



# maxon spindle drive

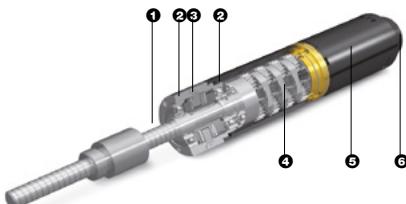
**Compact, easy to configure linear actuators as part of a complete system with integrated thrust bearing for high axial loads. Versions available with metric lead screw, trapezoidal lead screw or ball screw.**

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# Spindle Drive Basics

## Design

- ➊ Screw, directly implemented in the gearhead
- ➋ Radial bearing
- ➌ Axial bearing
- ➍ Planetary gearhead 0–4 stages
- ➎ Motor
- ➏ Encoder



The particular type of screw required must first be established before a spindle drive can be designed. Every type of screw has different characteristics and a number of specific limits. These limits are taken into account in the technical data.

### Ball screw:

- highly efficient
- not self-locking
- high load capacity

### Metric lead screw:

- self-locking
- low costs

### Trapezoidal lead screw:

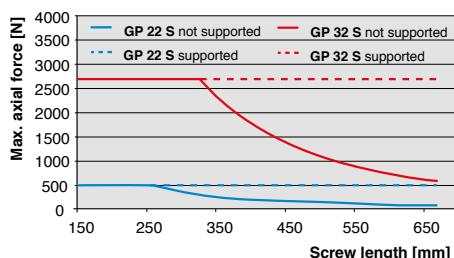
- same as metric lead screw
- higher load capacity than metric lead screw

### Feed force

For the calculation of the feed force acceleration and friction forces as well as gravity have to be taken into consideration. Exceeding the maximum permissible load must be avoided, as this damages the screw. The maximum permissible feed force is displayed for standard screws. For longer screws, the permissible feed force can be limited by the critical compressive force of the screw. In this case, supporting the end of the screw may be necessary.

### Torque

#### Limitation for ball screws



The required torque of the screw  $M_a$  [mNm] is calculated with the feed force  $F_L$  [N] (load), the thread lead  $p$  [mm] and the efficiency of the screw  $\eta_1$ .

$$M_a = \frac{F_L \cdot p}{2 \cdot \pi \cdot \eta_1}$$

In combination with the gearhead, the required motor torque  $M_{mot}$  [mNm] is:

$$M_{mot} = \frac{F_a \cdot p}{2 \cdot \pi \cdot i \cdot \eta}$$

Where  $i$  is the gearhead reduction ratio and  $\eta$  the efficiency of the complete spindle drive.

## Technical Data

The “Technical Data” block contains generally applicable data on screw, nut and gearhead. These are independent of the gearhead reduction ratio.

### Length

The data sheets show the spindle drives with the standard lengths. Other lengths are available as an option in 5 mm steps up to a given maximum length. Please give detailed requirements for special lengths.

### Max. efficiency/mass inertia

The values stated refer to the screw alone (without gearhead). The values with gearhead are given in the “Gearhead data” main data field.

### Nut

Standard spindle drives are supplied with a thread nut. Flange or cylinder nuts are also available as an option. See details with corresponding reference number on page 369.

### Bearing

The output stage and the screw are supported by preloaded axial bearings. This means that the high axial forces can be absorbed directly by the gearhead without additional support.

## Explanation

### 7 Max. efficiency

The given efficiency is a maximum value that applies when loaded with maximum feed force. Efficiency falls sharply with very small loads. The stated value refers to the complete spindle drive (gearhead and screw).

### 20 Max. feed velocity

Specifies the maximum permissible feed velocity.

### 21 Max. feed force (continuous)

Is the maximum permissible feed force which may be continuously applied. Exceeding this value results in a reduced service life.

### 22 Max. feed force (intermittent)

Is the maximum permissible feed force which may be intermittently applied. “Intermittently” is defined as follows:

- during max. 1 second
  - during max. 10% of operation
- Exceeding these values results in a reduced service life.

### 23 Mechanical positioning accuracy

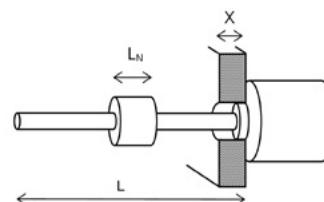
In this value, following factors are taken into consideration:

- backlash of the gearhead
- accuracy of the screw
- axial play of the nut

### Maximum stroke

The maximum possible stroke depends on the length of the screw  $L$  [mm]. The length of the nut  $L_N$  [mm] and the thickness of its mounting plate  $X$  [mm] must be taken into consideration.

$$\text{Stroke} = L - (L_N + X + \text{stroke reserve} + \text{opt. SPIN02})$$



### Mounting and safety instructions

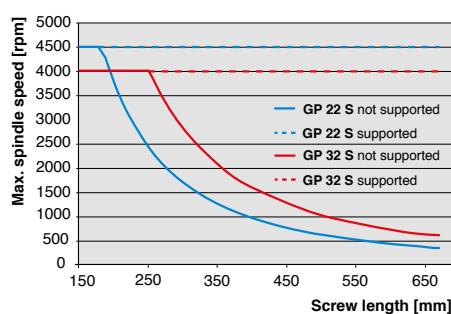
Using a ball screw with a flange nut, the mounting through a hole is only possible with the optional rectangular mounting flange.

The ball screw nut may never be removed. As the balls are preloaded remounting would be impossible.

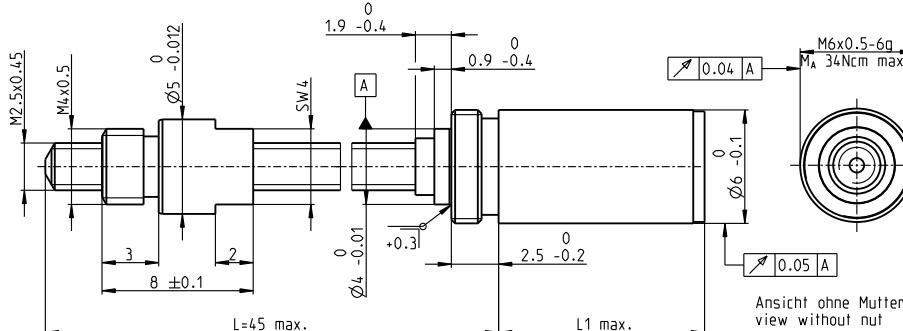
The screw may never block during operation, as this could damage the screw nut or gearhead. Service life crucially depends on the precision with which the gear is fixed to the screw nut. Eccentricities and angle errors sometimes result in massive radial loading which must never exceed the given maximum value.

Additional information can be found in the maxon online shop at the item under download.

#### Max. spindle speed at ball screws



# Spindle Drive GP 6 S Ø6 mm, Metric Lead Screw



## Technical Data

Screw	M2.5 x 0.45, stainless steel
Standard length	45 mm
Special length (5 mm steps)	max. 80 mm
Nut (standard)	thread nut
Material	bronze
Axial play	< 0.088 mm
Planetary gearhead	straight teeth
Bearing	ball bearing
Radial play, 5 mm from flange	< 0.12 mm
Axial play	preloaded
Max. continuous input speed	12 000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	10 N
Number of stages	1 2 3 4 5
Max. radial load, 5 mm from flange	5 N 5 N 5 N 5 N 5 N

- █ Stock program
- █ Standard program
- Special program (on request)

## Part Numbers

	428758	428757	428756	420663	428755				
1 Reduction	3.9 : 1	15 : 1	57 : 1	221 : 1	854 : 1				
2 Absolute reduction	27/7	729/49	19683/343	531441/2401	1438907/16807				
20 Max. feed velocity <sup>1</sup>	mm/s	15	10	2.6	0.7	0.2			
21 Max. feed force (continuous) <sup>1</sup>	N	2	3	4	6	10			
22 Max. feed force (intermittent) <sup>1</sup>	N	6	8	12	15	15			
4 Number of stages		1	2	3	4	5			
7 Max. efficiency gearhead incl. screw	%	28	24	21	19	16			
8 Weight <sup>1</sup>	g	2.9	3.3	3.7	4.1	4.5			
9 Average backlash no load	°	1.8	2.0	2.2	2.5	2.8			
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.106	0.107	0.107	0.107	0.108			
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm²	0.001	0.001	0.001	0.001	0.001			
11 Gearhead length L1	mm	6.9	9.4	12.0	14.5	17.1			

<sup>1</sup> based on screw length 45 mm

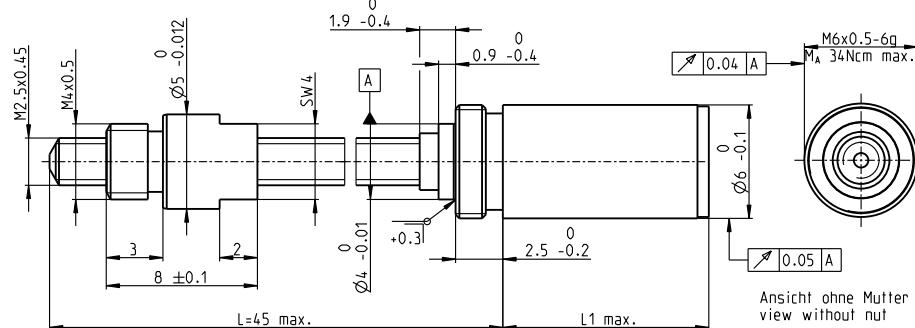


## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm] = Motor length + gearhead length + (sensor / brake) + assembly parts				
RE 6, 0.3 W, A	98			22.6	25.1	27.7	30.2	32.8
RE 6, 0.3 W, B	98			26.6	29.1	31.7	34.2	36.8
EC 6, 1.5 W	206			28.3	30.8	33.4	35.9	38.5
EC 6, 1.5 W	206	Enc 6-8 MAG	391	30.4	32.9	35.5	38.0	40.6
EC 6, 1.5 W	206	Enc 6-8 OPT	406	30.4	32.9	35.5	38.0	40.6
EC 6, 2 W	207			28.3	30.8	33.4	35.9	38.5
EC 6, 2 W	207	Enc 6-8 MAG	391	30.4	32.9	35.5	38.0	40.6
EC 6, 2 W	207	Enc 6-8 OPT	406	30.4	32.9	35.5	38.0	40.6

# Spindle Drive GP 6 S Ø6 mm, Metric Lead Screw

Ceramic Version



M 5:2

## Technical Data

Screw	M2.5 x 0.45, ceramic
Standard length	45 mm
Special length (5 mm steps)	max. 80 mm
Nut (standard)	thread nut
Material	stainless steel
Axial play	< 0.079 mm
Planetary gearbox	straight teeth
Bearing	ball bearing
Radial play, 5 mm from flange	< 0.12 mm
Axial play	preloaded
Max. continuous input speed	12000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	10 N
Number of stages	1    2    3    4    5
Max. radial load, 5 mm from flange	5 N    5 N    5 N    5 N    5 N

- █ Stock program
- Standard program
- Special program (on request)

## Part Numbers

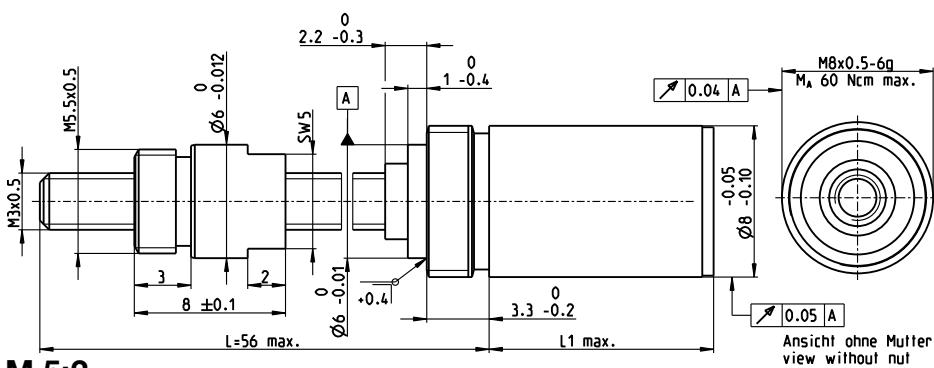
	437380	437379	437378	437377	437375
1 Reduction	3.9 : 1	15 : 1	57 : 1	221 : 1	854 : 1
2 Absolute reduction	27/7	729/49	19683/343	531441/2401	1438907/16807
20 Max. feed velocity <sup>1</sup>	mm/s	25	10	2.6	0.7
21 Max. feed force (continuous) <sup>1</sup>	N	2	3	5	7
22 Max. feed force (intermittent) <sup>1</sup>	N	6	10	15	15
4 Number of stages		1	2	3	4
7 Max. efficiency gearhead incl. screw	%	39	34	30	27
8 Weight <sup>1</sup>	g	2.9	3.3	3.7	4.1
9 Average backlash no load	°	1.8	2.0	2.2	2.5
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.081	0.082	0.082	0.082
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	0.001	0.001	0.001	0.001
11 Gearhead length L1	mm	6.9	9.4	12.0	14.5
1 based on screw length 45 mm					



## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm] = Motor length + gearhead length + (sensor / brake) + assembly parts				
RE 6, 0.3 W, A	98			22.6	25.1	27.7	30.2	32.8
RE 6, 0.3 W, B	98			26.6	29.1	31.7	34.2	36.8
EC 6, 1.5 W	206			28.3	30.8	33.4	35.9	38.5
EC 6, 1.5 W	206	Enc 6-8 MAG	391	30.4	32.9	35.5	38.0	40.6
EC 6, 1.5 W	206	Enc 6-8 OPT	406	30.4	32.9	35.5	38.0	40.6
EC 6, 2 W	207			28.3	30.8	33.4	35.9	38.5
EC 6, 2 W	207	Enc 6-8 MAG	391	30.4	32.9	35.5	38.0	40.6
EC 6, 2 W	207	Enc 6-8 OPT	406	30.4	32.9	35.5	38.0	40.6

## **Spindle Drive GP 8 S Ø8 mm, Metric Lead Screw**



## M 5:2

- Stock program
- Standard program
- Special program (on request)

## **Part Numbers**

Spindle Drive Data		473043	473044	473045	473046	473047		
1 Reduction		4:1	16:1	64:1	256:1	1024:1		
2 Absolute reduction		4/1	16/1	64/1	256/1	1024/1		
20 Max. feed velocity <sup>1</sup>	mm/s	15	6.3	1.6	0.4	0.1		
21 Max. feed force (continuous) <sup>1</sup>	N	3	6	9	14	22		
22 Max. feed force (intermittent) <sup>1</sup>	N	8	18	27	27	27		
4 Number of stages		1	2	3	4	5		
7 Max. efficiency gearhead incl. screw	%	27	24	22	19	17		
8 Weight <sup>1</sup>	g	6.3	6.9	7.5	8.1	8.7		
9 Average backlash no load	°	1.8	2.0	2.2	2.5	2.8		
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.112	0.112	0.112	0.112	0.113		
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	0.005	0.004	0.004	0.004	0.004		
11 Gearhead length L1	mm	7.0	9.6	12.2	14.8	17.4		

<sup>1</sup> based on screw length 56 mm

**Technical Data**

Screw	M3 x 0.5, stainless steel
Standard length	56 mm
Special length (5 mm steps)	max. 100 mm
Nut (standard)	thread nut
Material	bronze
Axial play	< 0.1 mm
Planetary gearhead	straight teeth
Bearing	ball bearing
Radial play, 5 mm from flange	< 0.08 mm
Axial play	preloaded
Max. continuous input speed	12 000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	25 N
Number of stages	1      2      3      4      5
Max. radial load, 5 mm from flange	5 N      5 N      5 N      5 N      5 N

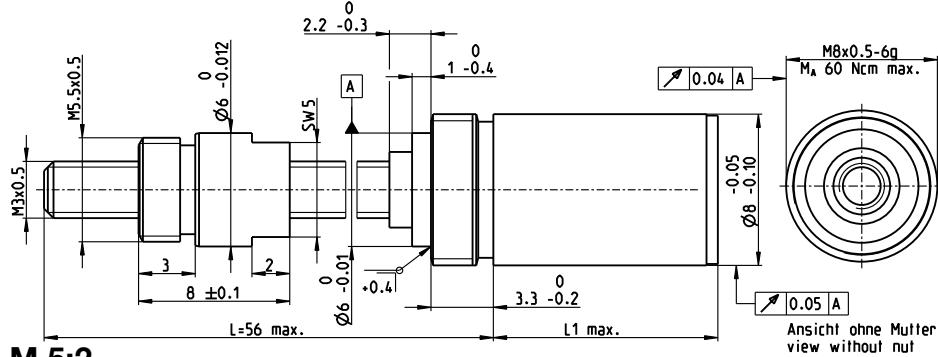


**maxon Modular System**

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm] = Motor length + gearbox length + (sensor / brake) + assembly parts				
RE 8, 0.5 W, A	99			23.7	26.3	28.9	31.5	34.1
RE 8, 0.5 W, B	99			26.7	29.3	31.9	34.5	37.1
RE 8, 0.5 W, A	99	MR	397/398	30.3	32.9	35.5	38.1	40.7
RE 8, 0.5 W, A	99	8 OPT	407	31.9	34.5	37.1	39.7	42.3
EC 8, 2 W	208			30.1	32.7	35.3	37.9	40.5

# Spindle Drive GP 8 S Ø8 mm, Metric Lead Screw

Ceramic Version



M 5:2

## Technical Data

Screw	M3 x 0.5, ceramic
Standard length	56 mm
Special length (5 mm steps)	max. 100 mm
Nut (standard)	thread nut stainless steel
Material	< 0.09 mm
Axial play	straight teeth
Planetary gearbox	ball bearing
Bearing	< 0.08 mm
Radial play, 5 mm from flange	preloaded
Axial play	12 000 rpm
Max. continuous input speed	-15...+80°C
Recommended temperature range	25 N
Max. axial load (static) <sup>1</sup>	1 2 3 4 5
Number of stages	5 N 5 N 5 N 5 N 5 N
Max. radial load, 5 mm from flange	5 N 5 N 5 N 5 N 5 N

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

	473636	473637	473639	473640	473641
1 Reduction	4:1	16:1	64:1	256:1	1024:1
2 Absolute reduction	1/4	16/4	64/4	256/4	1024/4
20 Max. feed velocity <sup>1</sup>	mm/s	25	6.3	1.6	0.4
21 Max. feed force (continuous) <sup>1</sup>	N	3	7	11	17
22 Max. feed force (intermittent) <sup>1</sup>	N	14	22	32	32
4 Number of stages	1	2	3	4	5
7 Max. efficiency gearhead incl. screw	%	38	34	31	28
8 Weight <sup>1</sup>	g	6.3	6.9	7.5	8.1
9 Average backlash no load	°	1.8	2.0	2.2	2.5
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.087	0.087	0.087	0.088
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	0.005	0.004	0.004	0.004
11 Gearhead length L1	mm	7.0	9.6	12.2	14.8

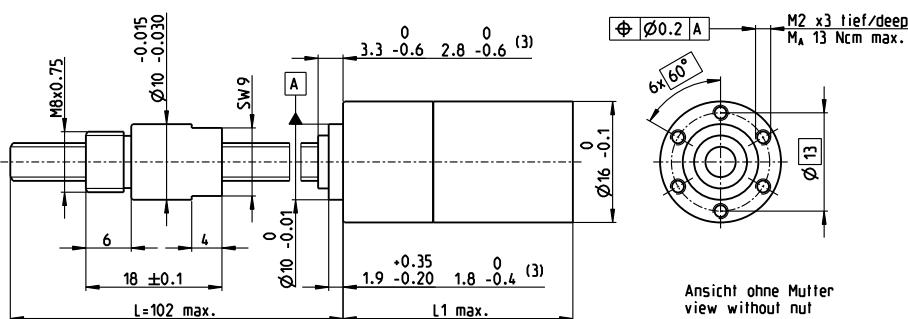
<sup>1</sup> based on screw length 56 mm



## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm]	= Motor length + gearhead length + (sensor / brake) + assembly parts		
RE 8, 0.5 W, A	99			23.7	26.3	28.9	31.5
RE 8, 0.5 W, B	99			26.7	29.3	31.9	34.5
RE 8, 0.5 W, A	99	MR	397/398	30.3	32.9	35.5	38.1
RE 8, 0.5 W, A	99	8 OPT	407	31.9	34.5	37.1	39.7
EC 8, 2 W	208			30.1	32.7	35.3	37.9

# Spindle Drive GP 16 S Ø16 mm, Ball Screw



M 1:1

## Technical Data

Screw	Ø5 x 2, stainless steel
Standard length	102 mm
Special length (5 mm steps)	max. 200 mm
Nut (standard)	thread nut
Material	X46Cr13, hardened
Axial play	< 0.01 mm
Planetary gearbox	straight teeth
Bearing	ball bearing/axial bearing
Radial play, 6 mm from flange	< 0.08 mm
Axial play	preloaded
Max. continuous input speed <sup>2</sup>	12000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	500 N
Number of stages	0 1 2 3 4
Max. radial load, 6 mm from flange	20 N 40 N 60 N 80 N 80 N

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

	424221	424222	424223	424219	424224				
<b>Spindle Drive Data (provisional)</b>									
1 Reduction	1:1	4.4:1	19:1	84:1	370:1				
2 Absolute reduction	1/1	57/13	3249/169	185193/2197	10556001/28561				
20 Max. feed velocity <sup>1</sup>	mm/s	150	90.9	21.1	4.8	1.1			
21 Max. feed force (continuous) <sup>1</sup>	N	54	64	104	171	280			
22 Max. feed force (intermittent) <sup>1</sup>	N	149	176	287	403	403			
<b>Part Numbers</b>	424731	424733	424745	424749					
1 Reduction	5.4:1	24:1	104:1	455:1					
2 Absolute reduction	27/6	1539/65	87723/645	5000211/10985					
20 Max. feed velocity <sup>1</sup>	mm/s	74.1	16.7	3.8	0.9				
21 Max. feed force (continuous) <sup>1</sup>	N	69	113	184	300				
22 Max. feed force (intermittent) <sup>1</sup>	N	189	311	403	403				
<b>Part Numbers</b>	424744	424747	424750						
1 Reduction	29:1	128:1	561:1						
2 Absolute reduction	729/25	41559/325	2368521/4225						
20 Max. feed velocity <sup>1</sup>	mm/s	13.8	3.1	0.7					
21 Max. feed force (continuous) <sup>1</sup>	N	120	197	322					
22 Max. feed force (intermittent) <sup>1</sup>	N	331	403	403					
<b>Part Numbers</b>	424748	424751							
1 Reduction	157:1	690:1							
2 Absolute reduction	19683/125	1121931/1625							
20 Max. feed velocity <sup>1</sup>	mm/s	2.5	0.6						
21 Max. feed force (continuous) <sup>1</sup>	N	211	345						
22 Max. feed force (intermittent) <sup>1</sup>	N	403	403						
<b>Part Numbers</b>	424752								
1 Reduction	850:1								
2 Absolute reduction	531441/625								
20 Max. feed velocity <sup>1</sup>	mm/s	0.5							
21 Max. feed force (continuous) <sup>1</sup>	N	370							
22 Max. feed force (intermittent) <sup>1</sup>	N	403							
4 Number of stages	0	1	2	3	4				
7 Max. efficiency gearhead incl. screw	%	93	87	79	71	63			
8 Weight <sup>1</sup>	g	52	58	61	65	69			
9 Average backlash no load	°	1.0	1.4	1.6	2.0	2.4			
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.039	0.041	0.042	0.044	0.046			
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	0.23	0.11	0.05	0.05	0.05			
11 Gearhead length L1	mm	19.2	22.3	27.4	31.0	34.6			

<sup>1</sup> based on screw length 102 mm (standard length)<sup>2</sup> for reduction 1:1 = 4500 rpm

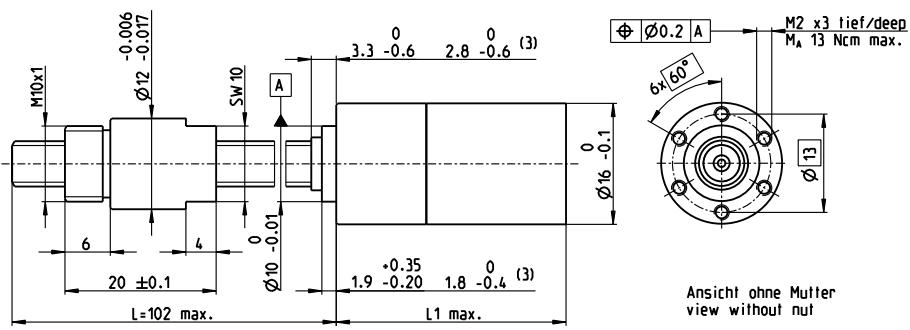
## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm] = Motor length + gearhead length + (sensor / brake) + assembly parts
RE 16, 2 W	120			41.6 44.7 49.8 53.4 57.0
RE 16, 2 W	120	MR	400/402	47.3 50.4 55.5 59.1 62.7
RE 16, 3.2 W	121/122			59.7 62.8 67.9 71.5 75.1
RE 16, 3.2 W	122	MR	400/402	64.7 67.8 72.9 76.5 80.1
RE 16, 3.2 W	122	MEnc 13	393	65.8 68.9 74.0 77.6 81.2
RE 16, 4.5 W	123/124			62.7 65.8 70.9 74.5 78.1
RE 16, 4.5 W	124	MR	400/402	67.7 70.8 75.9 79.5 83.1
RE 16, 4.5 W	124	MEnc 13	393	68.9 72.0 77.1 80.7 84.3

Continuation of the modular system (irrespective of the screw) on page 362 and 363.

**Spindle Drive GP 16 S Ø16 mm, Metric Lead Screw**

maxon spindle drive



Technical Data	
Screw	M6 x 1, stainless steel
Standard length	102 mm
Special length (5 mm steps)	max. 200 mm
Nut (standard)	thread nut
Material	bronze
Axial play	< 0.134 mm
Planetary gearhead	straight teeth
Bearing	ball bearing/axial bearing
Radial play, 6 mm from flange	< 0.08 mm
Axial play	preloaded
Max. continuous input speed <sup>2</sup>	12 000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	500 N
Number of stages	0    1    2    3    4
Max. radial load, 6 mm from flange	20 N    40 N    60 N    80 N    80 N

St

-  Stock program
-  Standard program
-  Special program (on request)

**Spindle Drive Data** (provisional)

Spindle Drive Data (provisional)		1:1	4.4:1	19:1	84:1	370:1			
1 Reduction		1/1	57/13	3249/169	185193/2197	10556001/28561			
2 Absolute reduction									
20 Max feed velocity <sup>1</sup>	mm/s	50.0	45.5	10.5	2.4	0.5			
21 Max. feed force (continuous) <sup>1</sup>	N	35	37	60	98	160			
22 Max. feed force (intermittent) <sup>1</sup>	N	134	138	224	315	315			

## **Part Numbers**

1	Reduction		5.4:1	24:1	104:1	455:1		
2	Absolute reduction		27%	1539/65	87723/845	5000211/10985		
20	Max. feed velocity <sup>1</sup>	mm/s	37.0	8.3	1.9	0.4		
21	Max. feed force (continuous) <sup>1</sup>	N	39	64	105	172		
22	Max. feed force (intermittent) <sup>1</sup>	N	148	243	315	315		

**Part Numbers**

1 Reduction		29:1	128:1	561:1	
2 Absolute reduction		729 <sub>25</sub>	41559 <sub>325</sub>	2368521 <sub>4225</sub>	
20 Max. feed velocity <sup>1</sup>	mm/s	6.9	1.6	0.4	
21 Max. feed force (continuous) <sup>1</sup>	N	69	112	184	
22 Max. feed force (intermittent) <sup>1</sup>	N	258	315	315	

## Part Numbers

1 Reduction		157:1	690:1
2 Absolute reduction		19683/ <sub>125</sub>	112193/ <sub>1625</sub>
20 Max. feed velocity <sup>1</sup>	mm/s	1.3	0.3
21 Max. feed force (continuous) <sup>1</sup>	N	120	197
22 Max. feed force (intermittent) <sup>1</sup>	N	315	315

## Part Numbers

1 Reduction				850:1		
2 Absolute reduction				531441/625		
20 Max. feed velocity <sup>1</sup>	mm/s				0.2	
21 Max. feed force (continuous) <sup>1</sup>	N				211	
22 Max. feed force (intermittent) <sup>1</sup>	N				315	
4 Number of stages		0	1	2	3	4
7 Max. efficiency gearhead incl. screw	%	28	27	24	22	19
8 Weight <sup>1</sup>	g	55	61	64	68	72
9 Average backlash no load	°	1.0	1.4	1.6	2.0	2.4
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.166	0.167	0.167	0.169	0.170
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	0.23	0.11	0.05	0.05	0.05
11 Gearhead length l 1	mm	19.2	22.3	27.4	31.0	34.6

<sup>1</sup> based on screw length 102 mm (standard length)      <sup>2</sup> for reduction 1:1 = 3000 rpm



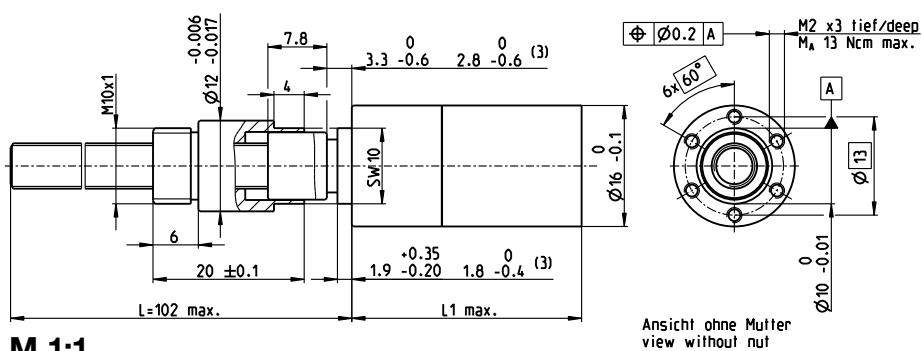
**maxon Modular System**

<b>+ Motor</b>	Page	<b>+ Sensor/Brake</b>	Page	<b>Overall length [mm]</b> = Motor length + gearbox length + (sensor/brake) + assembly parts				
A-max 16	139-142			—	47.8	52.9	56.5	60.1
A-max 16	140/142	MR	400/402	—	52.8	57.9	61.5	65.1
A-max 16	140/142	MFeC 13	393	—	55.9	61.0	61.6	68.2

Continuation of the modular system (irrespective of the screw) on pages 361 and 363

# Spindle Drive GP 16 S Ø16 mm, Metric Lead Screw

Ceramic Version



M 1:1

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

	424241	424242	424243	424244	424245				
1 Reduction	1:1	4.4:1	19:1	84:1	370:1				
2 Absolute reduction	1/1	57/13	3249/169	185193/2197	10556001/28561				
20 Max. feed velocity <sup>1</sup>	mm/s	50.0	45.5	10.5	2.4	0.5			
21 Max. feed force (continuous) <sup>1</sup>	N	44	46	74	122	200			
22 Max. feed force (intermittent) <sup>1</sup>	N	134	138	224	315	315			
Part Numbers	424811	424812	424814	424819					
1 Reduction	5.4:1	24:1	104:1	455:1					
2 Absolute reduction	27/6	1539/65	87723/645	5000211/0985					
20 Max. feed velocity <sup>1</sup>	mm/s	37.0	8.3	1.9	0.4				
21 Max. feed force (continuous) <sup>1</sup>	N	49	80	131	215				
22 Max. feed force (intermittent) <sup>1</sup>	N	148	243	315	315				
Part Numbers	424813	424815	424820						
1 Reduction	29:1	128:1	561:1						
2 Absolute reduction	729/25	41559/325	2368521/4225						
20 Max. feed velocity <sup>1</sup>	mm/s	6.9	1.6	0.4					
21 Max. feed force (continuous) <sup>1</sup>	N	86	141	230					
22 Max. feed force (intermittent) <sup>1</sup>	N	258	315	315					
Part Numbers	424818	424821							
1 Reduction	157:1	690:1							
2 Absolute reduction	19683/125	1121931/1625							
20 Max. feed velocity <sup>1</sup>	mm/s	1.3	0.3						
21 Max. feed force (continuous) <sup>1</sup>	N	150	246						
22 Max. feed force (intermittent) <sup>1</sup>	N	315	315						
Part Numbers	424822								
1 Reduction	850:1								
2 Absolute reduction	53144/625								
20 Max. feed velocity <sup>1</sup>	mm/s	0.2							
21 Max. feed force (continuous) <sup>1</sup>	N	264							
22 Max. feed force (intermittent) <sup>1</sup>	N	315							
4 Number of stages	0	1	2	3	4				
7 Max. efficiency gearhead incl. screw	%	41	38	34	31	28			
8 Weight <sup>1</sup>	g	55	61	64	68	72			
9 Average backlash no load	°	1.0	1.4	1.6	2.0	2.4			
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.166	0.167	0.167	0.169	0.170			
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	0.23	0.11	0.05	0.05	0.05			
11 Gearhead length L1	mm	19.2	22.3	27.4	31.0	34.6			

<sup>1</sup> based on screw length 102 mm (standard length)

<sup>2</sup> for reduction 1:1 = 3000 rpm

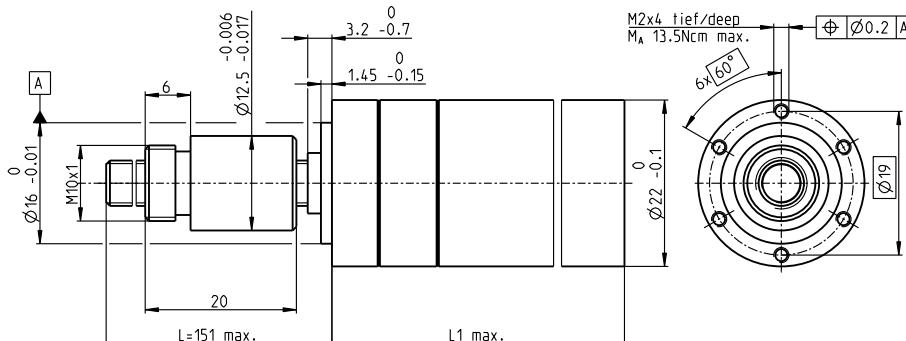


## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm] = Motor length + gearhead length + (sensor/brake) + assembly parts				
EC 16, 30 W	212			59.3	62.4	67.5	71.1	74.7
EC 16, 30 W	212	MR	403	70.0	73.1	78.2	81.8	85.4
EC 16, 60 W	213			75.3	78.4	83.5	87.1	90.7
EC 16, 60 W	213	MR	403	86.0	89.1	94.2	97.8	101.4
EC-max 16, 5 W	225			–	46.4	51.5	55.1	58.7
EC-max 16, 5 W	225	MR	403	–	53.7	58.8	62.4	66.0
EC-max 16, 8 W	227			–	58.4	63.5	67.1	70.7
EC-max 16, 8 W	227	MR	403	–	65.7	70.8	74.4	78.0

Continuation of the modular system (irrespective of the screw) on pages 361 and 362.

# Spindle Drive GP 22 S Ø22 mm, Ball Screw



M 1:1

## Technical Data

Screw	Ø6 x 2, stainless steel
Standard length	151 mm
Special length (5 mm steps)	max. 300 mm
	thread nut
Nut (standard)	100CR6, hardened
Material	< 0.01 mm
Axial play	straight teeth
Planetary gearbox	Bearing ball bearing/thrust roller bearing
	Radial play, 5 mm from flange
Axial play	< 0.05 mm
Max. continuous input speed <sup>2</sup>	preloaded
Recommended temperature range	8000 rpm
Max. axial load (static) <sup>1</sup>	-15...+80°C
Number of stages	500 N
Max. radial load,	1 2 3 4
15 mm from flange	80 N 130 N 180 N 180 N

  Stock program  
  Standard program  
  Special program (on request)

## Part Numbers

	363863	363864	363867	363871	363872	363877	363882	363887	363892
<b>Spindle Drive Data</b>									
1 Reduction	1:1	3.8:1	14:1	29:1	53:1	89:1	198:1	333:1	479:1
2 Absolute reduction	1/1	15/4	225/16	729/25	3375/64	4617/52	50625/256	69255/208	124659/260
20 Max. feed velocity <sup>1</sup>	mm/s	150	70	19	9.2	5.0	3.0	1.3	0.8
21 Max. feed force (continuous) <sup>1</sup>	N	77	100	154	196	240	285	372	443
22 Max. feed force (intermittent) <sup>1</sup>	N	183	236	365	465	500	500	500	500
<b>Part Numbers</b>									
1 Reduction	363865	364041	363873	363878	363883	363888	363893		
2 Absolute reduction	57/3	885/52	12825/208	87723/645	192375/632	10556001/28561	2368521/4225		
20 Max. feed velocity <sup>1</sup>	mm/s	61	17	4.3	2.6	1.2	0.7	0.5	
21 Max. feed force (continuous) <sup>1</sup>	N	105	161	253	300	392	458	500	
22 Max. feed force (intermittent) <sup>1</sup>	N	248	381	500	500	500	500	500	
<b>Part Numbers</b>									
1 Reduction	363866	363868	363874	363879	363884	363889	363894		
2 Absolute reduction	5.4:1	19:1	72:1	109:1	270:1	389:1	561:1		
20 Max. feed velocity <sup>1</sup>	mm/s	49	14	3.7	2.4	1.0	0.7	0.5	
21 Max. feed force (continuous) <sup>1</sup>	N	112	170	266	305	413	466	500	
22 Max. feed force (intermittent) <sup>1</sup>	N	266	404	500	500	500	500	500	
<b>Part Numbers</b>									
1 Reduction	363869		363875	363880	363885	363890	363895		
2 Absolute reduction	20:1		76:1	128:1	285:1	410:1	690:1		
20 Max. feed velocity <sup>1</sup>	mm/s	81/4	1215/16	41553/325	18225/64	6561/16	1121931/1625		
21 Max. feed force (continuous) <sup>1</sup>	N	13	3.5	2.1	0.9	0.7	0.4		
22 Max. feed force (intermittent) <sup>1</sup>	N	173	270	322	420	474	500		
<b>Part Numbers</b>									
1 Reduction	363870		363876	363881	363886	363891	363896		
2 Absolute reduction	24:1		84:1	157:1	316:1	455:1	850:1		
20 Max. feed velocity <sup>1</sup>	mm/s	1539/65	185193/2197	19683/125	2777895/6788	5000211/0985	531441/625		
21 Max. feed force (continuous) <sup>1</sup>	N	11	3.2	1.7	0.8	0.6	0.3		
22 Max. feed force (intermittent) <sup>1</sup>	N	184	280	345	435	491	500		
4 Number of stages	0	1	2	3	3	4	4	4	4
7 Max. efficiency gearbox incl. screw	%	96	81	67	67	57	47	47	47
8 Weight <sup>1</sup>	g	103	103	115	115	128	141	141	141
9 Average backlash no load	°	1.0	1.0	1.2	1.2	1.6	2.0	2.0	2.0
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.039	0.039	0.040	0.040	0.042	0.044	0.044	0.044
10 Mass inertia gearbox incl. screw <sup>1</sup>	gcm <sup>2</sup>	10	1.0	0.4	0.4	0.3	0.3	0.3	0.3
11 Gearhead length L1	mm	38.0	38.0	44.8	44.8	51.6	58.4	58.4	58.4

<sup>1</sup> based on screw length 151 mm (standard length)

<sup>2</sup> for reduction 1:1 = 4500 rpm

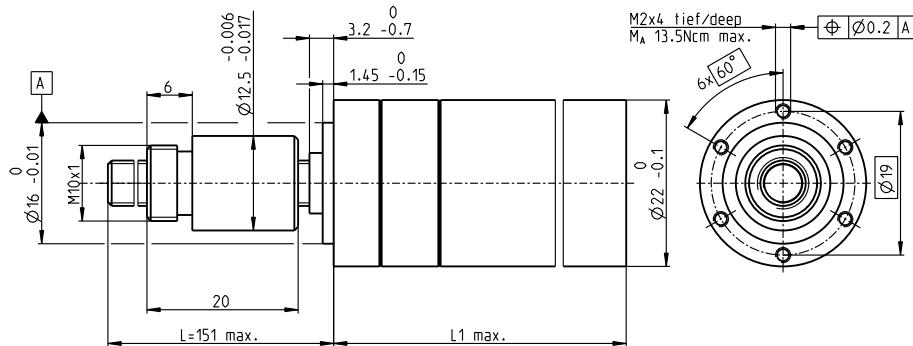


## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm]	= Motor length + gearhead length + (sensor / brake) + assembly parts						
A-max 19	143/144			—	64.2	71.0	71.0	77.8	77.8	84.6	84.6
A-max 19, 1.5 W	144	MR	400/402	—	69.3	76.1	76.1	82.9	82.9	89.7	89.7
A-max 19, 1.5 W	144	Enc 22	411	—	78.6	85.4	85.4	92.2	92.2	99.0	99.0
A-max 19, 1.5 W	144	MEnc 13	393	—	71.7	78.5	78.5	85.3	85.3	92.1	92.1
A-max 19, 2.5 W	145/146			—	66.8	73.6	73.6	80.4	80.4	87.2	87.2
A-max 19, 2.5 W	146	MR	400/402	—	71.1	77.9	77.9	84.7	84.7	91.5	91.5
A-max 19, 2.5 W	146	Enc 22	411	—	81.2	88.0	88.0	94.8	94.8	101.6	101.6
A-max 19, 2.5 W	146	MEnc 13	393	—	74.3	81.1	81.1	87.9	87.9	94.7	94.7
A-max 22	147-150			—	67.2	74.0	74.0	80.8	80.8	87.6	87.6
A-max 22	148/150	MR	400/402	—	72.2	79.0	79.0	85.8	85.8	92.6	92.6
A-max 22	148/150	Enc 22	411	—	81.6	88.4	88.4	95.2	95.2	102.0	102.0
A-max 22	148/150	MEnc 13	393	—	74.3	81.1	81.1	87.9	87.9	94.7	94.7
RE-max 21	169/170			—	64.2	71.0	71.0	77.8	77.8	84.6	84.6
RE-max 21, 3.5 W	170	MR	401/403	—	69.3	76.1	76.1	82.9	82.9	89.7	89.7
RE-max 21	171/172			—	66.8	73.6	73.6	80.4	80.4	87.2	87.2
RE-max 21, 6 W	172	MR	401/403	—	71.1	77.9	77.9	84.7	84.7	91.5	91.5

Continuation of the modular system (irrespective of the screw) on page 365.

# Spindle Drive GP 22 S Ø22 mm, Metric Lead Screw



M 1:1

## Technical Data

Screw	M6 x 1, stainless steel
Standard length	151 mm
Special length (5 mm steps)	max. 300 mm
Nut (standard)	thread nut
Material	bronze
Axial play	< 0.008 mm
Planetary gearbox	straight teeth
Bearing	ball bearing/thrust roller bearing
Radial play, 5 mm from flange	< 0.05 mm
Axial play	preloaded
Max. continuous input speed <sup>2</sup>	8000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	550 N
Number of stages	1 2 3 4
Max. radial load, 15 mm from flange	80 N 130 N 180 N 180 N

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

	363826	363827	363830	363834	363835	363840	363845	363850	363855
<b>Spindle Drive Data</b>									
1 Reduction	1:1	3.8:1	14:1	29:1	53:1	89:1	198:1	333:1	479:1
2 Absolute reduction	1/1	15/4	225/16	729/25	3375/64	4617/52	50625/256	69255/208	124659/260
20 Max. feed velocity <sup>1</sup>	mm/s	101	35	9.5	4.6	2.5	1.5	0.7	0.4
21 Max. feed force (continuous) <sup>1</sup>	N	42	60	92	118	144	171	223	266
22 Max. feed force (intermittent) <sup>1</sup>	N	118	167	259	330	350	350	350	350
<b>Part Numbers</b>									
1 Reduction	363828	364040	363836	363841	363846	363851	363856		
2 Absolute reduction			4.4:1	16:1	62:1	104:1	231:1	370:1	561:1
20 Max. feed velocity <sup>1</sup>	mm/s	57/43	885/52	12825/208	87725/645	192375/632	10556001/28561	2368521/4225	
21 Max. feed force (continuous) <sup>1</sup>	N	30	8.3	2.2	1.3	0.6	0.4	0.2	
22 Max. feed force (intermittent) <sup>1</sup>	N	63	97	152	180	235	275	316	
<b>Part Numbers</b>									
1 Reduction	363829	363831	363837	363842	363847	363852	363857		
2 Absolute reduction			5.4:1	19:1	72:1	109:1	270:1	389:1	590:1
20 Max. feed velocity <sup>1</sup>	mm/s	27/6	3249/169	48735/676	2187/20	731025/2704	263169/676	59049/100	
21 Max. feed force (continuous) <sup>1</sup>	N	25	7.0	1.9	1.2	0.5	0.3	0.2	
22 Max. feed force (intermittent) <sup>1</sup>	N	67	102	159	183	248	280	321	
<b>Part Numbers</b>									
1 Reduction	363832		363838	363843	363848	363853	363858		
2 Absolute reduction			20:1	76:1	128:1	285:1	410:1	690:1	
20 Max. feed velocity <sup>1</sup>	mm/s		81/4	1215/16	41553/325	18225/64	6561/16	1121931/1625	
21 Max. feed force (continuous) <sup>1</sup>	N	6.7	6.7	1.8	1.0	0.5	0.3	0.2	
22 Max. feed force (intermittent) <sup>1</sup>	N	67	104	162	193	252	285	339	
<b>Part Numbers</b>									
1 Reduction	363833		363839	363844	363849	363854	363859		
2 Absolute reduction			24:1	84:1	157:1	316:1	455:1	850:1	
20 Max. feed velocity <sup>1</sup>	mm/s		1539/65	185193/2197	19683/125	2777895/6788	5000211/0985	531441/625	
21 Max. feed force (continuous) <sup>1</sup>	N	5.6	5.6	1.6	0.8	0.4	0.3	0.2	
22 Max. feed force (intermittent) <sup>1</sup>	N	111	111	168	207	261	295	350	
4 Number of stages		0	1	2	3	3	4	4	4
7 Max. efficiency gearhead incl. screw	%	42	35	29	29	25	25	20	20
8 Weight <sup>1</sup>	g	103	103	116	116	128	128	141	141
9 Average backlash no load	°	1.0	1.0	1.2	1.2	1.6	1.6	2.0	2.0
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.034	0.034	0.034	0.034	0.034	0.037	0.037	0.037
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	10	1.0	0.4	0.4	0.3	0.3	0.3	0.3
11 Gearhead length L1	mm	38.0	38.0	44.8	44.8	51.6	51.6	58.4	58.4

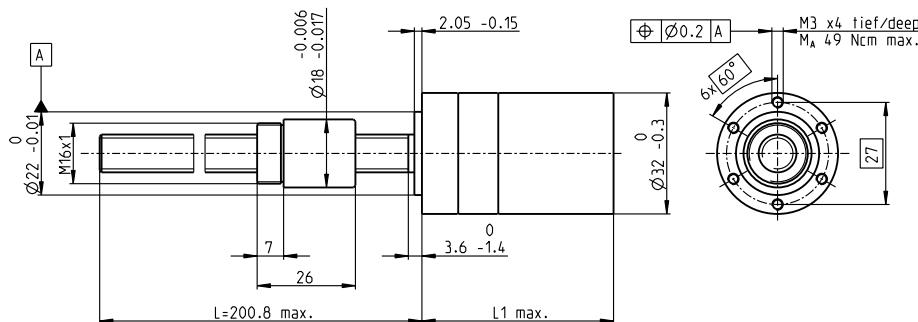
<sup>1</sup> based on screw length 151 mm (standard length)<sup>2</sup> for reduction 1:1 = 6088 rpm

## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm] = Motor length + gearhead length + (sensor/brake) + assembly parts							
EC 16, 60 W	213			94.2	94.2	101.0	101.0	107.8	107.8	114.6	114.6
EC 16, 60 W	213	MR	403	104.9	104.9	111.7	111.7	118.5	118.5	125.3	125.3
EC 22, 40 W	214			82.7	82.7	89.5	89.5	96.3	96.3	103.1	103.1
EC 22, 40 W	214	MR	403	88.7	88.7	95.5	95.5	102.3	102.3	109.1	109.1
EC 22, 100 W	215			100.9	100.9	107.7	107.7	114.5	114.5	121.3	121.3
EC 22, 100 W	215	MR	403	106.9	106.9	113.7	113.7	120.5	120.5	127.3	127.3
EC-max 16, 8 W	227			—	71.4	78.2	78.2	85.0	85.0	91.8	91.8
EC-max 16, 8 W	227	MR	403	—	78.7	85.5	85.5	92.3	92.3	99.1	99.1
EC-max 22, 12 W	228			—	70.1	76.9	76.9	83.7	83.7	90.5	90.5
EC-max 22, 12 W	228	MR	403	—	79.8	86.6	86.6	93.4	93.4	100.2	100.2
EC-max 22, 12 W	228	AB 20	456	—	105.7	112.5	112.5	119.3	119.3	126.1	126.1

Continuation of the modular system (irrespective of the screw) on page 364.

# Spindle Drive GP 32 S Ø32 mm, Ball Screw



M 1:2

## Technical Data

Screw	Ø10 x 2, stainless steel
Standard length	200.8 mm
Special length (5 mm steps)	max. 600 mm
Nut (standard)	thread nut
Material	100CR6, hardened
Axial play	< 0.01 mm
Planetary gearhead	straight teeth
Bearing	ball bearing/thrust roller bearing
Radial play, 5 mm from flange	< 0.05 mm
Axial play	preloaded
Max. continuous input speed <sup>2</sup>	8000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	2700 N
Number of stages	1    2    3    4
Max. radial load, 15 mm from flange	200 N 350 N 400 N 400 N

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

	363970	363971	363974	363979	363980	363985	363990	363995	364000
<b>Spindle Drive Data</b>									
1 Reduction	1:1	3.7:1	14:1	33:1	51:1	111:1	246:1	492:1	762:1
2 Absolute reduction	1/1	26/7	676/49	529/16	17576/343	13824/125	42182/1715	86112/175	19044/25
20 Max. feed velocity <sup>1</sup>	mm/s	133	72	19	8.1	5.2	2.4	1.1	0.5
21 Max. feed force (continuous) <sup>1</sup>	N	386	474	739	983	1137	1473	1921	2420
22 Max. feed force (intermittent) <sup>1</sup>	N	1023	1255	1956	2604	2700	2700	2700	2700
<b>Part Numbers</b>									
1 Reduction	363972	363975		363981	363986	363991	363996	364001	
2 Absolute reduction				16224/245	6877/56	101062/343	331776/625	36501/40	
20 Max. feed velocity <sup>1</sup>	mm/s	56	15		4.0	2.2	0.9	0.5	0.3
21 Max. feed force (continuous) <sup>1</sup>	N	517	803		1239	1524	2041	2482	2700
22 Max. feed force (intermittent) <sup>1</sup>	N	1369	2127		2700	2700	2700	2700	2700
<b>Part Numbers</b>									
1 Reduction	363973	363976		363982	363987	363992	363997	364002	
2 Absolute reduction				3887/49	3312/25	389376/1225	20631/45	279841/256	
20 Max. feed velocity <sup>1</sup>	mm/s	46	13		3.4	2.0	0.8	0.5	0.2
21 Max. feed force (continuous) <sup>1</sup>	N	551	846		1315	1561	2092	2569	2700
22 Max. feed force (intermittent) <sup>1</sup>	N	1458	2239		2700	2700	2700	2700	2700
<b>Part Numbers</b>									
1 Reduction	363977			363983	363988	363993	363998		
2 Absolute reduction				14976/175	1587/10	359424/875	79488/125		
20 Max. feed velocity <sup>1</sup>	mm/s	12			3.1	1.7	0.6	0.4	
21 Max. feed force (continuous) <sup>1</sup>	N	872			1353	1661	2279	2636	
22 Max. feed force (intermittent) <sup>1</sup>	N	2308			2700	2700	2700	2700	
<b>Part Numbers</b>									
1 Reduction	363978			363984	363989	363994	363999		
2 Absolute reduction				3588/35	12167/64	89401/196	15817/224		
20 Max. feed velocity <sup>1</sup>	mm/s	9.5			2.6	1.4	0.6	0.4	
21 Max. feed force (continuous) <sup>1</sup>	N	931			1437	1762	2359	2700	
22 Max. feed force (intermittent) <sup>1</sup>	N	2465			2700	2700	2700	2700	
4 Number of stages	0	1	2	2	3	3	4	4	4
7 Max. efficiency gearhead incl. screw	%	94	75	71	71	66	66	56	56
8 Weight <sup>1</sup>	g	304	304	331	331	359	359	387	387
9 Average backlash no load	°	0.7	0.7	0.8	0.8	1.0	1.0	1.0	1.0
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.037	0.037	0.037	0.037	0.039	0.039	0.039	0.039
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	42.3	4.2	0.9	0.9	0.7	0.7	0.7	0.7
11 Gearhead length L1	mm	51.0	51.0	57.7	57.7	64.4	64.4	71.1	71.1

<sup>1</sup> based on screw length 200.8 mm (standard length)

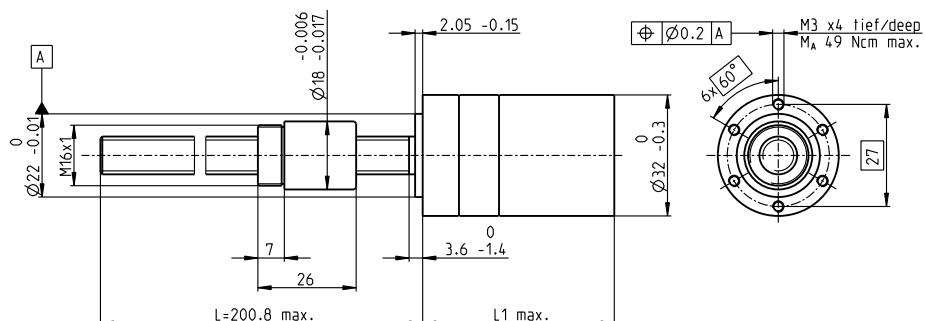
<sup>2</sup> for reduction 1:1 = 4000 rpm

## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm]	= Motor length + gearhead length + (sensor/brake) + assembly parts
RE 25	125/127			105.6	105.6
RE 25	125/127 MR	404		116.6	116.6
RE 25	125/127 Enc 22	411		119.7	119.7
RE 25	125/127 HED_5540	413/415		126.4	126.4
RE 25	125/127 DCT 22	421		127.9	127.9
RE 25, 20 W	126			94.1	94.1
RE 25, 20 W	126	MR	404	105.1	105.1
RE 25, 20 W	126	HED_5540	413/415	114.9	114.9
RE 25, 20 W	126	DCT 22	421	116.4	116.4
RE 25, 20 W	126	AB 28	458	128.2	128.2
RE 25, 20 W	126	HED_5540/AB 28	413/458	145.4	145.4
RE 25, 20 W	127	AB 28	458	139.7	139.7
RE 25, 20 W	127	HED_5540/AB 28	413/458	156.9	156.9
RE 30, 60 W	129			119.1	119.1
RE 30, 60 W	129	MR	405	130.5	130.5
RE 30, 60 W	129	HED_5540	413/415	139.9	139.9
RE 35, 90 W	130			122.1	122.1
RE 35, 90 W	130	MR	405	133.5	133.5
RE 35, 90 W	130	HED_5540	413/415	142.8	142.8
RE 35, 90 W	130	DCT 22	421	140.2	140.2
RE 35, 90 W	130	AB 28	458	158.2	158.2
RE 35, 90 W	130	HEDS 5540/AB 28	413/458	175.4	175.4

Continuation of the modular system (irrespective of the screw) on pages 367 and 368.

# Spindle Drive GP 32 S Ø32 mm, Metric Lead Screw



M 1:2

## Technical Data

Screw	M10 x 1, stainless steel
Standard length	200.8 mm
Special length (5 mm steps)	max. 600 mm
Nut (standard)	thread nut
Material	bronze
Axial play	< 0.008 mm
Planetary gearhead	straight teeth
Bearing	ball bearing/thrust roller bearing
Radial play, 5 mm from flange	< 0.05 mm
Axial play	preloaded
Max. continuous input speed <sup>2</sup>	8000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	2700 N
Number of stages	1 2 3 4
Max. radial load, 15 mm from flange	200 N 350 N 400 N 400 N

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

	363900	363901	363904	363909	363910	363915	363920	363925	363930
1 Reduction	1:1	3.7:1	14:1	33:1	51:1	111:1	246:1	492:1	762:1
2 Absolute reduction	1/1	26/7	676/49	529/16	17576/343	13824/125	421824/1715	86112/175	19044/25
20 Max. feed velocity <sup>1</sup>	mm/s	100	36	9.5	4.0	2.6	1.2	0.5	0.3
21 Max. feed force (continuous) <sup>1</sup>	N	183	257	400	533	616	798	1040	1311
22 Max. feed force (intermittent) <sup>1</sup>	N	455	638	995	1324	1350	1350	1350	1350
Part Numbers	363902	363905			363911	363916	363921	363926	363931
1 Reduction	4.8:1	18:1			66:1	123:1	295:1	531:1	913:1
2 Absolute reduction	24/5	624/35			16224/245	6877/56	101062/343	331776/625	36501/40
20 Max. feed velocity <sup>1</sup>	mm/s	28	7.4		2.0	1.1	0.5	0.3	0.1
21 Max. feed force (continuous) <sup>1</sup>	N	280	435		671	826	1105	1345	1350
22 Max. feed force (intermittent) <sup>1</sup>	N	696	1082		1350	1350	1350	1350	1350
Part Numbers	363903	363906			363912	363917	363922	363927	363932
1 Reduction	5.8:1	21:1			79:1	132:1	318:1	589:1	1093:1
2 Absolute reduction	23/4	299/14			3887/49	3312/25	389376/1225	20631/35	279841/256
20 Max. feed velocity <sup>1</sup>	mm/s	23	6.3		1.7	1.0	0.4	0.2	0.1
21 Max. feed force (continuous) <sup>1</sup>	N	298	458		712	845	1133	1350	1350
22 Max. feed force (intermittent) <sup>1</sup>	N	742	1139		1350	1350	1350	1350	1350
Part Numbers	363907				363913	363918	363923	363928	
1 Reduction	23:1				86:1	159:1	411:1	636:1	
2 Absolute reduction		576/25			14976/175	1587/10	359424/875	79486/125	
20 Max. feed velocity <sup>1</sup>	mm/s	5.8			1.6	0.8	0.3	0.2	
21 Max. feed force (continuous) <sup>1</sup>	N	472			733	899	1234	1350	
22 Max. feed force (intermittent) <sup>1</sup>	N	1174			1350	1350	1350	1350	
Part Numbers	363908				363914	363919	363924	363929	
1 Reduction	28:1				103:1	190:1	456:1	706:1	
2 Absolute reduction		138/5			3588/35	12167/64	89401/196	158171/224	
20 Max. feed velocity <sup>1</sup>	mm/s	4.8			1.3	0.7	0.3	0.2	
21 Max. feed force (continuous) <sup>1</sup>	N	504			778	955	1278	1350	
22 Max. feed force (intermittent) <sup>1</sup>	N	1253			1350	1350	1350	1350	
4 Number of stages	0	1	2	2	3	3	4	4	4
7 Max. efficiency gearhead incl. screw	%	27	22	20	20	19	19	16	16
8 Weight <sup>1</sup>	g	304	304	331	331	359	359	387	387
9 Average backlash no load	°	0.7	0.7	0.8	0.8	1.0	1.0	1.0	1.0
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.033	0.033	0.033	0.033	0.034	0.034	0.034	0.034
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	43.3	3.0	0.9	0.9	0.7	0.7	0.7	0.7
11 Gearhead length L1	mm	51.0	51.0	57.7	57.7	64.4	64.4	71.1	71.1

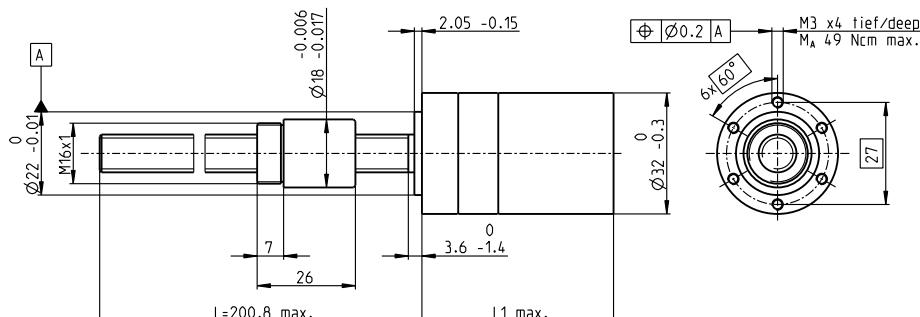
<sup>1</sup> based on screw length 200.8 mm (standard length)<sup>2</sup> for reduction 1:1 = 5984 rpm

## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm]	= Motor length + gearhead length + (sensor/brake) + assembly parts
A-max 26	151-158			95.8	102.5 102.5 109.2 109.2 115.9 115.9 115.9
A-max 26	152-158	MEnc 13	393	102.9	109.6 109.6 116.3 116.3 123.0 123.0 123.0
A-max 26	152-158	MR	404	104.6	111.3 111.3 118.0 118.0 124.7 124.7 124.7
A-max 26	152-158	Enc 22	411	110.2	116.9 116.9 123.6 123.6 130.3 130.3 130.3
A-max 26	152-158	HED_5540	413/415	114.2	120.9 120.9 127.6 127.6 134.3 134.3 134.3
A-max 32	159/161			114.0	120.7 120.7 127.4 127.4 134.1 134.1 134.1
A-max 32	160/162			112.6	119.3 119.3 126.0 126.0 132.7 132.7 132.7
A-max 32	160/162	MR	405	123.8	130.5 130.5 137.2 137.2 143.9 143.9 143.9
A-max 32	160/162	HED_5540	413/415	133.4	140.1 140.1 146.8 146.8 153.5 153.5 153.5
EC 32, 80 W	218			111.1	111.1 117.8 117.8 124.5 124.5 131.2 131.2
EC 32, 80 W	218	HED_5540	414/416	129.5	129.5 136.2 136.2 142.9 142.9 149.6 149.6
EC 32, 80 W	218	Res 26	422	131.2	131.2 137.9 137.9 144.6 144.6 151.3 151.3
MCD EPOS, 60 W	453			171.1	171.1 177.8 177.8 184.5 184.5 191.2 191.2
MCD EPOS P 60 W	453			171.1	171.1 177.8 177.8 184.5 184.5 191.2 191.2

Continuation of the modular system (irrespective of the screw) on pages 366 and 368.

# Spindle Drive GP 32 S Ø32 mm, Trapezoidal Lead Screw



## Technical Data

Screw	TR10 x 2, stainless steel
Standard length	200.8 mm
Special length (5 mm steps)	max. 600 mm
Nut (standard)	thread nut
Material	bronze
Axial play	< 0.008 mm
Planetary gearbox	straight teeth
Bearing	ball bearing/thrust roller bearing
Radial play, 5 mm from flange	< 0.05 mm
Axial play	preloaded
Max. continuous input speed <sup>2</sup>	8000 rpm
Recommended temperature range	-15...+80°C
Max. axial load (static) <sup>1</sup>	2700 N
Number of stages	1 2 3 4
Max. radial load, 15 mm from flange	200 N 350 N 400 N 400 N

M 1:2

- Stock program
- Standard program
- Special program (on request)

## Spindle Drive Data

	363936	363937	363940	363945	363946	363951	363956	363961	363966
1 Reduction	1:1	3.7:1	14:1	33:1	51:1	111:1	246:1	492:1	762:1
2 Absolute reduction	1/1	26/7	676/49	529/16	17576/343	13824/125	42182/1715	86112/175	19044/25
20 Max. feed velocity <sup>1</sup>	mm/s	186	72	19	8.1	5.2	2.4	1.1	0.5
21 Max. feed force (continuous) <sup>1</sup>	N	216	296	462	614	710	921	1200	1512
22 Max. feed force (intermittent) <sup>1</sup>	N	528	723	1127	1500	1530	1530	1530	1530
Part Numbers	363938	363941		363947	363952	363957	363962	363967	
1 Reduction	4.8:1	18:1		66:1	123:1	295:1	531:1	913:1	
2 Absolute reduction	24/6	624/35		16224/245	6877/56	101062/343	331776/625	36501/40	
20 Max. feed velocity <sup>1</sup>	mm/s	56	15		4.0	2.2	0.9	0.5	0.3
21 Max. feed force (continuous) <sup>1</sup>	N	323	502		774	953	1275	1530	1530
22 Max. feed force (intermittent) <sup>1</sup>	N	789	1226		1530	1530	1530	1530	1530
Part Numbers	363939	363942		363948	363953	363958	363963	363968	
1 Reduction	5.8:1	21:1		79:1	132:1	318:1	589:1	1093:1	
2 Absolute reduction	23/4	299/14		3887/49	3312/25	389376/1225	2063/45	279841/256	
20 Max. feed velocity <sup>1</sup>	mm/s	46	13		3.4	2.0	0.8	0.5	0.2
21 Max. feed force (continuous) <sup>1</sup>	N	344	529		822	975	1308	1530	1530
22 Max. feed force (intermittent) <sup>1</sup>	N	840	1291		1530	1530	1530	1530	1530
Part Numbers	363943		363949	363954	363959	363964			
1 Reduction	23:1		86:1	159:1	411:1	636:1			
2 Absolute reduction	576/25		14976/175	1587/10	359424/875	79488/125			
20 Max. feed velocity <sup>1</sup>	mm/s	12		3.1	1.7	0.6	0.4		
21 Max. feed force (continuous) <sup>1</sup>	N	545		846	1038	1424	1530		
22 Max. feed force (intermittent) <sup>1</sup>	N	1330		1530	1530	1530	1530		
Part Numbers	363944		363950	363955	363960	363965			
1 Reduction	28:1		103:1	190:1	456:1	706:1			
2 Absolute reduction	138/5		3588/35	12167/64	89401/196	158171/224			
20 Max. feed velocity <sup>1</sup>	mm/s	9.5		1.3	0.7	0.3	0.2		
21 Max. feed force (continuous) <sup>1</sup>	N	582		898	1101	1475	1530		
22 Max. feed force (intermittent) <sup>1</sup>	N	1420		1530	1530	1530	1530		
4 Number of stages	0	1	2	2	3	3	4	4	4
7 Max. efficiency gearhead incl. screw	%	47	38	35	35	33	33	28	28
8 Weight <sup>1</sup>	g	304	304	331	331	359	359	387	387
9 Average backlash no load	°	0.7	0.7	0.8	0.8	1.0	1.0	1.0	1.0
23 Mechanical positioning accuracy <sup>1</sup>	mm	0.035	0.035	0.035	0.035	0.037	0.037	0.037	0.037
10 Mass inertia gearhead incl. screw <sup>1</sup>	gcm <sup>2</sup>	42.3	2.4	0.9	0.9	1.0	1.0	1.0	1.0
11 Gearhead length L1	mm	51.0	51.0	57.7	57.7	64.4	64.4	71.1	71.1

<sup>1</sup> based on screw length 200.8 mm (standard length)

<sup>2</sup> for reduction 1:1 = 5569 rpm



## maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm]	= Motor length + gearhead length + (sensor/brake) + assembly parts						
EC-max 22, 25 W	229			—	99.6	106.3	106.3	113.0	113.0	119.7	119.7
EC-max 22, 25 W	229	MR	403	—	109.3	116.0	116.0	122.7	122.7	129.4	129.4
EC-max 22, 25 W	229	AB 20	456	—	135.4	142.1	142.1	148.8	148.8	155.5	155.5
EC-max 30, 40 W	230			—	93.1	99.8	99.8	106.5	106.5	113.2	113.2
EC-max 30, 40 W	230	MR	404	—	105.3	112.0	112.0	118.7	118.7	125.4	125.4
EC-max 30, 40 W	230	HEDL5540	416	—	113.7	120.4	120.4	127.1	127.1	133.8	133.8
EC-max 30, 40 W	230	AB 20	456	—	128.9	135.6	135.6	142.3	142.3	148.3	148.3
EC-max 30, 40 W	230	HEDL 5540 / AB 20	416/456	—	149.5	156.2	156.2	162.9	162.9	169.6	169.6
EC-4pole 22, 90 W	237			99.7	99.7	106.4	106.4	113.1	113.1	119.8	119.8
EC-4pole 22, 90 W	237	16 EASY	395/396	111.9	111.9	118.6	118.6	125.3	125.3	132.0	132.0
EC-4pole 22, 90 W	237	AEDL/HEDL	412/417	121.2	121.2	127.9	127.9	134.6	134.6	141.3	141.3
EC-4pole 22,120 W	238			117.1	117.1	123.8	123.8	130.5	130.5	137.2	137.2
EC-4pole 22,120 W	238	16 EASY	395/396	129.3	129.3	136.0	136.0	142.7	142.7	149.4	149.4
EC-4pole 22,120 W	238	AEDL/HEDL	412/417	138.6	138.6	145.3	145.3	152.0	152.0	158.7	158.7
EC-i 40, 50 W	247			82.7	82.7	89.4	89.4	96.1	96.1	102.8	102.8
EC-i 40, 50 W	247	16 EASY	395/396	94.4	94.4	101.1	101.1	107.8	107.8	114.5	114.5
EC-i 40, 50 W	247	AEDL/HEDL	412/417	105.7	105.7	112.4	112.4	119.1	119.1	125.8	125.8
EC-i 40, 70 W	249			92.7	92.7	99.4	99.4	106.1	106.1	112.8	112.8
EC-i 40, 70 W	249	16 EASY	395/396	104.4	104.4	111.1	111.1	117.8	117.8	124.5	124.5
EC-i 40, 70 W	249	AEDL/HEDL	412/417	115.7	115.7	122.4	122.4	129.1	129.1	135.8	135.8

Continuation of the modular system (irrespective of the screw) on pages 366 and 367.

# Spindle Drive Options

Option	to GP 6 S	to GP 8 S
<b>Special length</b> Order reference SPIN01	Without specification, the screw is supplied in the standard length 45 mm. Special lengths can be ordered in 5 mm steps up to the stated maximum length.	Without specification, the screw is supplied in the standard length 56 mm. Special lengths can be ordered in 5 mm steps up to the stated maximum length.
<b>Screw end</b> Order reference SPIN02	In order to support the end of the screw by an additional bearing, it can be delivered according to the illustration.  Customer specific screw ends on request.	
<b>Flange nut</b> Order reference SPIN04	Flange nut instead of the standard thread nut.	
<b>Low backlash ball screw nut</b> Order reference SPIN05	Not available for GP 6 S.	Not available for GP 8 S.
<b>Rectangular mounting flange</b> Order reference SPIN06	Spindle drive with rectangular mounting flange allows mounting from the gearbox side.	

# Spindle Drive Options

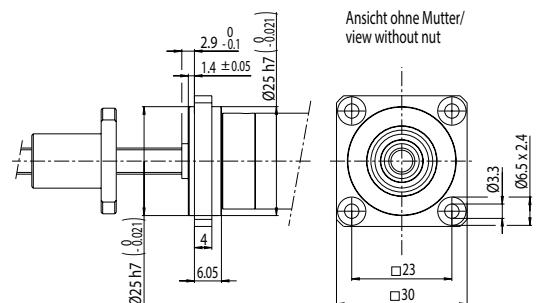
Option	to GP 16 S	to GP 22 S
<b>Special length</b> Order reference SPIN01	Without specification, the screw is supplied in the standard length 102 mm. Special lengths can be ordered in 5 mm steps up to the stated maximum length.	Without specification, the screw is supplied in the standard length 151 mm. Special lengths can be ordered in 5 mm steps up to the stated maximum length.
<b>Screw end</b> Order reference SPIN02	In order to support the end of the screw by an additional bearing, it can be delivered according to the illustration.  Customer specific screw ends on request.	
<b>Flange nut</b> Order reference SPIN04	Flange nut instead of the standard thread nut.  If using a ball screw, the rectangular mounting flange (SPIN 06) must be used.	
<b>Low backlash ball screw nut</b> Order reference SPIN05	Not available for GP 16 S.	Axial play is almost eliminated through increased preloading of the ball screw nut. Although, the increased load can lead to greater wear.

## Rectangular mounting flange Order reference SPIN06

Spindle drive with rectangular mounting flange allows mounting from the gearhead side.

If using a ball screw with flange nut, the rectangular assembly flange must be used for mounting.

On request.



# Spindle Drive Options

Option	to GP 32 S
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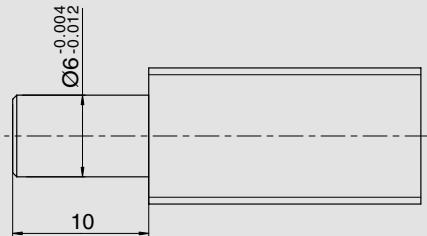
**Special length**  
Order reference SPIN01

Without specification, the screw is supplied in the standard length 200.8 mm. Special lengths can be ordered in 5 mm steps up to the stated maximum length.

**Screw end**  
Order reference SPIN02

In order to support the end of the screw by an additional bearing, it can be delivered according to the illustration.

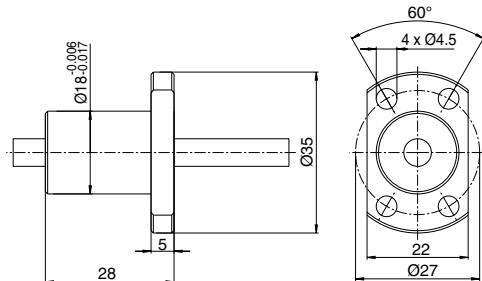
Customer specific screw ends on request.



**Flange nut**  
Order reference SPIN04

Flange nut instead of the standard thread nut.

If using a ball screw, the rectangular mounting flange (SPIN 06) must be used.



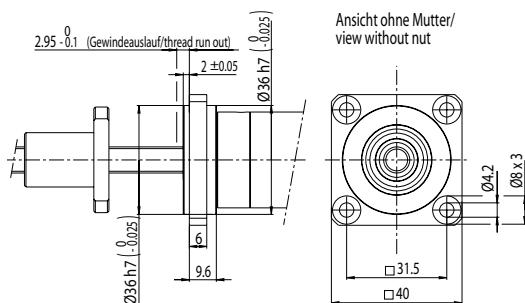
**Low backlash ball screw nut**  
Order reference SPIN05

Axial play is almost eliminated through increased preloading of the ball screw nut. Although, the increased load can lead to greater wear.

**Rectangular mounting flange**  
Order reference SPIN06

Spindle drive with rectangular mounting flange allows mounting from the gearhead side.

If using a ball screw with flange nut, the rectangular assembly flange must be used for mounting.



For your personal notes.

# Inductive, magnetic, and optical encoders. DC tachos and resolvers.

maxon sensor

<b>Standard Specification No. 103</b>	61
<b>Inductive encoder</b>	
<b>Encoder MILE</b> 256–2048 CPT, 2 channel	388
<b>Encoder MILE</b> 512–4096 CPT, 2 channel	389
<b>Encoder MILE</b> 512–6400 CPT, 2 channel	390
<b>Magnetic encoders</b> (ENX can be configured online)	
<b>ENX 6/8 MAG</b> 64–256 CPT, <b>NEW</b>	376
<b>ENX 8 EASY INT</b> 1–1024 CPT, 3 channel	377
<b>ENX 8 EASY INT Absolute</b> 4096 steps per turn	378
<b>ENX 10 EASY/QUAD</b> 1–1024 CPT, 2/3 channel	379
<b>ENX 13 EASY INT</b> 1–1024 CPT, 4096 steps per turn <b>NEW</b>	380
<b>ENX 16 EASY</b> 1024 CPT, 3 channel	381
<b>ENX 16 Absolute</b> 4096 steps per turn	382
<b>ENX 16 EASY INT</b> 1–1024 CPT, 4096 steps per turn <b>NEW</b>	383
<b>Encoder 6 MAG</b> 64–256 CPT, 3 channel	391
<b>Encoder MEnc 10</b> 12 CPT, 2 channel	392
<b>Encoder MEnc 13</b> 16 CPT, 2 channel	393–394
<b>Encoder 16 EASY</b> 128–1024 CPT, 3 channel	395
<b>Encoder 16 EASY Absolute</b> 4096 steps per turn	396
<b>Encoder MR</b> 16–1024 CPT, 2/3 channel	397–405

<b>Optical Encoder</b> (ENX can be configured online)		
<b>ENX 6/8 OPT</b> 128 CPT, 3 channel	<b>NEW</b>	384
<b>ENX 16 RIO</b> 512–65536 CPT, 3 channel	<b>NEW</b>	385
<b>Encoder 6 OPT</b> 128 CPT, 3 channel		406
<b>Encoder 8 OPT</b> 50 CPT, 2 channel		407
<b>Encoder 16 RIO</b> 512–65536 CPT, 3 channel	<b>NEW</b>	408
<b>Encoder SCH16F</b> 2000–3600 CPT, 3 channel		409
<b>Encoder 2RMHF</b> 3000–5000 CPT, 3 channel		410
<b>Encoder Enc 22</b> 100 CPT, 2 channel		411
<b>Encoder AEDL 5810</b> 1024–5000 CPT, 3 channel		412
<b>Encoder HEDS 5540</b> 500 CPT, 3 channel		413–414
<b>Encoder HEDL 5540</b> 500 CPT, 3 channel		415–418
<b>Encoder HEDL 9140</b> 500 CPT, 3 channel		419–420
<b>DC Tacho/Resolver</b>		421–422
<b>DC-Tacho DCT 22</b> 0.52 V		421
<b>Resolver Res 26</b> 10 V		422

DC Motor  
EC Motor  
(BLDC Motor)

Gearhead  
Spindle drive

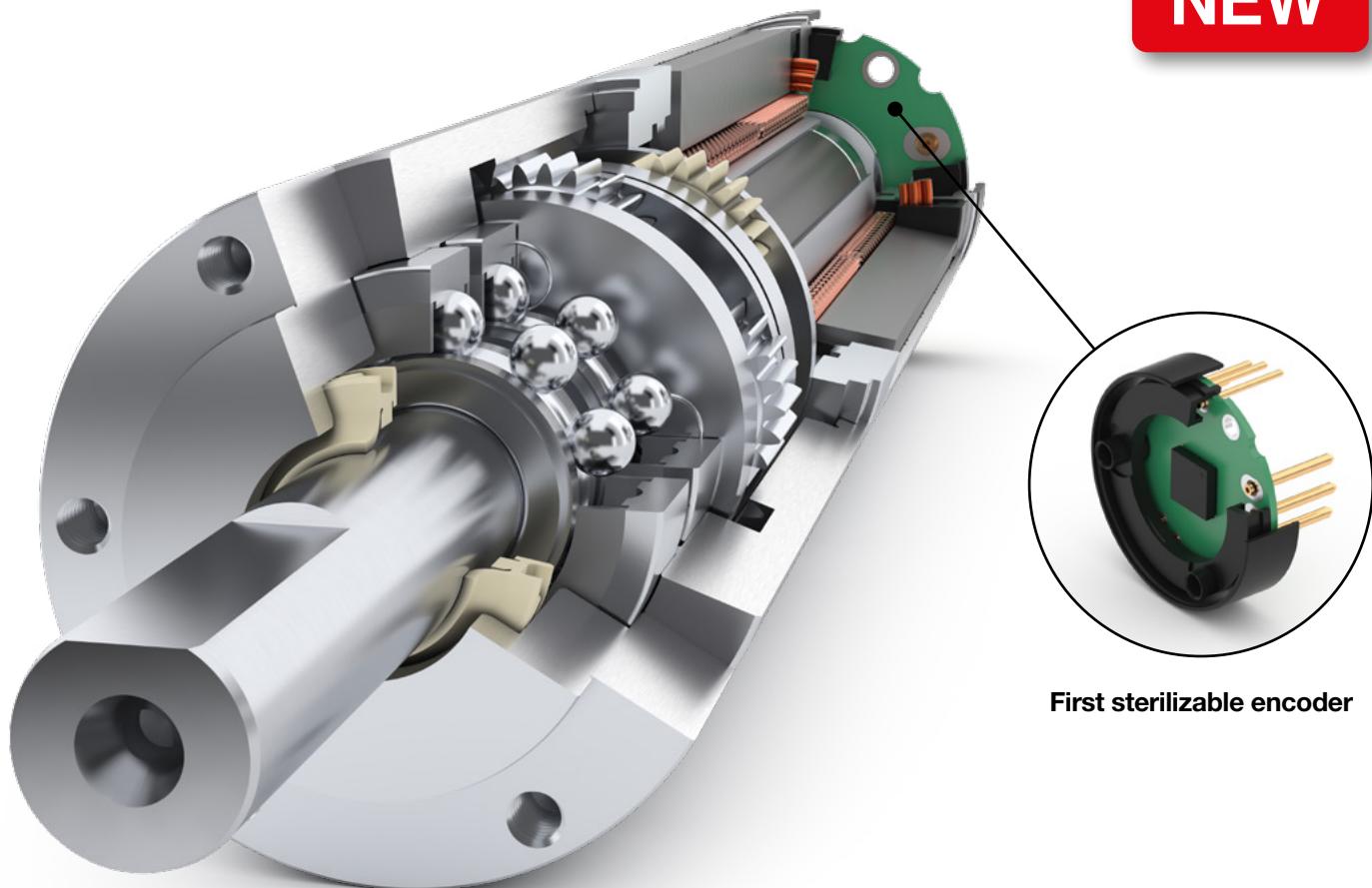
Sensor  
Motor control

Compact Drive

Accessories  
Ceramic

Contact information

NEW



First sterilizable encoder

# The first sterilizable drive system.

maxon's sterilizable encoder offers customers a complete system with high speed BLDC motor, gearhead and encoder that survives more than 1000 autoclave cycles.

## Advantages of a sterilizable drive system

<b>maxon ECX motor</b>	Up to 120'000 rpm, smooth-running.
<b>maxon GPX gearhead</b>	Transmission of high torque and speed. Up to 90% efficiency.
<b>maxon ENX encoder</b>	Integrated incremental (1024 impulses) or absolute (4096 steps) encoder.
<b>Fast delivery</b>	Configurable online and ready for delivery within 11 days.

[sterilizable.maxonmotor.com](http://sterilizable.maxonmotor.com)



# maxon ENX

maxon ENX encoders make an impression with their robust design and high signal quality. The 3-channel encoders with differential signals guarantee interference-free function even under the very high load, and the optical RIO encoder delivers the highest resolution in a small space. maxon ENX encoders can be configured online and are ready for delivery within 11 working days.

[enx.maxonmotor.com](http://enx.maxonmotor.com)

## Standard Specification No. 103

61

<b>ENX Program</b> (can be configured online)	376–385
<b>Inductive encoders</b>	388–390
<b>Magnetic encoders</b>	391–405
<b>Optical encoders</b>	406–420
<b>DC Tacho/Resolver</b>	421–422

**ENX 6/8 MAG**

Encoder Ø6/Ø8 mm, 64...256 CPT

NEW



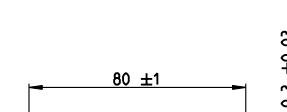
<b>Key Data</b>	<b>ENX 6 MAG Incremental</b>	<b>ENX 8 MAG Incremental</b>
Number of channels	3	3
Max. counts per turn	256	256
Encoder length L	mm 6.2	7.0
Ambient temperature	°C -40...125	-40...125
Weight	g 1	1

<b>Selection criteria</b>	<b>ENX 6 MAG Incremental</b>	<b>ENX 8 MAG Incremental</b>
Speed and rotation direction detection	■	■
Speed and position control	■	■
Compact and robust design	■	■
High resolution	▲	▲
Cost effective	■	■

■ suitable    ▲ suitable to a limited extent    ● not suitable

Specifications	ENX 6 MAG Incremental	ENX 8 MAG Incremental
Supply voltage Vcc	V 3.0...3.6	3.0...3.6
Typical current draw	mA 10	10
Max. operating frequency	kHz 64	64
Max. Speed	min <sup>-1</sup> 100000	100000
Connection	FPC, 12 pole, pitch 0.5 mm Pin 1 Motor+ Pin 2 Motor- Pin 3 Do not connect <sup>1</sup> Pin 4 GND Pin 5 V <sub>cc</sub> Pin 6 Channel A Pin 7 Channel B Pin 8 Channel I Pin 9-12 Do not connect <sup>1</sup> Output signal: CMOS compatible Output current per channel: +4 mA	FPC, 12 pole, pitch 0.5 mm compatible connector: Molex 52746-0697, Tyco 1-1734839-4 Pin 1 Motor+ Pin 2 Motor- Pin 3 Do not connect <sup>1</sup> Pin 4 GND Pin 5 V <sub>cc</sub> Pin 6 Channel A Pin 7 Channel B Pin 8 Channel I Pin 9-12 Do not connect <sup>1</sup> Output signal: CMOS compatible Output current per channel: +4 mA

<b>Configuration</b>	<b>ENX 6 MAG Incremental, magnetic</b>	<b>ENX 8 MAG Incremental, magnetic</b>
Counts per turn <sup>1</sup>	64, 128, 256	64, 128, 256

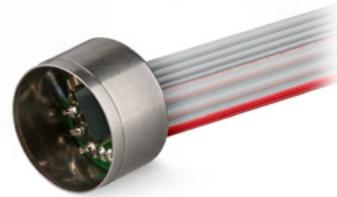
maxon Modular System	Seite	Dimensions Standard Version	Notes
<b>maxon DC motor</b>			
DCX 6 M	66		
DCX 8 M	67		
			
			<p><sup>1</sup> Applying voltage to these pins may destroy the encoder.</p> <p><b>Compatible connector:</b> Molex 52745-0697, Tyco 1-1734839-4 Adapter 498157 required for all maxon controllers</p> <p><b>Please note:</b> max. continuous current 0.5 A</p>

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# ENX 8 EASY INT

Encoder Ø8 mm, 1...1024 CPT

Capitalize Integrated



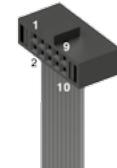
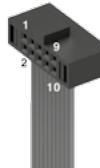
maxon ENX

Key Data	EASY Incremental Differential	EASY Incremental, Commutation Signal
Number of channels	3	3
Max. counts per turn	1024	1024
Encoder length L	mm 0 (integrated into motor)	0 (integrated into motor)
Ambient temperature <sup>2</sup>	°C -20...100 (-40...100)	-20...100 (-40...100)
Weight	g <4	<4

Selection criteria	EASY Incremental Differential	EASY Incremental, Commutation Signal
Speed and rotation direction detection	■ suitable	■ suitable
Speed and position control	■ suitable	■ suitable
Compact and robust design	■ suitable	■ suitable
High resolution	■ suitable	■ suitable
Cost effective	■ suitable	■ suitable

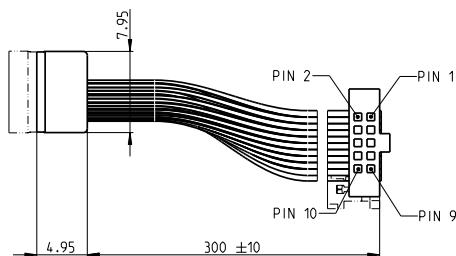
■ suitable ▲ suitable to a limited extent ● not suitable

Specifications	EASY Incremental Differential	EASY Incremental, Commutation Signal
Supply voltage Vcc	V 5 ±0.5	5 ±0.5
Typical current draw	mA 17	17
Max. operating frequency	kHz 500	500
Max. Speed	rpm 80000	80000
Connector <sup>3</sup>	10-pin 1.27 mm multipoint connector e.g. Samtec FFSD series Pin 1 Do not connect (BiSS-C Data) Pin 2 V <sub>cc</sub> 4.5...5.5 Pin 3 GND Pin 4 Do not connect (BiSS-C CLK <sup>4</sup> ) Pin 5 Channel Ā Pin 6 Channel A Pin 7 Channel B̄ Pin 8 Channel B Pin 9 Channel Ī Pin 10 Channel I Output signal: EIA-Standard RS 422 Output current per channel: ± 20 mA	10-pin 1.27 mm multipoint connector e.g. Samtec FFSD series Pin 1 Do not connect (BiSS-C Data) Pin 2 V <sub>cc</sub> 4.5...5.5 Pin 3 GND Pin 4 Do not connect (BiSS-C CLK) Pin 5 H1 Pin 6 Channel A Pin 7 H2 Pin 8 Channel B Pin 9 H3 Pin 10 Channel I Output signal: CMOS compatible Output current per channel: + 20 mA



Configuration	EASY Incremental Differential	EASY Incremental, Commutation Signal
Counts per turn <sup>1</sup>	1...128, 256, 512, 1024	1...128, 256, 512, 1024
Cable length	mm 50, 100, 150, 200, 250, 300	50, 100, 150, 200, 250, 300
Cable insulation <sup>2</sup>	PVC/PO/FEP	PVC/PO/FEP
Alignment of cable outlet in relation to motor flange	° axial	axial

maxon Modular System	Page	Dimensions Standard Version	M 3:4	Notes
maxon EC motor				
ECX 8 SPEED	176-177			
				1 maxon controllers require a resolution of at least 16 counts per turn and commutation signals.
				2 For PVC-cable (-20...100°C) For PO- and FEP cable (-40...100°C)
				3 H1, index and angle zero are aligned with angle commutation zero (see p. 40).
				4 Applying voltage to these pins may destroy the encoder.
				EASY incremental, commutation signal: Adapter Micromotor (Art.-Nr. 498157) required for all maxon controllers.



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# ENX 8 EASY INT Absolute

Encoder Ø8 mm, 4096 steps, Single Turn

Capitalize Integrated

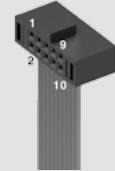
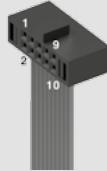


Key Data		EASY Absolute	EASY Absolute, Commutation Signal
Steps per turn	4096	4096	4096
Resolution (bit single turn)	12	12	12
Encoder length L	mm 0 (integrated into motor)	0 (integrated into motor)	0 (integrated into motor)
Ambient temperature <sup>1</sup>	°C -20...100 (-40...100)	-20...100 (-40...100)	-20...100 (-40...100)
Weight	g <4	<4	<4

Selection criteria		EASY Absolute	EASY Absolute, Commutation Signal
Speed and rotation direction detection		■ suitable	■ suitable
Speed and position control		■ suitable	■ suitable
Compact and robust design		■ suitable	■ suitable
High resolution		■ suitable	■ suitable
Cost effective		■ suitable	■ suitable

■ suitable ▲ suitable to a limited extent ● not suitable

Specifications		EASY Absolute	EASY Absolute, Commutation Signal
Supply voltage Vcc	V	5 ±0.5	5 ±0.5
Typical current draw	mA	17	17
Max. operating frequency	kHz	80 000	80 000
Connector <sup>2</sup>		10-pin 1.27 mm multipoint connector e.g. Samtec FFSD series Pin 1 Data Pin 2 V <sub>cc</sub> 4.5...5.5 Pin 3 GND Pin 4 CLK Pin 5 Do not connect (A) Pin 6 Do not connect (A) Pin 7 Do not connect (B) Pin 8 Do not connect (B) Pin 9 Do not connect (I) Pin 10 Do not connect (I) Output signal: CMOS compatible Output current per channel: + 20 mA	10-pin 1.27 mm multipoint connector e.g. Samtec FFSD series Pin 1 Data Pin 2 V <sub>cc</sub> 4.5...5.5 Pin 3 GND Pin 4 CLK Pin 5 H1 Pin 6 Do not connect (A) Pin 7 H2 Pin 8 Do not connect (B) Pin 9 H3 Pin 10 Do not connect (I) Output signal: CMOS compatible Output current per channel: + 20 mA



Configuration		EASY Absolute	EASY Absolute, Commutation Signal
Signal protocol		BiSS-C, SSI	BiSS-C, SSI
Cable length	mm	50, 100, 150, 200, 250, 300	50, 100, 150, 200, 250, 300
Cable insulation <sup>1</sup>		PVC/PO/FEP	PVC/PO/FEP
Alignment of cable outlet in relation to motor flange	°	axial	axial

maxon Modular System	Page	Dimensions Standard Version	M 3:4	Notes
maxon EC motor				
ECX 8 SPEED	176			Adapter EASY Absolute (Part number 488167) required for all maxon controllers.
				<sup>1</sup> For PVC-cable (-20...100°C)
				For PO- and FEP cable (-40...100°C)
				<sup>2</sup> H1, index and angle zero are aligned with angle commutation zero (see p. 40).

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# ENX 10 EASY/QUAD

Encoder Ø10 mm, 1...1024 CPT

Capitalize Integrated



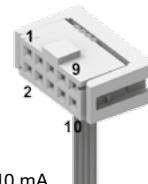
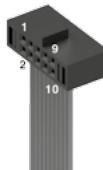
maxon ENX

Key Data	EASY Incremental Differential	QUAD Incremental
Number of channels	3	2
Max. counts per turn	1024	1
Encoder length L <sup>4</sup>	8.5 mm	8.5
Ambient temperature	-40 ... +100 °C	-40 ... +100
Weight	g <5	<5

Selection criteria	EASY Incremental Differential	QUAD Incremental
Speed and rotation direction detection	■	■
Speed and position control	■	▲
Compact and robust design	■	■
High resolution	■	●
Cost effective	■	■

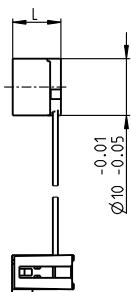
■ suitable ▲ suitable to a limited extent ● not suitable

Specifications	EASY Incremental Differential	QUAD Incremental
Supply voltage Vcc	V 5 ±0.5	5 ±0.5
Typical current draw	mA 22	5.5
Max. operating frequency	kHz 500	2
Max. Speed	rpm 30000	30000
Connector	10-pin 1.27 mm multipoint connector <sup>5</sup> e.g. Samtec FFSD series	10-pin 2.54 mm multipoint connector <sup>3</sup> (IEC/EN 60603-1-DIN41651)
	Pin 1 Do not connect <sup>1</sup> (BiSS-C Data) Pin 2 V <sub>cc</sub> Pin 3 GND Pin 4 Do not connect <sup>1</sup> (BiSS-C CLK) Pin 5 Channel A Pin 6 Channel A Pin 7 Channel B Pin 8 Channel B Pin 9 Channel I Pin 10 Channel I Output signal: EIA-Standard RS 422 Output current per channel: ± 20 mA	Pin 1 Not connected Pin 2 V <sub>cc</sub> Pin 3 Channel A Pin 4 Channel B Pin 5 GND Pin 6 Not connected Pin 7 Not connected Pin 8 Not connected Pin 9 Not connected Pin 10 Not connected Output signal: TTL compatible Output current per channel: + 10 mA



Configuration	EASY Incremental Differential	QUAD Incremental
Counts per turn <sup>2</sup>	1 ... 1024	1
Cable length	mm 50, 100, 150, 200, 300, 500, 1000	50, 100, 150, 200, 300, 500, 1000
Alignment of cable outlet in relation to motor flange	° 15	15

maxon Modular System	Page	Dimensions Standard Configuration	M 1:1	Notes
maxon DC motor				
DCX 10 S	EASY, QUAD	68		<sup>1</sup> Applying voltage to these pins can destroy the encoder.
DCX 10 L	EASY, QUAD	69		<sup>2</sup> maxon controllers require a resolution of at least 16 counts per turn.
DCX 12 S	EASY, QUAD	70		<sup>3</sup> Option: 6-pol 2.54 mm pin header.
DCX 12 L	EASY, QUAD	71		<sup>4</sup> For attachment to DCX motors: plus 2-4 mm thick intermediate plate.
DCX 14 L	EASY, QUAD	72-73		<sup>5</sup> Option: Also available with FFC cable, 0.5 mm pitch matching connector Molex 52745-1097, adapter 506579 required for maxon controllers.
DCX 16 S	EASY, QUAD	74-75		
DCX 16 L	EASY, QUAD	76-77		
DCX 19 S	EASY, QUAD	78-79		
DCX 22 S	EASY, QUAD	80-81		
DCX 22 L	EASY, QUAD	82-83		
DCX 26 L	EASY, QUAD	84-85		
DCX 32 L	EASY, QUAD	86		
DCX 35 L	EASY, QUAD	87		
DC-max 16 S	EASY, QUAD	90-91		
DC-max 22 S	EASY, QUAD	92-93		
DC-max 26 S	QUAD	94-95		



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**ENX 13 EASY INT**

NEW

Encoder Ø13 mm, 1...1024 CPT/4096 steps, Single Turn

Sterilizable, integrated into motor



Key Data	EASY Incremental Differential	EASY Absolute
Number of channels	3	
Max. counts per turn	1024	
Steps per turn		4096
Resolution (bit single turn)		12
Encoder length L	mm 0 (integrated into motor)	0 (integrated into motor)
Ambient temperature	°C -40...100	-40...100
Weight	g <5	<5

Selection criteria	EASY Incremental Differential	EASY Absolute
Speed and rotation direction detection	■	■
Speed and position control	■	■
Compact and robust design	■	■
High resolution	■	■
Cost effective	■	■

■ suitable ▲ suitable to a limited extent ● not suitable

Specifications	EASY Incremental Differential <sup>a</sup>	EASY Absolute
Supply voltage Vcc	V 5 ± 0.5	5 ± 0.5
Typical current draw	mA 22	22
Max. operating frequency	kHz 4000	
Max. Speed	rpm 200 000	200 000
Connector <sup>b</sup>	10-pin 2.54 mm multipoint connector (IEC/EN 60603-1-DIN41651) cable AWG 28	without connector
	Pin 1 Do not connect	cable AWG 28
	Pin 2 (black) V <sub>cc</sub>	green Data
	Pin 3 (brown) GND	black V <sub>cc</sub>
	Pin 4 Do not connect	brown GND
	Pin 5 (red) Channel A	yellow CLK
	Pin 6 (orange) Channel A	
	Pin 7 (yellow) Channel B	
	Pin 8 (green) Channel B	
	Pin 9 (blue) Channel I	
	Pin 10 (violet) Channel I	
	Output signal: EIA-Standard RS 422	Output signal: CMOS compatible
	Output current per channel: ± 20 mA	Output current per channel + 20 mA



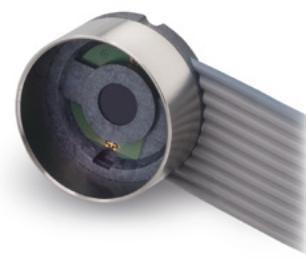
Configuration	EASY Incremental Differential	EASY Absolute
Counts per turn <sup>1</sup>	1...1024	
Signalprotokoll		BiSS-C, SSI
Cable length	mm 200, 500	200, 500

maxon Modular System	Page	Sterilization information	Notes
maxon EC motor			
ECX 13 SPEED	180	135°C 	1 maxon controllers require a resolution of at least 16 counts per turn and commutation signals.
		Typically 1000 autoclave cycles	2 H1, index and angle zero are aligned with angle commutation zero (see p. 40).
		Sterilization with steam	
		Temperature	
		Compression pressure up to	+134°C ±4°C
		Rel. humidity	2.3 bar
		Cycle length	100%
			18 minutes
		The connector is not sterilizable	
		and needs to be removed first.	

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# ENX 16 EASY

Encoder Ø16 mm, 1...1024 CPT



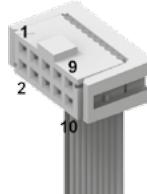
maxon ENX

Key Data	EASY Incremental Differential
Number of channels	3
Max. counts per turn	1024
Encoder length L <sup>2</sup>	mm 8.5
Ambient temperature	°C -40 ... +100
Weight	g 7

Selection criteria	EASY Incremental Differential
Speed and rotation direction detection	■ suitable
Speed and position control	■ suitable
Compact and robust design	■ suitable
High resolution	■ suitable
Cost effective	■ suitable

■ suitable ▲ suitable to a limited extent ● not suitable

Specifications	EASY Incremental Differential
Supply voltage Vcc	V 5 ±0.5
Typical current draw	mA 22
Max. operating frequency	kHz 500
Max. Speed	rpm 30000
Connector	10-pin 2.54 mm multipoint connector (IEC/EN 60603-1-DIN41651) Pin 1 N.C. Pin 2 V <sub>CC</sub> Pin 3 GND Pin 4 N.C. Pin 5 Channel Ā Pin 6 Channel A Pin 7 Channel B̄ Pin 8 Channel B Pin 9 Channel Ī Pin 10 Channel I Output signal: EIA-Standard RS 422 Output current per channel: ± 20 mA



Configuration	EASY Incremental Differential
Counts per turn <sup>1</sup>	1 ... 1024
Cable length	mm 50, 100, 150, 200, 300, 500, 1000
Alignment of cable outlet in relation to motor flange	° 15

maxon Modular System	Page	Dimensions Standard Version	M 3:4	Notes
maxon DC motor				
DCX 16 S	74-75			
DCX 16 L	76-77			
DCX 19 S	78-79			
DCX 22 S	80-81			
DCX 22 L	82-83			
DCX 26 L	84-85			
DCX 32 L	86			
DCX 35 L	87			
DC-max 26 S	94-95			
				<sup>1</sup> maxon controllers require a resolution of at least 16 counts per turn. <sup>2</sup> For attachment to DCX motors: plus 2-4 mm thick intermediate plate. <sup>3</sup> Option: Also available with single wires, for ambient temperature -55 °C ... +125 °C

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# ENX 16 Absolute

Encoder Ø16 mm, 4096 steps, Single Turn

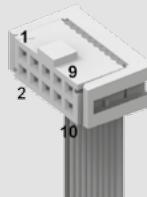


<b>Key Data</b>		<b>EASY Absolute</b>
Steps per turn	4096	
Resolution (bit single turn)	12	
Encoder length L <sup>1</sup>	mm 8.5	
Ambient temperature	°C -40 ... +100	
Weight	g 7	

<b>Selection criteria</b>		<b>EASY Absolute</b>
Speed and rotation direction detection		■
Speed and position control		■
Compact and robust design		■
High resolution		■
Cost effective		■

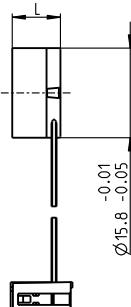
■ suitable   ▲ suitable to a limited extent   ● not suitable

<b>Specifications</b>		<b>EASY Absolute</b>
Supply voltage Vcc	V 5 ±0.5	
Typical current draw	mA 17	
Max. Speed	rpm 30000	
Connector		10-pin 2.54 mm multipoint connector (IEC/EN 60603-1-DIN41651) Pin 1 Data Pin 2 V <sub>cc</sub> Pin 3 GND Pin 4 CLK Pin 5 Do not connect (A) Pin 6 Do not connect (A) Pin 7 Do not connect (B) Pin 8 Do not connect (B) Pin 9 Do not connect (I) Pin 10 Do not connect (I)



<b>Configuration</b>		<b>EASY Absolute</b>
Signal protocol		BISS-C, SSI
Cable length	mm	50, 100, 150, 200, 300, 500, 1000
Alignment of cable outlet in relation to motor flange	°	15

<b>maxon Modular System</b>	<b>Page</b>	<b>Dimensions Standard Version</b>	<b>M 3:4</b>	<b>Notes</b>
<b>maxon DC motor</b>				
DCX 16 S	74-75			
DCX 16 L	76-77			
DCX 19 S	78-79			
DCX 22 S	80-81			
DCX 22 L	82-83			
DCX 26 L	84-85			
DCX 32 L	86			
DCX 35 L	87			
DC-max 26 S	94-95			
				Adapter EASY Absolute (Part number 488167) required for all maxon controllers.
				<sup>1</sup> For attachment to DCX motors: added 2-4 mm thick intermediate plate.



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## **ENX 16 EASY INT**

NEW

Encoder Ø16 mm, 1...1024 CPT / 4096 steps, Single Turn

Sterilizable, integrated into motor



**maxon ENX**

<b>Key Data</b>	<b>EASY Incremental Differential</b>	<b>EASY Absolute</b>
Number of channels	3	
Max. counts per turn	1024	
Steps per turn		4096
Resolution (bit single turn)		12
Encoder length L <sup>2</sup>	mm -1 (integrated into motor)	-1 (integrated into motor)
Ambient temperature	°C -40...100	-40...100
Weight	g <5	<5

Selection criteria	EASY Incremental Differential	EASY Absolute
Speed and rotation direction detection	■	■
Speed and position control	■	■
Compact and robust design	■	■
High resolution	■	■
Cost effective	■	■

■ suitable    ▲ suitable to a limited extent    ● not suitable

Specifications		EASY Incremental Differential <sup>3</sup>	EASY Absolute
Supply voltage Vcc	V	5 ± 0.5	5 ± 0.5
Typical current draw	mA	22	22
Max. operating frequency	kHz	4000	
Max. Speed	rpm	200000	200000
Connector <sup>2</sup>		10-pin 2.54 mm multipoint connector (IEC/EN 60603-1-DIN41651) cable AWG 28 Pin 1 Do not connect Pin 2 (black) V <sub>cc</sub> Pin 3 (brown) GND Pin 4 Do not connect Pin 5 (red) Channel A Pin 6 (orange) Channel A Pin 7 (yellow) Channel B Pin 8 (green) Channel B Pin 9 (blue) Channel I Pin 10 (violet) Channel I Output signal: EIA-Standard RS 422 Output current per channel: ± 20 mA	without connector cable AWG 28 green Data black V <sub>cc</sub> brown GND yellow CLK 

<b>Configuration</b>	<b>EASY Incremental Differential</b>	<b>EASY Absolute</b>
Counts per turn <sup>1</sup>	1...1024	
Signalprotokoll		BiSS-C, SSI
Cable length	mm 200, 500	200, 500

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**ENX 6/8 OPT**

Encoder Ø6/Ø8 mm, 128 CPT

NEW



Key Data		ENX 6 OPT Incremental, optical	ENX 8 OPT Incremental, optical
Number of channels	3	3	3
Max. counts per turn	128	128	128
Encoder length L	mm 6.2	7.0	7.0
Ambient temperature	°C -20...85	-20...85	-20...85
Weight	g 1	1	1

Selection criteria		ENX 6 OPT Incremental, optical	ENX 8 OPT Incremental, optical
Speed and rotation direction detection		■	■
Speed and position control		■	■
Compact and robust design		■	■
High resolution		▲	▲
Cost effective		■	■

■ suitable ▲ suitable to a limited extent ● not suitable

Specifications		ENX 6 OPT Incremental, optical	ENX 8 OPT Incremental, optical
Supply voltage Vcc	V	3.0...6.0	3.0...6.0
Typical current draw	mA	6	6
Max. operating frequency	kHz	64	64
Max. Speed	min <sup>-1</sup>	60000	60000
Connection		FPC, 12 pole, pitch 0.5 mm Pin 1 Motor+ Pin 2 Motor- Pin 3 Do not connect Pin 4 GND Pin 5 V <sub>cc</sub> Pin 6 Channel A Pin 7 Channel B Pin 8 Channel I Pin 9-11 Do not connect Pin 12 Do not connect <sup>1</sup>	FPC, 12 pole, pitch 0.5 mm Pin 1 Motor+ Pin 2 Motor- Pin 3 Do not connect Pin 4 GND Pin 5 V <sub>cc</sub> Pin 6 Channel A Pin 7 Channel B Pin 8 Channel I Pin 9-11 Do not connect Pin 12 Do not connect <sup>1</sup>

Configuration		ENX 6 OPT Incremental, optical	ENX 8 OPT Incremental, optical
Counts per turn <sup>1</sup>		128	128

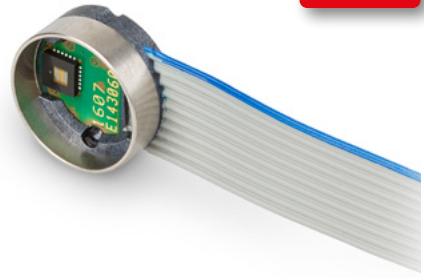
maxon Modular System	Seite	Dimensions Standard Version	Notes
maxon DC motor			
DCX 6 M	66		<sup>1</sup> Applying voltage to these pins may destroy the encoder.
DCX 8 M	67		
			<b>Compatible connector:</b> Molex 52745-0697, Tyco 1-1734839-4 Adapter 498157 required for all maxon controllers
			<b>Please note:</b> max. continuous current 0.5 A

[xdrives.maxonmotor.com](http://xdrives.maxonmotor.com)

# ENX 16 RIO

NEW

Encoder Ø16 mm, 512 ... 65536 CPT



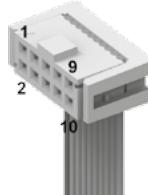
maxon ENX

Key Data	RIO Incremental optical
Number of channels	3
Max. counts per turn	65536
Encoder length L <sup>1</sup>	mm 7.0
Ambient temperature	°C -40 ... +100
Weight	g 15

Selection criteria	RIO Incremental optical
Speed and rotation direction detection	■ suitable
Speed and position control	■ suitable
Compact and robust design	■ suitable
High resolution	■ suitable
Cost effective	■ suitable

■ suitable ▲ suitable to a limited extent ● not suitable

Specifications	RIO Incremental, optical
Supply voltage Vcc	V 5 ± 10%
Typical current draw	mA 50
Max. operating frequency	kHz 3125
Max. Speed	min <sup>-1</sup> 40000
Connection	10-pin 2.54 mm multipoint connector (IEC/EN 60603-1-DIN41651) Pin 1 Do not connect Pin 2 V <sub>CC</sub> Pin 3 GND Pin 4 Do not connect Pin 5 Channel Ā Pin 6 Channel A Pin 7 Channel B̄ Pin 8 Channel B Pin 9 Channel Ī Pin 10 Channel I



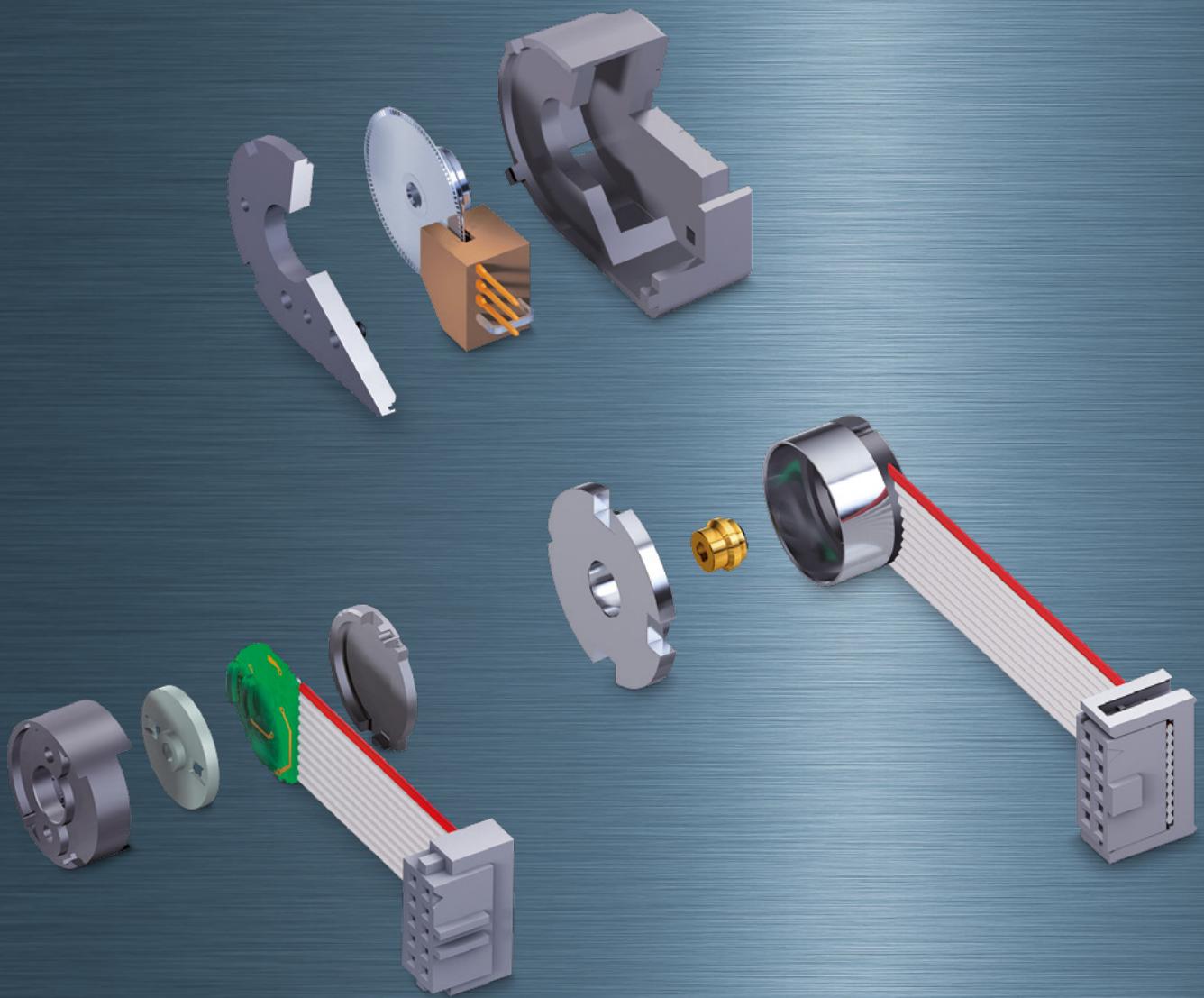
Configuration	RIO Incremental, optical
Counts per turn	512... 65536 (in steps of 256)
Cable length	mm 50, 100, 150, 200, 300, 500, 1000
Alignment of cable outlet in relation to motor flange	° 15

maxon Modular System	Seite	Dimensions Standard Version	Notes
maxon DC motor			
DCX 16 S	74-75		
DCX 16 L	76-77		
DCX 19 S	78-79		
DCX 22 S	80-81		
DCX 22 L	82-83		
DCX 26 L	84-85		
DCX 32 L	86		
DCX 35 L	87		
			<sup>1</sup> Applying voltage to these pins may destroy the encoder.

xdrives.maxonmotor.com

For your personal notes.

xdrives.maxonmotor.com



# maxon sensor

**Robust encoders, DC tachometers, and resolvers with high accuracy and high signal resolution. Due to resonance, these are mainly mounted on motors with a continuous shaft. The assembly requires adjustment to the motors and may only be done in the delivery plant.**

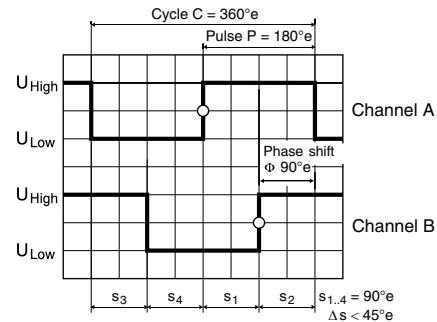
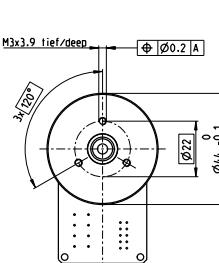
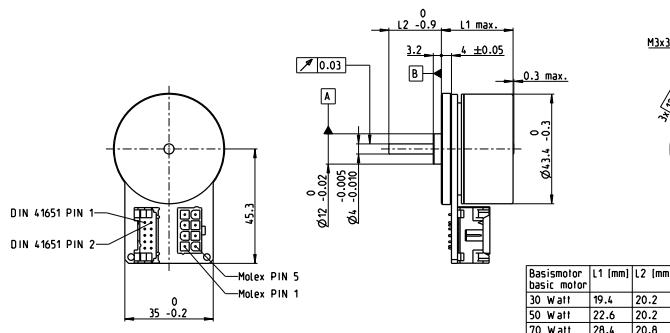
## Spécification Standard No. 103

61

<b>ENX Program (can be configured online)</b>	376–385
<b>Inductive encoders</b>	388–390
<b>Magnetic encoders</b>	391–405
<b>Optical encoders</b>	406–420
<b>DC Tacho/Resolver</b>	421–422

# Encoder MILE 256–2048 CPT, 2 Channels, with Line Driver

Integrated into motor



M 1:3

Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Type

Counts per turn	256	512	1024	2048
Number of channels	2	2	2	2
Max. operating frequency (kHz)	500	500	500	500
Max. speed (rpm)	10000	10000	10000	10000



## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
EC 45 flat, 30 W, A	265					19.4
EC 45 flat, 30 W, A	265	GP 42, 3 - 15 Nm	347			● 19.4
EC 45 flat, 30 W, A	265	GS 45, 0.5 - 2.0 Nm	349			● 19.4
EC 45 flat, 50 W, A	266					22.6
EC 45 flat, 50 W, A	266	GP 42, 3 - 15 Nm	347			● 22.6
EC 45 flat, 50 W, A	266	GS 45, 0.5 - 2.0 Nm	349			● 22.6
EC 45 flat, 70 W, A	267					28.4
EC 45 flat, 70 W, A	267	GP 42, 3 - 15 Nm	347			● 28.4
EC 45 flat, 70 W, A	267	GS 45, 0.5 - 2.0 Nm	349			● 28.4

## Technical Data

Supply voltage $V_{CC}$	$5 \text{ V} \pm 10\%$
Typical current draw	14 mA
Output signal	CMOS compatible
State length $s_n$ , 90°e (1000 rpm)	45...135°e
Signal rise time (typically, at $C_L = 25 \text{ pF}$ , $R_L = 1 \text{ k}\Omega$ , 25°C)	100 ns
Signal fall time (typically, at $C_L = 25 \text{ pF}$ , $R_L = 1 \text{ k}\Omega$ , 25°C)	100 ns
Operating temperature range	-40...+100°C
Moment of inertia of code wheel	$\leq 3.5 \text{ gcm}^2$
Output current per channel	max. 4 mA
Open collector output of the Hall sensors with integrated pull-up resistor	$10 \text{ k}\Omega \pm 20\%$
Wiring diagram for Hall sensors see p. 43	

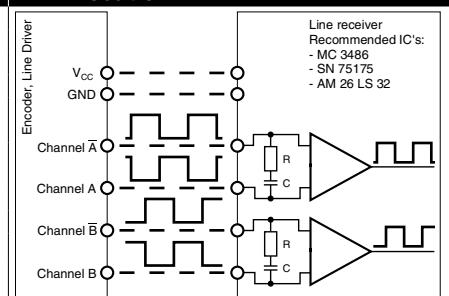
Additional information can be found under 'Downloads' in the maxon online shop.

## Pin Allocation

Connection motor	Connection Encoder
Pin 1 Hall sensor 1*	Pin 1 N.C.
Pin 2 Hall sensor 2*	Pin 2 $V_{CC}$
Pin 3 $V_{Hall}$ 4.5...18 VDC	Pin 3 GND
Pin 4 Motor winding 3	Pin 4 N.C.
Pin 5 Hall sensor 3*	Pin 5 Channel $\bar{A}$
Pin 6 GND	Pin 6 Channel A
Pin 7 Motor winding 1	Pin 7 Channel $\bar{B}$
Pin 8 Motor winding 2	Pin 8 Channel B
*Internal pull-up (10 kΩ) on pin 3 ( $V_{Hall}$ )	
Connector: 39-28-1083 Molex DIN 41651/EN 60603-13	
Note: Pull-down resistors < 100 kΩ on the encoder outputs are not permitted. Pull-up resistors are permitted, but not required.	

Option  
With Cable and Connector  
(Ambient temperature -20...+100°C)

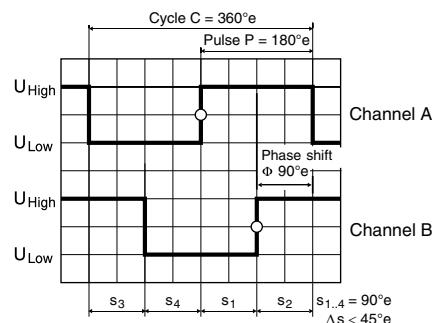
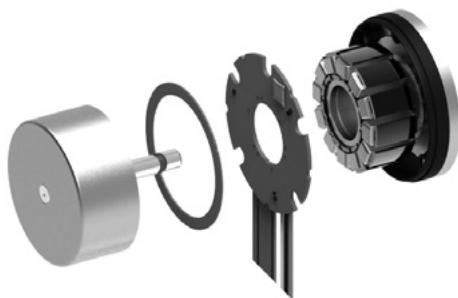
## Pin Allocation



Opt. terminal resistance R = typical 120 Ω  
Capacitor C ≥ 0.1 nF per m line length

**Encoder MILE** 512–4096 CPT, 2 Channels, with Line Driver

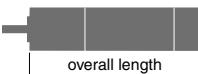
Integrated into motor



Direction of rotation cw (definition cw p. 60)

- █ Stock program
- █ Standard program
- █ Special program (on request)

Type	421965	421966	421967	421968
Counts per turn	512	1024	2048	4096
Number of channels	2	2	2	2
Max. operating frequency (kHz)	500	500	500	500
Max. speed (rpm)	6,000	6,000	6,000	6,000



**maxon Modular System**

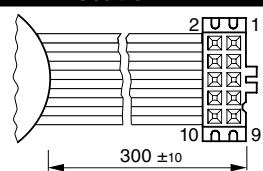
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead			
EC 60 flat, IP00	270					39.0	39.0	39.0	39.0
EC 60 flat, IP00	270	GP 52, 4 - 30 Nm	351			●	●	●	●
EC 60 flat, IP54	270					43.0	43.0	43.0	43.0
EC 60 flat, IP54	270	GP 52, 4 - 30 Nm	351			●	●	●	●

**Technical Data**

Supply voltage $V_{cc}$	$5\text{ V} \pm 10\%$
Typical current draw	$14\text{ mA}$
Output signal	CMOS compatible
State length $s_n$ (1000 rpm)	$90^\circ\text{e} \pm <45^\circ\text{e}$
Signal rise time (typically, at $C_L = 25\text{ pF}$ , $R_L = 1\text{ k}\Omega$ , $25^\circ\text{C}$ )	$100\text{ ns}$
Signal fall time (typically, at $C_L = 25\text{ pF}$ , $R_L = 1\text{ k}\Omega$ , $25^\circ\text{C}$ )	$100\text{ ns}$
Operating temperature range	$-40\text{...}+100^\circ\text{C}$
Moment of inertia of code wheel	$\leq 13\text{ gcm}^2$
Output current per channel	max. $4\text{ mA}$
Open collector output of the Hall sensors with integrated pull-up resistor	$10\text{ k}\Omega \pm 20\%$
Wiring diagram for Hall sensors see p. 43	

Additional information can be found under 'Downloads' in the maxon online shop.

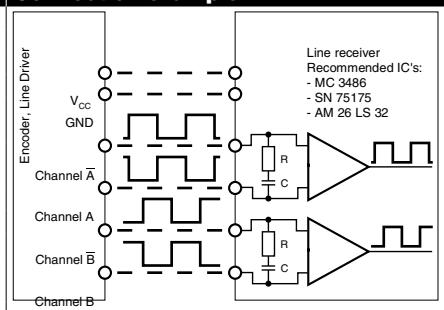
## Pin Allocation



DIN Connector 41651/EN 60603-13  
flat ribbon cable AWG 28

**Note:** Pull-down resistors < 100 kΩ on the encoder outputs are not permitted. Pull-up resistors are permitted, but not required.

## Connection example

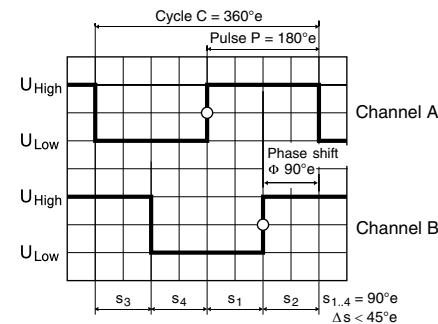
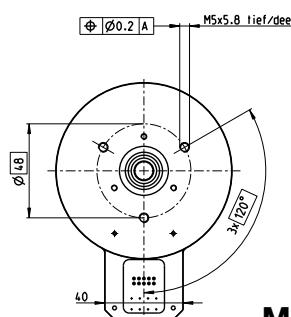
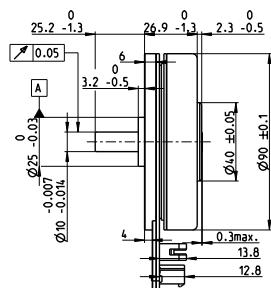
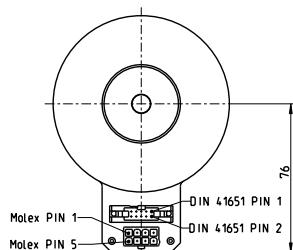


Opt. terminal resistance  $R = \text{typical } 120 \Omega$   
 Capacitor  $C \geq 0.1 \text{ nF per m line length}$

# Encoder MILE 512–6400 CPT, 2 Channels, with Line Driver RS 422

Integrated into motor

maxon sensor

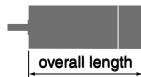


Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Type

Counts per turn	512	800	1024	1600	2048	3200	4096	6400
Number of channels	2	2	2	2	2	2	2	2
Max. operating frequency (kHz)	500	500	500	500	500	500	500	500
Max. speed (rpm)	5000	5000	5000	5000	5000	5000	5000	4650



## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead							
EC 90 flat	271					29.2	29.2	29.2	29.2	29.2	29.2	29.2	
EC 90 flat	271	GP 52, 4 - 30 Nm	351			●	●	●	●	●	●	●	

## Technical Data

Supply voltage V <sub>CC</sub>	5 V ± 10%
Typical current draw	14 mA
Output signal	EIA Standard RS422
driver used:	AM26C31QD
State length s <sub>0</sub> (500 rpm)	90°e ± <45°e
Signal rise and fall times (typically, at C <sub>L</sub> = 120 pF, R <sub>L</sub> = 100 Ω)	20 ns
Operating temperature range	-40...+100°C
Moment of inertia of code wheel	≤ 65 gcm <sup>2</sup>
Output current per channel	min. -20 mA, max. 20 mA
Open collector output of the Hall sensors with integrated pull-up resistor	10 kΩ ± 20%
Wiring diagram for Hall sensors	see p. 43

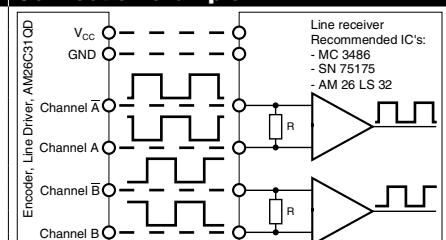
## Pin Allocation

Connection motor		Connection Encoder	
Pin 1	Hall sensor 1*	Pin 1	N.C.
Pin 2	Hall sensor 2*	Pin 2	V <sub>CC</sub>
Pin 3	V <sub>Hall</sub> 4.5...18 VDC	Pin 3	GND
Pin 4	Motor winding 3	Pin 4	N.C.
Pin 5	Hall sensor 3*	Pin 5	Channel Ā
Pin 6	GND	Pin 6	Channel A
Pin 7	Motor winding 1	Pin 7	Channel B̄
Pin 8	Motor winding 2	Pin 8	Channel B

\*Internal pull-up (10 kΩ) on pin 3 (V<sub>Hall</sub>)

Connector:  
39-28-1083 Molex  
DIN 41651/EN 60603-13

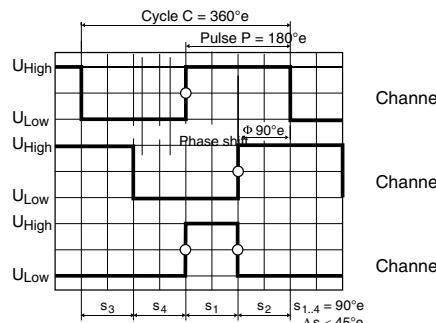
## Connection example



Opt. terminal resistance R = typical 120 Ω

Additional information can be found under 'Downloads' in the maxon online shop.

# Encoder 6 MAG 64–256 CPT, 3 Channels



Direction of rotation cw (definition cw p. 60)

- █ Stock program
- █ Standard program
- █ Special program (on request)

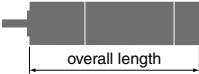
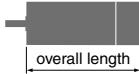
## Type (provisional)

	64	128	256	64	128	256
Counts per turn						
Number of channels	3	3	3	3	3	3
Max. operating frequency (kHz)	64	64	64	64	64	64

Max. speed (rpm)

## Part Numbers

	502804	502805	502806	547012	547013	547014
	100000	50000	25000	100000	50000	25000



## maxon Modular System

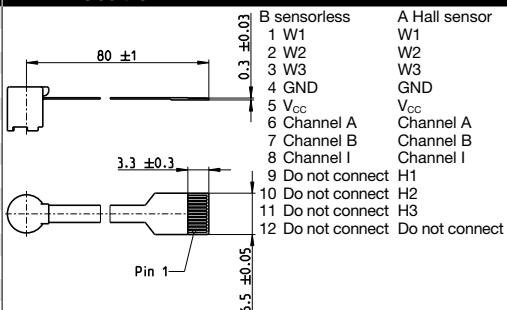
+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead
EC 6, 1.5 W, B	206			6 (8")	23.4 23.4 23.4
EC 6, 1.5 W, B	206	GP 6, 0.002 - 0.03 Nm	309	6 (8")	● ● ●
EC 6, 1.5 W, B	206	GP 6 S	357-358	6 (8")	● ● ●
EC 6, 2.0 W, B	207			6 (8")	23.4 23.4 23.4
EC 6, 2.0 W, B	207	GP 6, 0.002 - 0.03 Nm	309	6 (8")	● ● ●
EC 6, 2.0 W, B	207	GP 6 S	357-358	6 (8")	● ● ●
EC 6, 1.5 W, A	206			6 (8")	23.4 23.4 23.4
EC 6, 1.5 W, A	206	GP 6, 0.002 - 0.03 Nm	309	6 (8")	● ● ●
EC 6, 1.5 W, A	206	GP 6 S	357-358	6 (8")	● ● ●
EC 6, 2.0 W, A	207			6 (8")	23.4 23.4 23.4
EC 6, 2.0 W, A	207	GP 6, 0.002 - 0.03 Nm	309	6 (8")	● ● ●
EC 6, 2.0 W, A	207	GP 6 S	357-358	6 (8")	● ● ●

\*Max diameter of the end cap (incl. extension).

## Technical Data

Supply voltage $V_{CC}$	3 - 3.6 V
Typical current draw	10 mA
Output signal $V_{CC} = 3.3$ VDC	TTL compatible
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Index pulse width	$90^\circ e \pm 45^\circ e$
Operating temperature range	-40...+125 °C
Moment of inertia of code wheel	$\leq 0.001 \text{ gcm}^2$
Output current per channel	$\leq 4 \text{ mA}$

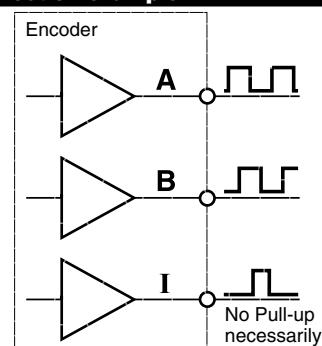
## Pin Allocation



Compatible connector: Molex 52745-1297, Tyco 1-1734839-2  
Adapter: 498157

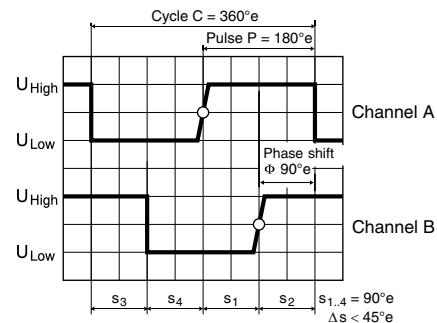
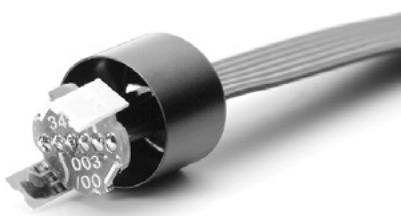
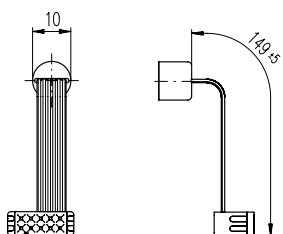
Please note: max. continuous current 0.5 A

## Connection example



# Encoder MEnc 10 12 CPT, 2 Channels

maxon sensor



Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

138061

### Type

Counts per turn <sup>1</sup>	12
Number of channels	2
Max. operating frequency (kHz)	20
Max. speed (rpm)	100 000



### maxon Modular System

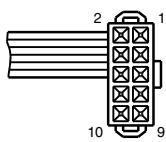
+ Motor	Page	+ Gearhead	Page	Overall length [mm] / ● see Gearhead
RE 10, 0.75 W	101			25.1
RE 10, 0.75 W	101	GP 10, 0.005 - 0.1 Nm	311	●
RE 10, 0.75 W	101	GP 10, 0.01 - 0.15 Nm	312	●
RE 10, 1.5 W	103			32.7
RE 10, 1.5 W	103	GP 10, 0.005 - 0.1 Nm	311	●
RE 10, 1.5 W	103	GP 10, 0.01 - 0.15 Nm	312	●

### Technical Data

Supply voltage V <sub>cc</sub>	3.8 - 24 V
Typical current draw	6 mA
Output signal V <sub>cc</sub> = 5 VDC	TTL compatible
Phase shift $\phi$	90°e ± 45°e
Power input at V <sub>cc</sub> 5 VDC	max. 8 mA
Inertia of the magnetic disc	0.03 gcm <sup>2</sup>
Operating temperature range	-20...+80 °C
Open collector output with integrated pull-up resistance	10 kΩ ± 20%

<sup>1</sup> maxon controllers require a resolution of at least 16 pulses.

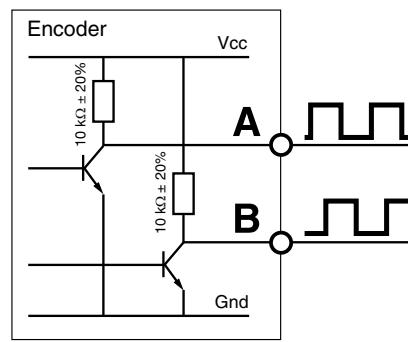
### Pin Allocation



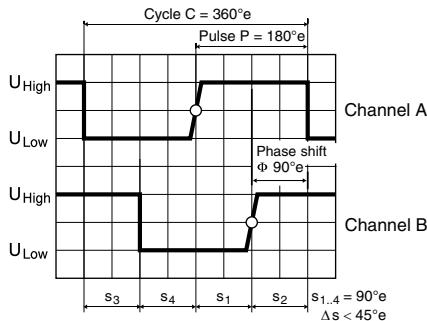
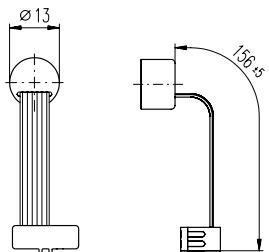
1 Motor +  
2 V<sub>cc</sub>  
3 Channel A  
4 Channel B  
5 GND  
6 Motor -

Pin type DIN 41651/  
EN 60603-13  
(Type 3M 89110-0101 HA)  
flat band cable AWG 28

### Connection example



# Encoder MEnc 13 16 CPT, 2 Channels



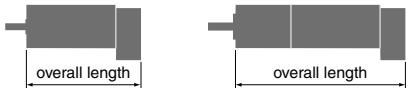
Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

110778

Type	Counts per turn	16
Number of channels	2	
Max. operating frequency (kHz)	20	
Max. speed (rpm)	75000	



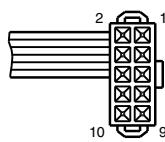
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	Overall length [mm] / ● see Gearhead
RE 13, 0.75 W	106/107			27.0/29.4
RE 13, 0.75 W	107	GP 13, 0.05 - 0.15 Nm	314	●
RE 13, 0.75 W	107	GP 13, 0.2 - 0.35 Nm	315	●
RE 13, 2 W	110/111			39.2/41.6
RE 13, 2 W	111	GP 13, 0.05 - 0.15 Nm	314	●
RE 13, 2 W	111	GP 13, 0.2 - 0.35 Nm	315	●
RE 13, 1.5 W	114/115			30.3/32.7
RE 13, 1.5 W	115	GP 13, 0.05 - 0.15 Nm	314	●
RE 13, 1.5 W	115	GP 13, 0.2 - 0.35 Nm	315	●
RE 13, 3 W	118/119			42.5/44.9
RE 13, 3 W	119	GP 13, 0.05 - 0.15 Nm	314	●
RE 13, 3 W	119	GP 13, 0.2 - 0.35 Nm	315	●
RE 16, 3.2 W	122			46.5
RE 16, 3.2 W	122	GP 16, 0.1 - 0.6 Nm	320/321	●
RE 16, 3.2 W	122	GP 16 S	361/362	●
RE 16, 4.5 W	124			49.7
RE 16, 4.5 W	124	GP 16, 0.1 - 0.6 Nm	320/321	●
RE 16, 4.5 W	124	GP 16 S	361/362	●
A-max 16	140/142			33.5
A-max 16	140/142 GS 16, 0.01 - 0.03 Nm	316/317		●
A-max 16	140/142 GS 16, 0.06 - 0.1 Nm	318/319		●
A-max 16	140/142 GP 16, 0.1 - 0.3 Nm	320		●
A-max 16	140/142 GP 16 S	361/362		●
A-max 19	144/146			36.4/39.0
A-max 19	144/146 GP 19, 0.1 - 0.3 Nm	322		●
A-max 19	144/146 GP 22, 0.5 - 2.0 Nm	325/327		●
A-max 19	144/146 GS 24, 0.1 Nm	331		●
A-max 19	144/146 GP 22 S	364/365		●

## Technical Data

Supply voltage $V_{cc}$	3.8 - 24 V
Typical current draw	6 mA
Output signal $V_{cc} = 5 \text{ VDC}$	TTL compatible
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Power input at $V_{cc} = 5 \text{ VDC}$	max. 8 mA
Inertia of the magnetic disc	0.07 gcm <sup>2</sup>
Operating temperature range	-20...+80 °C
Open collector output with integrated pull-up resistance	10 kΩ ± 20%

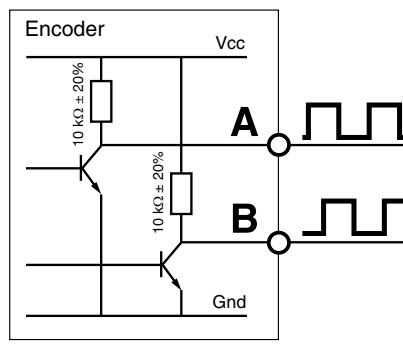
## Pin Allocation



1 Motor +  
2  $V_{cc}$   
3 Channel A  
4 Channel B  
5 GND  
6 Motor -

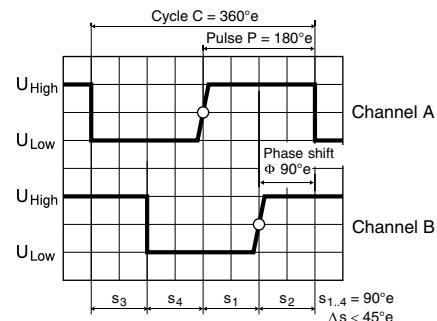
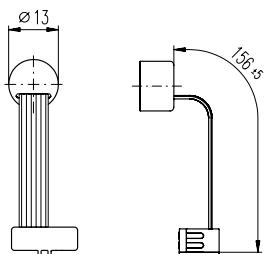
Pin type  
DIN 41651/EN 60603-13  
(Type 3M 89110-0101 HA)  
flat band cable AWG 28

## Connection example



# Encoder MEnc 13 16 CPT, 2 Channels

maxon sensor



Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

110778

### Type

Counts per turn	16
Number of channels	2
Max. operating frequency (kHz)	20
Max. speed (rpm)	75000



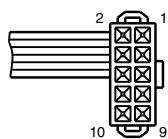
### maxon Modular System

+ Motor	Page	+ Gearhead	Page	Overall length [mm] / ● see Gearhead
A-max 22	148/150			39.0
A-max 22	148/150 GP 22, 0.1 - 0.6 Nm	323/324	●	
A-max 22	148/150 GP 22, 0.5 - 2.0 Nm	325/327	●	
A-max 22	148/150 GS 24, 0.1 Nm	331	●	
A-max 22	148/150 GP 22 S	364/365	●	
A-max 26	152-158			51.8
A-max 26	152-158 GP 26, 0.75 - 4.5 Nm	332	●	
A-max 26	152-158 GS 30, 0.07 - 0.2 Nm	333	●	
A-max 26	152-158 GP 32, 0.75 - 4.5 Nm	334	●	
A-max 26	152-158 GP 32, 0.75 - 6.0 Nm	335	●	
A-max 26	152-158 GS 38, 0.1 - 0.6 Nm	344	●	
A-max 26	152-158 GP 32 S	366-368	●	

### Technical Data

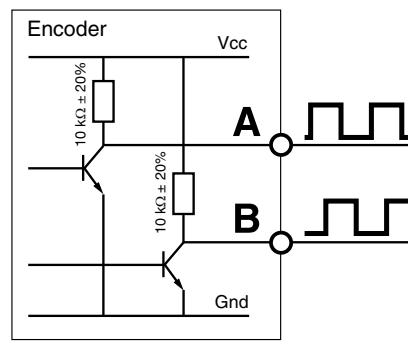
Supply voltage $V_{CC}$	3.8 - 24 V
Typical current draw	6 mA
Output signal $V_{CC} = 5$ VDC	TTL compatible
Phase shift $\phi$	$90^\circ e \pm 45^\circ e$
Power input at $V_{CC}$ 5 VDC	max. 8 mA
Inertia of the magnetic disc	0.07 gcm <sup>2</sup>
Operating temperature range	-20...+80 °C
Open collector output with integrated pull-up resistance	10 kΩ ± 20%

### Pin Allocation

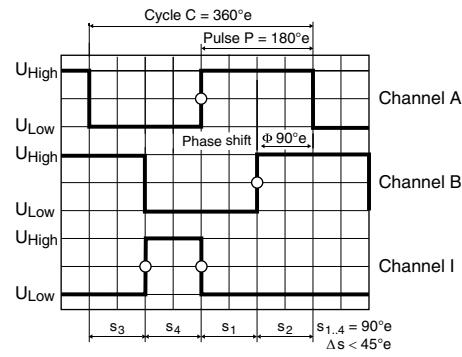
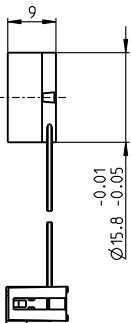


Pin type  
DIN 41651/EN 60603-13  
(Type 3M 89110-0101 HA)  
flat band cable AWG 28

### Connection example



# Encoder 16 EASY 128–1024 CPT, 3 Channels, with Line Driver RS 422



- Stock program
- Standard program
- Special program (on request)

## Type (provisional)

	128	256	500	512	1000	1024
Counts per turn						
Number of channels	3	3	3	3	3	3
Max. operating frequency (kHz)	200	400	800	800	1600	1600
Max. speed (rpm)	30000	30000	30000	30000	30000	30000
Phase shift $\phi$ (°e)	90 ± 45	90 ± 45	90 ± 60	90 ± 45	90 ± 80	90 ± 70
Index pulse width (°e)	90 ± 45	90 ± 45	90 ± 60	90 ± 45	90 ± 80	90 ± 70



## Part Numbers

499356	499357	499358	499359	499360	499361
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## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
EC-4-pole 22, 90 W	237					60.8 60.8 60.8 60.8 60.8 60.8
EC-4-pole 22, 90 W	237	GP 22/GP 32	329/339			● ● ● ● ● ●
EC-4-pole 22, 90 W	237	GP 32 S	366-368			● ● ● ● ● ●
EC-4-pole 22, 120 W	238					78.2 78.2 78.2 78.2 78.2 78.2
EC-4-pole 22, 120 W	238	GP 22/GP 32	329/339			● ● ● ● ● ●
EC-4-pole 22, 120 W	238	GP 32 S	366-368			● ● ● ● ● ●
EC-4-pole 30, 100 W	239					60.9 60.9 60.9 60.9 60.9 60.9
EC-4-pole 30, 100 W	239	GP 32, 4.0 - 8.0 Nm	341			● ● ● ● ● ●
EC-4-pole 30, 100 W	239	GP 42, 3 - 15 Nm	346			● ● ● ● ● ●
EC-4-pole 30, 100 W	239					● ● ● ● ● ●
EC-4-pole 30, 100 W	239	GP 32, 4.0 - 8.0 Nm	341			● ● ● ● ● ●
EC-4-pole 30, 100 W	239	GP 42, 3 - 15 Nm	346			● ● ● ● ● ●
EC-4-pole 30, 200 W	241					77.9 77.9 77.9 77.9 77.9 77.9
EC-4-pole 30, 200 W	241	GP 32, 4.0 - 8.0 Nm	341			● ● ● ● ● ●
EC-4-pole 30, 200 W	241	GP 42, 3 - 15 Nm	346			● ● ● ● ● ●
EC-4-pole 30, 200 W	241					● ● ● ● ● ●
EC-4-pole 30, 200 W	241	GP 32, 4.0 - 8.0 Nm	341			● ● ● ● ● ●
EC-4-pole 30, 200 W	241	GP 42, 3 - 15 Nm	346			● ● ● ● ● ●
EC-i 40, 50 W	247/248					37.7 37.7 37.7 37.7 37.7 37.7
EC-i 40, 50 W	247	GP 32, 1 - 6 Nm	339			● ● ● ● ● ●
EC-i 40, 50 W	247	GP 32 S	366-368			● ● ● ● ● ●
EC-i 40, 50 W	247/248	GP 42, 3 - 15 Nm	346			● ● ● ● ● ●
EC-i 40, 70 W	249/250					47.7 47.7 47.7 47.7 47.7 47.7
EC-i 40, 70 W	249	GP 32, 1 - 6 Nm	339			● ● ● ● ● ●
EC-i 40, 70 W	249	GP 32 S	366-368			● ● ● ● ● ●
EC-i 40, 70 W	249/250	GP 42, 3 - 15 Nm	346			● ● ● ● ● ●
EC-i 40, 100 W	251					67.7 67.7 67.7 67.7 67.7 67.7
EC-i 40, 100 W	251	GP 42, 3 - 15 Nm	346			● ● ● ● ● ●
EC-i 52, 180 W	252					93.7 93.7 93.7 93.7 93.7 93.7
EC-i 52, 180 W	252	GP 52, 4 - 30 Nm	354			● ● ● ● ● ●

## Technical Data

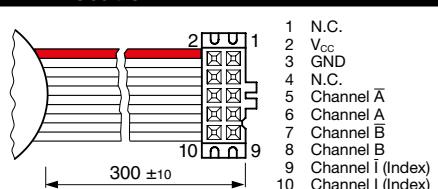
Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	22 mA
Output signal	EIA Standard RS 422
Operating temperature range	-40...+100 °C
Moment of inertia of code wheel	≤ 0.09 gcm²
Output current per channel	± 20 mA
Hysteresis	0.17 °m
Min. state duration s	125 ns
Signal rise and fall times (typically, at $C_L = 200 \text{ pF}$ , $R_L = 100 \Omega$ )	20 ns

The angle value 0 is matched to the commutation phase of winding 1 (in acc. with Hall 1 signal on motors with Hall sensors, block commutation), see p. 40.

Additional information can be found in the maxon online shop under downloads.

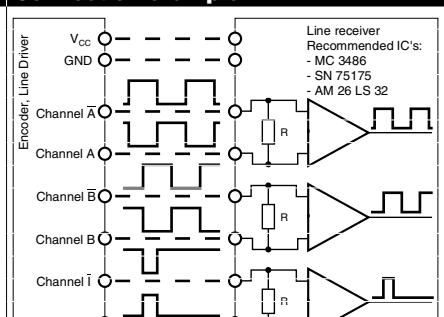
The index signal I is synchronized with channel A or B.

## Pin Allocation



DIN Connector 41651/  
EN 60603-13  
flat band cable AWG 28

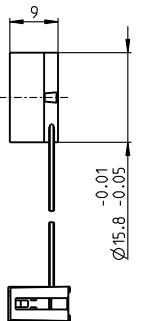
## Connection example



Opt. terminal resistance R = typical 120 Ω

# Encoder 16 EASY Absolute 4096 steps, Single Turn

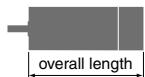
maxon sensor



- Stock program
- Standard program
- Special program (on request)

## Type (provisional)

Steps per turn	4096	4096
Resolution (bit single turn)	12	12
Signal protocol	BiSS-C	SSI
Max. mech. speed (rpm)	30000	30000
Data encoding	Binary	Gray Symmetric
Min. clock frequency CLK (MHz)	0.6	0.04
Max. clock frequency CLK (MHz)	10	4
Timeout (μs)	2	16



## maxon Modular System

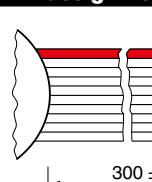
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
EC-4-pole 22, 90 W	237					60.8 60.8
EC-4-pole 22, 90 W	237	GP 22/GP 32	329/339			● ●
EC-4-pole 22, 90 W	237	GP 32 S	366-368			● ●
EC-4-pole 22, 120 W	238					78.2 78.2
EC-4-pole 22, 120 W	238	GP 22/GP 32	329/339			● ●
EC-4-pole 22, 120 W	238	GP 32 S	366-368			● ●
EC-4-pole 30, 100 W	239					60.9 60.9
EC-4-pole 30, 100 W	239	GP 32, 4.0 - 8.0 Nm	341			● ●
EC-4-pole 30, 100 W	239	GP 42, 3 - 15 Nm	346			● ●
EC-4-pole 30, 100 W	239					● ●
EC-4-pole 30, 100 W	239	GP 32, 4.0 - 8.0 Nm	341			● ●
EC-4-pole 30, 100 W	239	GP 42, 3 - 15 Nm	346			● ●
EC-4-pole 30, 200 W	241					77.9 77.9
EC-4-pole 30, 200 W	241	GP 32, 4.0 - 8.0 Nm	341			● ●
EC-4-pole 30, 200 W	241	GP 42, 3 - 15 Nm	346			● ●
EC-4-pole 30, 200 W	241					● ●
EC-4-pole 30, 200 W	241	GP 32, 4.0 - 8.0 Nm	341			● ●
EC-4-pole 30, 200 W	241	GP 42, 3 - 15 Nm	346			● ●
EC-i 40, 50 W	247/248					37.7 37.7
EC-i 40, 50 W	247	GP 32, 1 - 6 Nm	339			● ●
EC-i 40, 50 W	247	GP 32 S	366-368			● ●
EC-i 40, 50 W	247/248	GP 42, 3 - 15 Nm	346			● ●
EC-i 40, 70 W	249/250					47.7 47.7
EC-i 40, 70 W	249	GP 32, 1 - 6 Nm	339			● ●
EC-i 40, 70 W	249	GP 32 S	366-368			● ●
EC-i 40, 70 W	249/250	GP 42, 3 - 15 Nm	346			● ●
EC-i 40, 100 W	251					67.7 67.7
EC-i 40, 100 W	251	GP 42, 3 - 15 Nm	346			● ●
EC-i 52, 180 W	252					93.7 93.7
EC-i 52, 180 W	252	GP 52, 4 - 30 Nm	354			● ●

## Technical data

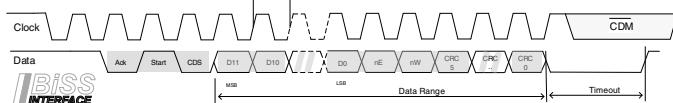
Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	17 mA
Output signal	CMOS compatible
Output current, data	max. 20 mA
Current draw, typ. (no load)	17 mA
Setup time after Power On	max. 4 ms
Hysteresis	0.17° mech
Moment of inertia of code wheel	$\leq 0.09 \text{ gcm}^2$
Operating temperature range	-40...+100°C

The angle value 0 is matched to the commutation phase of winding 1 (in acc. with Hall 1 signal on motors with Hall sensors, block commutation), see p. 40.

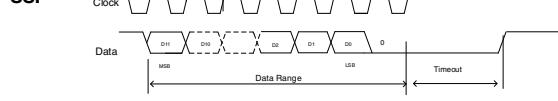
## Pin assignment



## BiSS-C



## SSI



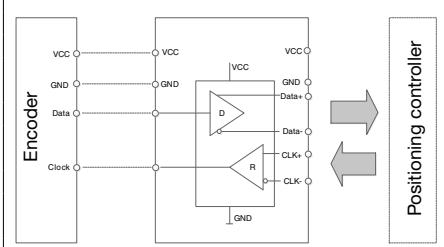
Angle values increase when direction of rotation is cw (definition of 'cw' on p. 60)

## Part numbers

488783      488782

## Connection example

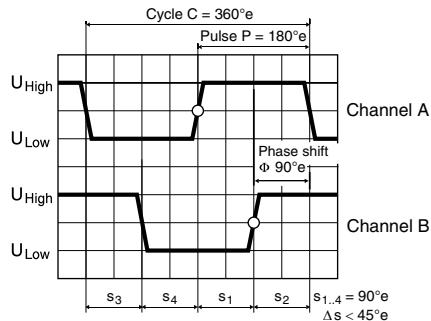
Adapter EASY Absolute 488167



Additional information can be found under 'Downloads' in the maxon online shop.

Adapter EASY Absolute 488167  
(required for all maxon controllers).

# Encoder MR Type S, 16 CPT, 2 Channels



Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

201933 | 224702

### Type

Counts per turn	16	16				
Number of channels	2	2				
Max. operating frequency (kHz)	8	8				
Max. speed (rpm)	30000	30000				



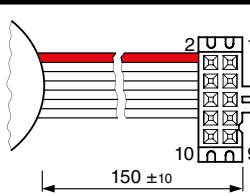
### maxon Modular System

+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead
RE 10, 0.75 W	101			10	22.8
RE 10, 0.75 W	101	GP 10, 0.005 - 0.15 Nm	311/312	10	●
RE 10, 1.5 W	103			10	30.4
RE 10, 1.5 W	103	GP 10, 0.005 - 0.15 Nm	311/312	10	●
RE 13, 0.75 W	106			13	26.3
RE 13, 0.75 W	107			13	28.7
RE 13, 0.75 W	107	GP 13, 0.05 - 0.15 Nm	314	13	●
RE 13, 0.75 W	107	GP 13, 0.2 - 0.35 Nm	315	13	●
RE 13, 2 W	110			13	38.5
RE 13, 2 W	111			13	40.9
RE 13, 2 W	111	GP 13, 0.05 - 0.15 Nm	314	13	●
RE 13, 2 W	111	GP 13, 0.2 - 0.35 Nm	315	13	●
RE 13, 1.5 W	114			13	28.4
RE 13, 1.5 W	115			13	30.8
RE 13, 1.5 W	115	GP 13, 0.05 - 0.15 Nm	314	13	●
RE 13, 1.5 W	115	GP 13, 0.2 - 0.35 Nm	315	13	●
RE 13, 3 W	118			13	40.6
RE 13, 3 W	119			13	43.0
RE 13, 3 W	119	GP 13, 0.05 - 0.15 Nm	314	13	●
RE 13, 3 W	119	GP 13, 0.2 - 0.35 Nm	315	13	●
A-max 12, 0.5 W	138			12	25.3
A-max 12, 0.5 W	138	GP 10, 0.01 - 0.15 Nm	312	12	●
A-max 12, 0.5 W	138	GS 12, 0.01 - 0.03 Nm	313	12	●
A-max 12, 0.5 W	138	GP 13, 0.05 - 0.15 Nm	314	12	●
A-max 12, 0.5 W	138	GP 13, 0.2 - 0.35 Nm	315	12	●
RE-max 13, 0.75 W	166			13	25.2
RE-max 13, 0.75 W	166	GP 13, 0.05 - 0.15 Nm	314	13	●
RE-max 13, 0.75 W	166	GP 13, 0.2 - 0.35 Nm	315	13	●
RE-max 13, 2 W	168			13	36.2
RE-max 13, 2 W	168	GP 13, 0.05 - 0.15 Nm	314	13	●
RE-max 13, 2 W	168	GP 13, 0.2 - 0.35 Nm	315	13	●

### Technical Data

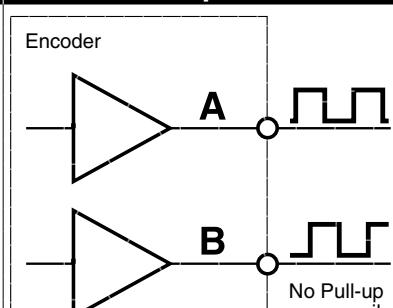
Supply voltage $V_{cc}$	2.7 - 5.5 V
Typical current draw	7 mA
Output signal $V_{cc} = 5$ VDC	TTL compatible
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Operating temperature range	-25...+85°C
Moment of inertia of code wheel	$\leq 0.005 \text{ gcm}^2$
Output current per channel	max. 5 mA

### Pin Allocation



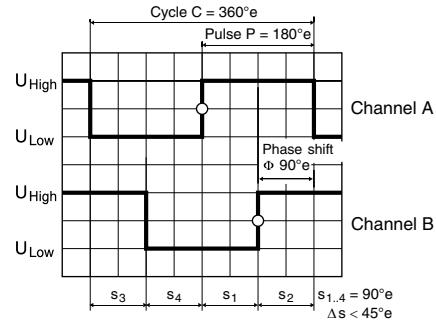
1 Motor +  
2  $U_{High}$   
3  $U_{Low}$   
4 Channel A  
5 GND  
6 Motor -  
10  $U_{High}$   
9  $U_{Low}$   
DIN Connector 41651/  
EN 60603-13  
flat band cable AWG 28

### Connection example



# Encoder MR Type S, 64–256 CPT, 2 Channels, with Line Driver

maxon sensor



- Stock program
- Standard program
- Special program (on request)

## Type

	Counts per turn	64	64	100	128	128	256	256
Number of channels		2	2	2	2	2	2	2
Max. operating frequency (kHz)		80	80	100	160	160	320	320
Max. speed (rpm)		75000	75000	60000	75000	75000	75000	75000



## Part Numbers

323049 | 323050 | 334910 | 323051 | 323052 | 323053 | 323054

## maxon Modular System

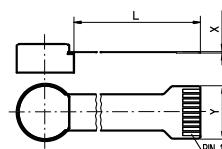
+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead
RE 8, 0.5 W, A	99			8	22.6
RE 8, 0.5 W, A	99	GP 8, 0.01 - 0.1 Nm	310	8	
RE 8, 0.5 W, A	99	GP 8 S	359-360	8	
RE 10, 0.75 W	101			10	22.8
RE 10, 0.75 W	101	GP 10, 0.005 - 0.15 Nm	311/312	10	22.8
RE 10, 1.5 W	103			10	30.4
RE 10, 1.5 W	103	GP 10, 0.005 - 0.15 Nm	311/312	10	30.4
RE 13, 0.75 W	106			13	26.3
RE 13, 0.75 W	107			13	28.7
RE 13, 0.75 W	107	GP 13, 0.05 - 0.15 Nm	314	13	28.7
RE 13, 0.75 W	107	GP 13, 0.2 - 0.35 Nm	315	13	30.4
RE 13, 2 W	110			13	38.5
RE 13, 2 W	111			13	40.9
RE 13, 2 W	111	GP 13, 0.05 - 0.15 Nm	314	13	40.9
RE 13, 2 W	111	GP 13, 0.2 - 0.35 Nm	315	13	40.9
RE 13, 1.5 W	114			13	28.4
RE 13, 1.5 W	115			13	30.8
RE 13, 1.5 W	115	GP 13, 0.05 - 0.15 Nm	314	13	30.8
RE 13, 1.5 W	115	GP 13, 0.2 - 0.35 Nm	315	13	30.8
RE 13, 3 W	118			13	40.6
RE 13, 3 W	119			13	43.0
RE 13, 3 W	119	GP 13, 0.05 - 0.15 Nm	314	13	43.0
RE 13, 3 W	119	GP 13, 0.2 - 0.35 Nm	315	13	43.0
A-max 12, 0.5 W	138			12	25.3
A-max 12, 0.5 W	138	GP 10, 0.01 - 0.15 Nm	312	12	25.3
A-max 12, 0.5 W	138	GS 12, 0.01 - 0.03 Nm	313	12	25.3
A-max 12, 0.5 W	138	GP 13, 0.05 - 0.15 Nm	314	12	25.3
A-max 12, 0.5 W	138	GP 13, 0.2 - 0.35 Nm	315	12	25.3
RE-max 13, 0.75 W	166			13	25.2
RE-max 13, 0.75 W	166	GP 13, 0.05 - 0.15 Nm	314	13	25.2
RE-max 13, 0.75 W	166	GP 13, 0.2 - 0.35 Nm	315	13	25.2
RE-max 13, 2 W	168			13	36.2
RE-max 13, 2 W	168	GP 13, 0.05 - 0.15 Nm	314	13	36.2
RE-max 13, 2 W	168	GP 13, 0.2 - 0.35 Nm	315	13	36.2

## Technical Data

Supply voltage $V_{CC}$	5 V ± 5%
Typical current draw	11 mA
Output signal	TTL compatible
Phase shift $\Phi$	90°e ± 45°e
Operating temperature range	-25...+85°C
Moment of inertia of code wheel	≤ 0.005 gcm²
Output current per channel	max. 5 mA

## Pin Allocation

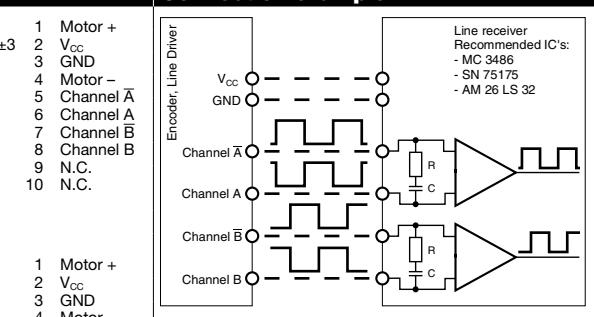
**Part Numbers 323049–323054**  
Pin 1–10 / X = 0.3 ± 0.05 / Y = 11 –0.1 / L = 80 ± 3  
Compatible connector:  
Molex 52207-1033, Tyco 1-84953-0  
Pitch 1.0 mm, top contact style



## Part Numbers 334910

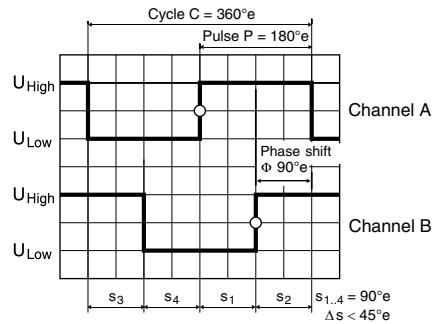
Pin 1–8 / X = 0.3 ± 0.03 / Y = 4.5 ± 0.07 / L = 84 ± 3  
Compatible connector:  
Molex 52745-0833

## Connection example



Terminal resistance R = typical 120 Ω  
Capacitor C ≥ 0.1 nF per m line length

# Encoder MR Type S, 64–256 CPT, 2 Channels

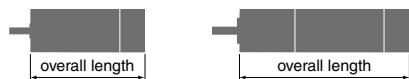


Direction of rotation cw (definition cw p. 60)

- █ Stock program
- █ Standard program
- █ Special program (on request)

## Type

	Counts per turn	64	128	256
	Number of channels	2	2	2
	Max. operating frequency (kHz)	80	160	320
	Max. speed (rpm)	75 000	75 000	75 000



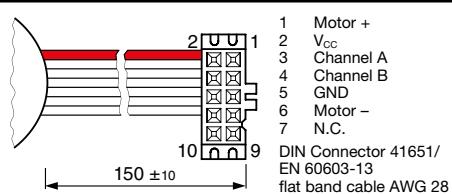
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead
RE 13, 0.75 W	106			13	26.3 26.3 26.3
RE 13, 0.75 W	107			13	28.7 28.7 28.7
RE 13, 0.75 W	107	GP 13, 0.05 - 0.15 Nm	314	13	● ● ●
RE 13, 0.75 W	107	GP 13, 0.2 - 0.35 Nm	315	13	● ● ●
RE 13, 2 W	110			13	38.5 38.5 38.5
RE 13, 2 W	111			13	40.9 40.9 40.9
RE 13, 2 W	111	GP 13, 0.05 - 0.15 Nm	314	13	● ● ●
RE 13, 2 W	111	GP 13, 0.2 - 0.35 Nm	315	13	● ● ●
RE 13, 1.5 W	114			13	28.4 28.4 28.4
RE 13, 1.5 W	115			13	30.8 30.8 30.8
RE 13, 1.5 W	115	GP 13, 0.05 - 0.15 Nm	314	13	● ● ●
RE 13, 1.5 W	115	GP 13, 0.2 - 0.35 Nm	315	13	● ● ●
RE 13, 3 W	118			13	40.6 40.6 40.6
RE 13, 3 W	119			13	43.0 43.0 43.0
RE 13, 3 W	119	GP 13, 0.05 - 0.15 Nm	314	13	● ● ●
RE 13, 3 W	119	GP 13, 0.2 - 0.35 Nm	315	13	● ● ●
RE-max 13, 0.75 W	166			13	25.2 25.2 25.2
RE-max 13, 0.75 W	166	GP 13, 0.05 - 0.15 Nm	314	13	● ● ●
RE-max 13, 0.75 W	166	GP 13, 0.2 - 0.35 Nm	315	13	● ● ●
RE-max 13, 2 W	168			13	36.2 36.2 36.2
RE-max 13, 2 W	168	GP 13, 0.05 - 0.15 Nm	314	13	● ● ●
RE-max 13, 2 W	168	GP 13, 0.2 - 0.35 Nm	315	13	● ● ●

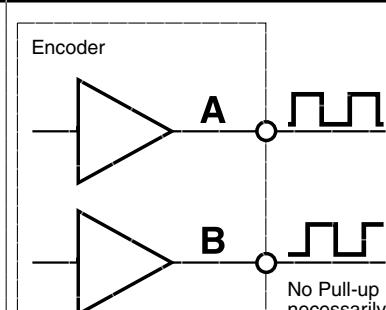
## Technical Data

Supply voltage $V_{cc}$	5 V ± 5%
Typical current draw	11 mA
Output signal	TTL compatible
Phase shift $\Phi$	90°e ± 45°e
Operating temperature range	-25...+85°C
Moment of inertia of code wheel	≤ 0.005 gcm²
Output current per channel	max. 5 mA

## Pin Allocation

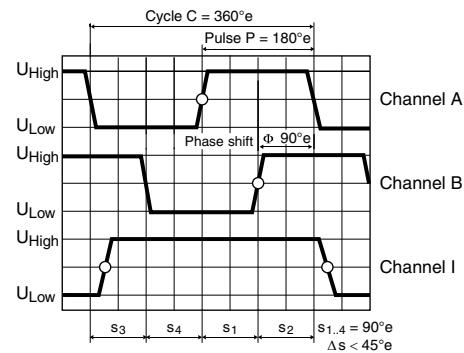


## Connection example



# Encoder MR Type M, 32 CPT, 2/3 Channels

maxon sensor



- Stock program
- Standard program
- Special program (on request)

## Part Numbers

201935	201938
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### Type

Counts per turn	32	32
Number of channels	2	3
Max. operating frequency (kHz)	8	8
Max. speed (rpm)	15 000	15 000



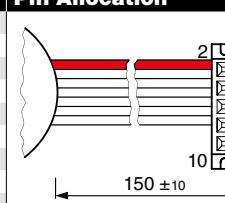
### maxon Modular System

+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead
RE 16, 2 W	120			16	28.0 28.0
RE 16, 2 W	120	GP 16, 0.1 - 0.6 Nm	320/321	16	● ●
RE 16, 2 W	120	GP 16 S	361/362	16	● ●
RE 16, 3.2 W	122			16	45.4 45.4
RE 16, 3.2 W	122	GP 16, 0.1 - 0.6 Nm	320/321	16	● ●
RE 16, 3.2 W	122	GP 16 S	361/362	16	● ●
RE 16, 4.5 W	124			16	48.4 48.4
RE 16, 4.5 W	124	GP 16, 0.1 - 0.6 Nm	320/321	16	● ●
RE 16, 4.5 W	124	GP 16 S	361/362	16	● ●
A-max 16	140/142			16	30.4 30.4
A-max 16	140/142 GS 16, 0.01 - 0.1 Nm	316-319		16	● ●
A-max 16	140/142 GP 16, 0.1 - 0.3 Nm	320		16	● ●
A-max 16	140/142 GP 16 S	361/362		16	● ●
A-max 19, 1.5 W	144			19	34.0 34.0
A-max 19, 1.5 W	144	GP 19, 0.1 - 0.3 Nm	322	19	● ●
A-max 19, 1.5 W	144	GP 22, 0.5 - 2.0 Nm	327	19	● ●
A-max 19, 1.5 W	144	GS 24, 0.1 Nm	331	19	● ●
A-max 19, 1.5 W	144	GP 22 S	364/365	19	● ●
A-max 19, 2.5 W	146			19	35.8 35.8
A-max 19, 2.5 W	146	GP 19, 0.1 - 0.3 Nm	322	19	● ●
A-max 19, 2.5 W	146	GP 22, 0.5 - 2.0 Nm	327	19	● ●
A-max 19, 2.5 W	146	GS 24, 0.1 Nm	331	19	● ●
A-max 19, 2.5 W	146	GP 22 S	364/365	19	● ●
A-max 22	148/150			22	36.9 36.9
A-max 22	148/150 GP 22, 0.1 - 0.6 Nm	323/324		22	● ●
A-max 22	148/150 GP 22, 0.5 - 2.0 Nm	323-327		22	● ●
A-max 22	148/150 GS 24, 0.1 Nm	331		22	● ●
A-max 22	148/150 GP 22 S	364/365		22	● ●

### Technical Data

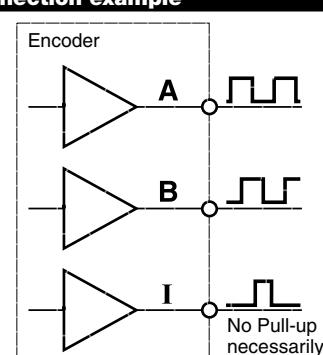
Supply voltage $V_{cc}$	2.7 - 5.5 V
Typical current draw 2 channel	6 mA
Typical current draw 3 channel	9 mA
Output signal $V_{cc} = 5$ VDC	TTL compatible
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Operating temperature range	-25...+85 °C
Moment of inertia of code wheel	$\leq 0.09$ gcm <sup>2</sup>
Output current per channel	max. 5 mA

### Pin Allocation



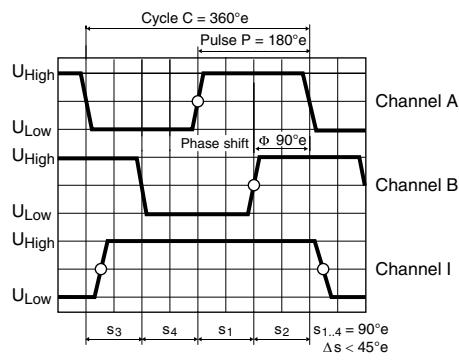
1 Motor +  
2  $V_{cc}$   
3 Channel A  
4 Channel B  
5 GND  
6 Motor -  
7\* Channel I (Index)  
DIN Connector 41651/  
EN 60603-13  
flat band cable AWG 28  
\*version with 3 channels

### Connection example



The index signal I is not synchronized with channel A or B.  
The length of the index signal can last more than one cycle.

# Encoder MR Type M, 32 CPT, 2/3 Channels

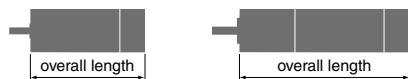


Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Type

	32	32
Counts per turn	32	32
Number of channels	2	3
Max. operating frequency (kHz)	8	8
Max. speed (rpm)	15 000	15 000



## Part Numbers

201935	201938
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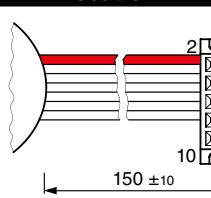
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm]	/ ● see Gearhead
RE-max 21, 3.5 W	170			21	34.0	34.0
RE-max 21, 3.5 W	170	GP 22, 0.5 - 2.0 Nm	325/327	21		●
RE-max 21, 3.5 W	170	GS 38, 0.1 - 0.6 Nm	344	21		●
RE-max 21, 3.5 W	170	GP 22 S	364/365	21		●
RE-max 21, 6 W	172			21	35.8	35.8
RE-max 21, 6 W	172	GP 22, 0.5 - 2.0 Nm	325/327	21		●
RE-max 21, 6 W	172	GS 38, 0.1 - 0.6 Nm	344	21		●
RE-max 21, 6 W	172	GP 22 S	364/365	21		●

## Technical Data

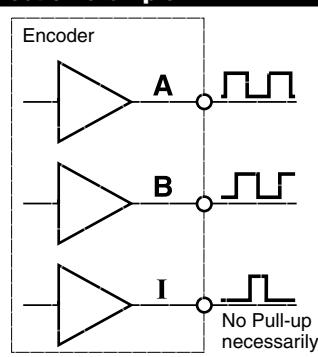
Supply voltage $V_{cc}$	2.7 – 5.5 V
Typical current draw 2 channel	6 mA
Typical current draw 3 channel	9 mA
Output signal $V_{cc} = 5$ VDC	TTL compatible
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Operating temperature range	-25...+85 °C
Moment of inertia of code wheel	$\leq 0.09$ gcm <sup>2</sup>
Output current per channel	max. 5 mA

## Pin Allocation



1 Motor +  
2  $V_{cc}$   
3 Channel A  
4 Channel B  
5 GND  
6 Motor -  
7\* Channel I (Index)  
  
DIN Connector 41651/  
EN 60603-13  
flat band cable AWG 28  
\*version with 3 channels

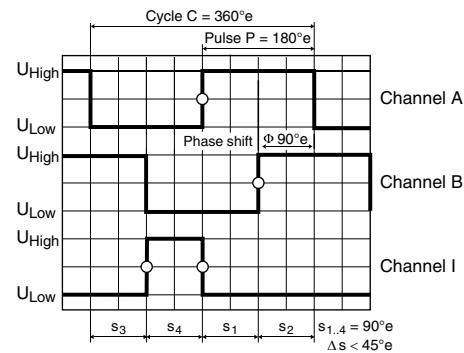
## Connection example



The index signal I is not synchronized with channel A or B.  
The length of the index signal can last more than one cycle.

# Encoder MR Type M, 128–512 CPT, 2/3 Channels, with Line Driver

maxon sensor



- Stock program
- Standard program
- Special program (on request)

## Type

	Counts per turn	128	128	256	256	512	512
Number of channels	2	3	2	3	2	3	
Max. operating frequency (kHz)	80	80	160	160	320	320	
Max. speed (rpm)	37500	37500	37500	37500	37500	37500	



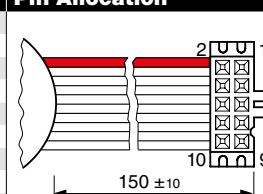
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm]	/ ● see Gearhead	
RE 16, 2 W	120			16	28.0	28.0	28.0
RE 16, 2 W	120	GP 16, 0.1 - 0.6 Nm	320/321	16	●	●	●
RE 16, 2 W	120	GP 16 S	361/362	16	●	●	●
RE 16, 3.2 W	122			16	45.4	45.4	45.4
RE 16, 3.2 W	122	GP 16, 0.1 - 0.6 Nm	320/321	16	●	●	●
RE 16, 3.2 W	122	GP 16 S	361/362	16	●	●	●
RE 16, 4.5 W	124			16	48.4	48.4	48.4
RE 16, 4.5 W	124	GP 16, 0.1 - 0.6 Nm	320/321	16	●	●	●
RE 16, 4.5 W	124	GP 16 S	361/362	16	●	●	●
A-max 16	140/142			16	30.4	30.4	30.4
A-max 16	140/142 GS 16, 0.01 - 0.1 Nm	316-319		16	●	●	●
A-max 16	140/142 GP 16, 0.1 - 0.6 Nm	320/321		16	●	●	●
A-max 16	140/142 GP 16 S	361/362		16	●	●	●
A-max 19, 1.5 W	144			19	34.0	34.0	34.0
A-max 19, 1.5 W	144	GP 19, 0.1 - 0.3 Nm	322	19	●	●	●
A-max 19, 1.5 W	144	GP 22, 0.5 - 2.0 Nm	325/327	19	●	●	●
A-max 19, 1.5 W	144	GS 24, 0.1 Nm	331	19	●	●	●
A-max 19, 1.5 W	144	GP 22 S	364/365	19	●	●	●
A-max 19, 2.5 W	146			19	35.8	35.8	35.8
A-max 19, 2.5 W	146	GP 19, 0.1 - 0.3 Nm	322	19	●	●	●
A-max 19, 2.5 W	146	GP 22, 0.5 - 2.0 Nm	325/327	19	●	●	●
A-max 19, 2.5 W	146	GS 24, 0.1 Nm	331	19	●	●	●
A-max 19, 2.5 W	146	GP 22 S	364/365	19	●	●	●
A-max 22	148/150			22	36.9	36.9	36.9
A-max 22	148/150 GP 22, 0.1 - 0.6 Nm	323/324		22	●	●	●
A-max 22	148/150 GP 22, 0.5 - 2.0 Nm	325/327		22	●	●	●
A-max 22	148/150 GS 24, 0.1 Nm	331		22	●	●	●
A-max 22	148/150 GP 22 S	364/365		22	●	●	●

## Technical Data

Supply voltage $V_{cc}$	5 V ± 5%
Typical current draw 2 channel	11 mA
Typical current draw 3 channel	14 mA
Output signal	TTL compatible
Phase shift $\phi$	90°e ± 45°e
Index pulse width	90°e ± 45°e
Operating temperature range	-25...+85 °C
Moment of inertia of code wheel	≤ 0.09 gcm²
Output current per channel	max. 5 mA

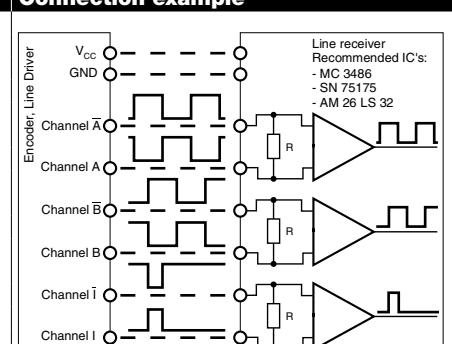
## Pin Allocation



1 Motor +  
2  $V_{cc}$   
3 GND  
4 Motor -  
5 Channel A  
6 Channel A  
7 Channel B  
8 Channel B  
9\* Channel I (Index)  
10\* Channel I (Index)

DIN Connector 41651/  
EN 60603-13  
flat band cable AWG 28  
version with 3 channels

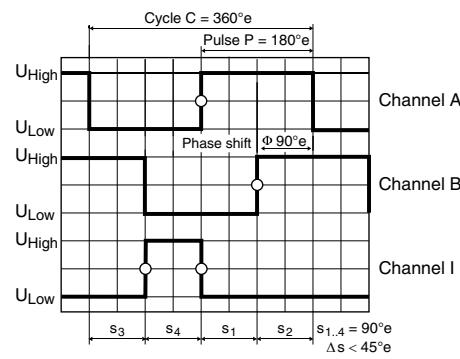
## Connection example



The index signal I is synchronized with channel A or B.

Opt. terminal resistance  $R > 1 \text{ k}\Omega$

**Encoder MR** Type M, 128–512 CPT, 2/3 Channels, with Line Driver



Direction of rotation cw (definition cw p. 60)

-  Stock program
-  Standard program
-  Special program (on request)

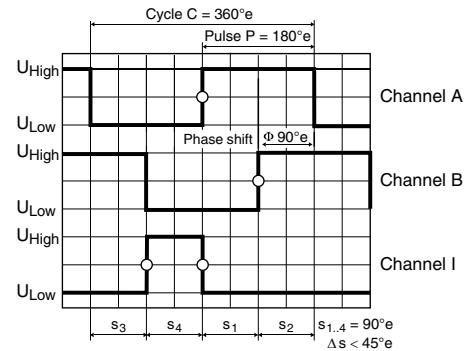
**maxon Modular System**

+ Motor		Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead					
RE-max 21, 3.5 W	170	GP 22, 0.5 - 2.0 Nm	325/327	19	34.0	34.0	34.0	34.0	34.0	34.0	34.0
RE-max 21, 3.5 W	170	GS 38, 0.1 - 0.6 Nm	344	19	●	●	●	●	●	●	●
RE-max 21, 3.5 W	170	GP 22 S	364/365	19	●	●	●	●	●	●	●
RE-max 21, 6 W	172	GP 22, 0.5 - 2.0 Nm	325/327	19	35.8	35.8	35.8	35.8	35.8	35.8	35.8
RE-max 21, 6 W	172	GS 38, 0.1 - 0.6 Nm	344	19	●	●	●	●	●	●	●
RE-max 21, 6 W	172	GP 22 S	364/365	19	●	●	●	●	●	●	●
EC 16, 30 W	212			16	50.7	50.7	50.7	50.7	50.7	50.7	50.7
EC 16, 30 W	212	GP 16, 0.1 - 0.6 Nm	320/321	16	●	●	●	●	●	●	●
EC 16, 30 W	212	GP 22, 0.5 - 1.0 Nm	325	16	●	●	●	●	●	●	●
EC 16, 30 W	212	GP 16 S	361/362	16	●	●	●	●	●	●	●
EC 16, 60 W	213			16	66.7	66.7	66.7	66.7	66.7	66.7	66.7
EC 16, 60 W	213	GP 16, 0.2 - 0.6 Nm	321	16	●	●	●	●	●	●	●
EC 16, 60 W	213	GP 22, 0.5 - 2.0 Nm	325/328	16	●	●	●	●	●	●	●
EC 16, 60 W	213	GP 16 S/GP 22 S	361/365	16	●	●	●	●	●	●	●
EC 22, 40 W	214			22	50.5	50.5	50.5	50.5	50.5	50.5	50.5
EC 22, 40 W	214	GP 22, 0.5 - 3.4 Nm	328/329	22	●	●	●	●	●	●	●
EC 22, 40 W	214	GP 22 S	364/365	22	●	●	●	●	●	●	●
EC 22, 100 W	215			22	68.7	68.7	68.7	68.7	68.7	68.7	68.7
EC 22, 100 W	215	GP 22, 0.5 - 3.4 Nm	328/329	22	●	●	●	●	●	●	●
EC 22, 100 W	215	GP 22 S	364/365	22	●	●	●	●	●	●	●
EC-max 16, 5 W	225			16	31.3	31.3	31.3	31.3	31.3	31.3	31.3
EC-max 16, 5 W	225	GP 16, 0.1 - 0.6 Nm	320/321	16	●	●	●	●	●	●	●
EC-max 16, 5 W	225	GP 16 S	361/362	16	●	●	●	●	●	●	●
EC-max 16, 8 W	227			16	43.3	43.3	43.3	43.3	43.3	43.3	43.3
EC-max 16, 8 W	227	GP 16, 0.2 - 0.6 Nm	321	16	●	●	●	●	●	●	●
EC-max 16, 8 W	227	GP 22, 0.5 - 2.0 Nm	328	16	●	●	●	●	●	●	●
EC-max 16, 8 W	227	GP 16 S/GP 22 S	361/365	16	●	●	●	●	●	●	●
EC-max 22, 12 W	228			16	41.7	41.7	41.7	41.7	41.7	41.7	41.7
EC-max 22, 12 W	228	GP 22, 0.5 - 2.0 Nm	328/329	16	●	●	●	●	●	●	●
EC-max 22, 12 W	228	KD 32, 1.0 - 4.5 Nm	343	16	●	●	●	●	●	●	●
EC-max 22, 12 W	228	GP 22 S	364/365	16	●	●	●	●	●	●	●
EC-max 22, 25 W	229			16	58.2	58.2	58.2	58.2	58.2	58.2	58.2
EC-max 22, 25 W	229	GP 22/GP 32	329/339	16	●	●	●	●	●	●	●
EC-max 22, 25 W	229	GP 32 S	366-368	16	●	●	●	●	●	●	●

Technical Data		Pin Allocation	Connection example
Supply voltage $V_{CC}$	$5\text{ V} \pm 5\%$		
Typical current draw 2 channel	11 mA		
Typical current draw 3 channel	14 mA		
Output signal	TTL compatible		
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$		
Index pulse width	$90^\circ e \pm 45^\circ e$		
Operating temperature range	-25...+85°C		
Moment of inertia of code wheel	$\leq 0.09\text{ gcm}^2$		
Output current per channel	max. 5 mA		
		DIN Connector 41651/ EN 60603-13 flat band cable AWG 28 *version with 3 channels	
		Pin assignment for RE-max see Page 402	
			The index signal I is synchronized with channel A or B.

The index signal I is synchronized with channel A or B.

# Encoder MR Type ML, 128–1000 CPT, 3 Channels, with Line Driver



- Stock program
- Standard program
- Special program (on request)

## Type

	Counts per turn	128	256	500	512	1000
Number of channels	3	3	3	3	3	3
Max. operating frequency (kHz)	80	160	200	320	200	
Max. speed (rpm)	37 500	37 500	24 000	37 500	12 000	



## Part Numbers

225771	225773	225778	225805	225780
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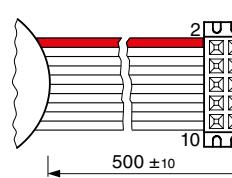
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm]	/ ● see Gearhead
RE 25	125/127			25	65.5	65.5
RE 25	125/127 GP 26, 0.75 - 2.0 Nm	332		25	●	●
RE 25	125/127 GP 32, 0.75 - 6.0 Nm	334-339		25	●	●
RE 25	125/127 KD 32, 1.0 - 4.5 Nm	343		25	●	●
RE 25	125/127 GP 32 S	366-368		25	●	●
RE 25, 20 W	126			25	54.0	54.0
RE 25, 20 W	126 GP 22, 0.5 Nm	325		25	●	●
RE 25, 20 W	126 GP 26, 0.75 - 2.0 Nm	332		25	●	●
RE 25, 20 W	126 GP 32, 0.75 - 6.0 Nm	334-339		25	●	●
RE 25, 20 W	126 KD 32, 1.0 - 4.5 Nm	343		25	●	●
RE 25, 20 W	126 GP 32 S	366-368		25	●	●
A-max 26	152-158			25	53.5	53.5
A-max 26	152-158 GP 26, 0.75 - 4.5 Nm	332		25	●	●
A-max 26	152-158 GS 30, 0.07 - 0.2 Nm	333		25	●	●
A-max 26	152-158 GP 32, 0.75 - 6.0 Nm	334-339		25	●	●
A-max 26	152-158 GS 38, 0.1 - 0.6 Nm	344		25	●	●
A-max 26	152-158 GP 32 S	366-368		25	●	●
EC-max 30, 40 W	230			25		54.2
EC-max 30, 40 W	230 GP 32, 1 - 8.0 Nm	339/341		25		●
EC-max 30, 40 W	230 KD 32, 1.0 - 4.5 Nm	343		25		●
EC-max 30, 40 W	230 GP 32 S	366-368		25		●
EC-max 30, 60 W	231			25		76.2
EC-max 30, 60 W	231 GP 32, 1 - 8.0 Nm	339/341		25		●
EC-max 30, 60 W	231 KD 32, 1.0 - 4.5 Nm	343		25		●
EC-max 30, 60 W	231 GP 42, 3 - 15 Nm	346		25		●

## Technical Data

Supply voltage $V_{CC}$	5 V $\pm$ 5%
Typical current draw	14 mA
Output signal	TTL compatible
Phase shift $\phi$	90°e $\pm$ 45°e
Index pulse width	90°e $\pm$ 45°e
Operating temperature range	-25...+85°C
Moment of inertia of code wheel	$\leq 0.7 \text{ gcm}^2$
Output current per channel	max. 5 mA

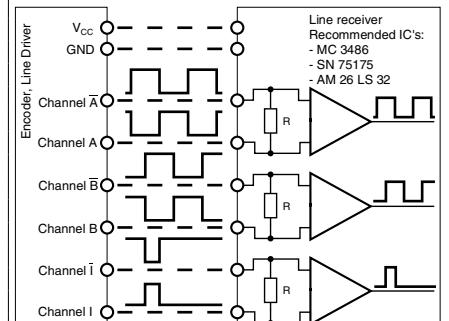
## Pin Allocation



1. N.C.
2.  $V_{CC}$
3. GND
4. N.C.
5. Channel A-bar
6. Channel A
7. Channel B-bar
8. Channel B
9. Channel I-bar (Index)
10. Channel I (Index)

DIN Connector 41651/  
EN 60603-13  
flat band cable AWG 28

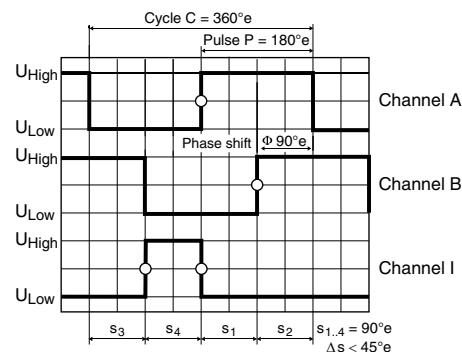
## Connection example



Opt. terminal resistance R > 1 kΩ

The index signal I is synchronized with channel A or B.

# Encoder MR Type L, 256–1024 CPT, 3 Channels, with Line Driver



  Stock program  
  Standard program  
  Special program (on request)

Type		225783	228452	225785	228456	225787
Counts per turn	256	500	512	1000	1024	
Number of channels	3	3	3	3	3	
Max. operating frequency (kHz)	80	200	160	200	320	
Max. speed (rpm)	18750	24000	18750	12000	18750	



## maxon Modular System

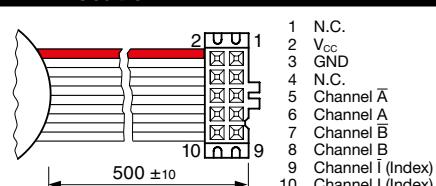
+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead		
RE 30, 15 W	128			32	79.4	79.4	79.4
RE 30, 15 W	128	GP 32, 0.75 - 4.5 Nm	336	32	●	●	●
RE 30, 60 W	129			32	79.4	79.4	79.4
RE 30, 60 W	129	GP 32, 0.75 - 4.5 Nm	334	32	●	●	●
RE 30, 60 W	129	GP 32, 0.75 - 6.0 Nm	336-340	32	●	●	●
RE 30, 60 W	129	GP 32 S	366-368	32	●	●	●
RE 35, 90 W	130			32	82.4	82.4	82.4
RE 35, 90 W	130	GP 32, 0.75 - 4.5 Nm	334	32	●	●	●
RE 35, 90 W	130	GP 32, 0.75 - 6.0 Nm	336-340	32	●	●	●
RE 35, 90 W	130	GP 32, 4.0 - 8.0 Nm	341	32	●	●	●
RE 35, 90 W	130	GP 42, 3 - 15 Nm	345	32	●	●	●
RE 35, 90 W	130	GP 32 S	366-368	32	●	●	●
RE 40, 25 W	131			32	82.4	82.4	82.4
RE 40, 150 W	132			32	82.4	82.4	82.4
RE 40, 150 W	132	GP 42, 3 - 15 Nm	345	32	●	●	●
RE 40, 150 W	132	GP 52, 4 - 30 Nm	350	32	●	●	●
A-max 32	160/162			32	72.7	72.7	72.7
A-max 32	160/162	GP 32, 0.75 - 6.0 Nm	336-339	32	●	●	●
A-max 32	160/162	GS 38, 0.1 - 0.6 Nm	344	32	●	●	●
A-max 32	160/162	GP 32 S	366-368	32	●	●	●
EC-max 40, 70 W	232			31.8	73.9	73.9	73.9
EC-max 40, 70 W	232	GP 42, 3 - 15 Nm	346	31.8	●	●	●
EC-max 40, 120 W	233			31.8	103.9	103.9	103.9
EC-max 40, 120 W	233	GP 52, 4 - 30 Nm	351	31.8	●	●	●

## Technical Data

Supply voltage $V_{CC}$	5 V ± 5%
Typical current draw	14 mA
Output signal	TTL compatible
Phase shift $\Phi$	90°e ± 45°e
Index pulse width	90°e ± 45°e
Operating temperature range	-25...+85°C
Moment of inertia of code wheel	≤ 1.7 gcm²
Output current per channel	max. 5 mA

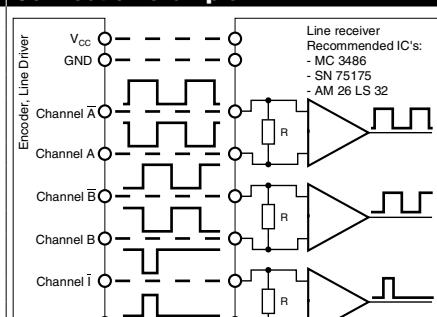
The index signal I is synchronized with channel A or B.

## Pin Allocation



DIN Connector 41651/  
EN 60603-13  
flat band cable AWG 28

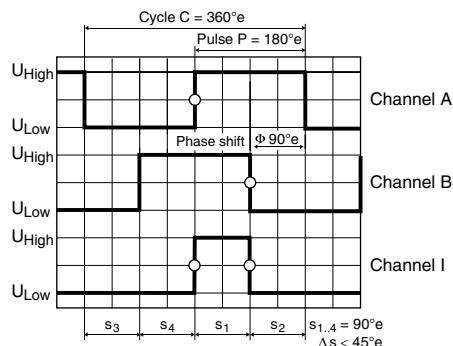
## Connection example



Opt. terminal resistance R > 1 kΩ

# Encoder 6 OPT 128 CPT, 3 Channels

maxon sensor



Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Type (provisional)

Counts per turn	128
Number of channels	3
Max. operating frequency (kHz)	64
Max. speed (rpm)	60000



## Part Numbers

502807

## maxon Modular System

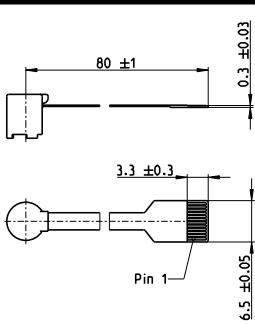
+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead
EC 6, 1.5 W	206	GP 6, 0.002 - 0.03 Nm	309	6 (8*)	23.4
EC 6, 1.5 W	206	GP 6 S	357-358	6 (8*)	●
EC 6, 2.0 W	207	GP 6, 0.002 - 0.03 Nm	309	6 (8*)	23.4
EC 6, 2.0 W	207	GP 6 S	357-358	6 (8*)	●

\*Max diameter of the end cap (incl. extension).

## Technical Data

Supply voltage $V_{cc}$	3 - 6 V
Typical current draw	6 mA
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Index pulse width	$90^\circ e \pm 45^\circ e$
Operating temperature range	-20...+85 °C
Moment of inertia of code wheel	$\leq 0.001 \text{ gcm}^2$
Output current per channel	$\leq 5 \text{ mA}$

## Pin Allocation

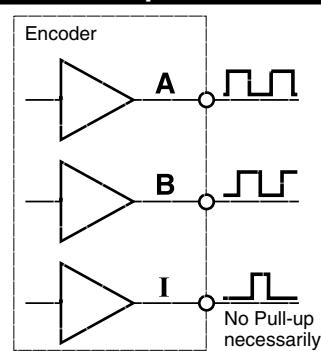


- |    |    |                |
|----|----|----------------|
| EC | 1  | W1             |
|    | 2  | W2             |
|    | 3  | W3             |
|    | 4  | GND            |
|    | 5  | $V_{cc}$       |
|    | 6  | Chanal A       |
|    | 7  | Chanal B       |
|    | 8  | Chanal I       |
|    | 9  | not connected  |
|    | 10 | not connected  |
|    | 11 | not connected  |
|    | 12 | do not connect |

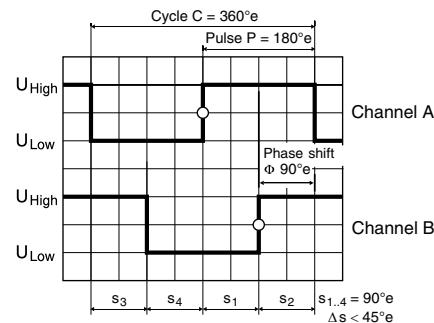
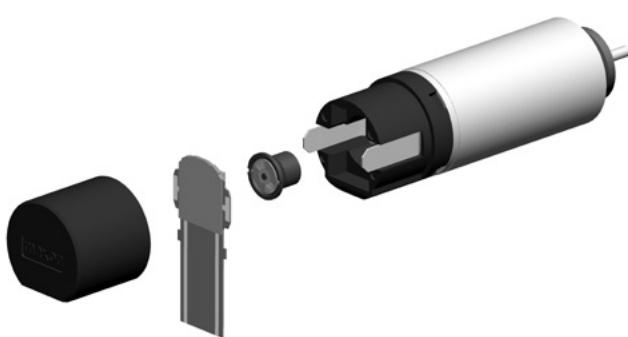
Compatible connector: Molex 52745-1297, Tyco 1-1734839-2  
Adapter: 498157

Please note: max. continuous current 0.5 A

## Connection example



# Encoder 8 OPT 50 CPT, 2 Channels



Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Type (provisional)

Counts per turn	50
Number of channels	2
Max. operating frequency (kHz)	15
Max. speed (rpm)	18000



## Part Numbers

473594

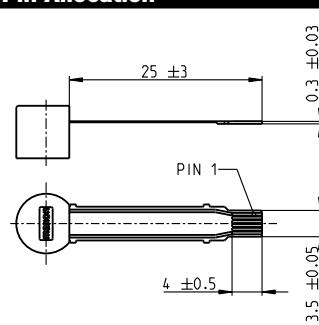
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	Ø Enc [mm]	Overall length [mm] / ● see Gearhead
RE 8, 0.5 W, A	99			8	24.2
RE 8, 0.5 W, A	99	GP 8, 0.01 - 0.1 Nm	310	8	●
RE 8, 0.5 W, A	99	GP 8 S	359-360	8	●

## Technical Data

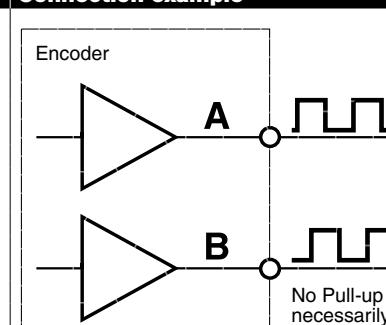
Supply voltage $V_{CC}$ <sup>1)</sup>	$3 V \pm 10\%$
Typical current draw	12 mA
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Operating temperature range	-20...+85 °C
Moment of inertia of code wheel	$\leq 0.001 \text{ gcm}^2$
Output current per channel	min. -1 mA, max. 8 mA

## Pin Allocation



Compatible connector:  
Molex 52745-0697

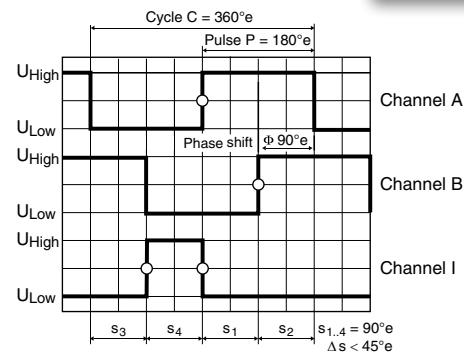
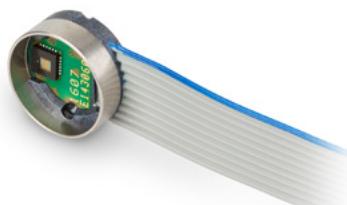
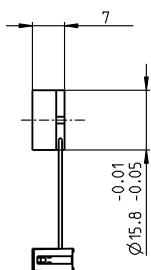
## Connection example



<sup>1)</sup> Not in combination with maxon controllers.

**Encoder 16 RIO** 512–65536 CPT, 3 Channels, with Line Driver RS 422

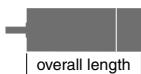
NEW



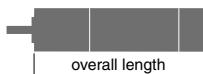
Direction of rotation cw (definition cw p. 60)

-  Stock program
-  Standard program
-  Special program (on request)

Type (provisional)	373820	373821	373828	373829	373830	X drives
Counts per turn	1024	4096	8192	16384	32768	512-65536
Number of channels	3	3	3	3	3	3
Max. operating frequency (kHz)	780	3125	3125	3125	3125	3125
Max. speed (rpm)	40000	40000	20000	10000	5000	
Phase shift $\Phi$ ('e)	90+/-5	90+/-10	90+/-15	90+/-30	90+/-45	
Index pulse width ('e)	90+/-5	90+/-10	90+/-15	90+/-30	90+/-45	



overall length



overall length

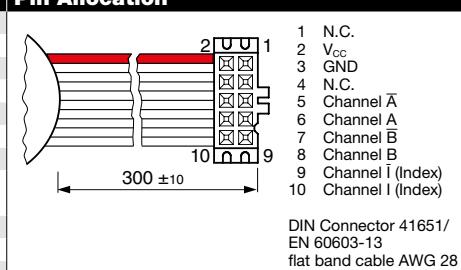
**maxon Modular System**

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead				
DCX 16 S	74									35.8
DCX 16 L	76									49.7
DCX 19 S	78									43.5
DCX 22 S	80									43.5
DCX 22 L	82									56.5
DCX 26 L	84									68.1
DCX 32 L	86									82.8
DCX 35 L	87									81.3
EC-4pole 22, 90 W	237					59.3	59.3	59.3	59.3	59.3
EC-4pole 22, 120 W	238					76.7	76.7	76.7	76.7	76.7
EC-4pole 30, 100 W	239					59.4	59.4	59.4	59.4	59.4
EC-4pole 30, 200 W	241					76.4	76.4	76.4	76.4	76.4
EC-i 40, 50 W	247-248					40.5	40.5	40.5	40.5	40.5
EC-i 40, 70 W	249/250					50.5	50.5	50.5	50.5	50.5
EC-i 40, 100 W	251					70.5	70.5	70.5	70.5	70.5
EC-i 52, 180 W	252					96.5	96.5	96.5	96.5	96.5

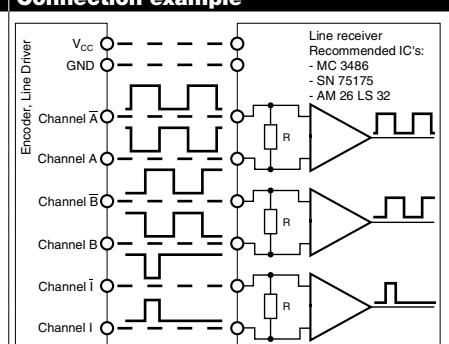
Technical Data

Technical Data	
Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	50 mA
Output signal	EIA Standard RS 422
Operating temperature range	-40...+100 °C
Moment of inertia of code wheel	≤ 1.2 gcm²
Output current per channel	± 20 mA
Min. state duration s	20 ns
Signal rise and fall times (typically, at $C_L = 200 \text{ pF}$ , $R_L = 100 \Omega$ )	5 ns

## Pin Allocation



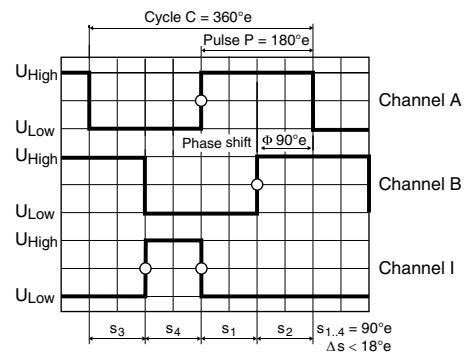
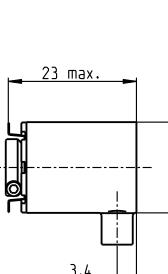
### Connection example



The index signal I is synchronized with channel A or B.

Opt. terminal resistance  $R =$  typical 120  $\Omega$

# Encoder SCH16F 2000–3600 CPT, 3 Channels, with Line Driver RS 422

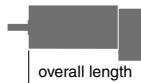


Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Type (provisional)

	461212	461211	X drives
Counts per turn	2000	3600	2000–3600
Number of channels	3	3	3
Max. operating frequency (kHz)	200	200	200
Max. speed (rpm)	6000	3333	6000–3333
Shaft diameter (mm)	3	3	2



## maxon Modular System

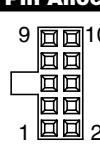
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
DCX 22 S	80-81					online
DCX 22 L	82-83					online
EC-4pole 22, 90 W	237					76.1
EC-4pole 22, 120 W	238					93.5
						76.1
						93.5

## Technical Data

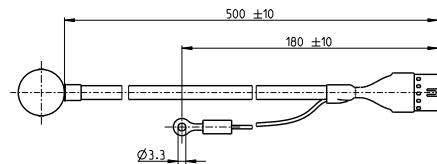
Supply voltage $V_{CC}$	4.5 – 30 V
Typical current draw	30 mA
Output signal	EIA Standard RS 422
Operating temperature range	-20...+70 °C
Moment of inertia of code wheel	0.25 gcm <sup>2</sup>
Output current per channel	± 20 mA
Phase shift $\Phi$	90°e ± 18°e
Index pulse width	90°e ± 18°e
Max. startup torque at 25 °C	< 5 mNm

The index signal I is synchronized with channel A or B.

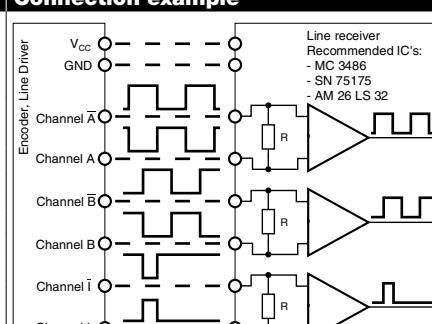
## Pin Allocation



- |                             |                   |
|-----------------------------|-------------------|
| 1 N.C.                      | 41651/EN 60603-13 |
| 2 $V_{CC}$                  | Ring terminal     |
| 3 GND                       | Molex 19324-0002  |
| 4 N.C.                      |                   |
| 5 Channel $\bar{A}$         |                   |
| 6 Channel A                 |                   |
| 7 Channel $\bar{B}$         |                   |
| 8 Channel B                 |                   |
| 9 Channel $\bar{I}$ (Index) |                   |
| 10 Channel I (Index)        | DIN Connector     |



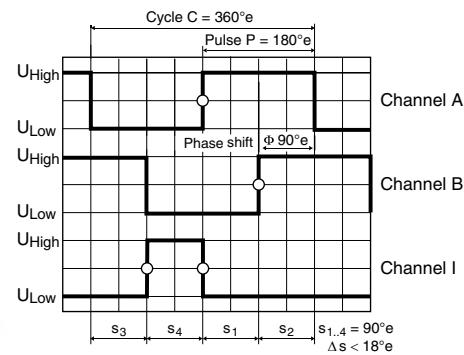
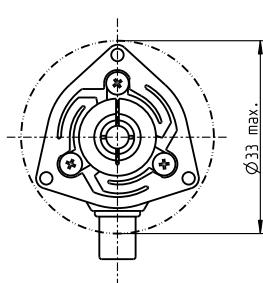
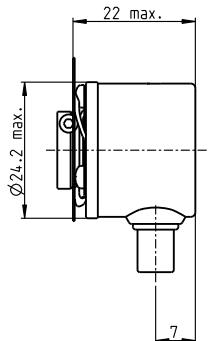
## Connection example



Opt. terminal resistance R = typical 120 Ω

# Encoder 2RMHF 3000–5000 CPT, 3 Channels, with Line Driver RS 422

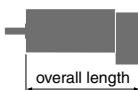
maxon sensor



- Stock program
- Standard program
- Special program (on request)

## Type (provisional)

	461214	461216	461213	461215	X drives
Counts per turn	3000	3000	5000	5000	3000–5000
Number of channels	3	3	3	3	3
Max. operating frequency (kHz)	200	200	200	200	200
Max. speed (rpm)	4000	4000	2400	2400	4000–2400
Shaft diameter (mm)	4	6	4	6	4



## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead	
DCX 32 L	86						online
DCX 35 L	87						online
EC-4pole 30, 100 W	239					75.2	
EC-4pole 30, 200 W	241					92.2	
EC-i 40, 50 W	247/248					56.2	56.2
EC-i 40, 70 W	249/250					66.2	66.2
EC-i 40, 100 W	251					86.2	86.2

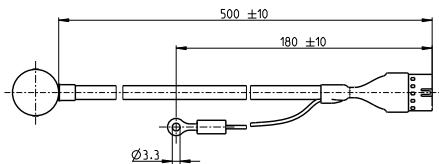
## Technical Data

Supply voltage $V_{CC}$	4.5 – 5.5 V
Typical current draw	30 mA
Output signal	EIA Standard RS 422
driver used:	26C31
Operating temperature range	-40...+85 °C
Moment of inertia of code wheel	1.0 gcm <sup>2</sup>
Output current per channel	± 30 mA
Phase shift $\Phi$	90°e ± 18°e
Index pulse width	90°e ± 18°e
Max. startup torque at 25 °C	< 5 mNm

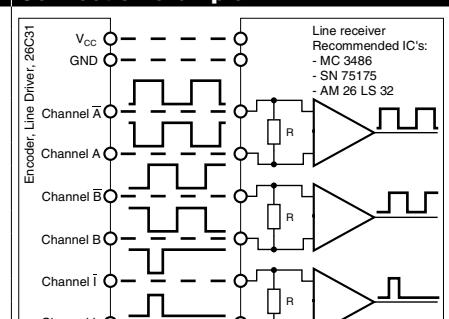
The index signal I is synchronized with channel A or B.

## Pin Allocation

9	10	1 N.C.	DIN Connector
		2 $V_{CC}$	41651/EN 60603-13
		3 GND	
		4 N.C.	
		5 Channel A	Ring terminal
		6 Channel A	Molex 19324-0002
		7 Channel B	
		8 Channel B	
		9 Channel I (Index)	
1	2	10 Channel I (Index)	

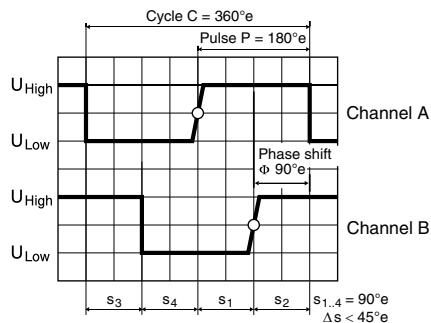
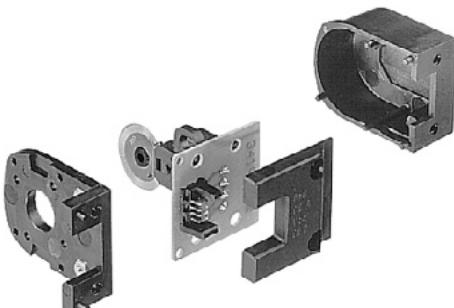
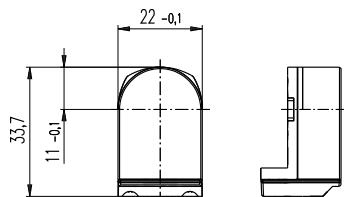


## Connection example



Opt. terminal resistance R = typical 120 Ω

# Encoder Enc 22 100 CPT, 2 Channels



Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

	103935	110520	110521
Counts per turn	100	100	100
Number of channels	2	2	2
Max. operating frequency (kHz)	20	20	20
Max. speed (rpm)	12 000	12 000	12 000
Shaft diameter (mm)	3	2	3



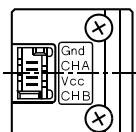
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	Overall length [mm] / ● see Gearhead
RE 25	125/127			68.6
RE 25	125/127 GP 26, 0.75 - 2.0 Nm	332		●
RE 25	125/127 GP 32, 0.75 - 4.5 Nm	334		●
RE 25	125/127 GP 32, 0.75 - 4.5 Nm	335		●
RE 25	125/127 GP 32, 1.0 - 6.0 Nm	338		●
RE 25	125/127 GP 32 S	366-368		●
A-max 19, 1.5 W	144			43.3
A-max 19, 1.5 W	144	GP 19, 0.1 - 0.3 Nm	322	●
A-max 19, 1.5 W	144	GP 22, 0.1 - 2.0 Nm	325/327	●
A-max 19, 1.5 W	144	GS 24, 0.1 Nm	331	●
A-max 19, 1.5 W	146	GP 22 S	364/365	●
A-max 19, 2.5 W	146			45.9
A-max 19, 2.5 W	146	GP 19, 0.1 - 0.3 Nm	322	●
A-max 19, 2.5 W	146	GP 22, 0.1 - 2.0 Nm	325/327	●
A-max 19, 2.5 W	146	GS 24, 0.1 Nm	331	●
A-max 19, 2.5 W	146	GP 22 S	364/365	●
A-max 22	148/150			46.3
A-max 22	148/150 GP 22, 0.1 - 0.3 Nm	323		●
A-max 22	148/150 GP 22, 0.2 - 0.6 Nm	324		●
A-max 22	148/150 GP 22, 0.1 - 2.0 Nm	323-327		●
A-max 22	148/150 GS 24, 0.1 Nm	331		●
A-max 22	148/150 GP 22 S	364/365		●
A-max 26	152-158			59.1
A-max 26	152-158 GP 26, 0.75 - 4.5 Nm	332		●
A-max 26	152-158 GS 30, 0.07 - 0.2 Nm	333		●
A-max 26	152-158 GP 32, 0.75 - 4.5 Nm	334		●
A-max 26	152-158 GP 32, 0.75 - 4.5 Nm	335		●
A-max 26	152-158 GP 32, 1.0 - 6.0 Nm	339		●
A-max 26	152-158 GS 38, 0.1 - 0.6 Nm	344		●
A-max 26	152-158 GP 32 S	366-368		●

## Technical Data

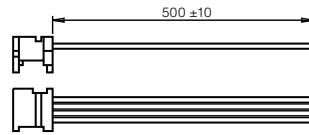
Supply voltage $V_{CC}$	$5 \text{ V} \pm 10\%$
Typical current draw	18 mA
Output signal	TTL compatible
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Signal rise time	(typically, at $C_L = 25 \text{ pF}$ , $R_L = 11 \text{ k}\Omega$ , $25^\circ C$ )
(typically, at $C_L = 25 \text{ pF}$ , $R_L = 11 \text{ k}\Omega$ , $25^\circ C$ )	200 ns
Signal fall time	50 ns
Operating temperature range	-20...+85°C
Moment of inertia of code wheel	$\leq 0.05 \text{ gcm}^2$
Output current per channel	min. -1 mA, max. 5 mA

## Pin Allocation

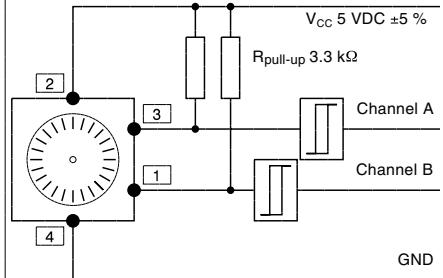


Micromodule contact strip  
Type Lumberg MICS 4  
Pin 4 GND  
Pin 3 Channel A  
Pin 2  $V_{CC}$ , Pin 1 Channel B  
recommended connectors:  
Micromodule connector  
Type Lumberg MICA 4

Order number for connector with cable: 3419.506



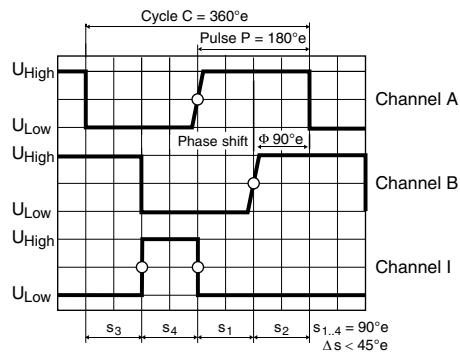
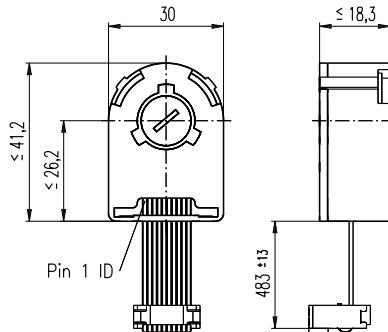
## Connection example



Ambient temperature range  $\vartheta_U = 22 - 25^\circ C$

# Encoder AEDL 5810 1024–5000 CPT, 3 Channels, with Line Driver RS 422

maxon sensor



Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

516205	516206	516207	516208	516209	533330	X drives	X drives
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### Type

Counts per turn	1024	5000	1024	5000	5000	5000	1024	5000
Number of channels	3	3	3	3	3	3	3	3
Max. operating frequency (kHz)	250	1000	250	1000	1000	1000	250	1000
Max. speed (rpm)	14000	12000	14000	12000	12000	12000	14000	12000
Shaft diameter (mm)	3	3	4	4	6	8	2–4	2–4
Phase shift Φ (°e)	90 ± 25	90 ± 45	90 ± 25	90 ± 45	90 ± 45	90 ± 45	90 ± 25	90 ± 45

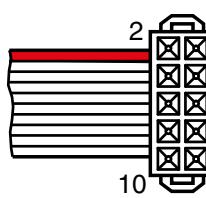
### maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead	
EC-4pole 22, 90 W	237					70.1	70.1
EC-4pole 22, 90 W	237	GP 22/GP 32	329/339			●	●
EC-4pole 22, 90 W	237	GP 32 S	366-368			●	●
EC-4pole 22, 120 W	238					87.5	87.5
EC-4pole 22, 120 W	238	GP 22/GP 32	329/339			●	●
EC-4pole 22, 120 W	238	GP 32 S	366-368			●	●
EC-4pole 30, 100 W	239						
EC-4pole 30, 100 W	239	GP 32, 4.0 - 8.0 Nm	341				67.6
EC-4pole 30, 100 W	239	GP 42, 3 - 15 Nm	346				67.6
EC-4pole 30, 100 W	239		AB 20	456			104.0
EC-4pole 30, 100 W	239	GP 32, 4.0 - 8.0 Nm	341	AB 20	456		104.0
EC-4pole 30, 100 W	239	GP 42, 3 - 15 Nm	346	AB 20	456		104.0
EC-4pole 30, 200 W	241						
EC-4pole 30, 200 W	241	GP 32, 4.0 - 8.0 Nm	341				84.6
EC-4pole 30, 200 W	241	GP 42, 3 - 15 Nm	346				84.6
EC-4pole 30, 200 W	241		AB 20	456			121.0
EC-4pole 30, 200 W	241	GP 32, 4.0 - 8.0 Nm	341	AB 20	456		121.0
EC-4pole 30, 200 W	241	GP 42, 3 - 15 Nm	346	AB 20	456		121.0
EC-i 40, 50 W	247-248						49.0
EC-i 40, 50 W	247	GP 32, 1 - 6 Nm	339				
EC-i 40, 50 W	247	247-248 GP 42, 3 - 15 Nm	346				
EC-i 40, 50 W	247	GP 32 S	366-368				
EC-i 40, 70 W	249/250						59.0
EC-i 40, 70 W	249	GP 32, 1 - 6 Nm	339				
EC-i 40, 70 W	249/250	GP 42, 3 - 15 Nm	346				
EC-i 40, 70 W	249	GP 32 S	366-368				
EC-i 40, 100 W	251						79.0
EC-i 40, 100 W	251	GP 42, 3 - 15 Nm	346				
EC-i 52, 180 W	252						102.8
EC-i 52, 180 W	252	GP 52, 4 - 30 Nm	350				
DCX 22 S	80-81						online
DCX 22 L	82-83						online
DCX 26 L	84-85						online
DCX 32 L	86						online
DCX 35 L	87						online

### Technical Data

Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	30 mA
Output signal driver used:	EIA Standard RS 422 AM26C31QD
Signal rise time (typically, at $C_L = 100 \text{ pF}, 25^\circ\text{C}$ )	10 ns
Signal fall time (typically, at $C_L = 100 \text{ pF}, 25^\circ\text{C}$ )	10 ns
Index pulse width	90°e
Operating temperature range	-40...+85 °C
Moment of inertia of code wheel	≤ 0.6 gcm²
Output current per channel	± 20 mA

### Pin Allocation

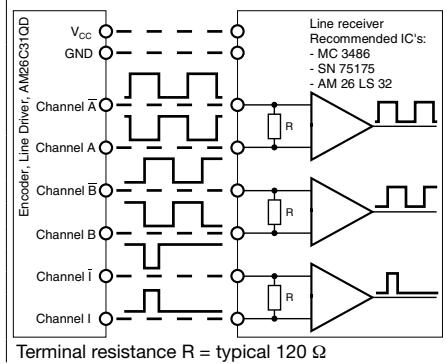


1 N.C.  
2  $V_{CC}$   
3 GND  
4 N.C.  
5 Channel Ā  
6 Channel A  
7 Channel B̄  
8 Channel B  
9 Channel I (Index)  
10 Channel I (Index)

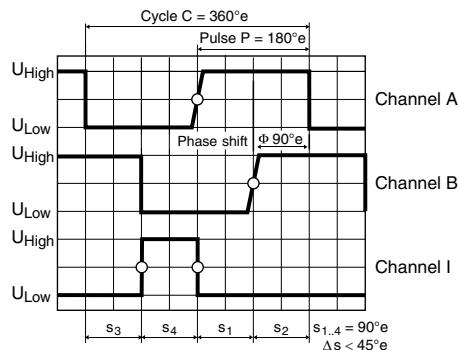
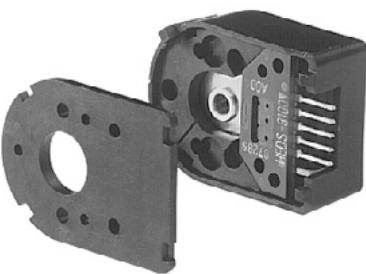
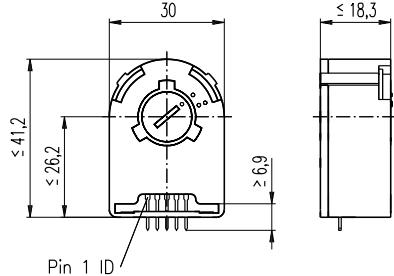
Pin type DIN 41651/  
EN 60603-13  
flat band cable AWG 28

The index signal I is synchronized with channel A or B.

### Connection example



# Encoder HEDS 5540 500 CPT, 3 Channels



- Stock program
- Standard program
- Special program (on request)

Type	Counts per turn	500	500	500	500
Number of channels		3	3	3	3
Max. operating frequency (kHz)		100	100	100	100
Max. speed (rpm)		12000	12000	12000	12000
Shaft diameter (mm)		3	4	6	2-4



## maxon Modular System

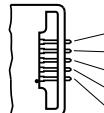
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
RE 25	125/127					75.3
RE 25	125/127 GP 26, 0.75 - 2.0 Nm	332				●
RE 25	125/127 GP 32, 0.75 - 6.0 Nm	334-338				●
RE 25	125/127 KD 32, 1.0 - 4.5 Nm	343				●
RE 25	125/127 GP 32 S	366-368				●
RE 25, 20 W	127	AB 28	458			105.8
RE 25, 20 W	127 GP 26, 0.75 - 2.0 Nm	332 AB 28	458			●
RE 25, 20 W	127 GP 32, 0.75 - 6.0 Nm	334-338 AB 28	458			●
RE 25, 20 W	127 KD 32, 1.0 - 4.5 Nm	343 AB 28	458			●
RE 25, 20 W	127 GP 32 S	366-368 AB 28	458			●
RE 30, 15 W	128					88.8
RE 30, 15 W	128 GP 32, 0.75 - 4.5 Nm	336				●
RE 30, 60 W	129					88.8
RE 30, 60 W	129 GP 32, 0.75 - 6.0 Nm	334-340				●
RE 30, 60 W	129 KD 32, 1.0 - 4.5 Nm	343				●
RE 30, 60 W	129 GP 32 S	366-368				●
RE 35, 90 W	130					91.7
RE 35, 90 W	130 GP 32, 0.75 - 8.0 Nm	334-341				●
RE 35, 90 W	130 GP 42, 3.0 - 15 Nm	345				●
RE 35, 90 W	130 GP 32 S	366-368				●
RE 35, 90 W	130 AB 28	458				124.3
RE 35, 90 W	130 GP 32, 0.75 - 8.0 Nm	334-341 AB 28	458			●
RE 35, 90 W	130 GP 42, 3.0 - 15 Nm	345 AB 28	458			●
RE 35, 90 W	130 GP 32 S	366-368 AB 28	458			●
RE 40, 25 W	131					91.7
RE 40, 150 W	132					91.7
RE 40, 150 W	132 GP 42, 3.0 - 15 Nm	345				●
RE 40, 150 W	132 GP 52, 4.0 - 30 Nm	350				●
RE 40, 150 W	132 AB 28	458				124.3
RE 40, 150 W	132 GP 42, 3.0 - 15 Nm	345 AB 28	458			●
RE 40, 150 W	132 GP 52, 4.0 - 30 Nm	350 AB 28	458			●
DCX 22 S	80-81					online
DCX 22 L	82-83					online
DCX 26 L	84-85					online
DCX 32 L	86					online
DCX 35 L	87					online

## Technical Data

Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	55 mA
Output signal	TTL compatible
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Signal rise time (typically, at $C_L = 25 \text{ pF}$ , $R_L = 2.7 \text{ k}\Omega$ , $25^\circ\text{C}$ )	180 ns
Signal fall time	
(typically, at $C_L = 25 \text{ pF}$ , $R_L = 2.7 \text{ k}\Omega$ , $25^\circ\text{C}$ )	40 ns
Index pulse width (nominal)	90°e
Operating temperature range	-40...+100°C
Moment of inertia of code wheel	$\leq 0.6 \text{ gcm}^2$
Max. angular acceleration	250000 rad s⁻²
Output current per channel	min. -1 mA, max. 5 mA

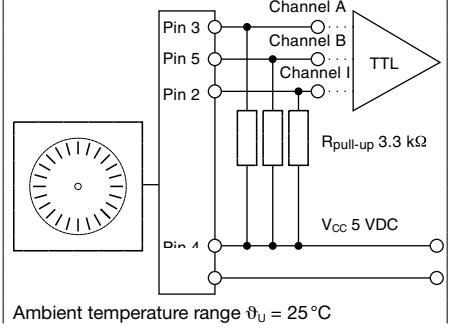
The index signal I is synchronized with channel A or B.

## Pin Allocation



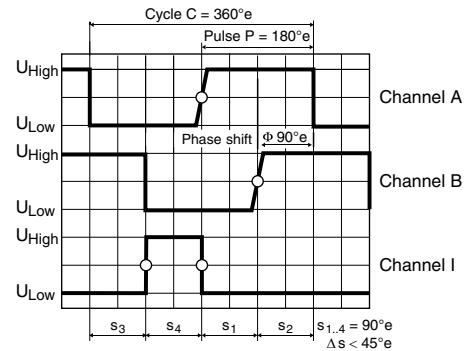
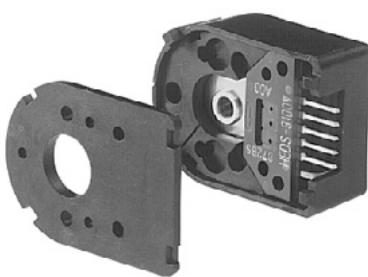
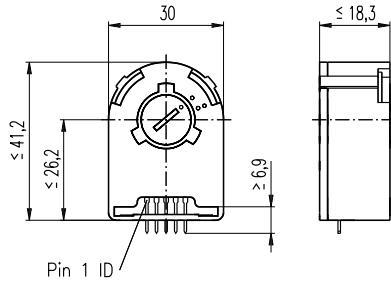
Encoder	Description	Pin no. from 3409.506
Pin 5	Channel B	1
Pin 4	$V_{CC}$	2
Pin 3	Channel A	3
Pin 2	Channel I	4
Pin 1	GND	5

## Connection example



# Encoder HEDS 5540 500 CPT, 3 Channels

maxon sensor



- Stock program
- Standard program
- Special program (on request)

## Type

	Counts per turn	500	500	500	500
	Number of channels	3	3	3	3
	Max. operating frequency (kHz)	100	100	100	100
	Max. speed (rpm)	12 000	12 000	12 000	12 000
	Shaft diameter (mm)	3	4	6	8

## maxon Modular System

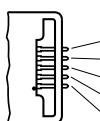
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
RE 25, 20 W	126					63.8
RE 25, 20 W	126	GP 26, 0.75 - 2.0 Nm	332			●
RE 25, 20 W	126	GP 32, 0.75 - 4.5 Nm	334			●
RE 25, 20 W	126	GP 32, 0.75 - 6.0 Nm	335/338			●
RE 25, 20 W	126	KD 32, 1.0 - 4.5 Nm	343			●
RE 25, 20 W	126	GP 32 S	366-368			●
RE 25, 20 W	126		AB 28	458		94.3
RE 25, 20 W	126	GP 22, 0.5 Nm	325			●
RE 25, 20 W	126	GP 26, 0.75 - 2.0 Nm	332	AB 28	458	●
RE 25, 20 W	126	GP 32, 0.75 - 4.5 Nm	334	AB 28	458	●
RE 25, 20 W	126	GP 32, 0.75 - 6.0 Nm	335/338 AB 28			●
RE 25, 20 W	126	KD 32, 1.0 - 4.5 Nm	343	AB 28	458	●
RE 25, 20 W	126	GP 32 S	366-368 AB 28			●
RE 50, 200 W	133					128.7
RE 50, 200 W	133	GP 52, 4 - 30 Nm	351			●
RE 50, 200 W	133	GP 62, 8 - 50 Nm	352			●
RE 65, 250 W	134					157.3
RE 65, 250 W	134	GP 81, 20 - 120 Nm	353			●
A-max 26	148/150				63.1	
A-max 26	148/150 GP 26, 0.75 - 4.5 Nm		332			●
A-max 26	148/150 GS 30, 0.07 - 0.2 Nm		333			●
A-max 26	148/150 GP 32, 0.75 - 4.5 Nm		334			●
A-max 26	148/150 GP 32, 0.75 - 6.0 Nm		335/339			●
A-max 26	148/150 GS 38, 0.1 - 0.6 Nm		344			●
A-max 26	148/150 GP 32 S		366-368			●
A-max 32	160/162				82.3	
A-max 32	160/162 GP 32, 0.75 - 6.0 Nm		334-339			●
A-max 32	160/162 GS 38, 0.1 - 0.6 Nm		344			●
A-max 32	160/162 GP 32 S		366-368			●
EC 32, 80 W	218				78.4	
EC 32, 80 W	218	GP 32, 0.75 - 6.0 Nm	334-340			●
EC 32, 80 W	218	GP 32 S	366-368			●
EC 40, 170 W	219				103.4	
EC 40, 170 W	219	GP 42, 3.0 - 15 Nm	345			●
EC 40, 170 W	219	GP 52, 4.0 - 30 Nm	350			●

## Technical Data

Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	55 mA
Output signal	TTL compatible
Phase shift $\Phi$	90°e ± 45°e
Signal rise time	(typically, at $C_L = 25 \text{ pF}$ , $R_L = 2.7 \text{ k}\Omega$ , 25 °C) 180 ns
Signal fall time	(typically, at $C_L = 25 \text{ pF}$ , $R_L = 2.7 \text{ k}\Omega$ , 25 °C) 40 ns
Index pulse width	90°e
Operating temperature range	-40...+100 °C
Moment of inertia of code wheel	≤ 0.6 gcm²
Max. angular acceleration	250 000 rad s⁻²
Output current per channel	min. -1 mA, max. 5 mA

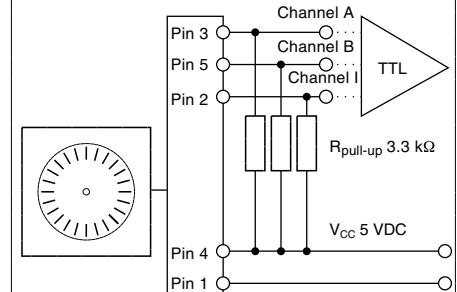
The index signal I is synchronized with channel A or B.

## Pin Allocation



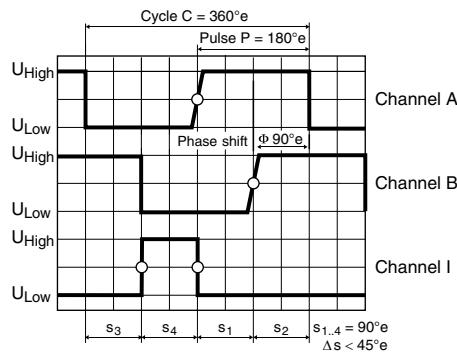
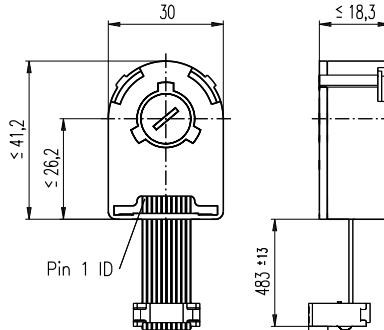
Encoder	Description	Pin no. from 3409.506
Pin 5	Channel B	1
Pin 4	$V_{CC}$	2
Pin 3	Channel A	3
Pin 2	Channel I	4
Pin 1	GND	5

## Connection example



Ambient temperature range  $\vartheta_U = 25^\circ\text{C}$

# Encoder HEDL 5540 500 CPT, 3 Channels, with Line Driver RS 422



- Stock program
- Standard program
- Special program (on request)

## Type

	Counts per turn	500	500	500
Number of channels		3	3	3
Max. operating frequency (kHz)		100	100	100
Max. speed (rpm)		12000	12000	12000
Shaft diameter (mm)		3	4	6



## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
RE 25	125/127					75.3
RE 25	125/127 GP 26/GP 32	332/334				●
RE 25	125/127 KD 32, 1.0 - 4.5 Nm	343				●
RE 25	125/127 GP 32, 0.75 - 6.0 Nm	335/338				●
RE 25	125/127 GP 32 S	366-368				●
RE 25, 20 W	126					63.8
RE 25, 20 W	126	GP 26/GP 32	332/334			●
RE 25, 20 W	126	KD 32, 1.0 - 4.5 Nm	343			●
RE 25, 20 W	126	GP 32, 0.75 - 6.0 Nm	335/338			●
RE 25, 20 W	126	GP 32 S	366-368			●
RE 25, 20 W	126		AB 28	458		94.3
RE 25, 20 W	126	GP 26/GP 32	332/334 AB 28	458		●
RE 25, 20 W	126	KD 32, 1.0 - 4.5 Nm	343 AB 28	458		●
RE 25, 20 W	126	GP 32, 0.75 - 6.0 Nm	335/338 AB 28	458		●
RE 25, 20 W	126	GP 32 S	366-368 AB 28	458		●
RE 25, 20 W	127		AB 28	458		105.8
RE 25, 20 W	127	GP 26/GP 32	332/334 AB 28	458		●
RE 25, 20 W	127	KD 32, 1.0 - 4.5 Nm	343 AB 28	458		●
RE 25, 20 W	127	GP 32, 0.75 - 6.0 Nm	335/338 AB 28	458		●
RE 25, 20 W	127	GP 32 S	366-368 AB 28	458		●
RE 30, 15 W	128					88.8
RE 30, 15 W	128	GP 32, 0.75 - 4.5 Nm	336			●
RE 30, 60 W	129					88.8
RE 30, 60 W	129	GP 32, 0.75 - 6.0 Nm	334-340			●
RE 30, 60 W	129	KD 32, 1.0 - 4.5 Nm	343			●
RE 30, 60 W	129	GP 32 S	366-368			●
RE 35, 90 W	130					91.7
RE 35, 90 W	130	GP 32, 0.75 - 8.0 Nm	334-341			●
RE 35, 90 W	130	GP 42, 3.0 - 15 Nm	345			●
RE 35, 90 W	130	GP 32 S	366-368			●
RE 35, 90 W	130		AB 28	458		124.3
RE 35, 90 W	130	GP 32, 0.75 - 8.0 Nm	334-341 AB 28	458		●
RE 35, 90 W	130	GP 42, 3.0 - 15 Nm	345 AB 28	458		●
RE 35, 90 W	130	GP 32 S	366-368 AB 28	458		●

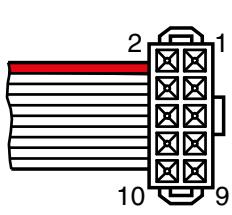
## Technical Data

Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	55 mA
Output signal driver used:	EIA Standard RS 422 DS26LS31
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Signal rise time (typically, at $C_L = 25 \text{ pF}$ , $R_L = 2.7 \text{ k}\Omega$ , $25^\circ\text{C}$ )	180 ns
Signal fall time (typically, at $C_L = 25 \text{ pF}$ , $R_L = 2.7 \text{ k}\Omega$ , $25^\circ\text{C}$ )	40 ns
Index pulse width	90°e
Operating temperature range	-40...+100°C
Moment of inertia of code wheel	$\leq 0.6 \text{ gcm}^2$
Max. angular acceleration	250000 rad s⁻²
Output current per channel	± 20 mA

The index signal I is synchronized with channel A or B.

May 2017 edition / subject to change

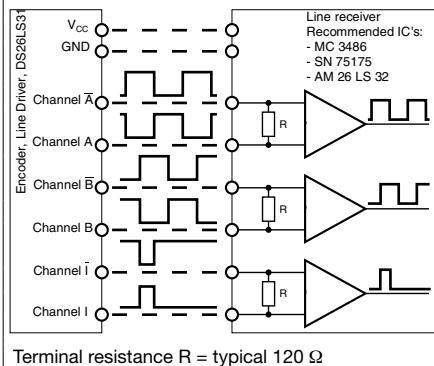
## Pin Allocation



1 N.C.  
2  $V_{CC}$   
3 GND  
4 N.C.  
5 Channel A  
6 Channel A  
7 Channel B  
8 Channel B  
9 Channel I (Index)  
10 Channel I (Index)

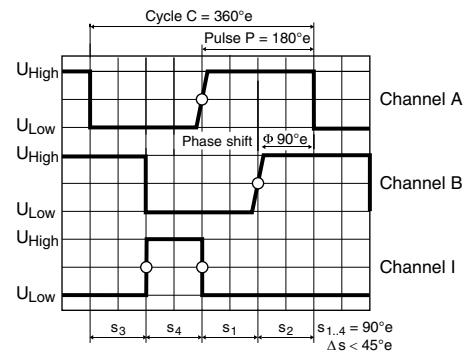
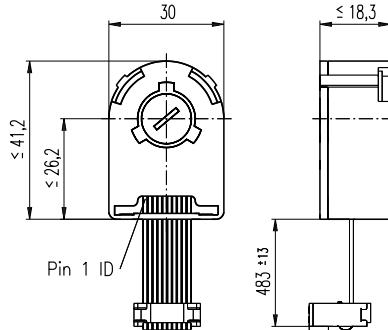
Pin type DIN 41651/  
EN 60603-13  
flat band cable AWG 28

## Connection example



# Encoder HEDL 5540 500 CPT, 3 Channels, with Line Driver RS 422

maxon sensor



- Stock program
- Standard program
- Special program (on request)

## Type

	Counts per turn	500	500	500	500
Number of channels		3	3	3	3
Max. operating frequency (kHz)		100	100	100	100
Max. speed (rpm)		12 000	12 000	12 000	12 000
Shaft diameter (mm)		3	4	6	8



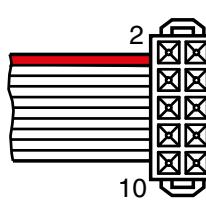
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
RE 40, 25 W	131					91.7
RE 40, 150 W	132					91.7
RE 40, 150 W	132	GP 42, 3.0 - 15 Nm	345			●
RE 40, 150 W	132	GP 52, 4.0 - 30 Nm	350			●
RE 40, 150 W	132		AB 28	458		124.3
RE 40, 150 W	132	GP 42, 3.0 - 15 Nm	345	AB 28	458	●
RE 40, 150 W	132	GP 52, 4.0 - 30 Nm	350	AB 28	458	●
RE 50, 200 W	133					128.7
RE 50, 200 W	133	GP 52, 4 - 30 Nm	351			●
RE 50, 200 W	133	GP 62, 8 - 50 Nm	352			●
RE 65, 250 W	134					157.3
RE 65, 250 W	134	GP 81, 20 - 120 Nm	353			●
A-max 26	148/150				63.1	
A-max 26	148/150	GP 26, 0.75 - 4.5 Nm	332		●	
A-max 26	148/150	GS 30/GP 32	333/336		●	
A-max 26	148/150	GP 32, 0.75 - 6.0 Nm	335/339		●	
A-max 26	148/150	GS 38, 0.1 - 0.6 Nm	344		●	
A-max 26	148/150	GP 32 S	366-368		●	
A-max 32	160/162				82.3	
A-max 32	160/162	GP 32, 0.75 - 6.0 Nm	334-339		●	
A-max 32	160/162	GS 38, 0.1 - 0.6 Nm	344		●	
A-max 32	160/162	GP 32 S	366-368		●	
EC 32, 80 W	218				78.4	
EC 32, 80 W	218	GP 32, 0.75 - 6.0 Nm	334-340		●	
EC 32, 80 W	218	GP 32 S	366-368		●	
EC 40, 170 W	219				103.4	
EC 40, 170 W	219	GP 42, 3.0 - 15 Nm	345		●	
EC 40, 170 W	219	GP 52, 4.0 - 30 Nm	350		●	

## Technical Data

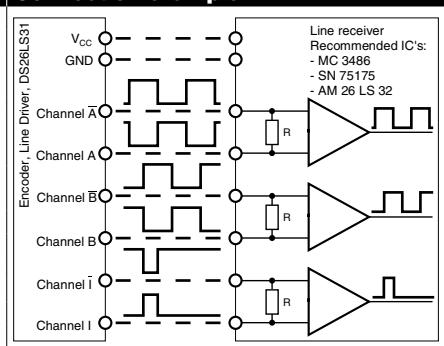
Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	55 mA
Output signal	EIA Standard RS 422
driver used:	DS26LS31
Phase shift $\Phi$	90°e ± 45°e
Signal rise time (typically, at $C_L = 25 \text{ pF}, R_L = 2.7 \text{ k}\Omega, 25^\circ\text{C}$ )	180 ns
Signal fall time (typically, at $C_L = 25 \text{ pF}, R_L = 2.7 \text{ k}\Omega, 25^\circ\text{C}$ )	40 ns
Index pulse width	90°e
Operating temperature range	-40...+100°C
Moment of inertia of code wheel	≤ 0.6 gcm²
Max. angular acceleration	250 000 rad s⁻²
Output current per channel	± 20 mA

## Pin Allocation



Pin type DIN 41651/  
EN 60603-13  
flat band cable AWG 28

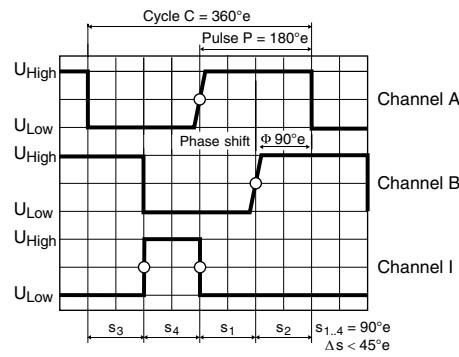
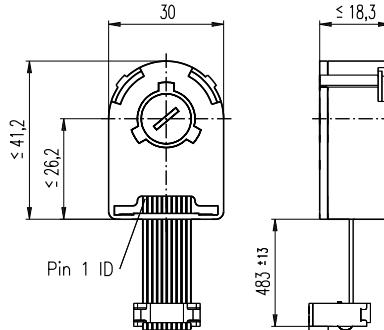
## Connection example



Terminal resistance R = typical 120 Ω

The index signal I is synchronized with channel A or B.

# Encoder HEDL 5540 500 CPT, 3 Channels, with Line Driver RS 422



- Stock program
- Standard program
- Special program (on request)

## Type

	Counts per turn	500	500	500
Number of channels		3	3	3
Max. operating frequency (kHz)		100	100	100
Max. speed (rpm)		12000	12000	12000
Shaft diameter (mm)		3	4	6



## maxon Modular System

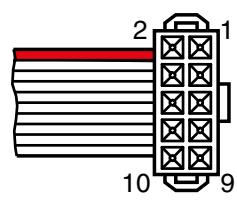
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
EC-max 30, 40 W	230					62.6
EC-max 30, 40 W	230	GP 32, 1.0 - 8.0 Nm	339/341			●
EC-max 30, 40 W	230	KD 32, 1.0 - 4.5 Nm	343			●
EC-max 30, 40 W	230	GP 32 S	366-368			●
EC-max 30, 40 W	230		AB 20	456		98.4
EC-max 30, 40 W	230	GP 32, 1.0 - 8.0 Nm	339/341 AB 20	456		●
EC-max 30, 40 W	230	KD 32, 1.0 - 4.5 Nm	343 AB 20	456		●
EC-max 30, 40 W	230	GP 32 S	366-368 AB 20	456		●
EC-max 30, 60 W	231					84.6
EC-max 30, 60 W	231	GP 32, 1.0 - 8.0 Nm	339/341			●
EC-max 30, 60 W	231	KD 32, 1.0 - 4.5 Nm	343			●
EC-max 30, 60 W	231	GP 42, 3 - 15 Nm	346			●
EC-max 30, 60 W	231		AB 20	456		120.4
EC-max 30, 60 W	231	GP 32, 1.0 - 8.0 Nm	339/341 AB 20	456		●
EC-max 30, 60 W	231	KD 32, 1.0 - 4.5 Nm	343 AB 20	456		●
EC-max 30, 60 W	231	GP 42, 3 - 15 Nm	346 AB 20	456		●
EC-max 40, 70 W	232					81.4
EC-max 40, 70 W	232	GP 42, 3 - 15 Nm	346			●
EC-max 40, 70 W	232		AB 28	457		110.7
EC-max 40, 70 W	232	GP 42, 3 - 15 Nm	346 AB 28	457		●
EC-max 40, 120 W	233					111.4
EC-max 40, 120 W	233	GP 52, 4 - 30 Nm	351			●
EC-max 40, 120 W	233		AB 28	457		140.7
EC-max 40, 120 W	233	GP 52, 4 - 30 Nm	351 AB 28	457		●
EC-4pole 22, 90 W	237					70.1
EC-4pole 22, 90 W	237	GP 22/GP 32	329/339			●
EC-4pole 22, 90 W	237	GP 32 S	366-368			●
EC-4pole 22, 120 W	238					87.5
EC-4pole 22, 120 W	238	GP 22/GP 32	329/339			●
EC-4pole 22, 120 W	238	GP 32 S	366-368			●

## Technical Data

Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	55 mA
Output signal driver used:	EIA Standard RS 422 DS26LS31
Phase shift $\Phi$	90°e ± 45°e
Signal rise time (typically, at $C_L = 25 \text{ pF}$ , $R_L = 2.7 \text{ k}\Omega$ , 25 °C)	180 ns
Signal fall time (typically, at $C_L = 25 \text{ pF}$ , $R_L = 2.7 \text{ k}\Omega$ , 25 °C)	40 ns
Index pulse width	90°e
Operating temperature range	-40...+100 °C
Moment of inertia of code wheel	≤ 0.6 gcm²
Max. angular acceleration	250 000 rad s⁻²
Output current per channel	± 20 mA

The index signal I is synchronized with channel A or B.

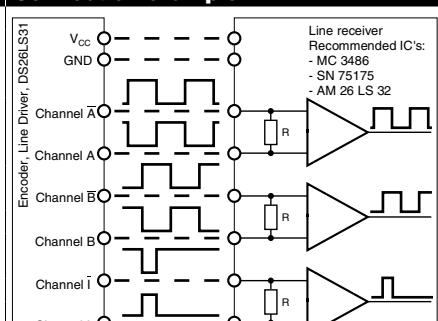
## Pin Allocation



1 N.C.  
2  $V_{CC}$   
3 GND  
4 N.C.  
5 Channel Ā  
6 Channel A  
7 Channel B̄  
8 Channel B  
9 Channel Ī (Index)  
10 Channel I (Index)

Pin type DIN 41651/  
EN 60603-13  
flat band cable AWG 28

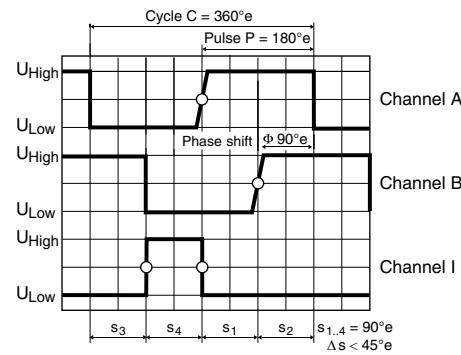
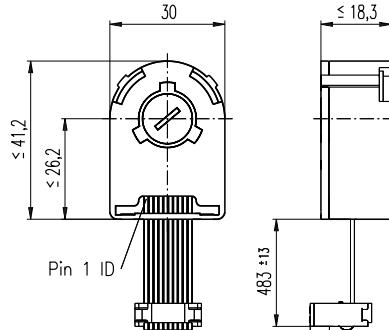
## Connection example



Terminal resistance R = typical 120 Ω

# Encoder HEDL 5540 500 CPT, 3 Channels, with Line Driver RS 422

maxon sensor



- Stock program
- Standard program
- Special program (on request)

## Type

Counts per turn	500	500	500	500	500
Number of channels	3	3	3	3	3
Max. operating frequency (kHz)	100	100	100	100	100
Max. speed (rpm)	12 000	12 000	12 000	12 000	12 000
Shaft diameter (mm)	3	4	6	8	2-4



## Part Numbers

110512	110514	110516	110518	X drives
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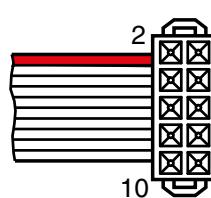
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
EC-4pole 30, 100 W	239					67.6
EC-4pole 30, 100 W	239	GP 32, 4.0 - 8.0 Nm	341			●
EC-4pole 30, 100 W	239	GP 42, 3 - 15 Nm	346			●
EC-4pole 30, 100 W	239		AB 20	456		104.0
EC-4pole 30, 100 W	239	GP 32, 4.0 - 8.0 Nm	341	AB 20	456	●
EC-4pole 30, 100 W	239	GP 42, 3 - 15 Nm	346	AB 20	456	●
EC-4pole 30, 200 W	241					84.6
EC-4pole 30, 200 W	241	GP 32, 4.0 - 8.0 Nm	341			●
EC-4pole 30, 200 W	241	GP 42, 3 - 15 Nm	346			●
EC-4pole 30, 200 W	241		AB 20	456		121.0
EC-4pole 30, 200 W	241	GP 32, 4.0 - 8.0 Nm	341	AB 20	456	●
EC-4pole 30, 200 W	241	GP 42, 3 - 15 Nm	346	AB 20	456	●
EC-i 40, 50 W	247-248					49.0
EC-i 40, 50 W	247	GP 32, 1 - 6 Nm	339			●
EC-i 40, 50 W	247-248	GP 42, 3 - 15 Nm	346			●
EC-i 40, 50 W	247	GP 32 S	366-368			●
EC-i 40, 70 W	249/250					59.0
EC-i 40, 70 W	249	GP 32, 1 - 6 Nm	339			●
EC-i 40, 70 W	249/250	GP 42, 3 - 15 Nm	346			●
EC-i 40, 70 W	249	GP 32 S	366-368			●
EC-i 40, 100 W	251					79.0
EC-i 40, 100 W	251	GP 42, 3 - 15 Nm	346			●
EC-i 52, 180 W	252					102.8
EC-i 52, 180 W	252	GP 52, 4 - 30 Nm	350			●
DCX 22 S	80-81					online
DCX 22 L	82-83					online
DCX 26 L	84-85					online
DCX 32 L	86					online
DCX 35 L	87					online

## Technical Data

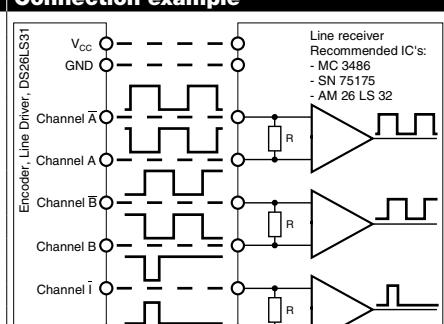
Supply voltage $V_{CC}$	5 V ± 10%
Typical current draw	55 mA
Output signal	EIA Standard RS 422
driver used:	DS26LS31
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Signal rise time (typically, at $C_L = 25 \text{ pF}, R_L = 2.7 \text{ k}\Omega, 25^\circ C$ )	180 ns
Signal fall time (typically, at $C_L = 25 \text{ pF}, R_L = 2.7 \text{ k}\Omega, 25^\circ C$ )	40 ns
Index pulse width	$90^\circ e$
Operating temperature range	-40...+100°C
Moment of inertia of code wheel	$\leq 0.6 \text{ gcm}^2$
Max. angular acceleration	250 000 rad s <sup>-2</sup>
Output current per channel	± 20 mA

## Pin Allocation



- 1 N.C.
  - 2  $V_{CC}$
  - 3 GND
  - 4 N.C.
  - 5 Channel  $\bar{A}$
  - 6 Channel A
  - 7 Channel  $\bar{B}$
  - 8 Channel B
  - 9 Channel  $\bar{I}$  (Index)
  - 10 Channel I (Index)
- Pin type DIN 41651/  
EN 60603-13  
flat band cable AWG 28

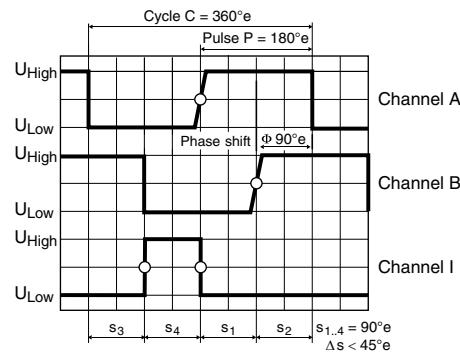
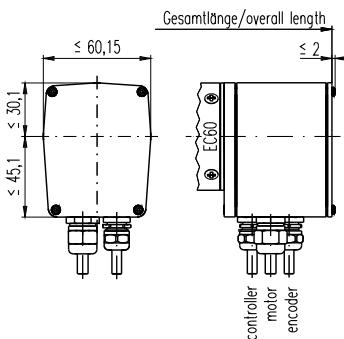
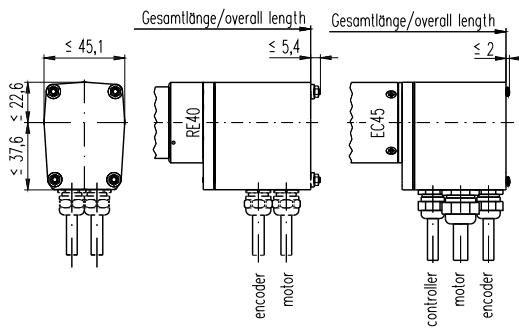
## Connection example



The index signal I is synchronized with channel A or B.

Terminal resistance R = typical 120 Ω

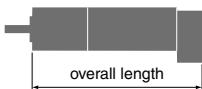
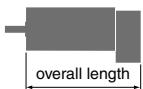
# Encoder HEDL 9140 500 CPT, 3 Channels, with Line Driver RS 422



■ Stock program  
□ Standard program  
■ Special program (on request)

## Type

Counts per turn	500
Number of channels	3
Max. operating frequency (kHz)	100
Max. speed (rpm)	12000



## Part Numbers

137959

## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
RE 40, 150 W	132					125.1
RE 40, 150 W	132	GP 42, 3 - 15 Nm	345			●
RE 40, 150 W	132	GP 52, 4 - 30 Nm	350			●
RE 40, 150 W	132		AB 28	459		135.6
RE 40, 150 W	132	GP 42, 3 - 15 Nm	345	AB 28	459	●
RE 40, 150 W	132	GP 52, 4 - 30 Nm	350	AB 28	459	●
EC 45, 150 W	220					126.8
EC 45, 150 W	220	GP 42, 3 - 15 Nm	345			●
EC 45, 150 W	220	GP 52, 4 - 30 Nm	350			●
EC 45, 150 W	220		AB 28	459		135.6
EC 45, 150 W	220	GP 42, 3 - 15 Nm	345	AB 28	459	●
EC 45, 150 W	220	GP 52, 4 - 30 Nm	350	AB 28	459	●
EC 45, 250 W	221					159.6
EC 45, 250 W	221	GP 42, 3 - 15 Nm	346			●
EC 45, 250 W	221	GP 52, 4 - 30 Nm	350			●
EC 45, 250 W	221	GP 62, 8 - 50 Nm	352			●
EC 45, 250 W	221		AB 28	459		168.4
EC 45, 250 W	221	GP 42, 3 - 15 Nm	346	AB 28	459	●
EC 45, 250 W	221	GP 52, 4 - 30 Nm	350	AB 28	459	●
EC 45, 250 W	221	GP 62, 8 - 50 Nm	352	AB 28	459	●
EC 60, 400 W	222					177.3
EC 60, 400 W	222	GP 81, 20 - 120 Nm	353			●
EC 60, 400 W	222		AB 41	461		214.9
EC 60, 400 W	222	GP 81, 20 - 120 Nm	353	AB 41	461	●

## Technical Data

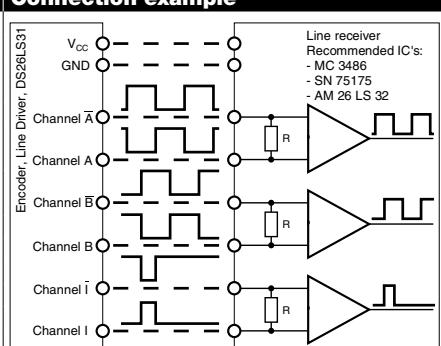
Supply voltage $V_{CC}$	$5 \text{ V} \pm 10\%$
Typical current draw	55 mA
Output signal driver used:	EIA Standard RS 422 DS26LS31
Phase shift $\Phi$	$90^\circ e \pm 45^\circ e$
Signal rise time (typically, at $C_L = 25 \text{ pF}, R_L = 11 \text{ k}\Omega, 25^\circ C$ )	180 ns
Signal fall time (typically, at $C_L = 25 \text{ pF}, R_L = 11 \text{ k}\Omega, 25^\circ C$ )	40 ns
Index pulse width	90°e
Operating temperature range	-40...+85°C
Moment of inertia of code wheel	$\leq 0.6 \text{ gcm}^2$
Max. angular acceleration	250 000 rad s $^{-2}$
Output current per channel	$\pm 20 \text{ mA}$

## Pin Allocation

Cable white	=	2 $V_{CC}$ 5 VDC
Cable brown	=	3 GND
Cable green	=	5 Channel A
Cable yellow	=	6 Channel A
Cable grey	=	7 Channel B
Cable pink	=	8 Channel B
Cable blue	=	9 Channel I (Index)
Cable red	=	10 Channel I (Index)

Cable size  $8 \times 0.25 \text{ mm}^2$

## Connection example

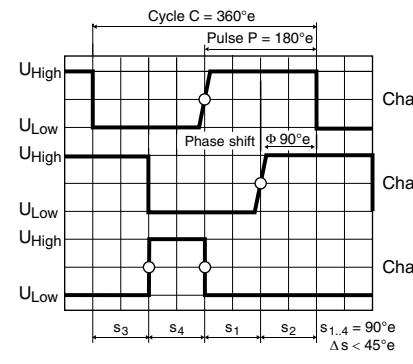
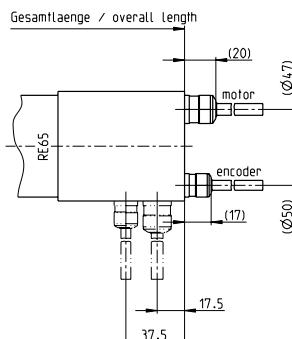
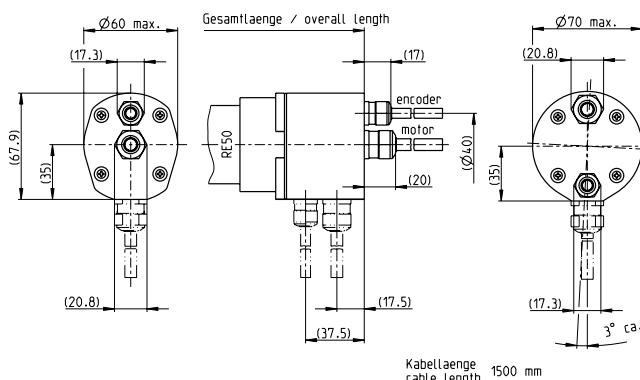


Terminal resistance  $R = \text{typical } 120 \Omega$

The index signal I is synchronized with channel A or B.

# Encoder HEDL 9140 500 CPT, 3 Channels, with Line Driver RS 422

maxon sensor



Direction of rotation cw (definition cw p. 60)

- Stock program
- Standard program
- Special program (on request)

## Part Numbers

cable outlet axial	386051	386001
cable outlet radial	386053	386002

## Type

Counts per turn	500	500
Number of channels	3	3
Max. operating frequency (kHz)	100	100
Max. speed (rpm)	12 000	12 000



## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead
RE 50, 200 W	133					170.4
RE 50, 200 W	133	GP 52, 4 - 30 Nm	351			●
RE 50, 200 W	133	GP 62, 8 - 50 Nm	352			●
RE 50, 200 W	133			AB 44	462	183.4
RE 50, 200 W	133	GP 52, 4 - 30 Nm	351	AB 44	462	●
RE 50, 200 W	133	GP 62, 8 - 50 Nm	352	AB 44	462	●
RE 65, 250 W	134					187.5
RE 65, 250 W	134	GP 81, 20 - 120 Nm	353			●
RE 65, 250 W	134			AB 44	462	205.5
RE 65, 250 W	134	GP 81, 20 - 120 Nm	353	AB 44	462	●

## Technical Data

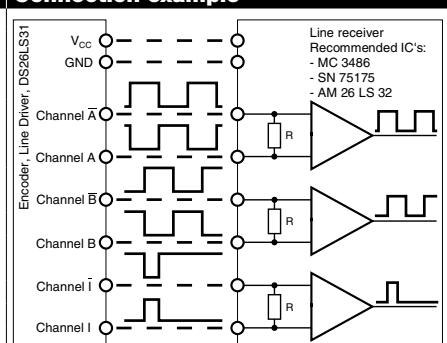
Supply voltage $V_{CC}$	$5 \text{ V} \pm 10\%$
Typical current draw	55 mA
Output signal	EIA Standard RS 422
driver used:	DS26LS31
Phase shift $\phi$	$90^\circ e \pm 45^\circ e$
Signal rise time (typically, at $C_L = 25 \text{ pF}, R_L = 11 \text{ k}\Omega, 25^\circ C$ )	180 ns
Signal fall time (typically, at $C_L = 25 \text{ pF}, R_L = 11 \text{ k}\Omega, 25^\circ C$ )	40 ns
Index pulse width	$90^\circ e$
Operating temperature range	-40...+85°C
Moment of inertia of code wheel	$\leq 0.6 \text{ gcm}^2$
Max. angular acceleration	250 000 rad s $^{-2}$
Output current per channel	$\pm 20 \text{ mA}$
Protection to	IP54

The index signal I is synchronized with channel A or B.

## Pin Allocation

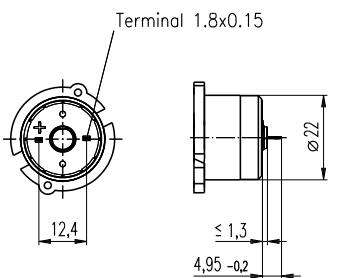
<b>Encoder</b>	=	
Cable white	=	$V_{CC}$ 5 VDC
Cable brown	=	GND
Cable green	=	Channel Ā
Cable yellow	=	Channel A
Cable grey	=	Channel B̄
Cable pink	=	Channel B
Cable blue	=	Channel I (Index)
Cable red	=	Channel I (Index)
Cable size 8 x 0.25 mm $^2$		
<b>Motor</b>		
Cable white	=	Motor +
Cable brown	=	Motor -
Cable size 2 x 1.0 mm $^2$		

## Connection example



Terminal resistance R = typical 120 Ω

# DC Tacho DCT 22 0.52 Volt



## Important Information

- Tacho with moving coil, maxon system.
- Tacho with precious metal commutation.
- To establish total inertia add motor and tacho inertias.
- With the output shaft turning CW as seen from the mounting surface, the tacho output voltage will be positive at the + terminal.
- A high impedance load is recommended at tacho terminals.
- The tacho current should be kept low.
- The indicated resonance frequency refers to the motor-tacho rotor system.

Stock program  
 Standard program  
 Special program (on request)

## Part Numbers

118909      118910

### Type

Shaft diameter (mm)

3      4



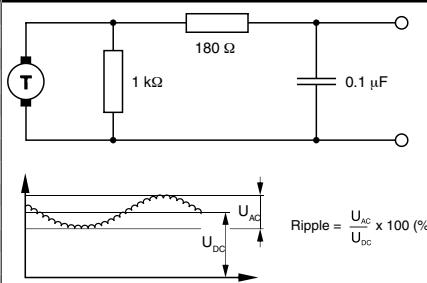
### maxon Modular System

+ Motor	Page	+ Gearhead	Page	Overall length [mm] / ● see Gearhead
RE 25	125/127			76.8
RE 25	125/127 GP 26, 0.75 - 2.0 Nm	332		●
RE 25	125/127 GP 32, 0.75 - 4.5 Nm	334/335		●
RE 25	125/127 GP 32, 0.75 - 6.0 Nm	338		●
RE 25	125/127 GP 32, 1.0 - 4.5 Nm	343		●
RE 25	125/127 GP 32 S	366-368		●
RE 25, 20 W	126			65.3
RE 25, 20 W	126	GP 22, 0.5 Nm	325	●
RE 25, 20 W	126	GP 26, 0.75 - 2.0 Nm	332	●
RE 25, 20 W	126	GP 32, 0.75 - 4.5 Nm	334/335	●
RE 25, 20 W	126	GP 32, 0.75 - 6.0 Nm	338	●
RE 25, 20 W	126	GP 32, 1.0 - 4.5 Nm	343	●
RE 25, 20 W	126	GP 32 S	366-368	●
RE 35, 90 W	130			89.1
RE 35, 90 W	130	GP 32, 0.75 - 6.0 Nm	334-340	●
RE 35, 90 W	130	GP 32, 8 Nm	341	●
RE 35, 90 W	130	GP 42, 3.0 - 15 Nm	345	●
RE 35, 90 W	130	GP 32 S	366-368	●

### Technical Data

Output voltage per 1000 rpm	0.52 V	Max. current	10 mA
Terminal resistance tacho	37.7 Ω	Tolerance of the output voltage	± 15 %
Typical peak to peak ripple	≤ 6 %	Rotor inertia (tacho only)	< 3 gcm <sup>2</sup>
Ripple frequency per turn	14	Resonance frequency with motors on p. 125-127	> 2 kHz
Linear voltage tolerance, 500 to 5000 rpm	± 0.2 %	with motors on p. 130	> 4.5 kHz
Linear voltage tolerance with 10 kΩ load resistance	± 0.7 %	Temperature range	-20 ... +65°C
Polarity error	± 0.1 %		
Temperature coefficient of EMF (magnet)	-0.02 % /°C	Option: Pigtails in place of solder terminals.	
Temperature coefficient of coil resistance	+0.4 % /°C		

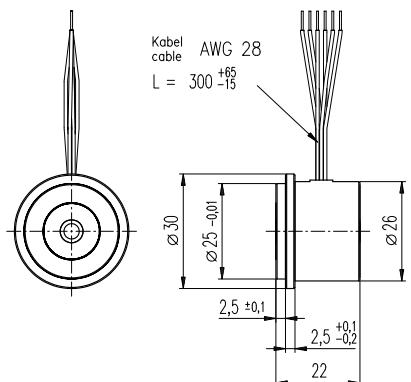
### Connection example



Resonance frequency Motor winding-Tacho winding  $f_R \geq 4$  kHz

# Resolver Res 26 10 Volt

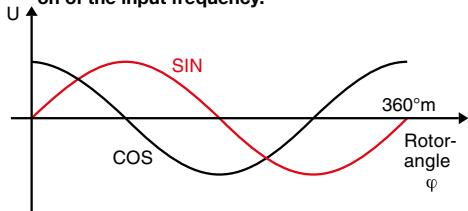
maxon sensor



Primary

Secondary

Output voltage as a function of the rotor angle after demodulation of the input frequency.



- Stock program
- Standard program
- Special program (on request)

## Part Numbers

166488	133405	268912	199287
--------	--------	--------	--------

### Type

Shaft diameter (mm)	4
Max. speed (rpm)	10000

6	6	10000	10000
---	---	-------	-------



### maxon Modular System

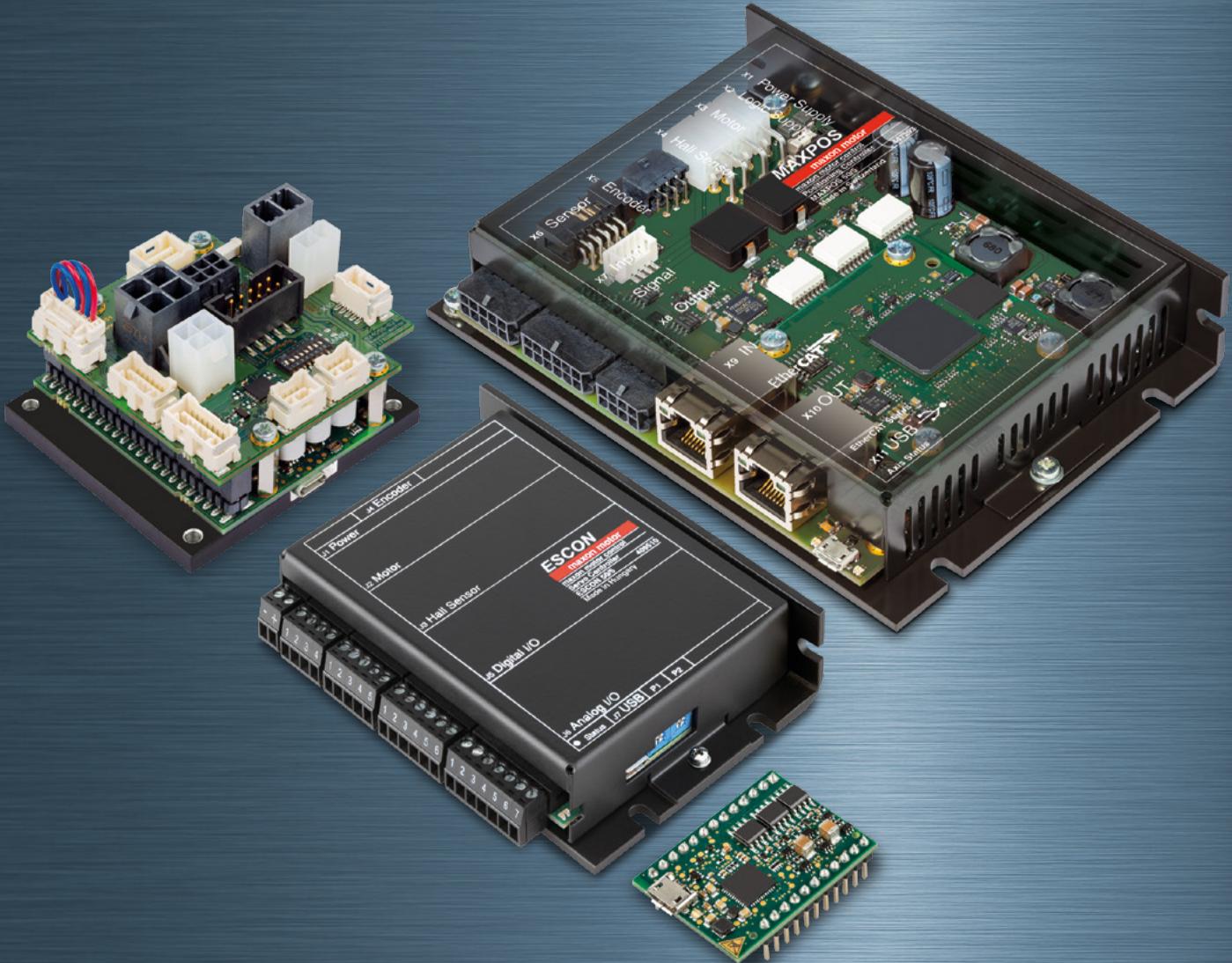
+ Motor	Page	+ Gearhead	Page	Overall length [mm] / ● see Gearhead
EC 32, 80 W	218			80.1
EC 32, 80 W	218	GP 32, 0.75 - 6.0 Nm	334-340	●
EC 32, 80 W	218	GP 32 S	366-368	●
EC 40, 170 W	219			107.2
EC 40, 170 W	219	GP 42, 3.0 - 15 Nm	345	●
EC 40, 170 W	219	GP 52, 4.0 - 30 Nm	350	●
EC 45, 150 W	220			111.2
EC 45, 150 W	220	GP 42, 3.0 - 15 Nm	345	●
EC 45, 150 W	220	GP 52, 4.0 - 30 Nm	350	●
EC 45, 250 W	221			144.0
EC 45, 250 W	221	GP 42, 3.0 - 15 Nm	345	●
EC 45, 250 W	221	GP 52, 4.0 - 30 Nm	350	●
EC 45, 250 W	221	GP 62, 8.0 - 50 Nm	352	●
EC 60, 400 W	222			177.3
EC 60, 400 W	222	GP 81, 20 - 120 Nm	353	●

### Technical Data

Input voltage	10 V peak, 10 kHz
Transmission ratio	0.5
Electrical error	± 10 minutes
Rotor inertia	6 gcm <sup>2</sup>
Weight	40 g
Operating temperature range	-55 ... +155°C

### Pin Allocation

Prim +	EC 32/EC 40	EC 45/EC 60
Prim GND	red/white	white
cos +	yellow/white	brown
sin +	red	green
cos -	yellow	yellow
sin -	schwarz	grey
	blue	pink



# maxon motor control

Various 4-quadrant PWM servo controllers for permanent magnet-activated brushed DC motors and brushless EC motors meet all requirements in terms of performance and functionality. Thanks to the fast current controller and dynamic speed controller, outstanding control characteristics are achieved. Combined with maxon motors, the positioning controllers constitute complete solutions for highly demanding motion control applications.

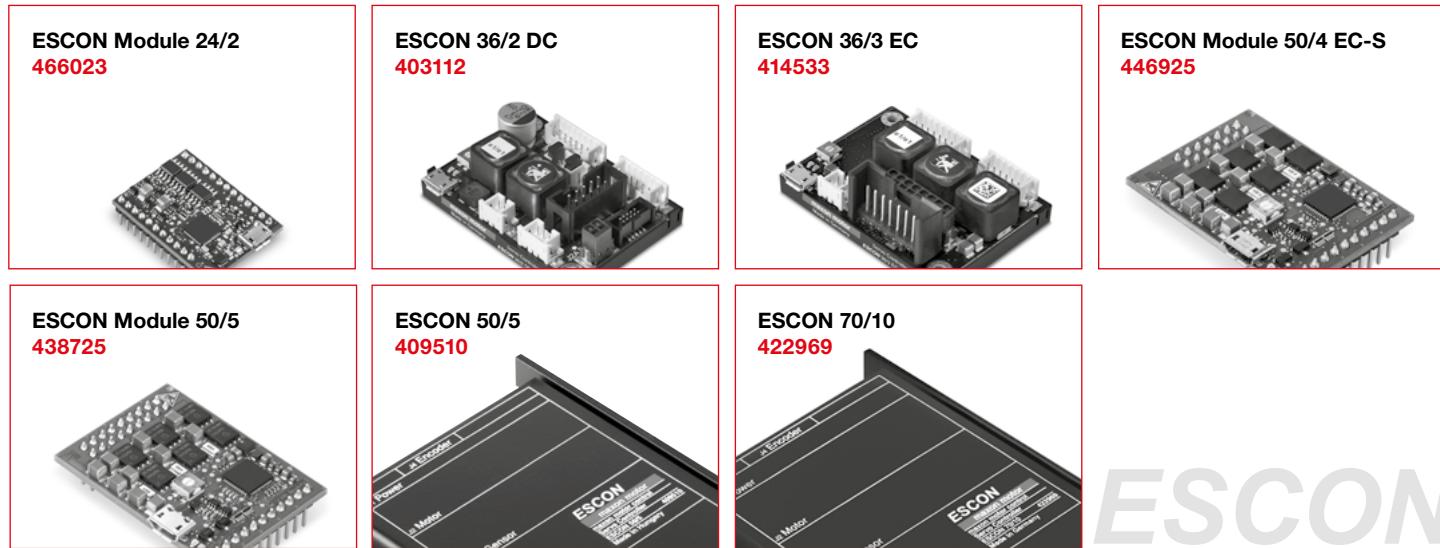
<b>ESCON servo controllers</b>	424–428
<b>1-Q-EC Servoamplifier</b>	429–430
<b>Positioning control units EPOS2</b>	<b>NEW</b> 431–435
<b>Positioning control unit EPOS2 P</b>	436–438
<b>Positioning control units EPOS4</b>	<b>NEW</b> 439–444
<b>Positioning control unit MAXPOS</b>	445–447
<b>Summary maxon motor control</b>	448
<b>Summary accessories</b>	449–450

# 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

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 and without 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

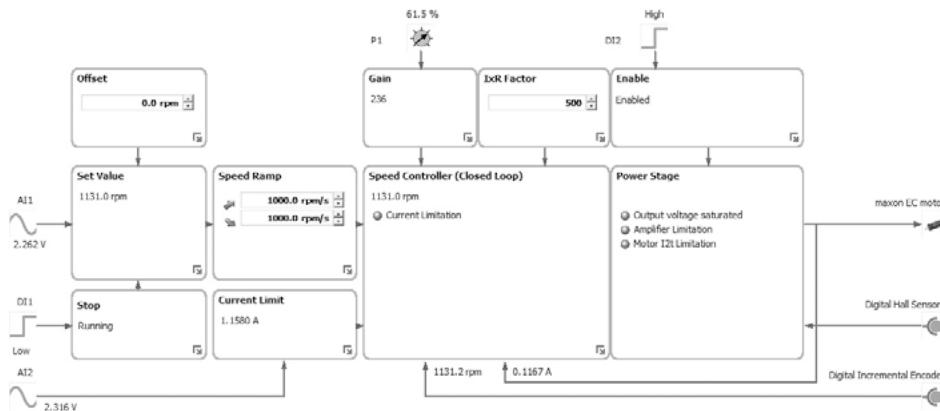
processing. Their impulses are counted to determine the speed. Channels A and B are phase-shifted signals, which are being compared to determine the direction of rotation.

- **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 direction of rotation.
- **Sensorless EC:** The speed is determined by the progression of the induced voltage. The electronics evaluates the zero crossing of the induced voltage (EMF).

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%.



ESCON Studio (Controller Monitor)

– **RC Servo Value:** The value is set with a signal pulse with a duration of 1.0...2.0 ms.

– **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 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 and Current Comparator:** The digital output is set depending on the actual value.

– **Limit:** The digital output is set as soon as the preset value is reached. It remains set as long as the value is exceeded.

- Range:** The digital output is set as soon as the preset value range is reached. It remains set as long as the value remains in range.
- Deviation:** The digital output is set as soon as the preset value deviation (based on the set value) is in range.

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.
- I<sub>x</sub>R 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 suitable ESCON servo controller can easily be determined. The "Hardware Reference" comprises the specifications of the hardware in detail. The documents "Firmware Version" and "Release Notes" describe changes and improvements of firmware and software. In addition, the graphical user interface "ESCON Studio" features 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 10, Windows 8, Windows 7, Windows XP SP3

Communication interface: USB 2.0/3.0 (full speed)

Accessories ESCON*	M 24/2	36/2 DC	36/3 EC	M 50/4 EC-S	M 50/5	50/5	70/10
404404 ESCON 36/2 DC Connector Set	—	✓	—	—	—	—	—
425255 ESCON 36/3 EC Connector Set	—	—	✓	—	—	—	—
403962 DC Motor Cable	—	✓	—	—	—	—	—
403964 I/O Cable 7core (analog I/O's)	—	✓	✓	—	—	—	—
403965 I/O Cable 6core (digital I/O's)	—	✓	✓	—	—	—	—
275934 Encoder Cable	—	✓	—	—	—	✓	✓
403957 Power Cable	—	✓	✓	—	—	—	—
403968 USB Type A - micro B Cable	✓	✓	✓	✓	✓	✓	✓
418719 Adapter BLACK FPC11poles	—	—	✓	—	—	—	—
418723 Adapter BLUE FPC8poles	—	—	✓	—	—	—	—
418721 Adapter GREEN FPC8poles	—	—	✓	—	—	—	—
486400 ESCON Module 24/2 Motherboard	✓	—	—	—	—	—	—
438779 ESCON Module Motherboard	—	—	—	—	✓	—	—
450237 ESCON Module Motherboard Sensorless	—	—	—	✓	—	—	—
409286 ESCON USB Stick	✓	✓	✓	✓	✓	✓	✓

\*not included in delivery

# ESCON Feature Comparison Chart



	<b>ESCON Module 24/2</b>	<b>ESCON 36/2 DC</b>
DC motors up to (continuous / maximum)	48 W / 144 W	72 W / 144 W
EC motors up to (continuous / maximum)	48 W / 144 W	–
<b>Sensors</b>		
Digital Incremental Encoder (2 channel with or without Line Driver)	Digital Incremental Encoder (2 channel with or without Line Driver)	Digital Incremental Encoder (2 channel with or without Line Driver)
DC Tacho	DC Tacho	DC Tacho
Without sensor (DC motors)	Without sensor (DC motors)	–
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)	Current controller (torque control), Speed controller (closed and open loop)
<b>Electrical data</b>		
Nominal operating voltage $V_{CC}$	10 - 24 VDC	10 - 36 VDC
Max. output voltage	$0.98 \times V_{CC}$	$0.98 \times V_{CC}$
Max. output current	6 A (<4 s)	4 A (<60 s)
Continuous output current	2 A	2 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	92%	95%
Max. speed (DC)	limited by max. speed (motor) and max. output voltage (controller)	limited by max. 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
<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
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...+60°C	-30...+45°C
Temperature – Extended range	+60...+80°C; Derating: -0.100 A/ $^{\circ}$ C	+45...+81°C; Derating: -0.056 A/ $^{\circ}$ C
Temperature – Storage	-40...+85°C	-40...+85°C
Humidity (condensation not permitted)	5...90%	5...90%
<b>Mechanical data</b>		
Weight	Approx. 7 g	Approx. 30 g
Dimensions (L x W x H)	35.6 x 26.7 x 12.7 mm	55.0 x 40.0 x 16.1 mm
Mounting holes	Plugable (socket headers with 2.54 mm pitch)	for screws M2.5
<b>Part numbers</b>		
	<b>466023</b> ESCON Module 24/2	<b>403112</b> ESCON 36/2 DC
	Order accessories separately, from page 449	Order accessories separately, from page 449

# ESCON Feature Comparison Chart



<b>ESCON 36/3 EC</b>	<b>ESCON Module 50/4 EC-S</b>	<b>ESCON Module 50/5</b>
–	–	250 W / 750 W
97 W / 324 W	200 W / 600 W	250 W / 750 W
<b>Sensors</b>		
–	–	Digital Incremental Encoder (2 channel with or without Line Driver)
–	–	DC Tacho
–	Without sensor (EC motors)	Without sensor (DC motors)
Digital Hall Sensors (EC motors)	–	Digital Hall Sensors (EC motors)
<b>Operating mode</b>		
Current controller (torque control), Speed controller (closed and open loop)	Speed controller (closed and open loop)	Current controller (torque control), Speed controller (closed and open loop)
<b>Electrical data</b>		
10 - 36 VDC	10 - 50 VDC	10 - 50 VDC
$0.98 \times V_{CC}$	$0.96 \times V_{CC}$	$0.98 \times V_{CC}$
9 A (<4 s)	12 A (<30 s)	15 A (<20 s)
2.7 A	4 A	5 A
53.6 kHz	53.6 kHz	53.6 kHz
53.6 kHz	–	53.6 kHz
5.36 kHz	5.36 kHz	5.36 kHz
95%	97%	98%
–	–	limited by max. speed (motor) and max. output voltage (controller)
150 000 rpm	120 000 rpm	150 000 rpm
3 x 47 $\mu$ H / 2.7 A	–	–
<b>Inputs/Outputs</b>		
H1, H2, H3	–	H1, H2, H3
–	–	A, A\, B, B\
–	–	1 MHz (100 kHz)
1	1	1
2	2	2
2	2	2
2	2	2
12-bit, -10...+10 V, differential	12-bit, -10...+10 V, differential	12-bit, -10...+10 V, differential
2	2	2
12-bit, -4...+4 V	12-bit, -4...+4 V	12-bit, -4...+4 V
+5 VDC ( $IL \leq 10$ mA)	+5 VDC ( $IL \leq 110$ mA)	+5 VDC ( $IL \leq 10$ mA)
+5 VDC ( $IL \leq 30$ mA)	–	+5 VDC ( $IL \leq 30$ mA)
–	–	+5 VDC ( $IL \leq 70$ mA)
Operation: green LED / Error: red LED	Operation: green LED / Error: red LED	Operation: green LED / Error: red LED
<b>Environmental conditions</b>		
-30...+45°C	-30...+45°C	-30...+45°C
+45...+78°C; Derating: -0.082 A/°C	+45...+65°C; Derating -0.200 A/°C	+45...+75°C; Derating: -0.167 A/°C
-40...+85°C	-40...+85°C	-40...+85°C
5...90%	5...90%	5...90%
<b>Mechanical data</b>		
Approx. 36 g	Approx. 11 g	Approx. 12 g
55.0 x 40.0 x 19.8 mm	43.2 x 31.8 x 12.7 mm	43.2 x 31.8 x 12.7 mm
for screws M2.5	Plugable (socket headers with 2.54 mm pitch)	Plugable (socket headers with 2.54 mm pitch)
<b>Part numbers</b>		
<b>414533</b> ESCON 36/3 EC	<b>446925</b> ESCON Module 50/4 EC-S	<b>438725</b> ESCON Module 50/5
Order accessories separately, from page 449	Order accessories separately, from page 449	Order accessories separately, from page 449

# ESCON Feature Comparison Chart



	<b>ESCON 50/5</b>	<b>ESCON 70/10</b>
DC motors up to (continuous / maximum)	250 W / 750 W	700 W / 2100 W
EC motors up to (continuous / maximum)	250 W / 750 W	700 W / 2100 W
<b>Sensors</b>		
Digital Incremental Encoder (2 channel with or without Line Driver)	Digital Incremental Encoder (2 channel with or without Line Driver)	Digital Incremental Encoder (2 channel with or without Line Driver)
DC Tacho	DC Tacho	DC Tacho
Without sensor (DC motors)	Without sensor (DC motors)	Without sensor (DC motors)
Digital Hall Sensors (EC motors)	Digital Hall Sensors (EC motors)	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)	Current controller (torque control), Speed controller (closed and open loop)
<b>Electrical data</b>		
Nominal operating voltage $V_{CC}$	10 - 50 VDC	10 - 70 VDC
Max. output voltage	$0.98 \times V_{CC}$	$0.95 \times V_{CC}$
Max. output current	15 A (<20 s)	30 A (<20 s)
Continuous output current	5 A	10 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%	98%
Max. speed (DC)	limited by max. speed (motor) and max. output voltage (controller)	limited by max. speed (motor) and max. output voltage (controller)
Max. speed (EC; 1 pole pair)	150 000 rpm	150 000 rpm
Built-in motor choke	3 x 30 $\mu$ H / 5 A	3 x 15 $\mu$ H / 10 A
<b>Inputs/Outputs</b>		
Hall sensor signals	H1, H2, H3	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	2	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)	+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...+85°C; Derating: -0.111 A/°C	+45...+82°C; Derating: -0.270 A/°C
Temperature – Storage	-40...+85°C	-40...+85°C
Humidity (condensation not permitted)	5...90%	5...90%
<b>Mechanical data</b>		
Weight	Approx. 204 g	Approx. 259 g
Dimensions (L x W x H)	115 x 75.5 x 24 mm	125 x 78.5 x 27 mm
Mounting holes	for screws M4	for screws M4
<b>Part numbers</b>		
	<b>409510</b> ESCON 50/5	<b>422969</b> ESCON 70/10
	Order accessories separately, from page 449	Order accessories separately, from page 449

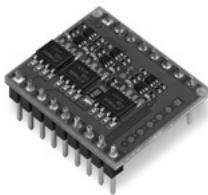
# 1-Q-EC Amplifier Summary

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

Simple speed controls are possible with 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.

## 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.

Technical data page 430.

### 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 optimized 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 speed input through external analog voltage. Status indicator with "Ready"-Output.

### Protection circuit

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

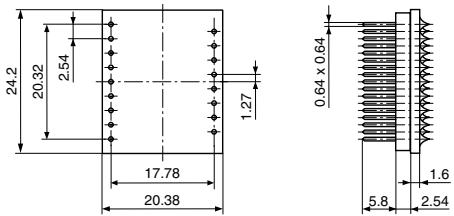
### DEC Module 24/2

#### Connections

Male header	8 + 9 = 17 poles
Pitch	2.54 mm

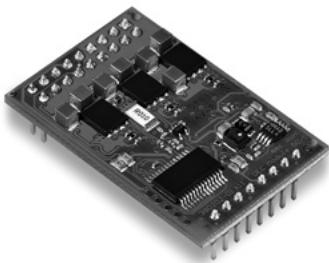
DEC Module 24/2

**367661**



Dimensions in [mm]

## 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.

Technical data page 430.

### 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.

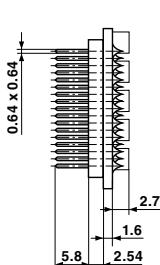
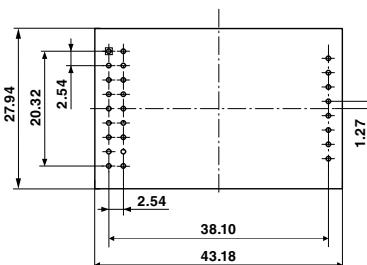
### DEC Module 50/5

#### 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]

# 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 Module 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 (closed and open loop)	Speed Controller (closed and open loop)
<b>Electrical data</b>		
Operating voltage $V_{CC}$	8 - 24 VDC (optional 5.0 VDC)	6 - 50 VDC (optional 5.0 VDC)
Max. output voltage	$V_{CC}$	0.95 x $V_{CC}$
Max. output current $I_{max}$	3 A	10 A
Continuous output current $I_{cont}$	2 A	5 A
Switching frequency of power stage	46.8 kHz	46.8 kHz
Max. speed (1 pole pair)	80 000 rpm	80 000 rpm
<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	“Current Limit” external resistor against GND
Enable	“Enable” +2.4...24 V	“Enable” +2.4...50 V
Direction	“Direction” +2.4...24 V	“Direction” +2.4...50 V
<b>Output</b>		
Monitor		“Monitor n”, digital, (5 V)
Status reading “Ready”	“Ready”, digital, (5 V)	“Ready”, digital, (5 V)
<b>Voltage outputs</b>		
Hall sensors supply voltage $V_{CC\ Hall}$	+5 VDC, max. 35 mA	+5 VDC, max. 35 mA
<b>Possible adjustments</b>	Input “Mode 0” and “Mode 1”	Input “Mode 0” and “Mode 1”
<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
Thermal protection of power stage	T > 95°C	T > 100°C
Under- / Overvoltage protection	Switches off when $V_{CC} < 6.5$ V or $V_{CC} > 30$ V	Switches off when $V_{CC} < 6$ V or $V_{CC} > 56$ 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. 4 g	Approx. 9 g
Dimensions (L x W x H)	24.2 x 20.38 x 12.7 mm (see page 429)	43.18 x 27.94 x 12.7 mm (see page 429)
Mounting	mountable on socket terminal strips pitch 2.54 mm	mountable on socket terminal strips pitch 2.54 mm
<b>Connections</b>	See page 429	See page 429
<b>Part numbers</b>	<b>367661 DEC Module 24/2 1-Q-EC Amplifier</b>	<b>380200 DEC Module 50/5 1-Q-EC Amplifier</b>

Accessories	370652 DEC Module Eva-Board	370652 DEC Module Eva-Board

# EPOS2 Positioning Controllers Summary

Online commanded



## EPOS2 24/2

- Several device variations allows the operation of various maxon DC and EC micromotors 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
- Miniaturized design

Details pages 432–434

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

Typical applications:

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

### Part Numbers

EPOS2 24/2      380264, 390003  
390438, 530239

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 432–434

Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, µ-Processor, etc.) or PC via USB<sup>1</sup> or RS232 interface

<sup>1</sup> requires external transceiver

Typical applications:

- Small apparatus/applications
- System automation tasks
- OEM customers

### Part Number

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 design

Details pages 432–435

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

### Part Number

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 design

Details pages 432–435

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

### Part Number

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
- Robust design

Details pages 432–435

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

### Part Number

EPOS2 70/10      375711

# EPOS2 Positioning Controllers

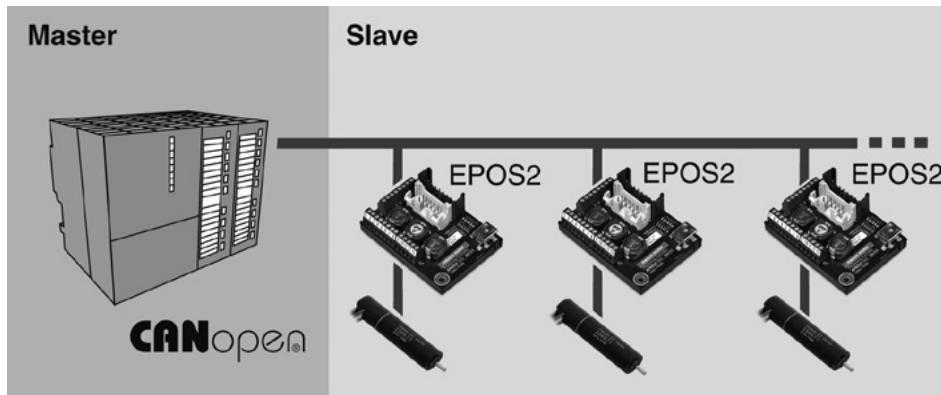
CANopen®



## CANopen Slave (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 to 700 watts continuous power. A number of operating modes provides flexible application in a wide range of drive systems in automation technology and mechatronics.

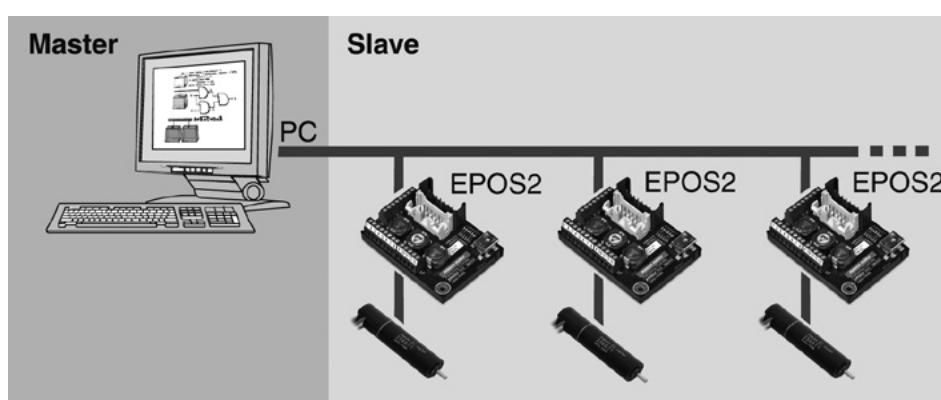


## Point to point

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

## 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 behavior. 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 is a wide variety of methods for referencing.

**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 synchronized 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 backlash 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. The delay times can be individually configured for switching on and off.

Additional information for technical data of page 434/435

**Standardized, extendable**

CANopen standard CiA 301, 402 and 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.

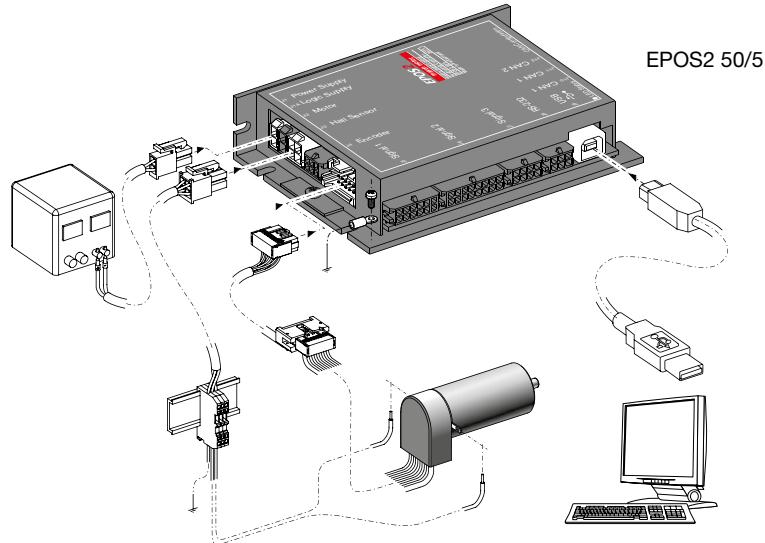
**Easy programming**

IEC 61131-3 libraries for CAN master units from industry leading manufacturers (Beckhoff, Siemens/Helmholz, VIPA) as well as 32/64-bit Windows DLLs for PC master units (IXXAT, Vector, National Instruments and Kvaser) are available. Programming examples for MS Visual C#, MS Visual C++, MS Visual Basic, Borland C++, Borland Delphi, National Instruments LabVIEW and National Instruments LabWindows/CVI are available at no charge.

Also available: The 32/64-bit Linux Shared Object Library with programming examples for Eclipse C++/QT as well as ARMv7 support for a wide variety of platforms (Raspberry Pi, BeagleBone). In addition, the maxon library for NI SoftMotion makes integration of EPOS2 in the National Instruments Compact Rio system easy.

**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 2.0/3.0 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/Linux Shared Object Library

IEC 61131-3 Libraries

Firmware

**Available documentation**

Feature Chart

Getting Started

Cable Starting Set

Hardware Reference

Firmware Specification

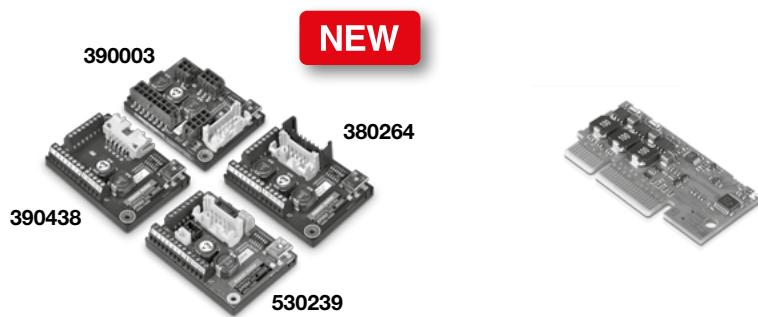
Communication Guide

Application Notes

**Cable**

A comprehensive range of cables is available as an option. Details can be found on page 449.

# EPOS2 Positioning Controllers Data



## EPOS2 24/2

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder up to 48/96 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 72/144 watts.

Controller versions	CANopen Slave	CANopen Slave
<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 $I_{max} (<1\text{ s})$	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 2.0/3.0	Data+; Data- (full speed)	external USB transceiver required
<b>Indicator</b>		
LED green = READY, red = ERROR	green LED, red LED	green LED, red LED
<b>Environmental conditions</b>		
Temperature – Operation	-10...+55°C	-10...+45°C
Temperature – Extended range	+55...+74°C; Derating: -0.105 A/ $^{\circ}$ C	+45...+75°C; Derating: -0.067 A/ $^{\circ}$ C
Temperature – Storage	-40...+85°C	-40...+85°C
Humidity (condensation not permitted)	5...90%	5...90%
<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	Flange for M2.5-screws	PCB edge connector with locking mechanism
<b>Part numbers</b>	<a href="#">390438</a> EPOS2 24/2 for DC motors <a href="#">380264</a> EPOS2 24/2 for EC motors <a href="#">390003</a> EPOS2 24/2 for DC/EC motors <a href="#">530239</a> EPOS2 24/2 for DC(X) motors	
<b>Accessories</b>	<a href="#">309687</a> DSR 50/5 Shunt regulator Order accessories separately, see page 449	
	<a href="#">360665</a> EPOS2 Module 36/2 Order accessories separately, see page 449	
	<a href="#">363407</a> EPOS2 Module Starter-Kit Order accessories separately, see page 449	

**EPOS2 24/5**

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder to 120/240 watts.

**EPOS2 50/5**

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder to 250/500 watts.

**EPOS2 70/10**

Matched with DC brush motors with encoder or brushless EC motors with Hall sensors or encoder to 700/1750 watts.

<b>Controller versions</b>		
CANopen Slave	CANopen Slave	CANopen Slave
<b>Electrical data</b>		
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
<b>Input</b>		
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 (12-bit resolution, 0...+5 V) configurable with DIP switch 1...7	2 (differential, 12-bit resolution, ±10 V) configurable with DIP switch 1...7	2 (differential, 12-bit resolution, 0...+5 V) configurable with DIP switch 1...7
<b>Output</b>		
4	5 (4 optically isolated, 1 differential) 1 (12-bit, 0...10 V)	5 (4 optically isolated, 1 differential)
+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)
<b>Interface</b>		
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)
<b>Indicator</b>		
green LED, red LED	green LED, red LED	green LED, red LED
<b>Environmental conditions</b>		
-10...+55°C	-10...+45°C	-10...+45°C
+55...+83°C; Derating: -0.179 A/°C	+45...+80°C; Derating: -0.143 A/°C	+45...+85°C; Derating: -0.250 A/°C
-40...+85°C	-40...+85°C	-40...+85°C
5...90%	5...90%	5...90%
<b>Mechanical data</b>		
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
<b>Part numbers</b>		
<b>367676 EPOS2 24/5</b>	<b>347717 EPOS2 50/5</b>	<b>375711 EPOS2 70/10</b>
<b>Accessories</b>		
<b>309687 DSR 50/5 Shunt regulator</b>	<b>309687 DSR 50/5 Shunt regulator</b>	<b>235811 DSR 70/30 Shunt regulator</b>
Order accessories separately, see page 449	Order accessories separately, see page 449	Order accessories separately, see page 449

# 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 438

Standalone operation, programmable from PC via RS232 or USB 2.0/3.0 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 2.0/3.0 or CANopen.

Typical applications:

- Work equipment manufacturing
- Tool building
- System automation tasks

**Part Number**  
EPOS2 P 24/5      **378308**

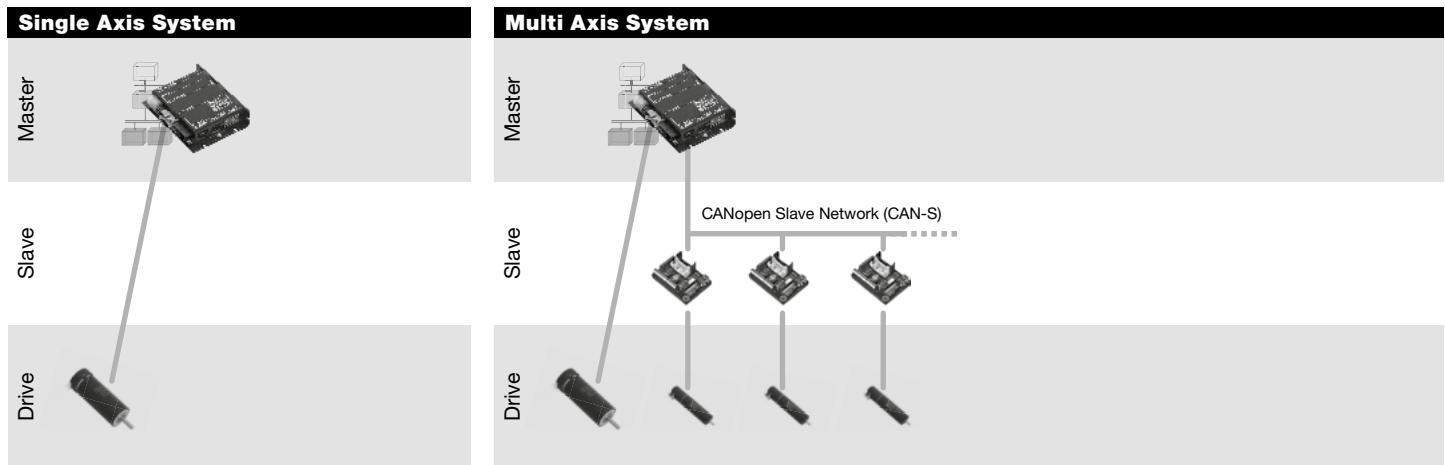
EPOS2 P is a freely programmable positioning controller with an integrated power stage, based on the EPOS2 slave version. It is suitable for DC and EC motors with incremental encoder and a continuous output power up to 120 W.

## Standalone drive systems

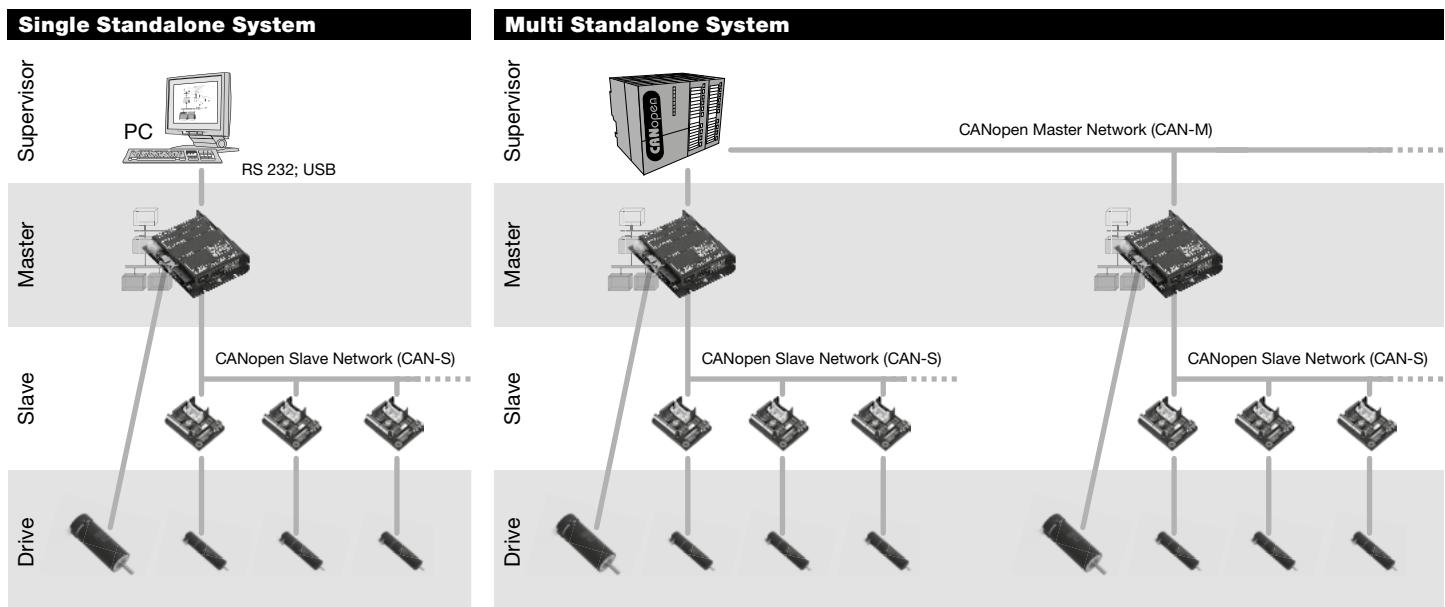
With self-compiled programs, the standalone version of EPOS2 can autonomously control single and multiple axis systems dispensing with the need for a superior intelligent control

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.

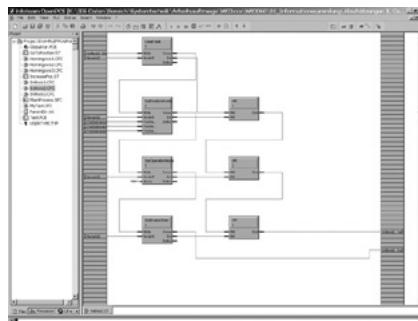
### maxon utility library

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 438

#### Performance features

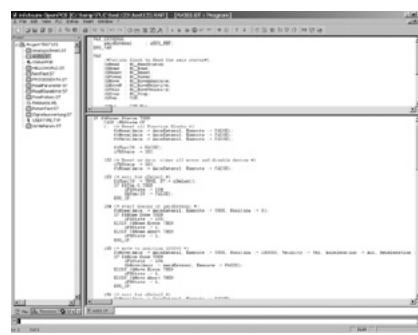
- 32 bit host processor, 60 MHz
- 1 MB memory, with 768 KB free user program memory
- typically 2.5 ms / 5000 lines IL
- 4 KB non-volatile memory
- Digital motion control signal processor



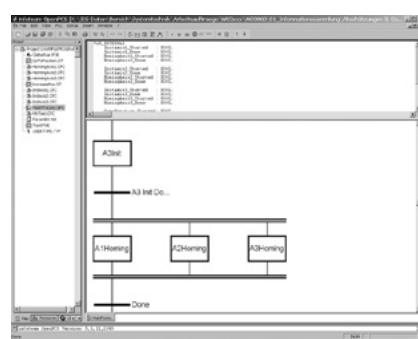
FBD Editor

#### 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



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 to 120/240 watts.

## Additional information

### Controller versions

#### CANopen Master (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\, B, B\, I, I\ (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 2.0/3.0	Data+; Data- (full speed)

##### Indicator

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

### Environmental conditions

Temperature – Operation	-10...+55°C
Temperature – Extended range	+55...+83°C; Derating: -0.179 A/°C
Temperature – Storage	-40...+85°C
Humidity (condensation not permitted)	5...90%

### Mechanical data

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

### Part numbers

**378308 EPOS2 P 24/5**

### Accessories

**309687 DSR 50/5 Shunt regulator**

Order accessories separately, see page 449

### 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 2.0/3.0 or RS232

Communication via CANopen, RS232 or USB 2.0/3.0 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 449.

# EPOS4 Positioning Controllers Overview

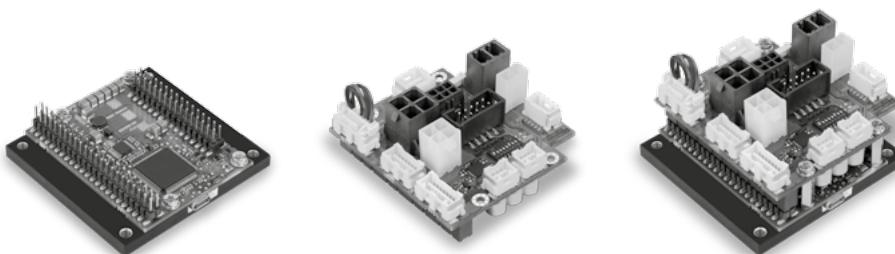


## CANopen slave with EtherCAT option

EPOS4 is the next generation of our CANopen positioning controller. It combines maximum power density with improved control performance and better functionality. The modular concept also provides for a wide variety of expansion options with Ethernet-based interfaces like EtherCAT or absolute rotary encoders. All these innovations combined with the proven concepts of the EPOS product line are consistently based on the successful principle of the **E**asy to use **P**ositioning **S**ystem.

As part of the new modular system, the EPOS4 controllers can be built with ready-to-install connector boards into compact solutions that match a wide variety of requirements. Optional expansion modules make it possible to provide custom basic functionalities at low cost:

Module + Connector Board = Compact



EPOS4 is a modular digital positioning controller. It is suitable for permanent magnet-activated DC motors and brushless, electronically commutated EC motors with incremental or absolute encoders with an operational range of up to 750 W continuous power. The variety of operating modes provides high flexibility: The controllers are suitable for use in a wide range of drive systems in automation and mechatronics.

### Cyclic Synchronous Position (CSP)

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

### Cyclic Synchronous Velocity (CSV)

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

### Cyclic Synchronous Torque (CST)

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

### Point-to-point

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

### Interpolated Position Mode (PVT)

Thanks to Interpolated Position Mode, the EPOS4 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, in preparation)

### Position and velocity control with feed forward

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

### Speed control

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

### Homing

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

### Feedback options

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

**Protection**

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

**Safe Torque Off (STO)**

With this safety feature in accordance with IEC61800-5-2 (certification pending), the drive can be brought to a safe state at any time from two independent digital inputs. The supply of torque-generating power is interrupted.

**Operating modes/Control**

Cyclic Synchronous Position (CSP)  
Cyclic Synchronous Velocity (CSV)<sup>1</sup>  
Cyclic Synchronous Torque (CST)

Profile Position, Profile Velocity and Homing Mode

Interpolated Position Mode (PVT)<sup>1</sup>

Speed and Acceleration Feed Forward

Sinusoidal or Block Commutation for EC motors

Alternative set value input via step/direction, master encoder or analog commands<sup>1</sup>

Dual-loop Position and Speed Control<sup>1</sup>

**Communication/Configuration**

Communication via CANopen and/or USB 2.0/3.0 and/or RS232

USB to CAN and RS232 to CAN gateway

Optional EtherCAT CoE<sup>1</sup>

**Inputs/Outputs**

STO (Safe Torque Off) inputs and outputs, optically isolated

Free digital inputs, configurable e.g. for limit/ reference switches

Free digital outputs, configurable e.g. for brake

Free analog inputs, configurable e.g. for set value

Free analog outputs, configurable e.g. for current monitor

**Available software**

EPOS Studio

Windows DLL (32-/64-bit) with programming examples

Linux shared object library (X86 32-/64-bit, ARMv7 for Raspberry Pi and BeagleBone) with programming examples

IEC 61131-3 libraries

Firmware

**Available documentation**

Feature Chart

Hardware Reference

Firmware Specification

Communication Guide

Application Notes

**Accessories**

A wide range of optional cables and connectors are available. See page 449.

<sup>1</sup> in preparation

The state can be monitored via an additional digital output. The inputs and outputs are optically isolated.

**Capture Inputs (Touch Probe)**

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

**Trigger Output (Position Compare)**

The digital outputs can be configured to that a digital signal is sent at a selectable position value (in preparation).

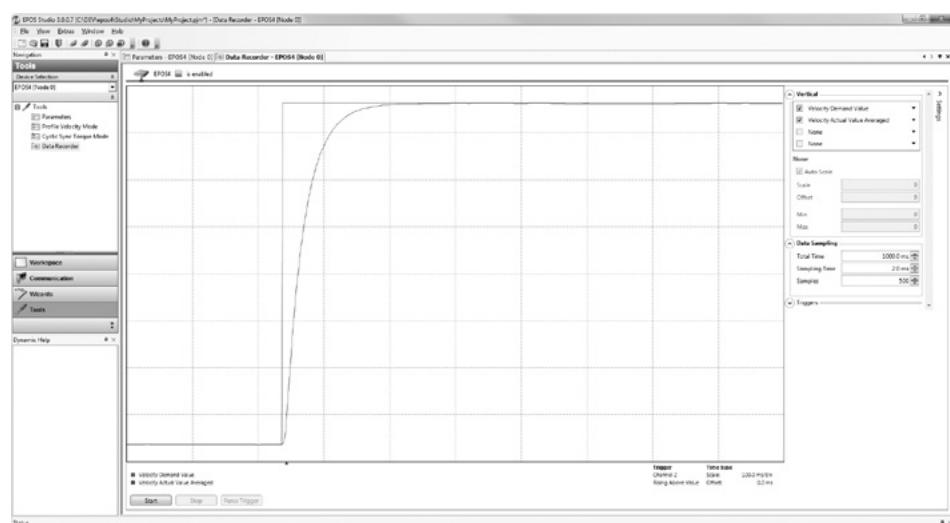
**Control of Holding Brakes**

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

Supplementary information for technical data page 443–444.

**EPOS4 performance characteristics**

- Maximum power density
- Convincing control performance even with highly dynamic motors
- Comprehensive feedback options
- Diverse I/O connection options for peripherals
- Uncompromising protective features for controller and drive
- Configuration and communication via CANopen (CiA 301, 402, 305), RS232 and USB (EtherCAT option in preparation)
- Easy commissioning via EPOS studio GUI and intuitive tools
- Libraries and programming examples for efficient integration in a wide variety of systems
- All software components are freely available at any time
- Full documentation and outstanding support

**The complete package for your motion control solution with added value.****Accessories EPOS4 (not included in delivery)**

	Module 24/1.5	Compact 24/1.5 CAN	Module 50/5	Compact 50/5 CAN	Module 50/8	Compact 50/8 CAN	Module 50/15	Compact 50/15 CAN
520858 CAN-CAN Cable	–	✓	–	–	–	✓	–	✓
520857 CAN-COM Cable	–	✓	–	✓	–	✓	–	✓
275934 Encoder Cable	–	–	–	–	–	–	–	–
275878 Hall Sensor Cable	–	–	–	–	–	–	–	–
520854 Signal Cable 7core	–	✓	–	✓	–	✓	–	✓
520853 Signal Cable 8core	–	✓	–	–	–	✓	–	✓
275851 Motor Cable	–	–	–	–	–	✓	–	✓
520851 Motor Cable High Current	–	–	–	–	–	–	–	✓
275829 Power Cable	–	–	–	–	–	✓(a)	–	✓(a)
520850 Power Cable High Current	–	–	–	–	–	✓(b)	–	✓(b)
520856 RS232-COM Cable	–	✓	–	✓	–	✓	–	✓
520852 Sensor Cable 5x2core	–	✓	–	✓	–	✓	–	✓
520860 STO Idle Connector X9	–	✓(i)	–	✓(i)	–	✓(i)	–	✓(i)
403968 USB Type A - micro B Cable	✓	✓	✓	✓	✓	✓	✓	✓
536997 EPOS4 CB 24/1.5 CAN	✓	–	–	–	–	–	–	–
534133 EPOS4 CB 50/5 CAN	–	–	✓	–	–	–	–	–
520884 EPOS4 CB Power CAN	–	–	–	–	✓	–	✓	–
520859 EPOS4 Connector Set	–	✓	–	✓	–	✓	–	✓

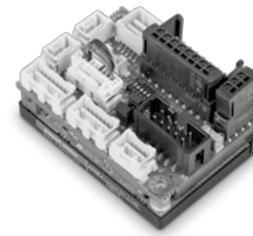
(a) optional for separate logic supply   (b) mandatory for supply of power stage   (i) included

# EPOS4 Positioning Controllers Data

(optional) EtherCAT® CANopen USB RS232 GUI



NEW



NEW

## EPOS4 Module 24/1.5

OEM position control module, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 36/108 Watt.

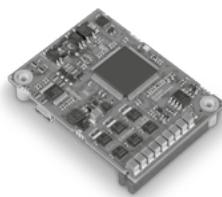
## EPOS4 Compact 24/1.5 CAN

Ready-to-install compact solution, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 36/108 Watt.

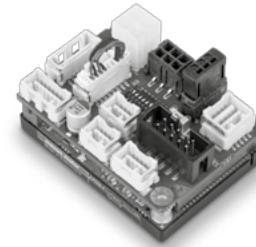
Controller version	CANopen Slave with EtherCAT option	CANopen Slave
<b>Electrical data</b>		
Operating voltage $V_{CC}$	10 - 24 VDC	10 - 24 VDC
Logic supply voltage $V_C$ (optional)	10 - 24 VDC	10 - 24 VDC
Max. output voltage	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
Max. output current $I_{max} (<30\text{ s})$	4.5 A	4.5 A
Continuous output current $I_{cont}$	1.5 A	1.5 A
Switching frequency of power stage	100 kHz	100 kHz
Sampling rate of PI current controller	25 kHz (40 µs)	25 kHz (40 µs)
Sampling rate of PI speed controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Sampling rate of PID position controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Max. speed (1 pole pair)	50000 rpm (sinusoidal), 100000 rpm (block)	50000 rpm (sinusoidal), 100000 rpm (block)
Built-in motor choke per phase	-	94 µH / 1.5 A
<b>Inputs</b>		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
Sensor signals	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\
Digital inputs	4 (logic level)	4 (level switchable: logic/PLC)
Digital inputs "High-speed"	4, differential	4, differential
Analog inputs	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)
CAN-ID (CAN node identification)	configurable with external wiring	configurable with DIP switch 1...5
<b>Outputs</b>		
Digital outputs	2	2
Digital outputs "High-speed"	1, differential	1, differential
Analog outputs	2 (12-bit resolution, -4...+4 V)	2 (12-bit resolution, -4...+4 V)
Encoder voltage output	+5 VDC, max. 70 mA	+5 VDC, max. 70 mA
Hall sensor voltage output	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
Auxiliary voltage output	+5 VDC, max. 150 mA	+5 VDC, max. 150 mA
<b>Interfaces</b>		
RS232	RxD; TxD (max. 115200 bit/s)	RxD; TxD (max. 115200 bit/s)
CAN	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
USB 2.0/3.0	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
EtherCAT	optional (in preparation)	-
<b>Indicator</b>		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
<b>Environmental conditions</b>		
Temperattrue – Operation	-30...+60 °C	-30...+45 °C
Temperature – Extended Range	+60...+73 °C; Derating: -0.115 A/°C	+45...+70 °C; Derating: -0.060 A/°C
Temperature – Storage	-40...+85 °C	-40...+85 °C
Humidity (condensation not permitted)	5...90%	5...90%
<b>Mechanical data</b>		
Weight	approx. 17 g	approx. 58 g
Dimensions (L x W x H)	53.8 x 38.8 x 11.1 mm	55.0 x 40.0 x 28.3 mm
Mounting	Socket header 1.27 mm or M2.5 screws	M2.5 screws
<b>Part numbers</b>	<b>536630</b> EPOS4 Module 24/1.5	<b>546714</b> EPOS4 Compact 24/1.5 CAN
<b>Accessories</b>	<b>309687</b> DSR 50/5 Shunt regulator Order accessories separately, see page 449	<b>309687</b> DSR 50/5 Shunt regulator Order accessories separately, see page 449

# EPOS4 Positioning Controllers Data

(optional) EtherCAT® CANopen USB RS232 GUI



**NEW**



**NEW**

## EPOS4 Module 50/5

OEM position control module, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 250/750 Watt.

## EPOS4 Compact 50/5 CAN

Ready-to-install compact solution, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 250/750 Watt.

Controller version	CANopen Slave with EtherCAT option	CANopen Slave
<b>Electrical data</b>		
Operating voltage $V_{cc}$	10 - 50 VDC	10 - 50 VDC
Logic supply voltage $V_c$ (optional)	10 - 50 VDC	10 - 50 VDC
Max. output voltage	$0.9 \times V_{cc}$	$0.9 \times V_{cc}$
Max. output current $I_{max} (<3 s)$	15 A	15 A
Continuous output current $I_{cont}$	5 A	5 A
Switching frequency of power stage	50 kHz	50 kHz
Sampling rate of PI current controller	25 kHz (40 µs)	25 kHz (40 µs)
Sampling rate of PI speed controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Sampling rate of PID position controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Max. speed (1 pole pair)	50000 rpm (sinusoidal), 100000 rpm (block)	50000 rpm (sinusoidal), 100000 rpm (block)
Built-in motor choke per phase	–	9.4 µH / 5 A
<b>Inputs</b>		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
Sensor signals	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\
Digital inputs	4 (logic level)	4 (level switchable: logic/PLC)
Digital inputs "High-speed"	4, differential	4, differential
Analog inputs	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)
CAN-ID (CAN node identification)	configurable with external wiring	configurable with DIP switch 1...5
<b>Outputs</b>		
Digital outputs	2	2
Digital outputs "High-speed"	1, differential	1, differential
Analog outputs	2 (12-bit resolution, -4...+4 V)	2 (12-bit resolution, -4...+4 V)
Encoder voltage output	+5 VDC, max. 70 mA	+5 VDC, max. 70 mA
Hall sensor voltage output	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
Auxiliary voltage output	+5 VDC, max. 150 mA	+5 VDC, max. 150 mA
<b>Interfaces</b>		
RS232	RxD; TxD (max. 115200 bit/s)	RxD; TxD (max. 115200 bit/s)
CAN	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
USB 2.0/3.0	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
EtherCAT	optional (in preparation)	–
<b>Indicator</b>		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
<b>Environmental conditions</b>		
Temperattrue – Operation	-30...+45 °C	-30...+25 °C
Temperature – Extended Range	+45...+75 °C; Derating: -0.167 A/°C	+25...+70 °C; Derating: -0.111 A/°C
Temperature – Storage	-40...+85 °C	-40...+85 °C
Humidity (condensation not permitted)	5...90%	5...90%
<b>Mechanical data</b>		
Weight	approx. 17 g	approx. 58 g
Dimensions (L x W x H)	53.8 x 38.8 x 11.1 mm	55.0 x 40.0 x 26.9 mm
Mounting	Socket header 1.27 mm or M2.5 screws	M2.5 screws
<b>Part numbers</b>	<b>534130</b> EPOS4 Module 50/5	<b>541718</b> EPOS4 Compact 50/5 CAN
<b>Accessories</b>	<b>309687</b> DSR 50/5 Shunt regulator Order accessories separately, see page 449	<b>309687</b> DSR 50/5 Shunt regulator Order accessories separately, see page 449

# EPOS4 Positioning Controllers Data

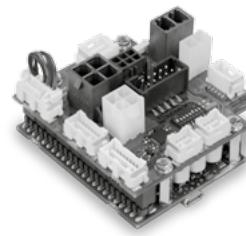
(optional)  
EtherCAT®

CANopen

USB

RS232

GUI



## EPOS4 Module 50/8

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

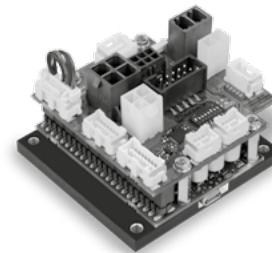
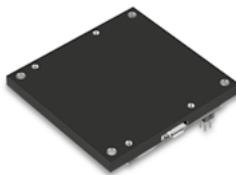
## EPOS4 Compact 50/8 CAN

Ready-to-install compact solution, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 400/1500 Watt.

Controller version	CANopen Slave with EtherCAT option	CANopen Slave
<b>Electrical data</b>		
Operating voltage $V_{CC}$	10 - 50 VDC	10 - 50 VDC
Logic supply voltage $V_C$ (optional)	10 - 50 VDC	10 - 50 VDC
Max. output voltage	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
Max. output current $I_{max} (<5 s)$	30 A	30 A
Continuous output current $I_{cont}$	8 A	8 A
Switching frequency of power stage	50 kHz	50 kHz
Sampling rate of PI current controller	25 kHz (40 µs)	25 kHz (40 µs)
Sampling rate of PI speed controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Sampling rate of PID position controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Max. speed (1 pole pair)	50000 rpm (sinusoidal), 100000 rpm (block)	50000 rpm (sinusoidal), 100000 rpm (block)
Built-in motor choke per phase	-	2.2 µH / 15 A
<b>Inputs</b>		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
Sensor signals	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\
Digital inputs	4 (logic level)	4 (level switchable: logic/PLC)
Digital inputs "High-speed"	4, differential	4, differential
Analog inputs	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)
CAN-ID (CAN node identification)	configurable with external wiring	configurable with DIP switch 1...5
<b>Outputs</b>		
Digital outputs	2	2
Digital outputs "High-speed"	1, differential	1, differential
Analog outputs	2 (12-bit resolution, -4...+4 V)	2 (12-bit resolution, -4...+4 V)
Encoder voltage output	+5 VDC, max. 70 mA	+5 VDC, max. 70 mA
Hall sensor voltage output	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
Auxiliary voltage output	+5 VDC, max. 150 mA	+5 VDC, max. 150 mA
<b>Interfaces</b>		
RS232	RxD; TxD (max. 115200 bit/s)	RxD; TxD (max. 115200 bit/s)
CAN	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
USB 2.0/3.0	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
EtherCAT	optional (in preparation)	-
<b>Indicator</b>		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
<b>Environmental conditions</b>		
Temperattrue – Operation	-30...+45 °C	-30...+45 °C
Temperature – Extended Range	+45...+77 °C; Derating: -0.250 A/°C	+45...+77 °C; Derating: -0.250 A/°C
Temperature – Storage	-40...+85 °C	-40...+85 °C
Humidity (condensation not permitted)	5...90%	5...90%
<b>Mechanical data</b>		
Weight	approx. 23 g	approx. 86 g
Dimensions (L x W x H)	59.5 x 46.0 x 14.1 mm	59.5 x 58.5 x 33.0 mm
Mounting	Socket header 2.54 mm or M2.5 screws	M2.5 screws
<b>Part numbers</b>		
	<b>504384</b> EPOS4 Module 50/8	<b>520885</b> EPOS4 Compact 50/8 CAN
<b>Accessories</b>		
	<b>235811</b> DSR 70/30 Shunt regulator	<b>235811</b> DSR 70/30 Shunt regulator
	Order accessories separately, see page 449	Order accessories separately, see page 449

# EPOS4 Positioning Controllers Data

(optional) EtherCAT® CANopen USB RS232 GUI



## EPOS4 Module 50/15

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

## EPOS4 Compact 50/15 CAN

Ready-to-install compact solution, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 750/1500 Watt.

Controller version	CANopen Slave with EtherCAT option	CANopen Slave
<b>Electrical data</b>		
Operating voltage $V_{cc}$	10 - 50 VDC	10 - 50 VDC
Logic supply voltage $V_c$ (optional)	10 - 50 VDC	10 - 50 VDC
Max. output voltage	$0.9 \times V_{cc}$	$0.9 \times V_{cc}$
Max. output current $I_{max} (<60\text{ s})$	30 A	30 A
Continuous output current $I_{cont}$	15 A	15 A
Switching frequency of power stage	50 kHz	50 kHz
Sampling rate of PI current controller	25 kHz (40 µs)	25 kHz (40 µs)
Sampling rate of PI speed controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Sampling rate of PID position controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Max. speed (1 pole pair)	50000 rpm (sinusoidal), 100000 rpm (block)	50000 rpm (sinusoidal), 100000 rpm (block)
Built-in motor choke per phase	–	2.2 µH / 15 A
<b>Inputs</b>		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
Sensor signals	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\
Digital inputs	4 (logic level)	4 (level switchable: logic/PLC)
Digital inputs "High-speed"	4, differential	4, differential
Analog inputs	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)
CAN-ID (CAN node identification)	configurable with external wiring	configurable with DIP switch 1...5
<b>Outputs</b>		
Digital outputs	2	2
Digital outputs "High-speed"	1, differential	1, differential
Analog outputs	2 (12-bit resolution, -4...+4 V)	2 (12-bit resolution, -4...+4 V)
Encoder voltage output	+5 VDC, max. 70 mA	+5 VDC, max. 70 mA
Hall sensor voltage output	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
Auxiliary voltage output	+5 VDC, max. 150 mA	+5 VDC, max. 150 mA
<b>Interfaces</b>		
RS232	RxD; TxD (max. 115200 bit/s)	RxD; TxD (max. 115200 bit/s)
CAN	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
USB 2.0/3.0	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
EtherCAT	optional (in preparation)	–
<b>Indicator</b>		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
<b>Environmental conditions</b>		
Temperattrue – Operation	-30...+25 °C	-30...+25 °C
Temperature – Extended Range	+25...+77 °C; Derating: -0.288 A/°C	+25...+77 °C; Derating: -0.288 A/°C
Temperature – Storage	-40...+85 °C	-40...+85 °C
Humidity (condensation not permitted)	5...90%	5...90%
<b>Mechanical data</b>		
Weight	approx. 70 g	approx. 126 g
Dimensions (L x W x H)	59.5 x 62.0 x 16.4 mm	59.5 x 65.5 x 35.1 mm
Mounting	Socket header 2.54 mm or M3 screws	M3 screws
<b>Part numbers</b>	<b>504383</b> EPOS4 Module 50/15	<b>520886</b> EPOS4 Compact 50/15 CAN
<b>Accessories</b>	<b>235811</b> DSR 70/30 Shunt regulator Order accessories separately, see page 449	<b>235811</b> DSR 70/30 Shunt regulator Order accessories separately, see page 449

# MAXPOS Positioning Controller Summary



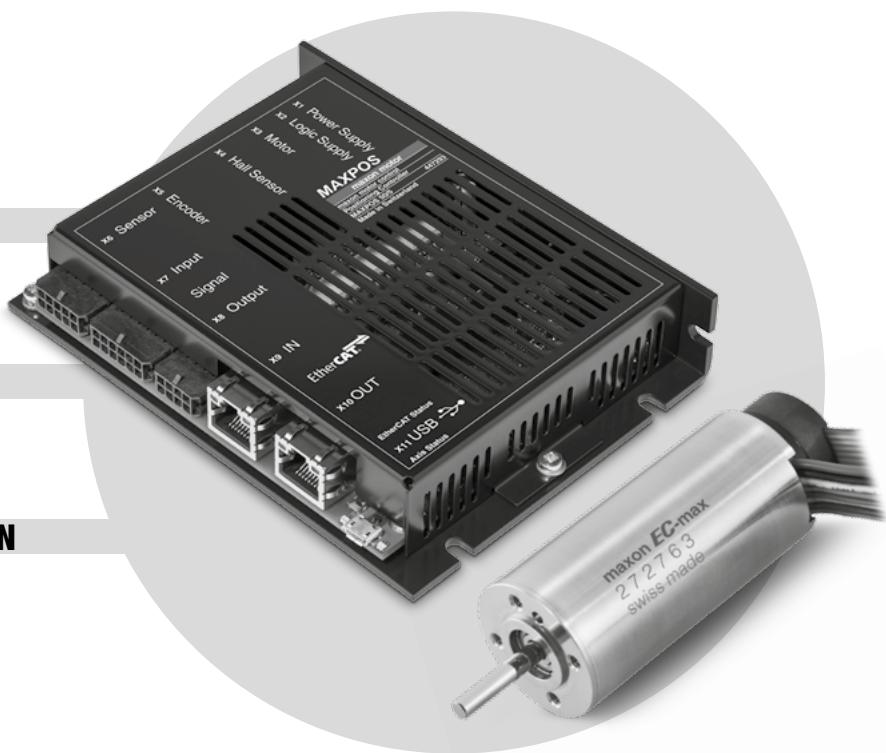
PRECISION



DYNAMIC



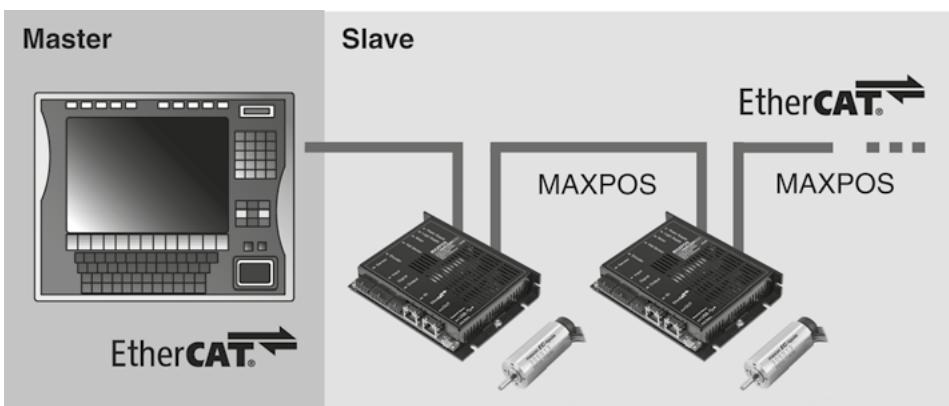
SYNCHRONIZATION



## MAXPOS 50/5 EtherCAT Slave

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

synchronously via the EtherCAT network to the MAXPOS. The torque (current) control loop runs in the MAXPOS. The MAXPOS delivers the measured actual position, speed and current values to the EtherCAT master. If the PID position control loop is closed via the EtherCAT master, CST mode is often used.



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

### Cyclic Synchronous Position (CSP)

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

The position control loop runs in the MAXPOS. The MAXPOS delivers the measured actual po-

sition, speed and current values to the EtherCAT master.

### Cyclic Synchronous Velocity (CSV)

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

### Cyclic Synchronous Torque (CST)

The EtherCAT master executes the path planning and sends the target torque cyclically and

### Point to point

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

### Position and Speed control with Feed Forward

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

### Speed control

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

### Homing

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

### Feedback options

Two different encoder signals can be evaluated simultaneously. In a suitable master unit, this enables dual loop control in order to compensate for mechanical backlash and elasticity.

There is a wide range of permitted sensors: Digital incremental encoders, analog incremental encoders (sin/cos), SSI and BiSS-C absolute encoders.

**Protection**

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

**Safe Torque Off (STO)**

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

**Capture inputs (Touch Probe)**

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

**Control of Holding Brakes**

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

Additional information for technical data of page 447

**Standardized**

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

**Flexible, modular**

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

**Easy start-up procedure**

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

**Optimal control characteristics**

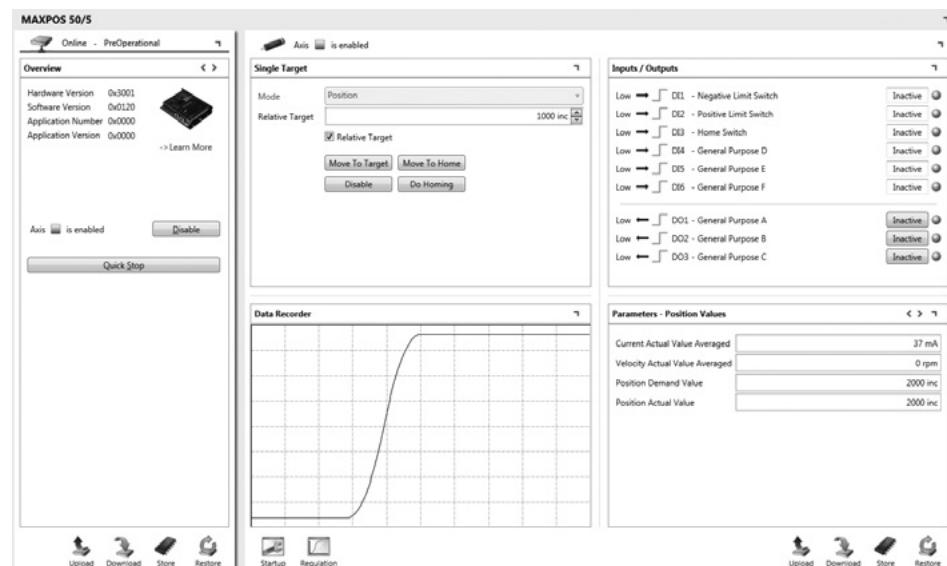
The fast controller rates and short cycle times of the EtherCAT communication enable applications with exacting requirements for the dynamics of the drive system. Control input from the EtherCAT master can be accepted by the MAXPOS at a frequency of up to 10 kHz and transmitted to the controllers. Distributed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

**EtherCAT Master: Integration made easy**

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

**State-of-the-art**

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

**Operating modes**

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

Profile Position-, Profile Velocity- and Homing Mode

Feed forward for velocity and acceleration

Sinusoidal commutation for EC motors

**Communication**

Communication via EtherCAT with:

- CoE/FoE
- Distributed Clocks Support
- CSP, CSV, CST with cycle times up to 100µs
- Variable PDO mapping

**Configuration**

Configuration via EtherCAT or USB 2.0/3.0

**Inputs/Outputs**

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

Free configurable digital outputs e.g. for holding brakes

**Available software**

MAXPOS Studio (Graphical User Interface)

Firmware

**Available documentation**

Feature Chart

Hardware Reference

Firmware Specification

Communication Guide

Application Notes

**Cable**

A comprehensive range of cables is available as an option. Details can be found on page 449.

# MAXPOS Positioning Controller Data

High Performance

EtherCAT®

USB

GUI



**MAXPOS 50/5**

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

## Controller versions

### EtherCAT Slave

#### Electrical data

Operating voltage $V_{CC}$	10 - 50 VDC
Logic supply voltage $V_C$ (optional)	10 - 50 VDC
Max. output voltage	$0.95 \times V_{CC}$
Max. output current $I_{max} (<1.5\text{ s})$	15 A
Continuous output current $I_{cont}$	5 A
Switching frequency of power stage	100 kHz
Sample rate of PI - current controller	100 kHz (10 $\mu\text{s}$ )
Sample rate of PI - speed controller	10 kHz (100 $\mu\text{s}$ )
Sample rate of PID - positioning control	10 kHz (100 $\mu\text{s}$ )
Max. speed (DC)	limited by max. speed (motor) and max. output voltage (controller)
Max. speed (EC; 1 pole pair)	200 000 rpm (sinusoidal)
Built-in motor choke per phase	22 $\mu\text{H}$ / 10 A

#### Input

Hall sensor signals	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 5 MHz)
Sensor signals	A, A\, B, B\, I, I\, Clock+, Clock-, Data+, Data-
Digital inputs	6 (galvanically isolated)

#### Output

Digital outputs	3 (galvanically isolated)
Encoder voltage output	+5 VDC, max. 70 mA
Hall sensor voltage output	+5 VDC, max. 30 mA
Sensor voltage output	+5 VDC, max. 150 mA
Auxiliary voltage output	+24 VDC, max. 300 mA when $V_{CC} > 30$ VDC $V_{CC}-5$ V, max. 300 mA when $V_{CC} < 30$ VDC

#### Interface

EtherCAT	IEEE 802.3 100 Base T (100 Mbit/s, Full Duplex)
USB 2.0/3.0	Data+; Data- (full speed)

#### Indicator

Axis Status	green LED, red LED
EtherCAT Status	green LED, red LED
EtherCAT Port Activity/Link State	green LED

#### Environmental conditions

Temperature – Operation	-30...+45°C
Temperature – Extended range	+45...+56°C; Derating: -0.455 A/°C
Temperature – Storage	-40...+85°C
Humidity (condensation not permitted)	5...90%

#### Mechanical data

Weight	Approx. 302 g
Dimensions (L x W x H)	140 x 103.5 x 27 mm
Mounting	Flange for M4-screws

#### Part numbers

**447293 MAXPOS 50/5**

#### Accessories

**309687 DSR 50/5 Shunt regulator**

Order accessories separately, see page 449

# Summary maxon motor control

			Page
<b>4-Q Servocontroller</b>			
<b>ESCON</b>			
	466023	ESCON Module 24/2, for DC/EC motors, speed control (open loop/closed loop), current control, 2/6 A, 10–24 VDC	426
	403112	ESCON 36/2 DC, for DC motors, speed control (open loop/closed loop), current control, 2/4 A, 10–36 VDC	426
	414533	ESCON 36/3 EC, for EC motors, speed control (open loop/closed loop), current control, 2.7/9 A, 10–36 VDC	427
	446925	ESCON Module 50/4 EC-S, for sensorless EC motors, speed control (open loop/closed loop), 4/12 A, 10–50 VDC	427
	409510	ESCON 50/5, for DC/EC motors, speed control (open loop/closed loop), current control, 5/15 A, 10–50 VDC	428
	438725	ESCON Module 50/5, for DC/EC motors, speed control (open loop/closed loop), current control, 5/15 A, 10–50 VDC	427
<b>NEW</b>	532872	ESCON Module 50/8, for DC/EC motors, speed control (open loop/closed loop), current control, 8/15 A, 10–50 VDC	428
<b>NEW</b>	586137	ESCON Module 50/8 HE, for DC/EC motors, speed control (open loop/closed loop), current control, 8/15 A, 10–50 VDC	428
	422969	ESCON 70/10, for DC/EC motors, speed control (open loop/closed loop), current control, 10/30 A, 10–70 VDC	428
<b>4-Q-DC Servoamplifier</b>			
<b>LSC</b>	<b>NRND</b>	250521	LSC 30/2, linear 4-Q-Servoamplifier 30 V/2 A in module housing
<b>ADS</b>	<b>NRND</b>	145391	ADS 50/5, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/5 A in module housing
	<b>NRND</b>	201583	ADS 50/10, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/10 A in module housing
	<b>NRND</b>	166143	ADS_E 50/5, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/5 A in racket card (Eurocard)
	<b>NRND</b>	168049	ADS_E 50/10, pulsed (PWM) 4-Q-DC Servoamplifier 50 V/10 A in racket card (Eurocard)
<b>1-Q-EC Amplifier</b>			
<b>DECS</b>	<b>NRND</b>	343253	DECS 50/5, digital 1-Q-EC Amplifier 50 V/5 A, sensorless, speed control, open electronic circuit board
<b>DEC</b>		367661	DEC Module 24/2, digital 1-Q-EC Amplifier 24 V/2 A, speed control, OEM module
		380200	DEC Module 50/5, digital 1-Q-EC Amplifier 50 V/5 A, speed control, OEM module
	<b>NRND</b>	230572	DEC 50/5, digital 1-Q-EC Amplifier 50 V/5 A, speed control, current control, PWM operation
<b>4-Q-EC Amplifier</b>			
<b>DEC</b>	<b>NRND</b>	306089	DEC 70/10, digital 4-Q-EC Amplifier 70 V/10 A, speed control, current control
<b>4-Q-EC Servoamplifier</b>			
<b>DES</b>	<b>NRND</b>	205679	DES 50/5, digital 4-Q-EC Servoamplifier 50 V/5 A, sinusoidal commutation
	<b>NRND</b>	228597	DES 70/10, digital 4-Q-EC Servoamplifier 70 V/10 A, sinusoidal commutation
<b>Positioning</b>			
<b>EPOS2</b>		380264	EPOS2 24/2 for EC motors, digital positioning controller, 2 A, 9–24 VDC
		390003	EPOS2 24/2 for DC/EC motors, digital positioning controller, 2 A, 9–24 VDC
		390438	EPOS2 24/2 for DC motors, digital positioning controller, 2 A, 9–24 VDC
<b>NEW</b>		530239	EPOS2 24/2 for DC(X) motors, digital positioning controller, 2 A, 9–24 VDC
		360665	EPOS2 Module 36/2 OEM positioning controller plug-in module, 2 A, 11–36 VDC
		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
		347717	EPOS2 50/5, digital positioning controller, 5 A, 11–50 VDC
		375711	EPOS2 70/10, digital positioning controller, 10 A, 11–70 VDC
<b>EPOS2 P</b>		378308	EPOS2 P 24/5, digital positioning controller, programmable, 5 A, 11–24 VDC
<b>EPOS4</b>	<b>NEW</b>	536630	EPOS4 Module 24/1.5, digital positioning controller, 1.5 A, 10–24 VDC
	<b>NEW</b>	546714	EPOS4 Compact 24/1.5 CAN, digital positioning controller, 1.5 A, 10–24 VDC
	<b>NEW</b>	534130	EPOS4 Module 50/5, digital positioning controller, 5 A, 10–50 VDC
	<b>NEW</b>	541718	EPOS4 Compact 50/5 CAN, digital positioning controller, 5 A, 10–50 VDC
	<b>NEW</b>	546047	EPOS4 50/5, digital positioning controller, 5 A, 10–50 VDC
		504384	EPOS4 Module 50/8, digital positioning controller, 8 A, 10–50 VDC
		520885	EPOS4 Compact 50/8 CAN, digital positioning controller, 8 A, 10–50 VDC
		504383	EPOS4 Module 50/15, digital positioning controller, 15 A, 10–50 VDC
		520886	EPOS4 Compact 50/15 CAN, digital positioning controller, 15 A, 10–50 VDC
<b>MAXPOS</b>		447293	MAXPOS 50/5, digital positioning controller, 5 A, 10–50 VDC

# Summary maxon motor control Accessories

## Backplane

<b>NRND</b>	166873	Backplane with screw type terminal block to ADS_E 50/5 (166143) and ADS_E 50/10 (168049)
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## Front panel

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

## Motor choke

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

## Cable

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

# Summary maxon motor control Accessories

## Adapter

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

## Shunt regulators

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

## Starter kits, Eva boards, motherboards, Connector boards

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

## Software

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



# maxon compact drive

maxon's compact drives feature controllers, sensors and motors in a modern aluminium casing.

The use of existing maxon products with an adapted design results in robust, space-saving drive solutions with high power density. The decentralized concept of these intelligent drives minimizes the use of centralized controllers.

## MCD EPOS/MCD EPOS P

### Accessories

452–453

454

DC Motor

EC Motor  
(BLDC Motor)

Gearhead

Spindle  
drive

Sensor

Motor  
control

Compact  
Drive

Accessories

Ceramic  
information

Contact  
information

# MCD EPOS Intelligent compact drive



CANopen

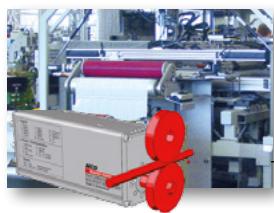
## Driving

A reliable drive solution is the key to production machinery with many years of maintenance-free operation in a variety of applications.



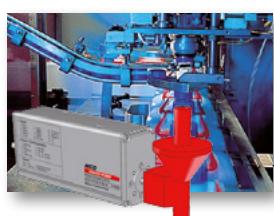
## Setting-up

The rapid set-up of processing machinery which offers both precision and long-term accuracy is the key to efficient production.



## Guiding

Products that are dynamically guided throughout the entire process ensure consistent product quality.



## Dispensing

The precise set-up of dispensing systems provides maximum flexibility through the accurate dosing of individual component quantities.



## Positioning

Several synchronized axes transport the product to the correct location with both high accuracy and sustained reproducibility.



## Maintenance-free positioning drive with tried and trusted components

The combination of the brushless maxon EC motor, digital MR encoder and the fully digital EPOS positioning controller results in a highly dynamic, maintenance-free positioning drive with excellent functionality and high efficiency. The programmable version MCD EPOS P is equipped with a processor and memory for standalone operation.

## A complete system – easy start-up procedure

The compact drive's controller-motor combination is optimally tuned and ready for use. Wiring is kept to a minimum through direct connection to the CANopen bus or a PLC. Wiring errors are largely avoided and installation time is significantly reduced. The drive is controlled, parameterized and diagnosed via the CAN bus or the serial port (RS232).



## Intelligence at the right place

maxon's compact drives are fitted with several optically isolated inputs and outputs. Sensor signals and events can be evaluated directly in the drive. Cable lengths are shorter, thus reducing susceptibility to interference.

## CANopen, IEC 61131-3 and Motion Control Library – key to standardized operation

The MCD can be connected according to the CANopen standard, allowing communication with other CANopen devices.

Drive programming complies with the IEC 61131-3 standard using the powerful "EPOS Studio" tool.

The integration of the Motion Control Library under the widely used standards reduces program complexity and development costs.

## Everything integrated – also a question of price

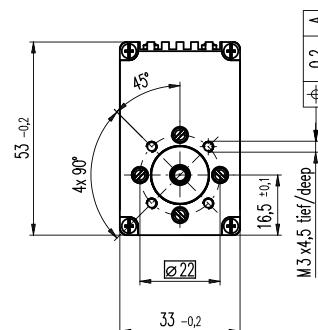
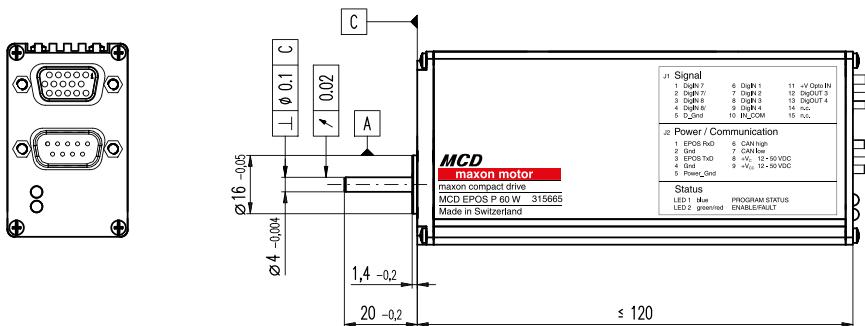
Substantial cost-savings have been made thanks to the careful selection and optimization of components. The resulting drive is available at an unsurpassed price which is well below the cost of the individual parts. Simplified mounting results in further cost-savings.

## Drives with a broad application spectrum

The requirements of compact design and enhanced functionality have been completely realized with maxon's compact drives. Their supreme flexibility ensures use in a wide range of industrial applications.

# MCD EPOS and EPOS P 60 W Compact Drive

DIGITAL CANopen  
RS232 GUI



M 1:2

## Motor Data

Nominal torque (Max. continuous torque)	54 mNm
(T <sub>U</sub> =25°C, 5000 rpm)	
Max. torque	218 mNm
Max. speed (restricted by econdor)	12000 rpm
Max. efficiency	70%
Torque constant	24.3 mNm/A
Speed constant	393 rpm/V
Speed/torque gradient	20.6 rpm/mNm
Rotor inertia	21.9 gcm <sup>2</sup>
Axial play at axial load (Preloaded ball bearings)	< 6 N 0 mm > 6 N 0.14 mm
Radial play	preloaded
Max. axial load (dynamic)	5.5 N
Max. force for press fits (static)	100 N
Max. radial load, 5 mm from flange	25 N

## Pin layout

### Connector J1: Signal

D Sub connector High Density 15 poles (female)

1 DigIN 7	6 DigIN 1	11 +V Opto IN
2 DigIN 7/	7 DigIN 2	12 DigOUT 3
3 DigIN 8	8 DigIN 3	13 DigOUT 4
4 DigIN 8/	9 DigIN 4	14 not connected
5 D_Gnd	10 IN_COM	15 not connected

### Connector J2: Power/Communication

D Sub connector 9 poles (male)

1 EPOS RxD	4 Gnd	7 CAN low
2 Gnd	5 Power_Gnd	8 +V <sub>C</sub> 12-50 VDC
3 EPOS TxD	6 CAN high	9 +V <sub>CC</sub> 12-50 VDC

## Ambient temperature/Humidity range

Protection class	IP42
Operating	-20 ... +85°C power derating 1.4%/K from T <sub>U</sub> = 25°C
Storage	-40 ... +85°C
Non condensating	20 ... 80 %
Max. case temperature	< 100°C

## Mechanical data

Weight	approx. 528 g
Dimensions (L x W x H)	120x33x53 mm
Mounting plate	four M3x4.5 threaded holes

## Electrical data

Power supply voltage +V <sub>CC</sub>	+12....+50 VDC
Logic supply voltage +V <sub>C</sub> (optional)	+12....+50 VDC
Max. output voltage	0.9 x V <sub>CC</sub>
Max. output current I <sub>max</sub>	9 A
Continuous output current I <sub>cont</sub>	2.6 A (T <sub>U</sub> = 25°C, 5000 rpm)
Switching frequency	50 kHz
<b>Controller</b>	
Sample rate PI-current controller	10 kHz
Sample rate PI-speed controller	1 kHz
Sample rate PID-positioning controller	1 kHz
Position resolution	0.09°
Position accuracy	± 1°
Position reproducibility	± 0.09°
Encoder	1000 Imp./3 channels
<b>Inputs</b>	
4 digital inputs (optically isolated)	+9...+24 VDC
2 digital inputs (differential)	EIA-standard RS-422
<b>Outputs</b>	
2 digital outputs (optically isolated)	max. +24 VDC (I <sub>L</sub> <350 mA)
<b>Interfaces</b>	
RS-232 (EIA-standard RS-232)	max. 115 200 bit/s
CAN (high-speed; ISO 11898 compatible)	max. 1 MBit/s
CAN ID	LSS CiA 305
<b>Protective functions</b>	Current Limit (adjustable), Under-/over-voltage limitation, Temperature monitoring

## LED indicator

Bi-colour LED	green = Enable, red = Fault blink pattern = Operating status
Blue LED (only master version)	program status

## Performance features MCD EPOS P

32 bit host processor, 60 MHz
512 KB memory, with 256 KB free user program memory
Typical 2.5 ms/5000 lines AWL
512 Byte non-volatile memory
Digital motion control signal processor

## maxon Modular System

**Planetary Gearhead**  
Ø32 mm, 1.0-8.0 Nm, P. 334/339/341/366-368

**Planetary Gearhead**  
Ø42 mm, 3.0 - 15.0 Nm, p. 346

## Part Numbers

326343  
315665

MCD EPOS 60 W  
MCD EPOS P 60 W

# Programming

## EPOS operating modes

### Point to point

- Positioning the motor axis from point A to point B (absolute and relative)

### Position control with feed forward

- Reducing control error through acceleration and speed feed forward

### Speed control

- Rotating the motor axis at a pre-defined set value speed

### Torque control (current control)

- Controlling a constant torque on the motor shaft. Minimum torque ripple through sinusoidal commutation

### Homing mode

- Referencing onto a special mechanical position with more than 30 different methods

### Electronic gearing

- Synchronizing (also with intermediate factor) with an externally produced reference variable

### Step/Direction

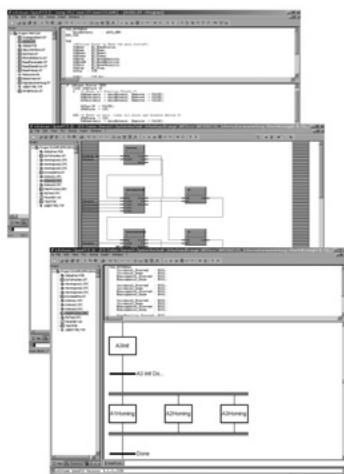
- Step-by-step movement of the motor axis

### Capture inputs (position marker)

- Saving positions when a positive and/or negative edge of an input signal appears

## EPOS Studio

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.



- 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

## Motion Control Library

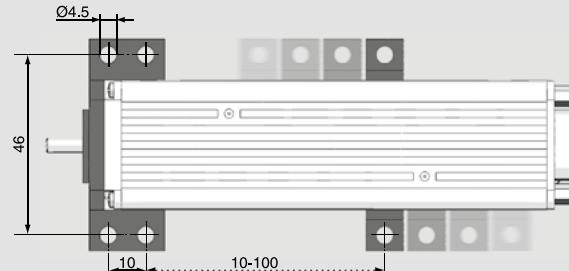
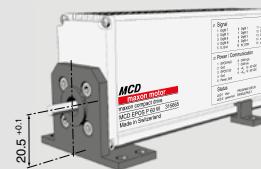
The complexity and development costs of drive systems are substantially reduced. The Motion Firmware Library was implemented according to the widely-used Motion Control Standard. Standardized function blocks make implementation easy.

- Drive control
- Referencing (Homing)
- Speed control
- Positioning absolute and relative
- Error management
- Parameter handling

# Accessories MCD EPOS 60 W

## Mounting Kit

Brackets for mounting the optional the MCD EPOS 60 W. The brackets provided can be placed in any position along the length of the MCD. Fixing screws are included.



**Part Number**  
326930

MCD EPOS 60 W Mounting-Kit

## Cable

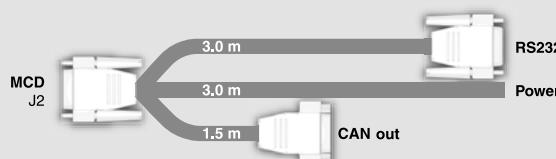
### Signal cable



**Part Number**  
326923

MCD EPOS Signal Cable

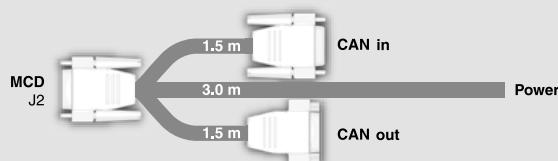
### Power/RS232-CAN cable



**Part Number**  
325939

MCD EPOS Power/RS232-CAN Cable

### Power/CAN-CAN cable



**Part Number**  
325235

MCD EPOS Power/CAN-CAN Cable

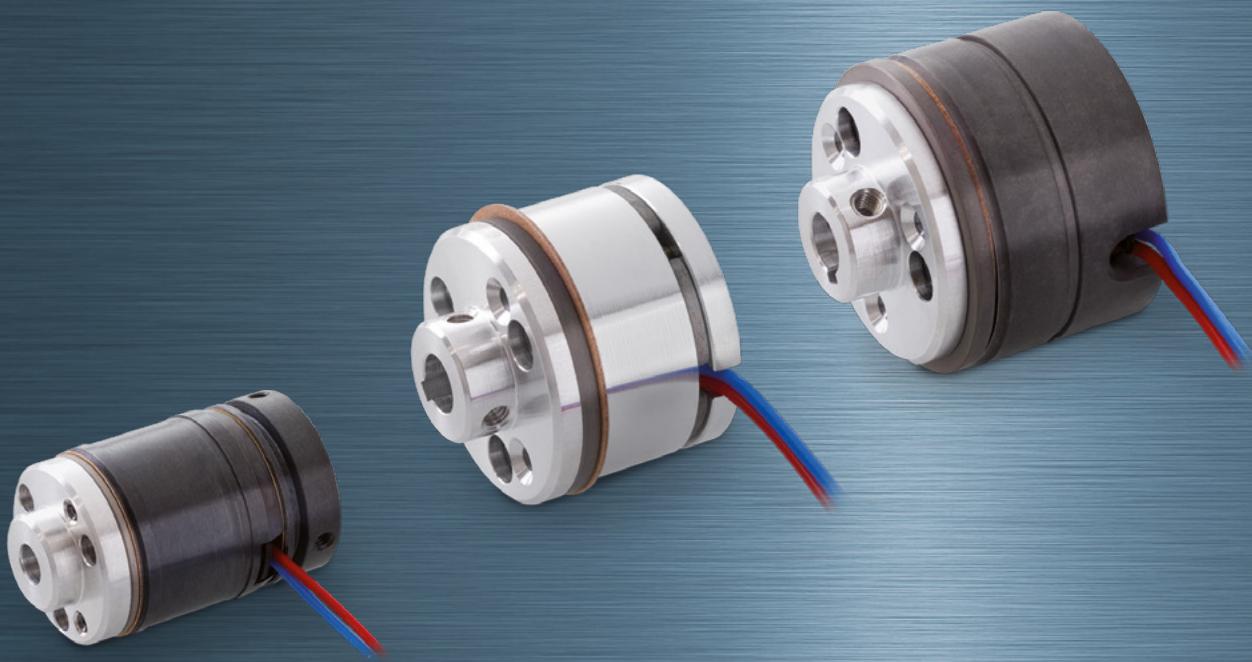
### CAN Termination plug

Is required as line termination for the CAN-Network.



**Part Number**  
326925

MCD EPOS CAN Termination Plug

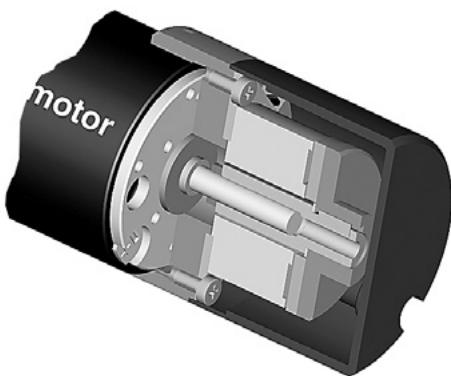


# maxon accessories

Useful parts complete maxon's full range of drive technology products. Brakes may only be assembled with motors in the delivery plant.

Brake AB 20 24 VDC, 0.1 Nm	456
Brake AB 28 24 VDC, 0.4 Nm	457–459
Brake AB 32 24 VDC, 0.4 Nm	460
Brake AB 41 24 VDC, 2.0 Nm	461
Brake AB 44 24 VDC, 2.5 Nm	462
End caps	463

# Brake AB 20 24 VDC, 0.1 Nm



Stock program  
 Standard program  
 Special program (on request)

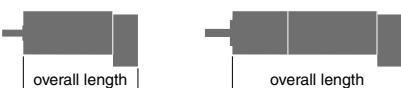
## Important Information

- Permanent magnet — single-face brake for DC (dry operation). Braking in unpowered condition.
- Holding brake, prevents rotation of the shaft at standstill or with turned off motor power.
- Not suitable for dynamic braking.

## Part Numbers

301212    301213

### Type



### maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Sensor	Page	$\varnothing$ AB [mm]	Overall length [mm] / • see Gearhead
EC-max 22, 12 W	228					22	67.8
EC-max 22, 12 W	228	GP 22, 0.5 - 2.0 Nm	328/329			22	•
EC-max 22, 12 W	228	KD 32	343			22	•
EC-max 22, 12 W	228	GP 22 S	364/365			22	•
EC-max 22, 25 W	229					22	84.2
EC-max 22, 25 W	229	GP 22, 0.5 - 3.4 Nm	329			22	•
EC-max 22, 25 W	229	GP 32, 1 - 6 Nm	339			22	•
EC-max 22, 25 W	229	KD 32	343			22	•
EC-max 22, 25 W	229	GP 32 S	366-368			22	•
EC-max 30, 40 W	230					30	
EC-max 30, 40 W	230	GP 32, 1.0 - 8.0 Nm	339/341			30	77.6
EC-max 30, 40 W	230	KD 32, 1.0 - 4.5 Nm	343			30	•
EC-max 30, 40 W	230	GP 32 S	366-368			30	•
EC-max 30, 40 W	230		HEDL 5540	416		30	98.4
EC-max 30, 40 W	230	GP 32, 1.0 - 8.0 Nm	339/341	HEDL 5540	416	30	•
EC-max 30, 40 W	230	KD 32, 1.0 - 4.5 Nm	343	HEDL 5540	416	30	•
EC-max 30, 40 W	230	GP 32 S	366-368	HEDL 5540	416	30	•
EC-max 30, 60 W	231					30	99.6
EC-max 30, 60 W	231	GP 32, 1.0 - 8.0 Nm	339/341			30	•
EC-max 30, 60 W	231	KD 32, 1.0 - 4.5 Nm	343			30	•
EC-max 30, 60 W	231	GP 42, 3 - 15 Nm	346			30	•
EC-max 30, 60 W	231		HEDL 5540	416		30	120.4
EC-max 30, 60 W	231	GP 32, 1.0 - 8.0 Nm	339/341	HEDL 5540	416	30	•
EC-max 30, 60 W	231	KD 32, 1.0 - 4.5 Nm	343	HEDL 5540	417	30	•
EC-max 30, 60 W	231	GP 42, 3 - 15 Nm	346	HEDL 5540	416	30	•
EC-4pole 30, 100 W	239					30	83.2
EC-4pole 30, 100 W	239	GP 32, 8 Nm	341			30	•
EC-4pole 30, 100 W	239	GP 42, 3 - 15 Nm	346			30	•
EC-4pole 30, 100 W	239		HEDL 5540	417		30	104
EC-4pole 30, 100 W	239	GP 32, 8 Nm	341	HEDL 5540	417	30	•
EC-4pole 30, 100 W	239	GP 42, 3 - 15 Nm	346	HEDL 5540	417	30	•
EC-4pole 30, 200 W	241					30	100.2
EC-4pole 30, 200 W	241	GP 32, 8 Nm	341			30	•
EC-4pole 30, 200 W	241	GP 42, 3 - 15 Nm	346			30	•
EC-4pole 30, 200 W	241		HEDL 5540	417		30	121
EC-4pole 30, 200 W	241	GP 32, 8 Nm	341	HEDL 5540	417	30	•
EC-4pole 30, 200 W	241	GP 42, 3 - 15 Nm	346	HEDL 5540	417	30	•

### Technical Data

Max. permissible static torque at 20°C	0.1 Nm	Nominal voltage, smoothed		24 VDC $\pm 10\%$
Mass inertia	1.8 gcm <sup>2</sup>	Resistance		R <sub>20</sub> = 227 $\Omega \pm 6\%$
Max. speed	49000 rpm	Duty cycle		100%
Weight	29 g	Reaction time	– Coupling	$\leq 12$ ms
Ambient temperature range	-40...+100°C		– Opening	$\leq 6$ ms

### Pin Allocation

Cable (AWG 26)	Designation
red	U <sub>Brake</sub> + 24 VDC
blue	U <sub>Brake</sub> GND

# Brake AB 28 24 VDC, 0.4 Nm



Stock program  
 Standard program  
 Special program (on request)

## Type



## Important Information

- Permanent magnet — single-face brake for DC (dry operation). Braking in unpowered condition.
- Holding brake, prevents rotation of the shaft at standstill or with turned off motor power.
- Not suitable for dynamic braking.
- It is possible to lower the voltage applied to the brake after it has been energized, for the purpose of reducing heat loss.

## Part Numbers

301215

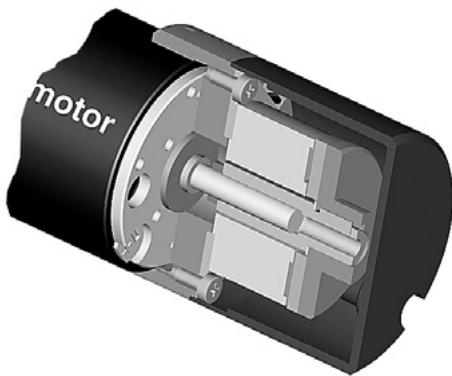
## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Sensor	Page	$\varnothing$ AB [mm]	Overall length [mm] / • see Gearhead
EC-max 40, 70 W	232					40	92.4
EC-max 40, 70 W	232	GP 42, 3 - 15 Nm	346			40	•
EC-max 40, 70 W	232			HEDL 5540	416	40	110.7
EC-max 40, 70 W	232	GP 42, 3 - 15 Nm	346	HEDL 5540	416	40	•
EC-max 40, 120 W	233					40	122.4
EC-max 40, 120 W	233	GP 52, 4 - 30 Nm	351			40	•
EC-max 40, 120 W	233			HEDL 5540	416	40	140.7
EC-max 40, 120 W	233	GP 52, 4 - 30 Nm	351	HEDL 5540	416	40	•

## Technical Data

Max. permissible static torque at 20°C	0.4 Nm	Nominal voltage, smoothed	24 VDC $\pm 10\%$	Pin Allocation
Mass inertia	10 gcm <sup>2</sup>	Resistance	$R_{20} = 92.5 \Omega \pm 6\%$	Cable (AWG 26)
Max. speed	16000 rpm	Duty cycle	100%	Designation
Weight	0.05 kg	Reaction time	$\leq 13$ ms	red
Ambient temperature range	-5...+85°C	– Coupling	$\leq 27$ ms	U <sub>Brake</sub> + 24 VDC
		– Opening		blue
				U <sub>Brake</sub> GND
				Min. cable length
				350 mm

# Brake AB 28 24 VDC, 0.4 Nm



Stock program  
 Standard program  
 Special program (on request)

## Type

### Important Information

- Permanent magnet — single-face brake for DC (dry operation). Braking in unpowered condition.
- Holding brake, prevents rotation of the shaft at standstill or with turned off motor power.
- Not suitable for dynamic braking.
- It is possible to lower the voltage applied to the brake after it has been energized, for the purpose of reducing heat loss.

### Part Numbers

228384    228387



### maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Sensor	Page	$\varnothing$ AB [mm]	Overall length [mm] / • see Gearhead
RE 25, 20 W	126					40	77.1
RE 25, 20 W	126	GP 22, 0.5 Nm	325			40	•
RE 25, 20 W	126	GP 26, 0.75 - 4.5 Nm	332			40	•
RE 25, 20 W	126	GP 32, 0.75 - 4.5 Nm	334			40	•
RE 25, 20 W	126	GP 32, 0.75 - 4.5 Nm	335			40	•
RE 25, 20 W	126	GP 32, 1.0 - 6.0 Nm	338/343			40	•
RE 25, 20 W	126	GP 32 S	366-368			40	•
RE 25, 20 W	126			HED_5540	414/417	40	
RE 25, 20 W	126	GP 22, 0.5 Nm	325	HED_5540	414/417	40	94.3
RE 25, 20 W	126	GP 26, 0.75 - 4.5 Nm	332	HED_5540	414/417	40	•
RE 25, 20 W	126	GP 32, 0.75 - 4.5 Nm	334	HED_5540	414/417	40	•
RE 25, 20 W	126	GP 32, 0.75 - 4.5 Nm	335	HED_5540	414/417	40	•
RE 25, 20 W	126	GP 32, 1.0 - 6.0 Nm	338/343	HED_5540	414/417	40	•
RE 25, 20 W	126	GP 32 S	366-368	HED_5540	414/417	40	•
RE 25, 20 W	127					40	88.6
RE 25, 20 W	127	GP 26, 0.75 - 4.5 Nm	332			40	•
RE 25, 20 W	127	GP 32, 0.75 - 4.5 Nm	334			40	•
RE 25, 20 W	127	GP 32, 0.75 - 4.5 Nm	335			40	•
RE 25, 20 W	127	GP 32, 1.0 - 6.0 Nm	338/343			40	•
RE 25, 20 W	127	GP 32 S	366-368			40	•
RE 25, 20 W	127			HED_5540	413/415	40	
RE 25, 20 W	127	GP 26, 0.75 - 4.5 Nm	332	HED_5540	413/415	40	105.8
RE 25, 20 W	127	GP 32, 0.4 - 2.0 Nm	334	HED_5540	413/415	40	•
RE 25, 20 W	127	GP 32, 0.75 - 4.5 Nm	335	HED_5540	413/415	40	•
RE 25, 20 W	127	GP 32, 1.0 - 6.0 Nm	338/343	HED_5540	413/415	40	•
RE 25, 20 W	127	GP 32 S	366-368	HED_5540	413/415	40	•
RE 35, 90 W	130					40	107.1
RE 35, 90 W	130	GP 32, 0.75 - 6.0 Nm	334-340			40	•
RE 35, 90 W	130	GP 32, 4.0 - 8.0 Nm	341			40	•
RE 35, 90 W	130	GP 42, 3 - 15 Nm	345			40	•
RE 35, 90 W	130			HED_5540	413/415	40	
RE 35, 90 W	130	GP 32, 0.75 - 6.0 Nm	334-340	HED_5540	413/415	40	124.3
RE 35, 90 W	130	GP 32, 4.0 - 8.0 Nm	341	HED_5540	413/415	40	•
RE 35, 90 W	130	GP 42, 3 - 15 Nm	345	HED_5540	413/415	40	•
RE 35, 90 W	130	GP 32 S	366-368	HED_5540	413/415	40	•
RE 35, 90 W	130	GP 32 S	366-368	HED_5540	413/415	40	•
RE 40, 150 W	132					45	107.1
RE 40, 150 W	132	GP 42, 3 - 15 Nm	345			45	•
RE 40, 150 W	132	GP 52, 4 - 30 Nm	350			45	•
RE 40, 150 W	132			HED_5540	413/415	45	
RE 40, 150 W	132	GP 42, 3 - 15 Nm	345	HED_5540	413/415	45	124.3
RE 40, 150 W	132	GP 52, 4 - 30 Nm	350	HED_5540	413/415	45	•

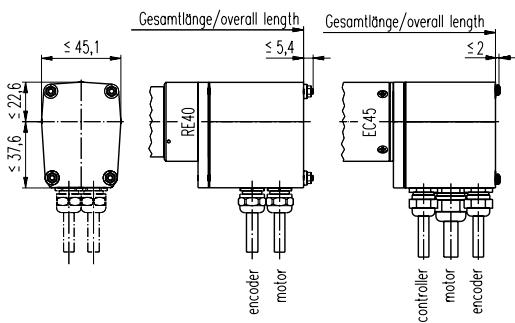
### Technical Data

Max. permissible static torque at 20°C	0.4 Nm	Nominal voltage, smoothed	24 VDC $\pm 10\%$
Mass inertia	10 gcm <sup>2</sup>	Resistance	$R_{20} = 92.5 \Omega \pm 6\%$
Max. speed	16000 rpm	Duty cycle	100%
Weight	0.05 kg	Reaction time	$\leq 13$ ms
Ambient temperature range	-5...+85°C	- Coupling	$\leq 27$ ms
		- Opening	

### Pin Allocation

Cable (AWG 26)	Designation
red	U <sub>Brake</sub> + 24 VDC
blue	U <sub>Brake</sub> GND
red	Motor+
black	Motor-
	Min. cable length
	350 mm

# Brake AB 28 24 VDC, 0.4 Nm



## Important Information

- Permanent magnet — single-face brake for DC (dry operation). Braking in unpowered condition.
- Holding brake, prevents rotation of the shaft at standstill or with turned off motor power.
- Not suitable for dynamic braking.
- It is possible to lower the voltage applied to the brake after it has been energized, for the purpose of reducing heat loss.

Stock program

Standard program

Special program (on request)

## Part Numbers

228389 | 228390

## Type



## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Sensor	Page	Overall length [mm] / • see Gearhead
RE 40, 150 W	132					115.1
RE 40, 150 W	132	GP 42, 3 - 15 Nm	345			•
RE 40, 150 W	132	GP 52, 4 - 30 Nm	350			•
RE 40, 150 W	132			HEDL 9140	419	135.6
RE 40, 150 W	132	GP 42, 3 - 15 Nm	345	HEDL 9140	419	•
RE 40, 150 W	132	GP 52, 4 - 30 Nm	350	HEDL 9140	419	•
EC 45, 150 W	220					118.6
EC 45, 150 W	220	GP 42, 3 - 15 Nm	345			•
EC 45, 150 W	220	GP 52, 4 - 30 Nm	350			•
EC 45, 150 W	220			HEDL 9140	419	135.6
EC 45, 150 W	220	GP 42, 3 - 15 Nm	345	HEDL 9140	419	•
EC 45, 150 W	220	GP 52, 4 - 30 Nm	350	HEDL 9140	419	•
EC 45, 250 W	221					151.4
EC 45, 250 W	221	GP 42, 3 - 15 Nm	346			•
EC 45, 250 W	221	GP 52, 4 - 30 Nm	350			•
EC 45, 250 W	221	GP 62, 8 - 50 Nm	352			•
EC 45, 250 W	221			HEDL 9140	419	168.4
EC 45, 250 W	221	GP 42, 3 - 15 Nm	346	HEDL 9140	419	•
EC 45, 250 W	221	GP 52, 4 - 30 Nm	350	HEDL 9140	419	•
EC 45, 250 W	221	GP 62, 8 - 50 Nm	352	HEDL 9140	419	•

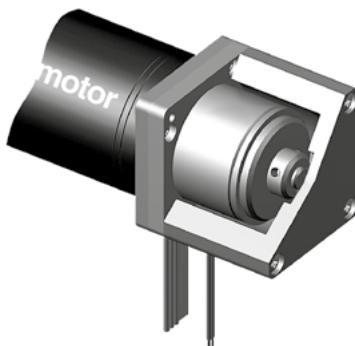
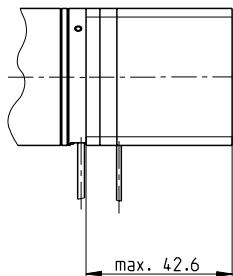
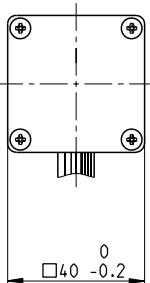
## Technical Data

Max. permissible static torque at 20°C	0.4 Nm	Nominal voltage, smoothed	24 VDC ±10%
Mass inertia	10 gcm²	Resistance	R <sub>20</sub> = 92.5 Ω ±6%
Max. speed	16000 rpm	Duty cycle	100%
Weight	0.05 kg	Reaction time	– Coupling – Opening
Ambient temperature range	-5...+85°C		≤ 13 ms ≤ 27 ms

## Pin Allocation

from motor clamp	Designation
RE 40	U <sub>Brake</sub> + 24 VDC
Cable green (AWG 20)	U <sub>Brake</sub> GND
Cable yellow (AWG 20)	EC 45
EC 45	No. 4 (AWG 18)
No. 4 (AWG 18)	U <sub>Brake</sub> + 24 VDC
No. 5 (AWG 18)	U <sub>Brake</sub> GND
Min. cable length	500 mm

# Brake AB 32 24 VDC, 0.4 Nm

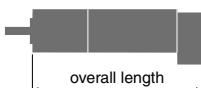
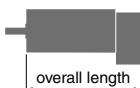


## Important Information

- Permanent magnet – single-face brake for DC (dry operation). Braking in unpowered condition.
- Holding brake, prevents rotation of the shaft at standstill or with turned off motor power.
- Not suitable for dynamic braking.
- It is possible to lower the voltage applied to the brake after it has been energized, for the purpose of reducing heat loss.

  Stock program  
  Standard program  
  Special program (on request)

### Type



### Part Numbers

392335

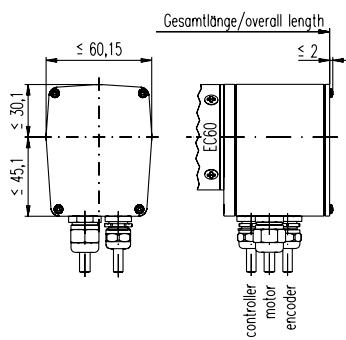
### maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Sensor	Page	Overall length [mm] / • see Gearhead
EC 40, 170 W	219					122.7
EC 40, 170 W	219	GP 42, 3 - 15 Nm	345			•
EC 40, 170 W	219	GP 52, 4 - 30 Nm	350			•
EC 40, 170 W	219			HED_5540	414/416	141.1
EC 40, 170 W	219	GP 42, 3 - 15 Nm	345	HED_5540	414/416	•
EC 40, 170 W	219	GP 52, 4 - 30 Nm	350	HED_5540	414/416	•

### Technical Data

Max. permissible static torque at 20°C	0.4 Nm	Nominal voltage, smoothed	24 VDC ±10%	<b>Pin Allocation</b>
Mass inertia	19 gcm <sup>2</sup>	Resistance	R <sub>20</sub> = 100 Ω ±7%	Cable (AWG 24)
Max. speed	10000 rpm	Duty cycle	100%	Designation
Weight	0.1 kg	Reaction time	– Coupling	U <sub>Brake</sub> + 24 VDC
Ambient temperature range	-40...+100°C		– Opening	U <sub>Brake</sub> GND
			≤ 13 ms	Min. cable length
			≤ 24 ms	350 mm

# Brake AB 41 24 VDC, 2.0 Nm



## Important Information

- Permanent magnet – single-face brake for DC (dry operation). Braking in unpowered condition.
- Holding brake, prevents rotation of the shaft at standstill or with turned off motor power.
- Not suitable for dynamic braking.
- It is possible to lower the voltage applied to the brake after it has been energized, for the purpose of reducing heat loss.

  Stock program

  Standard program

  Special program (on request)

## Part Numbers

228998

## Type



## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Sensor	Page	Overall length [mm] / • see Gearhead
EC 60, 400 W	222					190.9
EC 60, 400 W	222	GP 81, 20 - 120 Nm	353			•
EC 60, 400 W	222			HEDL 9140	419	214.9
EC 60, 400 W	222	GP 81, 20 - 120 Nm	353	HEDL 9140	419	•

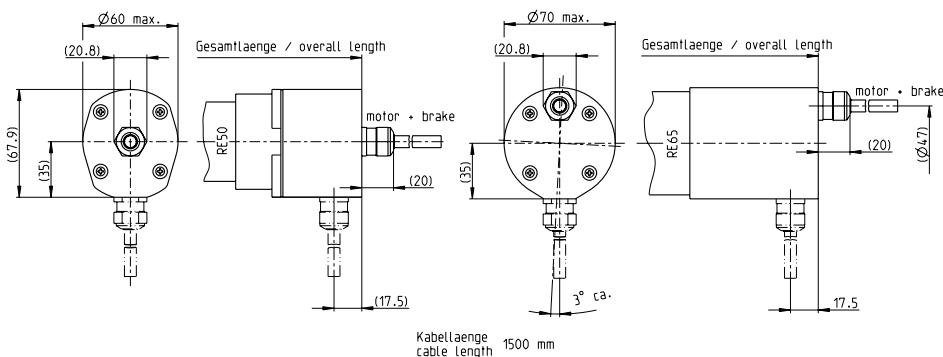
## Technical Data

Max. permissible static torque at 20°C	2.0 Nm	Nominal voltage, smoothed	24 VDC -10 ... +6%
Mass inertia	45 gcm <sup>2</sup>	Resistance	R <sub>20</sub> = 72 Ω ±7%
Max. speed	10 000 rpm	Duty cycle	100%
Weight	0.18 kg	Reaction time	- Coupling - Opening
Ambient temperature range	-5...+85°C		≤ 2 ms ≤ 25 ms

## Pin Allocation

	from motor clamp	Designation
Cable red	No 4 (AWG 16)	U <sub>Brake</sub> + 24 VDC
Cable black	No 5 (AWG 16)	U <sub>Brake</sub> GND
		Min. cable length 500 mm

# Brake AB 44 24 VDC, 2.5 Nm



## Important Information

- Permanent magnet – single-face brake for DC (dry operation). Braking in unpowered condition.
- Holding brake, prevents rotation of the shaft at standstill or with turned off motor power.
- Not suitable for dynamic braking.
- It is possible to lower the voltage applied to the brake after it has been energized, for the purpose of reducing heat loss.
- Protection: IP54

  Stock program  
  Standard program  
  Special program (on request)

## Part Numbers

Cable output axial	386052	385999
Cable output radial	386054	386000

## Type



## maxon Modular System

+ Motor	Page	+ Gearhead	Page	+ Sensor	Page	Overall length [mm] / • see Gearhead
RE 50, 200 W	133					170.4
RE 50, 200 W	133	GP 52, 4 - 30 Nm	351			•
RE 50, 200 W	133	GP 62, 8 - 50 Nm	352			•
RE 50, 200 W	133		HEDL 9140	420		183.4
RE 50, 200 W	133	GP 52, 4 - 30 Nm	351	HEDL 9140	420	•
RE 50, 200 W	133	GP 62, 8 - 50 Nm	352	HEDL 9140	420	•
RE 65, 250 W	134					187.5
RE 65, 250 W	134	GP 81, 20 - 120 Nm	353			•
RE 65, 250 W	134		HEDL 9140	420		205.5
RE 65, 250 W	134	GP 81, 20 - 120 Nm	353	HEDL 9140	420	•

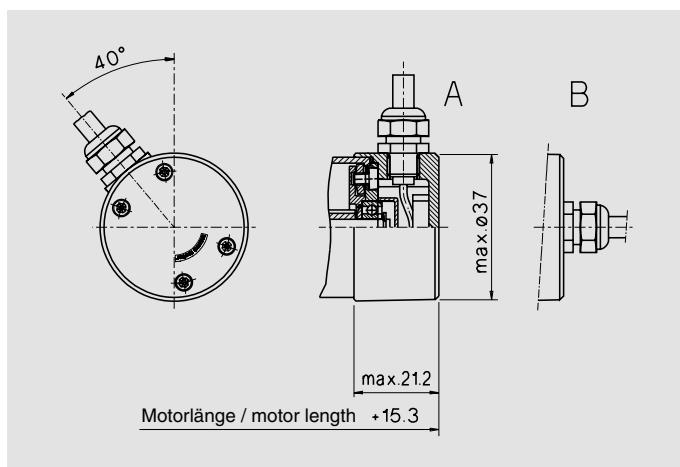
## Technical Data

Max. permissible static torque at 20°C	2.5 Nm	Nominal voltage, smoothed	24 VDC ±10%
Mass inertia	90 gcm <sup>2</sup>	Resistance	R <sub>20</sub> = 64 Ω ±7%
Max. speed	10000 rpm	Duty cycle	100%
Weight	0.19 kg	Reaction time	– Coupling ≤ 20 ms – Opening ≤ 35 ms
Ambient temperature range	-40...+100°C		

## Pin Allocation

Cable (AWG 18)	Designation
white	Motor+
brown	Motor-
green	U <sub>Brake</sub> + 24 VDC
yellow	U <sub>Brake</sub> GND
Min. cable length	1490 mm

## End Caps



### End cap for maxon DC motor RE 35 mm

Details for motor see page 130

- Plastic housing
- Protection to IP54
- With 500 mm cable, AWG 20 ( $2 \times 0.5 \text{ mm}^2$ ) other lengths on request!
- Radial or axial cable outlet
- Assembly only by maxon motor. The shaft must be shortened.

#### Pin Allocation

Cable No.	Color	Motor
1	black	+ Pol
2	black	- Pol

#### Part Numbers

Type number	Version/Item
137235	A End cap with radial cable outlet (500 mm)
137234	B End cap with axial cable outlet (500 mm)

### End cap for maxon DC motor RE 40 mm

Details for motor see page 132

- Plastic housing
- Protection to IP54
- With 500 mm cable, AWG 20 ( $2 \times 0.5 \text{ mm}^2$ ) other lengths on request!
- Radial or axial cable outlet
- Assembly only by maxon motor. The shaft must be shortened.

#### Pin Allocation

Cable No.	Color	Motor
1	black	+ Pol
2	black	- Pol

#### Part Numbers

Type number	Version/Item
232341	A End cap with radial cable outlet (500 mm)
232343	B End cap with axial cable outlet (500 mm)

### End cap for maxon DC motor RE 50 mm

Details for motor see page 133

- Aluminium housing
- Protection to IP54
- With 1500 mm cable, AWG 18 ( $2 \times 1.0 \text{ mm}^2$ ) other lengths on request!
- Radial or axial cable outlet
- Assembly only by maxon motor.

#### Pin Allocation

Cable No.	Color	Motor
1	white	+ Pol
2	brown	- Pol

#### Part Numbers

Type number	Version/Item
386056	A End cap with radial cable outlet (1500 mm)
386055	B End cap with axial cable outlet (1500 mm)

### End cap for maxon DC motor RE 65 mm

Details for motor see page 134

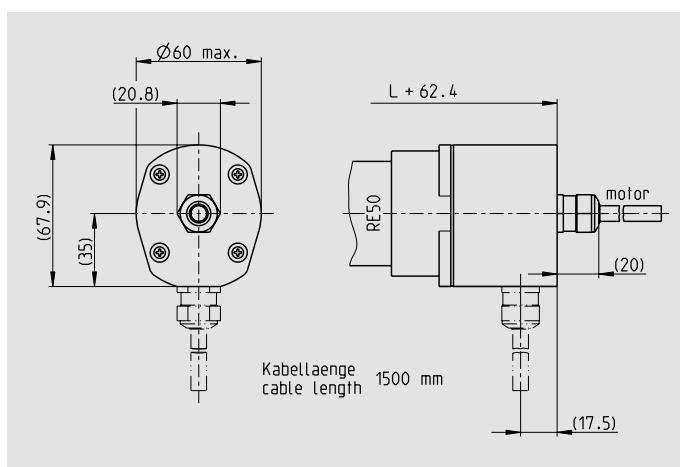
- Aluminium housing
- Protection to IP54
- With 1500 mm cable, AWG 18 ( $2 \times 1.0 \text{ mm}^2$ ) other lengths on request!
- Radial or axial cable outlet
- Assembly only by maxon motor.

#### Pin Allocation

Cable No.	Color	Motor
1	white	+ Pol
2	brown	- Pol

#### Part Numbers

Type number	Version/Item
386004	A End cap with radial cable outlet (1500 mm)
386003	B End cap with axial cable outlet (1500 mm)



### End cap for maxon DC motor RE 50 mm

Details for motor see page 133

- Aluminium housing
- Protection to IP54
- With 1500 mm cable, AWG 18 ( $2 \times 1.0 \text{ mm}^2$ ) other lengths on request!
- Radial or axial cable outlet
- Assembly only by maxon motor.

#### Pin Allocation

Cable No.	Color	Motor
1	white	+ Pol
2	brown	- Pol

#### Part Numbers

Type number	Version/Item
386056	A End cap with radial cable outlet (1500 mm)
386055	B End cap with axial cable outlet (1500 mm)

### End cap for maxon DC motor RE 65 mm

Details for motor see page 134

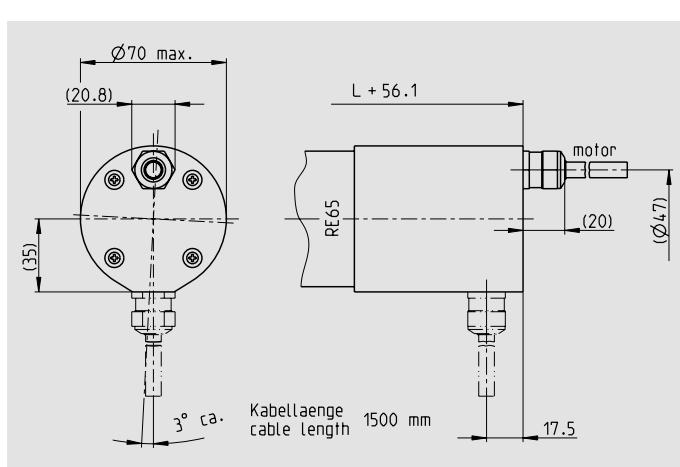
- Aluminium housing
- Protection to IP54
- With 1500 mm cable, AWG 18 ( $2 \times 1.0 \text{ mm}^2$ ) other lengths on request!
- Radial or axial cable outlet
- Assembly only by maxon motor.

#### Pin Allocation

Cable No.	Color	Motor
1	white	+ Pol
2	brown	- Pol

#### Part Numbers

Type number	Version/Item
386004	A End cap with radial cable outlet (1500 mm)
386003	B End cap with axial cable outlet (1500 mm)



For your personal notes.



# maxon ceramic

High performance industrial ceramic is used primarily for applications where customary materials would fail. maxon ceramic products include: precision spindles, axles and shafts, customer-specific components for microtechnology, and scratch-resistant housing components.

<b>Innovative high-tech ceramic components</b>	466–468
<b>Material properties</b>	469–471
<b>Standard spindles</b>	472
<b>System-specific nuts</b>	473–474
<b>Standard axles</b>	475

**Smooth-running and wear-proof.**  
Ceramic precision spindles.



**Resilient and long-lasting.**  
Ceramic axles for power tools.



**Complex shapes for microtechnology.**  
Ceramic components for miniaturized applications.



**Protection against high temperatures  
and aggressive media.**  
Ceramic sensor housing for measuring equipment.



**Shiny, scratch-resistant surfaces.**  
Earphone housing made of black ceramic.





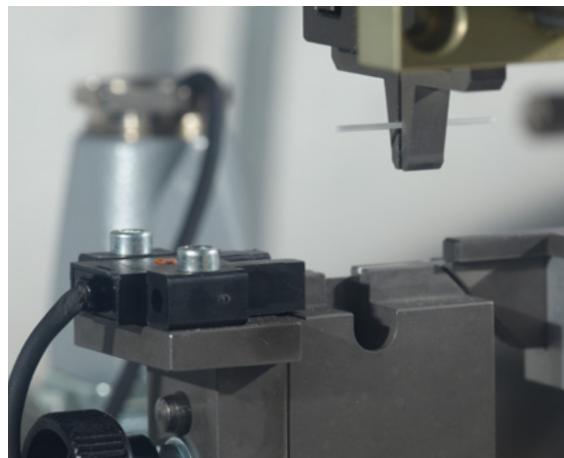
# Experience and innovation.

## maxon ceramic.

maxon ceramic in Sexau, Germany, is part of maxon motor, the global leading provider of high-precision drive systems, based in Switzerland. maxon ceramic has extensive knowledge and more than 20 years of experience in the field of powder injection molding. Customized ceramic and metallic components are produced CIM (Ceramic Injection Molding) and MIM (Metal Injection Molding).

In addition to our extensive standard program, we also offer components manufactured to customer specifications. We not only develop components for drive technology and the watch industry, but also high-precision spindles made of high-performance ceramic. Our development and engineering department use cutting-edge CAD technology and make use of the finite element calculation method.

For additional information, contact your local maxon representative found at:  
[contact.maxonmotor.com](http://contact.maxonmotor.com)



## Complex shapes for microtechnology.

### Ceramic pawls in automatic watches.

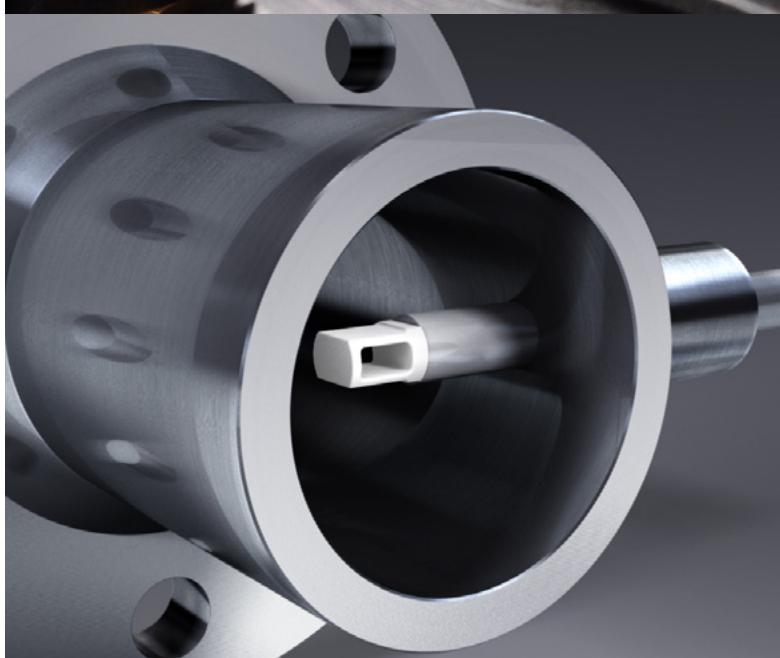
In clockwork, the tiny mechanical parts have to be machined with utmost precision for the clockwork to run reliably. With ceramic components, the meshing parts maintain precision over life spans never achieved before.



## Protection against high temperatures and aggressive media.

### Ceramic sensor housing in a flow meter.

Ceramic resists harsh conditions. As a sensor housing, it shows its resistance against high temperatures, abrasive dust in the mass flow and chemically aggressive condensate. The low heat conductance protects the electronics inside of the sensor. This passive behavior towards electric and magnetic fields make it possible to use electronic sensors.



## Shiny, scratch-resistant surfaces.

### Ceramic housing for earphones.

Ceramic surfaces feature scratch-resistance and shine. The continuous development of our polishing and shaping processes combines aesthetic design and functionality in a very special way. Ceramic housings protect the high-quality technical components inside and give the products a long-lasting high-quality exterior.





# Zirconia.

Zirconia is a high-performance industrial ceramic. It is used primarily for applications where customary materials would fail. These applications include wear optimization, as well as non-magnetic applications in a vacuum and in medical applications. Zirconia measures up to these tasks even while meeting high requirements for chemical and thermal stability as well as thermal and electrical insulation.

Zirconia shares many of the properties of steel (elasticity modulus of approx. 200 000 N/mm<sup>2</sup>, bending strength of >800 N/mm<sup>2</sup>, expansion co-efficient of  $10 \times 10^{-6}$  1/K). However, at 1350 HV, it is many times harder than steel. This is the main benefit when using ceramics and surfaces are virtually wearproof.

## General material properties.

Bending strength	>800 N/mm <sup>2</sup>
Elasticity modulus	$2 \times 10^5$ N/mm <sup>2</sup>
Density	$\geq 6.03$ g/cm <sup>3</sup>
Hardness	1350 HV
Heat expansion coefficient	$10 \times 10^{-6}$ 1/K
Thermal conductivity	2 W/mK
Dielectric constant	22 [ ]
Electrical resistance	$10^8$ $\Omega$ m



# Precision spindles made of ceramic.

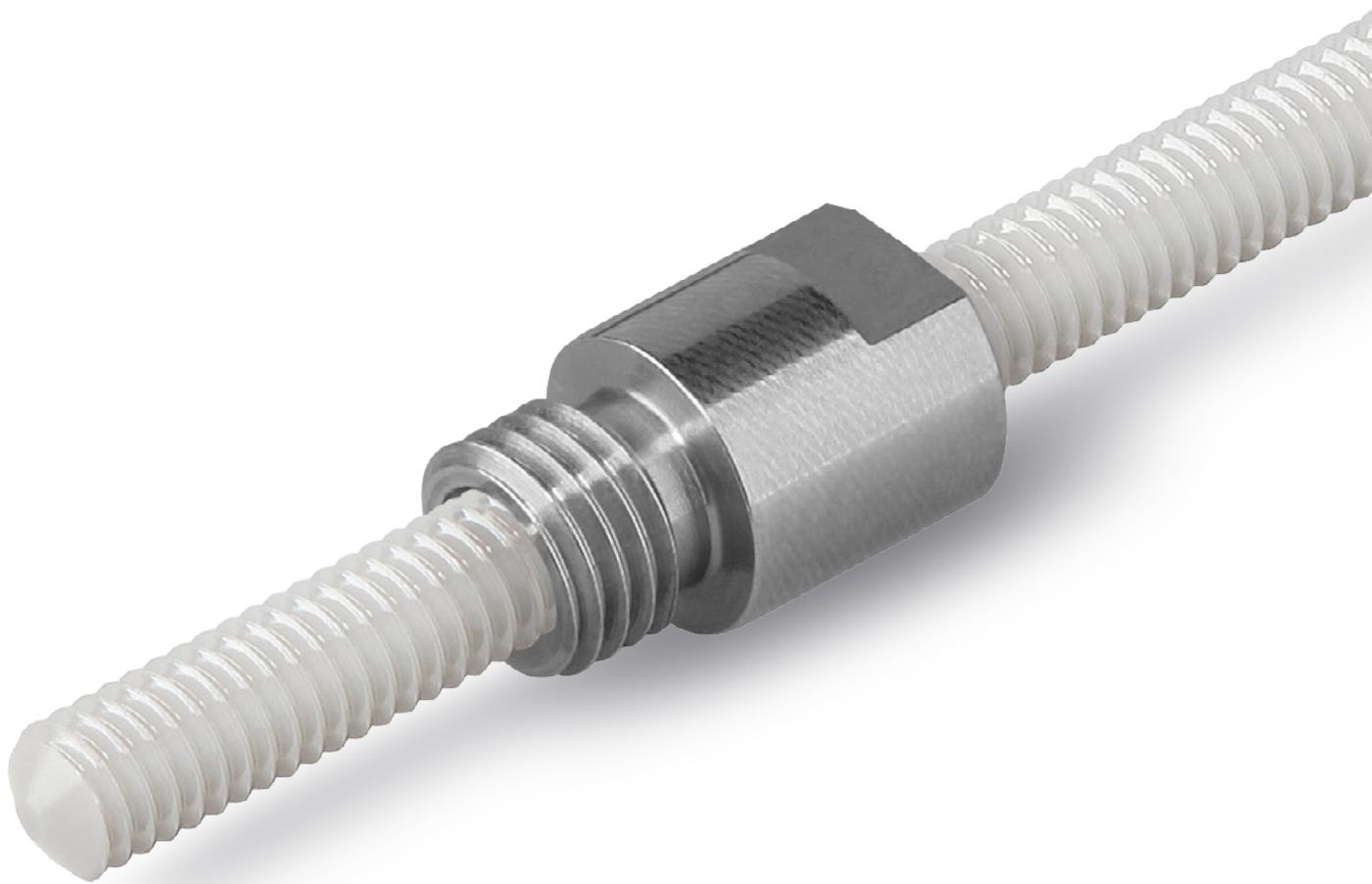
## The maxon cgs spindle – smooth-running and wear-proof.

Ground ceramic surfaces are extremely suitable for sliding movements. Our ceramic spindles with specially developed cgs surface (ceramic glide surface) work almost completely without slip-stick effect. Ceramic components can be positioned easily, even in areas with strong electric fields or high vacuum.

Due to the high hardness of the ceramic, the maxon cgs spindles achieve an exceptionally long life span, especially in the case of dynamic operation. All these properties make ceramic spindles a better alternative to customary steel spindles and ball screws.

### cgs surface for ceramic spindles.

To use this high-strength material for spindles, maxon ceramic has designed the spindle flanks with a special cgs surface structure. The result is an unprecedented wear resistance and extremely high efficiency.



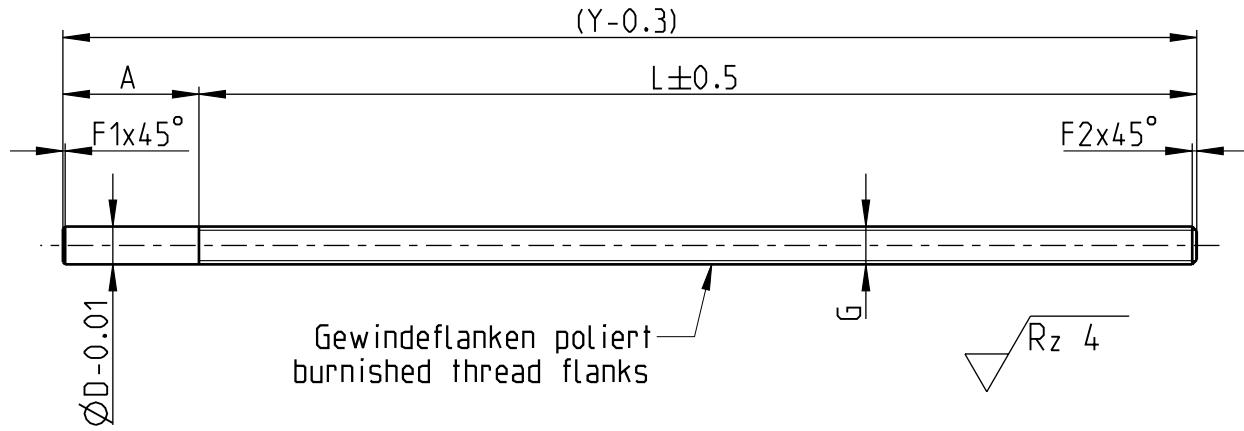


## Ceramic as spindle material makes it possible to use the spindles in:

- Applications with high power transmission
- Applications with long life span
- High temperature environments
- Magnetic and electric fields
- Chemically aggressive environments
- Cleanrooms
- High vacuum technologies

## Benefits of ceramic spindles:

- Excellent sliding characteristics
- Extreme wear resistance
- Significant increase in life span
- Excellent efficiency
- Almost non-existent stick-slip effect
- Thermally isolating
- Spindles resistant to thermal stress (~800°C)
- Electrically insulating
- No warming up in induction fields
- Chemically stable
- Corrosion-free
- Strength, Elasticity modulus and thermal expansion similar to that of steel



# maxon standard spindles.

## Ceramic spindles (in white).

Size	Color	Part no.	D	A max.	L max.	F1	F2	(Y) max.
M2	white	426634	2.0	18	102	0.3	0.3	120
M2.5	white	426707	2.5	18	132	0.3	0.3	150
M3	white	426715	3.0	18	132	0.4	0.4	150
M4	white	426717	4.0	18	132	0.5	0.5	150
M5	white	426730	5.0	18	132	0.6	0.6	150
M6	white	426740	6.0	18	232	0.7	0.7	250
M8	white	426763	8.0	18	232	0.8	0.8	250
M10	white	426783	10.0	18	232	1.0	1.0	250

## Ceramic spindles (in black).

Size	Color	Part no.	D	A max.	L max.	F1	F2	(Y) max.
M2	black	427107	2.0	18	102	0.3	0.3	120
M2.5	black	427186	2.5	18	132	0.3	0.3	150
M3	black	427199	3.0	18	132	0.4	0.4	150
M4	black	427209	4.0	18	132	0.5	0.5	150
M5	black	427216	5.0	18	132	0.6	0.6	150
M6	black	427221	6.0	18	232	0.7	0.7	250
M8	black	427231	8.0	18	232	0.8	0.8	250



# System-specific nuts.

## The right nut for each application.

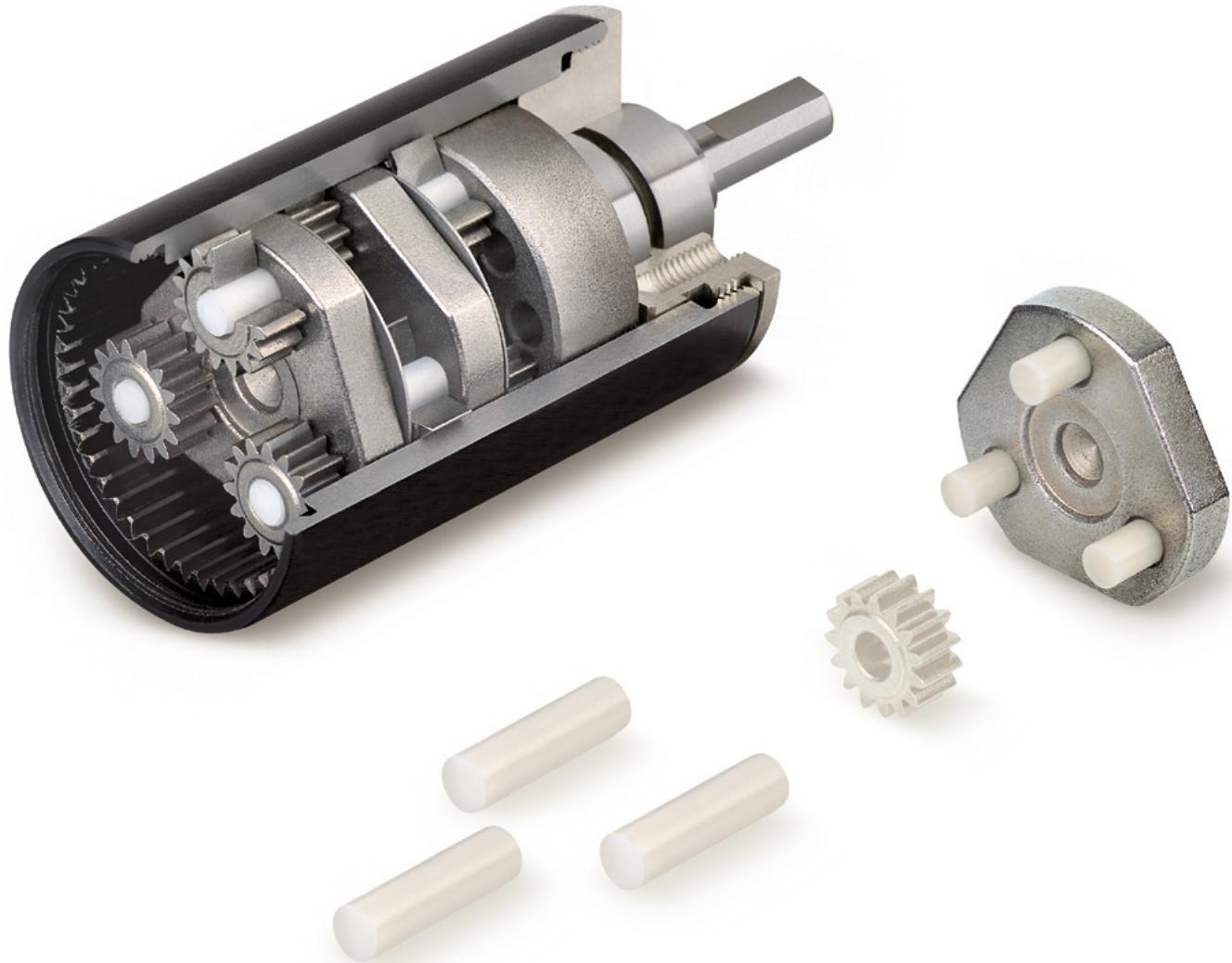
In combination with ceramic spindles, nuts are available in steel, brass, bronze or plastic. For applications with very high demands to the life span, we use CVD-coated steel nuts.

The nuts profit from the special maxon cgs surface of the spindles, this results in significantly longer life spans than those offered by metal spindles.

For backlash-free applications, we offer preloaded nuts. For applications with strong magnetic or electric fields, plastic nuts are preferred. In applications involving movements with little load, the nuts may be operated without the lubricant.

## Individual solutions.

In addition to our standard program, we also offer spindles and nuts tailored to your application needs. We provide spindles with fine thread, special leads, as well as double-thread spindles. A customer-specific integration with your bearing system is also possible. Please contact us if you are interested in learning more.

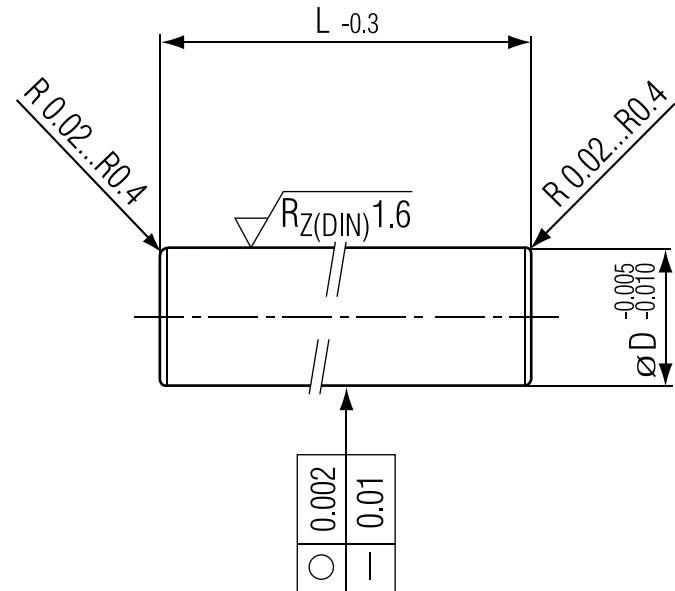


## How can the life span of planetary gearheads be increased?

Planetary gearheads have existed for centuries; their simple structure makes it possible to transmit high torque in small spaces. To increase the life span, maxon motor increased the precision of the components and set new benchmarks for efficiency and life span by using a new material.

The use of ceramic axles in our gearheads led to a separate program for ceramic rods. Ceramic axles may be used in:

- Linear guides
- Positioning pins
- Joints
- Rollers



# maxon standard axles.

## Resilient and long-lasting.

Ceramic is an excellent material for small dynamic systems. When the miniaturization of rolling bearings has reached its limits and milling of complex geometries gets difficult, ceramic as material offers decisive benefits. With its excellent sliding characteristics, the high wear resistance and the ability to shape components by means of injection molding, ceramic outperforms conventional solutions.

<b>Ø D</b>	<b>L = 2.4</b>	<b>L = 6.4</b>	<b>L = 7.4</b>	<b>L = 10.6</b>	<b>L = 13.8</b>	<b>L = 15</b>	<b>L = 35</b>	<b>L = 40</b>	<b>L = 60</b>	<b>L = 70</b>	<b>L = 120</b>
0.8	255899	255900	255901	255902	255903	255904	255905 <sup>4)</sup>	348501 <sup>4)</sup>	348502 <sup>5)</sup>	348503 <sup>6)</sup>	
1.0	255891	255892	255893	255894	255895	255896	255898 <sup>4)</sup>	348498 <sup>4)</sup>	348499 <sup>5)</sup>	348500 <sup>6)</sup>	
1.5	255883	255884	255885	255886	255887	255888	255889 <sup>4)</sup>	255890 <sup>4)</sup>	255792 <sup>5)</sup>	255793 <sup>6)</sup>	
2.0	255872	255873	348693	255875	255876	255877	255879	255880	255881	255882	
2.5	255864	143825 <sup>3)</sup> <sup>7)</sup>	255866	255867	255868	255869	255870	255871	346621	348288	
3.0	255856	255857	255858	255859	255860	255861	255862	255863	346619	346620	
4.0	255845	255846	166875 <sup>1)</sup> <sup>3)</sup> <sup>7)</sup>	137962 <sup>1)</sup> <sup>3)</sup> <sup>7)</sup>	255849	255850	255851	255853	255854	255791	255787 <sup>5)</sup>
5.0	255833	255834	255835	255836	255837	255838	255839	255840	255841	255842	255843 <sup>5)</sup>
5.5	255818	255819	255820	255786	205063 <sup>2)</sup> <sup>3)</sup> <sup>7)</sup>	255825	255826	255827	255828	255830	255831 <sup>5)</sup>
6.0	255806	255807	255808	255809	255810	255811	255812	255813	255814	255815	255816 <sup>5)</sup>
8.0	255794	255795	255796	255797	255798	255799	255800	255801	255802	255803	255804 <sup>5)</sup>

<sup>1)</sup> Diameter tolerance deviation: -0.008/-0.013

<sup>2)</sup> Diameter tolerance deviation: -0.013/-0.018

<sup>3)</sup> Rounded edges R 0.3 ± 0.1

<sup>4)</sup> Straightness tolerance deviation: 0.02 mm

<sup>5)</sup> Straightness tolerance deviation: 0.03 mm

<sup>6)</sup> Straightness tolerance deviation: 0.04 mm

<sup>7)</sup> Roundness tolerance deviation: 0.003 mm

For your personal notes.



# Born in Switzerland. Grown into the world.

## maxon motor ag headquarters

**maxon motor ag**  
Brünigstrasse 220  
P.O. Box 263  
6072 Sachseln  
Switzerland  
Phone: +41 (0) 41 666 15 00  
Fax: +41 (0) 41 666 16 50  
E-mail: info@maxonmotor.com  
www.maxonmotor.com

## maxon Divisions

**maxon ceramic**  
maxon motor GmbH  
Untere Ziel 1  
79350 Sexau  
Germany  
Phone: +49 (0) 7641 9114 0  
Fax: +49 (0) 7641 9114 14  
E-mail: ceramic@maxonmotor.com  
www.maxonceramic.de

**maxon medical**  
Brünigstrasse 220  
P.O. Box 263  
6072 Sachseln  
Switzerland  
Phone: +41 (0) 41 666 15 00  
Fax: +41 (0) 41 666 19 75  
E-mail: maxonmedical@maxonmotor.com  
www.maxonmedical.com

## mars maxon bikedrive

**maxon advanced robotics & systems**  
Industriestrasse 24  
6074 Giswil  
Switzerland  
Phone: +41 (0) 41 666 19 45  
www.maxonbikedrive.com

## maxon Manufacturing Companies

**maxon motor GmbH**  
Untere Ziel 1  
79350 Sexau  
Germany  
Phone: +49 (0) 7641 9114 0  
Fax: +49 (0) 7641 9114 14

**maxon motor hungary kft**  
Tartu u. 4.  
8200 Veszprém  
Hungary  
Phone: +36 14088000  
Fax: +36 14088792  
E-mail: mmh-info@maxonmotor.com

**maxon motor manufacturing Co., Ltd.**  
26, Yongwon 3-gil  
Seongnam-myeon, Dongnam-gu  
Cheonan, Korea 31246  
Phone: +82 (41) 908 3330  
Fax +82 (41) 908 8880  
E-mail: info.kr@maxonmotor.com  
www.maxonmotor.co.kr

**mdp**  
21 Porte du Grand Lyon  
01700 Neyron  
France  
Phone: +33/472 - 018 300  
Fax: +33/472 - 018 309  
E-mail: contact@mdp.fr  
www.mdp.fr

**maxon motor benelux B.V.**  
Josink Kolkweg 38  
7545 PR Enschede  
Netherlands  
Phone: +31 53 - 7440744  
E-mail: info@maxonmotor.nl  
www.maxonmotor.nl

## maxon Sales Companies and Sales Agents

### Europe

#### **Belgium / Luxembourg**

maxon motor benelux B.V.  
Mechelen Campus  
Schaliënhoedreef 20 C  
2800 Mechelen  
Belgium  
Phone: +32/15 - 20 00 10  
E-mail: info@maxonmotor.be  
[www.maxonmotor.be](http://www.maxonmotor.be)

#### **Denmark**

DJ Stork Drives ApS  
Kirkebjerg Parkvej 12  
2605 Brøndby  
Denmark  
Phone: +45 8988 2416  
Mobile: +45 5353 5051  
E-mail: [ulrik.eriksen@storkdrives.dk](mailto:ulrik.eriksen@storkdrives.dk)  
[www.storkdrives.dk](http://www.storkdrives.dk)

#### **Germany (Head Office)**

maxon motor gmbh  
Truderinger Strasse 210  
81825 München  
Germany  
Phone: +49/89 - 42 04 93 -0  
E-mail: [info@maxonmotor.de](mailto:info@maxonmotor.de)  
[www.maxonmotor.de](http://www.maxonmotor.de)

#### **Finland**

DJ Stork Drives OY  
Mäenalantie 773  
24260 Salo  
Finland  
Phone: +358 45 11 06 433  
E-mail: [jyrki.leinonen@storkdrives.fi](mailto:jyrki.leinonen@storkdrives.fi)  
[www.storkdrives.fi](http://www.storkdrives.fi)

#### **France**

mdp  
21 Porte du Grand Lyon  
01700 Neyron  
France  
Phone: +33/472 - 018 300  
Fax: +33/472 - 018 309  
E-mail: [contact@mdp.fr](mailto:contact@mdp.fr)  
[www.mdp.fr](http://www.mdp.fr)

#### **Great Britain**

maxon motor uk Ltd.  
Maxon House  
Hogwood Lane, Finchampstead  
Berkshire, RG40 4QW  
Great Britain  
Phone: +44 (0) 1189 733337  
Fax: +44 (0) 1189 737472  
E-mail: [salesuk@maxonmotor.com](mailto:salesuk@maxonmotor.com)  
[www.maxonmotor.co.uk](http://www.maxonmotor.co.uk)

#### **Italy**

maxon motor italia S.r.l.  
Società Unipersonale  
Via Sirtori 35  
20017 Rho MI  
Italy  
Phone: +39 02 93580588  
Fax: +39 02 93580473  
E-mail: [info.it@maxonmotor.com](mailto:info.it@maxonmotor.com)  
[www.maxonmotor.it](http://www.maxonmotor.it)

#### **Netherlands**

maxon motor benelux B.V.  
Josink Kolkweg 38  
7545 PR Enschede  
Netherlands  
Phone: +31 53 - 7440744  
E-mail: [info@maxonmotor.nl](mailto:info@maxonmotor.nl)  
[www.maxonmotor.nl](http://www.maxonmotor.nl)

#### **Norway**

DJ Stork Drives AS  
Postboks 13  
Storgata 15  
2711 Gran  
Norway  
Phone: +47/6199 3001  
Mobile: +47/9400 2990  
E-mail: [arve.stensrud@storkdrives.no](mailto:arve.stensrud@storkdrives.no)  
[www.storkdrives.no](http://www.storkdrives.no)

#### **Austria**

Hungary, Slovenia, Romania  
Kwapił & Co GmbH  
Kammelweg 9  
1210 Wien  
Austria  
Phone: +43/1 - 278 85 85  
Fax: +43/1 - 278 85 86  
E-mail: [verkauf@kwapił.com](mailto:verkauf@kwapił.com)  
[www.kwapił.com](http://www.kwapił.com)

#### **Sweden**

DJ Stork Drives AB  
Box 1158  
Solna Strandväg 116  
171 54 Solna  
Sweden  
Phone: +46/8 - 635 60 00  
Fax: +46/8 - 635 60 01  
E-mail: [info@storkdrives.se](mailto:info@storkdrives.se)  
[www.storkdrives.se](http://www.storkdrives.se)

#### **Spain (Madrid)**

maxon motor ibérica s.a.  
C/ Polo Norte nº 9  
28850 Torrejón de Ardoz  
Spain  
Phone: +34/91 - 656 49 73  
Fax: +34/91 - 656 48 72  
E-mail: [info@maxonmotor.es](mailto:info@maxonmotor.es)  
[www.maxonmotor.es](http://www.maxonmotor.es)

#### **Spain (Barcelona)**

maxon motor ibérica s.a.  
Via Massagué 26 4º 1ª  
08201 Sabadell  
Spain  
Phone: +34/93 - 715 69 52  
Fax: +34/93 - 725 73 59  
E-mail: [jordi.more@maxonmotor.com](mailto:jordi.more@maxonmotor.com)  
[www.maxonmotor.es](http://www.maxonmotor.es)

#### **Spain (La Rioja)**

maxon motor ibérica s.a.  
C/ General Vara del Rey, 9 5º K  
26002 Logroño  
Spain  
Phone: +34/941 23 65 91  
Fax: +34/941 23 65 13  
E-mail: [juan.ruiz@maxonmotor.com](mailto:juan.ruiz@maxonmotor.com)  
[www.maxonmotor.es](http://www.maxonmotor.es)

#### **Switzerland**

maxon motor ag  
P.O. Box 263  
6072 Sachseln  
Switzerland  
Phone: +41 (0) 41 662 95 95  
Fax: +41 (0) 41 666 16 16  
E-mail: [sales-swiss@maxonmotor.com](mailto:sales-swiss@maxonmotor.com)  
[www.maxonmotor.ch](http://www.maxonmotor.ch)

#### **Czech Republic, Slovakia, Poland**

Kwapił & Co. Gesellschaft m.b.H.  
Hlavní 1054/131  
624 00 Brno  
Czech Republic  
Phone: +420 541 211 538  
E-mail: [sales@kwapił.cz](mailto:sales@kwapił.cz)  
[www.kwapił.cz](http://www.kwapił.cz)

#### **maxon Sales Agents**

**Russia**  
AVI Solutions LLC  
Prospect Medikov 5-B  
197022 St. Petersburg  
Russia  
Phone: +7-812- 702 1001  
Fax: +7-812- 702 1148  
E-mail: [sales@avi-solutions.com](mailto:sales@avi-solutions.com)  
[www.avi-solutions.com](http://www.avi-solutions.com)

#### **Turkey**

Ensatek Mühendislik Otomasyon Sanayi Ticaret  
Limited Şirketi  
Cevizli Mah. Mustafa Kemal Cad.  
Hukukcular Towers Sit. A Blok Apt. No: 66/A  
Kat : 15 D : 103-16 34865 Kartal / İstanbul  
Turkey  
Phone: +90 216 970 13 31  
Fax: +90 850 220 04 51  
E-mail: [ensatek@ensatek.com.tr](mailto:ensatek@ensatek.com.tr)  
[www.ensatek.com.tr](http://www.ensatek.com.tr)

## maxon Sales Companies and Sales Agents

### America

#### USA (East Coast)

maxon precision motors, inc.  
101 Waldron Road  
Fall River, MA 02720  
USA  
Phone: +1/508 - 677 0520  
Fax: +1/508 - 677 0530  
E-mail: info@maxonmotorusa.com  
[www.maxonmotorusa.com](http://www.maxonmotorusa.com)

#### USA (West Coast)

maxon precision motors, inc.  
1065 East Hillsdale Blvd, Suite 210  
Foster City, CA 94404  
USA  
Phone: +1/650-524-8822  
Fax: +1/650-372-9395  
E-mail: info@maxonmotorusa.com  
[www.maxonmotorusa.com](http://www.maxonmotorusa.com)

#### maxon Sales Agents

##### Brazil

Treffer Ltda.  
Av. Protásio de Oliveira Penna 366 / 101  
Cep 30575-360 Bairro Buritis  
Belo Horizonte – MG  
Brazil  
Phone: +55 31 3378 6222  
Fax: +55 31 3378 6222  
E-mail: motores@treffer.com.br  
[www.treffer.com.br](http://www.treffer.com.br)

##### Canada

Electromate Inc.  
6221 Highway 7  
Unit #15  
Vaughan, Ontario L4H 0K8  
Canada  
Phone: +1/877 737 8698  
Fax: +1/877 737 8699  
E-mail: sales@electromate.com  
[www.electromate.com](http://www.electromate.com)

### Australia

#### Australia

maxon motor australia Pty Ltd  
Unit 1, 12-14 Beaumont Road  
Mount Kuring-Gai  
NSW 2080  
Australia  
Phone: +61 2 9457 7477  
Fax: +61 2 9457 8366  
E-mail: info.au@maxonmotor.com  
[www.maxonmotor.com.au](http://www.maxonmotor.com.au)

### Africa

#### maxon Sales Agent

##### South Africa

DNH TRADESERVE CC  
P.O. Box 31151  
1684 Kyalami  
South Africa  
Phone: +27 11 468 2722  
Fax-Mail: +27 86 509 6714  
E-mail: info@dnhtrade.co.za  
[www.dnhtrade.co.za](http://www.dnhtrade.co.za)

## **Asia**

### **China**

maxon motor (Suzhou) Co., Ltd.  
5F, Block 1, No. 1128, East Jiangxing Road,  
Wujiang Economic Developing Zone,  
215200 Suzhou, Jiangsu Province  
China  
Phone: +86/512-8207 9287  
Fax: +86/512-8207 9761  
E-mail: info@maxonmotor.com.cn  
[www.maxonmotor.com.cn](http://www.maxonmotor.com.cn)

### **India**

maxon precision motor India Pvt. Ltd.  
Niran Arade, No. 563/564,  
New BEL Road, RMV 2nd Stage  
Bangalore – 560 094  
India  
Phone: +91 80417 34132  
Fax: +91 80416 12703  
E-mail: info.in@maxonmotor.com  
[www.maxonmotor.in](http://www.maxonmotor.in)

### **Japan**

maxon japan corporation  
5-1-15 Shinjuku  
Shinjuku-Ku  
Tokyo 160-0022  
Japan  
Phone: +81/3 - 3350 42 61  
Fax: +81/3 - 3350 42 30  
E-mail: info@maxonjapan.co.jp  
[www.maxonjapan.co.jp](http://www.maxonjapan.co.jp)

### **Korea**

maxon motor Korea Co., Ltd.  
27, Banpo-daero 14-gil, Seocho-gu,  
Seoul, South Korea 06652  
Phone: +82 2 3486 3441  
Fax: +82 2 3486 8836  
E-mail: info.kr@maxonmotor.com  
[www.maxonmotor.co.kr](http://www.maxonmotor.co.kr)

### **Taiwan**

maxon motor Taiwan Co. Ltd.  
6F.-7 No. 16, Lane 609, Sec. 5  
Chongxin Rd., Sanchong Dist.,  
New Taipei City 241  
Taiwan (R.O.C.)  
Phone: +886-2-2999-3558  
Fax: +886-2-2999-7268  
E-mail: info.tw@maxonmotor.com  
[www.maxonmotor.com.tw](http://www.maxonmotor.com.tw)

### **maxon Sales Agents**

**Hong Kong**  
Servo Dynamics (H.K.) Ltd.  
Rm. 1504, 15/F, Yuen Long Trading Centre,  
33 Wang Yip Street West,  
N.T., Hong Kong.  
Phone: +852/2409 9986  
Fax: +852/2409 7872  
E-mail: sales@servodynamics.com.hk

### **Israel**

Electronardart Ltd.  
9 Ben Zion Gellis St.  
Segula Industrial Area  
Petach-Tikva 4927909  
Israel  
Phone: +972 (3) 931 4447  
Fax: +972 (3) 930 2867  
E-mail: sales@e-dart.co.il  
[www.electronardart.com](http://www.electronardart.com)

### **Malaysia**

Servo Engineering Sdn. Bhd.  
No. 15 G, Ground Floor, Highway Center,  
Jalan 51/205,  
46050 Petaling Jaya,  
Selangor Darul Ehsan  
Malaysia  
Phone: +603-7782 3540  
Fax: +603-7784 1013  
E-mail: sales-rfq@servo.my  
[www.servo.my](http://www.servo.my)

### **Singapore**

Servo Dynamics Pte. Ltd.  
No. 10 Kaki Bukit Road 1  
#01-30 KB Industrial Building  
416175 Singapore  
Phone: +65/6844 0288  
Fax: +65/6844 0070  
E-mail: servodynamics@servo.com.sg  
[www.servo.com.sg](http://www.servo.com.sg)

### **Thailand**

Servo Dynamics (Thailand) Co. LTD  
52/210 Moo 2, Soi Wadnamdaeng, Srinakarin Rd.  
10540 Bangkaew Bangplee Samutprakarn  
Thailand  
Phone: +66 2 753 56 25  
Fax: +66 2 753 56 50  
E-mail: info@servoline.com  
[www.servoline.com](http://www.servoline.com)





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