EPOS4 Positioning Controllers Overview

Modules

Micro

EPOS4 Micro 24/5 CAN

EPOS4 Micro 24/5 EtherCAT

Module

EPOS4 Module 24/1.5

EPOS4 Module 50/5

EPOS4 Module 50/8

EPOS4 Module 50/15

Ready-to-connect units

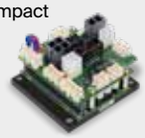
Compact CAN

EPOS4 Compact 24/1.5 CAN

EPOS4 Compact 50/5 CAN

EPOS4 Compact 50/8 CAN

EPOS4 Compact 50/15 CAN



Compact EtherCAT

EPOS4 Compact 24/1.5 EtherCAT

EPOS4 Compact 50/5 EtherCAT

EPOS4 Compact 50/8 EtherCAT

EPOS4 Compact 50/15 EtherCAT

EPOS4 Compact 24/5 EtherCAT 3-axes

Encased housing / Disk

EPOS4 50/5

EPOS4 70/15

NEW EPOS4 Disk 60/8 CAN

NEW EPOS4 Disk 60/8 EtherCAT

NEW EPOS4 Disk 60/12 CAN

NEW EPOS4 Disk 60/12 EtherCAT

maxon EPOS4 products are small, completely digital, intelligent positioning controllers. Their high power density provides high flexibility for use with brushed DC and brushless EC (BLDC) motors up to approx. 1050 W with various feedback options such as Hall sensors, incremental encoders and absolute encoders, in a variety of drive applications.

Modules
Robotic, analysis and handing systems require compact integration of a large number of energy-efficient drives, combined with highly dynamic controllers and a linked bus system.
With the established EPOS4 Module and Micro, modular multi-axis systems can be set up using CANopen or EtherCAT, without needing high investment in development.

Ready-to-connect units
For prototypes and small batches, the large variety of ready-to-connect controllers, available in various power classes and designs, provide attractive, economical options for using EPOS4 products in your application.

EPOS Studio
The EPOS Studio software, which is available free of charge, includes intuitive tools and wizards that make commissioning easy. It provides a basic overview of the EPOS4 functions and a command option. Analysis tools such as the Data Recorder or Command Analyzer supplement the features in EPOS Studio.

CANopen / EtherCAT
As a standardized motion control slave, EPOS4 can easily be integrated into the system manager tools and motion libraries of various PLC manufacturers. The data exchange and command functions make use of the CiA® 402 protocol (Device Profile for Drives and Motion Control).

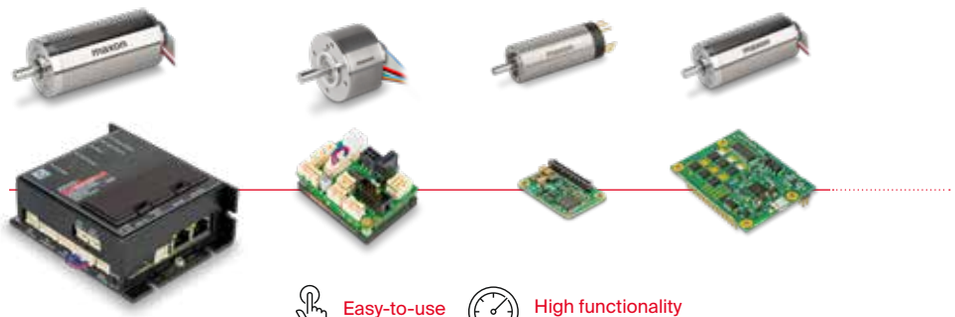
Cyclic Synchronuous Position (CSP)
The master executes the path planning and sends the target position cyclically and synchronously to the EPOS4 via the network. The position control loop runs on the EPOS4. The EPOS4 sends the measured actual position, speed and current values to the master.

Cyclic Synchronuous Velocity (CSV)
The master executes the path planning and sends the target speed cyclically and synchronously to the EPOS4 via the network. The speed control loop runs on the EPOS4. The EPOS4 sends the measured actual position, speed and current values to the master. The CSV mode is commonly used if a PI position control loop is closed via the master.

Cyclic Synchronuous Torque (CST)
The master executes the path planning and sends the target torque cyclically and synchronously to the EPOS4 via the network. The torque (current) control loop runs on the EPOS4. The EPOS4 sends the measured actual position, speed and current values to the master. The CST mode is commonly used if a PID position control loop is closed via the master.

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 velocity control with feed forward
The combination of feedback and feed forward control provides ideal motion behavior. Feed forward control reduces control error. EPOS4 supports feed forward acceleration and speed control.



Easy-to-use

High functionality and performance

Speed control
In the Profile Velocity Mode, the motor axis is moved with a defined set speed. The motor axis keeps the speed constant until a new speed set value is given.

Homing
The Homing Mode is used for referencing to a specific mechanical position. There is a wide variety of methods available.

Feedback options and dual loop
Two different encoder signals can be evaluated simultaneously. This allows dual-loop control, which can be tuned automatically to compensate for mechanical backlash and elasticity. A wide range of sensors is permitted: digital incremental encoders, analog incremental encoders (sin/cos), and SSI 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.

Safe Torque Off (STO)
With this safety feature based on IEC61800-5-2 (not certified), 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. The inputs and outputs are optically isolated.

Capture Inputs (Touch Probe)
The digital inputs can be configured so that the actual position value is stored whenever a positive or negative edge occurs at an input.

Trigger Output (Position Compare)
The digital outputs can be configured to that a digital signal is sent at a selectable position value (on request).

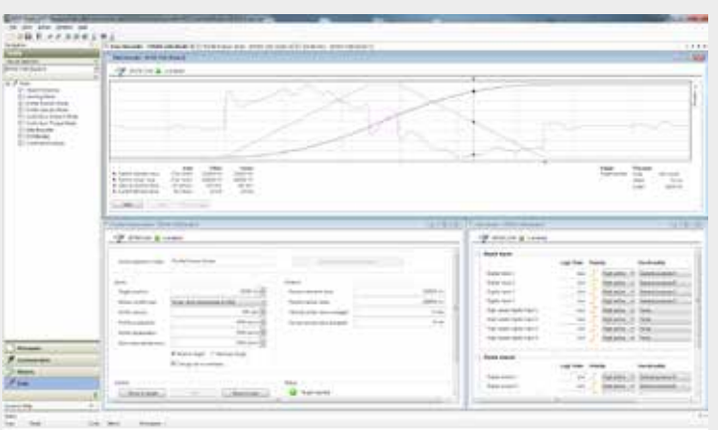
Control of Holding Brakes
Control of holding brakes can be integrated in the device status management. The delay times can be individually configured for switching on and off.

Supplementary information for technical data page 509–515.

Operating modes/Control
Cyclic Synchronous Position (CSP)
Cyclic Synchronous Velocity (CSV)
Cyclic Synchronous Torque (CST)
Profile Position, Profile Velocity and Homing Mode
Speed and Acceleration Feed Forward
Sinusoidal or Block Commutation for EC motors
Alternative set value input via analog commands
Dual-loop Position and Speed Control
Communication/Configuration
Communication via CANopen and/or USB 2.0/3.0 and/or RS232
EtherCAT (CoE)
USB to CAN and RS232 to CAN gateway
Inputs/Outputs
STO (Safe Torque Off) inputs and outputs, optically isolated, not certified
Free digital inputs, configurable e.g. for limit/reference switches
Free digital outputs, configurable e.g. for brake
Free analog inputs, configurable
Free analog ouputs, configurable
Available software
EPOS Studio
Windows DLL (32-/64-bit) with programming examples
Linux shared object library (X86 32-/64-bit, ARMv6/v7/v8 32-bit, ARMv8 64-bit for Raspberry Pi and BeagleBone) with programming examples
Firmware
Available documentation
Feature Chart
Hardware Reference
Firmware Specification
Communication Guide
Application Notes

EPOS4 performance characteristics
- Maximum power density.
- Convincing control performance even with highly dynamic motors.
- Comprehensive feedback options.
- Diverse I/O connection options for peripherals.
- Uncompromising protective features for controller and drive.
- Configuration and communication via CANopen (CiA 301, 402, 305), RS232, USB, or EtherCAT. IEC 61158 type 12 EtherCAT slave: CoE (CAN application layer over EtherCAT) compliant with IEC 61800-7 profile type 1 (CiA 402). Easy integration into existing EtherCAT systems. Can be connected to a network of other EtherCAT units.
- Easy commissioning via EPOS studio GUI and intuitive tools.
- Libraries and programming examples for efficient integration in a wide variety of systems.
- All software components are freely available at any time.
- Full documentation and outstanding support.

The complete package for your motion control solution with added value.

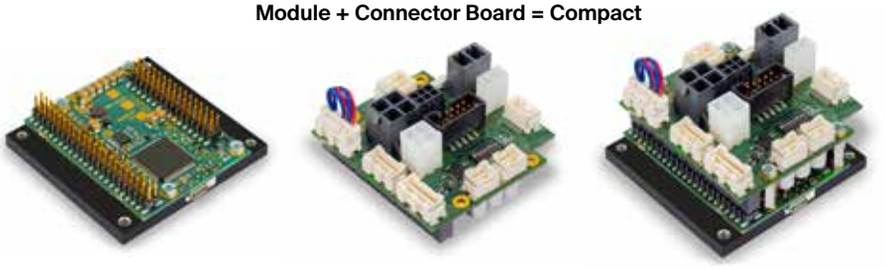


EPOS4 Positioning Controllers Overview

EtherCAT CANopen

USB RS232 GUI

Module + Connector Board = Compact



Accessories EPOS4 Module & Micro (not included in delivery)	638328 Micro 24/5 CAN	654731 Micro 24/5 EtherCAT	536630 Module 24/1.5	534130 Module 50/5	504384 Module 50/8	504383 Module 50/15
403968 USB Type A - micro B Cable			✓	✓	✓	✓
536997 EPOS4 CB 24/1.5 CAN			✓			
620048 EPOS4 CB 24/1.5 EtherCAT			✓			
534133 EPOS4 CB 50/5 CAN				✓		
620044 EPOS4 CB 50/5 EtherCAT				✓		
520884 EPOS4 CB Power CAN					✓	✓
604594 EPOS4 CB Power EtherCAT					✓	✓
581245 EPOS4 EtherCAT Card			✓ (a)	✓ (a)	✓ (a)	✓ (a)
638677 EPOS4 EB Micro	✓	✓				
659508 EPOS4 MB Micro EtherCAT 3-axes		✓				
590738 EPOS4 Module SMT socket 2 x 23 poles			✓	✓		
677324 EPOS4 Micro SMT socket 2 x 40 poles	✓	✓				

(a) with matching motherboard

Accessories EPOS4 Compact & Encased housing (not included in delivery)	684519 Compact 24/5 EtherCAT 3-axes	546714 Compact 24/1.5 CAN	628092 Compact 24/1.5 EtherCAT	541718 Compact 50/5 CAN	628094 Compact 50/5 EtherCAT	520885 Compact 50/8 CAN	605298 Compact 50/8 EtherCAT	520886 Compact 50/15 CAN	605299 Compact 50/15 EtherCAT	546047 50/5	594385 70/15
520858 CAN-CAN Cable		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
520857 CAN-COM Cable		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
275934 Encoder Cable		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
520859 EPOS4 Connector Set		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
581245 EPOS4 EtherCAT Card									✓	✓	✓
691408 EPOS4 MB 3-axes Conn. Set	✓										
422827 Ethernet Cable	✓		✓		✓	✓	✓	✓	✓	✓	
275878 Hall Sensor Cable	✓			✓	✓	✓	✓	✓	✓	✓	
275851 Motor Cable	✓			✓	✓	✓	✓	✓	✓	✓	
520851 Motor Cable High Current							✓	✓		✓	
275829 Power Cable	✓ (b)				✓ (b)	✓ (b)	✓ (b)	✓ (b)	✓	✓ (b)	
520850 Power Cable High Current	✓ (c)				✓ (c)	✓ (c)	✓ (c)	✓ (c)		✓ (c)	
520856 RS232-COM Cable		✓		✓	✓		✓		✓	✓	
520852 Sensor Cable 5 x 2core	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
520854 Signal Cable 7core	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
520853 Signal Cable 8core	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
520860 STO Idle Connector X9		✓ (i)	✓ (i)	✓ (i)	✓ (i)	✓ (i)	✓ (i)	✓ (i)	✓ (i)	✓ (i)	
403968 USB Type A - micro B Cable	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

(b) optional for separate logic supply (c) mandatory for supply of power stage (i) included Additional accessories from page 529

Accessories EPOS4 Disk (not included in delivery)	688770 Disk 60/8 CAN	688772 Disk 60/8 EtherCAT	688775 Disk 60/12 CAN	709859 Disk 60/12 CAN SSC	688777 Disk 60/12 EtherCAT	709862 Disk 60/12 EtherCAT SSC
710928 Brake Cable	✓	✓	✓	✓	✓	✓
710931 CAN-CAN Cable	✓		✓	✓		
710932 CAN-COM Cable	✓		✓	✓		
696285 Encoder Cable	✓	✓	✓	✓	✓	✓
710926 EPOS4 Disk Connector Set	✓	✓	✓	✓	✓	✓
710934 EtherCAT-COM Cable		✓			✓	✓
710933 EtherCAT-EtherCAT Cable		✓			✓	✓
275878 Hall Sensor Cable			✓	✓	✓	✓
696284 Hall Sensor Cable	✓	✓	✓	✓	✓	✓
710930 Motor Cable High Current			✓	✓	✓	✓
696283 Power & Motor Cable	✓	✓				
710929 Power Cable High Current			✓	✓	✓	✓
696286 Sensor Cable 3x2core	✓	✓	✓	✓	✓	✓
520852 Sensor Cable 5x2core			✓	✓	✓	✓
696288 Signal Cable 7core	✓	✓	✓	✓	✓	✓
696287 Signal Cable 8core	✓	✓	✓	✓	✓	✓
696289 USB Type A - Micro-Lock Cable	✓	✓	✓	✓	✓	✓

EPOS4 Positioning Controllers Data

	EPOS4 Micro 24/5 CAN Miniaturized OEM positioning controller module, designed for use with brushed DC motors with encoders and brushless EC motors (BLDC) with Hall sensors and encoders up to 120 W/360 W.	**EPOS4 Micro 24/5 EtherCAT** Miniaturized OEM positioning controller module, designed for use with brushed DC motors with encoders and brushless EC motors (BLDC) with Hall sensors and encoders up to 120 W/360 W.
Controller version		
	CANopen Slave	**EtherCAT Slave**
Electrical data		
Operating voltage V_{CC}	10 - 24 VDC	10 - 24 VDC
Logic supply voltage V_C (optional)	10 - 24 VDC	10 - 24 VDC
Max. output voltage	0.9 x V_{CC}	0.9 x V_{CC}
Max. output current I_{max}	15 A (<10 s)	15 A (<10 s)
Continuous output current I_{cont}	5 A	5 A
Switching frequency of power stage	50 kHz	50 kHz
Sampling rate of PI current controller	25 kHz (40 µs)	25 kHz (40 µs)
Sampling rate of PI speed controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Sampling rate of PID position controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Max. speed (1 pole pair)	50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)
Built-in motor choke per phase	–	–
Inputs		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
Sensor signals	Clock, Data	Clock, Data
Digital inputs	4 (logic level)	4 (logic level)
Digital inputs “High-speed”	1	1
Analog inputs	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)
CAN ID / DEV ID	configurable with external wiring	–
Outputs		
Digital outputs	2	2
Digital outputs “High-speed”	1	1
Analog outputs	1 (12-bit resolution, -4...+4 V, max. 1 mA)	1 (12-bit resolution, -4...+4 V, max. 1 mA)
Encoder voltage output	+5 VDC, max. 120 mA	+5 VDC, max. 120 mA
Hall sensor voltage output	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
Auxiliary voltage output	–	–
Interfaces		
RS232	RxD; TxD (max. 115 200 bit/s)	–
CAN	high; low (max. 1 Mbit/s)	–
USB 2.0/3.0	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
EtherCAT	–	100 Mbit/s (Full Duplex)
Indicator		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
Environmental conditions		
Temperatrue – Operation	-30...+45°C	-30...+40°C
Temperature – Extended Range	+45...+70°C; Derating: -0.200 A/°C	+40...+60°C; Derating: -0.25 A/°C
Temperature – Storage	-40...+85°C	-40...+85°C
Humidity (condensation not permitted)	5...90%	5...90%
Mechanical data		
Weight	approx. 6 g	approx. 7 g
Dimensions (L x W x H)	32.0 x 22.0 x 7.0 mm	36.5 x 27.0 x 7.0 mm
Mounting	M2 screws	M2 screws
Part numbers		
	638328 EPOS4 Micro 24/5 CAN	**654731** EPOS4 Micro 24/5 EtherCAT
Accessories		
	309687 DSR 50/5 Shunt regulator	**309687** DSR 50/5 Shunt regulator
	Order accessories separately, see page 529	Order accessories separately, see page 529

EPOS4 Positioning Controllers Data

EPOS4 Module 50/8
OEM position control module, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 400/1500 Watt.

EPOS4 Module 50/15
OEM position control module, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 750/1500 Watt.

EPOS4 Compact 24/5 EtherCAT 3-axes
Ready-to-install 3-axis compact solution, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 120/360 W per axis.

Controller version		
CANopen Slave with EtherCAT option	**CANopen Slave with EtherCAT option**	**EtherCAT Slave**
Electrical data		
10 - 50 VDC	10 - 50 VDC	10 - 24 VDC
10 - 50 VDC	10 - 50 VDC	10 - 24 VDC
0.9 x V_{CC}	0.9 x V_{CC}	0.9 x V_{CC}
30 A (<5 s)	30 A (<60 s)	15 A (<10 s) per axis
8 A	15 A	5 A per axis
50 kHz	50 kHz	50 kHz
25 kHz (40 µs)	25 kHz (40 µs)	25 kHz (40 µs)
2.5 kHz (400 µs)	2.5 kHz (400 µs)	2.5 kHz (400 µs)
2.5 kHz (400 µs)	2.5 kHz (400 µs)	2.5 kHz (400 µs)
50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)
–	–	–
Inputs		
H1, H2, H3	H1, H2, H3	H1, H2, H3 per axis
A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)	
A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\ per axis
4 (logic level)	4 (logic level)	4 (level switchable: logic/PLC) per axis
4, differential	4, differential	–
2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V) per axis
configurable with external wiring	configurable with external wiring	–
Outputs		
2	2	2 per axis
1, differential	1, differential	–
2 (12-bit resolution, -4...+4 V, max. 1 mA)	2 (12-bit resolution, -4...+4 V, max. 1 mA)	1 (12-bit resolution, -4...+4 V, max. 1 mA) per axis
+5 VDC, max. 70 mA	+5 VDC, max. 70 mA	+5 VDC, max. 100 mA per axis
+5 VDC, max. 30 mA	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA per axis
+5 VDC, max. 150 mA	+5 VDC, max. 150 mA	
Interfaces		
RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)	–
high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)	–
Data+; Data- (Full Speed)	Data+; Data- (Full Speed)	Data+; Data- (Full Speed) per axis
Optional 581245 EPOS4 EtherCAT Card available	Optional 581245 EPOS4 EtherCAT Card available	100 Mbit/s (Full Duplex)
Indicator		
Green LED, red LED	Green LED, red LED	Green LED, red LED
Environmental conditions		
-30...+45°C	-30...+25°C	-30...+25°C
+45...+77°C; Derating: -0.250 A/°C	+25...+77°C; Derating: -0.288 A/°C	+25...+50°C; Derating: -0.200 A/°C
-40...+85°C	-40...+85°C	-40...+85°C
5...90%	5...90%	5...90%
Mechanical data		
approx. 23 g	approx. 70 g	approx. 85 g
59.5 x 46.0 x 14.1 mm	59.5 x 62.0 x 16.4 mm	90.0 x 56.0 x 29.0 mm
Socket header 2.54 mm or M2.5 screws	Socket header 2.54 mm or M3 screws	M2.5 screws
Part numbers		
504384 EPOS4 Module 50/8	**504383** EPOS4 Module 50/15	**684519** EPOS4 Compact 24/5 EtherCAT 3-axes
Accessories		
235811 DSR 70/30 Shunt regulator	**235811** DSR 70/30 Shunt regulator	**235811** DSR 70/30 Shunt regulator
Order accessories separately, see page 529	Order accessories separately, see page 529	Order accessories separately, see page 529