

# Drive technology for AC and DC

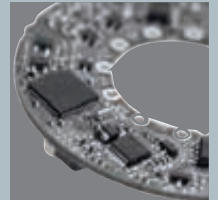
version 2011



The engineer's choice

**ebm**papst

*The right product  
for every requirement*



## Trendsetters in drive technology

Welcome to ebm-papst, the leaders and innovative trendsetters in drive technology. With constant customer focus, unrelenting pioneering spirit and over 60 years of application expertise, we develop intelligent solutions that set standards in performance, flexibility, efficiency and reliability throughout the world.

Drive technology without our modern AC and DC motors from 1 to 1500 watts is unthinkable. Virtually a legend: The ebm-papst EC motors – as external rotor or internal rotor motors. Renowned for their reliability, they are used in medical technology, in computer, textile and printing industries as well as in many other sectors.

“ebm-papst is your partner for drive solutions that do not yet exist” – the application's service for our customers is proverbial and based on sound advice on applications and an extensive sales service. In dialogue with you, we develop optimum drive concepts so that your solution transfers smoothly into production.

Insist on ebm-papst.



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## Company profile: ebm-papst

The entire scope of ventilation and drive technology: this is the world of ebm-papst. More than 10,000 people – in Germany and throughout the world – develop, produce and sell our motors and fans. Our global presence and unique range of products based on a quality standard that surpasses all others have made us what we are: the world market leader in motors and fans. Expertly knowing what our customers need and incessantly striving to arrive at the perfect application solution for a wide variety of different industries is what determines our daily work. Those who know us know the high standards we apply to our work and know our creed: to be as close to our customers as possible and to simply be the best in terms of innovation and reliability.



*Our location in St. Georgen*



*Left:  
Our headquarters in Muldingen  
Right:  
Our location in Landshut*

### Our history – Our drive

Rooted in ebm, PAPST and mvl, the three leading innovators in the development and production of motors and fans, ebm-papst has established itself as the world market leader. Now as ever, our legendary inventive spirit shines through in products that set standards in many segments of industry worldwide. We are proud to say that despite difficult competition, our performance has always been exemplary and outstanding – in business, in our personal relationship with our customers, and of course with respect to technology and engineering. For decades, we have contributed to the world of air technology and drive engineering with small revolutions and large milestones.

To maintain this advantage in skills and knowledge to get maximum quality and thus the highest degree of customer satisfaction, our employees around the world put their passion and dedication to work for you.

### Passionately involved in R&D

Our catalogues just list the results of our incessant efforts in R&D: products of highest quality and reliability. After all, it is our passion to constantly try something new and improve what we have. In doing so, we take advantage of the latest development methods and state-of-the-art technology and invest quite heavily in R&D facilities. Best of all, though, we rely on excellently trained and skilled engineers and technicians to be at your service in R&D and Sales & Distribution.

### Producing and safeguarding high-quality products and services

This is our promise without any compromise. Whether produced in one of our six factories in Germany or one of our eleven international production sites, our products always have the same high level of quality. This quality control is something you can definitely rely on! And this across all levels of production and throughout all processes: providing consultation to customers, development, material selection through to picking certified, choice suppliers and on to the production of parts and final delivery. On top of this, our products have to numerous tests under all realistic operating conditions: continuous stress test, salt spray test, vibration test, or the precision noise measurement laboratory, just to mention a few.

And the product gets clearance for serial production only after all the desired characteristics have been determined to be just right.

Environmental care is another priority with ebm-papst. This is why we have developed our product line in EC technology, which makes for very low power consumption. Due to our manufacturing philosophy, there is absolute focus on environmental care in production, recycling, and waste disposal.

### Global Domestic

In order to be the specialist for customised solutions throughout the world, you need strong partners. Global Domestic – i.e. being present all over the world and being a national company in each individual country – is how we have established ourselves in all important markets around the globe with our successful subsidiaries. And so you will always find ebm-papst close to home, speaking your language, and knowing the demands of your markets.

Moreover, our worldwide production alliance serves as a basis for competitive pricing. Our global services and logistic's, i.e. IT networking, safeguard short reaction times and just-in-time delivery.

All our efforts are documented in a comprehensive quality management system, both for products and services. Being certified as compliant with the tough requirements of the international standards DIN EN ISO 9001, ISO/TS 16949-2 and of standard DIN EN ISO 14001 is just one seal of approval we have received for our unceasing efforts to provide only the best quality products and services.

Sustainability is at the centre of our thoughts and actions. Out of conviction!

*Eco-friendliness and sustainability have always been at the core of our thoughts and actions. For decades, we have worked according to the simple but strict creed of our co-founder Gerhard Sturm: "Each new product we develop has to be better than the last one in terms of economy and ecology." GreenTech is the ultimate expression of our corporate philosophy.*





#### **GreenTech is pro-active development.**

Even in the design phase, the materials and processes we use are optimised for the greatest possible eco-friendliness, energy balance and – wherever possible – recyclability. We continually improve the material and performance of our products, as well as flow and noise characteristics. At the same time, we significantly reduce energy consumption. Close co-operation with universities and scientific institutes and the professorship we endow in the area of power engineering and regenerative energies allows us to benefit from the latest research findings in these fields – and at the same time ensure highly qualified young academics.

#### **GreenTech is eco-friendly production.**

GreenTech also stands for maximum energy efficiency in our production processes. There, the intelligent use of industrial waste heat and ground-water cooling, photovoltaics and, of course, our own cooling and ventilation technology are of the utmost importance. Our most modern plant, for instance, consumes 91% less energy than currently specified and required. In this way, our products contribute to protecting the environment, from their origin to their recyclable packaging.

#### **GreenTech is acknowledged and certified.**

Every step in our chain of production meets the stringent standards of environmental specialists and the public. The 2008 Environmental Prize of Baden-Wuerttemberg, the Green Award 2009, the Energy Efficiency Award 2009 of the dena – to give just a few examples – testify to this. The environmental advantage gained in the performance of the products developed from our GreenTech philosophy can also be measured in the fulfilment of the most stringent energy and environmental standards. In many instances, our products are already well below the thresholds energy legislation will impose a few years from now – several times over.

#### **Our customers profit from this every day.**

The heart of GreenTech is future-oriented EC technology from ebm-papst. The EC technology at the core of our most efficient motors and fans allows efficiency of up to 90%, saves energy at a very high level, significantly extends service life and makes our products maintenance-free. These values pay off not only for the environment, but every cent also pays off for the user! All ebm-papst products – even those for which GreenTech EC technology does not (yet) make sense from an application viewpoint – feature the greatest possible connection of economy and ecology.

## Electronic motor commutation

To produce a motor torque, the field windings in the stator of the motor receive a current. The resulting magnetic field reacts against the permanent magnetic field of the rotor, generating a torque. In order to ensure that the rotor continuously rotates, the current in the winding must be commutated. In conventional DC motors, the commutation necessary for constant rotation of the armature is achieved mechanically using a commutator and brushes. Thanks to modern semi-conductor technology, this mechanical commutation can be replaced by a non-contacting, electronic circuit.

The magnet is in the form of a rotor, and field windings that are distributed over the circumference of the stator are each connected to the voltage source via one or more transistor switches. The transistor switches are controlled depending on the position of the magnetic rotor. For determining the position of the rotor, Hall effect sensors are used-, one or more rotor position encoders positioned on the printed circuit board of the motor. Such motors are referred to as electronically commutated motors, in short EC motors.

The most distinct advantages of this type of motor: The EC motor sidesteps the disadvantages associated with the mechanical commutator such as, commutator wear, brush friction, accumulation of dust due to abrasion, noises, starting difficulties due to corrosion of the commutator segments and high-frequency interference caused by sparking.

A distinguishing feature of the EC motor is its compact size. Furthermore, the commutation electronics can be equipped at comparably low cost with an electronic control unit for maintaining a constant speed. The rotor position sensors are additionally used for determining the actual speed. The considerably better service life values in comparison to the brush DC motors are also a major feature.



Motor principles

The ebm-papst EC range is based on two types of motor that have completely different construction features: on the one hand, the external rotor motors of the VARIODRIVE, VARIODRIVE Compact and VarioDrive C series; on the other, the internal rotor motors of the ECI, ECI Compact and BG series.

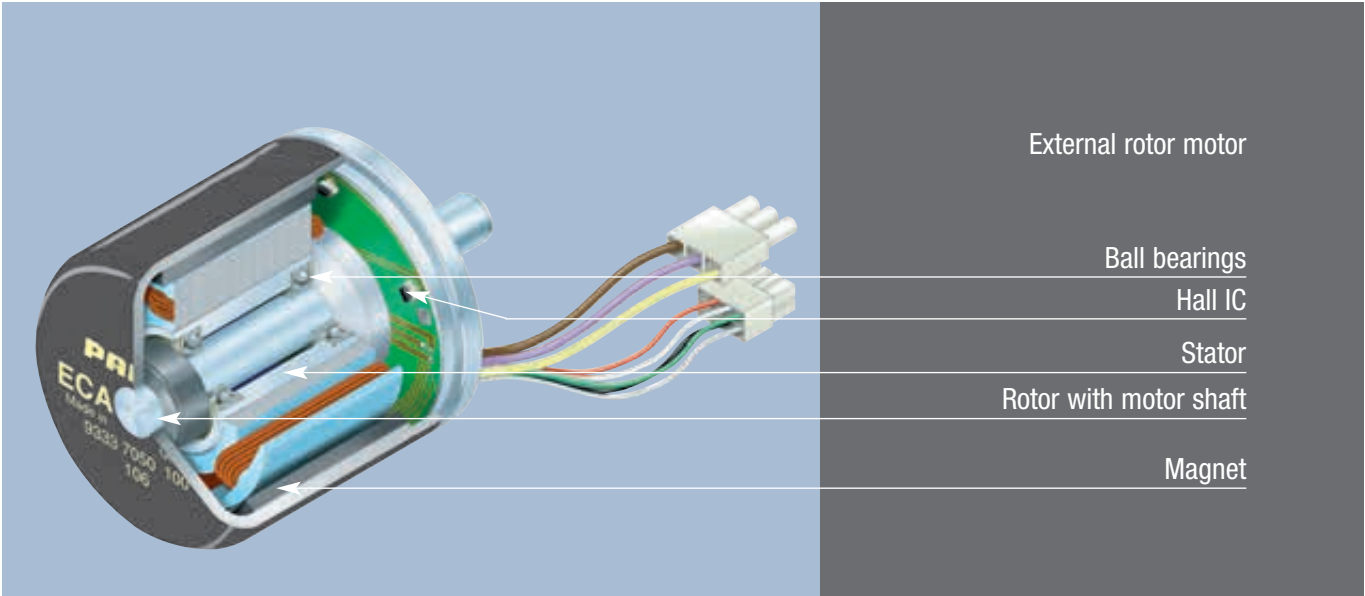
Each of these 6 series has an independent performance profile that is not only underlined by highly sophisticated motor characteristics but is also of economic significance. Detailed information can be found in the introductory passages of the individual product groups.

Another classifying feature for distinguishing between the internal and external rotor motor design is the basic structure of the winding and the active motor parts. Here, it is primarily the number of grooves of the stator and the number of pole pairs of the magnet rotor that are of key significance.

For the activation of the motors, we can make a basic distinction between the simpler variant of block commutation and the more elaborate one with sinus commutation. For block commutation, the number of switching pulses results from the number of phases of the winding and the number of poles of the rotor. For sinus commutation, the commutation of the current in all 3 winding phases is continuous. In this process, based on a continuous sine/cosine sensor signal, the 3 winding phases are energised by a high-frequency PWM modulation with sinusoidal phase-shifted currents for each, which enables smoother running behaviour and lower speeds.

The external rotor motor

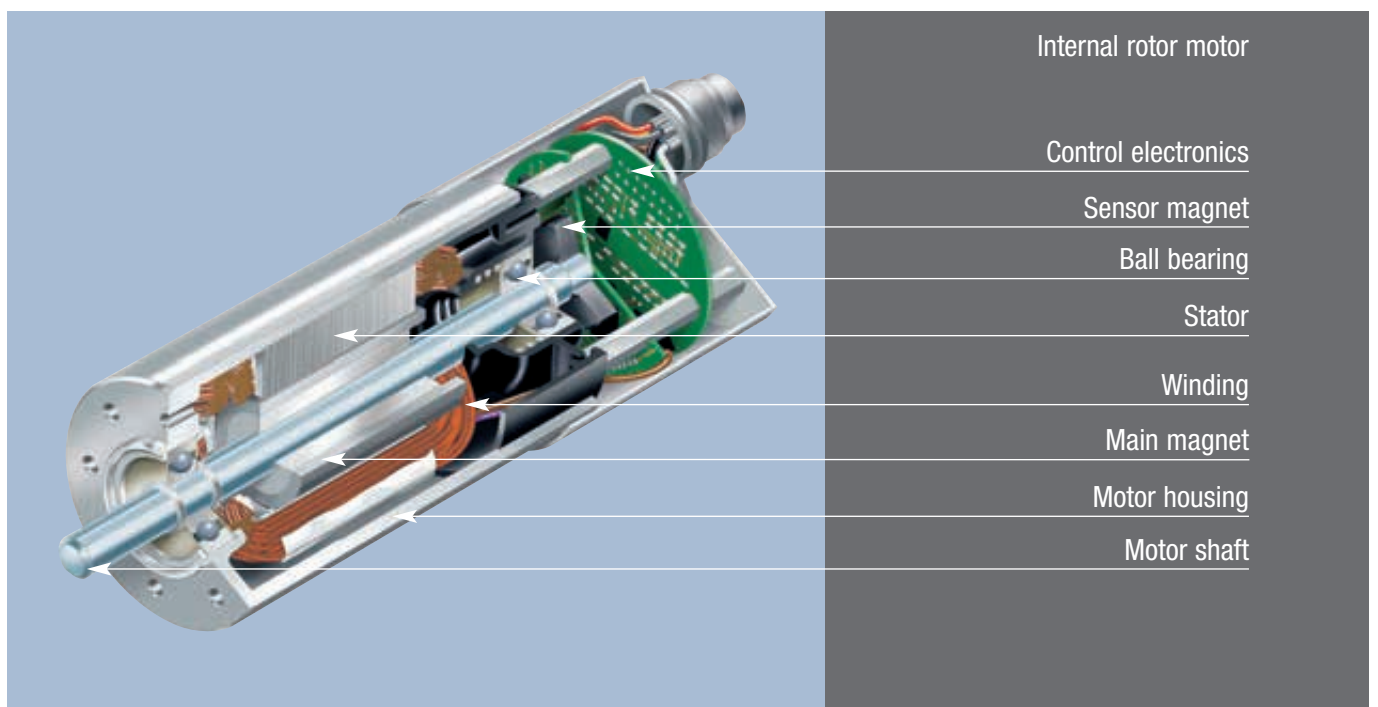
In external rotor motors, the bell-shaped rotor is firmly connected to the shaft and revolves around the stationary stator. The motor flange is extended axially to support the stator with windings and the printed circuit board. Magnetic field sensors (Hall ICs) in the main field are used to determine the rotor position. Compared to the internal rotor motor, the magnets are fixed on a greater diameter providing not only a larger magnetic volume but also a concentration of magnetic flux to the stator inside. Furthermore, the same electromagnetic force and the greater air gap diameter result in a higher torque.



## The internal rotor motor

The magnets of the internal rotor motor are situated directly on the shaft together with a ferromagnetic bushing to close the magnetic circuit. The stator lamination in the housing enables excellent cooling of the winding. The bearings are situated in both flanges, flush-fitted to the housing. The use of high-energy magnetic materials guarantees full utilisation of the physical dimensions. Magnetic sensors in the main field or in the field of a sensor magnet are used to determine the rotor position. Internal rotor

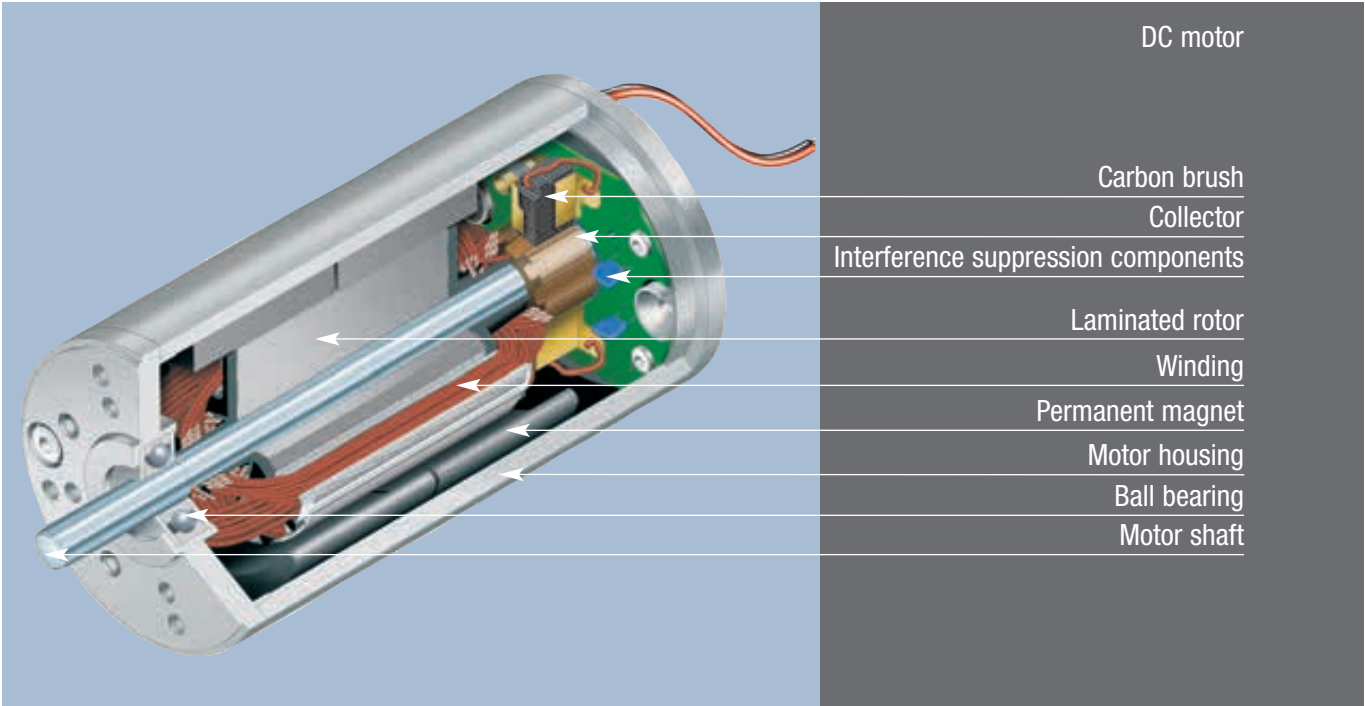
motors are more suitable than external rotor motors for functional drives. The low moment of inertia of the small, internal rotor enables a quick change of speed and direction of rotation. Thanks to specially selected materials, an extremely high power density can be achieved also in combination with miniaturised integrated electronics. In comparison to the external rotor motor, a higher protection class is also possible. Due to the two usable shaft ends, internal rotor motors provide greater versatility for the application of additional system or functional elements, e.g. brakes or encoders or tachogenerators for speed sensing and motor control. Versions with B-side completely integrated 4-quadrant speed control operating electronics are available off the shelf, ready to be connected.



The mechanical motor commutation

In permanent magnet direct current motors, the principle of the current-carrying wire loop in the magnetic field, on which an electromagnetic force works, is implemented directly. In motors of this type, the current supply to the rotating rotor windings and the reversal (commutation) of the current take place mechanically using what are called carbon brushes. These contact elements consist of a low-friction graphite material with copper mixed in to improve the conductivity. To transmit the required currents safely and reliably, these contact elements are pressed against the commutator by spring pre-tension. When the supply voltage is switched on, a current flows through the winding via the two carbon brushes and the armature starts turning. Due to the resulting rotation and the split of the commutator into many parts, the necessary conversion of the current in the rotor winding takes place automatically, and a continuous rotation results.

Brush-commutated direct current motors (DC motors) feature outstanding efficiency and a high start-up torque. Thus they are particularly well suited for applications that need a high start-up torque or good dynamics in short-term operation. The easily described operating performance also allows brush motors to be operated in a wide speed range by simply changing the applied supply voltage. Therefore, they are of interest as a simple, powerful and robust drive solution for a wide variety of applications.



### The KM capacitor motor

KM motors are 2- or 4-pole single-phase asynchronous motors with a main winding and an auxiliary winding. To generate a rotary field, the operating capacitor, which is switched in series with the auxiliary winding, attains a phase shift of the main and auxiliary winding. Compared to AC shaded-pole motors, the KM motors feature better efficiency and a higher start-up torque. This motor family includes a total of three different models, one with open housing (IP00), another with semi-open (IP20) and another with closed motor housing.

### Facts and figures

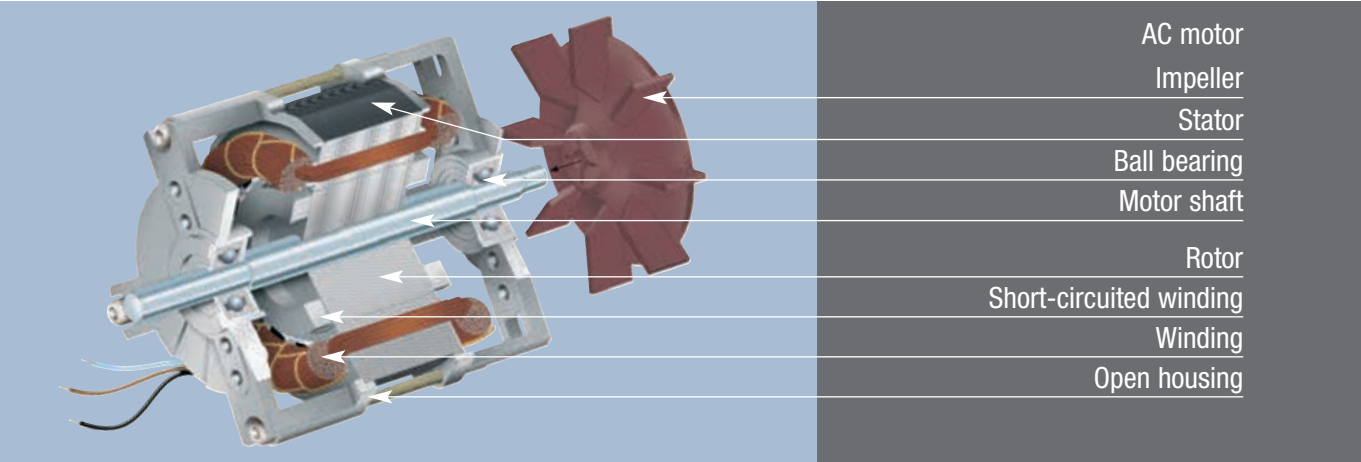
- Power range (depending on the motor package height and number of poles): rated output up to 300 watts, rated torque up to 70 Ncm  
An extension of the power range is possible for short-time operation (S2)
- Nominal voltage/frequency: 230V / 50Hz  
(Adaptation of the motor winding possible for other voltages and frequencies, e.g. 115V/60Hz)
- Direction of rotation: clockwise (also suitable for counter-clockwise rotation if current flow is changed)
- Insulation material class F (VDE/EN)
- Bearing system with two ball bearings
- Shaft diameter: 8mm (optionally, 10mm or 12mm possible)

- Drive-side shaft end: 25mm (up to 300mm possible for custom applications)
- Mounting position: any (longer service life for horizontal shaft)
- Various customer-specific designs available on request

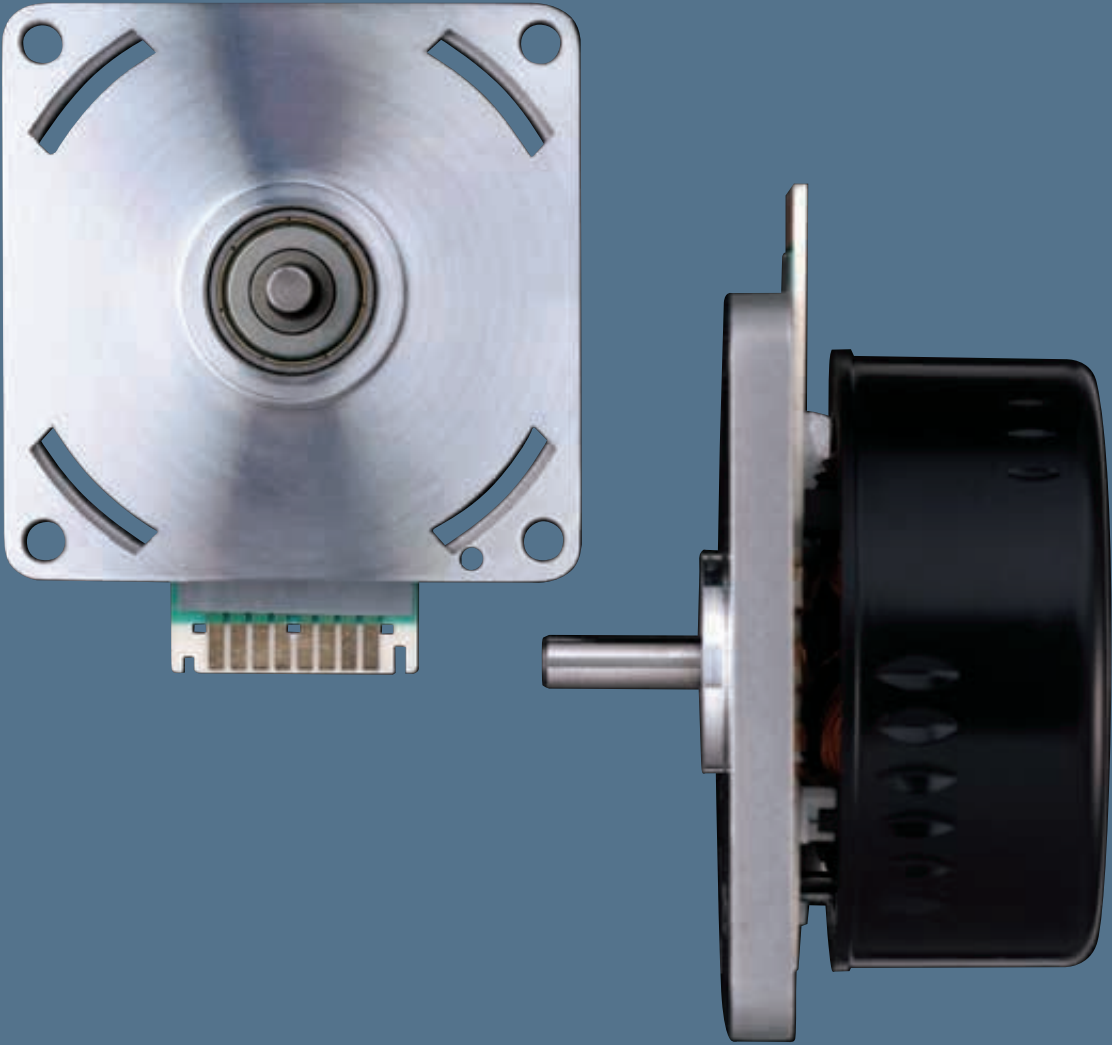
### Application areas

- Drive motor for gearbox (including spur, planetary and worm gear units)
- Tangential fans (e.g. underfloor convection heating)
- Centrifugal and axial fans (e.g. exhaust gas blowers)
- Circulation blower for hot air with impeller > 150mm (including ovens and other commercial applications)
- Drive motor for pumps (membrane, gear, submersible circulation and recirculating pumps, condensers and compressors)
- Heating engineering in solid fuel burners (including exhaust blowers, screw drives for conveying heating pellets, wood chips or combustion products)
- Locking systems and door/gate drives (garage door and roll-down gate drives, etc.)
- Polishing and grinding machines
- Medical applications (centrifuges, lifting devices such as adjustable operating tables, massagers etc.)
- Office equipment (e.g. postage meters, money counting and billing machines, file shredders, paper shredders or copiers)
- Conveying and handling equipment (keg pumps, filling systems, single-roll drives for conveyor belts etc.)
- Packaging machines (binding machines, shrink wrap machines, etc.)
- Food and food service machines (ice crushers, cutting machines, beverage tapping units, bottle coolers, beverage and sales vending machines etc.)
- Various special applications such as film developing machines (such as X-ray film), tank exhaust systems

The data listed on the following pages pertain to continuous operation S1 at the nominal voltage and frequency. A performance increase is possible for short-term operation (S2).



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## Technical information



VARIODRIVE offers you the extensive power range and dynamics of a modern EC drive with a price-performance ratio previously believed inconceivable. The motors and motor electronics of this product line originated essentially from the basic elements of the renowned ebm-papst DC fans. Production processes and material procurement benefit from the millions of fans produced. This formed the basis for 5 sizes of 3-phase EC external rotors in an extensive performance range.

With high operating efficiency – in other words, with low energy consumption and high motor performance – these motors are a convincing solution, offering a wide speed range and excellent control characteristics. High torque constant, no vibration and virtually noiseless running are further advantages of these motors.

A new addition to the VARIODRIVE motors is size VD-3-49.15. In addition to the basic strengths of the VARIODRIVE series, this motor has a multipole design and thus features outstanding high power density and powerful torque as well as IP 54 protection, even in the basic version. Thus it is exceptionally well suited for tough applications in the industrial environment.

### Facts and figures

- 3-phase external rotor motors in 5 different sizes
- EC technology for long service life and silent running
- Power range: 5 to 100 watts
- Precision ball bearings

# VARIODRIVE motor

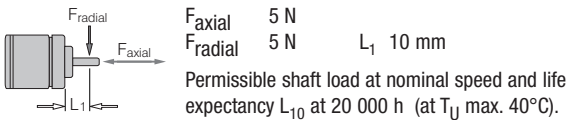
VD-3-25.07



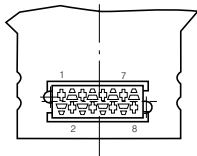
- 3-phase, 6-pulse external rotor motor.
- EC technology.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Rotor position detection via 3 Hall sensors.
- Motor supply and control via external operating electronics.
- Customer-specific winding layout and / or motor part sets available on request.

## Nominal data

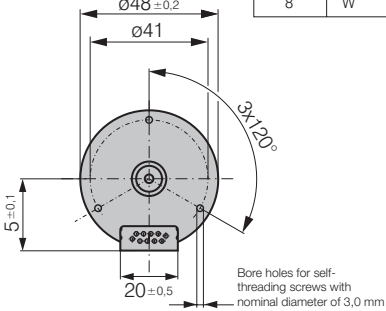
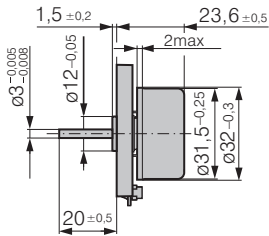
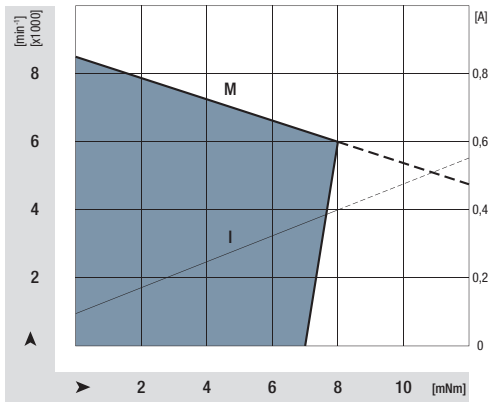
Type		VD-3-25.07 B01
Nominal voltage ( $U_{BN}$ )	V DC	24
Nominal speed ( $n_N$ )	rpm	6 000
Nominal torque ( $M_N$ )	mNm	8,0
Nominal current ( $I_{BN}$ )	A	0,4
Nominal output power ( $P_N$ )	W	5
Speed at no-load operation ( $n_l$ )	rpm	8 500
No-load current ( $I_{BL}$ )	A	0,095
Permanent stall torque ( $M_{BNO}$ )	mNm	7,0
Permissible eff. continuous stall current, motor lead ( $I_{n0eff}$ )	A	0,32
Permissible continuous stall power ( $P_{BNO}$ )	W	2,0
Short-term permiss. peak torque ( $M_{max}$ )	mNm	40
Permiss. peak current, motor lead ( $I_{max}$ )	A	1,8
Induced voltage ( $U_{imax}$ )	V/1000 rpm	2,78
Terminal resistance	$\Omega$	14,8
Terminal inductance	mH	8
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	4,3
Thermal resistance ( $R_{th}$ )	K/W	16,7
Protection class		IP 00
Ambient temperature range ( $T_U$ )	°C	0 to +40
Motor mass (m)	kg	0,055
Order No.		937 2507 000



**Operating electronics:**  
Adapted operating electronics  
DRIVECONTROL VT-A on request  
(adapter cable required)

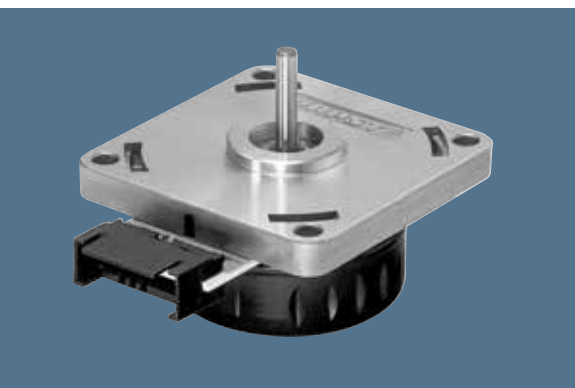


Pin position	Connection
1	GND
2	PS3
3	+Ub
4	PS2
5	PS1
6	U
7	V
8	W



# VARIODRIVE motor

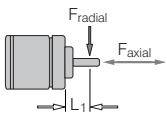
VD-3-35.06



- 3-phase, 6-pulse external rotor motor.
- EC technology.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Rotor position detection via 3 Hall sensors.
- Motor supply and control via external operating electronics.
- Customer-specific winding layout and / or motor part sets available on request.

## Nominal data

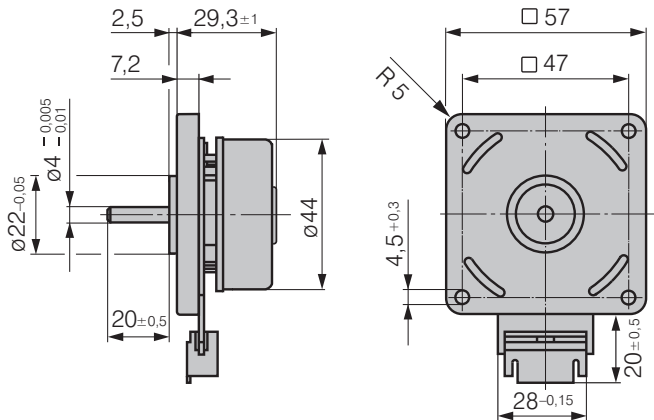
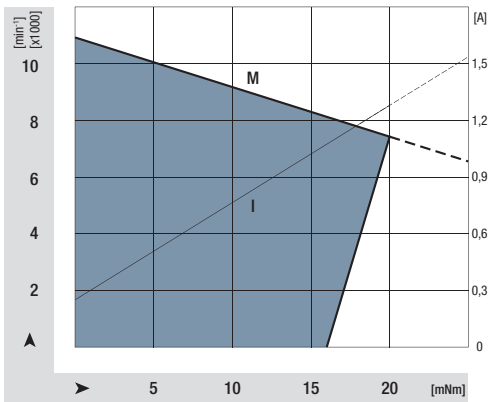
Type		VD-3-35.06 B01	VD-3-35.06 B00
Nominal voltage ( $U_{BN}$ )	V DC	24	24
Nominal speed ( $n_N$ )	rpm	7 500	3 700
Nominal torque ( $M_N$ )	mNm	20	20
Nominal current ( $I_{BN}$ )	A	1,25	0,8
Nominal output power ( $P_N$ )	W	16	8
Speed at no-load operation ( $n_l$ )	rpm	11 000	7 100
No-load current ( $I_{BL}$ )	A	0,25	0,16
Continuous stall torque ( $M_{BNO}$ )	mNm	16	16
Permissible eff. continuous stall current, motor lead ( $I_{n0eff}$ )	A	1,0	0,6
Permissible continuous stall power ( $P_{BNO}$ )	W	5,0	5,0
Short-term permiss. peak torque ( $M_{max}$ )	mNm	69	69
Permiss. peak current, motor lead ( $I_{max}$ )	A	4,0	2,5
Induced voltage ( $U_{imax}$ )	V/1000 rpm	2,19	3,52
Terminal resistance	$\Omega$	3,7	9,4
Terminal inductance	mH	2,5	6,4
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	16	16
Thermal resistance ( $R_{th}$ )	K/W	5,2	7,0
Protection class		IP 00	IP 00
Ambient temperature range ( $T_U$ )	°C	0 to +40	0 to +40
Motor mass (m)	kg	0,120	0,120
Order No.		937 3506 000	937 3506 010



$F_{axial}$  5 N  
 $F_{radial}$  20 N  $L_1$  10 mm  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).

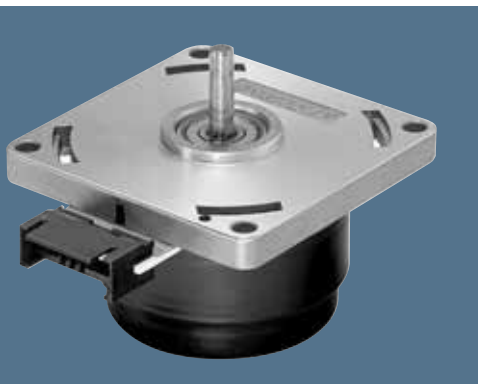
## Operating electronics for speed-controlled operation:

for Order No. 937 3506 000 = DRIVECONTROL VT-A / Order No. 937 1201 001  
 for Order No. 937 3506 010 = DRIVECONTROL VT-A / Order No. 937 1201 002



# VARIODRIVE motor

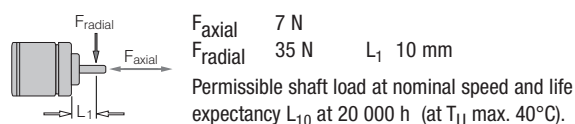
VD-3-43.10



- 3-phase, 6-pulse external rotor motor.
- EC technology.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Rotor position detection via 3 Hall sensors.
- Motor supply and control via external operating electronics.
- Customer-specific winding layout and / or motor part sets available on request.

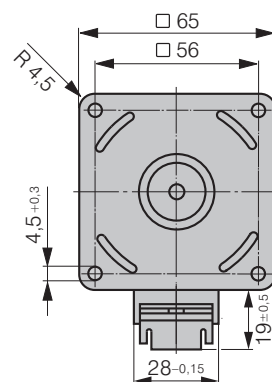
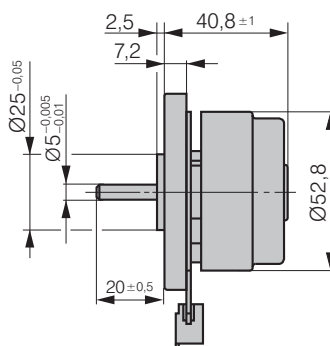
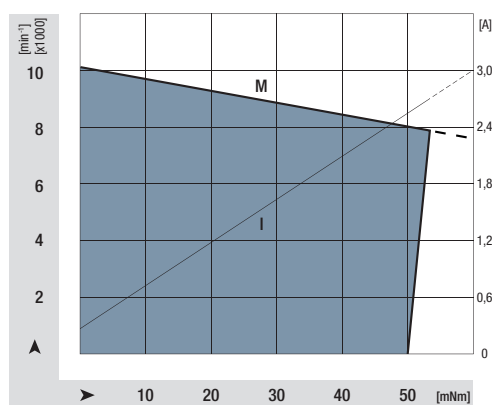
## Nominal data

Type		VD-3-43.10 B01	VD-3-43.10 B00
Nominal voltage ( $U_{BN}$ )	V DC	24	24
Nominal speed ( $n_n$ )	rpm	7 900	3 700
Nominal torque ( $M_N$ )	mNm	53	54
Nominal current ( $I_{BN}$ )	A	2,7	1,6
Nominal output power ( $P_N$ )	W	44	21
Speed at no-load operation ( $n_l$ )	rpm	10 200	8 000
No-load current ( $I_{BL}$ )	A	0,27	0,18
Continuous stall torque ( $M_{BNO}$ )	mNm	50	49
Permissible eff. continuous stall current, motor lead ( $I_{n0eff}$ )	A	2,7	1,8
Permissible continuous stall power ( $P_{BNO}$ )	W	10	10
Short-term permiss. peak torque ( $M_{max}$ )	mNm	110	110
Permiss. peak current, motor lead ( $I_{max}$ )	A	6,5	4,2
Induced voltage ( $U_{imax}$ )	V/1000 rpm	2,03	3,07
Terminal resistance	$\Omega$	0,96	2,3
Terminal inductance	mH	1,55	3,5
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	40	40
Thermal resistance ( $R_{th}$ )	K/W	4,11	4,75
Protection class		IP 00	IP 00
Ambient temperature range ( $T_U$ )	°C	0 to +40	0 to +40
Motor mass (m)	kg	0,24	0,24
Order No.		937 4310 000	937 4310 010



## Operating electronics for speed-controlled operation:

for Order No. 937 4310 000 = DRIVECONTROL VT-A / Order No. 937 1401 001  
for Order No. 937 4310 010 = DRIVECONTROL VT-A / Order No. 937 1401 002



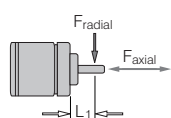
# VARIODRIVE motor

VD-3-54.14

- 3-phase, 6-pulse external rotor motor.
- EC technology.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Rotor position detection via 3 Hall sensors.
- Motor supply and control via external operating electronics.
- Customer-specific winding layout and / or motor part sets available on request.

## Nominal data

Type		VD-3-54.14 B01	VD-3-54.14 B00	VD-3-54.14 B02
Nominal voltage ( $U_{BN}$ )	V DC	24	24	24
Nominal speed ( $n_N$ )	rpm	5 600	3 700	6 200
Nominal torque ( $M_N$ )	mNm	150	150	150
Nominal current ( $I_{BN}$ )	A	5,1	3,6	5,7
Nominal output power ( $P_N$ )	W	88	57	97
Speed at no-load operation ( $n_l$ )	rpm	7 100	5 200	7 250
No-load current ( $I_{BL}$ )	A	0,41	0,26	0,43
Continuous stall torque ( $M_{BNO}$ )	mNm	115	115	135
Permissible eff. continuous stall current, motor lead ( $I_{n0eff}$ )	A	4,4	3,1	5,4
Permissible continuous stall power ( $P_{BNO}$ )	W	13	13	13
Short-term permiss. peak torque ( $M_{max}$ )	mNm	400	400	440
Permiss. peak current, motor lead ( $I_{max}$ )	A	15	10	20
Induced voltage ( $U_{imax}$ )	V/1000 rpm	3,06	4,38	2,95
Terminal resistance	$\Omega$	0,49	0,96	0,33
Terminal inductance	mH	1,00	2,00	0,72
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	145	145	165
Thermal resistance ( $R_{th}$ )	K/W	2,5	3,0	2,4
Protection class		IP 00	IP 00	IP 00
Ambient temperature range ( $T_U$ )	°C	0 to +40	0 to +40	0 to +40
Motor mass (m)	kg	0,52	0,52	0,52
Order No.		937 5414 000	937 5414 010	937 5414 005



Faxial 10 N  
Fradial 60 N L<sub>1</sub> 10 mm

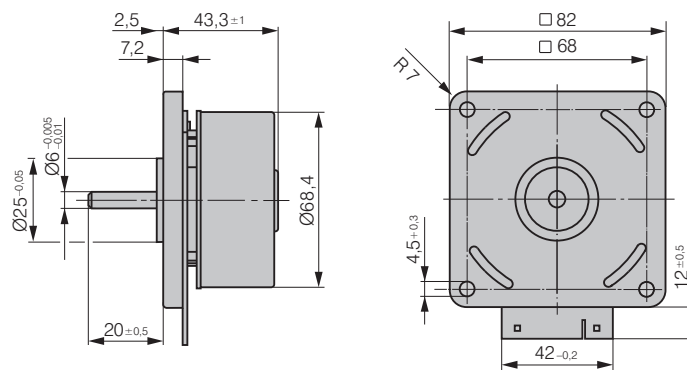
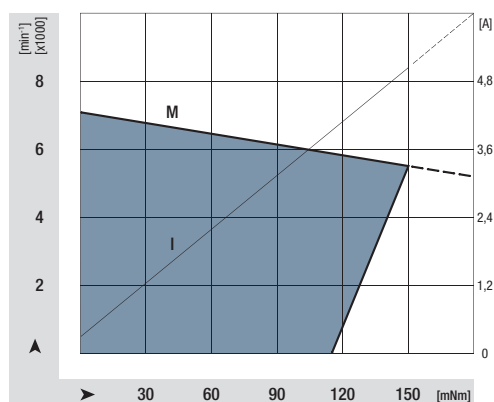
Permissible shaft load at nominal speed and life expectancy L<sub>10</sub> at 20 000 h (at T<sub>U</sub> max. 40°C).

## Operating electronics for speed-controlled operation:

for Order No. 937 5414 000 = DRIVECONTROL VT-A / Order No. 937 2501 001

for Order No. 937 5414 010 = DRIVECONTROL VT-A / Order No. 937 2501 002

for Order No. 937 5414 005 = DRIVECONTROL VT-D on request



# VARIODRIVE motor

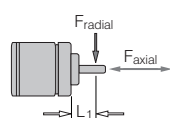
VD-3-49.15



- 3-phase external rotor motor in EC technology.
- Multi-pole motor design for high power density.
- Rotor with powerful neodymium magnet.
- Rotor position detection via 3 Hall sensors.
- Motor supply and control via external operating electronics.
- Robust mechanical design for industrial applications.
- Protection class IP 54 already achieved in the basic configuration.

## Nominal data

Type		VD-3-49.15 B00
Nominal voltage ( $U_{BN}$ )	V DC	24
Nominal speed ( $n_N$ )	rpm	4 500
Nominal torque ( $M_N$ )	mNm	235
Nominal current ( $I_{BN}$ )	A	6,1
Nominal output power ( $P_N$ )	W	110
Speed at no-load operation ( $n_l$ )	rpm	6 000
No-load current ( $I_{BL}$ )	A	0,47
Continuous stall torque ( $M_{BNO}$ )	mNm	245
Permissible eff. continuous stall current, motor lead ( $I_{n0eff}$ )	A	7,4
Permissible continuous stall power ( $P_{BNO}$ )	W	17,5
Short-term permiss. peak torque ( $M_{max}$ )	mNm	1150
Permiss. peak current, motor lead ( $I_{max}$ )	A	30
Induced voltage ( $U_{imax}$ )	V/1000 rpm	4,3
Terminal resistance	$\Omega$	0,23
Terminal inductance	mH	0,17
Rotor moment of inertia ( $J_R$ )	$\text{kgm}^2 \times 10^{-6}$	108
Thermal resistance ( $R_{th}$ )	K/W	-
Protection class		IP 54
Ambient temperature range ( $T_U$ )	$^{\circ}\text{C}$	0 to +40
Motor mass (m)	kg	0,59
Order No.		937 4915 000



Faxial 20 N  
Fradial 60 N L<sub>1</sub> 10 mm

Permissible shaft load at nominal speed and life expectancy L<sub>10</sub> at 20 000 h (at T<sub>U</sub> max. 40°C).

\* Blind holes for self threading screws according to DIN 7500. Max. length of engagement 9,5 mm. Max. fastening torque 3 Nm.

Connector housing 8-pole, Molex, receptacle 5557-NR, Mini Fit, Article No.: 39-01-2085 / with terminals 5556 female, Mini Fit Article No.: 39-00-0046

Connector housing 3-pole, Molex, receptacle 3191-3, Article No.: 39-03-6035 / with terminals 5556 female standard 093, Article No.: 39-00-0046

Signal line:

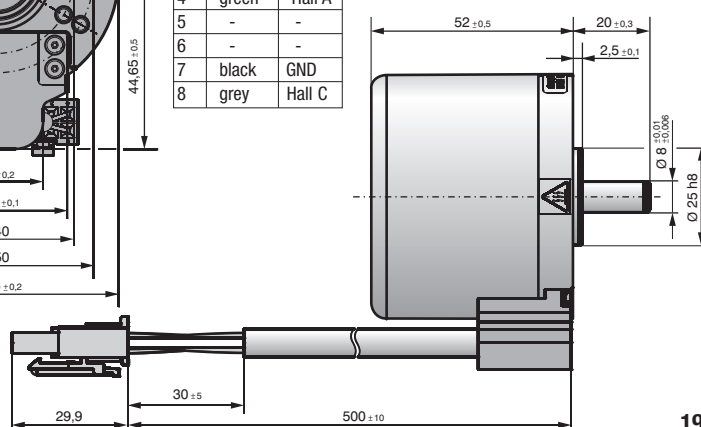
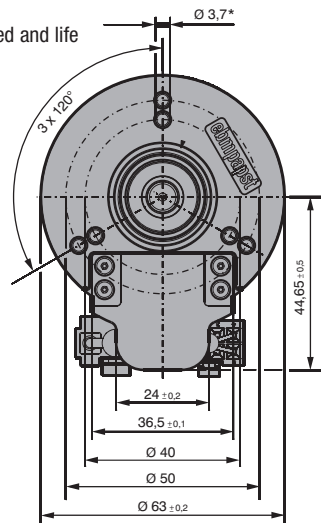
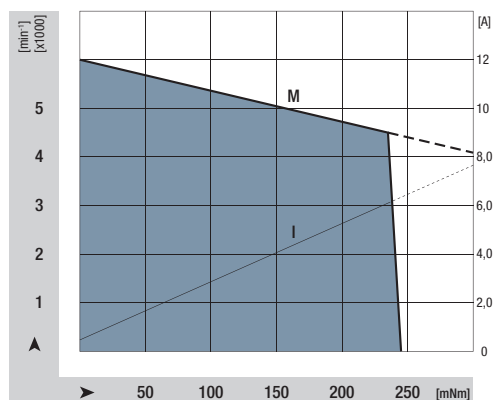
No.	Colour	Function
1	-	-
2	red	+12 V
3	white	Hall B
4	green	Hall A
5	-	-
6	-	-
7	black	GND
8	grey	Hall C

Pin Connection, customer side



Supply line:

No.	Colour	Function
1	yellow	W
2	violet	V
3	brown	U



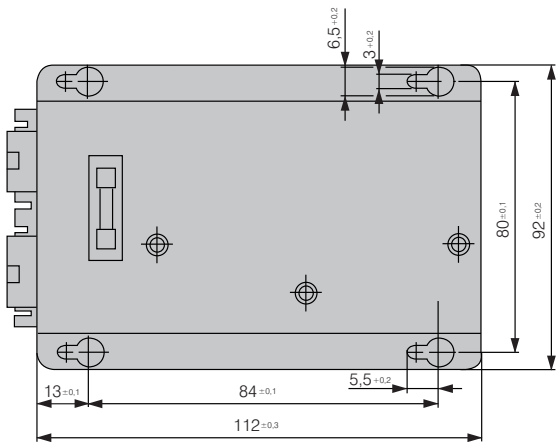
# DRIVECONTROL

## VT-A series

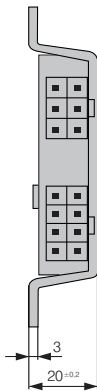


Operating electronics for driving 3-phase motors of the VARIODRIVE series. Simple OEM electronics for use in series applications. The DRIVECONTROL VT-A is available in 4 different performance levels for speed-controlled or voltage-controlled operation. Only one supply voltage is required for motor and electronics. Within the specified performance range there is a variety of defined product variants. Based on this a suitable version of electronics can be chosen by selecting the electronics matching to the desired motor performance, the required output current, the required speed control range, the connector system or the type of control characteristics.

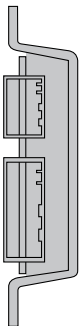
Nominal data			
Nominal data	Unit	Voltage-controlled	Speed-controlled
Nominal voltage	V	24	24
Nominal voltage range	V	10 to 30	14 to 28
Max. output voltage	V	UB - 2 V	UB - 2 V
Output current, peak	A	2 - 5	2 - 5
Set value input	V DC	0 to 10	0 to 10
Speed control range	rpm	–	300 to 4 000 / 300 to 10 000
Speed control	Type	–	P
ACTUAL speed value		–	yes
Operating temperature range	°C	0 to 40 °C	0 to 40 °C
Temperature monitoring		no	no
Mass	kg	0,2	0,2
Protection class		IP 00	IP 00



MOLEX-plug



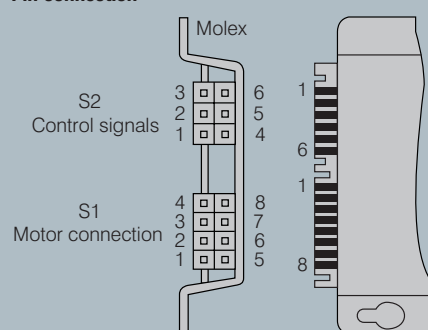
AMP-pLug



## Structure and performance features

- 1-quadrant controller. Positive set value alterations are adjusted by acceleration. Negative set value alterations cause short-circuit braking via the motor winding (increase in intermediate circuit voltage possible!)
- Speed setting via set value input (interface 0 to 10 V DC)
- Setting of operating modes via 2 control inputs
- Speed-controlled version with evaluation of Hall signals for ACTUAL speed value monitoring via MF-pin
- With voltage-controlled (= uncontrolled) version, no braking function and ACTUAL speed value monitoring
- Fixed limits for current and voltage
- Voltage supply with input filter, filtering and generation of auxiliary voltage
- Equipped with PCB plug or Molex plug depending on type of motor

### Pin connection



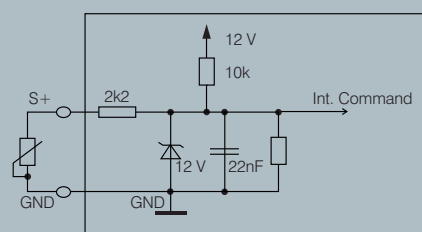
### Plug S2

Pin	Type MOLEX	Type AMP
1	GND	MF-Pin
2	A	B
3	S+	A
4	+U <sub>B</sub>	S+
5	B	Gnd
6	MF-Pin	+U <sub>B</sub>

### Plug S1

Pin	Type MOLEX	Type AMP
1	L 3	+U <sub>Hall</sub>
2	+U <sub>Hall</sub>	Gnd <sub>Hall</sub>
3	RLG 2	RLG 3
4	RLG 1	RLG 2
5	L 2	RLG 1
6	L 1	L 3
7	Gnd <sub>Hall</sub>	L 2
8	RLG 3	L 1

### Voltage-controlled version



Typical wiring of the reference input with the voltage controlled version. Special features are contained in the relevant data sheets.

### 1. Control input

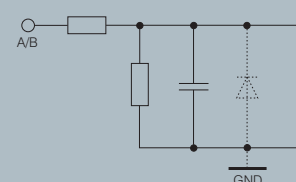
#### Speed-controlled version

A	B	
0	0	Output stage disabled
0	1	Counter-clockwise rotation
1	0	Clockwise rotation
1	1	Brake function*

low (0) 0 to 0,8 V  
high (1) 2,4 to 30 V

A	
0	Counter-clockwise rotation
1	Clockwise rotation

Input B is not connected

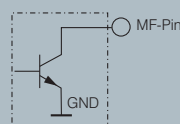
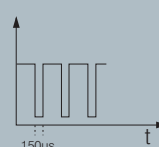


\*Brake function: The braking function serves to slow down the motor only. It has no holding brake function for the static duty.

### 2. Actual speed value output (MF-Pin)

Only with speed-controlled version, open collector that transmits a short pulse at every edge change of the motor Hall signals.

The illustrated signal sequence for standard assembly is the speed value output.



Voltage range U <sub>CE</sub> :	< 30 V
Max. current I <sub>C</sub> :	10 mA
Pull-up resistor:	> 2000 Ohm at 24 V
Pulse length:	150 µs
U <sub>CEsat</sub> :	< 0,8 V

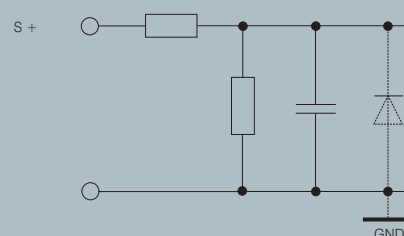
### 3. Set value input

The speed selection is normally made externally with a voltage in the range of 0 to 10 V DC. A voltage of 10 V is equivalent to the maximum speed determined internally.

With the voltage controlled version of the VT-A, the set value is internally fixed at the maximum value.

To reduce the set value, an external potentiometer can be connected or an external set value voltage can be applied.

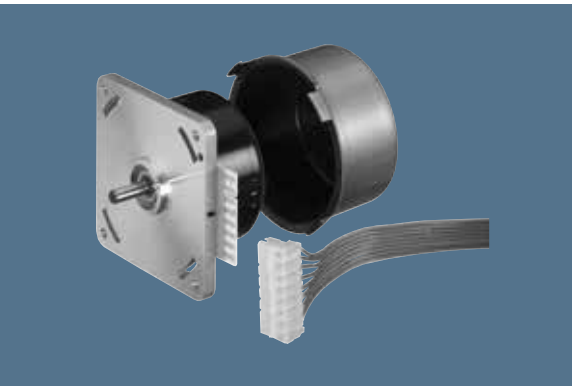
#### Speed-controlled version



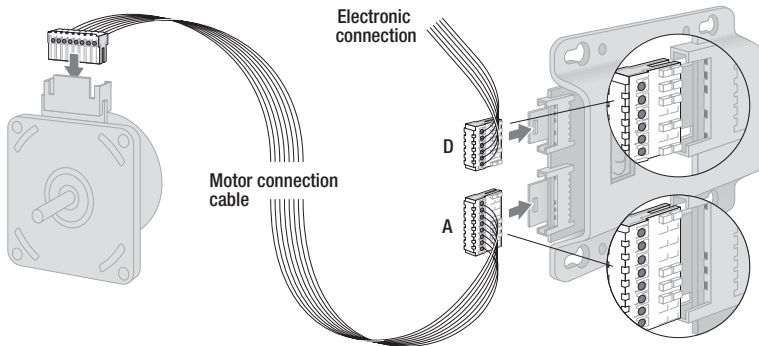
The interpretation of the set value and the corresponding level are described in the relevant data sheet.

For detailed information, please refer to the corresponding specification data sheets. The instructions and safety notes in the operating manual must be observed at all times.

# Accessories



## Electrical connection

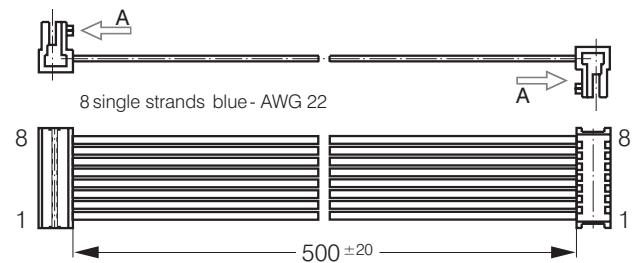


### Type 194 0010 000

Motor connection cable for  
VARIOdrive motors  
VD-3-35.06 / VD-3-43.10 and  
DRIVECONTROL VT-A with  
AMP plugs

#### Connector A

AMP Duoplug 2.5 - 8-pole grey  
No.: 3-829 868-8 (encoded)  
Alternative:  
Lumberg 35 21 08K30 (encoded)



### Type 194 0012 000

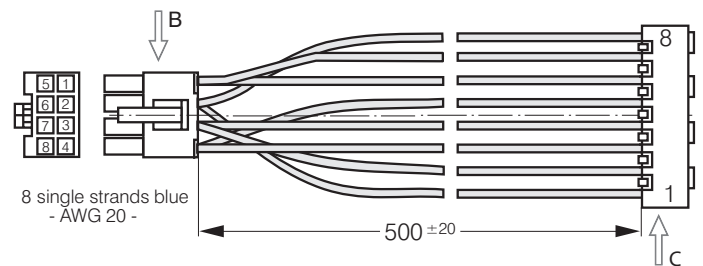
Motor connection cable for  
VARIOdrive Motor  
VD-3-54.14 and  
DRIVECONTROL VT-A with  
Molex plugs

#### Connector B

Molex 39-01-2085 Mini-Fit, Jr.

#### Connector C

AMP-Edge 5mm-8-pole  
No.: 829 213-8 (encoded)

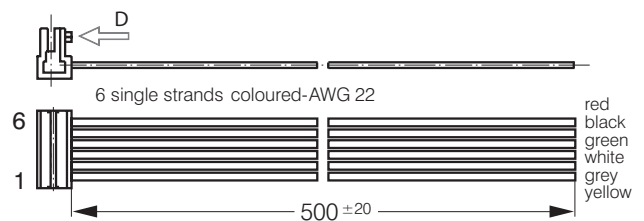


### Type 194 0011 000

Electronic connection cable for  
DRIVECONTROL VT-A with  
AMP plugs (motors  
VD-3-35.06 / VD-3-43.10)

#### Connector D (encoded)

AMP Duoplug 2,5 - 6-pole grey  
No.: 3-829 868-6  
or Lumberg 35 21 06K30

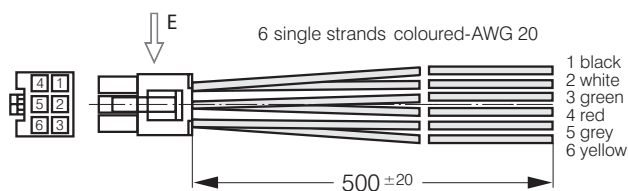


# Type 194 0013 000

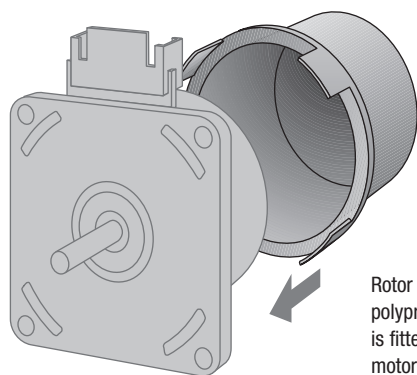
Electronic connection cable  
for DRIVECONTROL VT-A  
with Molex connectors  
(motors VD-3-54.14)

## Connector E

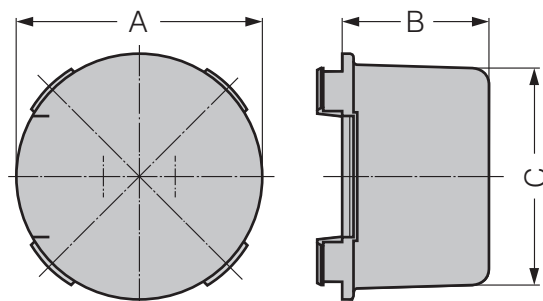
Molex 39-01-2065 Mini-fit, Jr.



## Rotor protective cap



Rotor protective cap of black polypropylene (PP). The cap is fitted directly onto the motor flange and sealed with a rubber seal.



The protective cap cannot be mounted with motor FDC-3-43.10!  
When using the protective cap, power is reduced due to the thermal conditions.

		VARIODRIVE VD ... 35.0X 194 3506 000	VARIODRIVE VD ... 43.10 194 4310 000	VARIODRIVE VD ... 54.14 194 5414 000
Dimension	A	57	65	82
	B	27,4	38,8	42
	C	49,5	57,4	74,4

# VARIODRIVE motors

The following diagram illustrates the sequence of the Hall signals and the corresponding drive sequence with the relevant colours and / or pin assignment that apply to customer-developed products and / or to purchased electronics. It also illustrates the phase position of these signals to the induced motor voltage.

## Commutation sequences

### Commutation sequence

Chronological signal sequence of integrated Hall sensors (= RLG) at the corresponding connections.

### Switching sequences of the power output stage

Required relationship between the signal change from RLG and the relevant change for the switching status of the power transistors in relation to the phase lead to the motor.

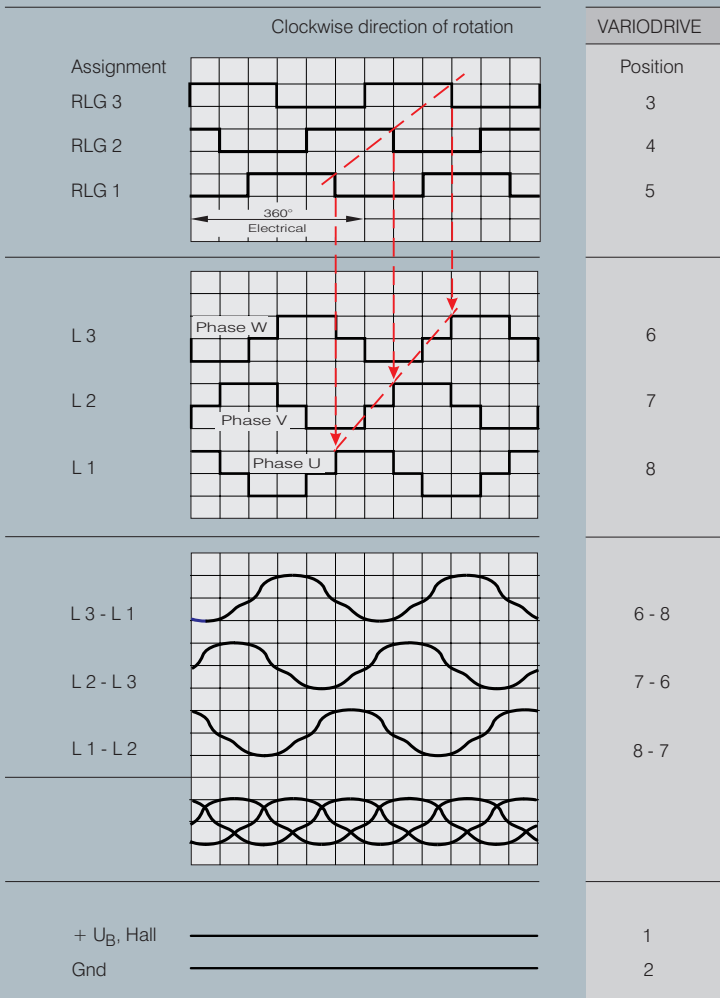
### Induced voltages

Idealised illustration of the sequence of the induced voltages between the relevant connections.

### Total of induced voltages

### Supply voltage for Hall sensor

Hall IC



### Hall IC

Specification data available on request.

### Plug

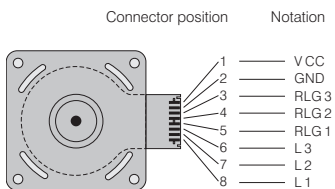
Electrical connection via 8-pole motor plug (not included in scope of delivery)

AMP-Edge 5 mm: No. 829-213-8 = VD-3-54.14

AMP-Duoplug: Type 2.5 No. 3-82 98 68-8

or, optionally

Lumberg-Duomodul: Type 3521 08K30 = VD-3-35.06 and VD-3-43.10



# VARIODRIVE Compact

	VARIODRIVE Compact technical information	26
	VARIODRIVE Compact motors	28
	VARIODRIVE Compact gearmotors	38



# VARIODRIVE Compact



## Technical information

### VARIODRIVE Compact

This is total integration – with a 3-phase electronically commutated DC motor and the control electronics all in a single package: unrivalled in this performance class. The extremely compact drive unit with microprocessor-controlled motor manager and FET power output stage has an internal closed-loop speed control compatible with all standard industrial interfaces. This means: just connect it up and off you go!

VARIODRIVE Compact is ultraflexible. The motor can be speed-controlled and the desired speed selected via a set value voltage. Via 2 control inputs the direction of rotation can be selected, the motor can be enabled or a motor brake function can be activated. An open collector frequency output for monitoring the actual speed is also available.



### Facts and figures VARIODRIVE Compact

- 3-phase, electronically commutated external rotor motor
- Excellent control response over the entire speed range due to digital 4-Q PI controller
- High operating efficiency due to FET output stage and special control process
- Excellent speed stability, silent running, long service life
- Motor manager: reliable operation in all ranges with speed-dependent current limitation and locked-rotor protection clock
- Actual speed output
- Motor electronics optimally adapted to motor characteristic
- Spur gears and planetary gears in different gear reduction stages for a variety of applications
- Winding insulation as per insulation class E
- Standard protection class IP 00, for VDCS-3-54.14 and VDC 3-54.32 in IP 40
- Customer-specific winding layout and motor part sets available on request
- Selectable operation mode (direction of rotation, motor brake and motor enable via two control inputs A, B)
- Software and hardware adaptations (e.g. fixed speed, direction of rotation) on request

### VARIODRIVE Compact VDC-3-49.15 - from 0 to 100 watts in 5.2 centimetres

When high output is required but only limited installation space is available, power density is the most important keyword. Therefore, an optimum ratio of rated output and size was one of the most important factors in developing the new VARIODRIVE Compact motor VDC-3-49.15. The performance data of both motor designs (nominal voltage 48 or 24 VDC) speak for themselves.

With a diameter of 63 mm and a length of just 52 mm, both versions are substantially shorter than comparable internal rotor motors. At a nominal speed of 4,000 rpm each, they attain a rated torque of 250 mNm or 150 mNm. The high overload capacity allows start-up torques that are twice that high. At a current draw of 2.9 A (48 V) and 3.5 A (24 V), the drives have a continuous output of 105 W and 63 W, respectively.

In addition to the performance data, the internal values of this motor also speak for themselves. With the integrated electronics with powerful DSP, this motor features field-oriented activation via sinus commutation. Thus the attainable speed control range goes all the way down to standstill with holding torque. An additional input for set value allows control of the speed as well as the current, and thus the motor torque. This opens up a wide range of additional application options.

### Facts and figures: VDC-3-49.15

- Compact model
- Very high power density
- Steep speed-torque curve
- High overload capacity
- Extremely wide speed control range
- Holding torque near  $n = 0$
- High dynamics, comparable to BCI
- Robust housing and bearing system
- Long service life
- Type of protection: IP 54, standard



# VARIODRIVE Compact motor

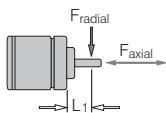
VDC-3-43.10



- 3-phase external rotor motor in EC technology.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- High operating efficiency due to FET power output stage.
- Analogue set value.
- Operating mode selection (direction of rotation, braking and motor enable) via 2 control inputs.
- Protection against overload due to integrated, speed-dependent current limiting.
- Customer-specific version possible based on software and hardware adaption (e.g. fixed speed, direction of rotation).

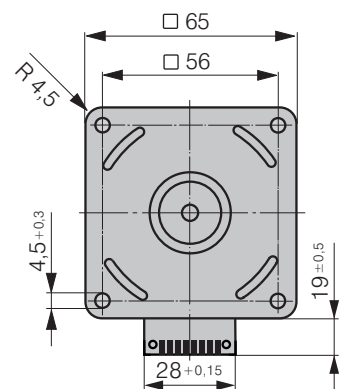
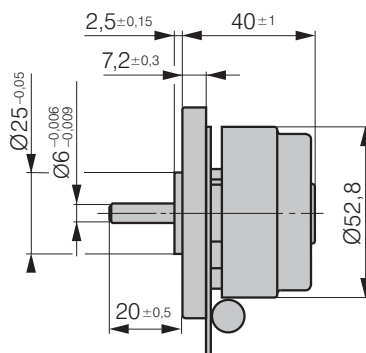
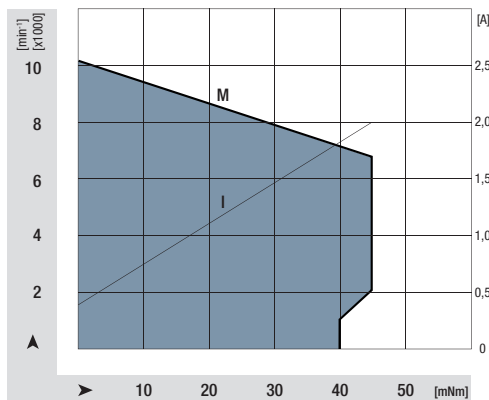
## Nominal data

Type		VDC-3-43.10 B01	VDC-3-43.10 B00
Nominal voltage ( $U_{BN}$ )	V DC	24	24
Permissible supply voltage range ( $U_P$ )	V DC	18 to 28	18 to 28
Nominal speed ( $n_N$ )	rpm	6 800	4 000
Nominal torque ( $M_N$ )	mNm	45	45
Nominal current ( $I_{BN}$ )	A	2,0	1,25
Nominal output power ( $P_N$ )	W	32	18,8
Speed at no-load operation ( $n_l$ )	rpm	10 200	4 100
No-load current ( $I_{BL}$ )	A	0,4	0,14
Max. reverse voltage	V DC	40	40
Set value input	V	0 to 10	0 to 10
Set speed	rpm	0 to 10 000	0 to 4 000
Recommended speed control range	rpm	300 to 6 800	300 to 4 000
Locked-rotor protection		Protection pulsing	Protection pulsing
with locked-rotor protection clock		$T_{on} 0,8 / T_{off} 2,5$ s	$T_{on} 0,8 / T_{off} 2,5$ s
Overload protection		yes	yes
Starting torque	mNm	67	67
Rotor moment of inertia ( $J_R$ )	$kgm^2 \times 10^{-6}$	40	40
Thermal resistance ( $R_{th}$ )	K/W	3,6	4,1
Protection class		IP 00	IP 00
Ambient temperature range ( $T_U$ )	°C	0 to +40	0 to +40
Motor mass (m)	kg	0,24	0,24
Order No.		937 4310 600	937 4310 610



$F_{axial}$  10 N  
 $F_{radial}$  35 N      $L_1$  10 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



### Permissible S1 performance data

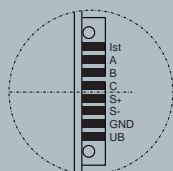
#### Order No. 937 4310 600

Speed n (rpm)	300	1000	2000	4000	5000
Torque M (mNm)	40	40	45	45	45
Input power $P_{S1 \max}$ (W)	7	11	19	30	45

#### Order No. 937 4310 610

Speed n (rpm)	300	1000	2000	4000
Torque M (mNm)	40	45	45	45
Input power $P_{S1 \max}$ (W)	10	15	20	30

### Pin connection



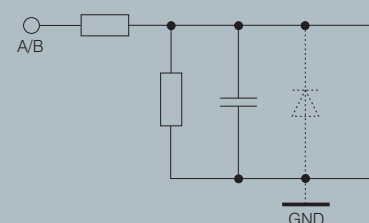
ACTUAL	ACTUAL Speed value	S+	Set value
A	Input A	S-	Ground set value
B	Input B	GND	Ground
C	Not connected	+UB	Supply voltage

### 1. Control inputs

A	B	
0	0	Output stage disabled
0	1	Counter-clockwise rotation
1	0	Clockwise rotation
1	1	Brake function*

low (0)	0 to 0.8 V
high (1)	2.4 to 30 V

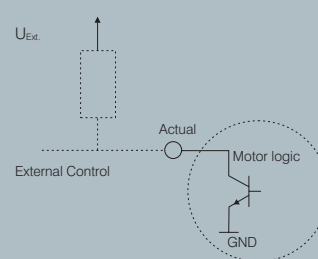
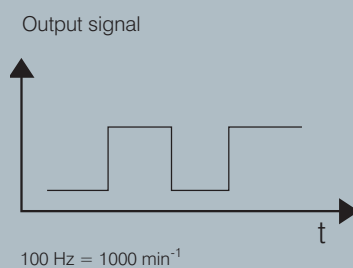
\* Brake function:  
The braking function serves to slow down the motor only.  
It has no holding brake function for static duty.



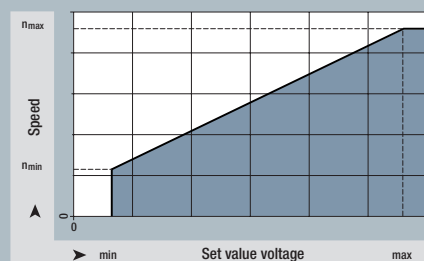
### 2. Actual speed value output

#### Version:

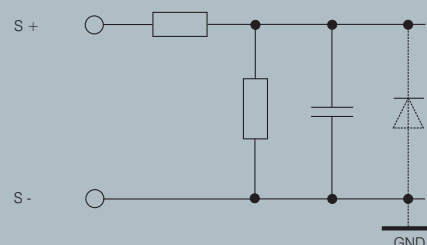
Open Collector  
 $U_{ext. \max} = 30 \text{ V}$   
 $U_{CESAT} = 0,5 \text{ V}$   
 $I_{CMAX} = 5 \text{ mA}$



### 3. Set value



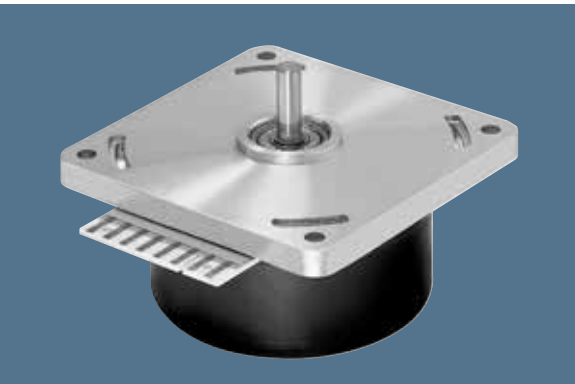
Speed setting for speed control via set value voltage (interface 0 to 10 V DC).



For detailed information, please refer to the corresponding specification data sheets.  
 The instructions and safety notes in the operating manual must be observed at all times.

# VARIODRIVE Compact motor

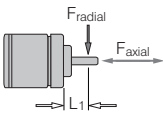
VDC-3-54.14



- 3-phase external rotor motor in EC technology.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- High operating efficiency due to FET power output stage.
- Analogue set value.
- Operating mode selection (direction of rotation, braking and motor enable) via 2 control inputs.
- Protection against overload due to integrated, speed-dependent current limiting.
- Customer-specific version possible based on software and hardware adaption (e.g. fixed speed, direction of rotation).

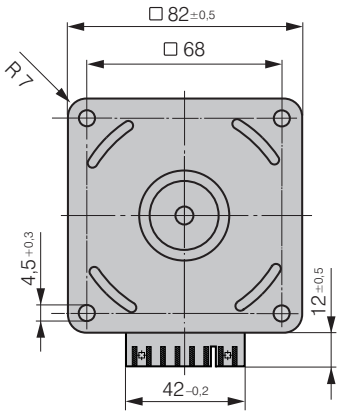
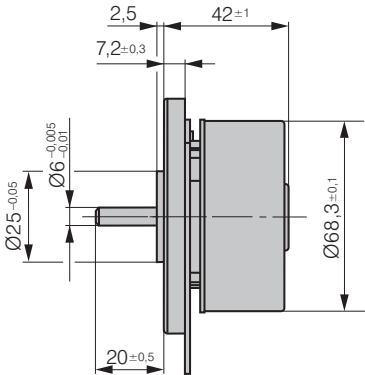
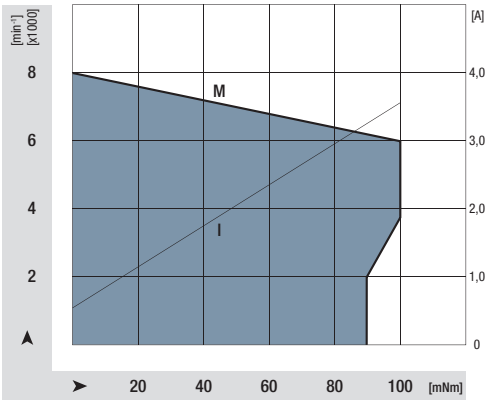
### Nominal data

Type		VDC-3-54.14 B01	VDC-3-54.14 B00
Nominal voltage ( $U_{BN}$ )	V DC	24	24
Permissible supply voltage range ( $U_P$ )	V DC	18 to 28	18 to 28
Nominal speed ( $n_N$ )	rpm	6 000	3 500
Nominal torque ( $M_N$ )	mNm	100	130
Nominal current ( $I_{BN}$ )	A	3,6	2,8
Nominal output power ( $P_N$ )	W	62,8	47,6
Speed at no-load operation ( $n_l$ )	rpm	8 000	4 000
No-load current ( $I_{Bl}$ )	A	0,51	0,21
Max. reverse voltage	V DC	40	40
Set value input	V	0 to 10	0 to 10
Set speed	rpm	0 to 10 000	0 to 4 000
Recommended speed control range	rpm	300 to 6 000	300 to 3 500
Locked-rotor protection		Protection pulsing	Protection pulsing
with locked-rotor protection clock		$T_{on} 0,8 / T_{off} 2,5$ s	$T_{on} 0,8 / T_{off} 2,5$ s
Overload protection		yes	yes
Starting torque	mNm	120	120
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	145	145
Thermal resistance ( $R_{th}$ )	K/W	2,5	3,0
Protection class		IP 00	IP 00
Ambient temperature range ( $T_U$ )	°C	0 to +40	0 to +40
Motor mass (m)	kg	0,52	0,52
Order No.		937 5414 622	937 5414 620



$F_{axial}$  20 N  
 $F_{radial}$  60 N       $L_1$  10 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



### Permissible S1 performance data

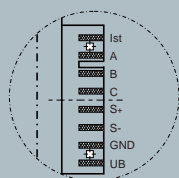
#### Order No. 937 5414 622

Speed n (rpm)	300	1000	2000	4000	6000
Torque M (mNm)	90	90	90	100	100
Input power $P_{S1 \max}$ (W)	14	22	33	63	88

#### Order No. 937 5414 620

Speed n (rpm)	300	1000	2000	4000
Torque M (mNm)	110	110	120	130
Input power $P_{S1 \max}$ (W)	14	23	40	70

### Pin connection



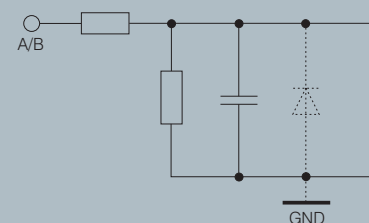
ACTUAL	ACTUAL Speed value	S+	Set value
A	Input A	S-	Ground set value
B	Input B	GND	Ground
C	Not connected	+UB	Supply voltage

### 1. Control inputs

A	B	
0	0	Output stage disabled
0	1	Counter-clockwise rotation
1	0	Clockwise rotation
1	1	Brake function*

low (0) 0 to 0,8 V  
high (1) 2,4 to 30 V

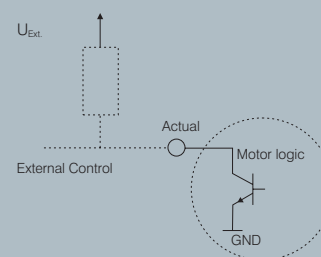
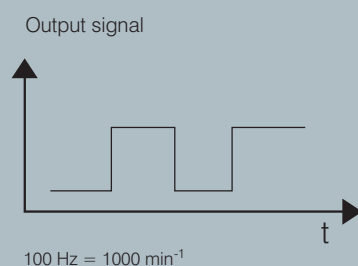
\* Brake function:  
The braking function serves to slow down the motor only.  
It has no holding brake function for static duty.



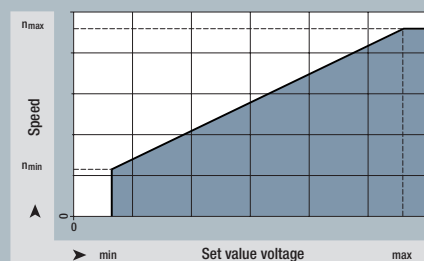
### 2. Actual speed value output

#### Version:

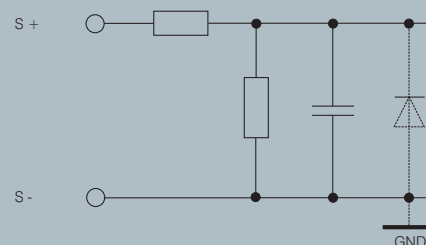
Open Collector  
 $U_{ext. \max} = 30 \text{ V}$   
 $U_{CESAT} = 0,5 \text{ V}$   
 $I_{CMAX} = 5 \text{ mA}$



### 3. Set value



Speed setting for speed control via set value voltage (interface 0 to 10 V DC).



For detailed information, please refer to the corresponding specification data sheets.  
The instructions and safety notes in the operating manual must be observed at all times.

# VARIODRIVE Compact motor

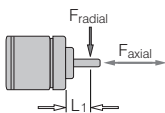
VDC-3-54.32



- 3-phase external rotor motor in EC technology.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- High operating efficiency due to FET power output stage.
- Analogue set value.
- Operating mode selection (direction of rotation, braking and motor enable) via 2 control inputs.
- Protection against overload due to integrated, speed-dependent current limiting.
- Customer-specific version possible based on software and hardware adaption (e.g. fixed speed, direction of rotation).

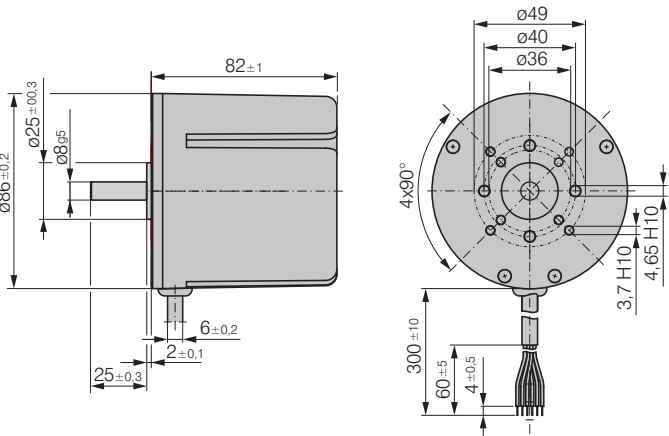
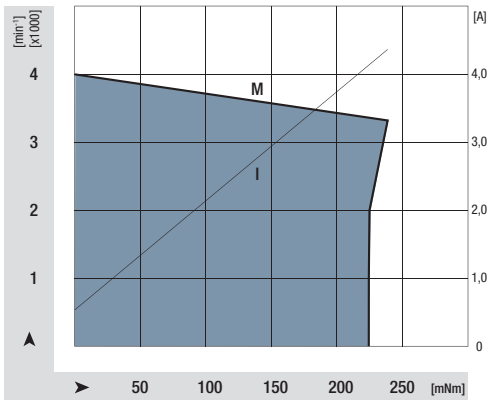
## Nominal data

Type		VDC-3-54.32 B00
Nominal voltage ( $U_{BN}$ )	V DC	24
Permissible supply voltage range ( $U_P$ )	V DC	18 to 28
Nominal speed ( $n_N$ )	rpm	3 300
Nominal torque ( $M_N$ )	mNm	240
Nominal current ( $I_{BN}$ )	A	4,3
Nominal output power ( $P_N$ )	W	83
Speed at no-load operation ( $n_l$ )	rpm	4 100
No-load current ( $I_{Bl}$ )	A	0,5
Max. reverse voltage	V DC	40
Set value input	V	0 to 10
Set speed	rpm	0 to 4 000
Recommended speed control range	rpm	300 to 3 300
Locked-rotor protection		Protection pulsing
with locked-rotor protection clock		$T_{on} 0,8 / T_{off} 2,5$ s
Overload protection		yes
Starting torque	mNm	280
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	500
Thermal resistance ( $R_{th}$ )	K/W	2,15
Protection class		IP 40
Ambient temperature range ( $T_U$ )	°C	0 to +40
Motor mass (m)	kg	1,1
Order No.		937 5432 610



$F_{axial}$  25 N  
 $F_{radial}$  60 N      $L_1$  10 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



### Permissible S1 performance data

#### Order No. 937 5432 610

Speed $n$ (rpm)	300	1000	2000	3300
Torque $M$ (mNm)	225	225	225	240
Input power $P_{S1 \max}$ (W)	31	50	70	115

### Pin connection

Yellow	ACTUAL	Actual speed value
White	A	Input A
Grey	B	Input B
–	C	Not connected

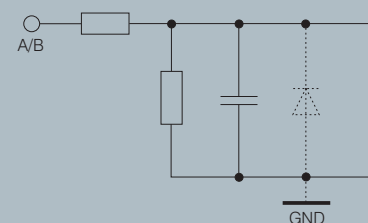
Green	S+	Set value
–	S-	Ground set value
Black	GND	Ground
Red	+Ub	Supply voltage

### 1. Control inputs

A	B	
0	0	Output stage disabled
0	1	Counter-clockwise rotation
1	0	Clockwise rotation
1	1	Brake function*

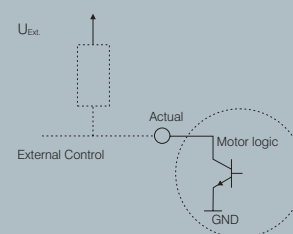
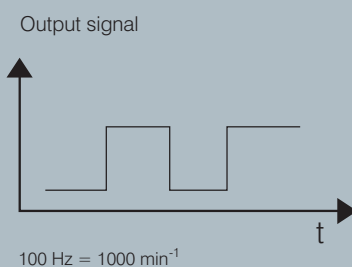
low (0) 0 to 0,8 V  
high (1) 2,4 to 30 V

\* Brake function:  
The braking function serves to slow down the motor only. It has no holding brake function for static duty.

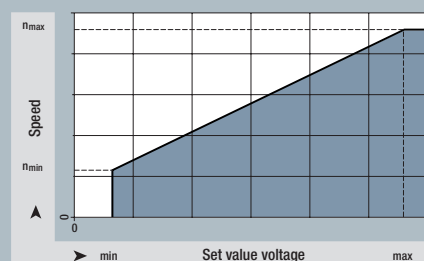


### 2. Actual speed value output

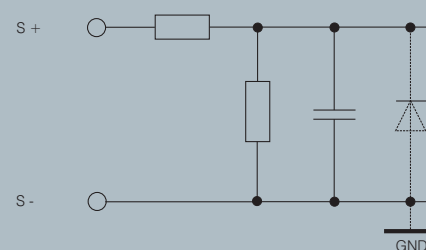
Version:  
Open Collector  
 $U_{ext. \max} = 30 \text{ V}$   
 $U_{CESAT} = 0,5 \text{ V}$   
 $I_{CMAX} = 5 \text{ mA}$



### 3. Set value



Speed setting for speed control via set value voltage (interface 0 to 10 V DC).



For detailed information, please refer to the corresponding specification data sheets.  
The instructions and safety notes in the operating manual must be observed at all times.

# VARIODRIVE Compact motor

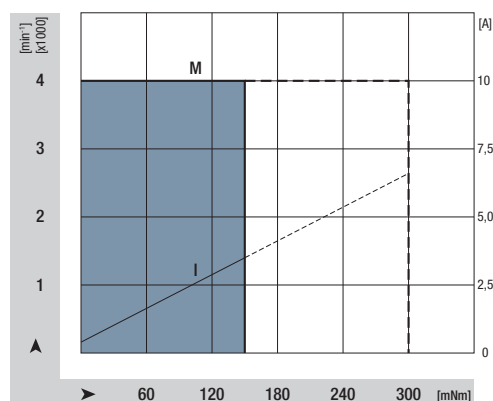
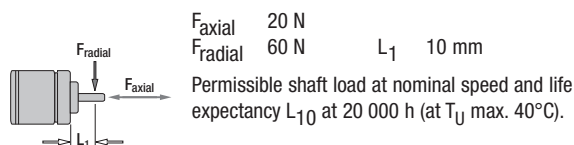
VDC-3-49.15



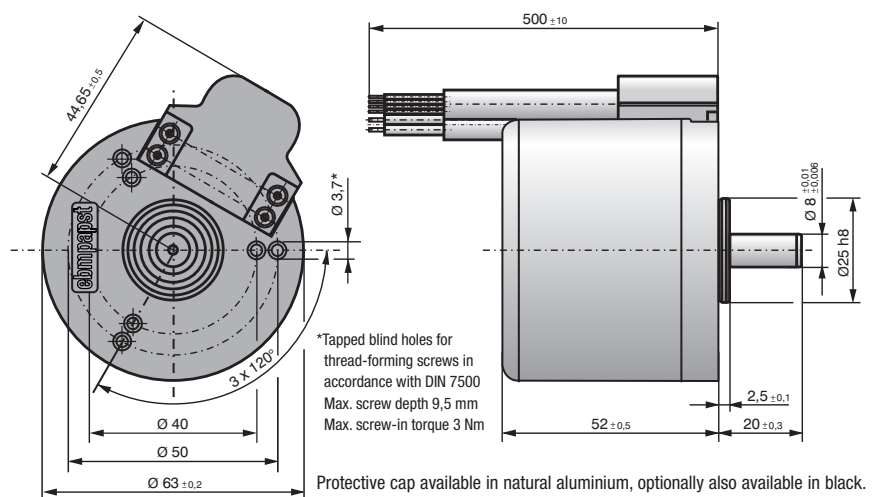
- 3-phase external rotor motor in EC technology.
- Multi-pole motor design with powerful neodymium magnet
- High power density with compact model.
- Integrated operating electronics with high-performance DSP.
- Excellent control behaviour with field-oriented control with sinus commutation.
- Extensive interface for variety of functions and operating mode selection.
- Overload protection with integrated temperature shutoff.
- Robust mechanical design with aluminium cover and sealed plug system.

## Nominal data

Type		VDC-3-49.15 B00	VDC-3-49.15 D00
Nominal voltage ( $U_N$ )	V DC	24	48
Permissible supply voltage range ( $U_{ZK}$ )	V DC	18 to 30	18 to 55
Nominal speed ( $n_N$ )	rpm	4 000	4 000
Nominal torque ( $M_N$ )	mNm	150	250
Nominal current ( $I_N$ )	A	3,5	2,75
Nominal output power ( $P_N$ )	W	63	105
Speed at no-load operation ( $n_L$ )	rpm	4 000	4 000
No-load current ( $I_L$ )	A	0,4	0,25
Max. reverse voltage	V DC	36,7	63
Set value input	V DC	0 ... 10	0 ... 10
Set speed	rpm	0 ... 4 000	0 ... 4 000
Recommended speed control range	rpm	0 ... 4 000	0 ... 4 000
Locked-rotor protection		thermal	thermal
with locked-rotor protection clock		no	no
Overload protection		yes	yes
Starting torque	mNm	300	500
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> ×10 <sup>-6</sup>	108	108
Thermal resistance ( $R_{th}$ )	K/W	–	–
Protection class		IP 54*	IP 54*
Ambient temperature range ( $T_U$ )	°C	0 ... +40	0 ... +40
Motor mass (m)	kg	0,59	0,59
Order No.		937 4915 600	937 4915 607



\* Type of protection specified pertains to installed state with seal on the flange side.



Protective cap available in natural aluminium, optionally also available in black.

## Basic functions:

- Closed-loop speed control with analogue set value input.
- Control of speed  $n = 0$  with holding torque.
- Extended motor dynamics based on short-term  $I^2t$  peak current limitation.  
Depending on the ambient conditions the increased peak torque can be used up to a few minutes.
- Torque limitation via analogue set value input (for current limitation).
- Control input for hardware enable for safe switch-on after safety shut-off.
- Separate signal output for information on direction of rotation.
- Signal output for status display of the drive (drive ready yes/no).
- Separate power supply for motor logic (logic power supply can remain active even when motor is switched off).

## Pin connection

Colour	Function	Description	Circuit*
Blue (1,5 mm <sup>2</sup> )	Gnd	Power supply earth	yes
Brown (1,5 mm <sup>2</sup> )	+Ub	Logic power supply	yes
Black (1,5 mm <sup>2</sup> )	UZK	Power supply	yes
Blue	Gnd	Power supply earth	optional
Pink	S1	0 to 10 V – speed controller	yes
Green	TXD	Communication / programming interface	no
White	RXD	Communication / programming interface	no
Grey-Pink	A	Control input A, TTL level	yes
Violet	B	Control input B, TTL level	yes
Grey	IST	Actual value 1	optional
Red-Blue	F+	Frequency specification for speed setpoint	no
Brown	S2	0 to +5 V current limitation (torque)	yes
Black	C	Control input C – hardware enable	yes
Red	E	Actual value 2	optional
Yellow	D	Drive status	optional

\*Connections marked "No" must not be occupied when carrying out basic functions.

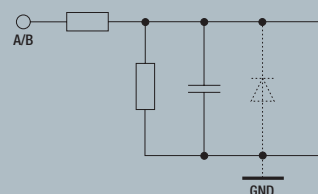
Other options on request:

- Set value input for closed loop speed control operation via set value frequency or PWM signal.
- Programming of the  $I^2t$  peak current limitation.
- 2-channel encoder signal with up to 100 pulses/revolution via programmable division ratio of the actual value output between both outputs.
- Electrically isolated inputs and outputs.
- Control inputs for direction of rotation and brakes with line break detection.
- Version with CANopen bus interface (DSP 402).

### 1. Actual speed value output

A	B		low (0)	0 to 0,8 V
			high (1)	2,4 to 30 V
0	0	Output stage disabled		
0	1	Counter-clockwise rotation		
1	0	Clockwise rotation		
1	1	Brake function*		

\*Brake operation:  
In holding status, the position can be held for long periods at rated torque or for short periods ( $I^2t$  function) at start-up torque.



### 2. Actual speed value output

#### Version:

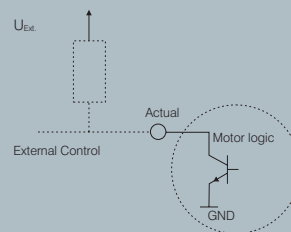
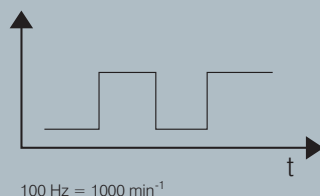
Open Collector

$U_{ext. max} = < 36 V$

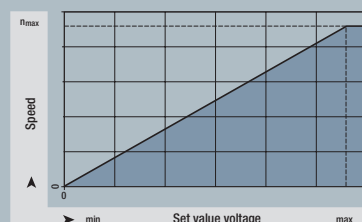
$U_{CESAT} = 0,4 V$

$I_{CMAX} = < 10 mA$

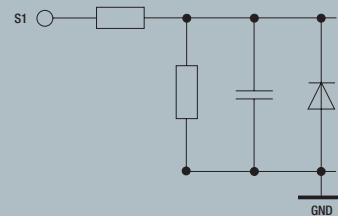
Output signal



### 3. Set value input



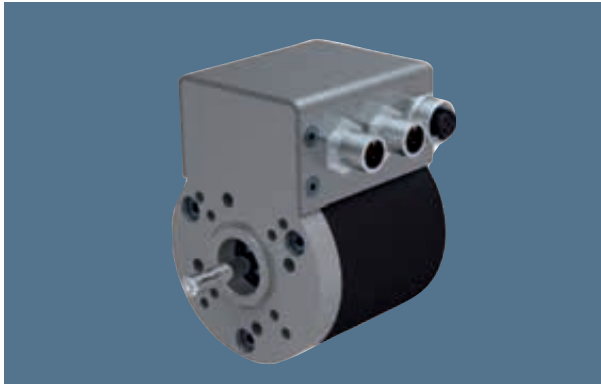
Speed setting for closed loop speed control  
using set point voltage  
(0 to 10 V DC interface)



For detailed information, please refer to the corresponding specification data sheets. The instructions and safety notes in the operating manual must be observed at all times.

# VDC-3-49-15

with electronics module K5

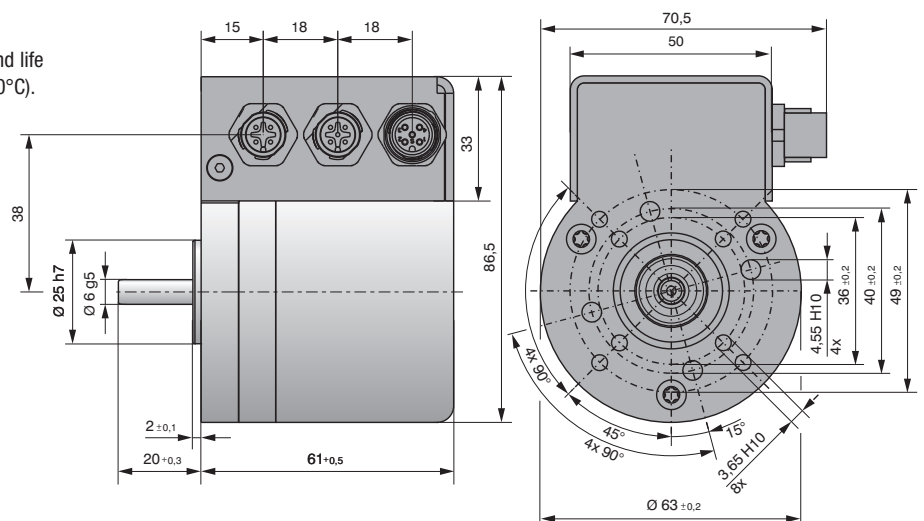
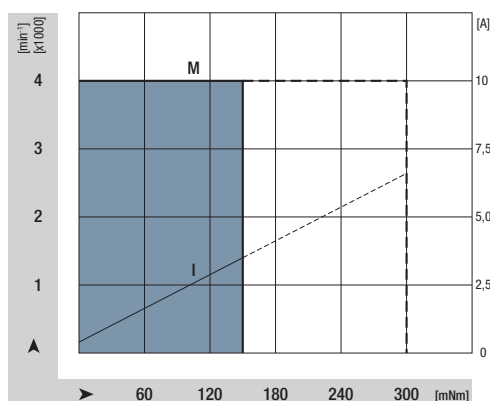
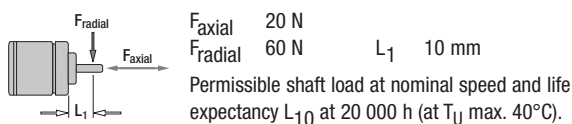


- Completely integrated operation and control electronics “K5” with CANopen communication interface and programming functionality
- Sine commutation of the drive based on field oriented control (FOC) and 4-quadrant operation
- Speed control range down to  $n=0$  rpm with holding torque
- Different modes of operation based on DSP 402 standard (speed, position, homing, torque) through CANopen interface
- Electronics-module in IP 54 version
- Connector system in sealed M12 industry standard
- Interface with digital inputs

## Nominal data

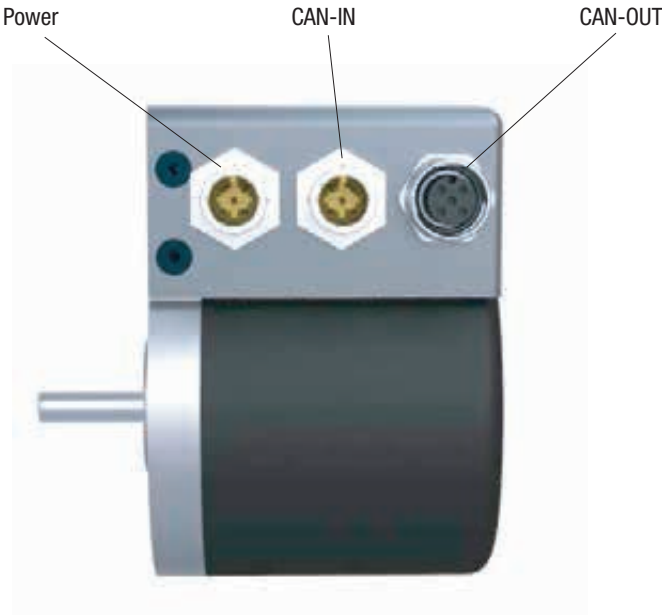
Type		VDC5-3-49.15 B00
Nominal voltage ( $U_N$ )	V DC	24
Permissible supply voltage range ( $U_{ZK}$ )	V DC	18 to 30
Nominal speed ( $n_N$ )	rpm	4 000
Nominal torque ( $M_N$ )	mNm	150
Nominal current ( $I_N$ )	A	3,5
Nominal output power ( $P_N$ )	W	63
Speed at no-load operation ( $n_L$ )	rpm	4 000
No-load current ( $I_L$ )	A	0,4
Max. reverse voltage	V DC	36,7
Set value input		Can Bus
Set speed	rpm	0 ... 4 000
Recommended speed control range	rpm	0 ... 4 000
Locked-rotor protection		thermal
with locked-rotor protection clock		no
Overload protection		yes
Starting torque	mNm	300
Rotor moment of inertia ( $J_R$ )	$\text{kgm}^2 \times 10^{-6}$	108
Thermal resistance ( $R_{th}$ )	K/W	–
Protection class		IP 54*
Ambient temperature range ( $T_U$ )	°C	0 ... +40
Motor mass (m)	kg	0,59
Order No.		-

\* Type of protection specified pertains to installed state with seal on the flange side.

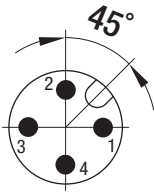


Description of connection interface with electronics module K5

The VDC-3-49.15 with built-on electronics module K5 is an extremely compact drive unit.  
With the CANopen interface, the extensive functionality and the robust design the motor is suitable for a large variety of applications such as automated format adjustments or torque-controlled winder drives.

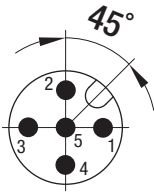


Power:



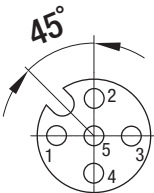
Pin 1	UZK	Power supply motor
Pin 2	GND	Power/ logic supply
Pin 3	UB	Logic supply
Pin 4	IN 1	Digital input

CAN-IN:



Pin 1	n.c.	
Pin 2	IN 2	Digital input
Pin 3	CAN-GND	CAN-GND
Pin 4	CAN_H	CAN High Signal
Pin 5	CAN_L	CAN Low Signal

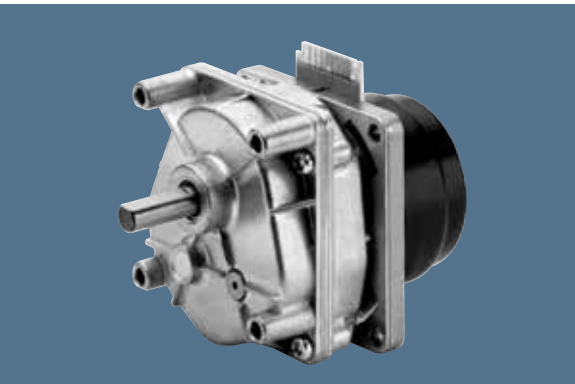
CAN-OUT:



Pin 1	n.c.	
Pin 2	IN 3	Digital input
Pin 3	CAN-GND	CAN-GND
Pin 4	CAN_H	CAN High Signal
Pin 5	CAN_L	CAN Low Signal

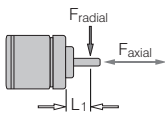
# VARIODRIVE Compact gearmotor

VDC-3-43.10-C



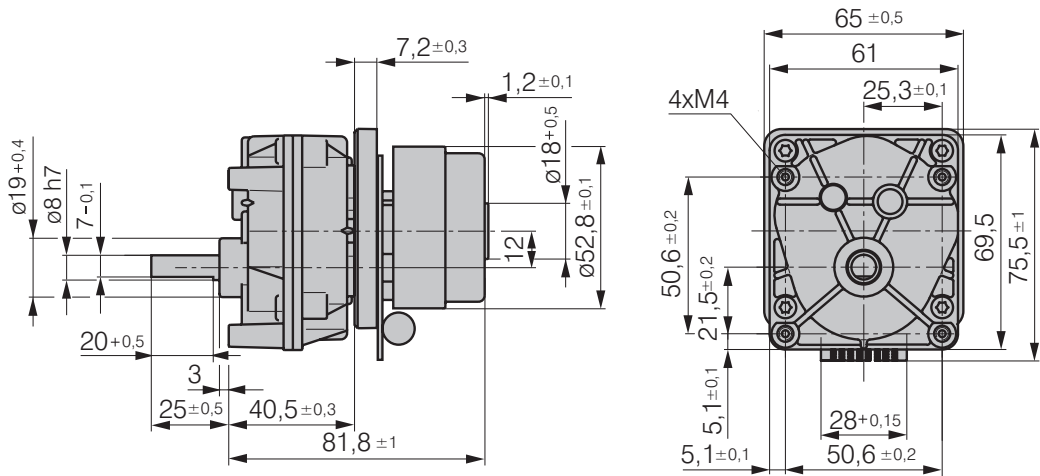
- 3-phase external rotor motor in EC technology for gear applications.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- Analogue set value.
- Available in various reduction ratios.

Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass	Order No.
Type	i		Nm	rpm	kg	
VDC-3-43.10 B00-C/16	16 : 1	2	0,6	19 to 250	0,53	947 4310 600
VDC-3-43.10 B00-C/23	22,9 : 1	2	0,8	13 to 175	0,53	947 4310 601
VDC-3-43.10 B00-C/32	32 : 1	2	1,2	9 to 125	0,53	947 4310 602
VDC-3-43.10 B00-C/45	45,4 : 1	3	1,5	7 to 88	0,55	947 4310 603
VDC-3-43.10 B00-C/58	57,8 : 1	3	1,9	5 to 69	0,55	947 4310 604
VDC-3-43.10 B00-C/79	79,1 : 1	3	2,6	4 to 51	0,55	947 4310 605
VDC-3-43.10 B00-C/122	121,6 : 1	3	4,0	2 to 33	0,55	947 4310 606



F<sub>axial</sub> 40 N  
 F<sub>radial</sub> 120 N    L<sub>1</sub> 17 mm  
 Permissible shaft load at nominal speed and life expectancy L<sub>10</sub> at 5 000 h (at T<sub>U</sub> max. 40°C).

**Gear type C**  
 Multi-stage spur gear in die-cast zinc body.  
 Grease lubrication for maintenance-free continuous operation.  
 Shaft output with combined sleeve / needle bearing.  
 Reversible direction of rotation.



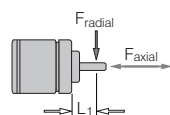
# VARIODRIVE Compact gearmotor

VDC-3-43.10-D



- 3-phase external rotor motor in EC technology for gear applications.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- Analogue set value.
- Available in various reduction ratios.

Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass	Order No.
Type	i		Nm	rpm	kg	
VDC-3-43.10 B00-D/11	11,3 : 1	2	0,4	27 to 354	0,59	947 4310 610
VDC-3-43.10 B00-D/13	13,2 : 1	2	0,5	23 to 303	0,59	947 4310 611
VDC-3-43.10 B00-D/16	15,9 : 1	2	0,6	19 to 252	0,59	947 4310 612
VDC-3-43.10 B00-D/26	26,4 : 1	2	1,0	11 to 152	0,59	947 4310 613
VDC-3-43.10 B00-D/39	38,6 : 1	2	1,4	8 to 104	0,59	947 4310 614

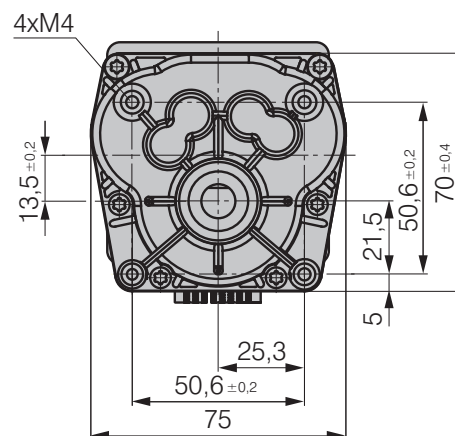
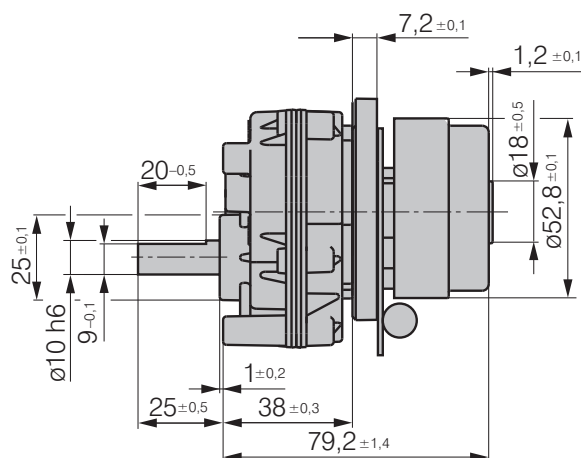


$F_{axial}$  50 N  
 $F_{radial}$  150 N  $L_1$  17 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).

## Gear type D

Multi-stage spur gear in die-cast zinc body.  
 Grease lubrication for maintenance-free continuous operation.  
 Shaft output with combined sleeve / needle bearing.  
 Reversible direction of rotation.



# VARIODRIVE Compact gearmotor

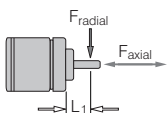
VDC-3-54.14-C



- 3-phase external rotor motor in EC technology for gear applications.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- Analogue set value.
- Available in various reduction ratios.

Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass	Order No.
Type	i		Nm	rpm	kg	
VDC-3-54.14 B00-C/16	16 : 1	2	1,7	19 to 250	0,81	947 5414 600
VDC-3-54.14 B00-C/23	22,9 : 1	2	2,4	13 to 175	0,81	947 5414 601
VDC-3-54.14 B00-C/32	32 : 1	2	3,4	9 to 125	0,81	947 5414 602
VDC-3-54.14 B00-C/45	45,4 : 1	3	4,3	7 to 88	0,83	947 5414 603
VDC-3-54.14 B00-C/58	57,8 : 1	3	5,5	5 to 69	0,83	947 5414 604
VDC-3-54.14 B00-C/79	79,1 : 1	3	7,0*	4 to 51	0,83	947 5414 605
VDC-3-54.14 B00-C/122	121, 6 : 1	3	7,0*	2 to 33	0,83	947 5414 606

\*Monitor torque limitation at max. 7.0 Nm on output side.



$F_{axial}$  40 N  
 $F_{radial}$  120 N  $L_1$  17 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).

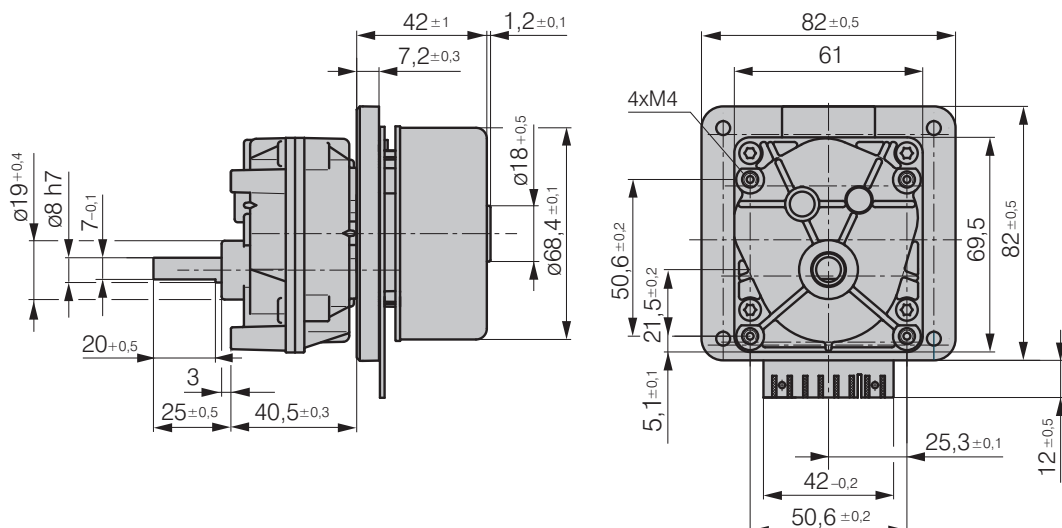
## Gear type C

Multi-stage spur gear in die-cast zinc body.

Grease lubrication for maintenance-free continuous operation.

Shaft output with combined sleeve / needle bearing.

Reversible direction of rotation.



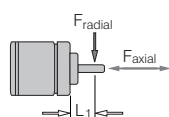
# VARIODRIVE Compact gearmotor

VDC-3-54.14-D



- 3-phase external rotor motor in EC technology for gear applications.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- Analogue set value.
- Available in various reduction ratios.

Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass	Order No.
Type	i		Nm	rpm	kg	
VDC-3-54.14 B00-D/11	11,3 : 1	2	1,2	27 to 354	0,9	947 5414 610
VDC-3-54.14 B00-D/16	15,9 : 1	2	1,7	19 to 252	0,9	947 5414 611
VDC-3-54.14 B00-D/26	26,4 : 1	2	2,8	11 to 152	0,9	947 5414 612
VDC-3-54.14 B00-D/39	38,6 : 1	2	4,1	8 to 104	0,9	947 5414 613



$F_{axial}$  50 N  
 $F_{radial}$  150 N  $L_1$  17 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).

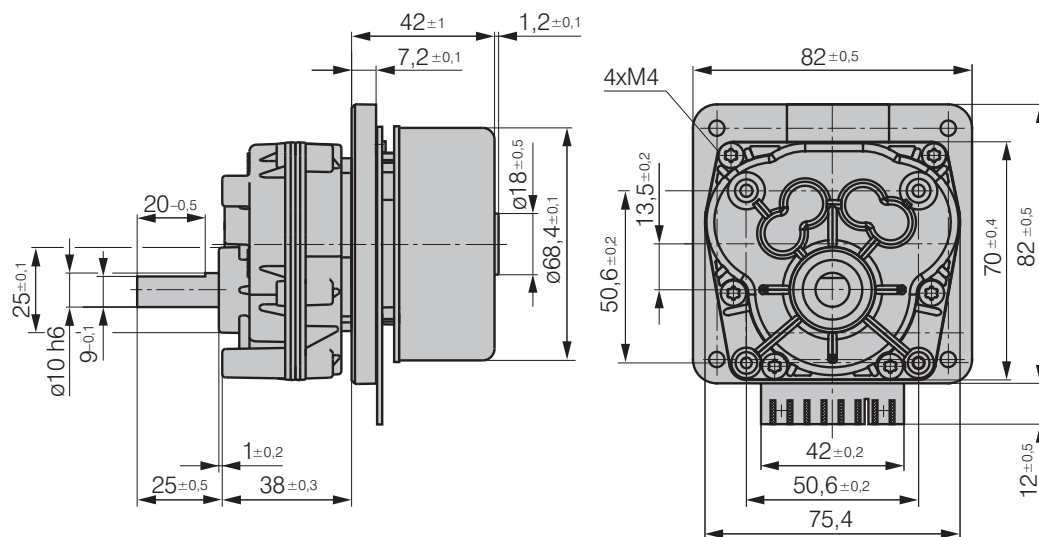
## Gear type D

Multi-stage spur gear in die-cast zinc body.

Grease lubrication for maintenance-free continuous operation.

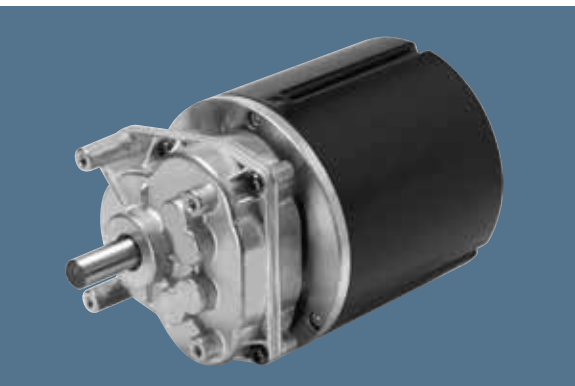
Shaft output with combined sleeve / needle bearing.

Reversible direction of rotation.



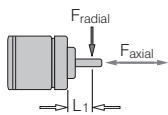
# VARIODRIVE Compact gearmotor

VDC-3-54.32-D



- 3-phase external rotor motor in EC technology for gear applications.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- Analogue set value.
- Available in various reduction ratios.

Nominal data		Gear ratio	Gear stages	Nominal torque	Speed range	Mass	Order No.
Type		i		Nm	rpm	kg	
VDC-3-54.32 B00-D/9		9,2 : 1	2	1,8	33 to 359	1,45	947 5432 610
VDC-3-54.32 B00-D/18		18,4 : 1	2	3,6	16 to 179	1,45	947 5432 611

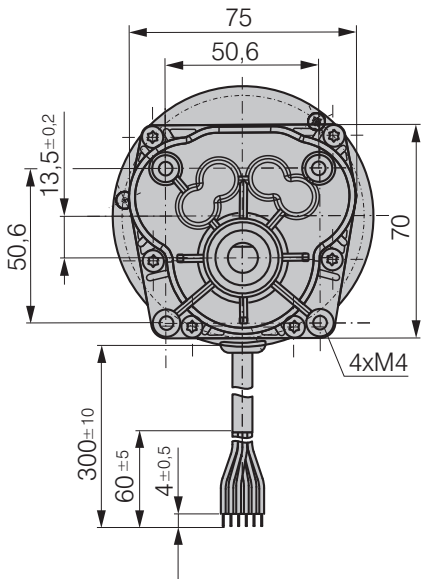
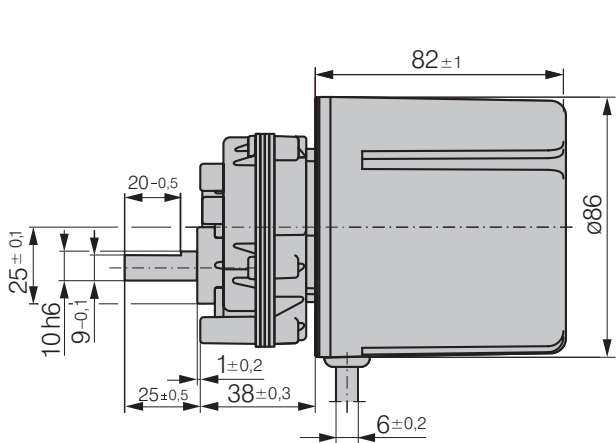


$F_{axial}$  50 N  
 $F_{radial}$  150 N  $L_1$  17 mm  
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).

## Gear type D

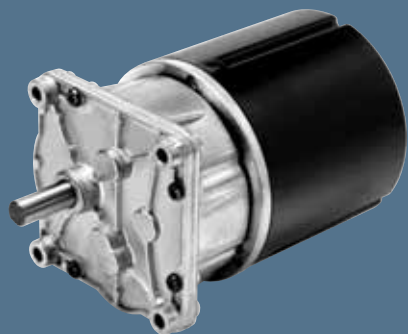
Multi-stage spur gear in die-cast zinc body.  
Grease lubrication for maintenance-free continuous operation.  
Shaft output with combined sleeve / needle bearing.  
Reversible direction of rotation.

Yellow	ACTUAL	ACTUAL Speed value
White	A	Input A
Grey	B	Input B
–	C	Not connected
Green	S+	Set value
–	S-	Ground set value
Black	GND	Ground
Red	+Ub	Supply voltage



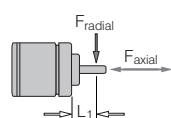
# VARIODRIVE Compact gearmotor

VDC-3-54.32-E



- 3-phase external rotor motor in EC technology for gear applications.
- Dynamically balanced rotor with 4-pole, plastic bonded ferrite magnet.
- Integrated operating electronics with powerful microcontroller.
- Excellent control response due to digital 4-Q PI controller.
- Analogue set value.
- Available in various reduction ratios.

Nominal data		Gear ratio	Gear stages	Nominal torque	Speed range	Mass	Order No.
Type	i			Nm	rpm	kg	
VDC-3-54.32 B00-E/31	31,1 : 1	2		6,0	10 to 106	1,58	947 5432 620
VDC-3-54.32 B00-E/70	70,4 : 1	3		12,3	4 to 47	1,58	947 5432 621



$F_{axial}$  50 N  
 $F_{radial}$  150 N  $L_1$  17 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).

Yellow	ACTUAL	ACTUAL Speed value
White	A	Input A
Grey	B	Input B
–	C	Not connected
Green	S+	Set value
–	S-	Ground set value
Black	GND	Ground
Rot	+Ub	Supply voltage

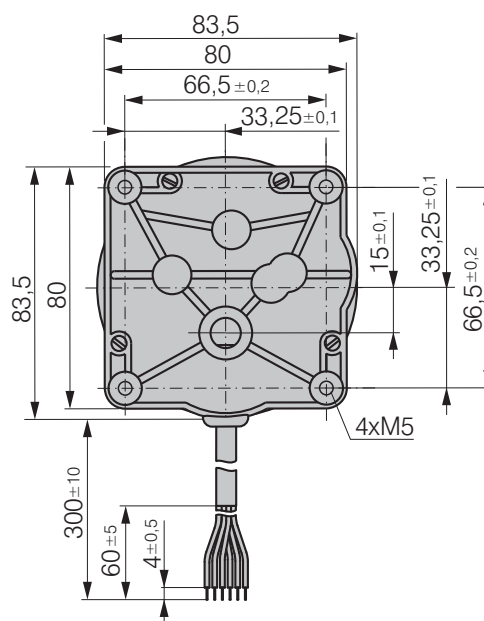
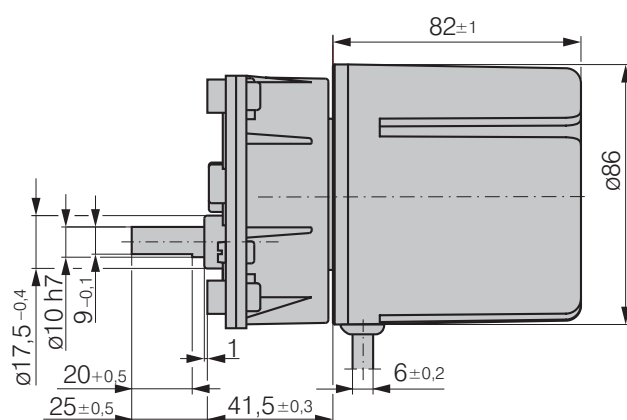
## Gear type E

Multi-stage spur gear in die-cast zinc body.

Grease lubrication for maintenance-free continuous operation.

Shaft output with combined sleeve / needle bearing.

Reversible direction of rotation.



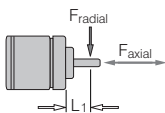
# VARIODRIVE Compact gearmotor

VDC-3-49.15-B



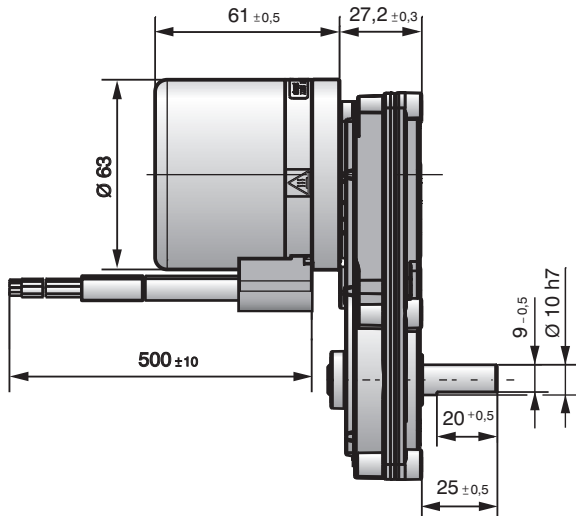
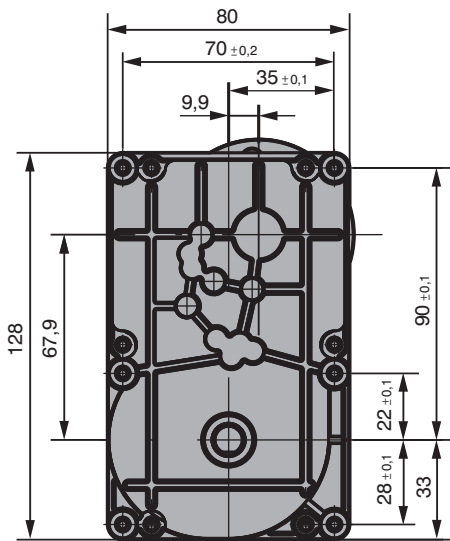
- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with multi-stage spur gearboxes in flat design
- Gearbox housing made of die-cast zinc
- Noise-optimised helical gears in the first stage
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios

Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass		
						Type	
	i		Nm	rpm	kg		
VDC-3-49.15 B00-B/8	8,2 : 1	3	0,9	0 to 488	1,2		
VDC-3-49.15 B00-B/12	12,3 : 1	3	1,3	0 to 325	1,2		
VDC-3-49.15 B00-B/28	27,6 : 1	3	3,0	0 to 145	1,2		
VDC-3-49.15 B00-B/40	40,3 : 1	3	4,4	0 to 99	1,2		
VDC-3-49.15 B00-B/64	64,0 : 1	3	7,0	0 to 63	1,2		
VDC-3-49.15 B00-B/102	101,8 : 1	3	11,1	0 to 39	1,2		



$F_{axial}$  50 N  
 $F_{radial}$  150 N  $L_1$  17 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).



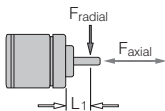
# VARIODRIVE Compact gearmotor

VDC-3-49.15-D



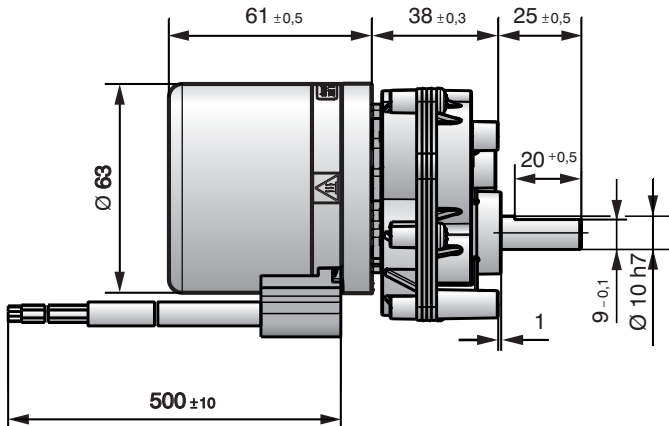
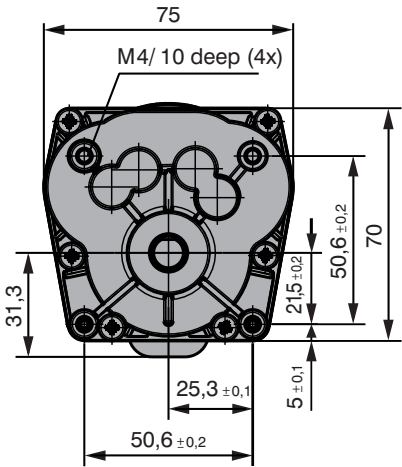
- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with multi-stage spur gearboxes in flat design
- Gearbox housing made of die-cast zinc
- Noise-optimised helical gears in the first stage
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios

Nominal data		Gear ratio	Gear stages	Nominal torque	Speed range	Mass
Type	i			Nm	rpm	kg
VDC-3-49.15 B00-D/9	9,2 : 1	2		1,1	0 to 435	1,1
VDC-3-49.15 B00-D/18	18,4 : 1	2		2,2	0 to 217	1,1
VDC-3-49.15 B00-D/28	27,6 : 1	2		3,4	0 to 145	1,1



$F_{axial}$  50 N  
 $F_{radial}$  150 N     $L_1$  17 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).



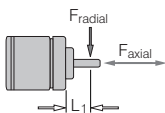
# VARIODRIVE Compact gearmotor

VDC-3-49.15-E



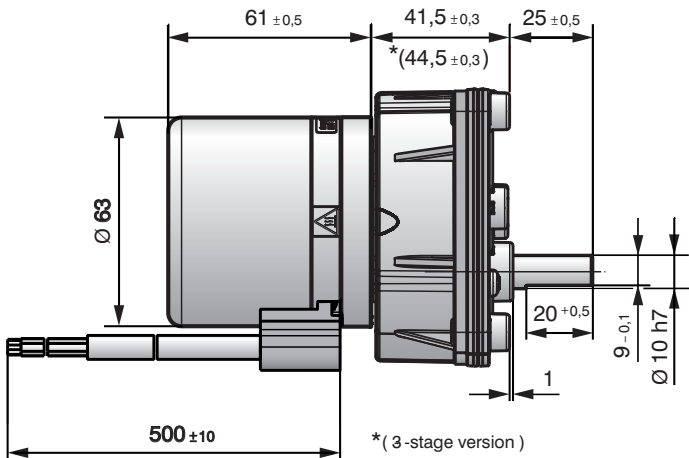
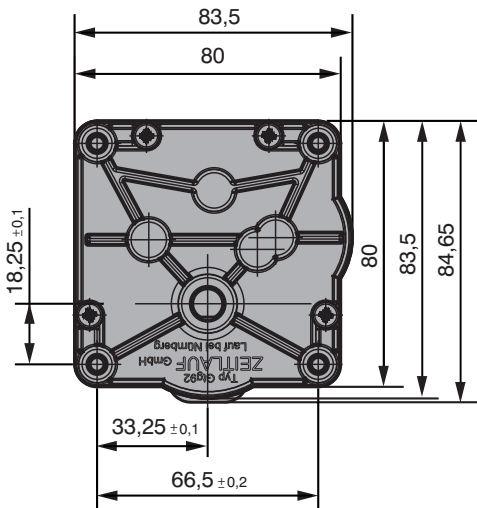
- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with multi-stage spur gearboxes in flat design
- Gearbox housing made of die-cast zinc
- Noise-optimised helical gears in the first stage
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios

Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass
Type	i		Nm	rpm	kg
VDC-3-49.15 B00-E/16	15,5 : 1	2	1,9	0 to 258	1,1
VDC-3-49.15 B00-E/18	18,4 : 1	2	2,2	0 to 217	1,1
VDC-3-49.15 B00-E/23	23,1 : 1	2	2,8	0 to 173	1,1
VDC-3-49.15 B00-E/31	31,1 : 1	2	3,8	0 to 129	1,1
VDC-3-49.15 B00-E/40	40,1 : 1	2	4,9	0 to 100	1,1
VDC-3-49.15 B00-E/55	55,0 : 1	3	6,0	0 to 73	1,2
VDC-3-49.15 B00-E/70	70,4 : 1	3	7,7	0 to 57	1,2
VDC-3-49.15 B00-E/92	92,3 : 1	3	10,1	0 to 43	1,2



F<sub>axial</sub> 50 N  
F<sub>radial</sub> 150 N    L<sub>1</sub> 17 mm

Permissible shaft load at nominal speed and life expectancy L<sub>10</sub> at 5 000 h (at T<sub>U</sub> max. 40°C).



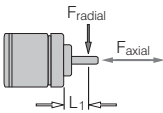
# VARIODRIVE Compact gearmotor

VDC-3-49.15-PX63 / -PX63 HRL

- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with one- and multi-stage planetary gearboxes in modular design
- Gearbox housing made of die-cast zinc
- First stage with noise optimized helical gears made of low-friction-optimised plastics
- Second stage with planetary gears made of case-hardened steel for high torques
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios
- Version HRL 63 with reinforced support of the output stage for increased radial loads



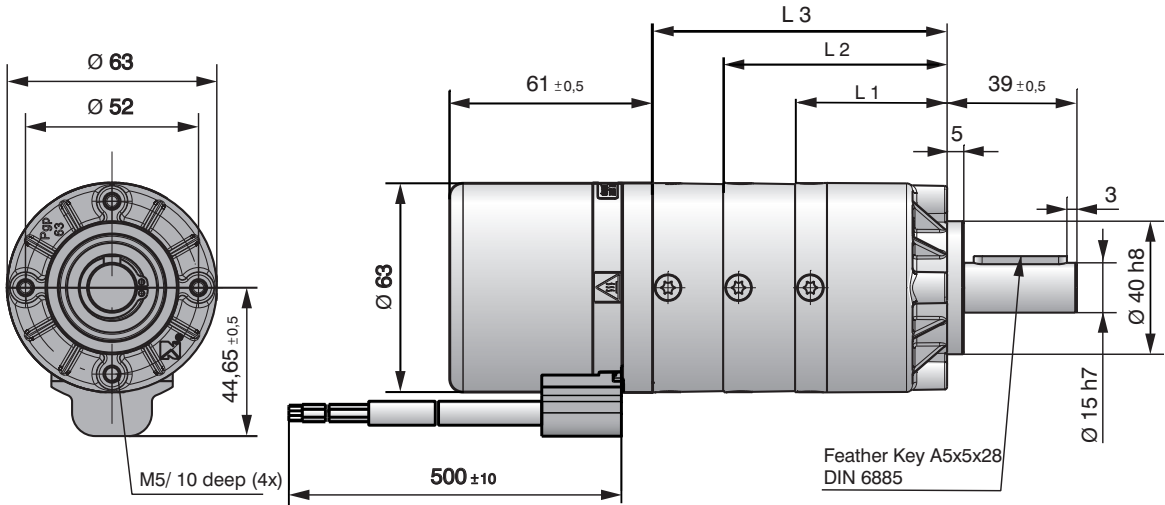
Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass
Type	i		Nm	rpm	kg
VDC-3-49.15 B00-PX63/3	3,2 : 1	1	0,4	0 to 1258	1,1
VDC-3-49.15 B00-PX63/5	5,0 : 1	1	0,7	0 to 800	1,1
VDC-3-49.15 B00-PX63/21	21,3 : 1	2	2,6	0 to 188	1,3
VDC-3-49.15 B00-PX63/30	30,0 : 1	2	3,6	0 to 133	1,3
VDC-3-49.15 B00-PX63HRL/5	5,0 : 1	1	0,7	0 to 800	1,4
VDC-3-49.15 B00-PX63HRL/9	9,0 : 1	1	1,2	0 to 444	1,4
VDC-3-49.15 B00-PX63HRL/30	30,0 : 1	2	3,6	0 to 133	2,0



F<sub>axial</sub> 500 N  
F<sub>radial</sub> 350 N (PX..), 500 N (PX..HRL) L<sub>1</sub> 19 mm  
Permissible shaft load at nominal speed and life expectancy L<sub>10</sub> at 5 000 h (at T<sub>U</sub> max. 40°C).

### Motor length (mm)

	Type	
L3	PX 63 2-stage with HRL	88,6 ± 0,3
L2	PX 63 1-stage with HRL	67,2 ± 0,3
L2	PX 63 2-stage without HRL	67,2 ± 0,3
L1	PX 63 1-stage without HRL	45,8 ± 0,3



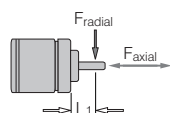
# VARIODRIVE Compact gearmotor

VDC-3-49.15-PN63

- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with one- and multi-stage planetary gearboxes
- Gearbox housing made of machined aluminium
- Precision machined gears in the aluminium hollow wheel
- Noise-optimised helical gears in all stages
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios

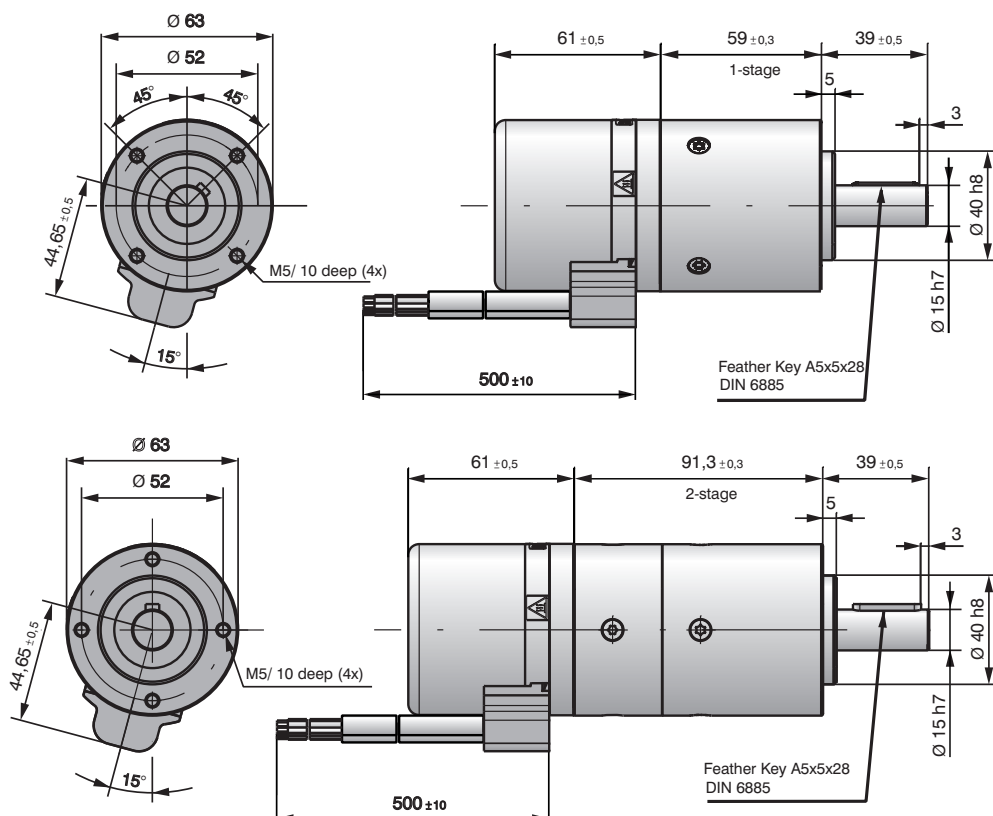


Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass
Type	i		Nm	rpm	kg
VDC-3-49.15 B00-PN63/4	4,3 : 1	1	0,6	0 to 930	1,2
VDC-3-49.15 B00-PN63/6	6,0 : 1	1	0,8	0 to 667	1,2
VDC-3-49.15 B00-PN63/26	26,0 : 1	2	3,2	0 to 154	1,4



$F_{axial}$  1000 N  
 $F_{radial}$  500 N  $L_1$  19 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).



# VARIODRIVE Compact gearmotor

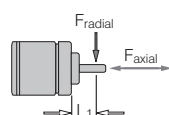
VDC-3-49.15-EC75



- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with single and multi-stage angular gearboxes
- High efficiency through innovative crown gear technology
- Gearbox housing made of die-cast zinc
- Smooth-running and robust due to optimized gear design
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios

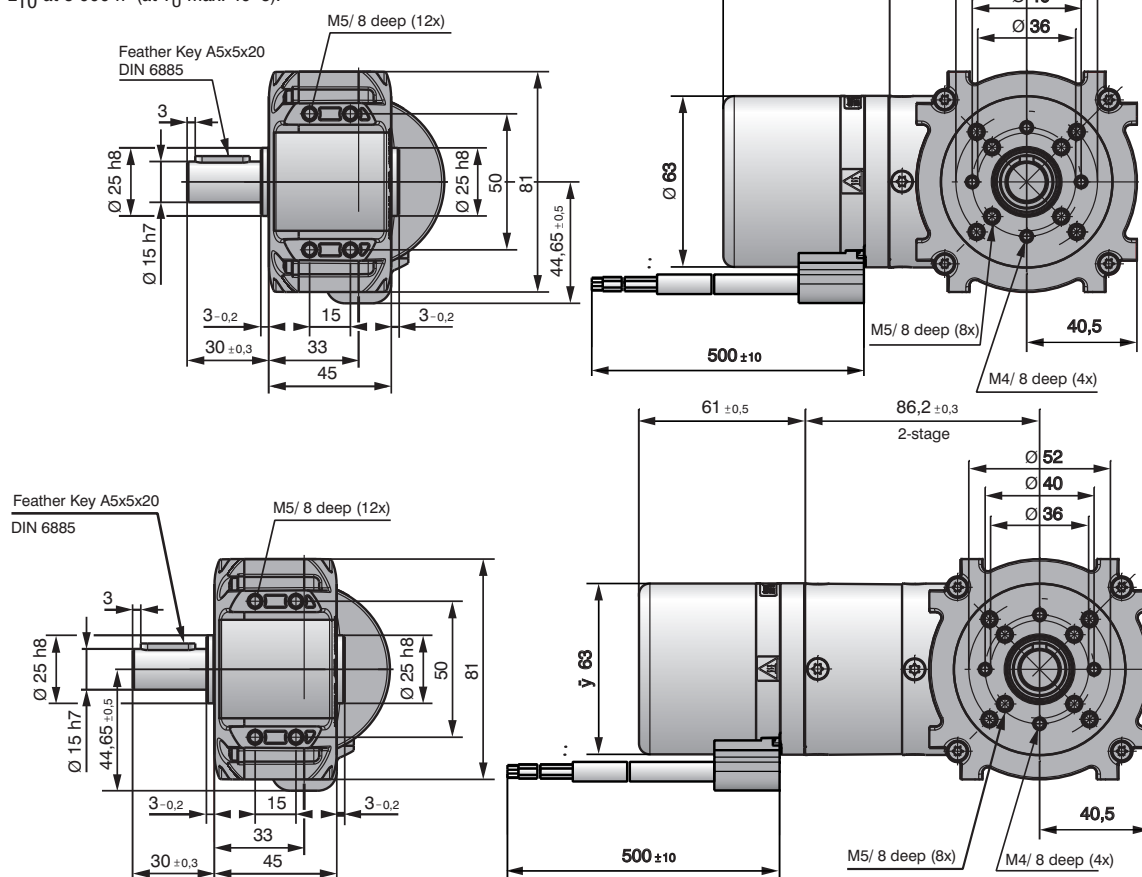
## Nominal data

Type	Gear ratio <i>i</i>	Gear stages	Nominal torque Nm	Speed range rpm	Mass kg
VDC-3-49.15 B00-EC75/4	4,1 : 1	1	0,6	0 to 976	1,6
VDC-3-49.15 B00-EC75/7	6,7 : 1	1	0,9	0 to 597	1,6
VDC-3-49.15 B00-EC75/20	20,3 : 1	2	2,5	0 to 120	2,0
VDC-3-49.15 B00-EC75/33	33,3 : 1	2	4,0	0 to 120	2,0



$F_{axial}$  500 N  
 $F_{radial}$  400 N  $L_1$  15 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).



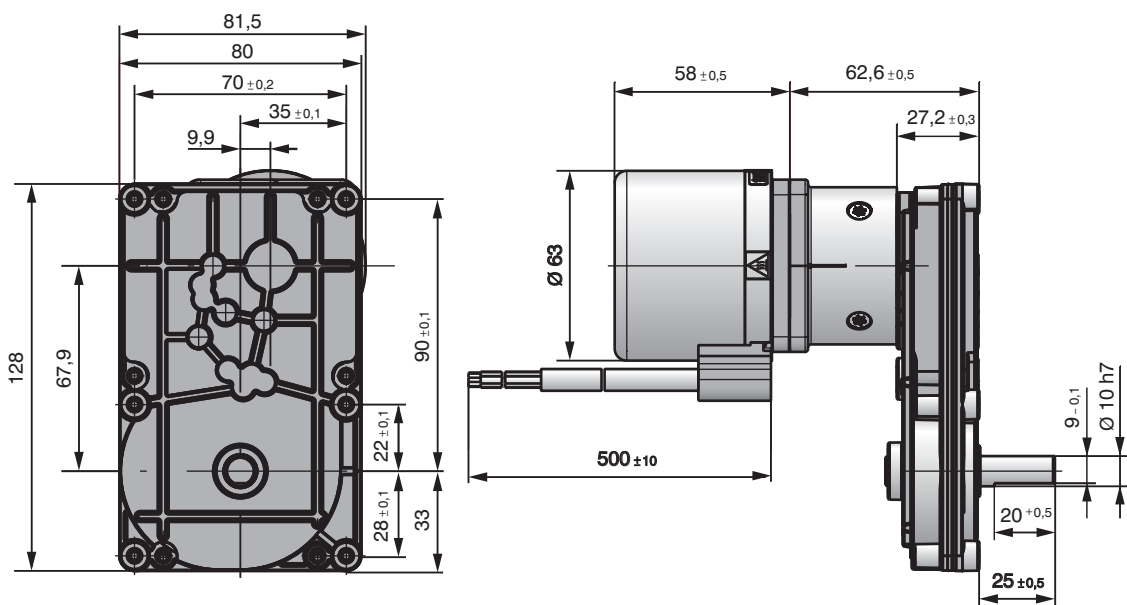
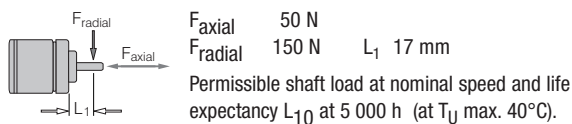
# VARIODRIVE Compact gearmotor

VDC-3-49.15-B, NEMA



- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with multi-stage spur gearboxes in flat design
- Gearbox assembly through standardised NEMA 23 interface
- Easy mounting or gearbox exchange through the use of a clamped gearwheel
- Gearbox housing made of die-cast zinc
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios

Nominal data		Gear ratio	Gear stages	Nominal torque	Speed range	Mass
Type		i		Nm	rpm	kg
VDC-3-49.15 B00-B/18-N23		18,0 : 1	3	2,0	0 to 222	1,3
VDC-3-49.15 B00-B/28-N23		27,6 : 1	3	3,0	0 to 145	1,3
VDC-3-49.15 B00-B/40-N23		40,3 : 1	3	4,4	0 to 99	1,3
VDC-3-49.15 B00-B/64-N23		64,0 : 1	3	7,0	0 to 63	1,3
VDC-3-49.15 B00-B/102-N23		101,8 : 1	3	11,1	0 to 39	1,3



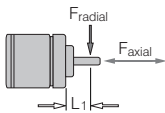
# VARIODRIVE Compact gearmotor

VDC-3-49.15-D, NEMA

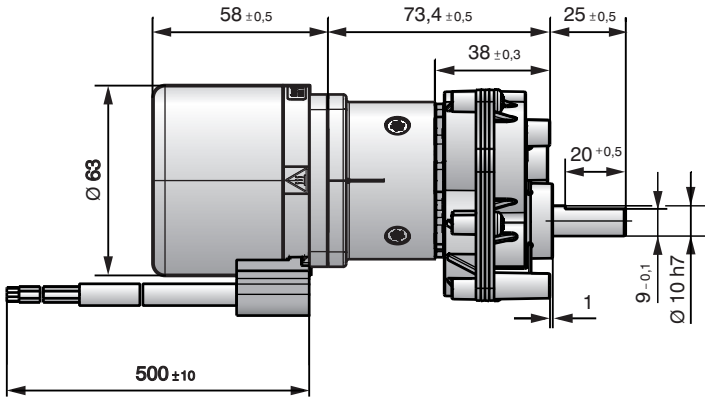
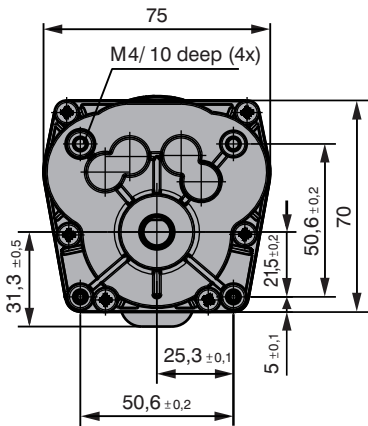


- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with multi-stage spur gearboxes in flat design
- Gearbox assembly through standardised NEMA 23 interface
- Easy mounting or gearbox exchange through the use of a clamped gearwheel
- Gearbox housing made of die-cast zinc
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios

Nominal data		Gear ratio	Gear stages	Nominal torque	Speed range	Mass
Type		i		Nm	rpm	kg
VDC-3-49.15 B00-D/8-N23		7,8 : 1	2	0,9	0 to 513	1,2
VDC-3-49.15 B00-D/9-N23		9,1 : 1	2	1,1	0 to 440	1,2
VDC-3-49.15 B00-D/11-N23		11,1 : 1	2	1,3	0 to 360	1,2
VDC-3-49.15 B00-D/14-N23		13,8 : 1	2	1,7	0 to 290	1,2
VDC-3-49.15 B00-D/18-N23		18,4 : 1	2	2,2	0 to 217	1,2
VDC-3-49.15 B00-D/22-N23		22,0 : 1	2	2,7	0 to 182	1,2
VDC-3-49.15 B00-D/28-N23		27,6 : 1	2	3,4	0 to 145	1,2
VDC-3-49.15 B00-D/42-N23		41,6 : 1	3	5,1	0 to 96	1,25
VDC-3-49.15 B00-D/67-N23		67,3 : 1	3	8,2	0 to 59	1,25



Faxial 50 N  
Fradial 150 N    L<sub>1</sub> 17 mm  
Permissible shaft load at nominal speed and life expectancy L<sub>10</sub> at 5 000 h (at T<sub>U</sub> max. 40°C).



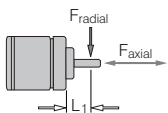
# VARIODRIVE Compact gearmotor

VDC-3-49.15-PX52, NEMA



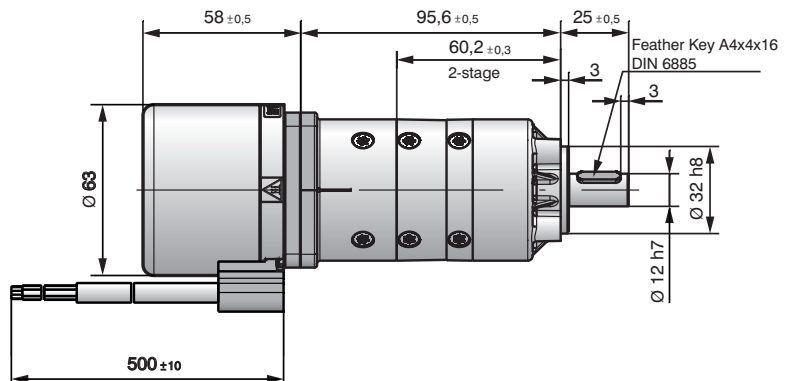
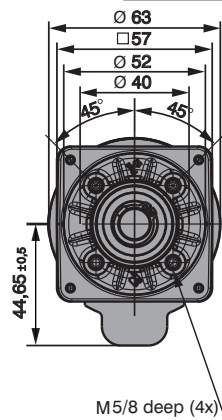
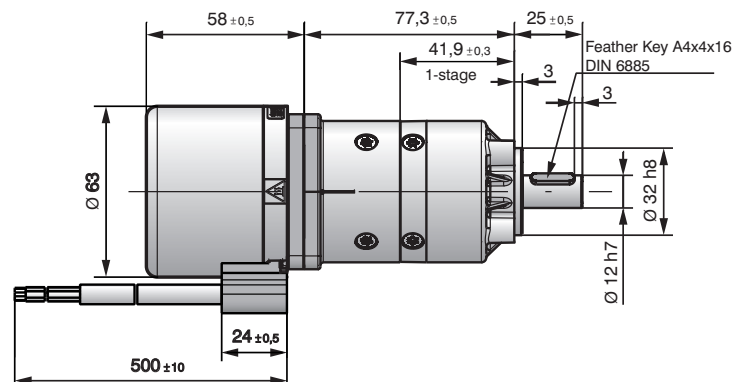
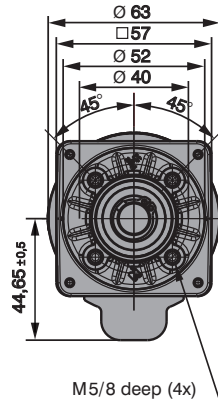
- 3-phase external rotor motor in EC technology
- Integrated operating electronics with extensive functionality
- Combined with one- and multi-stage planetary gearboxes in modular design
- Gearbox assembly through standardised NEMA 23 interface
- Easy mounting or gearbox exchange through the use of a clamped gearwheel
- Gearbox housing made of die-cast zinc
- Grease lubrication for maintenance-free continuous operation
- Available in various reduction ratios

Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Mass
Type	i		Nm	rpm	kg
VDC-3-49.15 B00-PX52/5-N23	5,0 : 1	1	0,7	0 to 800	1,1
VDC-3-49.15 B00-PX52/9-N23	9,0 : 1	1	1,2	0 to 444	1,1
VDC-3-49.15 B00-PX52/21-N23	21,3 : 1	2	2,6	0 to 188	1,25
VDC-3-49.15 B00-PX52/30-N23	30,0 : 1	2	3,6	0 to 133	1,25
VDC-3-49.15 B00-PX52/38-N23	38,3 : 1	2	4,6	0 to 105	1,25
VDC-3-49.15 B00-PX52/54-N23	54,0 : 1	2	6,6	0 to 74	1,25



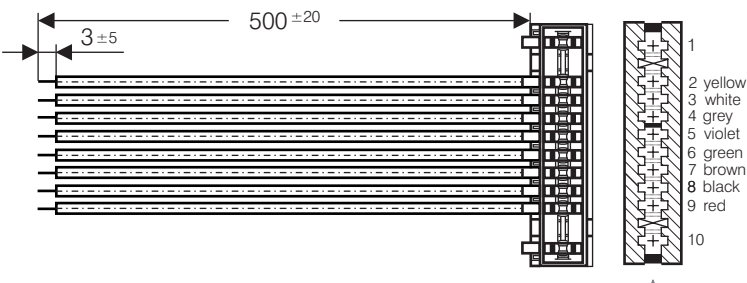
$F_{axial}$  500 N  
 $F_{radial}$  350 N  $L_1$  12,5 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).



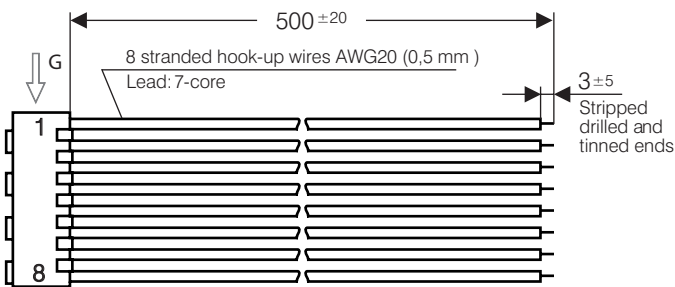
**Type 194 0009 000**  
Motor connection cable for  
VARIODRIVE Compact  
motors VD-3-43.10

**Connector F**  
Lumberg Duomodul -  
plug, connector 2,5 mm  
10 pole,  
Lumberg Order No.  
35 15 10 K05 S01

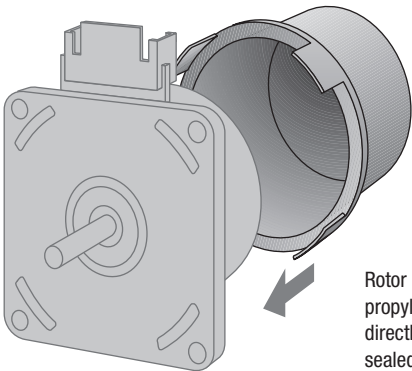


**Type 194 0014 000**  
Motor connection cable for  
VARIODRIVE Compact  
motors VDC-3-54.14.

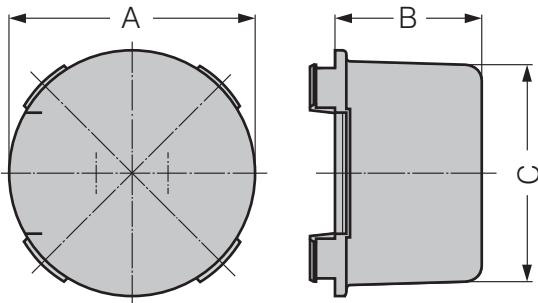
**Connector G**  
MT-Edge 5 mm - 8pole natural  
for 0,5 mm contact  
with 2 IDC contacts  
Order No. AMP 829 213-8



**Rotor protective cap**

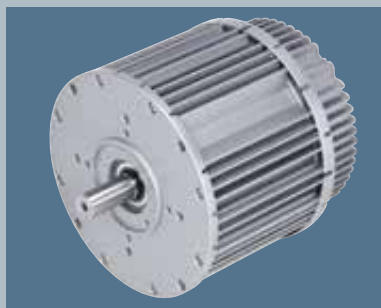


Rotor protective cap of black polypropylene (PP). The cap is fitted directly onto the motor flange and sealed with a rubber seal.



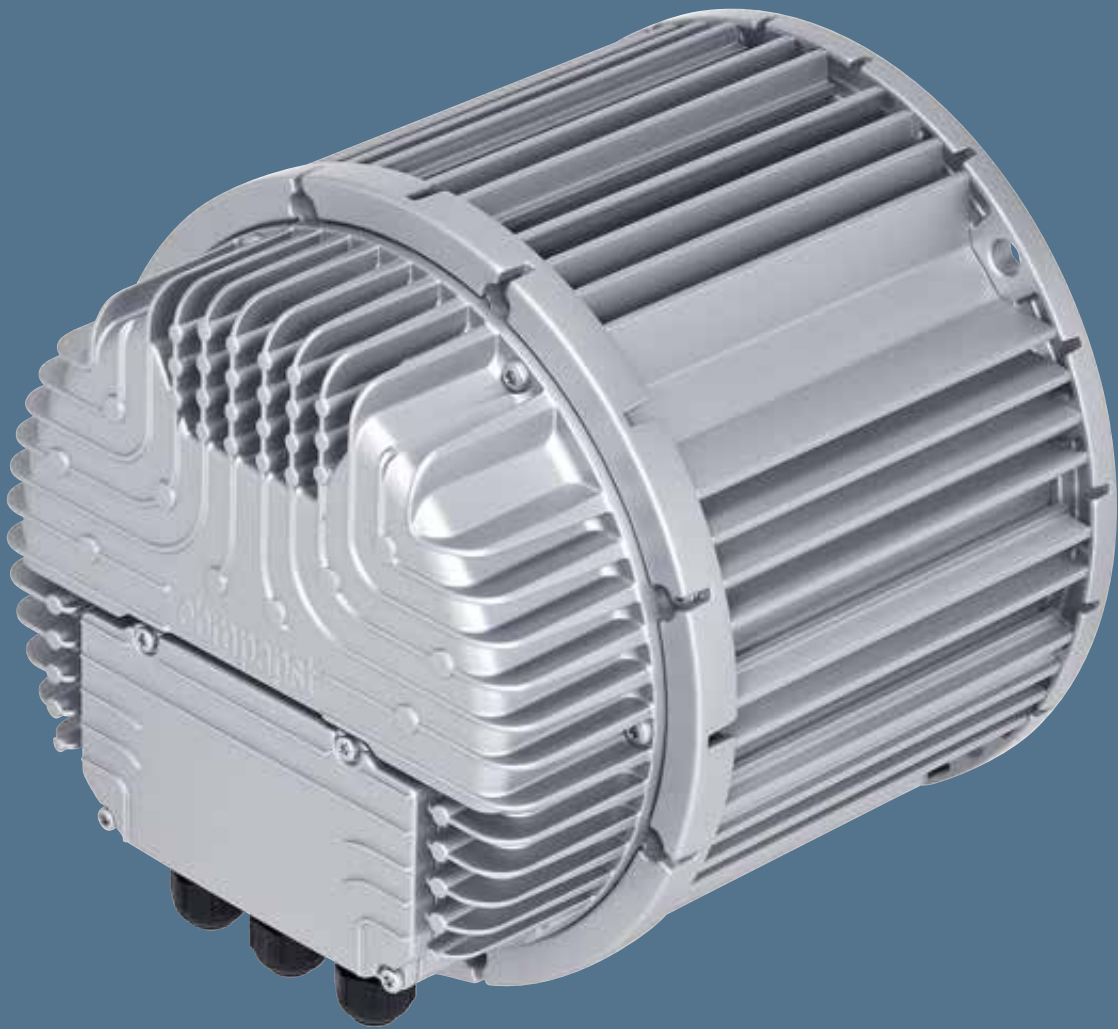
The protective cap cannot be mounted with motor VDC-3-43.10!  
When using the protective cap, power is reduced due to the thermal conditions.

		VARIODRIVE VD ... 35.0X 194 3506 000	VARIODRIVE VD ... 43.10 194 4310 000	VARIODRIVE VD ... 54.14 194 5414 000
Dimension	A	57	65	82
	B	27,4	38,8	42
	C	49,5	57,4	74,4



# VarioDrive C

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VarioDrive C, size 150	67



# Our new EC drive motors VarioDrive C

## Technical information

The new line-fed EC drive solution VarioDrive C from ebm-papst Mulfingen is an intelligent alternative to IEC standard motors with frequency inverter. Their robust mechanical design with IP 55 type of protection and insulation class "B" or "F" make for long service life and allow operation in tough ambient conditions. Their mounting options are the same as with the well-known B14 / B5 flange variant and make them easy to connect to the customer application.

A common feature of all three different sizes M3G084, M3G112 and M3G150 is their closed and compact design with integrated electronics. Torques between 1.0 - 18.0 Nm can easily be realised in the 390 - 2100 W performance range in connection with variable speed control.

There are numerous analogue and digital control inputs available to control the motor. Additionally, connection is also possible via RS485 interface.

Diverse functions such as under-voltage detection, over-temperature protection, locked-rotor protection and motor current limitation ensure motor safety.

Electronically commutated synchronous machines come with high efficiency. This advantage becomes especially apparent with speed control in partial load operation when comparing them to asynchronous machines. Here, higher efficiency brings about a considerable savings in energy, thus conserving resources and protecting the environment. Wear-and-tear of the motor and the unit it drives is also reduced at partial load, increasing service life and bringing down the maintenance expenditure of the complete application.

**Application areas:**

The VarioDrive C is particularly suited for applications with square torque curve, such as fan and pump drives.

If aggressive media, high temperatures or fluids are involved, the motor usually has to be installed outside the delivery chamber or delivery medium.

Therefore, typical applications include:

- Climate-controlled cabinets
- Air exhaust boxes
- Process technology plants
- And many more ...



# EC drive motors

VarioDrive C, size 084

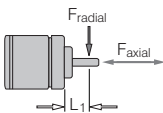


- **Material:** Motor housing / electronics:  
Die-cast aluminium
  - **Direction of rotation:**  
Counter-clockwise, seen on shaft
  - **Type of protection:** IP 55
  - **Insulation class:** "B"
  - **Mounting position:** Any
  - **Mode of operation:**  
Continuous operation (S1)
  - **Bearings:** Maintenance-free ball bearings
  - **Technical features:**  
See electr. connection p. 70
- **EMC:**  
Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2  
Harmonics acc. to EN 61000-3-2/3
  - **Leakage current:**  
< 3,5 mA acc. to EN 61800-5-1
  - **Cable exit:** Variable
  - **Protection class:** I
  - **Product conforming to standards:**  
CE; EN 61800-5-1

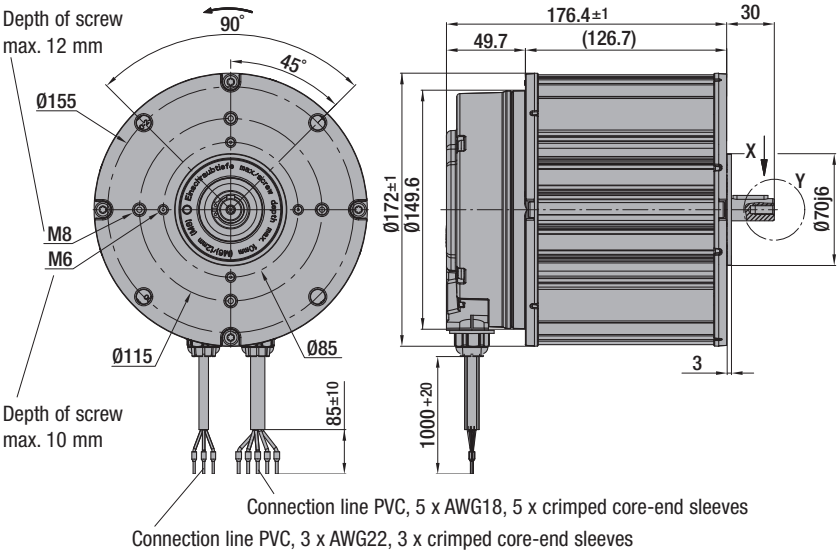
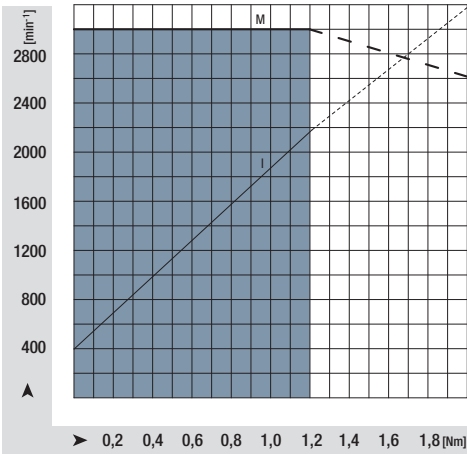
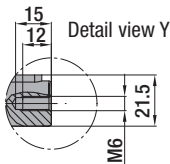
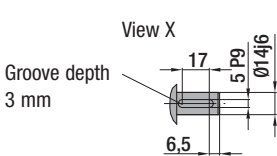
Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> x10 <sup>-6</sup>	°C	kg	p. 70
M3G084-DF18 -81	1~ 200-277	50/60	3000	1,2	2,2	500	380	1960	-25..+40	5,3	K1)

subject to alterations

Nominal data at maximum load and 230 VAC



Faxial 150 N  
 Fradial 450 N    L<sub>1</sub> 15 mm  
 Permissible shaft load at nominal speed and life expectancy L<sub>10</sub> at 20 000 h (at T<sub>U</sub> max. 40°C).





# EC drive motors

VarioDrive C, size 084



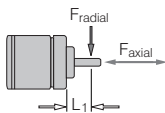
- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "B"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 71
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2  
Harmonics acc. to EN 61000-3-2/3
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

## Nominal data

Type	Nominal voltage range VAC	Frequency Hz	Speed/rpm	Torque Nm	Current draw A	Input power W	Output power W	Rotor moment of inertia kgm <sup>2</sup> x10 <sup>-6</sup>	Perm. amb. temp. °C	Mass kg	Electr. connection p. 71
M3G084-FA33 -82	1~ 200-277	50/60	3000	1,6	2,7	621	503	2440	-25..+40	6,9	L7)

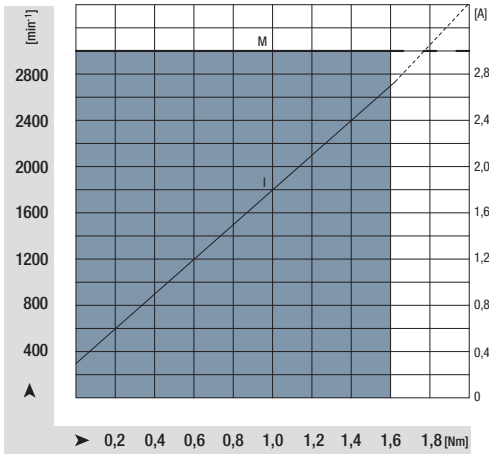
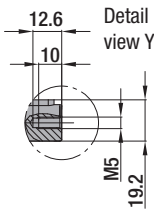
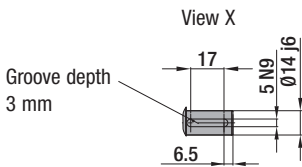
subject to alterations

Nominal data at maximum load and 230 VAC

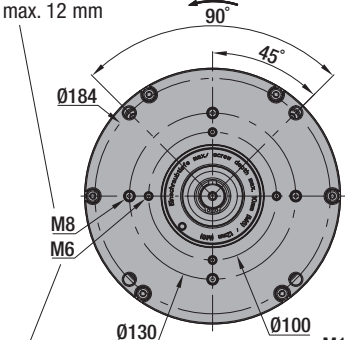


$F_{axial}$  150 N  
 $F_{radial}$  540 N  $L_1$  15 mm

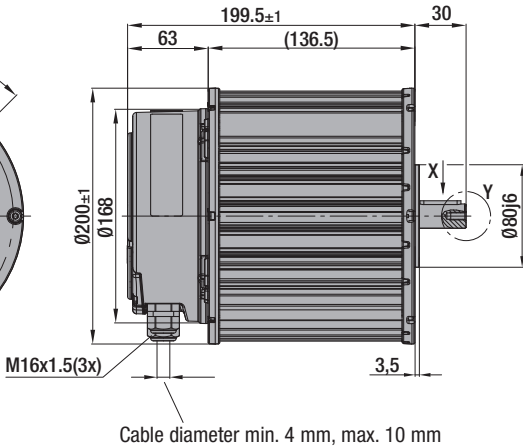
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



Depth of screw max. 12 mm



Depth of screw max. 10 mm



# EC drive motors

VarioDrive C, size 084

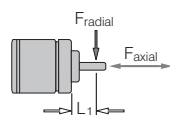


- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "B"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 71
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2  
Harmonics acc. to EN 61000-3-2/3
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> ×10 <sup>-6</sup>	°C	kg	p. 71
<b>M3G084-GF06 -42</b>	3~ 380-480	50/60	3000	2,0	1,4	750	630	3120	-25..+40	7,7	L6)

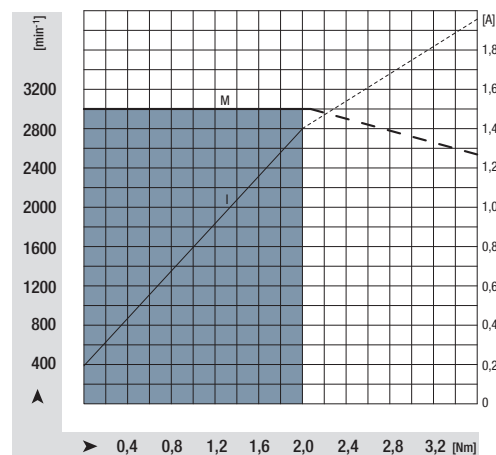
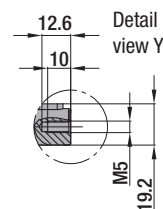
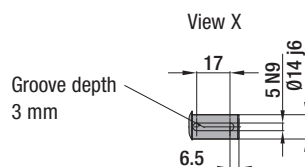
subject to alterations

Nominal data at maximum load and 400 VAC

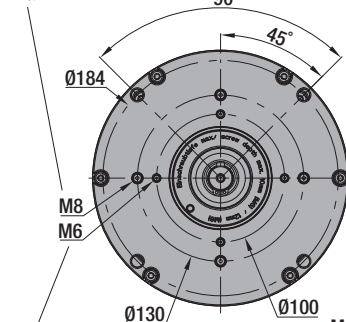


$F_{axial}$  150 N  
 $F_{radial}$  650 N  $L_1$  15 mm

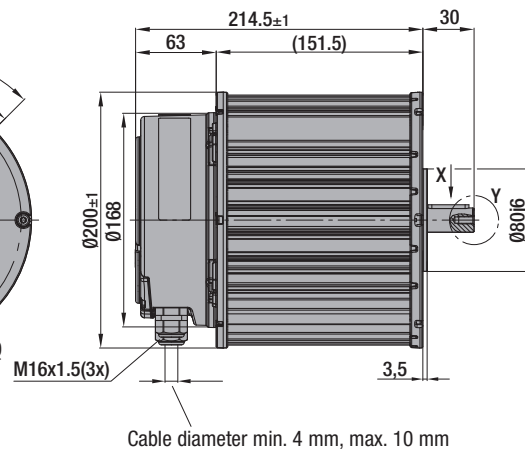
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



Depth of screw max. 12 mm



Depth of screw max. 10 mm



Cable diameter min. 4 mm, max. 10 mm

# EC drive motors

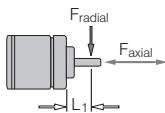
VarioDrive C, size 112



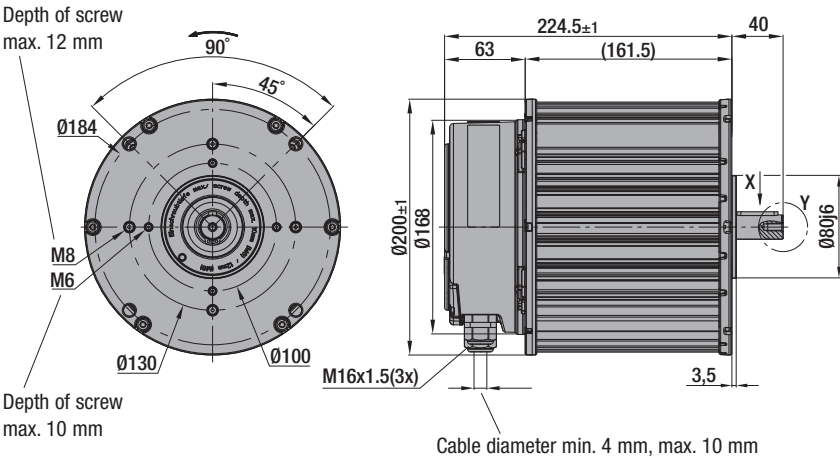
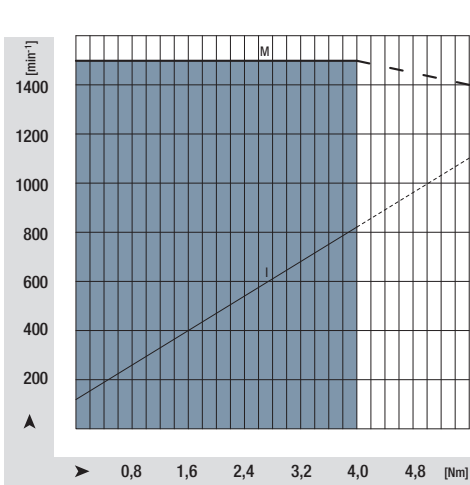
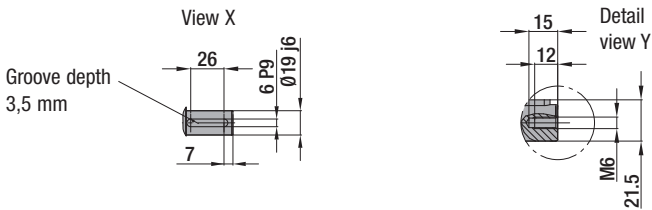
- **Material:** Motor housing / electronics: Die-cast aluminium
  - **Direction of rotation:** Counter-clockwise, seen on shaft
  - **Type of protection:** IP 55
  - **Insulation class:** "B"
  - **Mounting position:** Any
  - **Mode of operation:** Continuous operation (S1)
  - **Bearings:** Maintenance-free ball bearings
  - **Technical features:** See electr. connection p. 71
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2  
Harmonics acc. to EN 61000-3-2/3
  - **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
  - **Connection leads:** Via terminal box
  - **Protection class:** I (acc. to EN 61800-5-1)
  - **Product conforming to standards:** CE; EN 61800-5-1

Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> x10 <sup>-6</sup>	°C	kg	p. 71
M3G112-GA52 -71	1 ~ 200-277	50/60	1500	4,0	3,4	740	630	10240	-25..+40	10,3	L7)

subject to alterations
 Nominal data at maximum load and 230 VAC



$F_{axial}$  200 N  
 $F_{radial}$  2000 N     $L_1$  20 mm  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



# EC drive motors

VarioDrive C, size 112

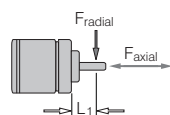


- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "B"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 71
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2  
Harmonics acc. to EN 61000-3-2/3
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> ×10 <sup>-6</sup>	°C	kg	p. 71
<b>M3G112-IA85 -71</b>	1 ~ 200-277	50/60	1000	5,0	2,8	620	520	12550	-25...+40	13,0	L7)

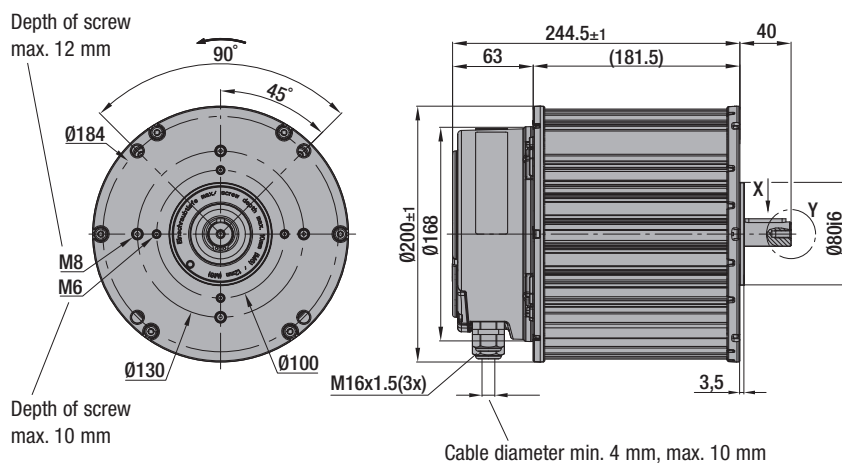
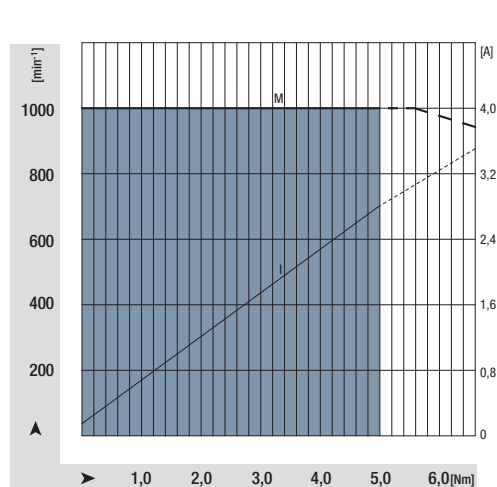
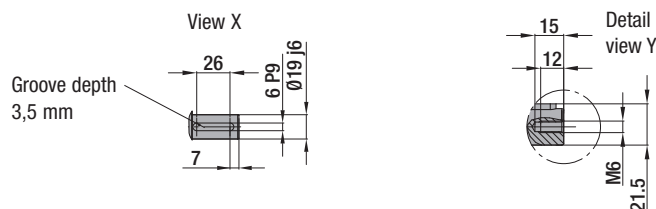
subject to alterations

Nominal data at maximum load and 230 VAC



$F_{axial}$  200 N  
 $F_{radial}$  3200 N  $L_1$  20 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



# EC drive motors

VarioDrive C, size 112



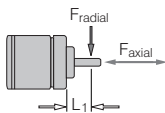
- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "B"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 71
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2  
Harmonics acc. to EN 61000-3-2/3
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

## Nominal data

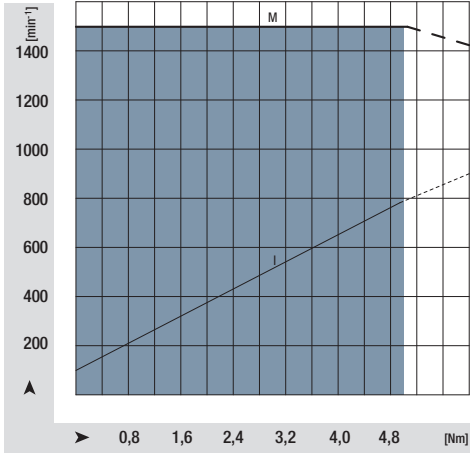
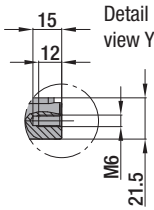
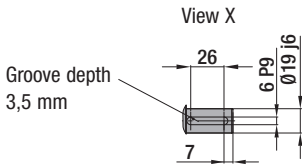
Type	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> x10 <sup>-6</sup>	°C	kg	p. 71
M3G112-GA32 -51	3~ 380-480	50/60	1500	5,0	1,6	915	785	10240	-25..+40	9,8	L6)

subject to alterations

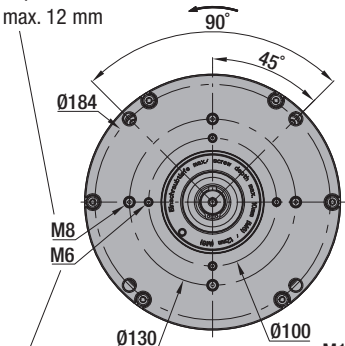
Nominal data at maximum load and 400 VAC



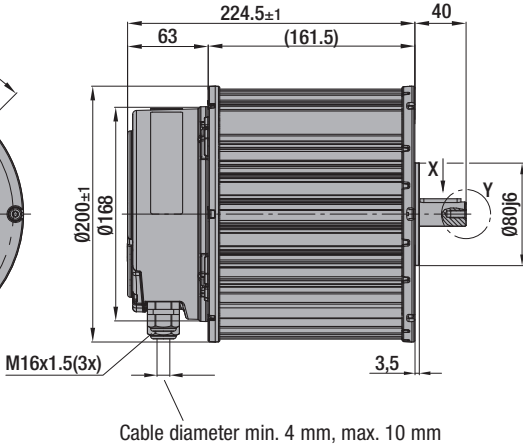
$F_{axial}$  200 N  
 $F_{radial}$  2000 N  $L_1$  20 mm  
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



Depth of screw max. 12 mm



Depth of screw max. 10 mm



# EC drive motors

VarioDrive C, size 112

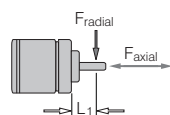


- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "B"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 72
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> ×10 <sup>-6</sup>	°C	kg	p. 72
<b>M3G112-GA53 -72</b>	1 ~ 200-277	50/60	3000	3,5	5,8	1330	1100	10240	-25..+40	14,5	L8)

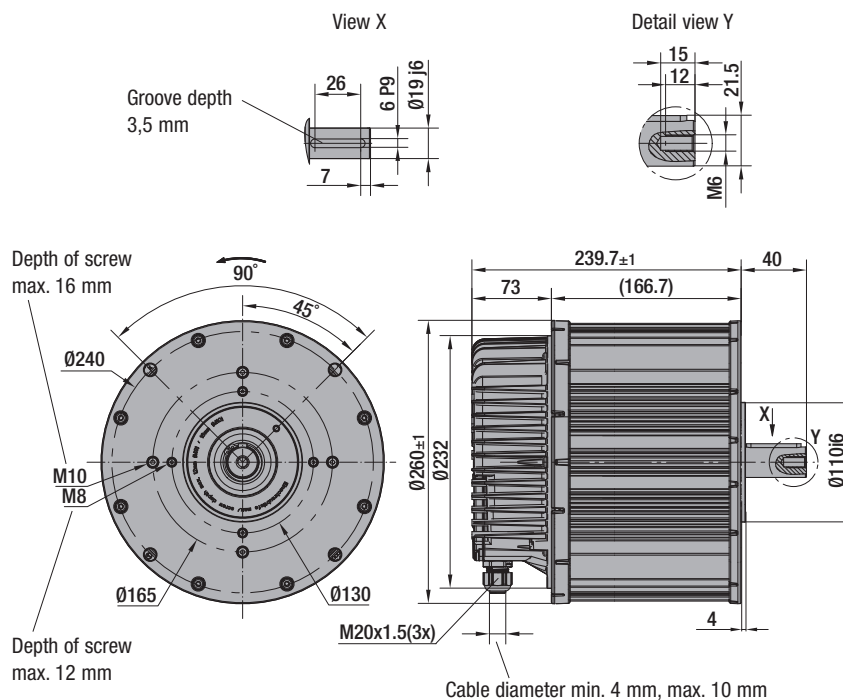
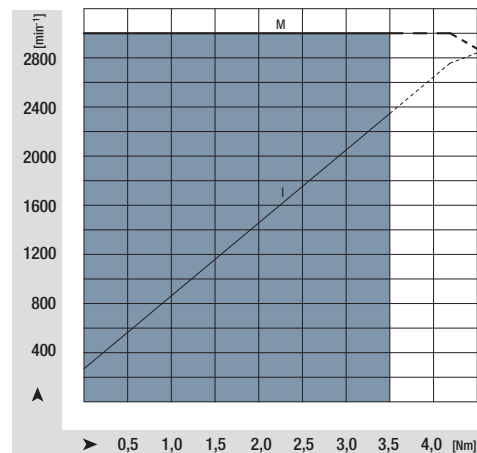
subject to alterations

Nominal data at maximum load and 230 VAC



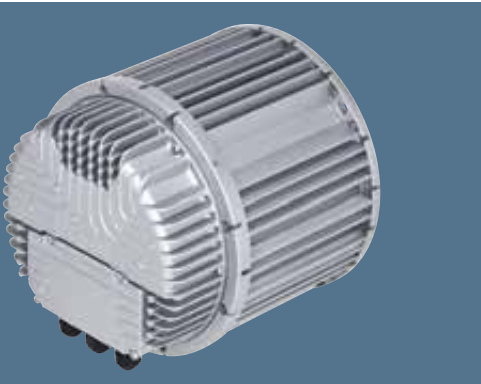
$F_{axial}$  200 N  
 $F_{radial}$  1200 N  $L_1$  20 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



# EC drive motors

## VarioDrive C, size 112

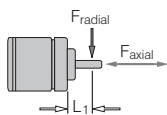


- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "B"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 73
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> ×10 <sup>-6</sup>	°C	kg	p. 73
<b>M3G112-GA43 -52</b>	3~ 380-480	50/60	3000	4,5	2,6	1650	1420	10240	-25..+40	14,5	L5)

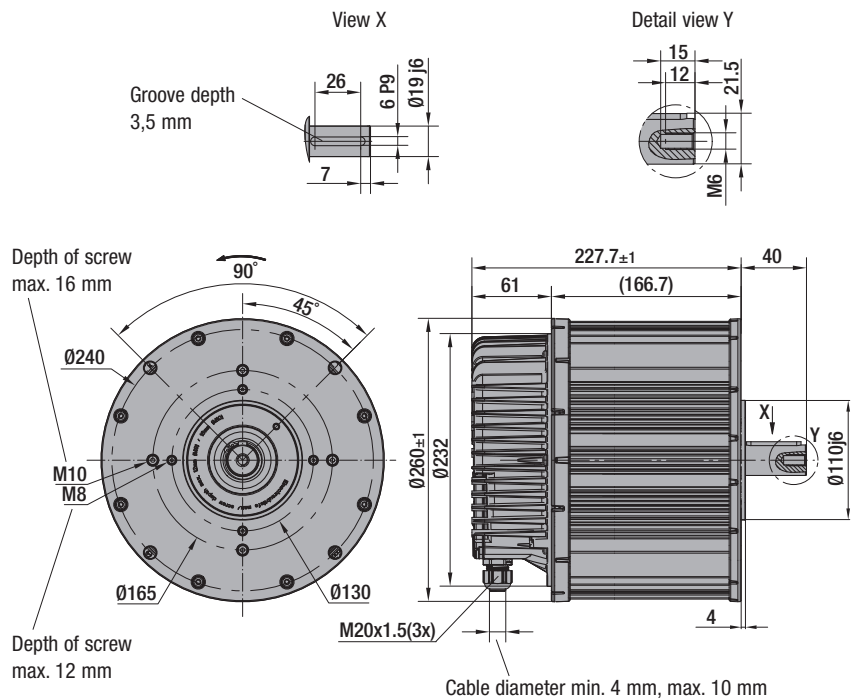
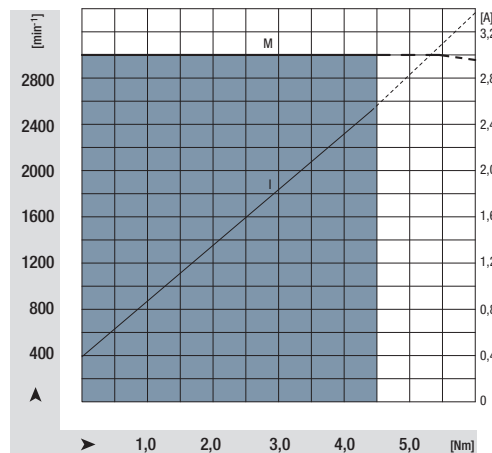
subject to alterations

Nominal data at maximum load and 400 VAC



$F_{axial}$  200 N  
 $F_{radial}$  1200 N  $L_1$  20 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



# EC drive motors

VarioDrive C, size 150

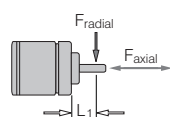


- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "F"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 73
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> ×10 <sup>-6</sup>	°C	kg	p. 73
<b>M3G150-FF21 -51</b>	3~ 380-480	50/60	1500	9,0	2,5	1620	1420	35720	-25..+40	20,4	L5)

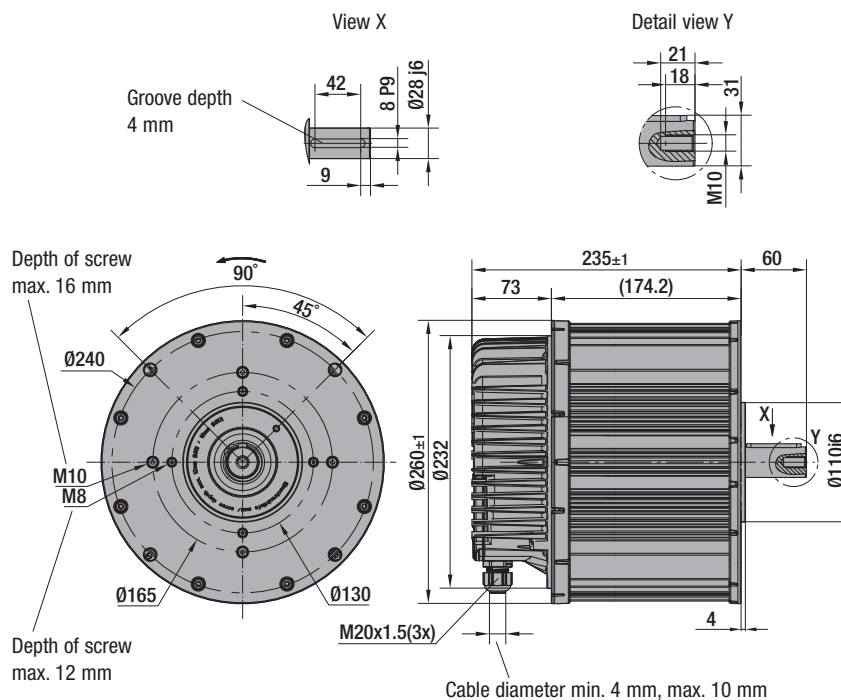
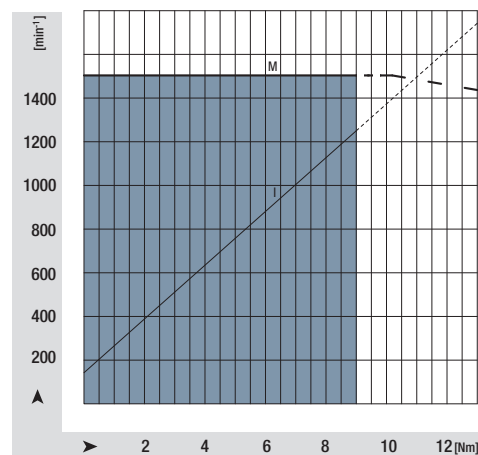
subject to alterations

Nominal data at maximum load and 400 VAC



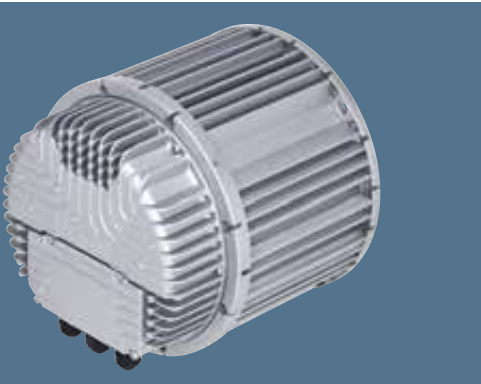
$F_{axial}$  300 N  
 $F_{radial}$  1800 N  $L_1$  30 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



# EC drive motors

VarioDrive C, size 150

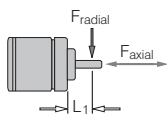


- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "F"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 73
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> x10 <sup>-6</sup>	°C	kg	p. 73
<b>M3G 150-IF21 -52</b>	3~ 380-480	50/60	1500	12,0	3,3	2100	1890	47980	-25..+40	26,2	L5)

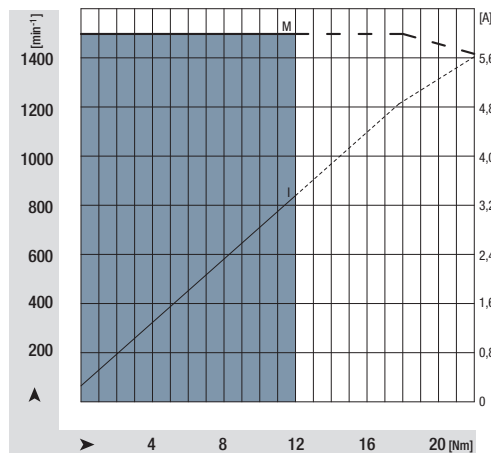
subject to alterations

Nominal data at maximum load and 400 VAC



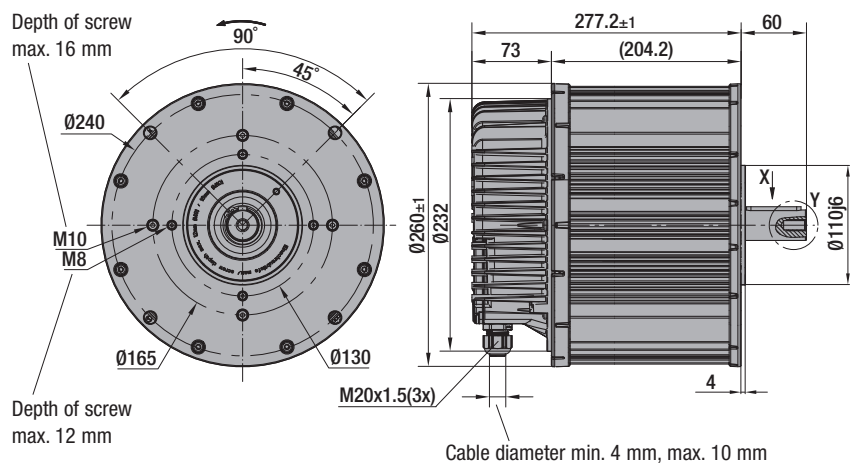
$F_{axial}$  300 N  
 $F_{radial}$  2480 N  $L_1$  30 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



Depth of screw max. 16 mm

Depth of screw max. 12 mm



# EC drive motors

VarioDrive C, size 150

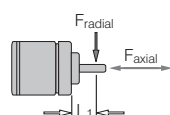


- **Material:** Motor housing / electronics: Die-cast aluminium
- **Direction of rotation:** Counter-clockwise, seen on shaft
- **Type of protection:** IP 55
- **Insulation class:** "F"
- **Mounting position:** Any
- **Mode of operation:** Continuous operation (S1)
- **Bearings:** Maintenance-free ball bearings
- **Technical features:** See electr. connection p. 73
- **EMC:** Interference emission acc. to EN 61000-6-4  
Interference immunity acc. to EN 61000-6-2
- **Leakage current:** < 3,5 mA acc. to EN 61800-5-1
- **Connection leads:** Via terminal box
- **Protection class:** I (acc. to EN 61800-5-1)
- **Product conforming to standards:** CE; EN 61800-5-1

Nominal data	Nominal voltage range	Frequency	Speed/rpm	Torque	Current draw	Input power	Output power	Rotor moment of inertia	Perm. amb. temp.	Mass	Electr. connection
Type	VAC	Hz	rpm	Nm	A	W	W	kgm <sup>2</sup> x10 <sup>-6</sup>	°C	kg	p. 73
<b>M3G150-NA02 -52</b>	3~ 380-480	50/60	1000	18,0	3,2	2100	1900	62900	-25..+40	31,7	L5)

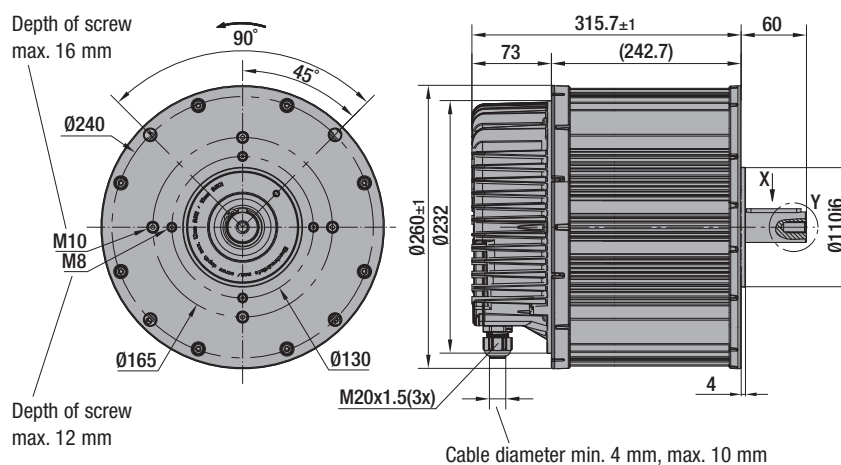
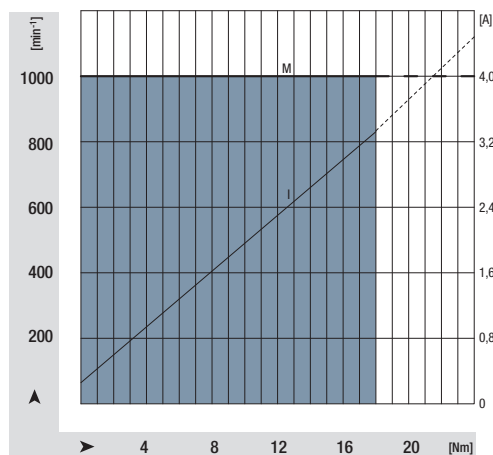
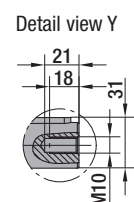
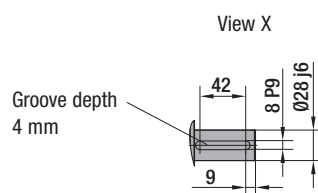
subject to alterations

Nominal data at maximum load and 400 VAC



$F_{axial}$  300 N  
 $F_{radial}$  4100 N  $L_1$  30 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).

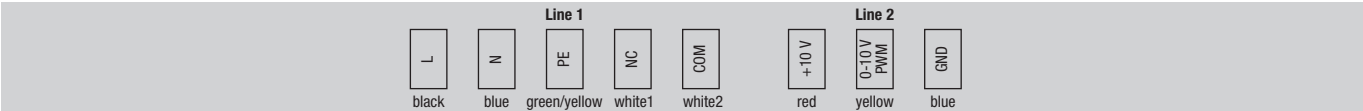
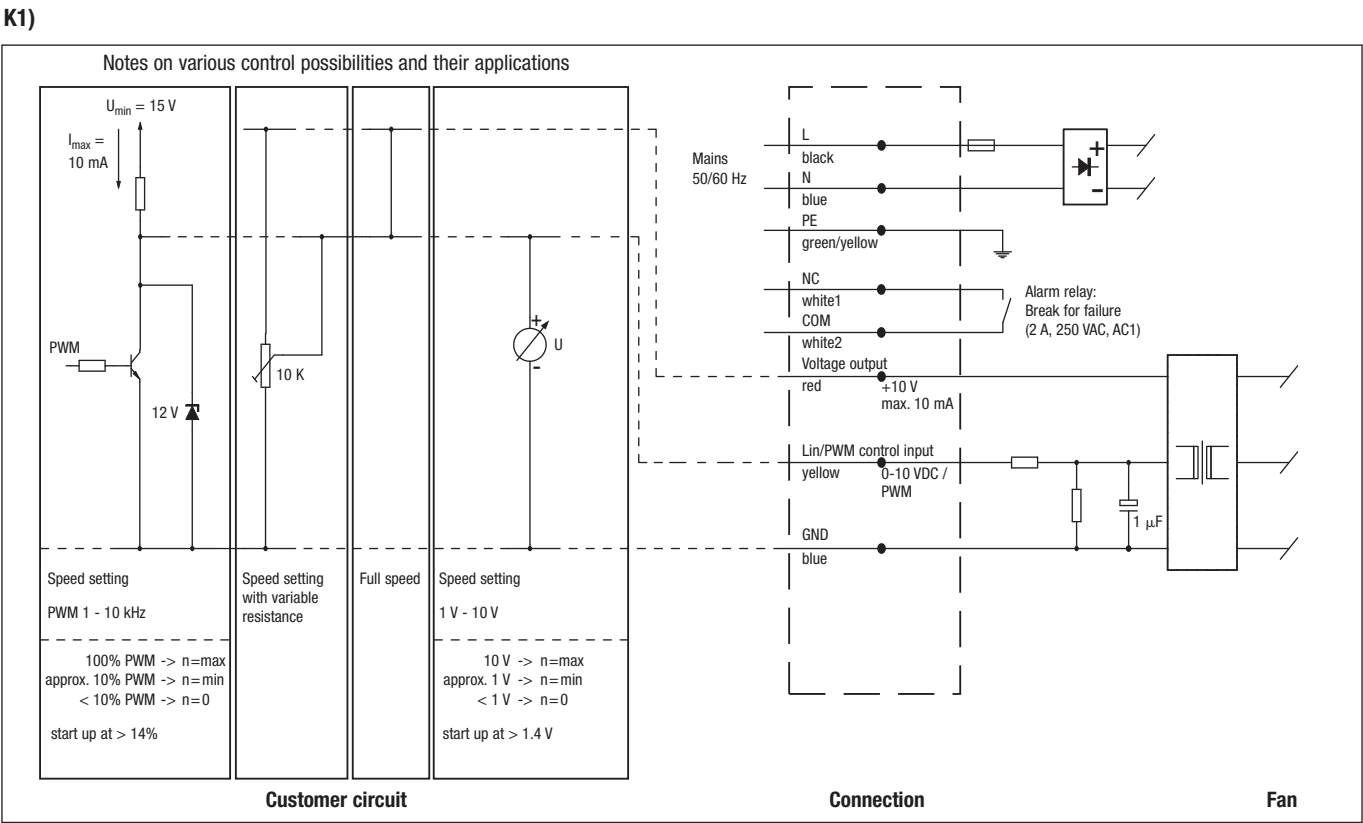


# Electrical connection VarioDrive C

Size 084

**Technical features:**

- PFC (active)
- Control input 0-10 VDC / PWM
- Output 10 VDC max. 10 mA
- Alarm relay
- Electronics / motor overtemperature protection



Line	Connection	Colour	Assignment / function	Line	Connection	Colour	Assignment / function
1	L	black	Mains 50/60 Hz, phase	2	+10 V	red	Voltage output +10 V max. 10 mA
	N	blue	Mains 50/60 Hz, neutral		0-10 V / PWM	yellow	Control input (Impedance 100 kΩ)
	PE	green/yel	Protective earth		GND	blue	GND
	NC	white1	Alarm relay, break for failure				
	COM	white2	Alarm relay, COMMON				

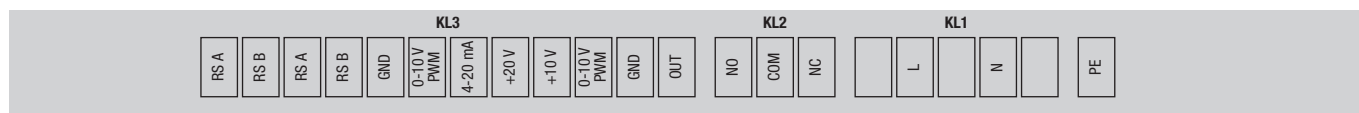
# Electrical connection VarioDrive C

Size 084/112

## Technical features:

- L7 = PFC (active) / L6 = PFC (passive)
- Integrated PID controller
- Control input 0-10 VDC / PWM
- Input for sensor 0-10 V or 4-20 mA
- Slave output 0-10 V max. 3 mA
- Output 20 VDC ( $\pm 20\%$ ) max. 50 mA
- Output 10 VDC ( $\pm 10\%$ ) max. 10 mA
- RS485 ebmBUS
- Alarm relay
- Line undervoltage detection
- only L6 = Phase failure detection
- Motor current limitation
- Electronics / motor overtemperature protection
- Locked-rotor protection
- Soft start

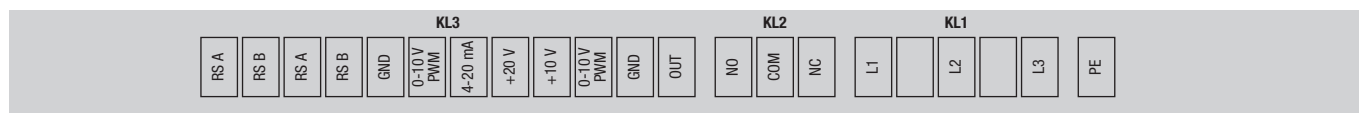
L7)



Connector	Connection	Assignment / function
PE	PE	Protective earth
KL1	N	Mains 50/60 Hz. neutral
	L	Mains 50/60 Hz. phase
KL2	NC	Alarm relay, break for failure
	COM	Alarm relay, COMMON (2A, 250 VAC, AC1)
	NO	Alarm relay, make for failure

Connector	Connection	Assignment / function
KL3	OUT	Master output 0-10 V max. 3 mA
	GND	GND
	0-10 V / PWM	Control / Actual value input (Impedance 100 k $\Omega$ )
	+10 V	Supply for external potentiometer, 10 VDC ( $\pm 10\%$ ) max. 10 mA
	+20 V	Supply for external sensor, 20 VDC ( $\pm 20\%$ ) max. 50 mA
	4-20 mA	Control / Actual value input
	0-10 V / PWM	Control / Actual value input
	GND	GND
	RSB	RS485 interface for ebmBUS; RS B
	RSA	RS485 interface for ebmBUS; RS A
	RSB	RS485 interface for ebmBUS; RS B
	RSA	RS485 interface for ebmBUS; RS A

L6)



Connector	Connection	Assignment / function
PE	PE	Protective earth
KL1	L3	Mains; L3
	L2	Mains; L2
	L1	Mains; L1
KL2	NC	Alarm relay, break for failure
	COM	Alarm relay, COMMON (2A, 250 VAC, AC1)
	NO	Alarm relay, make for failure

Connector	Connection	Assignment / function
KL3	OUT	Master output 0-10 V max. 3 mA
	GND	GND
	0-10 V / PWM	Control / Actual value input (Impedance 100 k $\Omega$ )
	+10 V	Supply for external potentiometer, 10 VDC ( $\pm 10\%$ ) max. 10 mA
	+20 V	Supply for external sensor, 20 VDC ( $\pm 20\%$ ) max. 50 mA
	4-20 mA	Control / Actual value input
	0-10 V / PWM	Control / Actual value input
	GND	GND
	RSB	RS485 interface for ebmBUS; RS B
	RSA	RS485 interface for ebmBUS; RS A
	RSB	RS485 interface for ebmBUS; RS B
	RSA	RS485 interface for ebmBUS; RS A

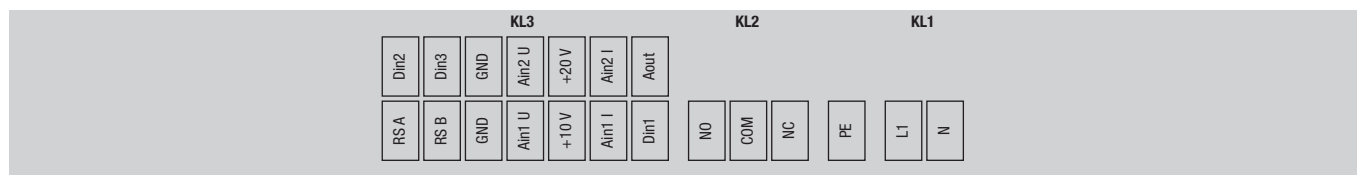
# Electrical connection VarioDrive C

Size 112

## Technical features:

- PFC (active)
- Integrated PID controller
- Control input 0-10 VDC or 4-20 mA
- Input for sensor 0-10 V or 4-20 mA
- Slave output 0-10 V max. 5 mA
- Output 20 VDC ( $\pm 25\%$  /  $-10\%$ ) max. 50 mA
- Output 10 VDC ( $+3\%$ ) max. 10 mA
- RS485 MODBUS
- Motor current limitation, alarm relay
- Line undervoltage / phase failure detection
- Electronics / motor overtemperature protection
- Locked-rotor protection, soft start
- Digital inputs for day/night switch, enabling, cooling / heating

L8)



Connector	Connection	Assignment / function
KL1	N	Mains; N
	L1	Mains; L1
PE	PE	Protective earth
KL2	NC	Alarm relay, break for failure
	COM	Alarm relay, COMMON (2A, 250 VAC, AC1)
	NO	Alarm relay, make for failure

Connector	Connection	Assignment / function
KL3	Din1	Digital input 1 (enabling / disabling of electronics),, Enabling: Pin open or applied voltage 5 to 50 VDC Disabling: Bridge to GND or applied voltage $< 1$ VDC
	Ain1 I	Analogue set value input, 4-20 mA (impedance 100 $\Omega$ ), only to be used as alternative to terminal Ain1 U
	+10 V	Supply for external potentiometer, 10 VDC ( $\pm 3\%$ ) max. 10 mA
	Ain1U	Analogue set value input, 0-10 V (impedance 100 k $\Omega$ ), only to be used as alternative to terminal Ain1 I
	GND	GND
	RSB	RS485 interface for MODBUS RTU; RS B
	RSA	RS485 interface for MODBUS RTU; RS A
	Aout	Analogue output 0-10 V max. 5 mA, reading of current motor speed / current motor control factor
	Ain2 I	Analog. actual value input, 4-20mA (impedance 100 $\Omega$ ), only to be used as alternative to terminal Ain2 U
	+20 V	Supply for external sensor, 20 VDC ( $+25\%$ / $-10\%$ ) max. 40 mA
	Ain2 U	Analog. actual value input, 0-10 V (impedance 100 k $\Omega$ ), only to be used as alternative to terminal Ain2 I
	GND	GND
	Din3	Digital input 3 (switch Normal / Inverse), The preset effective direction of the integrated controller can be selected via BUS or via digital input Normal/Inverse. Normal: Pin open or applied voltage 5 to 50 VDC Inverse: Bridge to GND or applied voltage $< 1$ VDC
	Din2	Digital input 2 (switch Day / Night), The preset set of parameters can be selected via BUS or via digital input Day/Night. Day: Pin open or applied voltage 5 to 50 VDC Night: Bridge to GND or applied voltage $< 1$ VDC

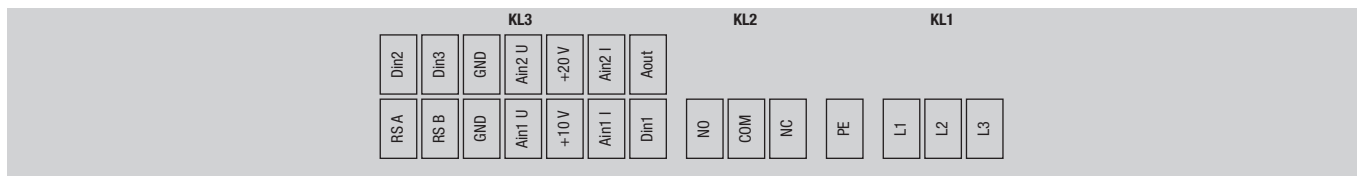
# Electrical connection VarioDrive C

Size 112/150

## Technical features:

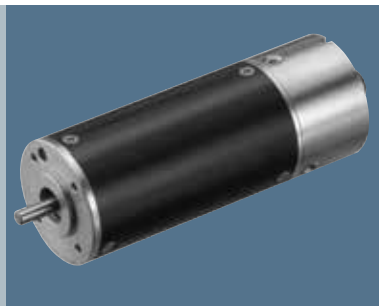
- PFC (passive)
- Integrated PID controller
- Control input 0-10 VDC or 4-20 mA
- Input for sensor 0-10 V or 4-20 mA
- Slave output 0-10 V max. 5 mA
- Output 20 VDC ( $\pm 25\%$  /  $-10\%$ ) max. 50 mA
- Output 10 VDC ( $+3\%$ ) max. 10 mA
- RS485 MODBUS
- Motor current limitation, alarm relay
- Line undervoltage / phase failure detection
- Electronics / motor overtemperature protection
- Locked-rotor protection, soft start
- Digital inputs for day/night switch, enabling, cooling / heating

L5)



Connector	Connection	Assignment / function
KL1	L3	Mains; L3
	L2	Mains; L2
	L1	Mains; L1
PE	PE	Protective earth
KL2	NC	Alarm relay, break for failure
	COM	Alarm relay, COMMON (2A, 250 VAC, AC1)
	NO	Alarm relay, make for failure

Connector	Connection	Assignment / function
KL3	Din1	Digital input 1 (enabling / disabling of electronics),, Enabling: Pin open or applied voltage 5 to 50 VDC Disabling: Bridge to GND or applied voltage $< 1$ VDC
	Ain1 I	Analogue set value input, 4-20 mA (impedance 100 $\Omega$ ), only to be used as alternative to terminal Ain1 U
	+10 V	Supply for external potentiometer, 10 VDC ( $\pm 3\%$ ) max. 10 mA
	Ain1U	Analogue set value input, 0-10 V (impedance 100 k $\Omega$ ), only to be used as alternative to terminal Ain1 I
	GND	GND
	RSB	RS485 interface for MODBUS RTU; RS B
	RSA	RS485 interface for MODBUS RTU; RS A
	Aout	Analogue output 0-10 V max. 5 mA, reading of current motor speed / current motor control factor
	Ain2 I	Analog. actual value input, 4-20mA (impedance 100 $\Omega$ ), only to be used as alternative to terminal Ain2 U
	+20 V	Supply for external sensor, 20 VDC ( $+25\%$ / $-10\%$ ) max. 40 mA
	Ain2 U	Analog. actual value input, 0-10 V (impedance 100 k $\Omega$ ), only to be used as alternative to terminal Ain2 I
	GND	GND
	Din3	Digital input 3 (switch Normal / Inverse), The preset effective direction of the integrated controller can be selected via BUS or via digital input Normal/Inverse. Normal: Pin open or applied voltage 5 to 50 VDC Inverse: Bridge to GND or applied voltage $< 1$ VDC
	Din2	Digital input 2 (switch Day / Night), The preset set of parameters can be selected via BUS or via digital input Day/Night. Day: Pin open or applied voltage 5 to 50 VDC Night: Bridge to GND or applied voltage $< 1$ VDC



# The ECI motor family

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ECI motor sensor	94



# The ECI motor – dynamics, performance and high flexibility



## Technical information

Are you looking for high dynamic properties, high torque and full power on demand? The electronically commutated inner rotor motors of the ECI series are the professional drive solution when short cycle times, fast motion-sequences and long lifetime are required.

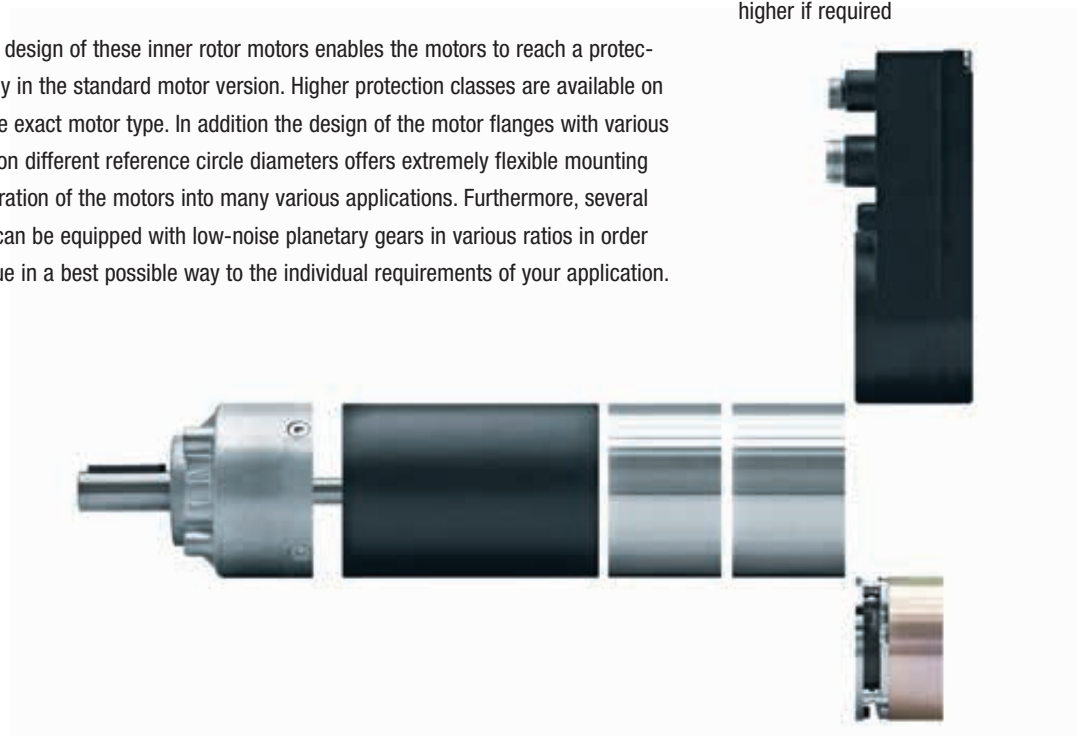
With the electronic commutation of the ECI motors, the maximum values for life expectancy are made possible. Based on this the ECI motors can be used in many various applications as maintenance-free drive components throughout the entire life span of the device or machine. Depending on the motor type and size the commutation electronics to operate these motors is available either as integrated or external version.

High power density has been achieved by using highly efficient neodymium magnetic materials. This enables the ECI motors to deliver a high output power from a comparably small motor volume for a vast variety of applications and assembly situations. For most of the motors in this series the magnets are designed as bar magnets that are embedded into the slots of a stacked rotor lamination core. Being permanently embedded, these magnets are not only efficient to manufacture in automated production, but they can also be used up to high motor speeds without the need for any additional safety measures.

The mechanically closed design of these inner rotor motors enables the motors to reach a protection class of IP 40 already in the standard motor version. Higher protection classes are available on request depending on the exact motor type. In addition the design of the motor flanges with various diameters of bore holes on different reference circle diameters offers extremely flexible mounting possibilities for the integration of the motors into many various applications. Furthermore, several types of the ECI motors can be equipped with low-noise planetary gears in various ratios in order to adapt speed and torque in a best possible way to the individual requirements of your application.

### In brief and straight to the point

- 3-phase, electronically commutated internal rotor with neodymium magnet
- Power range from 30 to 270 watts, high power density and wide overload margin
- Long service life and silent running
- Rotor position detection via 3 Hall-sensors
- Several motor types also available with planetary gears
- Optoelectronic encoder for some motor types available on request
- Spring applied brake for some motor types available on request
- Customer-specific winding layouts
- Winding insulation as per Insulation Class E
- Protection class as per EN 60 034-5: IP 40, higher if required



The ECI motor series consists of 4 sizes, with diameters from 35 to 63 mm, and some are available in several lengths. In addition to the DRIVECONTROL series operating electronics included, a variety of gearboxes are also available. Other accessory components, which are available on request, can be used to expand the application possibilities to a vast array of drive tasks.

### **ECI 63 Modular System - from the module to the smart module:**

At the heart of this series is newly developed multi-pole internal rotor motors that have been optimised by means of elaborate FEM calculations for ideal distribution of the magnetic flow density in the motor.

This effort yields remarkable results: Nominal torque up to nearly 900 mNm and thus up to 400 W output power and a motor efficiency of up to 90 % for size 63 mean an enormous increase in performance compared to the predecessor motors.

The combination of the auxiliary modules can be selected as desired according to the modular principle, but follows a clear structure. The motor is always the first module in the drive housing. Depending on the requirement, it is followed by a high-torque permanent magnet brake and high-resolution encoders in various designs. The "rear panel" of all of the functional modules that can be integrated is the motor control element with integrated electronics, including the corresponding interfaces. All modules are assembled using a systematic interface design. The result is a drive with type of protection IP 54 from a single cast.

### **External expansions are no problem.**

However, even with the installation of the integrated modules, the limit of expansion options is not yet reached. As an alternative to the integrated modules or in addition to them, you can install additional modules with a shaft in open design that is lead through the B side or rear of the drive. Here, additional brakes with powerful spring force mechanics and encoders in various designs are available.

### **Electronics that are modular and scalable.**

The complete modularity of the ECI module includes the drive electronics. This reduces the range of motor variants needed to a minimum and enables each configuration to be equipped with different performance classes or different range of function for its drive task. This range extends from a simple module with rotor position encoder and external commutation (K1) to the high-end design (K5), which includes features such as a CANopen interface with multiple program modules to DSP 402 (or IEC 61800-7-201). An implementation and programming tool and an interpreter enable you to create user-specific sequence programs that carry out the functions of a small PLC.

### **Performance advantages at a glance:**

- Reduced design and maintenance effort for versatility in forming variants
- Full compatibility of all modules
- Very high power density with dramatically increased torque
- IP 54 possible as standard for every configuration
- CANopen interface in size K5

# ECI motors

The following diagram illustrates the sequence of the Hall signals and the corresponding drive sequence with the relevant colours and / or pin assignment that apply to customer-developed products and / or to purchased electronics. It also illustrates the phase position of these signals to the induced motor voltage.

## Commutation sequences

### Commutation sequence

Chronological signal sequence of integrated Hall sensors (= RLG) at the corresponding connections.

### Switching sequences of the power output stage

Required relationship between the signal change from RLG and the relevant change for the switching status of the power transistors in relation to the phase lead to the motor.

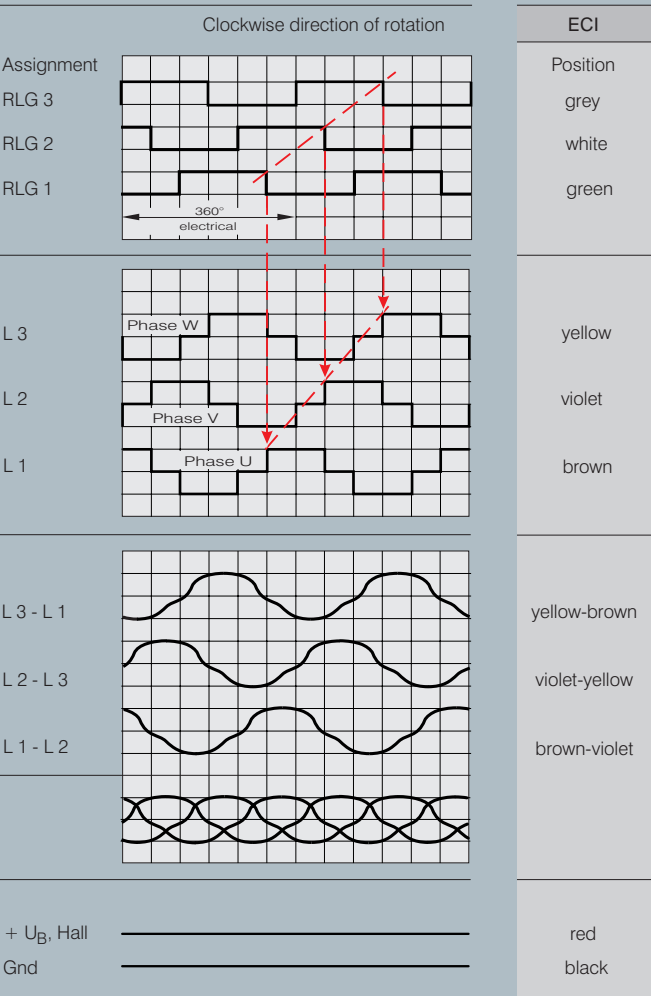
### Induced voltages

Idealised illustration of the sequence of the induced voltages between the relevant connections.

### Total of induced voltages

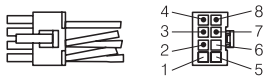
### Supply voltage for

Hall IC



### Sensor plug ECI 24.XX / 63.XX

Type: Molex  
No.: 39-01-2085



1: —	2: red	3: white
4: green	5: —	6: —
7: black	8: grey	

### Power plug ECI 24.XX / 63.XX

Type: Molex  
No.: 19-09-1036



1: yellow	2: violet	3: brown
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### Hall IC

Specification data available on request.

# ECI motor

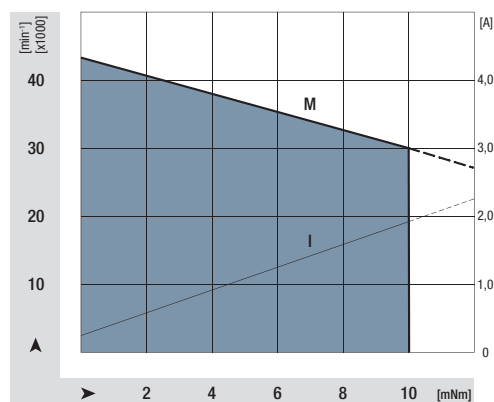
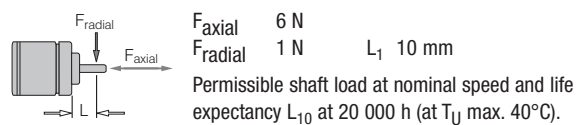
## ECI 30.20



- Very dynamic 3-phase, 6-pulse internal rotor motor.
- EC technology with slotless stator design.
- Extremely silent running, no cogging torque.
- Very suitable for high speed applications due to minimized iron losses.
- Dynamically balanced rotor with 4-pole neodymium magnet.
- Detection of rotor position via 3 Hall sensors.  
Option: motor without sensors for sensorless operation.
- Precision ball bearings for long service life and silent running.
- Motor supply and control via external operating electronics.

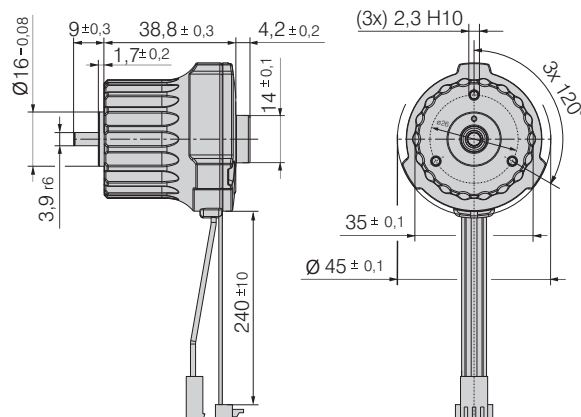
### Nominal data

Type		ECI 30.20 B01
Nominal voltage ( $U_{BN}$ )	V DC	24
Nominal speed ( $n_N$ )	rpm	30 000
Nominal torque ( $M_N$ )	mNm	10
Nominal current ( $I_{BN}$ )	A	1,9
Nominal output power ( $P_N$ )	W	32
Speed at no-load operation ( $n_L$ )	rpm	43 000
No-load current ( $I_{BL}$ )	A	0,20
Continuous stall torque ( $M_{BNO}$ )	mNm	---
Permissible eff. continuous stall current, motor lead ( $I_{n0eff}$ )	A	---
Permissible continuous stall power ( $P_{BNO}$ )	W	---
Short-term permiss. peak torque ( $M_{max}$ )	mNm	45
Permiss. peak current, motor lead ( $I_{max}$ )	A	8
Induced voltage ( $U_{imax}$ )	V/1000 rpm	0,62
Terminal resistance ( $R_v$ )	$\Omega$	1,9
Terminal inductance ( $L_v$ )	mH	0,26
Rotor moment of inertia ( $J_R$ )	$\text{kgm}^2 \times 10^{-6}$	1,5
Thermal resistance ( $R_{th}$ )	K/W	---
Protection class		IP 20
Ambient temperature range ( $T_U$ )	$^{\circ}\text{C}$	0 to +40
Motor mass (m)	kg	0,21
Order No.		932 3020 001



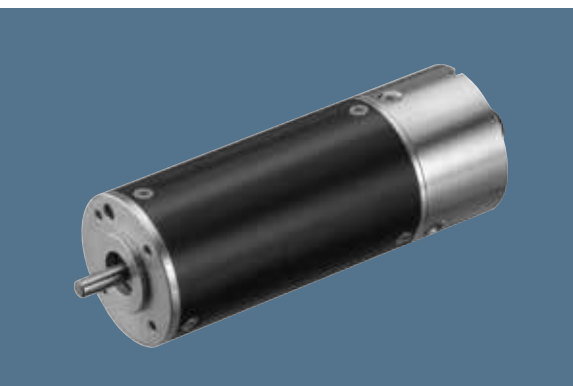
**Operating electronics:**  
DRIVECONTROL VT-A in a version without speed control can be used for tests (adapter cable necessary).

Blind holes for self threading screws according to DIN 7500. Screw in depth 5,3 mm max.



# ECI motor

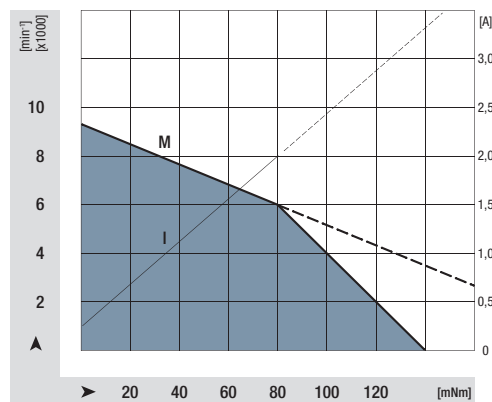
ECI-C-42.40



- Dynamic 3-phase internal rotor motor in EC technology with increased starting torque.
- Integrated operating electronics with powerful microcontroller.
- Excellent controllability due to digital 4-Q PI controller.
- High efficiency due to FET power output stage.
- Analog set value.
- Protection against overload due to integrated, speed-dependent current limiting.
- Customised versions possible by software and hardware adaption (e.g. fixed speed, direction of rotation).

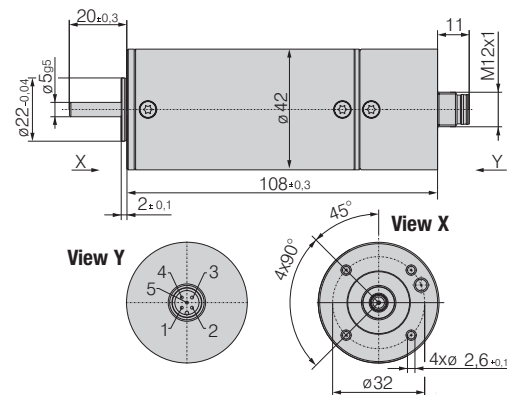
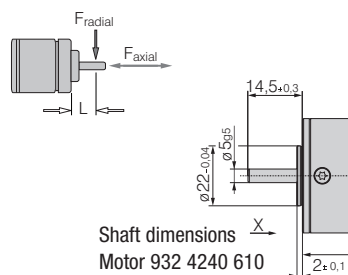
## Nominal data

Type		ECI-C-42.40 B01	ECI-C-42.40 B00
Nominal voltage ( $U_{BN}$ )	V DC	24	24
Permissible supply voltage range ( $U_B$ )	V DC	18 to 28	18 to 28
Nominal speed ( $n_N$ )	rpm	6 000	5 000
Nominal torque ( $M_N$ )	mNm	80	100
Nominal current ( $I_{BN}$ )	A	3,0	3,0
Nominal output power ( $P_N$ )	W	50	52
Speed at no-load operation ( $n_l$ )	rpm	9 300	6 300
No-load current ( $I_{BL}$ )	A	0,30	0,25
Max. reverse voltage	V DC	30	30
Set value input	V	0to10	0to10
Set speed	rpm	0 to 10 000	0 to 10 000
Recommended speed control range	rpm	300 to 6 000	300 to 5 000
Locked-rotor protection		thermal	thermal
Locked-rotor protection		no	no
Overload protection		yes	yes
Starting torque	mNm	140	140
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	3,2	3,2
Thermal resistance ( $R_{th}$ )	K/W	3,3	3,3
Protection class		IP 40	IP 40
Ambient temperature range ( $T_U$ )	°C	0 to +40	0 to +40
Motor mass (m)	kg	0,7	0,7
Order No.		932 4240 600	932 4240 610



$F_{axial}$  30 N  
 $F_{radial}$  15 N  $L_1$  10 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).



# Pin configuration for ECI-C-42.40

### Pin connection

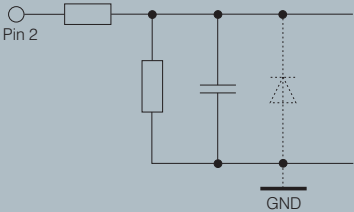
Pin 1	U <sub>B</sub>
Pin 2	Direction of rotation
Pin 3	GND
Pin 4	ACTUAL speed value
Pin 5	Set value

### Pin configuration

**Plug Type: Company Lumberg:**  
Lumberg Type RKT 5-228/...m (direct coupling)  
RKT 5-228/2m  
ebm-papst Order No. 992 0160 001  
Type RKWT 5-228/...m (angle coupling)  
Type FST 5-FKT 5-293/...m (Fixcon plug / coupling)

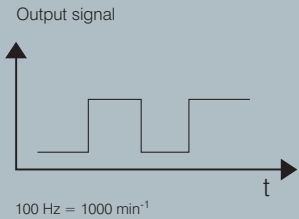
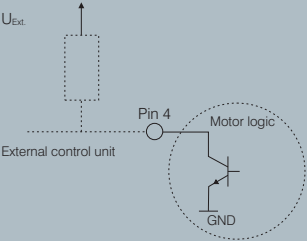
### 1. Control input rotation (Pin 2)

Pin 2  
1 Counter-clockwise rotation  
0 Clockwise rotation  
  
low (0) 0 to 0.8 V  
high (1) 2.4 to 28 V  
  
Direction of rotation viewed on shaft

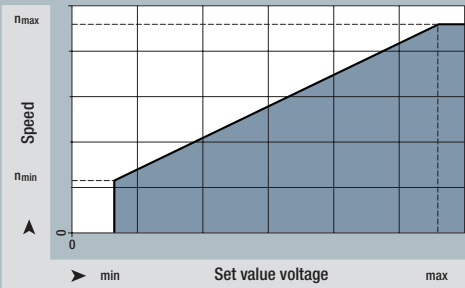


### 2. Actual speed value output (Pin 4)

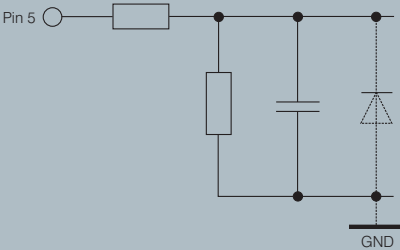
**Version:**  
Open Collector  
U<sub>ext. max</sub> = 30 V  
U<sub>CESAT</sub> = 0.5 V  
I<sub>C MAX</sub> = 5mA



### 3. Set value input (Pin 5)



Speed setting for speed control via set value voltage interface 0 to 10 V DC.  
(1 V = 1 000 U/min)  
  
By set value voltage <0.2 V the brake function will be activated. The braking function serves to slow down the motor only. It has no holding brake function for static duty.



For detailed information, please refer to the corresponding specification data sheets.  
The instructions and safety notes in the operating manual must be observed at all times.

# ECI gearmotor

ECI-C-42.40-PX



- Dynamic 3-phase internal rotor motor in EC technology with increased starting torque.
- Integrated operating electronics with powerful microcontroller.
- Excellent controllability due to digital 4-Q PI controller.
- High efficiency due to FET power output stage.
- Analog set value.
- Protection against overload due to integrated, speed-dependent current limiting.
- Customised versions possible by software and hardware adaption (e.g. fixed speed, direction of rotation).

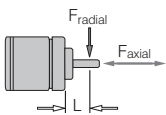
Nominal data	Gear ratio	Gear stages	Nominal torque	Speed range	Length L1	Length L2	Mass	Order No. 942 4240 ...
Type	I		Nm	rpm	mm	mm	kg	
ECI-C-42.40 B00-PX42/3	3,2 : 1	1	0,3	100 to 1 572	143,3	35,3	0,9	...603
ECI-C-42.40 B00-PX42/5	5,0 : 1	1	0,5	60 to 1 000	143,3	35,3	0,9	...600
ECI-C-42.40 B00-PX42/21	21,3 : 1	2	1,7	14 to 235	158,8	50,8	1,0	...601
ECI-C-42.40 B00-PX42/30	30,0 : 1	2	2,4	10 to 167	158,8	50,8	1,0	...602
ECI-C-42.40 B00-PX42/150	150,0 : 1	3	10,3*	2 to 33	174,3	66,3	1,0	...604

\* Limiting of max. output torque to 10.3 Nm required.

## Gearmotor PX

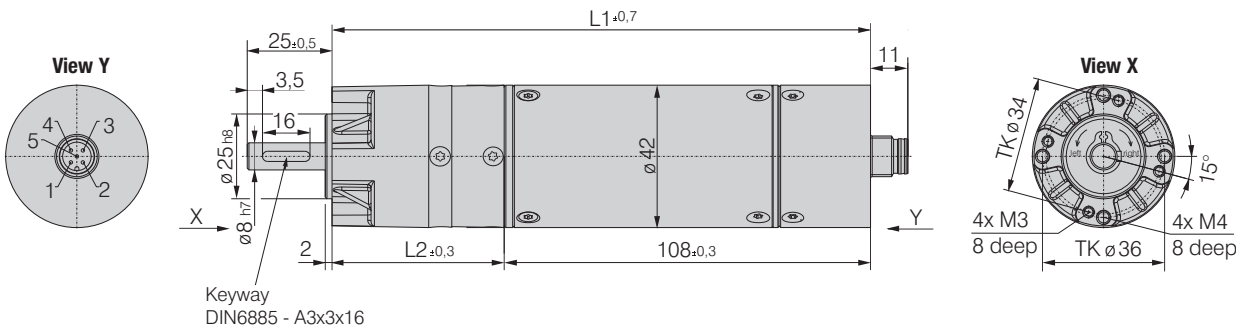
One stage and multi-stage planetary gearbox with zinc die-cast housing.  
Grease lubrication for maintenance-free continuous operation.  
Output shaft with combined sleeve- / ball bearings.  
Optimized helical gearing for long service life and quiet running in the first stage.

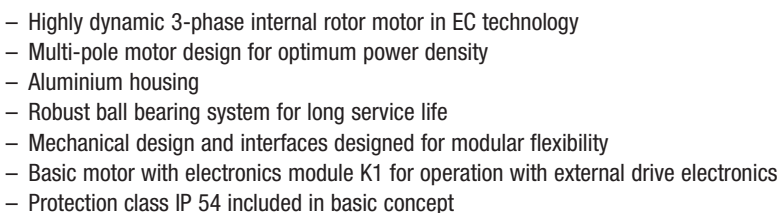
## Gear-Output shaft load



$F_{axial}$  150 N  
 $F_{radial}$  250 N  $L_1$  12,5 mm

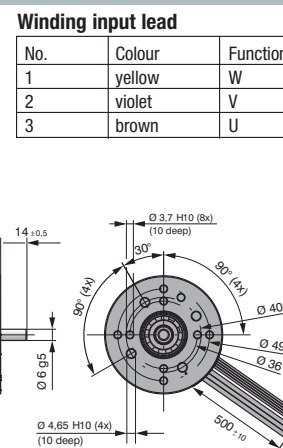
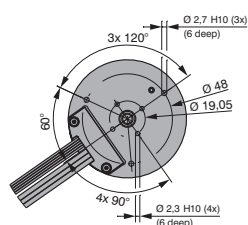
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).





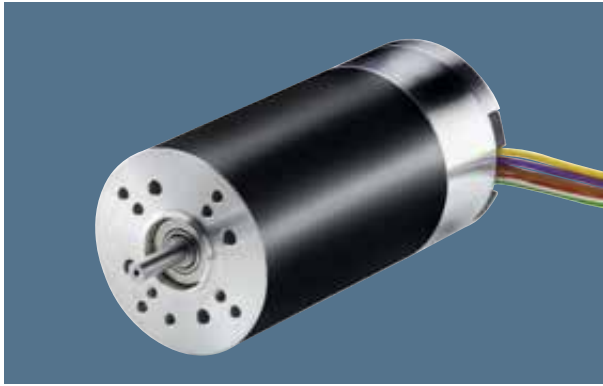
## Type


 $F_{\text{axial}}$  150 N  
 $F_{\text{radial}}$  150 N       $L_1$  20 mm  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_{H1}$  max. 40°C).



# ECI motor

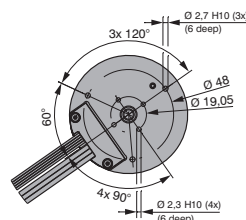
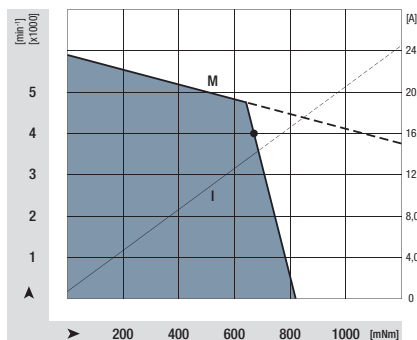
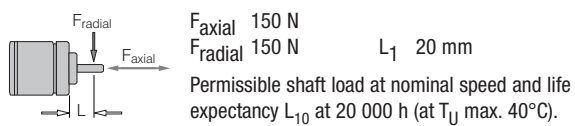
## ECI 63.40



- Highly dynamic 3-phase internal rotor motor in EC technology
- Multi-pole motor design for optimum power density
- Aluminium housing
- Robust ball bearing system for long service life
- Mechanical design and interfaces designed for modular flexibility
- Basic motor with electronics module K1 for operation with external drive electronics
- Protection class IP 54 included in basic concept

### Nominal data

Type		ECI 63.40 B00	ECI 63.40 D00
Nominal voltage ( $U_{BN}$ )	V DC	24	48
Nominal speed ( $n_N$ )	rpm	4 000	4 000
Nominal torque ( $M_N$ )	mNm	670	670
Nominal current ( $I_{BN}$ )	A	14,0	6,5
Nominal output power ( $P_N$ )	W	280	280
Speed at no-load operation ( $n_L$ )	rpm	5 900	5 900
No-load current ( $I_{BL}$ )	A	0,70	0,32
Continuous stall torque ( $M_{BNO}$ )	mNm	820	820
Permissible eff. continuous stall current, motor lead ( $I_{n0eff}$ )	A	16,5	9,0
Permissible continuous stall power ( $P_{BNO}$ )	W	29	29
Short-term permiss. peak torque ( $M_{max}$ )	mNm	3 300	3 300
Permiss. peak current, motor lead ( $I_{max}$ )	A	95	45
Induced voltage ( $U_{imax}$ )	V/1000 rpm	4,39	8,73
Terminal resistance ( $R_V$ )	$\Omega$	0,075	0,24
Terminal inductance ( $L_V$ )	mH	0,14	0,565
Rotor moment of inertia ( $J_R$ )	$\text{kgm}^2 \times 10^{-6}$	38	38
Thermal resistance ( $R_{th}$ )	K/W	2,9	2,9
Protection class		IP 40 / IP 54	IP 40 / IP 54
Ambient temperature range ( $T_U$ )	$^{\circ}\text{C}$	0 to +40	0 to +40
Motor mass (m)	kg	1,2	1,2
Order No.	Cable design	932 6340 100*	932 6340 102
Order No.	Strand design	932 6340 103	932 6340 105



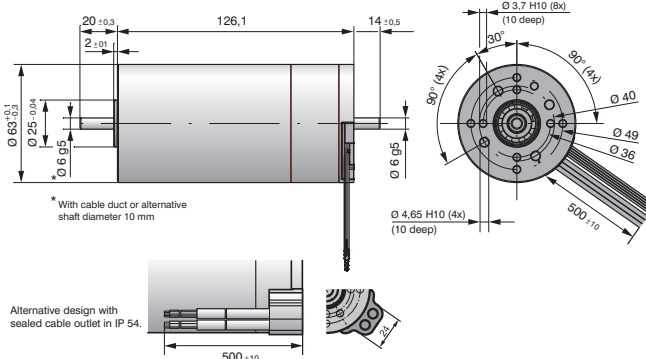
### Signal line

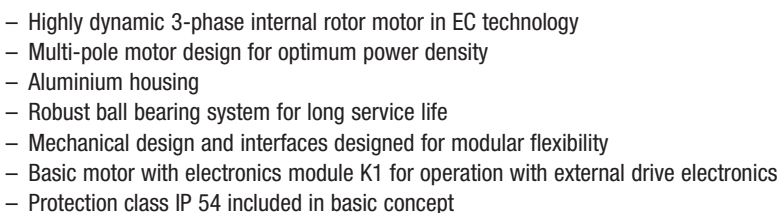
Colour	Function
green	Hall A
white	Hall B
grey	Hall C
red	$U_B$ Hall, 12 V DC
black	Gnd

\* only with limited continuous current (13A) applicable

### Winding input lead

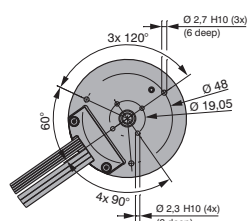
No.	Colour	Function
1	yellow	W
2	violet	V
3	brown	U





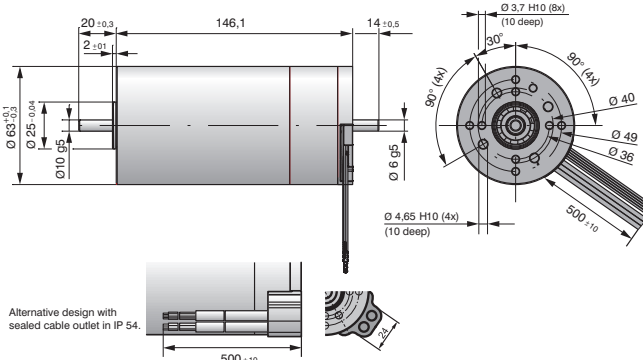
## Type


 $F_{axial}$  150 N  
 $F_{radial}$  150 N       $L_1$  20 mm  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_{II}$  max. 40°C).



Colour	Function
green	Hall A
white	Hall B
grey	Hall C
red	U <sub>B</sub> Hall, 12 V DC
black	Gnd

No.	Colour	Function
1	yellow	W
2	violet	V
3	brown	U



# ECI 63.20

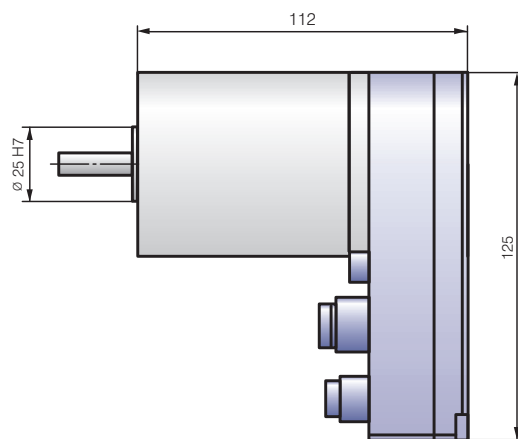
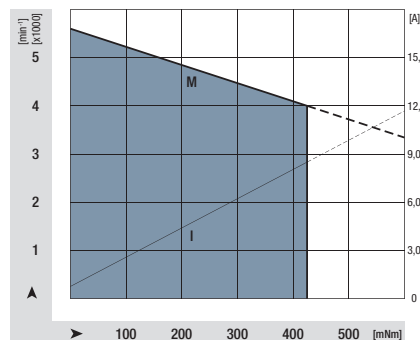
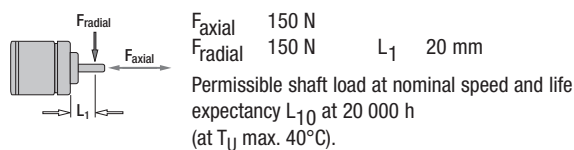
with electronics module K5



- Completely integrated electronic operation and control unit “K5” with CANopen communication interface
- Sinus commutation of the drives with field-oriented control
- Speed control range down to  $n = 0$  rpm with holding torque
- Different operating modes according to DSP 402 (speed, positioning, homing, torque) possible via software
- Electronics in safely sealed housing
- Connectors M16 and M12 in sealed industry standard
- Extensive interface with many inputs and outputs

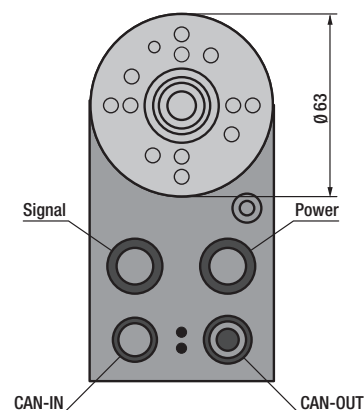
## Nominal data

Type		ECI-C5-63.20 B00	ECI-C5-63.20 D00
Nominal voltage ( $U_N$ )	V DC	24	48
Permissible supply voltage range ( $U_{ZK}$ )	V DC	20 to 28	40 to 53
Nominal speed ( $n_N$ )	rpm	4 000	4 000
Nominal torque ( $M_N$ )	mNm	425*	450*
Nominal current ( $I_N$ )	A	8,5*	5,4*
Nominal output power ( $P_N$ )	W	178*	188*
Speed at no-load operation ( $n_L$ )	rpm	5 600*	6 000
No-load current ( $I_L$ )	A	0,76*	0,6*
Max. reverse voltage	V DC	35	58
Set value input		Can Open	Can Open
Set speed	rpm	-	-
Recommended speed control range	rpm	0 ... 5 000	0 to 5 000
Locked-rotor protection		thermal	thermal
with locked-rotor protection clock		no	no
Overload protection		yes	yes
Starting torque	mNm	1,5x $M_N^*$	2x $M_N^*$
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	19	19
Thermal resistance ( $R_{th}$ )	K/W	3,6	3,6
Protection class		IP 54**	IP 54**
Ambient temperature range ( $T_U$ )	°C	0 ... +40	0 ... +40
Motor mass (m)	kg	0,9	0,9
Order No.		932 6320 500	932 6320 502



\* Preliminary data

\*\* Classification of protection class refers to installed state with sealing on the flange side.



# ECI 63.40

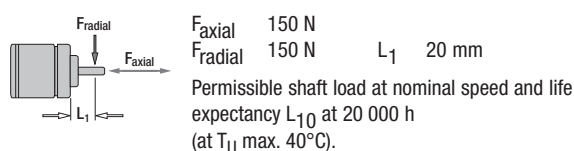
with electronics module K5



- Completely integrated electronic operation and control unit “K5” with CANopen communication interface
- Sinus commutation of the drives with field-oriented control
- Speed control range down to  $n = 0$  rpm with holding torque
- Different operating modes according to DSP 402 (speed, positioning, homing, torque) possible via software
- Electronics in safely sealed housing
- Connectors M16 and M12 in sealed industry standard
- Extensive interface with many inputs and outputs

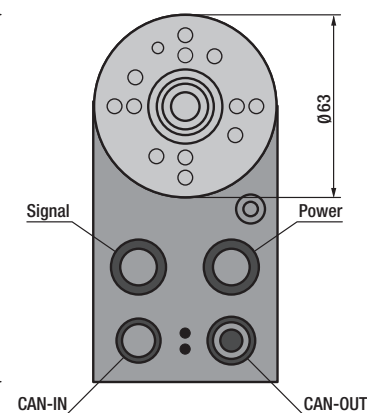
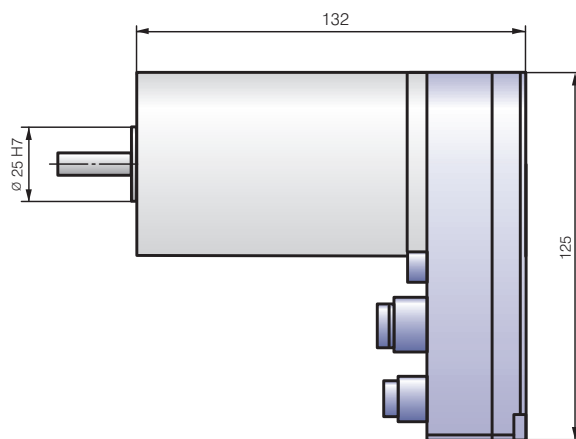
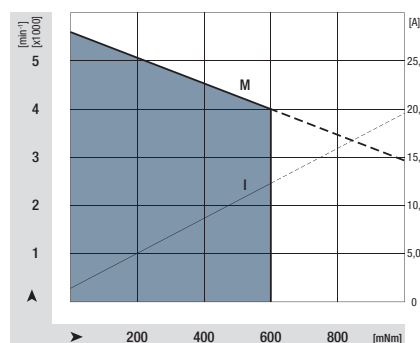
## Nominal data

Type		ECI-C5-63.40 B00	ECI-C5-63.40 D00
Nominal voltage ( $U_N$ )	V DC	24	48
Permissible supply voltage range ( $U_{ZK}$ )	V DC	20 to 28	40 to 53
Nominal speed ( $n_N$ )	rpm	4 000	4 000
Nominal torque ( $M_N$ )	mNm	600*	750*
Nominal current ( $I_N$ )	A	12,3*	7,2*
Nominal output power ( $P_N$ )	W	251*	314*
Speed at no-load operation ( $n_L$ )	rpm	5 600*	5 400*
No-load current ( $I_L$ )	A	1,4*	0,5*
Max. reverse voltage	V DC	35	58
Set value input		Can Open	Can Open
Set speed	rpm	-	-
Recommended speed control range	rpm	0 ... 5 000	0 to 5 000
Locked-rotor protection		thermal	thermal
with locked-rotor protection clock		no	no
Overload protection		yes	yes
Starting torque	mNm	1,5x $M_N$ *	2x $M_N$ *
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x10 <sup>-6</sup>	38	38
Thermal resistance ( $R_{th}$ )	K/W	2,9	2,9
Protection class		IP 54**	IP 54**
Ambient temperature range ( $T_U$ )	°C	0 ... +40	0 ... +40
Motor mass (m)	kg	1,2	1,2
Order No.		932 6340 500	932 6340 502



\* Preliminary data

\*\* Classification of protection class refers to installed state with sealing on the flange side.



# ECI 63.60

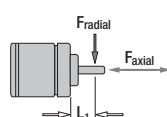
with electronics module K5



- Completely integrated electronic operation and control unit “K5” with CANopen communication interface
- Sinus commutation of the drives with field-oriented control
- Speed control range down to  $n = 0$  rpm with holding torque
- Different operating modes according to DSP 402 (speed, positioning, homing, torque) possible via software
- Electronics in safely sealed housing
- Connectors M16 and M12 in sealed industry standard
- Extensive interface with many inputs and outputs

## Nominal data

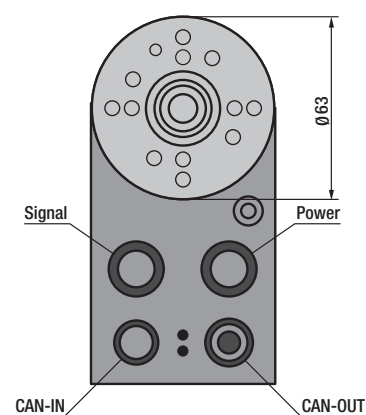
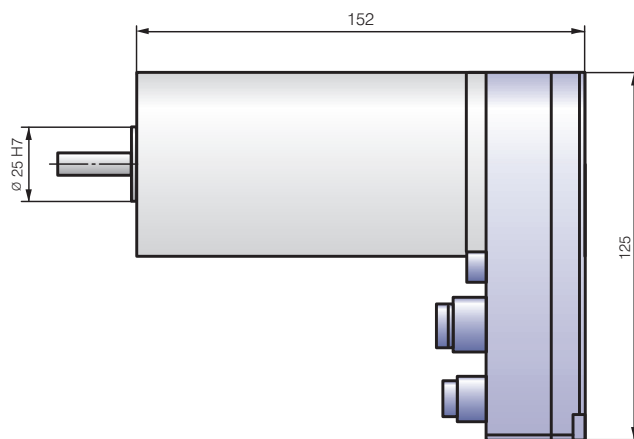
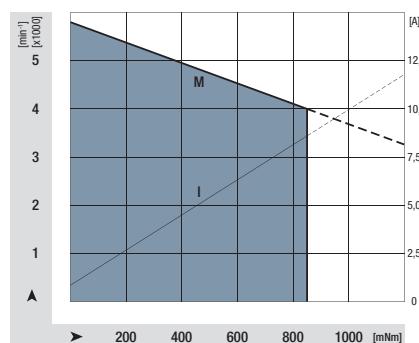
Type	ECI-C5-63.60 D00	
Nominal voltage ( $U_N$ )	V DC	48
Permissible supply voltage range ( $U_{ZK}$ )	V DC	40 to 53
Nominal speed ( $n_N$ )	rpm	4 000
Nominal torque ( $M_N$ )	mNm	850*
Nominal current ( $I_N$ )	A	8,6*
Nominal output power ( $P_N$ )	W	356*
Speed at no-load operation ( $n_L$ )	rpm	5 800*
No-load current ( $I_L$ )	A	0,85*
Max. reverse voltage	V DC	58
Set value input		Can Open
Set speed	rpm	-
Recommended speed control range	rpm	0 ... 5 000
Locked-rotor protection		thermal
with locked-rotor protection clock		no
Overload protection		yes
Starting torque	mNm	$2 \times M_N^*$
Rotor moment of inertia ( $J_R$ )	$\text{kgm}^2 \times 10^{-6}$	57
Thermal resistance ( $R_{th}$ )	K/W	2,5
Protection class		IP 54
Ambient temperature range ( $T_U$ )	°C	0 ... +40
Motor mass (m)	kg	1,6
Order No.		932 6360 502



$F_{\text{axial}} \quad 150 \text{ N}$   
 $F_{\text{radial}} \quad 150 \text{ N} \quad L_1 \quad 20 \text{ mm}$

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 20 000 h (at  $T_U$  max. 40°C).

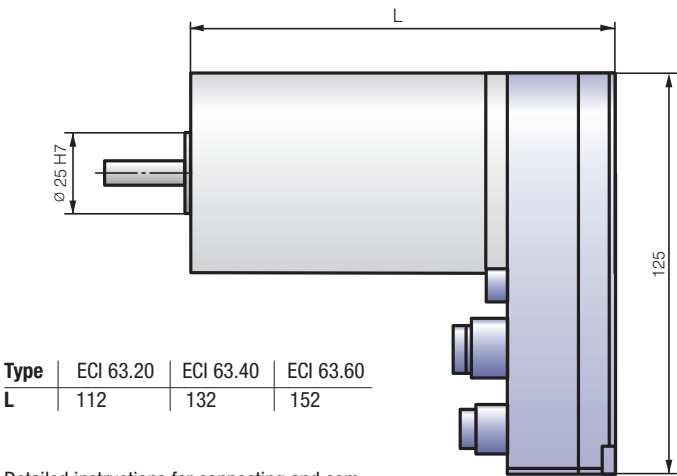
\* Preliminary data



# ECI 63.20 / 63.40 / 63.60

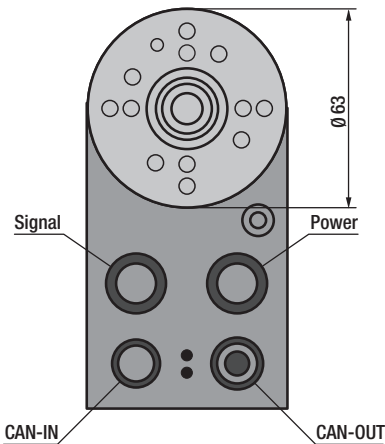
## Connection description with electronics module K5

- Connector system in sealed industry standard.
- 2 plugs in M16 for power and logic supply.
- Extensive interface functions due to a large number of analogue and digital I/Os.
- 2 plugs in M12 for separate CAN-IN and CAN-Out configuration (simplified and safe wiring; additional CAN-open T piece for looping through the CAN wires for 1 -plug solutions no longer necessary!).

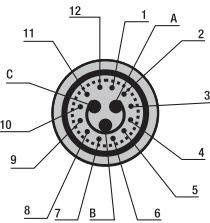


Type	ECI 63.20	ECI 63.40	ECI 63.60
L	112	132	152

Detailed instructions for connecting and commissioning are provided with the specifications.

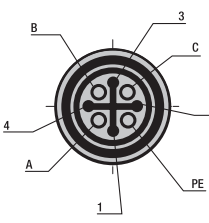


### Detail of signal



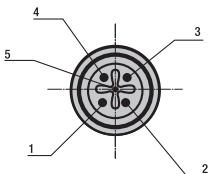
Pin 1	Digital I/O 1	PNP 24 V
Pin 2	Digital I/O 2	PNP 24 V
Pin 3	Digital I/O 3	PNP 24 V
Pin 4	Digital I/O 4	PNP 24 V
Pin 5	Digital I/O 5	PNP 24 V
Pin 6	Digital I/O 6	PNP 24 V
Pin 7	Digital I/O 7	PNP 24 V
Pin 8	Digital I/O 8	PNP 24 V
Pin 9	Digital I/O 9	NPN / PNP 24 V
Pin 10	Enable	24 V
Pin 11	Analog IN 1	0 to 10 V
Pin 12	Analog IN 2	0 to 10 V
Pin A	Analog GND	GND <sub>Analog</sub>
Pin B	U <sub>C</sub>	Logic power supply + (24 V)
Pin C	GND	Logic power supply – (GND)

### Detail of power



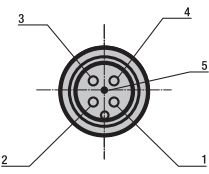
Pin A	U <sub>ZK</sub>	Power supply
Pin B	Ballast/Brake	Ballast resistor/brake connection
Pin C	GND power	Power supply
Pin PE	PE	Earthing (on motor housing)
Pin 1	CAN <sub>H</sub>	CAN-Bus high signal
Pin 2	CAN <sub>L</sub>	CAN-Bus low signal
Pin 3	Enable	24 V
Pin 4	Digital I/O 9	NPN / PNP 24 V

### Detail of CAN-IN



Pin 1	n.c.	
Pin 2	Bridge to pin 2 CAN-OUT	
Pin 3	Bridge to pin 3 CAN-OUT	
Pin 4	CAN_H	CAN-Bus high signal
Pin 5	CAN_L	CAN-Bus low signal

### Detail of CAN-OUT



Pin 1	n.c.	
Pin 2	Bridge to pin 2 CAN-IN	
Pin 3	Bridge to pin 3 CAN-IN	
Pin 4	CAN_H	CAN-Bus high signal
Pin 5	CAN_L	CAN-Bus low signal

# ECI gearbox versions

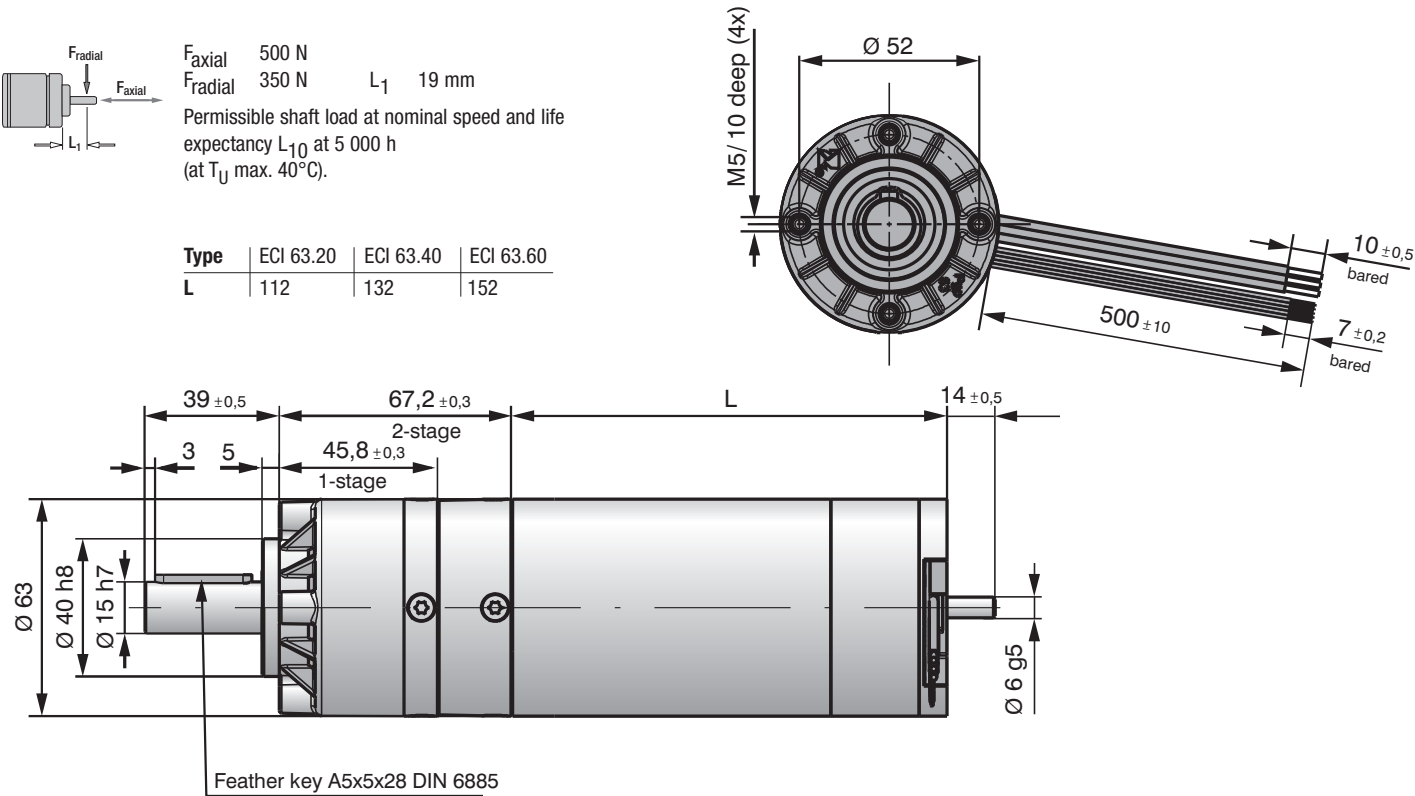
## ECI with Performax 63



- 3-phase internal rotor motor in EC technology.
- Motor supply and control via external operating electronics.
- Combined with single and multi-stage planetary gearboxes in modular design.
- Gearbox housing made of die-cast zinc.
- First stage with noise optimized helical gears made of low-friction-optimised plastics.
- Second stage with planetary gears made of case-hardened steel for high torques.
- Grease lubrication for maintenance-free continuous operation.
- Available in various reduction ratios.

Gear data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Nominal current	Mass
Type	i		Nm	rpm	A	kg
ECI 63.20 B00-PX63/3	3,2	1	1,0	1258	6,9	1,4
ECI 63.20 B00-PX63/5	5	1	1,6	800	6,9	1,4
ECI 63.20 B00-PX63/21	21,3	2	6,2	188	6,9	1,9
ECI 63.20 B00-PX63/30	30	2	8,7	133	6,9	1,9
ECI 63.40 B00-PX63/3	3,2	1	1,9	1258	15,1	1,7
ECI 63.40 B00-PX63/5	5	1	3,0	800	15,1	1,7
ECI 63.40 B00-PX63/21	21,3	2	11,5	188	15,1	2,2
ECI 63.40 B00-PX63/30	30	2	16,3	133	15,1	2,2
ECI 63.60 B00-PX63/3	3,2	1	2,5	1258	21	2,0
ECI 63.60 B00-PX63/21	21,3	2	15,1	188	21	2,5

Additional designs with alternative gearboxes available on request



# ECI gearbox versions

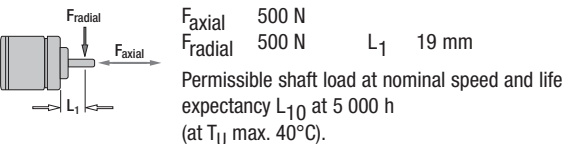
## ECI with Performax 63 HRL



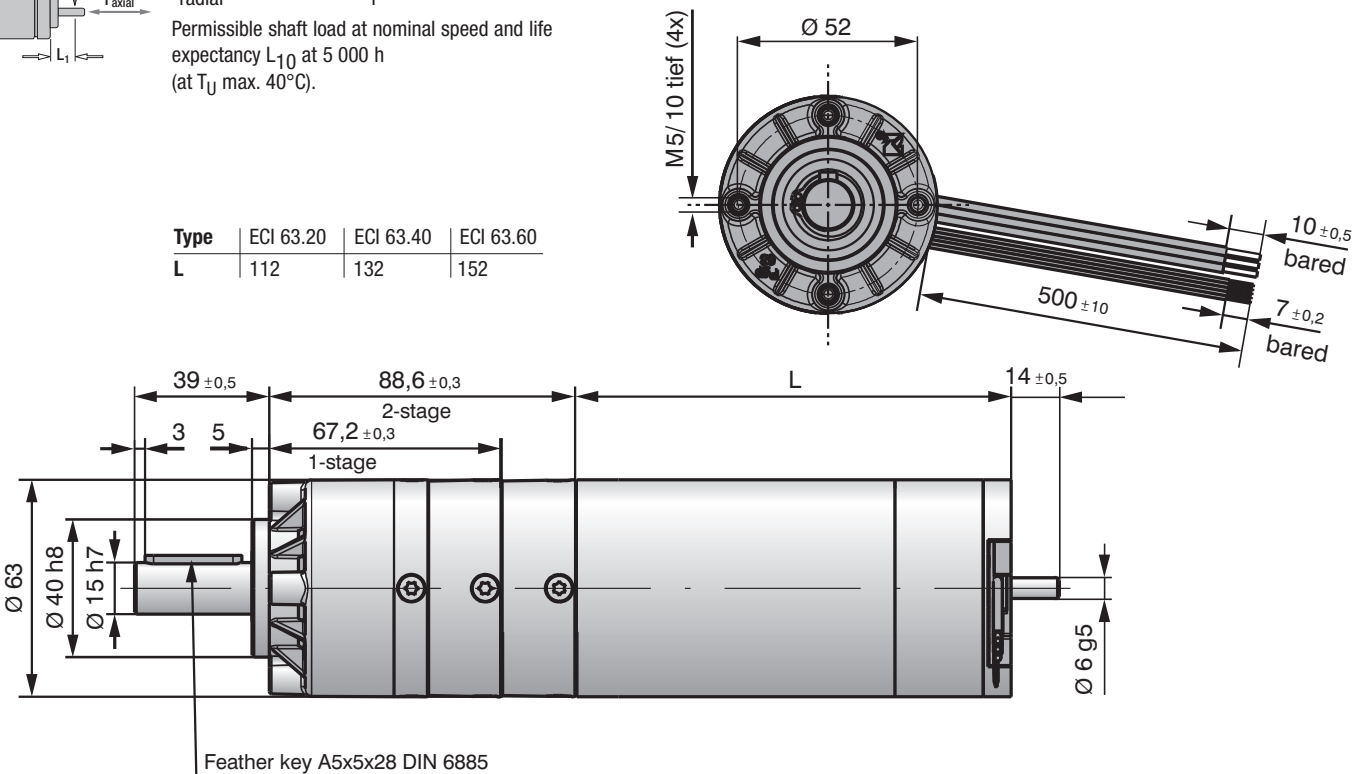
- 3-phase internal rotor motor in EC technology.
- Motor supply and control via external operating electronics.
- Combined with single and multi-stage planetary gearboxes in modular design.
- Gearbox housing made of die-cast zinc.
- First stage with noise optimized helical gears made of low-friction-optimised plastics.
- Second stage with planetary gears made of case-hardened steel for high torques.
- Grease lubrication for maintenance-free continuous operation.
- Available in various reduction ratios.
- Version HRL 63 with reinforced support of the output stage for increased radial loads.

Gear data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Nominal current	Mass
Type	i		Nm	rpm	A	kg
ECI 63.20 B00-PX63HRL/5	5	1	1,6	800	6,9	1,6
ECI 63.20 B00-PX63HRL/30	30	2	8,7	133	6,9	2,0
ECI 63.40 B00-PX63HRL/5	5	1	3,0	800	15,1	1,9
ECI 63.40 B00-PX63HRL/30	30	2	16,3	133	15,1	2,3
ECI 63.60 B00-PX63HRL/5	5	1	4,0	800	21	2,2
ECI 63.60 B00-PX63HRL/30	30	2	21,4	133	21	2,6

Additional designs with alternative gearboxes available on request



Type	ECI 63.20	ECI 63.40	ECI 63.60
L	112	132	152



# ECI gearbox versions

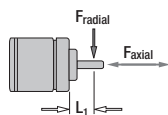
## ECI with NoiselessPlus 63



- 3-phase internal rotor motor in EC technology.
- Motor supply and control via external operating electronics.
- Combined with single and multi-stage planetary gearboxes in modular design.
- Gearbox housing made of machined aluminium.
- Precision machined gears in the aluminium hollow wheel.
- Noise-optimised helical gears in all stages.
- Grease lubrication for maintenance-free continuous operation.
- Available in various reduction ratios.

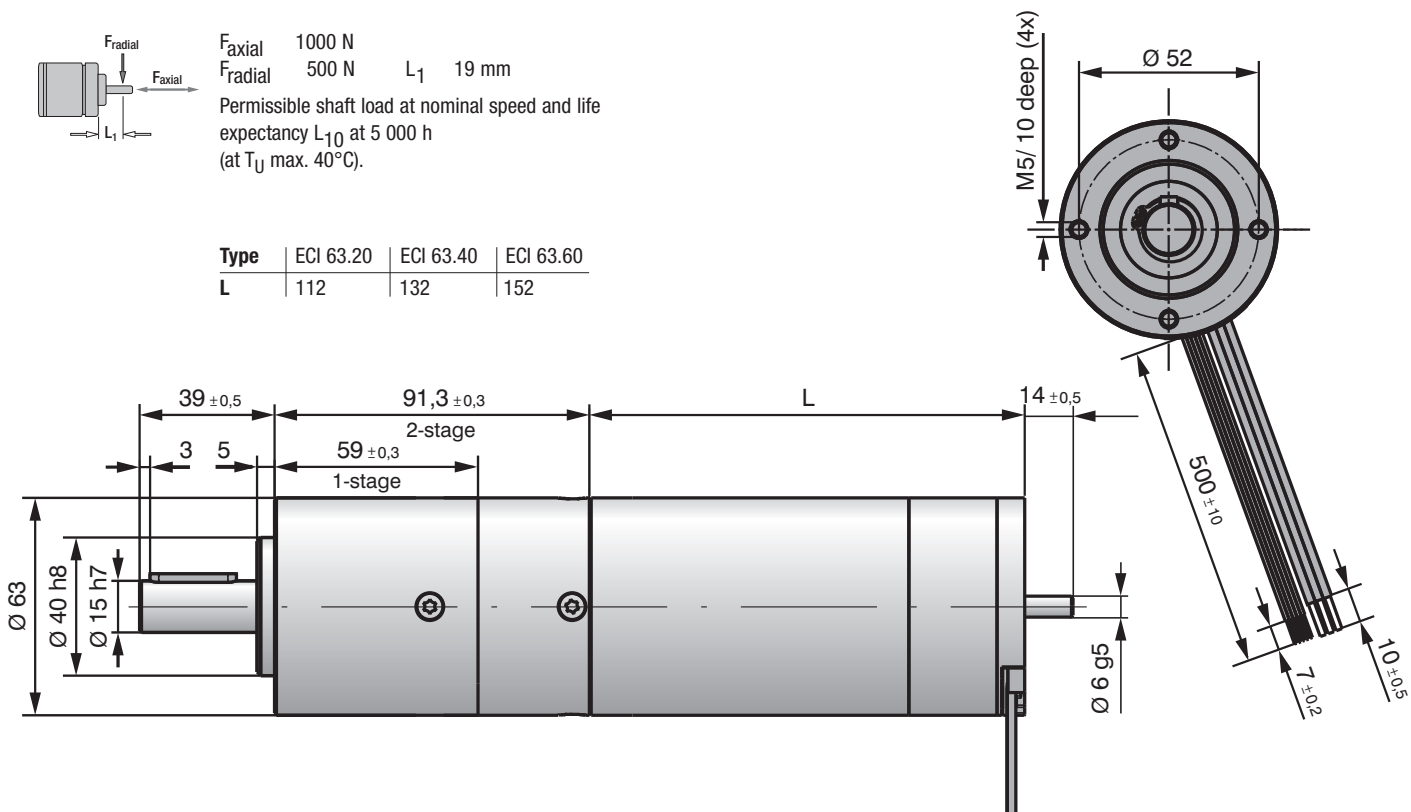
Gear data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Nominal current	Mass
Type	i		Nm	rpm	A	kg
ECI 63.20 B00-PN63/4	4,3	1	1,4	930	6,9	1,5
ECI 63.20 B00-PN63/6	6	1	1,9	667	6,9	1,5
ECI 63.20 B00-PN63/26	26	2	7,6	667	6,9	1,7
ECI 63.40 B00-PN63/4	4,3	1	2,6	930	15,1	1,8
ECI 63.40 B00-PN63/6	6	1	3,6	667	15,1	1,8
ECI 63.40 B00-PN63/26	26	2	14,1	667	15,1	2,0
ECI 63.60 B00-PN63/4	4,3	1	3,4	930	21	2,1
ECI 63.60 B00-PN63/6	6	1	4,8	667	21	2,1
ECI 63.60 B00-PN63/26	26	2	18,5	667	21	2,3

Additional designs with alternative gearboxes available on request



$F_{axial}$  1000 N  
 $F_{radial}$  500 N     $L_1$  19 mm  
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 5 000 h (at  $T_U$  max. 40°C).

Type	ECI 63.20	ECI 63.40	ECI 63.60
L	112	132	152



# ECI gearbox versions

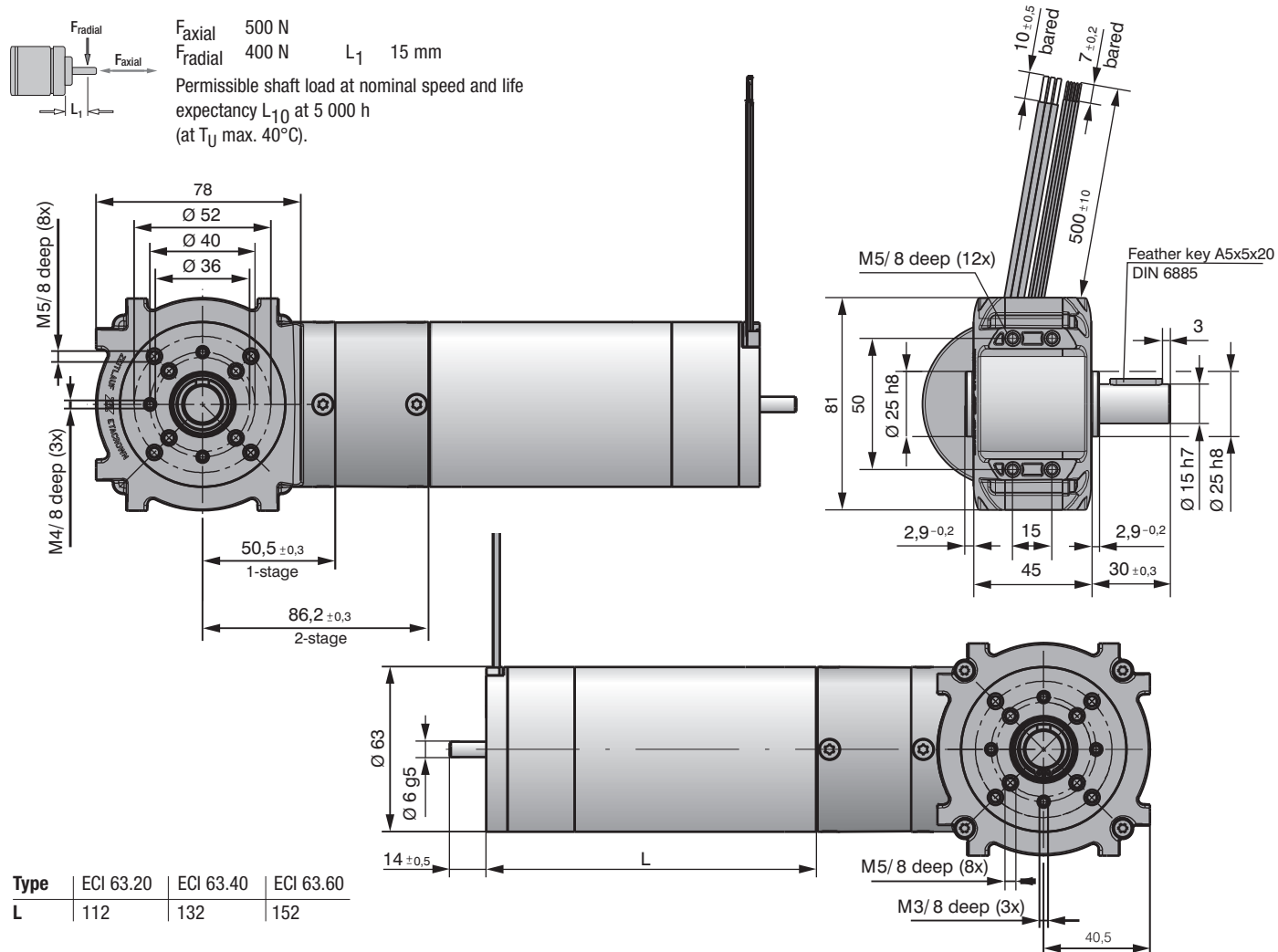
## ECI with EtaCrown 75

- 3-phase internal rotor motor in EC technology.
- Motor supply and control via external operating electronics.
- Combined with single and multi-stage bevel gearboxes.
- High efficiency through innovative crown gear technology.
- Gearbox housing made of die-cast zinc.
- Smooth-running and robust due to optimized gear design.
- Grease lubrication for maintenance-free continuous operation.
- Available in various reduction ratios.



Gear data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Nominal current	Mass
Type	i		Nm	rpm	A	kg
ECI 63.20 B00-EC75/4	4,1	1	1,3	976	6,9	1,8
ECI 63.20 B00-EC75/7	6,7	1	2,2	597	6,9	1,8
ECI 63.20 B00-EC75/20	20,3	2	5,9	197	6,9	2,2
ECI 63.20 B00-EC75/33	33,3	2	9,7	120	6,9	2,2

Additional designs with alternative gearboxes available on request



Type	ECI 63.20	ECI 63.40	ECI 63.60
L	112	132	152

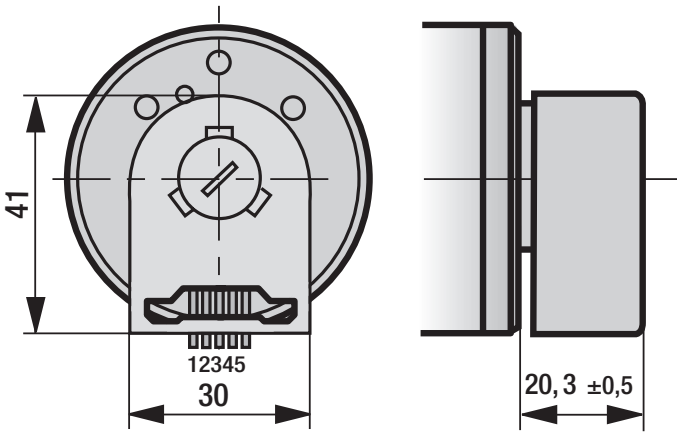
# ECI sensor module external

Encoder HEDS 5500



- Optoelectronic 2-channel incremental encoder
- The encoder features non-contact, wear-free operation
- 2 rectangular signals with 90° phase shift, TTL compatible
- Variants with other encoder resolutions on request

Type		HEDS 5500
Number of pulses		512 pulses per revolution (channel A and B), other encoder resolutions on request!
Cut-off frequency	kHz	100
Supply voltage	V DC	5 +/- 10 %
Current draw	mA	typ. 17 (max. 40)
Protection class		IP 00
Pin assignment		1=Gnd   2=free   3=A   4=UB   5=B
Plug type		e. g. AMP 103686-4 or 600442-5



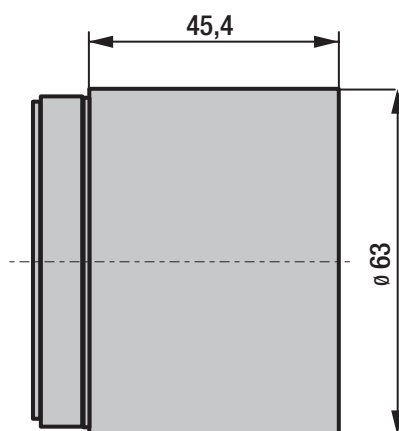
## ECI sensor module integrated

### Multiturn absolute encoder FMG-Kit



- Module integrated between basic motor and electronics module
- Multiturn absolute encoder
- System with magnetic scanning and reduction gear
- Positioning capability with absolute value measurement
- The current position value is available immediately after switching on
- Available in conjunction with electronics modules of class K5 only

Type	FMG-Kit
Multiturn resolution	12 Bit
Measuring range	0 ... 4 096 revolutions
Direction of rotation	cw / ccw
Protection class	IP 54 (for built-in module)



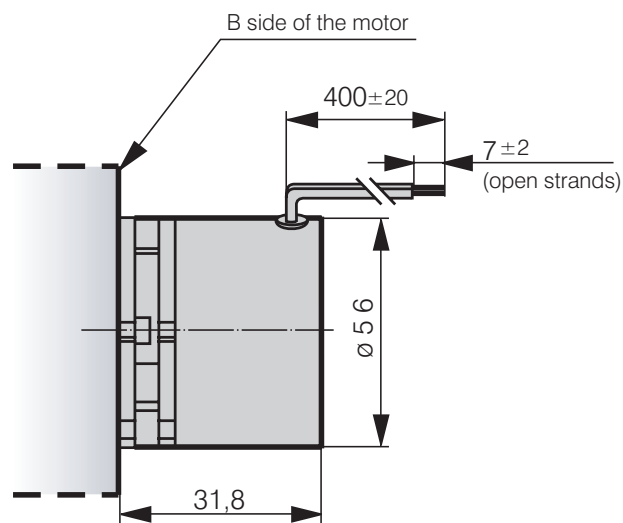
# ECI brake module external

## Spring applied brake BFK



- Open mounting of the module to the motor B side
- Holding brake with emergency stop function
- Spring applied braking torque, released electromagnetically
- Single-disk brake with 2 friction contact surfaces

Type		BFK
Nominal voltage	V DC	24 +/- 10 %
Rated output	W	9
Braking torque	Nm	0,5
Mass	kg	0,4
Closing time	ms	12,5
Opening time	ms	18
Protection class		IP 00



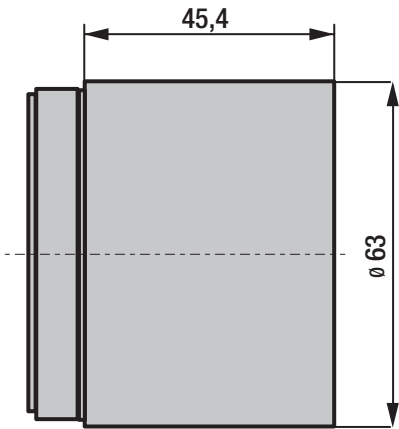
# ECI brake module integrated

## High torque permanent magnet brake



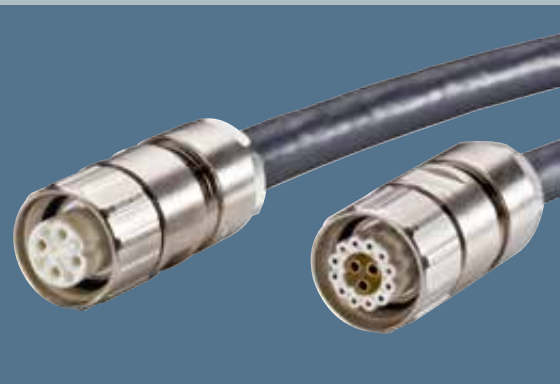
- Module assembled between basic motor and electronics module
- Holding brake with limited emergency stop function
- Optimized magnetic design with high power density
- Braking torque is generated by a permanent magnetic field and is released electromagnetically
- Free of residual torque and play
- Reduced mass inertia for optimum dynamics

Type		High Torque	
Nominal voltage	V DC	24	+/- 10 %
Rated output	W	9	
Braking torque	Nm	2	
Mass moment of inertia	kgm <sup>2</sup>	9 x 10 <sup>-6</sup>	
Closing time	ms	20	
Opening time	ms	35	
Protection class		IP 54 (for built-in module)	



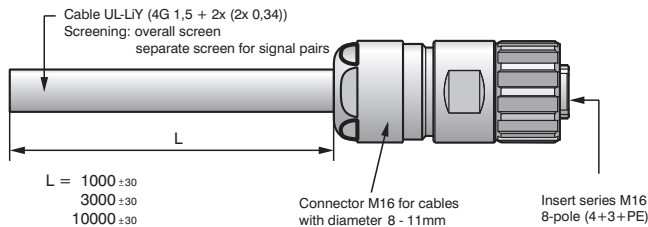
# ECI 63 with electronics K5

## Commissioning accessories



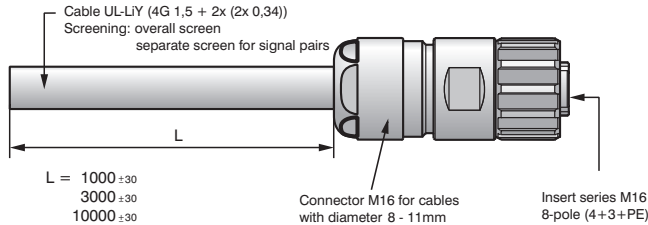
### Power cable and logic cable

- All cables available in 3 standard lengths.
- Connecting cable for power supply available in 2 versions.
- Version 1 with CANopen for operating single drives at a CANopen interface.
- Version 2 without CANopen for integration of multiple drives on a CANopen network via separate CANopen wires.
- Connecting cable for logic interface for separate logic power supply and for wiring the analogue and digital I/Os.



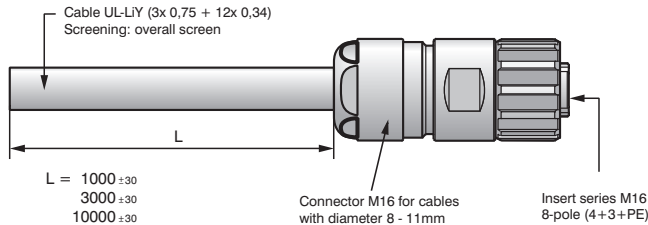
Order No. (1000 mm)	= 992 0160 002
Order No. (3000 mm)	= 992 0160 005
Order No. (10000 mm)	= 992 0160 008

Strand	Pin		
brown	Pin A	U_ZK	Power supply
grey	Pin B	Ballast/Break	Ballast resistor / brake connection
black	Pin C	GND power	Power supply
yellow/green	Pin PE	PE	Earthing (on motor housing)
white	Pin 1	CAN_H	CAN-Bus high signal
brown	Pin 2	CAN_L	CAN-Bus low signal
green	Pin 3	Enable	24 V
yellow	Pin 4	Digital I/O 9	NPN / PNP 24 V



Order No. (1000 mm)	= 992 0160 003
Order No. (3000 mm)	= 992 0160 006
Order No. (10000 mm)	= 992 0160 009

Strand	Pin		
brown	Pin A	U_ZK	Power supply
grey	Pin B	Ballast/Break	Ballast resistor / brake connection
black	Pin C	GND power	Power supply
yellow/green	Pin PE	PE	Earthing (on motor housing)
	Pin 1	n.c.	
	Pin 2	n.c.	
green	Pin 3	Enable	24 V
yellow	Pin 4	Digital I/O 9	NPN / PNP 24 V



Order No. (1000 mm)	= 992 0160 004
Order No. (3000 mm)	= 992 0160 007
Order No. (10000 mm)	= 992 0160 010

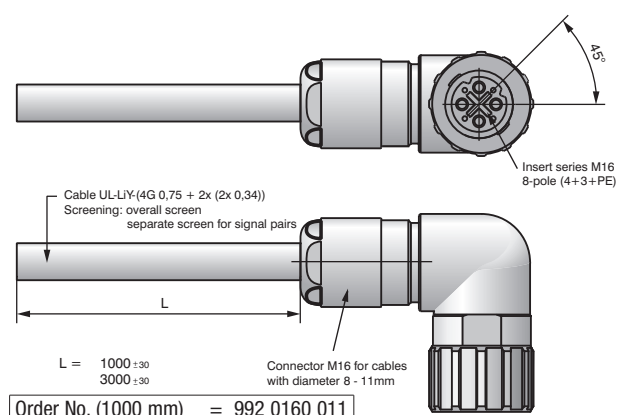
Strand	Pin		
white	Pin 1	Digital / 01	PNP 24
brown	Pin 2	Digital / 02	PNP 24
green	Pin 3	Digital / 03	PNP 24
yellow	Pin 4	Digital / 04	PNP 24
grey	Pin 5	Digital / 05	PNP 24
pink	Pin 6	Digital / 06	PNP 24
blue	Pin 7	Digital / 07	PNP 24
red	Pin 8	Digital / 08	PNP 24
black	Pin 9	Digital / 09	NPN / PNP 24 V
violet	Pin 10	Enable	24 V
grey/pink	Pin 11	Analog IN 1	0 to 10V
red/blue	Pin 12	Analog IN 2	0 to 10V
grey	Pin A	Analog GND	GND Analog
brown	Pin B	Uc	Logic power supply + (24V)
black	Pin C	GND	Logic power supply - (GND)

# ECI 63 with electronics K5

## Commissioning accessories

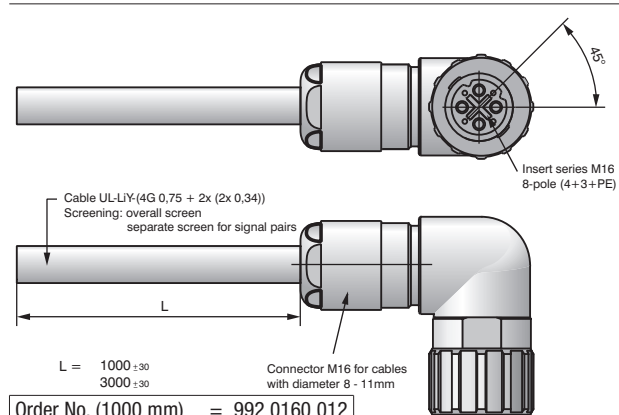
### Power cable and logic cable

- All cables available in 3 standard lengths.
- Connecting cable for power supply available in 2 versions.
- Version 1 with CANopen for operating single drives at a CANopen interface.
- Version 2 without CANopen for integration of multiple drives on a CANopen network via separate CANopen wires.
- Connecting cable for logic interface for separate logic power supply and for wiring the analogue and digital I/Os.



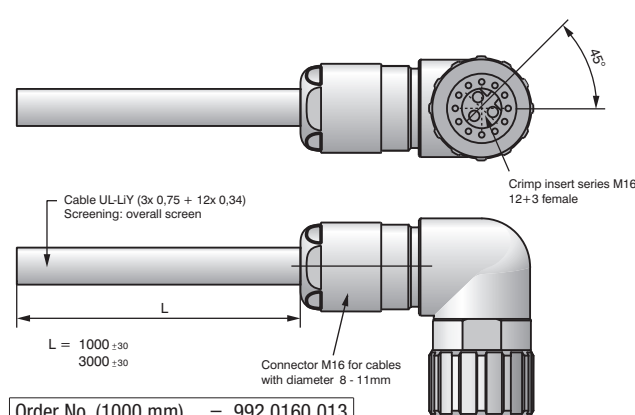
Order No. (1000 mm) = 992 0160 011  
Order No. (3000 mm) = 992 0160 014

Strand	Pin		
brown	Pin A	U_ZK	Power supply
grey	Pin B	Ballast/Break	Ballast resistor / brake connection
black	Pin C	GND power	Power supply
yellow/green	Pin PE	PE	Earthing (on motor housing)
white	Pin 1	CAN_H	CAN-Bus high signal
brown	Pin 2	CAN_L	CAN-Bus low signal
green	Pin 3	Enable	24 V
yellow	Pin 4	Digital I/O 9	NPN / PNP 24 V



Order No. (1000 mm) = 992 0160 012  
Order No. (3000 mm) = 992 0160 015

Strand	Pin		
brown	Pin A	U_ZK	Power supply
grey	Pin B	Ballast/Break	Ballast resistor / brake connection
black	Pin C	GND power	Power supply
yellow/green	Pin PE	PE	Earthing (on motor housing)
	Pin 1	n.c.	
	Pin 2	n.c.	
green	Pin 3	Enable	24 V
yellow	Pin 4	Digital I/O 9	NPN / PNP 24 V

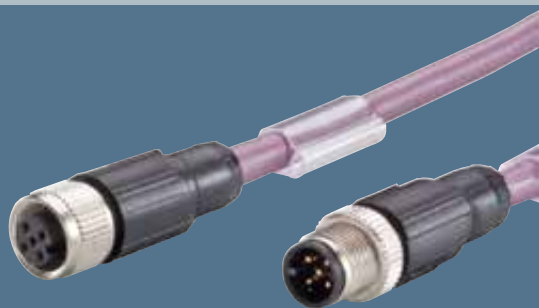


Order No. (1000 mm) = 992 0160 013  
Order No. (3000 mm) = 992 0160 016

Strand	Pin		
white	Pin 1	Digital / 01	PNP 24
brown	Pin 2	Digital / 02	PNP 24
green	Pin 3	Digital / 03	PNP 24
yellow	Pin 4	Digital / 04	PNP 24
grey	Pin 5	Digital / 05	PNP 24
pink	Pin 6	Digital / 06	PNP 24
blue	Pin 7	Digital / 07	PNP 24
red	Pin 8	Digital / 08	PNP 24
black	Pin 9	Digital / 09	NPN / PNP 24 V
violet	Pin 10	Enable	24 V
grey/pink	Pin 11	Analog IN 1	0 to 10V
red/blue	Pin 12	Analog IN 2	0 to 10V
grey	Pin A	Analog GND	GND Analog
brown	Pin B	Uc	Logic power supply + (24V)
black	Pin C	GND	Logic power supply - (GND)

# ECI 63 with electronics K5

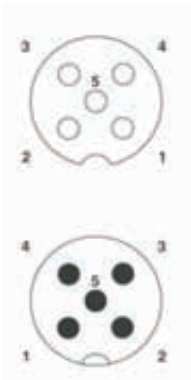
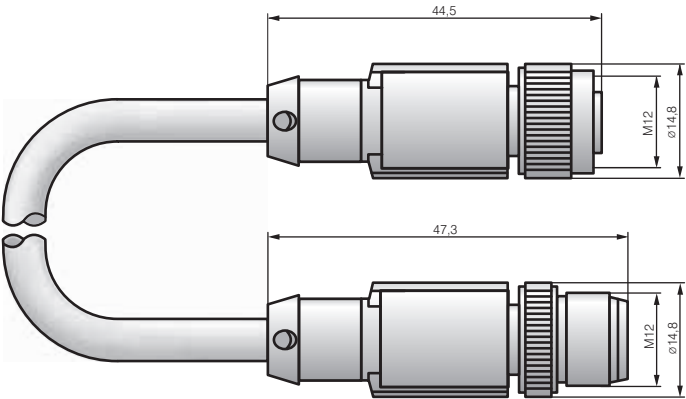
## Commissioning accessories



### CANopen connection cable and adaptor lead

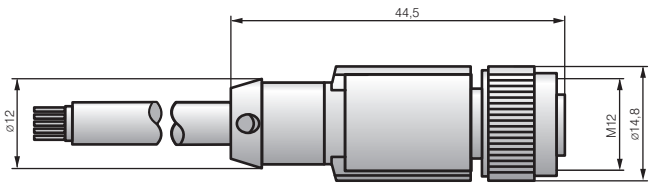
- For connecting individual drives or networking multiple drives to be operated via the CANopen interface.
- Connection and output cable in 5m length.
- Adapter cable in 2m length.
- Use of standardised M12 plug and cable from Phoenix Contact.

### CAN-Bus twisted pair connecting cable / screened (Phoenix Contact No. 1507557)



Order No. (2000 mm) = 992 0160 019

### Socket M12 x 1, straight, screened

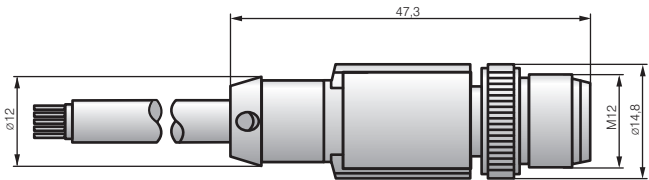


Order No. (5000 mm) = 992 0160 017

(Phoenix Contact No. 1507489)  
Sensor/actuator cable for CAN\_OUT, 5-pole, PUR halogen-free black, screened, free cable end to straight socket M12

Pin	Function	Description	Colour
1	SH	shield	
2	V+	CAN supply	red
3	GND	Ground	black
4	CAN_H	CAN-Bus high signal	white
5	CAN_L	CAN-Bus low signal	blue

### Plug M12 x 1, straight, screened



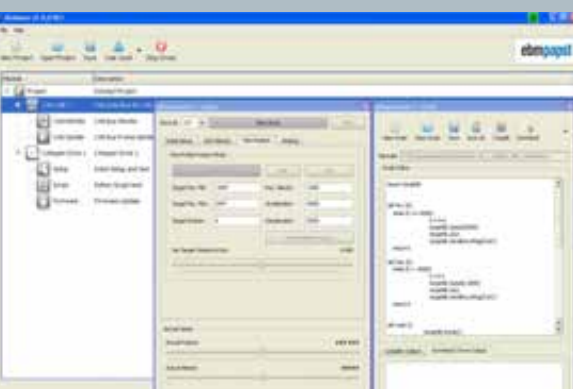
Order No. (5000 mm) = 992 0160 018

(Phoenix Contact No. 1507434)  
Sensor/actuator cable for CAN\_OUT, 5-pole, PUR halogen-free black, screened, free cable end to straight plug M12

Pin	Function	Description	Colour
1	SH	shield	
2	V+	CAN supply	red
3	GND	Ground	black
4	CAN_H	CAN-Bus high signal	white
5	CAN_L	CAN-Bus low signal	blue

# Electronics K5 commissioning accessories

PC commissioning tool, CANopen adapter and small parts



- Windows-based PC commissioning tool for all drives of electronics class K5 with CANopen communication interface.
- Quick and intuitive operation and commissioning of the drives.
- Range of function based on the possibilities of the CiA Drives Profile DSP 402.
- Commissioning, parameter configuration, programming (via interpreter) and monitoring of drives via CANopen communication interface.
- Can be run on all common software platforms (e.g. Windows 2000, Windows XP, Windows Vista, Windows 7) directly from USB stick (automatic hardware detection and driver installation necessary).

## SAC-5P-M12MS CAN TR

(Phoenix No. 1507816)

Order No. = 992 0160 021



CANopen terminal plug with integrated 120 Ohm terminating resistor.

## PROT-M12 SH

(Phoenix No. 1503302)

Order No. = 992 0160 023



M12 metal cap for plug connectors with internal thread for reliably sealing off the CAN-out terminal when not in use.

## PROT-M12 FS-M

(Phoenix No. 1430488)

Order No. = 992 0160 022



M12 metal cap for plug connectors with external thread for reliably sealing off the CAN-in terminal when not in use.

## M 16 metal cap

(Hummel No. 7010900162)

Order No. = 992 0160 024



Brass protective cap for plug connectors with external thread.

CAN to USB adapter for commissioning motors of class K5 via a computer with commissioning software and CANopen bus system.

Order No. = 914 0000 000



Function	Description
CAN speed	CAN high speed (up to 1 Mbit/s)
CAN signals	CAN_H, CAN_L, CAN_GND, CAN_V+, GND
CAN plug	DB9 plug
USB interface	USB 2.0 Full Speed
USB output	Max. 1 W/max. 200 mA via USB port
USB plug	USB Type B socket
Permitted ambient temp. range	0 ... 60 °C
Mass	50 g
Dimensions (L x B x H)	58 x 50 x 23 mm

Adapter cable for connecting the CAN-to-USB adapter to a CANopen drive or a CANopen network via M12 plug CAN-in.

Order No. = 992 0160 020



Configuration: M12: as Phoenix No. 1507476  
Configuration SUB-D-female: Table - pinning for 9-pin D-sub connector

M12	SUB-D	Signal	Description
5	2	CAN_L	CAN_L bus line
3	n.c.		
1	housing	(CAN_SHIELD)	CAN Shield
4	7	CAN_H	CAN_H bus line (dominant high)
2	n.c.		



# BG motor

	BG 43 technical information	104
	BG 43 application area and specific solutions	105
	BG 43 motors	106
	BG 43 electronics	109

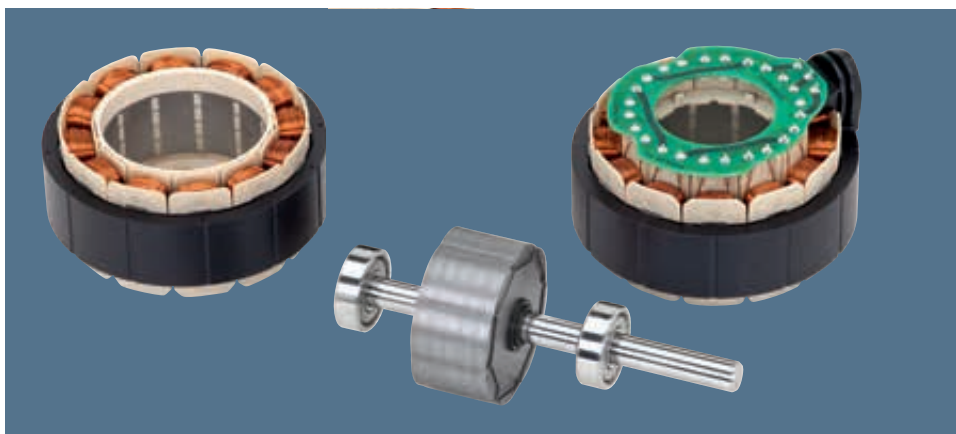


## Technical information

The new EC motor of the size 43 series from ebm-papst features outstandingly robust technology, simple control and a long service life. It unites high efficiency with exceptional noise characteristics. The size 43 features high-performance commutation and control electronics that can also be positioned remotely from the motor.

### Facts and figures:

- EC motor for mains supply voltage (AC), but also for low voltage (DC)
- 3-core internal rotor motor in three sizes
- Efficiency up to 80%
- High start-up and operating torque
- Precision ball bearings for long service life and low-noise performance
- 8-pole rotor with neodymium iron boron (NdFeB) magnet
- Sensorless sine commutation
- Optionally with PFC (Power Factor Correction)
- Die-cast aluminium bearing shields
- Type of protection: IP 20 (optionally IP 54)
- Protection class I
- Clockwise and counter-clockwise operation possible
- Wide variety of customer or application-specific versions possible (see next page)



**Application area:**

The newly developed, high-efficiency size 43 motor with a maximum output power of 300 watts enables a broad spectrum of applications:

- Tangential blowers for underfloor convection heating, cold/hot air door curtains and air-conditioning units
- Pump drives, for example for heating engineering and medical technology
- Applications in the drive engineering area, also possible with various gearboxes, for example
- And many more ...

**Customer-specific solution options:**

The motor can be adapted electrically and mechanically to the specific requirements:

- Drive shaft on one or both sides possible
- Clockwise and counter-clockwise operation
- Reversible operation
- Possible shaft diameters: 8, 12 and 12.7 mm
- Various interfaces for speed-controlled operation
- External operating electronics adapted optimally to the motor characteristics, can be installed either on the motor or remotely (see page 109)



# BG 43 motor

BG 4310



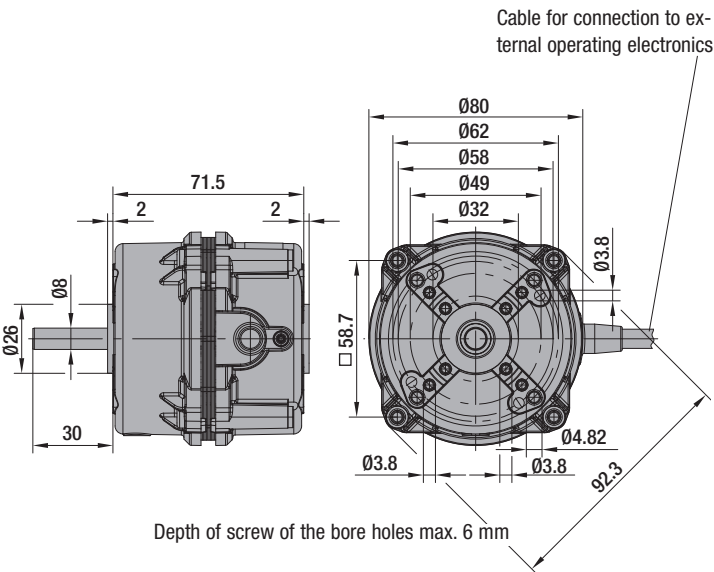
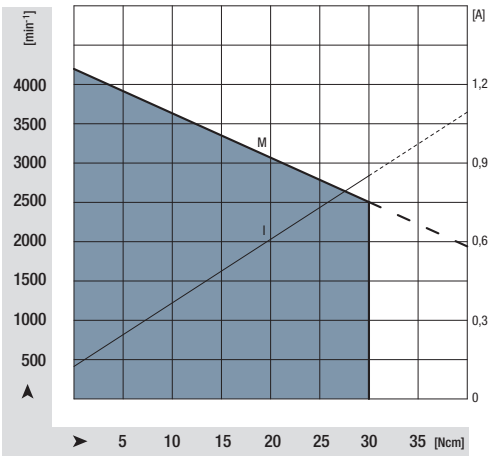
- 3-core internal rotor motor.
- 8-pole rotor with neodymium iron boron (NdFeB) magnet.
- Precision ball bearings for long service life and low-noise performance.
- Motor supply and control via external operating electronics (see page 109).
- Protection class I.
- Optionally with PFC (Power Factor Correction).
- Customer-specific versions possible (see page 105).

## Nominal data\*

### Type BG 4310

Nominal voltage ( $U_{BN}$ )	V AC	230
Nominal speed ( $n_N$ )	rpm	2 500
Nominal torque ( $M_N$ )	Ncm	30
Nominal current ( $I_{BN}$ )	A	0,85
Nominal output power ( $P_N$ )	W	78
Starting torque ( $M_N$ )	Ncm	30
Starting current (max.)	A	0,85
Direction of rotation (seen on shaft)		clockwise (optionally counter-clockwise)
Protection class		IP 20 (optionally IP 54)
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40
Motor mass (m)	kg	0,17

\*The power range can be limited at the bottom or extended upwards by various factors (including ambient temperatures, installation situation, type of protection and model of the motor).



# BG 43 motor

BG 4320



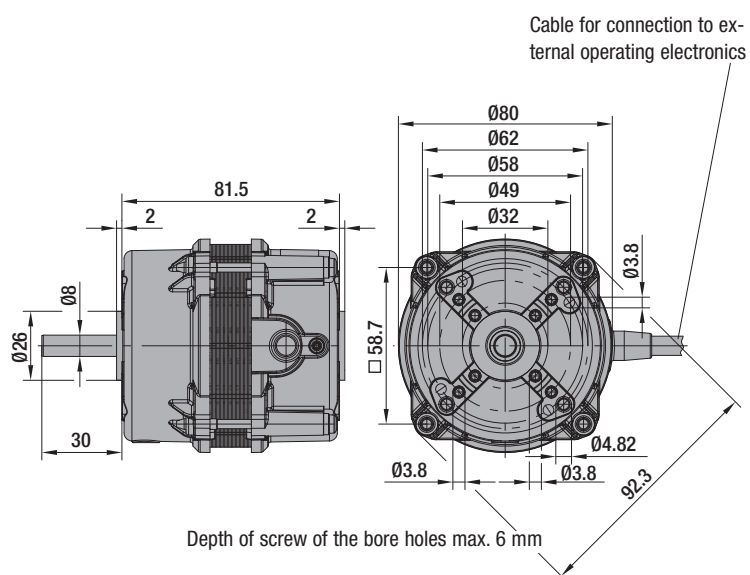
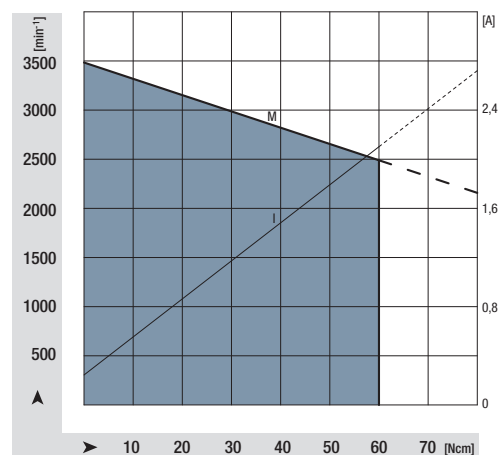
- 3-core internal rotor motor.
- 8-pole rotor with neodymium iron boron (NdFeB) magnet.
- Precision ball bearings for long service life and low-noise performance.
- Motor supply and control via external operating electronics (see page 109).
- Protection class I.
- Optionally with PFC (Power Factor Correction).
- Customer-specific versions possible (see page 105).

## Nominal data\*

### Type BG 4320

Nominal voltage ( $U_{BN}$ )	V AC	230
Nominal speed ( $n_N$ )	rpm	2 500
Nominal torque ( $M_N$ )	Ncm	60
Nominal current ( $I_{BN}$ )	A	2,1
Nominal output power ( $P_N$ )	W	157
Starting torque ( $M_N$ )	Ncm	60
Starting current (max.)	A	2,1
Direction of rotation (seen on shaft)		clockwise (optionally counter-clockwise)
Protection class		IP 20 (optionally IP 54)
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40
Motor mass (m)	kg	0,44

\*The power range can be limited at the bottom or extended upwards by various factors (including ambient temperatures, installation situation, type of protection and model of the motor).



# BG 43 motor

BG 4340



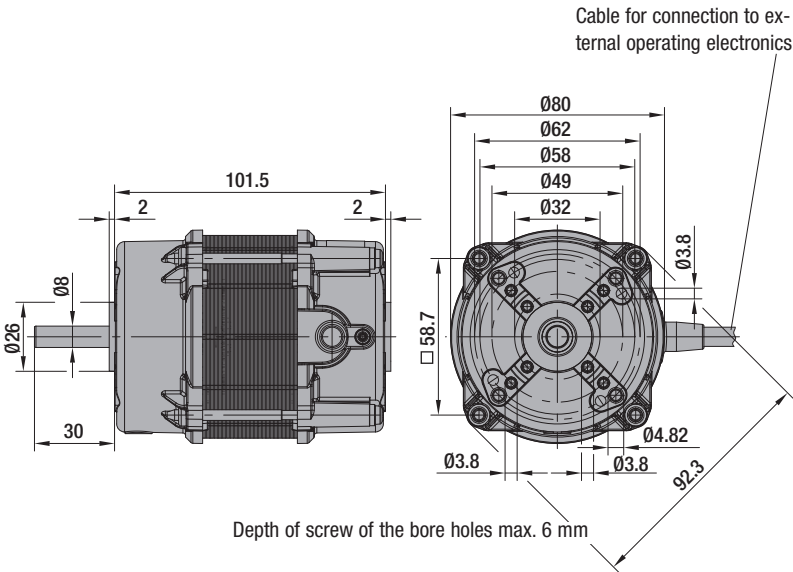
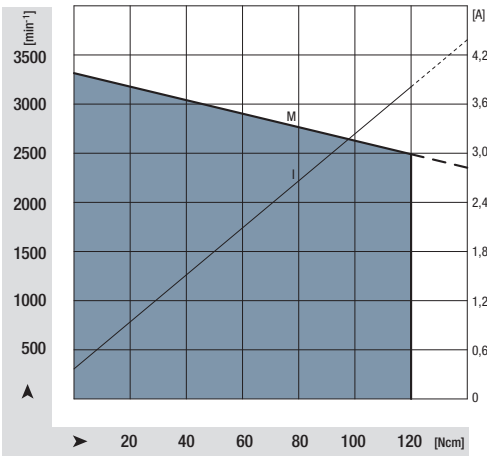
- 3-core internal rotor motor.
- 8-pole rotor with neodymium iron boron (NdFeB) magnet.
- Precision ball bearings for long service life and low-noise performance.
- Motor supply and control via external operating electronics (see page 109).
- Protection class I.
- Optionally with PFC (Power Factor Correction).
- Customer-specific versions possible (see page 105).

## Nominal data\*

### Type BG 4340

Nominal voltage ( $U_{BN}$ )	V AC	230
Nominal speed ( $n_N$ )	rpm	2 500
Nominal torque ( $M_N$ )	Ncm	120
Nominal current ( $I_{BN}$ )	A	3,8
Nominal output power ( $P_N$ )	W	314
Starting torque ( $M_N$ )	Ncm	120
Starting current (max.)	A	3,8
Direction of rotation (seen on shaft)		clockwise (optionally counter-clockwise)
Protection class		IP 20 (optionally IP 54)
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40
Motor mass (m)	kg	1,0

\*The power range can be limited at the bottom or extended upwards by various factors (including ambient temperatures, installation situation, type of protection and model of the motor).



# BG 43 motor

External operating electronics

The external operating electronics for the three-phase size 43 motor are available in various designs and numerous hardware extension levels. The motor is safeguarded using electronics software. These electronics allow you to control the size 43 motor exactly as desired, whether you need a change of direction of rotation, high-precision closed-loop speed control or a fixed speed profile. Depending on the power range and ambient conditions, the electronics can be ventilated using the motor or externally. Additional details are available on request.

## Features:

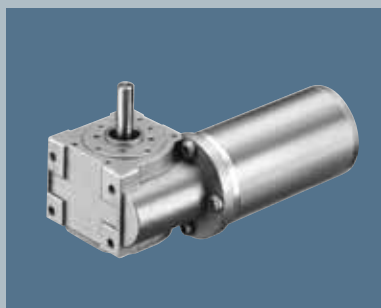
### Activation options:

- Analogue signal (0-10 volts)
- PWM signal (rectangular signal)
- Additional customer-specific solutions

### Installation options:

- Directly on the motor
- Remotely in the customer's application





# The BCI motor family

BCI motors technical information	112
BCI basic motors	114
BCI gearmotors	120
Motor brake and sensor	132



# BCI motor – the complete drive solution with a design made to order



## Technical information

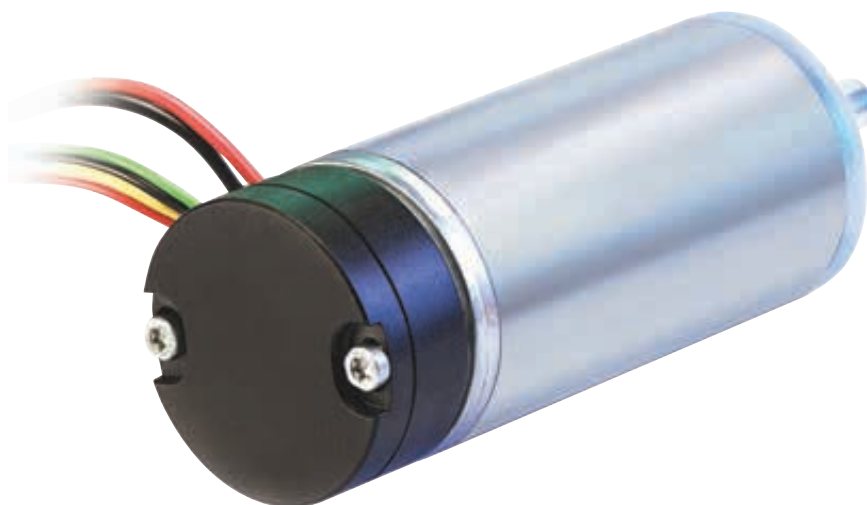
Apart from providing exceptional value for money, the mechanically commutated internal rotor BCI motors provide everything expected in a genuine ebm-papst motor:

Reliable technology with reliable development and application services, as well as accessories to suit your specific needs, from drives, to brakes, to speed sensors.

The new DC motors operate with particular economic efficiency in industrial automation, robotics, mechanical and plant engineering, in chemical and medical engineering, in laboratory equipment, building automation as well as in the textile and printing industries.

The modern armature design with an 8- or 12-piece commutator and special carbon qualities guarantee flawless, durable service. The brush unit for the commutation is mounted on a special PCB. BCI motors are designed in line with EMC regulations and, where additional EMC screening is required, additional components for interference suppression can be mounted on the same PCB.

The permanent magnet BCI motors can be used within a wide range of speeds. Thanks to their minimal cogging torque, they are outstandingly well suited to lower speeds and provide exceptionally smooth running characteristics. In addition, with their high overload capacity in short-time operation, BCI motors offer excellent dynamic properties.



The versatile basis of the BCI motor series consists of three frame sizes, with diameters of 42 mm, 52 mm and 63 mm, each available in two lengths. In addition to worm gears, spur gears and planetary gears, the extensive system range includes components such as magnetic sensors, encoders and brakes. These allow complex solutions to be implemented for almost all drive tasks.

BCI motors are equipped with high-quality precision ball bearings with long-term lubrication. The closed ball bearings are additionally protected against carbon dust by covers on both sides. This reduces the wear, consequently increasing the service life.

Industry standard die-cast zinc flanges with mounting holes in several pitch circles ensure ease of assembly of the motor. Mounting by using blind holes and self threading screws.

Shoulders on both sides of the shaft and a special bearing system are designed to protect the armature system against excessive axial load. High axial forces on the shaft no longer inevitably lead to the destruction of the motor.

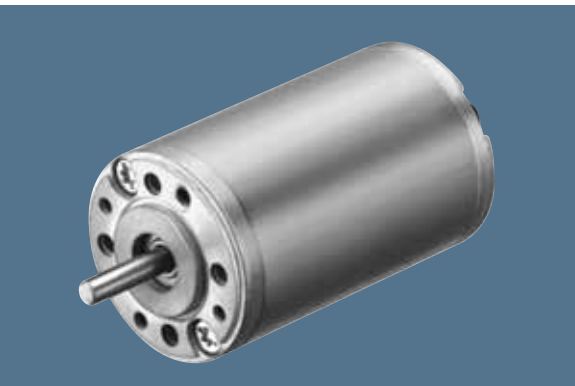
#### In brief and straight to the point

- Designed for 12, 24, 40 and 60 V DC
- Service life 3.000 hrs for nominal operation
- Operation in both directions of rotation
- Radio interference suppression optionally on request
- Temperature class B, VDE 0530
- Protection class IP 40, optionally higher



# BCI motor

BCI 42.25



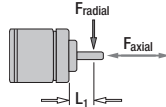
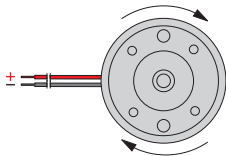
- Direct current motor with permanent magnets made of ceramic bound ferrite.
- Mechanical commutation through 8-piece collector.
- Closed steel motor housing with die-cast zinc bearing flanges.
- Operation in both directions of rotation.
- Service life 3.000 hrs for continuous operation (S1).
- Insulation class B.
- Protection class IP 40, optionally higher.

## Nominal data

Type		BCI 42.25 A00	BCI 42.25 B00	BCI 42.25 C00	BCI 42.25 E00
Nominal voltage ( $U_{BN}$ )	V DC	12	24	40	60
Nominal speed ( $n_N$ )	rpm	3 300	3 300	3 300	3 300
Nominal torque ( $M_N$ )	mNm	38	38	38	38
Nominal current ( $I_{BN}$ )	A	1,90	0,96	0,55	0,36
Nominal output power ( $P_N$ )	W	13	13	13	13
Nominal efficiency approx. ( $\eta_N$ )	%	60	60	60	60
Speed at no-load operation ( $n_l$ )	rpm	4 000	3 900	4 000	4 000
No-load current ( $I_{Bl}$ )	A	0,30	0,19	0,11	0,07
Starting torque ( $M_A$ )	mNm	200	190	240	240
Starting current ( $I_A$ )	A	7,6	4,0	2,6	1,7
Induced voltage ( $U_{imax}$ )	V/1000 rpm	2,74	5,5	9,15	13,7
Terminal resistance ( $R_V$ )	Ohm	1,54	6,05	15,2	35
Terminal inductance ( $L_V$ )	mH	2,2	8,9	25	56
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x 10 <sup>-6</sup>	7,4	7,4	7,4	7,4
Thermal resistance ( $R_{th}$ )	K/W	4,8	4,8	4,8	4,8
Protection class		IP 40	IP 40	IP 40	IP 40
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40	0 to +40	0 to +40	0 to +40
Motor mass (m)	kg	0,4	0,4	0,4	0,4
Order No.		931 4225 002	931 4225 001	931 4225 003	931 4225 004

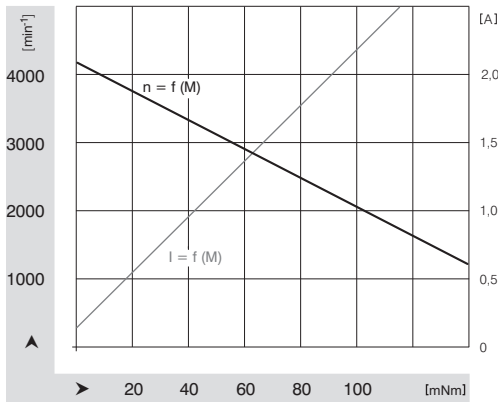
### Electrical connection

Direction of rotation, clockwise as seen on shaft  
 Cable length 300 ± 30 from motor  
 Cable length 7 ± 2 stripped and tin-coated

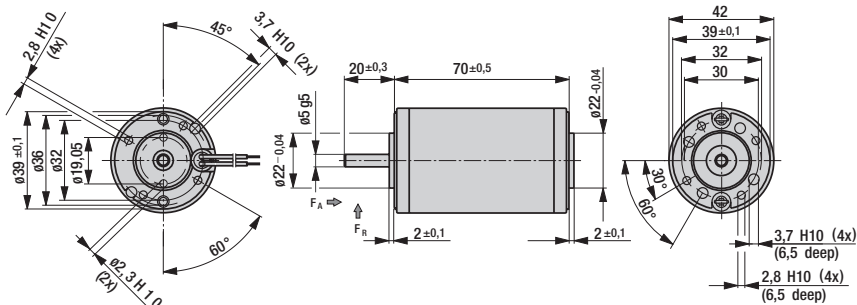


$F_{axial}$  30 N  
 $F_{radial}$  60 N  
 $L_1$  20 mm  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).

### Motor curves for 24 V



Blind holes for self threading screws according to DIN 7500



## BCI motor

BCI 42.40



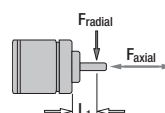
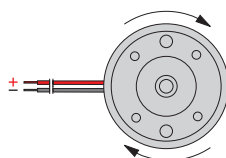
- Direct current motor with permanent magnets made of ceramic bound ferrite.
- Mechanical commutation through 8-piece collector.
- Closed steel motor housing with die-cast zinc bearing flanges.
- Operation in both directions of rotation.
- Service life 3.000 hrs for continuous operation (S1).
- Insulation class B.
- Protection class IP 40, optionally higher.

## Nominal data

Type		BCI 42.40 A00	BCI 42.40 B00	BCI 42.40 C00	BCI 42.40 E00
Nominal voltage ( $U_{BN}$ )	V DC	12	24	40	60
Nominal speed ( $n_N$ )	rpm	3 100	3 100	3 100	3 100
Nominal torque ( $M_N$ )	mNm	57	57	57	57
Nominal current ( $I_{BN}$ )	A	2,5	1,1	0,7	0,46
Nominal output power ( $P_N$ )	W	19	19	19	19
Nominal efficiency approx. ( $\eta_N$ )	%	63	70	68	68
Speed at no-load operation ( $n_L$ )	rpm	3 850	3 600	3 700	3 670
No-load current ( $I_{BL}$ )	A	0,27	0,17	0,09	0,06
Starting torque ( $M_A$ )	mNm	330	320	390	390
Starting current ( $I_A$ )	A	11,2	5,9	4,0	2,5
Induced voltage ( $U_{imax}$ )	V/1000 rpm	3,04	6,4	10,5	16
Terminal resistance ( $R_V$ )	Ohm	1,08	4,1	10,2	23,5
Terminal inductance ( $L_V$ )	mH	1,2	5,1	13,7	32,0
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x 10 <sup>-6</sup>	11,5	11,5	11,5	11,5
Thermal resistance ( $R_{th}$ )	K/W	4,75	4,75	4,75	4,75
Protection class		IP 40	IP 40	IP 40	IP 40
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40	0 to +40	0 to +40	0 to +40
Motor mass (m)	kg	0,5	0,5	0,5	0,5
Order No.		931 4240 002	931 4240 001	931 4240 003	931 4240 004

## Electrical connection

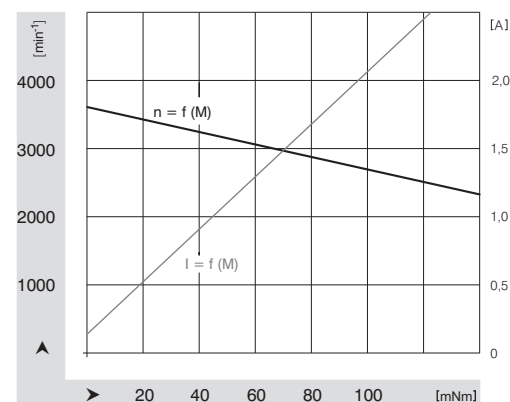
Direction of rotation, clockwise as seen on shaft  
Cable length  $300 \pm 30$  from motor  
Cable length  $7 \pm 2$  stripped and tin-coated



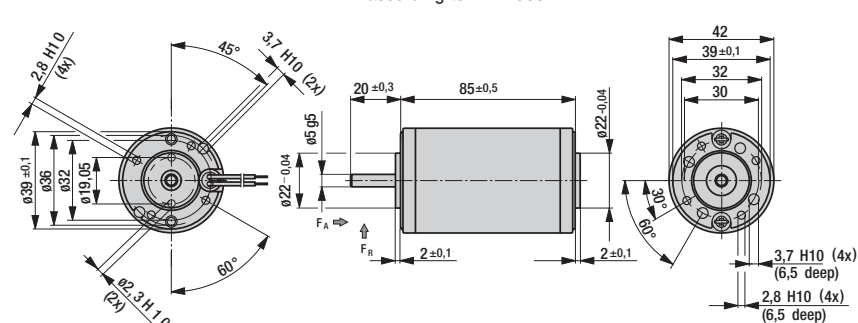
$F_{\text{axial}}$  30 N  
 $F_{\text{radial}}$  60 N       $L_1$  20 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_{H1}$  max. 40°C).

### Motor curves for 24 V

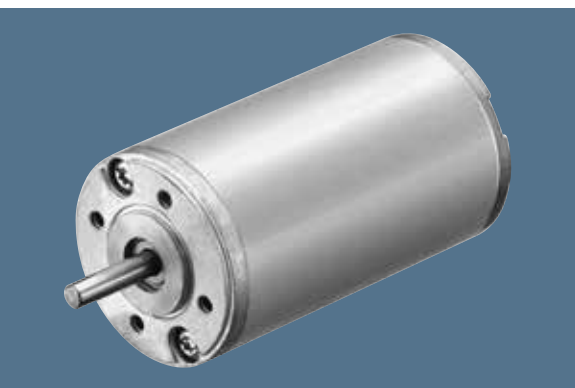


Blind holes for self threading screws  
according to DIN 7500



# BCI motor

## BCI 52.30



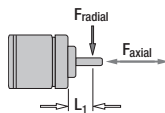
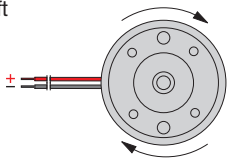
- Direct current motor with permanent magnets made of ceramic bound ferrite.
- Mechanical commutation through 12-piece collector.
- Closed steel motor housing with die-cast zinc bearing flanges.
- Operation in both directions of rotation.
- Service life 3.000 hrs for continuous operation (S1).
- Insulation class B.
- Protection class IP 40, optionally higher.

### Nominal data

Type		BCI 52.30 A00	BCI 52.30 B00	BCI 52.30 C00	BCI 52.30 E00
Nominal voltage ( $U_{BN}$ )	V DC	12	24	40	60
Nominal speed ( $n_N$ )	rpm	3 600	3 600	3 600	3 600
Nominal torque ( $M_N$ )	mNm	100	100	100	100
Nominal current ( $I_{BN}$ )	A	4,8	2,2	1,35	1,0
Nominal output power ( $P_N$ )	W	38	38	38	38
Nominal efficiency approx. ( $\eta_N$ )	%	66	71	71	71
Speed at no-load operation ( $n_L$ )	rpm	4 200	4 200	4 200	4 200
No-load current ( $I_{BL}$ )	A	0,48	0,30	0,17	0,12
Starting torque ( $M_A$ )	mNm	550	650	650	790
Starting current ( $I_A$ )	A	20,8	12,0	8,8	5,9
Induced voltage ( $U_{imax}$ )	V/1000 rpm	2,78	5,6	9,3	13,9
Terminal resistance ( $R_V$ )	Ohm	0,58	2,0	4,6	10,1
Terminal inductance ( $L_V$ )	mH	0,9	3,6	10,1	22,5
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x 10 <sup>-6</sup>	23	23	23	23
Thermal resistance ( $R_{th}$ )	K/W	3,2	3,2	3,2	3,2
Protection class		IP 40	IP 40	IP 40	IP 40
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40	0 to +40	0 to +40	0 to +40
Motor mass (m)	kg	0,9	0,9	0,9	0,9
Order No.		931 5230 002	931 5230 001	931 5230 003	931 5230 004

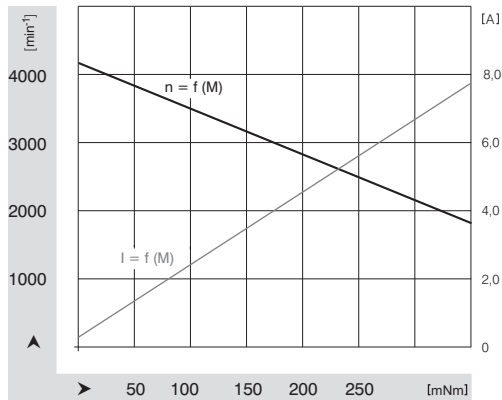
### Electrical connection

Direction of rotation, clockwise as seen on shaft  
Cable length  $300 \pm 30$  from motor  
Cable length  $7 \pm 2$  stripped and tin-coated

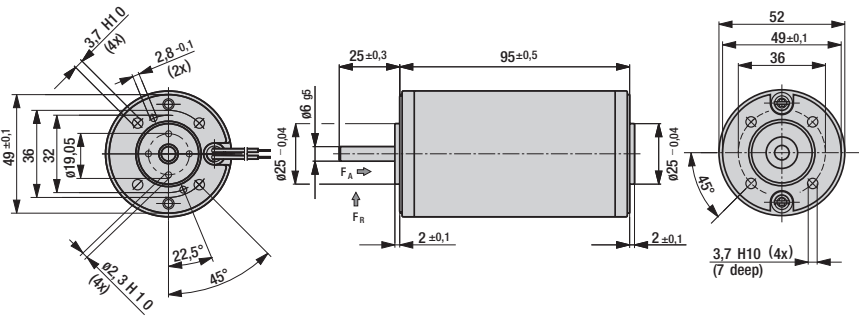


$F_{axial}$  90 N  
 $F_{radial}$  130 N  $L_1$  20 mm  
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).

### Motor curves for 24 V



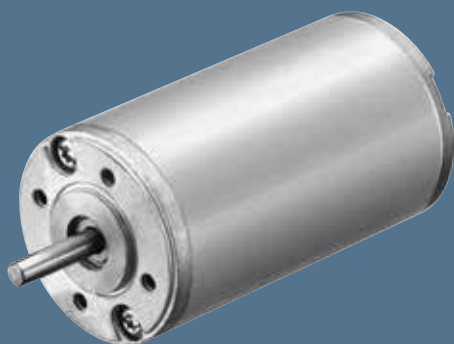
Blind holes for self threading screws according to DIN 7500



# BCI motor

BCI 52.60

- Direct current motor with permanent magnets made of ceramic bound ferrite.
- Mechanical commutation through 12-piece collector.
- Closed steel motor housing with die-cast zinc bearing flanges.
- Operation in both directions of rotation.
- Service life 3.000 hrs for continuous operation (S1).
- Insulation class B.
- Protection class IP 40, optionally higher.

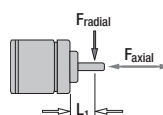
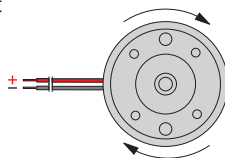


## Nominal data

Type		BCI 52.60 A00	BCI 52.60 B00	BCI 52.60 C00	BCI 52.60 E00
Nominal voltage ( $U_{BN}$ )	V DC	12	24	40	60
Nominal speed ( $n_N$ )	rpm	3 100	3 100	3 100	3 100
Nominal torque ( $M_N$ )	mNm	170	170	170	170
Nominal current ( $I_{BN}$ )	A	6,4	3,0	1,8	1,2
Nominal output power ( $P_N$ )	W	55	55	55	55
Nominal efficiency approx. ( $\eta_N$ )	%	72	77	77	77
Speed at no-load operation ( $n_l$ )	rpm	3 500	3 500	3 500	3 500
No-load current ( $I_{Bl}$ )	A	0,60	0,40	0,20	0,13
Starting torque ( $M_A$ )	mNm	800	980	1 500	1 500
Starting current ( $I_A$ )	A	27,6	16,0	15,2	9,7
Induced voltage ( $U_{imax}$ )	V/1000 rpm	3,04	6,4	10,65	16,1
Terminal resistance ( $R_V$ )	Ohm	0,44	1,5	2,64	6,2
Terminal inductance ( $L_V$ )	mH	1,1	4,7	13,1	29,9
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x 10 <sup>-6</sup>	46	46	46	46
Thermal resistance ( $R_{th}$ )	K/W	3,3	3,3	3,3	3,3
Protection class		IP 40	IP 40	IP 40	IP 40
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40	0 to +40	0 to +40	0 to +40
Motor mass (m)	kg	1,1	1,1	1,1	1,1
Order No.		931 5260 002	931 5260 001	931 5260 003	931 5260 004

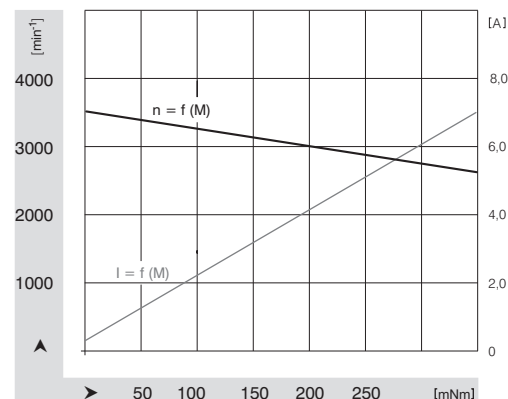
## Electrical connection

Direction of rotation, clockwise as seen on shaft  
 Cable length  $300 \pm 30$  from motor  
 Cable length  $7 \pm 2$  stripped and tin-coated

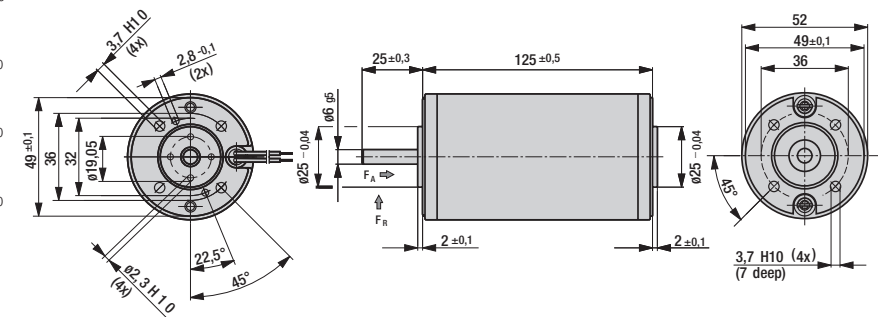


$F_{axial}$  90 N  
 $F_{radial}$  130 N  $L_1$  20 mm  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).

## Motor curves for 24 V



Blind holes for self threading screws according to DIN 7500



## BCI 63.25



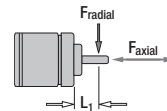
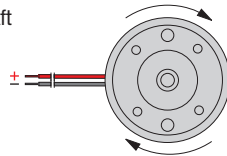
- Direct current motor with permanent magnets made of ceramic bound ferrite.
- Mechanical commutation through 12-piece collector.
- Closed steel motor housing with die-cast zinc bearing flanges.
- Operation in both directions of rotation.
- Service life 3.000 hrs for continuous operation (S1).
- Insulation class B.
- Protection class IP 40, optionally higher.

## Nominal data

Type		BCI 63.25 A00	BCI 63.25 B00	BCI 63.25 C00	BCI 63.25E00	
Nominal voltage ( $U_{BN}$ )	V DC	12	24	40	60	
Nominal speed ( $n_N$ )	rpm	3 150	3 150	3 150	3 150	
Nominal torque ( $M_N$ )	mNm	140	140	140	140	
Nominal current ( $I_{BN}$ )	A	5,4	2,7	1,65	1,1	
Nominal output power ( $P_N$ )	W	46	46	46	46	
Nominal efficiency approx. ( $\eta_N$ )	%	71	71	71	71	
Speed at no-load operation ( $n_L$ )	rpm	3 600	3 600	3 600	3 600	
No-load current ( $I_{BL}$ )	A	0,8	0,4	0,25	0,15	
Starting torque ( $M_A$ )	mNm	840	1 100	1 100	1 100	
Starting current ( $I_A$ )	A	28,0	17,5	12,0	7,4	
Induced voltage ( $U_{imax}$ )	V/1000 rpm	3,2	6,6	10,0	16,0	
Terminal resistance ( $R_V$ )	Ohm	0,44	1,4	3,35	8,1	
Terminal inductance ( $L_V$ )	mH	0,7	2,9	7,1	18,1	
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x 10 <sup>-6</sup>	40	40	40	40	
Thermal resistance ( $R_{th}$ )	K/W	2,75	2,75	2,75	2,75	
Protection class		IP 40	IP 40	IP 40	IP 40	
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40	0 to +40	0 to +40	0 to +40	
Motor mass (m)	kg	1,2	1,2	1,2	1,2	
Order No.		931 6325 002	931 6325 001	931 6325 003	931 6325 004	

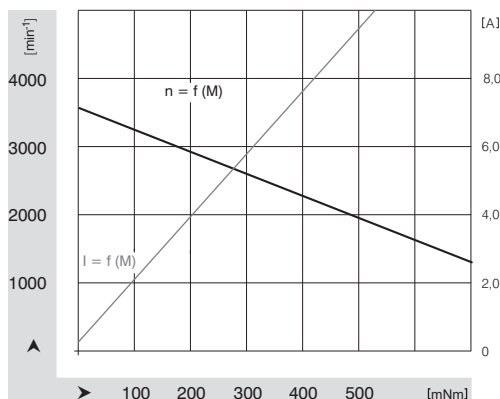
## Electrical connection

Direction of rotation, clockwise as seen on shaft  
Cable length  $300 \pm 30$  from motor  
Cable length  $7 \pm 2$  stripped and tin-coated

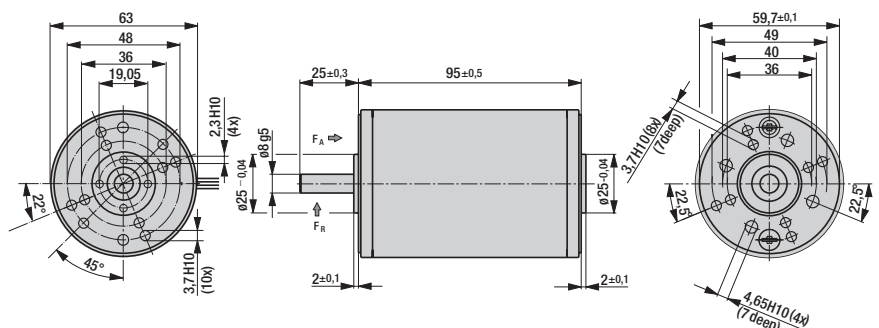


$F_{axial}$  150 N  
 $F_{radial}$  150 N       $L_1$  20 mm  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_{II}$  max. 40°C).

### Motor curves for 24 V



Blind holes for self threading screws  
according to DIN 7500



## BCI motor

BCI 63.55



- Direct current motor with permanent magnets made of ceramic bound ferrite.
- Mechanical commutation through 12-piece collector.
- Closed steel motor housing with die-cast zinc bearing flanges.
- Operation in both directions of rotation.
- Service life 3.000 hrs for continuous operation (S1).
- Insulation class B.
- Protection class IP 40, optionally higher.

## Nominal data

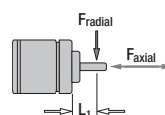
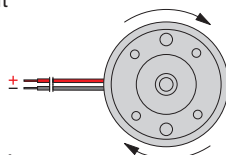
Type		BCI 63.55 A00	BCI 63.55 B00	BCI 63.55 C00	BCI 63.55 E00
Nominal voltage ( $U_{BN}$ )	V DC	12	24	40	60
Nominal speed ( $n_N$ )	rpm	3 000	3 300	3 300	3 300
Nominal torque ( $M_N$ )	mNm	270	270	270	270
Nominal current ( $I_{BN}$ )	A	8,6	4,9	2,95	1,95
Nominal output power ( $P_N$ )	W	85	93	93	93
Nominal efficiency approx. ( $\eta_N$ )	%	79	79	79	79
Speed at no-load operation ( $n_L$ )	rpm	3 600	3 600	3 600	3 600
No-load current ( $I_{BL}$ )	A	1,0	0,5	0,3	0,2
Starting torque ( $M_A$ )	mNm	1 900	2 550	2 900	3 100
Starting current ( $I_A$ )	A	63,0	40,0	28,8	19,7
Induced voltage ( $U_{imax}$ )	V/1000 rpm	3,3	6,7	10,8	16,6
Terminal resistance ( $R_V$ )	Ohm	0,19	0,65	1,39	3,05
Terminal inductance ( $L_V$ )	mH	0,4	1,5	4,0	9,4
Rotor moment of inertia ( $J_R$ )	kgm <sup>2</sup> x 10 <sup>-6</sup>	75	75	75	75
Thermal resistance ( $R_{th}$ )	K/W	2,45	2,45	2,45	2,45
Protection class		IP 40	IP 40	IP 40	IP 40
Perm. amb. temp. range ( $T_U$ )	°C	0 to +40	0 to +40	0 to +40	0 to +40
Motor mass (m)	kg	1,7	1,7	1,7	1,7
Order No.		931 6355 002	931 6355 001	931 6355 004	931 6355 003

## Electrical connection

Direction of rotation, clockwise as seen on shaft

Cable length  $300 \pm 30$  from motor

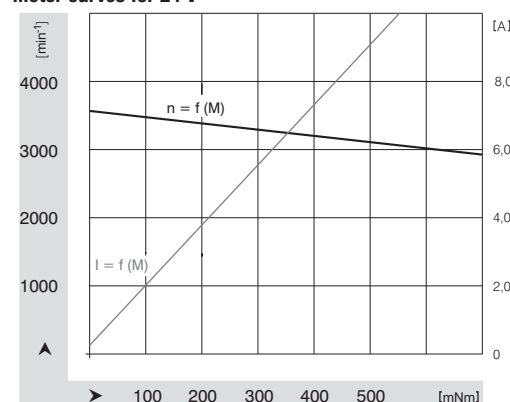
Cable length  $7 \pm 2$  stripped and tin-coated



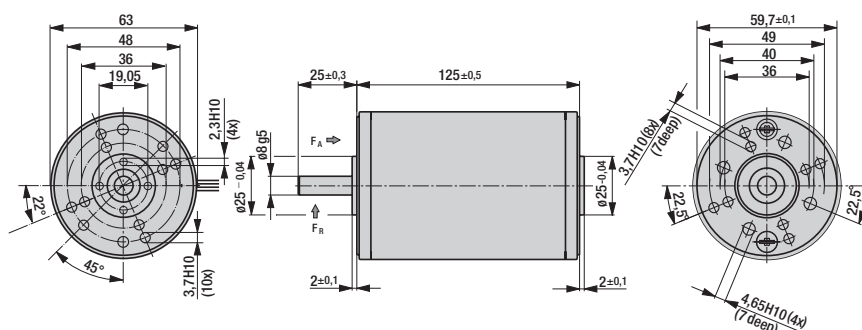
$F_{\text{axial}}$  150 N  
 $F_{\text{radial}}$  150 N       $L_1$  20 mm

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_{H1}$  max. 40°C).

### Motor curves for 24 V



Blind holes for self threading screws  
according to DIN 7500

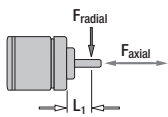


## BCI 42.25 A spur gearmotor 24 V DC



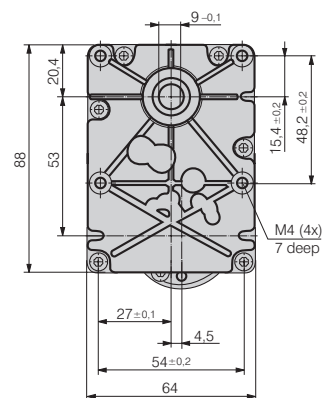
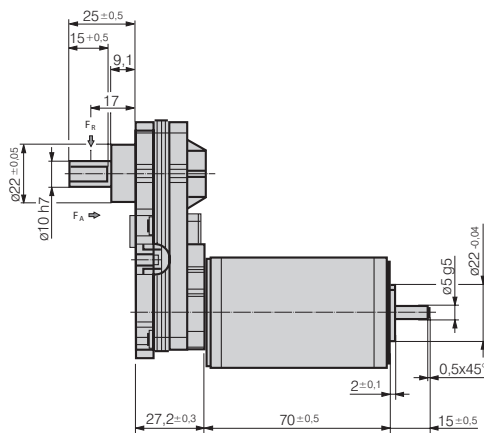
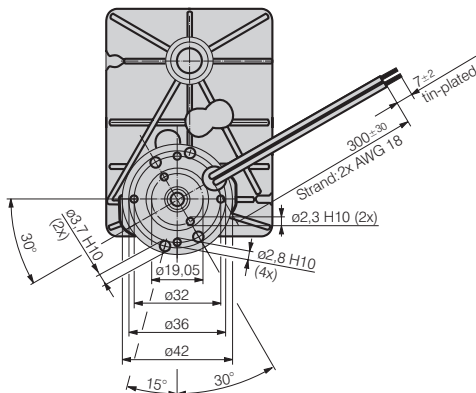
- DC motor with multi-stage spur gearbox.
- Gear housing made of die-cast zinc.
- Gearbox output shaft with needle-bearing.
- Flatline design optimized for short installation length.
- Grease lubrication for maintenance-free continuous operation.
- Service life 3.000 hrs for continuous operation (S1).
- Other voltages available on request.

Nominal data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	Order No.
Type	i		Nm	rpm	kg	941 4225...
BCI-42.25 B00-A/39	38,6 : 1	3	1,1	85	0,7	...140
BCI-42.25 B00-A/65	65,2 : 1	3	1,5	51	0,7	...141
BCI-42.25 B00-A/82	82,8 : 1	3	2,3	40	0,7	...142
BCI-42.25 B00-A/106	106,1 : 1	3	2,6	31	0,7	...143
BCI-42.25 B00-A/140	140,8 : 1	3	3,2	23	0,7	...144
BCI-42.25 B00-A/191	191,9 : 1	4	4,7	17	0,7	...145
BCI-42.25 B00-A/252	252,6 : 1	4	6,2	13	0,7	...146



$F_{\text{axial}}$	50 N		
$F_{\text{radial}}$	300 N	$L_1$	17 mm

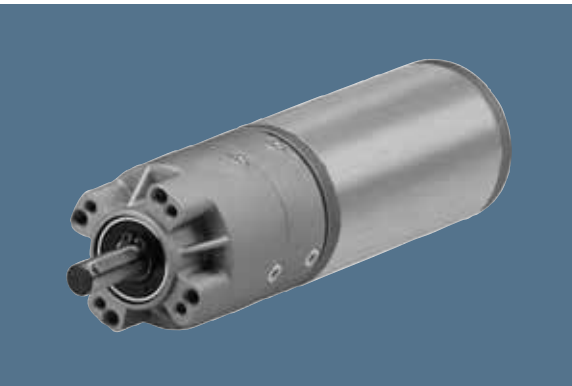
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_H$  max. 40°C).





# BCI motor

BCI 42 PX planetary gearbox 24 V DC



- DC motor with planetary gearbox PX 42 and PX 52.
- Robust die-cast zinc housing in modular construction.
- Grease lubrication for maintenance-free continuous operation.
- Output shaft with combined sleeve- / ball bearings.
- Optimized helical gearing for long service life and quiet running in the first stage.
- Other voltages available on request.

Nominal data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	
Type	i		Nm	rpm	kg	Order No. 941 4225...
BCI-42.25 B00-PX42/17	17 : 1	1	0,6	194	0,6	...136
BCI-42.25 B00-PX42/72	72,25 : 1	2	2,2	46	0,7	...137
BCI-42.25 B00-PX42/102	102 : 1	2	3,2	32	0,7	...138
BCI-42.25 B00-PX42/204	204 : 1	2	6,3	16	0,7	...139

Nominal data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	
Type	i		Nm	rpm	kg	Order No. 941 4240...
BCI-42.40 B00-PX42/9	9 : 1	1	0,5	344	0,7	...166
BCI-42.40 B00-PX52/17	17 : 1	1	0,9	182	0,9	...136
BCI-42.40 B00-PX42/38	38,25 : 1	2	1,8	81	0,8	...167
BCI-42.40 B00-PX42/54	54 : 1	2	2,5	57	0,8	...168
BCI-42.40 B00-PX52/72	72,25 : 1	2	3,3	43	1,0	...137
BCI-42.40 B00-PX52/102	102 : 1	2	4,7	30	1,0	...138
BCI-42.40 B00-PX52/204	204 : 1	2	9,4	15	1,0	...139

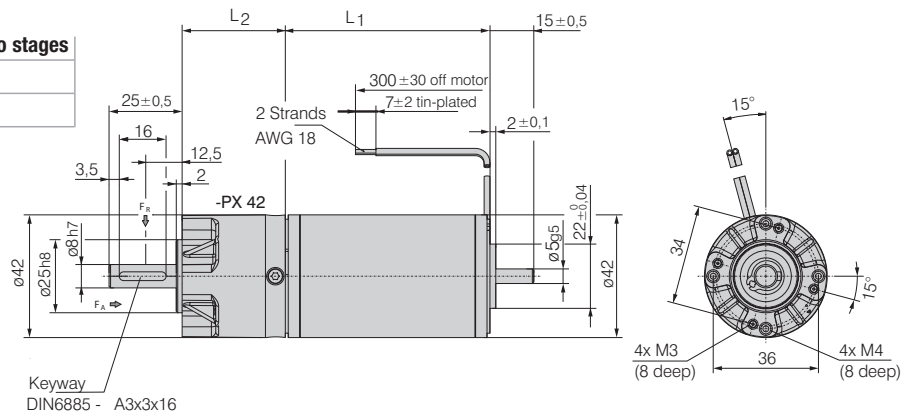
## Motor lengths (mm)

Type	L1	L2 one stage	L2 two stages
BCI 42.25	70 ± 0,5	35,3	50,8
BCI 42.40	85 ± 0,5	35,3	50,8

## Gear lengths PX 42

## Output shaft load

$F_A$ : max. permissible axial load 150 N  
 $F_R$ : max. permissible radial load 250 N  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).



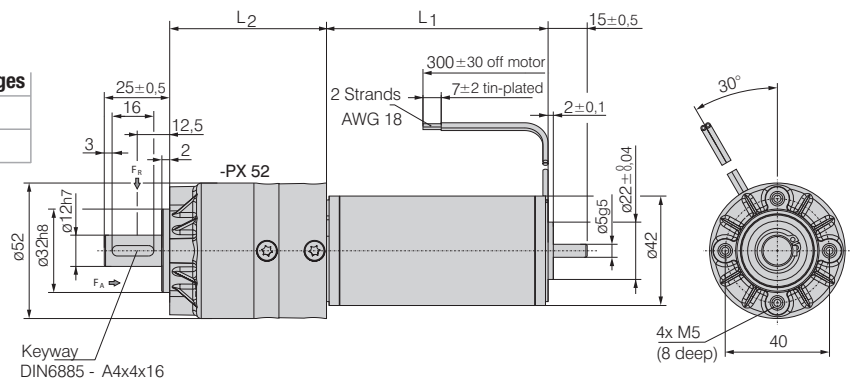
## Motor lengths (mm)

Type	L1	L2 one stage	L2 two stages
BCI 42.25	70 ± 0,5	41,9	60,2
BCI 42.40	85 ± 0,5	41,9	60,2

## Gear lengths PX 52

## Output shaft load

$F_A$ : max. permissible axial load 500 N  
 $F_R$ : max. permissible radial load 350 N  
 Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).





# BCI motor

BCI 52.60 PX planetary gearmotor 24 V DC

- DC motor with planetary gearbox PX 42 and PX 52.
- Robust die-cast zinc housing in modular construction.
- Grease lubrication for maintenance-free continuous operation.
- Output shaft with combined needle- / ball bearings.
- Optimized helical gearing for long service life and quiet running in the first stage.
- Other voltages available on request.



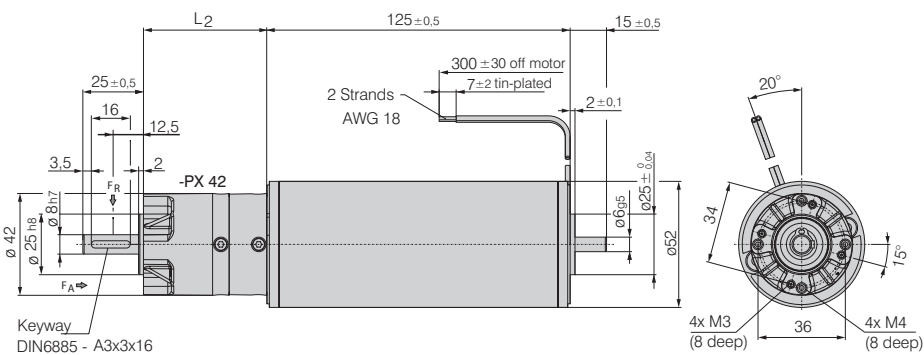
Nominal data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	
Type	i		Nm	rpm	kg	Order No. 941 5260...
BCI-52.60 B00-PX42/3	3,18 : 1	1	0,5	975	1,3	...300
BCI-52.60 B00-PX42/5	5 : 1	1	0,8	620	1,3	...301
BCI-52.60 B00-PX52/9	9 : 1	1	1,4	344	1,5	...320
BCI-52.60 B00-PX42/21	21,25 : 1	2	2,9	146	1,4	...302
BCI-52.60 B00-PX42/30	30 : 1	2	4,1	103	1,4	...303
BCI-52.60 B00-PX52/38	38,25 : 1	2	5,3	81	1,6	...321
BCI-52.60 B00-PX52/54	54 : 1	2	7,4	57	1,6	...322

## Gear lengths PX 42

L2 one stage	L2 two stages
35,3	50,8

## Output shaft load

$F_A$ : max. permissible axial load 150 N  
 $F_R$ : max. permissible radial load 250 N  
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).

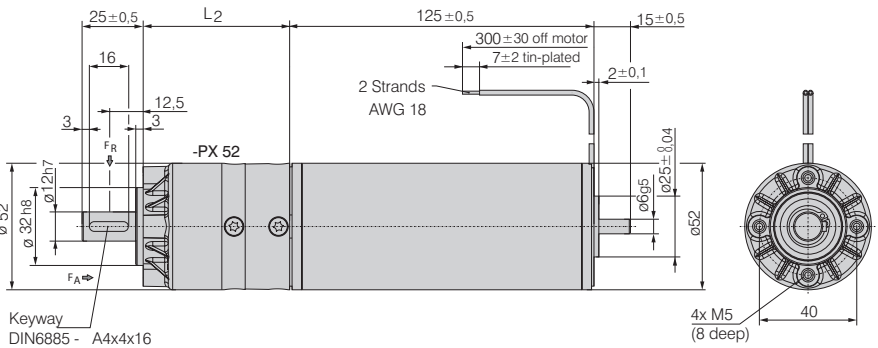


## Gear lengths PX 52

L2 one stage	L2 two stages
41,9	60,2

## Output shaft load

$F_A$ : max. permissible axial load 500 N  
 $F_R$ : max. permissible radial load 350 N  
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).





# BCI motor

BCI 63 B spur gearmotor 24 V DC



- DC motor with multi-stage spur gearbox.
- Gear housing made of die-cast zinc.
- Gearbox output shaft with needle-bearing.
- Flatline design optimized for short installation length.
- Grease lubrication for maintenance-free continuous operation.
- Service life 3.000 hrs for continuous operation (S1).
- Other voltages available on request.

Nominal data		Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	Order No. 941 6325...
Type	i			Nm	rpm	kg	
BCI-63.25 B00-B/303	303,6 : 1	4	28	10	1,8	...190	
BCI-63.25 B00-B/454*	454 : 1	4	30	7	1,8	...191	
BCI-63.25 B00-B/687*	687 : 1	4	30	5	1,8	...192	
BCI-63.25 B00-B/1028*	1028,7 : 1	4	30	3	1,8	...193	

Nominal data		Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	
Type		i		Nm	rpm	kg	Order No. 941 6355...
BCI-63.55 B00-B/8		8,2 : 1	3	1,6	402	2,2	...190
BCI-63.55 B00-B/12		12,3 : 1	3	2,4	268	2,2	...191
BCI-63.55 B00-B/18		18 : 1	3	3,5	183	2,2	...192
BCI-63.55 B00-B/27		27,6 : 1	3	5,4	120	2,2	...193
BCI-63.55 B00-B/40		40,3 : 1	3	7,9	82	2,2	...194
BCI-63.55 B00-B/64		64 : 1	3	12,6	52	2,2	...195
BCI-63.55 B00-B/101		101,8 : 1	3	20,0	32	2,2	...196
BCI-63.55 B00-B/136*		136,5 : 1	3	25,0	24	2,2	...197
BCI-63.55 B00-B/189*		189 : 1	3	25,0	18	2,2	...198

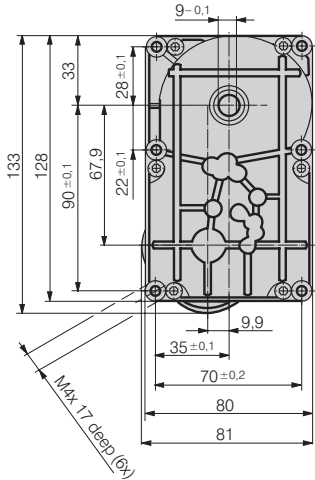
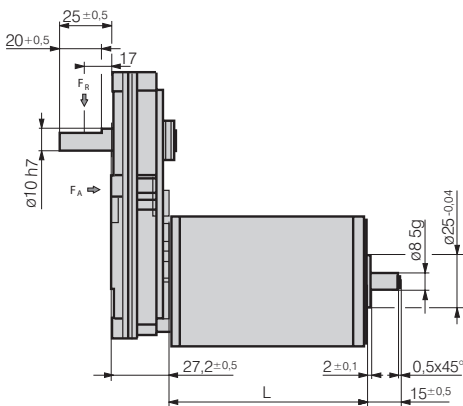
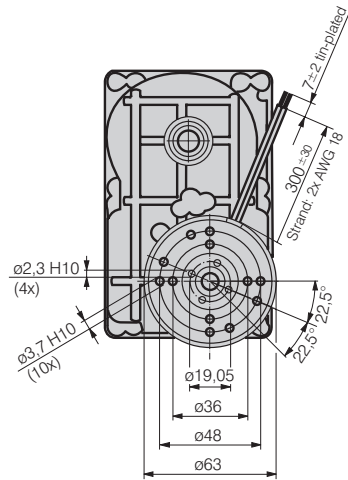
\* **Attention:** Compliance with the max. permitted gear output torque must be ensured by an external limitation of the motor current.

### Output shaft load

$F_A$ : max. permissible axial load 50 N  
 $F_R$ : max. permissible radial load 150 N  
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).

### Motor lengths (mm)

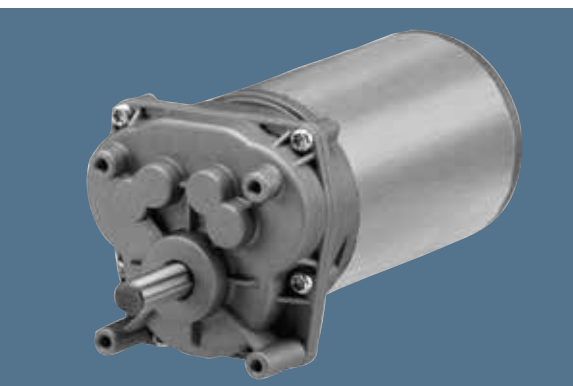
Type	L
BCI 63.25	95 ± 0,5
BCI 63.55	125 ± 0,5



# BCI motor

BCI 63 D spur gearmotor 24 V DC

- DC motor with multi-stage spur gearbox.
- Gear housing made of die-cast zinc.
- Gearbox output shaft with combined sleeve-/needle-bearing.
- Grease lubrication for maintenance-free continuous operation.
- Service life 3.000 hrs for continuous operation (S1).
- Other voltages available on request.



Nominal data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	
Type	i		Nm	rpm	kg	Order No. 941 6325...
BCI-63.25 B00-D/7	7,85 : 1	2	0,9	401	1,6	...160
BCI-63.25 B00-D/9	9,2 : 1	2	1,0	342	1,6	...161
BCI-63.25 B00-D/11	11,1 : 1	2	1,3	284	1,6	...162
BCI-63.25 B00-D/13	13,8 : 1	2	1,6	228	1,6	...163
BCI-63.25 B00-D/18	18,4 : 1	2	2,1	171	1,6	...164
BCI-63.25 B00-D/22	22,0 : 1	2	2,5	143	1,6	...165
BCI-63.25 B00-D/27	27,6 : 1	2	3,1	114	1,6	...166
BCI-63.25 B00-D/41	41,3 : 1	3	4,2	76	1,6	...167
BCI-63.25 B00-D/67	67,3 : 1	3	6,8	47	1,6	...168
BCI-63.25 B00-D/117*	117,1 : 1	3	9,0	27	1,6	...169
BCI-63.25 B00-D/165*	165,8 : 1	3	9,0	19	1,6	...170

Nominal data	Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	
Type	i		Nm	rpm	kg	Order No. 941 6355...
BCI-63.55 B00-D/7	7,85 : 1	2	1,7	420	2,1	...250
BCI-63.55 B00-D/9	9,2 : 1	2	2,0	359	2,1	...251
BCI-63.55 B00-D/11	11,1 : 1	2	2,4	297	2,1	...252
BCI-63.55 B00-D/13	13,8 : 1	2	3,0	239	2,1	...253
BCI-63.55 B00-D/18	18,4 : 1	2	4,0	179	2,1	...254
BCI-63.55 B00-D/22	22,0 : 1	2	4,8	150	2,1	...255
BCI-63.55 B00-D/27	27,6 : 1	2	6,0	120	2,1	...256
BCI-63.55 B00-D/41	41,3 : 1	3	8,1	80	2,1	...257
BCI-63.55 B00-D/67*	67,3 : 1	3	9,0	49	2,1	...258
BCI-63.55 B00-D/117*	117,1 : 1	3	9,0	28	2,1	...259
BCI-63.55 B00-D/165*	165,8 : 1	3	9,0	20	2,1	...260

\* **Attention:** Compliance with the max. permitted gear output torque must be ensured by an external limitation of the motor current.

## Output shaft load

$F_A$ : max. permissible axial load 50 N

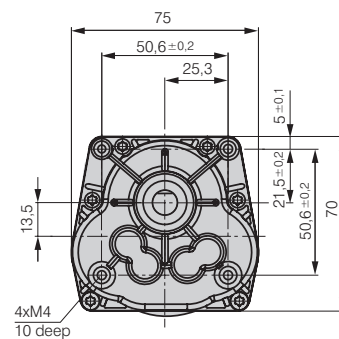
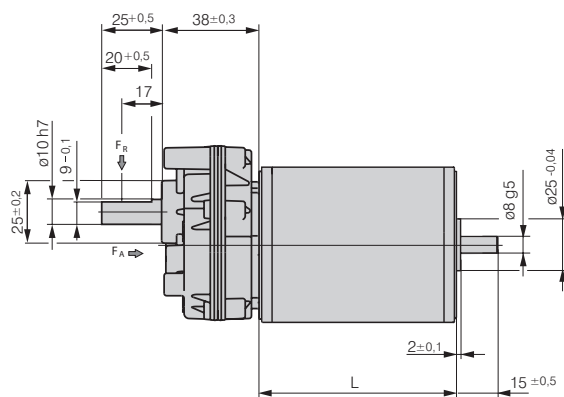
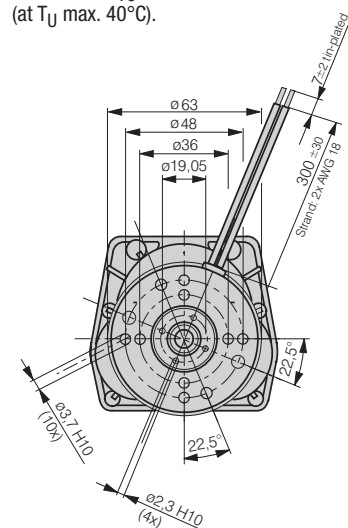
$F_R$ : max. permissible radial load 150 N

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h

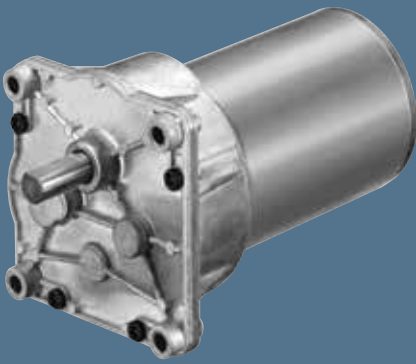
(at  $T_U$  max. 40°C).

## Motor lengths (mm)

Type	L
BCI 63.25	95 ± 0,5
BCI 63.55	125 ± 0,5



## BCI 63 E spur gearmotor 24 V DC



- DC motor with multi-stage spur gearbox.
- Gear housing made of die-cast zinc.
- Gearbox output shaft with combined sleeve-/needle-bearing.
- Grease lubrication for maintenance-free continuous operation.
- Service life 3.000 hrs for continuous operation (S1).
- Other voltages available on request.

Nominal data		Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	
Type	i		Nm	rpm	kg	Order No.	
BCI-63.25 B00-E/15	15,47 : 1	2	1,7	204	1,6	941 6325...	...171
BCI-63.25 B00-E/18	18,4 : 1	2	2,1	171	1,6	941 6325...	...172
BCI-63.25 B00-E/23	23,14 : 1	2	2,6	136	1,6	941 6325...	...173
BCI-63.25 B00-E/31	31,1 : 1	2	3,5	101	1,6	941 6325...	...174
BCI-63.25 B00-E/40	40,1 : 1	2	4,5	79	1,6	941 6325...	...175
BCI-63.25 B00-E/55	55,0 : 1	3	5,6	57	1,7	941 6325...	...176
BCI-63.25 B00-E/70	70,4 : 1	3	7,2	45	1,7	941 6325...	...177
BCI-63.25 B00-E/92	92,3 : 1	3	9,4	34	1,7	941 6325...	...178
BCI-63.25 B00-E/142	142 : 1	3	14,4	22	1,7	941 6325...	...179
BCI-63.25 B00-E/184*	184,8 : 1	3	15,0	17	1,7	941 6325...	...180
BCI-63.25 B00-E/274*	274,6 : 1	3	15,0	11	1,7	941 6325...	...181

Nominal data						
Type	Gear ratio i	Gear stages	Nominal torque Nm	Nominal speed rpm	Mass kg	Order No. 941 6355...
BCI-63.55 B00-E/15	15,47 : 1	2	3,4	213	2,1	...144
BCI-63.55 B00-E/18	18,4 : 1	2	4,0	179	2,1	...145
BCI-63.55 B00-E/23	23,14 : 1	2	5,0	143	2,1	...146
BCI-63.55 B00-E/31	31,1 : 1	2	6,8	106	2,1	...147
BCI-63.55 B00-E/40	40,1 : 1	2	8,7	82	2,1	...148

\* **Attention:** Compliance with the max. permitted gear output torque must be ensured by an external limitation of the motor current.

### Output shaft load

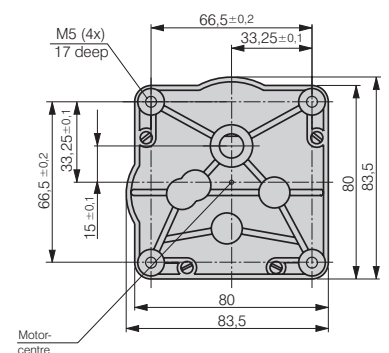
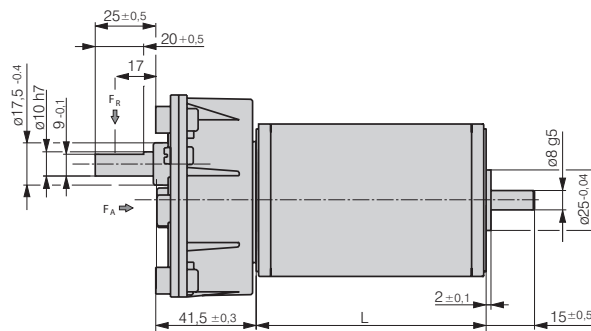
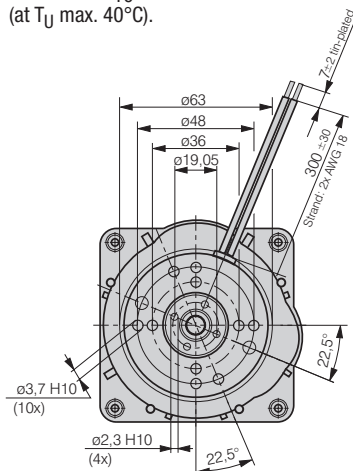
$F_A$ : max. permissible axial load 50 N

$F_R$ : max. permissible radial load 150 N

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).

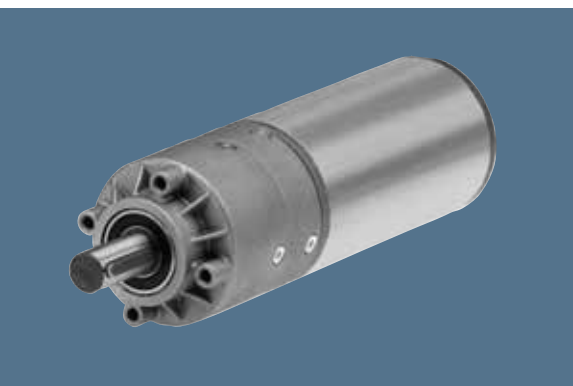
**Motor lengths (mm)**

Type	L
BCI 63.25	95 ± 0,5
BCI 63.55	125 ± 0,5



## BCI motor

BCI 63 PX planetary gearmotor 24 V DC



- DC motor with planetary gearbox PX 52 and PX 63.
- Robust die-cast zinc housing in modular construction.
- Grease lubrication for maintenance-free continuous operation.
- Output shaft with combined needle- / ball bearings.
- Optimized helical gearing for long service life and quiet running in the first stage.
- Other voltages available on request.

Nominal data		Gear ratio	Gear stages	Nominal torque	Nominal speed	Mass	
Type		i		Nm	rpm	kg	Order No. 941 6325..
BCI-63.25 B00-PX63/17*		17 : 1	1	1,5	185	1,6	...131
BCI-63.25 B00-PX63/72*		72,25 : 1	2	5,9	44	1,7	...132
BCI-63.25 B00-PX63/102*		102 : 1	2	8,3	31	1,7	...133
BCI-63.25 B00-PX63/204*		204 : 1	2	16,5	15	1,7	...134

Nominal data						
Type	i	1	Nm	rpm	kg	Order No. 941 6355..
BCI-63.55 B00-PX52/3	3,18 : 1	1	0,8	1038	2,1	...300
BCI-63.55 B00-PX52/5	5,0 : 1	1	1,2	660	2,1	...301
BCI-63.55 B00-PX63/9	9,0 : 1	1	2,2	367	2,1	...135
BCI-63.55 B00-PX52/21	21,25 : 1	2	4,6	155	2,2	...302
BCI-63.55 B00-PX52/30	30,0 : 1	2	6,5	110	2,2	...303
BCI-63.55 B00-PX63/38	38,25 : 1	2	8,3	86	2,2	...136
BCI-63.55 B00-PX63/54	54,0 : 1	2	11,8	61	2,2	...137

\* **Attention:** Compliance with the max. permitted gear output torque must be ensured by an external limitation of the motor current.

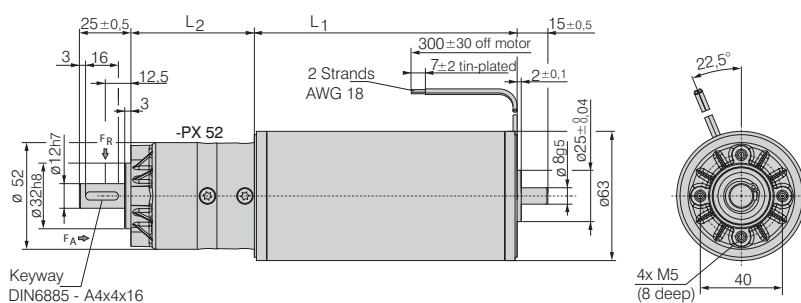
Motor lengths (mm)		Gear lengths PX 52	
Type	L1	L2 one stage	L2 two stages
BCI 63.25	95 ± 0,5	41,9	60,2
BCI 63.55	125 ± 0.5	41.9	60.2

### Output shaft load

$F_A$ : max. permissible axial load 500 N

F<sub>B</sub>: max. permissible radial load 350 N

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_{II}$  max. 40°C).

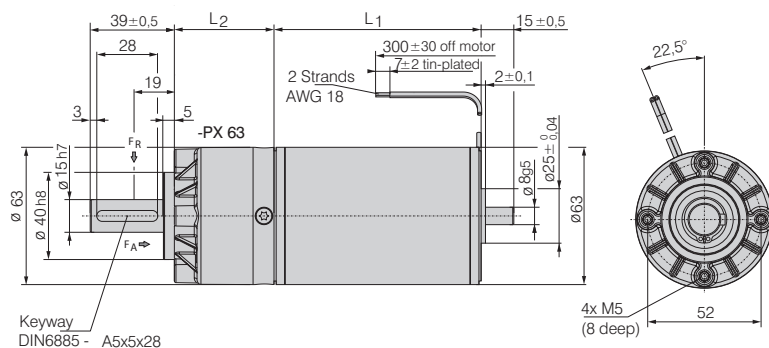


Motor lengths (mm)		Gear lengths PX 63	
Type	L1	L2 one stage	L2 two stages
BCI 63.25	95 ± 0,5	45,8	67,2
BCI 63.55	125 ± 0,5	45,8	67,2

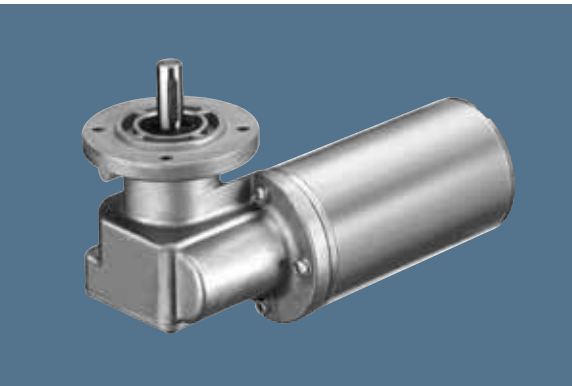
### Output shaft load

$F_A$ : max. permissible axial load 500 N

$F_B$ : max. permissible radial load 350 N



## BCI 63 SB worm gearmotor 24 V DC



- DC motor with worm gearbox.
- Gear housing made of die-cast zinc.
- Gearbox output shaft with ball bearings.
- Grease lubrication for maintenance-free continuous operation.
- Service life 3.000 hrs for continuous operation (S1).
- Other voltages available on request.

Nominal data		Gear ratio	Nominal torque	Nominal speed	Mass	
Type		i	Nm	rpm	kg	Order No. 941 6325...
<b>BCI-63.25 B00-SB1/2</b>		2,5 : 1	0,30	1260	2,5	...230
<b>BCI-63.25 B00-SB1/7</b>		7 : 1	0,77	450	2,5	...231
<b>BCI-63.25 B00-SB1/10</b>		10 : 1	1,02	315	2,5	...232
<b>BCI-63.25 B00-SB1/15</b>		15 : 1	1,45	210	2,5	...233
<b>BCI-63.25 B00-SB1/20</b>		20 : 1	1,79	158	2,5	...234
<b>BCI-63.25 B00-SB1/30</b>		30 : 1	2,23	105	2,5	...235
<b>BCI-63.25 B00-SB1/55</b>		55 : 1	3,54	57	2,5	...236
<b>BCI-63.25 B00-SB1/75</b>		75 : 1	3,26	42	2,5	...237

Nominal data	Gear ratio	Nominal torque	Nominal speed	Mass	
Type	i	Nm	rpm	kg	Order No. 941 6355...
BCI-63.55 B00-SB1/2	2,5 : 1	0,57	1320	3,0	...230
BCI-63.55 B00-SB1/7	7 : 1	1,49	471	3,0	...231
BCI-63.55 B00-SB1/10	10 : 1	1,97	330	3,0	...232
BCI-63.55 B00-SB1/15	15 : 1	2,79	220	3,0	...233
BCI-63.55 B00-SB1/20	20 : 1	3,46	165	3,0	...234
BCI-63.55 B00-SB1/30	30 : 1	4,29	110	3,0	...235
BCI-63.55 B00-SB1/55	55 : 1	6,83	60	3,0	...236
BCI-63.55 B00-SB1/75	75 : 1	6,28	44	3,0	...237

### Output shaft load

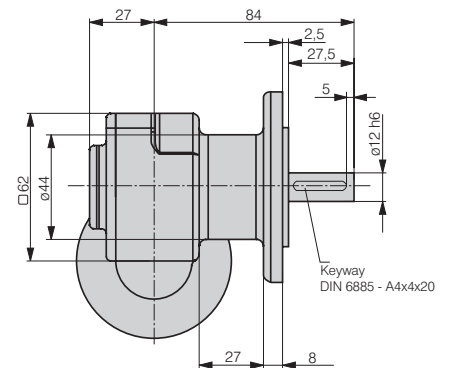
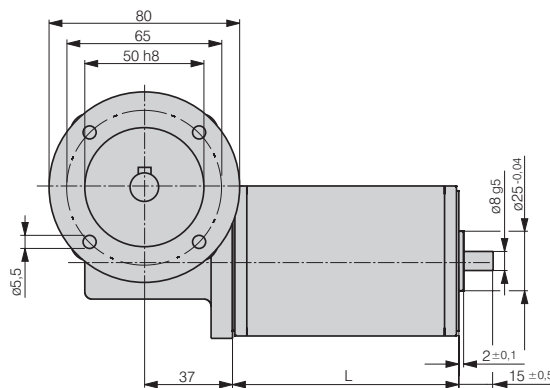
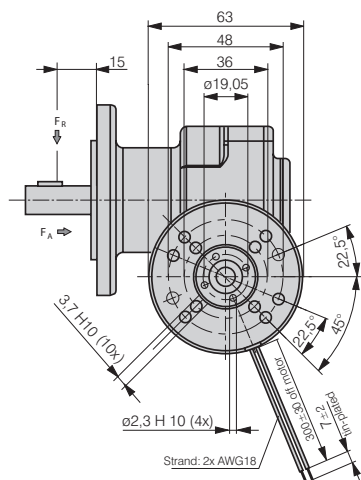
$F_A$ : max. permissible axial load 80 N

$F_R$ : max. permissible radial load 120 N

Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).

**Motor lengths (mm)**

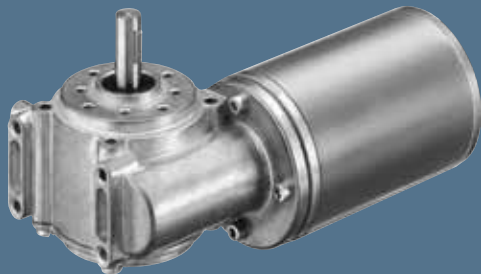
Type	L
BCI 63.25	95 ± 0,5
BCI 63.55	125 ± 0,5



# BCI motor

BCI 63 SC worm gearmotor 24 V DC

- DC motor with worm gearbox.
- Gear housing made of die-cast zinc.
- Gearbox output shaft with ball bearings.
- Grease lubrication for maintenance-free continuous operation.
- Service life 3.000 hrs for continuous operation (S1).
- Other voltages available on request.



Nominal data	Gear ratio	Nominal torque	Nominal speed	Mass	
Type	i	Nm	rpm	kg	Order No. 941 6325..
BCI-63.25 B00-SC1/2	2,5 : 1	0,30	1260	2,1	...240
BCI-63.25 B00-SC1/7	7 : 1	0,77	450	2,1	...241
BCI-63.25 B00-SC1/10	10 : 1	1,02	315	2,1	...242
BCI-63.25 B00-SC1/15	15 : 1	1,45	210	2,1	...243
BCI-63.25 B00-SC1/20	20 : 1	1,79	158	2,1	...244
BCI-63.25 B00-SC1/24	24 : 1	1,81	131	2,1	...245
BCI-63.25 B00-SC1/30	30 : 1	2,23	105	2,1	...246
BCI-63.25 B00-SC1/55	55 : 1	3,54	57	2,1	...247
BCI-63.25 B00-SC1/75	75 : 1	3,26	42	2,1	...248

Nominal data	Gear ratio	Nominal torque	Nominal speed	Mass	
Type	i	Nm	rpm	kg	Order No. 941 6355..
BCI-63.55 SC 2	2,5 : 1	0,57	1320	2,6	...240
BCI-63.55 B00-SC1/7	7 : 1	1,49	471	2,6	...241
BCI-63.55 B00-SC1/10	10 : 1	1,97	330	2,6	...242
BCI-63.55 B00-SC1/15	15 : 1	2,79	220	2,6	...243
BCI-63.55 B00-SC1/20	20 : 1	3,46	165	2,6	...244
BCI-63.55 B00-SC1/24	24 : 1	3,50	138	2,6	...245
BCI-63.55 B00-SC1/30	30 : 1	4,29	110	2,6	...246
BCI-63.55 B00-SC1/55	55 : 1	6,83	60	2,6	...247
BCI-63.55 B00-SC1/75	75 : 1	6,28	44	2,6	...248

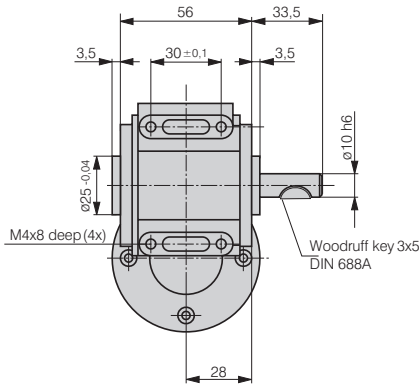
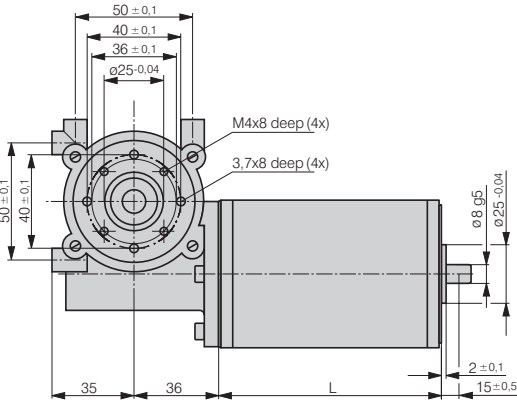
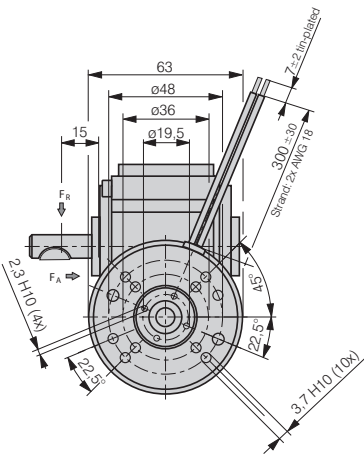
## Output shaft load

$F_A$ : max. permissible axial load 100 N  
 $F_R$ : max. permissible radial load 150 N  
Permissible shaft load at nominal speed and life expectancy  $L_{10}$  at 3 000 h (at  $T_U$  max. 40°C).

## Motor lengths (mm)

Type	L
BCI 63.25	95 ± 0,5
BCI 63.55	125 ± 0,5

Other shaft dimensions and shaft output on the right or on both sides on request.



# BCI brake

24 V DC



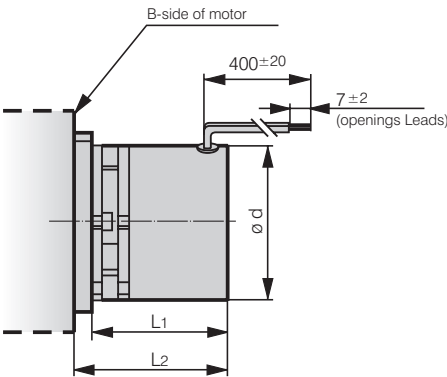
- The spring-applied brakes are single-disc brakes with two friction surfaces.
- The braking torque is generated by compression springs.
- The brake is released electromagnetically. Braking occurs when there is no current feed.
- Protection class IP 00.
- Insulation class F.

Nominal data					
Type		BFK 457-01	BFK 457-02	BFK 457-03	
Nominal power*	W	5,0	6,6	9,0	
Nominal torque of brake**	Nm	0,12	0,25	0,50	
Engagement time	ms	11,0	8,0	12,5	
Disengagement time	ms	17	17	18	
Maximum speed	rpm	5000	5000	5000	
Weight	kg	0,20	0,25	0,40	
d	mm	37,0	47,0	56,0	
L1	mm	31,3	31,0	31,8	
L2	mm	36,8	37,2	38,0	
Motor Series***		BCI 42	BCI 52	BCI 63	

\* Nominal power of the coil at 24 V DC and 20° C..

\*\* Nominal torque of brake, referring to a speed of 100 rpm.

\*\*\* Brake for motors and worm gear motors available on request.  
Available at short notice for all other designs.



**Note:**  
Only one accessory component  
(brake or sensor) can be mounted  
onto a motor at a time.

# BCI sensor

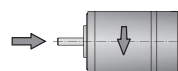
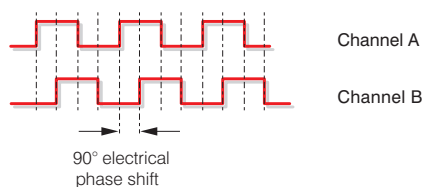
BCI magnetic sensor PMG 2-2, PMG 2-4, PMG 2-12



- Magnetic sensor for DC motors.
- The sensor is designed for speed monitoring, speed control and positioning in combination with appropriate electronics.
- The sensor operates contact-free and wear-free by means of 2 Hall sensors. The sensors are positioned around a magnet and generate two rectangular pulse signals with a phase shift of 90°.
- The sensor unit is assembled to the motor, electrical connection via leads.
- Protection class IP 40.

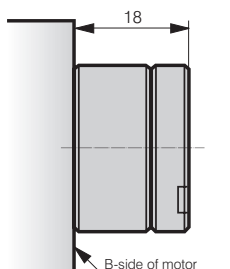
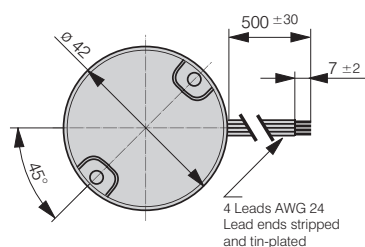
## Nominal data

Type		PMG 2-2, PMG 2-4, PMG 2-12
No. of pulses	Z	2,4 and 12 pulses per revolution (channel A and B)
Output signal	A, B	2 rectangular pulses 90 ° ± 15 °, for 12 pulses ± 25° electr. phase shift
Pulse ratio		High signal : low signal = 180° : 180° ± 10°, for 12 pulses ± 25° electr. phaseshift
Slope	rise	≤ 400 ns (U = 12 V DC, RL = 820 Ω )
	fall	≤ 400 ns (U = 12 V DC, CL = 20 pF )
Output load current	I <sub>load</sub>	≤ 12 mA (U = 12 V DC)
Design		Open-collector-output stage with internal pull-up resistor Supply voltage: U <sub>B</sub> = 4,5 to 24 V DC (reverse polarity protected) Output amplitude: U <sub>LOW</sub> < 0,4 V (at 12 V DC +20 mA)
Electr. connection		4 single strands AWG 24, 500 +30 mm long Stripped and tin-plated ends 7 ± 2 mm
Connection table	colour	red: U <sub>B</sub> = +5 V to 24 V   yellow: A channel   black: GND   green: B channel
Temperature range		-20°C bis +80 °C
Weight		0.03 kg



Electronics pulse diagram when shaft rotates clockwise (seen on motor shaft)

Type	PMG 2-2	PMG 2-4	PMG 2-12
BCI 42.25	931 4225 200	931 4225 201	931 4225 202
BCI 42.40	931 4240 200	931 4240 201	931 4240 202
BCI 52.30	931 5230 200	931 5230 201	931 5230 202
BCI 52.60	931 5260 200	931 5260 201	931 5260 202
BCI 63.25	931 6325 200	931 6325 201	931 6325 202
BCI 63.55	931 6355 200	931 6355 201	931 6355 202



### Note:

Only one accessory component (brake or sensor) can be mounted onto a motor at a time.

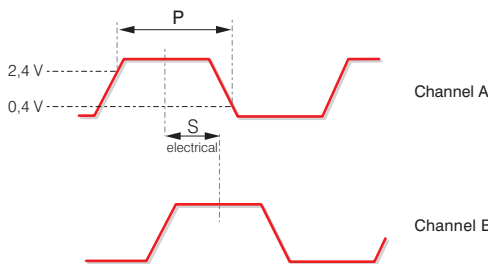
# BCI sensor

## Encoder HEDS 5500

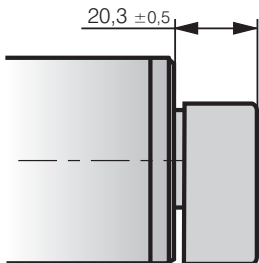
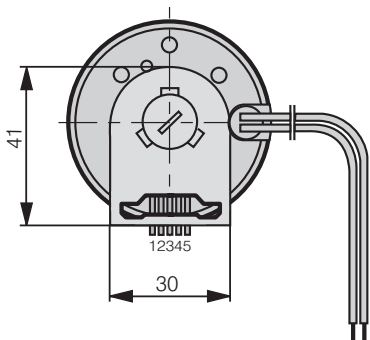


- Optoelectronic 2-channel incremental encoder. A resolution of max. 2.048 increments per revolution is attained by appropriate evaluation in an external control.
- The encoder works contact-free and wear-free. The resolution of the angle of rotation is effected by means of a light-emitting diode in front of a metal encoder disc and a photodiode array.
- Optional: Variants with other encoder resolutions are available on request.

Nominal data		
Type		HEDS 5500
No. of pulses	Z	512 per revolution (channel A and B)
Output signal	A, B	2 rectangular-pulse signals, (90° C phase offset; TTL-compatible)
Limiting frequency	f	100 kHz
Supply voltage	U <sub>B</sub>	+ 5 V ± 10%
Current consumption	I <sub>B</sub>	typ. 17 mA (max. 40 mA)
Deviation of pulse width	ΔP	typ. 5° relative to P = 90° pulse width (electrically by U <sub>B</sub> = 5 V and 25 °C )
Deviation of phase shift	ΔS	typ. 7° relative to S = 90° phase shift between channel A and B (electrically by U <sub>B</sub> = 5 V and 25 °C )
Electrical connection	AMP	103686-4 or 600442-5
Plug type	Berg	65039-032 / 4825-000
	Molex	65801-034
Connection table	Pim	2695 / 2759
		1: Ground   2: free   3: A   4: U <sub>B</sub>   5: B



HEDS for motors and worm gear motors available on request.  
Available at short notice for all other designs.



**Note:**  
Only one accessory component (brake or sensor) can be mounted onto a motor at a time.

	Shaded-pole motors	137
	Capacitor motors	140
	Gear motors	144





## Technical information

**EM Shaded-pole motors** are of asymmetrical design, have two poles and feature a squirrel-cage rotor. Motors of this type have a simple, sturdy design, they are self-starting, require no maintenance and create no interference.

**KM Capacitor motors** are two- or four-pole single-phase motors with squirrel-cage rotors. Their winding is two-stranded and they have an auxiliary winding connected via capacitor.

### Bearings

High quality sintered calotte sleeve bearings with a lubricant depot are used, suitable for ambient temperatures from approx. 0 to 60°C. Time-tested bearing systems are also available for lower or higher temperatures.

With high axial and / or radial stresses, e.g. with vertical shaft positions, belt drive systems, etc., a bearing design suitable for the required service life will be needed. Ball bearings may also be used for series EM30. Ball bearings are standard for capacitor motors.

### Direction of rotation

The standard direction of rotation is clockwise, viewed onto drive shaft. Versions with counter-clockwise rotation are also possible. For capacitor motors in standard version, the main and auxiliary windings are symmetrical so that operation in both directions is possible without difference in power.

### Rated data (power, torque)

The catalogue data refer to permanent operation S1 at rated voltage and frequency. Power may be increased by using a higher insulation class or for temporary operating mode S2.

### Voltage / Frequency

Rated voltage: 230 V, 50 Hz.

In principle, adjustments to other voltages and frequencies are possible. Motors designed for 50 Hz can generally also be used at 60 Hz with the same voltage (see diagram). As a result of the different speed / torque ratio thus created, however, perfect operation can only be established by testing the actual unit. Constructive measures such as changing the rotor material, cage ring height and induction can adjust the load curve to the requirements in specific cases.

### Electrical connection

Shaded-pole motors: As standard with plug-in lugs, stranded-wire connection on request.

Capacitor motors: 3 leads.

### Insulation structure

Structure according to EN 60335 (VDE700). Design to meet foreign regulations (UL, CSA, etc.) is also possible.

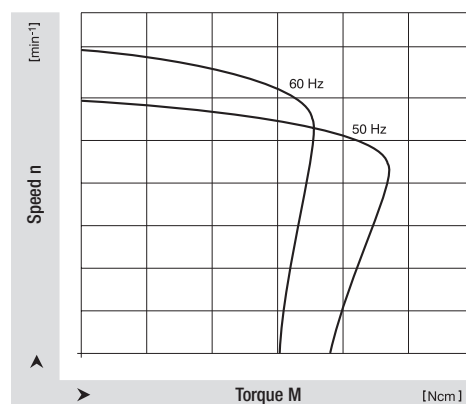
Standard for shaded-pole motors: Insulation class B (EN / VDE), protection type IP 00, protection class I.

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.

### Non-standard operation

Motors which may suffer excessive temperatures within the unit in the event of a malfunction (e.g. locked rotor), must be secured by direct action (impedance protection, temperature-overload protector) or by safety devices in the unit itself. As a standard, capacitor motors are supplied with temperature overload protector (TOP).



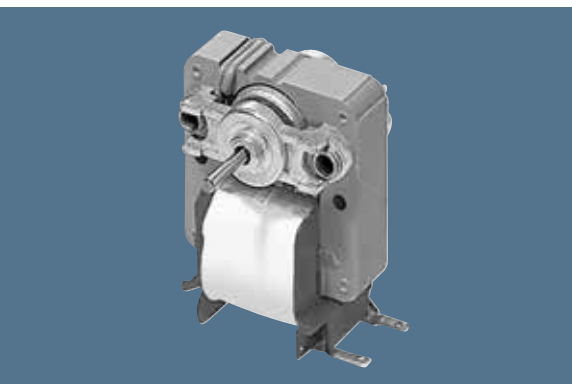
Load characteristic of a shaded-pole motor designed for 50 Hz, operated at 60 Hz, with identical voltage.

# Shaded-pole motors

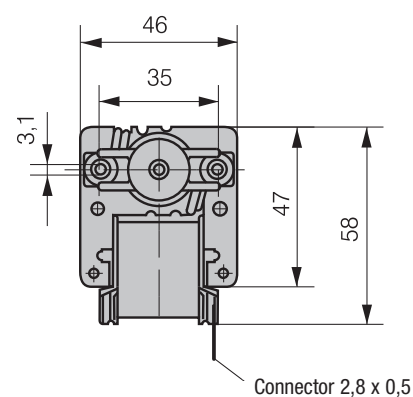
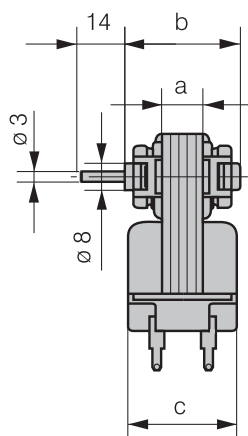
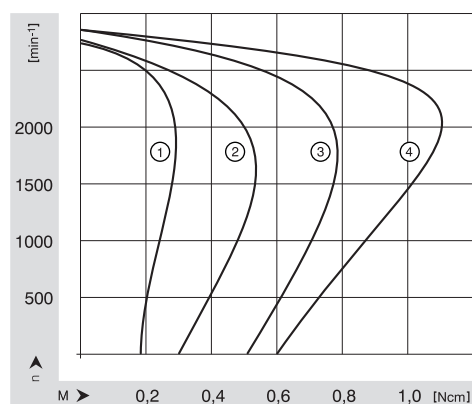
## EM 21

Standard version:

- Direction of rotation clockwise
- Mounting position with horizontal shaft
- Mode of operation S1
- Sintered sleeve bearings with additional lubricant depot
- Permissible ambient temperature 0 – 60° C.

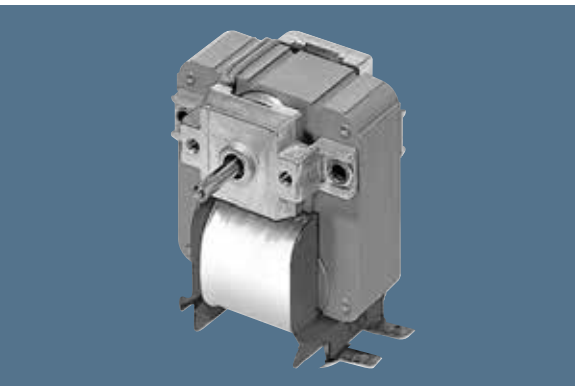


Nominal data	Output power	Input power	Nominal voltage	Frequency	Nominal speed	Nominal current	Rated torque	Mass	Dimensions (mm)			Curve
Type	W	W	V	Hz	rpm	mA	Ncm	kg	a	b	c	
EM 2108	0,6	6,2	230	50	2100	60	0,28	0,20	8	31	24	1
EM 2112	1,0	9,5	230	50	2200	90	0,46	0,25	12	35	32	2
EM 2118	1,5	12,0	230	50	2300	100	0,7	0,32	18	41	38	3
EM 2124	2,0	13,5	230	50	2350	120	1,0	0,40	24	47	44	4



# Shaded-pole motors

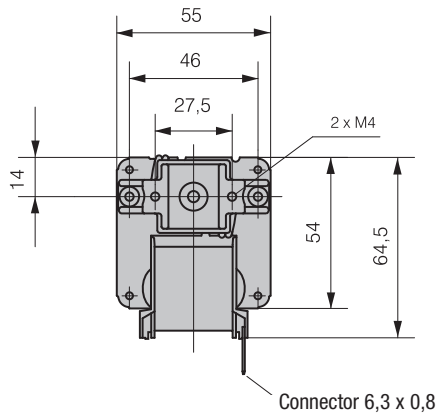
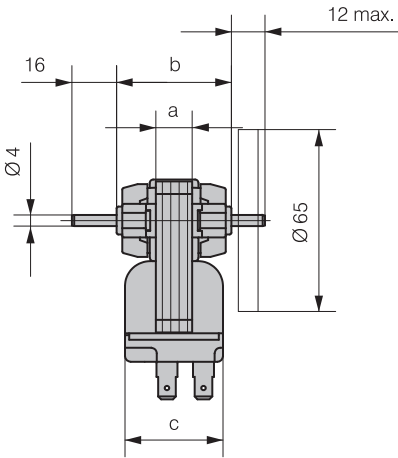
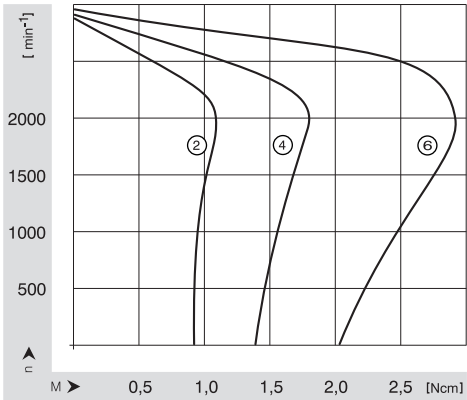
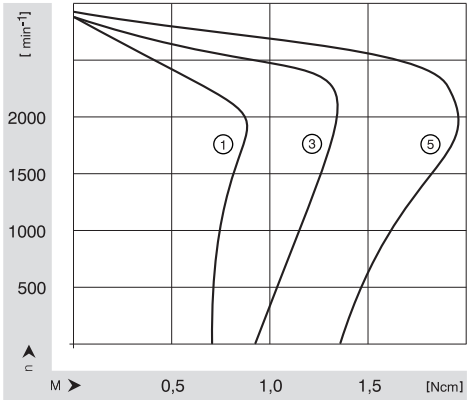
EM 25



Standard version:

- Direction of rotation clockwise
- Mounting position with horizontal shaft
- Mode of operation S1
- Sintered sleeve bearings with additional lubricant depot
- Permissible ambient temperature 0 – 60° C.

Nominal data				Output power	Input power	Nominal voltage	Frequency	Nominal speed	Nominal current	Rated torque	With/without cooling blades	Mass	Dimensions (mm)			Curve
Type		W	W	V	Hz	rpm	mA	Ncm		kg	a	b	c			
EM 2513		1,4	14	230	50	2300	135	0,55	without	0,40	13	42	35	1		
EM 2513		1,8	16	230	50	2500	185	0,70	with	0,40	13	42	35	2		
EM 2518		2,7	16	230	50	2500	150	1,05	without	0,50	18	47	40	3		
EM 2518		3,7	23	230	50	2500	260	1,45	with	0,50	18	47	40	4		
EM 2524		4,0	22	230	50	2600	200	1,55	without	0,60	24	53	46	5		
EM 2524		6,2	30	230	50	2500	350	2,40	with	0,60	24	53	46	6		

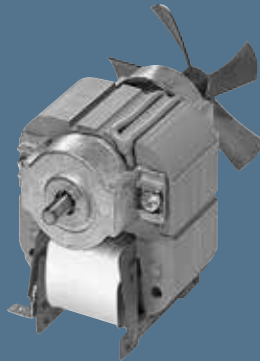


# Shaded-pole motors

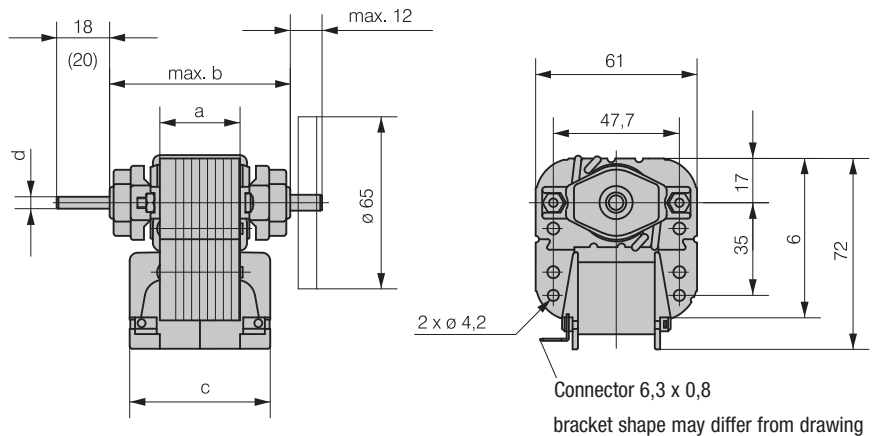
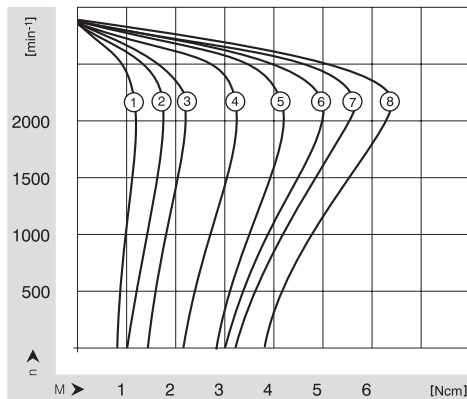
## EM 30

Standard version:

- Direction of rotation clockwise
- Mounting position with horizontal shaft
- Mode of operation S1
- Sintered sleeve bearings with additional lubricant depot
- Permissible ambient temperature 0 – 60° C.

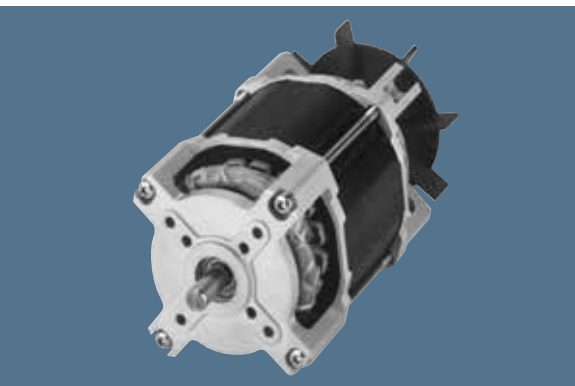


Nominal data	Output power	Input power	Nominal voltage	Frequency	Nominal speed	Nominal current	Rated torque	with/without cooling blades	Mass	Dimensions (mm)				Curve
Type	W	W	V	Hz	rpm	mA	Ncm		kg	a	b	c	d	
EM 3015	1,9	12	230	50	2600	120	0,7	without	0,50	15	53	37	4,5	1
EM 3020	2,8	16	230	50	2600	150	1,05	without	0,70	20	58	42	4,5	2
EM 3020	5,6	38	230	50	2600	380	2,1	with	0,70	20	58	42	4,5	3
EM 3025	4,0	22	230	50	2600	200	1,5	without	0,80	25	63	47	4,5	4
EM 3025	7,5	46	230	50	2600	440	2,8	with	0,80	25	63	47	4,5	5
EM 3030	8,3	50	230	50	2600	460	3,1	with	0,90	30	69	52	6,0	6
EM 3038	11,0	54	230	50	2600	480	3,9	with	1,20	38	76	60	6,0	7
EM 3045	12,0	56	230	50	2600	500	4,3	with	1,30	45	84	67	6,0	8



# Capacitor motors

KM 40 IP00

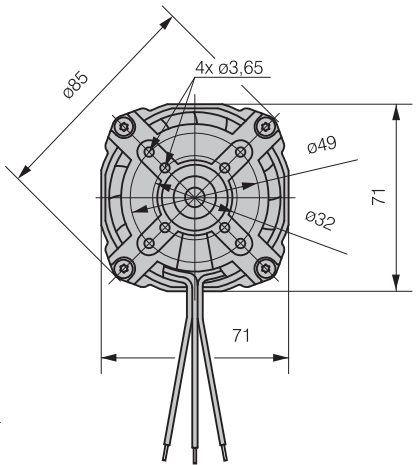
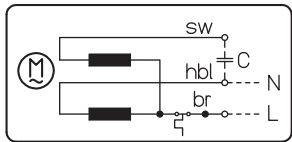
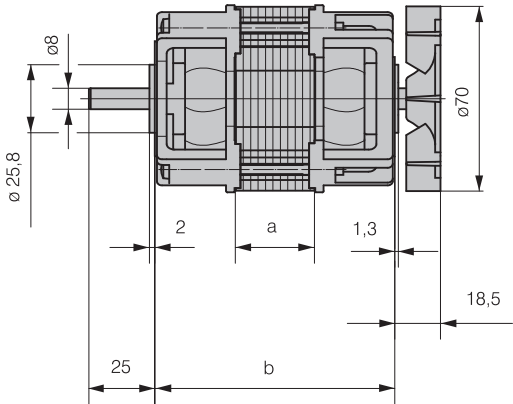
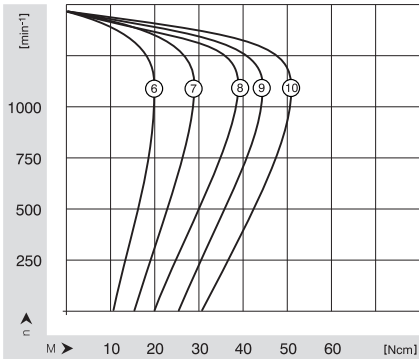
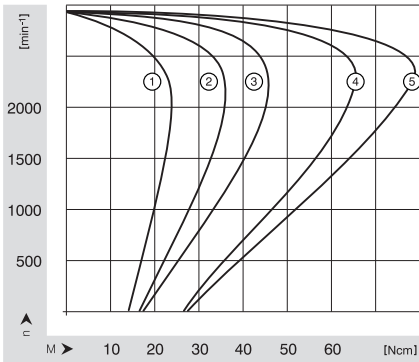


Standard version:

- Direction of rotation clockwise (see connection diagram)  
symmetric winding, also suitable for counter-clockwise rotation
- Continuous operation S1
- Ball bearings
- Insulation class F(VDE/EN)

Nominal data		Number of poles	Output power	Input power	Nominal voltage	Frequency	Nominal speed	Nominal current	Rated torque	Capacitor	Mass	Dimensions (mm)		Curve
Type			W	W	V	Hz	rpm	mA	Ncm	μF*)	kg	a	b	
KM 4020/2-..		2	45,0	115	230	50	2600	490	16	3,5	1,0	20	82	1
KM 4030/2-..		2	67,0	142	230	50	2700	620	23	4,0	1,4	30	92	2
KM 4040/2-..		2	100,0	190	230	50	2700	820	36	5,0	1,6	40	102	3
KM 4050/2-..		2	138,0	230	230	50	2700	970	47	7,0	1,8	50	112	4
KM 4060/2-..		2	176,0	275	230	50	2700	1200	62	7,0	2,0	60	122	5
KM 4020/4-..		4	19,5	72	230	50	1300	330	14	2,0	1,0	20	82	6
KM 4030/4-..		4	31,0	84	230	50	1300	380	22	2,5	1,4	30	92	7
KM 4040/4-..		4	38,0	93	230	50	1350	420	26	3,0	1,6	40	102	8
KM 4050/4-..		4	44,0	104	230	50	1350	470	31	3,5	1,8	50	112	9
KM 4060/4-..		4	49,0	112	230	50	1350	500	34	4,0	2,0	60	122	10

\*) not supplied

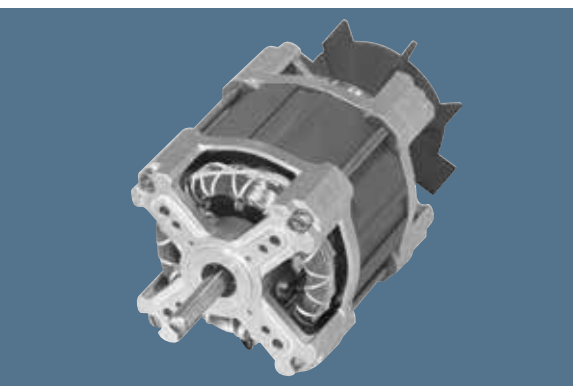


# Capacitor motors

KM 43 IP00

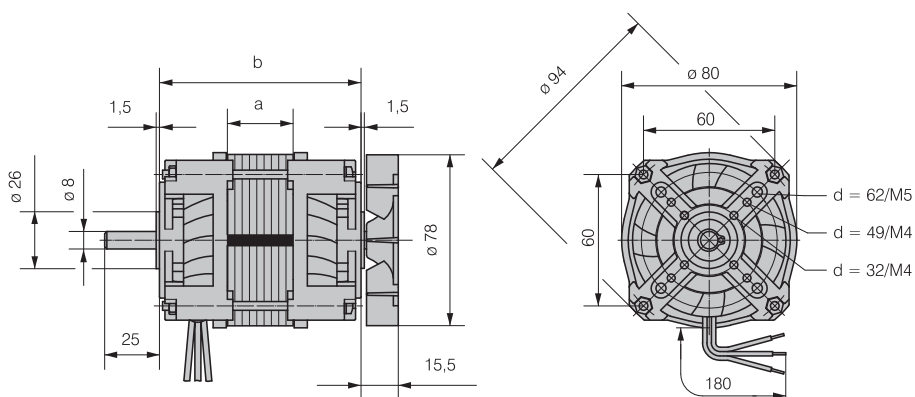
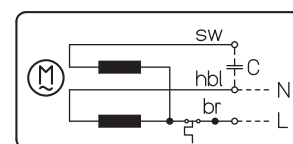
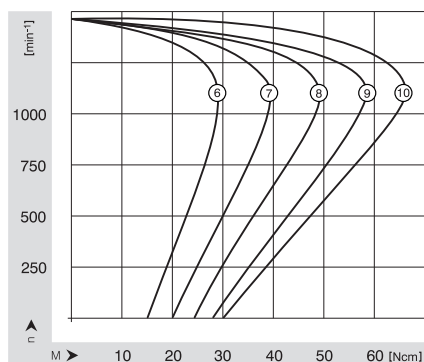
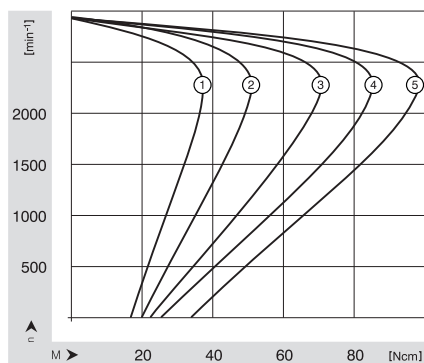
Standard version:

- Direction of rotation clockwise (see connection diagram)  
symmetric winding, also suitable for counter-clockwise rotation
- Continuous operation S1
- Ball bearings
- Insulation class F(VDE/EN)



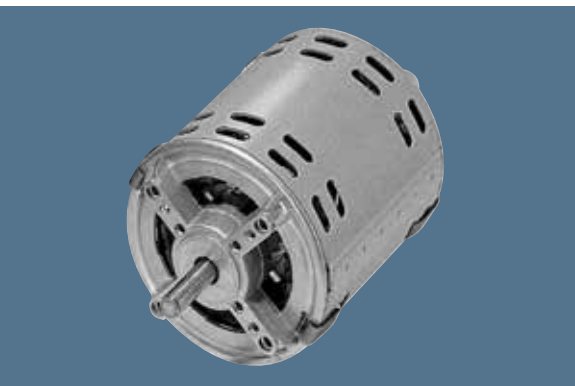
Nominal data	Number of poles	Output power	Input power	Nominal voltage	Frequency	Nominal speed	Nominal current	Rated torque	Capacitor	Mass	Dimensions (mm)		Curve
Type		W	W	V	Hz	rpm	mA	Ncm	μF*)	kg	a	b	
KM 4320/2-3..	2	58	150	230	50	2650	690	20	4,0	1,2	20	83	1
KM 4330/2-3..	2	90	190	230	50	2700	900	31	5,0	1,5	30	93	2
KM 4340/2-3..	2	105	285	230	50	2750	850	38	7,0	1,8	40	103	3
KM 4350/2-3..	2	165	260	230	50	2750	1150	57	8,0	2,2	50	113	4
KM 4360/2-3..	2	180	275	230	50	2750	1200	62	9,0	2,5	60	123	5
KM 4320/4-3..	4	27	85	230	50	1300	380	20	2,5	1,1	20	83	6
KM 4330/4-3..	4	39	100	230	50	1300	440	28	3,0	1,4	30	93	7
KM 4340/4-3..	4	46	105	230	50	1350	460	33	3,5	1,8	40	103	8
KM 4350/4-3..	4	51	115	230	50	1350	500	36	4,0	2,1	50	113	9
KM 4360/4-3..	4	67	145	230	50	1350	620	47	4,5	2,4	60	123	10

\*) not supplied



# Capacitor motors

KM 43 IP20

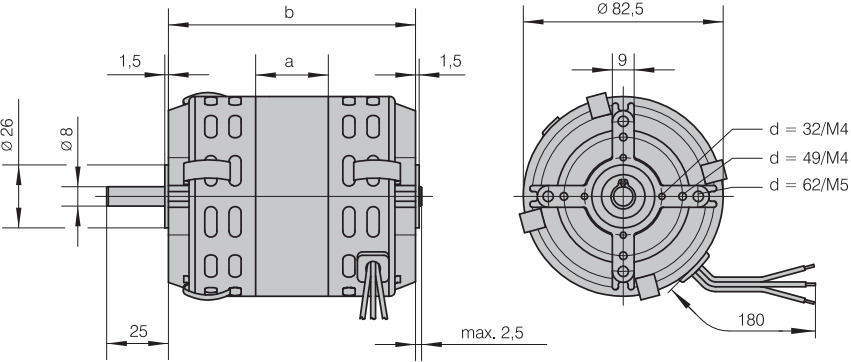
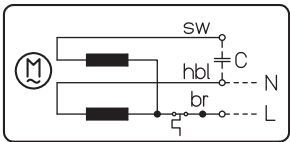
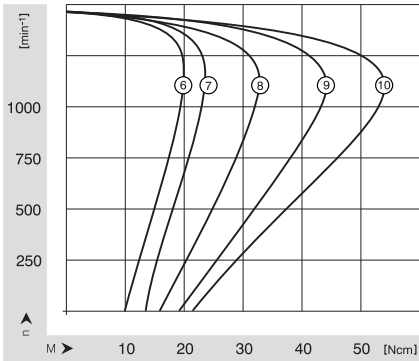
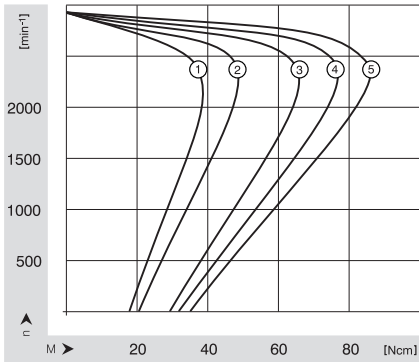


Standard version:

- Direction of rotation clockwise (see connection diagram)  
symmetric winding, also suitable for counter-clockwise rotation
- Continuous operation S1
- Ball bearings
- Insulation class F(VDE/EN)

Nominal data		Number of poles	Output power	Input power	Nominal voltage	Frequency	Nominal speed	Nominal current	Rated torque	Capacitor	Mass	Dimensions (mm)		Curve
Type			W	W	V	Hz	rpm	mA	Ncm	$\mu F^*)$	kg	a	b	
KM 4320/2-1..		2	64	135	230	50	2650	600	23	4,0	1,3	20	93	1
KM 4330/2-1..		2	100	180	230	50	2700	800	36	5,0	1,6	30	103	2
KM 4340/2-1..		2	105	190	230	50	2750	1000	40	7,0	1,9	40	113	3
KM 4350/2-1..		2	155	245	230	50	2750	1100	55	8,0	2,3	50	123	4
KM 4360/2-1..		2	165	255	230	50	2750	1150	67	9,0	2,6	60	133	5
KM 4320/4-1..		4	23	70	230	50	1300	350	17	2,5	1,2	20	93	6
KM 4330/4-1..		4	27	65	230	50	1300	280	20	3,0	1,5	30	103	7
KM 4340/4-1..		4	35	85	230	50	1350	350	25	3,5	1,8	40	113	8
KM 4350/4-1..		4	47	100	230	50	1350	430	33	4,0	2,2	50	123	9
KM 4360/4-1..		4	49	110	230	50	1350	500	35	4,5	2,5	60	133	10

\*) not supplied



# Capacitor motors

## KM 43 closed

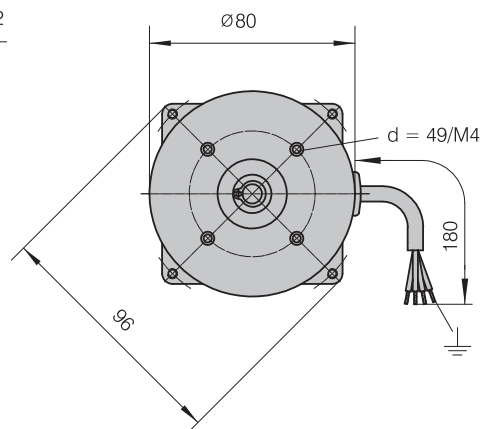
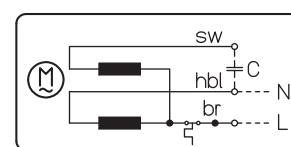
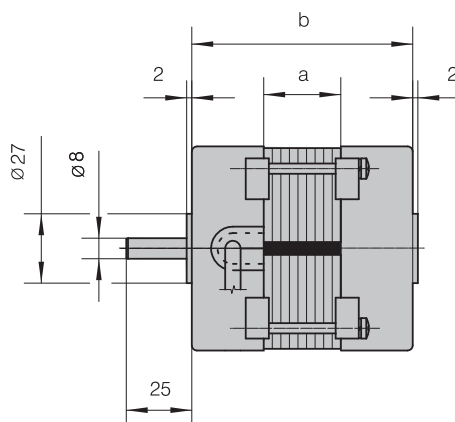
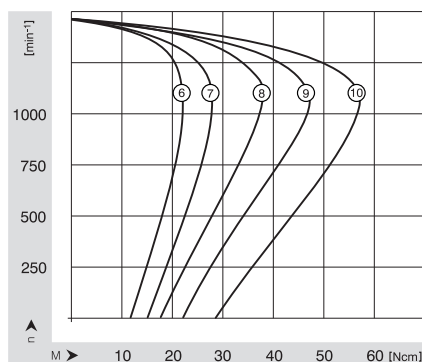
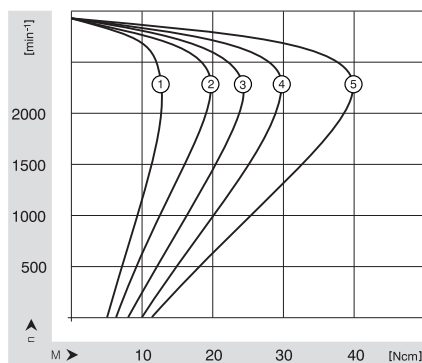
Standard version:

- Direction of rotation clockwise (see connection diagram)  
symmetric winding, also suitable for counter-clockwise rotation
- Continuous operation S1
- Ball bearings
- Insulation class F(VDE/EN)



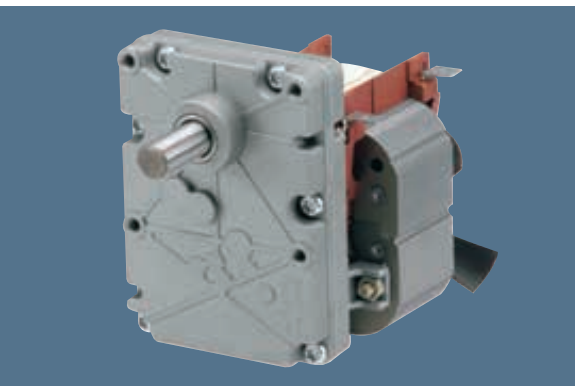
Nominal data	Number of poles	Output power	Input power	Nominal voltage	Frequency	Nominal speed	Nominal current	Rated torque	Capacitor	Mass	Dimensions (mm)		Curve
Type		W	W	V	Hz	rpm	mA	Ncm	μF*)	kg	a	b	
KM 4320/2-2..	2	26	55	230	50	2650	230	9	1,4	1,2	20	77	1
KM 4330/2-2..	2	32	70	230	50	2700	260	11	1,6	1,5	30	87	2
KM 4340/2-2..	2	42	80	230	50	2750	320	14	2,0	1,8	40	97	3
KM 4350/2-2..	2	56	100	230	50	2750	380	19	2,5	2,1	50	107	4
KM 4360/2-2..	2	77	120	230	50	2750	530	27	2,5	2,4	60	117	5
KM 4320/4-2..	4	12	35	230	50	1300	140	8	1,0	1,1	20	77	6
KM 4330/4-2..	4	17	40	230	50	1300	170	12	1,2	1,4	30	87	7
KM 4340/4-2..	4	18	45	230	50	1350	200	13	1,4	1,8	40	97	8
KM 4350/4-2..	4	22	50	230	50	1350	220	16	1,6	2,1	50	107	9
KM 4360/4-2..	4	28	70	230	50	1350	290	20	1,8	2,4	60	117	10

\*) not supplied



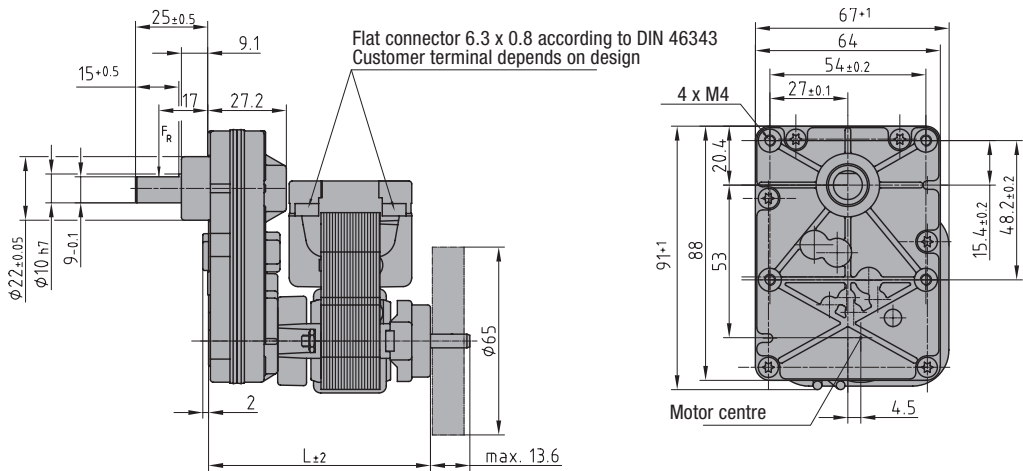
# Gear motors

Gtg 78



- Shaded-pole motor
- Spur gear unit with die-cast zinc housing
- Max. permitted radial load 150 N
- Max. permitted axial load 50 N
- Lifetime lubrication
- Expected service life: 5000 h
- Noise-optimized input stage
- Gearbox output shaft: slide/needle bearing
- S1 operation at ambient temperatures up to 50 °C

Nominal data		Nominal voltage	Frequency	Reduction	Drive torque	Output speed	Output power	Nominal current	Weight	Length
Order number	Motor	V	Hz	i/No. of stages	M <sub>ab</sub> (NM)	n <sub>ab</sub> (rpm)	P <sub>ab</sub> (W)	I (A)	m (kg)	L (mm)
78.3.3045.F20	EM3045	230	50	38,6 / 3	1,1	67,3	7,8	0,5	1,5	102
78.3.3045.F21	EM3045	230	50	65,2 / 3	1,5	39,9	6,3	0,5	1,5	102
78.3.3045.F22	EM3045	230	50	82,8 / 3	2,3	31,4	7,6	0,5	1,5	102
78.3.3045.F23	EM3045	230	50	106,1 / 3	2,6	24,5	6,7	0,5	1,5	102
78.3.3045.F24	EM3045	230	50	140,8 / 3	3,2	18,5	6,2	0,5	1,5	102
78.4.3030.F25	EM3030	230	50	191,9 / 4	3,8	13,5	5,4	0,46	1,1	87
78.4.3030.F26	EM3030	230	50	252,6 / 4	5,1	10,3	5,4	0,46	1,1	87
78.4.3030.F27	EM3030	230	50	315,7 / 4	6,3	8,24	5,4	0,46	1,1	87
78.5.3030.F28	EM3030	230	50	408,4 / 5	6	6,37	4	0,46	1,1	87
78.5.3030.F29	EM3030	230	50	737,4 / 5	6,3	3,53	2,3	0,46	1,1	87
78.5.3030.F40	EM3030	230	50	408,4 / 5	7,4	6,37	4,9	0,46	1,1	87
78.5.3030.F41	EM3030	230	50	737,4 / 5	12,5	3,53	4,6	0,46	1,1	87
78.5.3020.F30	EM3020	230	50	976 / 5	6,3	2,66	1,8	0,15	0,9	77
78.5.3020.F31	EM3020	230	50	1266,1 / 5	7	2,05	1,5	0,15	0,9	77
78.5.3020.F32	EM3020	230	50	1648,6 / 5	7,1	1,58	1,2	0,15	0,9	77
78.5.3020.F33	EM3020	230	50	2135,9 / 5	7,3	1,22	0,9	0,15	0,9	77
78.5.3020.F42	EM3020	230	50	976 / 5	11,9	2,66	3,3	0,15	0,9	77
78.5.3020.F43	EM3020	230	50	1266,1 / 5	13	2,05	2,8	0,15	0,9	77
78.5.3020.F44	EM3020	230	50	1648,6 / 5	14	1,58	2,3	0,15	0,9	77
78.5.3020.F45	EM3020	230	50	2135,9 / 5	15	1,22	1,9	0,15	0,9	77



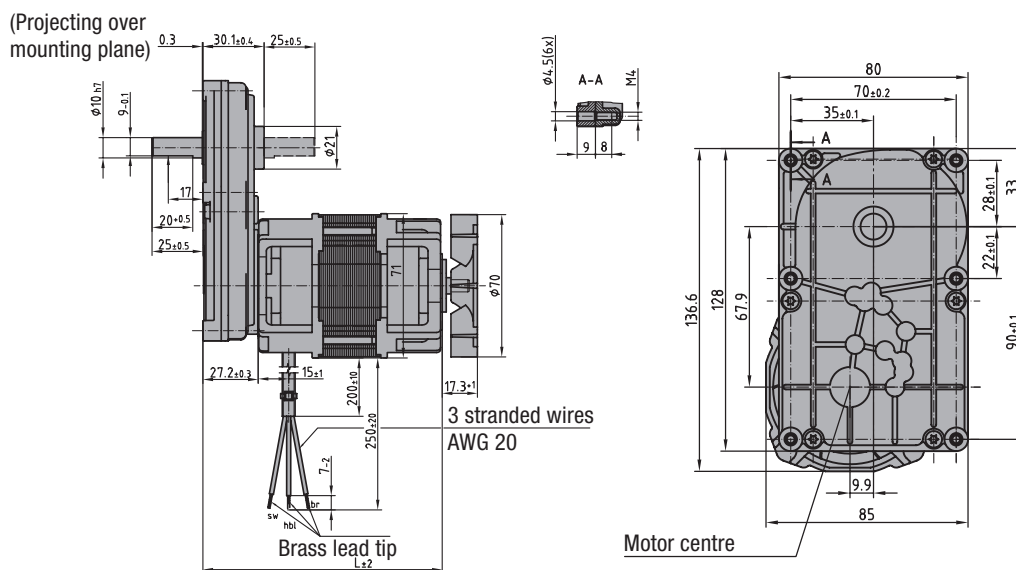
# Gear motors

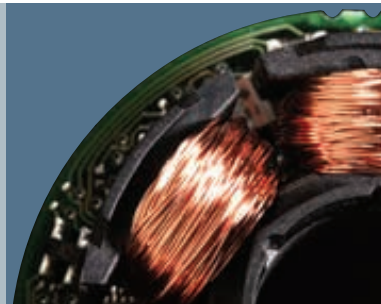
Gtg 85



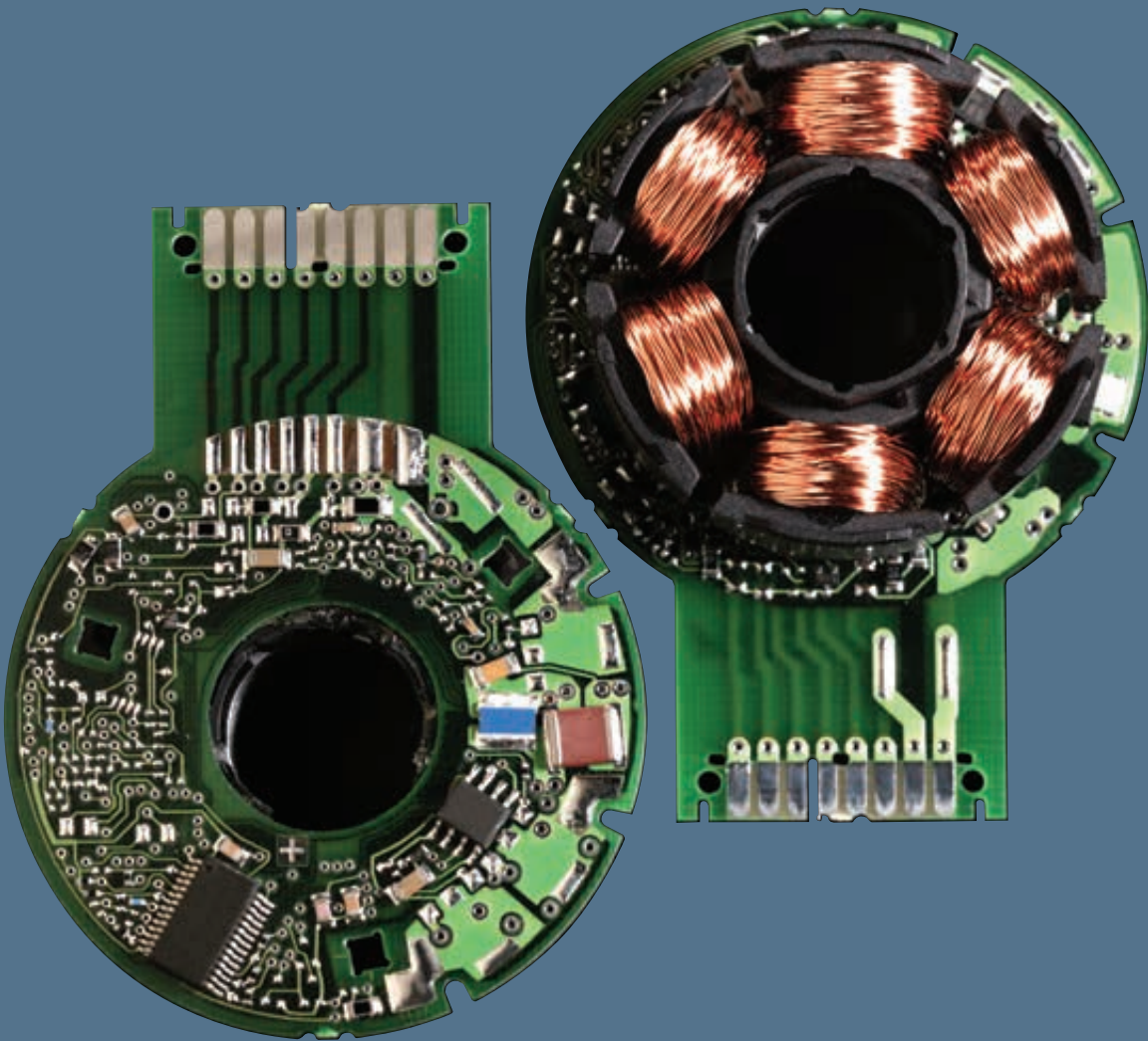
- Capacitor motor
- Spur gear unit with die-cast zinc housing
- Max. permitted radial load 150 N
- Max. permitted axial load 50 N
- Lifetime lubrication
- Expected service life: 5000 h
- Noise-optimized input stage
- Gearbox output shaft: sleeve bearings on both sides
- S1 operation at ambient temperatures up to 50 °C

Nominal data		Nominal voltage	Frequency	Reduction	Drive torque	Output speed	Output power	Nominal-current	Capacitor	Weight	Length
Order number	Motor	V	Hz	i/No. of stages	M <sub>an</sub> (NM)	n <sub>an</sub> (rpm)	P <sub>an</sub> (W)	I (A)		m (kg)	L (mm)
85.3.4050.2.F01	KM4050-2	230	50	8,2 / 3	1,5	335	52	0,68	5µF/400 V	2,1	139
85.3.4050.2.F02	KM4050-2	230	50	12,3 / 3	2,2	224	52	0,68	5µF/400 V	2,1	139
85.3.4050.2.F03	KM4050-2	230	50	18 / 3	3,3	153	52	0,68	5µF/400 V	2,1	139
85.3.4050.2.F04	KM4050-2	230	50	27,6 / 3	5	99,6	52	0,68	5µF/400 V	2,1	139
85.3.4050.2.F05	KM4050-2	230	50	40,3 / 3	7,3	68,2	52	0,68	5µF/400 V	2,1	139
85.3.4050.2.F06	KM4050-2	230	50	64 / 3	11,7	43	52	0,68	5µF/400 V	2,1	139
85.3.4050.2.F07	KM4050-2	230	50	101,8 / 3	18,6	27	52	0,68	5µF/400 V	2,1	139
85.3.4050.2.F08	KM4050-2	230	50	136,5 / 3	24,9	20,1	52	0,68	5µF/400 V	2,1	139
85.3.4050.2.F09	KM4050-2	230	50	189 / 3	25	14,6	38	0,68	5µF/400 V	2,1	139
85.4.4030.F10	KM4030-2	230	50	303,6 / 4	27,7	9,06	26	0,38	3,5µF/400 V	1,7	119
85.4.4030.F11	KM4030-2	230	50	454 / 4	30	6,06	19	0,38	3,5µF/400 V	1,7	119
85.4.4030.F12	KM4030-2	230	50	687 / 4	30	4	13	0,38	3,5µF/400 V	1,7	119
85.5.4030.F13	KM4030-2	230	50	1028,7 / 4	30	2,67	8,4	0,38	3,5µF/400 V	1,7	119





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## **Basic information on standards and guidelines for electrical small-power motors and drive systems operated with a DC voltage of max. 75 VDC (nominal voltage):**

The series described in this catalogue, the Variodrive, Variodrive Compact, ECI, ECI Compact and BCI, are direct current motors in an electronically commutated or brush-commutated design, all of which are designed and specified for a nominal voltage of max. 75 VDC. Thus the supply voltage of these drives is within the range of safety extra-low voltage (SELV). On this basis, ebm-papst would like to provide some information intended to help you understand the classification of the motors from the relevant EC Directives and the resulting consequences.

### **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 harmonisation. This has been welcomed by all relevant parties and is visible in many products as a CE label giving proof of agreement with the harmonised provisions.

What does CE actually mean?

Why don't all products bear the CE label?

CE is the abbreviation for "Communauté Européenne". The harmonised statutory provisions are framework directive and belong to the so-called New Approach. These framework directives define 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 skeleton guideline applies to which product. For electrical small-powered motors the following framework directive can be applied:

- 1) Mechanical engineering Directive 2006/42/EC
- 2) Electrical engineering Low Voltage Legislation:  
Low Voltage Directive (LVD) 2006/95/EC
- 3) Electrical engineering Electromagnetic Compatibility (EMC) Legislation:  
Directive 2004/108/EC

Based on these directives, ebm-papst St. Georgen GmbH & Co. KG does not mark the drive systems described in these installation instructions with the "CE" mark and does not issue an EC Declaration of Conformity. The reason for this is consideration of the relevant EC Directives and the definitions of the terms used, >Electric motor< and >Drive system<, by ebm-papst St. Georgen GmbH & Co. KG.

### **Definition of the electric motor:**

An electric motor is a motor without electronics or a motor with integrated electronics of low complexity, such as commutation sensors, simple commutation electronics or commutation electronics with simple speed control with a voltage range of <75VDC (nominal voltage) for use by customers who incorporate them into end devices. According to this definition, electric motors include, for example, the BCI, VDC-3-54.14 and ECI 42.40-C series.

### **Definition of drive systems:**

Drive systems are motors with built-in electronic control systems that have a certain degree of complexity. These include electronic control systems which, in addition to a closed-loop speed control, offer other functions such as current control or position control. This also includes electronic control systems which, for example, have a CANopen interface or that can be operated via programmable sequential controls. For these drive systems, the voltage range of <75 VDC (nominal voltage) and the intended use by customers who will use the systems in end devices also apply. Drive systems include the VDC-3-49.15 and ECI-C5-63 series, for example.

**Reasons according to the Machinery Directive 2006/42/EC:**

Electric motors are expressly exempt in Art. 1, Par. (2), lit. k) and thus are NOT given the CE mark.

According to the definition of the term in Art. 2, lit. g), a drive system is an "incomplete machine" and thus does not receive a CE mark, but falls under the process for incomplete machines according to Art. 13.

Installation instructions to Annex IV and a Declaration of Incorporation to Annex II, Part 1, Section B are available for each motor. The specific technical documents to Art. 13, Par. (1), lit. a) have been created in-house and are archived for the government agencies of the individual countries.

Based on this directive, the machine manufacturer is responsible for verifying and ensuring compliance with the basic requirements of the Machinery Directive.

**Reasons according to the Low Voltage Directive 2006/95/EC:**

Due to the voltage ranges (nominal voltage), the specified electric motors and drive systems do not fall under the application area of the low voltage directive according to Art. 1.

**Reasons according to the EMC Directive 2004/108/EC:**

Because they are sold exclusively to customers who incorporate them into end devices and not to the end user, the specified electric motors and drive systems do not fall under the application area of the EMC directive according to the definition of the term in Art. 2, Par. (1), lit. B.

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 drives in this catalogue 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!

Therefore, it must not be put into service until the machinery into which this product is to be incorporated or of which it is a component has been found and declared to be in conformity with the protection requirements of the Machinery Directive.

If, when using our drives, 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.

**All of the products listed on the individual product pages are installation components in which the following documents are applied:**

1) German Equipment and Product Safety Act (GPSG)

2) Low Voltage Directive 2006/95/EC

They conform to the DIN EN 60335-1:2007-02 standard with restrictions in the following chapters:

1) Heating, especially in conjunction with improper operation (DIN EN 60335-1 Chap. 19).

2) Protection from access to moving, active and insulating parts, including clearance and creepage distance, (DIN EN 60335-1 Chap. 8, 20.2, 21.1, 21.2, 22.5).

3) Resistance to oil, grease and similar substances (DIN EN 60335-1 Chap. 22.9).

4) Safety precautions against excessive gas pressure (DIN EN 60335-1 Chap. 22.7).

Therefore, safety must always be considered in the application or device in which the drive motor is installed. In particular, the EMC behaviour when installed must be checked. For more specifications, refer to the installation instructions (drawing Z10) of the respective motor, which is available on request. Here, we refer, for example, to the types of protection and the insulation material classes (DIN EN 60335-1 Chap. 22.6).

European Directive EC No. 2002/95 (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 2002/95/EC (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 catalogue 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, Authorisation 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 fulfils 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.

# Definitions for EC motors

All information is based on the measuring conditions mentioned below. The values mentioned are typical values for the design in question and are also subject to the tolerances included in the specification drawings. Unless otherwise stated, the supplements and safety notes contained in the relevant manual and / or in the specification drawings must be observed at all times.

## Nominal voltage $U_{BN}$ [V DC]

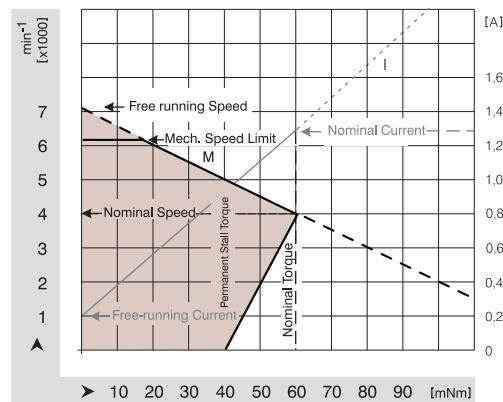
The DC voltage that is applied to the commutation electronics as a system supply voltage. All nominal values listed in the technical tables of the individual motors refer to this voltage. The system can, however, be operated at other voltages within limits defined at the lower end by the reliability of the electronic components at low voltages and at the higher end by the mechanical speed limitations of the motor and ability of the electronic components to survive the high voltages and currents. For motors with integrated operating electronics, the permissible operating voltage range is determined by the electronics. For these motors, the permitted range is specified as an additional table value. For drive systems that have a separate supply for power and logic (example: VDC-3-49.15), the nominal voltage is called  $U_N$ , which applies to both the power and logic supply. The designation  $U_B$  is then used for the low-power logic supply of these drives. The ripple of the supply voltage should not exceed 3.5 %, as higher ripple means poorer efficiency and control quality.

## Nominal speed $n_N$ [rpm]

The speed at which the motor may be operated continuously while delivering nominal torque at an ambient temperature of 40 °C and nominal output torque. It is an operating point on the max. motor curve based on an ideal electronics with negligible losses. When using an electronics with non-negligible losses or with PWM-pulsing, the nominal speed that can be achieved is reduced accordingly when the supply voltage remains constant.

## Nominal torque $M_N$ [mNm]

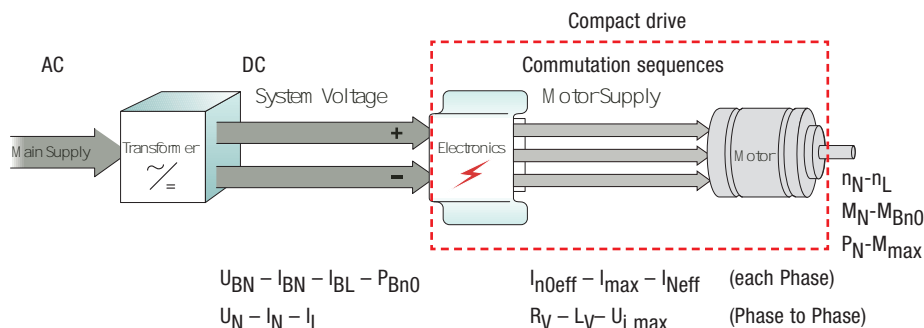
The torque that the motor can deliver continuously at an ambient temperature of 40 °C and nominal speed.



The illustrated curves are idealized representations based on the figures in the tables.

## Nominal current $I_{BN}$ [A]

The current that is drawn from the system supply when the motor delivers nominal torque at nominal speed. For drive systems that have a separate supply for power and logic (example: VDC-3-49.15), the nominal current is called  $I_N$ . This nominal current is the sum of the power supply ( $I_{ZK}$ ) and the low-power logic supply ( $I_B$ ). The actual current that creates the torque is the current that flows in the motor lads, (Nominal current effective in the supply =  $I_{Neff}$ ) it is generated by the operating electronics as output current. Due to the influence of the operating electronics in use (operating efficiency of the electronics and PWM pulsing), a certain deviation to the nominal current from the system supply is possible.



**Nominal output power  $P_N$  [W]**

The product of the nominal torque and nominal angular velocity. When calculating this value, the tolerances of the individual values contained in the specification data sheets must be considered. For the electromagnetic design of the motor the determination of the rated operating point is based on the fact that the nominal output power is close the maximum output power of the motor.

$$P_N = M_N \cdot \omega_N = \frac{\pi}{30} \cdot n_N \cdot M_N = \text{ca. } 0,1 \cdot M_N \cdot n_N$$

**Free-running Speed  $n_L$  [rpm]**

The speed that is achieved with nominal voltage and unloaded motor. It is usually proportional to the connected system supply voltage. The free-running speed that is theoretically possible can be limited by the mechanical speed limit.

**No-load current  $I_{BL}$  [A]**

Is established with nominal voltage and unloaded motor; is largely influenced by the bearing friction. For drive systems that have a separate supply for power and logic (example: VDC-3-49.15), the no-load current is called  $I_L$ . This no-load current is the sum of the power supply ( $I_{ZK}$ ) and the low-power logic supply ( $I_B$ ).

**Permanent stall Torque  $M_{Bn0}$  [mNm]**

Is the maximum permissible torque with which the motor may be permanently loaded when the rotor is locked.

**Permissible eff. continuous stall current  $I_{n0eff}$  [A]**

Is the maximum permissible current which at a stalled motor is allowed to flow into the motor lead as an effective value. In case of customer-specific operating electronics, this value must be adhered to in case of blocking to avoid overloading the motor.

**Continuous stall power  $P_{Bn0}$  [W]**

Is an approximate value for the voltage-independent maximum permitted output ( $P=U \cdot I$ ) that can be taken from the DC voltage source in holding status. To prevent overload of the motor, observing this value is mandatory, even if using ebm-papst operating electronics. The specification is based on the max. permitted copper losses in case of stall. These are calculated from the continuous stall current and the connection resistance, taking into account the max. permitted winding temperature and the temperature-dependent resistance change.

**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. Based on the natural motor curve, this value usually applies to the speed 0 when the motor is started up. In specific cases, however, a correspondingly lower demagnetization current can be the basis for this limit value, in which case this value must not be exceeded.

**Induced voltage  $U_{imax}$  [V/1000 rpm]**

Maximum value of the induced voltage between two motor leads at 1000 rpm. It is a dimension for the electromagnetic utilisation of the motor. The values mentioned in the technical data refer to an ambient temperature of 25 °C.

**Terminal resistance  $R_V$  [Ohm]**

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

**Terminal 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  $J_R$  [kgm<sup>2</sup>·10<sup>-6</sup>]**

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

**Thermal resistance  $R_{th}$  [K/W]**

A substitutional resistance at normal rating that results from the difference between the winding temperature and the ambient temperature in relation to the overall power loss. Electronic loss is taken into consideration with motors that have integrated electronics.

## Protection class

Information on the protection class complies with the valid Standard EN 60 034-5. It describes protection against foreign particles (Point 1) and water (Point 2).

## Permissible ambient temperature range $T_U$ [°C]

Defines the minimum and maximum permissible ambient temperature to which the mentioned performance values apply when the motor is in operation. Other ambient temperatures are possible but should be given special consideration as e. g. higher ambient temperatures result in a reduction of output power. The permissible winding temperature in the motor (115 °C for insulation Class E, as per EN 60 034-1) should not be exceeded. The following formula can be used to provide a rough estimate of the reduced torque permitted at a higher temperature:

$$M_{\text{red}} = M_N \cdot \sqrt{\frac{T_{\text{winding.max.}} - T_{\text{amb.}}}{T_{\text{winding.max.}} - T_N}}$$

$M_{\text{red}}$  = value for the reduced torque to be measured

$T_{\text{winding.max.}}$  = max. permitted winding temperature defined by the ISO class of the motor

$T_{\text{amb.}}$  = Value for the elevated ambient temperature

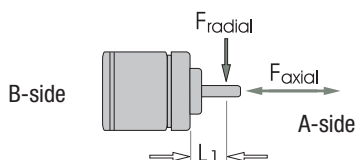
$T_N$  = Reference temperature for specifying the nominal data

## Motor mass $m$ [kg]

Weight of the delivered unit without additional units or packaging.

## Max. shaft load $F_{\text{radial}}/F_{\text{axial}}$ [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 L10. This statistical value, which is based on many years of lifetime testing, means that min. 90 % of the motors of a tested amount achieve this service life under the stipulated measurement conditions.



The point of application of the axial load is defined as the centre point of the shaft (A-side, both directions) and for the radial load, it is the distance from the A-sided flange to the point of entry, defined as  $L_1$ .

## L<sub>10</sub> service life

The values for the L<sub>10</sub> 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, these values also provide information about the theoretically calculated service life under certain assumptions. This is done using extrapolations based on statistical variables. In the respective customer applications, different influences may occur which cannot be included in the calculations due to their complexity. Therefore, the service life information is explicitly not a guarantee of service life, but strictly a theoretical quality figure.

## Special definitions for motor series

### VARIODRIVE Compact and ECI Compact with integrated operating electronics

## Max. reverse Voltage [V DC]

When the braking function is activated via the control inputs A / B and when the set value step change is negative, the Compact 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 behaviour should be given special consideration when selecting the system supply.

## Set value input

Speed setting via an analogue interface for DC voltage (0 to 10 V DC). Depending on the drive design, the set speed can be configured in a range from 0 to  $n_{\text{max}}$ , where the minimum possible speed value (with limited control quality) is about 0 rpm (sinus commutation) or approx. 50 to 100 rpm (block commutation).

**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 average 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.

**Locked-rotor protection**

Depending on the motor series, different concepts for locked rotor protection are implemented. For the motors of series VDC-3-43.10, VDC-3-54.14 and VDC-3-54.32, the protection function is integrated in the form of a locked-rotor protection clock. At speeds < 100 rpm a locked rotor protection function is activated to thermally protect the motor. This function together with the stipulated cycle times  $T_{on} / T_{off}$  prevents overloading the motor and simultaneously attempts to re-start the motor at regular intervals. For the VDC-3-49.15 series motors, the 0 rpm speed can be controlled with full torque. The thermal protection of the drive is provided by torque limitation via the  $I^2t$  function and the additional fixed temperature monitoring on the integrated printed circuit board.

**Motor selection**

For selecting the suitable motor and / or the correct size of motor, the determination of the effective torque plays the major role in preventing the motor from becoming thermally overloaded during operation.

**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:

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

$M_A$	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 catalogue for the selected motor. For intermittent operation (operating mode  $S_3$  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.

**Measuring conditions**

Operation of motors using reference electronics "ebm-papst Motor Tester 112-200; 70 V / 20 A" at an ambient temperature of max. 40 °C and a motor temperature of 20 °C when attached (thermally conductive) to a free-standing steel plate of the following size:

**VARIODRIVE, BG, ECI:**

Steel plate 105 x 105 x 10 mm

Subject to technical alterations.  
German and foreign protection rights  
(patented designs and patents).  
PAPST, VARIODRIVE are registered trademarks  
of ebm-papst GmbH & Co.KG.

## Nominal voltage $U_{BN}$ [V DC]

The DC voltage supplied to the DC motor. All nominal data in the technical tables of the individual motors is based this voltage. However, the motor application is not limited to this voltage. Changing the voltage results in a parallel shift of the motor curve. The lower voltage limit is defined by the commutator contact resistance and the start-up behaviour of the motor. The lower limit results from the mechanical ceiling speed of the motor. In every case, when selecting the voltage and defining the operating point, thermal overload of the motor in continuous operation or the selected operating cycle must be avoided. The ripple of the supply voltage should not exceed 3-5 % in normal operation, as higher ripple means poorer efficiency and control quality and corresponding speed fluctuations.

## Nominal speed $n_N$ [rpm]

The speed at which the motor can be operated for long periods at an ambient temperature of 40 °C and with output of the nominal torque in a thermally conductive installation. It is an operating point at the max. motor curve.

## Nominal torque $M_N$ [mNm]

The torque that the motor can output for long periods at an ambient temperature at 40 °C and with output of the nominal torque in a thermally conductive installation.

## Nominal current $I_N$ [A]

The current drawn from the DC voltage source as the supply current when the motor outputs nominal torque at nominal speed.

## Nominal output power $P_N$ [W]

The product of nominal torque and nominal angular velocity. When calculating this value, the tolerances for the individual values listed in the specification data sheets must be taken into account. In the electromagnetic design of the motors, the nominal operating point is defined with consideration of the fact that the nominal output corresponds approximately to the maximum permitted long-term output power of the motor.

$$P_N = M_N \cdot \omega_N = \frac{\pi}{30} \cdot n_N \cdot M_N = \text{ca. } 0,1 \cdot M_N \cdot n_N$$

## Rated efficiency $\eta_N$ [%]

Indicates the ratio in % of the mechanical output power to the absorbed electrical output relative to the nominal operating point. Typically, the nominal operating point is close to the optimum efficiency. .

## Speed at no-load operation $n_L$ [rpm]

The speed that takes effect at the nominal voltage and with unloaded motor. For the DC motor, it is proportional to the applied supply voltage. The theoretical possible speed at no-load operation can, in some cases, be limited by the mechanical ceiling speed.

## Start-up torque $M_A$ [mNm]

The torque that the motor can output for short periods at speed "0" rpm and current draw in the amount of the start-up current at start-up or as holding torque

## Start-up current $I_A$ [A]

The current drawn from the DC voltage source as the supply current if the motor outputs "0" rpm as the start-up torque. If the power supply used has a design that is too weak, it may not be possible to reach this point. In this case, the maximum possible start-up torque is limited by the power pack.

## Induced current $U_{imax}$ [V/1000 rpm]

The value of the induced current in the motor per 1000 rpm. It is a measure for the electromagnetic design of the motor. In no-load operation, the induced current is approximately equal to the applied supply voltage (minus the voltage loss via the ohmic resistance of the winding). Torque-forming current no longer flows; as a result, no more torque can be output to the shaft in no-load operation. The values specified in the technical data are based on an ambient temperature of 25 °C.

**Connection resistance  $R_V$**  [ohms]

The resistance measure at both connection lines of the motor at 20 °C. Thus it is the total resistance composed of the line resistance, brush-collector contact resistance and the actual winding resistance.

**Connection inductance  $L_V$**  [mH]

The average inductance measured at 20 °C between the two connection lines of the motor with a sinusoidal measuring frequency of 1 kHz.

**Rotor moment of inertia  $J_R$**  [kgm<sup>2</sup>×10<sup>-6</sup>]

The mass moment of inertia of the wound rotor and thus a defining variable for the dynamic properties of the motor.

**Thermal resistance  $R_{th}$**  [K/W]

A substitutional resistance at normal rating that results from the difference between the winding temperature and the ambient temperature in relation to the overall power loss.

**Protection class**

Information on the protection class complies with the valid Standard EN 60 034-5. It describes protection against foreign particles (Point 1) and water (Point 2).

**Permissible ambient temperature range  $T_U$**  [°C]

Defines the minimum and maximum permissible ambient temperature to which the mentioned performance values apply when the motor is in operation. Other ambient temperatures are possible but should be given special consideration as e. g. higher ambient temperatures result in a reduction of output power. Here, it must be ensured that the permitted winding temperature in the motor (e.g. for insulation material class B = 130°C, to EN 60 034-1) is not exceeded. The following formula can be used to provide a rough estimate of the reduced torque permitted at a higher temperature:





$$M_{red} = M_N \cdot \sqrt{\frac{T_{winding,max.} - T_{amb.}}{T_{winding,max.} - T_N}}$$

$M_{red}$  = value for the reduced torque to be measured

$T_{winding,max.}$  = max. permitted winding temperature defined by the ISO class

$T_{amb.}$  = Value for the elevated ambient temperature

$T_N$  = Reference temperature for specifying the nominal data

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