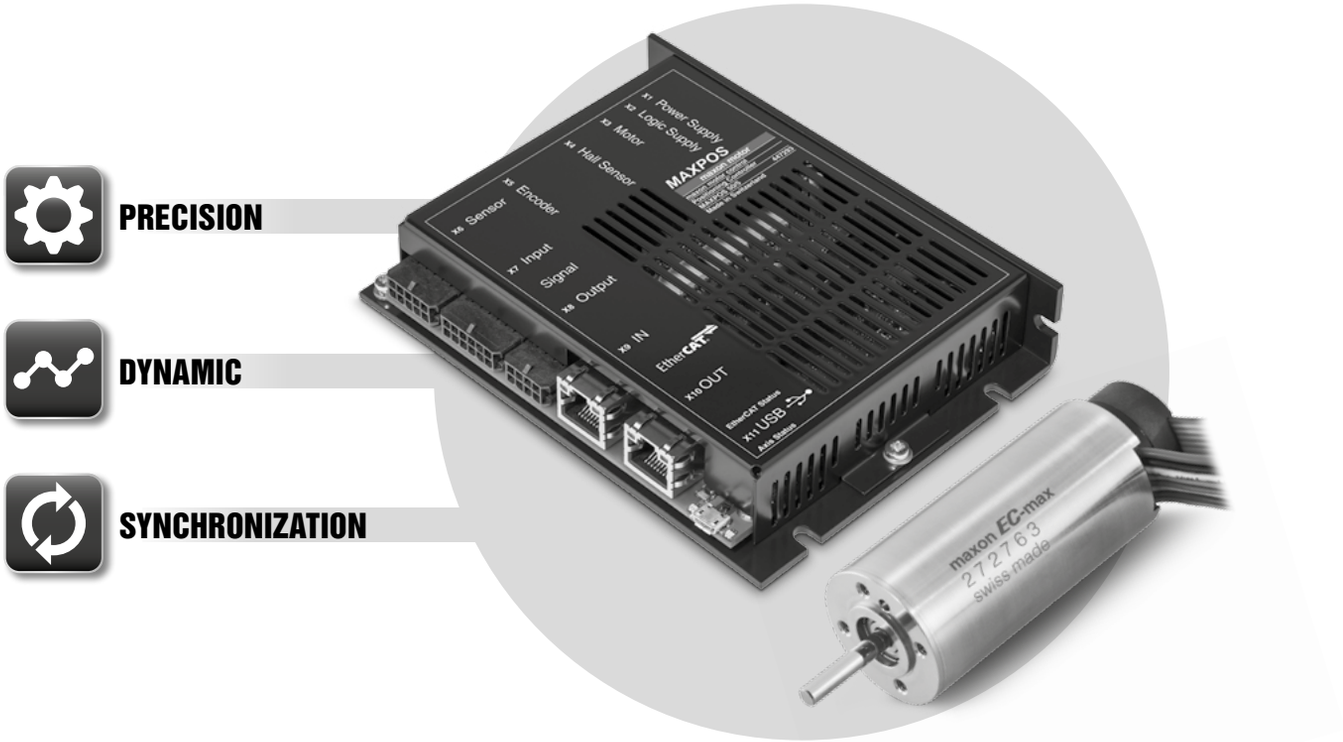
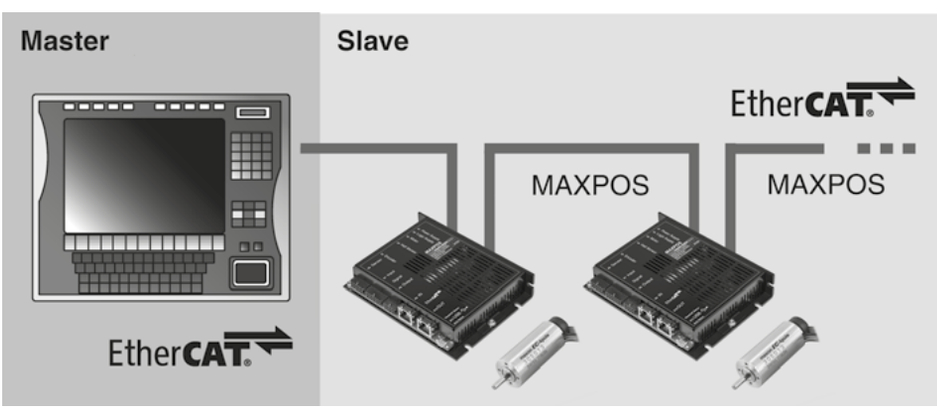
MAXPOS Positioning Controller Summary



MAXPOS 50/5 EtherCAT Slave

The MAXPOS 50/5 is a motion controller for highly dynamic applications and receives motion and I/O commands from the higher-level EtherCAT master controlling the process. The extremely fast controllers together with the diverse feedback options provide ideal conditions for operation in high-performance applications, raising the bar for precision and synchronization. The MAXPOS 50/5 supports CoE (CAN application layer over EtherCAT).



MAXPOS is a modular, digital positioning controller. It is suitable for permanent magnet-activated DC motors and brushless, electronically commutated EC motors with incremental or absolute encoders with an operational range of up to 250 W continuous power.
A wide range of operating modes allows flexible use in a variety of fields in drive systems, automation, and mechatronics.

Cyclic Synchronous Position (CSP)
The EtherCAT master executes the path planning and sends the target position cyclically and synchronously via the EtherCAT network to the MAXPOS.
The position control loop runs in the MAXPOS. The MAXPOS delivers the measured actual position, speed and current values to the EtherCAT master.

Cyclic Synchronous Velocity (CSV)
The EtherCAT master executes the path planning and sends the target speed cyclically and synchronously via the EtherCAT network to the MAXPOS. The speed control loop runs in the MAXPOS. The MAXPOS delivers the measured actual position, speed and current values to the EtherCAT master. If the PI position control loop is closed via the EtherCAT master, CSV mode is often used.

Cyclic Synchronous Torque (CST)
The EtherCAT master executes the path planning and sends the target torque cyclically and synchronously via the EtherCAT network to the MAXPOS. The torque (current) control loop runs in the MAXPOS. The MAXPOS delivers the measured actual position, speed and current values to the EtherCAT master. If the PID position control loop is closed via the EtherCAT master, CST mode is often used.

Point to point
The “Profile Position Mode” moves the position of the motor axis from point A to point B. Positioning is in relation to the axis Home position (absolute) or the actual axis position (relative).

Position and Speed control with Feed Forward
The combination of feedback and feed forward control provides ideal motion behavior. Feed forward control reduces control error. MAXPOS supports feed forward for acceleration and speed.

Speed control
In “Profile Velocity Mode”, the motor axis is moved with a set speed. The motor axis retains speed until a new speed is set.

Homing
The “Homing Mode” is for referencing to a special mechanical position. There is a wide variety of methods for achieving this.

Feedback options
Two different encoder signals can be evaluated simultaneously. In a suitable master unit, this enables dual loop control in order to compensate for mechanical backlash and elasticity.
There is a wide range of permitted sensors: Digital incremental encoders, analog incremental encoders (sin/cos), SSI and BiSS-C absolute encoders.

Protection
The positioning controller has protective circuits against overcurrent, excess temperature, under- and overvoltage, voltage transients, short-circuits in the motor cable, and against feedback signal loss. An adjustable current limitation protects the motor and load. The digital inputs and outputs are galvanically isolated and protected against overvoltage.

Safe Torque Off (STO)
With this safety feature based on IEC61800-5-2, the drive can be brought to a safe state at any time, from two independent digital inputs. The supply of torque-generating power is interrupted. The state can be monitored via an additional digital output.

Capture inputs (Touch Probe)
Digital inputs can be configured so that the actual position value is saved when a positive and/or negative edge of an input appears.

Control of Holding Brakes
Control of the holding brake can be integrated in the device status management. Thereby the delay times can be individually configured for switching on and off.

Additional information for technical data of page 447

Standardized
IEC 61158 type 12 EtherCAT slave: CoE (CAN Application Layer over EtherCAT) according to IEC 61800-7 profile type 1 (CiA 402) CANopen standard device profile for drives and motion control. Easily integrated in existing EtherCAT systems. It can be connected to a network of other EtherCAT units. Alternatively configurable via serial interface (USB 2.0/3.0).

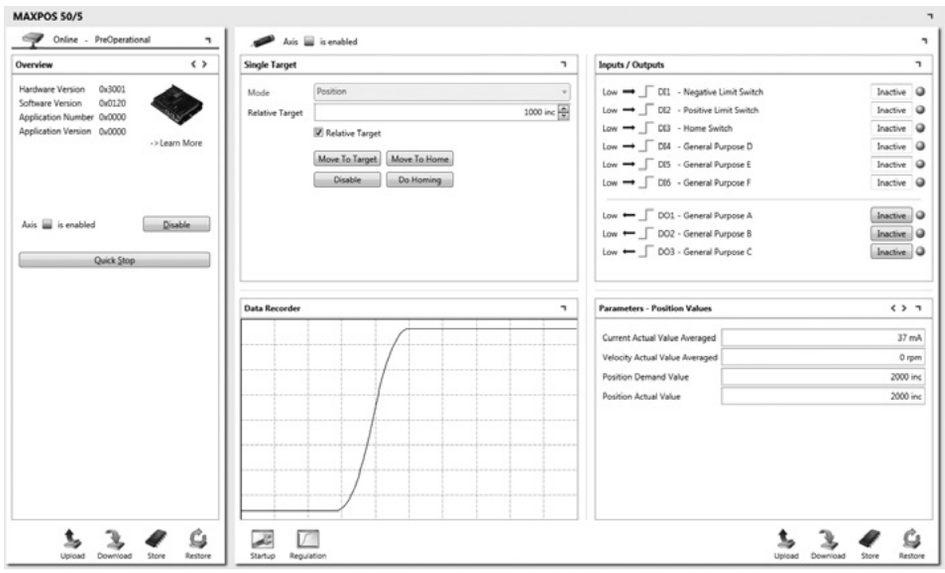
Flexible, modular
The same technology for DC and EC motors. Configurable inputs and outputs for limit switches, reference switches, holding brakes and for other sensors and indicators near the drive.

Easy start-up procedure
Graphic user interface with many functions and wizards for start-up procedure, automatic control settings, I/O configuration, tests.

Optimal control characteristics
The fast controller rates and short cycle times of the EtherCAT communication enable applications with exacting requirements for the dynamics of the drive system. Control input from the EtherCAT master can be accepted by the MAXPOS at a frequency of up to 10 kHz and transmitted to the controllers. Distributed Clocks are supported to optimize synchronization of multiple drive axes. With MAXPOS, all the requirements are met for optimal performance in a wide range of high-performance applications.

EtherCAT Master: Integration made easy
Integration of the MAXPOS 50/5 position controller in a wide variety of master systems is simplified with the provided device description file (ESI file) and device-specific configuration instructions. For a current overview, please visit http://maxpos.maxonmotor.com

State-of-the-art
Digital position, speed and current/torque control. Sinusoidal commutation (FOC) for smooth operation of EC motors.



Operating modes
Cyclic Synchronuous Position (CSP), Cyclic Synchronuous Velocity (CSV), Cyclic Synchronuous Torque (CST)
Profile Position-, Profile Velocity- and Homing Mode
Feed forward for velocity and acceleration
Sinusoidal commutation for EC motors
Communication
Communication via EtherCAT with: – CoE/FoE – Distributed Clocks Support – CSP, CSV, CST with cycle times up to 100µs – Variable PDO mapping
Configuration
Configuration via EtherCAT or USB 2.0/3.0

Inputs/Outputs
Free configurable digital inputs e.g. for limit switches and reference switches
Free configurable digital outputs e.g. for holding brakes
Available software
MAXPOS Studio (Graphical User Interface)
Firmware
Available documentation
Feature Chart
Hardware Reference
Firmware Specification
Communication Guide
Application Notes
Cable
A comprehensive range of cables is available as an option. Details can be found on page 449.

MAXPOS Positioning Controller Data

High Performance | EtherCAT | USB | GUI

MAXPOS 50/5
Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder to 250 watts.

Controller versions	
	EtherCAT Slave
Electrical data	
Operating voltage V_{CC}	10 - 50 VDC
Logic supply voltage V_C (optional)	10 - 50 VDC
Max. output voltage	0.95 x V_{CC}
Max. output current I_{max} (<1.5 s)	15 A
Continuous output current I_{cont}	5 A
Switching frequency of power stage	100 kHz
Sample rate of PI - current controller	100 kHz (10 µs)
Sample rate of PI - speed controller	10 kHz (100 µs)
Sample rate of PID - positioning control	10 kHz (100 µs)
Max. speed (DC)	limited by max. speed (motor) and max. output voltage (controller)
Max. speed (EC; 1 pole pair)	200 000 rpm (sinusoidal)
Built-in motor choke per phase	22 µH / 10 A
Input	
Hall sensor signals	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 5 MHz)
Sensor signals	A, A\, B, B\, I, I\, Clock+, Clock-, Data+, Data-
Digital inputs	6 (galvanically isolated)
Output	
Digital outputs	3 (galvanically isolated)
Encoder voltage output	+5 VDC, max. 70 mA
Hall sensor voltage output	+5 VDC, max. 30 mA
Sensor voltage output	+5 VDC, max. 150 mA
Auxiliary voltage output	+24 VDC, max. 300 mA when V_{CC} > 30 VDC
	V_{CC}-5 V, max. 300 mA when V_{CC} < 30 VDC
Interface	
EtherCAT	IEEE 802.3 100 Base T (100 Mbit/s, Full Duplex)
USB 2.0/3.0	Data+; Data- (full speed)
Indicator	
Axis Status	green LED, red LED
EtherCAT Status	green LED, red LED
EtherCAT Port Activity/Link State	green LED
Environmental conditions	
Temperature – Operation	-30…+45°C
Temperature – Extended range	+45…+56°C; Derating: -0.455 A/°C
Temperature – Storage	-40…+85°C
Humidity (condensation not permitted)	5…90%
Mechanical data	
Weight	Approx. 302 g
Dimensions (L x W x H)	140 x 103.5 x 27 mm
Mounting	Flange for M4-screws
Part numbers	
	447293 MAXPOS 50/5
Accessories	
	309687 DSR 50/5 Shunt regulator
	Order accessories separately, see page 449

Summary maxon motor control

4-Q Servocontroller				Page
ESCON		466023	ESCON Module 24/2, for DC/EC motors, speed control (open loop/closed loop), current control, 2/6 A, 10–24 VDC	426
		403112	ESCON 36/2 DC, for DC motors, speed control (open loop/closed loop), current control, 2/4 A, 10–36 VDC	426
		414533	ESCON 36/3 EC, for EC motors, speed control (open loop/closed loop), current control, 2.7/9 A, 10–36 VDC	427
		446925	ESCON Module 50/4 EC-S, for sensorless EC motors, speed control (open loop/closed loop), 4/12 A, 10–50 VDC	427
		409510	ESCON 50/5, for DC/EC motors, speed control (open loop/closed loop), current control, 5/15 A, 10–50 VDC	428
		438725	ESCON Module 50/5, for DC/EC motors, speed control (open loop/closed loop), current control, 5/15 A, 10–50 VDC	427
	NEW	532872	ESCON Module 50/8, for DC/EC motors, speed control (open loop/closed loop), current control, 8/15 A, 10–50 VDC	
	NEW	586137	ESCON Module 50/8 HE, for DC/EC motors, speed control (open loop/closed loop), current control, 8/15 A, 10–50 VDC	
		422969	ESCON 70/10, for DC/EC motors, speed control (open loop/closed loop), current control, 10/30 A, 10–70 VDC	428

4-Q-DC Servoamplifier			
LSC	NRND	250521	LSC 30/2, linear 4-Q-Servoamplifier 30 V/2 A in module housing
ADS	NRND	145391	ADS 50/5, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/5 A in module housing
	NRND	201583	ADS 50/10, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/10 A in module housing
	NRND	166143	ADS_E 50/5, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/5 A in racket card (Eurocard)
	NRND	168049	ADS_E 50/10, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/10 A in racket card (Eurocard)

1-Q-EC Amplifier				
DECS	NRND	343253	DECS 50/5, digital 1-Q-EC Amplifier 50 V/5 A, sensorless, speed control, open electronic circuit board	
DEC		367661	DEC Module 24/2, digital 1-Q-EC Amplifier 24 V/2 A, speed control, OEM module	430
		380200	DEC Module 50/5, digital 1-Q-EC Amplifier 50 V/5 A, speed control, OEM module	430
	NRND	230572	DEC 50/5, digital 1-Q-EC Amplifier 50 V/5 A, speed control, current control, PWM operation	

4-Q-EC Amplifier			
DEC	NRND	306089	DEC 70/10, digital 4-Q-EC Amplifier 70 V/10 A, speed control, current control

4-Q-EC Servoamplifier			
DES	NRND	205679	DES 50/5, digital 4-Q-EC Servoamplifier 50 V/5 A, sinusoidal commutation
	NRND	228597	DES 70/10, digital 4-Q-EC Servoamplifier 70 V/10 A, sinusoidal commutation

Positioning				
EPOS2		380264	EPOS2 24/2 for EC motors, digital positioning controller, 2 A, 9–24 VDC	434
		390003	EPOS2 24/2 for DC/EC motors, digital positioning controller, 2 A, 9–24 VDC	434
		390438	EPOS2 24/2 for DC motors, digital positioning controller, 2 A, 9–24 VDC	434
	NEW	530239	EPOS2 24/2 for DC(X) motors, digital positioning controller, 2 A, 9–24 VDC	434
		360665	EPOS2 Module 36/2 OEM positioning controller plug-in module, 2 A, 11–36 VDC	434
		392159	EPOS2 Module 24/3 OEM positioning controller plug-in module, 3 A, 11–24 VDC	
		367676	EPOS2 24/5, digital positioning controller, 5 A, 11–24 VDC	435
		347717	EPOS2 50/5, digital positioning controller, 5 A, 11–50 VDC	435
		375711	EPOS2 70/10, digital positioning controller, 10 A, 11- 70 VDC	435
EPOS2 P		378308	EPOS2 P 24/5, digital positioning controller, programmable, 5 A, 11–24 VDC	438
EPOS4	NEW	536630	EPOS4 Module 24/1.5, digital positioning controller, 1.5 A, 10–24 VDC	441
	NEW	546714	EPOS4 Compact 24/1.5 CAN, digital positioning controller, 1.5 A, 10–24 VDC	441
	NEW	534130	EPOS4 Module 50/5, digital positioning controller, 5 A, 10–50 VDC	442
	NEW	541718	EPOS4 Compact 50/5 CAN, digital positioning controller, 5 A, 10–50 VDC	442
	NEW	546047	EPOS4 50/5, digital positioning controller, 5 A, 10–50 VDC	
		504384	EPOS4 Module 50/8, digital positioning controller, 8 A, 10–50 VDC	443
		520885	EPOS4 Compact 50/8 CAN, digital positioning controller, 8 A, 10–50 VDC	443
		504383	EPOS4 Module 50/15, digital positioning controller, 15 A, 10–50 VDC	444
		520886	EPOS4 Compact 50/15 CAN, digital positioning controller, 15 A, 10–50 VDC	444
MAXPOS		447293	MAXPOS 50/5, digital positioning controller, 5 A, 10–50 VDC	447

Summary maxon motor control Accessories

Backplane

NRND	166873	Backplane with screw type terminal block to ADS_E 50/5 (166143) and ADS_E 50/10 (168049)

Front panel

NRND	167850	Front panel 3HE / 5TE to ADS_E 50/5 (166143)
NRND	168910	Front panel 3HE / 7TE to ADS_E 50/10 (168049)

Motor choke

	137303	Choke module, 3 x 0.25 mH, 5.0 A, L x W x H (90 x 70 x 49 mm) with screw type terminal block
	347919	Choke module, 3 x 0.1 mH, 10.0 A, L x W x H (90 x 70 x 49,7 mm) with screw type terminal block

Cable

	403957	Power Cable (length 1.5 m) to 403112, 414533
	403962	DC Motor Cable (length 1.5 m) to 403112
	403964	I/O Cable 7core (length 1.5 m) for analog I/Os to 403112, 414533
	403965	I/O Cable 6core (length 1.5 m) for digital I/Os to 403112, 414533
	403968	USB Type A - micro B Cable (length 1.5 m) to 403112, 409510, 414533, 422969, 438725, 446925, 447293, 466023, 504383, 504384, 520885, 520886, 534130, 536630, 541718, 546714
	275829	Power Cable (length 3 m) to 347717, 361435, 367676, 375711, 378308, 407582, 447293, 520884, 520885, 520886
	520850	Power Cable High Current (length 3 m) to 520884, 520885, 520886
	275851	Motor Cable (length 3 m) to 347717, 361435, 367676, 375711, 378308, 407582, 447293, 520885, 520886, 534133, 541718
	520851	Motor Cable High Current (length 3 m) to 520884, 520886
	303490	DC Motor Cable (length 3 m) to 390003
	275878	Hall Sensor Cable (length 3 m) to 347717, 361435, 367676, 375711, 378308, 407582, 447293, 520884, 520885, 520886, 534133, 541718
	302948	Motor/Hall Sensor Cable (length 3 m) to 390003
	275934	Encoder Cable (length 3 m) to 347717, 361435, 367676, 375711, 378308, 380264, 390003, 390438, 403112, 407582, 409510, 422969, 438779, 447293, 486400, 520884, 520885, 520886, 534133, 536997, 541718, 546714
	275932	Signal Cable 16core (length 3 m) to 347717, 361435, 367676, 375711, 378308, 390003
	300586	Signal Cable 6x2core (length 3 m) to 347717, 375711
	350390	Signal Cable 4x2core (length 3 m) to 347717
	378173	Signal Cable 3x2core (length 3m) to 375711
	520854	Signal Cable 7core (length 3 m) for analog I/Os with 520884, 520885, 520886, 534133, 536997, 541718, 546714
	520853	Signal Cable 8core (length 3 m) for digital I/Os and STO with 520884, 520885, 520886, 534133, 536997, 541718, 546714
	275900	RS232-COM Cable (length 3 m) to 347717, 361435, 367676, 375711, 378308, 390003
	520856	RS232-COM Cable (length 3 m) to 520884, 520885, 520886, 534133, 536997, 541718, 546714
	350392	USB Type A - B Cable (length 3 m) to 347717, 361435
	370513	USB Type A - mini B Cable (length 3 m) to 367676, 375711, 378308, 390438, 380264, 390003
	275908	CAN-COM Cable (length 3 m) to 347717, 361435, 367676, 375711, 378308, 390003
	520857	CAN-COM Cable (length 3 m) to 520884, 520885, 520886, 534133, 536997, 541718, 546714
	275926	CAN-CAN Cable (length 3 m) to 347717, 361435, 367676, 375711, 378308, 390003
	520858	CAN-CAN Cable (length 3 m) to 520884, 520885, 520886, 534133, 536907, 541718, 546714
	319471	CAN-Y Cable to 390003, 378308
	422827	Ethernet Cable (length 2 m) to 447293
	451290	Sensor Cable 5x2core (length 3 m) to 447293
	520852	Sensor Cable 5x2core (length 3 m) to 520884, 520885, 520886, 534133, 536907, 541718, 546714
	451291	Signal Cable 12core (length 3 m) to 447293
	451292	Signal Cable 8core (length 3 m) to 447293
	404404	ESCON 36/2 DC Connector Set to 403112
	425255	ESCON 36/3 EC Connector Set to 414533
	303807	EPOS2 24/2 Connector Set to 390003
	351061	EPOS2 50/5 Connector Set to 347717
	384915	EPOS2 24/5 Connector Set to 367676, 378308
	381405	EPOS2 70/10 Connector Set to 375711
	520859	EPOS4 Connector Set to 520884, 520885, 520886, 536997, 546714, 534133, 541718
	451746	MAXPOS 50/5 Connector Set to 447293

Summary maxon motor control Accessories

Adapter

	220300	Adapter 11-pole flexprint connector to 8-pole screw terminal, for use with motors EC 10/13, EC 20/32/45 flat
	220310	Adapter 4-pole flexprint connector to 4-pole screw terminal, for use with EC micro motors without Hall sensors
	425931	Adapter 8-pole flexprint connector to 8-pole screw terminal, for use with motors EC 6 (1.5 W/2 W) EC 8, EC 9.2 flat
	498157	Adapter Micromotor for use with motors EC 6/8 and RE 6/8 with encoder (flexprint connector) or cable version
	473103	Adapter 6-pole flexprint connector to 6-pole screw terminal, for use with encoder 8 OPT
	223774	Adapter 10-pole spring contact strip (DIN 41651) to 8-pole screw terminal
	262359	Adapter 10-pole pin header (DIN 41651) to 10-pole screw terminal
	459875	Adapter encoder connector 2.54 mm pitch to 2.54 mm pitch (DIN 41651) with spring terminal for motor connections
	405120	Adapter encoder connector 1.27 mm pitch to 2.54 mm pitch (DIN 41651) with spring terminal for motor connections
NEW	549609	Adapter encoder connector 1.27 mm pitch to 2.54 mm pitch (DIN 41651)
	488167	Adapter EASY Absolute to 6-pole screw terminal for use with encoder ENX 10/16 EASY Absolute
	418719	Adapter BLACK FPC11poles, for use with motors EC 10/13, EC 20/32/45 flat with 380264 and 414533
	418723	Adapter BLUE FPC8poles, for use with motors EC 6 (1.5 W/2 W) EC 8, EC 9.2 flat with 380264 and 414533
	418721	Adapter GREEN FPC8poles, for use with motors EC 6 (1.2 W), EC 10 flat with 380264 and 414533

Shunt regulators

	309687	DSR 50/5, shunt regulator 27 VDC and 56 VDC (selectable), P_{max} 300 W, P_{cont} 10 W
	235811	DSR 70/30, shunt regulator 12-75 VDC (adjustable), P_{max} 475 W, P_{cont} 25 W, module housing 180 x 103 x 26 mm

Starter kits, Eva boards, motherboards, Connector boards

DEC		370652	DEC Module Evaluation Board, with switch, LED, potentiometer etc., for use with 367661 and 380200
ESCON		486400	ESCON Module 24/2 Motherboard with pluggable screw terminal block, for use with 466023
		438779	ESCON Module Motherboard with pluggable screw terminal block, for use with 438725
	NEW	586048	ESCON Module 50/8 Motherboard with pluggable screw terminal block, for use with 532872, 586137
		450237	ESCON Module Motherboard Sensorless with pluggable screw terminal block, for use with 446925
EPOS2		363407	EPOS2 Module 36/2 Starter Kit, consisting of 361435, 360665, 275829, 275851, 275878, 275934, 275932, 350392
		361435	EPOS2 Module Evaluation Board, 1-axis (with switch, LED, potentiometer and connector) for use with 360665
		407582	EPOS2 Module Motherboard, 1 to max. 11 axes, for use with 360665 (including 1 each red & black Power Link connector and CAN-link cable) Optional accessories: 407583 EPOS2 Motherboard USB Module (incl. 4-wire connection leads l = 0.25 m, 2 x M3 screws) 407584 EPOS2 Motherboard RS232 Module (incl. 6-wire connection leads l = 0.25 m, 2 x M3 screws) 407585 EPOS2 Motherboard I/O Expander Module (2 x M3 screws) 423536 EPOS2 Motherboard Dual Encoder Module (2 x M3 screws) 423507 EPOS2 Motherboard Power Cable (l = 1 m) for use with 407582 423526 EPOS2 Motherboard USB type A Cable (l = 1.5 m) for use with 407583 423530 EPOS2 Motherboard RS232 DB9 Cable (l = 1 m) for use with 407584
EPOS2 P		327460	EPOS2 P 24/5 Starter Kit, consisting of EPOS2 P 24/5, EC motor with encoder, power supply, I/O board, cables
EPOS4		520884	EPOS4 CB Power CAN, connector board including STO Idle Connector, compatible with 504383 and 504384
	NEW	536997	EPOS4 CB 50/5 CAN, connector board including STO Idle Connector, compatible with 534130
	NEW	534133	EPOS4 CB 24/1.5 CAN, connector board including STO Idle Connector, compatible with 536630

Software

ESCON	409286	ESCON USB Stick including ESCON Setup, for use with 466023, 403112, 414533, 446925, 409510, 438725, 422969
MAXPOS	459639	MAXPOS USB Stick including MAXPOS Setup, for use with 447293