised design of the individual axes.

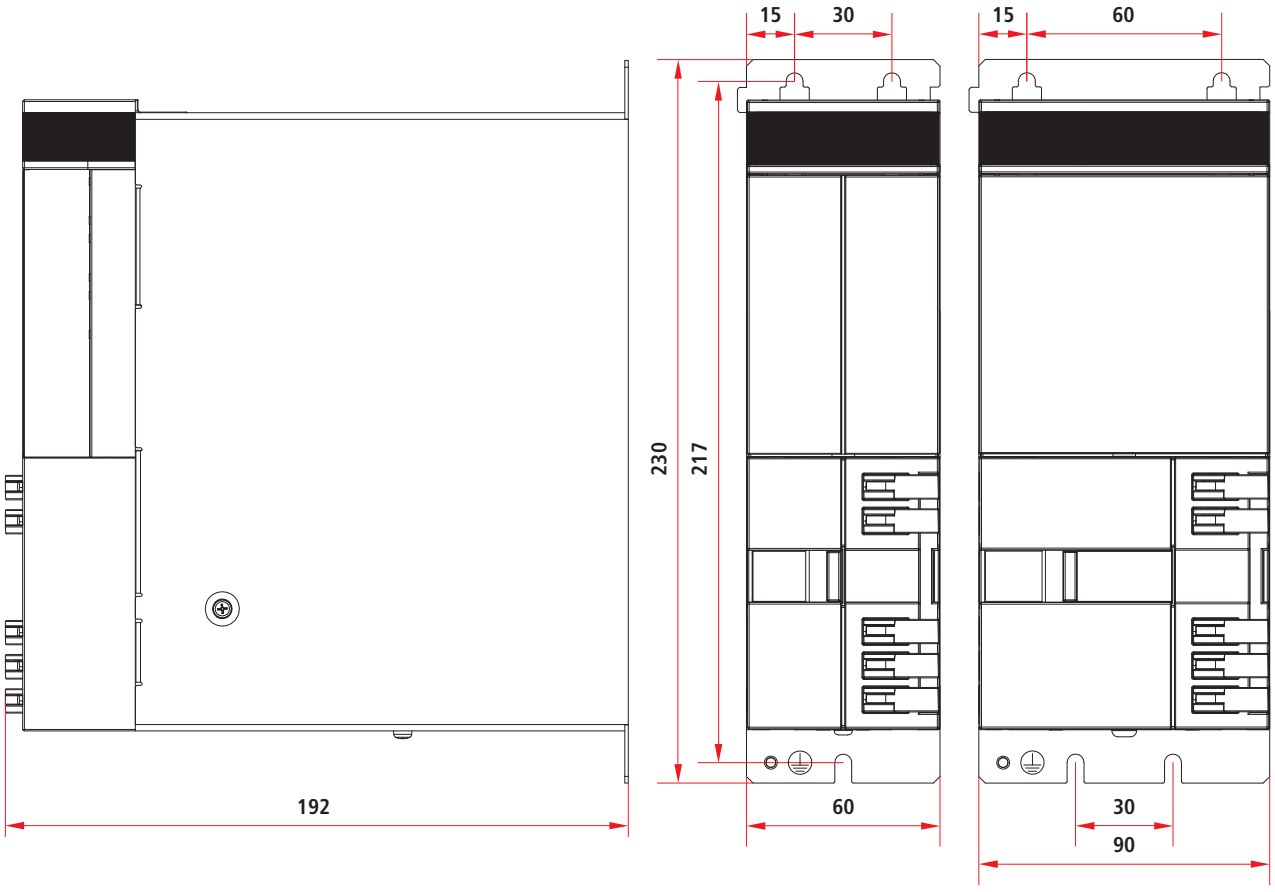
Supporting a wide supply voltage range from 100 to 480 V AC, the axis modules can be operated without limitation with any of the supply modules. This flexibility simplifies the implementation of machine configurations for any type of mains supply. The electrical connection is established without tools via the already integrated AX-Bridge: it automatically connects DC-Link, 24 V DC control voltage and communication via EtherCAT between the attached modules. The DC-Link connection enables the exchange of energy during acceleration and braking procedures, where the regenerative brake energy is primarily stored in the common DC-Link. If the energy exceeds the DC-Link capacitance, it can be destroyed via a brake resistor of the supply module.

Technical data	AX8108-0000	AX8118-0000	AX8206-0000
Rated current	1 x 8 A	1 x 18 A	2 x 6 A
DC-Link voltage	max. 890 V DC		
DC-Link capacitance	135 µF	270 µF	135 µF
Number of channels	1	1	2
Minimum rated channel current at full current resolution	1 A	4 A	1 A
Peak output current	20 A	40 A	14 A | 20 A
Further information	www.beckhoff.com/AX81xx	www.beckhoff.com/AX81xx	www.beckhoff.com/AX82xx

AX88xx | Option modules

An AX8810 capacitor module extends the DC-Link capacitance and is particularly suitable in combination with the AX8620-1000 single-phase supply for the support of the DC-Link. It enables energy savings: voltage peaks generated by braking motors are taken up and stored. This makes the activation of the brake resistor mostly unnecessary and helps to reduce power losses. Overall, the use of the capacitor module makes a reduction in the total connected load possible and also a smaller dimensioning of the fuse.

Technical data	AX8810-0000	AX8810-1000
Function	capacitor module/DC-Link extension module	
For power supply modules	AX86xx-0000	AX86xx-1000
DC-Link voltage	max. 890 V DC	max. 440 V DC
DC-Link capacitance	1755 µF	4420 µF
Further information	www.beckhoff.com/AX8810	



Dimensions	Height without connectors	Depth without connectors	Width
AX8620	230 mm	192 mm	60 mm
AX8640	230 mm	192 mm	90 mm
AX8108	230 mm	192 mm	60 mm
AX8118	230 mm	192 mm	90 mm
AX8206	230 mm	192 mm	60 mm
AX8810	230 mm	192 mm	60 mm

Accessories for AX8000 Servo Drives at AM8xxx

Motor cables 1 mm² with iTec plug system for AM801x, AM802x, AM803x and AM853x at AX8108 and AX8206

Ordering information	Motor cable with 1 mm² wire gauge, highly flexible for drag-chain use
ZK4800-8022-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 81 mm (7 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 1 mm² + (2 x 0.75 mm²) + (2 x AWG22))
ZK4800-8022-0050	example for 5 m length
ZK4501-8022-xxxx	extension cable

Motor cables 1.5 mm² with M23 speedtec® plug for AM883x and AM8x4x up to AM8x6x (up to winding code P) at AX8108 and AX8206

Ordering information	Motor cable with 1.5 mm² wire gauge, fixed installation
ZK4800-8003-xxxx	cables for fixed installation, min. bending radius = 61 mm (5 x OD), (4 x 1.5 mm² + (2 x 0.75 mm²) + (2 x AWG22))
ZK4800-8003-0050	example for 5 m length
ZK4501-8003-xxxx	extension cable

Ordering information	Motor cable with 1.5 mm² wire gauge, highly flexible for drag-chain use
ZK4800-8023-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 89 mm (7 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 1.5 mm² + (2 x 0.75 mm²) + (2 x AWG22))
ZK4800-8023-0050	example for 5 m length
ZK4501-8023-xxxx	extension cable

Motor cables 2.5 mm² with M23 speedtec® plug for AM8x4x up to AM8x6x (up to winding code P) at AX8118

Ordering information	Motor cable with 2.5 mm² wire gauge, fixed installation
ZK4800-8004-xxxx	cables for fixed installation, min. bending radius = 69 mm (5 x OD), (4 x 2.5 mm² + (2 x 1 mm²) + (2 x AWG22))
ZK4800-8004-0050	example for 5 m length
ZK4501-8004-xxxx	extension cable

Ordering information	Motor cable with 2.5 mm² wire gauge, highly flexible for drag-chain use
ZK4800-8024-xxxx	highly flexible, drag-chain suitable cable with 5 million bending cycles, max. 240 m/min, max. 30 m/s², min. bending radius = 97 mm (7 x OD), max. drag-chain length horizontal 20 m, vertical 5 m, (4 x 2.5 mm² + (2 x 1 mm²) + (2 x AWG22))
ZK4800-8024-0050	example for 5 m length
ZK4501-8024-xxxx	extension cable

Brake energy management

Ordering information	AX2090-BW80-xxxx | Ballast resistors
AX2090-BW80-1000	external ballast resistor for AX8620-1000 and AX8640-0000 supply modules, 1.0 kW, 18 Ω (1)
AX2090-BW80-1600	external ballast resistor for AX8620-0000 supply modules, 1.6 kW, 33 Ω (1)
AX2090-BW80-2000	external ballast resistor for AX8640-1000 supply modules, 2.0 kW, 8 Ω (2)
AX2090-BW80-3000	external ballast resistor for AX8640-0000 supply modules, 3.0 kW,15 Ω (2)

Recommended interface cables: (1) ZK4000-2101-2xxx (1.5 mm²), (2) ZK4000-2102-2xxx (2.5 mm²)

Servo and Linear Motors

Servomotors

- AM8000 for applications with highest demands on dynamics and performance, One Cable Technology (OCT) for power and feedback
- AM8500 with increased internal inertia ratio, One Cable Technology (OCT) for power and feedback
- AM8800 for use in the food, chemical and pharmaceutical industries, One Cable Technology (OCT) for power and feedback
- AM3000 for applications with highest demands on dynamics and performance

For dynamic applications in the lower power range Beckhoff offers the Compact Drive Technology series.

See page 816,
Compact Drive Technology see page 858

Planetary gear units

– AG2300: high-end gear series for AM8000/AM8500 motor series, high-speed variant suited for positioning with high nominal speeds in continuous operation
– AG2210: for AM8000/AM8500 and AM3000 motor series, low backlash and high performance with up to 16 transmission ratios, very low running noise coupled with maximum quality
– AG2800: stainless steel gearbox turns the AM8800 into a perfectly matched and certified Hygienic Design servo axis by dead-space-free design, smooth surfaces, a round motor adapter and high resistance to corrosion

See page 833

Linear Servomotors

– AL2xxx: iron core motor for high forces with different magnetic path widths (50/80/130 mm)

See page 848

▶ **www.beckhoff.com/Servomotors**

AMxxxx | Synchronous Servomotors

One Cable Technology (OCT) for power and feedback with absolute encoder

Backlash-free permanent magnet holding brake

Rotatable speedtec® plug

- Modular design
- Greatest possible variability

- Salient-pole winding technology
- Fully-encapsulated stator

Thermal sensor KTY

Powder-coated
- scratchproof
- durable
- high quality

Single- and multi-turn encoder, resolver

- Low cogging
- High performance
- High power density
- High overload capacity

High-quality radial bearing
- service life 30,000 hrs
- maximum axial and radial loadability

AM80xx high performance type with forced cooling

AM85xx

AM88xx

AM8000 – Dynamic power packages made in Germany

The AM8000 servomotor range stands for durable and powerful synchronous servomotors. Seven sizes, each with three overall lengths, provide seamless coverage for all areas of application. The high-performance servomotor series is characterised by an exceptional power density. Small end turns and the fully potted stator enable an optimised thermal transition from winding to motor housing.

As a result of low rotor moment of inertia coupled with an overload capability of up to 5 times, the AM8000 series is highly dynamic. The motors can be optionally equipped with the proven resolver (2-cable standard) or the innovative One Cable Technology (OCT) feedback system. With OCT, no encoder cable is required, since the feedback signals are digitally transmitted over the existing standard motor cable. Thus, the wiring costs can be reduced by up to 50 %.

Typical for all seven sizes of this motor series is the modular design. Therefore, mechanical adjustments to suit customer requirements can be made quickly and easily. With a guaranteed service life of 30,000 h for wearing parts such as ball bearings, this motor series offers high durability and robustness. Matching accessories such as gears and pre-assembled motor and encoder cables are available.

AM8500 – Synchronous servomotors with increased rotor moment of inertia

The AM8500 series extends the servomotor range by a complete series with increased rotor moment of inertia. This series covers a wide performance range with four sizes and three lengths with standstill torques ranging from 1.37 to 29 Nm. Due to the high rotor moment of inertia, the control of AM8500 servomotors is simplified in applications where a high external inertia has to be moved, because these motor types tend to vibrate less and are much easier to adjust via the servo controller.

AM8000/AM8500 – Forced Cooling

High torques even at high speeds: This is the benefit of the AM8000 and AM8500 motor series with additional forced cooling for increased performance. Equipped with a fan for axial ventilation, the standstill torques of these servomotors can be increased by about 35 %, and the rated torques at the rated speed by even up to 150 %. The external 24 V DC fan can be actuated independently of the motor.

AM8800 – Attractive hygienic design, EHEDG certified

The AM8800 stainless steel motor range is based on the AM8000 range and especially designed for use in the food, chemical and pharmaceutical industries. The motor design complies with the EHEDG requirements and the materials used with the FDA guidelines. The motors are made from AISI-316L stainless steel, making them resistant to aggressive cleaning materials. All AM8800 motors comply with protection class IP 69K and are provided with a hygienic-design cable gland. Four sizes, each with three different lenghts, are available. The AM8800 range supports the One Cable Technology (OCT) as standard. The available options include a resolver, a sealing-air connection, or an AG2280 stainless steel gear unit for the implementation of a perfectly matched and standards-compliant servo axis in hygienic design.

AM3000 – High-dynamic, brushless servomotors

The low-inertia servomotors of the AM3000 series are equipped with rotors containing high-grade neodymium. The high-quality permanent magnet material highly contributes to the exceptionally dynamic behaviour of the motor series. Consequently, the AM3000 synchronous servomotors are mainly used in motion applications with highly dynamic requirements.

The AM3000 series incorporate resolvers as standard feedback unit; however, they can also be fitted with single-turn or multi-turn absolute encoders. The connection plugs can be rotated continuously. The IP 65/64 protection class of the motors can be increased to IP 65/65 by adding a sealing ring. Available accessories for these series include matching gears an pre-assembled motor and encoder cables.

▶ **www.beckhoff.com/Servomotors**

OCT | **One Cable Technology**

The One Cable Technology (OCT) of the AM8xxx motor series reduces the motor cabling to the mandatory motor cable, which can then also be used directly for the feedback signals. As in sensorless control, the user no longer has to use an additional feedback cable. All the information required for control purposes is transferred reliably and interference-proof via a digital interface.

The symbiosis of power and feedback cable enables reliable implementation of high-precision positioning and lower velocity fluctuations. The encoder data, rotor position, multi-turn information and thermal conditions in motor are transferred via a purely digital interface. Costly analog evaluation function blocks in the drive amplifier can be avoided, while retaining extensive diagnostic options.

Since a cable and plug are omitted at both the motor and controller end, the component and commissioning costs are significantly reduced. The wiring is simplified significantly, possible error sources are eliminated. This also has positive effects on the peripheral devices, since drag-chains, cable bushings and areas reserved for cables in machines and control cabinets can now be made smaller. OCT can be used for line lengths of up to 100 m.

This results in greater degrees of freedom on the motor side: the omission of a plug connector allows the new technology to be used even in the smallest motor sizes. The AX5000 EtherCAT Servo Drives support OCT.

Features

- digital single-cable transmission via the existing motor cable
- digital transmission of sensor data
- no interference-susceptible analog signals
- support for the electronic identification plate
- Encoder cables, including expensive plugs, are dispensed with.
- reduction
  - in the costs for cable, plug and assembly
  - in warehouse costs by dispensing with a cable variant
  - in space requirements in cable carrier chains
  - in space requirements on the motor (important with small sizes)
  - in the sources of error and wear
- Remote diagnostics are possible up to the motor.
- Cable lengths of up to 100 m are possible.
- operating hours counter and error memory integrated in the motor

The AX5000 EtherCAT Servo Drives support OCT.

AM8000 | **Synchronous Servomotors**

The AM8000 series represents robust, durable and high-performance synchronous servomotors "Made in Germany". The seven flange sizes, each with three overall lengths, cover a wide torque range.

The AM8000 motors feature a low rotor moment of inertia and a very high overload capacity. Based on these technical characteristics, the most highly dynamic applications can be realised.

The windings of the AM8000 motors are implemented using salient pole-wound technology, resulting in a high copper space factor. Due to the high slot space factor, high continuous torques can be achieved. The fully potted stator provides for an ideal thermal transition from winding to housing. Another advantage is mechanical protection of the winding wires against vibrations.

Amply sized, sealed grooved ball bearings in conjunction with a sophisticated mechanical design ensure a bearing service life of 30,000 hours. All motors feature an integrated KTY temperature sensor for exact temperature evaluation.

In the forced-cooling version, the power density of the AM8000 motor series can be further increased by means of external axial ventilation. This option is available for the AM806x to AM807x sizes.

The modular design of the AM8000 motors enables rapid implementation of mechanical adjustments. Customer-specific variants are available. The motors offer an electronic identification plate for simple commissioning.

The housing is fully powder-coated so that cutting edges are covered. The acrylic powder coating also offers high resistance against scratching and corrosion. In the basic version, AM8000 motors feature IP 54 protected housings. For harsh environmental conditions, the shaft feed-through can optionally be equipped with an FPM sealing ring (fluoropolymer rubber), so that the whole motor is IP 65 protected.

Planetary gear units
see page 836

Pre-assembled cables
see page 804

Technical data	AM80xx
Motor type	permanent magnet-excited three-phase synchronous motor
Magnet material	neodymium-iron-boron
Insulation class	thermal class F (155 °C)
Design form	flange-mounted according to IM B5, IM V1, IM V3
Protection class	IP 54, IP 65 (shaft seal)
Cooling	convection, permissible ambient temperature 40 °C, optionally: external axial ventilation
Coating/surface	dark grey powder coating, similar to RAL7016
Temperature sensor	KTY in stator winding
Connection method	round plug connector, swivelling, angled
Life span	L_{10h} = 30,000 hrs for ball bearings
Approvals	CE, UL
Feedback system	absolute encoder single-turn and multi-turn (OCT), resolver

AM801x | Flange code F1, motor length 1 – 3

Data for 230 V AC	AM8011-wByz	AM8012-wCyz	AM8013-wDyz
Standstill torque	0.20 Nm	0.38 Nm	0.52 Nm
Rated torque	0.18 Nm	0.33 Nm	0.45 Nm
Rated speed	8000 min^{-1}	8000 min^{-1}	8000 min^{-1}
Rated power	0.15 kW	0.28 kW	0.38 kW
Standstill current	0.76 A	1.30 A	1.65 A
Rotor moment of inertia	0.029 $kgcm^2$	0.048 $kgcm^2$	0.067 $kgcm^2$
Rotor moment of inertia (with brake)	0.052 $kgcm^2$	0.071 $kgcm^2$	0.090 $kgcm^2$

AM8021 | Flange code F2, motor length 1

Data for 400 V AC	AM8021-wByz	AM8021-wDyz
Standstill torque	0.50 Nm	0.50 Nm
Rated torque	0.50 Nm	0.50 Nm
Rated speed	8000 min^{-1}	9000 min^{-1}
Rated power	0.42 kW	0.47 kW
Standstill current	0.85 A	1.60 A
Rotor moment of inertia	0.134 $kgcm^2$	0.134 $kgcm^2$
Rotor moment of inertia (with brake)	0.156 $kgcm^2$	0.156 $kgcm^2$

AM8022 | Flange code F2, motor length 2

Data for 400 V AC	AM8022-wDyz	AM8022-wEyz
Standstill torque	0.80 Nm	0.80 Nm
Rated torque	0.70 Nm	0.65 Nm
Rated speed	8000 min^{-1}	9000 min^{-1}
Rated power	0.59 kW	0.61 kW
Standstill current	1.50 A	2.44 A
Rotor moment of inertia	0.253 $kgcm^2$	0.253 $kgcm^2$
Rotor moment of inertia (with brake)	0.276 $kgcm^2$	0.276 $kgcm^2$

AM8023 | Flange code F2, motor length 3

Data for 400 V AC	AM8023-wEyz	AM8023-wFyz
Standstill torque	1.20 Nm	1.20 Nm
Rated torque	1.00 Nm	0.90 Nm
Rated speed	8000 min^{-1}	9000 min^{-1}
Rated power	0.84 kW	0.85 kW
Standstill current	2.20 A	3.40 A
Rotor moment of inertia	0.373 $kgcm^2$	0.373 $kgcm^2$
Rotor moment of inertia (with brake)	0.396 $kgcm^2$	0.396 $kgcm^2$

AM8031 | Flange code F3, motor length 1

Data for 400 V AC	AM8031-wCyz	AM8031-wDyz	AM8031-wFyz
Standstill torque	1.37 Nm	1.38 Nm	1.40 Nm
Rated torque	1.34 Nm	1.33 Nm	1.30 Nm
Rated speed	3000 min^{-1}	6000 min^{-1}	9000 min^{-1}
Rated power	0.42 kW	0.84 kW	1.23 kW
Standstill current	1.00 A	1.95 A	3.20 A
Rotor moment of inertia	0.462 $kgcm^2$	0.462 $kgcm^2$	0.462 $kgcm^2$
Rotor moment of inertia (with brake)	0.541 $kgcm^2$	0.541 $kgcm^2$	0.541 $kgcm^2$

AM8032 | Flange code F3, motor length 2

Data for 400 V AC	AM8032-wDyz	AM8032-wEyz	AM8032-wHyz
Standstill torque	2.38 Nm	2.37 Nm	2.37 Nm
Rated torque	2.30 Nm	2.20 Nm	1.85 Nm
Rated speed	3000 min^{-1}	6000 min^{-1}	9000 min^{-1}
Rated power	0.72 kW	1.38 kW	1.74 kW
Standstill current	1.70 A	2.95 A	5.10 A
Rotor moment of inertia	0.842 $kgcm^2$	0.842 $kgcm^2$	0.842 $kgcm^2$
Rotor moment of inertia (with brake)	0.921 $kgcm^2$	0.921 $kgcm^2$	0.921 $kgcm^2$

AM8033 | Flange code F3, motor length 3

Data for 400 V AC	AM8033-wEyz	AM8033-wFyz	AM8033-wJyz
Standstill torque	3.20 Nm	3.22 Nm	3.22 Nm
Rated torque	2.98 Nm	2.70 Nm	2.30 Nm
Rated speed	3000 min^{-1}	6000 min^{-1}	9000 min^{-1}
Rated power	0.94 kW	1.70 kW	2.17 kW
Standstill current	2.10 A	4.10 A	6.80 A
Rotor moment of inertia	1.22 $kgcm^2$	1.22 $kgcm^2$	1.22 $kgcm^2$
Rotor moment of inertia (with brake)	1.46 $kgcm^2$	1.46 $kgcm^2$	1.46 $kgcm^2$

AM8041 | Flange code F4, motor length 1

Data for 400 V AC	AM8041-wDyz	AM8041-wEyz	AM8041-wHyz
Standstill torque	2.37 Nm	2.45 Nm	2.40 Nm
Rated torque	2.30 Nm	2.31 Nm	2.10 Nm
Rated speed	3000 min^{-1}	6000 min^{-1}	8000 min^{-1}
Rated power	0.72 kW	1.45 kW	1.76 kW
Standstill current	1.65 A	3.00 A	5.25 A
Rotor moment of inertia	1.08 $kgcm^2$	1.08 $kgcm^2$	1.08 $kgcm^2$
Rotor moment of inertia (with brake)	1.73 $kgcm^2$	1.73 $kgcm^2$	1.73 $kgcm^2$

AM8042 | Flange code F4, motor length 2

Data for 400 V AC	AM8042-wEyz	AM8042-wFyz	AM8042-wJyz
Standstill torque	4.10 Nm	4.10 Nm	4.10 Nm
Rated torque	3.90 Nm	3.70 Nm	3.10 Nm
Rated speed	2500 min^{-1}	5000 min^{-1}	8000 min^{-1}
Rated power	1.02 kW	1.94 kW	2.60 kW
Standstill current	2.15 A	4.10 A	6.90 A
Rotor moment of inertia	1.97 $kgcm^2$	1.97 $kgcm^2$	1.97 $kgcm^2$
Rotor moment of inertia (with brake)	2.62 $kgcm^2$	2.62 $kgcm^2$	2.62 $kgcm^2$

AM8043 | Flange code F4, motor length 3

Data for 400 V AC	AM8043-wEyz	AM8043-wHyz	AM8043-wKyz
Standstill torque	5.65 Nm	5.65 Nm	5.60 Nm
Rated torque	5.30 Nm	4.90 Nm	4.10 Nm
Rated speed	2500 min^{-1}	5000 min^{-1}	8000 min^{-1}
Rated power	1.39 kW	2.57 kW	3.43 kW
Standstill current	2.90 A	5.40 A	9.30 A
Rotor moment of inertia	2.87 $kgcm^2$	2.87 $kgcm^2$	2.87 $kgcm^2$
Rotor moment of inertia (with brake)	3.52 $kgcm^2$	3.52 $kgcm^2$	3.52 $kgcm^2$

AM8051 | Flange code F5, motor length 1

Data for 400 V AC	AM8051-wEyz	AM8051-wGyz	AM8051-wKyz
Standstill torque	4.80 Nm	4.90 Nm	4.90 Nm
Rated torque	4.60 Nm	4.40 Nm	3.90 Nm
Rated speed	2500 min^{-1}	5000 min^{-1}	8000 min^{-1}
Rated power	1.24 kW	2.30 kW	3.27 kW
Standstill current	2.70 A	4.75 A	8.50 A
Rotor moment of inertia	2.24 $kgcm^2$	2.24 $kgcm^2$	2.24 $kgcm^2$
Rotor moment of inertia (with brake)	2.90 $kgcm^2$	2.90 $kgcm^2$	2.90 $kgcm^2$

AM8051 | Flange code F5, motor length 1, high-performance type with forced cooling

Data for 400 V AC	AM8051-wFyz	AM8051-wJyz	AM8051-wLyz
Standstill torque	6.2 Nm	6.3 Nm	6.3 Nm
Rated torque	5.8 Nm	5.5 Nm	3.6 Nm
Rated speed	2500 min^{-1}	4750 min^{-1}	8000 min^{-1}
Rated power	1.52 kW	2.74 kW	3.02 kW
Standstill current	3.5 A	5.8 A	11.1 A
Rotor moment of inertia	2.24 $kgcm^2$	2.24 $kgcm^2$	2.24 $kgcm^2$
Rotor moment of inertia (with brake)	2.90 $kgcm^2$	2.90 $kgcm^2$	2.90 $kgcm^2$

AM8052 | Flange code F5, motor length 2

Data for 400 V AC	AM8052-wFyz	AM8052-wJyz	AM8052-wLyz
Standstill torque	8.20 Nm	8.20 Nm	8.20 Nm
Rated torque	7.50 Nm	6.90 Nm	5.40 Nm
Rated speed	2000 min^{-1}	4000 min^{-1}	7300 min^{-1}
Rated power	1.57 kW	2.89 kW	4.13 kW
Standstill current	3.30 A	6.30 A	11.3 A
Rotor moment of inertia	4.08 $kgcm^2$	4.08 $kgcm^2$	4.08 $kgcm^2$
Rotor moment of inertia (with brake)	4.74 $kgcm^2$	4.74 $kgcm^2$	4.74 $kgcm^2$

AM8052 | Flange code F5, motor length 2, high-performance type with forced cooling

Data for 400 V AC	AM8052-wGyz	AM8052-wKyz	AM8052-wNyz
Standstill torque	10.7 Nm	10.7 Nm	9.9 Nm
Rated torque	9.7 Nm	9.0 Nm	6.5 Nm
Rated speed	2000 min^{-1}	4000 min^{-1}	6000 min^{-1}
Rated power	2.03 kW	3.77 kW	4.08 kW
Standstill current	4.3 A	8.5 A	13.9 A
Rotor moment of inertia	4.08 $kgcm^2$	4.08 $kgcm^2$	4.08 $kgcm^2$
Rotor moment of inertia (with brake)	4.74 $kgcm^2$	4.74 $kgcm^2$	4.74 $kgcm^2$

AM8053 | Flange code F5, motor length 3

Data for 400 V AC	AM8053-wGyz	AM8053-wKyz	AM8053-wNyz
Standstill torque	11.4 Nm	11.4 Nm	11.4 Nm
Rated torque	10.0 Nm	8.35 Nm	4.50 Nm
Rated speed	2000 min^{-1}	4000 min^{-1}	7000 min^{-1}
Rated power	2.09 kW	3.50 kW	3.30 kW
Standstill current	4.70 A	8.80 A	15.6 A
Rotor moment of inertia	5.92 $kgcm^2$	5.92 $kgcm^2$	5.92 $kgcm^2$
Rotor moment of inertia (with brake)	7.04 $kgcm^2$	7.04 $kgcm^2$	7.04 $kgcm^2$

AM8053 | Flange code F5, motor length 3, high-performance type with forced cooling

Data for 400 V AC	AM8053-wJyz	AM8053-wLyz	AM8053-wPyz
Standstill torque	15.4 Nm	15.4 Nm	13.3 Nm
Rated torque	14.9 Nm	12.9 Nm	7.1 Nm
Rated speed	2000 min^{-1}	4000 min^{-1}	5000 min^{-1}
Rated power	3.12 kW	5.41 kW	3.72 kW
Standstill current	6.4 A	11.9 A	18.6 A
Rotor moment of inertia	5.92 $kgcm^2$	5.92 $kgcm^2$	5.92 $kgcm^2$
Rotor moment of inertia (with brake)	7.04 $kgcm^2$	7.04 $kgcm^2$	7.04 $kgcm^2$

AM8061 | Flange code F6, motor length 1

Data for 400 V AC	AM8061-wGyz	AM8061-wJyz	AM8061-wMyz
Standstill torque	12.8 Nm	12.8 Nm	12.8 Nm
Rated torque	12.1 Nm	11.0 Nm	9.00 Nm
Rated speed	1500 min^{-1}	3000 min^{-1}	5000 min^{-1}
Rated power	1.90 kW	3.46 kW	4.71 kW
Standstill current	4.00 A	7.80 A	13.1 A
Rotor moment of inertia	11.1 $kgcm^2$	11.1 $kgcm^2$	11.1 $kgcm^2$
Rotor moment of inertia (with brake)	13.4 $kgcm^2$	13.4 $kgcm^2$	13.4 $kgcm^2$

AM8061 | Flange code F6, motor length 1, high-performance type with forced cooling

Data for 400 V AC	AM8061-wHyz	AM8061-wLyz	AM8061-wNyz
Standstill torque	17.1 Nm	17.1 Nm	15.5 Nm
Rated torque	16.1 Nm	14.7 Nm	10.7 Nm
Rated speed	1400 min^{-1}	3000 min^{-1}	5000 min^{-1}
Rated power	2.36 kW	4.60 kW	5.60 kW
Standstill current	5.20 A	10.1 A	15.8 A
Rotor moment of inertia	11.1 $kgcm^2$	11.1 $kgcm^2$	11.1 $kgcm^2$
Rotor moment of inertia (with brake)	13.4 $kgcm^2$	13.4 $kgcm^2$	13.4 $kgcm^2$

AM8062 | Flange code F6, motor length 2

Data for 400 V AC	AM8062-wJyz	AM8062-wLyz	AM8062-wPyz
Standstill torque	21.1 Nm	21.1 Nm	21.1 Nm
Rated torque	18.50 Nm	15.2 Nm	6.50 Nm
Rated speed	1500 min^{-1}	3000 min^{-1}	5000 min^{-1}
Rated power	2.91 kW	4.78 kW	3.40 kW
Standstill current	6.20 A	12.4 A	20.3 A
Rotor moment of inertia	20.0 $kgcm^2$	20.0 $kgcm^2$	20.0 $kgcm^2$
Rotor moment of inertia (with brake)	22.3 $kgcm^2$	22.3 $kgcm^2$	22.3 $kgcm^2$

AM8062 | Flange code F6, motor length 2, high-performance type with forced cooling

Data for 400 V AC	AM8062-wKyz	AM8062-wNyz	AM8062-wRyz
Standstill torque	29.9 Nm	29.9 Nm	28.1 Nm
Rated torque	26.4 Nm	22.2 Nm	13.4 Nm
Rated speed	1400 min^{-1}	3000 min^{-1}	5000 min^{-1}
Rated power	3.87 kW	7.00 kW	7.00 kW
Standstill current	8.70 A	17.4 A	28.7 A
Rotor moment of inertia	20.0 $kgcm^2$	20.0 $kgcm^2$	20.0 $kgcm^2$
Rotor moment of inertia (with brake)	22.3 $kgcm^2$	22.3 $kgcm^2$	22.3 $kgcm^2$

AM8063 | Flange code F6, motor length 3

Data for 400 V AC	AM8063-wKyz	AM8063-wNyz	AM8063-wRyz
Standstill torque	29.0 Nm	29.0 Nm	29.0 Nm
Rated torque	22.3 Nm	13.2 Nm	6.10 Nm
Rated speed	1500 min^{-1}	3000 min^{-1}	4000 min^{-1}
Rated power	3.50 kW	4.15 kW	2.56 kW
Standstill current	8.70 A	17.2 A	29.5 A
Rotor moment of inertia	29.0 $kgcm^2$	29.0 $kgcm^2$	29.0 $kgcm^2$
Rotor moment of inertia (with brake)	34.9 $kgcm^2$	34.9 $kgcm^2$	34.9 $kgcm^2$

AM8063 | Flange code F6, motor length 3, high-performance type with forced cooling

Data for 400 V AC	AM8063-wLyz	AM8063-wQyz	AM8063-wTyz
Standstill torque	41.4 Nm	41.4 Nm	40.1 Nm
Rated torque	33.9 Nm	25.5 Nm	15.1 Nm
Rated speed	1400 min^{-1}	3000 min^{-1}	4000 min^{-1}
Rated power	4.97 kW	8.00 kW	6.30 kW
Standstill current	11.6 A	24.0 A	39.8 A
Rotor moment of inertia	29.0 $kgcm^2$	29.0 $kgcm^2$	29.0 $kgcm^2$
Rotor moment of inertia (with brake)	34.9 $kgcm^2$	34.9 $kgcm^2$	34.9 $kgcm^2$

AM8071 | Flange code F7, motor lengths 1

Data for 400 V AC	AM8071-wKyz	AM8071-wNyz	AM8071-wRyz
Standstill torque	31.8 Nm	31.8 Nm	29.0 Nm
Rated torque	26.5 Nm	19.5 Nm	8.00 Nm
Rated speed	1500 min^{-1}	3000 min^{-1}	4000 min^{-1}
Rated power	4.16 kW	6.13 kW	3.35 kW
Standstill current	9.60 A	17.8 A	28.2 A
Rotor moment of inertia	49.6 $kgcm^2$	49.6 $kgcm^2$	49.6 $kgcm^2$
Rotor moment of inertia (with brake)	68.3 $kgcm^2$	68.3 $kgcm^2$	68.3 $kgcm^2$

AM8071 | Flange code F7, motor length 1, high-performance type with forced cooling

Data for 400 V AC	AM8071-wMyz	AM8071-wPyz	AM8071-wTyz
Standstill torque	42.8 Nm	42.8 Nm	41.2 Nm
Rated torque	36.2 Nm	29.2 Nm	18.1 Nm
Rated speed	1500 min^{-1}	2900 min^{-1}	4000 min^{-1}
Rated power	5.70 kW	8.90 kW	7.60 kW
Standstill current	12.6 A	23.8 A	41.1 A
Rotor moment of inertia	49.6 $kgcm^2$	49.6 $kgcm^2$	49.6 $kgcm^2$
Rotor moment of inertia (with brake)	68.3 $kgcm^2$	68.3 $kgcm^2$	68.3 $kgcm^2$

AM8072 | Flange code F7, motor lengths 2

Data for 400 V AC	AM8072-wLyz	AM8072-wPyz	AM8072-wTyz
Standstill torque	54.6 Nm	54.6 Nm	50.0 Nm
Rated torque	48.9 Nm	38.2 Nm	13.0 Nm
Rated speed	1000 min^{-1}	2000 min^{-1}	3000 min^{-1}
Rated power	5.12 kW	8.00 kW	4.08 kW
Standstill current	11.1 A	20.6 A	37.5 A
Rotor moment of inertia	92.3 $kgcm^2$	92.3 $kgcm^2$	92.3 $kgcm^2$
Rotor moment of inertia (with brake)	110.9 $kgcm^2$	110.9 $kgcm^2$	110.9 $kgcm^2$

AM8072 | Flange code F7, motor length 2, high-performance type with forced cooling

Data for 400 V AC	AM8072-wNyz	AM8072-wRyz	AM8072-wUyz
Standstill torque	80.7 Nm	80.7 Nm	74.0 Nm
Rated torque	72.6 Nm	60.1 Nm	33.8 Nm
Rated speed	1000 min^{-1}	2000 min^{-1}	3000 min^{-1}
Rated power	7.6 kW	12.6 kW	10.6 kW
Standstill current	16.1 A	29.2 A	53.0 A
Rotor moment of inertia	92.2 $kgcm^2$	92.2 $kgcm^2$	92.2 $kgcm^2$
Rotor moment of inertia (with brake)	111 $kgcm^2$	111 $kgcm^2$	111 $kgcm^2$

AM8073 | Flange code F7, motor lengths 3

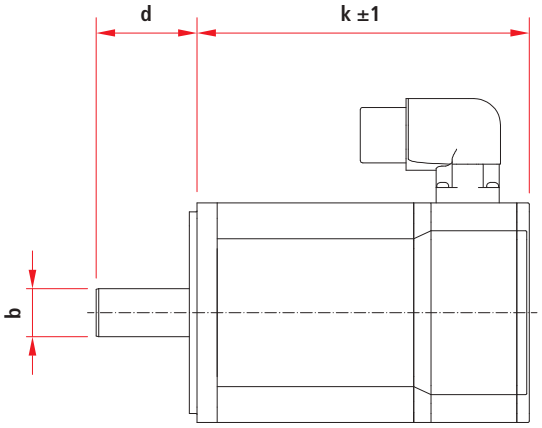
Data for 400 V AC	AM8073-wNyz	AM8073-wQyz	AM8073-wTyz
Standstill torque	72.6 Nm	72.6 Nm	70.0 Nm
Rated torque	58.5 Nm	38.8 Nm	10.8 Nm
Rated speed	1000 min^{-1}	2000 min^{-1}	3000 min^{-1}
Rated power	6.13 kW	8.13 kW	3.39 kW
Standstill current	14.7 A	27.9 A	45.6 A
Rotor moment of inertia	134.9 $kgcm^2$	134.9 $kgcm^2$	134.9 $kgcm^2$
Rotor moment of inertia (with brake)	153.6 $kgcm^2$	153.6 $kgcm^2$	153.6 $kgcm^2$

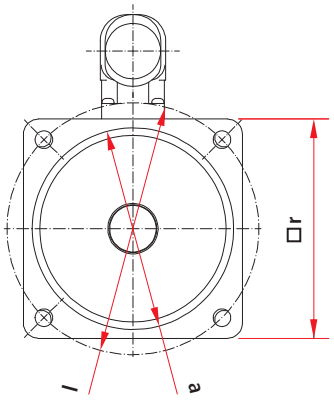
AM8073 | Flange code F7, motor length 3, high-performance type with forced cooling

Data for 400 V AC	AM8073-wPyz	AM8073-wRyz	AM8073-wUyz
Standstill torque	104 Nm	104 Nm	95.0 Nm
Rated torque	83.7 Nm	63.3 Nm	17.8 Nm
Rated speed	1000 min^{-1}	2000 min^{-1}	3000 min^{-1}
Rated power	8.8 kW	13.3 kW	5.60 kW
Standstill current	19.8 A	37.4 A	66.5 A
Rotor moment of inertia	135 $kgcm^2$	135 $kgcm^2$	135 $kgcm^2$
Rotor moment of inertia (with brake)	154 $kgcm^2$	154 $kgcm^2$	154 $kgcm^2$

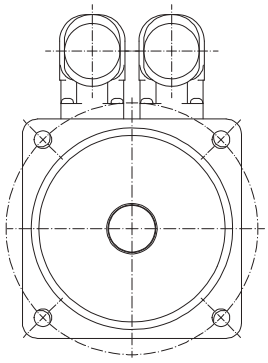
Order reference	AM80uv-wxyz
u	flange code F
v	motor length
w = 0	smooth shaft
w = 1	shaft with groove and feather key according to DIN 6885
w = 2	shaft with IP 65 sealing ring and smooth shaft (not for AM801x)
w = 3	shaft with IP 65 sealing ring and shaft with groove and feather key (not for AM801x)
x	winding code A…Z
y = 0	2-cable standard: feedback resolver (not for AM801x)
y = 1	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, single-turn, absolute position within one revolution, 18 bit resolution
y = 2	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, multi-turn, absolute position within 4096 revolutions, 18 bit resolution
y = 4	2-cable standard: feedback multi-turn, absoulte encoder SKM36, 128 sincos periods (only for AM806x and AM807x)
y = A	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, single-turn, absolute position within one revolution, resolution 23 bit (only for AM803x to AM807x and AM853x to AM856x)
y = B	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, multi-turn, absolute position within 4096 revolutions, resolution 23 bit (only for AM803x to AM807x and AM853x to AM856x)
z = 0	without holding brake
z = 1	with holding brake
z = A	forced cooling, without holding brake, for AM805x, AM806x, AM807x [1]
z = B	forced cooling, with holding brake, for AM805x, AM806x, AM807x [1]

[1] The EL2022 354 or KL2022 609 digital output terminal is recommended for controlling the external 24 V DC ventilation.





One Cable Technology



Resolver version

Dimensions	a	b	d	l	r	k (without brake)	k (with brake)
AM8011	30 h7	8 h7	25 mm	46 mm	40 mm	97 mm	129 mm
AM8012	30 h7	8 h7	25 mm	46 mm	40 mm	117 mm	149 mm
AM8013	30 h7	8 h7	25 mm	46 mm	40 mm	137 mm	169 mm
AM8021	40 j6	9 k6	20 mm	63 mm	58 mm	111.5 mm	146 mm
AM8022	40 j6	9 k6	20 mm	63 mm	58 mm	133.5 mm	168 mm
AM8023	40 j6	9 k6	20 mm	63 mm	58 mm	155.5 mm	190 mm
AM8031	60 j6	14 k6	30 mm	75 mm	72 mm	129 mm	168 mm
AM8032	60 j6	14 k6	30 mm	75 mm	72 mm	154 mm	194 mm
AM8033	60 j6	14 k6	30 mm	75 mm	72 mm	180 mm	229 mm
AM8041	80 j6	19 k6	40 mm	100 mm	87 mm	132 mm	179.5 mm
AM8042	80 j6	19 k6	40 mm	100 mm	87 mm	162 mm	209.5 mm
AM8043	80 j6	19 k6	40 mm	100 mm	87 mm	192 mm	239.5 mm
AM8051	95 j6	24 k6	50 mm	115 mm	104 mm	136.5 mm	183.5 mm
AM8051*	95 j6	24 k6	50 mm	115 mm	104 mm	209 mm	256 mm
AM8052	95 j6	24 k6	50 mm	115 mm	104 mm	169.5 mm	216.5 mm
AM8052*	95 j6	24 k6	50 mm	115 mm	104 mm	242 mm	289 mm
AM8053	95 j6	24 k6	50 mm	115 mm	104 mm	202.5 mm	251.5 mm
AM8053*	95 j6	24 k6	50 mm	115 mm	104 mm	275 mm	324 mm
AM8061	130 j6	32 k6	58 mm	165 mm	142 mm	176 mm	228 mm
AM8061*	130 j6	32 k6	58 mm	165 mm	142 mm	259 mm	311 mm
AM8062	130 j6	32 k6	58 mm	165 mm	142 mm	216 mm	268 mm
AM8062*	130 j6	32 k6	58 mm	165 mm	142 mm	299 mm	351 mm
AM8063	130 j6	32 k6	58 mm	165 mm	142 mm	256 mm	315 mm
AM8063*	130 j6	32 k6	58 mm	165 mm	142 mm	339 mm	398 mm
AM8071	180 j6	38 k6	80 mm	215 mm	194 mm	212 mm	284.5 mm
AM8071*	180 j6	38 k6	80 mm	215 mm	194 mm	322.5 mm	395 mm
AM8072	180 j6	38 k6	80 mm	215 mm	194 mm	269 mm	341.5 mm
AM8072*	180 j6	38 k6	80 mm	215 mm	194 mm	379.5 mm	452 mm
AM8073	180 j6	38 k6	80 mm	215 mm	194 mm	326 mm	398.5 mm
AM8073*	180 j6	38 k6	80 mm	215 mm	194 mm	436.5 mm	509 mm

* high-performance type: oversize caused by fan, see dimension "k"

▶ **www.beckhoff.com/AM80xx**

AM8500 | Synchronous Servomotors with higher moment of inertia

The AM8500 series extends the servomotor range by a complete series with increased rotor moment of inertia. Due to the modified rotor geometry it is increased, depending on the length, by 100 to 300 % compared to the AM8000 servomotors. The AM8500 series covers a wide performance range with four sizes and three lengths with standstill torques from 1.37 to 29 Nm. A particular highlight, as with all servomotors from the AM8000 series, is the One Cable Technology (OCT) that combines power and feedback system in the standard motor cable.

Due to the high rotor inertia, control of the AM8500 is simplified in areas in which a high external inertia has to be moved, e.g. CNC applications in machine tools and woodworking machines. The servo motors tend to vibrate less and are much easier to adjust to the application on the servo controller. Where the ratio of external to inherent inertia has previously required a gearbox, this can now be dispensed with in some cases. Typical areas of application for the AM8500 servomotors are in woodworking machines, printing machines and machine tools as well as in film winders and feeding drive units.

In the forced cooling version the power density of the AM8500 motor series is thus increased further thanks to the external axial ventilation of the servomotors: the standstill torques can be increased by about 35 %; the rated torques at the rated speed even by up to 150 %. In this version the servomotor series offers high torques even at high speeds. Cooling takes place with a 24 V DC fan, which is actuated independently of the motor.In the forced cooling version all further options are available in accordance with the order data such as OCT or backlash-free permanent magnet holding brake. The forced cooling option is available for AM855x and AM856x.

Planetary gear units
see page 836

Pre-assembled cables
see page 804

Technical data	AM85xx
Motor type	permanent magnet-excited three-phase synchronous motor
Magnet material	neodymium-iron-boron
Insulation class	thermal class F (155 °C)
Design form	flange-mounted according to IM B5, IM V1, IM V3
Protection class	IP 54, IP 65 (shaft seal)
Cooling	convection, permissible ambient temperature 40 °C, optionally: external axial ventilation
Coating/surface	dark grey powder coating, similar to RAL7016
Temperature sensor	KTY in stator winding
Connection method	round plug connector, swivelling, angled
Life span	L_{10h} = 30,000 hrs for ball bearings
Approvals	CE, UL
Feedback system	absolute encoder single-turn and multi-turn (OCT), resolver

AM8531 | Flange code F3, motor length 1

Data for 400 V AC	AM8531-wCyz	AM8531-wDyz	AM8531-wFyz
Standstill torque	1.37 Nm	1.38 Nm	1.40 Nm
Rated torque	1.34 Nm	1.33 Nm	1.30 Nm
Rated speed	3000 min^{-1}	6000 min^{-1}	9000 min^{-1}
Rated power	0.42 kW	0.84 kW	1.23 kW
Standstill current	1.00 A	1.95 A	3.20 A
Rotor moment of inertia	1.67 $kgcm^2$	1.67 $kgcm^2$	1.67 $kgcm^2$
Rotor moment of inertia (with brake)	1.76 $kgcm^2$	1.76 $kgcm^2$	1.76 $kgcm^2$

AM8532 | Flange code F3, motor length 2

Data for 400 V AC	AM8532-wDyz	AM8532-wEyz	AM8532-wHyz
Standstill torque	2.38 Nm	2.37 Nm	2.37 Nm
Rated torque	2.30 Nm	2.20 Nm	1.85 Nm
Rated speed	3000 min^{-1}	6000 min^{-1}	9000 min^{-1}
Rated power	0.72 kW	1.38 kW	1.74 kW
Standstill current	1.70 A	2.95 A	5.10 A
Rotor moment of inertia	2.05 $kgcm^2$	2.05 $kgcm^2$	2.05 $kgcm^2$
Rotor moment of inertia (with brake)	2.15 $kgcm^2$	2.15 $kgcm^2$	2.15 $kgcm^2$

AM8533 | Flange code F3, motor length 3

Data for 400 V AC	AM8533-wEyz	AM8533-wFyz	AM8533-wJyz
Standstill torque	3.20 Nm	3.22 Nm	3.22 Nm
Rated torque	2.98 Nm	2.70 Nm	2.30 Nm
Rated speed	3000 min^{-1}	6000 min^{-1}	9000 min^{-1}
Rated power	0.94 kW	1.70 kW	2.17 kW
Standstill current	2.10 A	4.10 A	6.80 A
Rotor moment of inertia	2.44 $kgcm^2$	2.44 $kgcm^2$	2.44 $kgcm^2$
Rotor moment of inertia (with brake)	–	–	–

AM8541 | Flange code F4, motor length 1

Data for 400 V AC	AM8541-wDyz	AM8541-wEyz	AM8541-wHyz
Standstill torque	2.37 Nm	2.45 Nm	2.40 Nm
Rated torque	2.30 Nm	2.31 Nm	2.10 Nm
Rated speed	3000 min^{-1}	6000 min^{-1}	8000 min^{-1}
Rated power	0.72 kW	1.45 kW	1.76 kW
Standstill current	1.65 A	3.00 A	5.25 A
Rotor moment of inertia	4.63 $kgcm^2$	4.63 $kgcm^2$	4.63 $kgcm^2$
Rotor moment of inertia (with brake)	5.27 $kgcm^2$	5.27 $kgcm^2$	5.27 $kgcm^2$

AM8542 | Flange code F4, motor length 2

Data for 400 V AC	AM8542-wEyz	AM8542-wFyz	AM8542-wJyz
Standstill torque	4.10 Nm	4.10 Nm	4.10 Nm
Rated torque	3.90 Nm	3.70 Nm	3.10 Nm
Rated speed	2500 min^{-1}	5000 min^{-1}	8000 min^{-1}
Rated power	1.02 kW	1.94 kW	2.60 kW
Standstill current	2.15 A	4.10 A	6.90 A
Rotor moment of inertia	5.53 $kgcm^2$	5.53 $kgcm^2$	5.53 $kgcm^2$
Rotor moment of inertia (with brake)	6.16 $kgcm^2$	6.16 $kgcm^2$	6.16 $kgcm^2$

AM8543 | Flange code F4, motor length 3

Data for 400 V AC	AM8543-wEyz	AM8543-wHyz	AM8543-wKyz
Standstill torque	5.65 Nm	5.65 Nm	5.60 Nm
Rated torque	5.30 Nm	4.90 Nm	4.10 Nm
Rated speed	2500 min^{-1}	5000 min^{-1}	8000 min^{-1}
Rated power	1.39 kW	2.57 kW	3.43 kW
Standstill current	2.90 A	5.40 A	9.30 A
Rotor moment of inertia	6.43 $kgcm^2$	6.43 $kgcm^2$	6.43 $kgcm^2$
Rotor moment of inertia (with brake)	–	–	–

AM8551 | Flange code F5, motor length 1

Data for 400 V AC	AM8551-wEyz	AM8551-wGyz	AM8551-wKyz
Standstill torque	4.80 Nm	4.90 Nm	4.90 Nm
Rated torque	4.60 Nm	4.40 Nm	3.90 Nm
Rated speed	2500 min^{-1}	5000 min^{-1}	8000 min^{-1}
Rated power	1.20 kW	2.30 kW	3.27 kW
Standstill current	2.70 A	4.75 A	8.50 A
Rotor moment of inertia	8.74 $kgcm^2$	8.74 $kgcm^2$	8.74 $kgcm^2$
Rotor moment of inertia (with brake)	9.40 $kgcm^2$	9.40 $kgcm^2$	9.40 $kgcm^2$

AM8551 | Flange code F5, motor length 1, high-performance type with forced cooling

Data for 400 V AC	AM8551-wFyz	AM8551-wJyz	AM8551-wLyz
Standstill torque	6.20 Nm	6.30 Nm	6.30 Nm
Rated torque	5.8 Nm	5.5 Nm	3.6 Nm
Rated speed	2500 min^{-1}	4750 min^{-1}	8000 min^{-1}
Rated power	1.52 kW	2.74 kW	3.02 kW
Standstill current	3.5 A	5.8 A	11.1 A
Rotor moment of inertia	8.74 $kgcm^2$	8.74 $kgcm^2$	8.74 $kgcm^2$
Rotor moment of inertia (with brake)	9.40 $kgcm^2$	9.40 $kgcm^2$	9.40 $kgcm^2$

AM8552 | Flange code F5, motor length 2

Data for 400 V AC	AM8552-wFyz	AM8552-wJyz	AM8552-wLyz
Standstill torque	8.20 Nm	8.20 Nm	8.20 Nm
Rated torque	7.50 Nm	6.90 Nm	5.40 Nm
Rated speed	2000 min^{-1}	4000 min^{-1}	7300 min^{-1}
Rated power	1.57 kW	2.89 kW	4.24 kW
Standstill current	3.30 A	6.30 A	11.3 A
Rotor moment of inertia	10.6 $kgcm^2$	10.6 $kgcm^2$	10.6 $kgcm^2$
Rotor moment of inertia (with brake)	11.2 $kgcm^2$	11.2 $kgcm^2$	11.2 $kgcm^2$

AM8552 | Flange code F5, motor length 2, high-performance type with forced cooling

Data for 400 V AC	AM8552-wGyz	AM8552-wKyz	AM8552-wNyz
Standstill torque	10.7 Nm	10.7 Nm	9.9 Nm
Rated torque	9.7 Nm	9.0 Nm	6.5 Nm
Rated speed	2000 min^{-1}	4000 min^{-1}	6000 min^{-1}
Rated power	2.03 kW	3.77 kW	4.08 kW
Standstill current	4.3 A	8.5 A	13.9 A
Rotor moment of inertia	10.6 $kgcm^2$	10.6 $kgcm^2$	10.6 $kgcm^2$
Rotor moment of inertia (with brake)	11.2 $kgcm^2$	11.2 $kgcm^2$	11.2 $kgcm^2$

AM8553 | Flange code F5, motor length 3

Data for 400 V AC	AM8553-wGyz	AM8553-wKyz	AM8553-wNyz
Standstill torque	11.4 Nm	11.4 Nm	11.4 Nm
Rated torque	10.0 Nm	8.35 Nm	4.50 Nm
Rated speed	2000 min^{-1}	4000 min^{-1}	7000 min^{-1}
Rated power	2.09 kW	3.50 kW	3.30 kW
Standstill current	4.70 A	8.80 A	15.6 A
Rotor moment of inertia	12.5 $kgcm^2$	12.5 $kgcm^2$	12.5 $kgcm^2$
Rotor moment of inertia (with brake)	–	–	–

AM8553 | Flange code F5, motor length 3, high-performance type with forced cooling

Data for 400 V AC	AM8553-wJyz	AM8553-wLyz	AM8553-wPyz
Standstill torque	15.4 Nm	15.4 Nm	13.3 Nm
Rated torque	14.9 Nm	12.9 Nm	7.1 Nm
Rated speed	2000 min^{-1}	4000 min^{-1}	5000 min^{-1}
Rated power	3.12 kW	5.41 kW	3.72 kW
Standstill current	6.4 A	11.9 A	18.6 A
Rotor moment of inertia	12.5 $kgcm^2$	12.5 $kgcm^2$	12.5 $kgcm^2$
Rotor moment of inertia (with brake)	–	–	–

AM8561 | Flange code F6, motor length 1

Data for 400 V AC	AM8561-wGyz	AM8561-wJyz	AM8561-wMyz
Standstill torque	12.8 Nm	12.8 Nm	12.8 Nm
Rated torque	12.1 Nm	11.0 Nm	9.00 Nm
Rated speed	1500 min^{-1}	3000 min^{-1}	5000 min^{-1}
Rated power	1.90 kW	3.46 kW	4.71 kW
Standstill current	4.00 A	7.80 A	13.1 A
Rotor moment of inertia	48.2 $kgcm^2$	48.2 $kgcm^2$	48.2 $kgcm^2$
Rotor moment of inertia (with brake)	50.6 $kgcm^2$	50.6 $kgcm^2$	50.6 $kgcm^2$

AM8561 | Flange code F6, motor length 1, high-performance type with forced cooling

Data for 400 V AC	AM8561-wHyz	AM8561-wLyz	AM8561-wNyz
Standstill torque	17.1 Nm	17.1 Nm	15.5 Nm
Rated torque	16.1 Nm	14.7 Nm	10.7 Nm
Rated speed	1400 min^{-1}	3000 min^{-1}	5000 min^{-1}
Rated power	2.36 kW	4.60 kW	5.60 kW
Standstill current	5.20 A	10.1 A	15.8 A
Rotor moment of inertia	48.2 $kgcm^2$	48.2 $kgcm^2$	48.2 $kgcm^2$
Rotor moment of inertia (with brake)	50.6 $kgcm^2$	50.6 $kgcm^2$	50.6 $kgcm^2$

AM8562 | Flange code F6, motor length 2

Data for 400 V AC	AM8562-wJyz	AM8562-wLyz	AM8562-wPyz
Standstill torque	21.1 Nm	21.1 Nm	21.1 Nm
Rated torque	18.5 Nm	15.2 Nm	6.50 Nm
Rated speed	1500 min^{-1}	3000 min^{-1}	5000 min^{-1}
Rated power	2.91 kW	4.78 kW	3.40 kW
Standstill current	6.20 A	12.4 A	20.3 A
Rotor moment of inertia	57.1 $kgcm^2$	57.1 $kgcm^2$	57.1 $kgcm^2$
Rotor moment of inertia (with brake)	59.6 $kgcm^2$	59.6 $kgcm^2$	59.6 $kgcm^2$

AM8562 | Flange code F6, motor length 2, high-performance type with forced cooling

Data for 400 V AC	AM8562-wKyz	AM8562-wNyz	AM8562-wRyz
Standstill torque	29.9 Nm	29.9 Nm	28.1 Nm
Rated torque	26.4 Nm	22.2 Nm	13.4 Nm
Rated speed	1400 min^{-1}	3000 min^{-1}	5000 min^{-1}
Rated power	3.87 kW	7.00 kW	7.00 kW
Standstill current	8.70 A	17.4 A	28.7 A
Rotor moment of inertia	57.1 $kgcm^2$	57.1 $kgcm^2$	57.1 $kgcm^2$
Rotor moment of inertia (with brake)	59.6 $kgcm^2$	59.6 $kgcm^2$	59.6 $kgcm^2$

AM8563 | Flange code F6, motor length 3

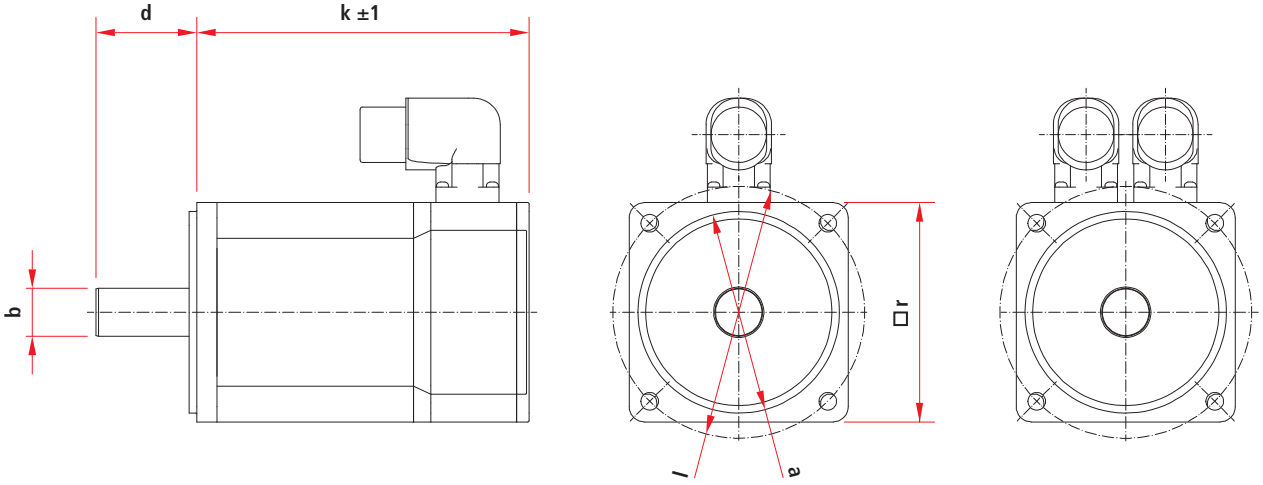
Data for 400 V AC	AM8563-wKyz	AM8563-wNyz	AM8563-wRyz
Standstill torque	29.0 Nm	29.0 Nm	29.0 Nm
Rated torque	22.3 Nm	13.2 Nm	6.10 Nm
Rated speed	1500 min^{-1}	3000 min^{-1}	4000 min^{-1}
Rated power	3.50 kW	4.15 kW	2.56 kW
Standstill current	8.70 A	17.2 A	29.5 A
Rotor moment of inertia	66.1 $kgcm^2$	66.1 $kgcm^2$	66.1 $kgcm^2$
Rotor moment of inertia (with brake)	–	–	–

AM8563 | Flange code F6, motor length 3, high-performance type with forced cooling

Data for 400 V AC	AM8563-wLyz	AM8563-wQyz	AM8563-wTyz
Standstill torque	41.4 Nm	41.4 Nm	40.1 Nm
Rated torque	33.9 Nm	25.5 Nm	15.1 Nm
Rated speed	1400 min^{-1}	3000 min^{-1}	4000 min^{-1}
Rated power	4.97 kW	8.00 kW	6.30 kW
Standstill current	11.6 A	24.0 A	39.8 A
Rotor moment of inertia	66.1 $kgcm^2$	66.1 $kgcm^2$	66.1 $kgcm^2$
Rotor moment of inertia (with brake)	–	–	–

Order reference	AM85uv-wxyz
u	flange code F
v	motor length
w = 0	smooth shaft
w = 1	shaft with groove and feather key according to DIN 6885
w = 2	shaft with IP 65 sealing ring and smooth shaft
w = 3	shaft with IP 65 sealing ring and shaft with groove and feather key
x	winding code A…Z
y = 0	2-cable standard: feedback resolver
y = 1	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, single-turn, absolute position within one revolution, 18 bit resolution
y = 2	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, multi-turn, absolute position within 4096 revolutions, 18 bit resolution
y = 4	2-cable standard: feedback multi-turn, absoulte encoder SKM36, 128 sincos periods (only for AM856x)
y = A	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, single-turn, absolute position within one revolution, resolution 23 bit
y = B	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, multi-turn, absolute position within 4096 revolutions, resolution 23 bit
z = 0	without holding brake
z = 1	with holding brake (not available for AM8533, AM8543, AM8553 and AM8563)
z = A	forced cooling, without holding brake, for AM855x, AM856x [1]
z = B	forced cooling, with holding brake, for AM855x, AM856x (not available for AM8553 and AM8563) [1]

[1] The EL2022 354 or KL2022 609 digital output terminal is recommended for controlling the external 24 V DC ventilation.



One Cable Technology

Resolver version

Dimensions	a	b	d	l	r	k (without brake)	k (with brake)
AM8531	60 j6	14 k6	30 mm	75 mm	72 mm	168 mm	194 mm
AM8532	60 j6	14 k6	30 mm	75 mm	72 mm	194 mm	229 mm
AM8533	60 j6	14 k6	30 mm	75 mm	72 mm	229 mm	–
AM8541	80 j6	19 k6	40 mm	100 mm	87 mm	179.5 mm	209.5 mm
AM8542	80 j6	19 k6	40 mm	100 mm	87 mm	209.5 mm	239.5 mm
AM8543	80 j6	19 k6	40 mm	100 mm	87 mm	239.5 mm	–
AM8551	95 j6	24 k6	50 mm	115 mm	104 mm	183.5 mm	216.5 mm
AM8551*	95 j6	24 k6	50 mm	115 mm	104 mm	256 mm	289 mm
AM8552	95 j6	24 k6	50 mm	115 mm	104 mm	216.5 mm	251.5 mm
AM8552*	95 j6	24 k6	50 mm	115 mm	104 mm	289 mm	324 mm
AM8553	95 j6	24 k6	50 mm	115 mm	104 mm	251.5 mm	–
AM8553*	95 j6	24 k6	50 mm	115 mm	104 mm	324 mm	–
AM8561	130 j6	32 k6	58 mm	165 mm	142 mm	228 mm	268 mm
AM8561*	130 j6	32 k6	58 mm	165 mm	142 mm	311 mm	351 mm
AM8562	130 j6	32 k6	58 mm	165 mm	142 mm	268 mm	315 mm
AM8562*	130 j6	32 k6	58 mm	165 mm	142 mm	351 mm	398 mm
AM8563	130 j6	32 k6	58 mm	165 mm	142 mm	315 mm	–
AM8563*	130 j6	32 k6	58 mm	165 mm	142 mm	398 mm	–

* high-performance type: oversize caused by fan, see dimension "k"

▶ **www.beckhoff.com/AM85xx**

AG2300 | High-end gear series for AM8000 and AM8500 servomotors

The low-backlash, high-performance planetary gear units of the AG2300 series offer high torque, low torsional backlash and a very low noise level in all 14 gear ratios. The high-end gear units for the AM8000 and AM8500 servomotors have a high power density and are able to absorb high radial and axial forces. The high quality and running smoothness of this helical gear unit series meet the highest control quality demands.

The MF standard variant allows high positioning accuracy and highly dynamic operating cycles (duty cycle < 60 %). The high-speed MC variant is suited for positioning with high nominal speeds in continuous operation (duty cycle > 60 %).

The gear units of the AG2300 series are perfectly matched to the AM8000 and AM8500 motor series. The inertia ratios, the required torques and the suitable motors can be conveniently calculated directly in TwinCAT with the TC Motion Designer. In addition, the tool checks in a single step whether the selected motor can be adapted to the gear unit. The planetary gear units are fitted to the respective motor in the factory and delivered as a complete motor/gear unit.

Features

- standard version MF for high positioning quality in highly dynamic operating cycles
- high-speed version MC for high speeds in continuous operation
- low-backlash planetary gear unit with output shaft
- absolutely maintenance-free, thanks to unique lubrication concept
- high axial and radial forces
- long service life (MF > 20,000 h, MC > 30,000 h)
- maximum efficiency
- maximum power density
- low running noise and smooth running thanks to helical gearing
- flexible installation position
- output shaft with feather key or smooth shaft
- available in 7 or 6 sizes
  - MF: SP060 to SP240
  - MC: SP075 to SP240
- 14 gear ratios, i = 3, 4, 5, 7, 10 (single-stage), i = 16, 20, 25, 28, 35, 40, 50, 70, 100 (two-stage)
- acceleration torques between 30 and 4500 Nm
- low torsional backlash (1…8 arcmin)

Technical data	AG2300
Type of gear	planetary gear with two variants
Variant	MF (standard), MC (high-speed)
Life span	MF > 20,000 h/MC > 30,000 h
Coating/surface	RAL7016 (grey)
Ambient temperature	-15 °C…+40 °C
Lubrication	lubricated for life
Installation position	variable
Protection class	IP 65
Mechanically compatible with	flange size F (typical combination according to specifications)

AG2300 | **Size 060**

Technical data	AG2300-+SP060S-MF1-i	AG2300-+SP060S-MF2-i
Variant	standard MF	standard MF
Gear ratio	3/4/5/7/10	16/20/25/28/35/40/50/70/100
Nominal output torque	17…26 Nm	17…26 Nm
Max. acceleration torque	30…42 Nm	32…42 Nm
Max. torsion. backlash standard/reduced	≤ 4/2 arcmin	≤ 6/4 arcmin
Typ. flange size F	F2, F3	F2, F3

AG2300 | **Size 075**

Technical data	AG2300-+SP075S-MF1-i	AG2300-+SP075S-MF2-i	AG2300-+SP075S-MC1-i	AG2300-+SP075S-MC2-i
Variant	standard MF	standard MF	high-speed MC	high-speed MC
Gear ratio	3/4/5/7/10	16/20/25/28/35/40/50/70/100	3/4/5/7/10	16/20/25/28/35/40/50/70/100
Nominal output torque	47…75 Nm	52…75 Nm	28…48 Nm	30…60 Nm
Max. acceleration torque	85…110 Nm	90…110 Nm	68…90 Nm	70…90 Nm
Max. torsion. backlash standard/reduced	≤ 4/2 arcmin	≤ 6/4 arcmin	≤ 6/4 arcmin	≤ 8/6 arcmin
Typ. flange size F	F3, F4, F5	F3, F4	F3, F4, F5	F3, F4

AG2300 | **Size 100**

Technical data	AG2300-+SP100S-MF1-i	AG2300-+SP100S-MF2-i	AG2300-+SP100S-MC1-i	AG2300-+SP100S-MC2-i
Variant	standard MF	standard MF	high-speed MC	high-speed MC
Gear ratio	3/4/5/7/10	16/20/25/28/35/40/50/70/100	3/4/5/7/10	16/20/25/28/35/40/50/70/100
Nominal output torque	120…180 Nm	120…180 Nm	70…105 Nm	80…140 Nm
Max. acceleration torque	235…315 Nm	235…315 Nm	180…240 Nm	180…240 Nm
Max. torsion. backlash standard/reduced	≤ 3/1 arcmin	≤ 5/3 arcmin	≤ 4/2 arcmin	≤ 6/4 arcmin
Typ. flange size F	F4, F5, F6	F3, F4, F5	F4, F5, F6	F3, F4, F5

AG2300 | **Size 140**

Technical data	AG2300-+SP140S-MF1-i	AG2300-+SP140S-MF2-i	AG2300-+SP140S-MC1-i	AG2300-+SP140S-MC2-i
Variant	standard MF	standard MF	high-speed MC	high-speed MC
Gear ratio	3/4/5/7/10	16/20/25/28/35/40/50/70/100	3/4/5/7/10	16/20/25/28/35/40/50/70/100
Nominal output torque	200…360 Nm	220…360 Nm	130…210 Nm	180…290 Nm
Max. acceleration torque	390…660 Nm	530…660 Nm	310…480 Nm	380…480 Nm
Max. torsion. backlash standard/reduced	≤ 3/1 arcmin	≤ 5/3 arcmin	≤ 4/2 arcmin	≤ 6/4 arcmin
Typ. flange size F	F5, F6, F7	F4, F5, F6	F5, F6, F7	F4, F5, F6

AG2300 | **Size 180**

Technical data	AG2300-+SP180S-MF1-i	AG2300-+SP180S-MF2-i	AG2300-+SP180S-MC1-i	AG2300-+SP180S-MC2-i
Variant	standard MF	standard MF	high-speed MC	high-speed MC
Gear ratio	3/4/5/7/10	16/20/25/28/35/40/50/70/100	3/4/5/7/10	16/20/25/28/35/40/50/70/100
Nominal output torque	530…750 Nm	750 Nm	290…450 Nm	600 Nm
Max. acceleration torque	970…1210 Nm	970…1210 Nm	700…880 Nm	700…880 Nm
Max. torsion. backlash standard/reduced	≤ 3/1 arcmin	≤ 5/3 arcmin	≤ 4/2 arcmin	≤ 6/4 arcmin
Typ. flange size F	F6, F7	F5, F6	F6, F7	F5, F6, F7

AG2300 | **Size 210**

Technical data	AG2300-+SP210S-MF1-i	AG2300-+SP210S-MF2-i	AG2300-+SP210S-MC1-i	AG2300-+SP210S-MC2-i
Variant	standard MF	standard MF	high-speed MC	high-speed MC
Gear ratio	3/4/5/7/10	16/20/25/28/35/ 40/50/70/100	3/4/5/7/10	16/20/25/28/35/ 40/50/70/100
Nominal output torque	1000…1500 Nm	1000…1500 Nm	800…1300 Nm	780…1000 Nm
Max. acceleration torque	1600…2500 Nm	1900…2500 Nm	1200…2000 Nm	1040…2000 Nm
Max. torsion. backlash standard/reduced	≤ 3/1 arcmin	≤ 5/3 arcmin	≤ 4/2 arcmin	≤ 5/4 arcmin
Typ. flange size F	F7	F7	F7	F7

AG2300 | **Size 240**

Technical data	AG2300-+SP240S-MF1-i	AG2300-+SP240S-MF2-i	AG2300-+SP240S-MC1-i	AG2300-+SP240S-MC2-i
Variant	standard MF	standard MF	high-speed MC	high-speed MC
Gear ratio	3/4/5/7/10	16/20/25/28/35/ 40/50/70/100	3/4/5/7/10	16/20/25/28/35/ 40/50/70/100
Nominal output torque	1500…2500 Nm	1700…2500 Nm	1100…1960 Nm	1100…1930 Nm
Max. acceleration torque	2750…4500 Nm	3400…4500 Nm	1750…3600 Nm	1800…3600 Nm
Max. torsion. backlash standard/reduced	≤ 3/1 arcmin	≤ 5/3 arcmin	≤ 4/2 arcmin	≤ 5/4 arcmin
Typ. flange size F	F7, AM308x	F7, AM308x	F7, AM308x	F7, AM308x

Order reference	AG2300-+SPaaaS-Mvs-i-wXy-Motorsize
aaa	series/size (060, 075, 100, 140, 180, 210, 240)
v = F	standard version for high positioning quality in highly dynamic operating cycles
v = C	high-speed version for high speeds in continuous operation
s = 1	1-stage with i = 3/4/5/7/10
s = 2	2-stage with i = 16/20/25/28/35/40/50/70/100
i	gear ratio
w = 0	smooth shaft
w = 1	shaft with groove and feather key
X	identifying letter for clamping hub diameter; not available for selection, is selected automatically based on the respective motor
y = 0	reduced torsional backlash
y = 1	standard torsional backlash
Motorsize	Specifies adapter unit between motor and gearbox. Correlates to motor flange size F or flange compatible motor type.
Motorsize = AM801x (F1)	flange code F1: AM801x; compatible with AM301x
Motorsize = AM802x (F2)	flange code F2: AM802x; compatible with AM302x
Motorsize = AM803x (F3)	flange code F3: AM803x, AM853x; compatible with AM303x
Motorsize = AM804x (F4)	flange code F4: AM804x, AM854x; compatible with AM304x
Motorsize = AM805x (F5)	flange code F5: AM805x, AM855x
Motorsize = AM305x	in combination with AM305x
Motorsize = AM806x (F6)	flange code F6: AM806x, AM856x; compatible with AM306x
Motorsize = AM807x (F7)	flange code F7: AM807x; compatible with AM307x
Motorsize = AM308x	in combination with AM308x

▶ **www.beckhoff.com/AG2300**

AG2210 | Planetary gear units for AM8000 and AM8500 servomotors

The low-backlash, high-performance gear units of the AG2210 series offer high torques, low torsional backlash and up to 16 transmission ratios for optimised drive solutions as well as a very low running noise coupled with maximum quality.

The gear units for the AM8000/AM8500 Synchronous Servomotors are mainly used in applications where large mass inertia has to be accelerated, or where the inertia ratio between load and motor prevents dynamic motion. Gears of the AG2210 series are also suitable for use with the motor series AM3xxx. The inertia ratios, the required torques and the suitable motors can be conveniently calculated directly in TwinCAT with the TC Motion Designer. In addition, the tool checks in a single step whether the selected motor can be adapted to the gear unit. The planetary gear units are fitted to the respective motor in the factory and delivered as a complete motor/gear unit.

Features

- maximum economic efficiency
- absolutely maintenance-free, thanks to unique lubrication concept
- long service life (> 20,000 h)
- high efficiency (> 95 % at full load)
- low running noise and smooth operation through maximum production quality
- flexible mounting position
- output shaft with feather key
- 5 sizes LP050…LP155
- 16 gear ratios i = 3, 4, 5, 7, 10 (single-stage), i = 9, 12, 16, 20, 25, 30, 35, 40, 50, 70, 100 (two-stage)
- acceleration torque between 13 and 500 Nm
- low torsional backlash (≤ 8…13 arcmin)

Technical data	AG2210
New generation	successor of AG2200, identical design
Type of gear	planetary gear
Life span	> 20,000 h
Coating/surface	RAL7016 (grey)
Ambient temperature	-15 °C…+40 °C
Lubrication	lubricated for life
Installation position	variable
Protection class	IP 64
Mechanically compatible with	flange size F (typical combination according to specifications)

AG2210 | **Size 050**

Technical data	AG2210-+LP050S-MF1-i	AG2210-+LP050S-MF2-i
Gear ratio	4/5/7/10	16/20/25/35/50/70/100
Nominal output torque	6…6.5 Nm	6…6.5 Nm
Max. acceleration torque	13…14 Nm	13…14 Nm
Max. torsion. backlash standard/reduced	≤ 10/– arcmin	≤ 13/– arcmin
Typ. flange size F	F1, F2	F1, F2

AG2210 | **Size 070**

Technical data	AG2210-+LP070S-MF1-i	AG2210-+LP070S-MF2-i
Gear ratio	3/4/5/7/10	9/12/16/20/25/30/40/50/70/100
Nominal output torque	19…29 Nm	19…29 Nm
Max. acceleration torque	37…55 Nm	37…55 Nm
Max. torsion. backlash standard/reduced	≤ 8/– arcmin	≤ 10/– arcmin
Typ. flange size F	F2, F3, F4	F2, F3, F4

AG2210 | **Size 090**

Technical data	AG2210-+LP090S-MF1-i	AG2210-+LP090S-MF2-i
Gear ratio	3/4/5/7/10	9/12/16/20/25/30/40/50/70/100
Nominal output torque	45…63 Nm	45…63 Nm
Max. acceleration torque	90…125 Nm	90…125 Nm
Max. torsion. backlash standard/reduced	≤ 8/– arcmin	≤ 10/– arcmin
Typ. flange size F	F4, F5	F4, F5

AG2210 | **Size 120**

Technical data	AG2210-+LP120S-MF1-i	AG2210-+LP120S-MF2-i
Gear ratio	3/4/5/7/10	9/12/16/20/25/30/40/50/70/100
Nominal output torque	110…155 Nm	110…155 Nm
Max. acceleration torque	220…305 Nm	220…305 Nm
Max. torsion. backlash standard/reduced	≤ 8/– arcmin	≤ 10/– arcmin
Typ. flange size F	F5, F6	F5, F6

AG2210 | **Size 155**

Technical data	AG2210-+LP155S-MF1-i	AG2210-+LP155S-MF2-i
Gear ratio	5/10	25/50/100
Nominal output torque	200…350 Nm	200…350 Nm
Max. acceleration torque	400…500 Nm	400…500 Nm
Max. torsion. backlash standard/reduced	≤ 8/– arcmin	≤ 10/– arcmin
Typ. flange size F	F6, F7	F6

Order reference	AG2210-+LPaaaS-MFs-i-wX1-Motorsize
aaa	series/size (050, 070, 090, 120, 155)
s = 1	1-stage with i = 3/4/5/7/10
s = 2	2-stage with i = 9/12/16/20/25/30/35/40/50/70/100
i	gear ratio
w = 0	smooth shaft
w = 1	shaft with groove and feather key according to DIN 6885
X	identifying letter for clamping hub diameter; not available for selection, is selected automatically based on the respective motor
Motorsize	Specifies adapter unit between motor and gearbox. Correlates to motor flange size F or flange compatible motor type.
Motorsize = AM801x (F1)	flange code F1: AM801x; compatible with AM301x
Motorsize = AM802x (F2)	flange code F2: AM802x; compatible with AM302x
Motorsize = AM803x (F3)	flange code F3: AM803x, AM853x; compatible with AM303x
Motorsize = AM804x (F4)	flange code F4: AM804x, AM854x; compatible with AM304x
Motorsize = AM805x (F5)	flange code F5: AM805x, AM855x
Motorsize = AM305x	in combination with AM305x
Motorsize = AM806x (F6)	flange code F6: AM806x, AM856x; compatible with AM306x
Motorsize = AM807x (F7)	flange code F7: AM807x; compatible with AM307x

▶ **www.beckhoff.com/AG2210**

AM8800 | Stainless steel servomotors

Based on the AM8000 technology, the AM8800 series has a stainless steel housing that is designed according to the EHEDG guidelines in Hygienic Design. The AM8800 is ideally suited for use in the food, pharmaceutical and chemical industries.

The windings of the AM8800 motors are implemented using salient pole-wound technology. This gives rise to a high copper space factor. Due to the high slot space factor, high continuous torques can be attained. The fully potted stator provides for a thermally ideal transition of the winding to the housing. A further positive consequence of this is the mechanical protection of the winding wires against vibrations.

Since the housing and motor shaft are manufactured from scratch-proof stainless steel AISI 316L, no corrosion creep or damage to the paint finish is possible. The motors are manufactured as standard with IP 69K protection, allowing the use of steam pressure cleaners. An optional sealing air connection to prevent the formation of condensation is also available. The cable gland also has a hygienic design. The lubricants used are certified food-safe (FDA).

One Cable Technology (OCT)
With the servomotors of the AM8000 series the feedback signals are sent directly along the conductor to the power supply so that the power and feedback systems are combined in a single motor connection cable. With the use of OCT, the information is sent reliably and without interference through a digital interface. Since a cable and plug are omitted at both the motor and controller end, the component and commissioning costs are significantly reduced.

For further information on OCT see page 818

Stainless steal gear units AG2800 see page 842

Pre-assembled cables see page 804

Technical data	AM88xx
Motor type	permanent magnet-excited three-phase synchronous motor
Magnet material	neodymium-iron-boron
Insulation class	thermal class F (155 °C)
Design form	flange-mounted according to IM B5, IM V1, IM V3, optionally IM B14, IM V18, IM V19
Protection class	IP 69K, PTFE double-lip shaft seal with FDA approval
Cooling	convection, permissible ambient temperature 40 °C
Materials	AISI 316L
Temperature sensor	KTY in stator winding
Connection method	direct cable outlet via cable gland with connected M23 coupling plug
Life span	L_{10h} = 30,000 hrs for ball bearings
Approvals	CE, UL, EHEDG
Feedback system	absolute encoder single-turn and multi-turn (OCT), resolver

AM883x | **Flange code 3**

Data for 400 V AC	AM8831-wByz	AM8832-wCyz	AM8833-wDyz
Standstill torque	0.85 Nm	1.40 Nm	1.85 Nm
Rated torque	0.70 Nm	1.00 Nm	1.35 Nm
Rated speed	3000 min^{-1}	3000 min^{-1}	3000 min^{-1}
Rated power	0.22 kW	0.31 kW	0.42 kW
Standstill current	0.65 A	1.00 A	1.25 A
Rotor moment of inertia	0.469 $kgcm^2$	0.850 $kgcm^2$	1.231 $kgcm^2$
Rotor moment of inertia (with brake)	0.548 $kgcm^2$	0.929 $kgcm^2$	1.471 $kgcm^2$

AM884x | **Flange code 4**

Data for 400 V AC	AM8841-wCyz	AM8842-wDyz	AM8843-wEyz
Standstill torque	1.60 Nm	2.60 Nm	3.50 Nm
Rated torque	1.30 Nm	1.90 Nm	2.75 Nm
Rated speed	3000 min^{-1}	2500 min^{-1}	2500 min^{-1}
Rated power	0.41 kW	0.50 kW	0.72 kW
Standstill current	1.10 A	1.60 A	1.90 A
Rotor moment of inertia	1.115 $kgcm^2$	2.006 $kgcm^2$	2.898 $kgcm^2$
Rotor moment of inertia (with brake)	1.765 $kgcm^2$	2.656 $kgcm^2$	3.548 $kgcm^2$

AM885x | **Flange code 5**

Data for 400 V AC	AM8851-wDyz	AM8852-wEyz	AM8853-wFyz
Standstill torque	3.10 Nm	4.80 Nm	6.40 Nm
Rated torque	2.70 Nm	3.70 Nm	4.30 Nm
Rated speed	2500 min^{-1}	2000 min^{-1}	2000 min^{-1}
Rated power	0.71 kW	0.77 kW	0.90 kW
Standstill current	1.80 A	2.10 A	2.80 A
Rotor moment of inertia	2.315 $kgcm^2$	4.142 $kgcm^2$	5.970 $kgcm^2$
Rotor moment of inertia (with brake)	2.975 $kgcm^2$	4.802 $kgcm^2$	7.090 $kgcm^2$

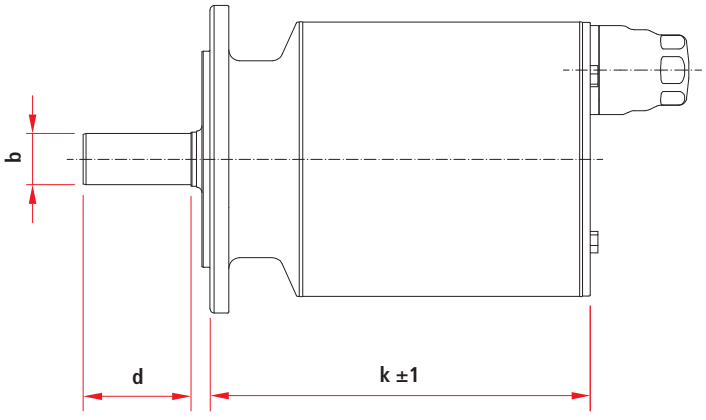
AM886x | **Flange code 6**

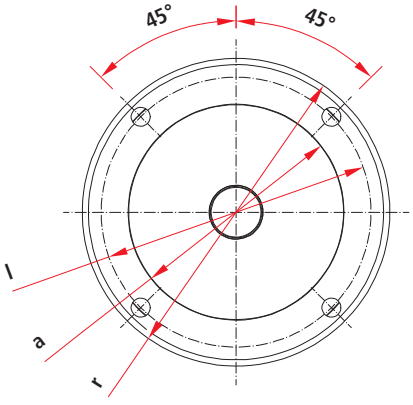
Data for 400 V AC	AM8861-wEyz	AM8862-wFyz	AM8863-wGyz
Standstill torque	7.75 Nm	12.0 Nm	16.7 Nm
Rated torque	6.20 Nm	6.00 Nm	8.00 Nm
Rated speed	1500 min^{-1}	1500 min^{-1}	1500 min^{-1}
Rated power	0.97 kW	0.94 kW	1.26 kW
Standstill current	2.53 A	3.70 A	4.90 A
Rotor moment of inertia	11.69 $kgcm^2$	20.93 $kgcm^2$	30.16 $kgcm^2$
Rotor moment of inertia (with brake)	13.94 $kgcm^2$	23.17 $kgcm^2$	32.40 $kgcm^2$

Order reference	AM88uv-wxyz-caaa
u	flange code
v	motor length
w = 0	smooth shaft with sealing ring IP 69K
w = 1	shaft with groove and feather key according to DIN 6885 and sealing ring IP 69K
x	winding code A…Z
y = 0	2-cable standard: feedback resolver
y = 1	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, single-turn, absolute position within one revolution, 18 bit resolution
y = 2	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, multi-turn, absolute position within 4,096 revolutions, 18 bit resolution
z = 0	without holding brake
z = 2	without holding brake, with sealing air connection
z = 1	with holding brake
z = 3	with holding brake, with sealing air connection
c = 0	motor connection via M23 speedtec® plug, cable length definable via aaa [1]
c = 2	direct connection for AX5000 up to 25 A (X13+X14), cable length definable via aaa
aaa	length of the motor cable in decimetres

[1] For motor connection via an M23 speedtec® plug, a motor supply cable ZK4500-80x3-xxxx must also be ordered in the required length.

Motor connections see page 804





Dimensions	a	b	d	l	r	k (without brake)	k (with brake)
AM8831	60 j6	14 k6	30 mm	75 mm	89 mm	134 mm	172 mm
AM8832	60 j6	14 k6	30 mm	75 mm	89 mm	159.5 mm	197.5 mm
AM8833	60 j6	14 k6	30 mm	75 mm	89 mm	185 mm	223 mm
AM8841	80 j6	19 k6	40 mm	100 mm	114 mm	141 mm	188 mm
AM8842	80 j6	19 k6	40 mm	100 mm	114 mm	171 mm	218 mm
AM8843	80 j6	19 k6	40 mm	100 mm	114 mm	201 mm	248 mm
AM8851	95 j6	24 k6	50 mm	115 mm	134 mm	146 mm	192 mm
AM8852	95 j6	24 k6	50 mm	115 mm	134 mm	179 mm	225 mm
AM8853	95 j6	24 k6	50 mm	115 mm	134 mm	212 mm	258 mm
AM8861	130 j6	32 k6	58 mm	165 mm	189 mm	171.5 mm	221.5 mm
AM8862	130 j6	32 k6	58 mm	165 mm	189 mm	211.5 mm	261.5 mm
AM8863	130 j6	32 k6	58 mm	165 mm	189 mm	251.5 mm	301.5 mm

▶ **www.beckhoff.com/AM88xx**

AG2800 | Planetary gear units for AM8800 stainless steel servomotors

The AM8800 stainless steel servomotors are fully compatible with the high requirements in the food, beverage and pharmaceutical industries with respect to optimum cleaning, resistance to aggressive cleaning agents, heavy mechanical loads and adverse environmental conditions. With their absolutely edge-free design these motors reduce the costs for machine manufacturers and users to a minimum.

A Hygienic Design drive axis does not always end at the stainless steel shaft of the motor; the use of a gearbox is often absolutely necessary. The same requirements apply here as to the stainless steel servomotors. All gearbox materials that come into contact with the environment exhibit high resistance to a large number of aggressive CIP (Cleaning in Place) cleaning media. The dead-space-free design, the smooth surface, the round motor adapter and the high resistance to corrosion of the gearboxes make the AM8800 a perfectly matched and certified Hygienic Design servo axis. The planetary gear units are fitted to the respective motor in the factory and delivered as a complete motor/gear unit.

Features

- corrosion-resistant implementation
- resistant to aggressive cleaning agents
- stainless steel screw plug
- food-compatible NSF-H1 lubrication
- high protection class IP 69K (at 30 bar, refering to DIN 40050-9)
- laser-etched name plate
- dead-space-free design and smooth, electro-polished surfaces

Technical data	AG2800
Type of gear	planetary gear stainless steel
Life span	> 20,000 h
Coating/surface	stainless steel 1.4404
Ambient temperature	-15 °C…+40 °C
Installation position	variable
Protection class	IP 69K (at 30 bar, refering to DIN 40050-9)

AG2800 | **Size 15**

Technical data	AG2800-+HDV015Z-MF1-i	AG2800-+HDV015Z-MF2-i
Gear ratio	4/5/7/10	16/20/25/35/50/70/100
Nominal output torque	15…16 Nm	15…16 Nm
Max. acceleration torque	29…32 Nm	29…32 Nm
Max. torsion. backlash standard/reduced	≤ 10/– arcmin	≤ 15/– arcmin

AG2800 | **Size 25**

Technical data	AG2800-+HDV025Z-MF1-i	AG2800-+HDV025Z-MF2-i
Gear ratio	4/5/7/10	16/20/25/35/50/70/100
Nominal output torque	35…40 Nm	35…40 Nm
Max. acceleration torque	72…80 Nm	72…80 Nm
Max. torsion. backlash standard/reduced	≤ 10/– arcmin	≤ 15/– arcmin

AG2800 | **Size 35**

Technical data	AG2800-+HDV035Z-MF1-i	AG2800-+HDV035Z-MF2-i
Gear ratio	4/5/7/10	16/20/25/35/50/70/100
Nominal output torque	90…100 Nm	90…100 Nm
Max. acceleration torque	180…200 Nm	180…200 Nm
Max. torsion. backlash standard/reduced	≤ 10/– arcmin	≤ 15/– arcmin

Order reference	AG2800-+HDVaaaZ-MFs-i-wX1-Motorsize
aaa	series/size (015, 025, 035)
s = 1	1-stage with i = 4/5/7/10
s = 2	2-stage with i = 16/20/25/35/50/70/100
i	gear ratio
w = 0	smooth shaft
w = 1	shaft with groove and feather key according to DIN 6885
X	identifying letter for clamping hub diameter; not available for selection, is selected automatically based on the respective motor
Motorsize	Specification of the size according to flange-compatible motors. The planetary gears are delivered as a unit with the assembled motor.
Motorsize = AM883x	in combination with AM883x
Motorsize = AM884x	in combination with AM884x
Motorsize = AM885x	in combination with AM885x

▶ **www.beckhoff.com/AG2800**

AM3000 | **Synchronous Servomotors**

Pole-wound motor series
For the AM3000 servomotors, the stator is not wound outside the housing but inside through a needle winder. With conventional technology, the winding is pressed into the grooved laminated core. This only achieves a copper filling ratio (which determines the maximum torque) of approx. 40 %. Furthermore, the insulation layer has to be significantly thicker in order to protect the wire from mechanical stress and prevent damage.

With pole winding, the copper wire is in close contact with the iron core. The wire insulation can be much thinner, since no pressing of the winding head is required. These measures lead to a significant increase in the proportion of "active" copper, which determines the torque value, so that the performance of the AM3000 series is approx. 25…35 % higher. An additional benefit is that the motors are significantly shorter than conventional models.

Sealed winding
The AM3000 servomotors are characterised by an extremely low moment of inertia, robust design and high overload capacity. The winding is sealed in order to eliminate air between the individual wires, since the thermal resistance of air is higher than that of epoxy resin. This further increases mechanical resilience, e.g. in case of vibrations.

Single-piece motor housing
Servomotors dissipate a large proportion of the heat generated via the mounting flange. It is therefore important to keep the heat transfer resistance as small as possible. For this reason, the housings of the AM3000 motor series are made from a single piece, since material transitions increase the thermal resistance and have a negative influence on the stability of the motor.

The AM3000 Synchronous Servomotors are available with eight different flange sizes. For each size, once the flange size has been defined, there is scope for variation in the length. The motors are offered with torques between 0.18 and 180 Nm and with a wide range of nominal speeds, so that for each application and gear ratio the motor with the optimum dimensions can be selected.

Features
- Rotable plug connectors: The plug connectors for power and feedback are freely rotatable, making wiring of the whole machine easier.
- terminal box for AM308x
- tight tolerances: resulting in a highly symmetric structure inside the motor reducing cogging to an absolute minimum
- feedback option: resolver, single-turn and multi-turn absolute encoders
- The motors are available with smooth shaft or with groove and feather key.
- protection class IP 65, shaft feed through IP 54, optional IP 65/IP 65
- UL/CSA

Option
- planetary gear units in different variants

Planetary gear units
see page 836

Pre-assembled cables and more accessories
▶ www.beckhoff.com/AM30xx

AM30uv-wxyz-000a	Stand-still torque	Stand-still current	Rated speed at rated supply voltage 230 V AC	400 V AC	480 V AC	Rotor moment of inertia (without brake)	(with brake)	Weight (without brake)	Weight (with brake)
AM3011-wByz-000a	0.18 Nm	1.16 A	8000 min^{-1}	–	–	0.017 kg cm²	0.020 kg cm²	0.35 kg	0.55 kg
AM3012-wCyz-000a	0.31 Nm	1.51 A	8000 min^{-1}	–	–	0.031 kg cm²	0.034 kg cm²	0.49 kg	0.69 kg
AM3013-wCyz-000a	0.41 Nm	1.48 A	8000 min^{-1}	–	–	0.045 kg cm²	0.048 kg cm²	0.63 kg	0.83 kg
AM3013-wDyz-000a	0.40 Nm	2.40 A	–	–	–	0.045 kg cm²	0.048 kg cm²	0.63 kg	0.83 kg
AM3021-wCyz-000a	0.48 Nm	1.58 A	8000 min^{-1}	–	–	0.107 kg cm²	0.118 kg cm²	0.82 kg	1.09 kg
AM3022-wCyz-000a	0.84 Nm	1.39 A	3500 min^{-1}	8000 min^{-1}	8000 min^{-1}	0.161 kg cm²	0.172 kg cm²	1.10 kg	1.37 kg
AM3022-wEyz-000a	0.87 Nm	2.73 A	8000 min^{-1}	–	–	0.161 kg cm²	0.172 kg cm²	1.10 kg	1.37 kg
AM3023-wCyz-000a	1.13 Nm	1.41 A	2500 min^{-1}	5500 min^{-1}	7000 min^{-1}	0.216 kg cm²	0.227 kg cm²	1.38 kg	1.65 kg
AM3023-wDyz-000a	1.16 Nm	2.19 A	5000 min^{-1}	8000 min^{-1}	8000 min^{-1}	0.216 kg cm²	0.227 kg cm²	1.38 kg	1.65 kg
AM3024-wCyz-000a	1.38 Nm	1.42 A	2000 min^{-1}	4500 min^{-1}	5500 min^{-1}	0.270 kg cm²	0.281 kg cm²	1.66 kg	1.93 kg
AM3024-wDyz-000a	1.41 Nm	2.21 A	4000 min^{-1}	8000 min^{-1}	8000 min^{-1}	0.270 kg cm²	0.281 kg cm²	1.66 kg	1.93 kg
AM3031-wCyz-0000	1.15 Nm	1.37 A	2500 min^{-1}	5000 min^{-1}	6000 min^{-1}	0.330 kg cm²	0.341 kg cm²	1.55 kg	1.90 kg
AM3031-wEyz-0000	1.20 Nm	2.99 A	6000 min^{-1}	–	–	0.330 kg cm²	0.341 kg cm²	1.55 kg	1.90 kg
AM3032-wCyz-0000	2.00 Nm	1.44 A	1500 min^{-1}	3000 min^{-1}	3500 min^{-1}	0.590 kg cm²	0.601 kg cm²	2.23 kg	2.58 kg
AM3032-wDyz-0000	2.04 Nm	2.23 A	2500 min^{-1}	5500 min^{-1}	6000 min^{-1}	0.590 kg cm²	0.601 kg cm²	2.23 kg	2.58 kg
AM3032-wHyz-0000	2.10 Nm	5.50 A	7000 min^{-1}	–	–	0.590 kg cm²	0.601 kg cm²	2.23 kg	2.58 kg
AM3033-wCyz-0000	2.71 Nm	1.47 A	1000 min^{-1}	2000 min^{-1}	2500 min^{-1}	0.850 kg cm²	0.861 kg cm²	2.90 kg	3.25 kg
AM3033-wEyz-0000	2.79 Nm	2.58 A	2000 min^{-1}	4500 min^{-1}	5000 min^{-1}	0.850 kg cm²	0.861 kg cm²	2.90 kg	3.25 kg
AM3041-wCyz-0000	1.95 Nm	1.46 A	1200 min^{-1}	3000 min^{-1}	3500 min^{-1}	0.810 kg cm²	0.878 kg cm²	2.44 kg	3.07 kg
AM3041-wEyz-0000	2.02 Nm	2.85 A	3000 min^{-1}	6000 min^{-1}	6000 min^{-1}	0.810 kg cm²	0.878 kg cm²	2.44 kg	3.07 kg
AM3041-wHyz-0000	2.06 Nm	5.60 A	6000 min^{-1}	6000 min^{-1}	6000 min^{-1}	0.810 kg cm²	0.878 kg cm²	2.44 kg	3.07 kg
AM3042-wCyz-0000	3.35 Nm	1.40 A	–	1500 min^{-1}	2000 min^{-1}	1.450 kg cm²	1.518 kg cm²	3.39 kg	4.02 kg
AM3042-wEyz-0000	3.42 Nm	2.74 A	1800 min^{-1}	3500 min^{-1}	4000 min^{-1}	1.450 kg cm²	1.518 kg cm²	3.39 kg	4.02 kg
AM3042-wGyz-0000	3.53 Nm	4.80 A	3500 min^{-1}	6000 min^{-1}	6000 min^{-1}	1.450 kg cm²	1.518 kg cm²	3.39 kg	4.02 kg
AM3043-wEyz-0000	4.70 Nm	2.76 A	1500 min^{-1}	2500 min^{-1}	3000 min^{-1}	2.090 kg cm²	2.158 kg cm²	4.35 kg	4.98 kg
AM3043-wGyz-0000	4.80 Nm	4.87 A	2500 min^{-1}	5000 min^{-1}	6000 min^{-1}	2.090 kg cm²	2.158 kg cm²	4.35 kg	4.98 kg
AM3043-wHyz-0000	4.82 Nm	5.40 A	3000 min^{-1}	6000 min^{-1}	–	2.090 kg cm²	2.158 kg cm²	4.35 kg	4.98 kg
AM3044-wEyz-0000	5.76 Nm	2.90 A	1200 min^{-1}	2000 min^{-1}	2500 min^{-1}	2.730 kg cm²	2.798 kg cm²	5.30 kg	5.93 kg
AM3044-wGyz-0000	5.88 Nm	5.00 A	2000 min^{-1}	4000 min^{-1}	5000 min^{-1}	2.730 kg cm²	2.798 kg cm²	5.30 kg	5.93 kg
AM3044-wHyz-0000	5.89 Nm	5.60 A	2500 min^{-1}	5000 min^{-1}	6000 min^{-1}	2.730 kg cm²	2.798 kg cm²	5.30 kg	5.93 kg
AM3044-wJyz-0000	6.00 Nm	8.80 A	4000 min^{-1}	6000 min^{-1}	6000 min^{-1}	2.730 kg cm²	2.798 kg cm²	5.30 kg	5.93 kg
AM3051-wEyz-0000	4.70 Nm	2.75 A	1200 min^{-1}	2500 min^{-1}	3000 min^{-1}	3.420 kg cm²	3.593 kg cm²	4.20 kg	5.30 kg
AM3051-wGyz-0000	4.75 Nm	4.84 A	2500 min^{-1}	5000 min^{-1}	6000 min^{-1}	3.420 kg cm²	3.593 kg cm²	4.20 kg	5.30 kg
AM3051-wHyz-0000	4.79 Nm	6.00 A	3000 min^{-1}	6000 min^{-1}	6000 min^{-1}	3.420 kg cm²	3.593 kg cm²	4.20 kg	5.30 kg
AM3052-wGyz-0000	8.43 Nm	4.72 A	1500 min^{-1}	2500 min^{-1}	3000 min^{-1}	6.220 kg cm²	6.393 kg cm²	5.80 kg	6.90 kg
AM3052-wHyz-0000	8.48 Nm	5.90 A	1800 min^{-1}	3500 min^{-1}	4000 min^{-1}	6.220 kg cm²	6.393 kg cm²	5.80 kg	6.90 kg
AM3052-wKyz-0000	8.60 Nm	9.30 A	3000 min^{-1}	5500 min^{-1}	6000 min^{-1}	6.220 kg cm²	6.393 kg cm²	5.80 kg	6.90 kg
AM3053-wGyz-0000	11.37 Nm	4.77 A	1000 min^{-1}	2000 min^{-1}	2400 min^{-1}	9.120 kg cm²	9.293 kg cm²	7.40 kg	8.50 kg
AM3053-wHyz-0000	11.51 Nm	6.60 A	–	3000 min^{-1}	3500 min^{-1}	9.120 kg cm²	9.293 kg cm²	7.40 kg	8.50 kg
AM3053-wKyz-0000	11.60 Nm	9.40 A	2000 min^{-1}	4000 min^{-1}	4500 min^{-1}	9.120 kg cm²	9.293 kg cm²	7.40 kg	8.50 kg
AM3054-wGyz-0000	14.30 Nm	5.00 A	–	1500 min^{-1}	2000 min^{-1}	11.92 kg cm²	12.093 kg cm²	9.00 kg	10.1 kg
AM3054-wHyz-0000	14.90 Nm	5.50 A	1000 min^{-1}	1800 min^{-1}	2000 min^{-1}	11.92 kg cm²	12.093 kg cm²	9.00 kg	10.1 kg
AM3054-wKyz-0000	14.40 Nm	9.70 A	1800 min^{-1}	3500 min^{-1}	4000 min^{-1}	11.92 kg cm²	12.093 kg cm²	9.00 kg	10.1 kg
AM3054-wLyz-0000	14.10 Nm	12.50 A	2500 min^{-1}	4500 min^{-1}	–	11.92 kg cm²	12.093 kg cm²	9.00 kg	10.1 kg
AM3062-wGyz-0000	11.90 Nm	4.90 A	–	1800 min^{-1}	2000 min^{-1}	16.90 kg cm²	17.51 kg cm²	8.90 kg	10.9 kg
AM3062-wHyz-0000	11.90 Nm	5.40 A	1000 min^{-1}	2000 min^{-1}	2400 min^{-1}	16.90 kg cm²	17.51 kg cm²	8.90 kg	10.9 kg
AM3062-wKyz-0000	12.20 Nm	9.60 A	2000 min^{-1}	3500 min^{-1}	4500 min^{-1}	16.90 kg cm²	17.51 kg cm²	8.90 kg	10.9 kg
AM3062-wMyz-0000	12.20 Nm	13.40 A	3000 min^{-1}	6000 min^{-1}	6000 min^{-1}	16.90 kg cm²	17.51 kg cm²	8.90 kg	10.9 kg
AM3063-wKyz-0000	16.80 Nm	9.90 A	1500 min^{-1}	3000 min^{-1}	3500 min^{-1}	24.20 kg cm²	24.81 kg cm²	11.1 kg	13.1 kg
AM3063-wMyz-0000	17.00 Nm	13.80 A	2000 min^{-1}	4000 min^{-1}	4500 min^{-1}	24.20 kg cm²	24.81 kg cm²	11.1 kg	13.1 kg
AM3063-wNyz-0000	17.00 Nm	17.40 A	3000 min^{-1}	5000 min^{-1}	6000 min^{-1}	24.20 kg cm²	24.81 kg cm²	11.1 kg	13.1 kg

The table is continued on the next page.

AM30uv-wxyz-000a	Stand-still torque	Stand-still current	Rated speed at rated supply voltage 230 V AC	400 V AC	480 V AC	Rotor moment of inertia (without brake)	(with brake)	Weight (without brake)	Weight (with brake)
AM3063-wHyz-0000	16.60 Nm	5.60 A	–	1500 min^{-1}	1800 min^{-1}	31.60 kg cm²	32.21 kg cm²	13.3 kg	15.3 kg
AM3064-wKyz-0000	20.80 Nm	9.20 A	1200 min^{-1}	2000 min^{-1}	2500 min^{-1}	31.60 kg cm²	32.21 kg cm²	13.3 kg	15.3 kg
AM3064-wLyz-0000	21.00 Nm	12.80 A	1500 min^{-1}	3000 min^{-1}	3500 min^{-1}	31.60 kg cm²	32.21 kg cm²	13.3 kg	15.3 kg
AM3064-wPyz-0000	20.40 Nm	18.60 A	2500 min^{-1}	4500 min^{-1}	5500 min^{-1}	31.60 kg cm²	32.21 kg cm²	13.3 kg	15.3 kg
AM3065-wKyz-0000	24.80 Nm	9.80 A	1000 min^{-1}	2000 min^{-1}	2200 min^{-1}	40.00 kg cm²	40.61 kg cm²	15.4 kg	17.4 kg
AM3065-wMyz-0000	25.00 Nm	13.60 A	1500 min^{-1}	2500 min^{-1}	3000 min^{-1}	40.00 kg cm²	40.61 kg cm²	15.4 kg	17.4 kg
AM3065-wNyz-0000	24.30 Nm	17.80 A	2000 min^{-1}	3500 min^{-1}	4000 min^{-1}	40.00 kg cm²	40.61 kg cm²	15.4 kg	17.4 kg
AM3065-wPyz-0000	24.50 Nm	19.80 A	2400 min^{-1}	4000 min^{-1}	5000 min^{-1}	40.00 kg cm²	40.61 kg cm²	15.4 kg	17.4 kg
AM3072-wKyz-0000	29.70 Nm	9.30 A	–	1500 min^{-1}	1800 min^{-1}	64.50 kg cm²	66.14 kg cm²	19.7 kg	21.8 kg
AM3072-wMyz-0000	30.00 Nm	13.00 A	–	2000 min^{-1}	2500 min^{-1}	64.50 kg cm²	66.14 kg cm²	19.7 kg	21.8 kg
AM3072-wPyz-0000	29.40 Nm	18.70 A	1800 min^{-1}	3000 min^{-1}	3500 min^{-1}	64.50 kg cm²	66.14 kg cm²	19.7 kg	21.8 kg
AM3072-wQyz-0000	29.70 Nm	20.90 A	–	3500 min^{-1}	4000 min^{-1}	64.50 kg cm²	66.14 kg cm²	19.7 kg	21.8 kg
AM3073-wMyz-0000	42.00 Nm	13.60 A	–	1500 min^{-1}	1800 min^{-1}	92.10 kg cm²	93.74 kg cm²	26.7 kg	28.8 kg
AM3073-wPyz-0000	41.60 Nm	19.50 A	1300 min^{-1}	2400 min^{-1}	2800 min^{-1}	92.10 kg cm²	93.74 kg cm²	26.7 kg	28.8 kg
AM3073-wQyz-0000	41.60 Nm	24.60 A	–	3000 min^{-1}	3500 min^{-1}	92.10 kg cm²	93.74 kg cm²	26.7 kg	28.8 kg
AM3074-wLyz-0000	53.00 Nm	12.90 A	–	1200 min^{-1}	1400 min^{-1}	119.7 kg cm²	121.34 kg cm²	33.6 kg	35.7 kg
AM3074-wPyz-0000	52.50 Nm	18.50 A	–	1800 min^{-1}	2000 min^{-1}	119.7 kg cm²	121.34 kg cm²	33.6 kg	35.7 kg
AM3074-wQyz-0000	51.90 Nm	26.20 A	–	2500 min^{-1}	3000 min^{-1}	119.7 kg cm²	121.34 kg cm²	33.0 kg	35.7 kg
AM3082-wTyz-0006	75.00 Nm	48.00 A	–	2500 min^{-1}	3000 min^{-1}	172.0 kg cm²	177.00 kg cm²	65.0 kg	73.0 kg
AM3083-wTyz-0006	130.0 Nm	62.00 A	–	2200 min^{-1}	2500 min^{-1}	334.0 kg cm²	339.00 kg cm²	85.0 kg	93.0 kg
AM3084-wTyz-0006	180.0 Nm	67.00 A	–	1800 min^{-1}	2000 min^{-1}	495.0 kg cm²	500.00 kg cm²	105 kg	113 kg

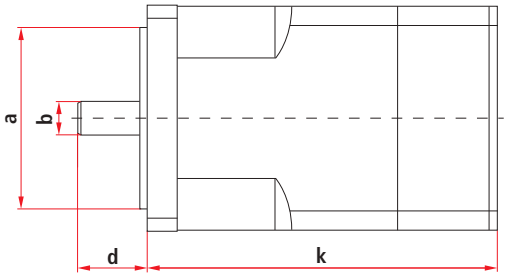
▶ **www.beckhoff.com/AM30xx**

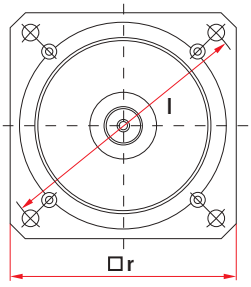
u: flange code
v: motor length

Option w = 0: smooth shaft (preferred type)
w = 1: shaft with groove and feather key according to DIN 6885
w = 2: shaft with IP 65 sealing ring and smooth shaft
w = 3: shaft with IP 65 sealing ring and shaft with groove and feather key
Option x = winding code A…T
Option y = 0: resolver, 2-pole
y = 1: single-turn absolute encoder, EnDat 2.1
absolute position within one revolution, electronic identification plate
AM302x…AM304x: 512 sine periods per revolution
AM305x…AM308x: 2,048 sine periods per revolution
y = 2: multi-turn absolute encoder, EnDat 2.1
absolute position within 4,096 revolutions, electronic identification plate
AM302x…AM304x: 512 sine periods per revolution
AM305x…AM308x: 2,048 sine periods per revolution
y = 3: single-turn absolute encoder, BiSS
absolute position within one revolution, electronic identification plate
AM302x…AM308x: 2,048 sine periods per revolution
y = 4: multi-turn absolute encoder, BiSS
absolute position within 4,096 revolutions, electronic identification plate
AM302x…AM308x: 2,048 sine periods per revolution
y = A: single-turn absolute encoder, Hiperface
absolute position within one revolution, electronic identification plate
AM301x: 16 sine periods per revolution (only for AM301x-xxxx-0005 with yTec plug)
y = B: multi-turn absolute encoder, Hiperface
absolute position within 4,096 revolutions, electronic identification plate
AM301x: 16 sine periods per revolution (only for AM301x-xxxx-0005 with yTec plug)
Option z = 0: without holding brake
z = 1: with holding brake

Option a = 0: rotatable angular connectors for motor and feedback cable (only for AM302x up to AM307x)
a = 1: connection cable 0.5 m with non-detachable plugs (only for AM301x/AM302x), only for resolver
a = 3: vertical connectors for motor and feedback cables (only for AM302x up to AM307x)
a = 5: yTec plug (only for AM301x)
a = 6: motor connection via terminal box (only for AM308x)

With the exception of the shaft seal, the options cannot be installed in the field. Options such as shaft seal, holding brake, absolute encoder can lead to a reduction of the nominal rating.





Dimensions	a	b	d	k (resolver) (without brake)	k (resolver) (with brake)	k (encoder) (without brake)	k (encoder) (with brake)	l	r
AM3011	30 mm	8 mm	25 mm	69.6 mm	106.6 mm	79.1 mm	116.1 mm	46 mm	40 mm
AM3012	30 mm	8 mm	25 mm	88.6 mm	125.6 mm	98.1 mm	135.1 mm	46 mm	40 mm
AM3013	30 mm	8 mm	25 mm	107.6 mm	144.6 mm	117.1 mm	154.1 mm	46 mm	40 mm
AM3021	40 mm	9 mm	20 mm	95.4 mm	129.5 mm	95.4 mm	129.5 mm	63 mm	58 mm
AM3022	40 mm	9 mm	20 mm	114.4 mm	148.5 mm	114.4 mm	148.5 mm	63 mm	58 mm
AM3023	40 mm	9 mm	20 mm	133.4 mm	167.5 mm	133.4 mm	167.5 mm	63 mm	58 mm
AM3024	40 mm	9 mm	20 mm	152.4 mm	186.5 mm	152.4 mm	186.5 mm	63 mm	58 mm
AM3031	60 mm	14 mm	30 mm	109.8 mm	141.3 mm	109.8 mm	141.3 mm	75 mm	70 mm
AM3032	60 mm	14 mm	30 mm	140.8 mm	172.3 mm	140.8 mm	172.3 mm	75 mm	70 mm
AM3033	60 mm	14 mm	30 mm	171.8 mm	203.3 mm	171.8 mm	203.3 mm	75 mm	70 mm
AM3041	80 mm	19 mm	40 mm	118.8 mm	152.3 mm	118.8 mm	152.3 mm	100 mm	84 mm
AM3042	80 mm	19 mm	40 mm	147.8 mm	181.3 mm	147.8 mm	181.3 mm	100 mm	84 mm
AM3043	80 mm	19 mm	40 mm	176.8 mm	210.3 mm	176.8 mm	210.3 mm	100 mm	84 mm
AM3044	80 mm	19 mm	40 mm	205.8 mm	239.3 mm	205.8 mm	239.3 mm	100 mm	84 mm
AM3051	110 mm	24 mm	50 mm	127.5 mm	172.5 mm	146.0 mm	189.0 mm	130 mm	108 mm
AM3052	110 mm	24 mm	50 mm	158.5 mm	203.5 mm	177.0 mm	220.0 mm	130 mm	108 mm
AM3053	110 mm	24 mm	50 mm	189.5 mm	234.5 mm	208.0 mm	251.0 mm	130 mm	108 mm
AM3054	110 mm	24 mm	50 mm	220.5 mm	265.5 mm	239.0 mm	282.0 mm	130 mm	108 mm
AM3062	130 mm	32 mm	58 mm	153.7 mm	200.7 mm	172.2 mm	219.7 mm	165 mm	138 mm
AM3063	130 mm	32 mm	58 mm	178.7 mm	225.7 mm	197.2 mm	244.7 mm	165 mm	138 mm
AM3064	130 mm	32 mm	58 mm	203.7 mm	250.7 mm	222.2 mm	269.7 mm	165 mm	138 mm
AM3065	130 mm	32 mm	58 mm	228.7 mm	275.7 mm	247.2 mm	294.7 mm	165 mm	138 mm
AM3072	180 mm	38 mm	80 mm	192.5 mm	234.5 mm	201.7 mm	253.7 mm	215 mm	188 mm
AM3073	180 mm	38 mm	80 mm	226.5 mm	268.5 mm	235.7 mm	287.3 mm	215 mm	188 mm
AM3074	180 mm	38 mm	80 mm	260.5 mm	302.5 mm	269.7 mm	321.3 mm	215 mm	188 mm
AM3082	250 mm	48 mm	110 mm	263.4 mm	329.4 mm	263.4 mm	329.4 mm	300 mm	260 mm
AM3083	250 mm	48 mm	110 mm	343.9 mm	410.0 mm	343.9 mm	410.0 mm	300 mm	260 mm
AM3084	250 mm	48 mm	110 mm	424.4 mm	490.4 mm	424.4 mm	490.4 mm	300 mm	260 mm

Technical drawings at ▶ **www.beckhoff.com/DriveTechnology**

ALxxxx | Linear Servomotors

AL20xx | Iron core motor, magnetic path width 80 mm

AL24xx | Iron core motor, magnetic path width 50 mm

AL28xx | Iron core motor, magnetic path width 130 mm

Compact power packages: Linear Servomotors AL2xxx

The AL2xxx Linear Servomotors complement the servomotors series and can be used wherever rotary design reaches mechanical limits during installation, or where special drive characteristics, in terms of dynamics, synchronism or acceleration, are required.

Linear Servomotors are easy to set up and are not subject to mechanical wear. Moreover, there are virtually no limits on travel options. With their high acceleration characteristics, Linear Servomotors can achieve positioning velocities of up to 10 m/s – with a high force constant and a very good force/mass ratio.

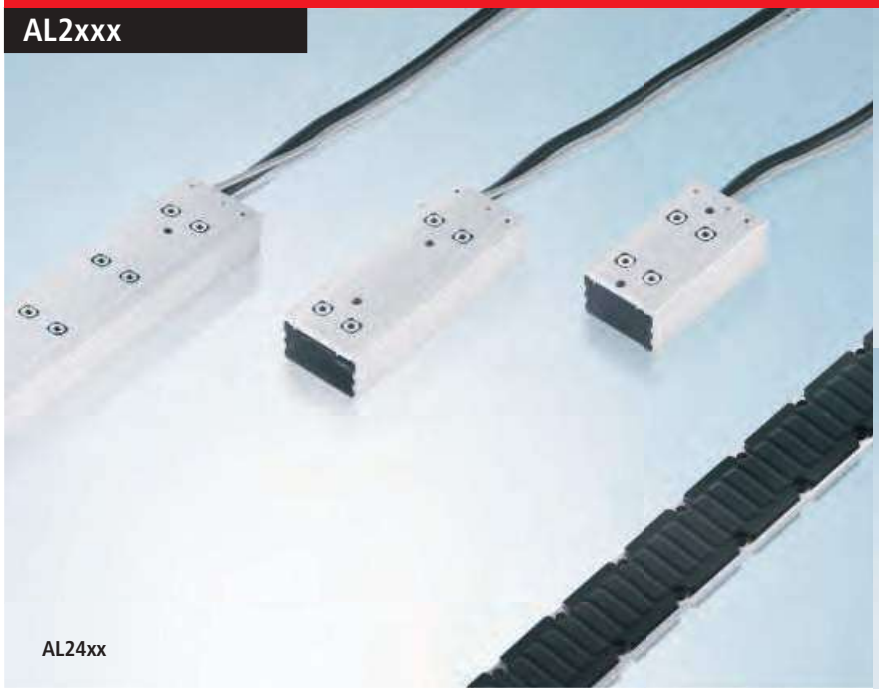
The pole spacing is the same for all the motors of a motor series. This has the advantage that the procedure for adjusting the drive amplifiers and the adaptation to a linear encoder is always the same, which saves time during commissioning. In principle, it is possible to operate several primary sections on one magnetic track. This significantly reduces the installation and component costs and opens up application options that would not normally be considered for linear motors.

AL2200 magnetic encoder system (MES) for linear motors

The feedback system required by linear motors for commutation and detection of speed and position normally consists of a reading head and a graduated rule installed parallel to the travel path. The hardware requirements for the complete system increase with the length of the travel path. The AL2200 in contrast detects the magnetic field of a magnetic plate and supplies the servo drive with the incremental encoder signals for commutation and position control. The MES supplies one sine oscillation per logical motor revolution. A logical motor revolution is equivalent to the distance between two homopolar magnets, i.e. between two north poles, for example. The attainable accuracy of ±0.1 mm is sufficient for simple positioning tasks and depends to a large extent on the mechanical accuracy and position of the magnets along the travel path. Since no graduated rule has to be installed, the MES is a cost-efficient feedback solution for linear motors.

Ironless AL3800 Linear Servomotors
▶ www.beckhoff.com/AL38xx

▶ **www.beckhoff.com/Linear-motors**



AL2xxx | Linear Servomotors

The 3-phase Synchronous Linear Servomotors of the AL2xxx series consist of a primary section and a secondary section. The primary section contains a grooved, laminated core with inlaid copper windings. It is generally used as the moving part. The secondary section contains the steel plate with attached permanent magnets.

The motors of the individual series have the same width (including magnetic plate), i.e. all motors can be operated on the same magnetic plates, in any combination. The magnetic plates are fully sealed and therefore have an almost perfectly level and robust surface.

The primary sections have an IP 64 protection rating and are therefore suitable for application in harsh environments. They are equipped with a 0.5 m cable strand and optionally with pre-assembled connectors, so that they can be coupled with the servo drives either via the connector box or via plug connectors. This greatly reduces the difficulty of implementing the cabling, and makes a significant contribution to avoiding errors.

In conjunction with the AX5000 Servo Drives the linear motors of the AL2xxx series are very suitable for dynamic movements, which require high acceleration values over short distances.

Features

- accelerations up to 30 g
- no mechanical wear
- complete absence of backlash, giving stiff control response
- extremely precise positioning, high repeatability
- even, immediate force, little cogging
- very low thermal resistance, allowing high capacity utilisation
- protection from thermal overload through integrated temperature sensors
- Operation with the AX5000 is made extremely simple through default values.
- connection to the AX5000 through pre-assembled cables

AL20xx

- velocity: 4 m/s or 10 m/s
- peak forces: 225 N to 1,800 N

AL24xx

- velocity: 8 m/s
- peak forces: 120 N to 480 N

AL28xx

- velocity: 2.5 m/s or 6 m/s
- peak forces: 1,800 N to 6,750 N
- operation optionally with or without water cooling

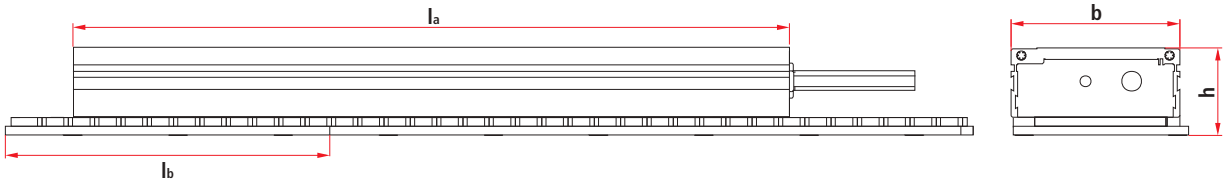
AL2200 scaleless feedback system (MES) for Linear Servomotors

An MES system is available as an optional accessory for monitoring the magnetic field of the permanent magnets on the magnetic plate. With the aid of an integrated electronic unit, it provides incremental encoder signals for the Servo Drives of the AX5000 series for commutation, velocity and position control. The MES provides a sine wave per 24 mm pole pitch and a precision of 1/10 mm.

AL225x connector box

The AL225x connector boxes facilitate wiring between linear motor and servo drive. On one side, the motor, feedback and thermal protection cables are connected. The standard motor and encoder cables are connected on the other side of the boxes.

AL2000 | **Linear Servomotors**



Dimensions	b	l_a	h
AL2003	77 mm	98 mm	40 mm
AL2006	77 mm	146 mm	40 mm
AL2009	77 mm	195 mm	40 mm
AL2012	77 mm	244 mm	40 mm
AL2015	77 mm	290 mm	40 mm
AL2018	77 mm	336 mm	40 mm
AL2024	77 mm	468 mm	40 mm

Technical drawings at ▶ **www.beckhoff.com/AL20xx**

Technical data	AL2003	AL2006	AL2009	AL2012	AL2015	AL2018	AL2024
Winding type	S	N | S	N | S	N | S	N | S	N | S	N | S
Speed max.	7 m/s	3.5 m/s (N), 7 m/s (S)	2.5 m/s (N), 7 m/s (S)	3.5 m/s (N), 7 m/s (S)	3.5 m/s (N), 7 m/s (S)	3.5 m/s (N), 7 m/s (S)	3.5 m/s (N), 7 m/s (S)
Motor configuration	3-phase synchronous Linear Servomotors (400…480 V AC)						
Peak force 3 sec. (F_P)	225 N	450 N	675 N	900 N	1125 N	1350 N	1800 N
Peak current (I_{Pa})	5 A	6.5 A (N), 15 A (S)	6.5 A (N), 19 A (S)	13.1 A (N), 26 A (S)	13 A (N), 33 A (S)	19.6 A (N), 41 A (S)	26 A (N), 52 A (S)
Continuous force with air cooling (F_{ca})	75 N	200 N	300 N	400 N	500 N	600 N	800 N
Continuous current with air cooling (I_{ca})	1.6 A	2.15 A (N), 4.3 A (S)	2.14 A (N), 6.45 A (S)	4.3 A (N), 8.6 A (S)	4.46 A (N), 10.7 A (S)	6.45 A (N), 13.38 A (S)	8.6 A (N), 17.2 A (S)
Force constant (K_f)	46 N/A	93 N/A (N), 46 N/A (S)	140 N/A (N), 46 N/A (S)	93 N/A (N), 46 N/A (S)	112 N/A (N), 46 N/A (S)	93 N/A (N), 44.9 N/A (S)	93 N/A (N), 46 N/A (S)
Motor constant (K_m)	185 N²/W	370 N²/W	570 N²/W	740 N²/W	950 N²/W	1140 N²/W	1520 N²/W
Magnet pitch	24 mm						
Magnetic attraction force (F_a)	500 N	950 N	1325 N	1700 N	2075 N	2450 N	3400 N
Weight of the coil (M_P)	0.9 kg	1.5 kg	2.0 kg	2.6 kg	3.2 kg	3.8 kg	5.2 kg
Air gap	0.5 mm						
Temperature sensor	PTC 1 kΩ						
Corresponding Servo Drive	AX5x03	AX5x03 (N), AX5x06 (S)	AX5x03 (N), AX5112 (S)	AX5x06 (N), AX5112 (S)	AX5x06 (N), AX5112 (S)	AX5112 (N), AX5118 (S)	AX5112 (N), AX5118 (S)

Ordering information	AL20xx-000x-000y coil unit
AL2003-0001-000y	Linear Servomotor, 400…480 V, F_p = 225 N, F_{ca} = 75 N
AL2006-000x-000y	Linear Servomotor, 400…480 V, F_p = 450 N, F_{ca} = 200 N
AL2009-000x-000y	Linear Servomotor, 400…480 V, F_p = 675 N, F_{ca} = 300 N
AL2012-000x-000y	Linear Servomotor, 400…480 V, F_p = 900 N, F_{ca} = 400 N
AL2015-000x-000y	Linear Servomotor, 400…480 V, F_p = 1125 N, F_{ca} = 500 N
AL2018-000x-000y	Linear Servomotor, 400…480 V, F_p = 1350 N, F_{ca} = 600 N
AL2024-000x-000y	Linear Servomotor, 400…480 V, F_p = 1800 N, F_{ca} = 800 N

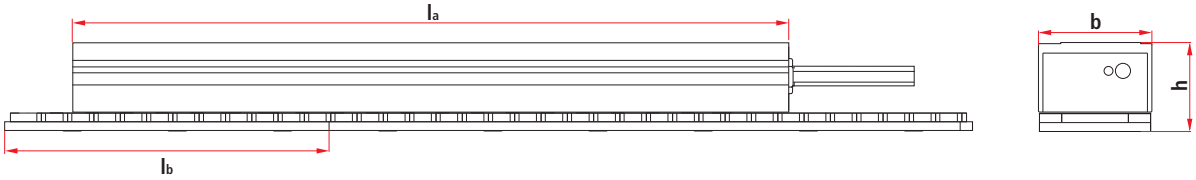
Option x = 0: N type, x = 1: S type

Option y = 0: without connector plug, y = 1: with connector plugs (motor and temperature)

Ordering information	AL21xx-0000 magnet plate
AL2110-0000	magnetic assembly (l_b = 192 mm, weight 3.8 kg/m), for AL20xx motors
AL2120-0000	magnetic assembly (l_b = 288 mm, weight 3.8 kg/m), for AL20xx motors

Options, pre-assembled cables and accessories see page 854

AL2400 | **Linear Servomotors**



Dimensions	b	l_a	h
AL2403	51 mm	93 mm	40 mm
AL2406	51 mm	143 mm	40 mm
AL2412	51 mm	241 mm	40 mm

Technical drawings at ▶ **www.beckhoff.com/AL24xx**

Technical data	AL2403	AL2406	AL2412
Winding type	S		
Speed max.	12 m/s		
Motor configuration	3-phase synchronous Linear Servomotors (400…480 V AC)		
Peak force 3 sec. (F_P)	120 N	240 N	480 N
Peak current (I_{Pa})	4.1 A	8.2 A	16.4 A
Continuous force with air cooling (F_{ca})	60 N	120 N	240 N
Continuous current with air cooling (I_{ca})	1.5 A	3.0 A	6.0 A
Force constant (K_f)	39 N/A		
Motor constant (K_m)	95 N²/W	190 N²/W	380 N²/W
Magnet pitch	24 mm		
Magnetic attraction force (F_a)	300 N	500 N	900 N
Weight of the coil (M_P)	0.6 kg	0.9 kg	1.6 kg
Air gap	0.5 mm		
Temperature sensor	PTC 1 kΩ		
Corresponding Servo Drive	AX5x03	AX5x03/AX5x06	AX5x06/AX5112

Ordering information	AL24xx-0001-000y coil unit
AL2403-0001-000y	Linear Servomotor, 400…480 V, F_p = 120 N, F_{ca} = 60 N
AL2406-0001-000y	Linear Servomotor, 400…480 V, F_p = 240 N, F_{ca} = 120 N
AL2412-0001-000y	Linear Servomotor, 400…480 V, F_p = 480 N, F_{ca} = 240 N

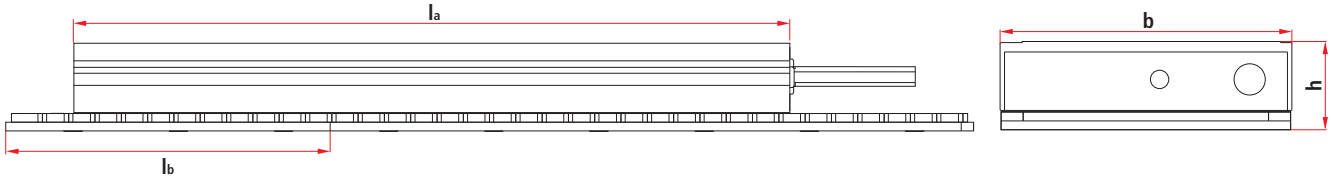
S type

Option y = 0: without connector plug, y = 1: with connector plugs (motor and temperature)

Ordering information	AL25xx-0000 magnet plate
AL2510-0000	magnetic assembly (l_b = 96 mm, weight 2.1 kg/m), for AL24xx motors
AL2520-0000	magnetic assembly (l_b = 144 mm, weight 2.1 kg/m), for AL24xx motors
AL2530-0000	magnetic assembly (l_b = 384 mm, weight 2.1 kg/m), for AL24xx motors

Options, pre-assembled cables and accessories see page 854

AL2800 | **Linear Servomotors**



Dimensions	b	l_a	h
AL2812	130 mm	244 mm	45 mm
AL2815	130 mm	290 mm	45 mm
AL2830	130 mm	568 mm	45 mm (1)
AL2845	130 mm	852 mm	47 mm

(1) Height h deviating for water-cooled variant: h = 47 mm

Technical drawings at ▶ **www.beckhoff.com/AL28xx**

Technical data	AL2812	AL2815	AL2830	AL2845
Winding type	N | S	N | S	N | S	N | S
Speed max.	3 m/s (N), 6 m/s (S)	3.5 m/s (N), 6 m/s (S)	2.5 m/s (N), 6 m/s (S)	2.5 m/s (N), 6 m/s (S)
Motor configuration	3-phase synchronous Linear Servomotors (400…480 V AC)			
Peak force 3 sec. (F_P)	1800 N	2250 N	4500 N	6750 N
Peak current (I_{Pa})	13 A (N), 26 A (S)	13.5 A (N), 33 A (S)	27 A (N), 65 A (S)	41 A (N), 98 A (S)
Continuous force with water cooling (F_{cw})	–	–	2000 N	3000 N
Continuous force with air cooling (F_{ca})	760 N	950 N	1900 N	2850 N
Continuous current with water cooling (I_{cw})	–	–	8.9 A (N), 21.5 A (S)	13.4 A (N), 32.3 A (S)
Continuous current with air cooling (I_{ca})	4.1 A (N), 8.2 A (S)	4.2 A (N), 10.2 A (S)	8.5 A (N), 20 A (S)	12.5 A (N), 31 A (S)
Force constant (K_f)	186 N/A (N), 93 N/A (S)	225 N/A (N), 93 N/A (S)	225 N/A (N), 93 N/A (S)	225 N/A (N), 93 N/A (S)
Motor constant (K_m)	1750 N²/W	2150 N²/W	4300 N²/W	6450 N²/W
Magnet pitch	24 mm			
Magnetic attraction force (F_a)	3400 N	4150 N	8300 N	12450 N
Weight of the coil (M_P)	5 kg	6 kg	12 kg	18 kg
Air gap	0.5 mm			
Temperature sensor	PTC 1 kΩ			
Corresponding Servo Drive	AX5x06 (N), AX5112 (S)	AX5x06 (N), AX5118 (S)	AX5112 (N), AX5125 (S)	AX5118 (N), AX5118 (S)

Ordering information	AL28xx-000x-000y coil unit
AL2812-000x-000y	Linear Servomotor, 400…480 V, F_p = 1800 N, F_{ca} = 760 N
AL2815-000x-000y	Linear Servomotor, 400…480 V, F_p = 2250 N, F_{ca} = 950 N
AL2830-000x-0000	Linear Servomotor, 400…480 V, F_p = 4500 N, F_{ca} = 1900 N
AL2830-100x-0000	Linear Servomotor, 400…480 V, F_p = 4500 N, F_{ca} = 1900 N, water cooling
AL2845-100x-0000	Linear Servomotor, 400…480 V, F_p = 6750 N, F_{ca} = 2850 N, water cooling

Option x = 0: N type, x = 1: S type

Option y = 0: without connector plug, y = 1: with connector plugs (only possible with AL2812 and AL2815!)

Ordering information	AL29xx-0000 magnet plate
AL2910-0000	magnetic assembly (l_b = 192 mm, weight 10.5 kg/m), for AL28xx motors
AL2920-0000	magnetic assembly (l_b = 288 mm, weight 10.5 kg/m), for AL28xx motors

Options, pre-assembled cables and accessories see page 854

Accessories for Linear Motors ALxxxx

MES feedback system for Linear Servomotors

The MES supplies one sine oscillation per logical motor revolution. Since no graduated rule has to be installed, the MES is an inexpensive feedback solution for linear motors.

Ordering information	AL2200-000x | Feedback system	Pict.
AL2200-000x	magnetic encoder system (MES) for AL2000, AL2400 and AL2800 Linear Servomotors	A

Option x = 0: without connector plug, x = 1: with connector plug

Connector box for ALxxxx

The AL225x connector boxes facilitate wiring between linear motor and the Servo Drive. They are mounted on the linear slide and move with the motor. The motor cable, the thermal protection contact cable and the encoder cable are inserted into the box through cable glands and connected to the terminal strip. The temperature contact is linked to the motor and encoder cable, so that no thermal protection contact cable is required. The standard motor and encoder cables are connected on the other side of the boxes.

Ordering information	AL225x-0001 | Connector box	Pict.
AL2250-0001	connector box for AL2003-AL2830-0001 and AL2830-1000	B
AL2255-0001	connector box for AL2830-1001 and AL2845-1000	
AL2256-0001	connector box for AL2845-1001	

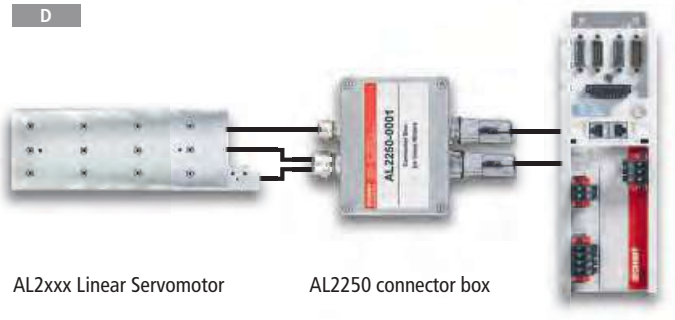
Installation options Linear Servomotors/connector box

Cable	AX5000	C	AX5000 + AL2250	D
Motor cable	ZK4500-0023			
Thermal protection contact cable	ZK4540-0020		–	
Encoder cable for MES or absolute encoder	ZK4510-0020			
Encoder cable for encoder with zero pulse	ZK4520-0020			
Coil and feedback system	with connector plugs		without connector plugs	

C

AL2xxx Linear Servomotor

D



AL2xxx Linear Servomotor AL2250 connector box

A

B

Motor cable 1.5 mm² for ALxxxx at AX5000 (1.5 A…12 A)

Ordering information	Motor cable with 1.5 mm² wire gauge, highly flexible, for drag-chain use	Pict.
ZK4500-0023-xxxx	highly flexible, drag-chain useable cable (5 million bending cycles), max. 240 m/min, max. 30 m/s², min. bending radius = 87 mm (7 x OD), max. chain length horizontal 20 m, vertical 5 m, length < 25 m, (4 x 1.5 mm² + 2 x (2 x 0.75 mm²))	E
ZK4500-0023-0050	example for 5 m length	
ZK4502-0023-xxxx	length ≥ 25 m	
ZK4509-0023-xxxx	not assembled	
ZK4501-0023-xxxx	extension cable	F

Motor cable 2.5 mm² for ALxxxx at AX5000 (18…25 A)

Ordering information	Motor cable with 2.5 mm² wire gauge, highly flexible, for drag-chain use	Pict.
ZK4500-0024-xxxx	highly flexible, drag-chain useable cable (5 million bending cycles), max. 240 m/min, max. 30 m/s², bending radius = 95 mm (7 x OD), max. chain length horizontal 20 m, vertical 5 m, length < 25 m, (4 x 2.5 mm² + 2 x (2 x 1 mm²))	E
ZK4500-0024-0050	example for 5 m length	
ZK4502-0024-xxxx	length ≥ 25 m	
ZK4509-0024-xxxx	not assembled	
ZK4501-0024-xxxx	extension cable	F

E

F

Encoder cable (absolute encoder) for ALxxxx and AL2250 at AX5000

Ordering information	Encoder cable with 0.14 mm² wire gauge, highly flexible, for drag-chain use	Pict.
ZK4510-0020-xxxx	highly flexible, drag-chain usable cable (5 million bending cycles), max. 240 m/min, max. 30 m/s², min. bending radius = 53 mm (7 x OD), max. chain length: horizontal = 20 m, vertical = 5 m, (7 x 2 x 0.14 mm² + 2 x 0.5 mm²)	A
ZK4510-0020-0050	example for 5 m length	
ZK4511-0020-xxxx	extension cable, highly dynamic, suitable as trailing cable	B
ZK4519-0020-xxxx	not assembled	

Encoder cable (SinCos encoder with zero pulse) for ALxxxx and AL2250 at AX5000

Ordering information	Encoder cable with 0.14 mm² wire gauge, highly flexible, for drag-chain use
ZK4520-0020-xxxx	highly flexible, drag-chain usable cable (5 million bending cycles), max. 240 m/min, max. 30 m/s², min. bending radius = 53 mm (7 x OD), max. chain length: horizontal = 20 m, vertical = 5 m, (7 x 2 x 0.14 mm² + 2 x 0.5 mm²)

Thermal protection cable for ALxxxx at AX5000

Ordering information	Thermal protection cable with 0.14 mm² wire gauge, highly flexible, for drag-chain use	Pict.
ZK4540-0020-xxxx	highly flexible, drag-chain usable cable (5 million bending cycles), max. 240 m/min, max. 30 m/s², min. bending radius = 38 mm (7 x OD), max. chain length: horizontal = 20 m, vertical = 5 m, (2 x 2 x 0.14 mm²)	C

Note: required if no connector box is used.

Connectors for AMxxxx, ALxxxx servomotors and cables

Ordering information		Pict.
ZS4000-2030	EMC thermo-protective plug (female), D-sub, 9-pin, for AL2000, AL2400, AL2800 linear motors (counterpart to thermostat contact at AX5000 Servo Drive)	D
ZS4000-2040	EMC power coupling (male), M23, 8-pin, for motor cable extension ZK4501-00x3-xxxx and ZK4501-00x4-xxx (counterpart to motor cable ZK4500-00x3-xxxx and ZK4500-00x4-xxxx)	E
ZS4000-2100	metal flange for motor cable, iTec, M23 and feedback cable with iTec, to adjust the connector, including sealings	
ZS4000-2101	metal flange for feedback cable, M23, to adjust the connector, including sealings	F
ZS4000-2102	EMC power connector (female), iTec, 9-pin, for motor cable ZK4704-0411-xxxx (counterpart to motor socket AM3100/AM8100)	
ZS4000-2104	EMC power connector (female), M23, 9-pin, for motor cable ZK450x-80x3-xxxx and ZK450x-80x4-xxxx (counterpart to motor socket AM8000/AM8500)	
ZS4000-2105	EMC resolver connector (female), iTec, 12-pin, for resolver cable ZK453x-8110-xxxx (counterpart to motor socket AM801x, AM802x, AM803x, AM853x)	
ZS4000-2106	EMC resolver connector (female), M23, 12-pin, for resolver cable ZK453x-8010-xxxx (counter part for motor socket AM8x4x up to AM8x7x)	
ZS4000-2107	EMC power connector (female), iTec, 9-pin, for motor cable ZK450x-8022-xxxx and ZK4704-0421-xxxx (counter part for motor socket AM80xx/AM81xx/AM85xx with iTec)	

A

B

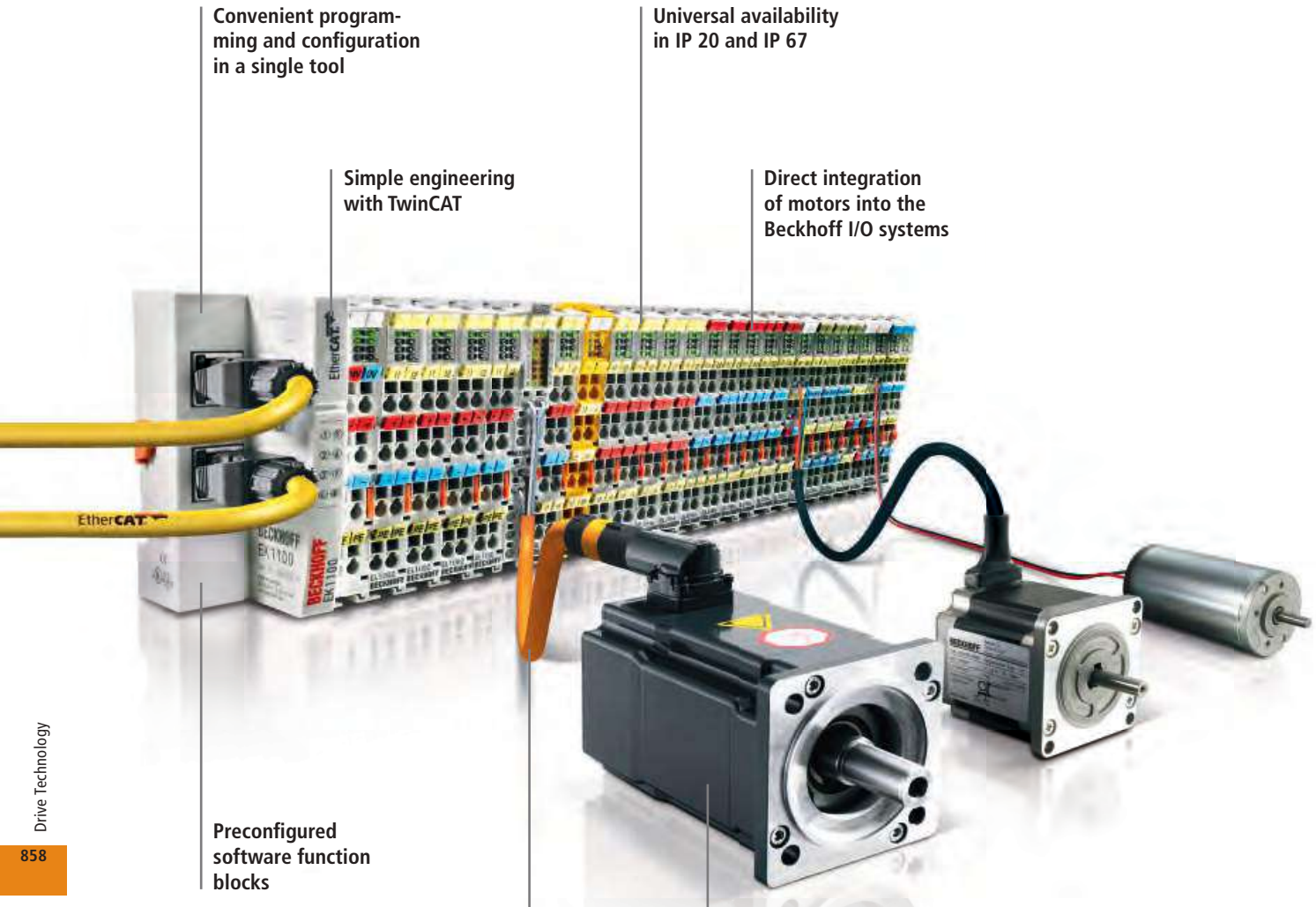
C

D

E

F

Compact Drive Technology



▶ www.beckhoff.com/compact-drive-technology

In combination with the wide range of available motors and gears the Beckhoff I/O systems enable the implementation of compact and affordable drive solutions: the modularly expandable motion terminals support servo, stepper and DC motors of different performance classes. For stepper and DC motors EtherCAT Box Modules with IP 67 protection are available for use outside of control cabinets. All compact drive solutions are integrated into the Beckhoff TwinCAT automation software, making parameterisation convenient.

Solutions for less complex motion requirements

High quality servo axes are not required for auxiliary drives such as simple adjustable axes, mobile stops, small conveying movements or simple positioning drives; in fact, stepper or DC motors are entirely adequate.

Motion | AS1000 stepper motors

The AS1000 stepper motors with flange sizes from 42 to 86 mm (NEMA17, NEMA23, NEMA34) and torques from 0.4 to 5 Nm are ideally suited to the simpler tasks mentioned above. They are characterised by robustness and high holding torques. Due to the integrated micro-stepping the motors can position very well even without a feedback system and require only a motion terminal for power electronics. Stepper or DC motors can also be operated with TwinCAT NC PTP for synchronisation functions such as cam plates or flying saws.

I/O | Stepper motor terminals

For stepper motor terminals, I/O components with different performance features are available: Bus Terminal (KL2531, KL2541), EtherCAT Terminal (EL7031/EL7041 and EL7037/EL7047) and EtherCAT Box (EP7041). The KL2531, EL7031 and EL7037 stepper motor terminals are exclusively designed for 24 V DC power supplies. The motor current can reach up to 1.5 A. The KL2541, EL7041 and EL7047 stepper motor terminals cover a supply voltage range from 8 to 50 V DC and additionally require a 24 V supply via the power contacts. The motor current can be set from 1 to 5 A. The EP7041 stepper motor module allows the connection of stepper motors up to 50 V DC and 5 A.

Solutions for high precision and dynamics

As a downside to stepper motors there is always a risk of "steps being lost" in an overloaded condition. When combined with an incremental encoder, however, they can also be used where higher precision is required. The encoder evaluation required for this is already integrated in the EL7047, EL7041 and KL2541 50 V DC output stages. With the integrated incremental encoder connection, the EP7041 enables the implementation of a simple servo axis in a compact IP 67 module.

However, the typical stepper motor disadvantages remain: their less dynamic behaviour, low efficiency and limited speed. Beckhoff also has a solution to this, however, in form of an EtherCAT Terminal: together with the AM8100 servomotors, the EL72x1 servomotor EtherCAT Terminal is probably the world's smallest servo multi-axis system.

Motion | AM8100 servomotors

Full-value servo axes can be implemented using the EL7201 and EL7211 EtherCAT Terminals in combination with AM8100 servomotors. The servo system delivers best-possible performance with respect to dynamics, accuracy, energy efficiency and robustness. The small motors from the AM811x series with an edge size of only 40 mm fit in the tiniest installation spaces. Nominal torques of up to 0.52 Nm can be achieved in the power range from 80 to 170 Watts with these small power packs. An integrated 18-bit absolute encoder with electronic identification plate simplifies commissioning and meets the highest requirements for precision. The absolute encoder is also available as a multiturn absolute encoder, which detects the absolute position of the drive during switch-on. Thus, reference trips (homing function) and additional limit switches are not required, saving costs and time. Thanks to the innovative One Cable Technology (OCT) wiring costs are drastically reduced, since no separate feedback cable is required and only six cores have to be connected at the most.

I/O | Servomotor terminals

The EL7201, EL7211, EL7201-0010 and EL7211-0010 servomotor terminals are fully functional Servo Drives for the direct control of servomotors. They offer terminal points for connection of a servomotor as well as motor brake and resolver. On the software side, solutions based on TwinCAT NC PTP are recommended even for moderate requirements to enable the synchronisation between axes. While the EL7201 and EL7211 support a resolver as feedback system, the EL7201-0010 and EL7211-0010 offer the option to use an absolute feedback system (OCT).

Product overview Compact Drive Technology

	DC motor			Stepper motor			
	IP 20		IP 67	IP 20			IP 67
	Bus Terminals	EtherCAT Terminals	EtherCAT Box	Bus Terminals	EtherCAT Terminals		EtherCAT Box
I/O	**KL2532** 627 1 A 	**EL7332** 435 1 A 	**EP/ER7342** 498 3.5 A 	**KL2531** 625 1.5 A 	**EL7031** 431 1.5 A 	**EL7037** 431 1.5 A 	**EP/ER7041-3002** 497 5 A 
	KL2552 627 5 A 	**EL7342** 435 3.5 A 		**KL2541** 625 5 A 	**EL7041** 431 5 A 	**EL7047** 431 5 A 	
Cables				**ZK4000-6700-2xxx** 870 Motor cable			**ZK4000-6261-xxxx** 871 Motor cable
				ZK4000-5100-2xxx 870 Encoder cable			**ZK4000-5151-xxxx** 871 Encoder cable
Motors				**AS10xx** 869 0.38…5.0 Nm, 1…5 A 		**AS1060** 869 5.0 Nm, 5 A 	
Gear units				**AG1000-+PM52.i** 871 at AS1030/AS1050 		**AG1000-+PM81.i** 871 at AS1060 	

Servo motor

IP 20

EtherCAT Terminals

EL7201-0010 433

OCT, 2.8 A_{RMS}

EL7201 433

Resolver, 2.8 A_{RMS}

EL7211-0010 433

OCT, 4.5 A_{RMS}

EL7211 433

Resolver, 4.5 A_{RMS}

ZK4704-0421-2xxx 864

OCT motor cable

ZK4704-0411-2xxx 864

Motor cable

ZK4724-0410-2xxx 864

Resolver cable

AM811x 862

0.20…0.52 Nm,

2.8…4.8 A

AM8122 862

0.8 Nm,

4.0 A

AM3111 862

0.21 Nm,

3.22 A

AM3121 862

0.69 Nm,

4.6 A

AM8121 862

0.5 Nm,

4.0 A

AM8131 862

1.35 Nm,

5 A

AM3112 862

0.34 Nm,

3.4 A

AG2250-+PLE40
AG2250-+WPLE40 865

AG2250-+PLE60
AG2250-+WPLE60 865

AG2250-+PLE40
AG2250-+WPLE40 865

AG2250-+PLE60
AG2250-+WPLE60 865

AM8100, AM3100 | **Synchronous Servomotors**

AM8100

The AM8100 servomotors from the AM8000 series are especially designed for operation with the EL7201 and EL7211 servo terminals. The high dynamics of the servomotors open up a multitude of possible applications: for example in industrial robots for pick-and-place applications, or in general in mechanical engineering, where a compact design and high positioning accuracy are necessary. Like all motors of the AM8xxx family they are available in One Cable Technology (OCT) versions where power and feedback are combined in a single cable.

Homing is no longer necessary thanks to the absolute value encoder integrated in the motor: the position of the drive is saved in the EEPROM, which is ideal for adjustable axes. The encoder data are transmitted entirely digitally to the EL7201-0010 or EL7211-0010 servo terminal via the motor cable. The encoder cable can be dispensed with. The full integration of the servo terminal in the Beckhoff control system facilitates the commissioning of the drive axis. All motors of the AM8xxx family use the electronic type plate, with which the engineering expenditure is additionally reduced by the simple reading of the motor parameters. The Beckhoff TwinCAT automation software enables the convenient parameterisation of the servomotors.

The AM81xx motors can optionally be equipped with a backlash-free permanent magnet holding brake, a sealing ring or a feather key groove. They are equipped with a sturdy rotary resolver encoder and for the purpose of long life have been developed with generously dimensioned bearings for general mechanical engineering. Matching gears and prefabricated connecting cables complete the ultra-compact drive axis.

AM3100

The AM3100 series of pole-wound servomotors with maximum torque yield covers three types with rated outputs of 50 W (rated voltage 24 V DC) as well as 100 W and 140 W (rated voltage 48 V DC).

In the standard version, the AM3100 servomotors are equipped with a resolver and a smooth shaft. They can be optionally equipped with a holding brake, even in the smallest size.

Technical data	AM81xx	AM31xx
Motor type	permanent magnet-excited three-phase synchronous motor	
Magnet material	neodymium-iron-boron	
Insulation class	thermal class F (155 °C)	
Design form	flange-mounted according to IM B5, IM V1, IM V3	
Protection class	IP 54, IP 65 (shaft seal only for AM812x, AM813x)	IP 54
Cooling	convection, permissible ambient temperature 40 °C	
Coating/surface	dark grey powder coating, similar to RAL7016	matt black coating RAL 9005
Connection method	round plug connector, swivelling, angled	straight connectors at 30 cm cable ends
Life span	L_{10h} = 30,000 hrs for ball bearings	L_{10h} = 20,000 hrs for ball bearings
Approvals	CE, UL	CE
Feedback system	resolver, OCT	resolver

AM8100 | Servomotors 0.20 – 0.52 Nm (standstill torque), OCT

Data for 50 V DC	AM8111-wFyz	AM8112-wFyz	AM8113-wFyz
Standstill torque	0.20 Nm	0.38 Nm	0.52 Nm
Rated torque	0.19 Nm	0.36 Nm	0.50 Nm
Rated speed	4000 min^{-1}	4500 min^{-1}	3000 min^{-1}
Rated power	0.08 kW	0.17 kW	0.16 kW
Standstill current	2.85 A	4.7 A	4.8 A
Rotor moment of inertia	0.029 $kgcm^2$	0.048 $kgcm^2$	0.067 $kgcm^2$
Rotor moment of inertia (with brake)	0.052 $kgcm^2$	0.071 $kgcm^2$	0.090 $kgcm^2$
EtherCAT Terminal	EL7201-0010	EL7211-0010	EL7211-0010

AM8100 | Servomotors 0.50 – 1.35 Nm (standstill torque), OCT

Data for 50 V DC	AM8121-wFyz	AM8122-wFyz	AM8131-wFyz
Standstill torque	0.50 Nm	0.80 Nm	1.35 Nm
Rated torque	0.50 Nm	0.80 Nm	1.35 Nm
Rated speed	3000 min^{-1}	2000 min^{-1}	1000 min^{-1}
Rated power	0.16 KW	0.17 KW	0.14 KW
Standstill current	4.0 A	4.0 A	5.0 A
Rotor moment of inertia	0.134 $kgcm^2$	0.253 $kgcm^2$	0.462 $kgcm^2$
Rotor moment of inertia (with brake)	0.156 $kgcm^2$	0.276 $kgcm^2$	0.541 $kgcm^2$
EtherCAT Terminal	EL7211-0010	EL7211-0010	EL7211-0010

▶ **www.beckhoff.com/AM81xx**

AM3100 | Servomotors 0.21 – 0.69 Nm (standstill torque)

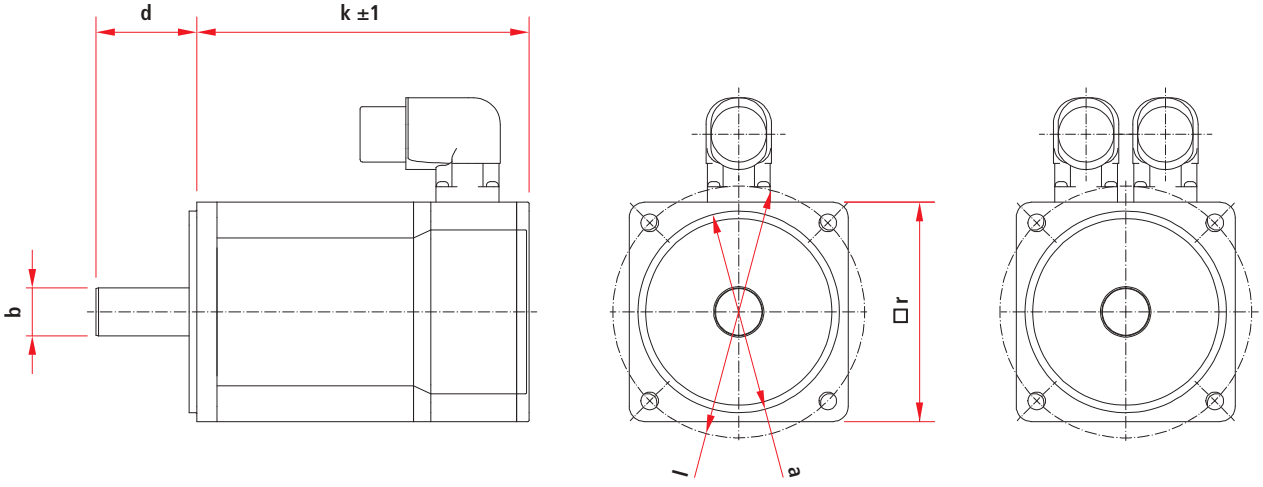
Data for 50 V DC	AM3111-w30z	AM3112-w40z	AM3121-w20z
Standstill torque	0.21 Nm	0.34 Nm	0.69 Nm
Rated torque	0.16 Nm	0.28 Nm	0.65 Nm
Rated speed	3000 min^{-1}	3500 min^{-1}	2000 min^{-1}
Rated power	0.05 kW	0.10 kW	0.14 kW
Standstill current	3.22 A	3.40 A	4.60 A
Rotor moment of inertia	0.026 $kgcm^2$	0.046 $kgcm^2$	0.150 $kgcm^2$
Rotor moment of inertia (with brake)	0.034 $kgcm^2$	0.054 $kgcm^2$	0.200 $kgcm^2$
EtherCAT Terminal	EL7201-0000	EL7211-0000	EL7211-0000

▶ **www.beckhoff.com/AM31xx**

Order reference	AM81uv-wxyz	AM31uv-wxyz-000a
u	flange code	
v	motor length	
w = 0	smooth shaft	
w = 1	shaft with groove and feather key according to DIN 6885	
w = 2	shaft with IP 65 sealing ring and smooth shaft (only for AM812x, AM813x)	–
w = 3	shaft with IP 65 sealing ring and shaft with groove and feather key (only for AM812x, AM813x)	–
x	winding code F	key number for rated speed in RPM x 1000, not available for selection
y = 0	resolver (only for AM812x, AM813x)	resolver
y = 1	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, single-turn, absolute position within one revolution, 18 bit resolution	–

The order reference is continued on the next page.

Order reference	AM81uv-wxyz	AM31uv-wxyz-000a
y = 2	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, multi-turn, absolute position within 4096 revolution, 18 bit resolution	–
z = 0	without holding brake	
z = 1	with holding brake	
a = 1	–	cable 0.3 m, with iTec plug for power, M12 plug for feedback



One Cable Technology

Resolver version

Dimensions	a	b	d	l	r	k (without brake)	k (with brake)
AM8111	30 h7	8 h7	25 mm	46 mm	40 mm	97 mm	129 mm
AM8112	30 h7	8 h7	25 mm	46 mm	40 mm	117 mm	149 mm
AM8113	30 h7	8 h7	25 mm	46 mm	40 mm	137 mm	169 mm
AM8121	40 j6	9 k6	20 mm	63 mm	58 mm	111.5 mm	146 mm
AM8122	40 j6	9 k6	20 mm	63 mm	58 mm	133.5 mm	168 mm
AM8131	60 j6	14 k6	30 mm	75 mm	72 mm	128.7 mm	168.2 mm
AM3111	30 j6	8 k6	25 mm	46 mm	40 mm	91 mm	122 mm
AM3112	30 j6	8 k6	25 mm	46 mm	40 mm	109 mm	140 mm
AM3121	50 j6	11 k6	23 mm	70 mm	60 mm	111 mm	148 mm

Accessories for AM8100 and AM3100 servomotors

Supply cables for servomotor terminal

Ordering information	Cables for servomotor terminal EL7201-0010/EL7211-0010 (OCT) and EL7201-0000/EL7211-0000 (resolver feedback)
ZK4704-0421-2xxx	motor cable for OCT feedback, drag-chain suitable, (4 x 0.75 mm² + (2 x 0.34 mm²) + (2 x AWG22)), shielded [1]
ZK4704-0411-2xxx	motor cable for resolver feedback, drag-chain suitable, (4 x 0.75 mm² + (2 x 0.5 mm²)), shielded [2]
ZK4724-0410-2xxx	resolver cable, drag-chain suitable, (3 x 2 x 0.25 mm²), shielded [2]

[1] Max. cable length 20 m

[2] Available in lengths of 1 m, 3 m, 5 m, 10 m and 20 m (xxx = length in decimetres, e.g. -2010 = 1 m)

Technical data for drag-chain use see ▶ **www.beckhoff.com/compact-drive-technology**

AG2250 | Planetary gear units for Compact Drive Technology

The AG2250 planetary gears especially matched to the AM8100 and AM3100 motor series and have been expanded by a two-stage version. For better design, planetary and angled planetary gears are available with the following transmission ratios: 12, 16, 20, 25, 32, 40 and 64.

The AG2250 series completes the range of small, affordable drive technology products. The gears are especially suited to applications where no particularly low torsional backlash is required. The inertia ratios, the required torques and the suitable motors can be conveniently calculated directly in TwinCAT with the TC Motion Designer. In addition, the tool checks in a single step whether the selected motor can be adapted to the gear unit. The planetary gear units are fitted to the respective motor in the factory and delivered as a complete motor/gear unit.The AG2250 series also contains angled planetary gears for the space-saving installation of motors at a right-angle.

Features

- low torsional backlash
- high output torques
- high efficiency
- single-stage planetary gear, transmission ratios 3, 4, 5, 7, 8, 10
- two-stage planetary gear/angled planetary gear, transmission ratios 12, 16, 20, 25, 32, 40, 64
- single-stage angled planetary gear, transmission ratios 3, 4, 5, 7, 8, 10
- two-stage angled planetary gear, transmission ratios 12, 16, 20, 25, 32, 40, 64
- flexible installation position
- lifetime lubrication
- suitable for motors of the AM801x series (230 V AC) and AM8100 and AM3100 series (48 V AC)

Technical data	AG2250
Type of gear	planetary gear/angled planetary gear
Life span	> 30,000 h/> 20,000 h
Lubrication	lubricated for life
Installation position	variable
Protection class	IP 54
Mechanically compatible with	flange size F (typical combination according to specifications)

AG2250 | **Size 40**

Technical data	AG2250-+PLE40-M01-i	AG2250-+PLE40-M02-i
Variant	planetary gear	planetary gear
Gear ratio	3/4/5/7/8/10	12/16/20/25/32/40/64
Nominal output torque	5…15 Nm	7.5…20 Nm
Max. acceleration torque	8…24 Nm	12…32 Nm
Max. torsion. backlash standard/reduced	≤ 15/– arcmin	≤ 19/– arcmin
Typ. flange size F	F1	F1

AG2250 | **Size 60**

Technical data	AG2250-+PLE60-M01-i	AG2250-+PLE60-M02-i
Variant	planetary gear	planetary gear
Gear ratio	3/4/5/7/8/10	12/16/20/25/32/40/64
Nominal output torque	15…40 Nm	18…44 Nm
Max. acceleration torque	24…64 Nm	29…70 Nm
Max. torsion. backlash standard/reduced	≤ 10/– arcmin	≤ 12/– arcmin
Typ. flange size F	F2, F3, AM312x	F2, F3, AM312x

AG2250 | **Size 40, angled**

Technical data	AG2250-+WPLE40-M01-i	AG2250-+WPLE40-M02-i
Variant	angled planetary gear	angled planetary gear
Gear ratio	3/4/5/7/8/10	12/16/20/25/32/40/64
Nominal output torque	4.5…8.5 Nm	7.5…20 Nm
Max. acceleration torque	7…13.5 Nm	12…32 Nm
Max. torsion. backlash standard/reduced	≤ 21/– arcmin	≤ 25/– arcmin
Typ. flange size F	F1	F1

AG2250 | **Size 60, angled**

Technical data	AG2250-+WPLE60-M01-i	AG2250-+WPLE60-M02-i
Variant	angled planetary gear	angled planetary gear
Gear ratio	3/4/5/7/8/10	12/16/20/25/32/40/64
Nominal output torque	14…25 Nm	18…44 Nm
Max. acceleration torque	24…40 Nm	29…70 Nm
Max. torsion. backlash standard/reduced	≤ 16/– arcmin	≤ 18/– arcmin
Typ. flange size F	F2, F3, AM312x	F2, F3, AM312x

Order reference	AG2250-+PLEaa-M0s-i-wXy-Motorsize
xPLEaa	series/size (PLE40, PLE60, WPLE40, WPLE60)
s = 1	1-stage with i = 3/4/5/7/8/10
s = 2	2-stage with i = 12/16/20/25/32/40/64
i	gear ratio
w = 0	smooth shaft
w = 1	shaft with groove and feather key
X	identifying letter for clamping hub diameter; not available for selection, is selected automatically based on the respective motor
Motorsize	Specification of the size according to flange-compatible motors. The planetary gears are delivered as a unit with the assembled motor.
Motorsize = AM811x (F1)	flange code F1: AM801x, AM811x; compatible with AM301x, AM311x
Motorsize = AM812x (F2)	flange code F2: AM802x, AM812x; compatible with AM302x
Motorsize = AM312x	in combination with AM312x
Motorsize = AM813x (F3)	flange code F3: AM813x, AM803x, AM853x; compatible with AM303x

▶ **www.beckhoff.com/AG2250**

AS1000 | **Stepper motors**

Motion | AS1000 stepper motors
The AS1000 stepper motors with flange sizes from 42 to 86 mm (NEMA17, NEMA23, NEMA34) and torques from 0.4 to 5 Nm are ideally suited for use as auxiliary axes and positioning drives. They are characterised by robustness and high holding torques. Due to the integrated micro-stepping the motors can position very well even without a feedback system and require only a motion terminal for power electronics. Stepper motors can also be operated with TwinCAT NC PTP for synchronisation functions such as cam plates or flying saws.

I/O | Stepper motor terminals
For stepper motor terminals, I/O components with different performance features are available: Bus Terminal (KL2531, KL2541), EtherCAT Terminal (EL7031/EL7041 and EL7037/EL7047) and EtherCAT Box (EP7041).

The KL2531, EL7031 and EL7037 stepper motor terminals are exclusively designed for 24 V DC power supplies. The motor current can reach up to 1.5 A. The KL2541, EL7041 and EL7047 stepper motor terminals cover a supply voltage range from 8 to 50 V DC and additionally require a 24 V DC supply via the power contacts. The motor current can be set from 1 to 5 A. The EP7041 stepper motor module allows the connection of stepper motors up to 50 V DC and 5 A.

EL7031, EL7041, EL7037, EL7074 | Stepper EtherCAT Terminals see page 431

KL2531, KL2541 | Stepper Bus Terminals see page 625

EP7041 | Stepper EtherCAT Box see page 496

EL957x | Buffer capacitor terminals see page 443

Technical data	AS10xx
Motor type	stepper motor
Rated supply voltage	24…50 V DC
Resolution	1.8°/200 full steps
Insulation class	thermal class B (130 °C)
Design form	AS1010/AS1020: flange-mounted according IM B14, IM V1, IM V3 AS1030/AS1050/AS1060: flange-mounted according IM B5, IM V1, IM V3
Protection class	IP 43, AS1060: IP 20
Cooling	Free ventilation of the motors must be ensured.
Connection method	direct cable outlet via cable gland with connected M12 coupling
Life span	L_{10h} = 30,000 hrs for ball bearings
Approvals	CE

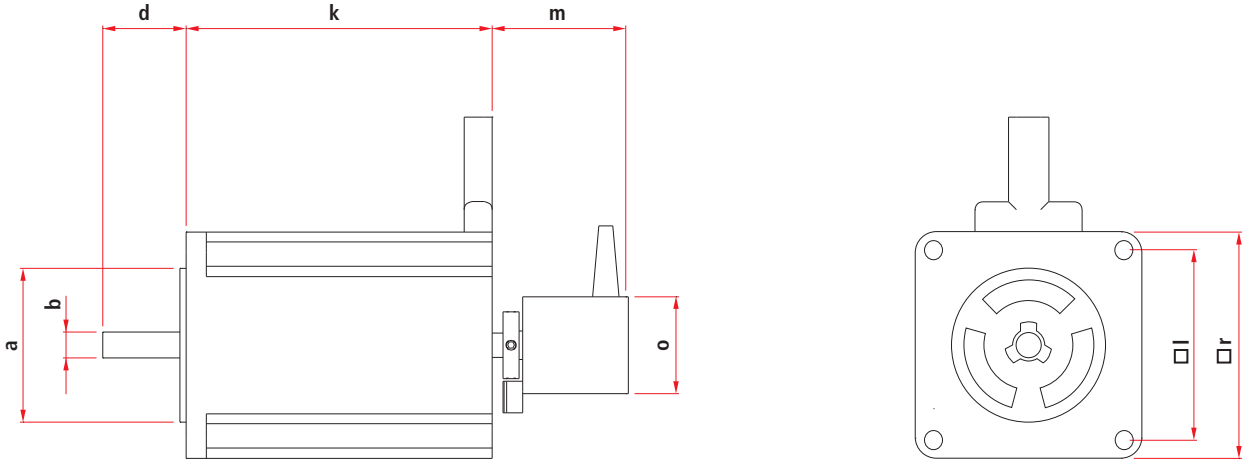
AS10xx | **Rated current 1.0…1.5 A**

Data for 24…50 V DC	AS1010-0000	AS1020-0xyz	AS1030-0000
Flange size	42 mm (NEMA17)	42 mm (NEMA17)	56 mm (NEMA23)
Rated current (per phase)	1.00 A	1.00 A	1.50 A
Standstill torque	0.38 Nm	0.50 Nm	0.60 Nm
Rotor moment of inertia	0.056 kgcm²	0.074 kgcm²	0.210 kgcm²
Bus Terminal	KL2531	KL2531/KL2541	KL2531
EtherCAT Terminal	EL7031/EL7037	EL7031/EL7041/EL7037/EL7047	EL7031/EL7037
EtherCAT Box	EP7041-1002	EP7041-1002	EP7041-1002
Gear unit	–	–	AG1000-+PM52.i

AS10xx | **Rated current 5 A**

Data for 24…50 V DC	AS1050-0xyz	AS1060-wxyz
Flange size	56 mm (NEMA23)	86 mm (NEMA34)
Rated current (per phase)	5.00 A	5.00 A
Standstill torque	1.20 Nm	5.00 Nm
Rotor moment of inertia	0.360 kgcm²	3.000 kgcm²
Bus Terminal	KL2541	KL2541
EtherCAT Terminal	EL7041/EL7047	EL7041/EL7047
EtherCAT Box	EP7041-3002	EP7041-3002
Gear unit	AG1000-+PM52.i	AG1000-+PM81.i

Order reference	AS10u0-wxyz
u	type
w = 0	AS1010, AS1020: smooth shaft with 1 flat AS1030, AS1050: smooth shaft AS1060: smooth shaft with 2 flats
w = 1	shaft with groove and feather key according to DIN 6885 (only available with AS1060)
x = 0	standard motor without second shaft
x = 1	second shaft (AS1020/AS1050/AS1060 only), necessary for y = 1 and y = 2
y = 0	no incremental encoder
y = 1	incremental encoder, 24 V DC, 200 lines (only available for AS1020, AS1050, AS1060), requires x = 1
y = 2	incremental encoder, 24 V DC, 1024 lines (only available for AS1020, AS1050, AS1060), requires x = 1



Dimensions	a	b	d	k	l	m	o	r
AS1010	22 mm	5 mm	24 mm	39 mm	31 mm	–	–	42 mm (NEMA17)
AS1020	22 mm	5 mm	24 mm	48 mm	31 mm	33 mm	24 mm	42 mm (NEMA17)
AS1030	38.1 mm	6.35 mm	20.6 mm	54 mm	47.14 mm	–	–	56 mm (NEMA23)
AS1050	38.1 mm	6.35 mm	20.6 mm	75.8 mm	47.14 mm	33 mm	24 mm	56 mm (NEMA23)
AS1060	73 mm	14 mm	30 mm	96.5 mm	69.6 mm	33 mm	24 mm	85.5 mm (NEMA34)

▶ **www.beckhoff.com/AS10xx**

Accessories for AS1000 stepper motors

Cables for AS1000 at Bus Terminal/EtherCAT Terminal up to 5 A

Ordering information	Cables for stepper terminals EL7031, EL7037, EL7041, EL7047 and KL2531, KL2541	Pict.
ZK4000-5100-2xxx	encoder cable, drag-chain suitable, (5 x 0.25 mm²), shielded, for EL7031/EL7037/EL7041/EL7047 or KL2531/KL2541	A
ZK4000-6200-2xxx	motor cable, drag-chain suitable, 4 x 0.5 mm², for EL7031/EL7037/EL7041/EL7047 or KL2531/KL2541	
ZK4000-6700-2xxx	motor cable, drag-chain suitable, (4 x 0.5 mm²), shielded, for EL7031/EL7037/EL7041/EL7047 or KL2531/KL2541	B

Available in lengths of 1 m, 3 m, 5 m and 10 m (2xxx = length in decimetres, e.g. -2010 = 1 m)
Technical data for drag-chain use see ▶ **www.beckhoff.com/compact-drive-technology**

A

B

Cables for AS1000 at EtherCAT Box up to 5 A

Ordering information	Cables for stepper EtherCAT Box EP7041	Pict.
ZK4000-5151-xxxx	encoder cable, drag-chain suitable, (4 x 0.35 mm²), shielded, for EP7041	C
ZK4000-6261-xxxx	motor cable, drag-chain suitable, 4 x 0.5 mm², for EP7041	D
ZK4000-6768-0xxx	motor cable, drag-chain suitable, shielded, (4 x 0.5 mm²), for EP7041	D

Available in lengths of 0.5 m, 1 m, and 2 m (xxxx = length in decimetres, e.g. -0005 = 0.5 m)
Technical data for drag-chain use see ▶ **www.beckhoff.com/compact-drive-technology**

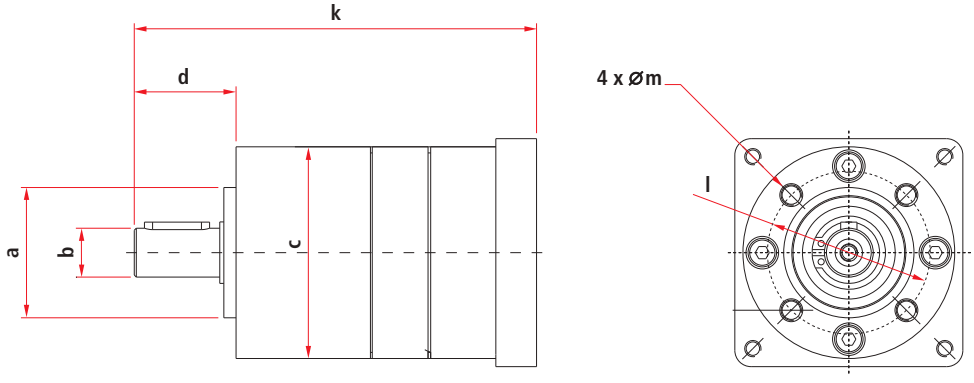
C

D

AG1000 | Planetary gear units for AS1000

Technical data	AG1000-+PM52.4	AG1000-+PM52.7	AG1000-+PM81.4	AG1000-+PM81.7
Nominal output torque	4 Nm	4 Nm	20 Nm	20 Nm
Max. acceleration torque	6 Nm	6 Nm	30 Nm	30 Nm
Gear ratio	3.7 resp. 63/17	6.75 resp. 27/4	3.7 resp. 63/17	6.75 resp. 27/4
Max. torsional backlash	≤ 0.7 °	≤ 0.7 °	≤ 0.5 °	≤ 0.5 °
Max. radial load	200 N	200 N	400 N	400 N
Efficiency	approx. 80 %			
Type of gear	planetary gear			
Weight	0.7 kg	0.7 kg	1.8 kg	1.8 kg
Combination with AS10xx	AS1030, AS1050	AS1030, AS1050	AS1060	AS1060

The planetary gears are delivered as a unit with the assembled stepper motor.



Dimensions	a	b	c	d	k	l	m
AG1000-+PM52.i	32 mm	12 mm	52 mm	25 mm	99.8 mm	40 mm	M5 x 10
AG1000-+PM81.i	50 mm	19 mm	81 mm	49 mm	151.2 mm	65 mm	M6 x 12

XTS | eXtended Transport System

XTS | **eXtended Transport System**

- linear motor characteristics on an endless path
- replaces classical mechanics with innovative mechatronics
- individual product transport with a continuous flow of material
- modular structure, simple adaptation to the application
- low spatial and power requirements

See page 874

AT200x | **Straight motor module**
- highly integrated motor module with coil package, power electronics and displacement measurement
- 250 x 38 x 96 mm (L x W x H)

See page 886

AT20xx | **Curved motor modules**
- highly integrated motor modules with coil package, power electronics and displacement measurement
- +180° (clothoid, radius not constant), +45°, +22.5° or -22.5°

See page 886

AT9xxx | **Guide rails**
- straight and curved segments
- with lock for the removal of movers
- abrasion-resistant hard anodised aluminium surface
- lengths up to 2.5 m

See page 890

AT9011 | **Mover**
- wireless, mobile carrier modules
- any desired number of movers on a common path
- contains magnetic plates which, together with the coils in the motor modules, can generate propulsive forces

See page 887

TF5850 | **Software and programming**
- simple handling of the desired movements by mapping the mover as a "normal" servo axis in TwinCAT
- With the XTS extension in TwinCAT, all algorithms can be calculated on an IPC. Interfaces between different subsystems are not required.
- All Motion Control functions such as flying saw, electrical gears and cam plate are usable.

See page 888

▶ **www.beckhoff.com/XTS**

XTS | The linear transport system

The linear transport system XTS (eXtended Transport System) unites the benefits of rotary and linear systems. XTS enables individual product transport with a continuous flow of material. Due to the low construction volume the energy efficiency can be improved and the size of a machine can be significantly reduced.

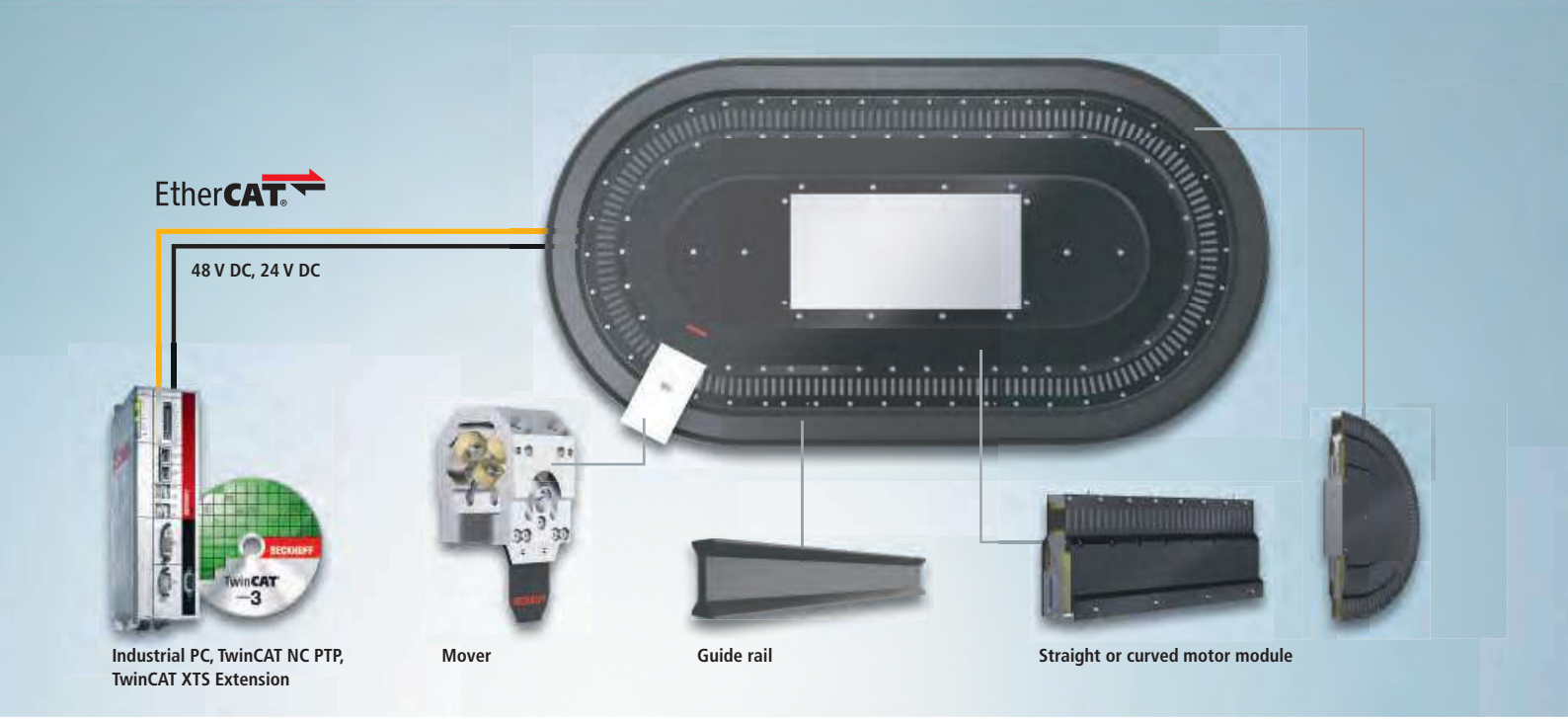
Only motor module, mover, software and Industrial PC

PC-based control from Beckhoff follows a principle that is equally simple and efficient: the maximum application of information technology for the simplification of mechanical processes. With XTS, Beckhoff has transferred this principle directly to the field of drive systems – and in this way has opened up new efficiency potentials in mechanical engineering, because XTS makes do with four simple components.

- Firstly: an arbitrary number of motor parts, which serve as path modules.
- Secondly: an arbitrary number of movers, which act individually or in groups.
- Thirdly: control software.
- And fourthly: an Industrial PC.

Flexible use, arbitrary functional options

There are virtually no limits to the possibilities of use of XTS: the movers can accelerate, brake, position and synchronise; they can take up absolute and positions relative to each other; they can group themselves and accumulate; they can create clamping forces in motion; they can travel through curves as fast as along straights; they can recover energy through regenerative braking and utilise both travel directions for transport purposes. And all of that with precise position control, without backlash, without material fatigue, virtually without wear – and without cost-intensive maintenance.

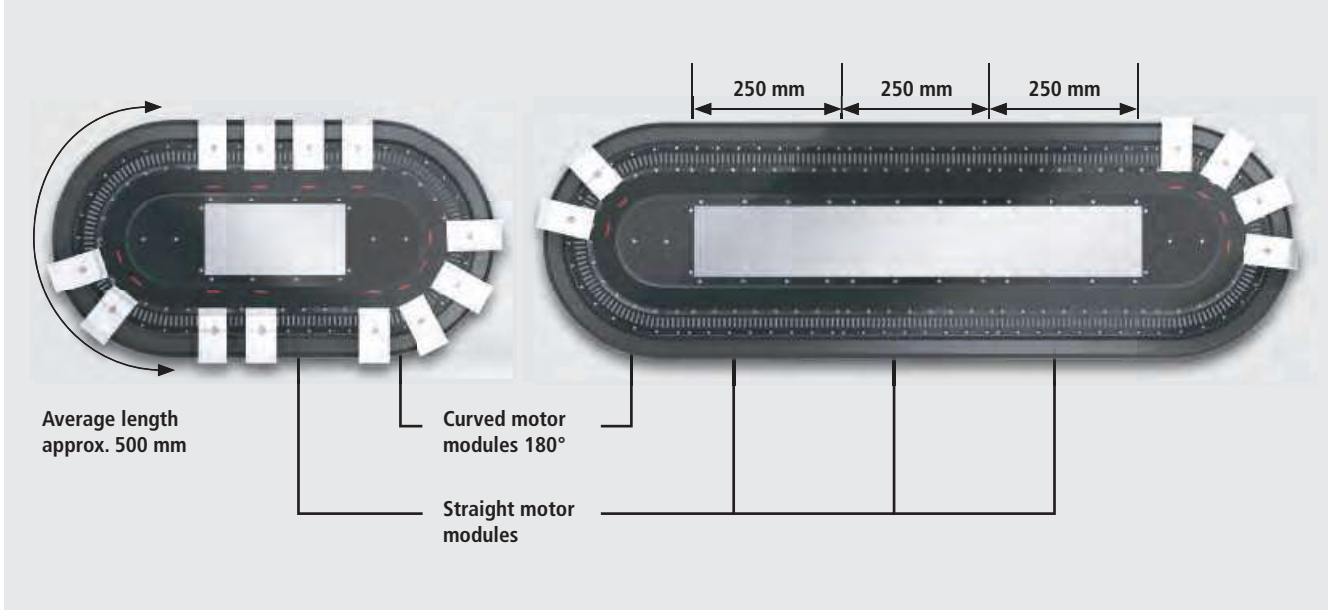


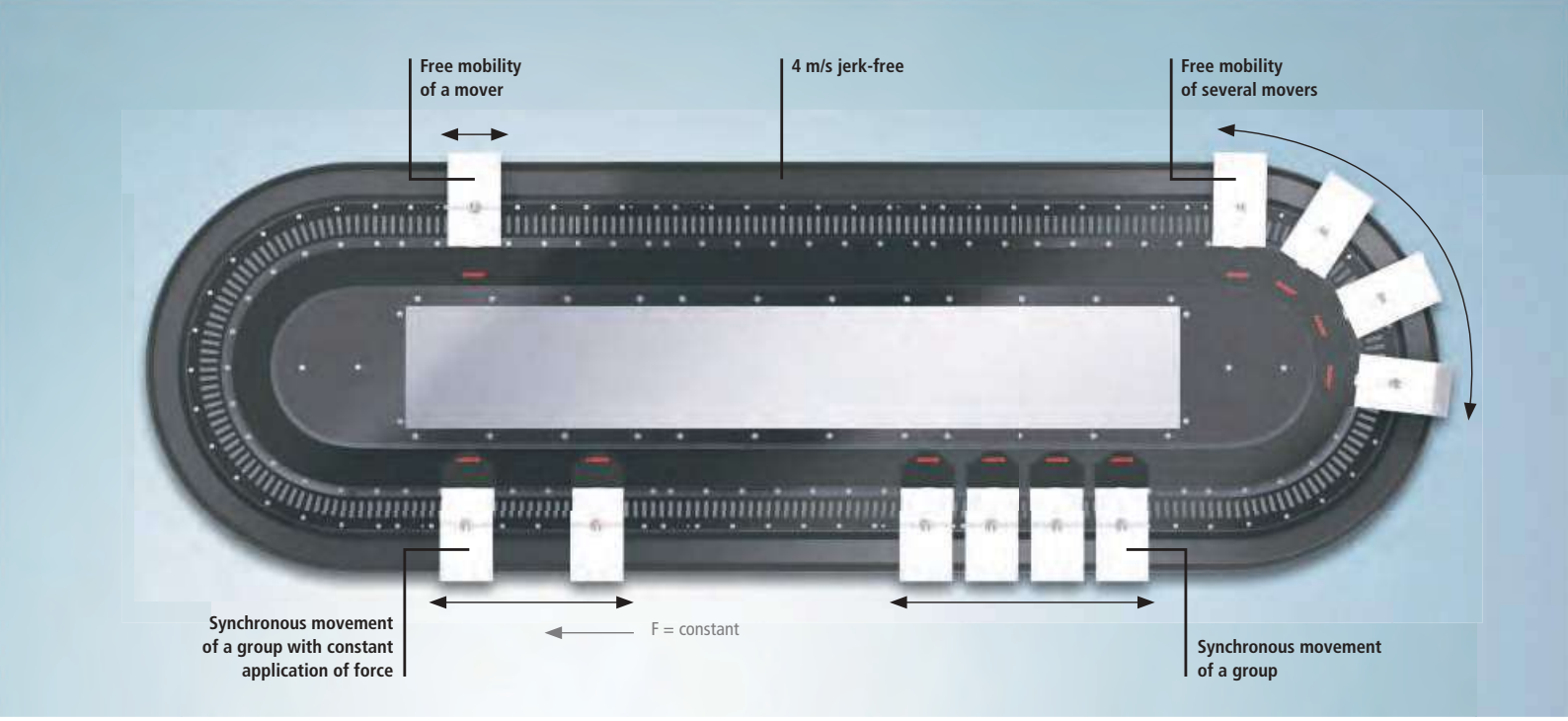
XTS | Modular and flexible

XTS is a mechatronic system containing all functions necessary for operation. A modular, fully integrated linear motor with power electronics and displacement measurement in one device. A mover as the moved part. A mechanical guide rail. The most diverse applications can be realised with these few coordinated components. The desired geometries, lengths and radii are formed by the number and choice of the components.

The XTS components for a continuous system

- curve sections
- 2 or more straight sections
- 1 or more movers
- Beckhoff Industrial PC
- TwinCAT NC PTP
- TwinCAT XTS extension
- power supply units





XTS | **Basic functions**

The XTS system enables a new class of functions that can be used at the same time in several places.
Completely new, particularly flexible: transport and positioning tasks are economically solvable with little effort.

The linear motor with NC and more degrees of freedom

Free mobility of an individual wireless mover
The individual mover can be moved like a linear motor along the entire path, since it makes do without cables. It can arbitrarily start, stop, brake, accelerate and drive to positions. Like a linear motor with NC, an individual mover can be synchronised to external motion profiles, thereby achieving maximum flexibility.

Production speed of up to 4 m/s over the entire path
An individual mover can be addressed sensitively – without jerking and with maximum positioning accuracy. The jerk-free acceleration profiles even allow the transport of open liquids.

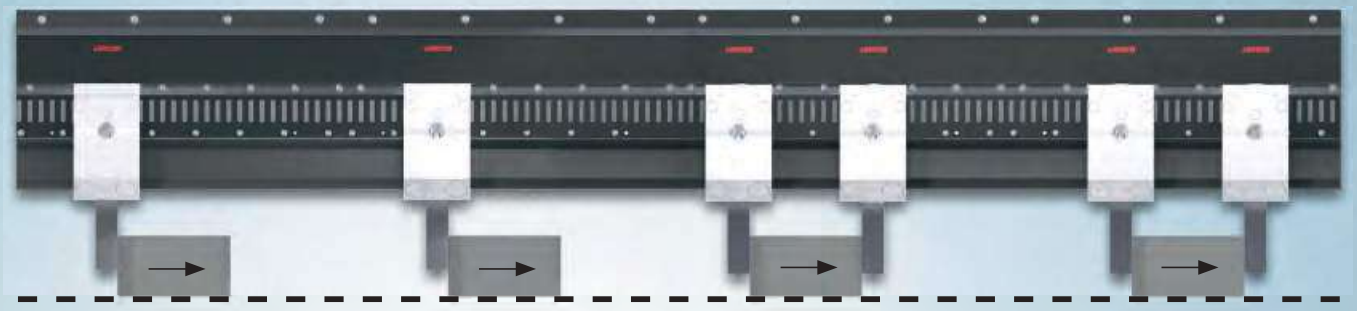
Less wear, less maintenance
The use of XTS leads to less mechanical wear, since only the mover needs mechanical bearings. Gears, belts, guide rollers and clamps are no longer necessary. Due to the high positioning accuracy, the compensation of inaccuracies as required in common transport solutions is unnecessary: there is no stretching of chains due to load and wear, re-tensioning of toothed belts or mechanical backlash during load changes. Apart from the payload, only the small mass of the mover is moved.

Synchronous movement in the group

Movements with constant force
A mover follows another with a defined force. It can apply a "clamping force" while at the same time following a movement, for example in order to hold a product. For other applications the force can be limited so as not to place an unnecessary load on a product under any conditions.

Synchronous movement of a group
At any place on the path during movement, groups can be formed that stop together or drive past processing stations with a specified speed profile. The size of the group (number and spacing) can be changed dynamically.

Free mobility of several movers
The movers can all be moved independently of one another. They can take up absolute positions along the entire travel distance. In addition, they can be moved relatively to each other and always avoid a collision with their neighbour.



Push product, adapt product spacing, reduce or increase product speed

Clamp and move product

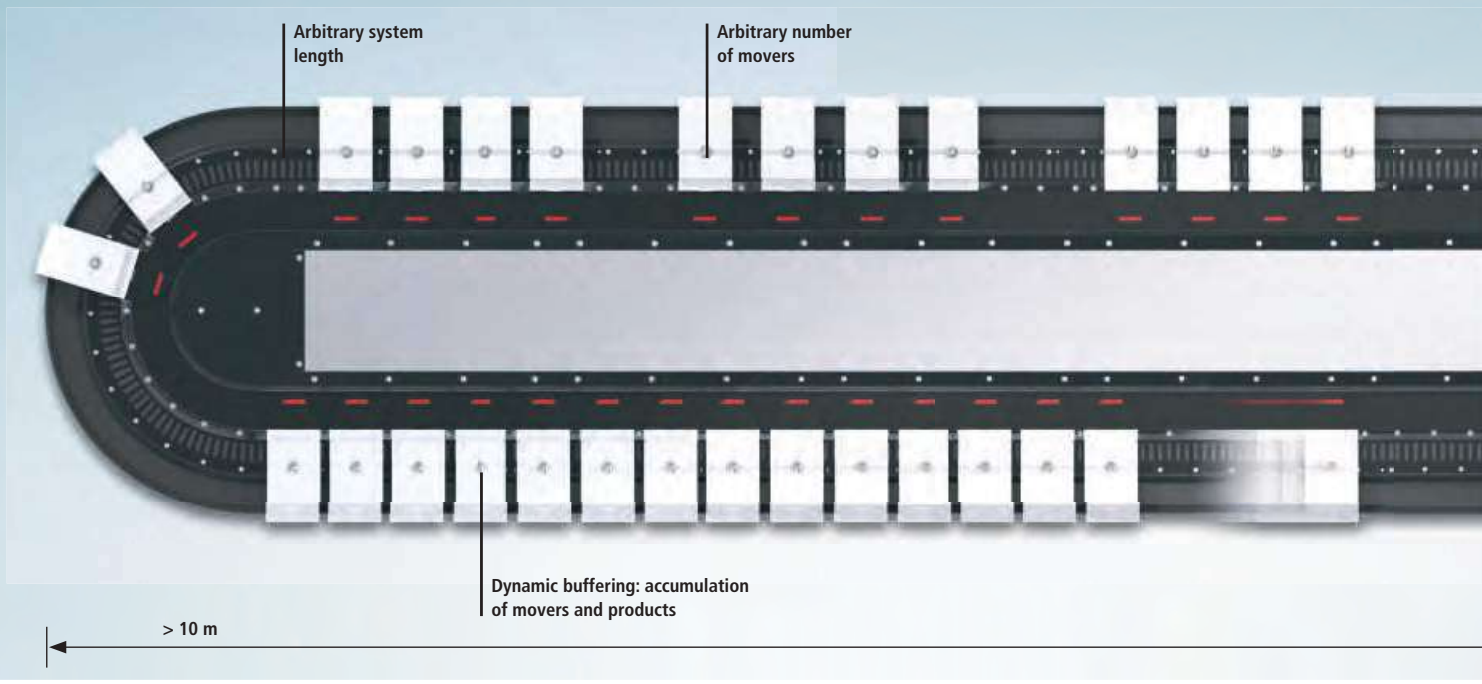
Use of the basic functions

Interruption-free production flow

From the combination of the basic functions, product flows can be kept constantly in motion with XTS. Since the movers in the XTS operate independently of each other, it is possible to stop and process individual objects without having to interrupt the entire process; viewed from the outside the production flow is maintained.

Push product, adapt product spacing, reduce or increase product speed
The movers of the XTS system can always run with the flow of product. No return trip or return stroke is necessary. The transported material can be accumulated and grouped during the movement via the dynamic buffering.

Clamp and move product
Through the combination of the synchronous movement of a group and the application of a constant force, a product can be clamped and moved in a clamped condition. Movement is controlled at all times and at all places on the transport path.



XTS | **Complex functions**

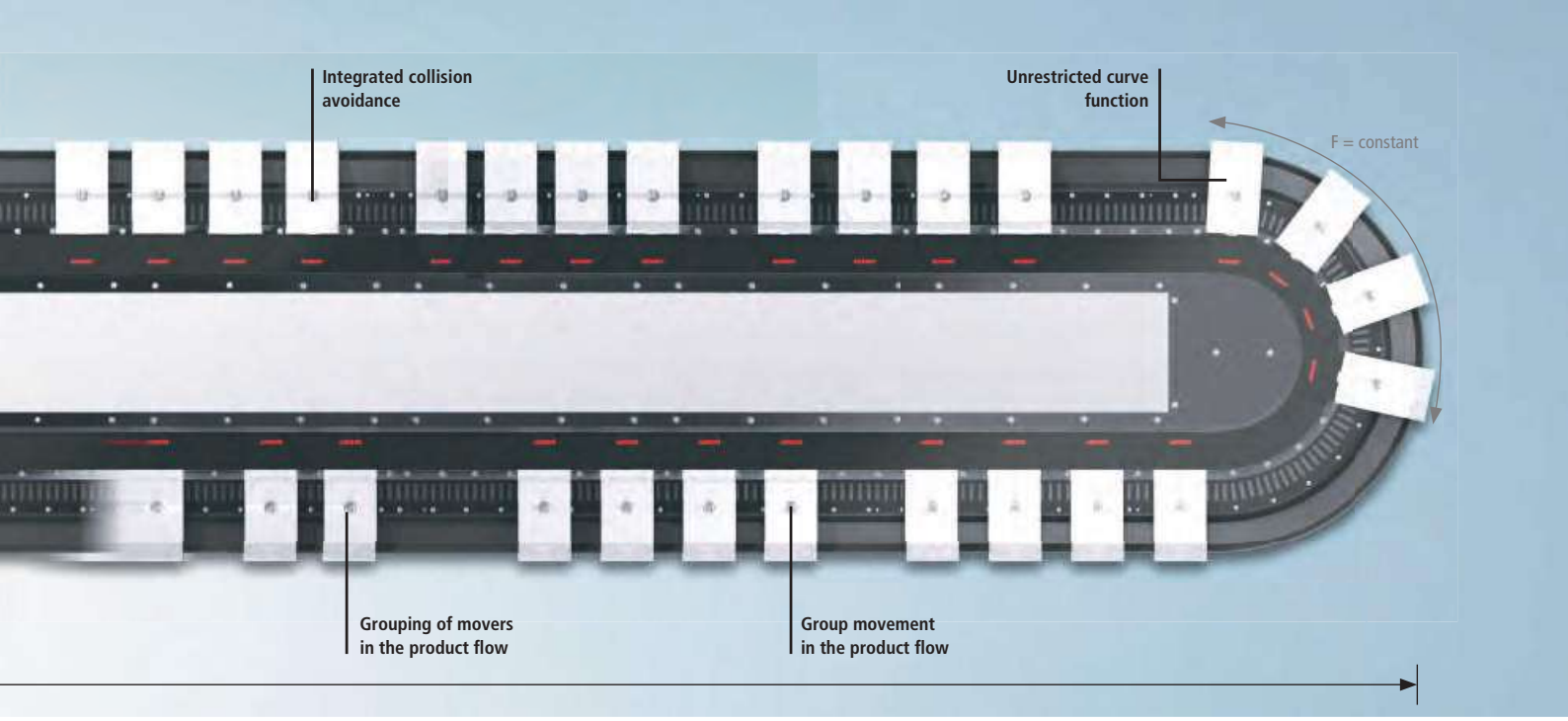
Due to the mechatronic concept, XTS combines functions and characteristics that are required for the dynamic transport of goods of all kinds. Apart from the basic functions of the movers, the complex functions of XTS enable the gentle control of an endless product flow.

Arbitrary number of movers
There are no system limits for the number of movers; consequently the number can be optimally adapted to the application. In practice the number is limited only by the available computing power of the PC.

Unrestricted curve function
The entire travel path becomes the utilisable path, since the outward and return path and also the curve segments are available for the transport and processing of materials. This maximum utilisation of the machine volume results in very compact application solutions, which enable completely new machine concepts.

Arbitrary system length
There are no restrictions on the total length of the path, so that 10 m and much more are technically possible. The system consists of individual modules, which when combined with one another create both small, compact solutions and metre-long transport paths. Straight sections are made up of 250 mm modules which can be made endless by the use of curved segments. A motor cable has to be attached at least every three metres. The electrical connection between the modules is automatically made when assembling. The guide rail system offers lengths of up to 2.5 m.

Lower mass, increased safety
Small masses lead to a lower hazard potential, because unlike XTS, a conveyor chain is kept in motion by a central drive unit. The total acting force corresponds to the sum of all necessary individual forces over the entire length. In the case of an error, a mechanical malfunction or a manual intervention in the process, this force acts on one place. With XTS this risk can be significantly minimised and safety can be increased, since in most cases only the parameterised force of a mover acts. Hence, even in the case of a collision with an obstacle, only the mass of a mover with its payload acts.



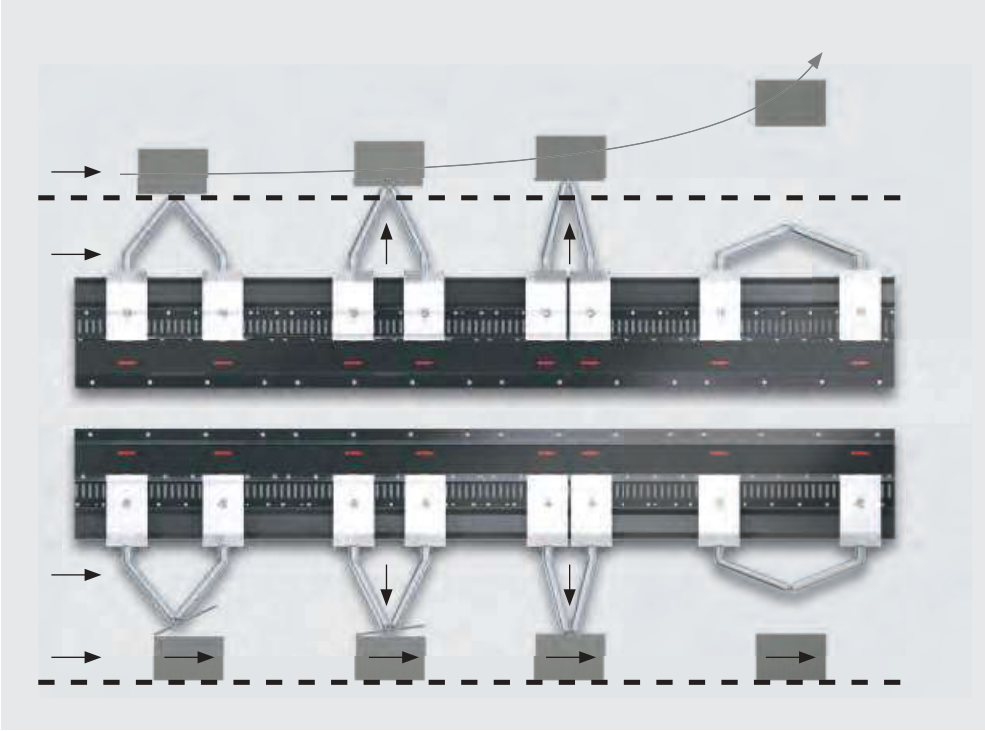
Control of a continuous product flow

High-power dynamics, but no unrestrained force
The fast signal processing and the large bandwidth of EtherCAT enable the best dynamic characteristics. Together with large peak forces, high acceleration is available to the application. Position lag monitoring avoids damage to the product in case of mechanical malfunctions. In addition, force limitation and jerk reduction allow the optimal handling of the product at all times at different points in the production. For example, the parameters can be adapted according to the filling level while moving.

Absolutely precise configuration
The arbitrary number of movers, the modular path guidance, the individual controllability of each individual mover and the simple integrability into existing machines and plants ensure a precisely matching solution with which the production efficiency of a machine can be further optimised.

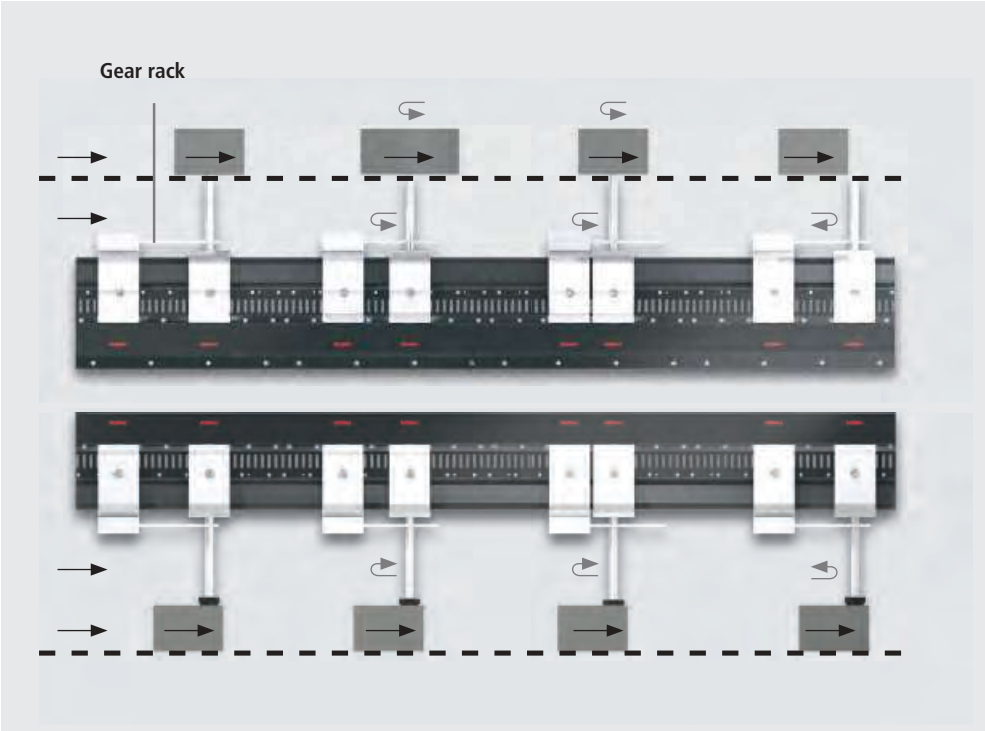
Fast, flexible format adaptation
A change of format when changing products or, for example, when the filling quantity changes can be carried out without stopping production: the modifications can be realised by changing the software parameters and empirical values can also be retrieved at any time in the form of a stored parameter set. The parameters can be exchanged between applications of the same type.

XTS | **Application examples**

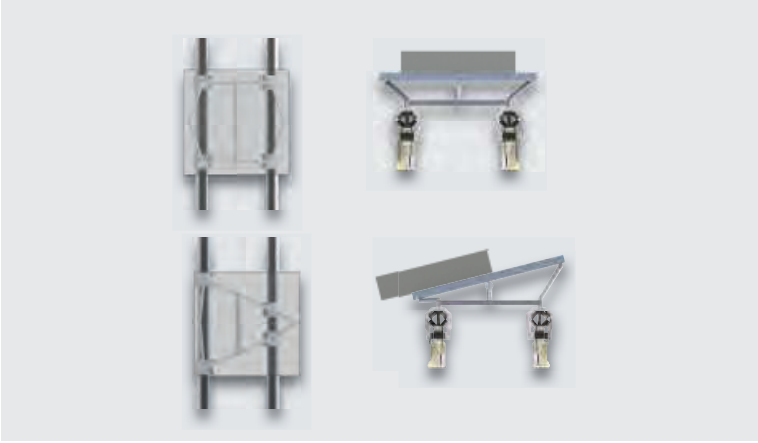


Movement kinematics in one system

Kinematics in linear motion for handling a product: lifting, sealing, etc.
A mechanical action generated by the relative movement between two movers creates an additional movement that can manipulate a product. Transported materials can be pushed upwards or to the side. A product can be closed or processed in some other way while moving.

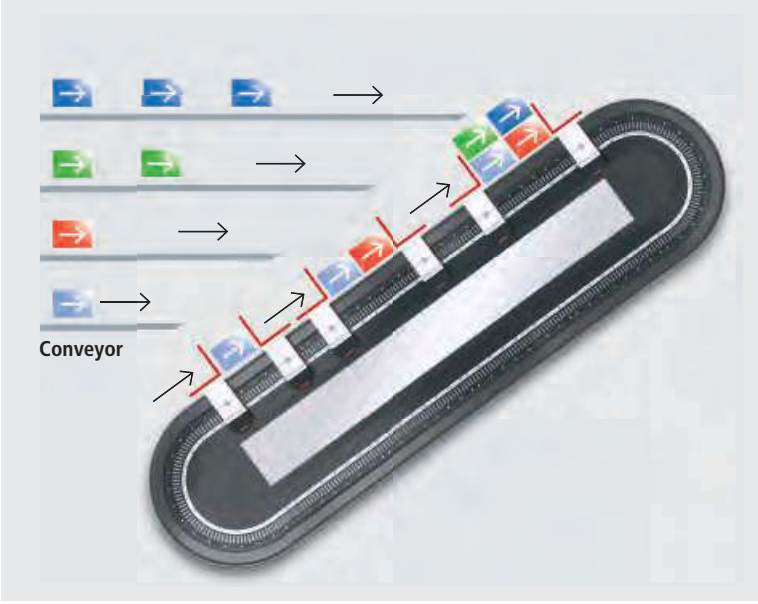


Kinematics in linear motion for handling a product: rotate, screw cap on, etc.
A rotary movement can be generated between two movers by a suitable mechanical action. This can, for example, screw a cap on or rotate the product.



Movement kinematics in two systems

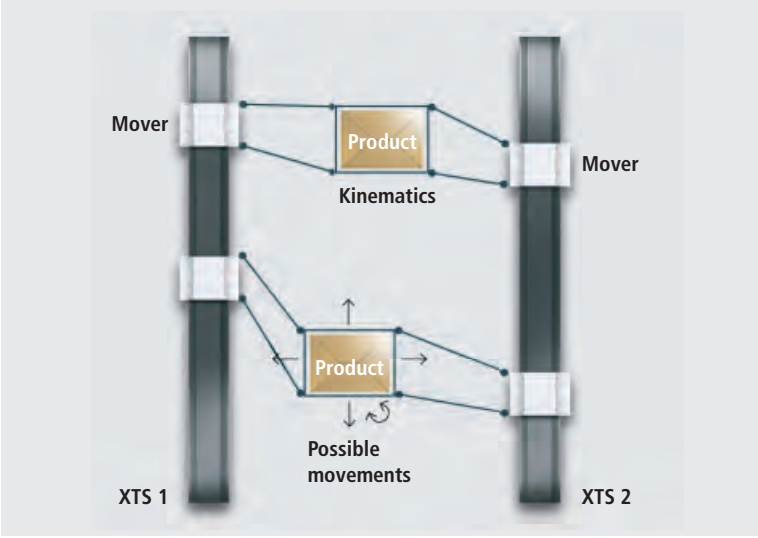
Transport and discharge product
A package or a case is transported on a surface. The package is to be deposited at a station. The surface is tilted to the side and the package slides off. Four movers on two paths move the tilting surface with the transported material. A change in the spacing of the movers with respect to each other generates a mechanical action that tilts the surface. The transported material can be prevented from sliding off when driving through curves by an inclined position and can be specifically deposited at another place while driving or after stopping.



Grouping system

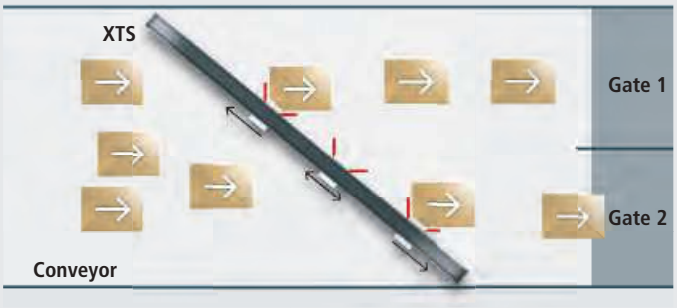
Used as a grouping system, the XTS can easily combine products arriving on multiple conveyor belts into predefined and easily changed groups and move them to the next station.

The plant can adapt to the product width, stack height and number of stacks without any manual intervention. The distance between the movers and also the motion profile are changed by parameters in the software. This can even be done during operation without a standstill.



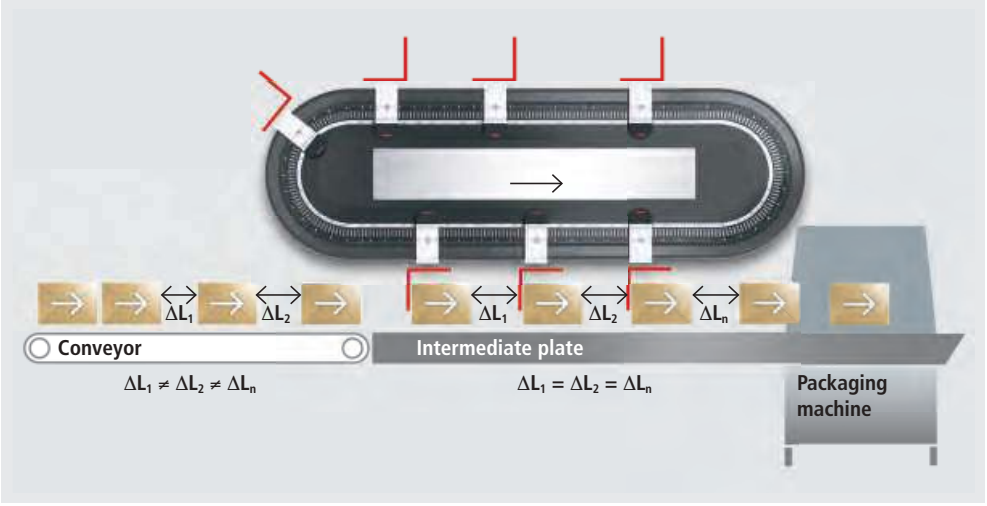
Travelling manipulator

With circulating kinematics the transported product can be influenced in X and Y directions. With two XTS systems arranged in parallel, the manipulator is synchronised to the product and shifts it on the belt at full speed. The product can even be slightly rotated by using appropriate kinematics.



Distribution system

Functioning as a distribution system, the XTS splits an incoming product stream into multiple streams (two in this case) inexpensively and with great flexibility.



Feeder with distance adjustment

The XTS makes it easy to implement a feeder with distance adjustment that synchronises products arriving at different intervals with the downstream process.

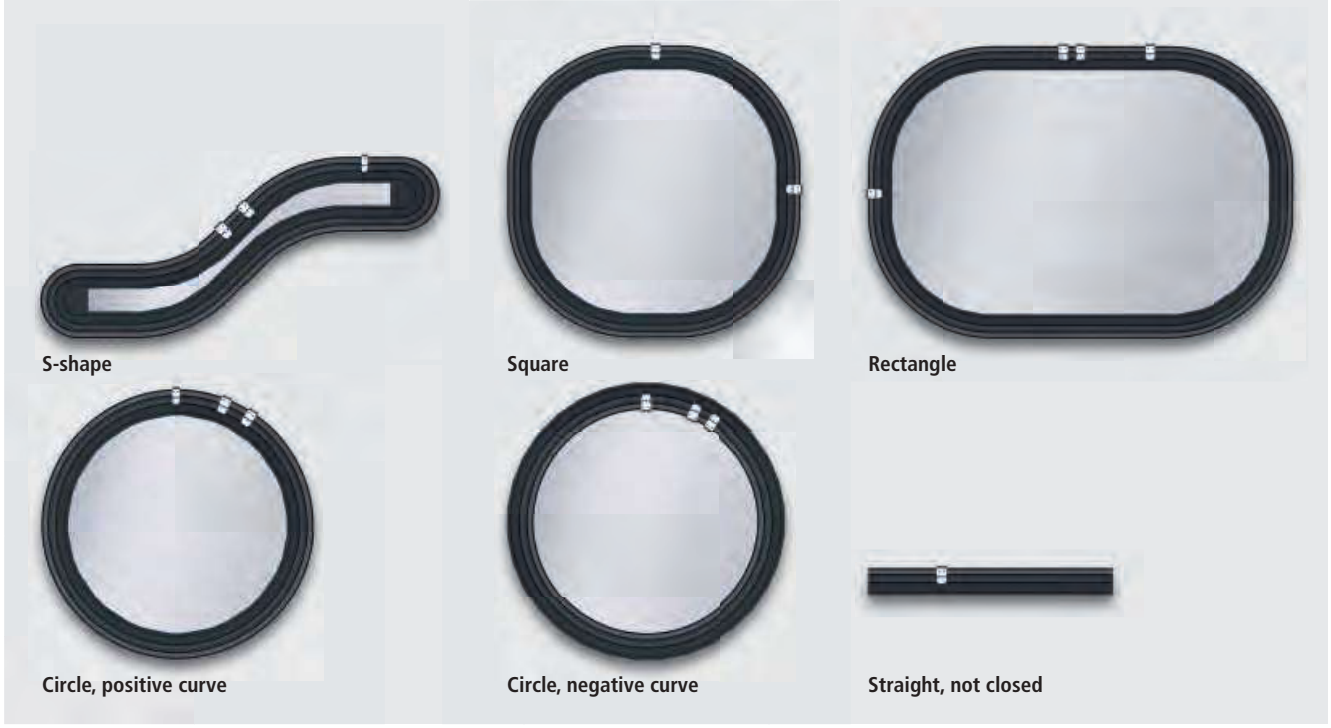
XY axis

Two movers, defined as a virtual XY axis, and can be controlled with G-code. For example, the XTS can move the product along in a targeted manner under a fixed adhesive nozzle, in order to apply adhesive evenly along the outer contour.

Synchronisation of open liquids

Every three seconds, ten open bottles are taken at a time from an intermittent filling machine to be transferred to a subsequent continuous process. To avoid spilling, the containers must be accelerated jerk-free while traversing a speed profile for the product transfer that prevents collisions with the holding clamps of the carousel.

XTS | **Trajectories**



XTS | The construction kit

To create a track the single parts with protection class IP 65 are mounted at the machine frame.

Installation area guide rail

Motor, coil package

Mounting area: This surface enables mounting at the machine base.

Displacement measurement integrated in motor module
- non-contact
- absolute positions of all movers
- multi-position measurement
- resistant to dirt

When mounting two modules, control voltage (24 V DC), power supply (50 V DC) and EtherCAT are automatically connected through.

Straight motor module

Curved motor modules | Guide rail system | Mover

Motor module

The motor module contains the electromagnetic coils and all other active functions necessary for the operation of the system. Only a power supply and an EtherCAT connection are required. The motor module contains no moving parts and is not subject to any wear.

– fully integrated linear motor with power electronics and displacement measurement
– Coil arrangement and mechanical structure make up a ready-to-use unit.

Guide rail system

Movers and guide rails are optimally matched to each other. The geometry of the rail and the hard anodised aluminium of the surface in combination with the running surface of the mover rollers allow good running characteristics and low wear. Lubrication of the system is not necessary.

Mover

The mover contains magnetic plates which, together with the coils in the motor modules, can generate propulsive forces. It absorbs the attractive forces of the magnets on both sides and compensates them as far as possible. This allows the rollers of the mover to run at high speed in the guide rail with low wear. The rollers are equipped with a particularly wear-resistant synthetic running surface.
The tensioning of the rollers prevents backlash and is at the same time designed for low wear. Consequently, the lifetime of the rollers depends on the payload. A mechanically robust encoder flag conveys the mover position to the motor module.

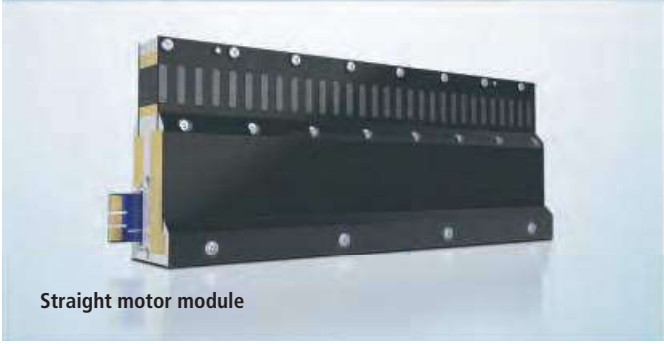
System properties	XTS
Max. force	100 N at standstill
Continuous force	30 N (at ~30 °C temperature increase in the motor compared to mounting frame)
Speed	4 m/s @ 48 V DC supply
Acceleration	> 100 m/s² (without payload)
Positioning accuracy	< ±0.15 mm @ 1.5 m/s
Absolute accuracy	< ±0.25 mm within a module
Repeatability	< ±10 µm (standstill)
Mover length	50 mm in direction of movement
Mover weight	approx. 410 g (complete mover without attachments)
Maximum system length	>> 10 m (dependent on computing power, no system limit)
Operating/storage temperature	0…+50 °C/-25…+85 °C (for further information see documentation)
Protection class	IP 65
Approvals	CE
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4

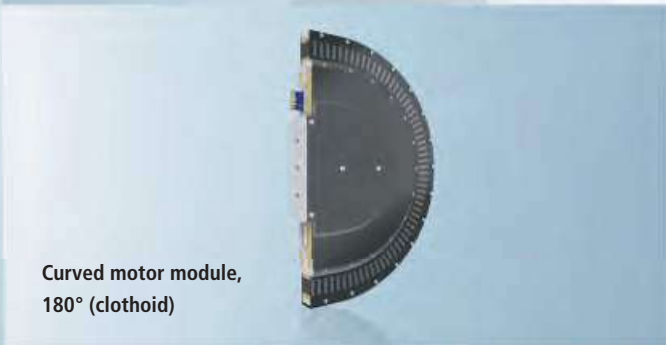
Electrical data	XTS
Supply voltage	control voltage 24 V DC, power supply 50 V DC
Current consumption	power supply: 16 A nominal current
Power consumption	motor modules: 19 W/m (communication, electronics, position determination)
Length per feed	max. 3 m (voltage supply, EtherCAT)
Power consumption per mover	approx. 12 W @ 4 m/s without payload

▶ **www.beckhoff.com/XTS**


Curved motor module, -22.5°


Curved motor module, +22.5°


Straight motor module


Curved motor module, 180° (clothoid)

AT20xx-0xxx | XTS motor modules

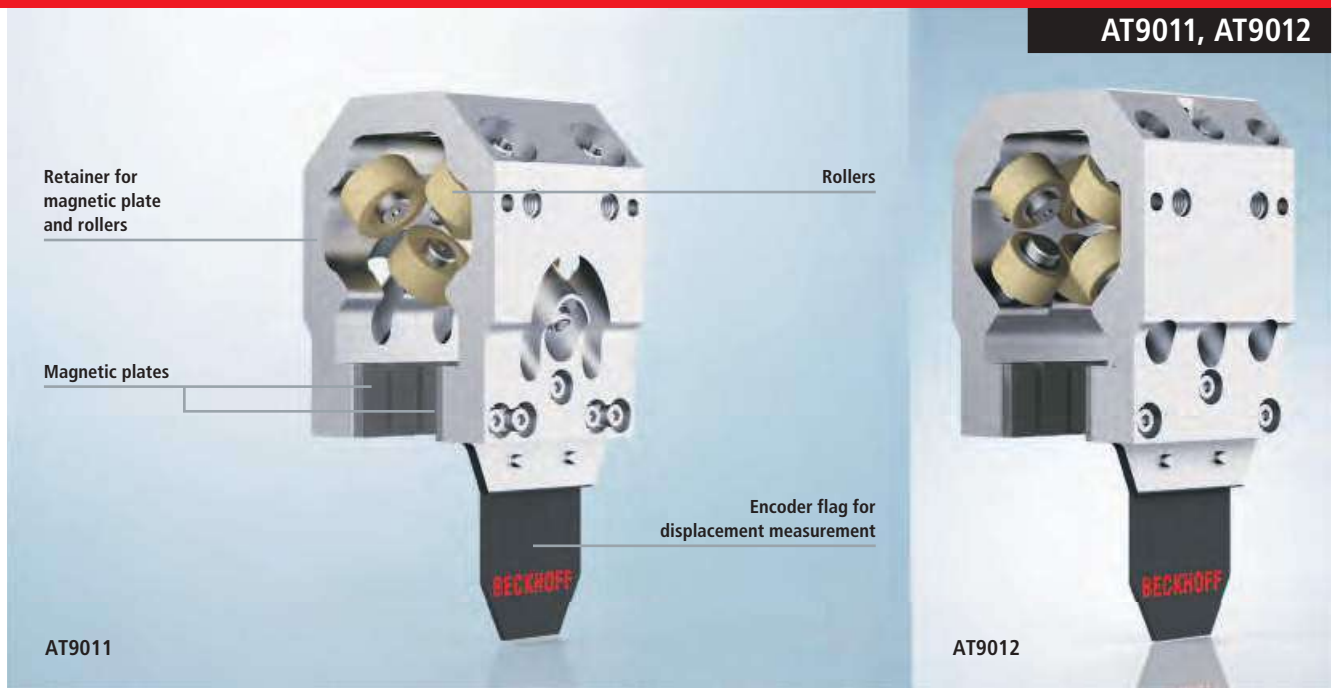
The motor module, the power electronics and the displacement measurement are built into the profile. The power electronics are optimised for the requirement and reduce assembly expenditure. There is an upper mechanical interface to the guide rail and a lower one to the support structure. Straight segments and curves can be combined arbitrarily. The geometry of the motor module without edges and openings allows easy cleaning.

Double-air-gap motor
- double-action linear motor, hence low resulting forces on the mechanical bearing and compact total solution
- displacement measurement integrated, no additional assembly, no calibration
- Tolerances are compensated automatically.
- Attractive forces neutralise each other.
- lower force effect (wear) on the guide
- Friction losses are greatly reduced.

Output stages and coil package integrated
- no cables between coil and output stage
  - no wiring expenditure
  - exclusion of errors
  - minimum mounting space
  - Output stage and coil are optimally matched to each other.
- supply voltage 50 V DC (low voltage, low safety expenditure)
- Independent supply of each individual coil with current is possible.
- arbitrary number of travelling fields/movers possible
- temperature monitoring of the output stage
- temperature model of the coils for optimum peak load use (I^2T model)
- low temperature rise due to good thermal coupling to the machine bed

Ordering information	XTS motor modules
AT2000-0250	motor module, straight, 50 V DC/24 V DC, 250 mm x 38 mm x 96 mm (L x W x H), 2.0 kg
AT2001-0250	motor module with feed, straight, 50 V DC/24 V DC, 250 mm x 38 mm x 96 mm (L x W x H), 2.2 kg
AT2020-0250	motor module, 22.5° (positive curve, convex, radius constant), 50 V DC/24 V DC, 257.7 mm x 38 mm x 96 mm (L x W x H), 2.2 kg
AT2021-0250	motor module with feed, 22.5° (positive curve, convex, radius constant), 50 V DC/24 V DC, 257.7 mm x 38 mm x 96 mm (L x W x H), 2.2 kg
AT2025-0250	motor module, -22.5° (negative curve, concave, radius constant), 50 V DC/24 V DC, 241.9 mm x 38 mm x 96 mm (L x W x H), 2.2 kg
AT2026-0250	motor module with feed, -22.5° (negative curve, concave, radius constant), 50 V DC/24 V DC, 241.9 mm x 38 mm x 96 mm (L x W x H), 2.2 kg
AT2040-0250	motor module, 45° (positive curve, convex, radius constant), 50 V DC/24 V DC, 258.9 mm x 39.1 mm x 114.4 mm (L x W x H), 2.1 kg
AT2041-0250	motor module with feed, 45° (positive curve, convex, radius constant), 50 V DC/24 V DC, 258.9 mm x 39.1 mm x 114.4 mm (L x W x H), 2.1 kg
AT2050-0500	motor module, 180° (clothoid, radius not constant), 50 V DC/24 V DC, 307 mm x 41 mm x 195 mm (L x W x H), 4.0 kg

▶ **www.beckhoff.com/AT2000**



AT9011, AT9012 | **XTS movers**

The mover is made of a light and solid aluminium alloy. Thanks to their arrangement the rollers allow backlash-free travel on the straights and in the curves. The coating of the rollers causes very little running noise and is particularly low-wear without lubrication of the guide rail. The attractive forces of the magnetic plates are largely balanced by the opposed arrangement, so that the rollers and the rail do not have to absorb the comparatively high attractive forces of the magnets.

The centre of the encoder flag supplies a position signal to the motor module. Movers can be distinguished from each other by different encoder flags. The encoder flag is made from a sturdy, lightweight glass-fibre reinforced material.

- no sliding contacts or cables to the moved part, purely passive mover
- 2 magnetic plates generate the controlled propulsive force via the motor module.
- The attractive forces largely neutralise each other in relation to the guide mechanism.
- low friction losses
- light mover (< 410…590 g)
- A light encoder flag generates the position signal.
- Short mover length allows small product spacings.
- Geometry allows driving through curves with full dynamics.
- no development of heat on and in the mover

Ordering information	XTS mover suitable for the guide rail system AT9000/AT9050
AT9011-0050-0550	mover, 6 rollers, length 50 mm with magnetic plate set AT9001-0550, 410 g, rollers: 6 x 19 mm, plastic coated
AT9011-0070-0550	mover, 6 rollers, length 70 mm with magnetic plate set AT9001-0550, 590 g, rollers: 4 x 22 mm, 2 x 26 mm, plastic coated
AT9012-0050-0550	mover, 12 rollers, length 51 mm with magnetic plate set AT9001-0550, 450 g, rollers: 12 x 16 mm, plastic coated

The magnetic plates can also be procured separately in order to be able to fit them to a self-developed mover.
Technical boundary conditions and support on enquiry.

Accessories	
AT9001-0550	magnetic plate set, 5-pin, 50 mm, encoder flag (individually orderable, components of mover AT9011-0050-0550)
AT9011-1440	encoder flag with electronic marking "Mover Standard", t = 1.4 mm, 4 absorber areas
AT9011-1441	encoder flag with electronic marking "Mover 1", t = 1.4 mm, 4 absorber areas

▶ **www.beckhoff.com/AT9011**

TF5850 | XTS – Software and programming

TwinCAT enables simple handling of the desired movements by mapping the movers as normal servo axes in TwinCAT. All Motion Control functions such as flying saw, electrical gears and cam plate are usable. Function extensions in TwinCAT take over typical XTS requirements such as automatic accumulation, collision avoidance, jerk avoidance or centrifugal force limitation. The integration of the XTS system into a production plant is easily possible thanks to support of numerous fieldbuses. Through realisation on a TwinCAT basis, the application-specific programming can be done in IEC 61131.

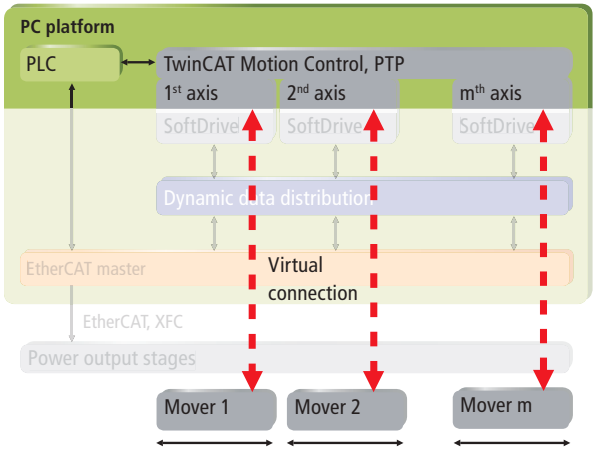
All TwinCAT interfaces and functions simplify development and maintenance:

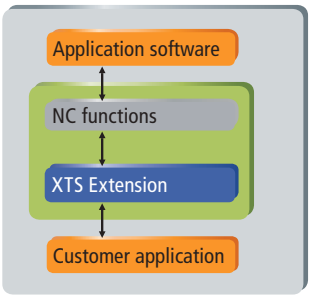
- remote access over Ethernet
- setting of breakpoints
- visualisation of arbitrary variables
- …

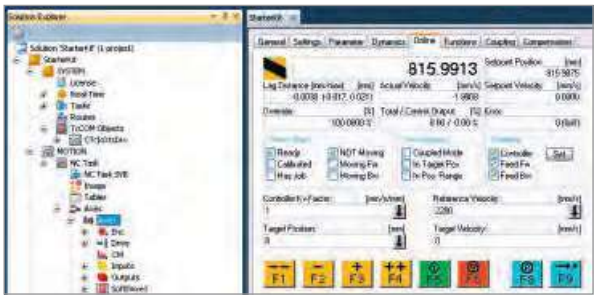
Practice-proven TwinCAT automation software controls NC axes

By means of the TC3 XTS Extension, servo algorithms are decoupled from the hardware and centrally calculated. Each output stage/coil is supplied with a current setpoint via EtherCAT.

- Each mover becomes a "servo axis".
- synchronisation (with external application)
- collision avoidance
- accumulation
- drive on in accumulated groups

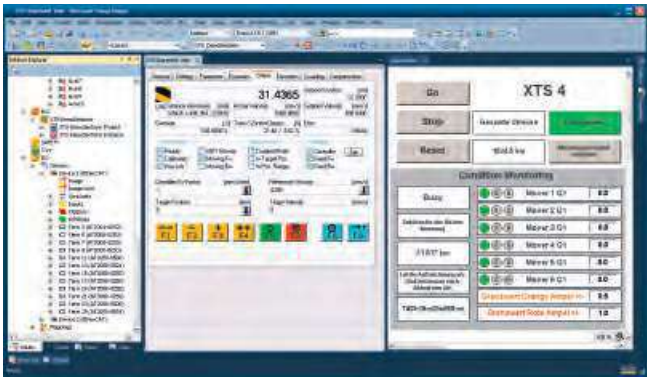




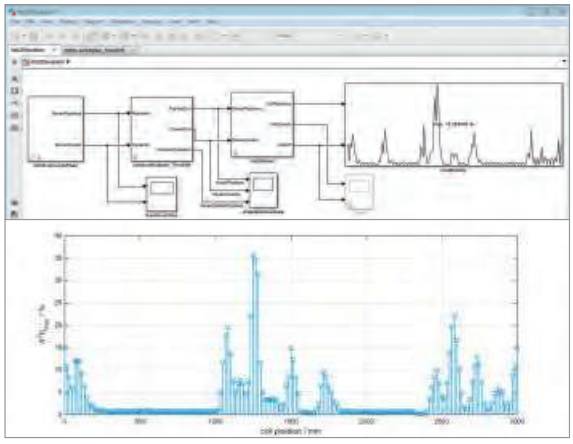


TC3 XTS Extension | From the point of view of application programming, a mover looks like a "normal" servo axis.

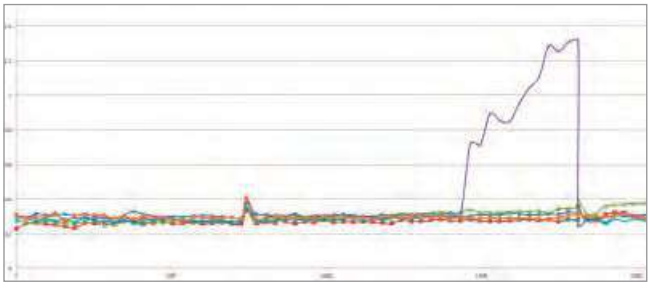
Wizard: modern look, enhanced functionality



The information from the Condition Monitoring can be reduced and simplified to a “traffic light”-style status display.



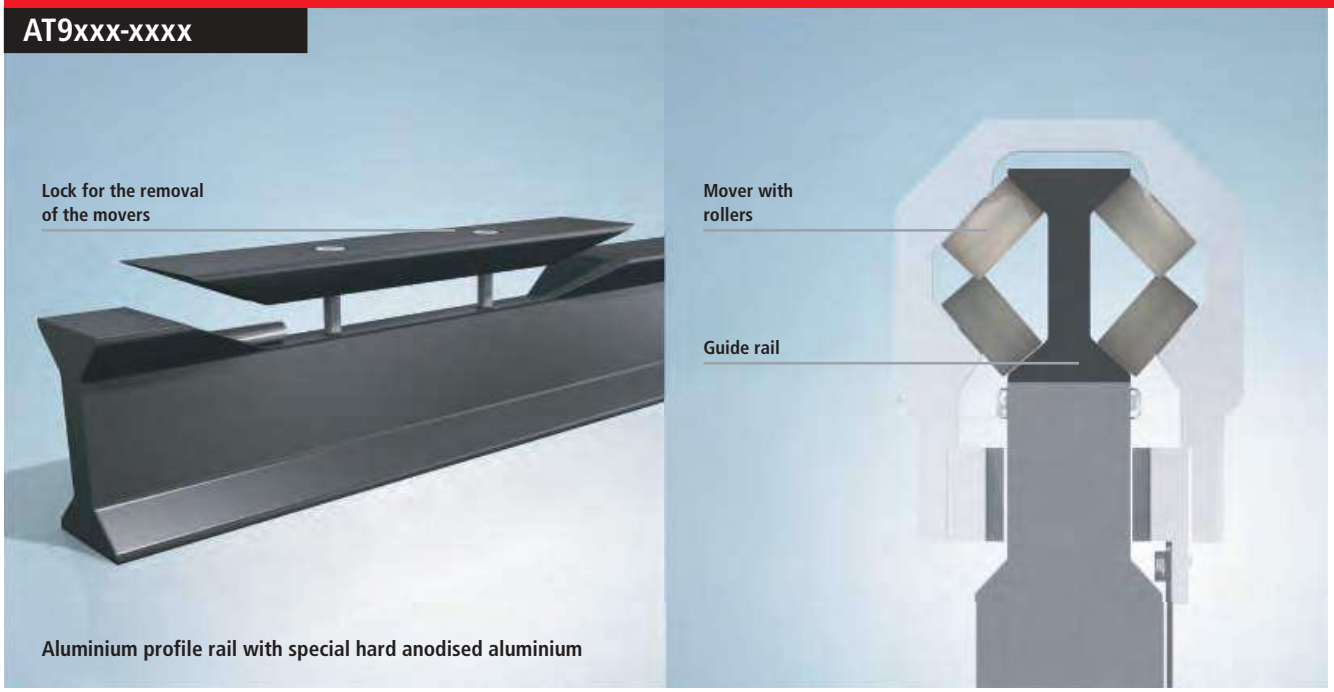
The simulation provides the load for each individual coil along the path.



Six movers in online monitoring: the impending failure of a ball bearing shows several days in advance.

Ordering information		
TF5000-00pp	TC3 NC PTP 10 Axes	925
TF5850-0060	software license, TwinCAT TC3 XTS Extension, TwinCAT 3 platform P60 (mid performance)	
TF5850-0070	software license, TwinCAT TC3 XTS Extension, TwinCAT 3 platform P70 (high performance)	
TF5850-0080	software license, TwinCAT TC3 XTS Extension, TwinCAT 3 platform P80 (very high performance)	

▶ **www.beckhoff.com/TwinCAT3**



AT9xxx-xxxx | XTS guide rails

The guide rail with the matching movers makes the XTS system a ready-to-use solution. However, the motor modules can also be used together with the magnetic plate sets as a custom solution without the XTS guide rail.
The movers can be removed or inserted without tools through a lock by releasing two screws and removing part of the rail.

- optimised solution for immediate mounting on the motor module
- backlash-free due to low manufacturing tolerances and pre-tensioned rollers
- abrasion-resistant hard anodised aluminium
- high-precision mounting by means of fits
- easy maintenance through lock for the removal of the movers

Movers and guide rail are optimally matched to each other.

The geometry of the aluminium rail and the hard anodised aluminium of the surface in combination with the running surface of the mover rollers allow good running characteristics and low wear.

Ordering information	XTS guide rails available to suit the motor modules
AT9020-0500	guide rail, 22.5° curve (positive curve, convex, radius constant) and 250 mm straight, suitable for 1 x AT2020-0250 and 1 x AT2000-0250
AT9025-0500	guide rail, -22.5° curve (negative curve, concave, radius constant) and 250 mm straight, suitable for 1 x AT2025-0250 and 1 x AT2000-0250
AT9040-0500	guide rail, 45° (positive curve, convex, radius constant) and 250 mm straight, suitable for 1 x AT2040-0250 and 1 x AT2000-0250
AT9040-0750	guide rail, 2 x 45° (positive curve, convex, radius constant) and 250 mm straight, suitable for 2 x AT2040-0250 and 1 x AT2000-0250
AT9040-1250	guide rail set for 180° curve, 2 parts, suitable for 4 x AT2040-0500 and 1 x AT2000-0250
AT9042-2000	guide rail set for full circle, 4 parts, suitable for 8 x AT2040-0500, with lock
AT9050-0500	guide rail, 180° (clothoid), 390 mm x 22 mm x 233 mm (L x W x H), suitable for 1 x AT2050-0500
AT9100-0250	guide rail, straight, with lock, suitable for 1 x motor module AT200x-0250: 250 mm
AT9100-0500	guide rail, straight, with lock, suitable for 2 x motor module AT200x-0250: 500 mm
AT9100-0750	guide rail, straight, with lock, suitable for 3 x motor module AT200x-0250: 750 mm
AT9100-1000	guide rail, straight, with lock, suitable for 4 x motor module AT200x-0250: 1000 mm
AT9100-1250	guide rail, straight, with lock, suitable for 5 x motor module AT200x-0250: 1250 mm
AT9100-1500	guide rail, straight, with lock, suitable for 6 x motor module AT200x-0250: 1500 mm
AT9000-xxxx	guide rails, straight, in steps of 250 mm in length, overall length up to 2.5 m, on request
AT9000-0250	guide rail, straight, suitable for 1 x motor module AT200x-0250: 250 mm
AT9000-0500	guide rail, straight, suitable for 2 x motor module AT200x-0250: 500 mm
AT9000-0750	guide rail, straight, suitable for 3 x motor module AT200x-0250: 750 mm
AT9000-1000	guide rail, straight, suitable for 4 x motor module AT200x-0250: 1000 mm
AT9000-1250	guide rail, straight, suitable for 5 x motor module AT200x-0250: 1250 mm
AT9000-1500	guide rail, straight, suitable for 6 x motor module AT200x-0250: 1500 mm

▶ www.beckhoff.com/AT9000

AT2000-xx00 | **XTS starter kit**

The starter kit facilitates fast and effective entry to the new technology. Mechanical tests and the programming of your own motion profiles are simple to accomplish. Programming experience in IEC 61131-3 and knowledge of TwinCAT NC are required for this. The XTS starter kit contains all components required for the operation of an XTS system. The construction is fully functional and completely pre-assembled.

Basic components:
- guide rail, assembled
- stand and holder for all mechanical parts
- Industrial PC with all necessary interfaces and sufficient system performance
- TwinCAT NC PTP and XTS function package
- installed in a control cabinet, fully wired, ready for operation
- power supply units 24 V DC and 48 V DC
- 1 day instruction and programming support

Starter kit small
- 4 x straight modules
- 2 x curve modules
- 5 x mover, with rollers, magnetic plates and encoder flag

Starter kit medium
- 8 x straight modules
- 2 x curve modules
- 10 x mover, with rollers, magnetic plates and encoder flag

Starter kit large
- 12 x straight modules
- 2 x curve modules
- 10 x mover, with rollers, magnetic plates and encoder flag

Required user skills
- practical experience with TwinCAT
- basic knowledge of Motion Control

For information on the Beckhoff training offers see page 998

Ordering information	XTS starter kit
AT2000-0500	starter kit small, 500 mm, straight length, 5 movers
AT2000-1000	starter kit medium, 1000 mm, straight length, 10 movers
AT2000-1500	starter kit large, 1500 mm, straight length, 10 movers


BECKHOFF
TwinCAT®
Version 3

TwinCAT

PLC and Motion Control on the PC

TwinCAT

The Windows Control and Automation Technology

TwinCAT

TwinCAT 3

- one engineering environment, based on Microsoft Visual Studio®
- IEC 61131, C/C++, MATLAB®/Simulink®
- integrated modules:
  - real-time
  - PLC, NC, CNC
  - robotics
  - measurement technology
  - Safety
- TwinCAT 3 modules: standardised programming frame for modular programming
- automatic code generation and project implementation with the TwinCAT Automation Interface

TwinCAT 3 runtime environment

- hard real-time for Windows
- one runtime for all modules
- IEC 61131, C/C++, MATLAB®/Simulink® objects in one runtime
- integrated TwinSAFE runtime
- extended real-time functionality: min. 50 µs cycle time and low jitter
- better performance: support of multi-core CPUs
- future-proof: support of 64-bit operating systems

See page 898

TwinCAT 2
- engineering and runtime
- IEC 61131-3 programming environment
- integrated modules:
  - real-time
  - PLC, NC, CNC
  - robotics
  - measurement technology
  - Safety

TwinCAT 2 runtime environment
- hard real-time for Windows
- real-time jitter < 5 µs
- cycle time adjustable from 50 µs
- pre-emptive multi-tasking

See page 938

▶ **www.beckhoff.com/TwinCAT**

TwinCAT 3 |
eXtended Automation Technology (XAT)

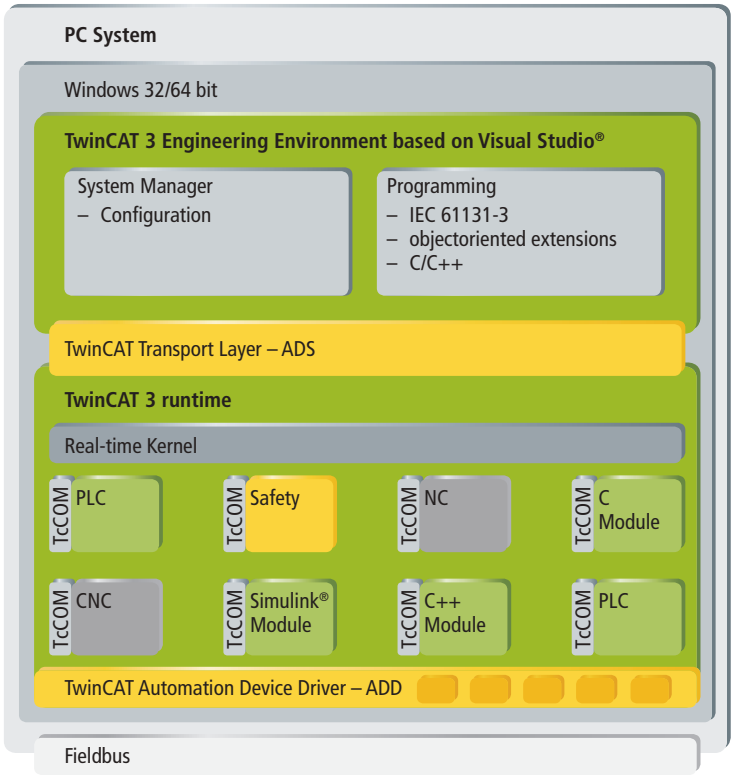
With TwinCAT 3 a PC-based control software is available which will expand the standard automation world considerably. In addition to the object-oriented IEC 61131-3 extensions, the languages of the IT world are available in C and C++. The integration of MATLAB®/Simulink® enables the application in scientific fields. And all of that in just one engineering environment. The modules run in different languages in a common runtime. The advantage of this modularity is the improved reuse of modules, once they have been written and tested. The runtime runs under harsh real-time conditions with the use of multi-core technology and the support of 32- or 64-bit operating systems.

TwinCAT 3 highlights

- only one software for programming and configuration
- Visual Studio® integration
- more freedom in selecting programming languages
- support for the object-oriented extension of IEC 61131-3
- use of C/C++ as the programming language for real-time applications
- link to MATLAB®/Simulink®
- open interfaces for expandability and adaptation to the tools landscape
- flexible runtime environment
- active support of multi-core and 64-bit systems
- migration of TwinCAT 2 projects
- automatic code generation and project implementation with the TwinCAT Automation Interface

▶ **www.beckhoff.com/TwinCAT3**

TwinCAT 3 | eXtended Automation Architecture (XAA)



In addition to the possibilities of controller programming according to the 3rd edition of IEC 61131-3, the new TwinCAT 3 architecture allows the use of C and C++ as the programming language. This opens up completely new application possibilities, as well as the expansion of or integration in existing systems. The link to MATLAB®/Simulink® is just one example of this new openness.

TwinCAT 3 extends the standard automation world

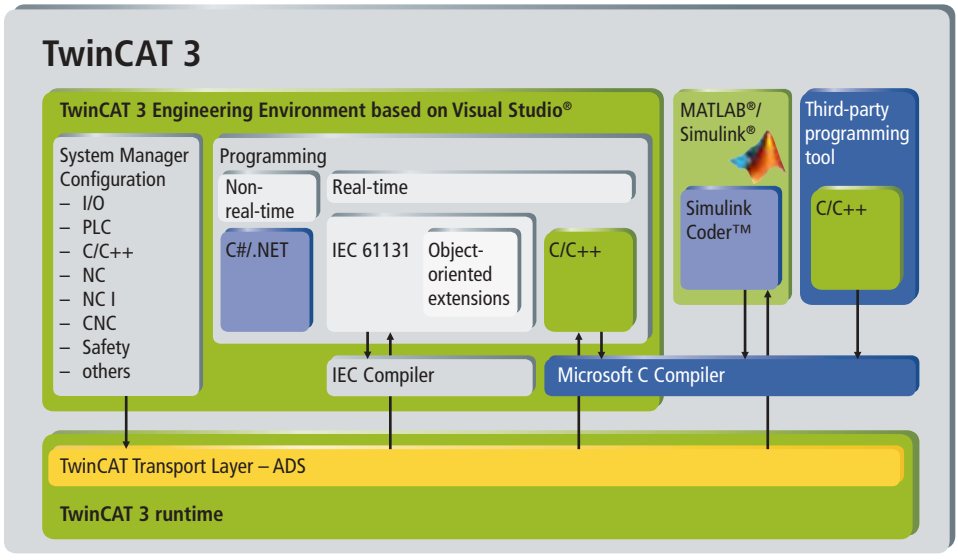
eXtended Automation Architecture
- supports all main fieldbuses
- supports IEC 61131, C/C++, MATLAB®/Simulink®
- supports Motion Control: from point-to-point to CNC
- supports TwinSAFE configuration
- supports Scientific Automation: robotics, measurement technology, Condition Monitoring

eXtended Automation Engineering
- one tool – Microsoft Visual Studio®
- integrated: IEC 61131 – worldwide standard in automation
- integrated: C/C++ – worldwide standard in IT
- integrated: TwinCAT System Manager – well-known configuration tool
- link to MATLAB®/Simulink®: worldwide standard in science
- expandable with other tools: editors, compilers
- TwinCAT 2 projects can be migrated.
- TwinCAT 3 modules: standardised programming frames
- using the .NET programming languages for non-real-time capable applications (e.g. HMI)

eXtended Automation Runtime
- IEC 61131, C/C++, MATLAB®/Simulink® objects in one runtime
- integrated TwinSAFE runtime
- extended real-time functionality: min. 50 µs cycle time and low jitter
- enhanced performance: support of multi-core CPUs
- future-proof: supports 64-bit operating systems

TwinCAT 3 | eXtended Automation Engineering (XAE)

Integration in Microsoft Visual Studio® makes it possible to program automation objects in parallel with the aid of the 3rd edition of IEC 61131-3 and the C or C++ languages. The objects (modules) generated can exchange data with each other and call each other independently of the language they were written in. The TwinCAT System Manager has been integrated into the development environment. This way, only one software is required to configure, parameterise, program and to diagnose automation devices.



Visual Studio® integration can be accomplished in two different ways. TwinCAT Standard only uses the basic framework of Visual Studio® with all its benefits in terms of handling, connection to source code control software, etc., while TwinCAT Integrated, as the name implies, integrates itself into Visual Studio®. In this version, the C/C++, C#, VB.NET programming languages and link to MATLAB®/Simulink® are available.

Flexible use of programming languages

C and C++ programming languages
- standardised
- widely used programming languages
- very powerful programming languages
- run under the same runtime as PLC programs
- for the implementation of drivers

Extended debugging of C++ programs
- debugging of C++ programs that run in real-time
- use of breakpoints
- use of watch lists
- use of call stacks

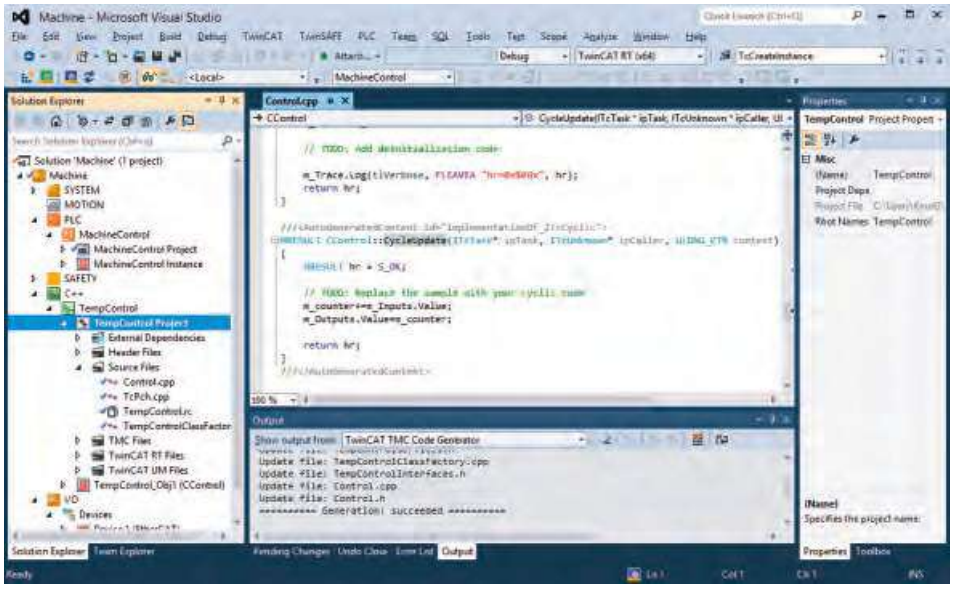
.NET programming languages
- used for non-real-time programming (e.g.: HMI)
- source code management in the same project

Link to MATLAB®/Simulink®
- great variety of toolboxes
- possibilities for use:
  - building of control circuits
  - in simulation
  - in optimisation
- automatic code generation
- debug interface between MATLAB®/Simulink® and TwinCAT

TwinCAT 3 | eXtended Automation Language Support

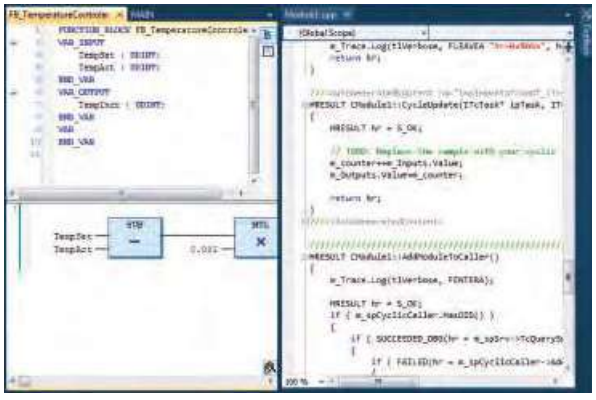
Real-time

- System Manager
- LD editor
- FBD editor
- SFC editor
- IL editor
- ST editor
- CFC editor
- Visual C/C++ editor

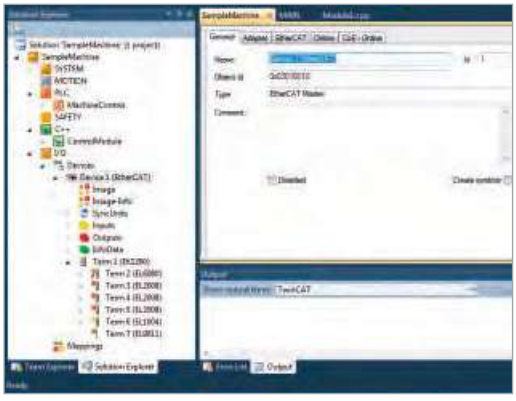


Non-real-time

- C#
- .NET
- Visual Basic
- C++
- Silverlight



Parallel use of the C++ and FBD programming languages



TwinCAT System Manager integrated into Visual Studio®

Integration of Visual Studio®

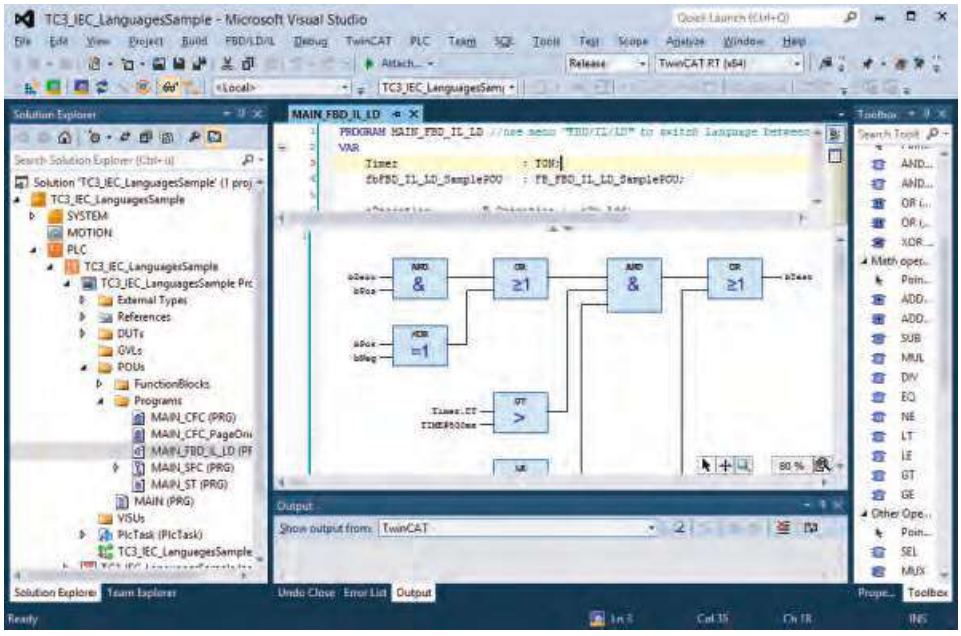
Automation devices and application programming in one environment

- use of the most famous and best supported development suite
- future-proof
- editing of PLC programs and complex visualisations in one environment
- multi-language support
- modern look and feel
- context-sensitive online help
- automatic syntax checking
- IntelliSense
- syntax highlighting
- use of the well-known source code control tools
- open architecture
- extendable by plug-ins

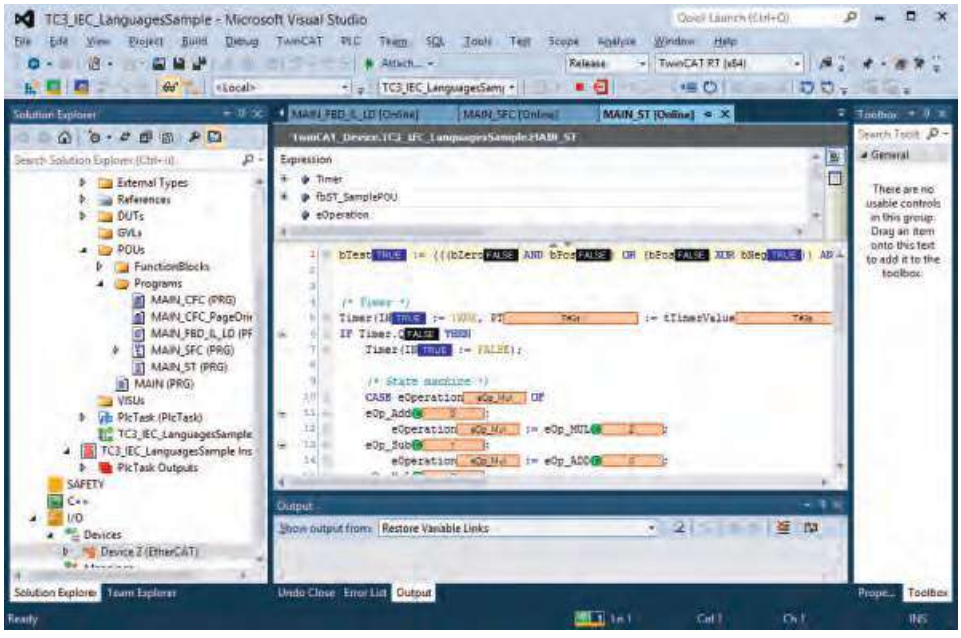
Visual Studio Microsoft Partner

TwinCAT 3 | **XA Language Support: IEC 61131-3**

For more efficient programming of automation devices, the editors for IEC 61131-3 programming in TwinCAT have been significantly improved. The operability in particular has been improved and the debugging options have been extended. The new options include improved inline monitoring, conditional break points and more.



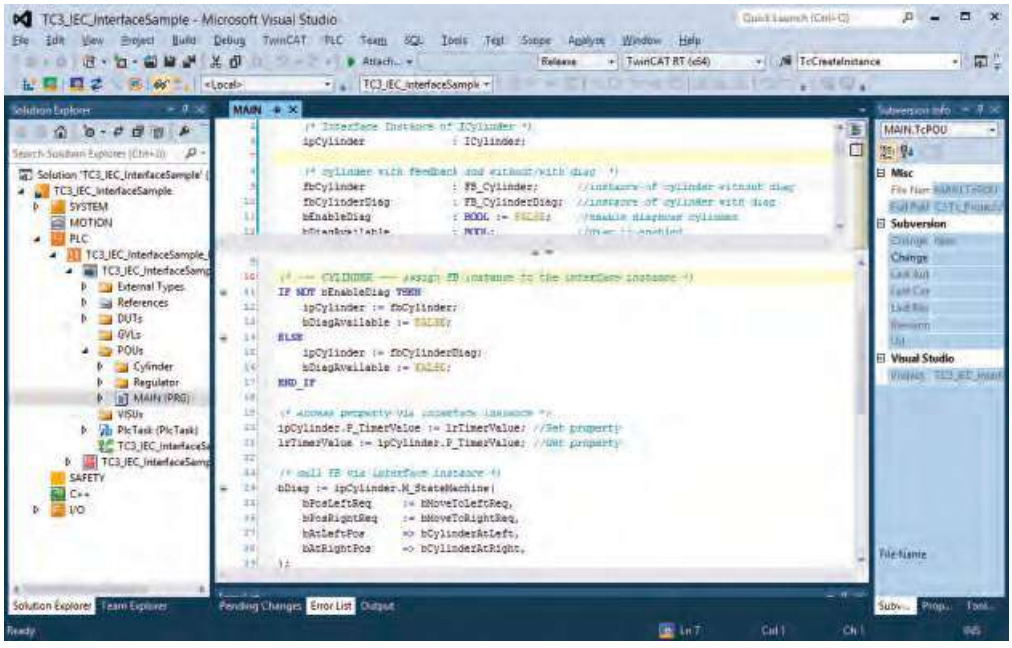
In TwinCAT 3, the editors of the IEC 61131-3 have been integrated seamlessly into the Visual Studio® environment. As a result, the editors use the original Visual Studio® toolbox for the graphical languages, for example.



Improved inline monitoring for the Structured Text (ST) programming language

TwinCAT 3 | **XA Language Support: IEC 61131-3**

TwinCAT 3 completely supports the 3rd edition of the IEC 61131-3. It enables among other things the use of object-oriented techniques such as single inheritance, interfaces, methods and attributes, which significantly increase both the reusability and the quality of the control code.



Example of the use of polymorphism within an IEC 61131-3 POU (Program Organization Unit)

IEC 61131-3 programming

- supplier-independent programming standard
- PLCopen certification
- portable, reusable software
- 5 graphic and text-based programming languages:
  - Structured Text and Instruction List
  - Function Block Diagram and Ladder Diagram
  - Sequential Function Chart
- data encapsulation by user-defined data types

Extended options in TwinCAT 3

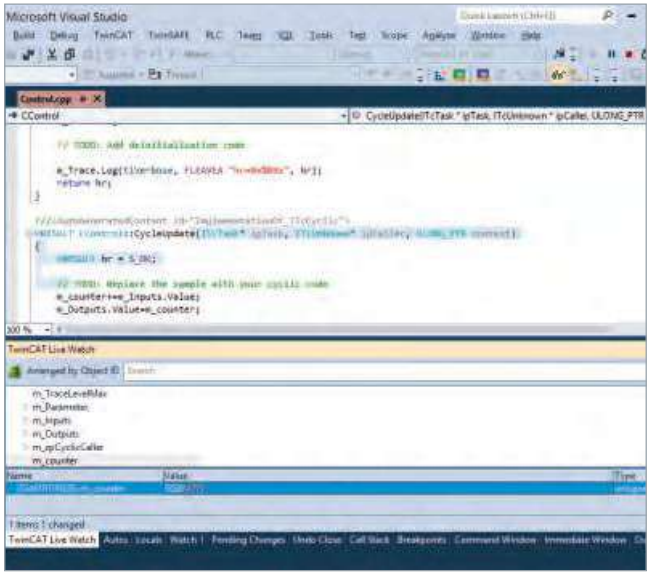
- improved ease of operation usability
  - auto-complete
  - marking of associated keywords
  - collapsing of programming structures
  - …
- extended debugging
  - use of conditional break points
  - improved inline monitoring
  - …
- object-oriented extensions
  - single inheritance
  - interfaces
  - methods
  - attributes

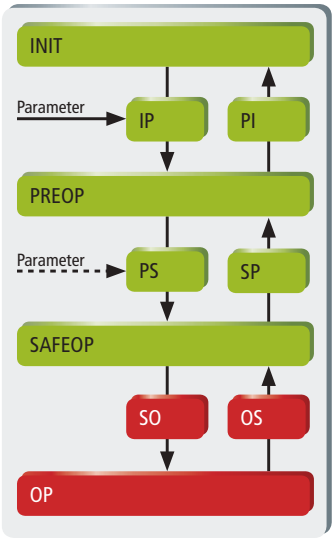
TwinCAT 3 | XA Language Support: C/C++

TwinCAT 3 offers the possibility to program TwinCAT runtime modules in C/C++ languages. For code generation, the C compiler integrated in Microsoft Visual Studio® 2010 is used. With TwinCAT 3 C++ libraries, functions for reading/writing files, starting treads, allocating memory or communicating with a database are provided. This corresponds to the IEC 61131-3 mechanism when using libraries.

Wizards for the creation of basic projects, classes and I/O variables make rapid engineering possible.

The routine "Cycle-Update" is cyclically processed. The internal variables are available for monitoring in the TwinCAT online watch window even without having to set a break-point.





State machine with transitions for the TwinCAT modules

C/C++ as programming languages in automation technology

C and C++ programming languages
- powerful, widely used programming languages
- standardised, object-orientated programming languages
- generation of efficient object code
- run under the same runtime as PLC programs
- for the implementation of drivers
- Beckhoff C++ Libraries for extended functionality in the real-time context

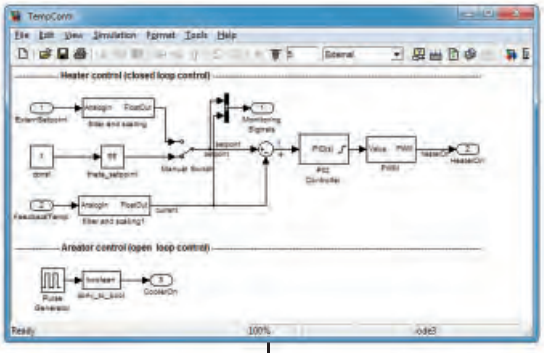
Extended debugging of C++ programs
- debugging of C++ programs that run in real-time
- monitoring, watch lists also without the use of break points

.NET programming languages
- used for non-real-time programming (e.g.: HMI)
- source control in the same project

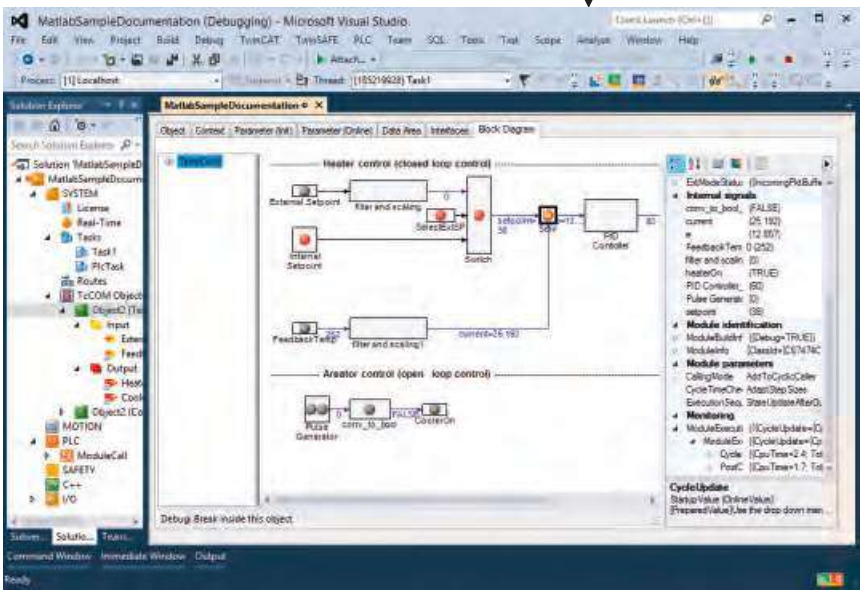
TwinCAT 3 | XA Language Support: MATLAB®/Simulink®

The integration of MATLAB®/Simulink® enables execution of TwinCAT modules that were generated as models in the Simulink® simulation environment. The chosen interfacing type displays the parameters and variables in the graphic interface of TwinCAT 3 and enables viewing and modification in the real-time environment at runtime.

MathWorks Partner



Example for temperature controller in MATLAB®/Simulink®



Parameter view of the generated module in TwinCAT

Integration with the simulation software MATLAB®/Simulink®

- standard tool in scientific and measuring applications
- wide range of toolboxes (e.g. Fuzzy Logic Toolbox)
- development, simulation and optimisation of complex control loops
- automatic code generation via Realtime Workshop
- debug interface between TwinCAT 3 and Simulink®
- parameterisation of the generated module in TwinCAT 3
- download and execution of the module in TwinCAT 3 runtime
- multiple module instantiation possible
- Modules can be used without MATLAB®/Simulink®.

TwinCAT 3 | eXtended Motion Control

With eXtended Motion Control, TwinCAT automation software offers an integrated and scalable solution for Motion Control applications including simple point-to-point movements, CNC and robot control.

Functionality

NC PTP	NC I	CNC	Robotics
Point-to-point movement – gearing – camming – superposition – flying saw	**Interpolated motion with 3 axes and 5 additional axes** – programming according to DIN 66025 – technological features – straightforward utilisation through function blocks from the PLC	**Complete CNC functionality** – interpolated movement for up to 32 axes per channel – various transformations	**Interpolated motion for robotic control** – support for a wide range of kinematic systems – optional torque pre-control

PLCopen motion control

Interpolated motion for robotic control

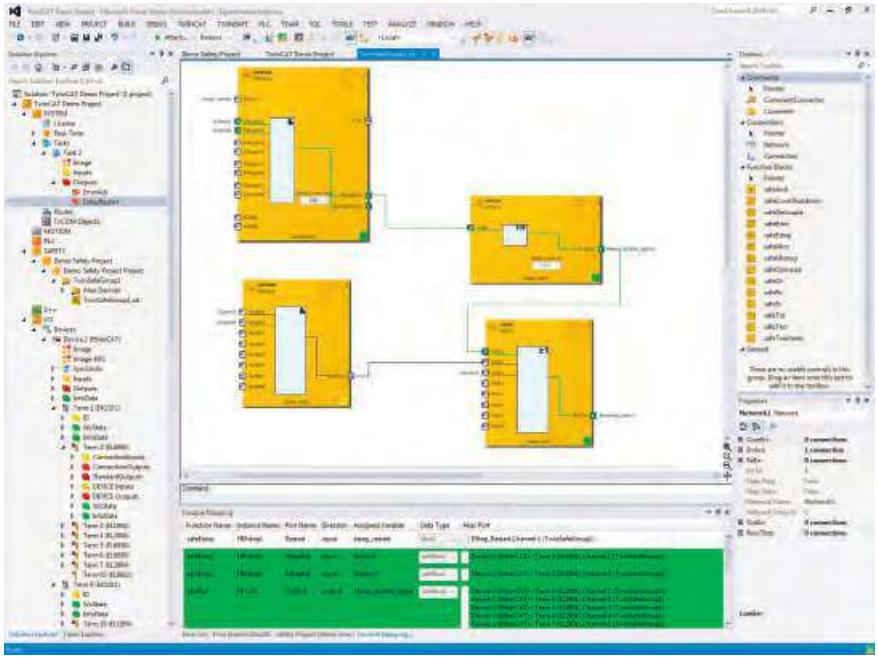
Advantages of the integration of robotic control in TwinCAT
- configuration, parameterisation, diagnostics and programming in TwinCAT
- optimum synergy between PLC, Motion Control and robot control system
- high performance and precision through direct interfaces

Kinematic calculation process
- forward transformation
- inverse transformation
- calculation of the dynamic model

TwinCAT 3 | **Safety Editor**

The Safety Editor integrated in TwinCAT 3 allows the creation of a safety application in a graphical environment. The user can program the desired logic directly with function blocks. The logic can initially be developed independently of the hardware configuration, leading to increased flexibility and portability. Additionally, the editor can automatically generate documentation for the application, making both the act of documenting and commissioning significantly easier.

For further information on TwinSAFE and the TwinSAFE products see page 966

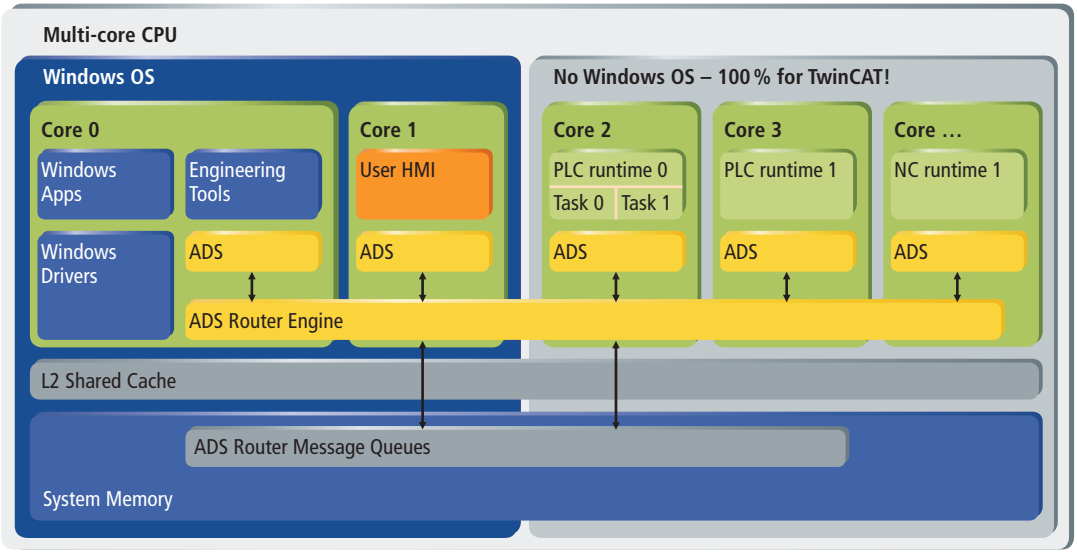


TwinCAT Safety Editor

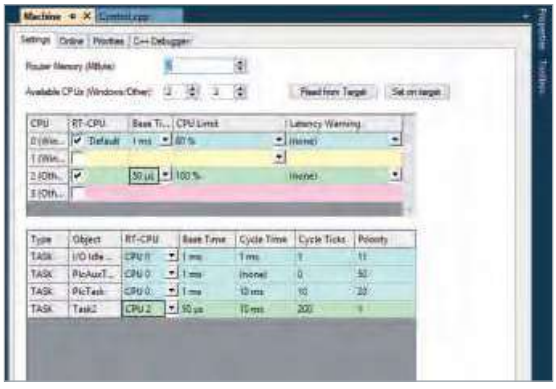
- fully integrated in TwinCAT 3
- graphical programming
- convenient diagnostics through the direct display of online values in the graphical environment
- overview of the online state of relevant groups, connections and function blocks
- multi-level verification of the application for consistency
- automatic project download verification
- automatic generation of the documentation for acception and commissioning

TwinCAT 3 | eXtended Automation Performance

Current developments in computer technology, which offer CPUs with more and more cores, enable the distribution of tasks across different cores. The TwinCAT 3 runtime environment follows this concept. It can be used to distribute functional units such as HMI, PLC runtime or MC to dedicated cores. For each of the cores used by the runtime environment the maximum load as well as the base time and therefore the possible cycle times can be set separately.



Due to the use of multi-core systems, functional units (e.g. PLC and NC runtimes, HMI) are distributed to individual processor cores.



Dialog for the distribution of tasks to processor cores: Moreover, in the so-called "core isolation" mode it is possible to make individual cores exclusively available for the use of TwinCAT. The context change between TwinCAT and the Windows operating system is thus avoided for these cores, which increases the attainable performance still further.

Multi-core and multi-tasking support

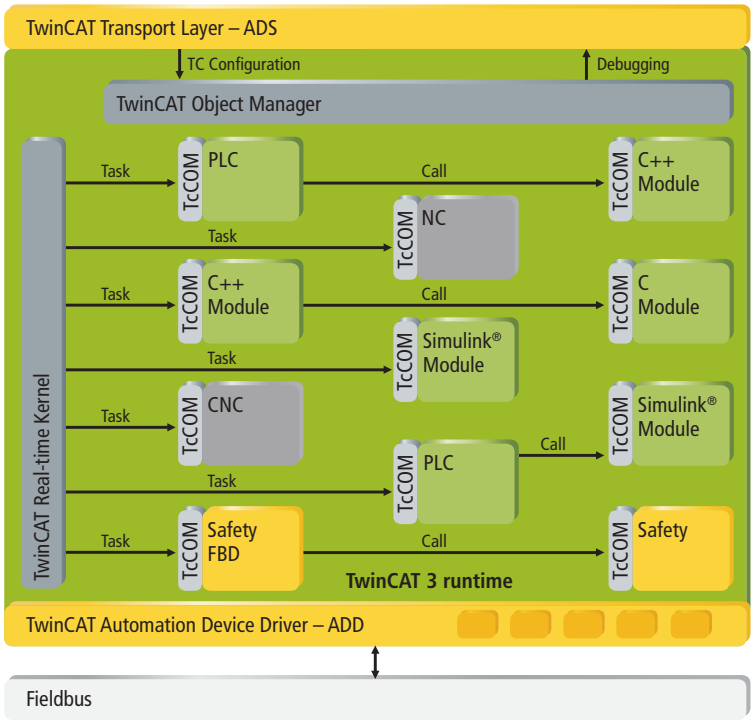
Support of multi-core systems
- distribution from applications to cores (e.g. PLC, NC and HMI can run on different cores)

Support of multi-tasking
- preemptive multi-tasking
- parallel processing of tasks

Support of 64-bit operating systems
- usage of more resources (memory)

TwinCAT 3 | eXtended Automation Runtime (XAR)

Standardised modules enable open and flexible design of the TwinCAT 3 runtime. It makes an environment available in which the TwinCAT 3 modules can run. Whether the modules are PLC, NC, CNC, RC (Robotic Control) or C/C++ code-based modules (e.g. created with MATLAB®/ Simulink®) is irrelevant.

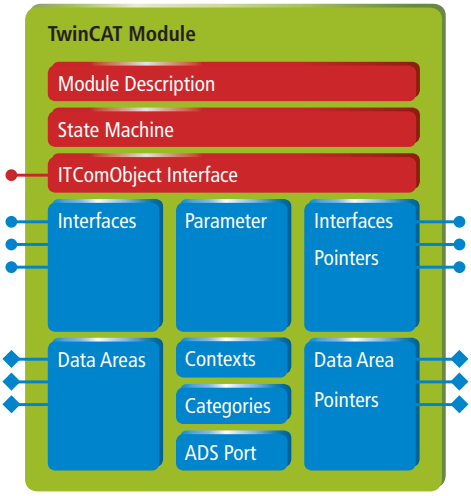


Modular TwinCAT 3 runtime

Modular design, openness, extendibility

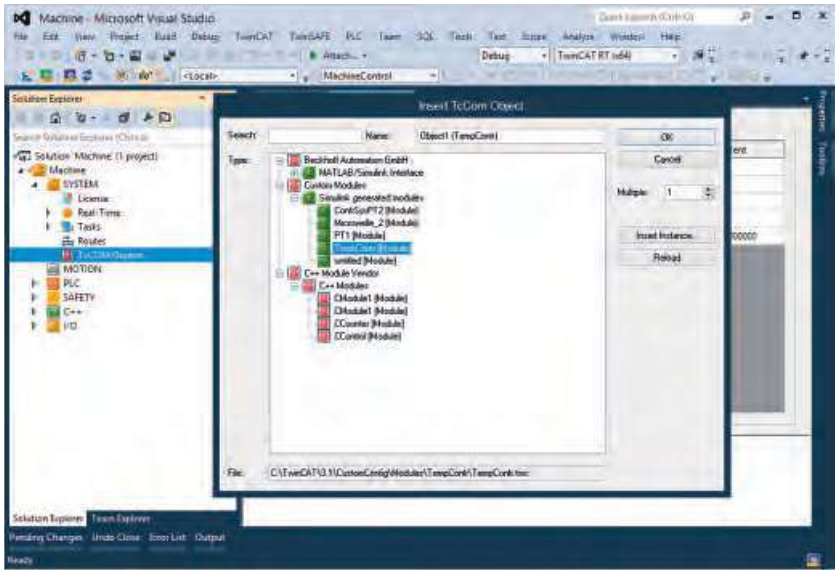
Open runtime interface
- separation of complete functionality into modules
- use of services from system modules (e.g. real-time)
- defined interfaces
- extension of the runtime by own modules (e.g. bus drivers)
- Scalability: modules can contain simple functions; complex algorithms and real-time tasks.

TwinCAT 3 modules consist of a range of formally defined attributes and interfaces. They enable general application of the modules with each other and externally. The predefined interfaces enable cyclic calling of the internal module logic, for example. Each module implements a state machine that controls the initialisation, parameterisation and linking of the respective module.



Structure of a TwinCAT 3 module

In addition to user modules, a number of system modules are already available which provide basic runtime functionality (e.g. TwinCAT real-time). These modules have fixed object IDs and are therefore accessible from each module.



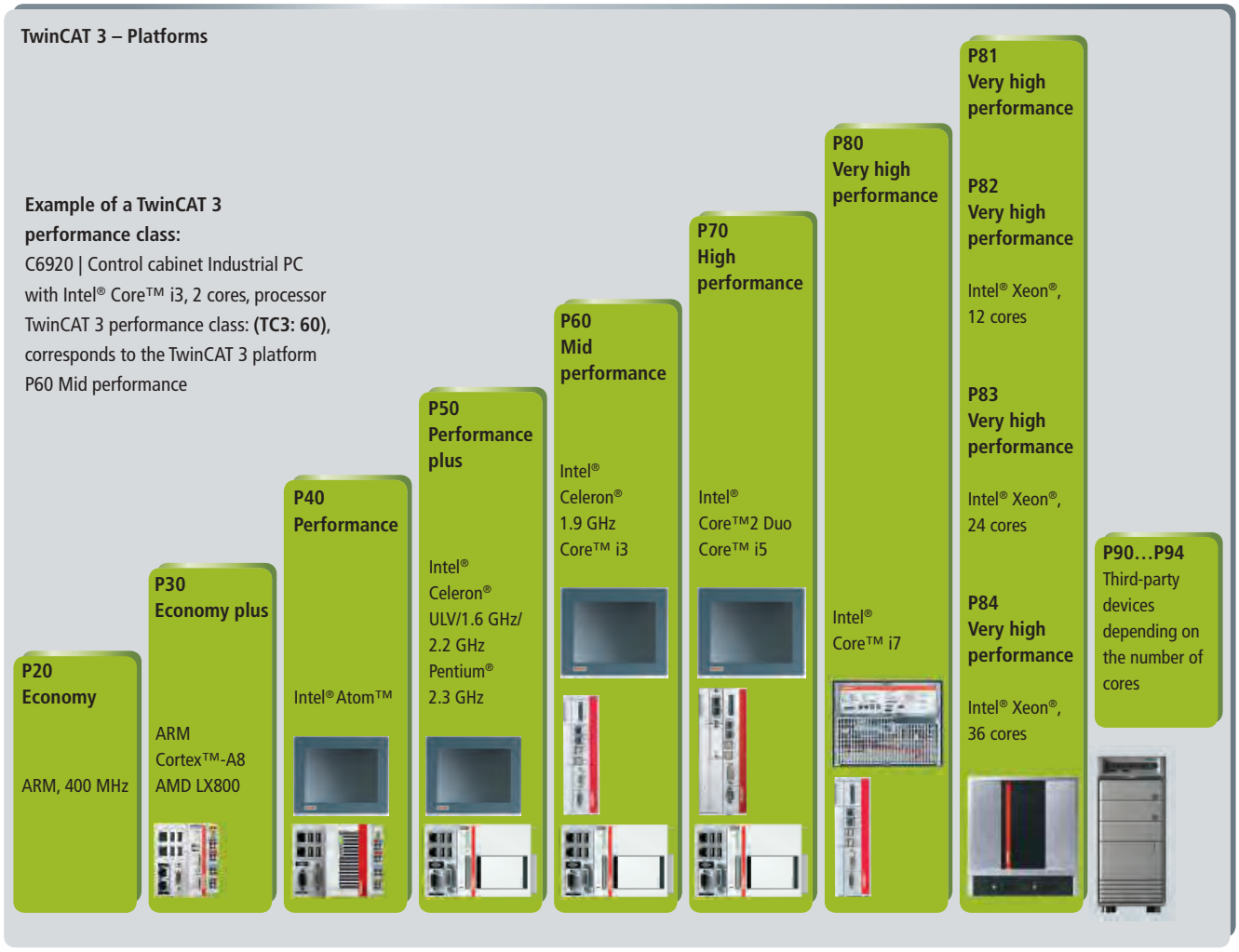
Selection and parameterisation of a MATLAB®/Simulink® module

Fast communication, reusability

- Functionality of the modules is scalable.
- direct and therefore very fast communication between modules
- Modules are sealed.
- Modules can be developed, serviced and tested independent of each other.
- high reusability

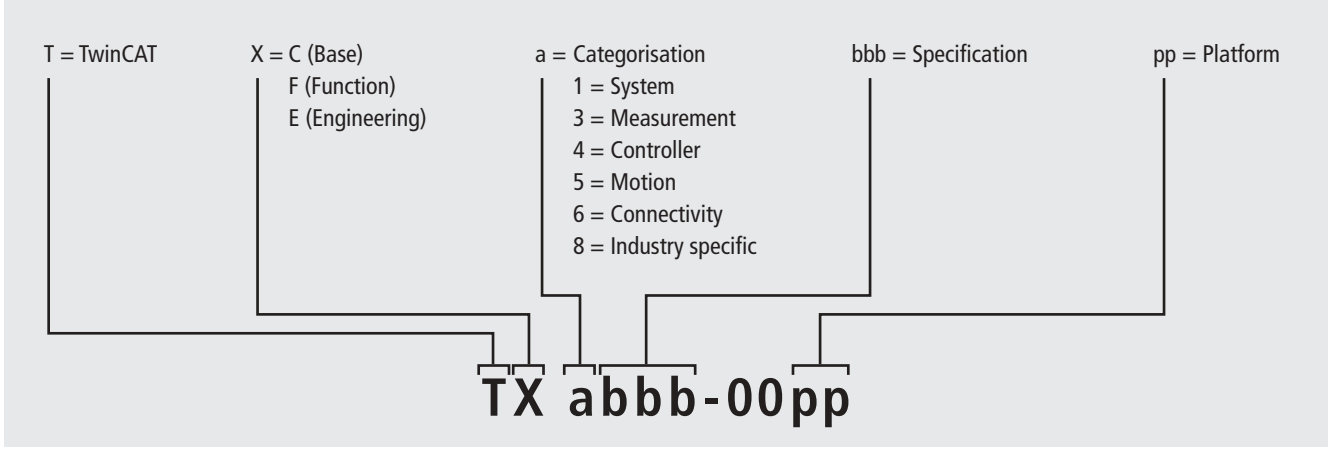
Product overview TwinCAT 3

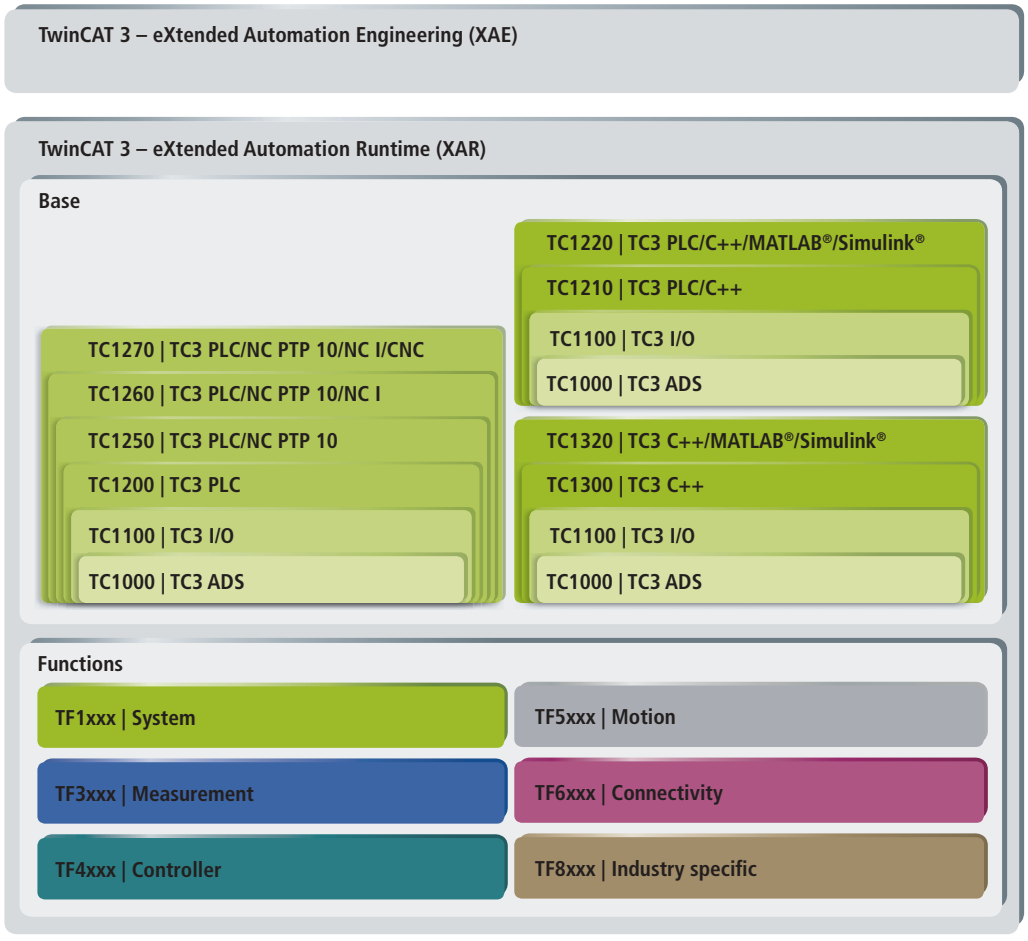
The TwinCAT 3 runtime components are available for different platforms.



The controllers shown in the platform categorisation are only example configurations.

TwinCAT 3 designation system





TwinCAT 3 is divided into components. The TwinCAT 3 engineering components enable the configuration, programming and debugging of applications. The TwinCAT 3 runtime consists of further components – basic components and functions. The basic components can be extended by functions.

TwinCAT 3 | Base

TC1000 | **TC3 ADS**	The TwinCAT Automation Device Specification (ADS) is the medium-independent protocol for the reading and writing of data and for instruction transmission within TwinCAT. An ADS router is made available for communication links. ADS clients can be connected to TwinCAT controllers in the network via ADS.
TC1100 | **TC3 I/O**	Using TwinCAT I/O, cyclic data can be collected by different fieldbuses in process images. Cyclic tasks drive the corresponding fieldbuses. Various fieldbuses can be operated with different cycle times on one CPU. Applications can directly access the process image. The fieldbuses and the process images are configured in TwinCAT Engineering.
TC1200 | **TC3 PLC**	TwinCAT PLC realises one or more PLCs with the international standard IEC 61131-3 3rd edition on one CPU. All programming languages described in the standard can be used for programming. Various convenient debugging options facilitate fault-finding and commissioning. PLC program modifications can be carried out at any times and in any size online, i.e. when the PLC is running. All variables are available symbolically by ADS and can be read and written in appropriate clients.
TC1300 | **TC3 C++**	The TwinCAT 3 C++ runtime environment enables the execution of real-time modules written in C++. Convenient debugging and monitoring options facilitate fault-finding and commissioning. All variables are available symbolically by ADS and can be read and written in appropriate clients.

Product overview TwinCAT 3

TwinCAT 3 | Engineering		
TE1000 | **TC3 Engineering**	TwinCAT 3 engineering environment	916
TE1110 | **TC3 Simulation Manager**	tool for easy configuration of a simulation environment	916
TE1111 | **TC3 EtherCAT Simulation**	easy configurations of simulation environments with several EtherCAT slaves	916
TE1120 | **TC3 XCAD Interface**	transfer of existing engineering results from ECAD tools	916
TE1140 | **TC3 Management Server**	central administration of Beckhoff CE controllers	916
TE1300 | **TC3 Scope View Professional**	software oscilloscope for the graphical display of data captured from several target systems	917
TE1400 | **TC3 MATLAB®/Simulink® Target**	TwinCAT target for MATLAB®/Simulink® for generating TwinCAT 3 modules	917
TE1410 | **TC3 Interface for MATLAB®/Simulink®**	communication interface between MATLAB®/Simulink® and the TwinCAT 3 runtime	917
TE1500 | **TC3 Valve Diagram Editor**	graphical tool for designing the characteristic curve of a hydraulic valve	917
TE1510 | **TC3 CAM Design Editor**	graphic design tool for electronic cam plates	917

TwinCAT 3 | Base		
TC1000 | **TC3 ADS**	TwinCAT 3 ADS	918
TC1100 | **TC3 I/O**	TwinCAT 3 I/O	918
TC1200 | **TC3 PLC**	TwinCAT 3 PLC	919
TC1210 | **TC3 PLC/C++**	TwinCAT 3 PLC and C++	919
TC1220 | **TC3 PLC/C++/MATLAB®/Simulink®**	TwinCAT 3 PLC, C++ and modules generated in MATLAB®/Simulink®	919
TC1250 | **TC3 PLC/NC PTP 10**	TwinCAT 3 PLC and NC PTP 10	920
TC1260 | **TC3 PLC/NC PTP 10/NC I**	TwinCAT 3 PLC, NC PTP 10 and NC I	920
TC1270 | **TC3 PLC/NC PTP 10/NC I/CNC**	TwinCAT 3 PLC, NC PTP 10, NC I and CNC	921
TC1275 | **TC3 PLC/NC PTP 10/NC I/CNC E**	TwinCAT 3 PLC, NC PTP 10, NC I and CNC E	921
TC1300 | **TC3 C++**	TwinCAT 3 C++	921
TC1320 | **TC3 C++/MATLAB®/Simulink®**	TwinCAT 3 C++ and modules generated in MATLAB®/Simulink®	921

TwinCAT 3 | Functions		
System		
TF1800 | **TC3 PLC HMI**	stand-alone tool for displaying visualisations from the PLC development environment	922
TF1810 | **TC3 PLC HMI Web**	display of visualisations from the PLC development environment in a web browser	922
TF1910 | **TC3 UML**	UML (Unified Modeling Language) for modelling of PLC software	922
Measurement		
TF3300 | **TC3 Scope Server**	data preparation for visual display in the TwinCAT 3 Scope View	923
TF3600 | **TC3 Condition Monitoring Level 1**	Condition Monitoring Level 1	923
TF3601 | **TC3 Condition Monitoring Level 2**	Condition Monitoring Level 2	923
TF3900 | **TC3 Solar Position Algorithm**	precise calculation of the sun's position	923
Controller		
TF4100 | **TC3 Controller Toolbox**	basic controllers (P, I, D), complex controllers (PI, PID), pulse width modulation, ramps, signal generators and filters	924
TF4110 | **TC3 Temperature Controller**	temperature control for monitoring and controlling different temperature ranges	924
Motion		
TF5000 | **TC3 NC PTP 10 Axes**	NC PTP (point-to-point movements) for up to 10 axes	925
TF5010 | **TC3 NC PTP Axes Pack 25**	extension of TwinCAT 3 NC PTP to up to 25 axes	925
TF5020 | **TC3 NC PTP Axes Pack unlimited**	extension of TwinCAT 3 NC PTP to over 25 axes	925
TF5050 | **TC3 NC Camming**	using the TwinCAT NC cam plate functionality (table coupling)	926
TF5055 | **TC3 NC Flying Saw**	implementing "flying saw" functionality	926
TF5060 | **TC3 NC FIFO Axes**	implementation of a pre-defined user setpoint generator for an NC axis	927
TF5065 | **TC3 Motion Control XFC**	high-precision logging and switching of digital signals in relation to axis positions	927

TwinCAT 3 | Functions

Motion

TF5100 | **TC3 NC I**	NC I with 3 interpolating axes and 5 additional axes	927
TF5110 | **TC3 Kinematic Transformation L1**	realisation of different kinematic transformations Level 1	928
TF5111 | **TC3 Kinematic Transformation L2**	realisation of different kinematic transformations Level 2	928
TF5112 | **TC3 Kinematic Transformation L3**	realisation of different kinematic transformations Level 3	928
TF5113 | **TC3 Kinematic Transformation L4**	realisation of different kinematic transformations Level 4	928
TF5120 | **TC3 Robotics mxAutomation**	direct communication between the PLC and the KUKA KR C4 robot control	929
TF5200 | **TC3 CNC**	CNC path control software	929
TF5210 | **TC3 CNC E**	CNC path control software export version	929
TF5220 | **TC3 CNC Axes Pack**	extension to up to a total of 64 axes/controlled spindles, of which a maximum of 32 can be path axes and a maximum of 12 can be controlled spindles	930
TF5230 | **TC3 CNC Channel Pack**	further CNC channel, extension to a maximum of 12 channels, channel synchronisation, axis transfer between channels	930
TF5240 | **TC3 CNC Transformation**	transformation functionality (5-axis functionality)	930
TF5250 | **TC3 CNC HSC Pack**	extending the CNC with HSC technology (high-speed cutting)	931
TF5260 | **TC3 CNC Spline Interpolation**	path programming via splines with programmable spline type, Akima-spline, B-spline	931
TF5270 | **TC3 CNC Virtual NCK Basis**	virtual TwinCAT CNC for simulation in a Windows environment	931
TF5271 | **TC3 CNC Virtual NCK Options**	virtual TwinCAT CNC for simulation in a Windows environment	931

Connectivity

TF6000 | **TC3 ADS Communication Library**	ADS communication components	932
TF6100 | **TC3 OPC UA**	access to TwinCAT in accordance with OPC UA with UA server (DA/HA/AC) and UA client (DA)	932
TF6120 | **TC3 OPC DA**	access to TwinCAT variables, in accordance with OPC DA and OPC XML DA specification	932
TF6220 | **TC3 EtherCAT Redundancy 250**	extension of the TwinCAT EtherCAT master with cable redundancy capability for up to 250 slaves	932
TF6221 | **TC3 EtherCAT Redundancy 250+**	extension of the TwinCAT EtherCAT master with cable redundancy capability for more than 250 slaves	933
TF6225 | **TC3 EtherCAT External Sync**	extension of the TwinCAT EtherCAT master with an option to synchronise the Beckhoff real-time communication with external signals	933
TF6250 | **TC3 Modbus TCP**	communication with Modbus TCP devices (server and client functionality)	933
TF6255 | **TC3 Modbus RTU**	serial communication with Modbus end devices	933
TF6270 | **TC3 PROFINET RT Device**	communication via PROFINET (PROFINET slave)	933
TF6271 | **TC3 PROFINET RT Controller**	communication via PROFINET (PROFINET master)	933
TF6280 | **TC3 Ethernet/IP Slave**	communication via EtherNet/IP (EtherNet/IP slave)	934
TF6281 | **TC3 Ethernet/IP Master**	communication via EtherNet/IP (EtherNet/IP master)	934
TF6300 | **TC3 FTP**	easy access from TwinCAT PLC to FTP server	934
TF6310 | **TC3 TCP/IP**	communication via generic TCP server	934
TF6311 | **TC3 TCP/UDP Realtime**	direct access from realtime to Ethernet communication	935
TF6340 | **TC3 Serial Communication**	communication via serial Bus Terminals or PC COM ports with the 3964R and RK512 protocol	935
TF6350 | **TC3 SMS/SMTP**	sending SMS and e-mails from the PLC	935
TF6360 | **TC3 Virtual Serial COM**	virtual serial COM driver for Windows platforms	935
TF6420 | **TC3 Database Server**	accessing databases from the PLC	935
TF6421 | **TC3 XML Server**	read and write access to XML files from the PLC	935
TF6500 | **TC3 IEC 60870-5-10x**	communication according to IEC 60870-101, -102, -103, -104	936
TF6510 | **TC3 IEC 61850/400-25**	communication according to IEC 61850 and IEC 61400-25	936
TF6600 | **TC3 RFID Reader Communication**	connection of RFID readers to the TwinCAT PLC	936
TF6610 | **TC3 S5/S7 Communication**	communication with S5/S7 controllers	936

Industry specific

TF8000 | **TC3 BA Connectivity Library**	libraries for programming of Bus Terminals for building automation (DALI, EnOcean, SMI, EIB, LON, M-Bus, GENIbus, MP-Bus and DMX)	937
TF8040 | **TC3 Building Automation**	software package covering all technical building automation services	937
TF8310 | **TC3 Wind Framework**	framework for the development of operational management software for wind turbines	937

TE1xxx | TwinCAT 3 Engineering

	TC3 Engineering	TC3 Simulation Manager	TC3 EtherCAT Simulation	TC3 XCAD Interface	TC3 Management Server
Technical data	**TE1000**	**i TE1110**	**TE1111**	**TE1120**	**TE1140**
	TwinCAT Engineering contains the engineering environment of the TwinCAT 3 control software: – integration into Visual Studio® 2010/2012/2013 (if available) – support for the native Visual Studio® interfaces (e.g. connection to source code management systems) – IEC 61131-3 (IL, ST, LD, FBD, SFC) and CFC editors – IEC 61131-3 compiler – integrated system manager for the configuration of the target system – instancing and parameterisation of TwinCAT modules – integrated C++ debugger – user interface for the parameterisation of modules generated by MATLAB®/Simulink® – if integrated into Visual Studio®, instancing of .NET projects in the same solution (e.g. for HMI) – includes TwinCAT Scope and TwinCAT Bode Plot as base version	The TwinCAT Simulation Manager is a tool for simplified configuration of a simulation environment, which integrates into the TwinCAT system environment. It supports the creation of a "virtual machine", which corresponds to a real one in its runtime performance.	Virtual machine commissioning becomes possible if the EtherCAT cable of the machine computer can simply be plugged into a simulation computer, without the need for reconfiguration. With the TC3 EtherCAT Simulation function and a network adapter the simulation computer can simulate a number of EtherCAT slaves. For configuration purposes the EtherCAT slaves of the original machine configuration are inverted. The temporal processing is modelled with all the required EtherCAT features including distributed clocks. Since the communication protocols CoE and SoE are implemented, acyclic commands can also be processed in the simulation environment.	TC3 XCAD Interface serves the purpose of importing already existing engineering results from an ECAD program. The TC3 XCAD Interface enables the import of information about the structure of the I/Os and their links to PLC variables, which is exported from the ECAD tool by means of XML description. On the basis of this information a system manager configuration and a basic PLC program with the I/O variables used are generated. The generation of NC and CNC axes is also possible.	The TwinCAT Management Server enables the central administration of Beckhoff CE controllers. Software updates, for example, can thus be loaded onto controllers in the network from a central location. In addition to operating system updates, device-specific components (PLC boot projects) can also be loaded. By the option of separating known network devices into groups, individual actions can be defined for each group.
Target system	Windows XP, Windows 7/8	Windows XP, Windows 7	Windows XP, Windows 7/8	Windows XP, Windows 7	Windows XP, Windows 7/8
Further information	www.beckhoff.com/TE1000	www.beckhoff.com/TE1110	www.beckhoff.com/TE1111	www.beckhoff.com/TE1120	www.beckhoff.com/TE1140

i For availability status see Beckhoff website at: www.beckhoff.com/TE1110

	TC3 Scope View Professional	TC3 Target for MATLAB®/Simulink®	TC3 Interface for MATLAB®/Simulink®	TC3 Valve Diagram Editor	TC3 Cam Design Tool
	TE1300	TE1400	TE1410	TE1500	TE1510

	TwinCAT 3 Scope View is a software oscilloscope for the graphical display of data as YT or XY plot. Scope View Professional extends the Scope View Base version which is included in TwinCAT 3 XAE by further functionalities. It can be used for tracking and monitoring processes over a longer period of time.
	Long-term recordings, print-out function and trigger-controlled data logging are part of the functionality. With multi-core support Scope View ensures optimised performance in the display of signals.
	Like TwinCAT 3 XAE, Scope View integrates itself into Microsoft Visual Studio®. It can be used as a stand-alone project or in combination with a TwinCAT project within a solution.
	Furthermore, Scope View Professional can be integrated into a user's .NET-based visualisation. Thus, seamless integration into an existing machine visualisation is possible.
		The TwinCAT MATLAB®/Simulink® Target offers System Target Files for the use of the MATLAB®/Simulink® coder. It enables the generation of TwinCAT 3 runtime modules, which can be instanced and parameterised in the TwinCAT 3 engineering environment.	The interface for MATLAB®/Simulink® provides a communication interface between MATLAB®/Simulink® and the TwinCAT 3 runtime. It supports the acquisition and visualisation of real-time parameters. It can be used both for the simulation of hardware ("software in the loop") and for the simulation of the controller ("hardware in the loop").
			
			Features
			– data exchange between fieldbus devices and MATLAB®/Simulink®, for example for the simple realisation of control loops or for HIL simulations with low real-time requirements
			– Data exchange between the TwinCAT controller and MATLAB®/Simulink®; this enables controller testing by SIL simulation, for example.
			– acquisition and visualisation of process data via MATLAB®/Simulink®
			– configuration via graphic editor
			– various data exchange options, access via:
			  – symbol name of a variable
			  – configurable interface module
				The TwinCAT Valve Diagram Editor allows the linearisation of non-linear curves of hydraulic valves with the aid of a graphical editor. On the basis of a few base points, straight lines or 5th degree polynomials can be determined that connect the points. The characteristic linearisation curve thus determined can be loaded into the TwinCAT NC real-time and taken into account when the voltages are output in the drive.	The TwinCAT CAM Design Editor allows the generation and modification of cam plates with the aid of a graphical editor. These are composed of sections of laws of motion such as modified sine waves, harmonic combinations, or of various polynomial functions. Velocity, acceleration and jerk are displayed in addition to the slave position. The generated cam plates can be transferred to the NC as tables with specified step size or as so-called motion functions.

	Windows XP, Windows 7/8	Windows XP, Windows 7/8	Windows XP, Windows 7/8	Windows XP, Windows 7/8	Windows XP, Windows 7/8
	www.beckhoff.com/TE1300	www.beckhoff.com/TE1400	www.beckhoff.com/TE1410	www.beckhoff.com/TE1500	www.beckhoff.com/TE1510

TC1xxx | TwinCAT 3 Base

	TC3 ADS	TC3 I/O
Technical data	**TC1000-00pp**	**TC1100-00pp**
	The Automation Device Specification (ADS) is the communication protocol of TwinCAT. It enables the data exchange and the control of TwinCAT systems. ADS is media-independent and can communicate via serial or network connections. ADS enables: – access to the process image – consistent data exchange – access to I/O tasks – detection of status changes – read-out of the PLC symbol information – access by variable name – sum commands – synchronous and asynchronous access – cyclic and event-based messages Libraries and runtime components are provided for common programming languages (including .NET, C/C++, Delphi and Java). In addition, interfaces are provided for communication with third-party software (e.g. MATLAB®, NI LabView, Office). The ADS web services enable the development of device-independent web applications (HTML5, WCF). The message router manages multiple connections and efficiently distributes the messages. The data packets can be recorded via the ADS monitor using the integrated diagnostic interface. The free TC3 ADS supplies the basic components required in order to communicate with TwinCAT systems. The setup can be integrated in your own installation routines.	Using TwinCAT I/O, cyclic data can be collected by different fieldbuses in process images. Cyclic tasks drive the corresponding fieldbuses. Various fieldbuses can be operated with different cycle times on one CPU. Applications can directly access the process image. The fieldbuses and the process images are configured in TwinCAT Engineering. – provides variable-oriented linkage of I/O devices to tasks – tasks are variable-oriented among each other – the smallest unit is one bit – upports both synchronous and asynchronous relationships – consistent exchange of data areas and process images – online display in the directory tree – online watch window – "Force and Write" for commissioning and for testing task variables and I/O devices – supported fieldbuses: – EtherCAT – Lightbus – PROFIBUS DP (master and slave) – Interbus – CANopen – SERCOS interface – DeviceNet – Ethernet – USB – SMB (System Management Bus)
Performance class (pp)	20 | 30 | 40 | 50 – | x | x | x 60 | 70 | 80 | 90 x | x | x | x	20 | 30 | 40 | 50 – | x | x | x 60 | 70 | 80 | 90 x | x | x | x
Target system	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE
Further information	www.beckhoff.com/TC1000	www.beckhoff.com/TC1100

	TC3 PLC				TC3 PLC/C++				TC3 PLC/C++/MATLAB®/Simulink®			
	TC1200-00pp				TC1210-00pp				TC1220-00pp			
	TwinCAT PLC realises one or more PLCs with the international standard IEC 61131-3 3rd edition on one CPU. All programming languages described in the standard can be used for programming. The blocks of the type PROGRAM can be linked with real-time tasks. Various convenient debugging options facilitate fault-finding and commissioning. Program modifications can be carried out at any times and in any size online, i.e. when the PLC is running. All variables are available symbolically by ADS and can be read and written in appropriate clients. – process image size, flag range, program size, POU size and number of variables are limited only by size of RAM – cycle times from 50 µs – link time: typically 1 µs (Intel® Core™2 Duo) for 1,000 commands – IEC 61131-3: IL, FBD, LD, SFC, ST, CFC – online changes in programs and variables – remote debugging via TCP/IP – online connection with PLC runtime system worldwide via TCP/IP or fieldbus – online monitoring of variables in variable lists, watch windows, editors – online status and powerflow (accumulator contents) of programs and instances – triggering, forcing and setting variables – powerful debugging with single cycle, break points, step in, step over, display of the current call stack, watchlist shows selection of variable, trace functions – online management of all variable names and structures across the whole system – remanent and persistent data, UPS supported storage on hard disk, storage in NOVRAM as option – variable reading and writing access via ADS, OPC – certified in accordance with PLCopen base level (IL/ST) – structured programming with modular program management – source code is stored in the target system – convenient library management – powerful compiler with incremental compilation – all common data types, structures, arrays, including multi-dimensional arrays – convenient creation of programs with: autoformat, autodeclare, cross-reference, search/replace, project comparison – simple linking to source code administration tools by embedding in Microsoft Visual Studio®				Extension of the TwinCAT PLC TC1200 with additional C++ functionalities: – online connection to PLC/C++ runtime system locally or worldwide via TCP/IP or via fieldbus – online monitoring of variables in variable lists, watch windows and editors without setting break points – online setting of variables				Extension of the TwinCAT PLC/C++ TC1210 by the possibility to execute modules generated in MATLAB®/Simulink®: – contains the TwinCAT 3 PLC and C++ runtime – allows the execution of modules generated in MATLAB®/Simulink® – multiple instancing of modules – parameterisation of these modules at runtime – online access to all parameters (can be deactivated) – generic modules (no hardware connection necessary within the models) – connection to the external mode of Simulink® – connection to the TwinCAT C++ debugger, with graphical representation of the blocks – modules can be called from other modules or directly by tasks			
	20	30	40	50	20	30	40	50	20	30	40	50
	–	x	x	x	–	–	x	x	–	–	x	x
	60	70	80	90	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x	x	x	x	x
	Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8				Windows XP, Windows 7/8			
	www.beckhoff.com/TC1200				www.beckhoff.com/TC1210				www.beckhoff.com/TC1220			

TC1xxx | TwinCAT 3 Base

	TC3 PLC/NC PTP 10	TC3 PLC/NC PTP 10/NC I
Technical data	**TC1250-00pp**	**TC1260-00pp**
	Extension of the TwinCAT PLC TC1200 by the possibility to realise point-to-point movements in software (TwinCAT Motion Control PTP 10). The axes are represented by axis objects and provide a cyclic interface, e.g. for the PLC. This axis object is then linked to a corresponding physical axis. In this way the most diverse axis types with the most diverse fieldbus interfaces can be connected abstractly with the axis objects, which always offer an identical configuration interface. The control of the axes can be configured in various constellations (position or velocity interface) and various controllers. The axes are configured in TwinCAT Engineering. – up to a maximum of 255 axes on one CPU – supports electrical and hydraulic Servo Drives, frequency converter drives, stepper motor drives, DC drives, switched drives (fast/slow axes), simulation axes and encoder axes – supports various encoders such as incremental encoder, absolute encoder, digital interface to the drives such as EtherCAT, SERCOS, SSI, Lightbus, PROFIBUS DP/MC, pulse train – standard axis functions such as start/stop/reset/ reference, velocity override, master/slave couplings, electronic gearbox, online distance compensation, programming is carried out via PLCopen-compliant IEC 61131-3 function blocks – convenient axis commissioning options – online monitoring of all axis state variables such as actual/set values, releases, control values – online axis tuning – forcing of axis variables – configuration of all axis parameters, such as measuring system, drive parameters and position controller – configurable controller structures: P control, PID control, PID with velocity pre-control, PID with velocity and acceleration pre-control – online master/slave and slave/master conversion – flying saw (diagonal saw [optional]) – cam plates (support by TC3 Cam Design Tool [optional]) – FIFO axes (optional) – external set value generators – multi-master coupling	Extension of the TwinCAT PLC/NC PTP 10 by the possibility to realise movements with up to three interpolating and up to five auxiliary axes. Various axis types with various fieldbus interfaces are supported. The movement is usually programmed in DIN 66025, but it can also alternatively be carried out via PLC function blocks. – max. 3 path axes and up to 5 auxiliary axes per group – 1 group per channel, max. 31 channels – supports electric servo axes, stepper motor drives – interpreter functions such as subroutine and jump technology, programmable loops, zero point shifts, tool corrections, M and H functions – geometry functions: straight lines and circles in 3-D space, circles at all main levels, helices with base circles at all main levels, linear, circular and helical interpolation at the main levels and freely definable levels, Bezier splines, look-ahead function – online reconfiguration of axes in groups, path override, slave coupling to path axes, auxiliary axes, axis error and sag compensation, measuring functions – programming in DIN 66025 – access alternatively via function blocks according to IEC 61131-3 – operation of automatic mode, manual mode (jog/inch), single block mode, referencing, handwheel mode (movement/overlay) – convenient debugging with online monitoring of current set/actual position (position lag of all axes), NC program line currently being processed, NC program line currently being interpreted, channel status – support of kinematic transformations in combination with TF511x

Performance class (pp)	20	30	40	50	20	30	40	50
	–	x	x	x	–	–	x	x
	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x
Target system	Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8, Windows CE			
Further information	www.beckhoff.com/TC1250				www.beckhoff.com/TC1260			

	TC3 PLC/NC PTP 10/NC I/CNC	TC3 PLC/NC PTP 10/NC I/CNC E	TC3 C++	TC3 C++/ MATLAB®/Simulink®
	TC1270-00pp	TC1275-00pp	TC1300-00pp	TC1320-00pp
	Extension of the TwinCAT PLC/NC PTP 10 by the possibility to realise an interpolation with up to 32 simultaneously interpolating axes. The number of axes and/or the number of channels can be adapted to the requirements of the application via the option packages. Various transformations can be supplemented via option packages. Programming takes place according DIN 66025. The axes and channels are configured in TwinCAT Engineering. – 8 path axes/controlled spindles, max. 64 axes/controlled spindles (optional), max. 12 channels (optional) – supports electric servo axes, stepper motor drives subroutine and jump technology, programmable loops, zero point shifts, tool corrections, M and H functions, mathematical functions, programming of parameters/variables, user macros, spindle and auxiliary functions, zero point shifts, tool functions – geometry functions: linear, circular and helical interpolation at the main levels and freely definable levels, max. 32 interpolating path axes per channel (optional), look-ahead function – axis functions, coupling and gantry axis function, override, axis error and sag compensation, measuring functions – programming in DIN 66025 with high-level language extension – access via function blocks from TwinCAT PLC according to IEC 61131-3 – operation with automatic mode, manual mode (jog/inch), single block mode, referencing, block advance, handwheel mode (movement/overlay) – convenient debugging with online monitoring of all states	TwinCAT CNC export version (E version): extension of the TwinCAT PLC/NC PTP 10 by the possibility to realise an interpolation with up to 32 simultaneously interpolating axes. The number of axes and/or the number of channels can be adapted to the requirements of the application via the option packages. Various transformations can be supplemented via option packages. Programming takes place according DIN 66025. The axes and channels are configured in TwinCAT Engineering. – 8 path axes/controlled spindles, max. 64 axes/controlled spindles (optional), max. 12 channels (optional) – supports electric servo axes, stepper motor drives subroutine and jump technology, programmable loops, zero point shifts, tool corrections, M and H functions, mathematical functions, programming of parameters/variables, user macros, spindle and auxiliary functions, zero point shifts, tool functions – geometry functions: linear, circular and helical interpolation at the main levels and freely definable levels, max. 32 interpolating path axes per channel (optional), look-ahead function – axis functions, coupling and gantry axis function, override, axis error and sag compensation, measuring functions – programming in DIN 66025 with high-level language extension – access via function blocks from TwinCAT PLC according to IEC 61131-3 – operation with automatic mode, manual mode (jog/inch), single block mode, referencing, block advance, handwheel mode (movement/overlay) – convenient debugging with online monitoring of all states	The TwinCAT 3 C++ runtime environment enables the execution of real-time modules written in C++. The following functions are supported, among others: – online connection to C++ runtime system locally or worldwide via TCP/IP or via fieldbus – online monitoring of variables in variable lists, watch windows and editors without setting break points – online setting of variables	Extension of the TC1300 by the possibility to execute modules generated by MATLAB®/Simulink®. – contains the TwinCAT 3 C++ runtime – allows the execution of modules generated in MATLAB®/Simulink® – multiple instancing of modules – parameterisation of these modules at runtime – online access to all parameters (can be deactivated) – generic modules (no hardware connection necessary within the models) – connection to the external mode of Simulink® – connection to the TwinCAT C++ debugger with graphical representation of the blocks – modules can be called from other modules or directly by tasks
20	–	–	–	–	–	–	–	–	–	x	x	–	x	x	x
30	–	–	–	–	–	–	–	–	–	x	x	–	x	x	x
40	–	–	–	–	–	–	–	–	x	x	x	–	x	x	x
50	x	x	x	x	x	x	x	x	x	x	x	–	x	x	x
60	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
70	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
80	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
90	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Windows XP, Windows 7/8				Windows XP, Windows 7/8				Windows XP, Windows 7/8				Windows XP, Windows 7/8			
	www.beckhoff.com/TC1270				www.beckhoff.com/TC1275				www.beckhoff.com/TC1300				www.beckhoff.com/TC1320			

TF1xxx | TwinCAT 3 System

	TC3 PLC HMI	TC3 PLC HMI Web	TC3 UML
Technical data	**TF1800-00pp**	**TF1810-00pp**	**TF1910-00pp**
	TC3 PLC HMI is a stand-alone tool for the presentation of visualisations which are created in the TwinCAT PLC development environment. They are shown in full-screen as soon as the system starts up.	TC3 PLC HMI Web is a web-based visualisation system. The TwinCAT PLC development environment can be used as an editor for creating web pages. The web pages are hosted by the Internet Information Server (IIS). For display of the web pages HTML5 and JavaScript is needed.	With the integration of UML (Unified Modeling Language), two additional editors for modelling of PLC software are available. The existing TwinCAT PLC programming languages are extended with the UML state and UML class diagrams. UML is a modelling language for software analysis, design and documentation. UML is particularly suitable for object-oriented implementations. The UML class diagram belongs to the group of UML structure diagrams and can be used for schematic representation of the software architecture. The UML state diagram is part of the UML behaviour diagrams and is used for dynamic software modelling. It can be used for a graphic specification of the dynamic response or the state-dependent system behaviour. The development process is supported by an online debugging option.
Performance class (pp)	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – x x x 60 70 80 90 x x x x
Required	TC1200	TC1200	TC1200
Target system	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE
Further information	www.beckhoff.com/TF1800	www.beckhoff.com/TF1810	www.beckhoff.com/TF1910

TF3xxx | TwinCAT 3 Measurement

	TC3 Scope Server	TC3 Condition Monitoring Level 1	TC3 Condition Monitoring Level 2	TC3 Solar Position Algorithm
Technical data	**TF3300-00pp**	**TF3600-00pp**	**i TF3601-00pp**	**TF3900-00pp**
	The TwinCAT 3 Scope Server prepares data for visual display in the TwinCAT 3 Scope View. It can be used for autarkic data recordings in distributed systems within production, plant or machine networks.	In order to implement Condition Monitoring for machines and plants, the TwinCAT Condition Monitoring library offers a modular construction kit of mathematical algorithms with which measured values can be analysed. The user can serve himself from this construction kit, depending upon the application background, thus having the option to develop a scalable solution on different platforms. The library's functions are primarily relevant to analysis, statistics and classification. In addition to spectral analysis via FFT or using, for instance, an envelope spectrum, it is possible to calculate key statistical values such as the kurtosis or the crest factor. Combining these algorithms with limit value monitoring is, for instance, ideally suited to monitoring roller bearings. Level 1 contains the following algorithms: – Power Spectrum – Magnitude Spectrum – Envelope – Envelope Spectrum – RMS – Crest Factor – Moment Coefficients – Mean, Standard Deviation, Skew, Kurtosis – Discrete Classification – Watch Upper Thresholds	In addition to the Level 1 functions, TwinCAT Condition Monitoring Level 2 contains the following algorithms: – Hilbert Transform – Analytic Signal – Instantaneous Phase – Overlap Add Synthesis – Statistics – Statistics of Frequency Spectra – Quantities and Percentiles – Homomorphic Signal Processing – Power Cepstrum – Instantaneous Frequency – Pattern Recognition/ Machine Learning – Bayesian Classification	With the TwinCAT Solar Position Algorithm it is possible to determine the sun angle using the date, time, geographical longitude and latitude as well as further parameters (depending on the desired accuracy). The function block works with a maximum inaccuracy of ±0.001°.
Performance class (pp)	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – – x x 60 70 80 90 x x x x	20 30 40 50 – – x x 60 70 80 90 x x x x	20 30 40 50 – x x x 60 70 80 90 x x x x
Required	TC1000	TC1200	TC1200	TC1200
Target system	Windows XP, Windows 7/8	Windows XP, Windows 7/8	Windows XP, Windows 7/8	Windows XP, Windows 7/8, Windows CE
Further information	www.beckhoff.com/TF3300	www.beckhoff.com/TF3600	www.beckhoff.com/TF3601	www.beckhoff.com/TF3900

i For availability status see Beckhoff website at: www.beckhoff.com/TF3601

TF4xxx | TwinCAT 3 Controller

Technical data	TC3 Controller Toolbox TF4100-00pp	TC3 Temperature Controller TF4110-00pp
	The TwinCAT Controller Toolbox covers all essential blocks for control applications. – controllers satisfy industrial requirements such as anti-reset windup – simple basic controllers (P, I, D) – complex controllers (PI, PID, switching controllers) – filter blocks – control value generators (limiters, PWM) – ramp and signal generator blocks	Temperature controllers can be simply implemented using TwinCAT Temperature Controller. Simple commissioning through self-adjustment of the controller (auto-tuning) is included. – automatic and manual operation with shock-free set up – control value analog or pulse-width modulated signal – tolerance monitoring, absolute value monitoring – scalable reaction to sensor error and heating power faults – limitation of set and control values – optional ramping of the set value – optional start-up phase for the setpoint variables – industrial PID controller as base control algorithm inside the temperature controller

Performance class (pp)	20	30	40	50	20	30	40	50
	–	x	x	x	–	x	x	x
	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x
Required	TC1200				TC1200			
Target system	Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8, Windows CE			
Further information	www.beckhoff.com/TF4100				www.beckhoff.com/TF4110			

TF5xxx | TwinCAT 3 Motion Control

	TC3 NC PTP 10 Axes	TC3 NC PTP Axes Pack 25	TC3 NC PTP Axes Pack unlimited
Technical data	TF5000-00pp	TF5010-00pp	TF5020-00pp
	TC3 NC PTP 10 Axes implements Motion Control for point-to-point movements in software. The axes are represented by axis objects and provide a cyclic interface, e.g. for the PLC. This axis object is then linked to a corresponding physical axis. In this way, the most diverse axis types with the most diverse fieldbus interfaces can be connected abstractly with the axis objects, which always offer an identical configuration interface. The control of the axes can be configured in various conformations (position or velocity interface) and various controllers. The axes are configured in TwinCAT Engineering. – up to 10 axes on a maximum of 255 axes included developable – supports electrical and hydraulic servo drives, frequency converter drives, stepper motor drives, DC drives, switched drives (fast/slow axes), simulation axes and encoder axes – supports various encoders such as incremental encoder, absolute encoder, digital interface to the drives such as EtherCAT, SERCOS, SSI, Lightbus, PROFIBUS DP/MC, pulse train – standard axis functions such as start/stop/reset/reference, velocity override, master/slave couplings, electronic gearbox, online distance compensation – programming is carried out via PLCopen-compliant IEC 61131-3 function blocks – convenient axis commissioning options – online monitoring of all axis state variables such as actual/setpoint values, releases, control values, online axis tuning – forcing of axis variables – configuration of all axis parameters, such as measuring system, drive parameters and position controller – configurable controller structures: P control, PID control, PID with velocity pre-control, PID with velocity and acceleration pre-control – online master/slave and slave/master conversion – flying saw (diagonal saw) – cam plates (support by TC3 Cam Design Editor [optional]) – FIFO axes (optional) – external set point value generators – multi-master coupling	Extension of TF5000-00pp up to a maximum of 25 axes	Extension of TF5000-00pp up to a maximum of 255 axes

Performance class (pp)	20	30	40	50	20	30	40	50	20	30	40	50
	–	x	x	x	–	–	x	x	–	–	x	x
	60	70	80	90	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x	x	x	x	x
Required	TC1200				TC1200				TC1200			
Target system	Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8, Windows CE			
Further information	www.beckhoff.com/TF5000				www.beckhoff.com/TF5010				www.beckhoff.com/TF5020			

TF5xxx | TwinCAT 3 Motion Control

	TC3 NC Camming				TC3 NC Flying Saw			
Technical data	TF5050-00pp				TF5055-00pp			
	TwinCAT NC Camming (cam plate) is a non-linear relationship between a master and a slave axis. The camming package offers various options for the storage of cam plates. Convenient PLC blocks enable the loading, coupling and uncoupling of cam plates. It is possible to load new cam plates or to modify cam plates during operation. The TwinCAT CAM Design Editor offers support for the creation of the cam plates. – position tables with master interpolation points and corresponding slave positions; interpolation between the points is done linearly or by splines – motion function table describing a cam plate via motion laws according to VDI guideline 2143 – cyclic or linear processing – cam plate with offset and scale, can be modified on the master or slave side – high flexibility through online change of the motion functions				TwinCAT NC Flying Saw implements the coupling of a slave axis to a master axis in a certain synchronous position (flying saw). PLC function blocks enable coupling and uncoupling as well as parameterisation. – The master axis can be a real axis, a virtual axis, or some other external source of actual values. – synchronisation of the slave axis from any motion situation (stop, forward or reverse travel) with the master in motion – simple synchronisation with the master velocity – precise position synchronisation with the master axis (velocity and position) – synchronous velocity can be set via a coupling factor – optional return prevention as additional safety function – superimposed section compensation during the synchronous phase for dynamic position correction			
Performance class (pp)	20	30	40	50	20	30	40	50
	–	–	x	x	–	–	x	x
	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x
Required	TC1250				TC1250			
Target system	Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8, Windows CE			
Further information	www.beckhoff.com/TF5050				www.beckhoff.com/TF5055			

	TC3 NC FIFO Axes				TC3 Motion Control XFC				TC3 NC I			
	TF5060-00pp				TF5065-00pp				TF5100-00pp			
	Using TwinCAT NC FIFO Axes, externally generated set position values can be output to the axes in the form of a velocity pre-control. The set value generation is designed in such a way that both the set position and the set velocity are determined as the FIFO inputs are worked through in sequence. It is also possible, if necessary, to interpolate between two neighbouring FIFO inputs.				eXtreme Fast Control (XFC) is the technique that enables very fast, temporally high-precision reactions using EtherCAT, special I/O terminals and TwinCAT on the PC. Using EtherCAT Distributed Clocks (DC) and appropriate terminals, distributed latches or cam controllers can be implemented simply in this way. – function blocks for the high-precision acquisition and switching of digital signals related to axis positions – EtherCAT Distributed Clocks with the time-stamp-based EtherCAT EL1252, EL2252 or EL2262 input and output terminals – blocks for the conversion of DC time to position and vice versa – convenient PLCopen-compliant TouchProbe block – digital cam controller as PLCopen-compliant block				Using TwinCAT NC I, movements can be implemented with up to three interpolating and up to five auxiliary axes in the interpolation package. Various axis types with various fieldbus interfaces are supported. The movement is usually programmed in DIN 66025, but it can also alternatively be carried out via PLC function blocks. – max. 3 path axes and up to 5 auxiliary axes per group – 1 group per channel, max. 31 channels – supports electric servo axes, stepper motor drives – interpreter functions such as subroutine and jump technology, programmable loops, zero point shifts, tool corrections, M and H functions – geometry functions: straight lines and circles in 3-D space, circles at all main levels, helices with base circles at all main levels, linear, circular and helical interpolation at the main levels and freely definable levels, Bezier splines, look-ahead function – online reconfiguration of axes in groups, path override, slave coupling to path axes, auxiliary axes, axis error and sag compensation, measuring functions – programming in DIN 66025 – access alternatively via function blocks according to IEC 61131-3 – operation of automatic mode, manual mode (jog/inch), single block mode, referencing, handwheel mode (movement/overlay) – convenient debugging with online monitoring of current setpoint/actual position (position lag of all axes), NC program line currently being processed, NC program line currently being interpreted, channel status – support of kinematic transformations in combination with TF511x			
	20	30	40	50	20	30	40	50	20	30	40	50
	–	–	x	x	–	–	x	x	–	–	x	x
	60	70	80	90	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x	x	x	x	x
	TC1250				TC1250				TC1250			
	Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8, Windows CE			
	www.beckhoff.com/TF5060				www.beckhoff.com/TF5065				www.beckhoff.com/TF5100			

TF5xxx | TwinCAT 3 Motion Control

	TC3 Kinematic Transformation L1	TC3 Kinematic Transformation L2	TC3 Kinematic Transformation L3	TC3 Kinematic Transformation L4
Technical data	**TF5110-00pp**	**TF5111-00pp**	**TF5112-00pp**	**TF5113-00pp**
	Various robot types kinematics can be realised using TwinCAT Kinematic Transformation. The programming of the robot movements takes place in Cartesian coordinates using either DIN 66025 instructions or the PLCopen-compliant blocks from the PLC. An integrated dynamic pre-control ensures high precision of the movement even at high accelerations and speeds. Configuration takes place in TwinCAT Engineering. – supports various parallel and also serial kinematics, e.g. for pick-and-place tasks – supports the programming of interpolating movements in G-code (DIN 66025) – alternatively, standard PTP and cam plate applications can be realised – simple programming in the Cartesian coordinate system – automatic calculation of the inverse kinematic for the relevant motor positions – kinematics configured in TwinCAT 3 Engineering; in addition to the type (e.g. delta), the bar lengths and offsets must also be parameterised – mass and mass inertia values can be specified for dynamic pre-control – optimised for the Beckhoff Servo Drives from the AX5000 series – basic package integrating the following kinematics: cartesian portals	Extension of the TwinCAT Kinematic Transformation L1 with additional kinematics: – 2-D parallel kinematics – shear kinematics – crane and roll kinematics	Extension of the TwinCAT Kinematic Transformation L1/L2 with additional kinematics: – 3-D Delta – SCARA	Extension of the TwinCAT Kinematic Transformation L1/L2/L3 with additional kinematics: – 5-D kinematics – serial 6-axis kinematics – Stewart platform
Performance class (pp)	20 30 40 50 – – x x 60 70 80 90 x x x x	20 30 40 50 – – x x 60 70 80 90 x x x x	20 30 40 50 – – x x 60 70 80 90 x x x x	20 30 40 50 – – x x 60 70 80 90 x x x x
Required	TC1260	TC1260	TC1260	TC1260
Target system	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE
Further information	www.beckhoff.com/TF5110	www.beckhoff.com/TF5111	www.beckhoff.com/TF5112	www.beckhoff.com/TF5113

For availability status see Beckhoff website at: www.beckhoff.com/TF5120

	TC3 Robotics mxAutomation				TC3 CNC				TC3 CNC E			
	TF5120-00pp				TF5200-00pp				TF5210-00pp			
	TC3 Robotics mxAutomation allows direct communication between the PLC and the KUKA KR C4 robot control via a common interface. The robot movements can be programmed directly in the PLC, and the actual values of the robot can be synchronised in real time. TC3 Robotics mxAutomation combines PLC control and robot on a single platform and enables programming from an existing system without knowledge of a specific robot programming language. Communication takes place via EtherCAT, with the TwinCAT EtherCAT master and the KR C4 controller from KUKA exchanging data via the EL6692 or EL6695 EtherCAT bridge terminals. In doing so, drive commands are transmitted from the controller to the robot and actual values from the robot to the controller. The robot position data are transmitted to the PLC in every cycle. In addition, the PLC programmer has access to the robot position data at all times in real-time.				TwinCAT CNC offers the option to implement interpolation with up to 32 simultaneously interpolating axes. The number of axes and/or the number of channels can be adapted to the requirements of the application via the option packages. Various transformations can be supplemented via option packages. Programming takes place according DIN 66025. The axes and channels are configured in TwinCAT Engineering. – 8 path axes/controlled spindles, max. 64 axes/controlled spindles (optional), max. 12 channels (optional) – supports electric servo axes, stepper motor drives – subroutine and jump technology, programmable loops, zero point shifts, tool corrections, M and H functions, mathematical functions, programming of parameters/variables, user macros, spindle and auxiliary functions, tool functions – geometry functions linear, circular and helical interpolation at the main levels and freely definable levels, max. 32 interpolating path axes per channel (optional), look-ahead function – axis functions, coupling and gantry axis function, override, axis error and sag compensation, measuring functions – programming in DIN 66025 with high-level language extension – access via function blocks from TwinCAT PLC according to IEC 61131-3 – operation with automatic mode, manual mode (jog/inch), single block mode, referencing, block advance, handwheel mode (movement/overlay) – convenient debugging with online monitoring of all states				TwinCAT CNC in the export version (E-version) offers the option to implement an interpolation with up to four simultaneously interpolating axes. The number of axes and/or the number of channels can be adapted to the requirements of the application via the option packages. Various transformations can be supplemented via option packages. Programming takes place according DIN 66025. The axes and channels are configured in TwinCAT Engineering. – maximum 8 path axes/controlled spindles, max. 64 axes/controlled spindles (optional), max. 12 channels – maximum 4 interpolationg path axes – supports electric servo axes, stepper motor drives – subroutine and jump technology, programmable loops, zero point shifts, tool corrections, M and H functions, mathematical functions, programming of parameters/variables, user macros, spindle and auxiliary functions, tool functions – geometry functions linear, circular and helical interpolation at the main levels and freely definable levels, max. 64 path axes per channel, look-ahead function – axis functions, coupling and gantry axis function, override, axis error and sag compensation, measuring functions – programming in DIN 66025 with high-level language extension – access via function blocks from TwinCAT PLC according to IEC 61131-3 – operation with automatic mode, manual mode (jog/inch), single block mode, referencing, block advance, handwheel mode (movement/overlay) – convenient debugging with online monitoring of all states			
	20	30	40	50	20	30	40	50	20	30	40	50
	–	–	–	x	–	–	–	x	–	–	–	x
	60	70	80	90	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x	x	x	x	x
	TC1200				TC1260				TC1260			
	Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8				Windows XP, Windows 7/8			
	www.beckhoff.com/TF5120				www.beckhoff.com/TF5200				www.beckhoff.com/TF5210			

TF5xxx | TwinCAT 3 Motion Control

	TC3 CNC Axes Pack	TC3 CNC Channel Pack	TC3 CNC Transformation
Technical data	**TF5220-00pp**	**TF5230-00pp**	**TF5240-00pp**
	Using the TwinCAT CNC Axes Pack, extension is possible up to a total of 64 axes/controlled spindles, of which a maximum of 32 can be path axes and a maximum of 12 can be controlled spindles.	Using TwinCAT CNC Channel Pack, a further CNC channel can be extended to a maximum of 12 channels. – channel synchronisation – axis transfer between channels	TwinCAT CNC Transformation is an optional function for the TwinCAT CNC. – transformation functionality (5-axis functionality) – kinematics selection from the kinematics library – RTCP function – TLC function – definition of different coordinate systems, linking/transition of coordinate systems

Performance class (pp)	20	30	40	50	20	30	40	50	20	30	40	50
	–	–	–	x	–	–	–	x	–	–	–	x
	60	70	80	90	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x	x	x	x	x
Required	TC1270				TC1270				TC1270			
Target system	Windows XP, Windows 7/8				Windows XP, Windows 7/8				Windows XP, Windows 7/8			
Further information	www.beckhoff.com/TF5220				www.beckhoff.com/TF5230				www.beckhoff.com/TF5240			

	TC3 CNC HSC Pack	TC3 CNC Spline Interpolation	TC3 CNC Virtual NCK Basis	TC3 CNC Virtual NCK Options
	TF5250-00pp	TF5260-00pp	TF5270-00pp	TF5271-00pp
	TwinCAT CNC HSC Pack is an optional high-speed cutting solution for the TwinCAT CNC: – cross-block velocity and acceleration control for optimum utilisation of the axis dynamics and thus higher path speeds – high surface quality through smoothed dynamics and associated reduction of vibrational excitation of the machine – effective control of specified contour tolerances – path programming via splines with programmable spline type (Akima-spline, B-spline) for reduction of NC blocks for free-form surfaces	TwinCAT CNC Spline Interpolation is an optional package for the TwinCAT CNC for path programming via splines with programmable spline type, Akima-spline, B-spline.	TwinCAT CNC Virtual NCK Basis is a virtual TwinCAT CNC for simulation in a Windows environment as an option for the TwinCAT CNC.	TwinCAT CNC Virtual NCK Options is a virtual TwinCAT CNC for simulation in a Windows environment as a further option package for the TwinCAT CNC and TwinCAT CNC Virtual NCK Basis.
	20 30 40 50	20 30 40 50	20 30 40 50	20 30 40 50
	– – – x	– – – x	– – – x	– – – x
	60 70 80 90	60 70 80 90	60 70 80 90	60 70 80 90
	x x x x	x x x x	x x x x	x x x x
	TC1270	TC1270	TC1000	TC1000
	Windows XP, Windows 7/8	Windows XP, Windows 7/8	Windows XP, Windows 7/8	Windows XP, Windows 7/8
	www.beckhoff.com/TF5250	www.beckhoff.com/TF5260	www.beckhoff.com/TF5270	www.beckhoff.com/TF5271

TF6xxx | TwinCAT 3 Connectivity

	TC3 ADS Communication	TC3 OPC UA	TC3 OPC DA	TC3 EtherCAT Redundancy 250
Technical data	**TF6000-00pp**	**TF6100-00pp**	**TF6120-00pp**	**TF6220-00pp**
	The Automation Device Specification (ADS) is the communication protocol of TwinCAT. It enables the data exchange and the control of TwinCAT systems. ADS is media-independent and can communicate via serial or network connections. ADS enables: – access to the process image – consistent data exchange – access to I/O tasks – detection of status changes – read-out of the PLC symbol information – access by variable name – sum commands – synchronous and asynchronous access – cyclic and event-based messages Libraries and runtime components are provided for common programming languages (including .NET, C/C++, Delphi and Java). In addition, interfaces are provided for communication with third-party software (e.g. MATLAB®, NI LabView, Office). The ADS web services enable the development of device-independent web applications (HTML5, WCF).	OPC Unified Architecture offers secure, reliable and manufacturer-neutral transport of raw data and pre-processed information from the manufacturing level into the production planning or ERP system. With OPC UA, all desired information is available to every authorised application and every authorised person at any time and in any place. TwinCAT OPC UA Server – certified in the OPC Laboratory, Europe – functions: DataAccess/ HistoricalAccess/ Alarm&Condition – PLC blocks for diagnosis and restart – intermediate storage of data on the server: interruption of the communication connection does not lead to loss of data – configurator for simple handling and diagnostics of local/remote OPC UA servers TwinCAT OPC UA Gateway – wrapper technology for an OPC DA (Data Access) interface according to OPC UA – high-performance OPC DA access – aggregation of TwinCAT OPC UA servers TwinCAT OPC UA Client – PLCopen PLC function blocks for OPC UA Data Access – Demo OPC UA client for diagnostic purposes	OPC is the standard for supplier-independent communication in automation technology. OPC DA (Data Access) is based on the Microsoft COM/DCOM standard. TwinCAT OPC DA Server – specifications OPC-DA2x and OPC-XML-DA – configurator for the set-up – demo DA client for diagnostic purposes and the loading of recipes The TF6120 product can be replaced by the new software component "TwinCAT OPC UA Gateway" of the TF6100 product.	TwinCAT EtherCAT Redundancy 250 extends the TwinCAT EtherCAT Master by the possibility to implement cable redundancy for up to 250 EtherCAT devices: from the last logical device a cable is returned back to the master. Configuration and diagnostics take place in the TwinCAT 3 engineering environment.
Performance class (pp)	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – – x x 60 70 80 90 x x x x
Required	TC1000	TC1000	TC1000	TC1100
Target system	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8	Windows XP, Windows 7/8, Windows CE
Further information	www.beckhoff.com/TF6000	www.beckhoff.com/TF6100	www.beckhoff.com/TF6120	www.beckhoff.com/TF6220

	TC3 EtherCAT Redundancy 250+	TC3 EtherCAT External Sync	TC3 Modbus TCP	TC3 Modbus RTU	TC3 PROFINET RT Device	TC3 PROFINET RT Controller
	TF6221-00pp	TF6225-00pp	TF6250-00pp	TF6255-00pp	TF6270-00pp	TF6271-00pp
	TwinCAT EtherCAT Redundancy 250+ extends the TwinCAT EtherCAT Master by the possibility to implement cable redundancy for more than 250 EtherCAT devices: from the last logical device a cable is returned back to the master. Configuration and diagnosis take place in the TwinCAT 3 engineering environment.	TC3 EtherCAT External Sync extends the TwinCAT EtherCAT master with an option to synchronise the Beckhoff real-time communication with external digital signals. The digital signals are read via terminals supporting time-stamping, such as the EL1252 EtherCAT Terminal.	TwinCAT Modbus acts as gateway between Modbus TCP devices and TwinCAT runtime systems. It provides both server and client functionalities. In server mode the memory areas of several TwinCAT runtime systems can be mapped directly to the Modbus memory areas. A PLC library is provided for implementing a Modbus TCP client, so that the memory areas of a Modbus TCP device can be accessed.	TwinCAT Modbus RTU implements Modbus RTU communication via a serial RS232, RS422 or RS485 interface and is thus suitable both for the PC/CX interfaces and for operation with the KL6xxx serial Bus Terminals. It contains function blocks for master and slave operating mode with simple configuration.	The TwinCAT PROFINET RT Device (slave) is a supplement that turns any PC-based controller with an Intel® chipset and the real-time Ethernet driver developed by Beckhoff into a PROFINET RT device. By installing the function, a standard Ethernet interface becomes a PROFINET slave.	The TwinCAT PROFINET RT Controller (master) is a supplement that turns any PC-based controller with an Intel® chipset and the real-time Ethernet driver developed by Beckhoff into a PROFINET RT controller. By installing the function, a standard Ethernet interface becomes a PROFINET master.
20	x	x	x	x	x	x
30	x	x	x	x	x	x
40	x	x	x	x	x	x
50	x	x	x	x	x	x
60	x	x	x	x	x	x
70	x	x	x	x	x	x
80	x	x	x	x	x	x
90	x	x	x	x	x	x
	TC1100	TC1100	TC1200	TC1200	TC1100	TC1100
	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE
	www.beckhoff.com/TF6221	www.beckhoff.com/TF6225	www.beckhoff.com/TF6250	www.beckhoff.com/TF6255	www.beckhoff.com/TF6270	www.beckhoff.com/TF6271

TF6xxx | TwinCAT 3 Connectivity

	TC3 EtherNet/IP Slave	TC3 EtherNet/IP Master	TC3 FTP Client	TC3 TCP/IP
Technical data	**TF6280-00pp**	**TF6281-00pp**	**TF6300-00pp**	**TF6310-00pp**
	The TwinCAT EtherNet/IP Slave is a supplement that turns any PC-based controller with an Intel® chipset and the real-time Ethernet driver developed by Beckhoff into an EtherNet/IP slave. Through this supplement the Ethernet interface becomes an EtherNet/IP slave. The product can be used on all PC controllers and Embedded PC controllers with an Intel® chipset. A further feature of the supplements is that it enables up to eight slaves to be parameterised using a single physical interface. For this purpose, a virtual MAC address is created in order to be able to operate a total of up to eight EtherNet/IP slaves on one PC via a single Ethernet interface. This feature can be used, for example, to exchange larger amounts of data using one EtherNet/IP master or to establish a connection to several EtherNet/IP masters in different subnets.	The TwinCAT EtherNet/IP Master is a supplement that turns any PC-based controller with an Intel® chipset and the real-time Ethernet driver developed by Beckhoff into an EtherNet/IP master. Through this supplement, the Ethernet interface becomes an EtherNet/IP master. The product can be used on all PC controllers and Embedded PC controllers with an Intel® chipset. The process data is configured using TwinCAT 3 allowing various process data and various sizes. The supplement supports both multicast and unicast connections. Up to 16 simple EtherNet/IP slave devices can be connected via one generic node.	TwinCAT FTP enables easy access from the PLC to one or several FTP servers with the aid of various function blocks. Files can be loaded to or from a server after the establishment of a connection (optional with authentication). Additional function blocks allow files or directories to be searched for, created, deleted and renamed.	TwinCAT TCP/IP enables the implementation and realisation of one or several TCP/IP servers and/or TCP/IP clients within the TwinCAT 3 PLC. Corresponding blocks exist for the establishment/ disconnection of communication as well as for the pure exchange of data (send and receive). The function blocks also support the use of multicast addresses.
Performance class (pp)	20 30 40 50	20 30 40 50	20 30 40 50	20 30 40 50
	– – x x	– – x x	– x x x	– x x x
	60 70 80 90	60 70 80 90	60 70 80 90	60 70 80 90
	x x x x	x x x x	x x x x	x x x x
Required	TC1200	TC1200	TC1200	TC1200
Target system	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE
Further information	www.beckhoff.com/TF6280	www.beckhoff.com/TF6281	www.beckhoff.com/TF6300	www.beckhoff.com/TF6310

For availability status see Beckhoff website at: www.beckhoff.com

	TC3 TCP/UDP Realtime	TC3 Serial Communication	TC3 SMS/SMTP	TC3 Virtual Serial COM	TC3 Database Server	TC3 XML Server
	TF6311-00pp	TF6340-00pp	TF6350-00pp	TF6360-00pp	TF6420-00pp	TF6421-00pp
	In contrast to TF6310, TC3 TCP/UDP Realtime (TF6311) enables fast and convenient access from the real-time directly to the network card. The TwinCAT 3 network card driver handles the access via a dedicated stack. The implementation facilitates cooperative use of the network card by the operating system. TF6311 provides both server and client functionality, so that the TCP/IP, UDP/IP and Ping/ARP protocols can be implemented.	TwinCAT Serial Communication implements communication with serial devices such as printers, bar code scanners, etc. The serial interface of the PC and the serial Beckhoff EL6xxx EtherCAT Terminals and and KL6xxx Bus Terminals are supported. Via the network-based fieldbus system from Beckhoff the serial terminals can be accessed over a distance of up to 100 m. In addition, it is possible to address virtual COM interfaces of the operating system from the PLC.	TwinCAT SMS/SMTP enables the transmission of SMS messages or e-mails using PLC function blocks. The latter also allows the transmission of file attachments, HTML texts and the setting of message priorities. Support for STARTTLS/SSL enables encrypted e-mail communication to be configured.	TwinCAT Virtual Serial COM enables serial EtherCAT terminals to be accessed from a Windows system. One virtual COMPort per serial connection can be generated locally or on a remote system. This enables serial communication independent of the range. Via the Windows API (e.g. .NET/ C++) you can develop your own applications that can communicate with the connected devices of the terminal.	TwinCAT Database Server enables the exchange of data between databases and the TwinCAT system. PLC variables or direct values of the EtherCAT I/Os can be logged cyclically when changes occur or event-controlled by means of PLC function blocks. – Microsoft SQL – Microsoft SQL Compact – Windows Azure SQL – MySQL – Oracle – PostgreSQL – Firebird – DB2 – InterBase – IBM AS400 iSeries – ASCII files (e.g. .csv, .txt) – Microsoft Excel – Microsoft Access – XML files	The TwinCAT XML Server provides a PLC library enabling write/read access for XML data. The user-friendly XML Server facilitates e.g. the loading of initialisation data, which is often required at machine startup.
	20 30 40 50	20 30 40 50	20 30 40 50	20 30 40 50	20 30 40 50	20 30 40 50
	– x x x	– x x x	– x x x	– x x x	– x x x	– x x x
	60 70 80 90	60 70 80 90	60 70 80 90	60 70 80 90	60 70 80 90	60 70 80 90
	x x x x	x x x x	x x x x	x x x x	x x x x	x x x x
	TC1200	TC1200	TC1200	TC1100	TC1200	TC1200
	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE
	www.beckhoff.com/TF6311	www.beckhoff.com/TF6340	www.beckhoff.com/TF6350	www.beckhoff.com/TF6360	www.beckhoff.com/TF6420	www.beckhoff.com/TF6421

TF6xxx | TwinCAT 3 Connectivity

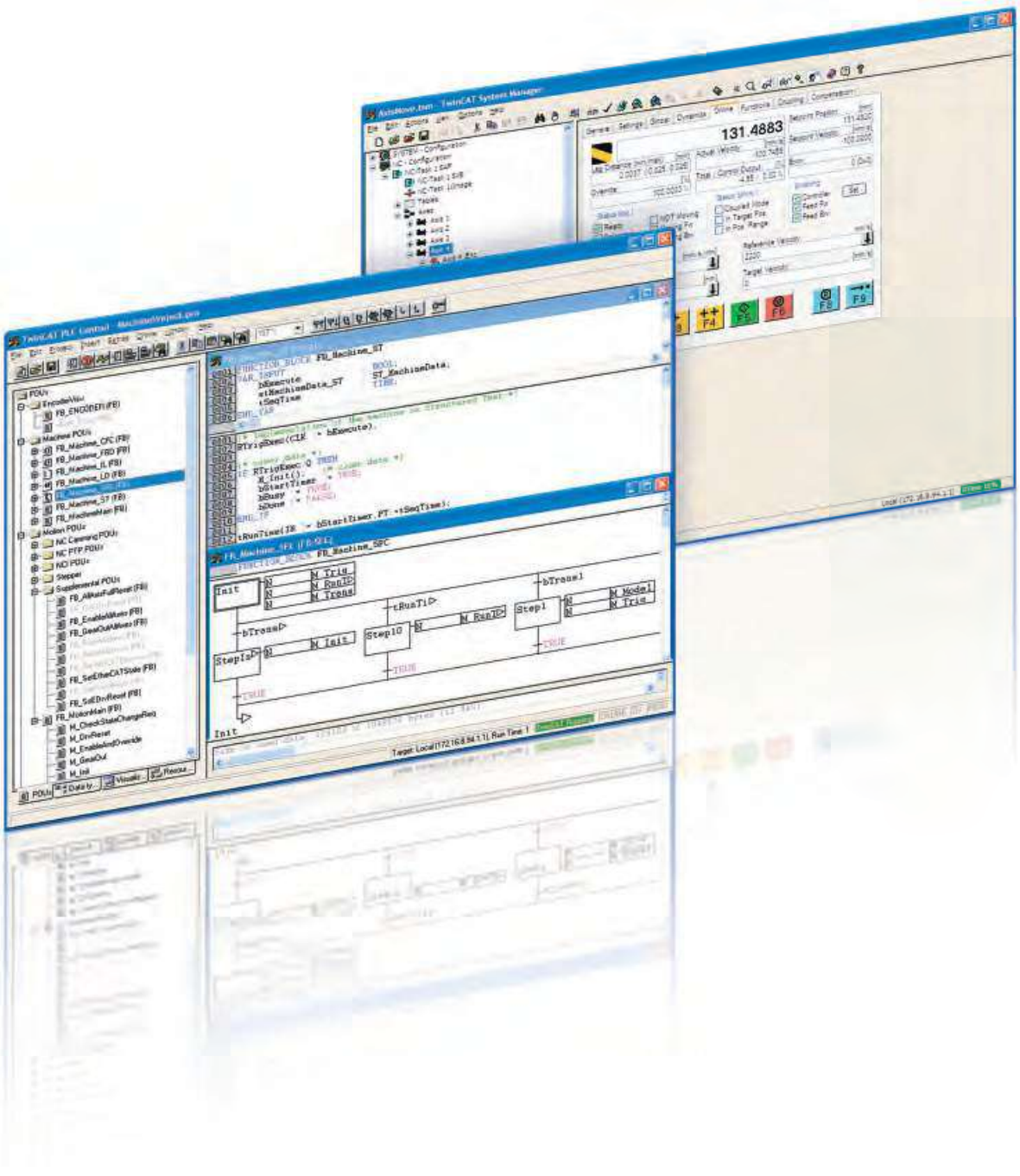
	TC3 IEC 60870-5-10x	TC3 IEC 61850/ IEC 61400-25	TC3 RFID Reader Communication	TC3 S5/S7 Communication
Technical data	**TF6500-00pp**	**TF6510-00pp**	**TF6600-00pp**	**TF6610-00pp**
	TwinCAT IEC 60870-5-10x enables communication according to the IEC standard 60870-5-10x from the PLC. Both server and client operating modes are possible. PLC library for the realisation of masters for – IEC 60870-5-101 – IEC 60870-5-102 – IEC 60870-5-103 – IEC 60870-5-104 PLC library for the realisation of slaves for – IEC 60870-5-101 – IEC 60870-5-104	For the standard-compliant communication between client and server, corresponding servers can be realised directly in the TwinCAT PLC with IEC 61850/IEC 61400-25 Telecontrol in TwinCAT 3. IEC 61850 provides data models for substation communication. IEC 61400-25 is based on IEC 61850 and offers specific extensions of the data model for wind farm communication. The respective server is configured using the TwinCAT telecontrol configurator. This decouples the configuration work from the programming work in the PLC and generates the corresponding PLC code. The PLC code can be imported into new or existing PLC projects.	RFID Reader Communication allows various RFID readers to be addressed via a serial interface. The new TwinCAT RFID reader library offers a general abstract interface that can be used for all readers. The configuration can easily be adapted to a specific reader.	TwinCAT S5/S7 Communication allows the simple connection of TwinCAT to an S5 or S7 controller. The data blocks, flags, inputs, outputs, counters and timers of an S5 or S7 controller can be accessed using function blocks. The communication takes place using TCP/IP.
Performance class (pp)	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – x x x 60 70 80 90 x x x x	20 30 40 50 – x x x 60 70 80 90 x x x x
Required	TC1200	TC1200	TC1200	TC1200
Target system	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE	Windows XP, Windows 7/8, Windows CE
Further information	www.beckhoff.com/TF6500	www.beckhoff.com/TF6510	www.beckhoff.com/TF6600	www.beckhoff.com/TF6610

TF8xxx | TwinCAT 3 Industry specific

	TC3 BA Connectivity Library	TC3 Building Automation	TC3 Wind Framework
Technical data	**TF8000-00pp**	**TF8040-00pp**	**TF8310-00pp**
	The TwinCAT BA Connectivity Library simplifies the programming of Bus Terminals for building automation. It contains all libraries for communication with the following fieldbus systems: – DALI: KL6811 – DMX: EL6851, EL6851-0010 – EnOcean: KL6021-0023, KL6023 and KL6581, KL6583, KL6583-0100 – EIB: KL6301 – LON: KL6401 – M-Bus: KL6781 – MP-Bus: KL6771 – SMI: KL6831, KL6841 – GENIbus: KL6041, EL6021	TC3 Building Automation is a software package that covers all technical building automation services. It contains PLC libraries for control, signal processing, special mathematical functions, alarm processing and general system functions. In addition to modules for conventional HVAC applications it also covers room automation including lighting, air-conditioning and shading.	The TwinCAT 3 Wind Framework is based on the modular architecture of TwinCAT 3 and provides control technology and industry expertise in the form of encapsulated modules and an application template. TcCOM modules provide higher-level system services. The status module enables the monitoring of all components and includes error detection, event management, error handling and reporting. The parameter and command modules provide services for configuration and interaction with the system. The acquisition of signals and their statistical analysis is supported by the capture and statistic module. The user module checks, manages and logs all interactions by the user. The recording of all events and signals as well as the saving and loading of the entire configuration are enabled by the database module, which is based on an SQL database. The programming of the operational management using these services is simplified by a PLC library and a complete sample application. When using the TC3 Wind Framework, each subsystem of the wind turbine system (such as converters, pitch, etc.) is representing an individual module. Each subsystem module comes with a specific set of information and settings. These properties integrate themselves via specific objects from the framework into the higher-level services and operational management. When replacing a subsystem module, the associated objects are automatically integrated into the services. In this way a group of objects is created that represent the complete system and enable the monitoring and parametrisation of the turbine. Nevertheless, these subsystem modules are self-contained and reusable in another operational management or test environment.

Performance class (pp)	20	30	40	50	20	30	40	50	20	30	40	50
	–	x	x	x	–	x	x	x	–	–	x	x
	60	70	80	90	60	70	80	90	60	70	80	90
	x	x	x	x	x	x	x	x	x	x	x	–
Required	TC1200				TC1200				TC1000			
Target system	Windows XP, Windows 7/8, Windows CE				Windows XP, Windows 7/8, Windows CE				Windows 7/8			
Further information	www.beckhoff.com/TF8000				www.beckhoff.com/TF8040				www.beckhoff.com/TF8310			

TwinCAT 2



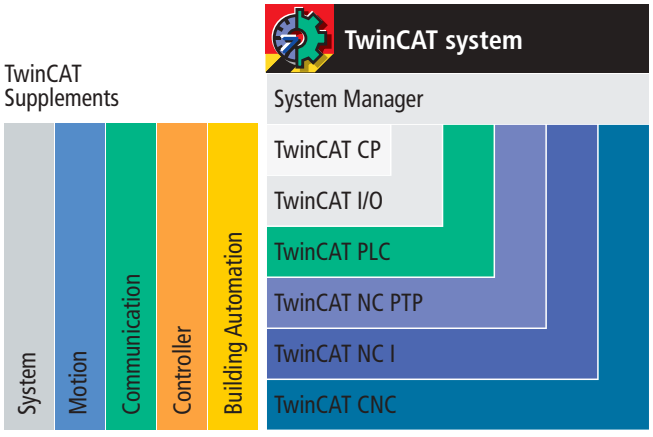
The Windows Control and Automation Technology

The Beckhoff TwinCAT software system transforms almost any compatible PC into a real-time controller with multi-PLC system, NC axis control, programming environment and operating station. At the same time, TwinCAT integrates the programming environment for all Beckhoff controllers: from high-end Industrial PC control to embedded controller.

TwinCAT architecture

TwinCAT consists of runtime systems for real-time execution of control programs and development environments for programming, configuration and diagnostics:

- TwinCAT I/O: versatile I/O interface for all common fieldbuses
- TwinCAT PLC: enables programming of up to four PLC runtimes on a single PC. The PLC program can optionally be written in one or several IEC 61131-3 languages (IL, LD, FBD, SFC, ST) or CFC.
- TwinCAT NC: enables simultaneous positioning of many axes. The levels NC PTP (point-to-point positioning), NC I (linear and circular interpolating movements of axis groups with up to eight drives) and CNC (extension of NC I with conventional CNC features for up to 32 interpolating axes per channel) are available for this purpose.



▶ **www.beckhoff.com/TwinCAT2**

Product overview TwinCAT 2

TX1200 | TwinCAT PLC

944

PC hardware	standard PC/IPC hardware, no extras
Operating systems	Windows NT/2000/XP/Vista, Windows 7, NT/XP/Windows 7 Embedded, CE*
Real-time	Beckhoff real-time kernel
I/O system	EtherCAT, Lightbus, PROFIBUS DP/MC, Interbus, CANopen, DeviceNet, SERCOS, Ethernet
Runtime system	4 multi-tasking PLCs each with 4 tasks in each PLC runtime system, development and runtime systems on one PC or separately (CE: only runtime)
Memory	process image size, flags area, program size, POU size, number of variables only limited by the size of the user memory (max. 2 GB with NT/2000/XP/Vista)
Cycle time	adjustable from 50 µs
Link time	1 µs (Intel® Core™2 Duo) for 1,000 PLC commands
Programming	IEC 61131-3: IL, FBD, LD, SFC, ST, powerful library management, convenient debugging

TX1250 | TwinCAT NC PTP

945

TwinCAT PLC	inclusive 944
PC hardware	standard PC/IPC hardware, no extras
Operating systems	Windows NT/2000/XP/Vista, Windows 7, NT/XP/Windows 7 Embedded, CE*
Real-time	Beckhoff real-time kernel
I/O system	EtherCAT, Lightbus, PROFIBUS DP/MC, Interbus, CANopen, DeviceNet, SERCOS, Ethernet
Programming	performed using function blocks for TwinCAT PLC according to IEC 61131-3 (standardised PLCopen Motion Control libraries), convenient axis commissioning menus in the System Manager
Runtime system	NC point-to-point including TwinCAT PLC
Number of axes	up to 255
Axis types	electrical and hydraulic servo drives, frequency converter drives, stepper motor drives, switched drives (fast/crawl axes)
Cycle time	50 µs upwards, typically 1 ms (selectable)
Axis functions	standard axis functions: start/stop/ reset/reference, speed override, special functions: master/slave cascading, cam plates, electronic gearings, online distance compensation of segments, "flying saw"

TX1100 | TwinCAT I/O

947

PC hardware	standard PC/IPC hardware, no extras
Operating systems	Windows NT/2000/XP/Vista, Windows 7, NT/XP/Windows 7 Embedded, CE (only runtime)*
Real-time	Beckhoff real-time kernel

Multi-purpose I/O interface for all common fieldbus systems, PC Fieldbus Cards and interfaces with integrated real-time driver

TX1000 | TwinCAT CP

947

PC hardware	standard PC/IPC hardware, no extras
Operating systems	Windows NT/2000/XP/Vista, Windows 7, NT/XP/Windows 7 Embedded*
Real-time	Beckhoff real-time kernel

Windows driver for Beckhoff Control Panel

* version-dependent

TX1260 | TwinCAT NC I

945

TwinCAT PLC	inclusive 944
TwinCAT NC PTP	inclusive 945
PC hardware	standard PC/IPC hardware, no extras
Operating systems	Windows NT/2000/XP/Vista, Windows 7, NT/XP/Windows 7 Embedded, CE*
Real-time	Beckhoff real-time kernel
I/O system	EtherCAT, Lightbus, PROFIBUS DP/MC, Interbus, CANopen, DeviceNet, SERCOS, Ethernet
Programming	DIN 66025 programs for NC interpolation, access via function blocks from TwinCAT PLC according to IEC 61131-3
Runtime system	NC interpolation, including TwinCAT NC PTP and PLC
Number of axes	max. 3 axes and up to 5 auxiliary axes per group, 1 group per channel, max. 31 channels
Axis types	electrical servo axes, stepper motor drives
Interpreter functions	subroutines and jumps, programmable loops, zeroshifts, tool compensations, M and H functions
Geometries	straight lines and circular paths in 3-D space, circular paths in all main planes, helixes with base circles in all main planes linear, circular, helical interpolation in the main lanes and freely definable planes, Bezier splines, look-ahead function
Axis functions	online reconfiguration of axes in groups, path override, slave coupling to path axes, auxiliary axes, axis error and sag compensation, measuring functions
Operation	automatic operation, manual operation (jog/inching), single block operation, referencing, handwheel operation (motion/superposition)

TS511x | TwinCAT NC I Options

Options	TS511x | **TwinCAT Kinematic Transformation** 956

TX1270 | TwinCAT CNC

946

TwinCAT PLC	inclusive 944
TwinCAT NC PTP	inclusive 945
TwinCAT NC I	inclusive 945
PC hardware	standard PC/IPC hardware, no extras
Operating systems	Windows NT/2000/XP/Vista, Windows 7, Windows NT/XP/Windows 7 Embedded*
Real-time	Beckhoff real-time kernel
I/O system	EtherCAT, Lightbus, PROFIBUS DP/MC, CANopen, DeviceNet, SERCOS, Ethernet
Programming	DIN 66025 programming language with high-level language extensions, access via function blocks from TwinCAT PLC according to IEC 61131-3
Runtime system	CNC, including TwinCAT NC I, NC PTP, PLC
Number of axes/spindles	8 path axes/controlled spindles, max. of 64 axes/controlled spindles (optional), max. 12 channels (optional)
Axis types	electrical servo-axes, analog/encoder interface via fieldbus, digital interface via fieldbus
Interpreter functions	subroutines and jumps, programmable loops, zero shifts, tool compensations, M and H functions, mathematical functions, programming of parameters/variables, user macros, spindle and help functions, tool functions
Geometries	linear, circular, helical interpolation in the main planes and freely definable planes, max. 32 interpolating path axes per channel, look-ahead function
Axis functions	coupling and gantry axis function, override, axis error and sag compensation, measuring functions
Operation	automatic operation, manual operation (jog/inching), single block operation, referencing, block search, handwheel operation (motion/superposition)

TS52xx | TwinCAT CNC Options

Options	TS5220 | **TwinCAT CNC Axes Pack**
	TS5230 | **TwinCAT CNC Channel Pack**
	TS5240 | **TwinCAT CNC Transformation**
	TS5250 | **TwinCAT CNC HSC Pack**
	TS5260 | **TwinCAT CNC Spline Interpolation**

TwinCAT 2 Supplements

TwinCAT 2 Supplements | System

TS1010 | **TwinCAT Eventlogger**	alarm and diagnostic system for logging events which occur in the TwinCAT system	948
TS1110 | **TwinCAT Simulation Manager**	simplified preparation and configuration of a simulation environment	949
TS1120 | **TwinCAT ECAD Import**	importing engineering results from an ECAD program	948
TS1140 | **TwinCAT Management Server**	central administration of Beckhoff CE control systems	951
TS1150 | **TwinCAT Backup**	backing up and restoring files, operating system and TwinCAT settings	949
TS1600 | **TwinCAT Engineering Interface Server**	co-ordinating programming tasks via a central source code management system	948
TS1800 | **TwinCAT PLC HMI**	displaying visualisations created in PLC Control	950
TS1800 | **TwinCAT PLC HMI CE** -0030	displaying visualisations created in PLC Control on Windows CE platforms	950
TS1810 | **TwinCAT PLC HMI Web**	displaying visualisations created in PLC Control in a web browser	950
TS3300 | **TwinCAT Scope 2**	graphical analysis tool for displaying time-continuous signals	951
TS3900 | **TwinCAT Solar Position Algorithm**	precise calculation of the sun's position	951
TS622x | **TwinCAT EtherCAT Redundancy**	extension of the TwinCAT EtherCAT master with cable redundancy capability	951
TS6420 | **TwinCAT Database Server**	accessing databases from the PLC	949
TS6420 | **TwinCAT Database Server CE** -0030	accessing databases from the PLC for Windows CE platforms	950
TS6421 | **TwinCAT XML Data Server**	reading and writing of XML-based data by the PLC	948
TS6421 | **TwinCAT XML Data Server CE** -0030	reading and writing of XML-based data by the PLC for Windows CE platforms	949

TwinCAT 2 Supplements | Controller

TS4100 | **TwinCAT PLC Controller Toolbox**	modules for basic controllers (P, I, D), complex controllers (PI, PID), pulse width modulation, ramps, signal generators and filters	952
TS4110 | **TwinCAT PLC Temperature Controller**	instanced temperature control function block for monitoring and controlling different temperature ranges	952

TwinCAT 2 Supplements | Motion

TS1500 | **TwinCAT Valve Diagram Editor**	graphical tool for designing the characteristic curve of a hydraulic valve	956
TS1510 | **TwinCAT Cam Design Tool**	graphic design tool for electronic cam plates	955
TS5050 | **TwinCAT NC Camming**	using the TwinCAT NC cam plate functionality (table coupling)	955
TS5055 | **TwinCAT NC Flying Saw**	implementing "flying saw" functionality	954
TS5060 | **TwinCAT NC FIFO Axes**	implementation of a pre-defined user setpoint generator for an NC axis	954
TS5065 | **TwinCAT PLC Motion Control XFC**	high-precision logging and switching of digital signals in relation to axis positions	953
TS5066 | **TwinCAT PLC Remote Synchronisation**	remote synchronisation	954
TS511x | **TwinCAT Kinematic Transformation**	implementation of different kinematic transformations for TwinCAT PTP or TwinCAT NC I	956
TS5800 | **TwinCAT Digital Cam Server**	software implementation of fast cam controller	955
TS5810 | **TwinCAT PLC Hydraulic Positioning**	control and adjustment of hydraulic axes	953

TwinCAT 2 Supplements | Communication

TS6100 | **TwinCAT OPC UA Server**	access to TwinCAT in accordance with OPC UA with UA server (DA/HA/AC) and UA client (DA)	960
TS6100 | **TwinCAT OPC UA Server CE** -0030	access to TwinCAT in accordance with OPC UA with UA server (DA/HA/AC) and UA client (DA) for Windows CE platforms	960

TwinCAT 2 Supplements | Communication

TS6120 | **TwinCAT OPC Server**	access to TwinCAT variables in accordance with the OPC DA/OPC XML DA specification	960
TS6250 | **TwinCAT Modbus TCP Server**	communication with Modbus TCP devices (server and client functionality)	958
TS6250 | **TwinCAT Modbus TCP Server CE** -0030	communication with Modbus TCP devices (server and client functionality) for Windows CE platforms	958
TS6255 | **TwinCAT PLC Modbus RTU**	serial communication with Modbus end devices	957
TS6270 | **TwinCAT PROFINET RT Device**	TwinCAT PROFINET RT device turns every PC-based controller into a PROFINET RT device.	962
TS6271 | **TwinCAT PROFINET RT Controller**	TwinCAT PROFINET RT controller turns every PC-based controller into a PROFINET RT controller.	962
TS6280 | **TwinCAT EtherNet/IP Slave**	TwinCAT EtherNet/IP slave turns every PC-based controller into an EtherNet/IP slave.	962
TS6300 | **TwinCAT FTP Client**	basic access from TwinCAT PLC to FTP server	963
TS6310 | **TwinCAT TCP/IP Server**	communication via generic TCP servers	961
TS6310 | **TwinCAT TCP/IP Server CE** -0030	communication via generic TCP servers for Windows CE platforms	961
TS6340 | **TwinCAT PLC Serial Communication**	communication via serial Bus Terminals or PC COM ports	957
TS6341 | **TwinCAT PLC Serial Communication 3964R/RK512**	communication via serial Bus Terminals or PC COM ports with the 3964R and RK512 protocol	957
TS6350 | **TwinCAT SMS/SMTP Server**	sending SMS and e-mails from the PLC	961
TS6350 | **TwinCAT SMS/SMTP Server CE** -0030	sending SMS and e-mails from the PLC for Windows CE platforms	961
TS6360 | **TwinCAT Virtual Serial COM Driver**	virtual serial COM driver for Windows and Windows CE platforms	963
TS6370 | **TwinCAT DriveCOM OPC Server**	fieldbus-independent communication connections between the engineering tool and the drive	959
TS6371 | **TwinCAT DriveTop Server**	configuring Indramat SERCOS drives with DriveTop software on TwinCAT systems	959
TS650x | **TwinCAT PLC IEC 60870-5-101, -102, -103, -104 Master**	implementation of IEC 60870-101, -102, -103 and -104 masters	958
TS6506 | **TwinCAT PLC IEC 60870-5-104** -0030 **Master CE**	implementation of IEC 60870-104 masters under Windows CE	958
TS6507 | **TwinCAT PLC IEC 60870-5-101, -104 Slave**	implementation of IEC 60870-101 and -104 slaves	958
TS6507 | **TwinCAT PLC IEC 60870-5-104** -0030 **Slave CE**	implementation of IEC 60870-104 slaves under Windows CE	958
TS6509 | **TwinCAT PLC IEC 61400-25 Server**	IEC 61400-25 communication	959
TS6511 | **TwinCAT PLC IEC 61850 Server**	IEC 61850 communication	959
TS6600 | **TwinCAT PLC RFID Reader Communication**	connection of RFID readers to the TwinCAT PLC	963
TS6610 | **TwinCAT PLC S5/S7 Communication**	communication with S5/S7 controllers	963

TwinCAT 2 Supplements | Building Automation

TS8000 | **TwinCAT PLC HVAC**	automation of HVAC and sanitary installations	964
TS8010 | **TwinCAT PLC Building Automation Basic**	executing basic room automation functions	964
TS8020 | **TwinCAT BACnet/IP**	communication with the data networks of the building automation and building control systems	964
TS8035 | **TwinCAT FIAS Server**	communication between TwinCAT PLC and a system using the FIAS standard	965
TS8036 | **TwinCAT Crestron Server**	communication between a TwinCAT PLC and a Crestron controller	965
TS8037 | **TwinCAT Bang & Olufsen Server**	communication between a TwinCAT PLC and a Bang & Olufsen audio/video installation	965
TS8040 | **TwinCAT Building Automation**	software package covering all technical building automation services	965
TS8100 | **TwinCAT Building Automation Framework**	configuration and commissioning of building automation projects	965

TX12xx | TwinCAT 2

TwinCAT PLC

Technical data	TX1200
	TwinCAT PLC realises one or more PLCs with the international standard IEC 61131-3 on one CPU. All programming languages described in the standard can be used for programming. The blocks of the type PROGRAM can be linked with real-time tasks. Various convenient debugging options facilitate fault-finding and commissioning. Program modifications can be carried out at any times and in any size online, i.e. when the PLC is running. All variables are available symbolically by ADS and can be read and written in appropriate clients. – process image size, flag range, program size, POU size and number of variables are limited only by size of RAM – cycle times from 50 µs – link time: typically 1 µs (Intel® Core™2 Duo) – IEC 61131-3: IL, FBD, LD, SFC, ST, CFC – online changes in programs and variables – remote debugging via TCP/IP – online connection with PLC runtime system worldwide via TCP/IP or fieldbus – online monitoring of variables in variable lists, watch windows, editors – online status and powerflow (accumulator contents) of programs and instances – triggering, forcing and setting variables – powerful debugging with single cycle, break points, step in, step over, display of the current call stack, watchlist shows selection of variable, trace functions – online management of all variable names and structures across the whole system – remanent and persistent data, UPS supported storage on hard disk, storage in NOVRAM as option – variable reading and writing access via ADS, OPC – certified in accordance with PLCopen base level (IL/ST) – source code is stored in the target system – convenient library management – powerful compiler with incremental compilation – all common data types, structures, arrays, including multi-dimensional arrays – convenient creation of programs with: autoformat, autodeclare, cross-reference, search/replace, project comparison
Target system	version-dependent: Windows NT/2000/XP, Windows 7, Windows Embedded NT/XP/WES2009/WES7, Windows CE (only runtime)
Further information	www.beckhoff.com/TX1200

	TwinCAT NC PTP	TwinCAT NC I
	TX1250	**TX1260**
	TwinCAT NC PTP implements Motion Control for point-to-point movements in software. The axes are represented by axis objects and provide a cyclic interface, e.g. for the PLC. This axis object is then linked to a corresponding physical axis. In this way, the most diverse axis types with the most diverse fieldbus interfaces can be connected abstractly with the axis objects, which always offer an identical configuration interface. The control of the axes can be configured in various conformations (position or velocity interface) and various controllers. The axes are configured in TwinCAT Engineering. – max. 255 axes – supports electrical and hydraulic servo drives, frequency converter drives, stepper motor drives, DC drives, switched drives (fast/slow axes), simulation axes and encoder axes – supports various encoders such as incremental encoder, absolute encoder, digital interface to the drives such as EtherCAT, SERCOS, SSI, Lightbus, PROFIBUS DP/MC, pulse train – standard axis functions such as start/stop/reset/reference, velocity override, master/slave couplings, electronic gearbox, online distance compensation – programming is carried out via PLCopen-compliant IEC 61131-3 function blocks – convenient axis commissioning options – online monitoring of all axis state variables such as actual/setpoint values, releases, control values, online axis tuning – forcing of axis variables – configuration of all axis parameters, such as measuring system, drive parameters and position controller – configurable controller structures: P control, PID control, PID with velocity pre-control, PID with velocity and acceleration pre-control – online master/slave and slave/master conversion – flying saw (diagonal saw [optional]) – cam plates (support by TwinCAT Cam Design Tool [optional]) – FIFO axes – external set point value generators – multi-master coupling	Using TwinCAT NC I, movements can be implemented with up to three interpolating and up to five auxiliary axes in the interpolation package. Various axis types with various fieldbus interfaces are supported. The movement is usually programmed in DIN 66025, but it can also alternatively be carried out via PLC function blocks. – max. 3 path axes and up to 5 auxiliary axes per group – 1 group per channel, max. 31 channels – supports electric servo axes, stepper motor drives – interpreter functions such as subroutine and jump technology, programmable loops, zero point shifts, tool corrections, M and H functions – geometry functions: straight lines and circles in 3-D space, circles at all main levels, helices with base circles at all main levels, linear, circular and helical interpolation at the main levels and freely definable levels, Bezier splines, look-ahead function – online reconfiguration of axes in groups, path override, slave coupling to path axes, auxiliary axes, axis error and sag compensation, measuring functions – programming in DIN 66025 – access alternatively via function blocks according to IEC 61131-3 – operation of automatic mode, manual mode (jog/inch), single block mode, referencing, handwheel mode (movement/overlay) – convenient debugging with online monitoring of current setpoint/actual position (position lag of all axes), NC program line currently being processed, NC program line currently being interpreted, channel status
	version-dependent: Windows NT/2000/XP, Windows 7, Windows Embedded NT/XP/WES2009/WES7, Windows CE (only runtime)	version-dependent: Windows NT/2000/XP, Windows 7, Windows Embedded NT/XP/WES2009/WES7, Windows CE (only runtime)
	www.beckhoff.com/TX1250	www.beckhoff.com/TX1260

TX1xxx | TwinCAT 2

TwinCAT CNC

Technical data	TX1270
	TwinCAT CNC offers the option to implement interpolation with up to 32 simultaneously interpolating axes. The number of axes and/or the number of channels can be adapted to the requirements of the application via the option packages. Various transformations can be supplemented via option packages. Programming takes place according DIN 66025. The axes and channels are configured in TwinCAT Engineering. – 8 path axes/controlled spindles, max. 64 axes/controlled spindles (optional), max. 12 channels (optional) – supports electric servo axes, stepper motor drives – subroutine and jump technology, programmable loops, zero point shifts, tool corrections, M and H functions, mathematical functions, programming of parameters/variables, user macros, spindle and auxiliary functions, tool functions – geometry functions linear, circular and helical interpolation at the main levels and freely definable levels, max. 32 interpolating path axes per channel (optional), look-ahead function – axis functions, coupling and gantry axis function, override, axis error and sag compensation, measuring functions – programming in DIN 66025 with high-level language extension – access via function blocks from TwinCAT PLC according to IEC 61131-3 – operation with automatic mode, manual mode (jog/inch), single block mode, referencing, block advance, handwheel mode (movement/overlay) – convenient debugging with online monitoring of all states
Target system	version-dependent: Windows NT/2000/XP, Windows 7, Windows Embedded NT/XP/WES2009/WES7
Further information	www.beckhoff.com/TX1270

	TwinCAT I/O	TwinCAT CP
	TX1100	**TX1000**

	Using TwinCAT I/O, cyclic data can be collected by different fieldbuses in process images. Cyclic tasks drive the corresponding fieldbuses. Various fieldbuses can be operated with different cycle times on one CPU. Applications can directly access the process image. The fieldbuses and the process images are configured in TwinCAT Engineering.
	– provides variable-oriented linkage of I/O devices to tasks
	– tasks are variable-oriented among each other
	– the smallest unit is one bit
	– supports both synchronous and asynchronous relationships
	– consistent exchange of data areas and process images
	– online display in the directory tree
	– online watch window
	– "Force and Write" for commissioning and for testing task variables and I/O devices
	– supported fieldbuses:
	  – EtherCAT
	  – Lightbus
	  – PROFIBUS DP (master and slave)
	  – Interbus
	  – CANopen
	  – SERCOS interface
	  – DeviceNet
	  – Ethernet
	  – USB
	– SMB (System Management Bus)
		TwinCAT CP is a driver for the Beckhoff Control Panels C6xxx and C7xxx, the industrial operating and display devices.
		Control Panels are optimised for use as a human-machine interface. Operating and display elements create an independent unit, separated from the PC by a simple cable link.
		TwinCAT CP creates the driver connection between general Windows programs and the operating and display elements on the Beckhoff Control Panel:
		– direct switches for fast machine functions
		– switch feedback by LEDs
		– UPS support
		The driver permits variable-oriented operation of the Control Panel's functions by the Windows programs.

	version-dependent: Windows NT/2000/XP, Windows 7, Windows Embedded NT/XP/WES2009/WES7, Windows CE (only runtime)	version-dependent: Windows NT/2000/XP, Windows 7, Windows Embedded NT/XP/WES2009/WES7
	www.beckhoff.com/TX1100	www.beckhoff.com/TX1000

TSxxxx | TwinCAT 2 Supplements, System

	TwinCAT ECAD Import	TwinCAT Engineering Interface Server	TwinCAT Eventlogger	TwinCAT XML Data Server
Technical data	**TS1120**	**TS1600**	**TS1010**	**TS6421**
	TwinCAT ECAD Import serves the purpose of importing already existing engineering results from an ECAD program. It enables the import of information about the structure of the I/Os and their links to PLC variables, which is exported from the ECAD tool by means of XML description. On the basis of this information a system manager configuration and a basic PLC program with the I/O variables used are generated. The generation of NC devices is also possible.	With the TwinCAT Engineering Interface (ENI) server it is possible for the work of a number of programmers to be coordinated via a central source code management system. The TwinCAT ENI server offers interfaces with Microsoft Visual Source Safe and a driver for Subversion (SVN). A user and rights management is as much part of the product as a database-independent diagnostic tool, which gives an overview of all current tasks of the various users.	The TwinCAT Eventlogger is an alarm and diagnostic system for TwinCAT-based controllers. The TwinCAT Eventlogger has the task of managing all messages (events) appearing in the TwinCAT system; to forward them and where necessary to write them into the TwinCAT log file. In this context "events" are understood to comprise alarms, warnings, notes or instructions. Messages can be acknowledged. The Message Formatter produces the connection between the actual event and its message text. This is stored in an external database. By integration of the TcEventViewer type library it is possible, to create your own message display. Configuration of the message text is done by the TcEvent configurator. The event logger is included in the main TwinCAT delivery.	The TwinCAT XML Data Server permits direct access to an XML file from the PLC. The values of variables can be read by the PLC or written to the XML file. Access to structures in the PLC is also possible.
Target system	Windows NT/2000/XP, Windows 7	Windows NT/2000/XP, Windows 7	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7
Min. TwinCAT level	TwinCAT PLC/TwinCAT NC PTP (for NC devices)	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
Further information	www.beckhoff.com/TS1120	www.beckhoff.com/TS1600	www.beckhoff.com/TS1010	www.beckhoff.com/TS6421

	TwinCAT XML Data Server CE	TwinCAT Backup	TwinCAT Simulation Manager	TwinCAT Database Server
	TS6421-0030	TS1150	TS1110	TS6420
	The TwinCAT XML Data Server CE permits direct access to an XML file from the PLC. The values of variables can be read by the PLC or written to the XML file. Access to structures in the PLC is also possible.	Files, directories, OS-specific information, settings and TwinCAT configurations can be backed up and restored using the TwinCAT Backup Server. This can be carried out on all connected media and also via the network.	The TwinCAT Simulation Manager is a tool for simplified configuration of a simulation environment, which integrates into the TwinCAT system environment. It supports the creation of a "virtual machine", which corresponds to a real one in its runtime performance.	TwinCAT Database Server enables the exchange of data between databases and the TwinCAT system. PLC variables or direct values of the EtherCAT I/Os can be logged cyclically when changes occur or event-controlled by means of PLC function blocks.
	Windows CE	Windows NT/2000/XP, Windows 7	Windows NT/2000/XP, Windows 7	Windows NT/2000/XP, Windows 7
	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
	www.beckhoff.com/TS6421-0030	www.beckhoff.com/TS1150	www.beckhoff.com/TS1110	www.beckhoff.com/TS6420

TSxxxx | TwinCAT 2 Supplements, System

	TwinCAT Database Server CE	TwinCAT PLC HMI	TwinCAT PLC HMI CE	TwinCAT PLC HMI Web
Technical data	**TS6420-0030**	**TS1800**	**TS1800-0030**	**TS1810**
	The TwinCAT Database Server CE has the same functional attributes as the version which runs on non-CE operating systems. The only difference is the range of supported databases: MS SQL, MS SQL Compact and ASCII files.	TwinCAT PLC HMI is a stand-alone tool for the presentation of visualisations which are created in TwinCAT PLC Control. They are shown in full-screen as soon as the system starts up.	TwinCAT PLC HMI CE is a stand-alone tool for the presentation of visualisations which are created in TwinCAT PLC Control. They are shown in full-screen as soon as the system starts up.	TwinCAT PLC HMI Web is a web-based visualisation system. The TwinCAT PLC Control acts as an editor for the generation of web pages. Activation is carried out simply by setting an option in the TwinCAT PLC Control. The web pages are hosted by the Internet Information Server (IIS). For display of the web pages a Java VM is needed.
Target system	Windows CE	Windows NT/2000/XP, Windows 7	Windows CE	Windows NT/2000/XP, Windows 7, Windows CE
Min. TwinCAT level	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
Further information	www.beckhoff.com/TS6420-0030	www.beckhoff.com/TS1800	www.beckhoff.com/TS1800-0030	www.beckhoff.com/TS1810

	TwinCAT Management Server	TwinCAT Scope 2	TwinCAT EtherCAT Redundancy	TwinCAT Solar Position Algorithm
	TS1140	**TS3300**	**TS622x**	**TS3900**
	The TwinCAT Management Server enables the central administration of Beckhoff CE controllers. Software updates, for example, can thus be loaded onto controllers in the network from a central location. In addition to operating system updates, device-specific components (PLC boot projects) can also be loaded. By the option of separating known network devices into groups, individual actions can be defined for each group.	With the TwinCAT Scope 2 Beckhoff offers a graphical tool for signal analysis and data collection. Due to the separation of the data logger and viewer it is possible to show the signal processes of multiple systems in the field in a central Scope 2 view. Depending on the system it is possible to browse, for example in the PLC, NC or directly in the connected EtherCAT I/Os, in order to select the corresponding values. Alongside the possibility of long-term recording, various trigger functionalities and cursors are available in the TwinCAT Scope 2.	With TwinCAT EtherCAT Redundancy the TwinCAT EtherCAT master offers the possibility of implementing cable redundancy. From the last logical device a cable is returned back to the master. The TwinCAT System Manager is used for configuration and diagnostics.	With the TwinCAT Solar Position Algorithm it is possible to determine the sun angle using the date, time, geographical longitude and latitude as well as further parameters (depending on the desired accuracy). The function block works with a maximum inaccuracy of ±0.001°.
	Windows NT/2000/XP, Windows 7	Windows XP, Windows 7	Windows NT/2000/XP, Windows 7, Windows NT/XP Embedded, Windows CE	Windows XP, Windows CE
	TwinCAT I/O	TwinCAT I/O	TwinCAT I/O	TwinCAT PLC
	www.beckhoff.com/TS1140	www.beckhoff.com/TS3300	www.beckhoff.com/TS622x	www.beckhoff.com/TS3900

TS4xxx | TwinCAT 2 Supplements, Controller

	TwinCAT PLC Controller Toolbox	TwinCAT PLC Temperature Controller
Technical data	**TS4100**	**TS4110**
	The TwinCAT Controller Toolbox covers all essential blocks for control applications. – controllers satisfy industrial requirements such as anti-reset windup – simple basic controllers (P, I, D) – complex controllers (PI, PID, switching controllers) – filter blocks – control value generators (limiters, PWM) – ramp and signal generator blocks	Temperature controllers can be simply implemented using TwinCAT Temperature Controller. Simple commissioning through self-adjustment of the controller (auto-tuning) is included. – automatic and manual operation with shock-free set up – control value analog or pulse-width modulated signal – tolerance monitoring, absolute value monitoring – scalable reaction to sensor error and heating power faults – limitation of set and control values – optional ramping of the set value – optional start-up phase for the setpoint variables – industrial PID controller as base control algorithm inside the temperature controller
Target system	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE
Min. TwinCAT level	TwinCAT PLC	TwinCAT PLC
Further information	www.beckhoff.com/TS4100	www.beckhoff.com/TS4110

TS5xxx | TwinCAT 2 Supplements, Motion

	TwinCAT PLC Motion Control XFC	TwinCAT PLC Hydraulic Positioning
Technical data	**TS5065**	**TS5810**
	eXtreme Fast Control (XFC) is the technique that enables very fast, temporally high-precision reactions using EtherCAT, special I/O terminals and TwinCAT on the PC. Using EtherCAT Distributed Clocks (DC) and appropriate terminals, distributed latches or cam controllers can be implemented simply in this way. – function blocks for the high-precision acquisition and switching of digital signals related to axis positions – EtherCAT Distributed Clocks with the time-stamp-based EtherCAT EL1252, EL2252 or EL2262 input and output terminals – blocks for the conversion of DC time to position and vice versa – convenient PLCopen-compliant TouchProbe block – digital cam controller as PLCopen-compliant block	Algorithms for the control and positioning of hydraulic axes are combined in TwinCAT Hydraulic Positioning and are available as PLCopen-compliant PLC blocks. – for the positioning and control of hydraulic axes – functions for the conversion of sensor signals to actual positions and of control values to output data – point-to-point movements, alternatively with time- or displacement-controlled ramps – position control, pressure output with the correct sign, automatic repositioning – optimisation and monitoring of the behaviour with further functions (e.g. dead time compensation, limit value monitoring)
Target system	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE
Min. TwinCAT level	TwinCAT NC PTP	TwinCAT NC PTP
Further information	www.beckhoff.com/TS5065	www.beckhoff.com/TS5810

TSxxxx | TwinCAT 2 Supplements, Motion

	TwinCAT NC FIFO Axes	TwinCAT NC Flying Saw	TwinCAT PLC Remote Synchronisation
Technical data	**TS5060**	**TS5055**	**TS5066**
	Using TwinCAT NC FIFO Axes, externally generated set position values can be output to the axes in the form of a velocity pre-control. The set value generation is designed in such a way that both the set position and the set velocity are determined as the FIFO inputs are worked through in sequence. It is also possible, if necessary, to interpolate between two neighbouring FIFO inputs.	TwinCAT NC Flying Saw implements the coupling of a slave axis to a master axis in a certain synchronous position (flying saw). PLC function blocks enable coupling and uncoupling as well as parameterisation. – The master axis can be a real axis, a virtual axis, or some other external source of actual values. – synchronisation of the slave axis from any motion situation (stop, forward or reverse travel) with the master in motion – simple synchronisation with the master velocity – precise position synchronisation with the master axis (velocity and position) – synchronous velocity can be set via a coupling factor – optional return prevention as additional safety function – superimposed section compensation during the synchronous phase for dynamic position correction	Due to the increasing use of decentralised controllers, time synchronisation of different systems is becoming an increasingly important issue. The implementation of cyclically-sent information on systems without identical timebase leads to a beat effect. These manifest themselves for example as periodic operational faults in the synchronisation of drives, whose axis information is transferred via network. The TwinCAT PLC Remote Synchronisation library offers options for general time synchronisation of information with distributed systems as well as special techniques for synchronising NC axes ("distributed axes").
Target system	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE
Min. TwinCAT level	TwinCAT NC PTP	TwinCAT NC PTP	TwinCAT PLC
Further information	www.beckhoff.com/TS5060	www.beckhoff.com/TS5055	www.beckhoff.com/TS5066

	TwinCAT NC Camming	TwinCAT Cam Design Tool	TwinCAT Digital Cam Server
	TS5050	TS1510	TS5800
	TwinCAT NC Camming (cam plate) is a non-linear relationship between a master and a slave axis. The camming package offers various options for the storage of cam plates. Convenient PLC blocks enable the loading, coupling and uncoupling of cam plates. It is possible to load new cam plates or to modify cam plates during operation. The TwinCAT CAM Design Editor offers support for the creation of the cam plates. – position tables with master interpolation points and corresponding slave positions; interpolation between the points is done linearly or by splines – motion function table describing a cam plate via motion laws according to VDI guideline 2143 – cyclic or linear processing – cam plate with offset and scale, can be modified on the master or slave side – high flexibility through online change of the motion functions	The TwinCAT CAM Design Editor allows the generation and modification of cam plates with the aid of a graphical editor. These are composed of sections of laws of motion such as modified sine waves, harmonic combinations, or of various polynomial functions. Velocity, acceleration and jerk are displayed in addition to the slave position. The generated cam plates can be transferred to the NC as tables with specified step size or as so-called motion functions.	The TwinCAT Digital Cam Server is a fast cam controller with monitoring for various fieldbuses. The cams are configured in TwinCAT Engineering. – high-performance fieldbus-independent cam controller with many functions – up to 320 outputs – up to 180 cams per output – path-path cams, path-time cams, brake cams – dynamic speed correction – measurement and monitoring of rotary speed
	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7	Windows NT/2000/XP, Windows 7, Windows CE
	TwinCAT NC PTP	TwinCAT NC PTP	TwinCAT NC PTP
	www.beckhoff.com/TS5050	www.beckhoff.com/TS1510	www.beckhoff.com/TS5800

TSxxxx | TwinCAT 2 Supplements, Motion

	TwinCAT Valve Diagram Editor	TwinCAT Kinematic Transformation
Technical data	**TS1500**	**TS511x**

	The TwinCAT Valve Diagram Editor allows the linearisation of non-linear curves of hydraulic valves with the aid of a graphical editor. On the basis of a few base points, straight lines or 5th degree polynomials can be determined that connect the points. The characteristic linearisation curve thus determined can be loaded into the TwinCAT NC real-time and taken into account when the voltages are output in the drive.	Various robot types kinematics can be realised using TwinCAT Kinematic Transformation. The programming of the robot movements takes place in Cartesian coordinates using either DIN 66025 instructions or the PLCopen-compliant blocks from the PLC. An integrated dynamic pre-control ensures high precision of the movement even at high accelerations and speeds. Configuration takes place in the TwinCAT Engineering Interface Server.
		– supports various parallel and also serial kinematics, e.g. for pick-and-place tasks
		– supports the programming of interpolating movements in G-code (DIN 66025)
		– alternatively, standard PTP and cam plate applications can be realised
		– simple programming in the Cartesian coordinate system
		– automatic calculation of the inverse kinematic for the relevant motor positions
		– kinematics configured in the TwinCAT Engineering Interface Server; in addition to the type (e.g. delta), the bar lengths and offsets must also be parameterised
		– mass and mass inertia values can be specified for dynamic pre-control
		– tracking with the aid of “flying saw” and “cam plates” for synchronisation (e.g. to conveyor belts)
		– optimised for the Beckhoff Servo Drives from the AX5000 series
		– The following kinematics are integrated:
		  – cartesian portals
		  – 2-D parallel kinematics
		  – shear kinematics
		  – crane and roll kinematics
		  – 3-D Delta
		  – SCARA
		– separated in different product levels, depending on the complexity of the kinematics

Target system	Windows NT/2000/XP, Windows 7	Windows NT/2000/XP, Windows 7, Windows CE
Min. TwinCAT level	TwinCAT NC PTP	TwinCAT NC I
Further information	www.beckhoff.com/TS1500	www.beckhoff.com/TS511x

TS6xxx | TwinCAT 2 Supplements, Communication

	TwinCAT PLC Serial Communication	TwinCAT PLC Serial Communication 3964R/RK512	TwinCAT PLC Modbus RTU
Technical data	**TS6340**	**TS6341**	**TS6255**
	TwinCAT Serial Communication implements communication with serial devices such as printers, bar code scanners, etc. The serial interface of the PC and the serial Beckhoff EL6xxx EtherCAT Terminals and and KL6xxx Bus Terminals are supported. Via the network-based fieldbus system from Beckhoff the serial terminals can be accessed over a distance of up to 100 m. In addition, it is possible to address virtual COM interfaces of the operating system from the PLC.	Serial communication via the 3964R or the RK512 protocols is implemented via the TwinCAT PLC Serial Communication 3964R/RK512 software library. The PCs serial interface and the Beckhoff KL6xxx serial Bus Terminals are supported. The library also contains the TwinCAT PLC Serial Communication library. The TwinCAT Serial Communication RK512 PLC library supports transmission and reception of PLC variables of any type. Data up to 128 bytes long is transferred transparently in the form of data blocks. To ensure secure data transmission, the 3964R protocol is used underneath the RK512 protocol.	TwinCAT Modbus RTU implements Modbus RTU communication via a serial RS232, RS422 or RS485 interface and is thus suitable both for the PC/CX interfaces and for operation with the KL6xxx serial Bus Terminals. It contains function blocks for master and slave operating mode with simple configuration.
Target system	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE
Min. TwinCAT level	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
Further information	www.beckhoff.com/TS6340	www.beckhoff.com/TS6341	www.beckhoff.com/TS6255

TS6xxx | TwinCAT 2 Supplements, Communication

	TwinCAT Modbus TCP Server	TwinCAT Modbus TCP Server CE	TwinCAT PLC IEC 60870-5-10x	TwinCAT PLC IEC 60870-5-104 CE
Technical data	**TS6250**	**TS6250-0030**	**TS650x**	**TS650x-0030**
	TwinCAT Modbus TCP Server acts as gateway between Modbus TCP devices and TwinCAT runtime systems. It provides both server and client functionalities. In server mode the memory areas of several TwinCAT runtime systems can be mapped directly to the Modbus memory areas. A PLC library is provided for implementing a Modbus TCP client, so that the memory areas of a Modbus TCP device can be accessed.	TwinCAT Modbus TCP Server CE acts as gateway between Modbus TCP devices and TwinCAT runtime systems. It provides both server and client functionalities. In server mode the memory areas of several TwinCAT runtime systems can be mapped directly to the Modbus memory areas. A PLC library is provided for implementing a Modbus TCP client, so that the memory areas of a Modbus TCP device can be accessed.	The TS650x enable IEC 60870-5-10x-compliant communication from the TwinCAT PLC. Both master and slave libraries are available. PLC library for the realisation of masters for – IEC 60870-5-101 – IEC 60870-5-102 – IEC 60870-5-103 – IEC 60870-5-104 PLC library for the realisation of slaves for – IEC 60870-5-101 – IEC 60870-5-104	The TS650x-0030 enable IEC 60870-5-10x-compliant communication from the TwinCAT PLC. Both master and slave libraries are available for applications under Windows CE. PLC library for the realisation of masters for – IEC 60870-5-104 PLC library for the realisation of slaves for – IEC 60870-5-104
Target system	Windows NT/2000/XP, Windows 7	Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows CE
Min. TwinCAT level	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
Further information	www.beckhoff.com/TS6250	www.beckhoff.com/TS6250-0030	www.beckhoff.com/TS650x	www.beckhoff.com/TS650x-0030

	TwinCAT PLC IEC 61850 Server	TwinCAT PLC IEC 61400-25 Server	TwinCAT DriveTop Server	TwinCAT DriveCOM OPC Server
	TS6511	TS6509	TS6371	TS6370
	IEC 61850 defines a communication protocol which is used particularly in electrical switchgears. Such standardised communication can be implemented using the PLC library TwinCAT IEC 61850 Server. The communication stack developed by Beckhoff is based on the MMS protocol and as well as the basic IEC 61850 standard also supports the related specialisations. For easy configuration the TwinCAT Telecontrol Configurator can be used, which is delivered with the PLC library. Thanks to the created configuration a PLC code export can be carried out, which can be integrated into existing PLC projects.	IEC 61400-25 is a specialisation of IEC 61850 for wind turbines. The data model is especially extended for objects, such as, for example wind turbine generators. The TwinCAT Telecontrol Configurator can also be used here. Beside PLC codes it can also generate TwinCAT Scope 2 configurations.	The TwinCAT DriveTop Server is a communication server for linking the Indramat DriveTop Tools to TwinCAT. This means that the DriveTop tool can be used for configuration and commissioning of Indramat drives. Configuration with a number of SERCOS rings is also supported.	The DriveCOM user organisation has set itself the aim of facilitating uniform, standardised communication between configuration, commissioning and diagnostic tools from different drive manufacturers, independent of the fieldbus. The TwinCAT DriveCOM OPC Server offers precisely this type of communication connection. It enables data flow from the engineering tool to the drive, independent of the fieldbus. Based on the network-capable ADS TwinCAT communication system, distributed drives can be configured and diagnosed from a central point. The TwinCAT DriveCOM OPC server requires a subordinate TwinCAT system with an FCxxxx-type Beckhoff fieldbus card. The TwinCAT DriveCOM configurator finds supported drives in the TwinCAT configuration and makes this information available for the engineering tool. The configurator features an automation interface and can therefore be operated remotely by other tools.
	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7	Windows NT/2000/XP, Windows 7
	TwinCAT PLC	TwinCAT PLC	TwinCAT NC PTP	TwinCAT NC PTP
	www.beckhoff.com/TS6511	www.beckhoff.com/TS6509	www.beckhoff.com/TS6371	www.beckhoff.com/TS6370

TS6xxx | TwinCAT 2 Supplements, Communication

	TwinCAT OPC Server	TwinCAT OPC UA Server	TwinCAT OPC UA Server CE
Technical data	**TS6120**	**TS6100**	**TS6100-0030**
	The TwinCAT OPC Server is a standardised data exchange interface. It supports the DataAccess (DA) and XML DA specifications. DataAccess (DA) is based on the Microsoft COM technology and provides data for the client. The OPC XML DA specification enables data exchange through XML via HTTP. Configuration of the server is carried out in a configuration tool or via XML.	OPC Unified Architecture (IEC 62541) is the newest technology generation of the OPC Foundation for the secure, reliable and manufacturer-neutral transport of raw data and pre-processed information from the manufacturing level into the production planning or ERP system. With OPC UA, all desired information is available to every authorised application and every authorised person at any time and in any place. TwinCAT OPC UA Server – certified in the OPC Laboratory, Europe – functions: DataAccess/ HistoricalAccess/Alarm&Condition – PLC blocks for diagnosis and restart – intermediate storage of data on the server: interruption of the communication connection does not lead to loss of data TwinCAT OPC UA Client – PLC function blocks for UA DataAccess – Demo UA client for diagnostic purposes	OPC Unified Architecture (IEC 62541) is the newest technology generation of the OPC Foundation for the secure, reliable and manufacturer-neutral transport of raw data and pre-processed information from the manufacturing level into the production planning or ERP system. With OPC UA, all desired information is available to every authorised application and every authorised person at any time and in any place. TwinCAT OPC UA Server CE – certified in the OPC Laboratory, Europe – functions: DataAccess/ HistoricalAccess/Alarm&Condition – PLC blocks for diagnosis and restart – intermediate storage of data on the server: interruption of the communication connection does not lead to loss of data TwinCAT OPC UA Client CE – PLC function blocks for UA DataAccess – Demo UA client for diagnostic purposes
Target system	Windows NT/2000/XP, Windows 7	Windows NT/2000/XP, Windows 7	Windows CE
Min. TwinCAT level	TwinCAT I/O	TwinCAT I/O	TwinCAT I/O
Further information	www.beckhoff.com/TS6120	www.beckhoff.com/TS6100	www.beckhoff.com/TS6100-0030

	TwinCAT SMS/SMTP Server	TwinCAT SMS/SMTP Server CE	TwinCAT TCP/IP Server	TwinCAT TCP/IP Server CE
	TS6350	TS6350-0030	TS6310	TS6310-0030
	TwinCAT SMS/SMTP Server enables the transmission of SMS messages or e-mails using PLC function blocks. The latter also allows the transmission of file attachments, HTML texts and the setting of message priorities. Support for STARTTLS/SSL enables encrypted e-mail communication to be configured.	TwinCAT SMS/SMTP Server CE enables the transmission of SMS messages or e-mails using PLC function blocks. The latter also allows the transmission of file attachments, HTML texts and the setting of message priorities. Support for START-TLS/SSL enables encrypted e-mail communication to be configured.	TwinCAT TCP/IP Server enables the implementation and realisation of one or several TCP/IP servers and/or clients within the TwinCAT PLC. Corresponding blocks exist for the establishment/disconnection of communication as well as for the pure exchange of data (send and receive). The SNMP library provided enables messages to be sent (traps) and queries to be answered (get) for monitoring TwinCAT runtimes.	TwinCAT TCP/IP Server CE enables the implementation and realisation of one or several TCP/IP servers and/or clients within the TwinCAT PLC. Corresponding blocks exist for the establishment/disconnection of communication as well as for the pure exchange of data (send and receive). The SNMP library provided enables messages to be sent (traps) and queries to be answered (get) for monitoring TwinCAT runtimes.
	Windows NT/2000/XP, Windows 7	Windows CE	Windows NT/2000/XP, Windows 7	Windows CE
	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
	www.beckhoff.com/TS6350	www.beckhoff.com/TS6350-0030	www.beckhoff.com/TS6310	www.beckhoff.com/TS6310-0030

TS6xxx | TwinCAT 2 Supplements, Communication

	TwinCAT PROFINET RT Controller	TwinCAT PROFINET RT Device	TwinCAT EtherNet/IP Slave	TwinCAT EtherNet/IP Slave CE
Technical data	**TS6271**	**TS6270**	**TS6280**	**TS6280-0030**
	The TwinCAT PROFINET RT Controller (master) is a supplement that turns any PC-based controller with an Intel® chipset and the real-time Ethernet driver developed by Beckhoff into a PROFINET RT controller. An Ethernet interface becomes a PROFINET controller by enabling a key. The PROFINET supplement is part of the TwinCAT installation and can be operated without key in Config mode. It runs on PCs and Embedded PCs and can be used from TwinCAT 2.11 R3. In conjunction with the EL6631 PROFINET terminal for the EtherCAT I/O system, PROFINET can also be tunnelled via EtherCAT. In this case the supplement is not required. In this way, any EtherCAT network can exchange data with PROFINET RT devices.	The TwinCAT PROFINET RT Device (slave) is a supplement that turns any PC-based controller with an Intel® chipset and the real-time Ethernet driver developed by Beckhoff into a PROFINET RT device. By installing the supplement, an Ethernet interface becomes a PROFINET slave. The supplement can be used on PCs and Embedded PCs. PROFINET can also be tunnelled via EtherCAT in conjunction with the EL6631-0010 PROFINET terminal for the EtherCAT I/O system. In this way, any EtherCAT network can exchange data with PROFINET IO controllers. If the EL6631-0010 is used, the TwinCAT PROFINET RT controller supplement is not required.	The TwinCAT EtherNet/IP Slave is a supplement turns any PC-based controller with an Intel® chipset and the real-time Ethernet driver developed by Beckhoff into an EtherNet/IP slave. By installing the supplement, the Ethernet interface becomes an EtherNet/IP slave. This product can be used on all PC controllers and Embedded PC controllers running Windows XP and Windows CE.	The TwinCAT EtherNet/IP Slave is a supplement turns any PC-based controller with an Intel® chipset and the real-time Ethernet driver developed by Beckhoff into an EtherNet/IP slave. By installing the supplement, the Ethernet interface becomes an EtherNet/IP slave. This product can be used on all PC controllers and Embedded PC controllers running Windows CE.
Target system	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows CE
Min. TwinCAT level	TwinCAT I/O	TwinCAT I/O	TwinCAT I/O	TwinCAT I/O
Further information	www.beckhoff.com/TS6271	www.beckhoff.com/TS6270	www.beckhoff.com/TS6280	www.beckhoff.com/TS6280-0030

	TwinCAT Virtual Serial COM Driver	TwinCAT FTP Client	TwinCAT PLC RFID Reader Communication	TwinCAT PLC S5/S7 Communication
	TS6360	TS6300	TS6600	TS6610
	TwinCAT Virtual Serial COM Driver allows the EL60xx EtherCAT Terminals or EP6002 EtherCAT Box modules to be integrated into Windows CE or Windows as normal serial interfaces. The computer on which a serial interface is to be generated for it is defined individually for each EL60xx/EP6002. Access to the device connected to the terminal takes place via Windows API for serial interfaces.	TwinCAT FTP Client enables simple access from the PLC to several FTP servers with the aid of various function blocks. This way, files can be loaded to or from a server after the establishment of a connection (optional with authentication). Additional function blocks allow files or directories to be searched for, created, deleted and renamed.	TwinCAT PLC RFID Reader Communication allows various RFID readers to be addressed via a serial interface. The new TwinCAT RFID reader library offers a general abstract interface that can be used for all readers. The configuration can easily be adapted to a specific reader.	TwinCAT PLC S5/S7 Communication allows the simple connection of TwinCAT to an S5 or S7 controller. The data blocks, flags, inputs, outputs, counters and timers of an S5 or S7 controller can be accessed using function blocks. The communication takes place using TCP/IP.
	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE
	TwinCAT I/O	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
	www.beckhoff.com/TS6360	www.beckhoff.com/TS6300	www.beckhoff.com/TS6600	www.beckhoff.com/TS6610

TS8xxx | TwinCAT 2 Supplements, Building Automation

	TwinCAT PLC HVAC	TwinCAT PLC Building Automation Basic	TwinCAT BACnet/IP
Technical data	**TS8000**	**TS8010**	**TS8020**
	TwinCAT PLC HVAC is an extensive TwinCAT PLC library with function blocks for automating all building services. In addition to conventional HVAC functions relating to energy generation and distribution, it also includes room automation functions for lighting, shading and air-conditioning.	The TwinCAT PLC Building Automation Basic software library allows the implementation of all functions which are important for room automation. Among these are lighting (constant light control, light dimmer,…), facade control, scaling functions, filter blocks, timer functions and peak load limiter for energy optimisation.	BACnet (Building Automation Control Network) is a standardised, manufacturer-independent communication protocol for building automation. Areas of application include HVAC, lighting control, safety and fire alarm technology. Implementation of this protocol is carried out as server as well as client and can be run on all Beckhoff Industrial PCs and Embedded PCs. All services of a BBC (BACnet Building Controller) are supported such as for example, common data use (DS), alarm and event processing (AE), time-tabling (SCHED), trend recording (T) as well as device and network management (DM). **BACnet revision 12** Embedded PCs corresponding to the ISO 16484-5:2012 standard: **Ordering information CX8091 and CX9020 with BACnet/IP image (license key included)** – ordering number of the CX8091 (no further ordering option necessary) (see page 204) – ordering number of the CX9020-xxxx (see page 214) + CX1800-1052 **Ordering information CX5010/CX5020 (see page 224)** – CX50x0 with Windows CE | Ordering number of the CX + CX1800-1052 (BACnet/IP image, license key included) – CX50x0 with Windows XPe | Ordering number of the CX + supplement TwinCAT BACnet/IP (TS8020, license key necessary), TwinCAT 2.11 R3 **BACnet revision 6** Embedded PCs corresponding to the ISO 16484-5:2010 standard: **Ordering information CX9001/CX9010 with BACnet/IP image (license key included) (see page 208)** – ordering number of the CX9001-xxxx + CX1800-1044 – ordering number of the CX9010-xxxx + CX1800-1044 **Ordering information CX5010/CX5020 (see page 224)** – CX50x0 with Windows CE | Ordering number of the CX + CX1800-1044 (BACnet/IP image, license key included) – CX50x0 with Windows XPe | Ordering number of the CX + Supplement TwinCAT BACnet/IP (TS8020, license key necessary), TwinCAT 2.11 R3
Target system	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE
Min. TwinCAT level	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
Further information	www.beckhoff.com/TS8000	www.beckhoff.com/TS8010	www.beckhoff.com/TS8020

	TwinCAT FIAS Server	TwinCAT Crestron Server	TwinCAT Bang & Olufsen Server	TwinCAT Building Automation	TwinCAT Building Automation Framework
	TS8035	**TS8036**	**TS8037**	**TS8040**	**TS8100**
	The FIAS (Fidelio Interface and Application Specification) interface is a world-leader in hotel management software. The TwinCAT FIAS Server is a software package for communication between TwinCAT PLC and a system with a FIAS standard interface. The communication takes place using TCP/IP. The connection of hotel management software and automation system helps to optimise the energy consumption: e.g. the climate control is automatically adjusted for an unoccupied room; if there is strong sunlight the shading is automatically activated.	Crestron is one of the leading manufacturers of AV control systems. The TwinCAT Crestron Server enables communication between a TwinCAT PLC and a Crestron control. Both systems are connected by Ethernet. SIMPL user macros are available for programming the Crestron controller. The required function blocks are included in the TwinCAT PLC library. Read and write access to the other device is available from the Crestron controller and the TwinCAT PLC.	Bang & Olufsen is recognised all over the world for its unmistakable range of high-quality audio, video and multimedia products. The TwinCAT Bang & Olufsen server enables communication between a TwinCAT PLC and a Bang & Olufsen audio/video installation. For the TwinCAT PLC a corresponding PLC library is available, which enables access to the Bang & Olufsen Masterlink gateway. The data exchange is bidirectional via Ethernet.	TwinCAT Building Automation is a software package that covers all technical building automation services. In addition to modules for conventional HVAC applications it also covers room automation including lighting, air-conditioning and shading. Essentially, the software package consists of three components: **TwinCAT BA PLC Libraries** The TwinCAT BA PLC libraries contain basic functions for control, signal processing, special mathematical functions, alarm processing and general system functions. **TwinCAT BA PLC Templates** TwinCAT BA PLC templates consist of ready-made TwinCAT program blocks for sensors, actuators, complete modules for system components and for entire heating, ventilation and air-conditioning system installations/plants. **TwinCAT BA Project Builder** The TwinCAT BA Project Builder is a configuration program for defining system components and assigning them to individual templates. Based on this information, the project files for TwinCAT PLC Control functions and the TwinCAT System Manager can be generated for each controller.	The TwinCAT Building Automation Framework includes a configuration program (TwinCAT Building Automation Manager) and a PLC library. The PLC library is configured such that a complete application program with the main room automation functions is available, including lighting, shading, climate control, time switching functions, scene management, weather stations and energy consumption monitoring. All actuators and sensors are registered in the TwinCAT Building Automation Manager, grouped together and linked with the Bus Terminals. The logical ordering of sensors to actuators is also done in the TwinCAT Building Automation Manager. From this information the configuration program generates and activates the I/O links for all devices entered in the system and writes all necessary parameters in the controller.
	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE	Windows NT/2000/XP, Windows 7, Windows CE
	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC	TwinCAT PLC
	www.beckhoff.com/TS8035	www.beckhoff.com/TS8036	www.beckhoff.com/TS8037	www.beckhoff.com/TS8040	www.beckhoff.com/TS8100


TwinSAFE
Logic
EL6900
BECKHOFF

TwinSAFE

Open and scalable safety technology

TwinSAFE

The open safety solution

TwinSAFE | Open and scalable safety technology

The TwinSAFE integrated safety solution represents the consistent continuation of the open and PC-based control philosophy from Beckhoff. Due to their modularity and versatility, the TwinSAFE terminals fit seamlessly into the Beckhoff control system. Thanks to the fieldbus-neutral safety protocol (TwinSAFE/Safety over EtherCAT), the TwinSAFE devices can be integrated into any desired fieldbus system. To this end, the IP 20 TwinSAFE Bus Terminals are integrated into existing stations with K-bus or EtherCAT or used directly in the machine as IP 67 modules. These safety I/Os form the interfaces to the safety-relevant sensors and actuators.

The possibility to transmit the safety-relevant signals over a standard bus system gives rise to substantial advantages in terms of planning, installation, operation, maintenance, diagnostics and costs.

The safety application is configured or programmed in TwinCAT software. This application is then loaded over the bus to a TwinSAFE Logic terminal of type KL6904 or EL69xx. These Logic terminals form the heart of the TwinSAFE system. All safety devices in the plant communicate with this Logic terminal. Due to the enormous flexibility of the system, however, several TwinSAFE Logic terminals can be operated simultaneously in one network.

Communication via independent safety circuits

Communication between distributed TwinSAFE Logic terminals is very simple to implement with TwinCAT software. This applies not only to terminals in a network, but also to devices on different controllers. Safety-relevant data and signals can also be exchanged as soon as the controllers have established a communication connection with the help of a fieldbus or via network variables. Of course, the reaction times and capabilities of the systems employed need to be considered.

For this, TwinCAT software assumes the task of distributing the data. This central distribution of the data has two significant advantages:

– All safety-relevant data are fed via the functional controller and are available to it for diagnostic purposes. The generation of diagnostic data on the safety controller is not necessary. That saves programming effort as well as computer performance and thus costs.
– All fieldbus systems operable from TwinCAT software are also accessible to the safety equipment. The TwinSAFE/Safety over EtherCAT protocol is so safe that even the mixing of fieldbus systems as well as the safety-relevant exchange of data between modules on different fieldbus systems are not a problem.

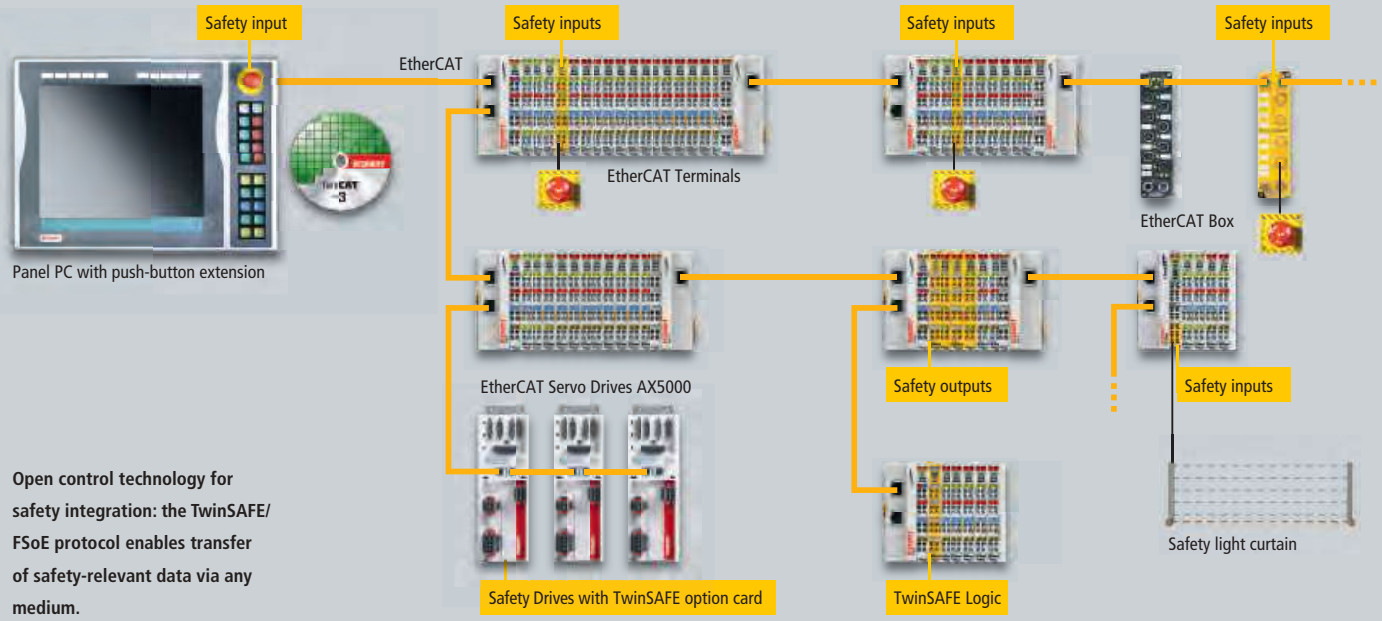
Certified safety function blocks facilitate configuration

The certified safety function blocks of the TwinSAFE Logic terminals allow the simple, error-free and inexpensive implementation of all safety tasks: from the simple monitoring of a safety door to complex muting functions and the safe control of networked and linked plants. The shutting down of individual "safety groups" or "communication shutdowns" enable the targeted shutdown of parts of the plant during the operation of a machine. These are essential functions that are required in order to be able to operate networked safety systems. Without them, the commissioning, maintenance and partial operation of linked machines are not possible.

With the EL69xx TwinSAFE Logic, all diagnostic data and statuses of the function blocks can be merged into the cyclic EtherCAT telegram. Extensive diagnosis is thus easy to implement without additional application expenditure.

A backup and restore mechanism facilitates exchange in the event of a fault

Since all parameters and settings as well as the application software are stored on the EL69xx TwinSAFE Logic, the safety controller, which is just 12 mm wide, can be programmed either in the plant over the bus or



Open control technology for safety integration: the TwinSAFE/ FSoE protocol enables transfer of safety-relevant data via any medium.

at the workstation and then simply plugged into the system.

The EL69xx has a special backup and restore mechanism. Therefore, no additional exchangeable storage medium is required as in other systems. The user can activate this function in TwinCAT software or by the application.

If the original terminal has been exchanged, e.g. due to a defect, the system automatically recognises a new TwinSAFE Logic and the valid TwinSAFE application is loaded automatically to the new terminal. The safety check takes place fully automatically and requires no intervention by the user.

The maintenance staff only needs to exchange the Bus Terminal, everything else is accomplished reliably and securely by the TwinSAFE system.

Safety over EtherCAT – Open safety protocol according to IEC 61784-3

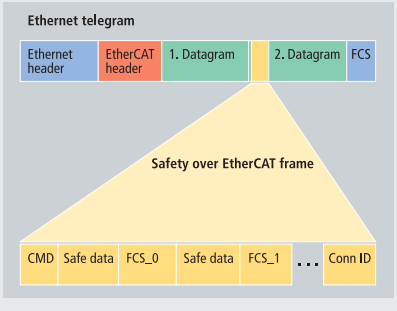
The open Safety over EtherCAT protocol (FSoE for short: "Failsafe over EtherCAT") defines a safety-related communication layer for EtherCAT. It meets the requirements of IEC 61508 SIL 3 and enables the transmission of secure and standard information on the same communication system without restrictions regarding transmission rates and cycle time.

Thanks to this openness any transmission media and transmission path can be used with Safety over EtherCAT. FSoE is focused on EtherCAT, the high-performance Ethernet fieldbus, and the transmission of safety-related process data is based on the Black Channel principle.

Thus, Safety over EtherCAT is also supported by other fieldbus systems and protocols such as PROFIBUS, CANopen or Ethernet. Copper or optical fibre cables, radio links or transmission technologies such as data light barriers can be used as transmission path. The telegram is arranged in such a way that a minimal container length of 6 bytes is sufficient for the transmission of all safety information including one byte of safe process data.

Safe data are cyclically exchanged between a Safety over EtherCAT master and a Safety over EtherCAT slave. This mechanism is called a connection (TwinSAFE connection). A master can establish and monitor several connections to different slaves.

Further information see page 311



Scalable safety technology

Irrespective of the complexity of the safety application, TwinSAFE is equally suited to small, local or central projects and to the decentralised networking of safety-related signals across different areas, plant parts and modules. Using TwinSAFE all safety functions can be programmed or configured on the uniform TwinCAT engineering platform.

TwinSAFE seamlessly integrates safe functions into the standard control platform from the PLC to the I/Os to the drive technology. TwinSAFE can be used both as a stand-alone system and as a decentralised controller:

Local | The TwinSAFE Compact Controller

The all-in-one solution for local safety applications is the EK1960 TwinSAFE Compact Controller. It integrates a complete safety controller including I/O level with 20 safe digital inputs and 10 safe digital outputs. The EK1960 can manage up to 32 TwinSAFE connections. For flexible adaptation to different safety tasks, the EK1960 can be extended by further TwinSAFE I/Os and drive components via the TwinSAFE protocol.

Local | Synthesis of safe and standard I/Os

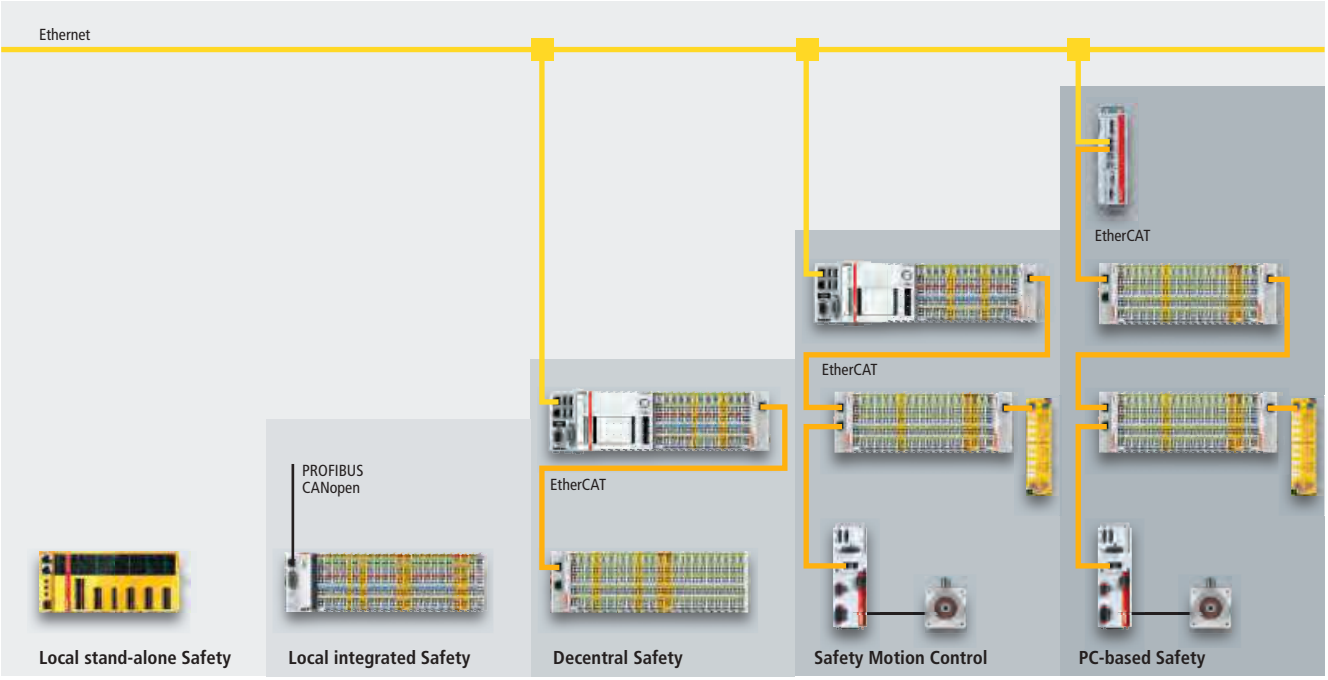
Safe signals and standard signals in automation technology can be mixed in a single system with the CX8000, CX5000 and CX9000 Embedded PCs as well as the small controllers from the BX series. The KL6904 safe logic and combinations of KL1904 safe inputs and KL2904 safe outputs can be placed anywhere in the Bus Terminal segment. According to the same principle a larger selection of components is available in the EtherCAT terminal system.

Decentralised | Safety beyond EtherCAT

The safe EtherCAT terminals are suitable for more complex topologies with a decentralised layout, since TwinSAFE fully leverages the performance capacity of EtherCAT. The safe logic is mapped by the EL6900 TwinSAFE Logic, which links the EL190x digital inputs and the EL290x digital outputs. In a decentralised safety solution, the terminals can be distributed throughout the entire network and, through the EtherCAT Box EP1908-0002, even into IP 67 areas.

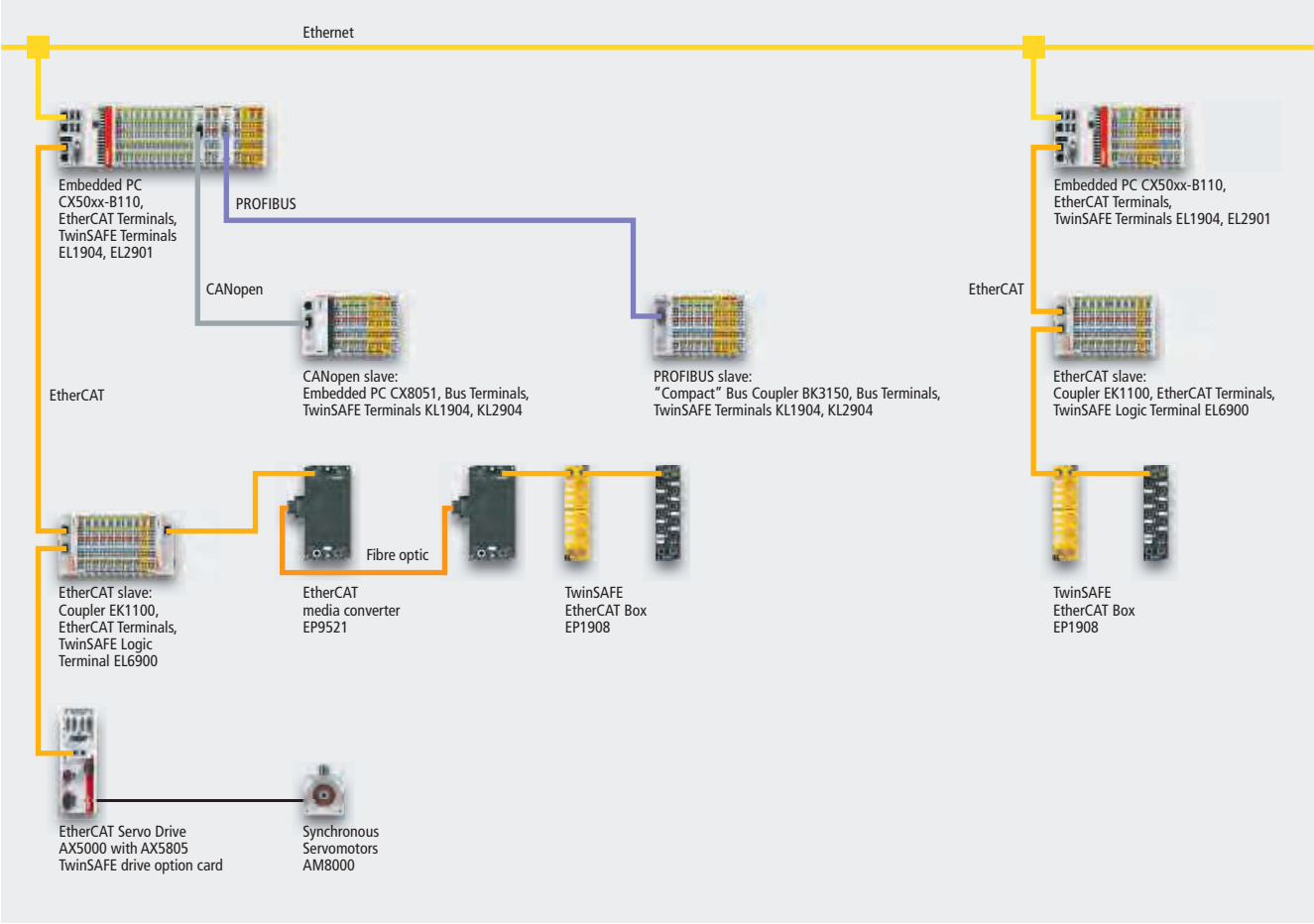
Motion Control | EtherCAT Servo Drives with integrated safety

With TwinSAFE, safe drive functions can be easily implemented using the AX58xx TwinSAFE drive option cards for the AX5000 EtherCAT Servo Drive. The AX5801 option card covers the functions STO and SS1. It is controlled via a safe output and is wired separately. The AX5805 option card is capable of switching the motor torque-free or monitoring speed, position and direction of rotation (in accordance with DIN EN ISO 13849-1:2008 up to PL e). No further circuits are necessary for this, such as circuit breakers or contactors in supply lines, or special external encoder systems. Therefore there is no further wiring. The safety option card communicates directly through the AX5000 with the TwinSAFE terminals existing in the network.



Great variety of decentralised safety solutions

TwinSAFE represents the systematic continuation of the open, PC-based control philosophy from Beckhoff. Thanks to the fieldbus-neutral safety protocol, TwinSAFE devices can be integrated into any desired fieldbus system. With the TwinSAFE I/O modules the safety technology can be seamlessly integrated into the terminal strand, where the safe signals can be mixed with standard signals as required. The encapsulation and decoupling of individual production or manufacturing cells is considerably facilitated by the TwinSAFE system because safety products can be placed precisely at the points where safety functions are required. This reduces the expenditure for project engineering, installation and material, and maintenance is also simplified by faster diagnostics and fewer replacement parts. System extensions or changeovers can be implemented quickly and without additional wiring. Thanks to the openness and fieldbus neutrality, any transmission media and transmission path can be used with Safety over EtherCAT: in addition to different fieldbuses, media converters between copper and optical fibre physics and between copper and radio can be used as well as transmission technologies such as data light barriers.



The following environmental and operating conditions apply to all TwinSAFE products unless stated otherwise:

Technical data	EKx9xx/ELx9xx/KLx9xx	EPx9xx
Nominal voltage	24 V DC (-15 %/+20 %)	
Climate class EN 60721-3-3	3K3	–
Permitted degree of contamination	2	–
Installation position	horizontal	variable
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4	
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27	
Protection class	IP 20	IP 65/66/67

With a safety development environment and a safety runtime, the next step in the field of safety solutions is completed with TwinCAT 3.

TwinCAT 3 and Safety | Simplified engineering

The introduction of TwinCAT 3 as a universal development tool creates further possibilities for safety-relevant fields of application. Firstly, TwinCAT 3 offers additional functionality for creating and managing safety-relevant applications with the safety editor. Secondly, a standard Industrial PC can be used as a safety controller for the first time. This is possible due to the new safety runtime.

Safety editor

The safety editor integrated in TwinCAT 3 allows the creation of a safety application in a graphical environment. The desired logic is programmed with the help of function blocks. The application can be organised in networks for increased clarity. The familiar function blocks from the KL6904 and EL69xx logic terminals can be used as logical elements. Furthermore, additional function blocks are provided as part of the safety runtime. The function blocks can be freely arranged and connected within the diagram.

The safety editor offers increased flexibility and portability. This is achieved by initially programming independently of the actual hardware used. To this end, both the target system and all input and output devices are made available as so-called alias devices. At this level, all safety-relevant settings can be made in advance. Before the project is finally transferred to the executing hardware, these alias devices must be mapped to the actually installed physical devices.

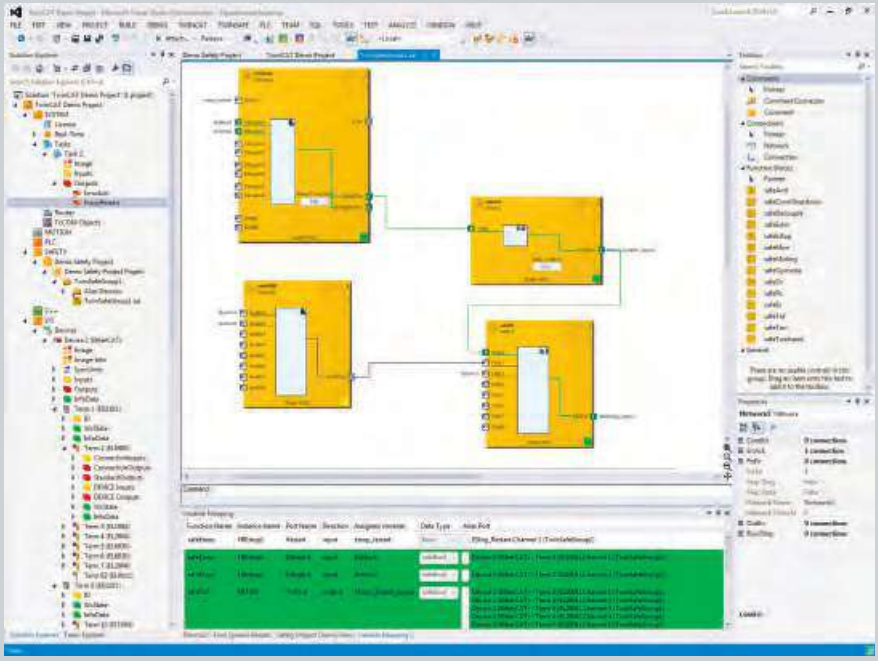
In addition to using the pre-specified function blocks, there is also the possibility to create custom function blocks. These can be created by combining existing – pre-certified – function blocks or by using Safety C (this can be done only for the safety runtime). Safety C is an almost unrestricted derivative of standard C. This allows well-known control structures such as IF-THEN-ELSE, SWITCH CASE and the data types usual in C to be used for safety applications.

An important novelty in the programming of safety-relevant applications in TwinCAT 3 is the extended user management. In the so-called basic mode, the user can create an application exclusively from pre-specified – and thus certified – function blocks. These also include function blocks that the user has created on the basis of pre-certified function blocks. In expert mode, it is possible to create function blocks in Safety C and thus creating custom libraries. Before loading into the safety controller, a check is made as to whether the programmed logic consists of already certified function blocks or whether the created application requires renewed examination.

In addition to programming, improved tools optimally support debugging and test phase. Programs can be debugged in the usual Visual Studio® environment: the online values of variables and states of the function blocks are displayed directly in the graphical environment, enabling fast and simple debugging of the application. Furthermore, the project can be simulated offline in order to considerably speed up and simplify commissioning.

The editor is equipped with an automatic verification mechanism which automatically checks whether the saved project corresponds to the one created in the editor. The previously familiar manual comparison by uploading the project back to the safety controller is no longer necessary.

In addition, the safety editor automatically generates documentation containing a detailed view of all relevant project data. From the illustration of the hardware terminals with their safety-relevant settings through to an exact listing of the function blocks used and their interconnections, this documentation contains all important data required to facilitate the wiring of the plant, fault finding and maintenance.



View of the graphical editor in TwinCAT 3

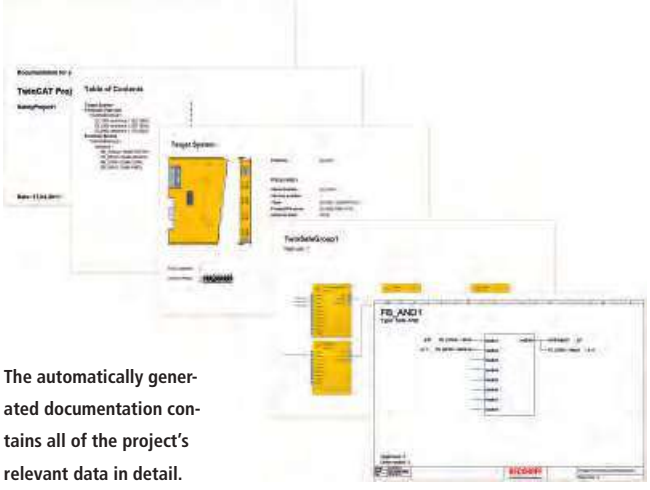
Safety runtime

The enormous development in the field of Industrial PCs and the associated increase in reliability and quality allow a standard PC to be used as a safety controller. This is made possible by a strict mathematical basis, so that the proof of safety does not need to make reference to the respective processor and its environment. The independence from the hardware basis that this creates enables the use of standard components up to SIL 3 according to IEC 61508. The certifiability of the solution in accordance with this standard has been confirmed in a report by the TÜV SÜD.

Mathematical coding is used for this that creates a diverse redundancy on the basis of which the correct execution of operations within the safety application can be checked and a safe reaction initiated in the case of an error. In addition to pre-specified function blocks, the use of Safety C allows custom function blocks to be created and saved in a library for later use.

Further information on TwinCAT 3 on page 898 or at ▶ www.beckhoff.com/TwinCAT3

Configuring the target system



The automatically generated documentation contains all of the project's relevant data in detail.

For availability status see Beckhoff website at: www.beckhoff.com/TwinSAFE

TwinSAFE | **Compact Controller**

The EK1960 TwinSAFE Compact Controller extends the application range of the integrated TwinSAFE safety solution. Thanks to its compact design, with 20 safe digital inputs and 24 safe digital outputs, it covers the safety requirements in particular for compact machines. The EK1960 can be operated in stand-alone mode or it can be networked with other controllers over the EtherCAT connectors. Like every EtherCAT Coupler the EK1960 can be extended by all EL/ES terminals.

The TwinSAFE Compact Controller is programmed via the TwinCAT Safety Editor in the same way as other TwinSAFE components. A TwinSAFE project is created and loaded over EtherCAT into the EK1960. The EK1960 supports the establishment of 127 TwinSAFE connections. For flexible adaptation to different safety functions, the TwinSAFE Compact Controller can be combined with TwinSAFE I/O components in IP 20 and IP 67 protection and the TwinSAFE drive option card via the Safety over EtherCAT protocol.

The fieldbus-neutral safety protocol Safety over EtherCAT enables the integration of TwinSAFE devices into arbitrary fieldbus systems. The safety I/Os form the interfaces to the safety-relevant sensors and actuators. The possibility to transmit the safety-relevant signals over a standard bus system gives rise to substantial advantages in terms of planning, installation, operation, maintenance, diagnostics and costs.

In addition to the Safety over EtherCAT protocol, the EK1960 also supports the TwinSAFE SC technology. This enables the secure transmission of data from TwinSAFE SC terminals to the EK1960 TwinSAFE Compact Controller.

The EK1960 also supports the processing of analog signals (16/32-bit, signed and unsigned). These signals can be transferred to the logic as standard, TwinSAFE SC or Safety over EtherCAT signals. Analog signals can thus be checked for plausibility within the logic. The entire calculation and scaling process is carried out at the SIL 3/PL e safety level in the safety-related EK1960 TwinSAFE Compact Controller.

Certified function blocks such as ADD, SUB, MUL, DIV and also more complex ones such as Counter, Limit or Compare are available for the processing of analog signals.

TwinSAFE Compact Controller,
20 safe digital inputs (24 V DC),
24 safe digital outputs (24 V DC)

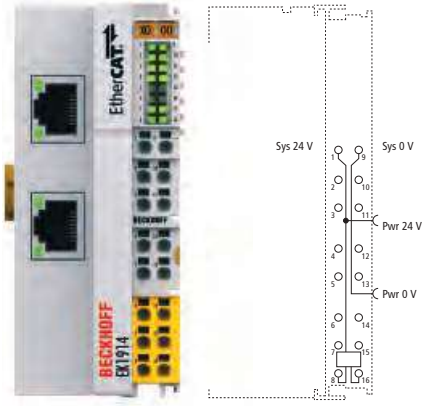
Technical data	EK1960
Task within EtherCAT system	coupling of EtherCAT Terminals (ELxxxx) to 100BASE-TX EtherCAT networks
No. of EtherCAT Terminals	up to 65,534
Data transfer rates	100 Mbaud
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)
	
Bus interface	2 x RJ45 or 2 x M8
Type/number of peripheral signals	max. 4.2 GB addressable I/O points
Data transfer medium	Ethernet/EtherCAT cable (min. CAT 5), shielded
Current consum. from U_S/U_P	typ. 100 mA/max. 50 mA
Nominal voltage	24 V DC (-15 %/+20 %)
Distance between stations	100 m (100BASE-TX)
Delay	approx. 1 µs
Number of communication partners	max. 127
Protocol	EtherCAT
Safety protocol	TwinSAFE/Safety over EtherCAT
Function blocks	max. 512
Response time	dependent on application (< 10 ms)
Fault response time	≤ watchdog time (parameterisable)
Number of inputs	20
Number of outputs	24 (of which up to 4 are clock outputs)
Max. output current	2 A (simultaneity factor 50 % at 2 A)
Current supply E-bus	1000 mA
Operating/storage temperature	0…+55 °C/-40…+70 °C
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
Approvals	in preparation (CE, UL, Ex, TÜV SÜD)
Protection class	IP 20
Further information	www.beckhoff.com/EK1960

For availability status see Beckhoff website at: www.beckhoff.com/EK1960

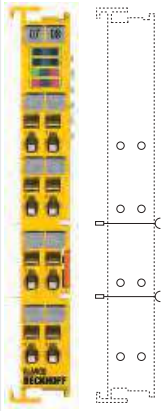
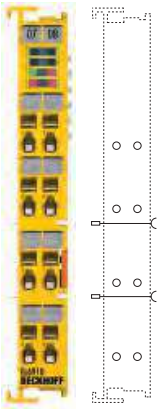
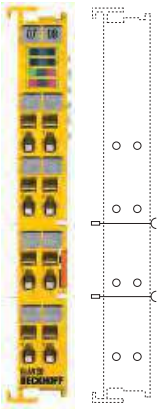
TwinSAFE | **Coupler**

The EK1914 EtherCAT Coupler combines the functionalities of the EK1100 EtherCAT Coupler with standard and safe digital I/Os. This results in a compact design that is especially suitable for applications with a low number of I/Os. The EK1914 can be extended by all EL/ES terminals.

The EK1914 has four digital inputs and four digital outputs as well as two fail-safe inputs and two fail-safe outputs. The safe outputs switch 24 V DC actuators with up to 0.5 A current per channel. The EK1914 meets the requirements of DIN EN ISO 13849-1:2008 (Cat 4, PL e).

	EtherCAT Coupler with 4 inputs and 4 outputs as well as 2 safe inputs and 2 safe outputs
Technical data	**EK1914**
Task within EtherCAT system	coupling of EtherCAT Terminals (ELxxxx) to 100BASE-TX EtherCAT networks
Number of EtherCAT Terminals	up to 65,534
Data transfer rates	100 Mbaud
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e)
Protocol	EtherCAT
	
Bus interface	2 x RJ45
Data transfer medium	Ethernet/EtherCAT cable (min. CAT 5), shielded
Nominal voltage	24 V DC (-15 %/+20 %) (PELV)
Current consumption	typ. 72 mA (excluding current consumption of the sensors/ actuators and further terminals on the E-bus)
Distance between stations	max. 100 m (100BASE-TX)
Delay	approx. 1 µs
Safety protocol	TwinSAFE/Safety over EtherCAT
Response time	typ. 4 ms (read input/write to E-bus) max. see fault response time
Fault response time	≤ watchdog time
Number of inputs	6 digital inputs, 2 of which are fail-safe inputs
Number of outputs	6 digital outputs, 2 of which are fail-safe outputs
Current supply E-bus	max. 500 mA (for higher current consumption use EL9410 power supply terminal)
Operating/storage temperature	-25…+55 °C/-40…+70 °C
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
Approvals	CE, UL, TÜV SÜD
Weight	approx. 123 g
Protection class	IP 20
Further information	www.beckhoff.com/EK1914

TwinSAFE | **Controller**

	TwinSAFE Logic, EtherCAT Terminal	TwinSAFE Logic, EtherCAT Terminal	TwinSAFE/PROFIsafe logic and gateway terminal, EtherCAT Terminal
Technical data	**EL6900**	**i EL6910**	**EL6930**
Technology	TwinSAFE Logic		TwinSAFE/PROFIsafe logic and gateway terminal
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)		
Protocol	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT, PROFIsafe
			
	The TwinSAFE Logic can establish 128 connections to other TwinSAFE devices.	The TwinSAFE Logic can establish 128 connections to other TwinSAFE devices.	The EL6930 logic terminal can establish 127 connections to other TwinSAFE/Safety over EtherCAT devices and one PROFIsafe slave connection to a PROFIsafe master.
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consum. pow. cont.	–	–	–
Current consumption E-bus	approx. 188 mA	approx. 188 mA	approx. 188 mA
Cycle time	500 µs…~25 ms	500 µs…~10 ms	500 µs…~25 ms
Fault response time	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
Permitted degree of contamination	2	2	2
Climate class EN 60721-3-3	3K3	3K3	3K3
Installation position	horizontal	horizontal	horizontal
Special features	backup restore	backup restore	1 PROFIsafe slave connection
Operating/storage temperature	-25…+55 °C/-40…+70 °C	-25…+55 °C/-40…+70 °C	-25…+55 °C/-40…+70 °C
EMC immunity/emission	conforms to EN 61000-6-2/ EN 61000-6-4	conforms to EN 61000-6-2/ EN 61000-6-4	conforms to EN 61000-6-2/ EN 61000-6-4
Vibration/shock resistance	conforms to EN 60068-2-6/ EN 60068-2-27	conforms to EN 60068-2-6/ EN 60068-2-27	conforms to EN 60068-2-6/ EN 60068-2-27
Approvals	CE, UL, Ex, TÜV SÜD	in preparation (CE, UL, Ex, TÜV SÜD)	CE, TÜV SÜD
Weight	approx. 50 g	approx. 50 g	approx. 50 g
Protection class	IP 20	IP 20	IP 20
Further information	www.beckhoff.com/EL6900	www.beckhoff.com/EL6910	www.beckhoff.com/EL6930

i For availability status see Beckhoff website at: www.beckhoff.com/EL6910

TwinSAFE | EtherCAT I/O – Digital input

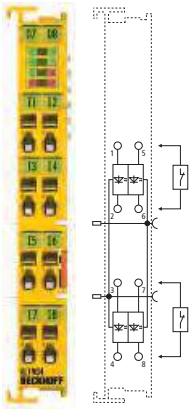
The safety input terminals are for sensors with potential-free 24 V DC contacts. They conform to the requirements of IEC 61508:2010 (SIL 3) and DIN EN ISO 13849-1:2008 (Cat 4, PL e). The EL1904 EtherCAT Terminal has four fail-safe inputs, the EL1908 EtherCAT Terminal has eight fail-safe inputs.

The EP1908 EtherCAT Box in protection class IP 67 is suitable for use directly in the field. The EP1908 has eight digital inputs and conforms to the requirements of IEC 61508:2010 (SIL 3) and DIN EN ISO 13849-1:2008 (Cat 4, PL e).

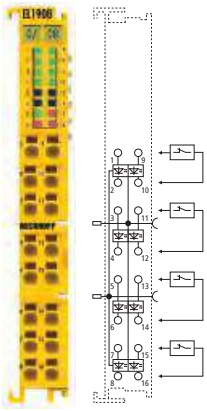
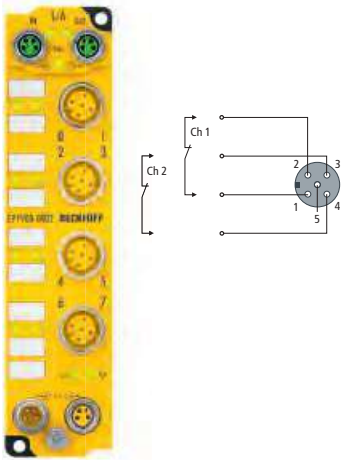
+60 °C
-25 °C

The EP1908 with extended temperature range of -25 to +60 °C (storage temperature -40…+85 °C) can also be used in extreme climates.

4-channel digital input terminal, TwinSAFE, 24 V DC, EtherCAT Terminal

Technical data	EL1904
Connection technology	1-/2-wire
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)
Number of inputs	4
	 The EL1904 Safety EtherCAT Terminal has four fail-safe inputs.
Protocol	TwinSAFE/Safety over EtherCAT
Nominal voltage	24 V DC (-15 %/+20 %)
Current consumption power contacts	see documentation
Current consumption E-bus	approx. 200 mA
Current consum. from U_S/U_P	–
Response time	typ. 4 ms (read input/write to E-bus)
Fault response time	≤ watchdog time (parameterisable)
Permitted degree of contamination	2
Climate class EN 60721-3-3	3K3
Installation position	horizontal
Special features	4 safe inputs
Operating/storage temperature	-25…+55 °C/-40…+70 °C
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
Approvals	CE, UL, Ex, TÜV SÜD
Weight	approx. 50 g
Protection class	IP 20
Further information	www.beckhoff.com/EL1904

For availability status see Beckhoff website at: www.beckhoff.com/EL1908

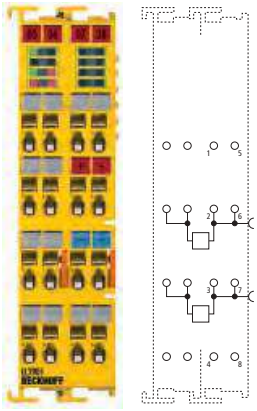
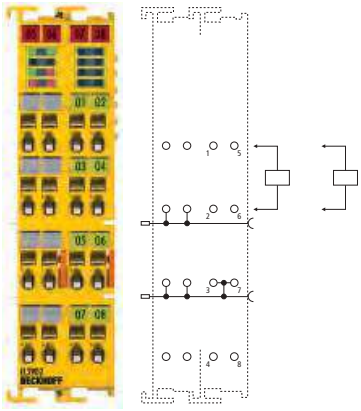
	8-channel digital input terminal, TwinSAFE, 24 V DC, EtherCAT Terminal	8-channel digital input module, TwinSAFE, 24 V DC, EtherCAT Box
	EL1908	**EP1908-0002**
		M12, screw type
		DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)
	8	8
	 The EL1908 Safety EtherCAT Terminal has eight fail-safe inputs.	 The EP1908 TwinSAFE EtherCAT Box has eight fail-safe inputs.
	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	see documentation	–
	approx. 200 mA	–
	–	80 mA/40 mA
	typ. 4 ms (read input/write to E-bus)	typ. 4 ms (read input/write to bus)
	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
	2	–
	3K3	–
	horizontal	variable
	8 safe inputs	8 safe inputs
	0…+55 °C/-40…+70 °C	-25…+60 °C/-40…+85 °C
	conforms to EN 61000-6-2/EN 61000-6-4	conforms to EN 61000-6-2/EN 61000-6-4
	conforms to EN 60068-2-6/EN 60068-2-27	conforms to EN 60068-2-6/EN 60068-2-27
	in preparation (CE, UL, Ex, TÜV SÜD)	CE, UL, TÜV SÜD
	approx. 50 g	approx. 165 g
	IP 20	IP 65/66/67 (according to EN 60529)
	www.beckhoff.com/EL1908	www.beckhoff.com/EP1908

TwinSAFE | EtherCAT I/O – Digital output

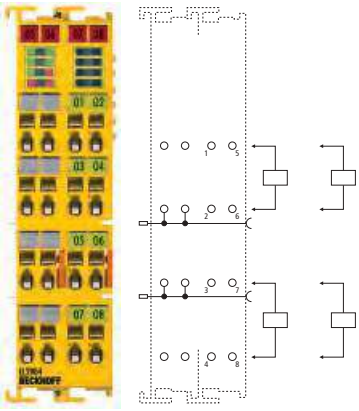
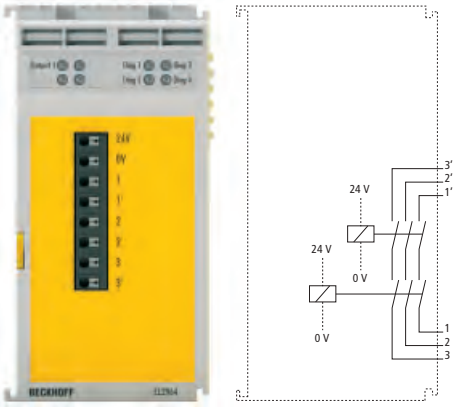
The safety output terminals switch 24 V DC actuators with a current of up to 0.5 A per channel (EL2902 with a current of up to 2.3 A per channel). The terminals switch off automatically on detection of a fault (fail stop). Whereas the EL2902 EtherCAT Terminal has two output channels, the EL2904 EtherCAT Terminal has four output channels.

The EL2901 EtherCAT Terminal enables configuration of safe potential groups within a terminal strand. It provides an output current of 10 A. The EL2964 Safety EtherCAT Terminal is a digital output terminal with three simultaneously switching, normally open, potential-free contacts.

The safety terminals conform to the requirements of IEC 61508:2010 (SIL 3) and DIN EN ISO 13849-1:2008 (Cat 4, PL e).

	Potential power supply terminal, TwinSAFE, 24 V DC, 10 A, EtherCAT Terminal	2-channel digital output terminal, TwinSAFE, 24 V DC, EtherCAT Terminal
Technical data	**EL2901**	**EL2902**
Connection technology	1-/2-wire and/or via power contacts	1-wire
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)	
Max. output current	10 A	2.3 A (per channel)
Number of outputs	1	2
	 The EL2901 Safety EtherCAT Terminal switches the power contacts on two channels.	 The EL2902 Safety EtherCAT Terminal has two outputs.
Protocol	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Current consum. pow. cont.	load-dependent	load-dependent
Current consumption E-bus	approx. 221 mA	approx. 221 mA
Fault response time	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
Permitted degree of contamination	2	2
Climate class EN 60721-3-3	3K3	3K3
Installation position	horizontal	horizontal
Special features	safe power supply	2 safe outputs
Operating/storage temperature	0…+55 °C/-40…+70 °C	0…+55 °C/-40…+70 °C
EMC immunity/emission	conforms to EN 61000-6-2/ EN 61000-6-4	conforms to EN 61000-6-2/ EN 61000-6-4
Vibration/shock resistance	conforms to EN 60068-2-6/ EN 60068-2-27	conforms to EN 60068-2-6/ EN 60068-2-27
Approvals	in preparation (CE, UL, Ex, TÜV SÜD)	in preparation (CE, UL, Ex, TÜV SÜD)
Weight	approx. 90 g	approx. 90 g
Protection class	IP 20	IP 20
Further information	www.beckhoff.com/EL2901	www.beckhoff.com/EL2902

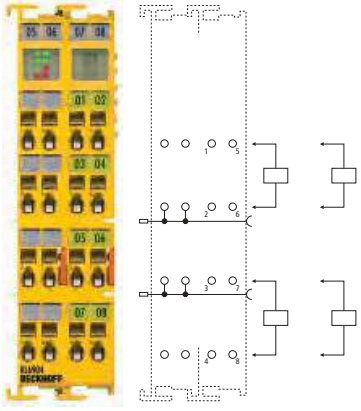
For availability status see Beckhoff website at: www.beckhoff.com

	4-channel digital output terminal, TwinSAFE, 24 V DC, EtherCAT Terminal	1-channel digital output terminal, TwinSAFE, 24 V DC, EtherCAT Terminal
	EL2904	**EL2964**
	1-/2-wire	2-wire
	0.5 A (per channel), min. 20 mA (with active current measurement)	–
	4	3 potential-free contacts (forcibly guided/synchronously switched)
		
	The EL2904 Safety EtherCAT Terminal has four outputs.	The EL2964 Safety EtherCAT Terminal has three simultaneously switching, normally open, potential-free contacts.
	TwinSAFE/Safety over EtherCAT	TwinSAFE/Safety over EtherCAT
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	load-dependent	–
	approx. 221 mA	typ. 190 mA
	≤ watchdog time (parameterisable)	≤ watchdog time (parameterisable)
	2	2
	3K3	3K3
	horizontal	horizontal
	4 safe outputs	1 safe output, 3 potential-free contacts
	-25…+55 °C/-40…+70 °C	0…+55 °C/-40…+70 °C
	conforms to EN 61000-6-2/ EN 61000-6-4	conforms to EN 61000-6-2/ EN 61000-6-4
	conforms to EN 60068-2-6/ EN 60068-2-27	conforms to EN 60068-2-6/ EN 60068-2-27
	CE, UL, Ex, TÜV SÜD	in preparation (CE, UL, Ex, TÜV SÜD)
	approx. 90 g	approx. 170 g
	IP 20	IP 20
	www.beckhoff.com/EL2904	www.beckhoff.com/EL2964

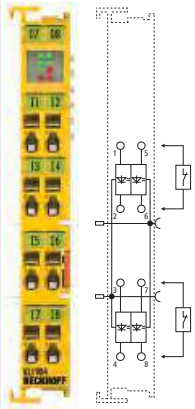
TwinSAFE | Logic Bus Terminal

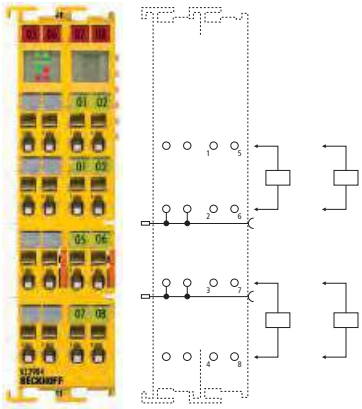
TwinSAFE enables networks with up to 1,024 TwinSAFE devices. The KL6904 Bus Terminal features certified safety function blocks, which are configured according to the application to be realised. Functions such as emergency stop, safety door monitoring etc. can thus easily be selected and linked. All blocks can be freely connected among each other and are complemented by operators such as AND, OR, etc. The necessary functions are configured using the TwinCAT System Manager and loaded into the terminal via the fieldbus.

TwinSAFE Logic Bus Terminal,
4 safe outputs

Technical data	KL6904
Technology	TwinSAFE Logic
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)
Number of outputs	4
Protocol	TwinSAFE/Safety over EtherCAT
	 The KL6904 can establish up to 15 connections (TwinSAFE connections). The TwinSAFE Logic Terminal has four safe, local outputs, so that safety applications can be realised with only two components (KL1904 and KL6904).
Nominal voltage	24 V DC (-15 %/+20 %)
Current consum. pow. cont.	load-dependent
Current consumption K-bus	250 mA
Cycle time	4…100 ms
Fault response time	≤ watchdog time (parameterisable)
Output current	0.5 A max./20 mA min. (per channel)
Permitted degree of contamination	2
Climate class EN 60721-3-3	3K3
Installation position	horizontal
Special features	4 safe outputs
Operating/storage temperature	0…+55 °C/-25…+70 °C
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
Approvals	CE, UL, Ex, TÜV SÜD
Weight	approx. 90 g
Protection class	IP 20
Further information	www.beckhoff.com/KL6904
Special terminals	**KL6904-0001**
Distinguishing features	pre-configured ex factory to 15 TwinSAFE connections

TwinSAFE | **Bus Terminal I/O**

	4-channel digital input terminal, TwinSAFE, 24 V DC, Bus Terminal
Technical data	**KL1904**
Connection technology	2-wire
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)
Number of inputs	4
Number of outputs	–
	
	The KL1904 Safety Bus Terminal has four fail-safe inputs.
Protocol	TwinSAFE/Safety over EtherCAT
Nominal voltage	24 V DC (-15 %/+20 %)
Current consum. pow. cont.	–
Current consumption K-bus	48 mA
Response time	typ. 4 ms (read input/write to K-bus)
Fault response time	≤ watchdog time (parameterisable)
Permitted degree of contamination	2
Climate class EN 60721-3-3	3K3
Installation position	horizontal
Special features	4 safe inputs
Operating/storage temperature	0…+55 °C/-25…+70 °C
EMC immunity/emission	conforms to EN 61000-6-2/ EN 61000-6-4
Vibration/shock resistance	conforms to EN 60068-2-6/ EN 60068-2-27
Approvals	CE, UL, Ex, TÜV SÜD
Weight	approx. 50 g
Protection class	IP 20
Further information	www.beckhoff.com/KL1904

	4-channel digital output terminal, TwinSAFE, 24 V DC, Bus Terminal
Technical data	**KL2904**
Connection technology	2-wire
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)
Max. output current	0.5 A/20 mA min. (per channel)
Number of outputs	4
	
	The KL2904 Safety Bus Terminal has four outputs.
Protocol	TwinSAFE/Safety over EtherCAT
Nominal voltage	24 V DC (-15 %/+20 %)
Current consum. pow. cont.	load-dependent
Current consumption K-bus	250 mA
Fault response time	≤ watchdog time (parameterisable)
Permitted degree of contamination	2
Climate class EN 60721-3-3	3K3
Installation position	horizontal
Special features	4 safe outputs
Operating/storage temperature	0…+55 °C/-25…+70 °C
EMC immunity/emission	conforms to EN 61000-6-2/ EN 61000-6-4
Vibration/shock resistance	conforms to EN 60068-2-6/ EN 60068-2-27
Approvals	CE, UL, Ex, TÜV SÜD
Weight	approx. 100 g
Protection class	IP 20
Further information	www.beckhoff.com/KL2904

TwinSAFE | Option cards for AX5000 Servo Drives

Significant hazards to persons arise from the dynamic movements of electrical drive equipment of machines. With the AX58xx TwinSAFE drive option cards numerous safety functions can be easily implemented by the user. Safe stop functions, safe motion functions and safe brake functions can be realised.

AX5801 | Personal protection against inadvertent restart of the drive axis (STO/SS1):

- Safe Torque Off (STO) according to IEC 61800-5-2
- control through safe 24 V DC outputs
- mains voltage and motor line remain connected

AX5805, AX5806 | Further drive-integrated safety functions according to IEC 61800-5-2. Control is performed via EtherCAT; no further wiring is required:

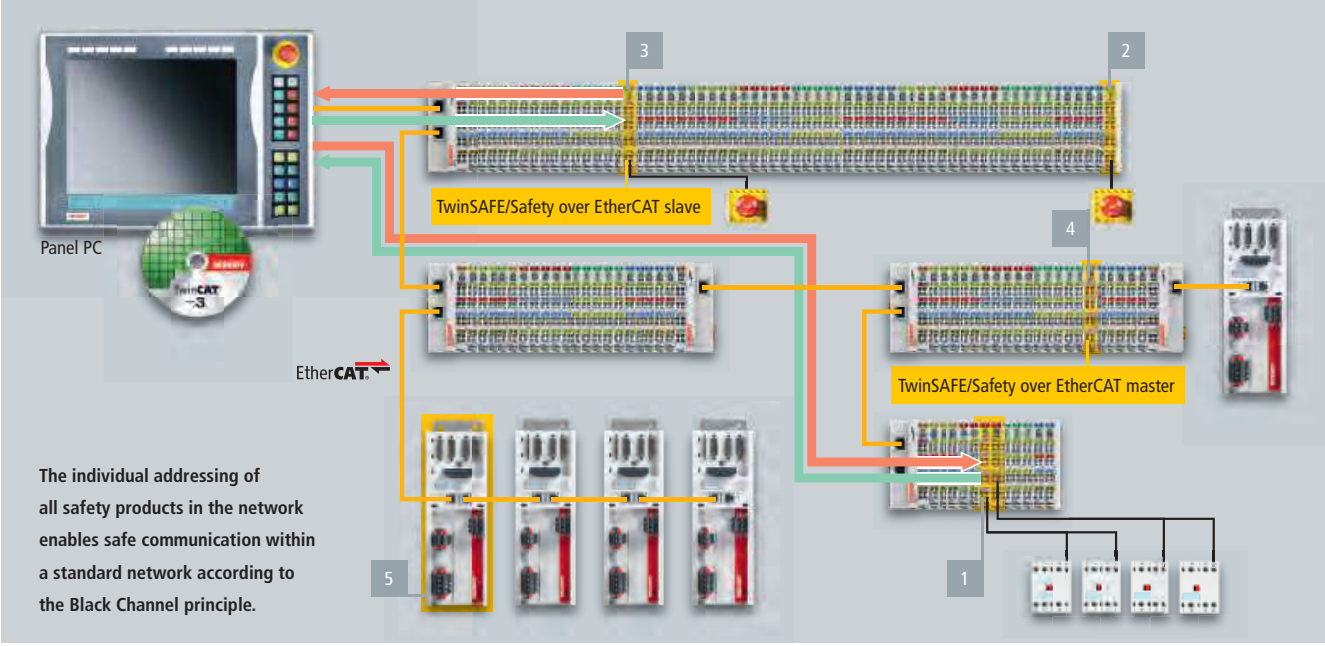
- stop functions (STO, SOS, SS1, SS2)
- speed functions (SLS, SSM, SSR, SMS) with up to 8 speeds
- position functions (SLP, SCA, SLI) with reference cams
- acceleration functions (SAR, SMA)
- rotating direction functions (SDIp, SDIn)

The AX5805/AX5806 option cards are capable of switching the motor torque-free or monitoring speed, position and direction of rotation (in accordance with DIN EN ISO 13849-1:2008 (Cat 4, PL e)). No further circuits are necessary for this, such as circuit breakers or contactors in supply lines, or special external encoder systems.

This enables a very lean installation and helps to lower costs and control cabinet space. No special encoder system is required in order to implement the SDI (Safe Direction) or SLS (Safety Limited Speed) functions; all Beckhoff standard motors can be used without modifications and without additional encoder systems for these functions. Even safe position monitoring or position range monitoring is simple to implement by means of the AX5805/AX5806 module. No additional wiring is required, since EtherCAT communication is used in the AX5000 Servo Drives. The safety option card communicates directly through the AX5000 with the TwinSAFE logic terminal present in the network.

Like the programming or configuration of the safety application, the entire parameterisation of the AX5805/AX5806 option cards takes place in TwinCAT. All system-specific settings are stored together with the application in the TwinSAFE logic terminal. For this reason, the AX5805/AX5806 TwinSAFE drive option card can be exchanged at any time without software. The card receives all necessary parameters at the next power-on or boot-up.

With the AX5805 TwinSAFE drive option card, the AX5000 servo drive is easily converted into a safe drive solution that offers the user numerous safety functions.



The individual addressing of all safety products in the network enables safe communication within a standard network according to the Black Channel principle.

	TwinSAFE drive option card
Technical data	**AX5801-0200**
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)
	
	Drive-integrated safety functions: – stop functions (STO, SS1)
Operating voltage of the relays	24 V DC (-15 %/+20 %)
Operating voltage of the feedback contacts	24 V DC (-15 %/+20 %)
Max. switching current of the feedback contacts	0.35 A
Cross-section of the connections (use of ferrules is recommended)	0.2…1.5 mm²
Stripping length of the wires	10 mm
Current consumption (total for both relays)	50 mA
Weight	approx. 85 g
Operating temperature	0…+55 °C
Storage temperature	-25…+70 °C
Permissible humidity	5…95 %, non-condensing
Further environmental and operating conditions	see AX5000, page 798
Approvals	CE, UL, TÜV SÜD
Further information	www.beckhoff.com/AX5801

	TwinSAFE drive option card
Technical data	**AX5805-0000, AX5806-0000**
Safety standard	DIN EN ISO 13849-1:2008 (Cat 4, PL e) and IEC 61508:2010 (SIL 3)
	
	Drive-integrated safety functions: – stop functions (STO, SS1, SOS, SS2) – speed functions (SLS, SSM, SSR, SMS) with up to 8 speeds – position functions (SLP, SCA, SLI) with reference cams – acceleration functions (SAR, SMA) – rotating direction functions (SDIp, SDIn)
Protocol	TwinSAFE/Safety over EtherCAT
Fault response time	≤ watchdog time (parameterisable)
Weight	approx. 75 g
Environmental and operating conditions	see AX5000, page 798
Approvals	CE, UL, TÜV SÜD
Further information	www.beckhoff.com/AX5805

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▶ **www.beckhoff.com/support**

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Beckhoff offers a comprehensive training program worldwide for Beckhoff system components. The training takes place at training centres at the headquarters in Germany or at the Beckhoff subsidiaries. Please contact the appropriate companies in your country with regard to training with the partner firms around the world. For addresses see page 10

▶ **www.beckhoff.com/training**

TwinCAT 2 Training

TR1000 | TwinCAT 2 Training: Compact programming

Information	TR1000
Content	TwinCAT PLC: TwinCAT handling, IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning; TwinCAT ADS: communication interface, high-level language communication
Requirements	sound knowledge of Windows operating systems; experience in PLC programming; knowledge of PLC or high-level language concepts such as declaration of variables, variable classes and structures
Duration	5 days
Further information	www.beckhoff.com/TR1000

TR1020 | TwinCAT 2 Training: Programming for those switching from PLCs

Information	TR1020
Content	TwinCAT PLC: TwinCAT handling, IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning
Requirements	sound knowledge of Windows operating systems; experience in PLC programming
Duration	5 days
Further information	www.beckhoff.com/TR1020

TR1010, TR1012 | TwinCAT 2 Training: Maintenance, repairs and service

Information	TR1010	TR1012
Content	TwinCAT PLC: TwinCAT handling, commissioning, IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning; TwinCAT ScopeView for diagnostics	same as TR1010, additionally overview of Structured Text programming
Requirements	sound knowledge of Windows basic functionalities; handling of PLC systems, such as logging in and out, saving PLC programmes, etc.	
Duration	4 days	5 days
Further information	www.beckhoff.com/TR1010	www.beckhoff.com/TR1012

TR2020 | TwinCAT 2 Training: NC Point-to-Point

Information	TR2020
Content	TwinCAT NC PTP: operation of TwinCAT NC feed forward, controller, functional plan; NC control with NC library blocks, cyclic interface, axis blocks; TwinCAT ScopeView: recording of the set value profiles; Motion Control (MC) blocks: standardisation of axis functions, simplifications in the use of MC blocks, advantages for programming and maintenance; programming examples; TwinCAT cam plates and MC blocks for cam plate functionality
Requirements	assured handling of TwinCAT PLC programming; solid knowledge of PLC programming; level of knowledge corresponding to courses TR1000/TR1020, or corresponding experience in IEC 61131-3 programming; programming languages: ST and Sequential Function Chart (SFC)
Duration	2 days
Further information	www.beckhoff.com/TR2020

TR2030 | TwinCAT 2 Training: NC Point-to-Point and NC Interpolation

Information	TR2030
Content	TwinCAT NC PTP: same as TR2020 without cam plates; TwinCAT NC I: creation of axis groups from single axes using function blocks from the TwinCAT libraries, creating NC programs in accordance with DIN 66025, sequential control from the System Manager, PLC libraries for creating NC channels and for controlling the interpreter, sequential control from the PLC, communication between NC program and PLC program (M functions), exchange of parameters between NC program and PLC (H, S and T), set value monitoring for the path from TwinCAT Scope
Requirements	assured handling of TwinCAT PLC programming, solid knowledge of PLC programming, level of knowledge corresponding to courses TR1000/TR1020, or corresponding experience in IEC 61131-3 programming, programming languages: ST
Duration	3 days
Further information	www.beckhoff.com/TR2030

TR5010, TR5012 | TwinCAT 2 Training: Basic course in building automation for electricians

Information	TR5010	TR5012
Content	TwinCAT PLC: TwinCAT handling, overview of IEC 61131-3; handling Embedded PC CX; building automation library	TwinCAT PLC: TwinCAT handling, overview of IEC 61131-3; handling Embedded PC CX; building automation library; overview of Structured Text programming
Requirements	sound knowledge of Windows operating systems	
Duration	3 days	4 days
Further information	www.beckhoff.com/TR5010	www.beckhoff.com/TR5012

TR5020 | TwinCAT 2 Training: Building automation for system integrators

Information	TR5020
Content	communication with and handling of Embedded PC CX; TwinCAT PLC: TwinCAT handling, IEC programming, overview of IEC 61131-3; TwinCAT BACnet/IP supplement; TwinCAT building automation software
Requirements	sound knowledge of Windows operating systems, experience in PLC programming
Duration	4 days
Further information	www.beckhoff.com/TR5020

TR8010 | TwinCAT 2 Training: TwinSAFE

Information	TR8010
Content	integration of TwinSAFE Terminals, handling the TwinSAFE configurator, using the TwinSAFE library
Requirements	experience in handling TwinCAT software
Duration	1 day
Further information	www.beckhoff.com/TR8010

TR8011 | TwinCAT 2 Training: TwinSAFE AX5805 drive option card

Information	TR8011
Content	overview of the AX5805 option card functions, development of an example project, configuration of the option card
Requirements	experience in handling of TwinCAT software, experience in TwinCAT NC PTP, training contents of TR8010 or experience in TwinSAFE Terminals
Duration	1 day
Further information	www.beckhoff.com/TR8011

TR8020 | TwinCAT 2 Training: EtherCAT

Information	TR8020
Content	EtherCAT basics, configuration in the System Manager, EtherCAT diagnostics (topology view, emergency scan), oversampling terminals
Requirements	experience in handling of TwinCAT software
Duration	1 day
Further information	www.beckhoff.com/TR8020

TR1900 | TwinCAT Training: Individual

Information	TR1900
Content	agreed upon with the customer
Requirements	agreed upon with the customer
Duration	by arrangement
Further information	www.beckhoff.com/TR1900

TwinCAT 3 Training

TR3010, TR3012 | **TwinCAT 3 Training: Maintenance, repairs and service**

Information	TR3010	TR3012
Content	TwinCAT PLC: introduction to TwinCAT eXtended Automation Technology (XAT); TwinCAT system architecture: configuration and diagnostics, basics of IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning and Motion Control blocks	same as TR3010, additionally overview of Structured Text programming
Requirements	sound knowledge of basic Windows functionalities; basics of PLC systems	
Duration	4 days	5 days
Further information	www.beckhoff.com/TR3010	www.beckhoff.com/TR3012

TR3020 | **TwinCAT 3 Training: Basic PLC programming**

Information	TR3020
Content	basic PLC principles: introduction to TwinCAT eXtended Automation Technology (XAT); eXtended Automation Engineering environment (XAE), Microsoft Visual Studio® integration; hardware configuration; IEC 61131-3 programming; FBD, LD, ST and SFC editors; basic principles of ADS communication; TwinCAT NC PTP: basis of axis commissioning, motion control function blocks, TcMC2 library
Requirements	sound knowledge of PLC programming; no prior knowledge of TwinCAT 2 or IEC 61131-3 is necessary
Duration	5 days
Further information	www.beckhoff.com/TR3020

TR3030 | TwinCAT 3 Training: Programming

Information	TR3030
Content	TwinCAT PLC: introduction to TwinCAT eXtended Automation Technology (XAT), eXtended Automation Engineering environment (XAE), Microsoft Visual Studio® integration, IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning and motion control components; TwinCAT ADS: communication interface, high-level language link
Requirements	sound knowledge of PLC or high-level language concepts such as declaration of variables, variable classes and structures; no prior knowledge of TwinCAT 2 is necessary
Duration	5 days
Further information	www.beckhoff.com/TR3030

TR3040 | TwinCAT 3 Training: How to switch from TC2 to TC3

Information	TR3040
Content	TwinCAT PLC: introduction to TwinCAT eXtended Automation Technology (XAT), eXtended Automation Engineering environment (XAE), Microsoft Visual Studio® integration, basic differences between TC2 and TC3, principles of object-oriented programming in the PLC, integration of TcCom modules, MATLAB®/Simulink®, C/C++
Requirements	sound knowledge of TwinCAT 2 programming; basics of high-level language programming
Duration	2 days
Further information	www.beckhoff.com/TR3040

TR3042 | TwinCAT 3 Training: C++ module creation, wizards, TMC editor

Information	TR3042
Content	TwinCAT PLC: TwinCAT architecture, TwinCAT XAE (Engineering) and XAR (Runtime), opportunities and limitations of C++ programming in the TwinCAT 3 real-time environment, requirements on the development PC; TwinCAT Class Wizard: creating and debugging examples, TwinCAT TMC editor, real-time settings, task configuration multi-core support, consolidation of the above topics using practical examples
Requirements	sound knowledge of the C++ programming language
Duration	2 days
Further information	www.beckhoff.com/TR3042

TR3044 | TwinCAT 3 Training: Object-oriented programming with the PLC

Information	TR3044
Content	introduction to OOP, new: keywords of IEC 61131-3 3rd edition, implementation of a PLC example in a FB with OOP elements, inheritance, overwrite
Requirements	sound knowledge of PLC programming with TwinCAT 3, training contents of TR3030
Duration	1 day
Further information	www.beckhoff.com/TR3044

TR3050 | TwinCAT 3 Training: NC Point-to-Point

Information	TR3050
Content	operation of TwinCAT NC feed forward, controller, functional plan, NC control with NC library blocks, cyclic interface, axis blocks; TwinCAT Measurement: recording of set value profiles; Motion Control (MC) blocks: standardisation of axis functions, simplifications in the use of MC blocks, advantages for programming and maintenance, programming examples, TwinCAT cam plates and MC blocks for cam plate functionality
Requirements	assured handling of TwinCAT 3 PLC programming; solid knowledge of PLC programming; level of knowledge corresponding to courses TR3020/TR3030, or corresponding experience in IEC 61131-3 programming; programming languages: ST
Duration	2 days
Further information	www.beckhoff.com/TR3050

TR3052 | TwinCAT 3 Training: NC Point-to-Point and NC Interpolation

Information	TR3052
Content	TwinCAT NC PTP: same as TR3050 without cam plates; TwinCAT NC I: creation of axis groups from single axes using function blocks from the TwinCAT libraries, creating CNC programs, sequential control from the System Manager, PLC libraries for creating NC channels and for controlling the interpreter, sequential control from the PLC, communication between NC and PLC program (M functions), exchange of parameters between NC program and PLC (H, S and T), set value monitoring for the path from TwinCAT Scope
Requirements	assured handling of TwinCAT PLC programming; solid knowledge of PLC programming; level of knowledge corresponding to courses TR3020/TR3030, or corresponding experience in IEC 61131-3 programming; programming languages: ST
Duration	3 days
Further information	www.beckhoff.com/TR3052

TR3054 | TwinCAT 3 Training: CNC

Information	TR3054
Content	introduction to TwinCAT CNC, creating and processing CNC configurations in the System Manager, creating NC programs compliant with DIN 66025 and extensions of the CNC kernel, operating CNC interfaces via structures in the PLC, data and communication exchange between PLC and CNC using M functions and V. E. variables, recording and displaying CNC quantities using Scope View, system diagnostics facilities, operation and use of the "HLI" (high level interface), kinematic transformations, commissioning of servo drives using the CNC
Requirements	basics of programming and automation technology using TwinCAT; familiarity with TwinCAT 3 system configuration and programming; in-depth knowledge of PLC programming; contents of the courses TR3030/TR3020, or equivalent experience of IEC 61131-3 programming (we recommend advanced TwinCAT 2 users to first take the course "TR3040 | Switching from TC2 to TC3" as a basis); ST programming language
Duration	2 days
Further information	www.beckhoff.com/TR3054

TR3060 | TwinCAT 3 Training: TwinSAFE Terminals

Information	TR3060
Content	introduction to the TwinSAFE system, integration of TwinSAFE Terminals, development of a TwinSAFE project, overview of the TwinSAFE function blocks
Requirements	experience in handling of TwinCAT 3 software
Duration	1 day
Further information	www.beckhoff.com/TR3060

TR3061 | TwinCAT 3 Training: TwinSAFE AX5805 drive option card

Information	TR3061
Content	overview of the functions of the AX5805 option card, development of an example project, configuration of the option card
Requirements	experience in handling of TwinCAT 3 software, experience in TwinCAT NC PTP, training contents of TR3060, experience in TwinSAFE Terminals
Duration	1 day
Further information	www.beckhoff.com/TR3061

TR3070 | TwinCAT 3 Training: Visualisation and Connectivity

Information	TR3070
Content	TwinCAT PLC visualisation: short insight with programming examples for various control elements of PLC visualisation, use of TF1800 for target visualisation, use of TF1810 for Web visualisation; OPC UA: configuration and commissioning of TF6100, programming examples for the use of the OPC UA server; ADS interface: presentation of TcAds.dll for establishing a connection between programs written in a high-level language and the TwinCAT 3 environment, program examples for the integration of TcAds.dll into a platform-based visualisation under C# and .NET, program examples for the integration of TcAds.dll into a Web-based visualisation under HTML5 and JavaScript
Requirements	experienced TwinCAT 3 users with knowledge of high-level language programming
Duration	3 days
Further information	www.beckhoff.com/TR3070

TR3072 | TwinCAT 3 Training: OPC UA

Information	TR3072
Content	overview and benefits of OPC Unified Architecture (OPC UA); basic components of TF6100 TC3 OPC UA; operating principle of the TwinCAT OPC UA Server (architecture, configuration, symbol files, communication patterns, security, setup scenarios); operating principle of the TwinCAT OPC UA Configurator (architecture, online panel, diagnostics, certificate management); operating principle of the TwinCAT OPC UA Client (architecture, function blocks of the PLCopen_Opc_Ua library, read/write workflow, MethodCall workflow, security)
Requirements	knowledge of handling the TwinCAT system is required, such as I/O configuration, PLC handling, linking of PLC variables
Duration	1 day
Further information	www.beckhoff.com/TR3072

TR3076 | TwinCAT 3 Training: EtherCAT

Information	TR3076
Content	EtherCAT basics, diagnostics, Hot Connect, XFC, redundancy, simulation
Requirements	knowledge of handling the TwinCAT 3 software
Duration	1 day
Further information	www.beckhoff.com/TR3076

TR3080 | TwinCAT 3 Training: Automation Interface

Information	TR3080
Content	basic functions of the TwinCAT Automation Interface (combination of two technologies: Visual Studio® and TwinCAT XAE, adding TwinCAT configurations); using TwinCAT I/O functions (adding I/O devices, managing I/O templates); using TwinCAT PLC functions (adding PLC projects, adding POUs, modifying PLC program code, managing libraries, placeholders and repositories); using TwinCAT TcCOM functions (adding and parameterising TcCOM modules); using TwinCAT measurement functions (adding TwinCAT measurement projects, adding and parameterising charts, axes and channels); mapping between I/O, PLC and TcCOM modules
Requirements	knowledge of handling the TwinCAT system is required, such as I/O configuration, PLC handling, linking of PLC variables
Duration	1 day
Further information	www.beckhoff.com/TR3080

EtherCAT Developer Training

TR8xxx | EtherCAT seminar and workshops for developers

The workshops are aimed at developers of EtherCAT slave devices (TR8100) or EtherCAT master devices (TR8200). In addition to theoretical content these workshops also include practical exercises. It is assumed that workshop participants have access to an EL9820 evaluation kit (slave workshop) or the ET9200 Master Sample Code (master workshop). Basic EtherCAT knowledge is assumed. The workshops are held by developers in manageable groups so that individual interests can be addressed.

TR8110	EtherCAT technology basics for developers
Ordering information	training location: Verl/Nuremberg, Germany
	duration: 1 day
Further information	course contents and requirements see www.beckhoff.com/training

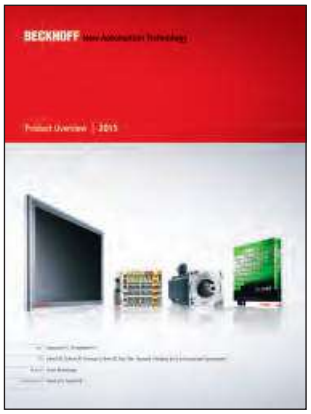
TR8100	EtherCAT evaluation kit workshop for slave developers
Ordering information	training location: Verl/Nuremberg, Germany
	duration: 1 day
Further information	course contents and requirements see www.beckhoff.com/training

TR8200	EtherCAT Master Sample Code workshop for master developers
Ordering information	training location: Verl/Nuremberg, Germany
	duration: 1 day
Further information	course contents and requirements see www.beckhoff.com/training

Information Media
Print

Order no. DK130x

News catalog



Order no. DK140x

Product overview

Order no. DK4000

Product DVD

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Ordering information	
DK1101	Main catalog, German
DK1102	Main catalog, English
DK1301	News catalog, German
DK1302	News catalog, English
DK1401	Product overview, German
DK1402	Product overview, English
DK1405	Product overview, French
DK1407	Product overview, Russian
DK1409	Product overview, Turkish
DK4000	Main catalog and software products on DVD, German, English

Information Media
Applications & Solutions

▶ www.beckhoff.com/applications

Ordering information	
DK3501	Flyer Building Automation, German
DK3502	Flyer Building Automation, English
DK3521	Image Flyer Building Automation, German
DK3522	Image Flyer Building Automation, English
DK3511	Flyer Wood Industry, German
DK3512	Flyer Wood Industry, English
DK3531	Flyer Water Treatment, German
DK3532	Flyer Water Treatment, English
DK3561	Flyer Plastic Industry, German
DK3562	Flyer Plastic Industry, English
DK3571	Flyer Wind Turbines, German
DK3572	Flyer Wind Turbines, English
DK3541	Flyer Packaging Industry, German
DK3542	Flyer Packaging Industry, English
DK3581	Flyer Robotics, German
DK3582	Flyer Robotics, English
DK3551	Flyer Tire and Rubber Industry, German
DK3552	Flyer Tire and Rubber Industry, English
DK3631	Flyer Photovoltaic Production, German
DK3632	Flyer Photovoltaic Production, English
DK3591	Flyer Forming Technology/Sheet Metal Working, German
DK3592	Flyer Forming Technology/Sheet Metal Working, English
DK3661	Flyer Urban Automation, German
DK3662	Flyer Urban Automation, English
DK3651	Flyer Shipbuilding, German
DK3652	Flyer Shipbuilding, English
DK3641	Flyer Stage and Show Technology, German
DK3642	Flyer Stage and Show Technology, English

Information Media
PC Control Magazine

Order no. DK600x

PC Control Magazine

PC Control "The New Automation Technology Magazine"
A further source of information is PC Control, the Beckhoff company magazine. PC Control is issued four times per year and includes general automation technology reports, particularly from the areas of IPC, I/O, Motion and Automation, and PC-based control technology. The online version of the Beckhoff company magazine can be found at www.pc-control.net. All contributions are available both in German and in English as web pages or as PDF files. The reports are supplemented with links to background or other additional information. The previous issues of PC Control are available in the archive for online viewing or for downloading.

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The Beckhoff Information System contains information about the Beckhoff products and technical information, manuals, TwinCAT example codes, a knowledge base and much more.

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TwinCAT automation software can be downloaded as a full version and or as a runtime version. The trial period for the runtime version is seven days.

▶ **www.beckhoff.com/TwinCAT**

Online documentation

In addition to all information contained in the printed catalog, the online service offers additional information, available in the universal PDF or in CHM (Compiled HTML) file format: detailed documentation and manuals for Beckhoff products and software updates, technical drawings and configuration files for fieldbus components.

▶ **www.beckhoff.com/documentations**

International units | Measures, weights and temperature

Linear measures	
1 inch (in)	25.4 mm
1 foot (ft)	30.48 cm

Square measures	
1 square inch (sq in)	6.4516 cm^2
1 square foot (sq ft)	0.09290306 m^2

Weights	
1 pound (lb)	453.59237 g
1 ounce (oz)	28.3495 g

Fahrenheit (°F)	Celsius (°C)
$t_F = 9/5 * t_C+32$	$t_C = 5/9 * (t_F-32)$

Каталог Beckhoff

Автоматизация