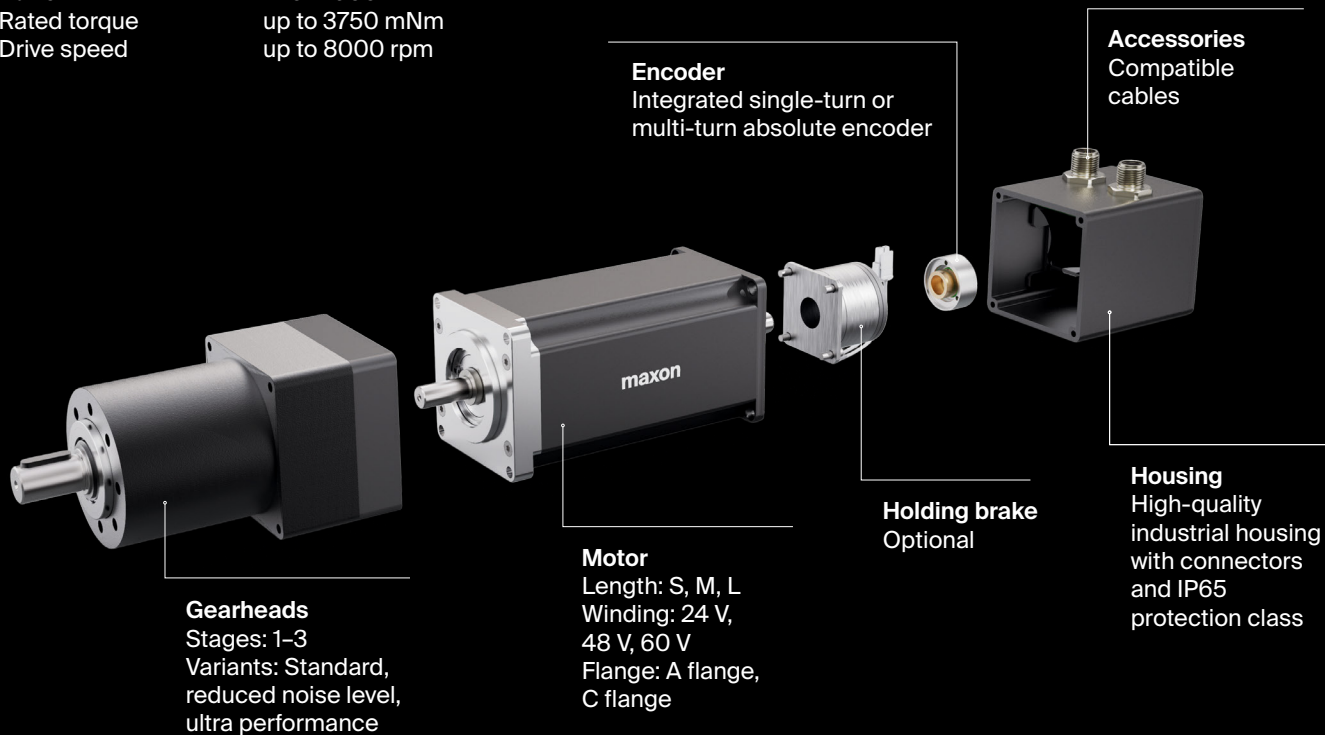# maxon IDX

The compact brushless EC-i motor combined with a high-quality sensor in robust industrial housing is ideally suited to demanding speed and positioning tasks. This motor is also available as a drive with integrated positioning and speed controller.

Key data

Drive □	56 ... 70 mm
Drive length	107 ... 193 mm
Power	270 ... 900 W
Rated torque	up to 3750 mNm
Drive speed	up to 8000 rpm

Encoder
Integrated single-turn or multi-turn absolute encoder

Accessories
Compatible cables

Holding brake
Optional

Housing
High-quality industrial housing with connectors and IP65 protection class

Motor
Length: S, M, L
Winding: 24 V, 48 V, 60 V
Flange: A flange, C flange

Gearheads
Stages: 1–3
Variants: Standard, reduced noise level, ultra performance

→ High continuous torque

→ Outstanding energy efficiency

→ Maximum power density

→ Unmatched precision in dynamic motion

→ IP65-protected design

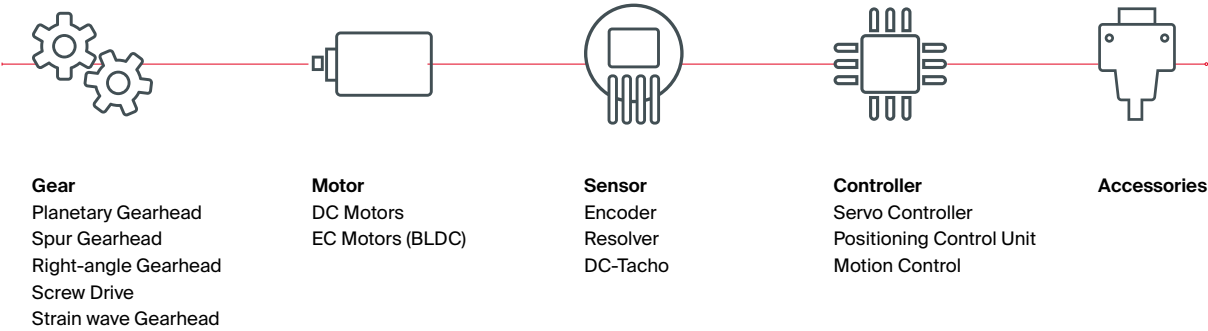→ Easily configured online

shop.maxongroup.com

Combine

The maxon modular system

The motors, gearheads, sensors, brakes, and controllers of maxon are perfectly matched to each other and can be combined in a number of ways. Our modular system makes it easy to find suitable components for your motor – in the catalog and in the online shop.

shop.maxongroup.com

Gear
Planetary Gearhead
Spur Gearhead
Right-angle Gearhead
Screw Drive
Strain wave Gearhead

Motor
DC Motors
EC Motors (BLDC)

Sensor
Encoder
Resolver
DC-Tacho

Controller
Servo Controller
Positioning Control Unit
Motion Control

Accessories

Great choice, easy ordering

The diversity of motors and product combinations offered by maxon is unmatched worldwide. The maxon modular system and the numerous options for windings offer even more possibilities for variation. To make the delivery times as short as possible for our customers, we organized our products into program groups.

Stock program
The market-oriented selection from our extensive product portfolio offers you short delivery times.

Standard program
In the comprehensive standard program, products are included which can be produced and delivered in a short time. The plenitude of versions in this program offer tried and tested standard products for optimized application.

Special program
A wide range of motors and combinations is available on request.

Explanations of maxon terminology EC motor

Dimensional drawings
Presentation of the views according to the projection method E (ISO). ⊏⊐⊕ All dimensions in [mm].

Motor Data
The values in lines 2–15 are valid when using block commutation.

1 **Nominal voltage** U_N [Volt]
is the applied voltage between two powered phases in block commutation. See page 66 for the timing diagram of the voltage in the three phases. All nominal data (lines 2–9) refer to this voltage. Lower and higher voltages are permissible, provided that limits are not exceeded.

2 **No load speed** n_0 [rpm] ±10%
is the speed at which the unloaded motor runs with the nominal voltage applied. It is approximately proportional to the applied voltage.

3 **No load current** I_0 [mA] ±50%
This is the typical current that the unloaded motor draws when operating at nominal voltage. It increases with rising speed owing to bearing friction and iron losses. No load friction depends heavily on temperature. In extended operation, the motor heats up and the no load friction and no load current decrese.

4 **Nominal speed** n_N [rpm]
is the speed set for operation at nominal voltage and nominal torque at a motor temperature of 25°C.

5 **Nominal torque** M_N [mNm]
is the torque generated for operation at nominal voltage and nominal current at a motor temperature of 25°C. It is at the limit of the motor's continuous operation range. Higher torques heat up the winding too much.

6 **Nominal current** I_N [A]
is the current in the active phase in block commutation that generates the nominal torque at the given nominal speed (= max. permissible continuous load current). The maximum winding temperature is reached at 25°C ambient temperature in continuous operation with I_N. I_N decreases as speed increases due to additional losses in the lamination.

7 **Stall torque** M_H [mNm]
For ironless windings, this is the calculated load torque that brings the shaft to a standstill at nominal voltage. For windings with an iron core, this is the measured value, as they are subject to the saturation effect.

8 **Stall current** I_A [A]
is the quotient from nominal voltage and the motor's terminal resistance. Stall current is equivalent to stall torque. With larger motors, I_A cannot often be reached due to the amplifier's current limits.

9 **Max. efficiency** η_{max} [%]
is the optimal relationship between input and output power at nominal voltage. It also doesn't always denote the optimal operating point.

10 **Terminal resistance phase to phase** R [Ω]
is determined by the resistance at 25°C between two connections of the default configuration.

11 **Terminal inductance phase to phase** L [mH]
is the winding inductance between two connections. It is measured at 1 kHz, sinusoidal.

12 **Torque constant** k_M [mNm/A]
This may also be referred to as «specific torque» and represents the quotient from generated torque and applicable current.

13 **Speed constant** k_n [rpm/V]
indicates the theoretical no load speed per volt of applied voltage, disregarding friction losses.

14 **Speed/torque gradient**
Δ_n/Δ_M [rpm/mNm]
The speed/torque gradient is an indicator of the motor's performance. The smaller the value, the more powerful the motor and consequently the less motor speed varies with load variations. It is based on the quotient of ideal no load speed and ideal stall torque (tolerance ± 20%).
The real characteristic curve depends on the speed for EC motors with slotted winding (EC flat and EC-i); it is steeper at high speeds and flatter at slow speeds. The real gradient at nominal voltage can be approximated by a straight line between no load speed and the nominal operating point (see page 83).

15 **Mechanical time constant** τ_m [ms]
is the time required for the rotor to accelerate from standstill to 63% of its no load speed.

16 **Rotor moment of inertia** J_R [gcm²]
is the mass moment of inertia of the rotor, based on the axis of rotation.

17 **Thermal resistance housing-ambient** R_{th2} [K/W]
and
18 **Thermal resistance winding-housing** R_{th1} [K/W]
Characteristic values of thermal contact resistance without additional heat sinking. Lines 17 and 18 combined define the maximum heating at a given power loss (load). Thermal resistance R_{th2} on motors with metal flanges can decrease by up to 80% if the motor is coupled directly to a good heat-conducting (e.g. metallic) mounting rather than a plastic panel.

19 **Thermal time constant winding** τ_w [s]
and
20 **Thermal time constant motor** τ_s [s]
These are the typical reaction times for a temperature change of winding and motor. It can be seen that the motor reacts much more sluggishly in thermal terms than the winding. The values are calculated from the product of thermal capacity and given heat resistances.

21 **Ambient temperature** [°C]
Operating temperature range. This derives from the heat reliability of the materials used and viscosity of bearing lubrication.

22 **Max. winding temperature** [°C]
Maximum permissible winding temperature.

23 **Max. speed** n_{max} [rpm]
is the maximum recommended speed based on thermal and mechanical perspectives. A reduced service life can be expected at higher speeds.

24 **Axial play** [mm]
On motors that are not preloaded, these are the tolerance limits for the bearing play. A preload cancels out the axial play up to the specified axial force. When load is applied in the direction of the preload force (away from the flange), the axial play is always zero. The length tolerance of the shaft includes the maximum axial play.

25 **Radial play** [mm]
Radial play is the bearing's radial movement. A spring is utilized to preload the motor's bearings, eliminating radial play up to a given axial load.

26/27 **Max. axial load** [N]
Dynamic: axial loading permissible in operation. If different values apply for traction and thrust, the smaller value is given.
Static: maximum axial force that does not cause permanent damage when applied to the front of the shaft at standstill.
Shaft supported: maximum axial force applying to the shaft at standstill if the force is not input at the other shaft end. This is not possible for motors with only one shaft end.

28 **Max. radial load** [N]
The value is given for a typical distance from the front flange. As the distance increases, this value decreases.

29 **Number of pole pairs**
Number of north poles of the permanent magnet. The phase streams and commutation signals pass through per revolution p cycles. Servo-controllers require the correct details of the number of pole pairs.

30 **Number of phases**
All maxon EC motors have three phases.

31 **Weight of motor** [g]

32 **Typical noise level** [dBA]
Is the statistical average of the noise level measured in accordance with the maxon standard (10 cm distance radially to the drive, no-load operation at a certain speed. The drive lies freely on a plastic foam mat in the noise chamber).
The acoustic noise level depends on a number of factors, such as component tolerances, and it is greatly influenced by the overall system in which the drive is installed. When the drive is installed in an unfavorable constellation, the noise level may be significantly higher than the noise level of the drive alone.
The acoustic noise level is measured and determined during product qualification. In manufacturing, a structure-borne noise test is performed with defined limits. Impermissible deviations can thus be identified.

33 **Max. torque** M_{max} [mNm]
Maximum torque the motor can briefly deliver. It is limited by the overload protection of the electronics.

34 **Max. current** I_{max} [A]
Surge current with which the peak torque is generated at nominal voltage. With an active speed controller, surge current is not proportionate to the torque, but also depends on the supply voltage. As a result, this value only applies at nominal voltage.

35 **Type of control**
«Speed» means that the drive is fitted with an integral speed controller. «Controlled» means that the drive is fitted with true commutation electronics.

36 **Supply voltage** $+V_{CC}$ [V]
Range of supply voltages measured in respect of GND at which the drive functions.

37 **Speed set value input** U_c [V]
Range of analog voltage for set speed value measured in respect of GND. For 2 wire solutions, the supply voltage acts as speed setting at the same time.

38 **Scaling Set speed value input** k_c [rpm/V]
Set speed value n_c is based on the product $n_c = k_c \cdot U_c$.

39 **Speed range**
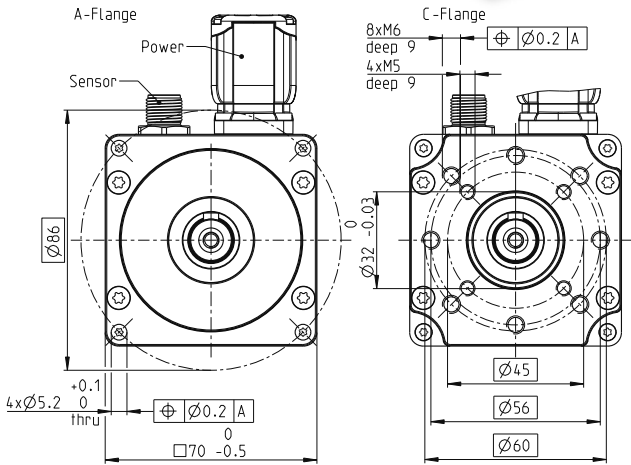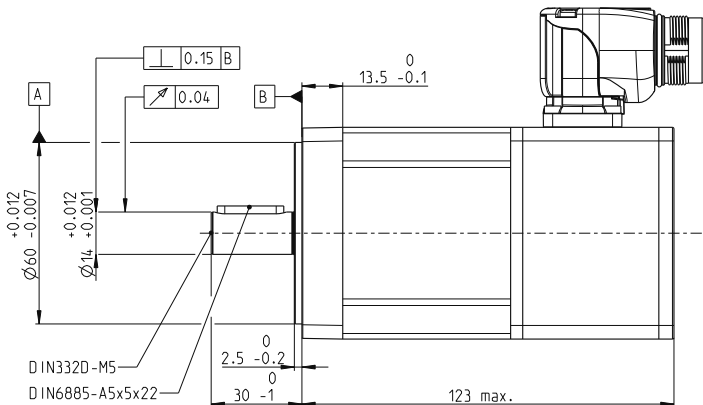Achievable speeds in the controlled range.

40 **Max. acceleration**
The set speed value follows a sudden set point change with a ramp. This value indicates the increase in the ramp.

IDX 70 S □70 mm, brushless, BLDC motor

IP65 motor with industrial housing

Key Data: 600/651 W, 1520 mNm, 6000 rpm

IDX

A-Flange

C-Flange

M 1:2½

	Motor Data				
1_	Nominal voltage	V	24	48	60
2_	No load speed	rpm	4770	4790	5000
3_	No load current	mA	1250	629	536
4_	Nominal speed	rpm	4090	4110	4310
5_	Nominal torque	mNm	1520	1510	1430
6_	Nominal current (max. continuous current)	A	29.2	14.6	11.6
7_	Stall torque	mNm	10200	10900	10800
8_	Stall current	A	1000	557	462
9_	Max. efficiency	%	92.9	93.2	93.1
10_	Terminal resistance	Ω	0.024	0.0862	0.13
11_	Terminal inductance	mH	0.058	0.235	0.344
12_	Torque constant	mNm/A	47.7	95	114
13_	Speed constant	rpm/V	200	101	83.9
14_	Speed/torque gradient	rpm/mNm	0.101	0.0912	0.0957
15_	Mechanical time constant	ms	0.598	0.543	0.569
16_	Rotor inertia	gcm²	568	568	568

	Thermal data			Operating Range	
17_	Thermal resistance housing-ambient	K/W	1.73		
18_	Thermal resistance winding-housing	K/W	0.61		
19_	Thermal time constant winding	s	38.9		
20_	Thermal time constant motor	s	969		
21_	Ambient temperature	°C	-40...+100		
22_	Max. winding temperature	°C	155		

n [rpm]   winding 48 V

- ■ Continuous operation
- ■ Continuous operation with reduced thermal resistance R_{th2} 50%
- □ Short term operation

	Mechanical data ball bearings		
23_	Max. speed	rpm	6000
24_	Axial play	mm	0.22
	Preload	N	28
	Direction of force		pull
25_	Radial play		preloaded
26_	Max. axial load (dynamic)	N	22
27_	Max. force for press fits (static)	N	270
	(static, shaft supported)	N	
28_	Max. radial load [mm from flange]	N	300 [15]

	Other specifications	
29_	Number of pole pairs	8
30_	Number of phases	3
31_	Weight of motor	g	1595
32_	Typical noise level [rpm]	dBA	55 [3000]
	Protection class without shaft		IP65

Modular System   Details on catalog page 44

Gear	Stages [opt.]	Sensor	Motor Control
408_GPX 70 A/UP	1–2	517_ENX 22 EASY INT	558_ESCON2 Module 60/30
409_GPX 70 LN	1–2	518_ENX 22 EMT INT	559_ESCON2 Compact 60/30
459_GB 12	1		565_EPOS4 Module 50/15
460_GB 9	1	**Accessories**	568–569_EPOS4 Compact 50/15
461_GB 65	2	593_Brake AB 60 S	569_EPOS4 70/15

Power Connection (M23, male, 6 poles, N-coded)
Pin 1   Motor winding 1
Pin 2   Motor winding 3
Pin 3   FE
Pin 4 U_{brake} + (optional)
Pin 5 U_{brake} GND (optional)
Pin 6   Motor winding 2

Sensor Connection (M12, male, 17 poles, A-coded)
Pin assignment available in encoder data sheet.

NTC resistor 25 °C: 10 kΩ ±1%, beta (25–100 °C): 3460 K

Compatible cables available online in the configurator.

Configuration
Flange front: A-Flange/C-Flange
Encoder Interface: SSI/BiSS-C
Angle Power Connector: 0°/90°
Shaft: Standard with feather key/small diameter without feather key
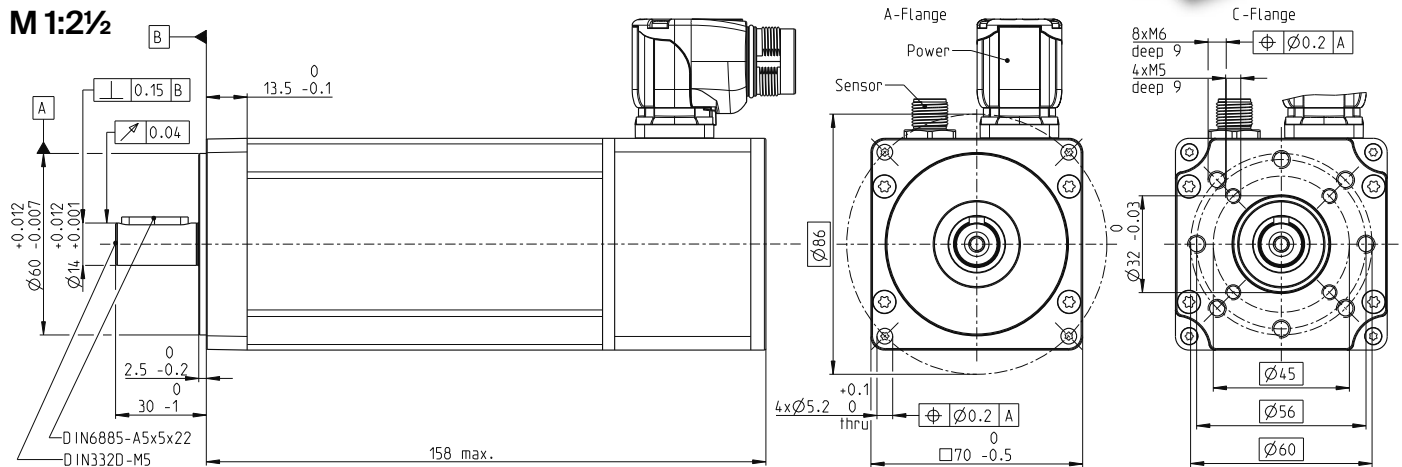
IDX 70 M □70 mm, brushless, BLDC motor

IP65 motor with industrial housing

Key Data: 800/890 W, 2650 mNm, 4000 rpm

M 1:2½

A-Flange

Power

Sensor

C-Flange

8×M6 deep 9
4×M5 deep 9

⊕ ∅0.2 A

∅45
∅56
∅60

∅32 0 -0.03

Ø86

4×Ø5.2 +0.1 0 thru

⊕ ∅0.2 A

□70 0 -0.5

13.5 0 -0.1

⊥ 0.15 B

⌀ 0.04

∅60 +0.012 -0.007
∅14 +0.012 -0.001

2.5 0 -0.2
30 0 -1

DIN6885-A5x5x22
DIN332D-M5

158 max.

	Motor Data			
1_	Nominal voltage	V	48	60
2_	No load speed	rpm	3670	3730
3_	No load current	mA	815	668
4_	Nominal speed	rpm	3130	3170
5_	Nominal torque	mNm	2530	2650
6_	Nominal current (max. continuous current)	A	18.6	15.7
7_	Stall torque	mNm	25400	27900
8_	Stall current	A	672	618
9_	Max. efficiency	%	93.0	93.3
10_	Terminal resistance	Ω	0.0715	0.097
11_	Terminal inductance	mH	0.246	0.373
12_	Torque constant	mNm/A	124	153
13_	Speed constant	rpm/V	76.9	62.5
14_	Speed/torque gradient	rpm/mNm	0.0443	0.0397
15_	Mechanical time constant	ms	0.487	0.437
16_	Rotor inertia	gcm²	1050	1050

|	Thermal data		
17_	Thermal resistance housing-ambient	K/W	1.35
18_	Thermal resistance winding-housing	K/W	0.38
19_	Thermal time constant winding	s	40.7
20_	Thermal time constant motor	s	1130
21_	Ambient temperature	°C	-40...+100
22_	Max. winding temperature	°C	155

	Mechanical data ball bearings		
23_	Max. speed	rpm	4000
24_	Axial play	mm	0.22
	Preload	N	28
	Direction of force		pull
25_	Radial play		preloaded
26_	Max. axial load (dynamic)	N	22
27_	Max. force for press fits (static)	N	270
	(static, shaft supported)	N	
28_	Max. radial load [mm from flange]	N	300 [15]
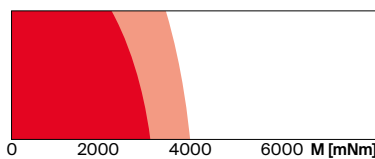
	Other specifications		
29_	Number of pole pairs		8
30_	Number of phases		3
31_	Weight of motor	g	2295
32_	Typical noise level [rpm]	dBA	60 [3000]
	Protection class without shaft		IP65

Operating Range

n [rpm]   winding 48 V

- Continuous operation
- Continuous operation with reduced thermal resistance R_th2 50%
- ☐ Short term operation

Modular System   Details on catalog page 44

Gear	Stages [opt.]	Sensor	Motor Control
408_GPX 70 A/UP	1–2	517_ENX 22 EASY INT	558_ESCON2 Module 60/30
409_GPX 70 LN	1–2	518_ENX 22 EMT INT	559_ESCON2 Compact 60/30
459_GB 12	1		565_EPOS4 Module 50/15
460_GB 9	1	**Accessories**	568–569_EPOS4 Compact 50/15
461_GB 65	2	593_Brake AB 60 S	569_EPOS4 70/15

Power Connection (M23, male, 6 poles, N-coded)
Pin 1   Motor winding 1
Pin 2   Motor winding 3
Pin 3   FE
Pin 4   U_brake + (optional)
Pin 5   U_brake GND (optional)
Pin 6   Motor winding 2

Sensor Connection (M12, male, 17 poles, A-coded)
Pin assignment available in encoder data sheet.

NTC resistor 25 °C: 10 kΩ ±1%, beta (25–100 °C): 3460 K
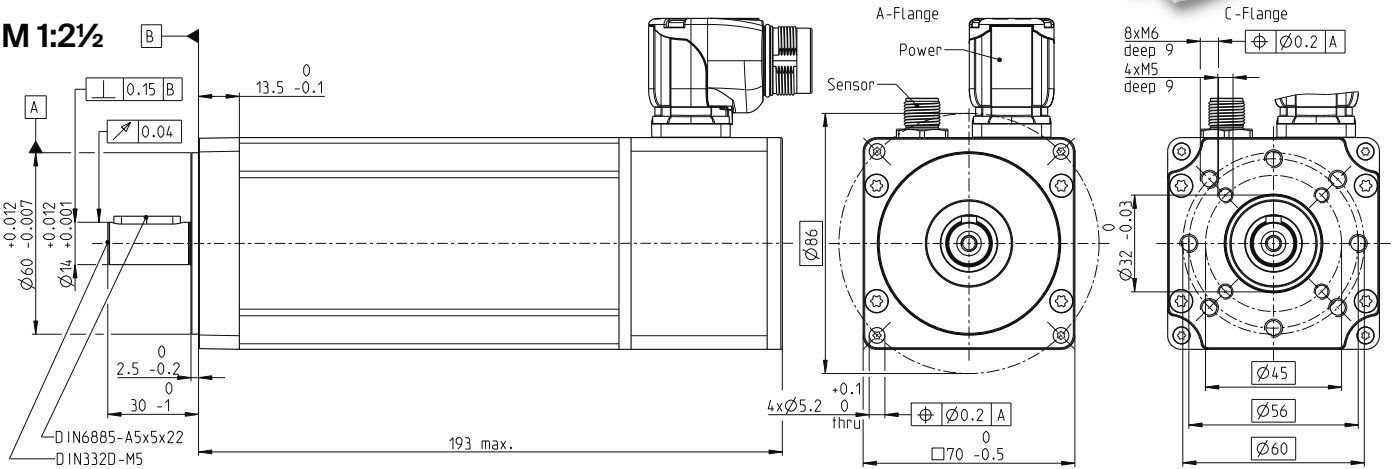
Compatible cables available online in the configurator.

Configuration
Flange front: A-Flange/C-Flange
Encoder Interface: SSI/BiSS-C
Angle Power Connector: 0°/90°
Shaft: Standard with feather key/small diameter without feather key

IDX 70 L □70 mm, brushless, BLDC motor

IP65 motor with industrial housing

Key Data: 900/954 W, 3750 mNm, 3000 rpm

IDX

M 1:2½

	Motor Data			
1_	Nominal voltage	V	48	60
2_	No load speed	rpm	2780	3070
3_	No load current	mA	771	712
4_	Nominal speed	rpm	2430	2710
5_	Nominal torque	mNm	3750	3360
6_	Nominal current (max. continuous current)	A	21.3	17.1
7_	Stall torque	mNm	25800	25400
8_	Stall current	A	669	592
9_	Max. efficiency	%	93.2	93.1
10_	Terminal resistance	Ω	0.0718	0.101
11_	Terminal inductance	mH	0.221	0.287
12_	Torque constant	mNm/A	164	186
13_	Speed constant	rpm/V	58.2	51.4
14_	Speed/torque gradient	rpm/mNm	0.0254	0.028
15_	Mechanical time constant	ms	0.408	0.449
16_	Rotor inertia	gcm^2	1530	1530

	Thermal data		
17_	Thermal resistance housing-ambient	K/W	1.21
18_	Thermal resistance winding-housing	K/W	0.28
19_	Thermal time constant winding	s	46.8
20_	Thermal time constant motor	s	1820
21_	Ambient temperature	°C	-40...+100
22_	Max. winding temperature	°C	155

	Mechanical data ball bearings		
23_	Max. speed	rpm	3200
24_	Axial play	mm	0.22
	Preload	N	28
	Direction of force		pull
25_	Radial play		preloaded
26_	Max. axial load (dynamic)	N	22
27_	Max. force for press fits (static)	N	270
	(static, shaft supported)	N	
28_	Max. radial load [mm from flange]	N	300 [15]
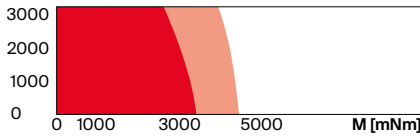
	Other specifications		
29_	Number of pole pairs		8
30_	Number of phases		3
31_	Weight of motor	g	2995
32_	Typical noise level [rpm]	dBA	65 [3000]
	Protection class without shaft		IP65

Operating Range

n [rpm]   winding 48 V

- ■ Continuous operation
- ■ Continuous operation with reduced thermal resistance R$_{th2}$ 50%
- □ Short term operation

Modular System   Details on catalog page 44

Sensor	Motor Control
517_ENX 22 EASY INT	558_ESCON2 Module 60/30
518_ENX 22 EMT INT	559_ESCON2 Compact 60/30
	565_EPOS4 Module 50/15
Accessories	568–569_EPOS4 Compact 50/15
593_Brake AB 60 S	569_EPOS4 70/15

Power Connection (M23, male, 6 poles, N-coded)
Pin 1   Motor winding 1
Pin 2   Motor winding 3
Pin 3   FE
Pin 4   U$_{brake}$ + (optional)
Pin 5   U$_{brake}$ GND (optional)
Pin 6   Motor winding 2

Sensor Connection (M12, male, 17 poles, A-coded)
Pin assignment available in encoder data sheet.

NTC resistor 25 °C: 10 kΩ ±1%, beta (25–100 °C): 3460 K

Compatible cables available online in the configurator.
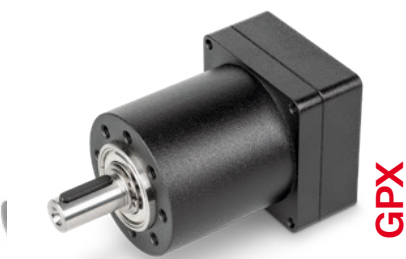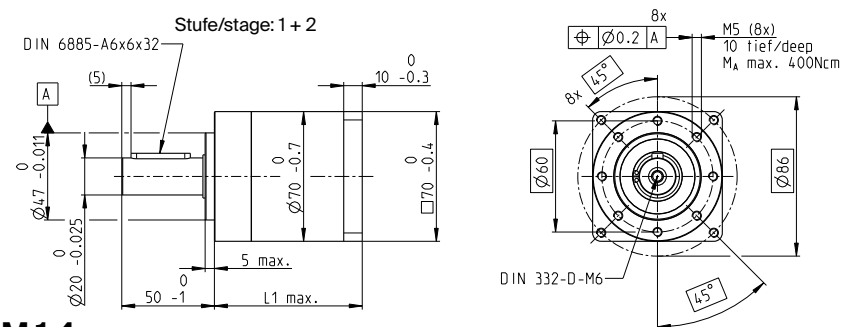
Configuration
Flange front: A-Flange/C-Flange
Encoder Interface: SSI/BiSS-C
Angle Power Connector: 0°/90°
Shaft: Standard with feather key/small diameter without feather key

GPX 70 ⌀70 mm, planetary gearhead

Stufe/stage: 1 + 2

DIN 6885-A6x6x32

DIN 332-D-M6

M5 (8x)
10 tief/deep
M_A max. 400Ncm

M 1:4

Key data		A Standard version	UP Ultra performance
Max. transmittable power	W	850	1200
Max. continuous torque	Nm	30.0	70.0
Max. continuous input speed	rpm	4000	4000
Ambient temperature	°C	-20...+100	-20...+100
Bearing at output		Ball bearing	Ball bearing

Operating range (output shaft)	A Standard version	UP Ultra performance
■ Continuous operation ---- Intermittent operation		
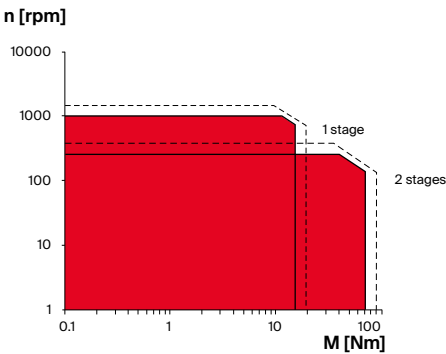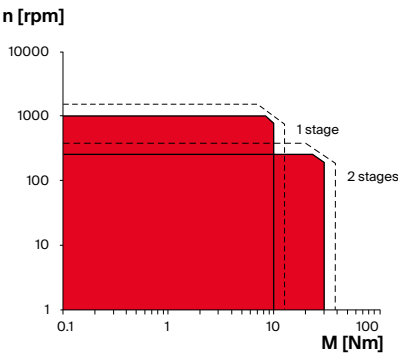
Specifications		A Standard version			UP Ultra performance		
Number of stages		1	2		1	2	
Max. transmittable power (continuous)	W	850	600		1200	1050	
Max. transmittable power (intermittent)	W	1063	750		1500	1313	
Max. continuous torque	Nm	10.0	30.0		15.0	70.0	
Max. intermittent torque	Nm	12.5	37.5		18.8	87.5	
Max. continuous input speed	rpm	4000	4000		4000	4000	
Max. intermittent input speed	rpm	6000	6000		6000	6000	
Max. efficiency	%	95	92		95	92	
Average backlash no load	°	0.5	0.5		0.5	0.5	
Max. axial load (dynamic)	N	825	825		825	825	
Max. permissible radial load, 10 mm from flange	N	1000	1200		1000	1200	
Gearhead length L1[1]	mm	58	80		58	80	
Weight	g	993	1399		1001	1425	

Configuration	A Standard version		UP Ultra performance	
Number of stages	1	2	1	2
Reduction	3.9, 5.3, 6.6	16, 21, 26, 28, 35, 44	3.9, 5.3, 6.6	16, 21, 26, 28, 35, 44
Version	Standard/noise reduced/ultra performance			
Flange	Standard flange			
Shaft				

Modular system		Page			Page	
EC motor	Nº of stages [opt.]		**Compact drive**	Nº of stages [opt.]		
IDX 70 S	1–2	252	IDX 70 S	1–2	356	
IDX 70 M	1–2	253	IDX 70 M	1–2	357	

[1]This length may vary depending on the configuration and choice of motor. The effective length is calculated at the end of the configuration process.

GPX 70 ⌀70 mm, planetary gearhead

Stufe/stage: 1 + 2

DIN 6885-A6x6x32

GPX

DIN 332-D-M6

M5 (8x)
10 tief/deep
M_A max. 400Ncm

M 1:4

Key data		LN Noise reduced
Max. transmittable power	W	700
Max. continuous torque	Nm	27.0
Max. continuous input speed	rpm	4000
Ambient temperature	°C	-20...+85
Bearing at output		Ball bearing
Typical noise level	dBA	-5 dBA compared to standard configuration

Operating range (output shaft)	LN Noise reduced

■ Continuous operation

---- Intermittent operation
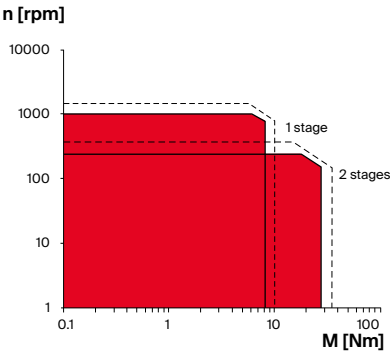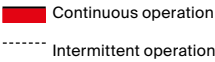
Specifications		LN Noise reduced	
Number of stages		1	2
Max. transmittable power (continuous)	W	700	450
Max. transmittable power (intermittent)	W	875	563
Max. continuous torque	Nm	8.0	27.0
Max. intermittent torque	Nm	10.0	34.0
Max. continuous input speed	rpm	4000	4000
Max. intermittent input speed	rpm	6000	6000
Max. efficiency	%	95	92
Average backlash no load	°	0.5	0.5
Max. axial load (dynamic)	N	825	825
Max. permissible radial load, 10 mm from flange	N	1000	1200
Gearhead length L1[1]	mm	58	80
Weight	g	924	1330

Configuration	LN Noise reduced	
Number of stages	1	2
Reduction	3.9, 5.3, 6.6	16, 21, 26, 28, 35, 44
Version	Standard/noise reduced/ultra performance	
Flange	Standard flange	
Shaft		

Modular system		Page			Page	
EC motor	Nº of stages [opt.]		**Compact drive**	Nº of stages [opt.]		
IDX 70 S	1–2	252	IDX 70 S	1–2	356	
IDX 70 M	1–2	253	IDX 70 M	1–2	357	

[1]This length may vary depending on the configuration
and choice of motor. The effective length is
calculated at the end of the configuration process.

GB 12 Worm Gear

Bronze Version

DETAIL A

Gearbox output positions
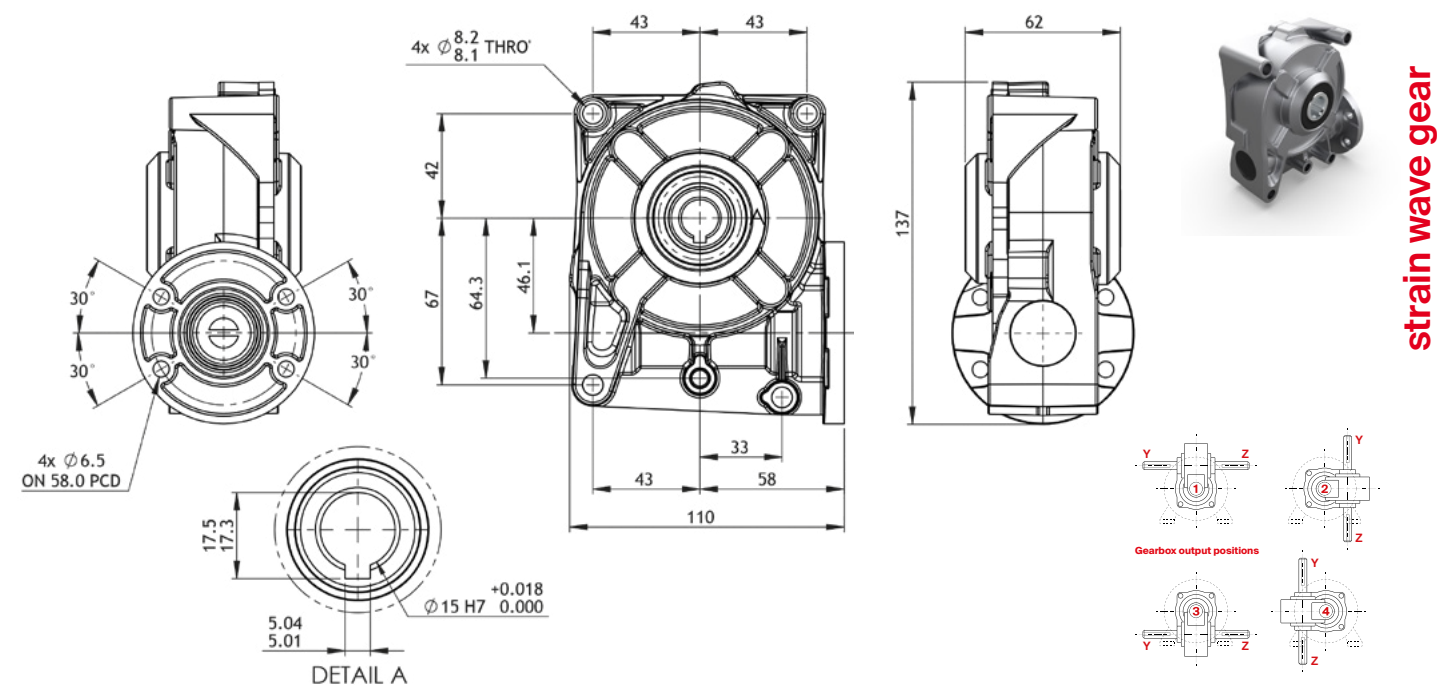
Key data		Bronze version
Max. continuous torque	Nm	30
Ambent temperature	°C	-30...+130
Max. continuous input speed	rpm	4000
Gearhead length[1]	mm	110
Bearing at output		Ball bearing
Weight	kg	1.5

Specifications		Bronze version		
Part numbers (special program on request)		735900	735901	735902
Reduction	X:1	15	30	60
Number of stages		1	1	1
Max. continuous torque	Nm	30	30	30
Max. intermittent torque	Nm	48	48	48
Max. continuous input speed	rpm	4000	4000	4000
Max. intermittent input speed	rpm	5000	5000	5000
Max. efficiency	%	75	65	50
Average backlash no load	arcmin	10–25	10–25	10–25
Max. axial load (dynamic)	N	600	600	600
Max. permissible radial load, 12 mm from flange	N	800	800	800

Configuration	Bronze version
Gearhead position to motor	4 positions, all at 90°

Modular system		Notes
EC motor	**Page**	[1]Length given excludes intermediate plate for motor combination
IDX 56	249–251	Standard shaft ⌀25, length 50 mm with
IDX 70 S, M	252–253	8 mm keyway 735903
EC-i 52	312–313	
EC 90 flat	324–329	
Compact drive		
IDX 56	353–355	
IDX 70 S, M	356–357	

GB 9 Worm Gear

Composite Version

DETAIL A

Gearbox output positions
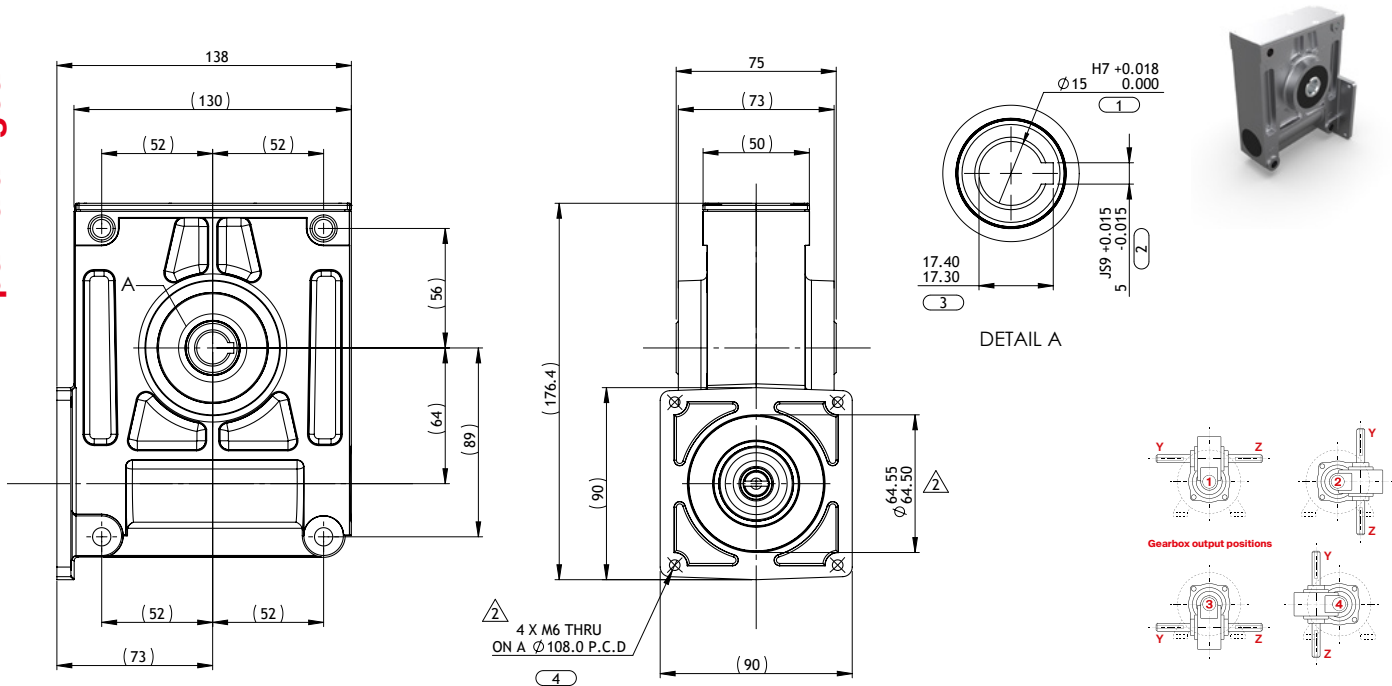
Key data		Composite version
Max. continuous torque	Nm	50
Ambient temperature	°C	-30...+130
Max. continuous input speed	rpm	4000
Gearhead length[1]	mm	138
Bearing at output		Ball bearing
Weight	kg	2.3

Specifications		Composite version		
Part numbers (special program on request)		735894	735895	735896
Reduction	X:1	15	30	60
Number of stages		1	1	1
Max. continuous torque	Nm	50	50	50
Max. intermittent torque	Nm	80	80	80
Max. continuous input speed	rpm	4000	4000	4000
Max. intermittent input speed	rpm	5000	5000	5000
Max. efficiency	%	85	75	65
Average backlash no load	arcmin	10–25	10–25	10–25
Max. axial load (dynamic)	N	600	600	600
Max. permissible radial load, 12 mm from flange	N	800	800	800

Configuration	Composite version
Gearhead position to motor	4 positions, all at 90°

Modular system		Notes
EC motor	Page	[1]Length given excludes intermediate plate for motor combination
EC 90 flat	324–329	
IDX 70 S, M	252–253	Standard shaft ⌀25, length 50 mm with 8 mm keyway 735898
Compact drive		
IDX 70 S, M	356–357	

GB 65 Worm Gear
Steel/Bronze Version
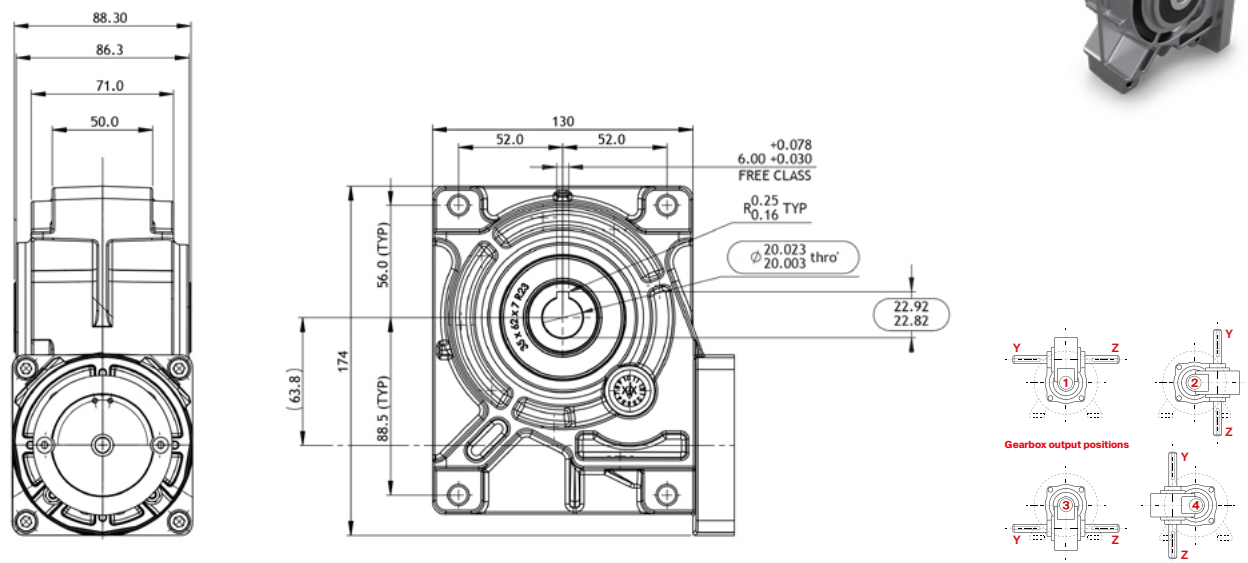
Key data		Steel/bronze version
Max. continuous torque	Nm	120
Ambient temperature	°C	-30...+120
Max. continuous input speed	rpm	4000
Gearhead length[1]	mm	130
Bearing at output		Ball bearing
Weight	kg	3.5

Specifications		Steel/bronze version		
Part numbers (special program on request)		848390	848392	848393
Reduction	X:1	80	120	160
Number of stages		2	2	2
Max. continuous torque	Nm	120	120	120
Max. intermittent torque	Nm	300	300	300
Max. continuous input speed	rpm	4000	4000	4000
Max. intermittent input speed	rpm	5000	5000	5000
Max. efficiency	%	70	60	55
Average backlash no load	arcmin	35	35	35
Max. axial load (dynamic)	N	1000	1000	1000
Max. permissible radial load, 12 mm from flange	N	3000	3000	3000

Configuration	Steel/bronze version
Gearhead position to motor	4 positions, all at 90°

Modular system			Notes
EC motor	Page		[1]Length given excludes intermediate plate for motor combination
EC 90 flat	324–329		
IDX 70 S, M	252–253		
Compact drive			
IDX 70 S, M	356–357		

ENX 22 EASY INT Encoder ⌀22 mm,
1024 CPT / 4096 steps, Single Turn
Integrated into motor

ENX

Key data	EASY incremental and absolute	
Number of channels	3	
Counts per turn	1024	
Steps per turn	4096	
Resolution (bit single turn)	12	
Encoder length L mm	0 (integrated into motor)	
Ambient temperature °C	-40...+125	

Selection criteria	EASY incremental and 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 and absolute	
Supply voltage V_{cc} V	5 ±0.5	
Typical current draw mA	22	
Max. operating frequency kHz	4000	
Max. Speed rpm	200 000	
Connector[1] M12, male, A-coded	Pin 1 GND (ground)	
	Pin 2 Motor NTC	
	Pin 3 $+V_{cc}$	
	Pin 4 channel A	
	Pin 5 channel $\bar{I}$	
	Pin 6 channel $\bar{A}$	
	Pin 7 channel $\bar{B}$	
	Pin 8 channel I	
	Pin 9 Motor NTC	
	Pin 10 channel B	
	Pin 11 Data_out-	
	Pin 12 Data_out	
	Pin 13 CLK_in	
	Pin 14 CLK_in-	
	Pin 15 Hall 3	
	Pin 16 Hall 1	
	Pin 17 Hall 2	
	Output signal: EIA-Standard RS 422	
	Output current per channel: ± 20 mA	
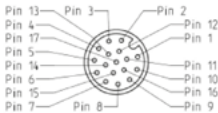
Configuration	EASY incremental and absolute	
Signalprotokoll	BiSS-C, SSI	

Modular system	Page	Notes
EC motor		[1]Connecting cables available in Online Configurator
IDX 56	249–251	
IDX 70	252–254	

Further technical details can be found in the product information in the online shop under Downloads.

ENX 22 EMT Encoder ⌀22 mm, 65 536 turns, Multi Turn
131 072 steps, Single Turn

Key data		EMT absolute differential	
Multi-turn: max. no. of turns		65 536	
Multi-turn: resolution	bits	16	
Single-turn: steps per turns		131 072	
Single-turn: resolution	bits	17	
Encoder length L[1]	mm	22.7	
Ambient temperature	°C	-40...+105	
Weight	g	25	

Selection criteria	EMT absolute differential	
Multi-turn detection	■	
Detection of speed and rotation direction	■	
Speed and position control	■	
Compact and robust design	■	
High resolution	■	
Economical	▲	

■ suitable   ▲ suitable to a limited extent   ● not suitable

Specifications		EMT for DCX, EC-4pole and EC-i		EMT integrated into IDX	
Supply voltage V_{CC}	V	5 ±0.5		5 ±0.5	
Typical current draw	mA	90		90	
Max. speed	rpm	12 000		12 000	
Data encoding		Binary		Binary	
Min. clock frequency CLK	MHz	BiSS-C: 0.08	SSI: 0.3	BiSS-C: 0.08	SSI: 0.3
Max. clock frequency CLK	MHz	BiSS-C: 5	SSI: 1	BiSS-C: 5	SSI: 1
Timeout	µs	BiSS-C: 18	SSI: 7	BiSS-C: 18	SSI: 7
Setup time after Power On	s	Max. 0.1		Max. 0.1	
Moment of inertia of pulse disk	gcm²	≤1.55		≤1.55	
Plug manufacturer JST		Pin 1 GND		Pin 1 GND	
Plug type no. BM08B-NSHSS -TBT		Pin 2 do not connect		Pin 2 Motor NTC	
Matching connector type no. NSHR-08V-S		Pin 3 do not connect		Pin 3 +V_{CC}	
		Pin 4 Data+ / SLO+		Pin 9 Motor NTC	
		Pin 5 Data- / SLO-		Pin 11 Data- / SLO-	
		Pin 6 CLK- / MA-		Pin 12 Data+ / SLO+	
		Pin 7 CLK+ / MA+		Pin 13 CLK+ / MA+	
		Pin 8 V_{CC}		Pin 14 CLK- / MA-	
				Other pins not connected	
		Output signals: EIA standard RS422		Output signals: EIA standard RS422	
		Output current per channel: ±20 mA		Output current per channel: ±20 mA	
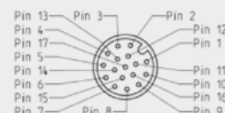
Configuration	EMT absolute differential	
Signal protocol	BiSS-C, SSI	

Modular system	Page
DC motor	
DCX 22	111–114
DCX 26 L	115–116
DCX 32 L	117
DCX 35 L	118
EC motor	
IDX 56	249–251
IDX 70	252–254
EC-4pole 22	291–292
EC-4pole 30	293/295
EC-i 30	302–305
EC-i 40	306–311
EC-i 52	312–313
ECX PRIME 22 L	239

Dimensions of standard configuration M 1:2

22.75

⌀22 ±0.2

25°

Connecting cable 300 mm for EMT to EPOS4 **708590**

Additional information
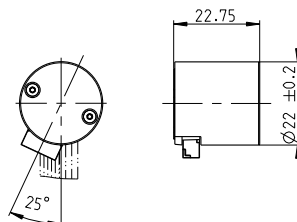
[1] The length shown here refers to the encoder. An additional intermediate plate is required for motor mounting. For more detailed information, see the combined dimensional drawing.
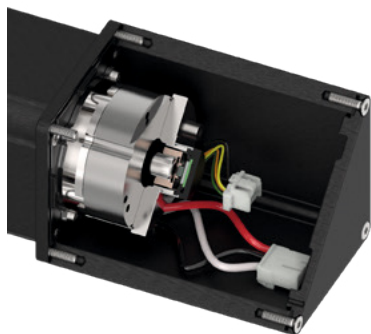
EC motors: The angle value 0 is calibrated to the commutation phase of coil 1 (equates to Hall signal 1 for motors with Hall sensors, block commutation), see p. 66

Ordering information: For motors that cannot be con figured online, the part numbers **711113** (BiSS-C) and **711112** (SSI) must be used when ordering.

Further technical details can be found in the product information in the online shop under Downloads.

Brake AB 60 S 24 VDC, 5.0 Nm

Important information
- Spring-loaded brake – single-disc brake with two friction surfaces for direct current. Braked in unpowered condition (dry operation).
- Holding brake, prevents rotation of the shaft at standstill or with turned off motor power.
- Not suitable for dynamic braking.
- Not backlash-free (±1° max.).
- Additional length +39 mm.

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

Part numbers

x drives

Type

overall length   overall length

Modular system

+ Drive	Page	+ Gearhead	Page	+ Sensor	Page	Overall length [mm] / • see Gearhead
IDX 70 S	356					online
IDX 70 S	356	GPX 70	408–409			online
IDX 70 S	356	GB 12	459			online
IDX 70 S	356	GB 9	460			online
IDX 70 S	356	GB 65	461			online
IDX 70 M	357					online
IDX 70 M	357	GPX 70	408–409			online
IDX 70 M	357	GB 12	459			online
IDX 70 M	357	GB 9	460			online
IDX 70 M	357	GB 65	461			online
IDX 70 L	358					online
IDX 70 L	358	GB 9	460			online
IDX 70 L	358	GB 65	461			online

+ Motor	Page	+ Gearhead	Page	+ Sensor	Page	Overall length [mm] / • see Gearhead
IDX 70 S	252					online
IDX 70 S	252	GPX 70	408–409			online
IDX 70 S	252	GB 12	459			online
IDX 70 S	252	GB 9	460			online
IDX 70 S	252	GB 65	461			online
IDX 70 M	253					online
IDX 70 M	253	GPX 70	408–409			online
IDX 70 M	253	GB 12	459			online
IDX 70 M	253	GB 9	460			online
IDX 70 M	253	GB 65	461			online
IDX 70 L	254					online
IDX 70 L	254	GB 9	460			online
IDX 70 L	254	GB 65	461			online

Technical data

Holding torque	5 Nm	Nominal voltage, smoothed	24 VDC -10...+5%
Mass inertia	25 gcm²	Resistance	R_{20} = 41.16 Ω 0...+10%
Max. speed	8800 rpm	Duty cycle	100%
Weight	480 g	Reaction time	
Ambient temperature range	-40...+120°C	– Coupling	≤ 75 ms
		– Opening	≤ 75 ms

Pin allocation online

ESCON2 Data

CANopen I/O ⇌

USB SCI GUI

NEW
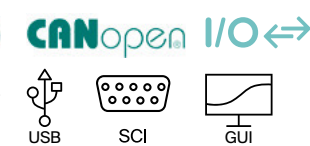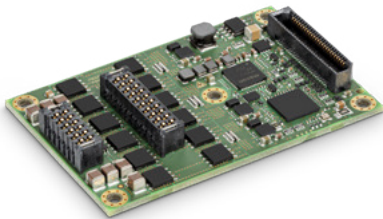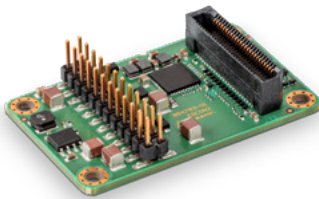
ESCON2 Module 60/12

ESCON2 Module 60/30

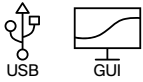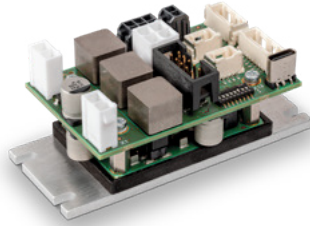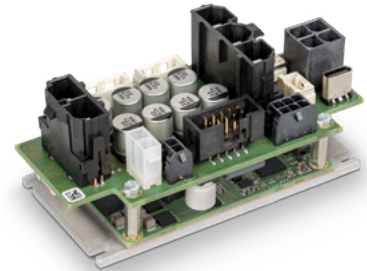| Controller version		
	Commands via I/O or CANopen Slave	Commands via I/O or CANopen Slave
Electrical data		
Operating voltage V_{CC}	10 - 60 VDC	10 - 60 VDC
Logic supply voltage V_C (optional)	10 - 60 VDC	10 - 60 VDC
Max. output voltage	0.90 x V_{CC}	0.95 x V_{CC}
Max. output current I_{max}	30 A (<2 s)	60 A (<4 s)
Continuous output current I_{cont}	12 A	30 A
Switching frequency of power stage	100 kHz	50 kHz
Sampling rate of PI current controller	50 kHz (20 µs)	50 kHz (20 µs)
Sampling rate of PI speed controller	10 kHz (100 µs)	10 kHz (100 µs)
Max. speed (1 pole pair)	120 000 rpm (sinusoidal)	120 000 rpm (sinusoidal)
Built-in motor choke per phase	–	–
Inputs		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\ (max. 6.67 MHz)	A, A\, B, B\ (max. 6.67 MHz)
Sensor signals	Clock[1], Data[1]	Clock[1], Data[1]
Digital inputs	4	4
Digital inputs "High-speed"	4	4
Analog inputs	2 (12-bit resolution, -10…+10 V)	2 (12-bit resolution, -10…+10 V)
CAN ID	configurable with external wiring	configurable with external wiring
Outputs		
Digital outputs	2	2
Digital outputs "High-speed"	1	1
Analog outputs	2 (12-bit resolution, -4…+4 V, max. 1 mA)	2 (12-bit resolution, -4…+4 V, max. 1 mA)
Encoder voltage output Hall sensor voltage output	5 VDC, max. 145 mA	5 VDC, max. 145 mA
Auxiliary voltage output	3.3 VDC, max. 20 mA	3.3 VDC, max. 20 mA
Communication interfaces		
CAN	yes	yes
SCI (RS232 ext. transceiver)	yes	yes
USB	yes	yes
Indicator		
LED green = READY, red= ERROR	External LEDs required	External LEDs required
Environmental conditions		
Temperatrue – Operation		-30…+25 °C
Temperature – Extended Range		25…75 °C; Derating: -0.506 A/ °C
Temperature – Storage	-40…+85 °C	-40…+85 °C
Humidity (condensation not permitted)	5…90%	5…90%
Mechanical data		
Weight	approx. 12 g	approx. 19 g
Dimensions (L x W x H)	49.5 x 31 x 12.4 mm	67.0 x 43.0 x 7.8 mm
Mounting	Pluggable and M2.5 screws	Pluggable and M2.5 screws
Part numbers		
	854796 ESCON2 Module 60/12	**783722** ESCON2 Module 60/30
Accessories		
	235811 DSR 70/30 Shunt regulator	**235811** DSR 70/30 Shunt regulator
	Order accessories separately, see page 555	Order accessories separately, see page 555

[1]in preparation

ESCON2 Data

CANopen I/O ⇄

USB   GUI

NEW

ESCON2 Compact 60/12

ESCON2 Compact 60/30

Controller version		
	Commands via I/O or CANopen Slave	Commands via I/O or CANopen Slave
Electrical data		
Operating voltage V_{CC}	10 - 60 VDC	10 - 60 VDC
Logic supply voltage V_C (optional)	10 - 60 VDC	10 - 60 VDC
Max. output voltage	0.90 x V_{CC}	0.95 x V_{CC}
Max. output current I_{max}	30 A (<2 s)	60 A (<4 s)
Continuous output current I_{cont}	12 A	30 A
Switching frequency of power stage	100 kHz	50 kHz
Sampling rate of PI current controller	50 kHz (20 µs)	50 kHz (20 µs)
Sampling rate of PI speed controller	10 kHz (100 µs)	10 kHz (100 µs)
Max. speed (1 pole pair)	120 000 rpm (sinusoidal)	120 000 rpm (sinusoidal)
Built-in motor choke per phase	4.7 µH / 12 A	0.47 µH / 30 A
Inputs		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\ (max. 6.67 MHz)	A, A\, B, B\ (max. 6.67 MHz)
Sensor signals	Clock[1], Data[1]	Clock[1], Data[1]
Digital inputs	4	4
Digital inputs "High-speed"	4	4
Analog inputs	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)
CAN ID	configurable with DIP switch 1...5	configurable with DIP switch 1...5
Outputs		
Digital outputs	2	2
Digital outputs "High-speed"	1	1
Analog outputs	2 (12-bit resolution, -4...+4 V, max. 1 mA)	2 (12-bit resolution, -4...+4 V, max. 1 mA)
Encoder voltage output	5 VDC, max. 145 mA	5 VDC, max. 145 mA
Hall sensor voltage output		
Auxiliary voltage output	–	–
Communication interfaces		
CAN	yes	yes
SCI (RS232 ext. transceiver)	–	–
USB	yes	yes
Indicator		
LED green = READY, red= ERROR	yes	yes
Environmental conditions		
Temperatrue – Operation		-30...+25 °C
Temperature – Extended Range		25...75 °C; Derating: -0.506 A/ °C
Temperature – Storage	-40...+85 °C	-40...+85 °C
Humidity (condensation not permitted)	5...90%	5...90%
Mechanical data		
Weight	approx. 90 g	approx. 128 g
Dimensions (L x W x H)	81 × 41 × 33.5 mm	93.5 x 46.0 x 41.0 mm
Mounting	M3 screws	M3 screws
Part numbers		
	854801 ESCON2 Compact 60/12	**783734** ESCON2 Compact 60/30
Accessories		
	235811 DSR 70/30 Shunt regulator	**235811** DSR 70/30 Shunt regulator
	Order accessories separately, see page 555	Order accessories separately, see page 555

[1]in preparation

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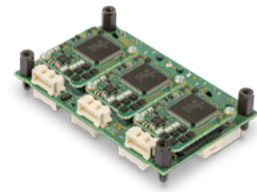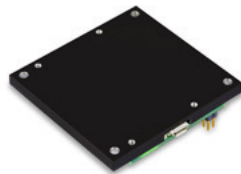
EPOS4 Module 50/8
OEM position control module, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 400/1500 Watt.

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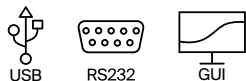

EPOS4 Compact 24/5 EtherCAT 3-axes
Ready-to-install 3-axis compact solution, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 120/360 W per axis.

Controller version		
CANopen Slave with EtherCAT option	CANopen Slave with EtherCAT option	EtherCAT Slave
Electrical data		
10 - 50 VDC	10 - 50 VDC	10 - 24 VDC
10 - 50 VDC	10 - 50 VDC	10 - 24 VDC
$0.9 \times V_{CC}$	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
30 A (<5 s)	30 A (<60 s)	15 A (<10 s) per axis
8 A	15 A	5 A per axis
50 kHz	50 kHz	50 kHz
25 kHz (40 µs)	25 kHz (40 µs)	25 kHz (40 µs)
2.5 kHz (400 µs)	2.5 kHz (400 µs)	2.5 kHz (400 µs)
2.5 kHz (400 µs)	2.5 kHz (400 µs)	2.5 kHz (400 µs)
50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)
–	–	–
Inputs		
H1, H2, H3	H1, H2, H3	H1, H2, H3 per axis
A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)	
A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\ per axis
4 (logic level)	4 (logic level)	4 (level switchable: logic/PLC) per axis
4, differential	4, differential	–
2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V) per axis
configurable with external wiring	configurable with external wiring	–
Outputs		
2	2	2 per axis
1, differential	1, differential	–
2 (12-bit resolution, -4...+4 V, max. 1 mA)	2 (12-bit resolution, -4...+4 V, max. 1 mA)	1 (12-bit resolution, -4...+4 V, max. 1 mA) per axis
5 VDC, max. 70 mA	5 VDC, max. 70 mA	5 VDC, max. 100 mA per axis
5 VDC, max. 30 mA	5 VDC, max. 30 mA	5 VDC, max. 30 mA per axis
5 VDC, max. 145 mA	5 VDC, max. 145 mA	
Communication interfaces		
high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)	–
Optional 581245 EPOS4 EtherCAT Card available	Optional 581245 EPOS4 EtherCAT Card available	100 Mbit/s (Full Duplex)
RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)	–
Data+; Data- (Full Speed)	Data+; Data- (Full Speed)	Data+; Data- (Full Speed) per axis
Indicator		
Green LED, red LED	Green LED, red LED	Green LED, red LED
Environmental conditions		
-30...+45 °C	-30...+25 °C	-30...+25 °C
45...77 °C; Derating: -0.250 A/°C	25...77 °C; Derating: -0.288 A/°C	25...50 °C; Derating: -0.200 A/°C
-40...+85 °C	-40...+85 °C	-40...+85 °C
5...90%	5...90%	5...90%
Mechanical data		
approx. 23 g	approx. 70 g	approx. 85 g
59.5 x 46.0 x 14.1 mm	59.5 x 62.0 x 16.4 mm	90.0 x 56.0 x 29.0 mm
Socket header 2.54 mm or M2.5 screws	Socket header 2.54 mm or M3 screws	M2.5 screws
Part numbers		
504384 EPOS4 Module 50/8	504383 EPOS4 Module 50/15	684519 EPOS4 Compact 24/5 EtherCAT 3-axes
Accessories		
235811 DSR 70/30 Shunt regulator	235811 DSR 70/30 Shunt regulator	235811 DSR 70/30 Shunt regulator
Order accessories separately, see page 562	Order accessories separately, see page 562	Order accessories separately, see page 562

EPOS4 Positioning Controllers Data

EtherCAT CANopen

USB RS232 GUI

EPOS4 Compact 50/8 EtherCAT
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.

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		
	EtherCAT Slave	CANopen Slave
Electrical data		
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}	30 A (<5 s)	30 A (<60 s)
Continuous output current I_{cont}	8 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)	50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)
Built-in motor choke per phase	2.2 µH / 15 A	2.2 µH / 15 A
Inputs		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
Sensor signals	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\
Digital inputs	4 (level switchable: logic/PLC)	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 / DEV ID	configurable with DIP switch 1...5	configurable with DIP switch 1...5
Outputs		
Digital outputs	2	2
Digital outputs "High-speed"	1, differential	1, differential
Analog outputs	2 (12-bit resolution, -4...+4 V, max. 1 mA)	2 (12-bit resolution, -4...+4 V, max. 1 mA)
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. 145 mA	5 VDC, max. 145 mA
Communication interfaces		
CAN	–	high; low (max. 1 Mbit/s)
EtherCAT	100 Mbit/s (Full Duplex)	–
RS232	–	RxD; TxD (max. 115 200 bit/s)
USB 2.0/3.0	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
Indicator		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
Environmental conditions		
Temperature – Operation	-30...+45°C	-30...+25°C
Temperature – Extended Range	45...77°C; Derating: -0.250 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%
Mechanical data		
Weight	approx. 100 g	approx. 126 g
Dimensions (L x W x H)	59.5 x 79.5 x 35.7 mm	59.5 x 65.5 x 35.1 mm
Mounting	M2.5 screws	M3 screws
Part numbers		
	605298 EPOS4 Compact 50/8 EtherCAT	**520886** EPOS4 Compact 50/15 CAN
Accessories		
	235811 DSR 70/30 Shunt regulator	**235811** DSR 70/30 Shunt regulator
	Order accessories separately, see page 562	Order accessories separately, see page 562

EPOS4 Positioning Controllers Data

EPOS4 Compact 50/15 EtherCAT
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.

EPOS4 50/5
Positioning controller in a robust housing, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 250/750 Watt.

EPOS4 70/15
Positioning controller in a robust housing, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 1050/2100 Watt.

Controller version		
EtherCAT Slave	CANopen Slave with EtherCAT option	CANopen Slave with EtherCAT option
Electrical data		
10 - 50 VDC	10 - 50 VDC	10 - 70 VDC
10 - 50 VDC	10 - 50 VDC	10 - 70 VDC
$0.9 \times V_{CC}$	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
30 A (<60 s)	15 A (<15 s)	30 A (<60 s)
15 A	5 A	15 A
50 kHz	50 kHz	50 kHz
25 kHz (40 µs)	25 kHz (40 µs)	25 kHz (40 µs)
2.5 kHz (400 µs)	2.5 kHz (400 µs)	2.5 kHz (400 µs)
2.5 kHz (400 µs)	2.5 kHz (400 µs)	2.5 kHz (400 µs)
50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)
2.2 µH / 15 A	15 µH / 5 A	15 µH / 15 A
Inputs		
H1, H2, H3	H1, H2, H3	H1, H2, H3
A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\
4 (level switchable: logic/PLC)	4 (level switchable: logic/PLC)	4 (level switchable: logic/PLC)
4, differential	4, differential	4, differential
2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)	2 (12-bit resolution, -10...+10 V)
configurable with DIP switch 1...5	configurable with DIP switch 1...5	configurable with DIP switch 1...5
Outputs		
2	2	2
1, differential	1, differential	1, differential
2 (12-bit resolution, -4...+4 V, max. 1 mA)	2 (12-bit resolution, -4...+4 V, max. 1 mA)	2 (12-bit resolution, -4...+4 V, max. 1 mA)
5 VDC, max. 70 mA	5 VDC, max. 70 mA	5 VDC, max. 70 mA
5 VDC, max. 30 mA	5 VDC, max. 30 mA	5 VDC, max. 30 mA
5 VDC, max. 145 mA	5 VDC, max. 145 mA	5 VDC, max. 145 mA
Communication interfaces		
–	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
100 Mbit/s (Full Duplex)	Optional 581245 EPOS4 EtherCAT Card available	Optional 581245 EPOS4 EtherCAT Card available
–	RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)
Data+; Data- (Full Speed)	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
Indicator		
Green LED, red LED	Green LED, red LED	Green LED, red LED
Environmental conditions		
-30...+25 °C	-30...+50 °C	-30...+50 °C
25...77 °C; Derating: -0.288 A/ °C	50...80 °C; Derating: -0.167 A/ °C	50...85 °C; Derating: -0.429 A/ °C
-40...+85 °C	-40...+85 °C	-40...+85 °C
5...90%	5...90%	5...90%
Mechanical data		
approx. 140 g	approx. 206 g	approx. 372 g
59.5 x 79.5 x 37.8 mm	105.0 x 83.0 x 38.7 mm	125.0 x 94.5 x 38.7 mm
M3 screws	Flange for M4-screws	Flange for M4-screws
Part numbers		
605299 EPOS4 Compact 50/15 EtherCAT	546047 EPOS4 50/5	594385 EPOS4 70/15
Accessories		
235811 DSR 70/30 Shunt regulator	309687 DSR 50/5 Shunt regulator	235811 DSR 70/30 Shunt regulator
Order accessories separately, see page 562	Order accessories separately, see page 562	Order accessories separately, see page 562

Multi-Axis Motion Controller Summary

motion control

	MicroMACS6	MicroMACS6 Module **NEW**	MiniMACS6-AMP4	MiniMACS6-AMP4-IF1	MiniMACS6-AMP4 OEM	MasterMACS
Fully programmable	✓	✓	✓	✓	✓	✓
Integrated power stage	No	No	✓	✓	✓	No
Number of axes	6	6	6 (4)	6 (4)	6 (4)	32
CANopen	✓	✓	✓	✓	✓	✓
Ethernet interfaces	✓	✓	No	✓	No	✓
EtherCat slave	No	No	No	✓	No	✓
EtherCat master	No	No	No	No	No	✓
Bluetooth	on request	on request	No	No	No	No

Solutions optimized for less complex or cost-sensitive applications:

- MicroMACS6
- MicroMACS6 Module
- MiniMACS6-AMP-4/50/10

Solutions for high flexibility:

- MiniMACS6-AMP-4/50/10-IF1

– Variants with integrated amplifiers (50 V/up to 10 A/30 A) and various encoder inputs (also absolute)

Solutions for highest performance:

- MasterMACS

– Most powerful Motion Controller
– Synchronization of up to 32 axes
– Various fieldbus interfaces
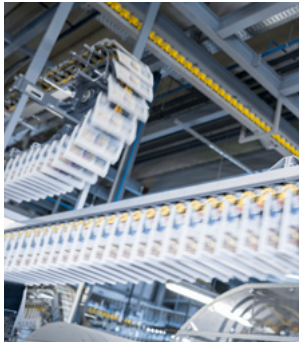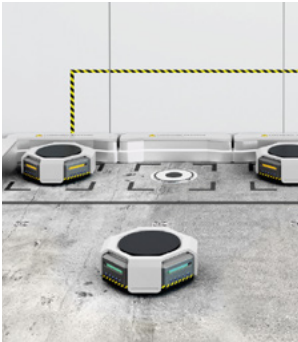
MiniMACS6-AMP-4/50/10-IF1 Data
Programmable Motion Controller
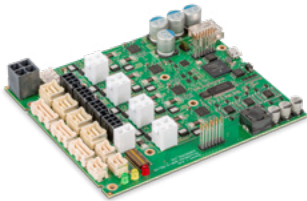
MiniMACS6-AMP-4/50/10 OEM
Freely programmable, compact multi-axis motion controller with integrated high-performance power stages, without housing.

MiniMACS6-AMP-4/50/10
Freely programmable, compact multi-axis motion controller with integrated high-performance power stages.

MiniMACS6-AMP-4/50/10-IF1
Freely programmable, compact multi-axis motion controller with integrated high-performance power stages and a network option card (Ethernet/EtherCAT/ProfiNet in planning).

Controller versions	
	CANopen Master/Slave, EtherCAT Slave optional, Ethernet optional, Standalone with APOSS® win

Features	
Motion features	Trapezoidal, jerk limited, CAM, synchronous travel, path, kinematics
Profile generator cycle	1 kHz (1 ms)
Sampling rate of PID positioning controller with speed and acceleration feed-forward control	1 kHz (1 ms)
Maximum number of axes	6
Web server (visualization)	optional
Expandable memory	yes (datalogging on USB stick)

Electrical data	
Logic supply voltage V_C	18 - 30 VDC
Inputs	
Digital inputs	16 (PLC level, 4 latch capable)
Analog inputs	2 (12-bit resolution, 0...10 V)
Hall sensor signals	4 x (H1, H2, H3)
CAN-ID (CAN node identification)	configurable with DIP switch
Output	
Digital output	8 (max. 100 mA per output)
Analog output	–
Encoder voltage output	5 VDC, max. 200 mA per output, total 1 A
Interfaces	
EtherCAT-Master / Profinet	on request
CAN	2 (max. 1 Mbit/s)
RS232 / RS485	–
EtherCAT-Slave	1
Ethernet	1
USB 2.0	1 Data+; Data- (High Speed)
Encoder inputs	4
Digital incremental	4 (differential, max. 6.25 MHz)
SSI absolute	4 (39 kHz...5 MHz)
Analog incremental (sin/cos)	4 (differential, max. 150 kHz)
Hiperface/EnDat	–
Encoder outputs	
Encoder TTL outputs	–
Indicator	
LEDs	3 (status) / EtherCAT
Display	–

Environmental conditions	
Temperature – Operation	-30...+70 °C
Temperature – Storage	-30...+85 °C
Humidity (condensation not permitted)	5...90%

Mechanical data	
Weight	ca. 600 g
Dimensions (L x W x H)	141 x 110 x 34 mm
Mounting	Metal compact housing / OEM without housing

Ordering Information: Please contact your maxon sales engineer

Amplifier	
Operating voltage V_{CC}: 12 - 60 VDC	
6 DC / 4 EC (BLDC) / 3 stepper motors / Twin Mode / Chopper	
Max. output voltage: 0.9 x V_{CC}	
Max. output current (per axis) I_{cont}: 10 A I_{max}: 30 A	
Switching frequency of power stage: 48 kHz	
Sampling rate of PI current controller: 24 kHz (41 µs)	
Sampling rate of PI speed controller: 8 kHz (125 µs)	
Sampling rate of PID positioning controller: 1 kHz (1 ms)	

Product variants	
Order no. 001755 MiniMACS6-AMP-4/50/10	
Order no. 001756 MiniMACS6-AMP-4/50/10 OEM	
Order no. 001757 MiniMACS6-AMP-4/50/ 10-IF1 EtherCAT	
Order no. 001784 MiniMACS6-AMP-4/50/10-IF1 Ethernet	

MicroMACS6 Data
Programmable Motion Controller

MicroMACS6
Compact, freely programmable multi-axis controller with optional BLE (Bluetooth Low Energy) interface.

MicroMACS6
Compact and powerful

The MicroMACS6 is a high-performance, ultra-compact, freely programmable multi-axis controller without power output stages.
One Ethernet and two independent CAN interfaces are available for commanding up to 6 power stages. The axes can be set up individually or as a kinematics group. Four PWM outputs are available for use with ESCON controllers.
An optional BLE (Bluetooth Low Energy) board expands the controller, making it possible to communicate with the controller via a smartphone app. Note: BLE option on request.

Controller versions	
	CANopen Master/Slave, Ethernet, Standalone with APOSS® win
Features	
Motion features	Trapezoidal, jerk limited, CAM, synchronous travel, path, kinematics
Profile generator cycle	1 kHz (1 ms)
Sampling rate of PID positioning controller with speed and acceleration feed-forward control	–
Maximum number of axes	6
Web server (visualization)	–
Expandable memory	–
Electrical data	
Logic supply voltage V_C	8 - 28 VDC
Inputs	
Digital inputs	6 (PLC 9...30 VDC or Logic 2...30 VDC)
Analog inputs	2 (12-bit resolution, 0...10 V, 1 kHz)
Hall sensor signals	–
CAN-ID (CAN node identification)	configurable with DIP switch
Output	
Digital output	4 (24 VDC, 100 mA, max. 25 kHz PWM)
Analog output	–
Encoder voltage output	–
Interfaces	
Profinet	–
CAN	2 (max. 1 Mbit/s)
BLE (Bluetooth Low Energy)	optional
EtherCAT-Master / EtherCAT-Slave	–
Ethernet	1 (TCP/IP, max. 100 Mbit/s)
USB 2.0	1
Encoder inputs	
Digital incremental	–
SSI absolute	–
Analog incremental (sin/cos)	–
Hiperface/EnDat	–
Encoder outputs	
Encoder TTL outputs	–
Indicator	
LEDs	3 (status) / Ethernet
Display	–
Environmental conditions	
Temperature – Operation	-30...+55 °C
Temperature – Storage	-40...+85 °C
Humidity (condensation not permitted)	5...90%
Mechanical data	
Weight	ca. 80 g
Dimensions (L x W x H)	55 x 40 x 21 mm
Mounting	M2.5 screws

Ordering Information: Please contact your maxon sales engineer
001794 MicroMACS6

MicroMACS6 Module Data
Programmable Motion Controller

MicroMACS6 Module
Compact, programmable multi-axis controller as plug-in option for integration into custom motherboards.

MicroMACS6 Module
Flexible and compact

The MicroMACS6 Module is designed for flexibility and can be integrated into custom motherboards. The MicroMACS6 Module, with its small size and focused functions (similar to the MicroMACS6), is an excellent choice for users looking for a more affordable alternative to high-performance master motion controllers. For initial commissioning, the MicroMACS6 with identical functionality can be used as a fully integrated and ready-to-use solution. This simplifies the setup process.

Controller versions	
	CANopen Master/Slave, Ethernet, Standalone with APOSS® win
Features	
Motion features	Trapezoidal, jerk limited, CAM, synchronous travel, path, kinematics
Profile generator cycle	1 kHz (1 ms)
Sampling rate of PID positioning controller with speed and acceleration feed-forward control	–
Maximum number of axes	6
Web server (visualization)	–
Expandable memory	–
Electrical data	
Logic supply voltage V_C	8 - 28 VDC
Inputs	
Digital inputs	6 (PLC 9...30 VDC or Logic 2...30 VDC)
Analog inputs	2 (12-bit resolution, 0...10 V, 1 kHz)
Hall sensor signals	–
CAN-ID (CAN node identification)	configurable
Output	
Digital output	4 (24 VDC, 100 mA, max. 25 kHz PWM)
Analog output	–
Encoder voltage output	–
Interfaces	
Profinet	–
CAN	2 (max. 1 Mbit/s)
BLE (Bluetooth Low Energy)	optional
EtherCAT-Master / EtherCAT-Slave	–
Ethernet	1 (TCP/IP, max. 100 Mbit/s)
USB 2.0	1
Encoder inputs	
Digital incremental	–
SSI absolute	–
Analog incremental (sin/cos)	–
Hiperface/EnDat	–
Encoder outputs	
Encoder TTL outputs	–
Indicator	
LEDs	3 (status) / Ethernet
Display	–
Environmental conditions	
Temperature – Operation	-30...+55 °C
Temperature – Storage	-40...+85 °C
Humidity (condensation not permitted)	5...90%
Mechanical data	
Weight	ca. 9 g
Dimensions (L x W x H)	45 x 30 x 9.8 mm
Mounting	M2 screws
Ordering Information: Please contact your maxon sales engineer	

001822 MicroMACS6 Module

MasterMACS Data
Programmable Motion Controller

MasterMACS
Rounds off the Motion Controller portfolio with the highest computing power and multiple integrated bus interfaces as standard.

Data logger/web server

For development and analysis purposes, it is frequently helpful to collect, prepare and output data on drive systems.

Our MACS controllers provide easy options for high-performance data storage, be it on an internal SD card or via a connected PC tool. Relevant data can be recorded on a per-event basis or for long-term observation.

This data can be read out and analyzed at a later time. This flexibility makes it possible to use the MasterMACS purely as data collectors. An integrated web server provides the option of performing analysis and configuration via remote diagnostics.

Controller versions	
	CANopen Master/Slave, EtherCAT Master, EtherCAT Slave, Ethernet, Standalone with APOSS® win
Features	
Motion features	Trapezoidal, jerk limited, CAM, synchronous travel, path, kinematics
Profile generator cycle	1 kHz (1 ms)
Sampling rate of PID positioning controller with speed and acceleration feed-forward control	1 kHz (1 ms)
Maximum number of axes	32
Web server (visualization)	yes
Expandable memory	SD-Card
Electrical data	
Logic supply voltage V_C	18 - 30 VDC
Inputs	
Digital inputs	10 (PLC level)
Analog inputs	–
Hall sensor signals	–
CAN-ID (CAN node identification)	configurable with DIP switch
Output	
Digital output	4 (max. 100 mA per output)
Analog output	–
Encoder voltage output	5 VDC, max. 200 mA
Profinet	on request
Interfaces	
CAN	2 high; low (max. 1 Mbit/s)
RS232 / RS485	1 x RxD; TxD / 1 x Data+; Data-
EtherCAT-Master / EtherCAT-Slave	1 / 1
Ethernet	1
USB 2.0	1 Data+; Data- (Full Speed)
Encoder inputs	1
Digital incremental	1 (differential, max. 5 MHz)
Hiperface/EnDat	–
Encoder outputs	
Encoder TTL outputs	–
Indicator	
LEDs	10 (status, USB, EtherCAT)
Display	Option
Environmental conditions	
Temperature – Operation	0...40 °C
Temperature – Storage	-20...+85 °C
Humidity (condensation not permitted)	20...80%
Mechanical data	
Weight	500 / 300 g (DIN/compact housing)
Dimensions (L x W x H)	108 x 108 x 67 / 125 (108) x 98 x 42 mm
Mounting	DIN mounting / compact housing
Ordering Information: Please contact your maxon sales engineer	

001725 MasterMACS DIN 32 ax

001728 MasterMACS compact housing 32ax

Programmable Motion Controllers
Application development

APOSS® win

APOSS® enables simplified implementation of complex motion control applications. The programming is performed in the high-level languages C, which has been supplemented with very powerful, specific motion control commands.
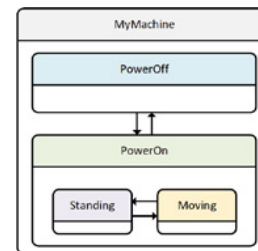

APOSS® IDE – Application Engineering

State machines

The development of extensive software systems requires a structured and modular procedure. It is essential to have an appropriate system architecture, including its components and the interfaces to the subsystems and system environment.


APOSS® makes it possible to create programs by means of hierarchical state machines. Thus comprehensive applications can be structured and developed in a transparent and serviceable way. Several state machines can be called up and processed in parallel.

Motion control functions

Comprehensive positioning and synchronization tasks are initiated with APOSS® using simple commands [e.g. AxisPosAbsStart(); AxisPosRelStart(); SyncPos(); SyncVel();] and processed independently in the background.

– **Jerk-limited positioning**
Profile motion with limited jerking. Jerk limiting can be individually defined for all four acceleration phases. Jerk-limited motion can be changed dynamically during the motion.

– **CAM profiles**
Each axis can travel along an own CAM profile. CAM profiles can be combined in any way desired and dynamically calculated. CAM segments can be splines, polynomials up to the fifth order or straight lines.

– **Path motion**
Path motion can be performed with constant or with maximum path speed, for any number of axes.

– **Synchronization tasks**
Axis motion synchronized with a master axis, position synchronization, speed synchronization or position synchronization with marker correction. Each axis can be synchronized with another master.

– **Kinematics**
Synchronization of several axes in a 2- or 3-dimensional Cartesian coordinate system. Various kinematic models are available, for example a SCARA or DELTA model.
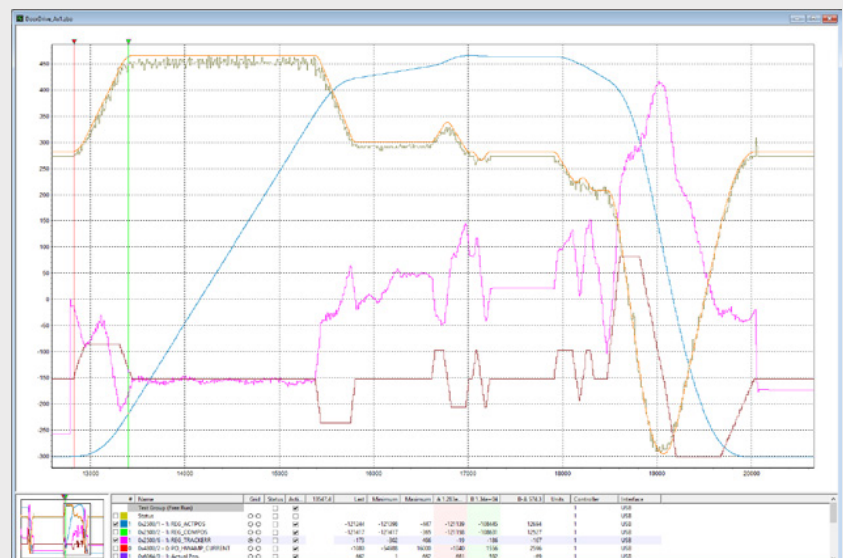
APOSS® Oscilloscope

Engineering tailored to your needs

The engineers at maxon have many years of experience in developing controllers and applications, and provide support from programming to commissioning.

Precision Drive Systems

www.maxongroup.com