

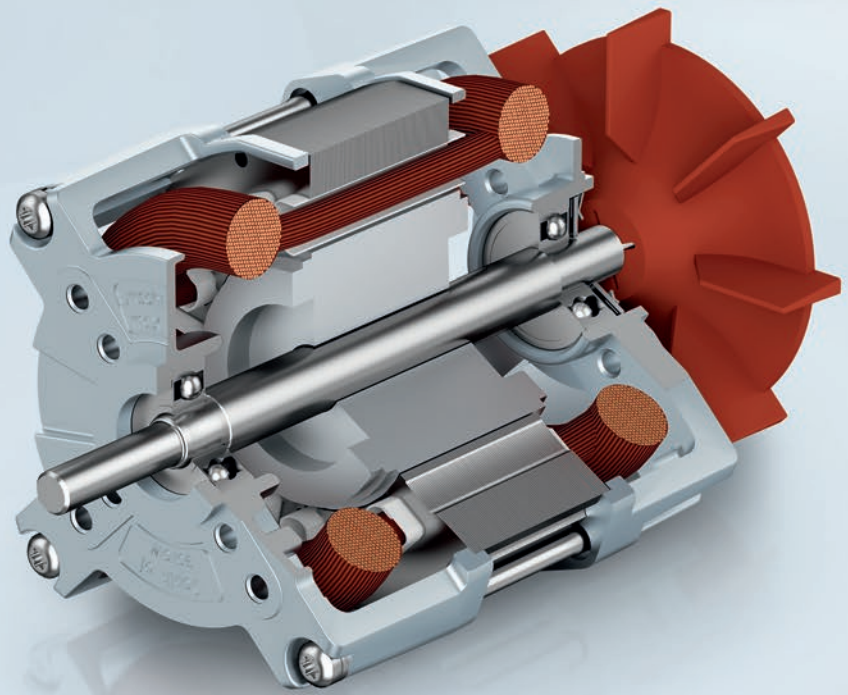
Customized drive systems | Components | assembly

Drive solutions | Industrial drive engineering 2018-06

ebmpapst

The engineer's choice





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About ebm-papst.

As technological leader for ventilation and drive engineering, ebm-papst is in demand as an engineering partner in many industries. With over 15,000 different products, we provide the right solution for just about any challenge. Our fans and drives are reliable, quiet and energy-efficient.

Six reasons that make us the ideal partner:

Our systems expertise.

You want the best solution for every project. The interrelationships between ventilation and drive engineering must thus be considered as a whole. And that's what we do – with **motor technology** that sets standards, sophisticated **electronics** and **aerodynamic designs** – all from a single source and perfectly matched. These system solutions release unique synergies worldwide. And in particular – they relieve you of a lot of work, so that you can concentrate on your core competency.

The ebm-papst spirit of invention.

In addition to our wide range of products, we are always able to develop customized solutions for you. A diversified team of 600 engineers and technicians works at our three locations in Germany: Mulfingen, Landshut and St. Georgen. Contact us to discuss your next project.

Our lead in technology.

As pioneer and trail-blazer for developing highly efficient EC technology, we are way ahead of other motor manufacturers. Almost all our products are also available with GreenTech EC technology. The list of benefits is long: higher efficiency, maintenance-free, longer service life, sound reduction, intelligent control characteristics and unrivalled energy efficiency with savings of up to 80 % compared to conventional AC technology. Let our technology be your competitive advantage as you lead in your industry.

Closeness to our customers.

ebm-papst has 25 production locations worldwide (including facilities in Germany, China and the USA), together with 49 sales offices, each of which has a dense network of sales representatives. You will always have a local contact, someone who speaks your language and knows your market.

Our standard of quality.

Of course you can rely on the highest standards of quality with our products. Our quality management is uncompromising, at every step in every process. This is underscored by our certification according to international standards including DIN EN ISO 9001, TS declaration of conformity and DIN EN ISO 14001.

Our sustainable approach.

Assuming responsibility for the environment, for our employees and for society is an integral part of our corporate philosophy. We develop products with an eye to maximum environmental compatibility, in particular resource-preserving production methods. We promote environmental awareness among our young staff and are actively involved in sports, culture and education. That's what makes us a leading company – and an ideal partner for you.

Our success story to becoming market leader and technological innovator.

- 1963** Elektrobau Mulfingen **GmbH & Co. KG founded by** Gerhard Sturm and Heinz Ziehl.
- 1965** Development of the first compact fan in the field of EC-/DC-technology.
- 1966** The ebm-papst success story started to take off with the release of the new 68 motor.
- 1972** The first foreign subsidiary was founded in Sweden.
- 1988** Gerhard Sturm receives the German Cross of Merit.
- 1990** The sixty millionth external rotor fan was produced.
- 1992** Acquisition of **PAPST Motoren GmbH** in St. Georgen.
- 1997** Purchase of the **Landshut** plant (mvl).
- 2003** Change of name to **ebm-papst**.
- 2007** Introduction of the gearhead "**EtaCrown®**".
- 2010** **GreenTech** – our symbol for energy-efficiency and resource conservation.
- 2012** Introduction of a new generation of control electronics (**K4**) for BLDC motors.
- 2013** ebm-papst acquires the gear specialist, **Zeitlauf**, and wins the **German Sustainability Award**.
- 2014** Launch of the BLDC internal rotor motor, **ECI 80**.
- 2015** Introduction of the overload-capable planetary gear "**Optimax 63**".
- 2016** Expansion of the electronic production plant, St. Georgen Hagenmoos.



Definitions for motors.

Continuous stall power P_{Bn0} [W]

Is an approximate value for the voltage-independent maximum permitted output ($P=U \times I$) that can be taken from the DC voltage source in holding status.

Permissible peak torque short-term M_{max} [mNm]

Is the torque which the motor can usually deliver in a short time.

Permissible peak current, motor lead I_{max} [A]

Is the current that must flow in to the motor lead as a peak value to achieve the short-time peak torque.

Induced voltage U_{imax} [V/1 000 rpm]

Maximum value of the induced voltage between two motor leads at 1 000 rpm. It is a dimension for the electromagnetic utilization of the motor.

Connection resistance R_v [Ohm]

The winding resistance that is measured at 20°C between any two of three winding terminations.

Connection inductance L_v [mH]

The average inductance that is measured at 20°C between any two of three winding terminations using a sinusoidal wave measuring frequency of 1 kHz.

Rotor moment of inertia J_r [kgm²x10⁻⁶]

The mass moment of inertia of the rotor and necessary dimension for the dynamic characteristics of the motor.

Protection class

Information on the protection class; it describes protection against foreign particles (Point 1) and water (Point 2).

Permissible ambient temperature range T_v [°C]

Defines the minimum and maximum permissible ambient temperature to which the mentioned performance values apply when the motor is in operation. The permissible winding temperature in the motor (115°C for insulation Class E, as per EN 60 034-1) </1125 should not be exceeded.

Weight m [kg]

Weight of the delivered unit without additional units or packaging.

Max. shaft load F_{radial}/F_{axial} [N]

The permissible forces are divided into radial and axial load values. They are based on the maximum permissible values for the motor bearing during operation at normal rating and a defined service life expectancy L_{10} .

Service life L_{10}

The values for the L_{10} service life specified in conjunction with the permitted bearing loads have been calculated to DIN ISO 281. In addition to the specified values, this calculation is based on operation of the motor at nominal conditions (nominal torque, nominal speed) and an ambient temperature of max. 40°C. Therefore, the service life information is explicitly not a guarantee of service life, but strictly a theoretical quality figure.

Max. reverse voltage [V DC]

When the braking function is activated and when the set value step change is negative, the motor operates in controlled braking mode. In this operating state, the large part of the braking energy is fed back to the intermediate circuit until the max. reverse voltage is reached and the electronics prevent a further increase beyond this value by chopped braking. This behavior should be given special consideration when selecting the system supply.

Set value input

Speed setting via an analogue interface for DC voltage.

Depending on the drive design, the set speed can be configured in a range from 0 ... n_{max} , where the minimum possible speed value (with limited control quality) is about 0 rpm (sine commutation)

or approx. 50 to 100 rpm (block commutation). (Relevant only for drives with integrated operating electronics).

Recommended speed range [rpm]

Speed control range within which the speed control accuracy stipulated in the system specification is complied with.

Starting torque [mNm]

Is the torque that can be delivered over a short time when the motor is started based on the electromagnetic motor characteristics and the set current limitation.

Effective torque M_{eff} [mNm]

For cycle operation (e.g. "S5" operating mode – intermittent duty with the effect of the startup losses and the losses due to electrical braking on the heating), the effective torque corresponding to continuous operation ("S1" operating mode) is determined according to the following formula:

$$M_{\text{eff}} = \sqrt{\frac{M_A^2 \cdot t_A + M_L^2 \cdot t_B + M_{Br}^2 \cdot t_{Br}}{t_A + t_B + t_{Br} + t_{St}}}$$

M_A	Starting torque	M_{Br}	Braking
t_A	Acceleration time	t_{Br}	Braking time
M_L	Load torque	t_{St}	Standstill time
t_B	Load period		

At an ambient temperature of 40°C this effective torque must not be greater than the nominal torque M_N listed in the catalog for the selected motor. For intermittent operation (operating mode S3 with t_r = relative on period) the following permissible load moment applies:

$$M_L = M_N \cdot \sqrt{\frac{100}{t_r}}$$

System selection

When selecting a motor and operating for a drive system, consideration should be given to the fact that the values permitted for the motor should not be exceeded by the electronics. Likewise, the relationship shown in the commutation sequences between the sequence of Hall signals and the corresponding switching times and switching states of the output stage at the phase supply lines must be observed in order to attain optimum operation of the motor.

Please contact the manufacturer if the products are operated or stored under non standard environmental conditions.

AC motors.



KM 40XX / 2-pole	12
KM 40XX / 4-pole	14
KM 43XX / 2-pole	16
KM 43XX / 4-pole	18

Information about AC motors.

Storage

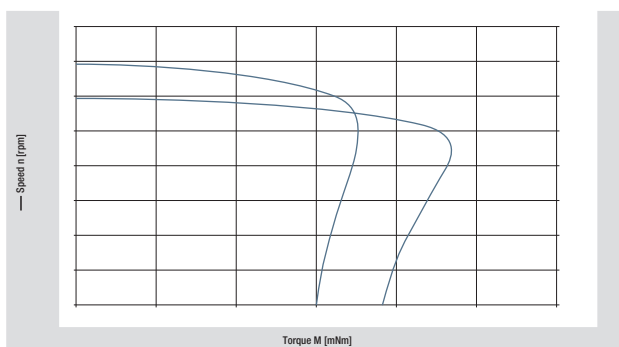
High quality sintered cup slide bearings with lubricant depot are used by default, suitable for ambient temperatures of approx. 0 to 60°C. Proven bearing systems are available for lower or higher temperatures. For increased axial or/and radial loads, such as vertical shaft positions, belt drives or the like, an appropriately adapted bearing structure is required depending on the service life requirement. Ball bearings can also be used for the EM30 series. For capacitor motors, a bearing assembly with ball bearings is provided by default.

Direction of rotation

The standard rotational direction is clockwise as seen on the drive shaft; version for counter-clockwise rotational direction is possible. In standard design capacitor motors, the main and auxiliary phases are designed symmetrically so that operation is possible in both rotational directions without a difference in power.

Nominal data (power/torque)

The catalogue data refer to the continuous operation S1 at rated voltage/frequency. A power increase is possible with a higher insulation class or for short-term operation S2.



A load characteristic curve of a shaded pole motor designed for 50 Hz during operation with 60 Hz at the same voltage.

Voltage/frequency

Nominal voltage: 230 V, 50 Hz adaptation for other voltages and frequencies is generally possible. Motors designed for 50 Hz can usually also be operated at the same voltage with 60 Hz (see diagram). However, due to the changed rpm/torque ratio, the flawless function can only be determined by checking the device. The load characteristic curve can be adapted to the requirements in each case through structural measures, such as changes to the rotor material, short circuit ring height and induction.

Electrical connection

Shaded pole motors: Standard with electrical terminals, stranded wire connection by request, capacitor motors: 3 stranded wires.

Insulation setup

Corresponds to EN 60335 (VDE700). Design for foreign regulations (UL, CSA and others) is possible.

Shaded pole motors: Standard: Insulation class B (EN/VDE), protection type IP 00, protection class I. Insulation systems for higher insulation classes (F, H) and protection class II are available for many motors.

Capacitor motors: Insulation class F, protection type IP 00/IP 20, protection class I.

Anomalous operation

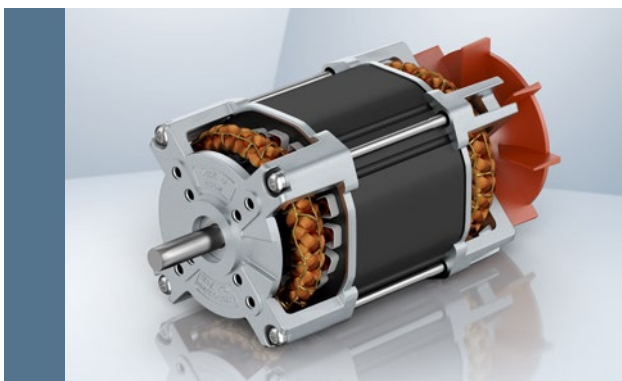
Motors that can reach unacceptably high temperatures in the event of a fault (e.g. in the case of a blockage) are to be secured by direct measures (impedance protection, temperature monitor), or by device-side protective devices. Capacitor motors are generally supplied with temperature monitors.



Technical information of shaded pole motors EM

- Asymmetrical setup
- 2-pole with short circuit rotor
- Simple and robust
- Self-starting
- Maintenance and radio interference-free

You can get additional information about shaded pole motors EM by request.



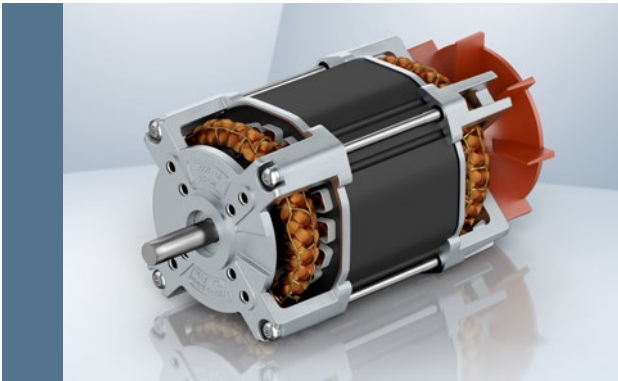
Technical information of capacitors KM

- 2- or 4-pole single-phase motors with short circuit rotor
- Winding, 2-stranded, with switched operating capacitor auxiliary phase

Additional information about capacitor motors KM can be found on the following pages of the catalogue (page 12-19).

AC motors.

KM 40XX / 2-pole



- Clockwise directional rotation (see connection diagram)
- Symmetrical winding, also suitable for counter-clockwise rotation
- Continuous operation S1
- Ball bearing
- Insulation class F (VDE/EN)

Nominal data

Type		KM 4020	KM 4030**	KM 4040	KM 4050**	KM 4060
Nominal voltage (U_N)	V AC	230				
Operating capacitor*	μF	3.50	4.50	5.00	7.00	7.00
Frequency	Hz	50				
Nominal speed (n_N)	rpm	2 600	2 700	2 700	2 700	2 700
Nominal torque (M_N)	mNm	160	230	360	470	620
Nominal current (I_N)	A	0.48	0.60	0.71	0.97	1.10
Nominal output power (P_N)	W	45	67	100	138	176
Starting torque (M_{max})	mNm	130	160	170	270	270
Speed at no-load operation (n_0)	rpm	2 950				
Anti-lock protection function, Overload protection		protection from thermal monitor in the winding				
Permissible ambient temperature range (T_U)	$^{\circ}\text{C}$	60				
Weight	kg	1.00	1.40	1.60	1.80	2.00
Order no.	IP 00	on request				

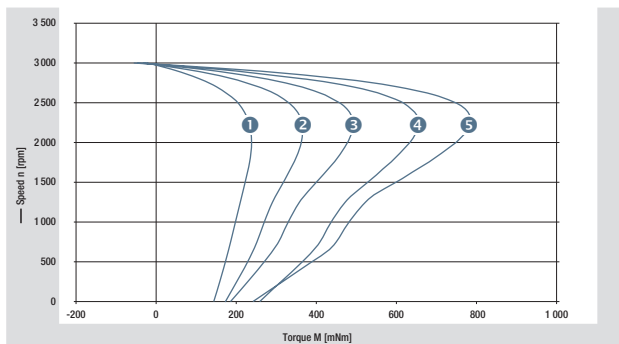
Subject to alterations

* Not in the scope of delivery

** Can be combined with Flatline 78 spur gearhead (page 38)

Characteristic curve

KM 40XX, number of poles 2 (at 25°C)

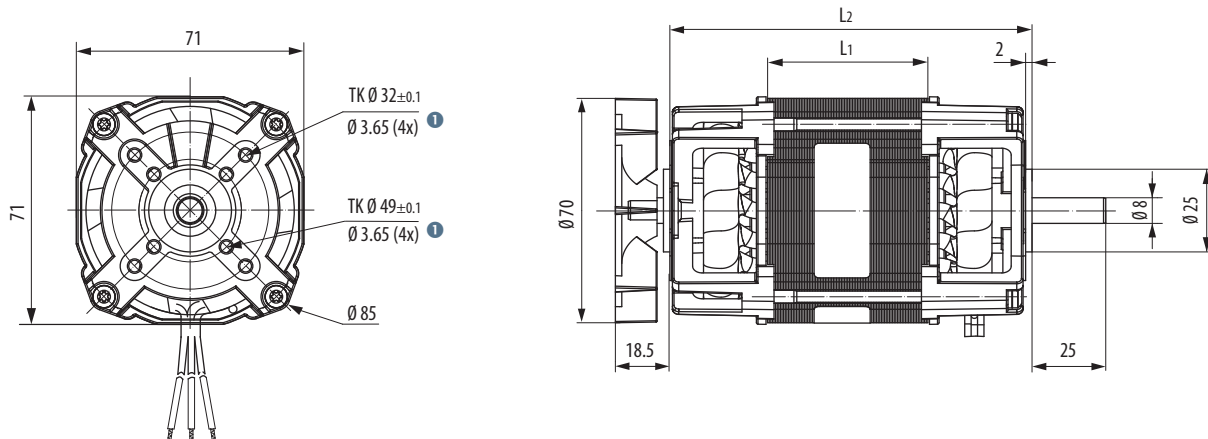


- 1 KM 4020
- 2 KM 4030
- 3 KM 4040
- 4 KM 4050
- 5 KM 4060

Nominal data, see table

Technical drawing

All dimensions in mm



Type	L1	L2
KM 4020	20	82
KM 4030	30	92
KM 4040	40	102
KM 4050	50	112
KM 4060	60	122

- ① Screw-in depth max. 8
For thread-forming screws according to DIN 7500

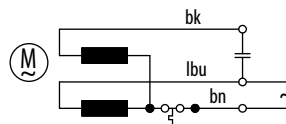
Electrical connection

Connection cable

Color	Function
brown (bn)	Phase
light blue (lbu)	Neutral conductor
black (bk)	Auxiliary phase

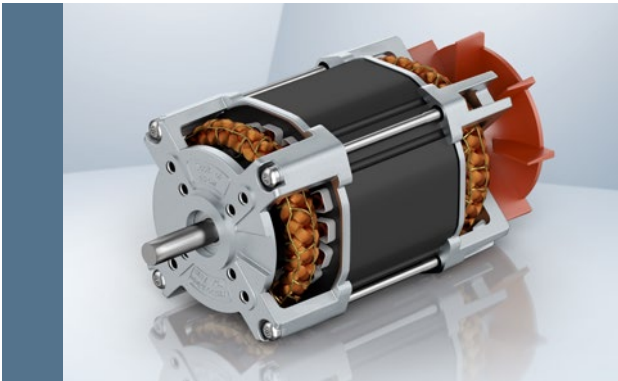
Cable length 180 ± 20 from motor
Cable end 6 ± 2 with ferrules

Change of the rotating direction is possible by polarity reversal of the wires



AC motors.

KM 40XX / 4-pole



- Clockwise directional rotation (see connection diagram)
- Symmetrical winding, also suitable for counter-clockwise rotation
- Continuous operation S1
- Ball bearing
- Insulation class F (VDE/EN)

Nominal data

Type		KM 4020	KM 4030**	KM 4040	KM 4050**	KM 4060
Nominal voltage (U_N)	V AC	230				
Operating capacitor*	μF	2.00	2.50	3.00	3.50	4.00
Frequency	Hz	50				
Nominal speed (n_N)	rpm	1 300	1 300	1 350	1 350	1 350
Nominal torque (M_N)	mNm	140	220	260	310	340
Nominal current (I_N)	A	0.33	0.38	0.42	0.47	0.50
Nominal output power (P_N)	W	19.5	31.0	38.0	44.0	49.0
Starting torque (M_{max})	mNm	110	160	200	240	300
Speed at no-load operation (n_0)	rpm	1 450				
Anti-lock protection function, Overload protection		protection from thermal monitor in the winding				
Permissible ambient temperature range (T_U)	$^{\circ}\text{C}$	60				
Weight	kg	1.00	1.40	1.60	1.80	2.00
Order no.	IP 00	on request				

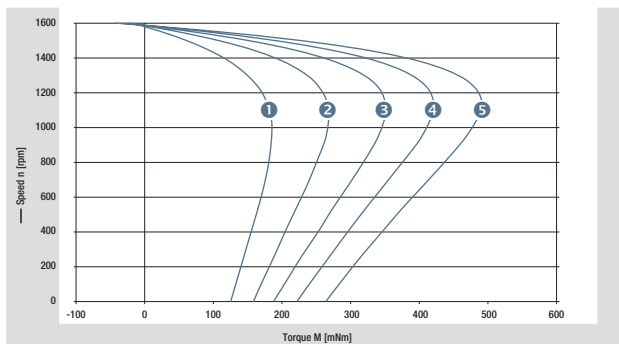
Subject to alterations

* Not in the scope of delivery

** Can be combined with Flatline 78 spur gearhead (page 38)

Characteristic curve

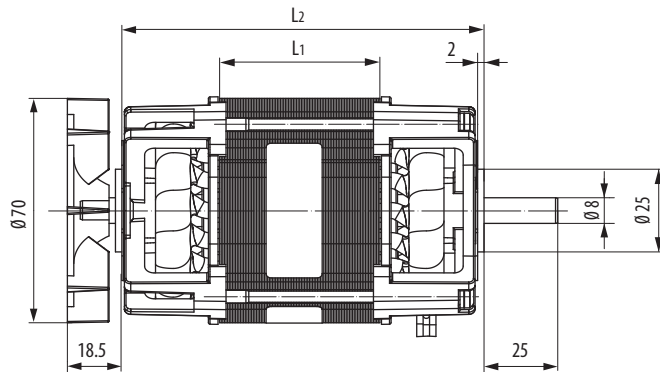
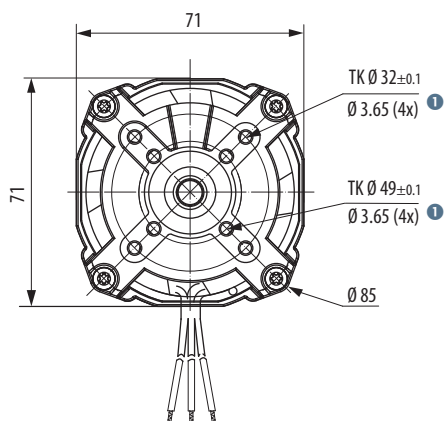
KM 40XX, Polzahl 4 (at 25°C)



- 1 KM 4020
- 2 KM 4030
- 3 KM 4040
- 4 KM 4050
- 5 KM 4060

Nominal data, see table

Technical drawing All dimensions in mm



Type	L1	L2
KM 4020	20	82
KM 4030	30	92
KM 4040	40	102
KM 4050	50	112
KM 4060	60	122

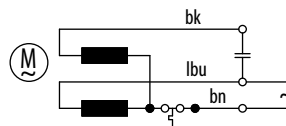
① Screw-in depth max. 8
For thread-forming screws according to DIN 7500

Electrical connection

Connection cable

Color	Function	
brown (bn)	Phase	Cable length 180 ± 20 from motor Cable end 6 ± 2 with ferrules
light blue (lbu)	Neutral conductor	
black (bk)	Auxiliary phase	

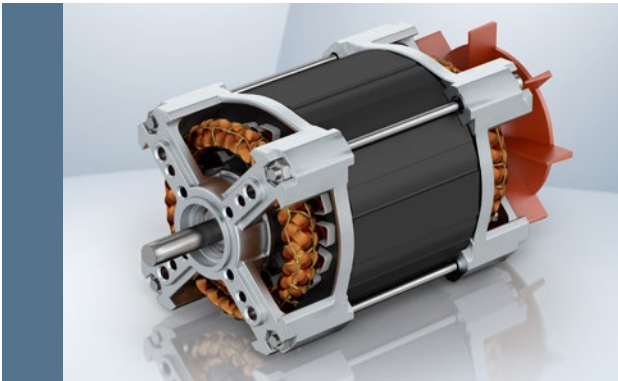
Change of the rotating direction is possible by polarity reversal of the wires



For motor-gearbox combinations, depending on the choice of the single components, the maximum allowable torque (gearbox) can be exceeded or respectively not reached.

AC motors.

KM 43XX / 2-pole



- Clockwise directional rotation (see connection diagram)
- Symmetrical winding, also suitable for counter-clockwise rotation
- Continuous operation S1
- Ball bearing
- Insulation class F (VDE/EN)

Nominal data

Type		KM 4320	KM 4330**	KM 4340	KM 4350**	KM 4360
Nominal voltage (U_N)	V AC	230				
Operating capacitor*	μF	4.00	5.00	7.00	8.00	9.00
Frequency	Hz	50				
Nominal speed (n_N)	rpm	2 650	2 700	2 750	2 750	2 750
Nominal torque (M_N)	mNm	200	310	380	570	620
Nominal current (I_N)	A	0.69	0.87	0.81	1.14	1.20
Nominal output power (P_N)	W	58	90	108	165	180
Starting torque (M_{max})	mNm	180	200	330	330	390
Speed at no-load operation (n_0)	rpm	2 950				
Anti-lock protection function, Overload protection		protection from thermal monitor in the winding				
Permissible ambient temperature range (T_U)	$^{\circ}\text{C}$	60				
Weight	kg	1.20	1.50	1.80	2.20	2.50
Order no.	IP 00	on request				

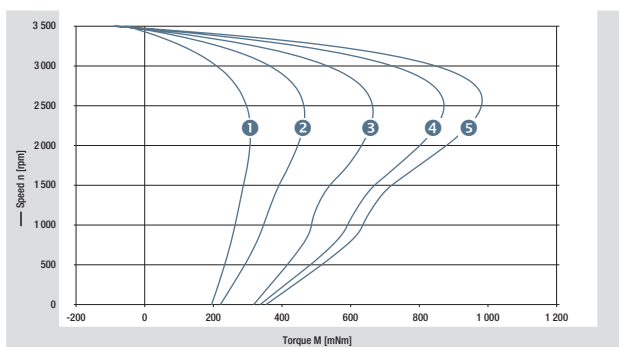
Subject to alterations

* Not in the scope of delivery

** Can be combined with Flatline 78 spur gearhead (page 38)

Characteristic curve

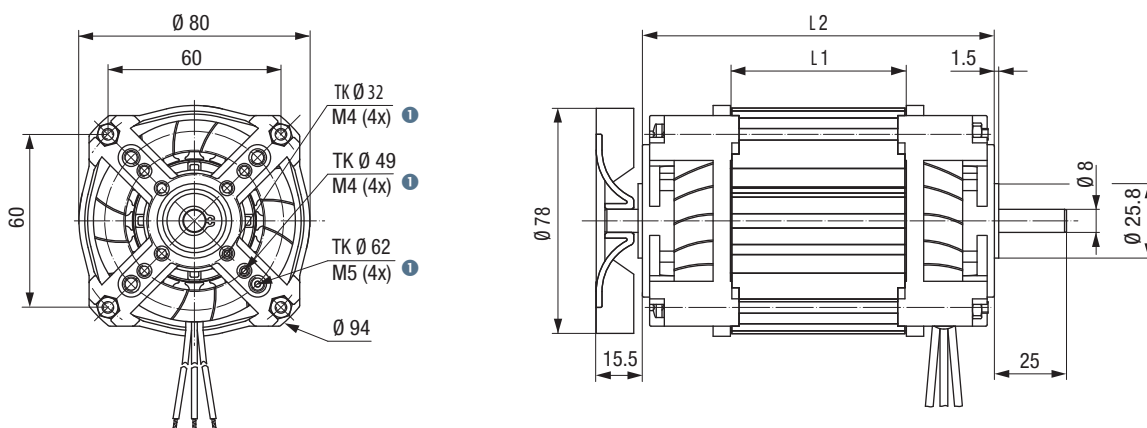
KM 43XX, number of poles 2 (at 25°C)



- 1 KM 4320
- 2 KM 4330
- 3 KM 4340
- 4 KM 4350
- 5 KM 4360

Nominal data, see table

Technical drawing All dimensions in mm



① Screw-in depth max. 8
For thread-forming screws according to DIN 7500

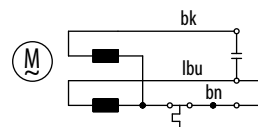
Type	L1	L2
KM 4320	20	83
KM 4330	30	93
KM 4340	40	103
KM 4350	50	113
KM 4360	60	123

Electrical connection

Connection cable

Color	Function	Cable length 180 ± 20 from motor Cable end 6 ± 2 with ferrules
brown (bn)	Phase	
light blue (lbu)	Neutral conductor	
black (bk)	Auxiliary phase	

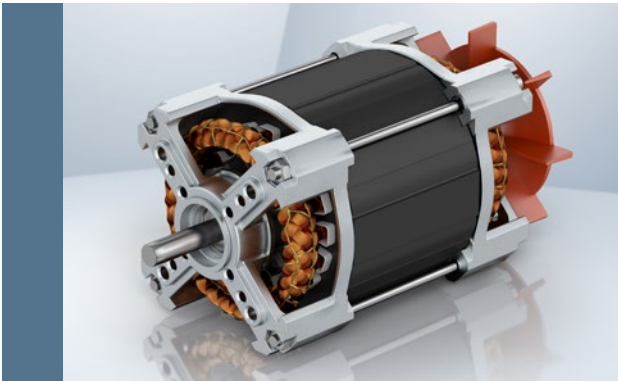
Change of the rotating direction is possible by polarity reversal of the wires



For motor-gearbox combinations, depending on the choice of the single components, the maximum allowable torque (gearbox) can be exceeded or respectively not reached.

AC motors.

KM 43XX / 4-pole



- Clockwise directional rotation (see connection diagram)
- Symmetrical winding, also suitable for counter-clockwise rotation
- Continuous operation S1
- Ball bearing
- Insulation class F (VDE/EN)

Nominal data

Type		KM 4320	KM 4330**	KM 4340	KM 4350**	KM 4360
Nominal voltage (U_N)	V AC	230				
Operating capacitor*	μF	2.50	3.00	3.50	4.00	4.50
Frequency	Hz	50				
Nominal speed (n_N)	rpm	1 300	1 300	1 350	1 350	1 350
Nominal torque (M_N)	mNm	200	280	330	360	470
Nominal current (I_N)	A	0.38	0.44	0.45	0.50	0.62
Nominal output power (P_N)	W	27.0	39.0	46.0	51.0	67.0
Starting torque (M_{max})	mNm	170	230	250	280	300
Speed at no-load operation (n_0)	rpm	1 450				
Anti-lock protection function, Overload protection		protection from thermal monitor in the winding				
Permissible ambient temperature range (T_U)	$^{\circ}\text{C}$	60				
Weight	kg	1.10	1.40	1.80	2.10	2.40
Order no.	IP 00	on request				

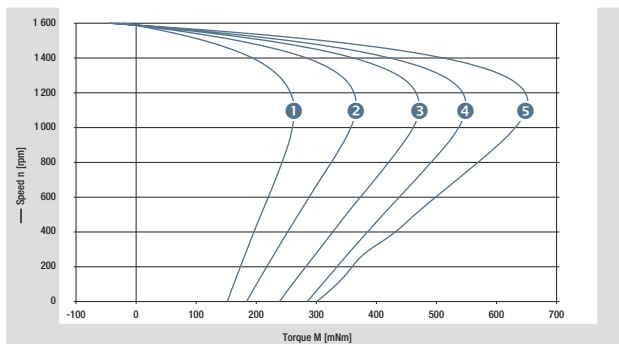
Subject to alterations

* Not in the scope of delivery

** Can be combined with Flatline 78 spur gearhead (page 38)

Characteristic curve

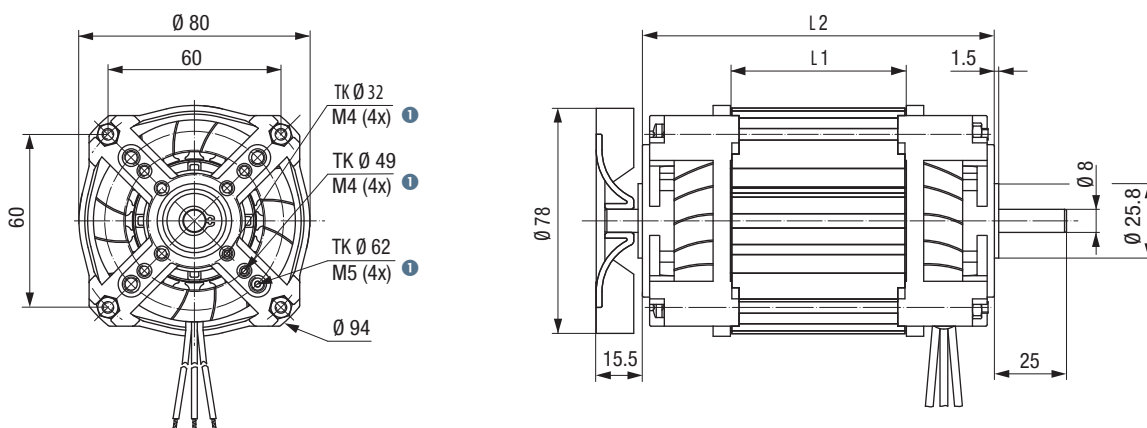
KM 43XX, Polzahl 4 (at 25°C)



- 1 KM 4320
- 2 KM 4330
- 3 KM 4340
- 4 KM 4350
- 5 KM 4360

Nominal data, see table

Technical drawing All dimensions in mm



Type	L1	L2
KM 4320	20	83
KM 4330	30	93
KM 4340	40	103
KM 4350	50	113
KM 4360	60	123

① Screw-in depth max. 8
For thread-forming screws according to DIN 7500

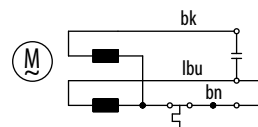
Electrical connection

Connection cable

Color	Function
brown (bn)	Phase
light blue (lbu)	Neutral conductor
black (bk)	Auxiliary phase

Cable length 180 ± 20 from motor
Cable end 6 ± 2 with ferrules

Change of the rotating direction is possible by polarity reversal of the wires



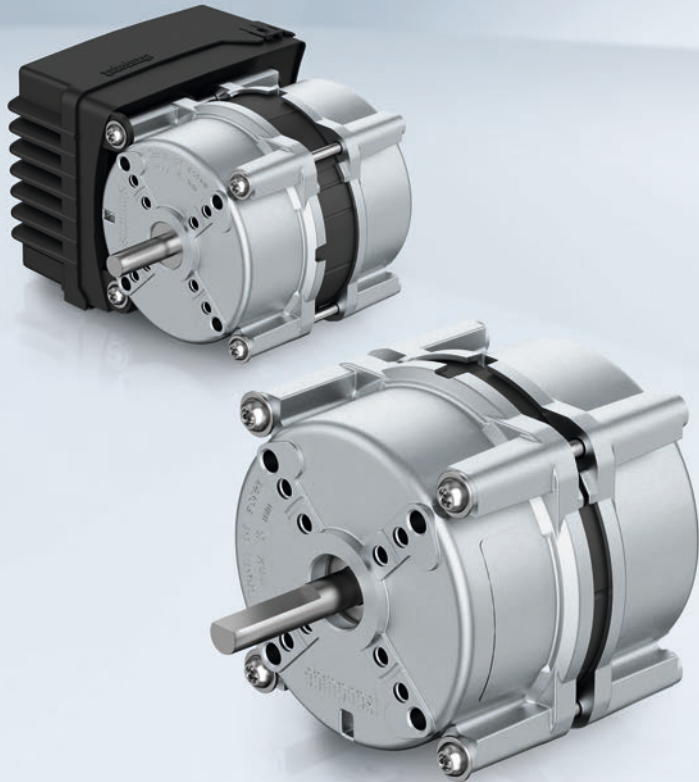
For motor-gearbox combinations, depending on the choice of the single components, the maximum allowable torque (gearbox) can be exceeded or respectively not reached.



BLDC motors.

BG 43XX

22



BLDC motor.

BG 43XX



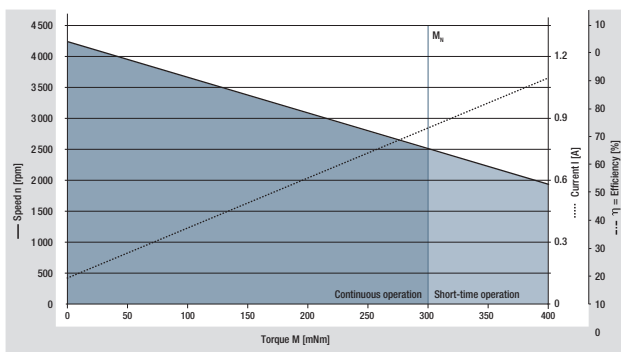
- EC motor for mains voltage (AC), but also for low voltage (DC)
- 3-stranded internal rotor motor in three installation lengths
- High start-up and operating torque
- Precision ball bearings for a long service life and low noise
- Sensorless sinus commutation
- Optional with PFC (Power Factor Correction)
- Clockwise and counter-clockwise rotation possible
- Customer-specific designs possible

Nominal data				
Type		BG 4310	BG 4320	BG 4340
Nominal voltage (U_N)	V AC		230	
Frequency	Hz		50	
Permissible supply voltage range (U_B)	V AC		187 - 254	
Nominal speed (n_N)	rpm		2 500	
Nominal torque (M_N)	mNm	300	600	1 200
Nominal current (I_N)	A	0.85	2.10	3.80
Nominal output power (P_N)	W	78	157	314
Starting torque (M_{max})	mNm	300	600	1 200
Recommended speed control range	rpm		500 ... 4 000	
Set value input	V		0 - 10	
Permissible ambient temperature range (T_U)	°C		0 ... +40	
Weight	kg	0.17	1.35	1.45
Order no.	IP 20		on request	
Order no.	IP 54 (optional)		on request	

Subject to alterations

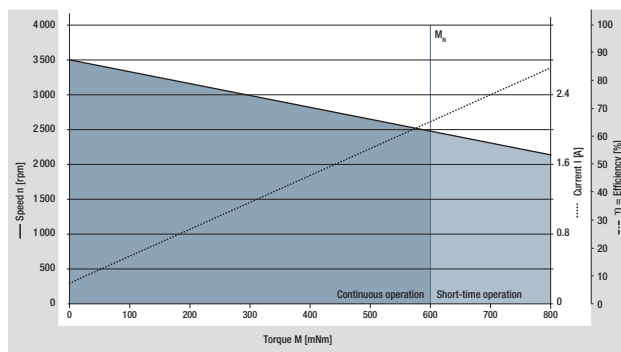
Characteristic curve

BG 4310, 230 V (at 25 °C)



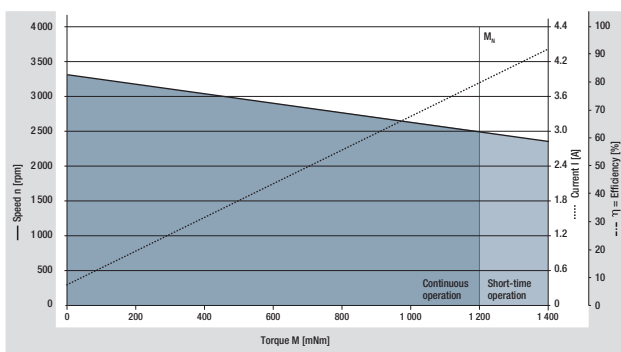
Nominal data, see table

BG 4320, 230 V (at 25 °C)

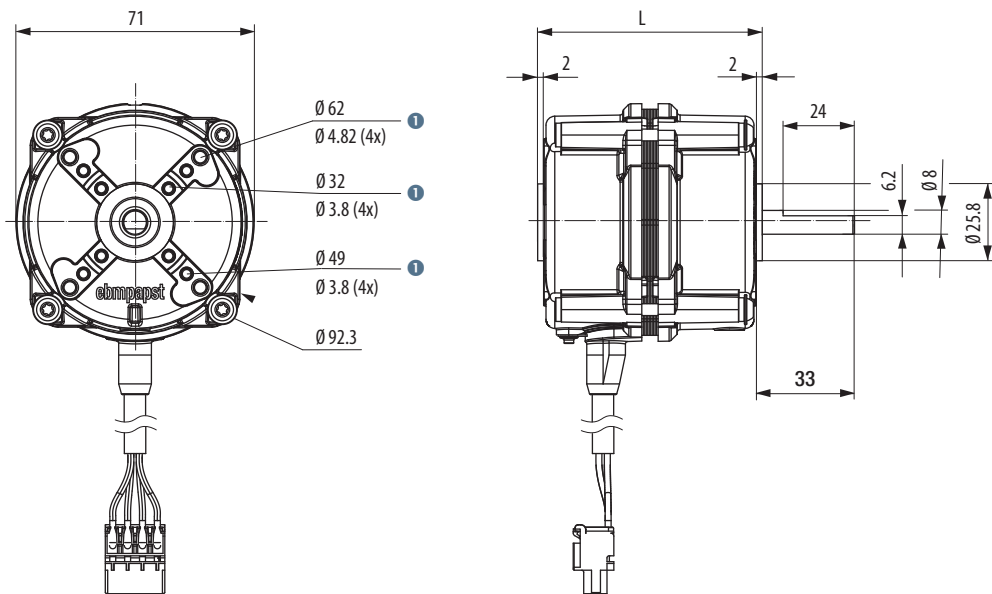


Nominal data, see table

BG 4340, 230 V (at 25 °C)



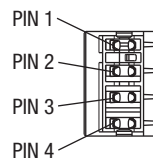
Nominal data, see table



- ① Screw-in depth max. 6
For thread-forming screws according to DIN 7500

Electrical connection

Counter-clockwise rotation		
No.	Color	Function
1	green/yellow	Phase PE
2	brown	Phase U
3	black	Phase V
4	blue	Phase W



Plug Fa. Stocko
MFVV_9590-04-FF06-000-960-000-00

Clockwise		
No.	Color	Function
1	green/yellow	Phase PE
2	black	Phase V
3	brown	Phase U
4	blue	Phase W

BG 43 motor.

Control electronics

Features

Operation at mains voltage (AC) and protection low voltage (DC) possible

Set speed

Rotational speed regulation

Clockwise or counter-clockwise rotation possible

Protection class IP 21 (depending on the installation position)

Control options

Analogue signal (0-10 volts)

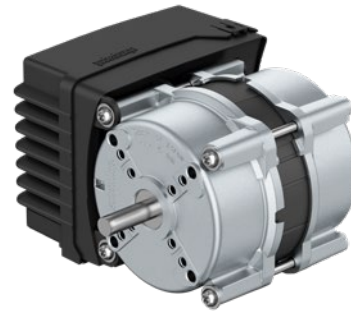
PWM signal (square wave signal)

Other customised solutions

Assembly options

Directly on the motor

Set in the customer application





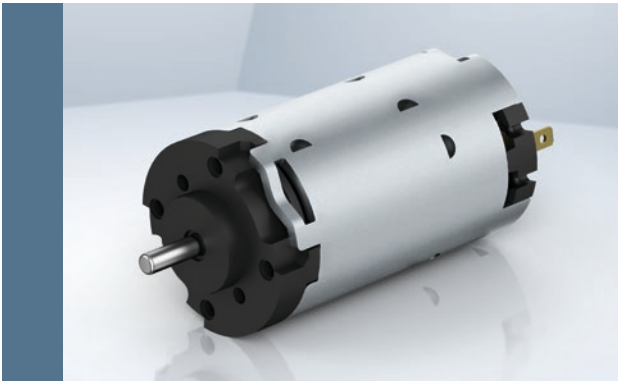
DC motor.



M28XX	28
M80XX	30

DC motor.

M28XX



- DC motor with permanent magnet
- Zinc plated housing
- Sintered bearing (optional with ball bearing)
- Service life $\leq 1\ 500$ h in continuous operation (S1)
- Fault clearance: possible

Nominal data

Type		M2820	M2820	M2840	M2840
Nominal voltage (U_N)	V DC	12	24	12	24
Nominal speed (n_N)*	rpm	3 150	3 000	3 100	3 100
Nominal torque (M_N)*	mNm	16.0	16.0	30.0	30.0
Nominal current (I_N)*	A	0.95	0.45	1.50	0.81
Nominal output power (P_N)*	W	5.30	5.00	9.70	9.70
Nominal efficiency, ca. (η_N)	%	46.3	46.5	54.1	50.1
Speed at no-load operation (n_0)	rpm	5 200	5 300	4 800	4 700
No-load current (I_0)	A	0.13	0.07	0.14	0.10
Starting torque (M_A)	mNm	41.0	37.0	85.0	88.0
Starting current (I_A)	A	2.20	0.90	4.00	2.20
Induced voltage (U_{imax})	V/1000 min ⁻¹	2.30	4.50	2.50	5.10
Connection resistance (R_v)	Ohm	5.43	25.38	3.02	10.98
Connection inductance (L_v)	mH	3.31	23.0	2.01	8.23
Rotor moment of inertia (J_R)	kgm ² x 10 ⁻⁶	1.40	1.40	2.40	2.40
Thermal resistance (R_{th})	K/W	8.90	8.90	6.20	6.20
Protection class**	IP	30			
Permissible ambient temperature range (T_U)	°C	-15 ... +40			
Weight	kg	0.10	0.10	0.16	0.16
Order no.		on request			

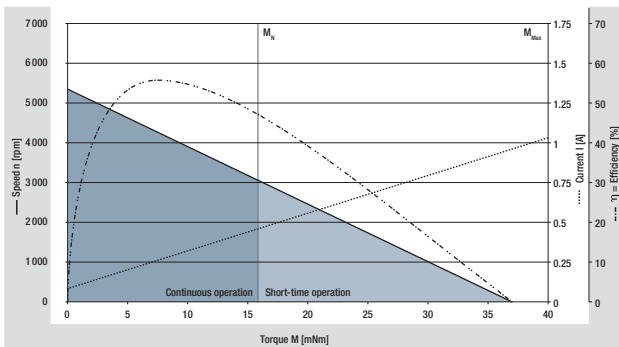
Subject to alterations

* At T_U max. 40 °C

** The degree of protection refers to the installed condition with sealing on the flange side

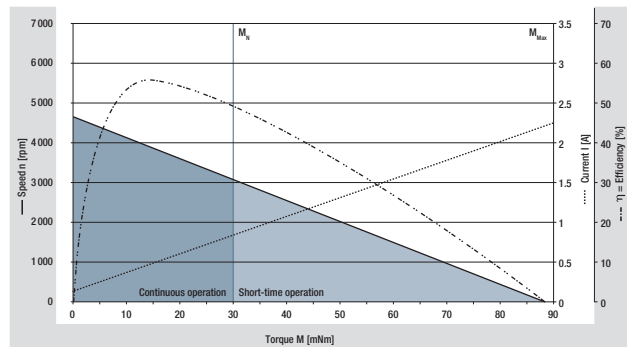
Characteristic curve

M2820, 24 V (at 25 °C)



Subject to alterations

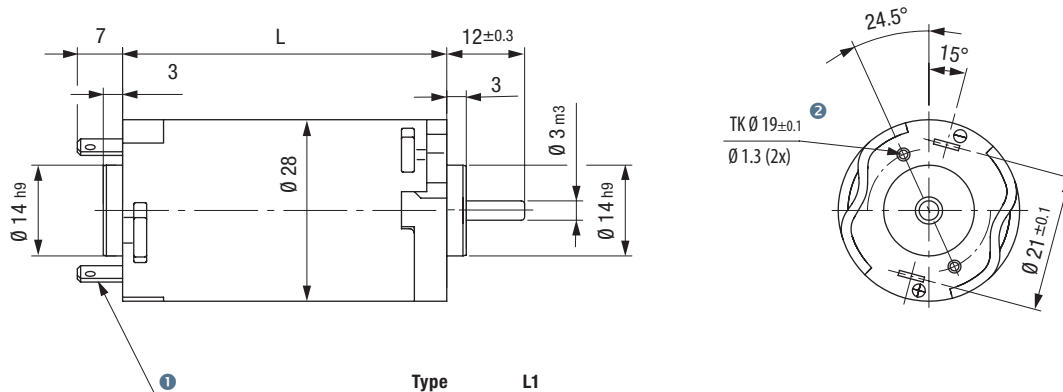
M2840, 24 V (at 25 °C)



Subject to alterations

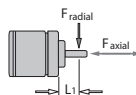
Technical drawing

All dimensions in mm



Type	L1
M2820	50
M2840	70

- 1 Flat connector 2.8 x 0.5 DIN46247
- 2 2⁺¹ deep
Blind bores for thread-forming screws according to DIN 7500



F _{axial}	5 N	Permissible shaft load at nominal speed and life expectancy L ₁₀ (nominal operation) of 3 000 h (at T _U max. 40°C)
F _{radial}	20 N	
L1	12 mm	

Electrical connection

Connection cable

Flat connector	Function
1	Power supply (+)
2	GND (-)

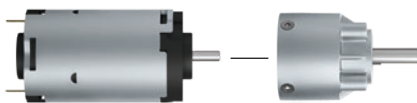
Change of the rotating direction is possible by polarity reversal of the flat connectors

Modular construction kit

Basic motor

Planetary gearheads

Performax® 32 (page 34)



For motor-gearbox combinations, depending on the choice of the single components, the maximum allowable torque (gearbox) can be exceeded or respectively not reached.

DC motor.

M80XX



- DC motor with permanent magnet
- Graphite-copper brushes
- Zinc plated housing
- Two ball bearings
- Mounting pattern according to DIN 42016
- Service life \leq 3 000 h
- Fault clearance: possible

Nominal data

Type		M8040	M8040	M8080	M8080
Nominal voltage (U_N)	V DC	12	24	12	24
Nominal speed (n_N)*	rpm	2 850	2 900	1 500	3 200
Nominal torque (M_N)*	mNm	380	380	700	700
Nominal current (I_N)*	A	12.5	6.20	11.3	11.4
Nominal output power (P_N)*	W	113.4	115.4	110	234.6
Nominal efficiency, ca. (η_N)	%	75.6	77.6	81.1	85.7
Speed at no-load operation (n_0)	rpm	3 250	3 250	1 700	3 450
No-load current (I_0)	A	1.10	0.60	0.70	0.70
Starting torque (M_A)	mNm	3 090	3 529	5 950	9 660
Starting current (I_A)	A	93.7	52.5	90.8	148.4
Induced voltage (U_{imax})	V/1000 min ⁻¹	3.70	7.40	7.10	7.00
Connection resistance (R_V)	Ohm	0.13	0.46	0.13	0.18
Connection inductance (L_V)	mH	0.21	0.90	0.33	0.33
Rotor moment of inertia (J_R)	kgm ² x 10 ⁻⁶	190	190	330	330
Thermal resistance (R_{th})	K/W	1.92	1.92	1.71	1.71
Protection class**	IP	40			
Permissible ambient temperature range (T_U)	°C	-30 ... +40			
Weight	kg	2.50	2.50	3.50	3.50
Order no.		on request			

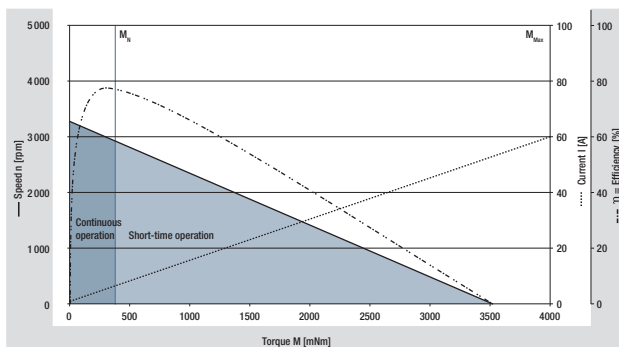
Subject to alterations

* At T_U max. 40 °C

** The degree of protection refers to the installed condition with sealing on the flange side

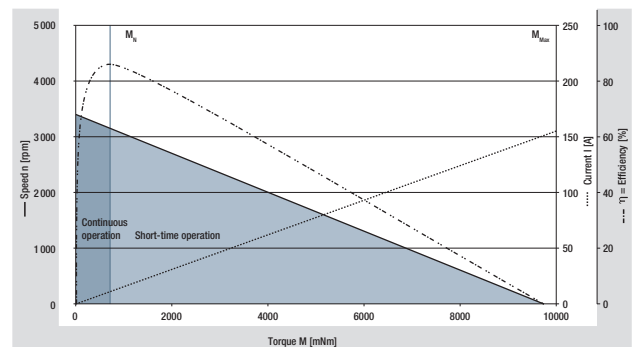
Characteristic curve

M8040, 24 V (at 25 °C)



Subject to alterations

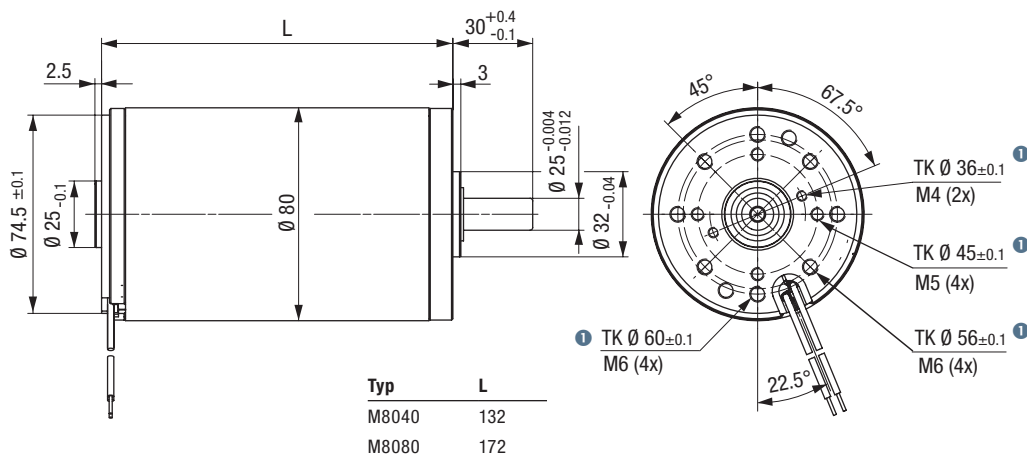
M8080, 24 V (at 25 °C)



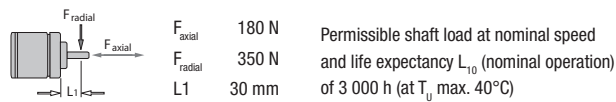
Subject to alterations

Technical drawing

All dimensions in mm



① 10⁻¹ deep




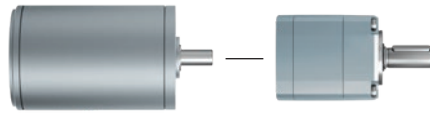
Electrical connection

Connection cable

Color	Function	
red	Power supply (+)	Cable length 300 ± 30 from motor Cable end 7 ± 2 stripped and tin-coated
black	GND (-)	

Change of the rotating direction is possible by polarity reversal of the wires

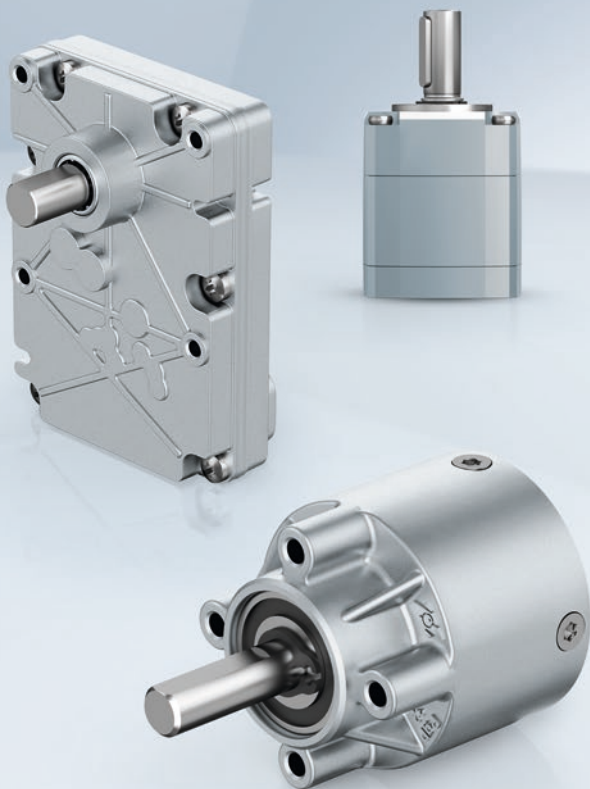
Modular construction kit

<p>Brake system</p> <p>Spring-applied braking BFK 457-03 (page 44)</p>	<p>Basic motor</p> 	<p>Planetary gearhead</p> <p>Optimax 63 (page 36)</p>
<p>Encoder system</p> <p>Optical incremental encoder HEDS 5500 (page 42)</p>		

For motor-gearbox combinations, depending on the choice of the single components, the maximum allowable torque (gearbox) can be exceeded or respectively not reached.



Gearheads.



Performax® 32 (planetary gearhead)	34
Optimax 63 (planetary gearhead)	36
Flatline 78 (spur gearhead)	38
Information on operating factor, lifetime, efficiency	50

Planetary gearheads.

Performax® 32



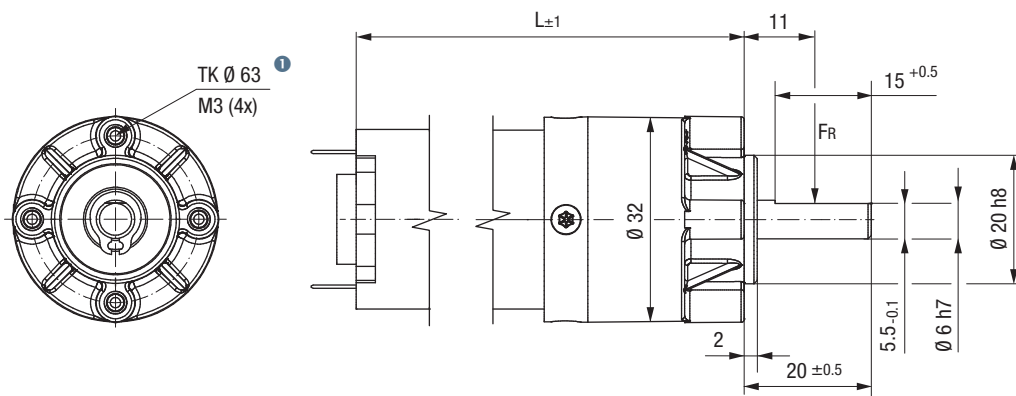
Image of 2-stage gearhead

- High power density of compact dimensions
- Very quiet operation due to helical teeth in the first gear stage
- Planetary wheels made of plastic with optimized sliding properties in the first stage ensure smooth operation
- Large effective diameter thanks to radial screw connection
- Economic setup due to the use of many finished casting individual parts

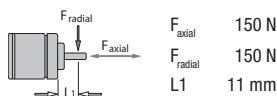
Nominal data												
Gearheads		Performax® 32.1				Performax® 32.2						
Reduction ratio		3.2	5	9*	17*	21.3	30	38.3*	54*	72.3*	102*	204*
No. of stages		1				2						
Efficiency		0.9				0.81						
Max. input speed (n_i)	rpm	6 000				6 000						
Rated output torque (M_{ab})	Nm	0.75	0.68	0.45	0.25	2.59	3.67	1.72	2.44	0.94	1.33	3.53
Short-term torque (M_{max})	Nm	1.88	1.70	1.125	0.63	6.48	9.175	4.30	6.10	2.35	3.33	8.8
Gear play	°	0.7 ... 1.2				0.7 ... 1.2						
Permissible operating temperature (T_{v})	°C	-20 ... +80				-20 ... +80						
Operating mode		S1				S1						
Protection class	IP	50				50						
Weight	kg	0.10	0.10	0.13	0.13	0.13	0.13	0.16	0.16	0.16	0.16	0.16
Shaft load radial / axial	N	150 / 150				150 / 150						
Service life**	h	5 000				5 000						
Lubrication		Maintenance-free grease lubrication for life										
Installation position		any										
Subject to alterations		* Gear with clutch pinion: With the clutch pinion, the gearbox is extended by one empty stage ** The service life can be reduced when combined with a motor										

Technical drawing

Image of 1-stage gearhead / 2-stage design completely cylindrical / All dimensions in mm



1 6⁺¹ deep



Permissible shaft load at nominal speed and life expectancy L_{10} (nominal operation) and operating factor $C_g = 1$ (see page 50) of 5 000 h (at T_u 40°C).

Length of the possible motor / gearhead combinations

Motor / gearhead		L - 1-stage	L - 2-stage
M2820-P32	mm (without clutch pinion)	81.2	94.9
	mm (with clutch pinion)	94.9	108.6
M2840-P32	mm (without clutch pinion)	101.2	114.9
	mm (with clutch pinion)	114.9	128.6

Subject to alterations

Planetary gearheads.

Optimax 63



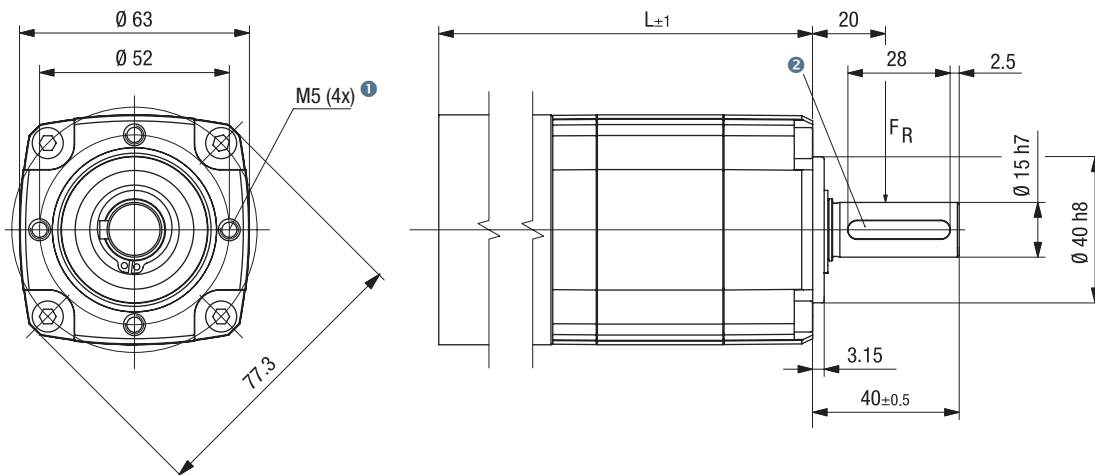
Image of 1-stage gearhead

- Extreme high overload capability to cope with peak torques
- Robust gearhead concept for extended service life
- Modular design and interfaces for maximum flexibility within ebm-papst modular system
- High efficiency realized in a compact design
- Noise optimized version with planetary wheels made from high-strength plastic
- Protection class IP 50 (optional IP 54)

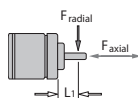
Nominal data								
Gearheads		Optimax 63.1			Optimax 63.2			
Reduction ratio		3.0	5.0	9.0	9.0	15	25	45
No. of stages		1			2			
Efficiency		0.90			0.81			
Max. input speed (n_i)	rpm	6 000			6 000			
Rated output torque (M_{ab})*/**	Nm	40.0 (13.0)	40.0 (13.0)	25.0 (6.00)	68.0 (35.0)	68.0 (58.0)	68.0 (58.0)	58.0 (27.0)
Short-term torque (M_{max})**	Nm	120.0 (39.0)	120.0 (39.0)	75.0 (18.0)	150.0 (105.0)	150.0 (150.0)	150.0 (150.0)	150.0 (81.0)
Gear play	°	< 0.9			< 1.2			
Permissible operating temperature (T_{ij})	°C	-30 ... +90			-30 ... +90			
Operating mode***		S1 / S3			S1 / S3			
Protection class	IP	50			50			
Weight	kg	1.3			1.9			
Shaft load radial / axial	N	500 / 500			500 / 500			
Service life****	h	10 000			10 000			
Lubrication		Maintenance-free grease lubrication for life						
Installation position		any						
Subject to alterations	* In S1 operation ** Value 1 applies to planetary gears (single stage) made from high-strength steel Value 2 (in brackets) applies to planetary gears (single stage) made from high-strength plastic *** $M_{ext} = M_{ab}$ **** The service life can be reduced when combined with a motor							

Technical drawing

Image of 1-stage gearhead / All dimensions in mm



- 1 15 deep
- 2 Fitted key DIN 6885 A-5x5x28



F_{axial} 500 N
 F_{radial} 500 N
 L_1 20 mm

Permissible shaft load at nominal speed and life expectancy L_{10} (nominal operation) and operating factor $C_b = 1$ (see page 50) of 10 000 h (at T_u 40°C).

Length of the possible motor / gearhead combinations

Motor / gearhead		L - 1-stage	L - 2-stage
M8040-063	mm	203	234
M8080-063	mm	243	274
Subject to alterations			

Spur gearheads.

Flatline 78



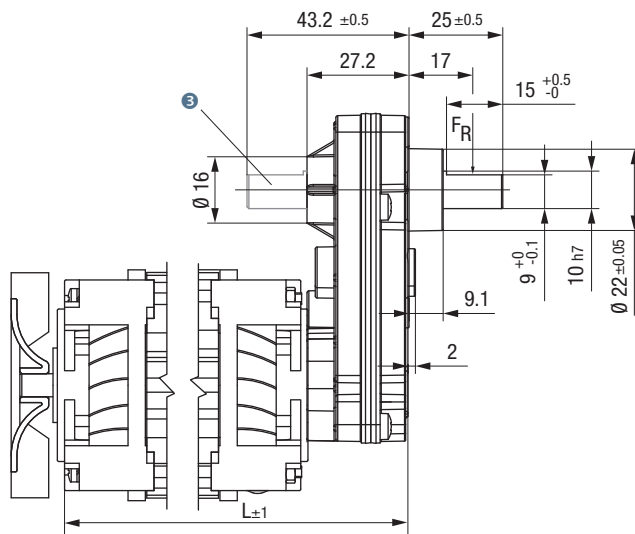
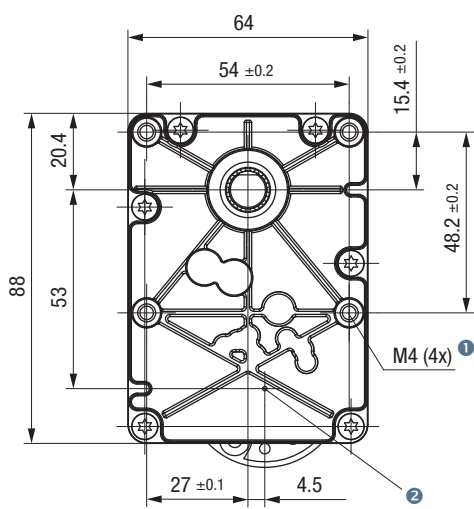
- Optimized installation length due to flat gear design
- Large reduction range
- Flexible connection to customer applications due to different available output shafts
- Use of alternative toothing materials as standard
- Maintenance-free over entire service life

Nominal data

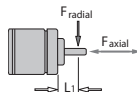
Gearheads		Flatline 78.3					Flatline 78.4	
Reduction ratio		38.6	65.2	82.8	106.1	140.8	191.9	252.6
No. of stages		3					4	
Efficiency		0.73					0.66	
Max. input speed (n_i)	rpm	4 000					4 000	
Rated output torque (M_{ab})	Nm	1.10	1.50	2.30	2.60	3.20	4.70	6.10
Short-term torque (M_{max})	Nm	2.80	3.80	5.80	6.50	8.00	12.0	15.0
Gear play	°	0.8 ... 1.8					0.8 ... 1.8	
Permissible operating temperature (T_U)	°C	-20 ... +80					-20 ... +80	
Operating mode		S1					S1	
Protection class**	IP	50					50	
Weight	kg	0.30					0.30	
Shaft load radial / axial	N	300 / 50					300 / 50	
Service life*	h	5 000					5 000	
Lubrication		Maintenance-free grease lubrication for life						
Installation position		any						
Subject to alterations		* The service life can be reduced when combined with a motor ** Classification of protection class refers to installed state with sealing on the flange side						

Technical drawing

All dimensions in mm



- 1 7 deep
- 2 Motor centre
- 3 Alternative shaft outlet on the motor side by request



F_{axial} 50 N
 F_{radial} 300 N
 $L1$ 17 mm

Permissible shaft load at nominal speed and a life expectancy L_{10} (nominal operation) and operating factor $C_g = 1$ (see page 50) of 5 000 h (at T_u 40°C).

Length of the possible motor / gearhead combinations

Motor / gearhead	L	
KM 4020-F78	mm	109
KM 4030-F78	mm	119
KM 4040-F78	mm	129
KM 4050-F78	mm	139
KM 4060-F78	mm	149
KM 4320-F78	mm	110
KM 4330-F78	mm	120
KM 4340-F78	mm	130
KM 4350-F78	mm	140
KM 4360-F78	mm	150

Subject to alterations



Accessories.



Optical encoder system	42
Brakes	44
Power supply unit	46

Optical encoder system.

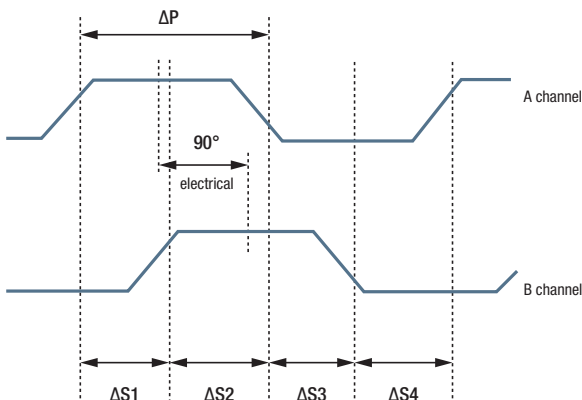


- Opto-electronic 2- and 3-channel incremental encoder.
- A corresponding evaluation in an external controller will achieve a resolution of max. 2048 increments per revolution
- The encoder is contactor-less and wear-free. The rotary angle resolution is achieved by means of an LED, a metallic encoder disk and a photo-diode array
- Electrical protection IP 40
- Temperature range -40°C to +100°C
- Additional resolutions and interfaces possible

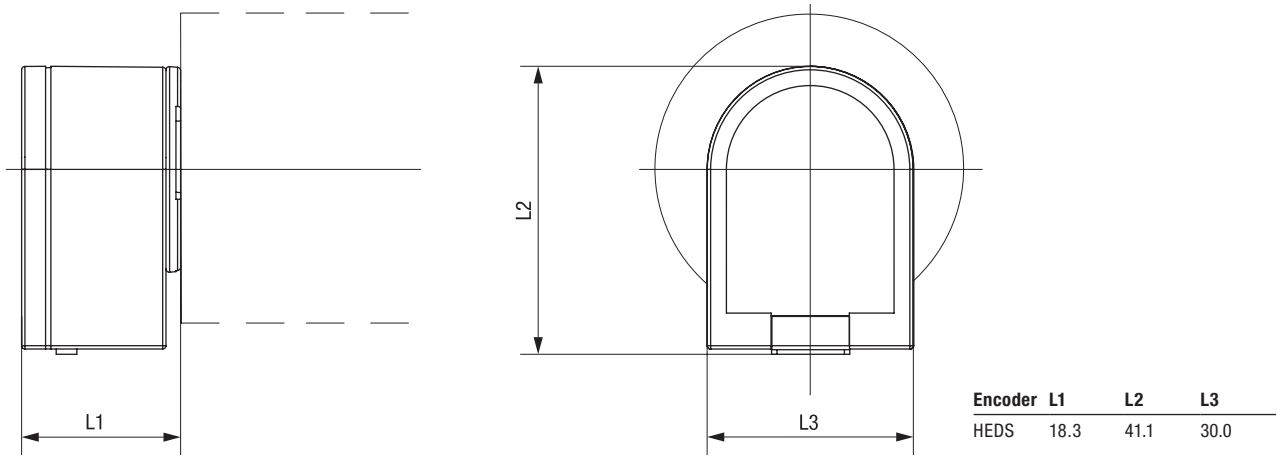
Important! Do not use in applications in which failure of the encoder interferes with the safety-relevant functions. If in doubt, consult the manufacturer.

Encoder systems		
		HEDS 5500
No. of pulses Z		512 per revolution (channel A and B)
Output signal A, B		2 rectangular signals (90° phase offset; TTL-compatible)
Reaction frequency [f]		100 kHz
Supply voltage [U _p]	V	+ 5 ± 10%
Power consumption [I _p]	mA	type 17 max. 40
Deviation, pulse width [Δ _s]		type 5° (from electrical 90°)
Deviation, phase shift [Δ _p]		type 7° (between channel A and B from electrical 90°)
Electrical connection		AMP: 103686-4 or 600442-5
Connector type		Berg: 65039-032 with 4825X-000 terminals or 65801-034 Molex: 2695 with 2759 terminals
Weight	kg	0.02
Subject to alterations		

Signal processing HEDS 5500

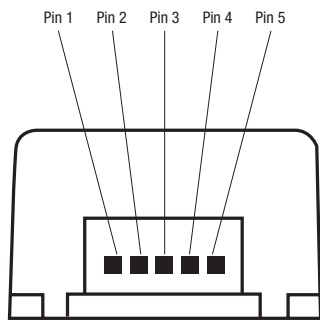


Technical drawing All dimensions in mm



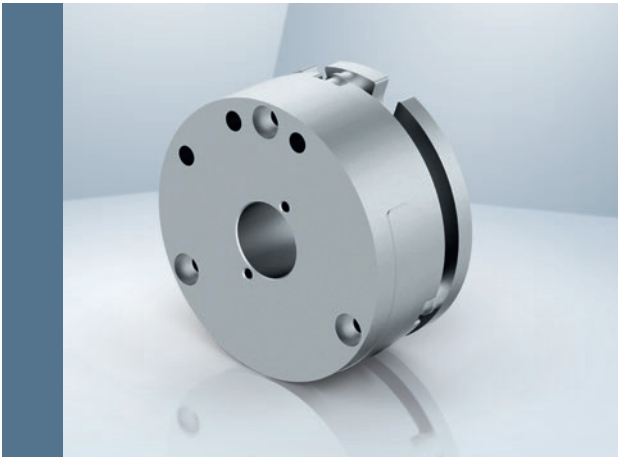
Electrical connection

HEDS 5500



Signal wire	
Pin	Function
1	GND
2	n.c.
3	A
4	U _B
5	B

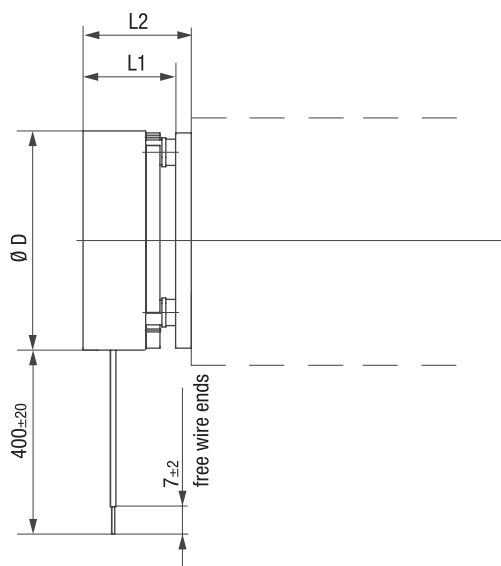
Brakes.



- Spring-applied braking
- Single-disk brakes with 2 friction contact surfaces
- Braking torque effective in powerless state
- Braking force is eliminated by electromagnetic force
- Holding brake with emergency stop function
- Currentless-operated brake with high power density
- Braking torque applied by spring force
- Reduced inertia for optimum dynamics

Brake system			
		external BFK 457-01	external BFK 457-03
Nominal voltage	V DC	24	24
Nominal power	W	5.00	9.00
Braking torque	Nm	0.12	1.00
Engagement time	ms	11.0	12.5
Disengagement time	ms	17.0	18.0
Subject to alterations			

Technical drawing All dimensions in mm



Brake type	Ø D	L1	L2
BFK 457-01 (M28XX)	37	31.3	35.3
BFK 457-03 (M80XX)	56	27.7	37.3

Electrical connection

Connection cable	
Color	Function
red	Power supply
black	GND

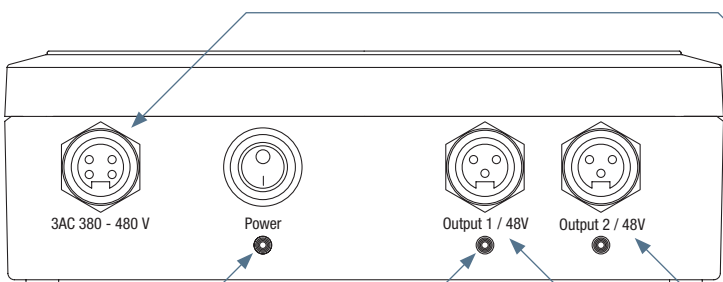
Power supply unit.



- Stable aluminium die cast housing
- Wide-range voltage input
- High overload capacity
- Status visualisation via LED
- On/Off switch
- Protection class: I (PE-connection required)

Nominal data				
		PS480-24-1	PS320-24-2	PS480-48-1
Output voltage	V DC	1 x 24.5 ±3%	2 x 24.5 ±3%	1 x 48 ±3%
Constant output power	W	1 x 480	2 x 160	1 x 480
Peak output power	W	max. 880	max. 2 x 440	max. 880
Protection against overvoltage (DC output side) ²	V	Permanent shutdown at ≥ 35 V		Permanent shutdown at ≥ 60 V
Resistance to feedback	V DC	< 35		< 60
Efficiency ¹	%	93		
Input voltage	V AC	380 - 480 (3~)		
Input operating voltage range	V AC	330 - 550 (3~)		
Input rated current ¹	A	< 1.0 (at 3 x 400 V AC, 50 Hz) < 0.8 (at 3 x 480 V AC, 50 Hz)		< 0.8 (at 3 x 400 V AC, 50 Hz) < 0.8 (at 3 x 480 V AC, 50 Hz)
Input peak current	A	< 4 (at 3 x 400V AC, 50 Hz)		
Input rated frequency	Hz	50 - 60 Hz		
Excess temperature protection ²		Permanent shutdown		
Phase error ¹		guaranteed at 2-phase operation (but reduction of service life and MTBF)		
Overvoltage category		III (according to EN50178)		
Separation of output / input		SELV, PELV IEC / EN 60950-1, EN50178 EN60204-1, IEC 60364-4-41		
Additional control input		not used => reduced power ≤ 100 W / channel		
Output ripple	mV	< 200		< 400
Overvoltage ²		Shutdown in the event of overvoltage		
Service life	h	50,000 at rated load in operation at 30 °C		
Protection class	IP	65		
Operating temperature	°C	-30 ... 40		
Weight	kg	2.3		
Dimensions (L x H x T)	mm	220 x 71 x 140		
Order no.		9920472002	9920472004	9920472003
Subject to alterations		¹ for Pout = 320 W ² to reset the power supply unit, switch off the on / off switch for ≥ 3 s		

Technical drawing All dimensions in mm



Visualisation (LED):

On/off switch

Lights up green:	3-phase operation
Flashes green:	2-phase operation

DC outputs

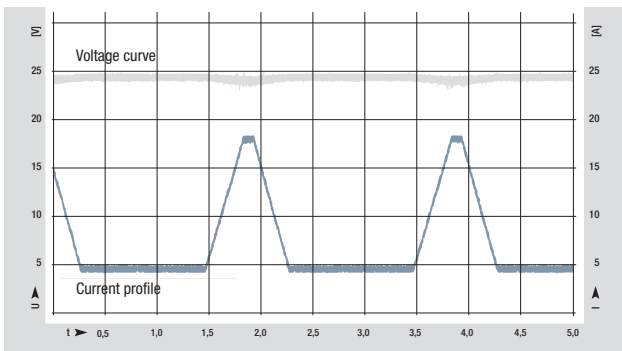
Lights up green:	Control input low, normal operation
Flashes green:	Control input low, normal operation, overload
Lights up green:	Control input high, power-limited operation
Flashes green:	Control input high, performance-limited operation, overload

Plug types:

3AC 380 - 480 V	AC input: Lumberg type RKW 40 Alternatively: Type RK 40
Output 1 / 48V Output 2 / 48V	PS320-24-2 / PS320-48-2 DC output: Lumberg type RSW 30 Alternatively: Type RS 30
Output / 48V	PS480-48-1 DC output: Lumberg type RSW 30 Alternatively: Type RS 30
Output / 24V	PS480-24-1 DC output: Cable connector 7.810.500.000 Crimp (pin) 7.003.983.101 Crimp contacts (pin) 7.010.982.001

Kennlinien

Current / voltage characteristic (example PS320-24-2):



Standards and Guidelines.

Basic information on standards and guidelines for electrical small-power motors and drive systems:

The CE label

In order to ensure a uniform safety level in the European internal market, the European commission has implemented a new approach for technical harmonization. This has been welcomed by all relevant parties and is visible in many products as a CE label giving proof of agreement with the harmonized provisions.



What does CE actually mean? Why don't all products bear the CE label?

CE is the abbreviation for "Communauté Européenne".

The harmonized statutory provisions are a framework directive and belong to the so-called New Approach. This framework directive defines the basic requirements, putting in circulation and operation as well as the applicable conformity assessment process. The manufacturer of a product must now decide which framework directive applies to which product. For electrical small-powered motors the following framework directive can be applied:

- 1) Machinery Directive 2006/42/EC
- 2) Low Voltage Directive 2014/35/EU
- 3) EMC Directive 2014/30/EU

EMC Directive 2014/30/EU

Because they are sold exclusively to customers who incorporate them into end devices and not to the end user, the electric motors do not fall under the application area of the EMC directive according to the definition of the term in Art. 3, Par. (2), 1: As the small motors are supplied to companies who incorporate them into end devices and not to the end user, ebm-papst has no control over further use of the pre-fabricated components in devices, machines or installations. Therefore, ebm-papst provides express notice that the system manufacturer must provide a suitable EMC circuit when selecting the power supply and must provide for EMC-compliant installation and use in the devices. For more information about EMC-compliant installation and EMC safety measures, refer to resources such as the IEC 61000-5-x series (Installation and Mitigation Guidelines).

Proper use

All motors in this catalog are determined for installation in permanently connected, stationary end devices and machines in the industrial area and must be operated on electricity only when in installed condition! Operation is prohibited until it has been ascertained that this product, along with the machine into which this product is to be installed, complies with the protective requirements of the Machinery Directive. If, when using our motors, market or application-specific product standards apply, compliance with these must be verified and ensured by the device manufacturer. This product is not intended for the end consumer.

RoHS **European Directive EC No. 2011/65/EU (RoHS)** **Legally regulated substances**

As an innovative company and trendsetter in the world of air technology and drive engineering, ebm-papst feels a special obligation towards the environment. Accordingly, under the GreenTech logo, we have implemented a comprehensive concept that extends from the origin to the use of our products. This includes, of course, protecting our environment and using natural resources in a way that conserves them. This applies equally to our manufacturing processes and to our products.

When developing our products, we already take into consideration any possible negative consequences they may have for the environment. Our goal is to prevent such environmental impact-even beyond the extent mandated by law-or to reduce it to a minimum, and thus to ensure sustainable development of our products. Thus we ensure that our products are free of materials and substances that are prohibited by law.

Of course, all current products have been designed for conformity with European Directive 2011/65/EU (RoHS). All older products that do not yet conform to these directives or parts thereof will be consistently redesigned. Our suppliers are required to provide us only with goods that conform to the directives. Thus we can confirm that basically, all of our products listed in this catalog conform to the above-mentioned directive. We are also available to help with any other questions you may have on both these topics.

REACH Directive (EC No. 1907/2006)

The EU legal regulation for Registration, Evaluation, Authorization and Restriction of Chemical substances (REACH) entered into force on 1 June 2007. This is a chemicals law intended to provide maximum protection to health and the environment. As defined by the REACH directive, ebm-papst is a downstream user. The units you purchase from us are products as defined by REACH and thus do not require registration. However, in our own interest and to ensure a high degree of product safety, we track the implementation of REACH and the resulting requirements as part of our duty to provide information. To comply with the requirements of REACH, we are in contact with all suppliers from whom we obtain chemicals (substances), preparations and components that we use as part of our production process. Within this framework, ebm-papst fulfills the obligations set forth in the REACH regulation. If you have any other questions about the implementation of the REACH directive in our company, please do not hesitate to contact us.

Operating factor, lifetime, efficiency.

Operating factor c_b

To achieve a uniform lifetime for the gearheads and motors, the necessary torques M must be increased by the respective operating factor c_b under the various operating loads so as not to exceed the maximum permissible gearhead torque $M_{2,max}$ (see table below).

Operating modes									
	Load			Operating period in h/day					
	even	gradual	sudden	3 h	8 h	24 h	3 h	8 h	24 h
				up to 10 switching ops./h			over 10 switching ops./h		
One rotation direction	•			1.00	1.00	1.20	1.00	1.20	1.52
Rotation direction change	•			1.00	1.30	1.59	1.20	1.59	1.92
One rotation direction		•		1.11	1.30	1.59	1.30	1.52	1.82
Rotation direction change		•		1.41	1.72	2.00	1.59	1.89	2.33
One rotation direction			•	1.20	1.52	1.82	1.52	1.82	2.22
Rotation direction change			•	1.59	2.00	2.33	2.00	2.33	2.86

Operating mode

It is necessary to define the operating mode under which a gear motor can be operated with certain nominal values in order to avoid overloading the motor and/or the gearhead. The values stated in this catalog refer to S1 operation (continuous operation). This means that the gear motor can be constantly operated with the stated values, but can also have a higher load placed on it for a short time. Please contact us if you require more information about this.

Lifetime

Lifetime is limited by the various components in the drive. If frequently overloaded, the gearhead components are subjected to more wear than under nominal load. Extreme ambient and operating conditions cause a reduction in the lifetime guaranteed for operation under operating ratio $c_b = 1$.

Efficiency η (eta)

The efficiency per gear stage is at least 90%. Depending on the tooth configuration and on the manufacturing quality, far better levels of efficiency can also be achieved. The following overall efficiencies were obtained for multi-stage gearheads:

Overall efficiency	
for 1-stage gearhead	$\eta = 0.9$
for 2-stage gearhead	$\eta = 0.9^2 = 0.81$
for 3-stage gearhead	$\eta = 0.9^3 = 0.73$
for 4-stage gearhead	$\eta = 0.9^4 = 0.66$
for 5-stage gearhead	$\eta = 0.9^5 = 0.59$

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