



# maxon motor control

These control electronics are optimized for use with maxon motors. Various 4-quadrant servo-amplifiers meet your needs regarding performance and speed accuracy with maxon DC motors. The most sophisticated electronic commutation is available with maxon EC motors. Together with maxon motors, the positioning control represents a complete solution for precise positioning with controlled rotation.

ESCON servo controllers	290–292
1-Q-EC Amplifier	293–301
4-Q-EC Amplifier	302–308
EPOS2, EPOS2 P, EPOS3	
Positioning controller	309–319
Summary and accessories	320–322

# ESCON Overview

The ESCON servo controllers are small-sized, powerful 4-quadrant PWM servo controller for the highly efficient control of permanent magnet-activated DC motors.

The featured operating modes – speed control (closed loop), speed control (open loop), and current control – meet the highest requirements. The ESCON servo controllers are designed being commanded by an analog set value and

features extensive analog and digital I/O functionality and are being configured via USB interface using the graphical user interface «ESCON Studio» for Windows PCs.

## // ESCON Setup Full version, including...

escon.maxonmotor.com



- ESCON Studio
- ESCON Firmware
- Documentation (Hardware Reference, Feature Comparison Chart, Firmware Version «Readme»)

# ESCON



- ESCON 36/2 DC**
- Feature Comparison Chart
  - Hardware Reference
  - Firmware
  - Firmware Version «Readme»

403112



- ESCON 50/5**
- Feature Comparison Chart
  - Hardware Reference
  - Firmware
  - Firmware Version «Readme»

409510

Depending on the ESCON variant, the following **motor types** can be operated

- **DC motor:** Permanent-magnet DC motor
- **EC motor:** Brushless, electronically commutated permanent-magnet DC motor (BLDC) with Hall sensors.

Various **operating modes** allow an adaptable use in a wide range of drive systems

- **Current controller:** The current controller compares the actual motor current (torque) with the applied set value. In case of deviation, the motor current is dynamically readjusted.
- **Speed controller (closed loop):** The closed loop speed controller compares the actual speed signal with the applied set value. In case of deviation, the speed is dynamically readjusted.

- **Speed controller (open loop):** The open loop speed controller feeds the motor with a voltage proportional to the applied speed set value. Changes in load are compensated using the IxR methodology.

**Speed measurement by**

- **Digital incremental encoder:** The encoders deliver simple square signals for further processing. Their impulses are counted to determine the speed. Channels A and B are phase-shifted signals, which are being compared to determine the sense of rotation.
- **DC tacho:** The DC tacho delivers a speed-proportional analog voltage.
- **Available Hall sensors:** The Hall sensors deliver six different combinations of switching impulses per electrical turn which are counted to determine speed. They also deliver phase-

shifted signals that are being compared to determine the sense of rotation.

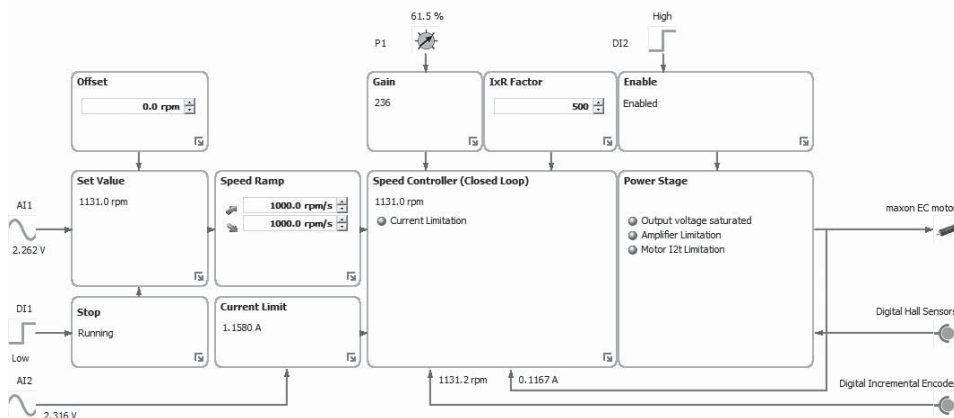
To the numerous **inputs** and **outputs**, various functionalities can be assigned to.

**Set value** (speed or current), **current** limitation, as well as **offset** can be assigned as follows.

- **Analog value:** The value is defined by an analog voltage set via external or internal potentiometer.
- **PWM value:** The value is defined by fixed frequency and amplitude. The desired change is achieved by variation of the duty cycle of 10...90%.
- **Fixed value:** The value is defined by a fixed preset value.
- **2 fixed values:** Value 1 is defined by a fixed preset value 1. Value 2 is defined by a fixed preset value 2. A digital input is used to switch between the two preset values.

Various functionalities are available to **enable** the power stage.

- **Enable:** Enables or disables the power stage.
- **Enable & Direction:** Enables or disables the power stage and determines the motor shaft's direction of rotation.
- **Enable CW:** Enables or disables the power stage in direction of rotation-dependent sense. The rotor can only turn clockwise (CW).
- **Enable CCW:** Enables or disables the power stage in direction of rotation-dependent sense. The rotor can only turn counterclockwise (CCW).
- **Enable CW & CCW:** Enables or disables the power stage in direction of rotation-dependent



ESCON Studio (Controller Monitor)



sense. The rotor can only turn in defined direction. The signals are interlocked against each other.

The **ramp function** permits controlled acceleration/deceleration of the motor shaft in both, open loop and closed loop speed controller mode.

- **Analog ramp:** The ramp is defined by a variable analog value.
- **Fixed ramp:** The ramp is defined by a fixed preset value.

**Stop:** The motor shaft decelerates with preset speed ramp until complete standstill.

**Ready:** The Ready signal can be used to transmit the operational status (respectively fault) to a superior control.

**Speed comparator:** The digital output is set as soon as the preset speed is reached.

- **Limit:** The digital output is set as soon as the preset speed is reached. It will continue set as long as the overspeed remains.
- **Range:** The digital output is set as soon as the preset speed range is reached. It will continue set as long as the speed remains in range.
- **Deviation:** The digital output is set as soon as the preset speed variation (based on the speed set value) is reached.

With the integrated **potentiometers** the additional following functions can be adjusted

- **Current Gain:** Adjustment of the current controller gain.
- **Speed Gain:** Adjustment of the speed controller gain.
- **IxR Factor:** The voltage drop caused by terminal resistance will be compensated in the range of [0...1000...2000].

Analog outputs allow monitoring of

- **Actual current:** Actually measured motor winding current.
- **Actual current averaged:** Actually measured motor winding current filtered by first order digital low-pass filter with a cut-off frequency of 5 Hz.
- **Actual speed:** Actually measured motor speed.
- **Actual speed averaged:** Actually measured motor speed filtered by 1st order digital low-pass filter with a cut-off frequency of 5 Hz.
- **Demand Current:** Demanded motor winding current.
- **Demand Speed:** Demanded motor speed.
- **Temperature Power Stage:** Actually measured power stage temperature.
- **Fixed value:** The output voltage is said fixed to the preset value.

## Easy startup

Startup and parameterization are performed using the intuitive graphical user interface «ESCON Studio» with the help of simple to use, menu-guided wizards. The following wizards are available: Startup, Regulation Tuning, Firmware Update, Controller Monitor, Parameters, Data Recording, and Diagnostics.

## Protective equipment

The servo controller has protective circuits against overcurrent, excess temperature, under- and overvoltage, against voltage transients, and against short-circuits in the motor cable. Furthermore it is equipped with protected digital inputs and outputs and an adjustable current limitation for protecting the motor and the load. The motor current and the actual speed of the motor shaft can be monitored by means of the analog output voltage.

## Comprehensive documentation

Using the «Feature Comparison Chart», the appropriate ESCON servo controller can be easily found. In the «Hardware Reference», the complete hardware is specified in detail. In the document «Firmware Version», the changes and improvements of the firmware are documented. The graphical user interface «ESCON Studio» also has a comprehensive online help.



## Software

Installation Program	ESCON Setup
Graphical User Interface	ESCON Studio
Startup Wizard	✓
Regulation Tuning	✓
Diagnostic	✓
Firmware Update	✓
Controller Monitor	✓
Parameters	✓
Data Recording	✓
Online Help	✓
Language	German, English, French, Italian, Spanish, Japanese, Chinese
Operating System	Windows 7, Windows XP SP3
Communication interface	USB 2.0 (full speed)

Accessories (not included in delivery)	ESCON 36/2 DC	ESCON 50/5
404404 ESCON 36/2 DC Connector Set	✓	—
403964 ESCON Analog I/O Cable	✓	—
403962 ESCON DC Motor Cable	✓	—
403965 ESCON Digital I/O Cable	✓	—
275934 ESCON Encoder Cable	optional	optional
403957 ESCON Power Cable	✓	—
409286 ESCON USB Stick	✓	✓
403968 USB 2.0 Type A micro-B Cable	✓	✓

# ESCON Feature Comparison Chart



NEW

NEW

	ESCON 36/2 DC	ESCON 50/5
DC motors up to	72 W	250 W
EC motors up to	–	250 W
<b>Sensors</b>		
	Digital Incremental Encoder (2 channel with or without Line Driver)	Digital Incremental Encoder (2 channel with or without Line Driver)
	DC Tacho	DC Tacho
	–	Digital Hall Sensors (EC motors)
<b>Operating Mode</b>		
	Current controller (torque control), Speed controller (closed and open loop)	Current controller (torque control), Speed controller (closed and open loop)
<b>Electrical Data</b>		
Nominal operating voltage $V_{CC}$	10 - 36 VDC	10 - 50 VDC
Max. output voltage	$0.98 \times V_{CC}$	$0.98 \times V_{CC}$
Max. output current	4 A (<60 s)	15 A (<20 s)
Continuous output current	2 A	5 A
Pulse width modulation frequency	53.6 kHz	53.6 kHz
Sampling rate PI current controller	53.6 kHz	53.6 kHz
Sampling rate PI speed controller	5.36 kHz	5.36 kHz
Max. efficiency	95%	95%
Max. speed (DC)	limited by max. permissible speed (motor) and max. output voltage (controller)	limited by max. permissible speed (motor) and max. output voltage (controller)
Max. speed (EC; 1 pole pair)	–	150 000 rpm
Built-in motor choke	300 $\mu$ H / 2 A	3 x 30 $\mu$ H / 5 A
<b>Inputs/Outputs</b>		
Hall sensor signals	–	H1, H2, H3
Encoder signals	A, A\, B, B\	A, A\, B, B\
Max. encoder input frequency differential (single-ended)	1 MHz (100 kHz)	1 MHz (100 kHz)
Potentiometers	1	2
Digital inputs	2	2
Digital inputs/outputs	2	2
Analog inputs	2	2
Resolution, Range, Circuit	12-bit, -10...+10 V, differential	12-bit, -10...+10 V, differential
Analog outputs	2	2
Resolution, Range	12-bit, -4...+4 V	12-bit, -4...+4 V
Auxiliary voltage output	+5 VDC (IL $\leq$ 10 mA)	+5 VDC (IL $\leq$ 10 mA)
Hall sensor supply voltage	–	+5 VDC (IL $\leq$ 30 mA)
Encoder supply voltage	+5 VDC (IL $\leq$ 70 mA)	+5 VDC (IL $\leq$ 70 mA)
Status Indicators	Operation: green LED / Error: red LED	Operation: green LED / Error: red LED
<b>Environmental Conditions</b>		
Temperature – Operation	-30...+45°C	-30...+45°C
Temperature – Extended range	+45...+81°C; Derating: -0.056 A/°C	+45...+85°C; Derating: -0.113 A/°C
Temperature – Storage	-40...+85°C	-40...+85°C
Humidity (condensation not permitted)	20...80%	20...80%
<b>Mechanical Data</b>		
Weight	Approx. 30 g	Approx. 204 g
Dimensions (L x W x H)	55 x 40 x 16.1 mm	115 x 75.5 x 24 mm
Mounting holes	for screws M2.5	for screws M4
<b>Article Numbers</b>		
	<b>403112</b> ESCON 36/2 DC	<b>409510</b> ESCON 50/5
	Order accessories separately, from <a href="#">page 321</a>	Order accessories separately, from <a href="#">page 321</a>

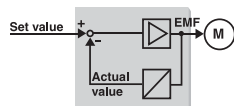
# 1-Q-EC Amplifier Summary

The basic function of EC motors electronics is the electronic commutation of the motor winding. Simple speed controls are possible with and

without Hall sensors. A further distinction is made between open or closed loop speed control.

1-Q amplifier functions in motor operation. Direction reverse via digital signal.

## sensorless closed loop



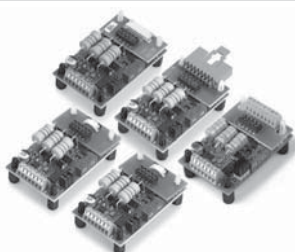
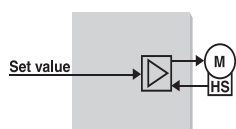
### 1-Q-EC Amplifier sensorless DECS 50/5

- Digital speed control for sensorless EC motors
- Selectable control gain
- Different start sequences can be selected
- Various options for set value
- Small design

Details on [page 294](#)

**Article Numbers** DECS 50/5 343253

## open loop



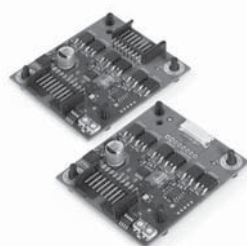
### 1-Q-EC Amplifier DEC 24/1

- Speed controller with Hall sensors
- Motor speed is adjustable with built-in potentiometer or external set value
- Direction, brake and disable input

Details on [page 294](#)

**Article Numbers** DEC 24/1 318305 249630 381510  
249631 249632

## Hall sensors



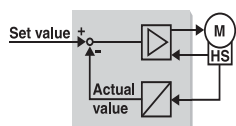
### 1-Q-EC Amplifier DEC 24/3

- Speed controller with Hall sensors
- Motor speed is adjustable with built-in potentiometer or external set value
- Direction, brake and disable input

Details on [page 295](#)

**Article Numbers** DEC 24/3 336286 336287

## closed loop



### 1-Q-EC Amplifier DEC Module 50/5

- Speed controller with Hall sensors
- Motor speed is adjustable with external set value
- Direction and enable input

Details on [page 296](#)

**Article Numbers** DEC Module 50/5 380200



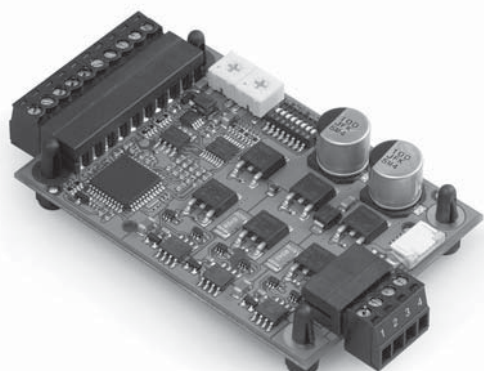
### 1-Q-EC Amplifier DEC 50/5

- Speed controller with Hall sensors
- Motor speed is adjustable with built-in potentiometer or external set value
- Direction, brake and disable input

Details on [page 296](#)

**Article Numbers** DEC 50/5 230572

## DECS 50/5 1-Q-EC Amplifier, sensorless



The DECS (Digital EC Controller Sensorless) is a 1-quadrant amplifier for the control of sensorless EC motors with a maximum output of 250 watts.

### Controlling sensorless EC motors

The actual rotor position is evaluated by using the Back-EMF sensing technique. Different start sequences with varying start-up procedures can be easily selected.

### Operating modes

Digital speed control with selectable regulation gain.

### Flexible

Wide supply voltage range 10 - 50 VDC. Pluggable screw type terminal block and a flexprint connector compatible with maxon flat motors.

### Small design

Open and compact electronics board. Easy mounting with hexagonal distance pins with inside thread.

### All-round functionality

Direction can be predetermined using a logic signal. The motor shaft can be disabled or braked, as required. Speed can be monitored through the speed monitor output. Different protective functions safeguard the motor and amplifier. Status indicator with green and red LED.

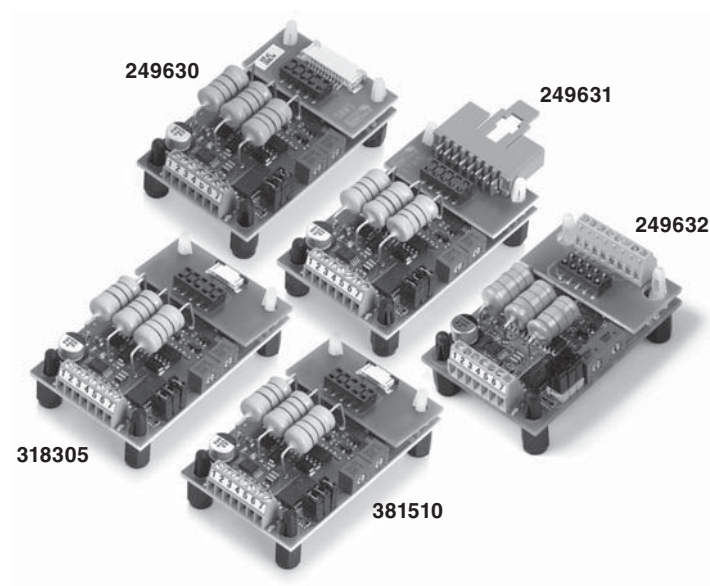
### Flexible set value input

Set value input either by internal potentiometer or external analog voltage. Different speed ranges can be selected using DIP switches.

Technical data [page 297](#)

Dimensions and connections [page 300](#)

## DEC 24/1 1-Q-EC Amplifier



### Operating modes

Digital speed control or open loop speed control operation can be selected with a built-in jumper.

### Flexible

Wide supply voltage range 5 - 24 VDC. A range of adapter boards allows the use of different maxon EC micro motors.

### Small design

Open and compact electronics board. Easy mounting with hexagonal distance pins with inside thread.

### All-round functionality

Direction can be predetermined with a logic signal. Motor shaft can be disabled or slowed down as required. Adjustable maximum current limitation. Status indicator with green LED.

### Flexible set value input

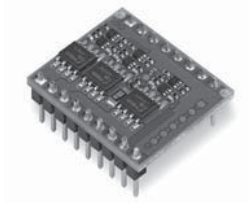
Set value input either by internal potentiometer or external, analog voltage. Different speed ranges can be selected using built-in jumpers.

The DEC 24/1 (Digital EC Controller) is a 1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 24 watts.

Technical data [page 297](#)

Dimensions and connections [page 300](#)

## DEC Module 24/2 1-Q-EC Amplifier



The DEC Module 24/2 (Digital EC Controller) is a 1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 48 watts.

### Operating modes

Digital speed control or open loop speed control operation can be preset by a digital signal.

### Excellent price/performance ratio

Reasonably priced 1-Q-EC amplifier optimised for OEM applications in small appliances.

### OEM Module

Miniaturized open electronics board. Two connector arrays arranged in a 2.54 mm (0.1") pattern support easy connectivity and integration into the motherboard.

### Functionality

Direction of rotation preset by a digital signal. The motor shaft can be enabled or disabled. Adjustable maximum current limitation. Set value input through external analog voltage.

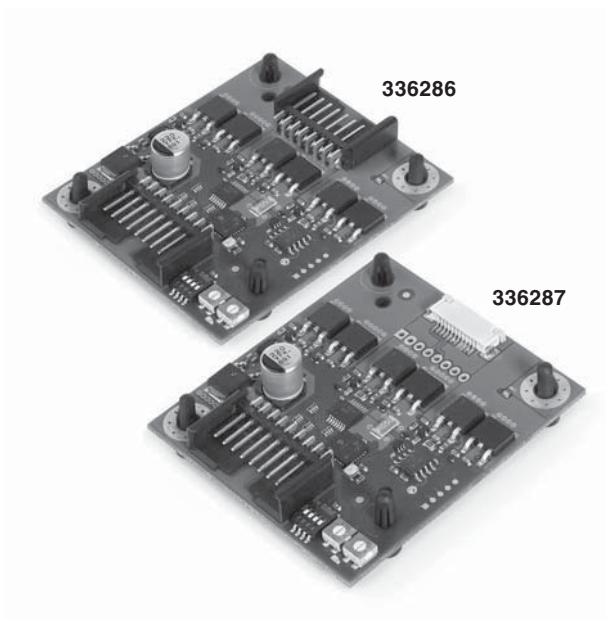
### Protection circuit

The power amplifier is protected against thermal overload and the control inputs against overvoltage.

Technical data [page 298](#)

Dimensions and connections [page 300](#)

## DEC 24/3 1-Q-EC Amplifier



### Operating modes

Digital speed control or open loop speed control operation can be selected with a built-in DIP switch.

### Flexible

Wide supply voltage range 5 - 24 VDC.

Two variants for direct connection of different maxon EC motors.

### Small design

Open and compact electronics board. Easy mounting with hexagonal distance pins with inside thread.

### All-round functionality

Direction can be predetermined with a logic signal. Motor shaft can be disabled or slowed down as required. Adjustable maximum current limitation. Status indicator with green LED.

### Flexible set value input

Set value input either through internal potentiometer or external, analog voltage. Different speed ranges can be selected using built-in DIP switches.

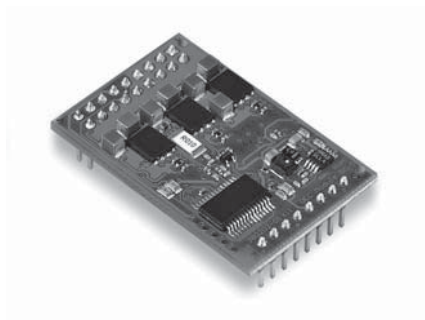
The DEC 24/3 (Digital EC Controller) is a 1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 72 watts.

Technical data [page 298](#)

Dimensions and connections [page 301](#)



## DEC Module 50/5 1-Q-EC Amplifier



The DEC Module 50/5 (Digital EC Controller) is a 1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 250 watts.

### Operating modes

Digital speed control or open loop speed control operation can be preset by a digital signal.

### Excellent price/performance ratio

Reasonably priced 1-Q-EC amplifier optimised for OEM applications in small appliances.

### OEM Module

Miniaturized open electronics board. Connector arrays arranged in a 2.54 mm (0.1") pattern support easy connectivity and integration into the motherboard.

### Functionality

Direction of rotation preset by a digital signal. The motor shaft can be enabled or disabled. Adjustable maximum current limitation. Set value speed input through external analog voltage. Speed can be monitored through the speed monitor output. Status indicator with "Ready"-Output.

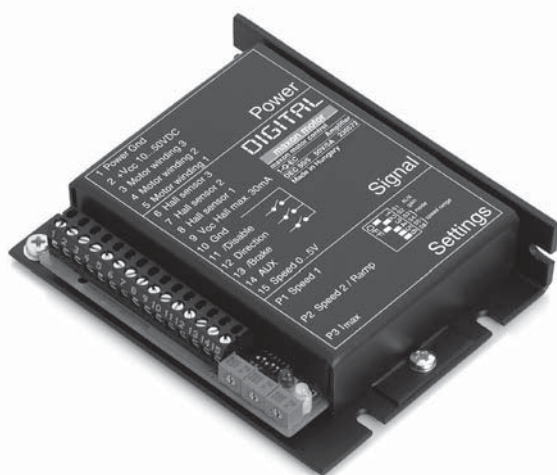
### Protection circuit

The power amplifier is protected against thermal overload and the control inputs against overvoltage.

Technical data [page 299](#)

Dimensions and connections [page 301](#)

## DEC 50/5 1-Q-EC Amplifier



The DEC 50/5 (Digital EC Controller) is a 1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 250 watts.

### Operating modes

Digital speed control, open loop speed control or current control can be selected with built-in DIP switch.

### Small design

Robust and compact modular metallic housing offers various mounting options.

### Easy start-up procedure

Plug-in terminal clamp, no extensive adjustment necessary.

### All-round functionality

Direction can be set with a logic signal. Motor shaft can be disabled or slowed down as required. Adjustable maximum current limitation. Operating status display with red and green LED.

### Flexible set value input

Set value input either through internal potentiometer or external analog voltage. Two preset speeds switchable. Speed ramp can be adjusted.

### Protection circuit

The power amplifier is protected against thermal overload and the control inputs against overvoltage.

Technical data [page 299](#)

Dimensions and connections [page 301](#)



# 1-Q-EC Amplifier Data



**DECS 50/5** 1-Q-EC Amplifier  
1-quadrant amplifier for controlling sensorless EC motors with a maximum output of 250 watts.



**DEC 24/1** 1-Q-EC Amplifier  
1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 24 watts.

Operating modes	Speed controller (sensorless)	Speed controller, open loop speed controller
<b>Electrical Data</b>		
Operating voltage $V_{CC}$	10 - 50 VDC	5 - 24 VDC
Max. output voltage	$0.8 \times V_{CC}$	$V_{CC}$
Max. output current $I_{max}$	8 A	2 A
Continuous output current $I_{cont}$	5 A	1 A
Switching frequency of power stage	50 kHz	39 kHz
Band width current controller		
Max. speed (1 pole pair)	80 000 rpm	120 000 rpm
Built-in motor choke per phase		150 $\mu$ H / 1 A
<b>Input</b>		
Set value	"Speed" 0...5 V (1024 Steps)	"Speed" 0...5 V (1024 Steps)
Current limit		
Enable	"Enable" +3.5...50 V	"/Disable" +2.4...24 V
Direction	"Direction" +3.5...50 V	"Direction" +2.4...24 V
Stop / Brake	"Brake" +3.5...50 V	"/Brake" +2.4...24 V
Configurable		
<b>Output</b>		
Monitor	"Monitor n", digital (5 V)	"Monitor n", digital (5 V)
Status reading "Ready"	"Ready" max. +50 V	
<b>Voltage outputs</b>		
Hall sensors supply voltage $V_{CC}$ Hall		+4.5...5 VDC, max. 30 mA
Auxiliary voltages	+5 VDC	
<b>Possible adjustments</b>		
Trim potentiometer	Speed, $I_{max}$	Speed, $I_{max}$
<b>Indicator</b>		
	Green LED = READY; red LED = ERROR	Green LED
<b>Protective functions</b>		
Blockage protection	Switches off after 5 unsuccessful starting attempts	Motor current limitation if motor shaft is blocked for longer than 1.5 s
Heat monitoring of power stage	$T > 90^{\circ}\text{C}$	
Dynamic current limit		$I_{max} = 2 \cdot I_{cont}$ is limited to $0.9 \cdot I_{cont}$ after 1 s
Under- / Overvoltage protection	Switches off when $V_{CC} < 9.5$ V or $V_{CC} > 59$ V	
<b>Ambient temperature and humidity range</b>		
Operation	-10...+45°C	-10...+45°C
Storage	-40...+85°C	-40...+85°C
No condensation	20...80%	20...80%
<b>Mechanical Data</b>		
Weight	Approx. 40 g	Approx. 20 g
Dimensions (L x W x H)	73.4 x 50.8 x 21 mm (see <a href="#">page 300</a> )	57 x 36 x 24 mm (see <a href="#">page 300</a> )
Mounting threads	4 Hexagonal distance pins with M3 inner thread	4 Hexagonal distance pins with M3 inner thread
Connections	See <a href="#">page 300</a>	See <a href="#">page 300</a>
<b>Article Numbers</b>		

**343253** DECS 50/5 1-Q-EC Amplifier sensorless  
**318305** DEC 24/1 1-Q-EC Amplifier  
**381510** DEC 24/1 with FPC pitch 0.5 mm  
**249630** DEC 24/1 with FPC pitch 1.0 mm  
**249631** DEC 24/1 with a pin con. pitch 2.5 mm  
**249632** DEC 24/1 with screw type terminal block pitch 2.54 mm

<b>Accessories</b>	<b>309687</b> DSR 50/5 Shunt regulator
--------------------	--

# 1-Q-EC Amplifier Data



**DEC Module 24/2** 1-Q-EC Amplifier  
1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 48 watts.



**DEC 24/3** 1-Q-EC Amplifier  
1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 72 watts.

Operating modes	Speed controller, open loop speed controller	Speed controller, open loop speed controller
Electrical Data		
Operating voltage $V_{CC}$	8 - 24 VDC (optional 5.0 VDC)	5 - 24 VDC
Max. output voltage	$V_{CC}$	$V_{CC}$
Max. output current $I_{max}$	3 A	6 A
Continuous output current $I_{cont}$	2 A	3 A
Switching frequency of power stage	46.8 kHz	39 kHz
Band width current controller		
Max. speed (1 pole pair)	80 000 rpm	120 000 rpm
Built-in motor choke per phase		
Input		
Set value	"Speed" 0...+5 V (1024 steps)	"Speed" 0...+5 V (1024 steps)
Current limit	"Current Limit" external resistor against GND	
Enable	"Enable" +2.4...24 V	"Enable" +2.4...24 V
Direction	"Direction" +2.4...24 V	"Direction" +2.4...24 V
Stop / Brake		"Brake" +2.4...24 V
Configurable		
Output		
Monitor		"Monitor n", digital, (5 V)
Status reading "Ready"	"Ready", digital, (5 V)	
Voltage outputs		
Hall sensors supply voltage $V_{CC}$ Hall	+5 VDC, max. 35 mA	+5 VDC, max. 30 mA
Auxiliary voltages		+5 VDC, max. 10 mA
Possible adjustments	Input "Mode 0" and "Mode 1"	DIP switch
Trim potentiometer		Speed, $I_{max}$
Indicator		Green LED
Protective functions		
Blockage protection	Motor current limitation if motor shaft is blocked for longer than 1.5 s	Motor current limitation if motor shaft is blocked for longer than 1.5 s
Heat monitoring of power stage	$T > 95^{\circ}\text{C}$	
Dynamic current limit		$I_{max} = 2 \cdot I_{cont}$ is limited to $0.9 \cdot I_{cont}$ after 1 s
Under- / Overvoltage protection	Switches off when $V_{CC} < 6.5 \text{ V}$ or $V_{CC} > 30 \text{ V}$	Switches off when $V_{CC} < 4.5 \text{ V}$
Ambient temperature and humidity range		
Operation	-10...+45°C	-10...+45°C
Storage	-40...+85°C	-40...+85°C
No condensation	20...80%	20...80%
Mechanical Data		
Weight	Approx. 4 g	Approx. 28 g
Dimensions (L x W x H)	24.2 x 20.38 x 12.7 mm (see <a href="#">page 300</a> )	65 x 58 x 18 mm (see <a href="#">page 301</a> )
Mounting threads	mountable on socket terminal strips pitch 2.54 mm	4 Hexagonal distance pins with M3 inner thread
Connections	See <a href="#">page 300</a>	See <a href="#">page 301</a>
Article Numbers		

**367661** DEC Module 24/2 1-Q-EC Amplifier

**DEC 24/3** 1-Q-EC Amplifier

**336287** DEC 24/3 with FPC pitch 1.0 mm

**336286** DEC 24/3 with a pin connector pitch 2.5 mm

## Accessories

**370652** DEC Module Eva-Board



**DEC Module 50/5** 1-Q-EC Amplifier  
1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 250 watts.

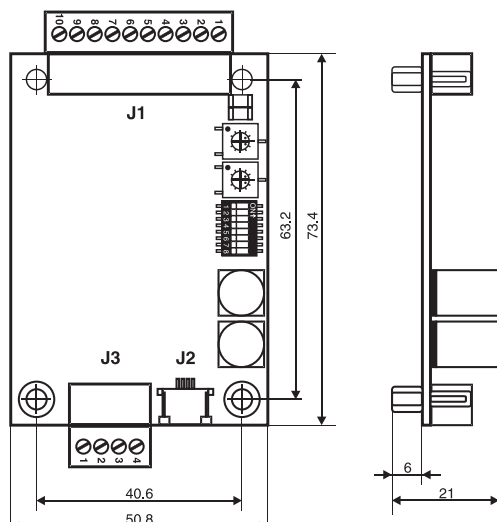


**DEC 50/5** 1-Q-EC Amplifier  
1-quadrant amplifier for controlling EC motors with Hall sensors with a maximum output of 250 watts.

Operating modes	Speed controller, open loop speed controller	Speed controller, open loop speed controller, current controller
<b>Electrical Data</b>		
Operating voltage $V_{CC}$	6 - 50 VDC (optional 5.0 VDC)	10 - 50 VDC
Max. output voltage	$0.95 \times V_{CC}$	$0.95 \times V_{CC}$
Max. output current $I_{max}$	10 A	10 A
Continuous output current $I_{cont}$	5 A	5 A
Switching frequency of power stage	46.8 kHz	39 kHz
Band width current controller		15 Hz
Max. speed (1 pole pair)	80 000 rpm	120 000 rpm
Built-in motor choke per phase		
<b>Input</b>		
Set value	"Speed" 0...+5 V (1024 steps)	"Speed" 0...+5 V (1024 steps)
Current limit	"Current Limit" external resistor against GND	
Enable	"Enable" +2.4...50 V	"/Disable" +2.4...50 V
Direction	"Direction" +2.4...50 V	"Direction" +2.4...50 V
Stop / Brake		"/Brake" +2.4...50 V
Configurable		"AUX" digital input / 5 VDC output
<b>Output</b>		
Monitor	"Monitor n", digital, (5 V)	
Status reading "Ready"	"Ready", digital, (5 V)	
<b>Voltage outputs</b>		
Hall sensors supply voltage $V_{CC}$ Hall	+5 VDC, max. 35 mA	+7...12 VDC, max. 30 mA
Auxiliary voltages		
<b>Possible adjustments</b>	Input "Mode 0" and "Mode 1"	DIP switch
<b>Trim potentiometer</b>		Speed 1, Speed 2 / Ramp, $I_{max}$ , gain
<b>Indicator</b>		Green LED = READY; red LED = ERROR
<b>Protective functions</b>		
Blockage protection	Motor current limitation if motor shaft is blocked for longer than 1.5 s	Motor current limitation if motor shaft is blocked for longer than 1.5 s
Heat monitoring of power stage	$T > 100^{\circ}\text{C}$	$T > 100^{\circ}\text{C}$
Dynamic current limit		
Under- / Overvoltage protection	Switches off when $V_{CC} < 6 \text{ V}$ or $V_{CC} > 56 \text{ V}$	
<b>Ambient temperature and humidity range</b>		
Operation	-10...+45°C	-10...+45°C
Storage	-40...+85°C	-40...+85°C
No condensation	20...80%	20...80%
<b>Mechanical Data</b>		
Weight	Approx. 9 g	Approx. 155 g
Dimensions (L x W x H)	43.18 x 27.94 x 12.7 mm (see <a href="#">page 301</a> )	95 x 75 x 24 mm (see <a href="#">page 301</a> )
Mounting threads	mountable on socket terminal strips pitch 2.54 mm	Flange for M3-screws
<b>Connections</b>	See <a href="#">page 301</a>	See <a href="#">page 301</a>
<b>Article Numbers</b>	<b>380200</b> DEC Module 50/5 1-Q-EC Amplifier	<b>230572</b> DEC 50/5 1-Q-EC Amplifier

<b>Accessories</b>	<b>370652</b> DEC Module Eva-Board
--------------------	------------------------------------

# 1-Q-EC Amplifier Dimensions and connections



Dimensions in [mm]

## DECS 50/5

### Power/Signal-Connections

Pluggable screw type terminal block J1  
10 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.5 mm<sup>2</sup>

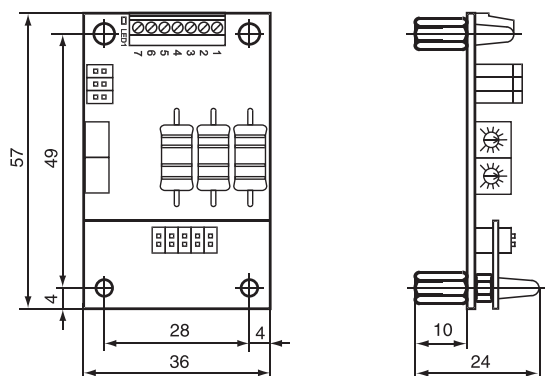
### Connections Motor

Pluggable screw type terminal block J3  
4 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.5 mm<sup>2</sup>

Flex print connector J2, top contact style  
4 poles  
Pitch 1.0 mm

DECS 50/5

343253



Dimensions in [mm]

## DEC 24/1

### Connections Power/Signal

Screw type terminal block  
7 poles  
Pitch 2.54 mm  
Suitable for wire cross section AWG 26 - 20  
0.14...0.5 mm<sup>2</sup>

### Connections Motor

DEC 24/1  
Flex print connector, top contact style  
8 poles  
Pitch 0.5 mm

DEC 24/1 381510

Flex print connector, top contact style  
8 poles  
Pitch 0.5 mm

DEC 24/1 249630

Flex print connector, top contact style  
11 poles  
Pitch 1.0 mm

DEC 24/1 249631  
Pin connector with snap-in  
8 poles  
Pitch 2.50 mm

DEC 24/1 249632  
Screw type terminal block  
8 poles  
Pitch 2.54 mm  
AWG 26 - 20  
0.14...0.5 mm<sup>2</sup>

## DEC 24/1 Adapter versions



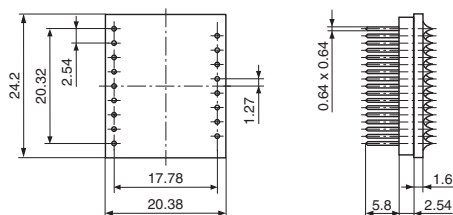
318305  
compatible with  
EC 6  
EC 10 flat

381510  
compatible with  
EC 8  
EC 9.2 flat

249630

249631

249632



Dimensions in [mm]

## DEC Module 24/2

### Connections

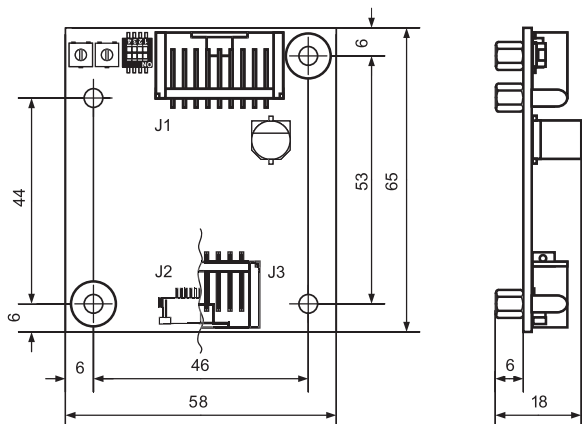
Male header  
8 + 9 = 17 poles  
Pitch 2.54 mm

DEC Module 24/2

367661



# 1-Q-EC Amplifier Dimensions and connections



Dimensions in [mm]

## DEC 24/3

### Connections Power/Signal

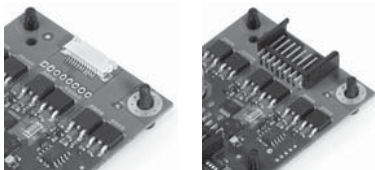
Male header J1	9 poles
Pitch	2.5 mm
Flat band cable, suitable for wire cross section	AWG 28

### Connections Motor

DEC 24/3	336287
Flex print connector J2, top contact style	11 poles
Pitch	1.0 mm

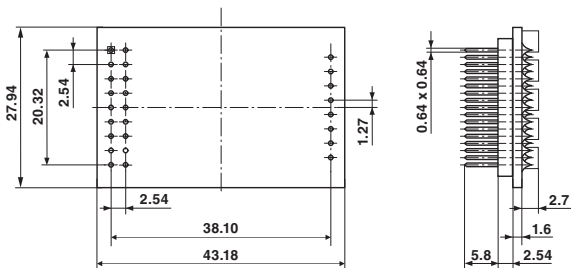
DEC 24/3	336286
Male header J3	8 poles
Pitch	2.50 mm
Flat band cable, suitable for wire cross section	AWG 28

## DEC 24/3 Variations



336287

336286



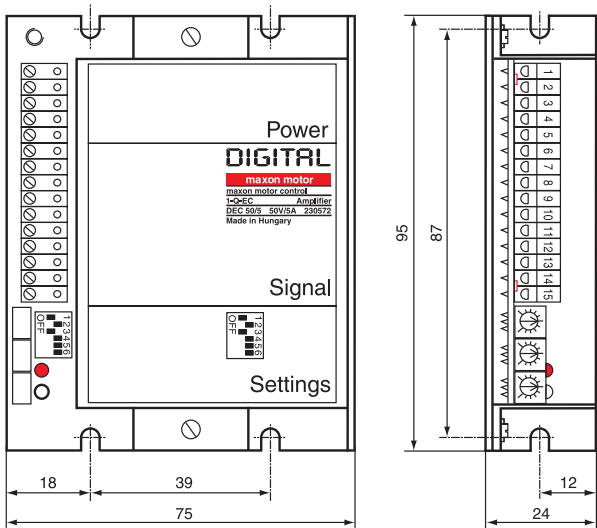
Dimensions in [mm]

## DEC Module 50/5

### Connections

Male header 1	2 rows, 2 x 9 poles
Male header 2	1 row, 8 poles
Pitch	2.54 mm

DEC Module 50/5	380200
-----------------	--------



Dimensions in [mm]

## DEC 50/5

### Connections Power/Signal

Plug-in terminal clamps	15 poles
Pitch	3.5 mm
Suitable for wire cross section	AWG 26 - 16
	0.14...1.0 mm <sup>2</sup> multi-core
	0.14...1.3 mm <sup>2</sup> single wire

### Note

The screw terminals are pluggable. In order to prevent the screw terminals from twisting, the recesses must be used for removal. (Maximum 20 plug-in cycles)

DEC 50/5	230572
----------	--------

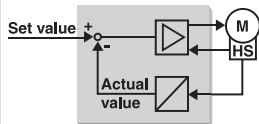
## 4-Q-EC Amplifier Summary

The basic function of EC motors electronics is the electronic commutation of the motor winding.

Simple speed controls are possible with Hall sensors. For high-quality controls the speed is detected using encoder signals.

The combination of EC motors and 4-quadrant amplifiers offers highly dynamic drive systems.

### Hall sensors closed loop



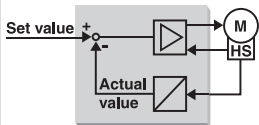
#### 4-Q-EC Amplifier DECV 50/5

- 4-Q speed controller with Hall sensors (controlled acceleration and braking)
- Motor speed and the current limitation can be adjusted through two different external set values
- Direction and Enable can be set
- Connection ready module
- Motor current 5 A / 10 A
- Supply voltage 12 up to 50 VDC
- Particularly suitable for low-impedance motors

Details on [page 303](#)

**Article Numbers** DECV 50/5 305259

### Hall sensors closed loop



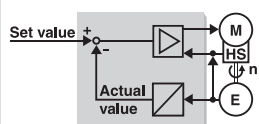
#### 4-Q-EC Amplifier DEC 70/10

- 4-Q speed controller with Hall sensors (controlled acceleration and braking)
- Voltage regulator with IxR compensation, digital speed controller (via Hall sensors) or current controller
- Motor speed is adjustable by a built-in potentiometer or by an external set value voltage
- Connection ready module
- Motor current 10 A / 20 A
- Supply voltage 10 up to 70 VDC

Details on [page 303](#)

**Article Numbers** DEC 70/10 306089

### Hall sensors and encoder closed loop



#### 4-Q-EC Servoamplifier DES

- Dynamical control of speed and torque
- Sinusoidal commutation
- Suitable for positioning applications
- 4-Q operation
- Connection ready module
- Communication by RS232 or CAN possible

Details on [page 304](#)

**Article Numbers** DES 50/5 205679  
DES 70/10 228597

## DECV 50/5 4-Q-EC Amplifier



The DEC5 50/5 (Digital EC Controller Voltage regulated) is a small-sized 4-quadrant digital speed controller for brushless EC motors up to 250 watts. The brushless EC motor must be only equipped with Hall sensors.

## Operating modes

Speed controller for speeds from 1000 rpm (not suitable for positioning tasks). Controlled acceleration and braking operation.

## Easy start-up procedure

Pluggable screw type terminal block, simple adjustment using DIP switch. Stable speed behaviour when set value and disturbance variable change.

### Reduced motor heating

Internally controlled DC link voltage reduces motor current ripple (lower self-heating of motor), particularly suitable for low-impedance motors. No additional motor chokes required.

## Flexible

Robust and compact modular metallic housing offers various mounting options. Wide supply voltage range 12 - 50 VDC.

### Protection circuit

Protected against overcurrent, overvoltage, undervoltage, short-circuit of motor cables against each other and thermal overload.

Technical data [page 305](#)

Dimensions and connections [page 307](#)

## DEC 70/10 4-Q-EC Amplifier



The DEC 70/10 (Digital EC Controller) is a small 4-quadrant digital controller for brushless EC motors up to 700 watts. The brushless EC motor must be only equipped with Hall sensors.

## Operating modes

Digital speed controller (via Hall sensor for speeds from 1000 rpm)  
voltage regulator with IxR compensation or current controller (suitable for positioning tasks) can be adjusted with DIP switch.

## Optimised design

**Optimised design**  
Robust and compact metal housing in module form several mounting options.

### Easy start-up procedure

Pluggable screw terminal block, no complex adjustment necessary.

### All-round functionality

Disabling of motor winding and braking of motor shaft can be controlled. Adjustable maximum current and speed limitation. Status indicator with green and red LED.

### Flexible set value input

Set value input by internal or external potentiometer or by analog voltage. Different speed ranges can be selected using built-in DIP-switches. Adjustable speed ramp.

### Protection circuit

Protected against overcurrent, overvoltage, undervoltage, short-circuit of motor cables against each other and thermal overload.

Technical data [page 305](#)

Dimensions and connections [page 307](#)

# DES 50/5 4-Q-EC Servoamplifier

CAN

RS232

GUI



The DES (Digital EC Servoamplifier) is a very powerful digital servoamplifier with sinusoidal commutation for perfectly controlling EC motors up to 250 watts. The motor used must be fitted with Hall sensors and a 3-channel encoder.

## Operating modes

Digital speed controller and current controller (torque controller), suitable for positioning tasks.

## Digital

Digital signal processor (DSP) allows fast digital controlling. Parameters can be set digitally in a reproducible way.

## Easy start-up procedure

Simple connection, compatible with maxon EC motors. Easy adjustment using few potentiometers or alternatively configurable and commanding by serial interface (RS232 or CAN).

## Protection circuit

Monitoring of overcurrent, short-circuiting of motor cables and overvoltage.

## PC based commanding

Support by graphical user interface (GUI), Windows DLL for RS232 with several programming examples.

Technical data [page 306](#)  
Dimensions and connections [page 308](#)

# DES 70/10 4-Q-EC Servoamplifier

CAN

RS232

GUI



The DES (digital EC servoamplifier) is a very powerful digital servoamplifier with sinusoidal commutation for perfectly controlling EC motors up to 700 watts. The motor used must be fitted with Hall sensors and a 3-channel encoder.

## Operating modes

Digital speed controller and current controller (torque controller), suitable for positioning tasks.

## Digital

Digital signal processor (DSP) allows fast digital controlling. Parameters can be set digitally in a reproducible way.

## Easy start-up procedure

Simple connection, compatible with maxon EC motors. Easy adjustment using few potentiometers or alternatively configurable and commanding by serial interface (RS232 or CAN).

## Protection circuit

Monitoring of overcurrent, short-circuiting of motor cables and overvoltage.

## PC based commanding

Support by graphical user interface (GUI), Windows DLL for RS232 with several programming examples.

Technical data [page 306](#)  
Dimensions and connections [page 308](#)



## 4-Q-EC Amplifier Data



**DECV 50/5** 4-Q-EC Amplifier  
4-quadrant controller for brushless EC motors with Hall sensors up to 250 watts.



**DEC 70/10** 4-Q-EC Amplifier  
4-quadrant controller for brushless EC motors with Hall sensors up to 700 watts.

Operating modes	Speed controller	Voltage regulator with IxR compensation, speed controller, current controller
<b>Electrical Data</b>		
Operating voltage $V_{CC}$	12 - 50 VDC	10 - 70 VDC
Max. output voltage	$0.95 \times V_{CC}$	$0.9 \times V_{CC}$
Max. output current $I_{max}$	10 A	20 A
Continuous output current $I_{cont}$	5 A	10 A
Switching frequency of power stage		50 kHz
Max. efficiency		95%
Band width current controller		300 Hz
Max. speed (1 pole pair)	60 000 rpm	80 000 rpm
Built-in motor choke per phase		25 $\mu$ H / 10 A
<b>Input</b>		
Set value	"Set value speed" 0...+5 V (1024 Steps)	"Set value" -10...+10 V (1024 Steps)
Current limit	"Set value current" 0...+5 V (1024 Steps)	
Enable	"Enable" +2.4...50 V	"Enable" +4...50 V
Direction	"Direction" +2.4...50 V	
Stop / Brake	"STOP" +2.4...50 V	"STOP" +4...50 V
Configurable		"Digital IN" +4...50 V
<b>Output</b>		
Monitor	"Monitor speed", analog, 0...5 V "Monitor current", analog, 0...5 V	"Monitor n" or "Monitor I", -10...+10 V
Status reading "Ready"	Open Collector max. 50 V ( $I_L < 10$ mA)	Open Collector max. 30 V ( $I_L < 20$ mA)
<b>Voltage outputs</b>		
Hall sensors supply voltage $V_{CC}$ Hall	+7...12 VDC, max. 30 mA	+5 VDC, max. 30 mA
Auxiliary voltages	+5 VDC, max. 2 mA	+12 VDC, max. 4 mA; -12 VDC, max. 2 mA
<b>Possible adjustments</b>	DIP switch	DIP switch
<b>Trim potentiometer</b>		$n_{max}$ , Offset, Ramp, $I_{max}$ , $n_{gain}$ , $I_{gain}$
<b>Indicator</b>	Green LED	Bi-colour LED, green = READY, red = ERROR
<b>Protective functions</b>		
Blockage protection	Error message, if motor shaft is blocked for longer than 0.5 s	
Heat monitoring of power stage	$T > 100^\circ\text{C}$	$T > 115^\circ\text{C}$
Dynamic current limit	$I_{max} = 2 \cdot I_{cont}$ is limited to $I_{cont}$ after 2 s	$I_{max} = 2 \cdot I_{cont}$ is limited to $I_{cont}$ after 2 s
Under- / Overvoltage protection	Switches off when $V_{CC} < 10.3$ V or $V_{CC} > 58$ V	Switches off when $V_{CC} < 9.4$ V or $V_{CC} > 77$ V
<b>Ambient temperature and humidity range</b>		
Operation	0...+45°C	-10...+45°C
Storage	-40...+85°C	-40...+85°C
No condensation	20...80%	20...80%
<b>Mechanical Data</b>		
Weight	Approx. 180 g	Approx. 400 g
Dimensions (L x W x H)	95 x 75.5 x 24 mm (see <a href="#">page 307</a> )	120 x 103 x 27 mm (see <a href="#">page 307</a> )
Mounting threads	Flange for M4-screws	Flange for M3-screws
<b>Connections</b>	See <a href="#">page 307</a>	See <a href="#">page 307</a>
<b>Article Numbers</b>	<b>305259</b> DECV 50/5 4-Q-EC Amplifier in module housing	<b>306089</b> DEC 70/10 4-Q-EC Amplifier in module housing
<b>Accessories</b>	<b>309687</b> DSR 50/5 Shunt regulator	<b>235811</b> DSR 70/30 Shunt regulator

# 4-Q-EC Servoamplifier Data

CAN RS232 GUI



**DES 50/5** 4-Q-EC Servoamplifier  
Digital servoamplifier with sinusoidal commutation for perfectly controlling EC motors with Hall sensors and encoder and an output of up to 250 watts.



**DES 70/10** 4-Q-EC Servoamplifier  
Digital servoamplifier with sinusoidal commutation for perfectly controlling EC motors with Hall sensors and encoder and an output of up to 700 watts.

Operating modes	Speed controller, current controller	Speed controller, current controller
<b>Electrical Data</b>		
Operating voltage $V_{CC}$	12 - 50 VDC	24 - 70 VDC
Max. output voltage	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
Max. output current $I_{max}$	15 A	30 A
Continuous output current $I_{cont}$	5 A	10 A
Switching frequency of power stage	50 kHz	50 kHz
Max. efficiency	92 %	92 %
Band width current controller	1 kHz	1 kHz
Max. speed (1 pole pair)	25 000 rpm	25 000 rpm
Built-in motor choke per phase	160 $\mu$ H / 5 A	Minimum required terminal inductance 400 $\mu$ H
<b>Input</b>		
Set value configurable (1024 Steps)	-10...+10 V/0...+5 V	-10...+10 V/0...+5 V
"Enable"	+2.4...50 V	+2.4...50 V
Digital 1 (Switch "Monitor n" / "Monitor I")	+2.4...50 V	+2.4...50 V
Digital 2 (Switch speed- / current controller)	+2.4...50 V	+2.4...50 V
STOP	+2.4...50 V	+2.4...50 V
Encoder signals	A, A\, B, B\, I, I\ max. 1 MHz 3-channel encoder is required	A, A\, B, B\, I, I\ max. 1 MHz 3-channel encoder is required
Hall sensor signals	H1, H2, H3	H1, H2, H3
<b>Output</b>		
Monitor configurable	-10...+10 V/0...+5 V	-10...+10 V/0...+5 V
Status reading "Ready"	Open Collector, max. 30 V ( $I_L < 20$ mA)	Open Collector, max. 30 V ( $I_L < 20$ mA)
<b>Voltage outputs</b>		
Encoder supply voltage	+5 VDC, max. 100 mA	+5 VDC, max. 100 mA
Hall sensors supply voltage	+5 VDC, max. 50 mA	+5 VDC, max. 50 mA
Auxiliary voltage	+5 VDC, max. 20 mA	+5 VDC, max. 20 mA
<b>Interface</b>		
RS232	RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)
CAN	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
<b>Trim potentiometer</b>	$n_{max}$ , Offset, $I_{max}$ , gain	$n_{max}$ , Offset, $I_{max}$ , gain
<b>Indicator</b>	Bi-colour LED, green = READY, red = ERROR	Bi-colour LED, green = READY, red = ERROR
<b>Ambient temperature and humidity range</b>		
Operation	-10...+45°C	-10...+45°C
Storage	-40...+85°C	-40...+85°C
No condensation	20...80%	20...80%
<b>Mechanical Data</b>		
Weight	Approx. 430 g	Approx. 400 g
Dimensions (L x W x H)	180 x 103 x 26 mm (see <a href="#">page 308</a> )	180 x 103 x 29 mm (see <a href="#">page 308</a> )
Mounting threads	Flange for M4-screws	Flange for M4-screws
<b>Connections</b>	See <a href="#">page 308</a>	See <a href="#">page 308</a>
<b>Article Numbers</b>		

**205679** DES 50/5, digital 4-Q-EC Servoamplifier in module housing

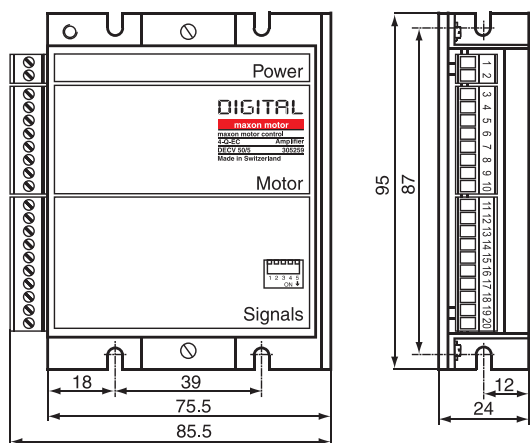
**228597** DES 70/10, digital 4-Q-EC Servoamplifier in module housing

## Accessories

**223774** Encoder adapter according to DIN41651 screw type terminal block  
**235811** DSR 70/30 Shunt regulator

**347919** Choke module 3 x 0.1 mH, 10 A  
**223774** Encoder adapter according to DIN41651 on screw type terminal block  
**235811** DSR 70/30 Shunt regulator

## 4-Q-EC Amplifier Dimensions and connections



Dimensions in [mm]

### DECV 50/5

#### Connections Power

Pluggable screw type terminal block 2 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.5 mm<sup>2</sup> multi-core  
0.14...1.5 mm<sup>2</sup> single wire

#### Connections Motor

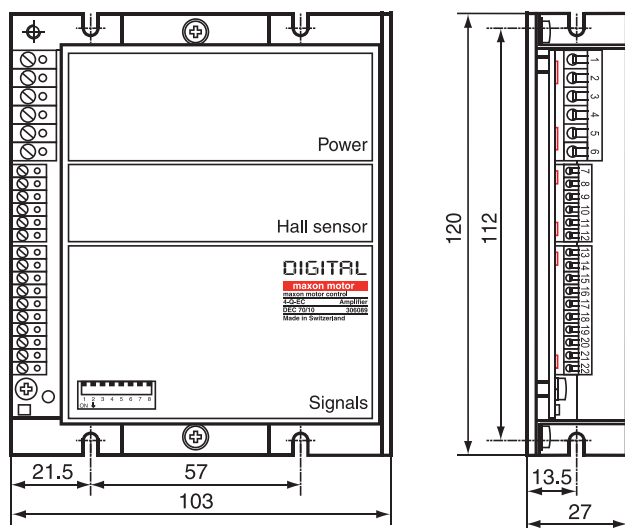
Pluggable screw type terminal block 8 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.5 mm<sup>2</sup> multi-core  
0.14...1.5 mm<sup>2</sup> single wire

#### Connections Signal

Pluggable screw type terminal block 10 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.5 mm<sup>2</sup> multi-core  
0.14...1.5 mm<sup>2</sup> single wire

DECV 50/5

305259



Dimensions in [mm]

### DEC 70/10

#### Connections Power

Plug-in terminal clamps 6 poles  
Pitch 5.0 mm  
Suitable for wire cross section AWG 26 - 14  
0.14...1.5 mm<sup>2</sup> multi-core  
0.14...2.5 mm<sup>2</sup> single wire

#### Connections Hall sensor

Plug-in terminal clamps 6 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.0 mm<sup>2</sup> multi-core  
0.14...1.3 mm<sup>2</sup> single wire

#### Connections Signal

Plug-in terminal clamps 10 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.0 mm<sup>2</sup> multi-core  
0.14...1.3 mm<sup>2</sup> single wire

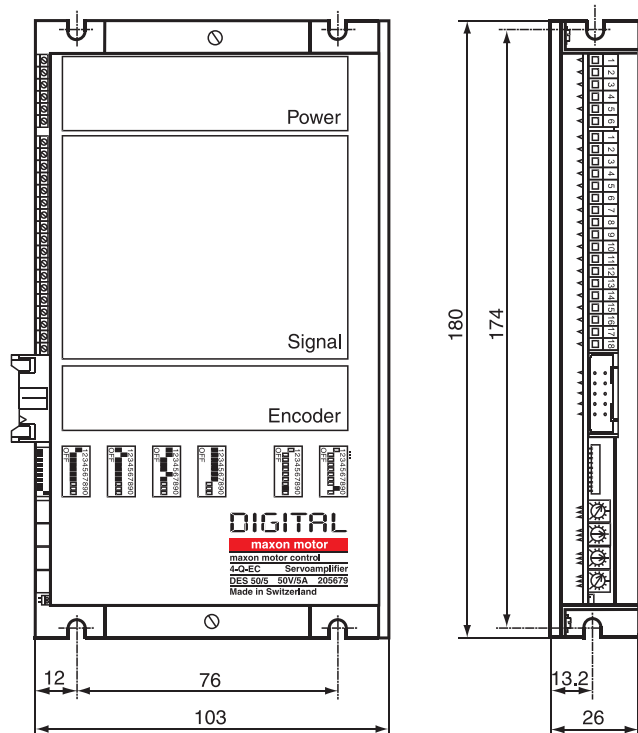
#### Note

The screw terminals are pluggable. In order to prevent the screw terminals from twisting, the recesses must be used for removal (Maximum 20 plug-in cycles).

DEC 70/10

306089

## 4-Q-EC Servoamplifier Dimensions and connections



Dimensions in [mm]

### DES 50/5

#### Connections Power

Screw type terminal block 6 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.0 mm<sup>2</sup> multi-core  
0.14...1.5 mm<sup>2</sup> single wire

#### Connections Signal

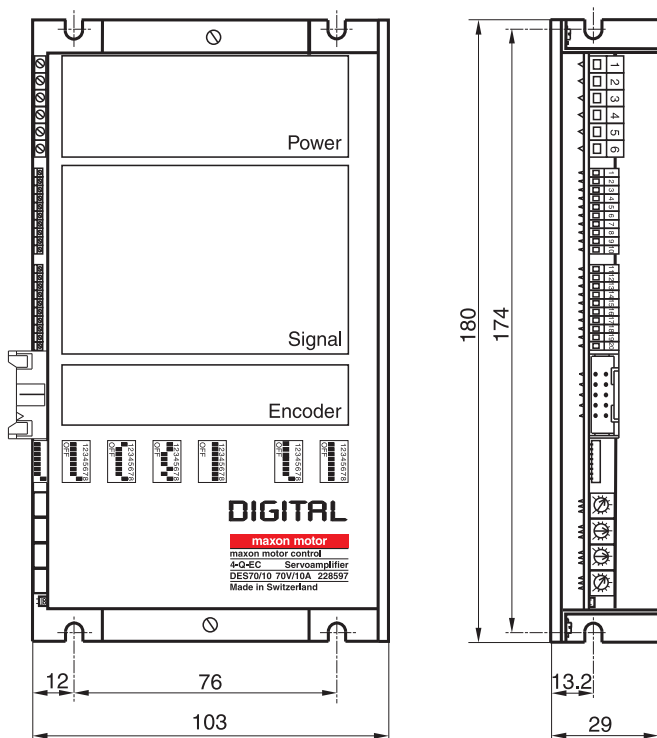
Screw type terminal block 18 poles  
Pitch 3.5 mm  
Suitable for wire cross section AWG 26 - 16  
0.14...1.0 mm<sup>2</sup> multi-core  
0.14...1.5 mm<sup>2</sup> single wire

#### Connection Encoder

Plug (DIN41651) 10 poles  
Pitch 1.27 mm  
Flat band cable,  
suitable for wire cross section AWG 28

DES 50/5

205679



Dimensions in [mm]

### DES 70/10

#### Connections Power

Screw type terminal block 6 poles  
Pitch 5.08 mm  
Suitable for wire cross section AWG 26 - 16  
0.14 - 1.5 mm<sup>2</sup>

#### Connections Signal

Screw type terminal block 20 poles (2 x 10)  
Pitch 2.54 mm  
Suitable for wire cross section AWG 26 - 20  
0.14...0.5 mm<sup>2</sup>

#### Connection Encoder

Plug (DIN41651) 10 poles  
Pitch 1.27 mm  
Flat band cable,  
suitable for wire cross section AWG 28

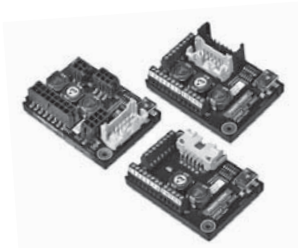
DES 70/10

228597



# EPOS2 Positioning Control Units Summary

Online commanded



## EPOS2 24/2

- Several device variations allows the operation of various maxon DC and EC micromotors of up to 48 watts
- Point to point control (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 6 digital inputs
- 2 digital outputs
- 2 analog inputs
- Miniaturised module design

Details [pages 310–312](#)

Slave version (online commanded) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, etc.) or PC via USB or RS232 interface

### Typical applications:

- Small apparatus/appliances
- System automation tasks
- Drive technology

### Article Numbers

EPOS2 24/2 **380264, 390003  
390438**

Online commanded



## EPOS2 Module 36/2

- DC and EC motors up to 72 W
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 6 digital inputs
- 3 digital outputs
- 2 analog inputs
- Miniaturized open electronics board (OEM)

Details [pages 310–312](#)

Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, SoftPLC,  $\mu$ -Processor, etc.) or PC via USB <sup>\*)</sup> or RS232 interface  
\*) requires external transceiver

### Typical applications:

- Small apparatus/appliances
- System automation tasks
- OEM customer

### Article Numbers

EPOS2 Module 36/2 **360665**

Online commanded



## EPOS2 24/5

- DC and EC motors up to 120 W
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 6 digital inputs
- 4 digital outputs
- 2 analog inputs
- Compact module design

Details [pages 310–313](#)

Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, etc.) or PC via USB or RS232 interface

### Typical applications:

- Tool building
- Production equipment
- System automation tasks

### Article Numbers

EPOS2 24/5 **367676**

Online commanded



## EPOS2 50/5

- DC and EC motors up to 250 W
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 11 digital inputs
- 5 digital outputs
- 2 analog inputs
- 1 analog output
- Compact module design

Details [pages 310–313](#)

Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, etc.) or PC via USB or RS232 interface

### Typical applications:

- Tool building
- Production equipment
- System automation tasks

### Article Numbers

EPOS2 50/5 **347717**

Online commanded



## EPOS2 70/10

- DC and EC motors up to 700 W
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 10 digital inputs
- 5 digital outputs
- 2 analog inputs (12-bit ADC, differential)
- Robust design

Details [pages 310–313](#)

Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, etc.) or PC via USB or RS232 interface

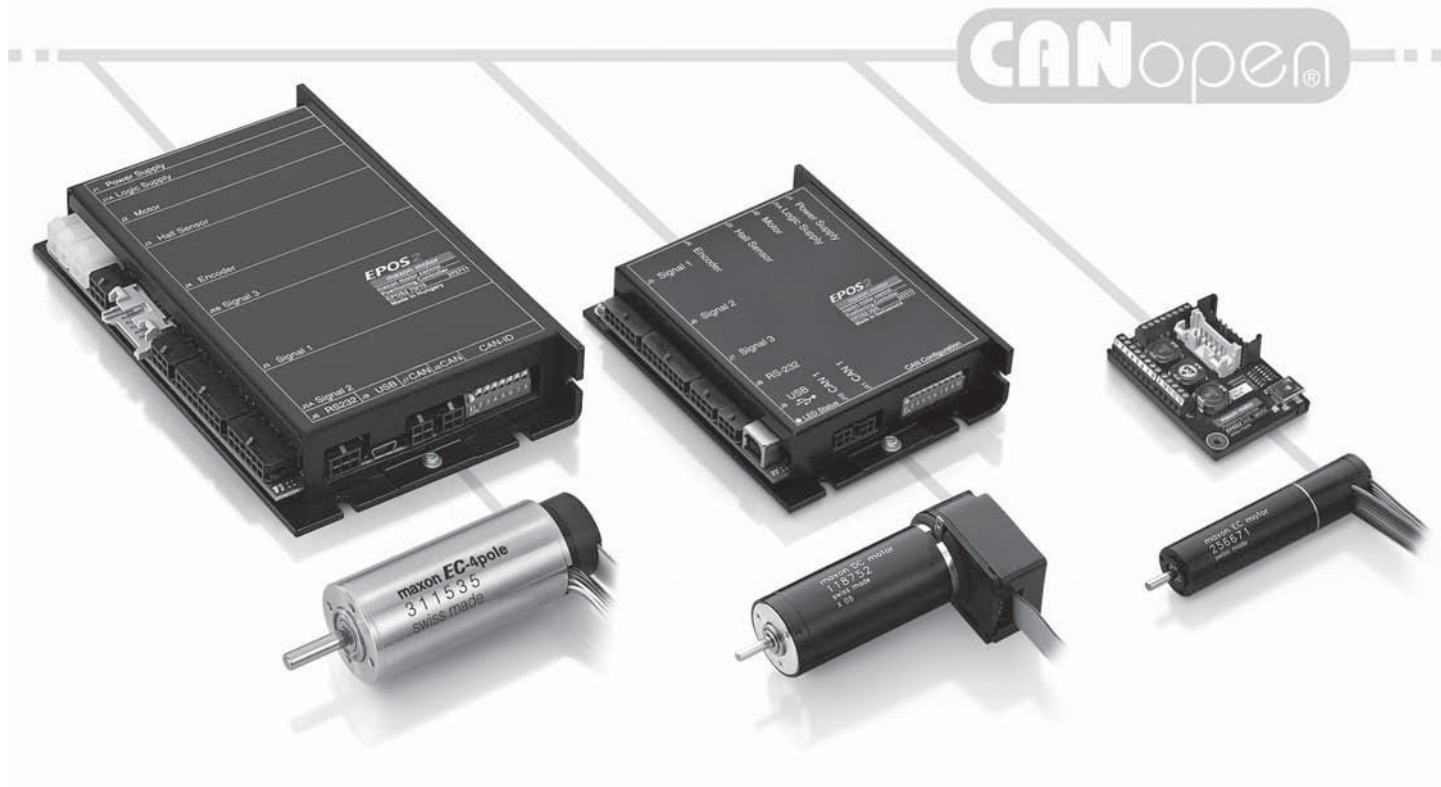
### Typical applications:

- Production equipment
- System automation tasks
- Plant construction

### Article Numbers

EPOS2 70/10 **375711**

# EPOS2 Positioning Control Units

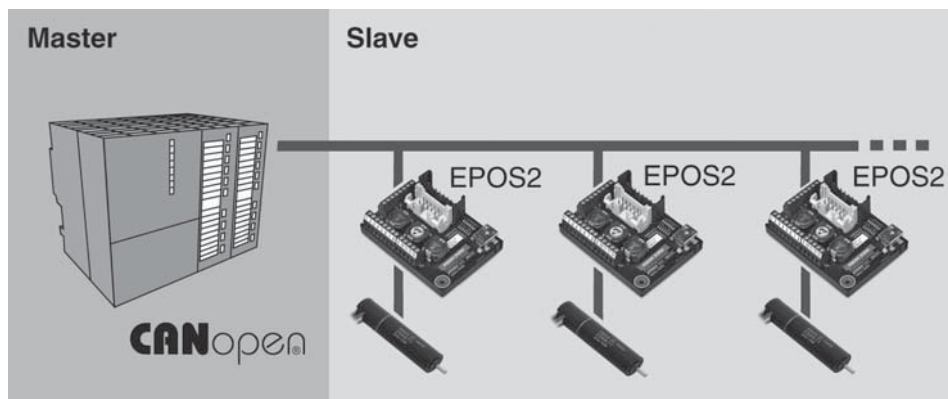


## Slave version (online commanded)

Single motion and I/O commands from the process control are transmitted to the positioning control unit by a superior system (Master). For that purpose product specific commands are available.

EPOS2 is a modular constructed digital positioning controller. It is suitable for DC and EC motors with incremental encoder with a power range from 1 - 700 watts.

A number of operating modes provides flexible application in a wide range of drive systems in automation technology and mechatronics.



## Point to point

The "CANopen Profile Position Mode" move 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).

## Interpolated Position Mode (PVT)

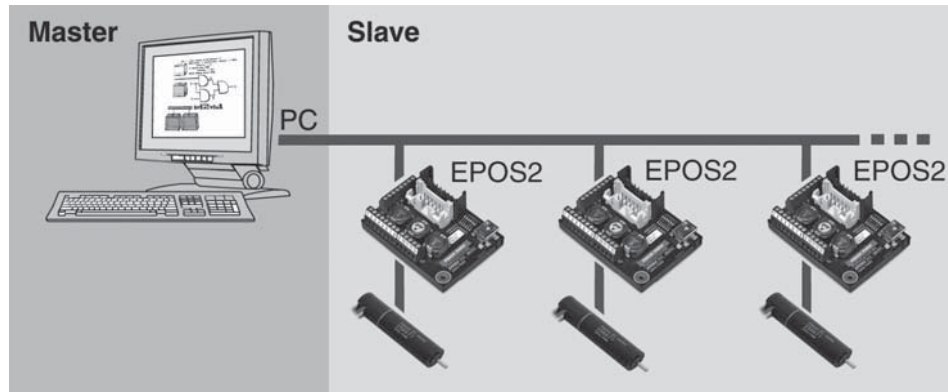
Thanks to Interpolated Position Mode, the EPOS2 is able to synchronously run a path specified by interpolating points. With a suitable master, coordinated multi-axis movements as well as any profile in a 1-axis system can be carried out. (PVT = Position and Velocity versus Time)

## Position and Speed control with Feed Forward

The combination of feedback and feed forward control provides ideal motion behaviour. Feed forward control reduces control error. EPOS2 supports feed forward acceleration and speed control.

## Speed control

In "CANopen Profile Velocity Mode", the motor axis is moved with a set speed. The motor axis retains speed until a new speed is set.



### Torque control

In "Current Mode", a controlled torque can be produced on the motor shaft. The sinusoidal commutation used produces minimum torque ripple.

### Homing

The "CANopen Homing Mode" is for referencing to a special mechanical position. There are more than 30 methods available for finding the reference position.

### Electronic gearhead

In "Master Encoder Mode", the motor follows a reference input produced by an external encoder. A gearing factor can also be defined using software parameters. Two motors can be very easily synchronised using this method.

### Step/Direction

In "Step/Direction Mode" the motor axis follows a digital signal step-by-step. This mode can replace stepper motors. It can also be used to control the EPOS2 by a PLC without CAN interface.

### Analog Commands

In the position, speed and current mode it is possible to give commands via an external analog set value. This function offers further possibilities to operate the EPOS2 without serial on-line commanding.

### Capture inputs (Position Marker)

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

### Trigger output (Position Compare)

Digital outputs can be configured so that a digital signal is emitted at a set position value.

### Dual Loop Position and Speed Control

With an additional sensor the load can be controlled directly and with high precision; the motor control is subordinated. The mechanical play and the elasticity can be compensated. Wide range of sensors can be handled: digital incremental encoder, SSI absolute encoder, analog incremental encoder (sin/cos). (Only in use with EPOS2 50/5 and EPOS2 70/10.)

### Control of Holding Brakes

The control of the holding brake can be implemented in the device state management. There the delay times can be individually configured for switching on and off.

Additional information for technical data of [page 312/313](#)

### Standardised, extendable

CANopen standard CiA DS-301, DSP-402 and DSP-305. Can easily be integrated into existing CANopen systems. Networks with other CANopen modules. Alternatively controllable by serial interface (USB and RS232).

### Flexible, modular

The same technology for DC and EC motors. Configurable inputs and outputs for limit switches, reference switches, 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.

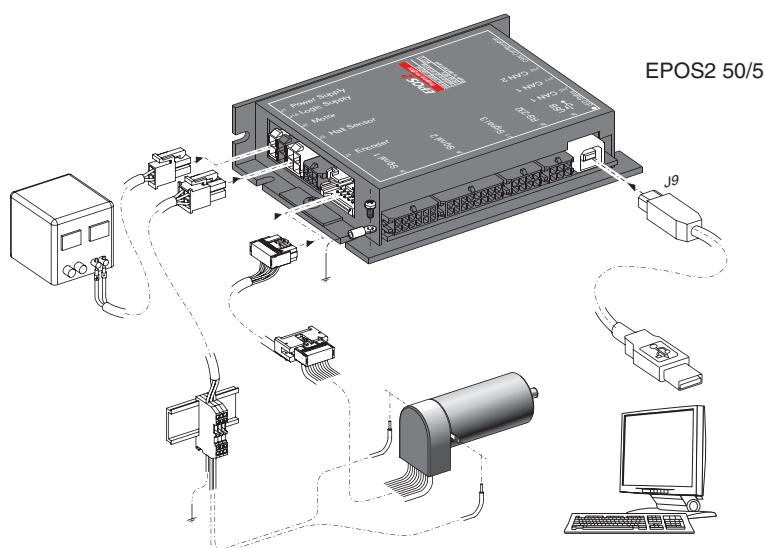
### Easy programming

Numerous IEC 61131-3 libraries free available for CAN-Master units of several PLC manufacturers providers (Beckhoff, Siemens/Helmholz, VIPA) and 32-/64-bit Windows-DLLs for PC Master (IXXAT, Vector and National Instruments). Various programming examples free available for MS Visual C#, MS Visual C++, MS Visual Basic, Borland C++, Borland Delphi, National Instruments LabVIEW and National Instruments LabWindows/CVI.

Also available is the 32-bit Linux Shared Object Library with the programming example for Eclipse C++/QT. In addition, the integration of the EPOS2 into the National Instruments Compact Rio System is easy to handle thanks to the available maxon library for NI SoftMotion.

### State-of-the-art

Digital position, speed and current/torque control. Sinusoidal commutation for smooth operation of EC motors.



### Operating modes

CANopen Profile Position-, Profile Velocity- and Homing Mode

Position, Velocity and Current Mode

Alternative set value setting via Step/Direction, Master Encoder or external analog commanding

Path generating with trapezoidal or sinusoidal profiles

Feed forward for velocity and acceleration

Interpolated Position Mode (PVT)

Sinusoidal or block commutation for EC motors

Dual loop position and speed controller

### Communication

Communication via CANopen and/or USB 2.0 and/or RS232

Gateway function USB-to-CAN and RS232-to-CAN

### Inputs/Outputs

Free configurable digital inputs e.g. for limit switches and reference switches

Free configurable digital outputs e.g. for holding brakes

Free analog inputs

### Available software

EPOS Studio

Windows DLL

IEC 61131-3 Libraries

Firmware

### Available documentation

Getting Started

Cable Starting Set

Hardware Reference

Firmware Specification

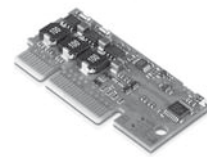
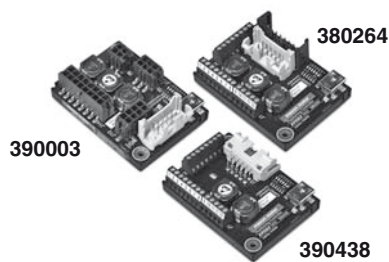
Communication Guide

Application Notes

### Cable

A comprehensive range of cables is available as an option. Details can be found on [page 321](#).

# EPOS2 Positioning control unit Data



## EPOS2 24/2

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder up to 48 watts.

## EPOS2 Module 36/2

The EPOS2 is an OEM positioning controller plug-in module for brushed DC motors with encoder or brushless EC motors with Hall sensors and encoder up to 72 watts.

Controller versions	Slave version	Slave version
<b>Electrical Data</b>		
Operating voltage $V_{CC}$	9 - 24 VDC	11 - 36 VDC (optional 0 - 36 VDC)
Logic supply voltage $V_C$ (optional)		11 - 36 VDC (optional 5.0 VDC)
Max. output voltage	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
Max. output current $I_{max}$ (<1 s)	4 A	4 A
Continuous output current $I_{cont}$	2 A	2 A
Switching frequency of power stage	100 kHz	50 kHz
Sample rate of PI - current controller	10 kHz	10 kHz
Sample rate of PI - speed controller	1 kHz	1 kHz
Sample rate of PID - positioning control	1 kHz	1 kHz
Max. speed (1 pole pair)	25 000 rpm (sinusoidal); 100 000 rpm (block)	25 000 rpm (sinusoidal); 100 000 rpm (block)
Built-in motor choke per phase	47 $\mu$ H / 2 A	10 $\mu$ H / 2 A
<b>Input</b>		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 5 MHz)	A, A\, B, B\, I, I\ (max. 5 MHz)
Digital inputs	6 (TTL level)	6 (TTL level)
Analog inputs	2 12-bit resolution, 0...+5 V	2 11-bit resolution, 0...+5 V
CAN-ID (CAN node identification)	configurable with DIP switch 1...4	set by external wiring
<b>Output</b>		
Digital outputs	2	3
Analog outputs		
Encoder voltage output	+5 VDC, max. 100 mA	+5 VDC, max. 100 mA
Hall sensor voltage output	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
Auxiliary voltage output	+5 VDC, max. 10 mA	
<b>Interface</b>		
RS232	RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)
CAN	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
USB 2.0	Data+; Data- (max. 12 Mbit/s)	external USB transceiver required
<b>Indicator</b>		
LED green = READY, red = ERROR	green LED, red LED	green LED, red LED
<b>Ambient temperature and humidity range</b>		
Operation	-10...+45°C	-10...+45°C
Storage	-40...+85°C	-40...+85°C
No condensation	20...80%	20...80%
<b>Mechanical data</b>		
Weight	Approx. 30 g	Approx. 10 g
Dimensions (L x W x H)	55 x 40 x 19.6 mm	54.5 x 28.2 x 9 mm
Mounting threads	Flange for M2.5-screws	PCB edge connector with locking mechanism
<b>Article Numbers</b>	<b>390438</b> EPOS2 24/2 for DC motors <b>380264</b> EPOS2 24/2 for EC motors <b>390003</b> EPOS2 24/2 for DC/EC motors	<b>360665</b> EPOS2 Module 36/2
<b>Accessories</b>	<b>309687</b> DSR 50/5 Shunt regulator Order accessories separately, see <a href="#">page 321</a>	<b>363407</b> EPOS2 Module Starter-Kit Order accessories separately, see <a href="#">page 321</a>



**EPOS2 24/5**

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder, from 5 to 120 watts.

**EPOS2 50/5**

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder, from 5 to 250 watts.

**EPOS2 70/10**


Matched with DC brush motors with encoder or brushless EC motors with Hall sensors or encoder, from 80 to 700 watts.

Controller versions		
Slave version	Slave version	Slave version
Electrical Data		
11 - 24 VDC	11 - 50 VDC	11 - 70 VDC
11 - 24 VDC	11 - 50 VDC	11 - 70 VDC
0.9 x V <sub>CC</sub>	0.9 x V <sub>CC</sub>	0.9 x V <sub>CC</sub>
10 A	10 A	25 A
5 A	5 A	10 A
50 kHz	50 kHz	50 kHz
10 kHz	10 kHz	10 kHz
1 kHz	1 kHz	1 kHz
1 kHz	1 kHz	1 kHz
25 000 rpm (sinusoidal); 100 000 rpm (block)	25 000 rpm (sinusoidal); 100 000 rpm (block)	25 000 rpm (sinusoidal); 100 000 rpm (block)
15 µH / 5 A	22 µH / 5 A	25 µH / 10 A
Input		
H1, H2, H3	H1, H2, H3	H1, H2, H3
A, A\, B, B\, I, I\ (max. 5 MHz)	A, A\, B, B\, I, I\ (max. 5 MHz)	A, A\, B, B\, I, I\ (max. 5 MHz)
6 (TTL and PLC level)	11 (7 optically isolated, 4 differential)	10 (7 optically isolated, 3 differential)
2	2 (differential)	2 (differential)
12-bit resolution, 0...+5 V	12-bit resolution, ±10 V	12-bit resolution, 0...+5 V
configurable with DIP switch 1...7	configurable with DIP switch 1...7	configurable with DIP switch 1...7
Output		
4	5 (4 optically isolated, 1 differential)	5 (4 optically isolated, 1 differential)
	1 (12-bit, 0...10 V)	
+5 VDC, max. 100 mA	+5 VDC, max. 100 mA	+5 VDC, max. 100 mA
+5 VDC, max. 30 mA	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
V <sub>CC</sub> , max. 1300 mA	+5 VDC, max. 150 mA	+5 VDC, max. 150 mA; +5 VDC (R <sub>i</sub> = 1 kΩ)
Interface		
RxD; TxD (max. 115 200 bit/s)	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)	high; low (max. 1 Mbit/s)
Data+; Data- (max. 12 Mbit/s)	Data+; Data- (max. 12 Mbit/s)	Data+; Data- (max. 12 Mbit/s)
Indicator		
green LED, red LED	green LED, red LED	green LED, red LED
Ambient temperature and humidity range		
-10...+45°C	-10...+45°C	-10...+45°C
-40...+85°C	-40...+85°C	-40...+85°C
20...80%	20...80%	20...80%
Mechanical data		
Approx. 170 g	Approx. 240 g	Approx. 330 g
105 x 83 x 24 mm	120 x 93.5 x 27 mm	150 x 93 x 27 mm
Flange for M3-screws	Flange for M3-screws	Flange for M3-screws
Article Numbers		
<b>367676</b> EPOS2 24/5	<b>347717</b> EPOS2 50/5	<b>375711</b> EPOS2 70/10

Accessories		
<b>309687</b> DSR 50/5 Shunt regulator	<b>309687</b> DSR 50/5 Shunt regulator	<b>235811</b> DSR 70/30 Shunt regulator
Order accessories separately, see <a href="#">page 321</a>	Order accessories separately, see <a href="#">page 321</a>	Order accessories separately, see <a href="#">page 321</a>

# EPOS2 P programmable positioning controller Summary

Standalone operation



**EPOS2 P 24/5 (programmable)**

- IEC 61131-3 programmable
- CANopen Master function
- Multiple axis systems via CAN Bus CANopen
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- DC and EC motors up to 120 W
- 6 digital inputs (TTL and PLC level)
- 4 digital outputs
- 2 analog inputs (12-bit ADC)
- compact design

Details [page 316](#)

Standalone operation, programmable from PC via RS232 or USB 2.0 with standard IEC 61131-3. Program languages (ST, IL, FBD, LD, SFC). CANopen master function for controlling other axes. Standard motion control library. Supervisory Control and Data Acquisition for monitoring and controlling a process via RS232; USB 2.0 or CANopen.

Typical applications:

- Work equipment manufacturing
- Tool building
- System automation tasks

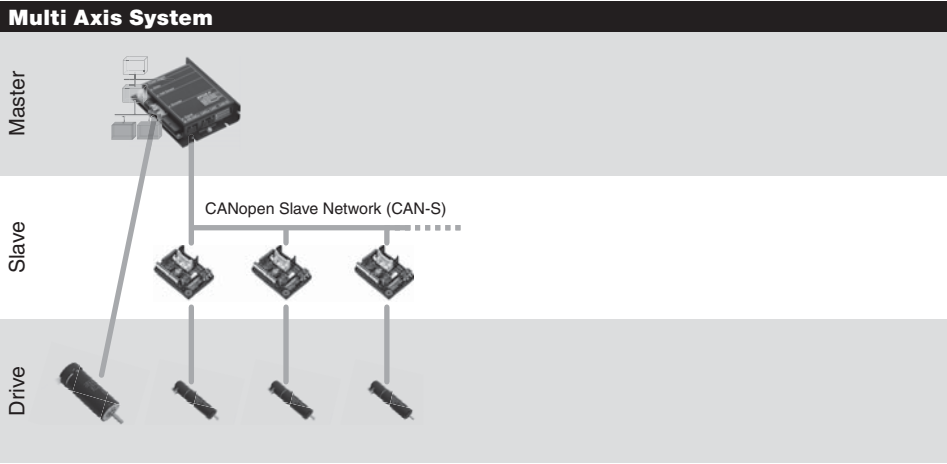
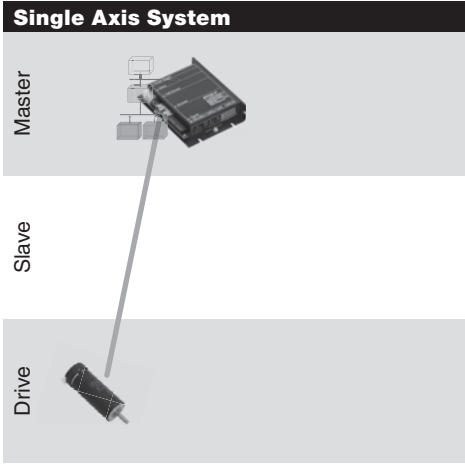
**Article Numbers**  
EPOS2 P 24/5    **378308**

EPOS2 P is a freely programmable positioning controller with an integrated power stage, based on the EPOS2 slave version. It is suitable for brushless and brush DC motors with incremental encoder and up to 120 watt output.

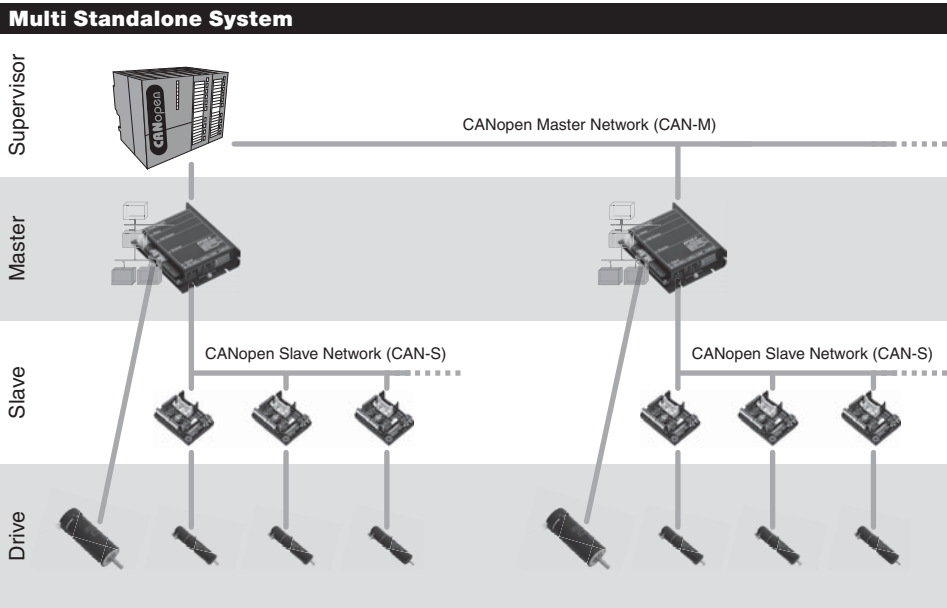
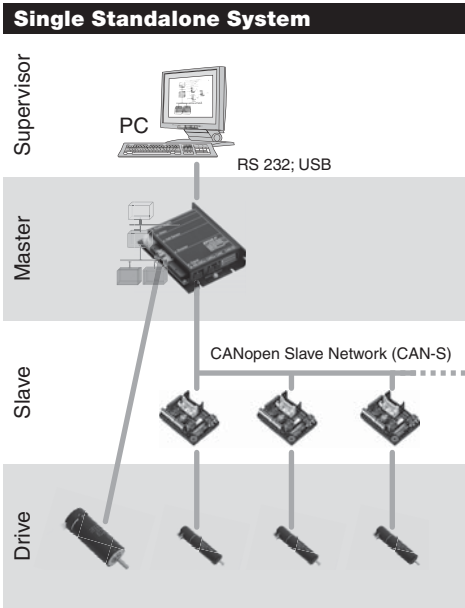
**Standalone drive systems**  
With self-compiled programs, the standalone version of EPOS2 can autonomously control single and multiple axis systems dispensing with the need for a superior intelligent control unit.

Via the CAN Bus all axes can be coordinated simultaneously. The combination with maxon motors produces drive systems for highly dynamic movements.

## Standalone



## Supervisory Control



## Technology

The programming of applications complies with IEC 61131-3 standard. A non-volatile flash memory is used for saving. The three-stage code optimization produces IEC 61131-3 programs adjusted for the application's needs; optimized by memory, performance or a combination of both.

## EPOS Studio – programming according to IEC 61131-3

Editors (ST, IL, FBD, LD, SFC) of the powerful “EPOS Studio” tool are available for programming according to IEC 61131-3. The integrated project browser shows all network resources. Complex programs with a large number of decentralized controls can be optimally managed with it. Drive systems are configured and networked quickly using intelligent step-by-step wizards.

## Motion control library

The complexity and development costs of drive systems are substantially reduced. The Motion Firmware Library was implemented according to the widely-used Motion Control Standard. Standardized function blocks make implementation easy.

## maxon utility library

Thanks to the additional maxon user library, the programming of recurring motion control tasks is simplified. By means of the “Best Practice” programs and the numerous applications examples, purposeful IEC 61131-3 application programs can be compiled.

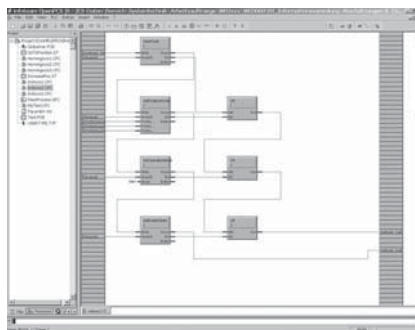
Technical data [page 316](#)

## Performance features

- 32 bit host processor, 60 MHz
- 1 MB memory, with 768 KB free user program memory
- typically 2.5 ms / 5000 lines IL
- 4 KB non-volatile memory
- Digital motion control signal processor

## Software features

- Windows-based development environment
- IEC 61131-3 programming languages (ST, IL, FBD, LD, SFC)
- IEC 61131-3 standard libraries
- Motion control function blocks
- maxon utility function block library
- CANopen function block library
- User libraries
- Network variables and data exchange
- Online debugger with break points and watch variables
- Axis configuration and parameterization
- Online help



FBD Editor

ST Editor



SFC Editor

## Motion firmware library

- Drive control
- Referencing (Homing)
- Speed control
- Positioning absolute and relative
- Error Management
- Parameter Handling

## Motion utility library

- Inputs and Outputs
- Error Handling
- Object Dictionary Access
- Homing Parameter
- Data Handling

# EPOS2 P programmable positioning controller Data

CANopen

USB

RS232

GUI



## EPOS2 P 24/5

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder, from 5 to 120 watts.

## Additional information

### Controller versions

#### Master-Version (programmable)

#### Electrical Data

Operating voltage $V_{CC}$	11 - 24 VDC
Logic supply voltage $V_C$ (optional)	11 - 24 VDC
Max. output voltage	$0.9 \times V_{CC}$
Max. output current $I_{max}$ (<1 s)	10 A
Continuous output current $I_{cont}$	5 A
Switching frequency of power stage	50 kHz
Sample rate of PI - current controller	10 kHz
Sample rate of PI - speed controller	1 kHz
Sample rate of PID - positioning control	1 kHz
Max. speed (1 pole pair)	25 000 rpm (sinusoidal); 100 000 rpm (block)
Built-in motor choke per phase	15 $\mu$ H / 5 A

#### Input

Hall sensor signals	H1, H2, H3
Encoder signals	A, A $\bar$ , B, B $\bar$ , I, I $\bar$ (max. 5 MHz)
Digital inputs	6 (TTL and PLC level)
Analog inputs	2
	12-bit resolution, 0...+5 V
CAN-ID (CAN node identification)	Configurable with DIP switch 1...7

#### Output

Digital outputs	4
Encoder voltage output	+5 VDC, max. 100 mA
Hall sensor voltage output	+5 VDC, max. 30 mA
Auxiliary voltage output	$V_{CC}$ , max. 1300 mA

#### Interface

RS232	RxD; TxD (max. 115 200 bit/s)
CAN	high; low (max. 1 Mbit/s)
USB 2.0	Data+; Data- (max. 12 Mbit/s)

#### Indicator

Operating/Error/Program	green LED, red LED, blue LED
-------------------------	------------------------------

#### Ambient temperature and humidity range

Operation	-10...+45°C
Storage	-40...+85°C
No condensation	20...80%

#### Mechanical Data

Weight	Approx. 180 g
Dimensions (L x W x H)	105 x 83 x 24 mm
Mounting threads	Flange for M3-screws

#### Article Numbers

**378308** EPOS2 P 24/5

#### Accessories

**309687** DSR 50/5 Shunt regulator

Order accessories separately, see [page 321](#)

### Operating modes

CANopen Profile Position, Profile Velocity- and Homing Mode

Position, Velocity and Current Mode

Path generating with trapezoidal or sinusoidal profiles

Feed forward for velocity and acceleration

Interpolated Position Mode (PVT)

Sinusoidal or block commutation for EC motors

### Communication

Programming interface (Windows) via USB 2.0 or RS232

Communication via CANopen, RS232 or USB 2.0 maxon protocol

### Inputs / Outputs

Free configurable digital inputs e.g. for limit switches and reference switches

Free configurable digital outputs e.g. for holding brakes

Free analog inputs

### Available software

EPOS Studio  
programming according to IEC 61131-3

IEC 61131-3 standard libraries

motion control library

maxon utility function block library

CANopen function block library

maxon utility library

Application Examples

Best Practice Examples

Firmware

### Available documentation

Getting Started

Cable Starting Set

Hardware Reference

Firmware Specification

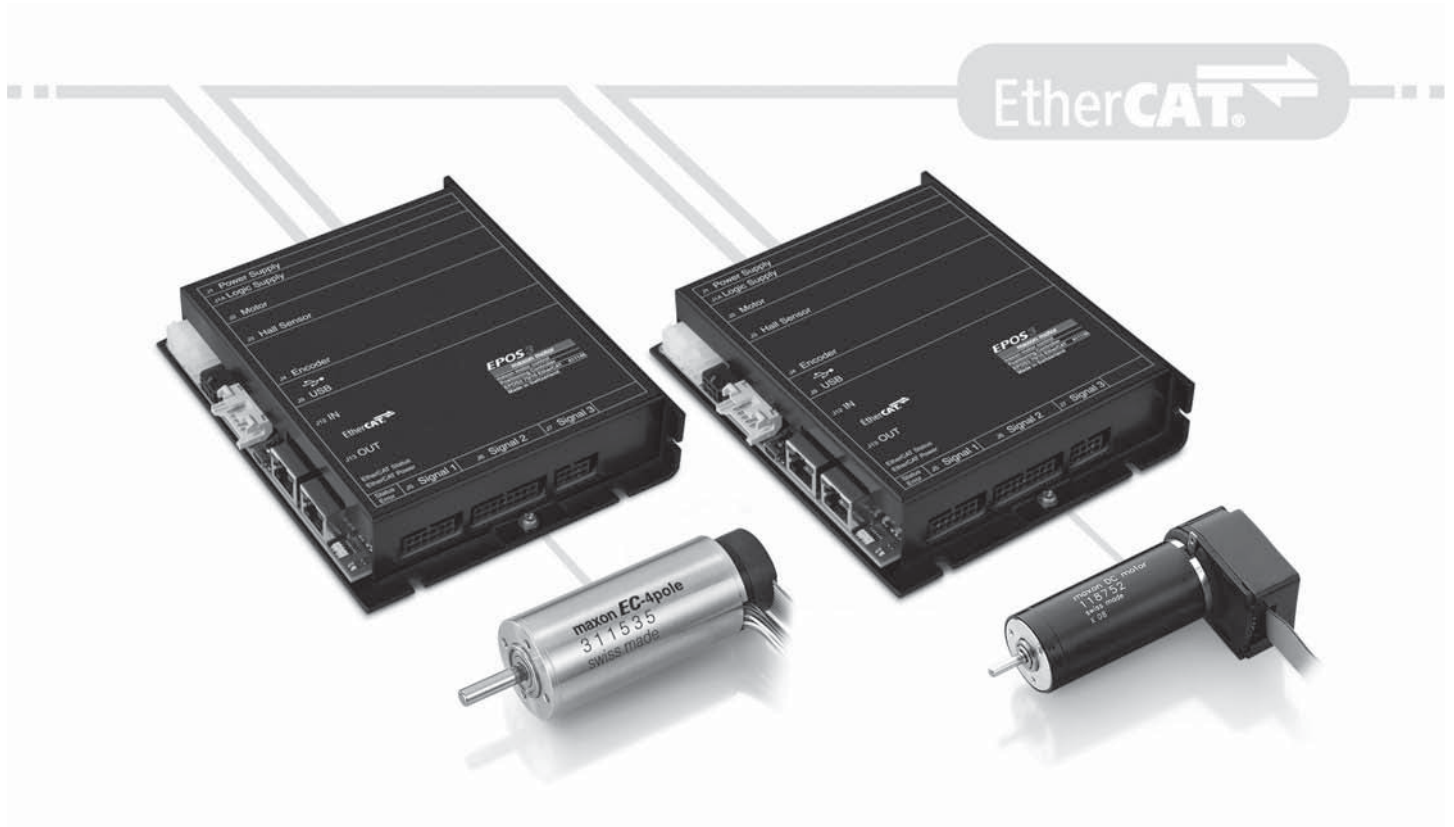
Programming Reference

Application Notes

### Cable

A comprehensive range of cables is available as an option. Details can be found on [page 321](#).

# EPOS3 Positioning Control Unit

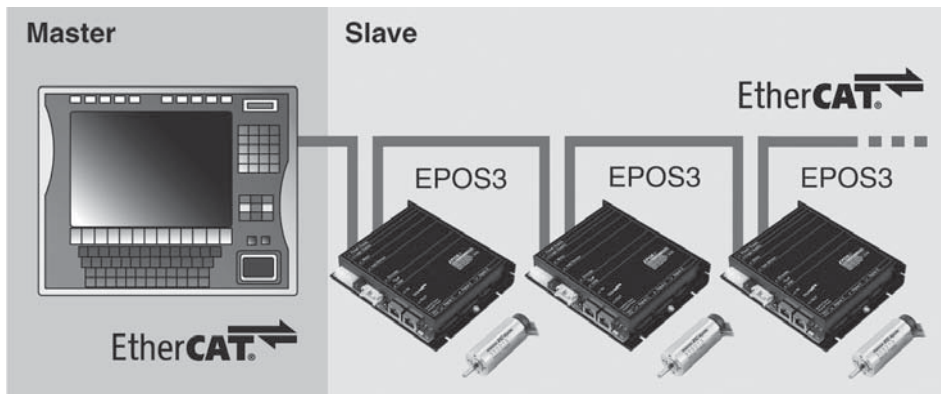


## EPOS3 70/10 EtherCAT Slave

The EPOS3 70/10 EtherCAT positioning controller receives motion and I/O commands from a superordinate EtherCAT-Master, which operates as sequence control system. The EPOS3 70/10 EtherCAT supports CoE (CAN application layer over EtherCAT).

The EPOS3 70/10 EtherCAT is a modular, digital positioning controller and suits DC and EC motors with incremental encoder in the range up to 700 Watt.

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 calculates the path planning and sends the target position cyclically and synchronously via the EtherCAT network to the EPOS3.

The position control loop runs in the EPOS3. Via the sensors, the EPOS3 delivers the measured current position, speed and current values to the EtherCAT master.

### Cyclic Synchronous Velocity (CSV)

The EtherCAT master calculates the path planning and sends the target speed cyclically and synchronously via the EtherCAT network to the EPOS3. The speed control loop runs in the EPOS3. Via the sensors, the EPOS3 delivers the measured current position, speed and current values to the EtherCAT master. If the position control loop is closed via the EtherCAT master, CSV mode is often used.

### Cyclic Synchronous Torque (CST)

The EtherCAT master calculates the path planning and sends the target torque cyclically and synchronously via the EtherCAT network to the EPOS3. The torque (current) control loop runs in the EPOS3. Via the sensors, the EPOS3 delivers the measured current 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" move 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).

## Interpolated Position Mode (PVT)

Thanks to Interpolated Position Mode, the EPOS3 is able to synchronously run a path specified by interpolating points. With a suitable master, coordinated multi-axis movements as well as any profile in a 1-axis system can be carried out. (PVT = Position and Velocity versus Time.)

## Position and Speed control with Feed Forward

The combination of feedback and feed forward control provides ideal motion behaviour. Feed forward control reduces control error. EPOS3 supports feed forward acceleration and speed control.

## 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 are more than 30 methods available for finding the reference position.

## Capture inputs (Position Marker)

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

## Trigger output (Position Compare)

Digital outputs can be configured so that a digital signal is emitted at a set position value.

## Dual Loop Position and Speed Control

With an additional sensor the load can be controlled directly and with high precision; the motor control is subordinated. The mechanical play and the elasticity can be compensated.

Wide range of sensors can be handled: digital incremental encoder, SSI absolute encoder, analog incremental encoder (sin/cos).

## 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 319](#)

## Standardized

EtherCAT Slave: CoE (CAN application layer over EtherCAT) according to CANopen standard DSP-402 Device Profile Drives and Motion Control. Easy integration into existing EtherCAT systems. Can be networked with additional EtherCAT units. Alternatively configurable via serial interface (USB 2.0).

## Flexible, modular

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

## Easy start-up procedure

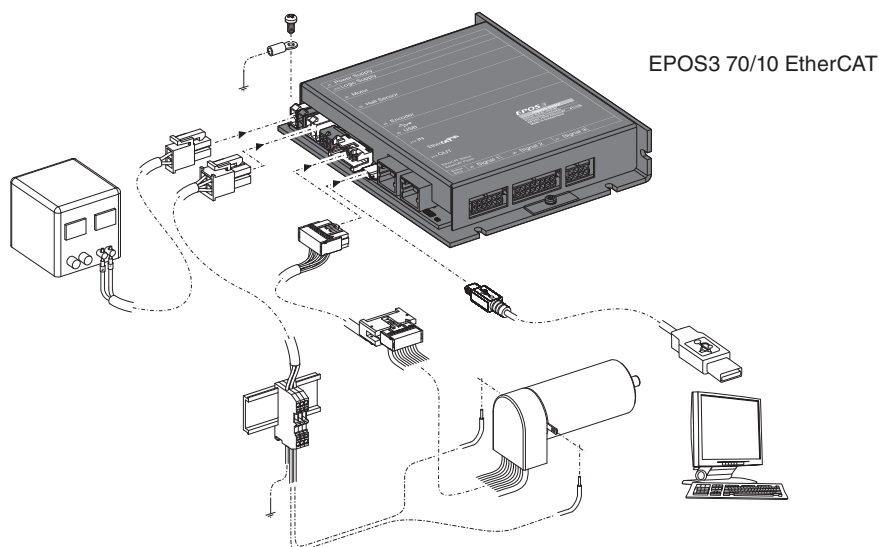
Graphic user interface with many functions and wizards for start-up procedure, automatic control settings, I/O configuration, tests.

## EtherCAT Master (Beckhoff TwinCAT®): Integration made easy

Easy integration of the position controller EPOS3 70/10 EtherCAT into the Beckhoff-TwinCAT SoftPLC thanks to existing device description file (ESI file) and device-specific configuration instructions.

## State-of-the-art

Digital position, speed and current/torque control. Sinusoidal commutation for smooth operation of EC motors.



## Operating modes

Cyclic Synchronous Position (CSP), Cyclic Synchronous Velocity (CSV), Cyclic Synchronous Torque (CST)

Profile Position-, Profile Velocity- and Homing Mode

Path generating with trapezoidal or sinusoidal profiles

Feed forward for velocity and acceleration

Interpolated Position Mode (PVT)

Sinusoidal or block commutation for EC motors

Dual loop position and speed controller

## Communication

Communication via EtherCAT

## Configuration

Configuration via EtherCAT or USB 2.0

## Inputs/Outputs

Free configurable digital inputs e.g. for limit switches and reference switches

Free configurable digital outputs e.g. for holding brakes

Free analog inputs

## Available software

EPOS Studio

Firmware

## Available documentation

Getting Started

Cable Starting Set

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 321](#).

# EPOS3 Positioning controller Data

EtherCAT

USB

GUI



**NEW**

## EPOS3 70/10 EtherCAT

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors or encoder to 700 watts.

Controller versions	
	EtherCAT Slave
Electrical Data	
Operating voltage $V_{CC}$	11 - 70 VDC
Logic supply voltage $V_C$ (optional)	11 - 70 VDC
Max. output voltage	$0.9 \times V_{CC}$
Max. output current $I_{max}$ (<1 s)	25 A
Continuous output current $I_{cont}$	10 A
Switching frequency of power stage	50 kHz
Sample rate of PI - current controller	10 kHz
Sample rate of PI - speed controller	1 kHz
Sample rate of PID - positioning control	1 kHz
Max. speed (1 pole pair)	25 000 rpm (sinusoidal); 100 000 rpm (block)
Built-in motor choke per phase	22 $\mu$ H / 10 A
Input	
Hall sensor signals	H1, H2, H3
Encoder signals	A, A $\bar$ , B, B $\bar$ , I, I $\bar$ (max. 5 MHz)
Digital inputs	11 (7 optically isolated, 4 differential)
Analog inputs	2 (differential) 12-bit resolution, $\pm 10$ V
Output	
Digital outputs	5 (4 optically isolated, 1 differential)
Analog outputs	1 (12-bit resolution, 0...10 V)
Encoder voltage output	+5 VDC, max. 100 mA
Hall sensor voltage output	+5 VDC, max. 30 mA
Auxiliary voltage output	+5 VDC, max. 150 mA
Interface	
EtherCAT	IEEE 802.3 100 Base Tx (100 Mbit/s, Full Duplex)
USB 2.0	Data+; Data- (max.12 Mbit/s)
Indicator	
Device	green LED, red LED
EtherCAT	green LED, red LED
EtherCAT Port	green LED, yellow LED
Ambient temperature and humidity range	
Operation	-10...+45°C
Storage	-40...+85°C
No condensation	20...80%
Mechanical data	
Weight	442 g
Dimensions (L x W x H)	150 x 120 x 29 mm
Mounting threads	Flange for M3-screws
Article Numbers	
	<b>411146</b> EPOS3 70/10 EtherCAT
Accessories	
	<b>235811</b> DSR 70/30 Shunt regulator
	Order accessories separately, see <a href="#">page 321</a>

# Summary maxon motor control

4-Q Servocontroller			Page
ESCON	403112	ESCON 36/2 DC, for DC motors, speed control (open loop/closed loop), current control, 2/4 A, 10 - 36 VDC	292
	409510	ESCON 50/5, for DC/EC motors, speed control (open loop/closed loop), current control, 5/15 A, 10 - 50 VDC	292

4-Q-DC Servoamplifier			
LSC	250521	LSC 30/2, linear 4-Q-Servoamplifier 30 V/2 A in module housing	372
ADS	145391	ADS 50/5, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/5 A in module housing	372
	201583	ADS 50/10, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/10 A in module housing	373
	166143	ADS_E 50/5, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/5 A in racket card (Eurocard)	373
	168049	ADS_E 50/10, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/10 A in racket card (Eurocard)	373

1-Q-EC Amplifier			
DECS	274645	DECS 5/0.05, digital 1-Q-EC Amplifier 5 V/0.05 A, sensorless, speed control, open electronic circuit board	
	343253	DECS 50/5, digital 1-Q-EC Amplifier 50 V/5 A, sensorless, speed control, open electronic circuit board	297
DEC	318305	DEC 24/1, digital 1-Q-EC Amplifier 24 V/1 A, speed control, adapter FPC pitch 0.5 mm	297
	249630	DEC 24/1, digital 1-Q-EC Amplifier 24 V/1 A, speed control, adapter FPC pitch 1.0 mm	297
	249631	DEC 24/1, digital 1-Q-EC Amplifier 24 V/1 A, speed control, adapter a pin connector pitch 2.5 mm	297
	249632	DEC 24/1, digital 1-Q-EC Amplifier 24 V/1 A, speed control, adapter screw type tepitchinal block pitch 2.54 mm	297
	381510	DEC 24/1, digital 1-Q-EC Amplifier 24V/1A, speed control, adapter FPC pitch 0.5 mm to EC 9.2 flat, EC 8	297
	249633	DEC 24/1, digital 1-Q-EC Amplifier 24 V/1 A, speed control, basic module, no adapter	
	367661	DEC Module 24/2, digital 1-Q-EC Amplifier 24 V/2 A, speed control, OEM module	298
	336286	DEC 24/3, digital 1-Q-EC Amplifier 24 V/3 A, speed control, adapter a pin connector pitch 2.5 mm	298
	336287	DEC 24/3, digital 1-Q-EC Amplifier 24 V/3 A, speed control, adapter FPC pitch 1.0 mm	298
	380200	DEC Module 50/5, digital 1-Q-EC Amplifier 50 V/5 A, speed control , OEM module	299
	230572	DEC 50/5, digital 1-Q-EC Amplifier 50 V/5 A, speed control, current control, PWM operation	299

4-Q-EC Amplifier			
DECV	305259	DECV 50/5, digital 4-Q-EC Amplifier 50 V/5 A, speed control	305
DEC	306089	DEC 70/10, digital 4-Q-EC Amplifier 70 V/10 A, speed control, current control	305

4-Q-EC Servoamplifier			
DES	205679	DES 50/5, digital 4-Q-EC Servoamplifier 50 V/5 A, sinusoidal commutation	306
	228597	DES 70/10, digital 4-Q-EC Servoamplifier 70 V/10 A, sinusoidal commutation	306

Positioning			
EPOS, EPOS2	280937	EPOS 24/1 for DC motors, digital positioning controller, 1 A, 9 - 24 VDC	
	317270	EPOS 24/1 for EC 10 flat motors, digital positioning controller, 1 A, 9 - 24 VDC	
	302267	EPOS 24/1 for EC 16 / EC 22 motors, digital positioning controller, 1 A, 9 - 24 VDC	
	302287	EPOS 24/1 for DC/EC motors (with crimp connector), digital positioning controller, 1 A, 9 - 24 VDC	
	380264	EPOS2 24/2 for EC motors, digital positioning controller, 2 A, 9 - 24 VDC	312
	390003	EPOS2 24/2 for DC/EC motors, digital positioning controller, 2 A, 9 - 24 VDC	312
	390438	EPOS2 24/2 for DC motors, digital positioning controller, 2 A, 9 - 24 VDC	312
	360665	EPOS2 Module 36/2 OEM positioning controller plug-in module, 2 A, 11 - 36 VDC	312
	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	313
	347717	EPOS2 50/5, digital positioning controller, 5 A, 11 - 50 VDC	313
	375711	EPOS2 70/10, digital positioning controller, 10 A, 11 - 70 VDC	313
EPOS2 P	378308	EPOS2 P 24/5, digital positioning controller, programmable, 5 A, 11 - 24 VDC	316
EPOS3	411146	EPOS3 70/10 EtherCAT, digital positioning controller, 10 A, 11 - 70 VDC	319

# Summary maxon motor control accessories

Backplane		Page
166873	<a href="#">Backplane with screw type terminal block to ADS_E 50/5 (166143) and ADS_E 50/10 (168049)</a>	373
Front panel		
167850	<a href="#">Front panel 3HE / 5TE to ADS_E 50/5 (166143)</a>	373
168910	<a href="#">Front panel 3HE / 7TE to ADS_E 50/10 (168049)</a>	373
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	ESCON power cable (length 1.5 m) to 403112	
403962	ESCON DC motor cable (length 1.5 m) to 403112	
403964	ESCON analog I/O cable (length 1.5 m) to 403112	
403965	ESCON digital I/O cable (length 1.5 m) to 403112	
403968	USB 2.0 Type A-micro B cable (length 1.5 m) to 403112, 409510	
275829	EPOS power cable (length 3 m) to 347717, 367676, 375711, 378308, 411146	
275851	EPOS motor cable (length 3 m) to 347717, 367676, 375711, 378308, 411146	
303490	EPOS motor cable (length 3 m) to 302287, 390003	
275878	EPOS Hall sensor cable (length 3 m) to 347717, 367676, 375711, 378308, 411146	
302948	EPOS motor- / Hall sensor cable (length 3 m) to 302287, 390003	
275934	EPOS encoder cable (length 3 m) to 347717, 367676, 375711, 378308, 390438, 380264, 390003, 403112, 409510, 411146	
275932	EPOS signal cable (length 3 m) to 302287, 347717, 367676, 375711, 378308, 390003, 411146	
300586	EPOS signal cable 2 (length 3 m) to 347717, 375711, 411146	
350390	EPOS2 signal cable 3 (length 3 m) to 347717, 411146	
378173	EPOS2 signal cable 4 (length 3m) to 375711	
275900	EPOS RS232-COM cable (length 3 m) to 347717, 367676, 375711, 378308, 390003	
350392	EPOS2 USB type A-B cable (length 3 m) to 347717	
370513	EPOS2 USB type A-mini B cable (length 3 m) to 367676, 375711, 378308, 390438, 380264, 390003, 411146	
275908	EPOS CAN-COM cable (length 3 m) to 347717, 367676, 375711, 378308, 390003	
275926	EPOS CAN-CAN cable (length 3 m) to 347717, 367676, 375711, 378308, 390003	
319471	EPOS CAN Y cable to 302287, 390003, 378308	
422827	EPOS3 Ethernet cable (length 2 m) to 411146	
404404	ESCON 36/2 DC connector set to 403112	
303807	EPOS connector set to 302287, 390003	
351061	EPOS2 connector set to 347717	
384915	EPOS2 connector set to 367676, 378308	
381405	EPOS2 connector set to 375711	
423544	EPOS3 70/10 EtherCAT connector set to 411146	
Adapter		
220300	Adapter Flex print connector 11 poles on screw type terminal block 8 poles available for maxon flat motor	
220310	Adapter Flex print connector 4 poles on screw type terminal block 4 poles available for maxon flat motor	
425931	Adapter Flex print connector 8 poles on screw type terminal block 8 poles available for maxon micromotors, pitch 0.5 mm	
223774	Adapter spring contact strip according to DIN41651 10 poles on screw type terminal block 8 poles	
262359	Adapter male header to DIN41651 10 poles on screw type terminal block 10 poles	
257703	Adapter to DEC 24/1: Flex print connector 8 poles, top contact style, pitch 0.5 mm	
249635	Adapter to DEC 24/1: Flex print connector 11 poles, top contact style, pitch 1.0 mm	
249636	Adapter to DEC 24/1: Pin connector with snap-in (Stocko) 8 poles, pitch 2.5 mm	
249637	Adapter to DEC 24/1: Screw type terminal block 8 poles, pitch 2.54 mm, AWG 20 - 26	
380555	Adapter to DEC 24/1: Flex print connector 8 poles , top contact style, pitch 0.5 mm to EC 9.2 flat and EC 8	
405120	Adapter, encoder connector adapter 1.27 mm pitch to 2.54 mm pitch (DIN 41651)	
397973	Adapter EC 6 MILE encoder to terminal strip and DIN 41651	

# Summary maxon motor control accessories

Shunt regulator		Page
	309687 DSR 50/5, shunt regulator 27 VDC and 56 VDC (adjustable), $P_{\max}$ 300 W, $P_{\text{cont}}$ 10 W	
	235811 DSR 70/30, shunt regulator 12-75 VDC (selectable), $P_{\max}$ 475 W, $P_{\text{cont}}$ 25 W, module housing 180 x 103 x 26 mm	
Starter kits, evaluation boards, motherboards		
DEC	370652 DEC module evaluation board, with switch, LED, potentiometer etc. suitable for 367661 and 380200	
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 connection plug) suitable for 360665	
	407582 EPOS2 module motherboard, 1 to max. 11 axes suitable for 360665 (inclusive 1 each red & black power-link -plug and CAN-link cable) Optional accessories: 407583 EPOS2 motherboard USB module (incl. 4-wire connection leads $l = 0.25$ m, 2x M3 screws) 407584 EPOS2 motherboard RS232 module (incl. 6-wire connection leads $l = 0.25$ m, 2x M3 screws) 407585 EPOS2 motherboard I/O expander module (2x M3 screws) 423536 EPOS2 motherboard dual encoder module (2x M3 screws) 423507 EPOS2 motherboard power cable ( $l = 1$ m) suitable for 407582 423526 EPOS2 motherboard USB type A cable ( $l = 1.5$ m) suitable for 407583 423530 EPOS2 motherboard RS232 DB9 cable ( $l = 1$ m) suitable for 407584	
EPOS2 P	327460 EPOS2 P 24/5 starter kit consisting of EPOS2 P 24/5, EC motor with encoder, power supply unit, I/O board, cables	
Software		
ESCON	409286 ESCON USB stick including ESCON Setup for 403112, 409510	