



Electric Drives

Product Catalogue



***Synchronous
Motors***



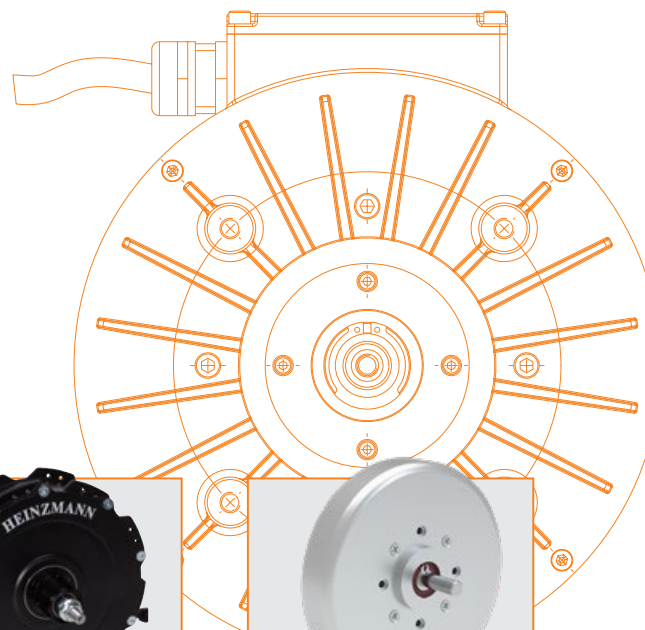
***Synchronous
Generators***



Wheel Hub Drives



DC Disc Motors



Electric Drives

ELECTRIC DRIVES & COMPLETE SYSTEMS

From its headquarters in Germany's Black Forest, Heinzmann GmbH & Co. KG develops and produces the most advanced drive technology solutions.

We supply complete system solutions on request, tailored to the specific requirements of the application in question.

HEINZMANN took over Perm Motor GmbH and its electric motors with patented rotor technology in 2008.

Our customers around the world benefit from the synergies of a flexible and innovative hotbed of ideas, and from the experience and reliability of a global yet traditional company with an international service and sales network. Make the most of our pooled expertise to gain outstanding drive solutions in consistently reliable quality.

HEINZMANN drive systems are used in a diverse range of industrial applications, in LEVs and electric vehicles, in block heating plants and within the rehabilitation field.



Synchronous Motors

Powerful brushless disc motors in patented rotor technology.



Synchronous Generators

Generators with outstanding key performance indicators and significant efficiency gains.



Wheel Hub Drives

HEINZMANN, pioneer in the field of e-bike drives, delivers complete drive systems.



DC Disc Motors

Disc motors with brushes in flat design.

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Series of Motors & Generators

SUITABLE DRIVE FOR YOUR APPLICATION

For decades now, HEINZMANN has been developing and producing robust, powerful electric drives rated up to 25 kW for use in a whole host of applications, which have proven themselves to be ideal within tough industrial environments in particular.

Our range of reliable, high-performance electric motors offers the optimal solution for your application.

From industrially produced series motors to application-based redesigns, substitute solutions and individual new developments – our patented rotor technology constantly excels through above-average performance data and significant increases in efficiency.

HEINZMANN provides

- ▶ Synchronous motors
- ▶ Synchronous generators
- ▶ Wheel hub drives
- ▶ DC disc motors

PMS/PGS - Double-sided Synchronous Disc Motors & Generators up to 25 kW

Powerful brushless disc motors and generators in patented rotor technology excel through above-average performance and significant increases in efficiency.



PMS/PGS 080



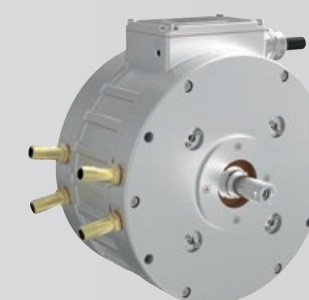
PMS/PGS 100



PMS/PGS 120



PMS/PGS 150



PMS/PGS 156W

PMS F/PGS F - Single-sided Synchronous Disc Motors & Generators

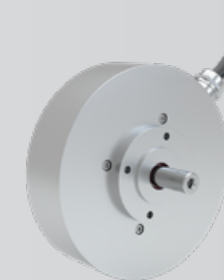
Powerful brushless disc motors and generators in flat design ideal for applications with very limited axial installation space and reduced weight.



PMS/PGS 066F



PMS/PGS 080F



PMS/PGS 100F

PRA/RN - High Torque Wheel Drives

Wide range of motors designed for tight integration into the wheel hub and for multiple applications.



PRA 230



PRA 180-25



RN 111

PMG - DC Disc Motors up to 5 kW

Multi-pole, permanently excited disc motor with brushes. Efficiency up to approx. 90 %.



PMG 132

SL - Disc Motors with Brushes up to 1 kW

Robust DC motor with brushes in extremely flat design.



SL 80-F



SL 100-F/SL 100-1NFB/SL 100-2NFB



SL 120-F/SL 120-1NFB/SL 120-2NFB



SL 140-2NFB



SL 160-2NFB



SL 180-2NFB

Range of Application

PARTNER FOR INNOVATIVE PROJECTS

HEINZMANN is a reliable partner for innovative, complete drive solutions for a wide range of application areas.

In addition to industrial applications, our drive systems are also in tune with the times when it comes to the hot topic of electric mobility.

Our powerful and robust motors have proven themselves in robotics, mobile machines, fans, pumps and agricultural technology. LEVs, electric vehicles, electric motorbikes and boats. As generators electrical power generation also forms a part of the diverse range of applications.

APPLICATION RANGE

- ▶ **Industry & Agriculture**
- ▶ **Mobility & Transport**
- ▶ **E-Bikes & Cargo Bikes**
- ▶ **Rehabilitation & Medical Care**
- ▶ **Electric Energy**
- ▶ **Consumer Products**

Industry & Agriculture

- Climbing systems
- Parking systems
- Harvesting and sowing machines
- Mobile lifting platforms
- Pumps
- Printing, textile and machine tools
- Lifters
- Forklift trucks

Mobility & Transport

- LEVs
- E-Motorcycles
- E-Karts
- E-Scooter
- Handicap vehicles
- Multi-purpose vehicles
- Driverless transport vehicles
- Boats and ships

E-Bikes & Cargo Bikes

- Cargo bikes
- E-Bikes
- Velotaxis
- Special bikes

Rehabilitation & Medical Care

- Stair climber
- Bedsides
- Centrifuges
- Medical pumps

Electric Energy

- Combined heat and power units

Consumer Products

- Cross trainer
- Turf applications, lawn tractors
- Cleaning machines

APPLICATION EXAMPLES



A typical application in the agricultural sector is the deployment of HEINZMANN electric drives in a **seeder**. In this machine, direct current brush motors from the SL product line are used to drive the sowing mechanism. Over the course of many years, the SL motors have proven to be robust and reliable drives for challenging environments.



The innovative, **mobile electric lift system** from the Swiss company HighStep is easy to transport while providing the full functionality of climbing system. It is equipped with HEINZMANN disc-type motors with brushes. These are powerful, light, small and thus the ideal solution for this application.



Samatec EVO4 **lifting platforms** are equipped with PMSG 100-1500 brushless disc-type motors. Their sophisticated design makes them ideal for the axially confined installation space on the EVO4 wheel hubs. Among other uses, the mobile lifting platforms are employed in agricultural settings as apple harvesters.



The PMS 120 serves as **drive for the modern robot system** RAY™ of SERVA Transport Systems GmbH. It is used among others on production sites, in car parks and on airports. Since February 2015, for example, these robots have been in operation at the AUDI plant in Ingolstadt, Germany, and transport in three-shift operation up to 2,000 cars per day.



Drive Systems

Applications

Synchronous Motors & Generators

Wheel Hub Motors

DC Disc Motors

Range of Application



Generators within the PGS series are a central module of small, modern **block heating plants** for obtaining electrical energy and heat. The PGS smart design allows very small total dimensions of CHPs.



The HYMOG of PTH Product Maschinenbau is a **robotic platform** with a powerful electric drive on tracks. Its compact design with low centre of gravity and broad base make the vehicle specifically qualified for use off-road. The powerful PMSG 100-1500 motors draw their energy from a smart lithium-ion battery with self-regulating heating system.



The Ziesel **tracked vehicle** from Mattro Mobility Revolutions is an innovative, electrically driven work-mobile and recreational vehicle.

The drive comprises PMS disc-type motors from HEINZMANN, which are particularly flat and feature a high power density. Like all PMS motors they stand out as a result of their very good acceleration characteristics and wide ranges.



The powerful and easy controllable PMG 132 is ideal for **drives in boats**. The electrical drive system ensures a virtually silent glide through the water and is thus an alternative and improvement on loud combustion engines. With no emissions, this drive makes water sports much more environmentally friendly.



KTM, the market leader for **electric motorbikes**, has used the HEINZMANN PMS 120 to motorise its Enduro „Freeride“. The water-cooled electric motor delivers a peak output of 16 kW (22 hp) and a torque of 42 Nm from a standstill. In other words: with a weight of just 111 kilos, the motorcycle gets off to an utterly flying start. Pure riding pleasure – without the noise and emissions.



Customers such as Deutsche Post and Post Danmark rely on **cargo bike drive systems** from HEINZMANN.

HEINZMANN's revolutionary cargo bike drive system CargoPower is extremely powerful and robust. The powerful motor combined with proven system components guarantees maximum driving force for a wide range of professional and commercial applications.



As an e-bike pioneer from the very beginning, HEINZMANN has decades of experience when it comes to motors for electric bicycles. The latest generation of **e-bikes** showcases the series of DirectPower motors. Combined with the appropriate system components, the DirectPower e-bike system meets every requirement.



Alber has used the reliable HEINZMANN SL 120-2NFB drive in its **stair climbers** for decades now. Stairs are often a difficult obstacle for the disabled and elderly. The HEINZMANN drive system helps overcome this problem in typically reliable fashion.



Drive Systems

Applications

Synchronous Motors & Generators

Wheel Hub Motors

DC Disc Motors

Series of PMS Motors

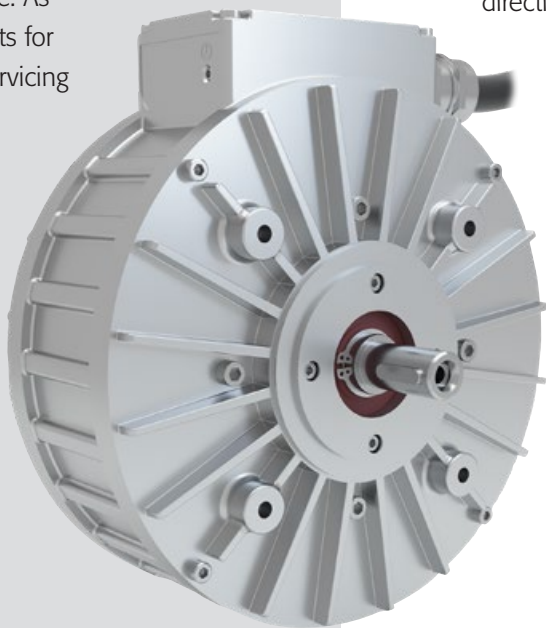
PMS MOTORS

The brushless synchronous disc motor excels in comparison with a conventional electric motor, providing benefits including compact size, flat design, low weight with identical power and higher efficiency.

This makes it ideal as a motor for drive tasks in axially confined installation spaces. Its small size yet high power makes it an efficient drive that is frequently used within machinery and equipment manufacture and within the traction sector.

HEINZMANN provides its customers with a complete range of these brushless drives. They deliver continuous loads of up to 25 kW and torques up to 59 Nm depending on the cooling type, and feature variable intermediate circuit voltage.

The brushless design means that the synchronous disc motors do not require any wearing parts such as charcoal or collectors. The drives offer a long service life and are almost maintenance free. As such, overall costs for maintenance, servicing and parts are significantly reduced.



Features

► Patented rotor technology

The special patented design and construction of the rotor discs make them lightweight by comparison. They are characterised by low inertia, which permits short run-up times. Their mechanical strength also makes them suitable for use in high-speed applications. Another benefit of the design (of the rotor discs) lies in the minimal detent torques.

► Powerful

The benefits of the large air gap area of the disc motor, coupled with the incorporation of the coil in the stator, enables a high torque and a powerful, highly efficient motor. With two stators, the effect is even more pronounced on the double-sided version. The result is a powerful motor within a small installation space.

► Maintenance-free and durable

The electronic commutation on PMS motors replaces the mechanical commutator. This makes the PMS motors maintenance-free. Our long-lasting motors are designed for use in a variety of settings.

► Dynamic

Thanks to the patented rotor technology, PMS motors with two stators have low inertia and therefore are the perfect solution for dynamic applications. They also have a low detent torque, enabling sound, simple control of dynamic servo drives.

► Flat

PMS motors are extremely flat, especially the variant with single-side stator (type F). This achieves space savings in an axial direction and means a significantly lower weight.

► Flexible

PMS motors are constructed as servo motors or slow-running, high-torque motors in various versions. They are produced with a high degree of protection, with air or liquid cooling. The models are available with a solid or hollow shaft or as a kit for integration within machines.



Liquid-cooled design

Applications

PMS motors are suited for use in applications within industry, medicine and traction. Their flat design makes them ideal for using where installation space is at a premium. Malfunctions caused by issues such as brush arcing, wear or dirt accumulation no longer apply, making the motors virtually maintenance-free.

Together with the controller, these motors are the ideal drive for any application where speed control and high

dynamic requirements prevail, and where quick changes in load or direction of rotation and fast run-ups are required.

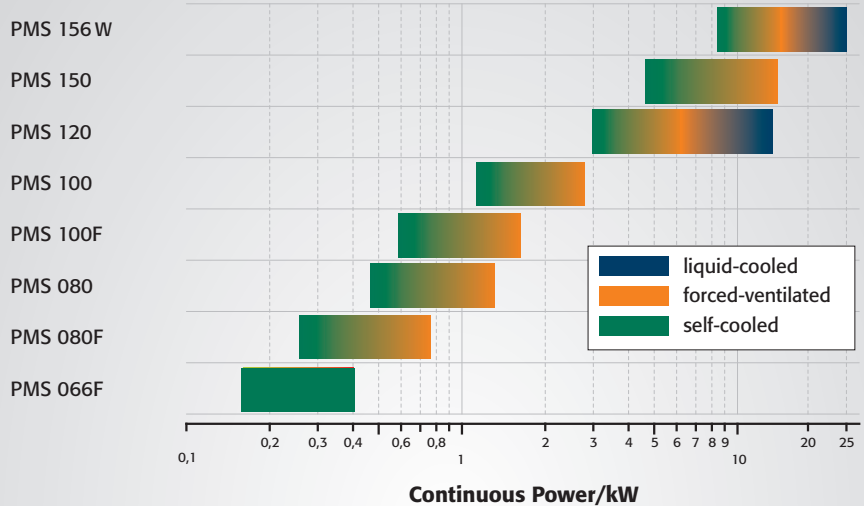
They are available with various sensor systems and also in a sensor-free version.

PMS motors can also function as highly efficient generators (see page 30 PGS generators).

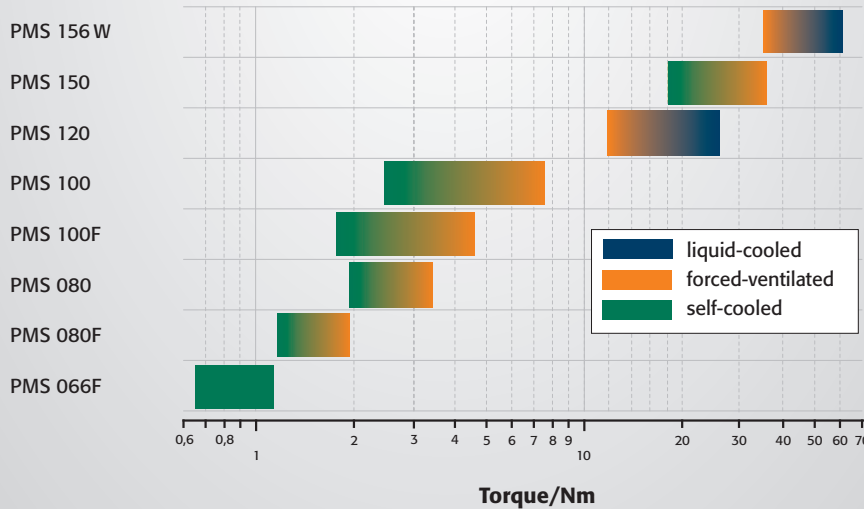
Range of Applications

- Industrial applications like printing, textile and machine tools, robotics
- Traction drive for electric vehicles, boats, lawn mowers or turf applications
- Compact pumps and fans for low-maintenance continuous service
- Drive for auxiliary generators in vehicles
- Medical equipment
- Cross trainer
- E-Motorcycles and E-Scooters

Power range PMS disc motors



Torque range PMS disc motors



Series of PMS Motors

CUSTOM-BUILT PMS MOTOR VARIANTS

Our experts will advise you on finding the right motor variant to suit your needs. Choose from one of our established standard versions or a special custom-built version. In this case, our engineers select a motor to meet your specifications and provide you with a quote once the technical details have been confirmed.

This guarantees you a tailored solution that meets your specific circumstances and requirements.

A number of satisfied industrial clients can testify to our expertise in this area.

Application: Electric Enduro

With its electric Enduro Freeride-E, the world market leader for off-road sports motorbikes KTM has brought new momentum to the off-road sport. PMS disc motors help here to lend an entirely new image to motocross bikes: offering pure riding pleasure without the noise and emissions. KTM has integrated the active components of the PMS motors into its own housing.



Its design, high power density and low inertia, which delivers very good acceleration characteristics, make the disc motor ideal for installation in a motorbike.

Application: Electric tracked vehicle

Mattro Mobility Revolutions, based in Schwaz, Austria, is causing a real sensation with the Ziesel: its revolutionary new electric fun and work-mobile. Using both PMS 120 motors, the Mattro Ziesel can reach a continuous load of 4.8 kW/6.5 hp and peak output of 15.4 kW/21 hp. Put your foot down and the torque reaches a solid 400 Nm, hitting the top speed of 35 km/h in under two seconds.



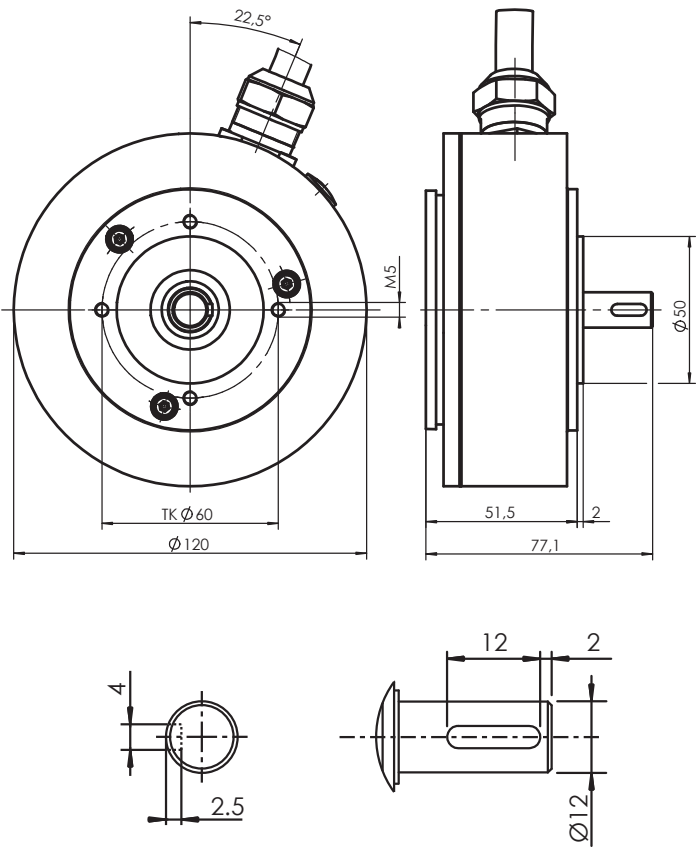
PMS 066F

PMS 066F is the smallest motor from the single-sided synchronous motor series.

Suitable for applications with very limited axial installation space.



Dimensions



Motor feedback: Hall sensor

Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
24 VDC	3000	0.35	20	1.11	0.055	4.05	0.5	37	2
	4500	0.40	20	0.85	0.041	2.97	0.7	49	2
	6000	0.35	19	0.56	0.029	2.09	0.9	71	2
36 VDC	3000	0.35	14	1.11	0.082	5.95	0.6	25	2
	4500	0.40	14	0.85	0.060	4.29	0.7	34	2
	6000	0.40	14	0.64	0.045	3.26	0.9	45	2
48 VDC	3000	0.35	10	1.11	0.111	8.11	0.6	19	2
	4500	0.40	10	0.85	0.083	5.95	0.8	25	2
	6000	0.40	11	0.64	0.058	4.19	1.0	35	2

► Cooling: Self-cooled ► m = approx. 1.5 kg ► J = 2.14 kg · cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1



Fully integrated PMS Motor of KTM E-Enduro Freeride-E

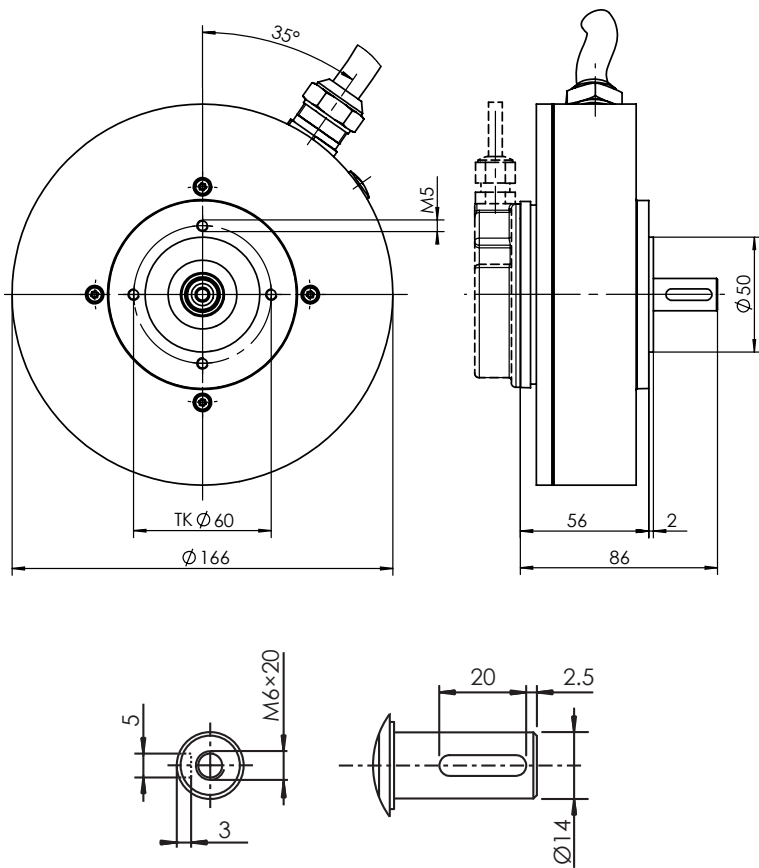
Series of PMS Motors

PMS 080F

PMS 080F is a larger variant of the single-sided synchronous motor series.



Dimensions



Standard motor feedback: sin/cos

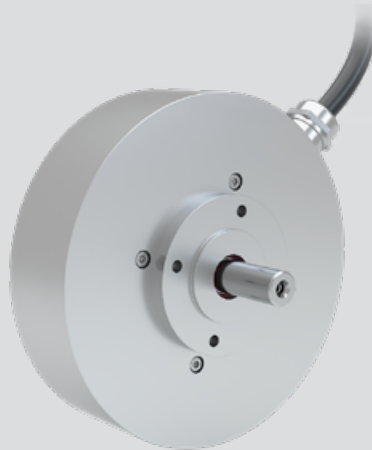
Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
24 VDC	3000	0.55	27	1.75	0.064	4.41	1.2	78	5
	4500	0.75	37	1.59	0.043	2.88	1.9	120	5
	6000	0.75	36	1.19	0.033	2.25	1.8	160	5
36 VDC	3000	0.55	18	1.75	0.099	6.78	1.2	51	5
	4500	0.75	24	1.59	0.065	4.41	1.9	77	5
	6000	0.75	24	1.19	0.051	3.44	1.9	99	5
48 VDC	3000	0.55	13	1.75	0.132	9.10	1.2	38	5
	4500	0.75	18	1.59	0.087	5.88	1.9	58	5
	6000	0.75	18	1.19	0.066	4.49	1.9	76	5

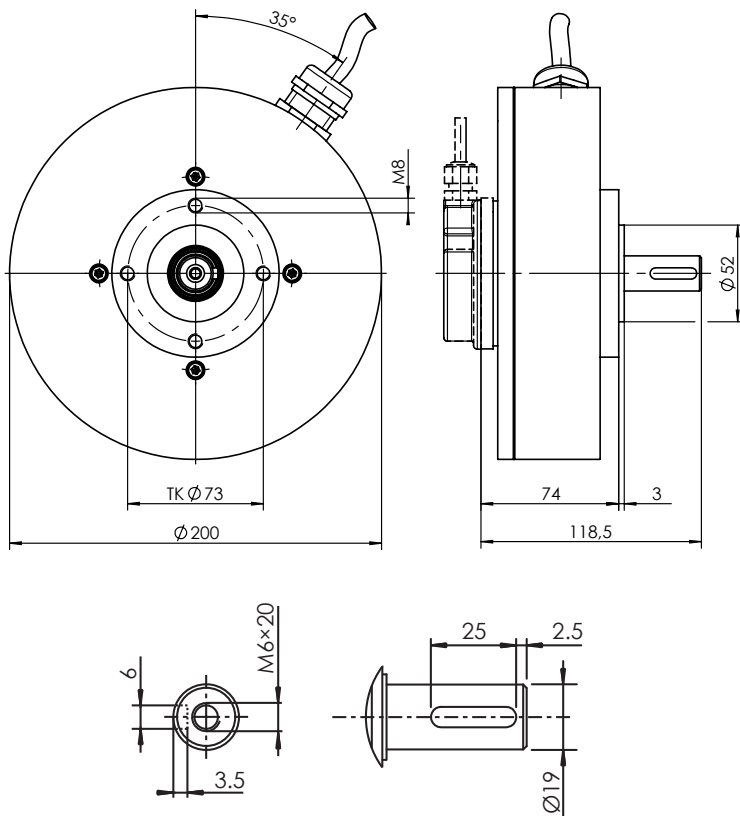
► Cooling: External ventilation ► m = approx. 3.2 kg ► J = 6.5 kg · cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1

PMS 100F

The PMS 100F motor is a variant of the single-sided synchronous motor series offering above-average torque with comparatively low overall height.



Dimensions



Standard motor feedback: sin/cos

Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
24 VDC	3000	0.65	32	2.07	0.065	4.38	2.4	210	13
	4500	1.40	70	2.97	0.042	2.80	3.0	310	13
	6000	1.50	74	2.39	0.320	2.15	4.2	410	13
36 VDC	3000	1.0	34	3.18	0.095	6.33	2.8	140	13
	4500	1.0	33	2.12	0.064	4.38	4.1	210	13
	6000	1.0	34	1.59	0.047	3.41	5.1	280	13
48 VDC	3000	1.35	37	4.30	0.116	7.79	3.3	120	13
	4500	1.5	36	3.18	0.087	5.81	3.5	150	13
	6000	1.5	38	2.39	0.063	4.22	4.6	210	13

► Cooling: External ventilation ► m = approx. 5.5 kg ► J = 17.5 kg · cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1

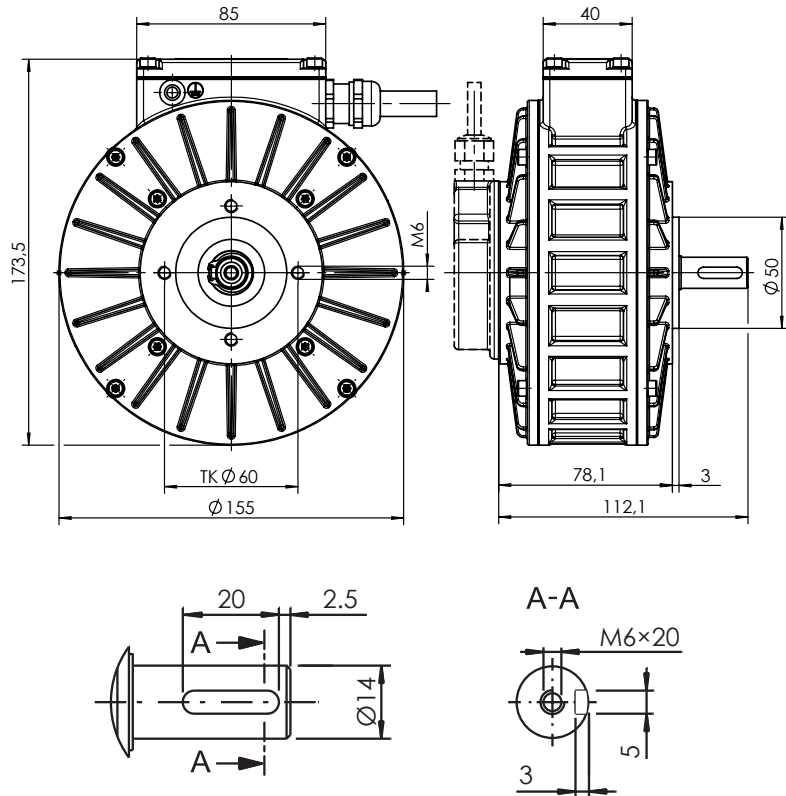
Series of PMS Motors

PMS 080

PMS 080 is the smallest from the series with double-sided stators. Suitable for applications with very limited axial installation space.



Dimensions



Standard motor feedback: sin/cos

Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
24 VDC	3000	1.00	47.2	3.2	0.07	4.6	2.2	150	10
	4500	1.10	57.9	2.3	0.04	2.8	2.7	250	10
	6000	1.20	65.7	1.9	0.03	2.0	3.7	350	10
36 VDC	3000	1.00	32.4	3.2	0.10	6.7	2.3	110	10
	4500	1.25	39.4	2.7	0.07	4.5	3.5	150	10
	6000	1.25	39.4	2.0	0.05	3.4	3.5	200	10
48 VDC	3000	1.00	24.5	3.2	0.13	8.8	2.5	78	10
	4500	1.25	29.8	2.7	0.09	6.0	3.3	120	10
	6000	1.15	27.3	2.0	0.07	4.5	3.5	150	10

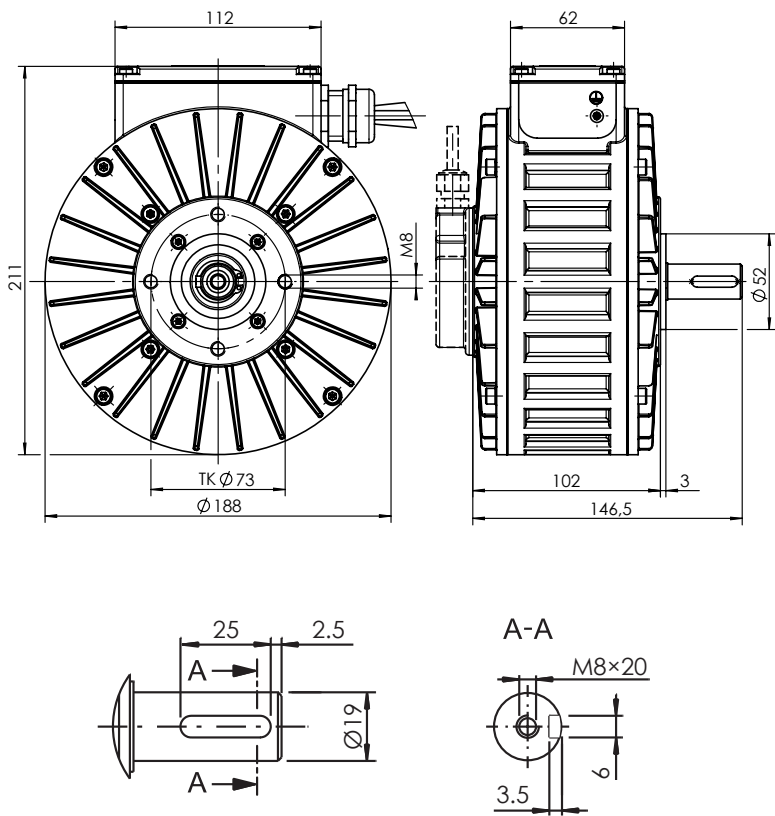
► Cooling: External ventilation ► m = 3.8 kg ► J = 3.8 kg • cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1

PMS 100

The PMS 100 motor is a variant of the double-sided stator series offering above-average torque with comparatively low overall height.



Dimensions



Standard motor feedback: sin/cos

Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
24 VDC	3000	1.40	69	4.46	0.064	4.32	4.2	320	20
	4500	1.68	83	3.57	0.043	2.86	3.7	370	15.8
	6000	1.40	71	2.23	0.031	2.15	4.4	460	14.3
48 VDC	3000	2.3	60	7.32	0.122	8.12	5.0	170	20
	4500	2.6	65	5.52	0.084	5.62	7.1	240	20
	6000	2.7	67	4.30	0.064	4.28	6.7	320	20

► Cooling: External ventilation ► m = 7.2 kg ► J = 9.6 kg • cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1

Drive Systems

Applications

Synchronous
Motors & Generators

Wheel Hub Motors

DC Disc Motors

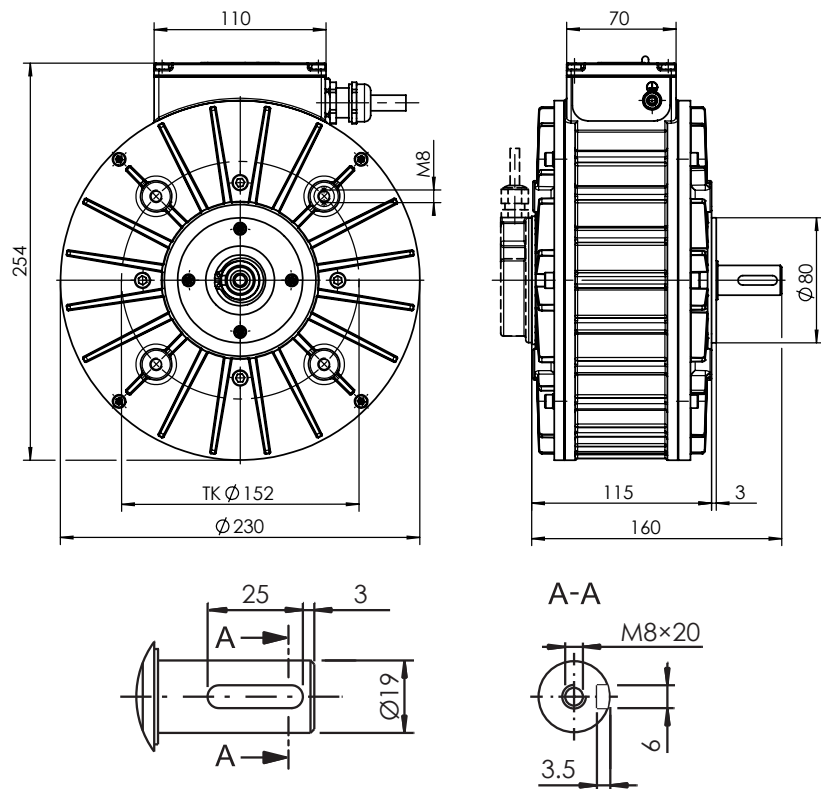
Series of PMS Motors

PMS 120

The PMS 120 is a particularly powerful motor from the series with two stators.



Dimensions



Standard motor feedback: sin/cos
Standard motor feedback >100 VDC: Resolver

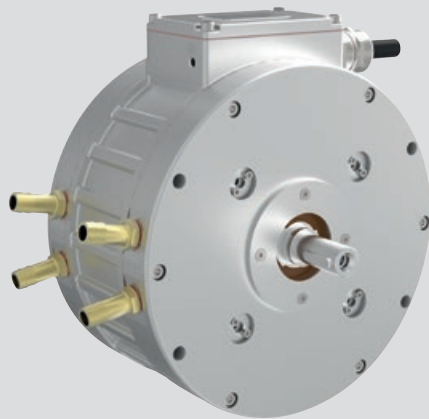
Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
48 VDC	3000	5.5	127	17.5	0.138	8.84	11.1	330	45
	4500	6.0	134	12.7	0.095	6.03	16.9	480	45
	6000	6.0	137	9.5	0.070	4.44	18.5	650	45
96 VDC	3000	6.4	74	20.4	0.277	17.70	11.3	170	45
	4500	7.5	84	15.9	0.190	12.10	17.3	240	45
	6000	8.0	94	12.7	0.136	8.63	20.8	340	45
330 VDC	3000	6.0	21	19.1	0.904	57.80	12.1	50	45
	4500	7.5	25	15.9	0.639	40.60	16.3	71	45
	6000	7.5	25	11.9	0.480	30.50	19.0	94	45
560 VDC	3000	6.0	12	19.1	1.560	100.00	11.9	29	45
	4500	7.5	14	15.9	1.110	70.70	17.2	41	45
	6000	7.5	15	11.9	0.818	52.00	18.8	55	45

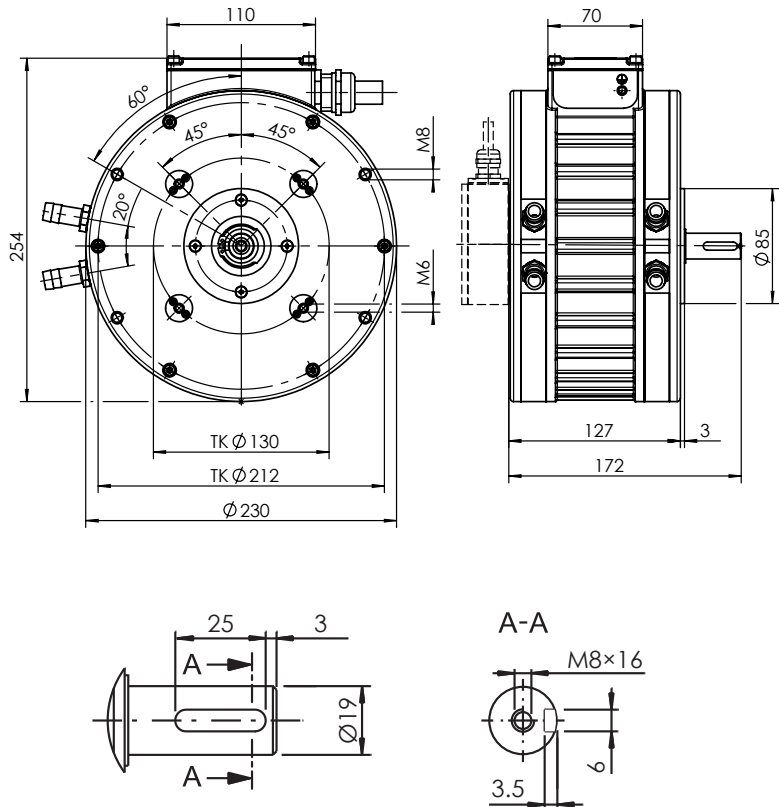
► Cooling: External ventilation ► m = 12.3 kg ► J = 26.3 kg • cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1

PMS 120W

The disc motor PMS 120W from the series with two stators achieves a considerable increase in performance by liquid cooling compared to the air-cooled variant.



Dimensions



Standard motor feedback: sin/cos
Standard motor feedback >100 VDC: Resolver

Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
96 VDC	3000	8.0	99	25.5	0.257	16.46	12.6	180	45
	4500	12.0	144	25.5	0.177	11.24	18.9	260	45
	6000	13.0	148	20.7	0.140	8.84	24.0	330	45
330 VDC	3000	8.0	28	25.5	0.900	57.80	12.1	51	45
	4500	11.5	40	24.4	0.606	38.54	18.5	75	45
	6000	13.0	49	20.7	0.423	26.80	23.6	110	45
560 VDC	3000	8.0	17	25.5	1.499	96.34	12.6	31	45
	4500	11.5	23	24.4	1.062	67.44	18.3	43	45
	6000	13.0	27	20.7	0.773	48.95	22.4	59	45

► Cooling: Liquid-cooled ► m = 16 kg ► J = 26.3 kg • cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1

Drive Systems

Applications

Synchronous Motors & Generators

Wheel Hub Motors

DC Disc Motors

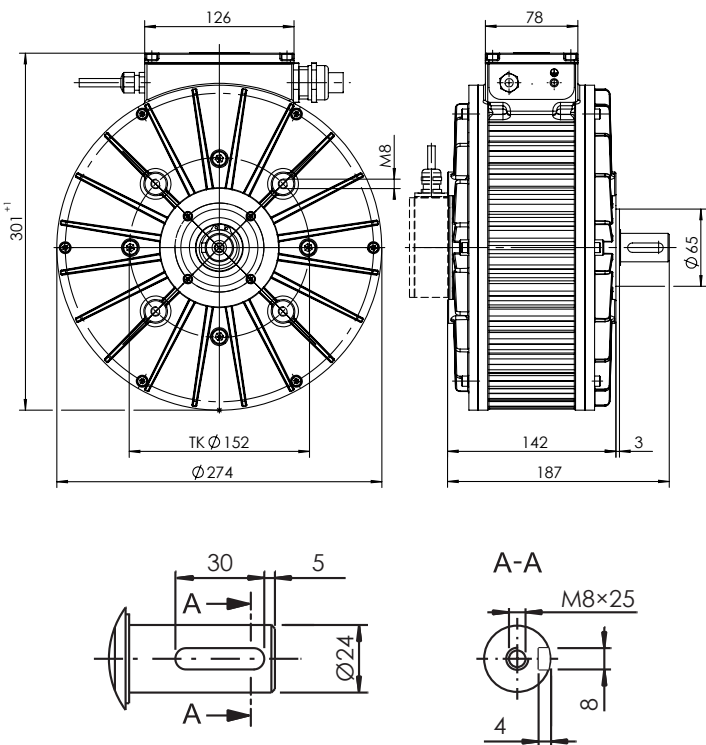
Series of PMS Motors

PMS 150

The PMS 150 is by far the strongest member of the series with two stators within the forced-ventilated cooled versions.



Dimensions



Standard motor feedback: sin/cos
Standard motor feedback >100 VDC: Resolver

Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
48 VDC	3000	8.5	192	27.1	0.141	8.95	18.7	570	80
	4500	8.5	191	18.0	0.095	6.03	27.7	850	80
	6000	8.5	192	13.5	0.07	4.55	33.6	1140	80
96 VDC	3000	10.5	131	33.4	0.256	16.22	21.5	320	80
	4500	14.0	167	29.7	0.178	11.19	31.8	460	80
	6000	13.0	157	20.7	0.131	8.30	34.0	610	80
330 VDC	3000	10.0	32	31.8	0.966	61.50	19.5	83	80
	4500	14.0	46	29.7	0.646	40.79	28.8	130	80
	6000	13.0	42	20.7	0.491	31.10	33.0	170	80
560 VDC	3000	10.0	24	31.8	1.334	85.04	24.4	60	80
	4500	14.0	26	29.7	1.134	71.60	29.0	71	80
	6000	13.0	26	20.7	0.802	50.71	34.3	100	80

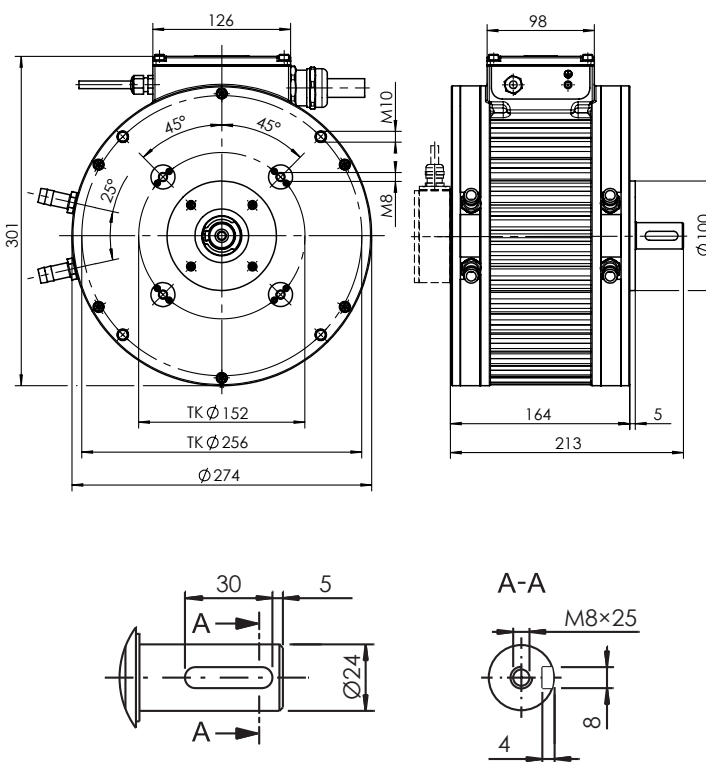
► Cooling: External ventilation ► m = 22.3 kg ► J = 58.6 kg · cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1

PMS 156W

Compared to the forced-ventilated cooled variant the PMS 156W from the series with two stators obtains maximum power density by its compact design and liquid cooling compared to motors of a similar performance class.



Dimensions



Standard motor feedback: sin/cos
Standard motor feedback >100 VDC: Resolver

Technical Data

	Rated speed	Rated power	Rated current	Rated load torque	Torque constant	Voltage constant	Max. power	Max. current	Max. load torque
Voltage	n	P _N	I _N	M _N	K _t	K _e	P _{max}	I _{max}	M _{max}
	rpm	kW	A (AC)	Nm	Nm/A	V/1000 rpm	kW	A	Nm
96 VDC	3000	18.5	237	58.9	0.248	15.60	23.2	330	80
	4500	21.0	250	44.6	0.178	11.14	32.5	450	80
	6000	21.0	245	33.4	0.136	8.56	40.7	590	80
330 VDC	3000	18.5	69	58.9	0.849	53.48	23.3	95	80
	4500	23.0	85	48.8	0.571	35.65	35.6	150	80
	6000	25.0	90	39.8	0.444	27.74	40.5	190	80
560 VDC	3000	18.5	42	58.9	1.400	88.02	24.0	58	80
	4500	25.0	53	53.1	1.007	62.95	34.3	80	80
	6000	25.0	54	39.8	0.740	46.20	40.4	110	80

► Cooling: Liquid-cooled ► m = 29.8 kg ► J = 58.6 kg · cm² ► Max. permissible load = 6/60 sec ► Operating mode = S1

Drive Systems

Applications

Synchronous
Motors & Generators

Wheel Hub Motors

DC Disc Motors

PMS System Components

SYSTEMS FROM A SINGLE SOURCE

As well as supplying the right type of motor for your application, we provide the associated system components to form a complete solution.

The benefit to you is that the HEINZMANN team of experts gives you support in choosing a tailored drive system for your application and you receive perfectly harmonised components from a single source.

HEINZMANN provides

- ▶ **Motors**
- ▶ **Motor controller**
- ▶ **Motor feedback**
- ▶ **Gears**
- ▶ **Brakes**

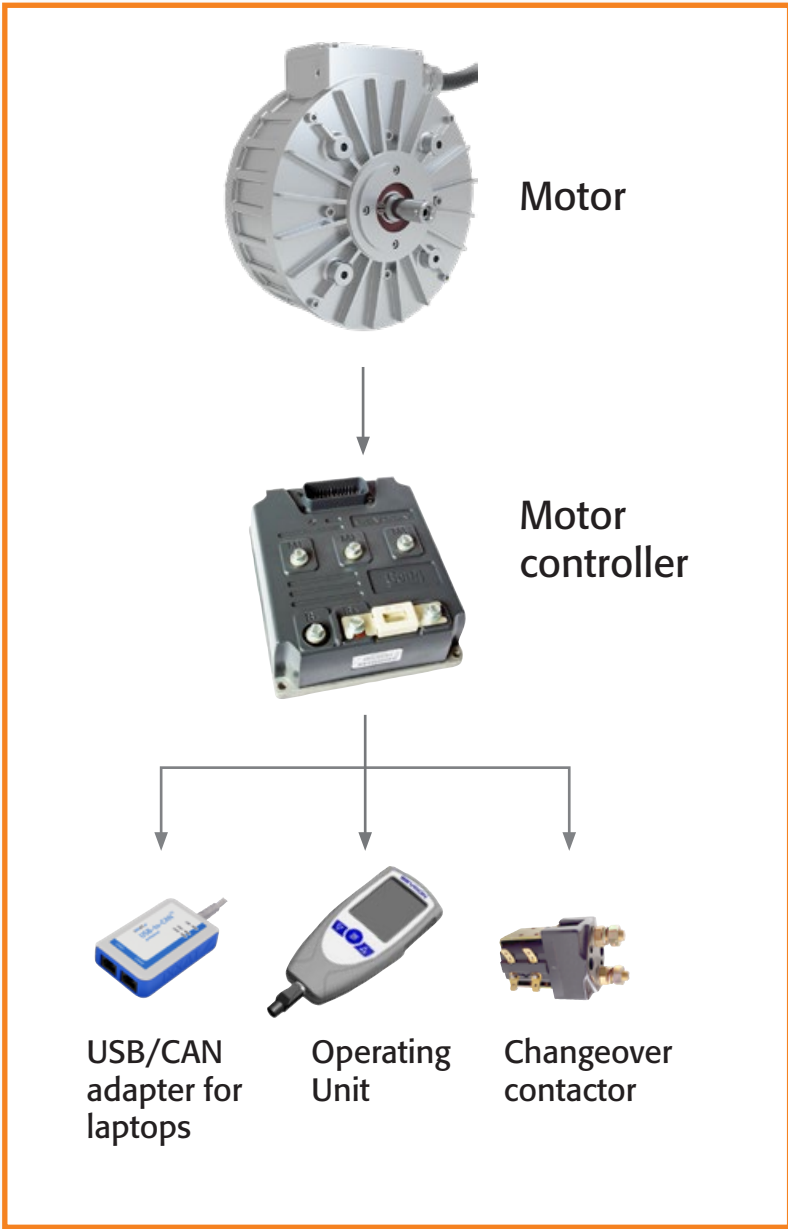
Motor Controller

Permanently excited synchronous motors require electronic controllers for their operation. These controllers are subject to the utmost dynamic requirements and must demonstrate extreme performance characteristics. That's why a selection of tried-and-tested motor controllers is available for the motors in the PMS series. As a result, the interplay of both components achieves optimum results.



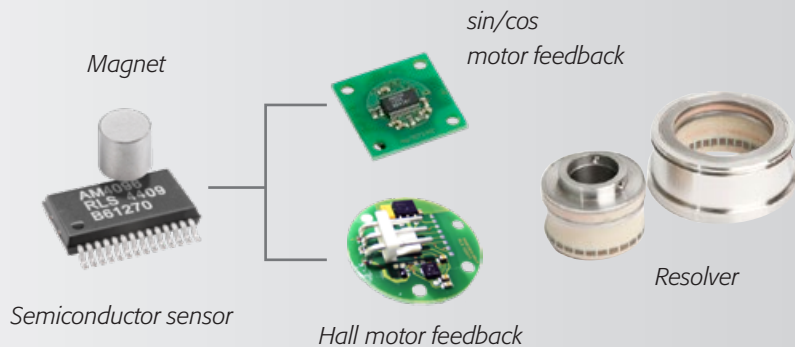
Motor controllers of varying levels of performance

System Overview



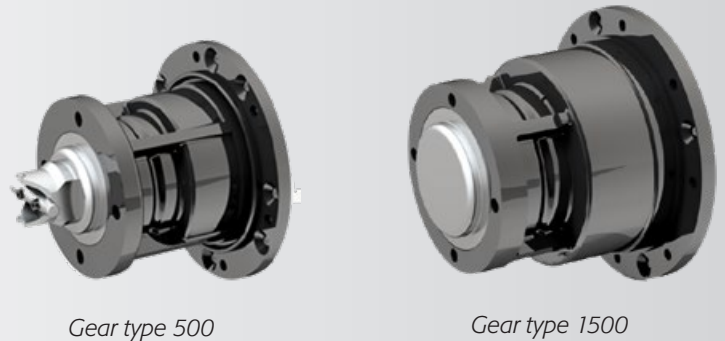
Motor feedback

Depending on requirements, we offer three types of sensors for the motor feedback within the PMS series: Hall and sin/cos motor feedback and resolver. This enables control of PMS motors by virtually any conventional motor controller.



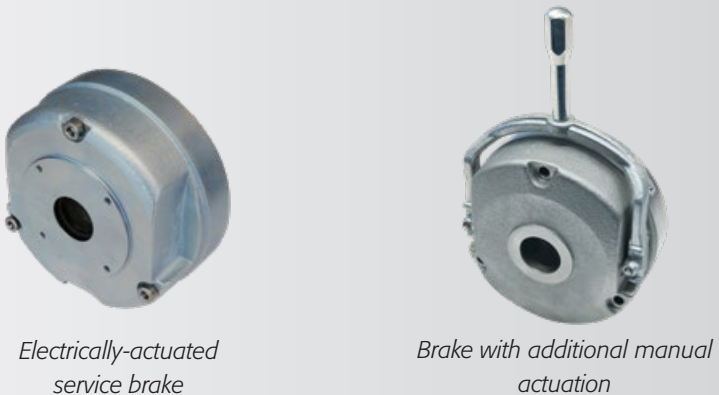
Gears

Motors in the PMS series are also available with a gear on request. 1-, 2- or 3-stage planetary gears are used to adjust speed and torque to meet requirements. For more details, please refer to the section on PMSG Systems Solutions.



Brakes

All PMS motors can also be equipped with brakes. Depending on requirements, this can be a service brake or parking brake with electric or manual control, and safety brakes are also available.



Series of PMSG System Solutions

PMSG MOTOR & GEAR COMBINATIONS

The PMSG wheel hub motor from HEINZMANN sets itself apart with a clean, environmentally-friendly drive concept that produces no emissions or noise.

It boasts a high starting torque with large overload factor, plus the option of energy recuperation during braking. This powerful motor requires no maintenance and also has a high level of efficiency in its favour.

It mounts directly on the rim, so no axle is required. The PMSG features an integrated planetary gear and inbuilt wheel bearing for direct mounting on the rim. A parking brake is available as an option.

This product is suitable for both 2-wheel and 4-wheel drives.

Features

- Maintenance-free
- Energy recuperation
- High efficiency
- Low noise
- High starting torque



Range of Applications

- Turf applications, lawn tractors
- Harvester
- Forklift trucks
- Lifters
- Floor care machinery
- Municipal vehicles
- Commercial vehicles
- Electric cars and NEV
- Replacement for hydraulic drives

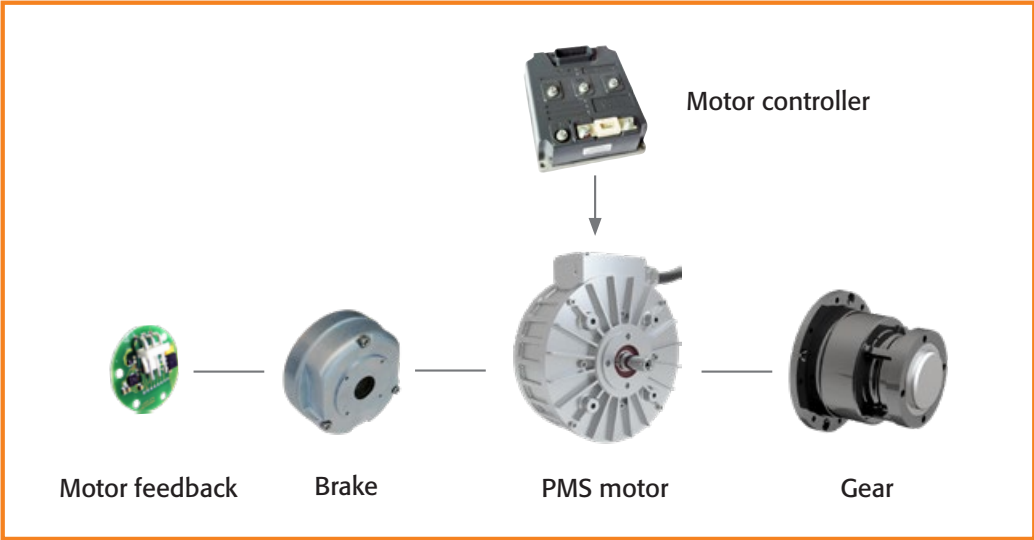


Gearing data	PMSG xxx-500	PMSG xxx-1500	PMSG xxx-4000
Reduction possibilities (some reduction possibilities are not available in standard versions)	1:4/1:7/1:16/1:24/1:42/1:96/1:144/1:252 (optional manual decoupling possible)	1:5/1:8/1:25/1:40/1:64/1:100/1:150/1:240/1:384 (optional manual decoupling possible)	1:5/1:24/1:32/1:120/1:198/1:298 (optional manual decoupling possible)
Max. continuous torque	160 Nm	800 Nm	1,600 Nm
Max. peak torque	500 Nm	2,000 Nm	4,000 Nm
Max. axial forces	2,500 N	5,000 N	9,000 N
Max. radial forces	8,000 N	25,000 N	45,000 N
Lubrication	Lifetime	Lifetime	Lifetime
Lifetime	20,000 hours (depending on application)	20,000 hours (depending on application)	20,000 hours (depending on application)
Degree of protection	up to IP67	up to IP67	up to IP67
Weight planetary gear	~ 7 kg	14 – 17.5 kg	38 – 44 kg

Implementation

Power connection: Cable length 1 m, open cable ends Motor feedback: Probe with sin/cos output
Encoder connection: Cable length 1 m, open cable ends Temperature sensor: KTY 84-130
Cooling: External ventilation, generated independently from motor, min. air velocity > 5 m/s

PMSG System Overview



The combinations described on the following pages are only a selection.

The complete list of standard combinations consists of the motors (page 13-21) and the gear list above. Other variants on request.

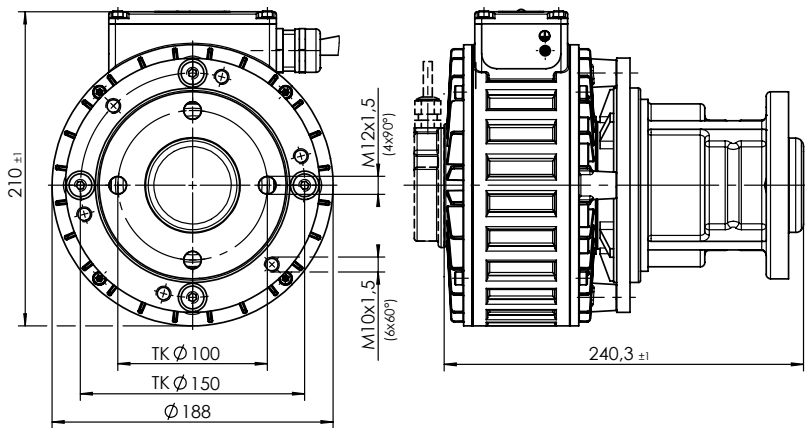
Series of PMSG System Solutions

PMSG 100-500 MOTOR & GEAR COMBINATION 1.45 - 2.7 KW

The PMSG 100-500 combines a PMS 100 motor with a gear and an output torque of up to 160 Nm.



Dimensions



Technical Data

Voltage	Motor data					Gearing data				
	Rated power	Rated speed	Rated load torque	Rated current		Gear ratio	Efficiency	Rated speed	Rated load torque	
	kW	rpm	Nm	A		i	%	rpm	Nm	
PMSG 100-500-2-16										
24 VDC	1.45	4500	3.1	71.8		16	94	281	46	
	1.4	6000	2.2	71.4		16	94	375	34	
36 VDC	2.6	4500	5.5	85.6		16	94	281	83	
	2.6	6000	4.1	92.4		16	94	375	62	
48 VDC	2.6	4500	5.5	65.4		16	94	281	83	
	2.7	6000	4.3	66.9		16	94	375	65	
PMSG 100-500-2-42										
24 VDC	1.45	4500	3.1	71.8			42	94	107	121
	1.4	6000	2.2	71.4	42		94	143	88	
36 VDC	2.6	4500	5.5	85.6	42		94	107	160	
	2.6	6000	4.1	92.4	42		94	143	160	
48 VDC	2.6	4500	5.5	65.4	42		94	107	160	
	2.7	6000	4.3	66.9	42		94	143	160	

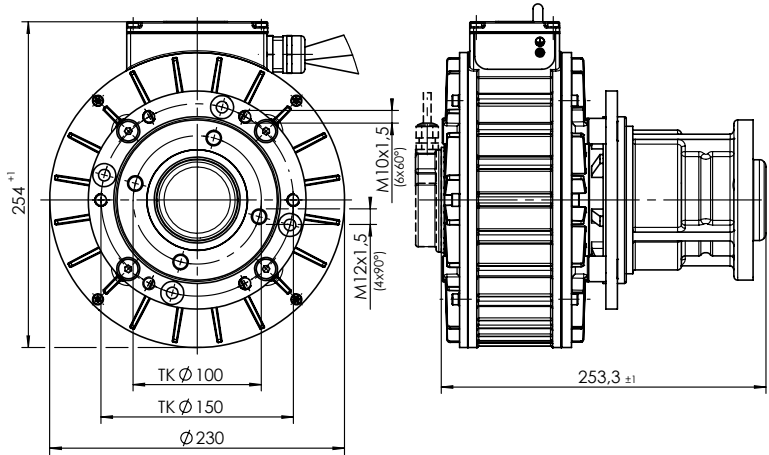
► Cooling: Forced ventilation ► m = 14.5 kg ► Operating mode = S1

PMSG 120-500 MOTOR & GEAR COMBINATION 3.0 - 8.0 KW

The PMSG 120-500 combines a PMS 120 motor with a gear and an output torque of up to 160 Nm.



Dimensions



Technical Data

Voltage	Motor data					Gearing data			
	Rated power	Rated speed	Rated load torque	Rated current		Gear ratio	Efficiency	Rated speed	Rated load torque
	kW	rpm	Nm	A		i	%	rpm	Nm
PMSG 120-500-2-16									
48 VDC	5.5	3000	17.5	126.9		16	94	188	160
	6.0	4500	12.7	134.0		16	94	281	160
	6.0	6000	11.9	137.0		16	94	375	160
96 VDC	6.4	3000	20.4	73.6		16	94	188	160
	7.5	4500	15.9	83.7		16	94	281	160
	8.0	6000	12.7	93.4		16	94	375	160

► Cooling: Forced ventilation ► m = 19.6 kg ► Operating mode = S1

Drive Systems

Applications

Synchronous
Motors & Generators

Wheel Hub Motors

DC Disc Motors

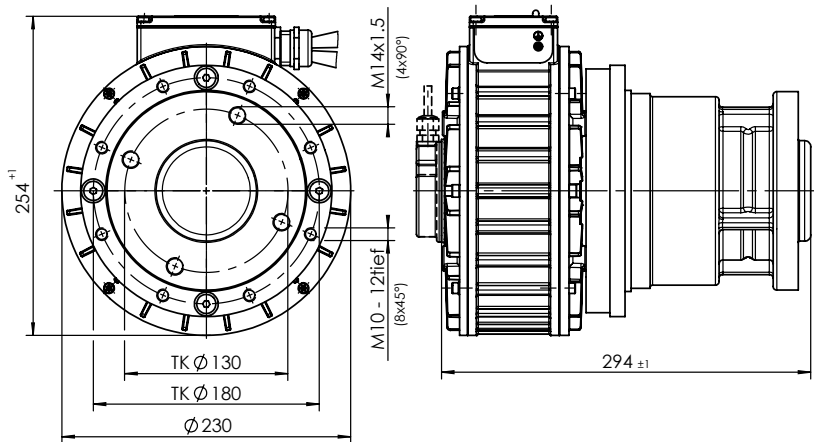
Series of PMSG System Solutions

PMSG 120-1500 MOTOR & GEAR COMBINATION 3.0 - 8.0 KW

The PMSG 120-1500 combines a PMS 120 motor with a gear and an output torque of up to 500 Nm.



Dimensions



Technical Data

Voltage	Motor data				Gearing data			
	Rated power	Rated speed	Rated load torque	Rated current	Gear ratio	Efficiency	Rated speed	Rated load torque
	kW	rpm	Nm	A	i	%	rpm	Nm
PMSG 120-1500-2-40								
48 VDC	5.5	3000	17.5	126.9	40	94	75	500
	6.0	4500	12.7	134.0	40	94	113	500
	6.0	6000	11.9	137.0	40	94	150	449
96 VDC	6.4	3000	20.4	73.6	40	94	75	500
	7.5	4500	15.9	83.7	40	94	113	500
	8.0	6000	12.7	93.4	40	94	150	479

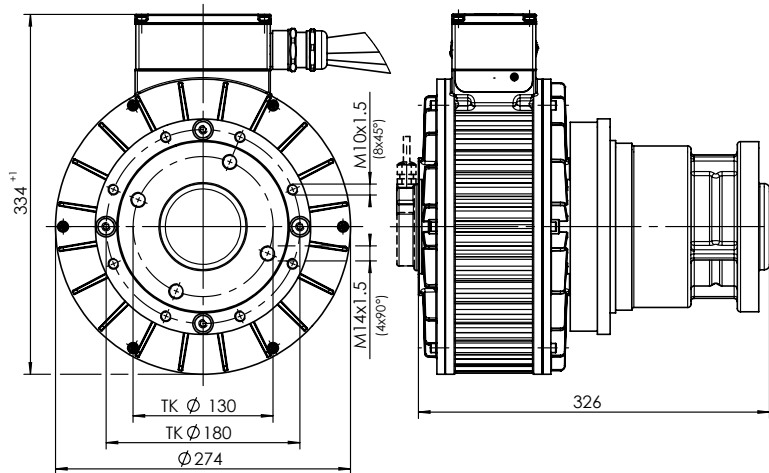
► Cooling: Forced ventilation ► m = 27.8 kg ► Operating mode = S1

PMSG 150-1500 MOTOR & GEAR COMBINATION 5.0 - 14.0 KW

The PMSG 150-1500 combines a PMS 150 motor with a gear and an output torque of up to 500 Nm.



Dimensions



Technical Data

Voltage	Motor data				Gearing data			
	Rated power	Rated speed	Rated load torque	Rated current	Gear ratio	Efficiency	Rated speed	Rated load torque
	kW	rpm	Nm	A	i	%	rpm	Nm
PMSG 150-1500-2-16								
48 VDC	8.5	3000	27.1	191.9	16	94	188	408
	8.5	4500	18.0	190.8	16	94	281	270
	8.5	6000	13.5	192.0	16	94	375	203
96 VDC	10.5	3000	33.4	130.8	16	94	188	500
	14.0	4500	29.7	167.4	16	94	281	447
	13.0	6000	20.7	157.5	16	94	375	311
PMSG 150-1500-2-40								
48 VDC	8.5	3000	27.1	191.9	40	94	75	500
	8.5	4500	18.0	190.8	40	94	113	500
	8.5	6000	13.5	192.0	40	94	150	500
96 VDC	10.5	3000	33.4	130.8	40	94	75	500
	14.0	4500	29.7	167.4	40	94	113	500
	13.0	6000	20.7	157.5	40	94	150	500

► Cooling: Forced ventilation ► m = 37.8 kg ► Operating mode = S1

Drive Systems

Applications

Synchronous
Motors & Generators

Wheel Hub Motors

DC Disc Motors

Series of PGS Generators

PGS GENERATORS

The PGS synchronous generators are brushless, highly efficient disc generators with patented rotor technology. This series of generators boasts a great power density, low weight, high efficiency and an extremely flat design. Their housing makes them completely enclosed.

The PGS series has been designed for a power range of 0.1 to 20 kVA at variable speeds and voltage. The voltage range reaches a maximum of 500 VAC.

Whether block heating plant or emergency power supply, we deliver the generator that meets your requirements, air or liquid-cooled. From special developments to large-scale production, we are the partner you can rely on.

Detailed information on the individual models of generator within the PGS series, including technical data and drawings, is available on request.



Features

► Double stator for high power density

The double-sided design sees the patented rotor disc operate using 2 stators. The generator demonstrates its full potential here with the neodymium iron boron magnets.

► High level of efficiency

The large air gap area on the double-sided version makes the PGS generators highly efficient. The result is a maximum-efficiency generator within a small installation space.

► Flat design

The small axial length of the PGS generators means they can even be used in restricted installation spaces. For even more extreme applications where even the double-sided generators can no longer be accommodated mechanically, the even flatter generators within the F series with single-side stator can be employed.

► Maintenance-free and long service life

As PGS generators have no mechanical commutation, they are completely maintenance-free. Designed to deliver an extremely long service life, these products are intended for use in a wide variety of environments and to meet high levels of requirements.

► Flexible

The PGS generators have been designed by HEINZMANN with special consideration given to customer requirements. The range of sizes cover a nominal speed range of 3,000 – 6,000 rpm and nominal voltages of up to 500 VAC. We therefore offer our customers the flexibility to resolve their technical problem from an individual standpoint.

Customer-Specific Applications

The generators in the PSG series are available in various versions. They can be self-cooled, forced-ventilated or liquid-cooled.

Our experts will advise you on finding the right generator to suit your needs. If our standard variants don't fit the bill, you can also opt for a custom-built design. Our engineers work with you to develop a specific solution and provide you with a quote once all the technical details have been confirmed.

This guarantees you a tailored solution that meets your specific circumstances and requirements.

A number of satisfied industrial clients can testify to our expertise in this area.

Range of Applications

- Combined heat and power plants
- Auxiliary power supplies
- Auxiliary power units
- Range extender
- Hydro-electric power plants



PMS/PGS Technical Data

Technical Data and Information

Motor type	Brushless synchronous disc motor/generator, excited by permanent magnet in disc motor technology		
Miscellaneous provisions	Relevant standards DIN EN 60034		
Operational mode	S1 (continuous duty)		
Cooling	Self-cooling	=	without fan, mounting on satisfactory cooling surface
	Forced ventilation	=	generated independently from motor, min. air velocity > 5 m/s required
	Liquid cooling	=	6 l/min, max. coolant temperature 60 °C, max. operating pressure 3 bar, customer specific design on request
Pairs of poles	4 (5 at PMS/PGS 066F)		
Magnet material	Neodymium iron boron (NdFeB)		
Electrical connection	Terminal box with cable approx. 1 m, wire cross-section depending on motor current Plug on request		
Electric strength	According to standard DIN EN 60034		
Thermal class	F (155 °C)		
Degree of protection	IP54, alternatives obtainable on request		
Permissible ambient temperature	-25 ... +40 °C		
Motor feedback	Resolver two-pin Digital Hall probe Analogue Hall probe with sin/cos output Further types of motor feedback on request		
Temperature sensor	KTY84-130, optional PTC according to DIN 44081		
Painting	On request Standard finish: cast aluminium		
Shaft	Shaft with key groove		
Types	PMS/PGS Type F: one stator, one rotor with closed magnetic circuit PMS/PGS double-sided: two stators, one rotor self-contained		
Specific features	The customer has the option of integrating components from PMS/PGS series drives into machinery in kit form		

Permissible Forces

for 20,000 hours lifespan

Radial force F _r [N] at n rpm				
Rated speed	3000	4500	6000	Bearing A-side
Motor type				
PMS/PGS 066	360	310	280	6002
PMS/PGS 080	500	430	400	6202 6004
PMS/PGS 100	1000	900	810	6304
PMS/PGS 120	900	780	720	6205
PMS/PGS 150	900	780	720	6205 6206

Axial force F _a [N] at n rpm			
Rated speed	3000	4500	6000
Motor type			
PMS/PGS 066	105	90	75
PMS/PGS 080	140	120	95
PMS/PGS 100	300	255	210
PMS/PGS 120	300	255	210
PMS/PGS 150	460	390	320

All given characteristics of the motors are calculated data which may differ slightly.
Subject to alterations.

On request: Alternative voltage, speed, torque or power for customised applications obtainable and additional mounting of gearbox or brake obtainable.

PMS/PGS Technical Data

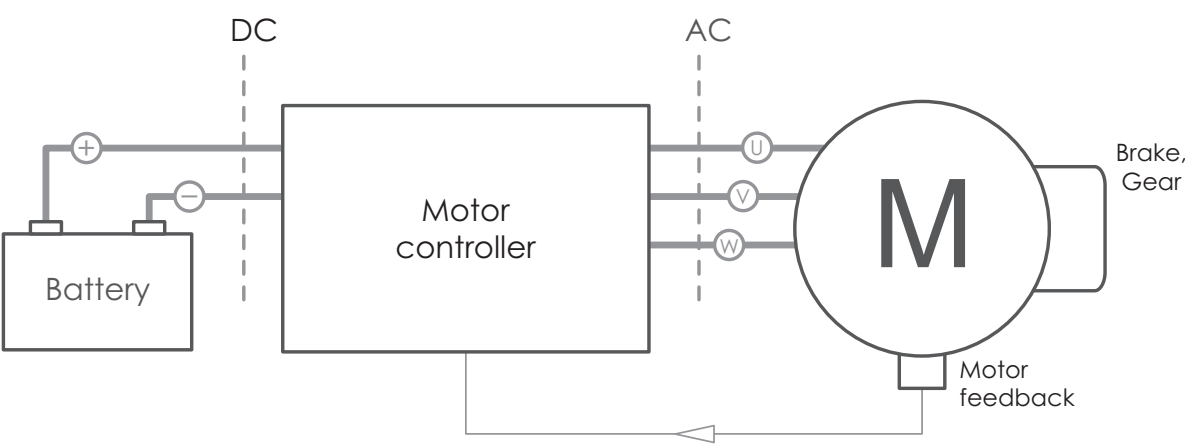
Permissible Mounting Orientation

For any PMS motors with protection grade lower than IP65 mounting with vertical or approx. vertical shaft is critical. These motors are not absolutely waterproof. Water accumulated at the bearing (e.g. spray, condensate or similar) may penetrate into the housing. Corrosion and motor failure may be the result.

Electrical Connections

Motor connection	Where possible the motors are equipped as standard with highly flexible, two-norm servo cables (UL/CSA and VDE-REG. no.) suitable for drag chains. These cables combine supply cores and pilot cores for thermal protection KTY 84-130. The cables are equipped with an additional overall screen for increased interference immunity (EMC). Motors with bigger wire cross-section are equipped with single strands.	
Technical data/design	Special PUR drag chain cable in accordance with UL AWM Style. Overall screen from galvanised copper braid with approx. 85 % cover.	
Pilot cores	Imprint BR1, BR2	Thermal protection
Outer sheath	PUR, extremely abrasion-resistant, low-adhesion, halogen-free, resistant to UV, oil, hydrolysis and microbes Sheath colour: orange (RAL 2003) in accordance with DESINA	
Lowest permissible bend radius	At least 7.5 × cable diameter	
Temperature range cable	Flexing: -30 ... +80 °C Fixed installation: -40 ... +80 °C	
Rated voltage according to VDE	Power cores: U _o /U 600/1000 V Pilot cores: U _o /U 300/500 V	

Structure Diagram of a Drive System with Synchronous Motor

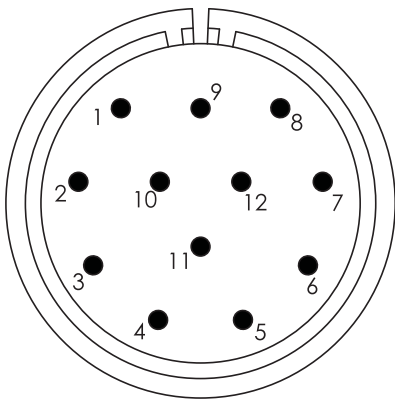


Core measurement motor connection & KTY cable		
Number of cores x cross section mm²	Current A	Outer diameter mm
4×1.5/(2×1)	up to 18	11.5
4×2.5/(2×1)	up to 26	13.6
4×4/(2×1)	up to 34	15
4×6/(2×1)	up to 44	16.1
4×10/(2×1)	up to 61	20.2
4×16/(2×1)	up to 82	23.8

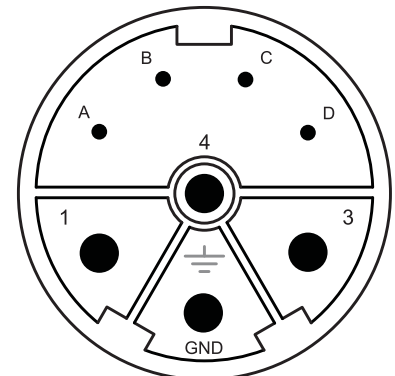
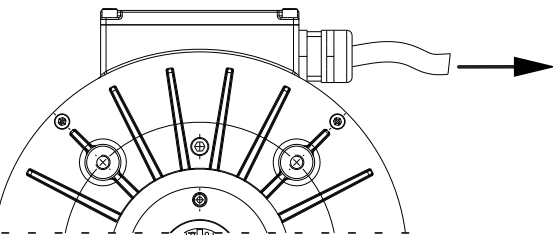
PMS/PGS Technical Data

Resolver connector: Coninvers - M 23 - Series RC - 12-pole
Type: Pin insert on motor side, reverse rotation, coding centre

Pin	Function
1	COS +
2	COS –
3	SIN +
4	SIN –
5	n.c.
6	REF +
7	REF –
8	n.c.
9	n.c.
10	n.c.
11	KTY +/PTC
12	KTY –/PTC



Coninvers-M23 pin, RC Series, 12-pole
view on pin insert from connector side



View of pin insert from the connector side

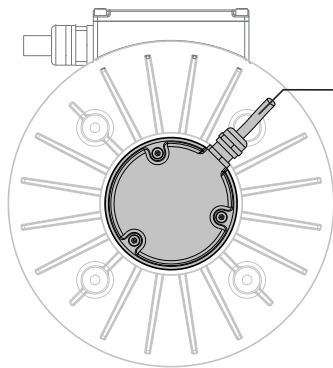
Power connector M23
Pin insert on motor side

Pin	Function
1	Phase U
4	Phase V
3	Phase W
GND/2	PE
A	n.c.
B	n.c.
C	KTY –/PTC
D	KTY +/PTC

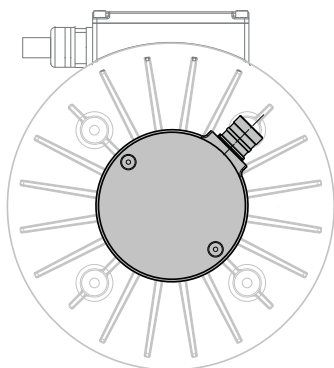
Open cable ends

Core colour	No.	Function
black	1	Phase U
black	2	Phase V
black	3	Phase W
green-yellow		PE
red or black		KTY +
black		KTY –

Motor feedback connection



Motor feedback with cable gland



Motor feedback with connector

Technical Data/Structure

Overall screen	Galvanised copper braid
Outer sheath	PVC
Lowest permissible bend radius	At least 6 × cable diameter
Temperature range sensor	Flexing: -5 ... +70 °C Fixed installation: -40 ... +80 °C
Rated voltage according to VDE	500 V
Effective capacitance	Core/core: approx. 120 nF/km Core/sheath: approx. 160 nF/km

Sinus-Cosinus Encoder Type: RMB 29AC (RLS)	Function	Wire colour	
		UNITRONIC PUR CP (colour code DIN 47100)	UNITRONIC 100 CY (colour code UNITRONIC)
	SIN	pink	black
	COS	brown	brown
	VCC	green	green
	GND/KTY –	yellow	yellow
	KTY+	white	beige

Resolver Type: RE (LTN)	Function	Wire colour
	REF+	red-white
	REF –	black-white (or yellow-white)
	COS+	red
	COS –	black
	SIN+	yellow
	SIN-	blue

SSI Encoder, 12bit Type RMB 28SC (RLS)	Function	Wire colour	
		UNITRONIC 100 CY (colour code UNITRONIC)	ÖLFLEX classic 100
	CLOCK+	pink	
	CLOCK –	blue	
	DATA+	white	
	DATA –	brown	
	VCC	green	
	GND	yellow	
	KTY+		brown
	KTY –		blue

Hall-type sensors (HEINZMANN)	Function	Wire colour
	Hall 1	yellow
	Hall 2	green
	Hall 3	grey
	VCC	brown
	GND	white

DirectPower E-Bike Motors

DIRECTPOWER PRA 180-25

HEINZMANN bicycle drives from the DirectPower series are characterised by innovative technology and flexibility. The independent control unit built into the battery box means that they can be integrated into a variety of systems. The power electronics are located outside the motor. So it is not affected by potential motor heat that might impair system performance. Whether used as a front or rear wheel drive, HEINZMANN e-bike drives will meet your needs.

The regeneration-enabled system can charge the battery during downhill travel and braking to achieve an increase in range.

Our drive can be installed in the front or rear wheel thanks to strict compliance with the standard dimensions used in the bicycle industry. This reduces manufacturing costs and gives our customers the highest possible flexibility in product design. After Sales Service and spare parts planning are therefore made significantly easier.

The option of turning the drives in both directions opens up a wealth of usage options, including outside the e-bike market. The mobility scooter sector is just one example.



Features

- ▶ Front/rear wheel drive
- ▶ Support up to 50 km/h*
 - ▶ Nominal output up to 500 W*
 - ▶ 11 Nm nominal and 60 Nm peak torque
 - ▶ Weight: 4.5 kg (front wheel), 4.7 kg (rear wheel)
 - ▶ Regeneration in the front and rear wheel
 - ▶ Brake discs can be mounted on the front and rear wheel
 - ▶ No gear, no brush, no wear, no noise
 - ▶ Cassette can be used
- ▶ The power electronics are not installed in the motor, so motor heat does not impair their performance
- ▶ Backwards travel is possible for special applications

* Comply with the relevant legal requirements when using.

Range of Applications

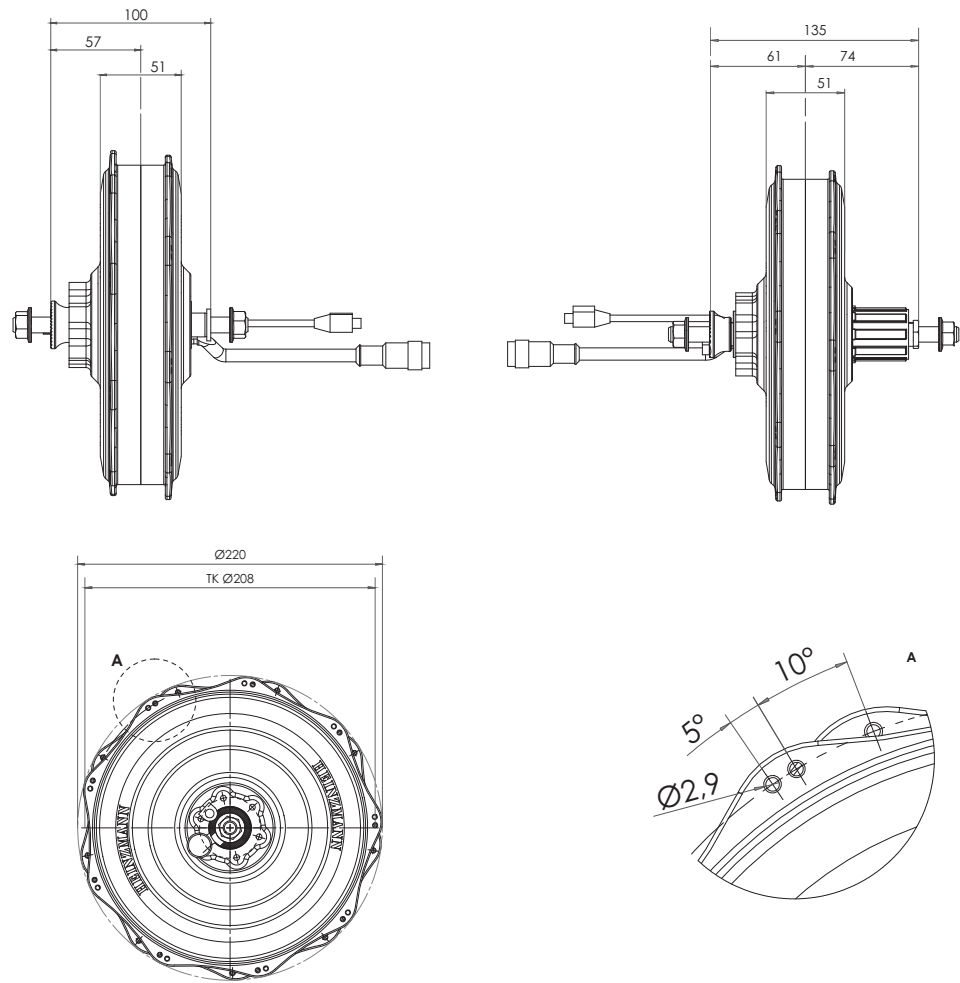
- E-Bikes
- Rehab bikes
- Pedelecs
- Special applications



Technical Data

	Pedelec	Pedelec 20"	Speed Pedelec
DC supply voltage	36 VDC		
Rated power	250 W	250 W	500 W
Nominal speed	210 rpm	275 rpm	380 rpm
Typical speed limit in km/h according to rim size	20"	25	38
	24"	32	42
	26"	34	46
	28"	37	50
Impulse torque	60 Nm		
Degree of protection	IP54		
Weight	4.5 kg front wheel motor 4.7 kg rear wheel motor		

Dimensions



DirectPower System Components

DIRECTPOWER COMPLETE SYSTEM

HEINZMANN supplies complete drive systems based on the DirectPower motor. A selection of system components has been specially tailored to the DirectPower drive. Customers can make a personal selection to meet their needs.



Downtube battery

Battery pack

Optionally perfectly integrated in the luggage carrier or as downtube battery
Safe, tested and proven lithium ion technology
Carrier battery: 36 V/11 Ah
Downtube battery: 36 V/14.25 Ah
Passive cell balancing increases the service life of the battery pack
Technically, mechanically and visually sophisticated
Magnetic plug connections for quick mounting of the battery
Watertight and robust
Shock and vibration resistant



Carrier battery



Display

Separate control unit on the handlebar for safe operation when traveling
Clear display of key operating data
Quick setting of support levels
Simple activation of assisted pull-away
Bicycle anti-theft protection through user-specific PIN
Easy to read, even in bright conditions



Twist grip

Can be combined with display and control unit
Assisted pull-away up to 6 km/h or 20 km/h E-bike and S-Pedelec
For handlebars with a diameter of 22.2 mm

Service Software	Clear user interface
	Quick troubleshooting in the event of faults
	Built-in wizard for convenient quick configuration
	Parameters can be set easily by the dealer
	All major system parameters can be configured in the field
	Protection system against plant data manipulation
	Control firmware can be updated in the field
	Automatic Internet



Luggage carrier

Universal e-bike carrier
Aluminium tube 10 mm, weight 1000 g
Outstanding weight/stability ratio and lateral rigidity
Corrosion-resistant
Various adaptation options through the built-in Quick Snap System
With LineTec lighting
Max. load limit 30 kg



Sensor

The pedal speed sensor can be mounted on the right or left
Cable length on request



Torque sensor

The system is pre-programmed and tested for a range of torque sensors. Additional adaptations can be made for the torque sensor of your choice as necessary.

Control

Drive control in the luggage carrier or on the downtube
Pre-programmed for various merchantable torque sensors
Various parameters can be adapted by the customer to set an individual driving style (support levels, assisted pull-away and many more)
Optimal monitoring of the electrical system
Integrated safety routines
Software can be updated via an interface
Optionally prepared for regeneration and equipped with brake levers with switches
Assisted pull-away can be parameterized via a control element on the display or via handle bar

CargoPower Motor

CARGOPOWER RN 111

HEINZMANN has developed a drive system for cargo bikes that leaves nothing to be desired. This powerful wheel hub motor combined with proven system components guarantee maximum driving force for a wide range of professional and commercial applications.

The HEINZMANN heavy-duty motor CargoPower RN 111 offers innovative technology, robust design and good reliability. It has been specially developed for heavy-duty applications. Torque, torque support and the reliable axle loads are specifically designed for uses like these.

CargoPower is the most compact motor in its class. A unique high torque and equally high power density are achieved with a high-performance planetary gear made from hardened steel and innovative oil lubrication and cooling. The wheel hub motor can run in reverse and regenerate. This makes manoeuvring easier, even on three-wheel models, and supports braking when travelling downhill. The range is increased and the wear on the brakes is reduced.



Features

- ▶ High torque at low speeds
- ▶ Maximum efficiency over the entire speed range
- ▶ High power and torque density due to optimal heat dissipation through oil cooling
- ▶ Reduced derating
- ▶ Torque sensor integrated in the rear wheel motor

Installation Versions

The compact design enables the motor to be installed in standard forks (100 mm) or standard frame dropouts (135 mm).

Mounting on one side is also possible, e.g. for three-wheel models. The optimised geometry of the flanges enables easy spoking on 20" to 29" rims.

The motor is suitable for rear wheel, front wheel or single sided mounting.

Range of Applications

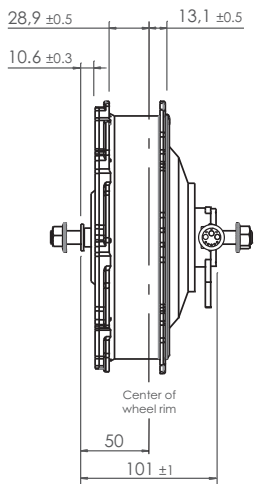
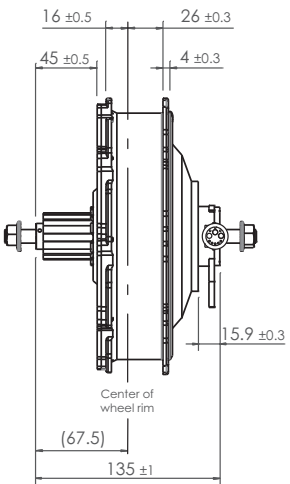
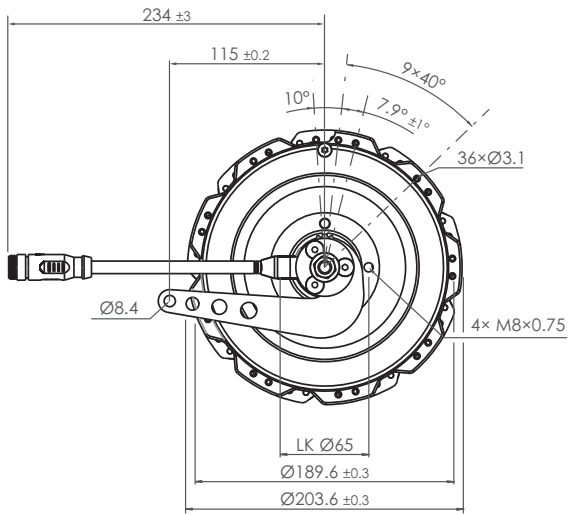
- Cargo bikes
- Rehab bikes
- Special applications



Technical Data

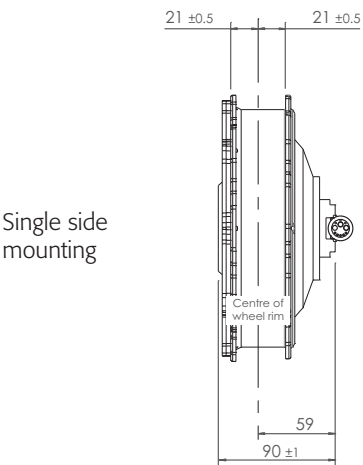
Nominal output	250 ... 600 W
Nominal speed	200 rpm
Torque	up to 31 Nm
Voltage	36 / 48 VDC
Temporary peak power	1350 W
Maximum torque	113 Nm
Degree of protection	IP65
Weight	5.1 kg
Speed	25 km/h
Axle load	Front wheel 150 kg Rear wheel 125 kg Single side mounting 100 kg

Dimensions



Rear wheel

Front wheel



Single side mounting

CargoPower System Components

CARGOPOWER COMPLETE SYSTEM


The system components for the CargoPower system are coordinated specifically for this powerful drive.

The complete system comprises a motor, a control unit, battery with mounting system, operating panel plus – depending on the configuration – supplementary sensors.

There are two types of battery available to meet various power requirements (Heavy Duty and Active Power Battery). Our systems can also be combined with batteries from other manufacturers.

A torque sensor is deployed in the hub as standard in order to control the support.

Other options for the system include a twist grip. Further variants are also possible. Our sales team will advise you on a tailored solution.



Controller box
Heavy Duty
Battery


Control	Drive control in a separate housing
	Various parameters can be adapted by the OEM to set an individual driving style (support levels, assisted pull-away and many more)
	Optimal monitoring of the electrical system
	Optionally prepared for regeneration and connecting brake handles with installed actuation switch
	Parametrizable assisted pull-away either via the control element on the display or via twist grip
	Reverse travel
	CAN bus interface
	Degree of protection IP65



Heavy Duty Battery


Battery pack	Heavy Duty Battery
	Safe, tried-and-tested lithium-ion technology
	46.8 V/807 Wh
	Passive cell balancing increases the service life of the battery pack
	Technically, mechanically and visually sophisticated
	CAN bus interface
	Degree of protection IP65

Service software	Clear user interface
	Quick troubleshooting in the event of faults
	Built-in wizard for convenient quick configuration
	Easy parametrisation for manufacturers
	All major system parameters can be configured in the field
	Protective system against plant data manipulation
	Control firmware can be updated in the field



Sensor

Sensor	Cadence sensor can be mounted on the right or left side
	Cable length on request



Control panel

Control panel	Can be mounted on the left or right side of handlebar and easily be switched to a laterally correct image on the screen
	Quick setting of support levels, safe operation while travelling
	Convenient display functions
	Outstanding readability, even in sunlight
	Bluetooth interface
	Micro USB interface with charging function for smartphone
	Degree of protection IP65

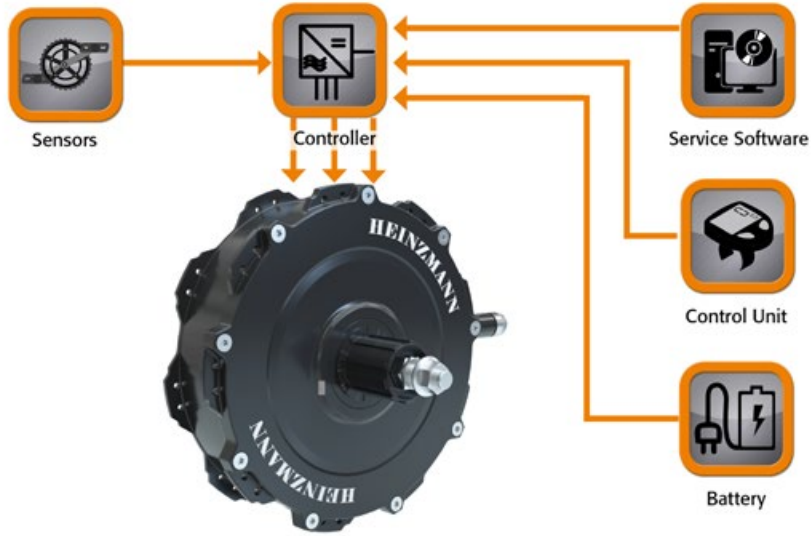


Twist grip

Twist grip	For handlebars with a diameter of 22.2 mm
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System overview

System modules for front and rear wheel installation and optional components.



CargoPower Motor

Classic Motor

System overviews

Front wheel installation

System components	Part numbers
Front wheel motor	880-00-181-xx
Controller	880-81-248-xx
Heavy Duty Battery	880-80-281-00
Charger	010-33-037-00
Control unit	010-69-325-20
Cadence sensor	870-81-134-10 (right pedal side) 870-81-145-10 (left pedal side) 010-29-049-00 (magnetic disc)

Variants on request

Rear wheel installation

System components	Part numbers
Rear wheel motor incl. freewheel for cassettes with integrated torque sensor	880-00-180-xx
Controller	880-81-248-xx
Heavy Duty Battery	880-80-281-00
Charger	010-33-037-00
Control unit	010-69-325-20

Variants on request

Optional components

System components	Part numbers
Splitter cable	010-69-325-50
Twist grip	870-90-069-00

CLASSIC RN 120

HEINZMANN Classic motors have been proving themselves in electric bicycles for decades. The HEINZMANN Classic bicycle drive is characterised by the tried-and-tested robust technology, combined with the innovative optimisation of its components and properties. The powerful DC motor offers even power development with economical use of the battery capacity.

Powerful torques are achieved with the built-in gear, which offers the rider maximum support, even during uphill travel or with increased loads. This makes this drive particularly suited to use in mobility scooters, for cargo bikes and for special applications.

At the heart of the Classic drive system is the RN 120, which combines the proven Classic motor with robust and reliable system modules.

Decades of experience in the field of bicycle drives make us a reliable partner. The reliability of HEINZMANN drives is also highly valued by Deutsche Post, who have them fitted on their electric bicycles.

Features

- ▶ Powerful, proven DC wheel hub motor
- ▶ Front/rear wheel drive
- ▶ Gear for highest torques
- ▶ Support up to 25 km/h
- ▶ Rated power 250 W
- ▶ Torque up to nominal 11.4 Nm (28"), up to nominal 13.2 Nm (26")
- ▶ Weight: approx. 3.5 kg
- ▶ Max. values for the torques are 35 to 60 Nm depending on the design



Range of Applications

- E-Bikes
- Velotaxis



E-Bike Deutsche Post

Drive Systems

Applications

Synchronous Motors & Generators

Wheel Hub Motors

DC Disc Motors

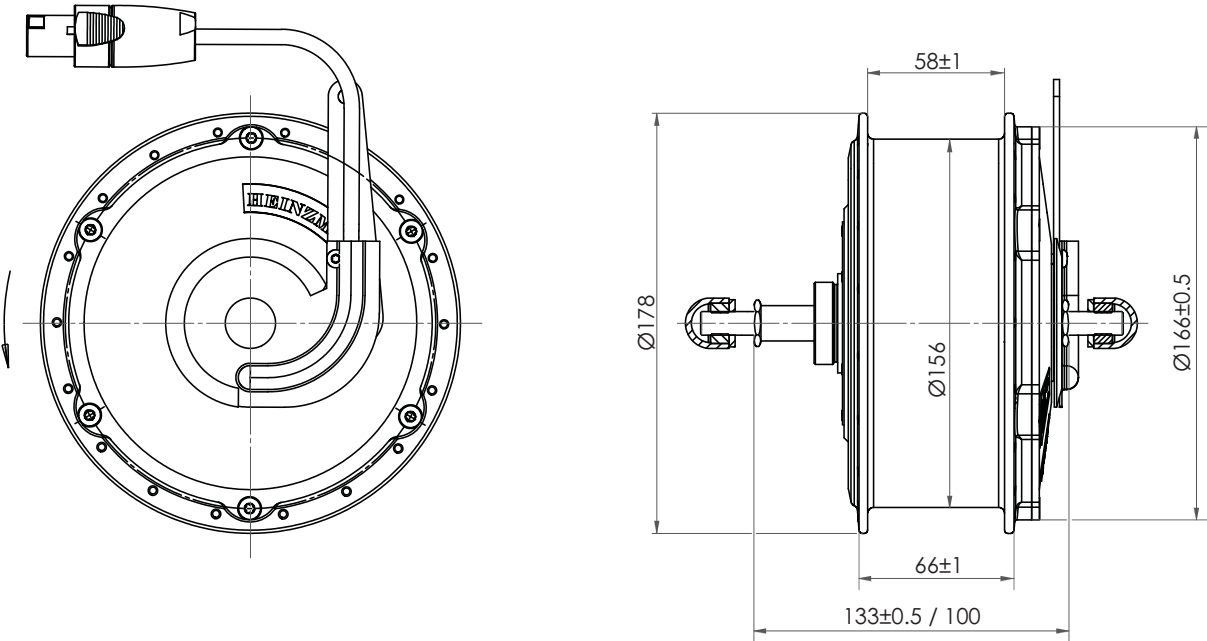
Classic Motor & System Components

Technical Data

Rated voltage	36 VDC	
Rated power	250 W	
Weight	3.5 kg	
Max. weight vehicle*	120 kg	
Wheel size	26"	28"
Rated speed	210 rpm	180 rpm
Rated torque in operational mode S1	13.2 Nm	11.4 Nm
Degree of protection	IP54	

* with load

Dimensions



COMPLETE SYSTEM CLASSIC

The Classic Drive System combines long-established system components.



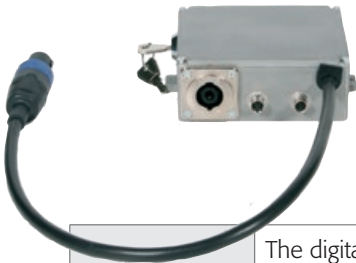
Battery

The lithium ion battery is in the saddle bag
Supplied with a built-in battery management system for longer battery life
Available with 9 or 13 Ah



Luggage carrier

The luggage carrier is designed for mounting a control unit and up to two batteries
Max. permitted total weight 30 kg



Control

The digital control unit offers two control options: customers can choose between a twist grip with pedal speed sensor or a solution with twist grip only
The control is pre-parameterised for all requirements, such as assisted pull-away up to 6 km/h or heavy load start



Twist grip

Digital twist grip
LED light indicator charge condition
ON/OFF switch
Eco Mode
Cable length on request



Sensor

The pedal speed sensor can be mounted on the right or left
Cable length on request

PRA Motor



PRA 230

The gearless PRA 230 wheel hub drive is a permanently excited, synchronous external-rotor motor with built-in wheel bearing and is mounted directly on the rim.

Successfully employed many times over, this wheel drive is maintenance-free, quiet and boasts impressive braking energy recuperation and a high starting torque.

Part of the PRA series, this direct drive is available in a gearless design and operated using a commercial controller. It is connected to the chassis via clamp connection. Naturally, it also has a brake-disc connection. Its degree of protection is IP54.

The PRA 230 is suitable for use on 1-wheel, 2-wheel and all-wheel drives.



Features

- ▶ Gearless
- ▶ Maintenance-free
- ▶ Low noise
- ▶ Integrated wheel bearing
- ▶ Energy recuperation
- ▶ High starting torque

Technical Data

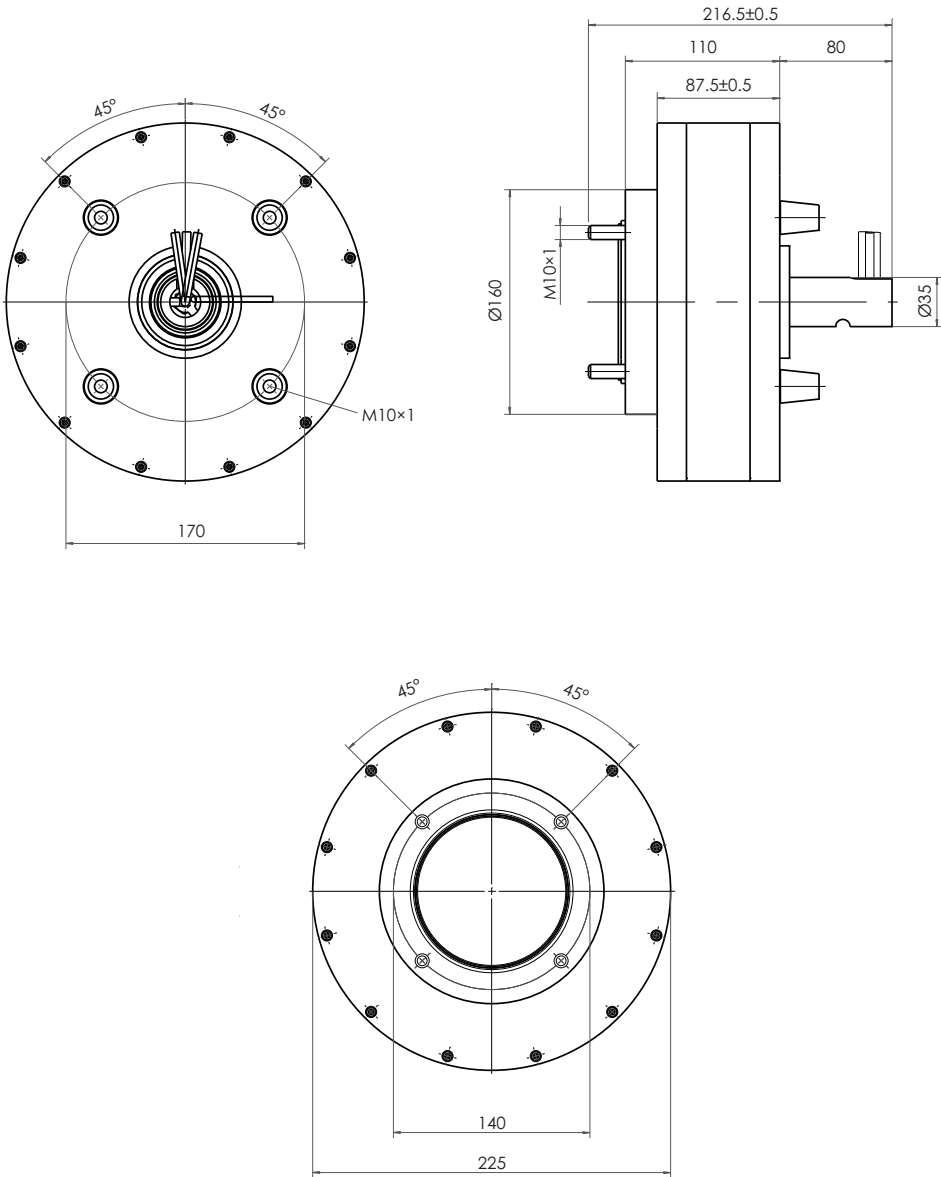
Rated power	1.6 kW Operational mode S1
Rated speed	420 rpm
Max. torque	160 Nm
Battery voltage	48 V
Max. wheel load	2000 N
Degree of protection	IP54
Weight	16 kg

Range of Applications

- Light electric vehicles
- E-Scooters
- Handicap vehicles
- Driverless transport vehicles



Dimensions



PMG Motor

PMG 132

The PMG 132 is a multi-pole, permanently excited DC disc motor.

The excitation field is created using high-performance permanent magnets from rare earths.



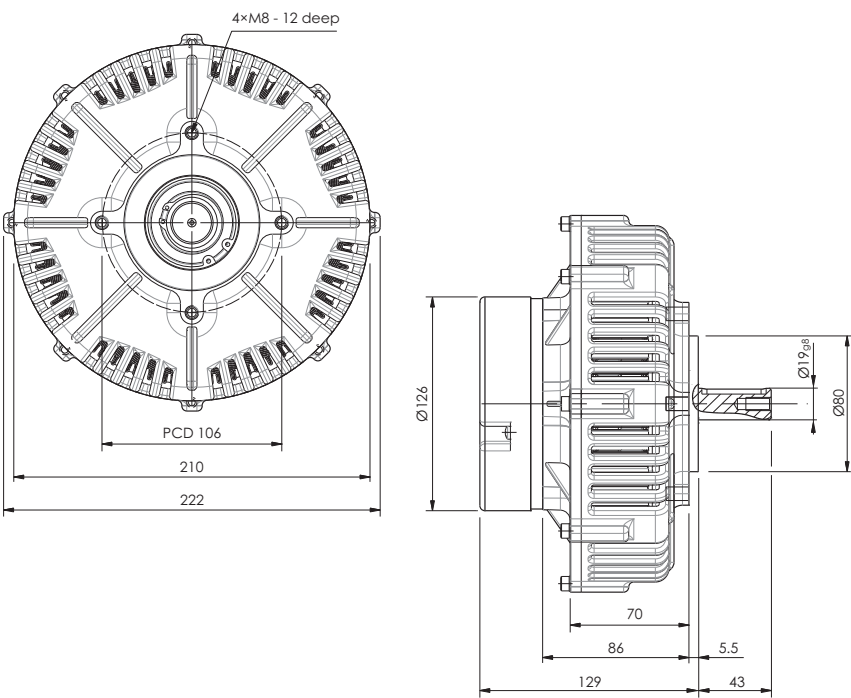
The disc-shaped rotor has been made with copper-profiled lamellae at whose inner end a disc commutator is moulded by means of suitable profiling. Power is transmitted via metalliferous carbon brushes that are optimally adapted to the shape of the commutator and conducted via a special brush holder alignment.

The magnetic flow passes axially through the lamination stacks. This alignment reduces the air gap to the minimum required mechanically and reduces magnetic losses. What results is far greater efficiency (approx. 90 %) across a broad range of operating conditions.

Features

- ▶ Compact
- ▶ Cost-efficient
- ▶ High efficiency
- ▶ Less installation space thanks to compact design
- ▶ Lower power-to-weight ratio
- ▶ Strong torque
- ▶ Greater efficiency over broad range of operating conditions
- ▶ Simple control
- ▶ Energy recovery possible through regenerative operation
- ▶ Cost advantage through integration of commutator into winding ends

Dimensions



Range of Applications

- Generally all kind of battery driven and electric vehicles
- Boat drives
- Cleaning machines
- Fans

Technical Data

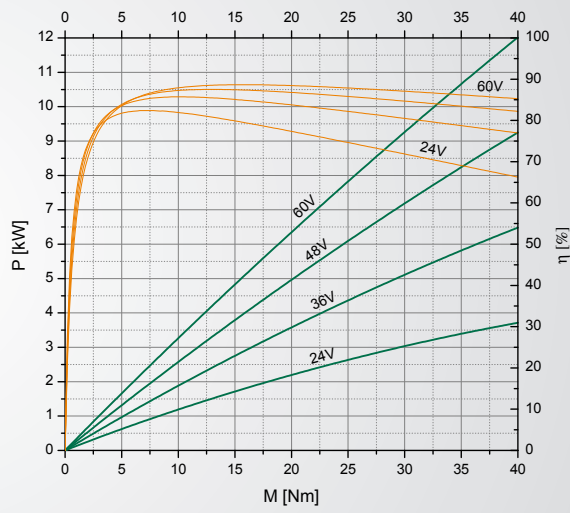
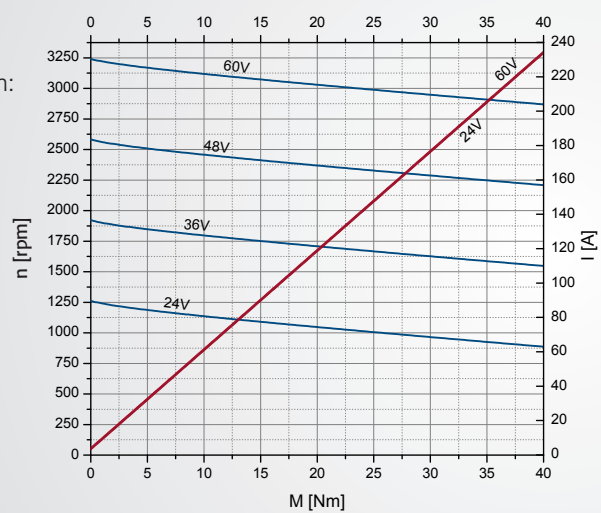
Operation voltage	24 V	36 V	48 V	60 V
Rated power	1.8 kW	3.1 kW	4.7 kW	5.1 kW
Rated speed	1100 rpm	1800 rpm	2400 rpm	3000 rpm
Rated current	90 A	97 A	110 A	97 A
Rated load torque	15 Nm	16 Nm	19 Nm	16 Nm
Table valid for operation in duty type S1				
DC current in short-time duty S2 10 min	210 A			
Peak torque	38 Nm			
Mass inertia	0,025 kgm ²			
Inductance	0,019 mH			
Resistance	16 mΩ			
Degree of protection	IP20			
Weight	approx. 12.5 kg			

Selection Diagram

Motor type:
PMG132

Magnet system:
3.9/1.2

Edition:
08/2014



Series of SL Motors

SL MOTORS

Flat, dynamic and extremely adaptable: HEINZMANN DC disc motors. Because of their streamlined design, which distinguishes them from other electric motors, they constitute the best solution for a customer seeking a drive of up to 1.1 kW that can be easily and precisely controlled and can fit in a restricted installation space.

Disc motors have proven themselves in many applications within machinery and equipment manufacture and also medical engineering, reliably performing a wide variety of drive tasks with quiet synchronous operation.

The continuous development of the materials used has achieved a much greater gap between maintenance intervals for wearing parts (e.g. charcoal and collectors). This is why brush drives with a somewhat limited service life now have only a subordinate role to play.

The „disc rotor“ is thus a drive solution that not only provides the aforementioned benefits, but also offers an impressive price-performance ratio.



Features

► Flat

HEINZMANN disc motors are flat when installed. It is this extremely flat design that opens up installation options that are just not possible with other motors. The permanent magnets arranged in a circle around the shaft produce an axial field through the disc rotor while ensuring a large air gap area proportional to the available torque. The result is a powerful motor within the smallest possible installation space.

► Dynamic

DC disc motors have a thin, non-ferrous disc armature for an extremely low intrinsic moment of inertia. Manufactured as air coils, the windings are characterised by low inductance and low internal resistance to ensure a very low electrical time constant. This results in dynamic drives that can be easily and precisely controlled.

► Adaptable

SL disc motors are not only available in the versions presented here. These are just a selection of the possibilities on offer in order to facilitate that first choice. We excel at providing customised solutions. Our strong sales, design and motor development teams will dedicate themselves to your request so we can arrive at the optimum solution for your drive together.

► Robust

HEINZMANN originally developed and optimised disc motors for use in proprietary products. The features mentioned above have been implemented to optimum levels in our internal mechatronic systems.

Our many years of testing has resulted in robust motors that can operate under the toughest of environmental conditions.

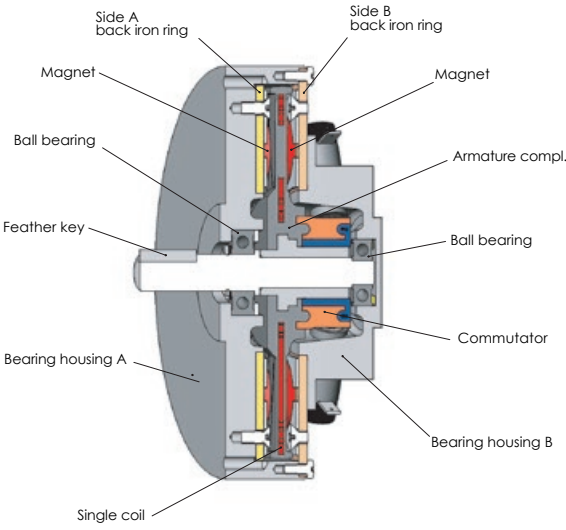
Applications

DC disc motors with brushes have been used for several decades now in rough environments in HEINZMANN actuators for medium and large combustion engines.

Range of Applications

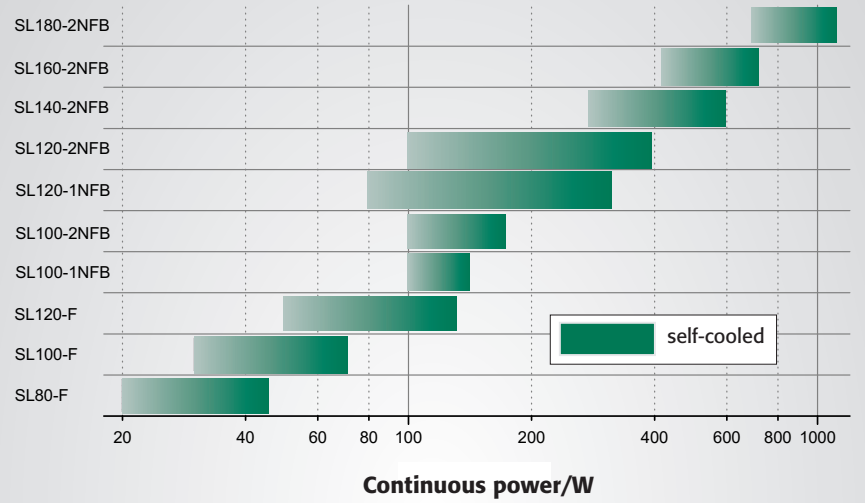
- Industrial and individual transport systems with greater range than electric vehicles, guided warehouse vehicles or disabled person assistance systems
- Positioning and delivery systems or handling units
- Machine tools, winding devices
- Pumps
- Replacement for hydraulic systems in agricultural vehicles and machinery
- Medical engineering, e.g. centrifuges, hose and metering pumps

They are also deployed in other industrial applications wherever reliable operation at the supply voltage itself is required, without any need for a controller. However, an optional controller does allow torque and speed to be regulated as well.

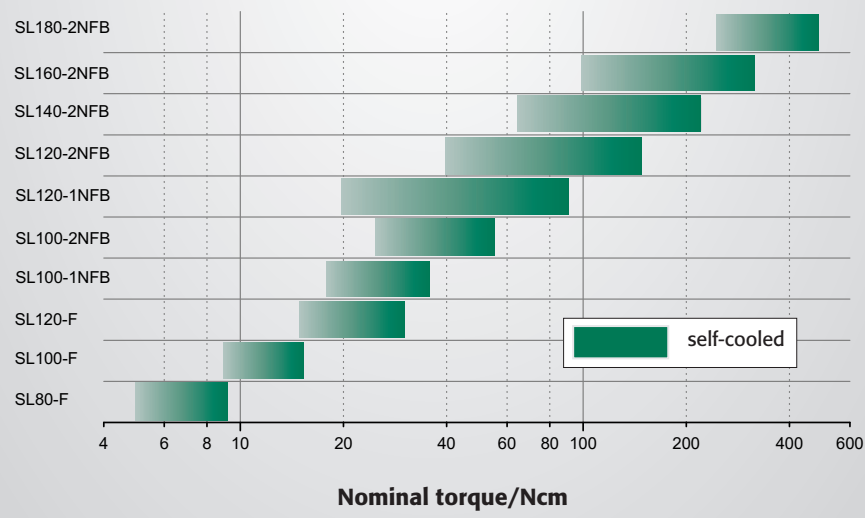


Cross section of a disc motor SL 120-2NFB

Power range SL motors



Torque range SL motors



Drive Systems

Applications

Synchronous Motors & Generators

Wheel Hub Motors

DC Disc Motors

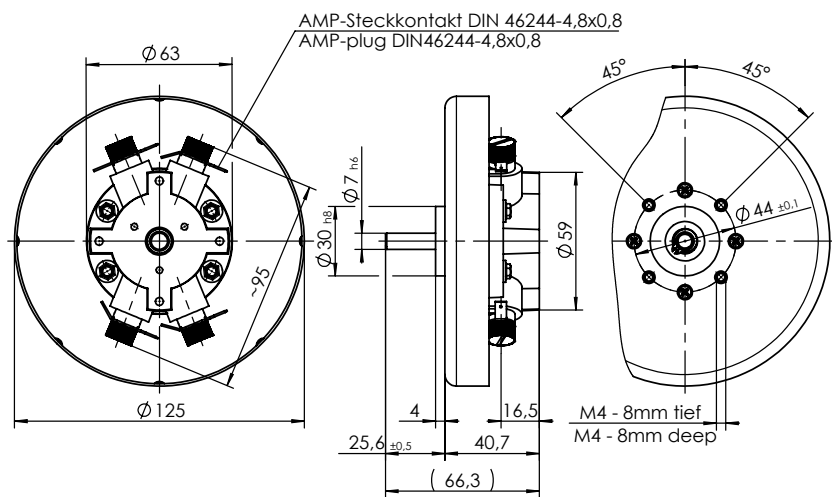
Series of SL Motors

SL 120-F

The SL 120-F is the largest SL series motor with brushes equipped with ferrite magnets.



Dimensions



Technical Data

	Rated voltage	Rated power	Rated speed	Rated load	Rated current	Back-EMF constant (25 °C)	Torque constant (25 °C)
Coil	U [VDC]	P [W]	n [rpm]	M [Ncm]	I [A]	K _E [V/1000 rpm]	K _T [Ncm/A]
8/63	12	44	1600	26	7.8	4.4	4.2
	15	63	2500	24	7.3		
	24	110	5000	20	6.5		
10/56	18	63	2400	25	6.1	5.5	5.3
	24	89	3700	23	5.8		
	36	110	6600	16	4.4		
12/53	24	79	2900	26	5.3	6.6	6.3
	36	110	5200	21	4.5		
	42	120	6400	18	4.1		
14/50	24	70	2300	29	5.0	7.7	7.4
	36	110	4300	25	4.6		
	48	125	6300	19	3.6		
16/45	24	53	1800	28	4.2	8.8	8.4
	36	95	3500	26	4.0		
	48	120	5200	22	3.5		
	60	120	7100	16	2.8		
22/40	36	64	2100	29	3.2	12.0	11.5
	48	96	3400	27	3.0		
	60	120	4700	24	2.8		
	72	130	5900	21	2.5		

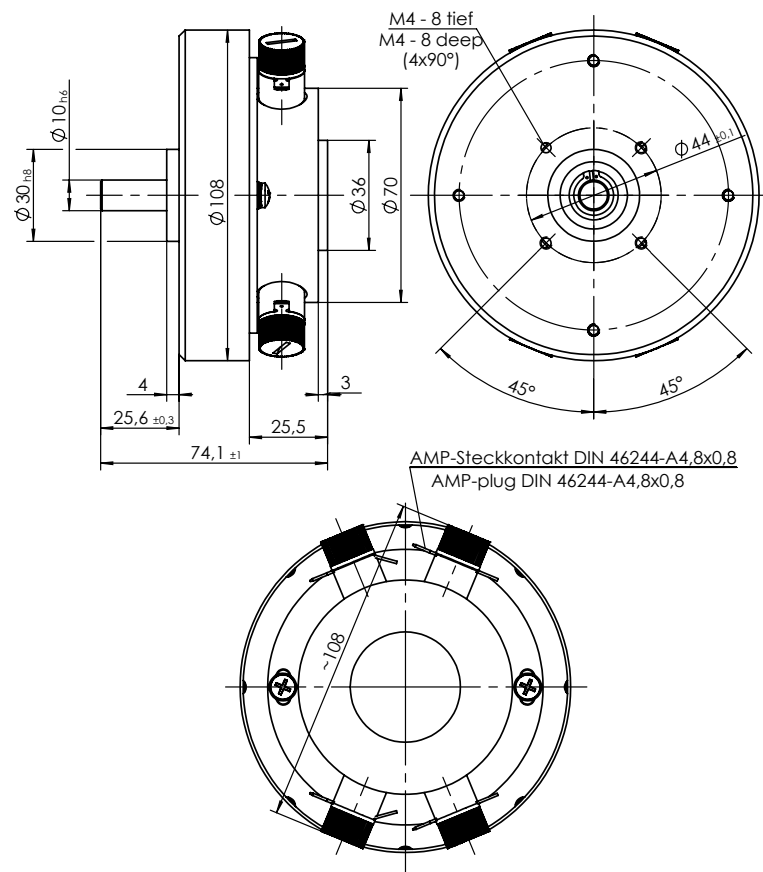
► m = 1.2 kg ► J = 2.5 kg · cm²

SL 100-1NFB

The SL 100-1NFB is the smallest DC disc motor with brushes of the SL series equipped with neodymium iron boron magnets.



Dimensions



Technical Data

	Rated voltage	Rated power	Rated speed	Rated load	Rated current	Back-EMF constant (25 °C)	Torque constant (25 °C)
Coil	U [VDC]	P [W]	n [rpm]	M [Ncm]	I [A]	K _E [V/1000 rpm]	K _T [Ncm/A]
4/90	12	100	4000	24	13	2.6	2.5
	15	100	5400	18	10		
5/85	12	100	3000	32	13	3.2	3.1
	18	120	5200	22	10		
7/71	18	110	3200	33	9.6	4.5	4.3
	24	120	4900	24	7.6		
10/60	27	110	5700	18	6.2	6.4	6.1
	24	120	3100	36	7.2		
	30	140	4200	31	6.5		
	36	130	5300	24	5.3		

► m = 0.9 kg ► J = 1.6 kg · cm²

Drive Systems

Applications

Synchronous
Motors & Generators

Wheel Hub Motors

DC Disc Motors

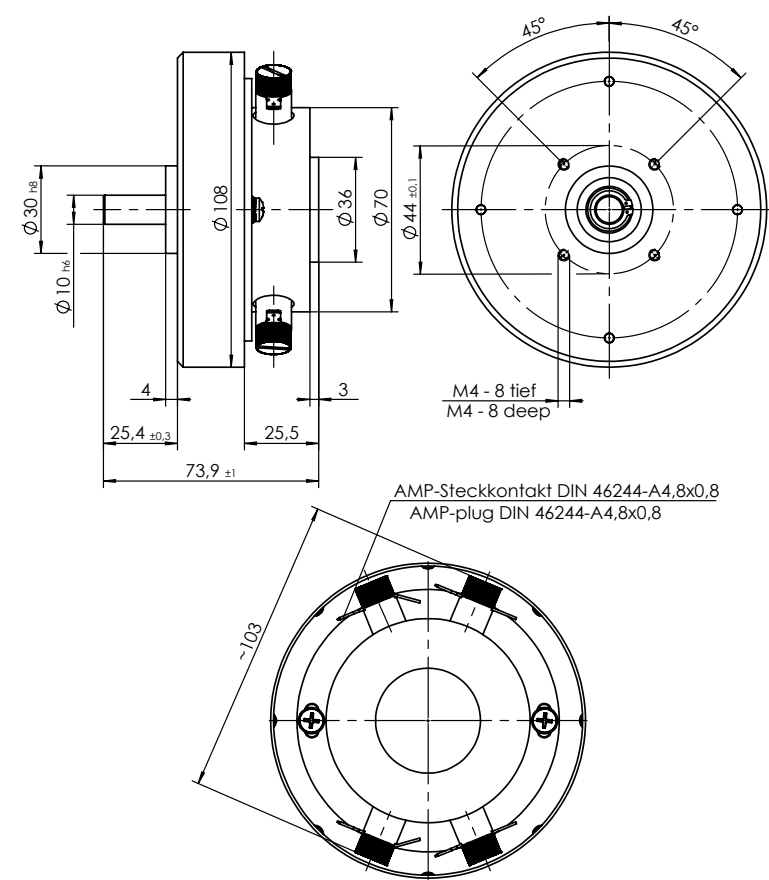
Series of SL Motors

SL 100-2NFB

In comparison, the SL 100-2NFB disc motor with brushes contains larger neodymium iron boron magnets.



Dimensions



Technical Data

	Rated voltage	Rated power	Rated speed	Rated load	Rated current	Back-EMF constant (25 °C)	Torque constant (25 °C)
Coil	U [VDC]	P [W]	n [rpm]	M [Ncm]	I [A]	K _E [V/1000 rpm]	K _T [Ncm/A]
4/90	12	110	2800	36	13.0	3.6	3.5
	15	140	3700	35	13.0		
5/85	18	160	3600	42	12.0	4.5	4.3
	24	130	5200	24	8.0		
7/71	18	120	2300	51	10.0	6.3	6.1
	24	160	3400	44	8.9		
	27	160	3900	40	8.3		
10/60	24	120	2100	56	7.6	9.0	8.6
	36	170	3600	46	6.5		
	48	140	5300	26	4.2		

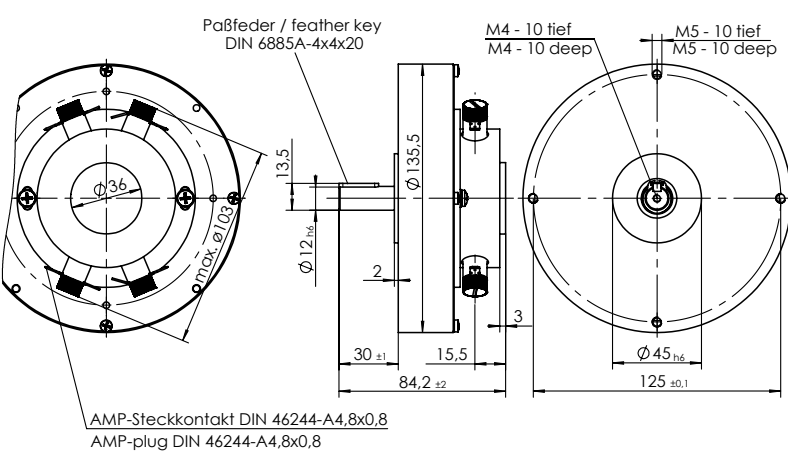
► m = 1.0 kg ► J = 1.6 kg · cm²

SL 120-1NFB

DC disc motor with brushes equipped with neodymium iron boron magnets.



Dimensions



Technical Data

	Rated voltage	Rated power	Rated speed	Rated load	Rated current	Back-EMF constant (25 °C)	Torque constant (25 °C)
Coil	U [VDC]	P [W]	n [rpm]	M [Ncm]	I [A]	K _E [V/1000 rpm]	K _T [Ncm/A]
3/106	12	77	3700	20	9.9	3.0	2.9
	15	96	4800	19	10.0		
5/100	18	140	3400	38	10.0	5.0	4.7
	24	180	4700	37	10.0		
7/90	27	200	5400	36	10.0	6.9	6.6
	36	270	5100	50	9.4		
10/75	24	160	1900	82	9.7	9.9	9.5
	36	260	3300	74	9.2		
15/63	48	300	4700	60	7.7	15.0	14.0
	36	180	1900	90	7.2		
17/56	48	250	2800	84	6.8	17.0	16.0
	72	310	4700	63	5.4		
	36	140	1600	85	6.0		
22/47,5	48	200	2400	80	5.7	22.0	21.0
	60	250	3200	75	5.4		
	72	280	4000	67	4.9		
	48	140	1600	84	4.6		
22/47,5	60	190	2300	80	4.4	22.0	21.0
	72	230	2900	76	4.2		
	80	250	3300	73	4.1		

► m = 1.8 kg ► J = 3.5 kg · cm²

Series of SL Motors

SL 120-2NFB

Disc motor variant 120-2NFB with brushes is equipped with enlarged neodymium iron boron magnets.

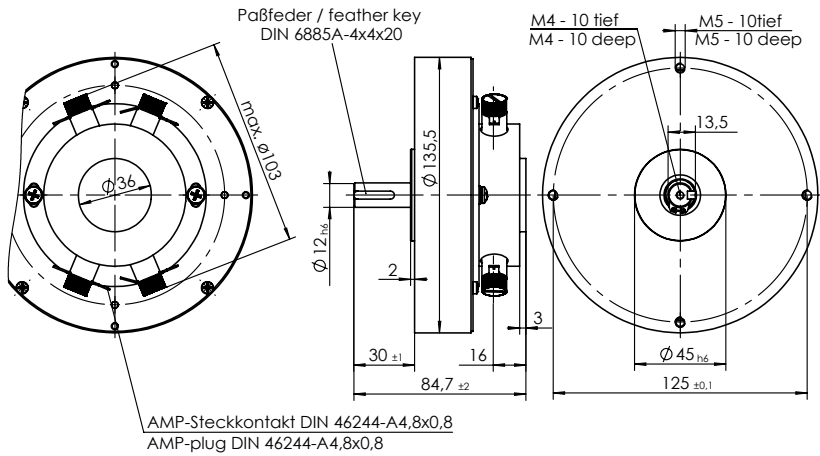


Technical Data

	Rated voltage	Rated power	Rated speed	Rated load	Rated current	Back-EMF constant (25 °C)	Torque constant (25 °C)
Coil	U [VDC]	P [W]	n [rpm]	M [Ncm]	I [A]	K _E [V/1000 rpm]	K _T [Ncm/A]
3/106	12	100	2300	41	11.0	4.8	4.6
	18	150	3600	40	12.0		
5/100	24	210	2900	70	11.0	8.1	7.7
	30	270	3700	70	11.0		
7/90	36	240	4500	50	8.7	11.0	10.0
	48	290	4300	65	7.7		
10/75	24	180	1900	90	9.7	16.0	15.0
	36	280	3100	85	9.7		
15/63	48	270	2000	130	9.6	24.0	23.0
	60	340	2800	115	8.7		
17/56	60	350	3700	90	7.1	27.0	26.0
	72	290	4600	60	5.1		
22/47,5	48	260	1700	145	7.1	35.0	34.0
	60	320	2300	135	6.7		
22/47,5	72	360	2900	120	6.0		
	80	380	3200	114	5.8		
22/47,5	48	200	1400	138	5.9	35.0	34.0
	60	270	2000	130	5.6		
22/47,5	72	310	2400	122	5.4		
	80	340	2800	116	5.2		
22/47,5	48	150	1000	140	4.6	35.0	34.0
	60	200	1400	135	4.5		
22/47,5	72	250	1800	133	4.5		
	80	260	2000	126	4.3		

► m = 1.9 kg ► J = 3.5 kg · cm²

Dimensions



SL 140-2NFB

Disc motor with brushes equipped with an enlarged rotor and neodymium iron boron magnets.

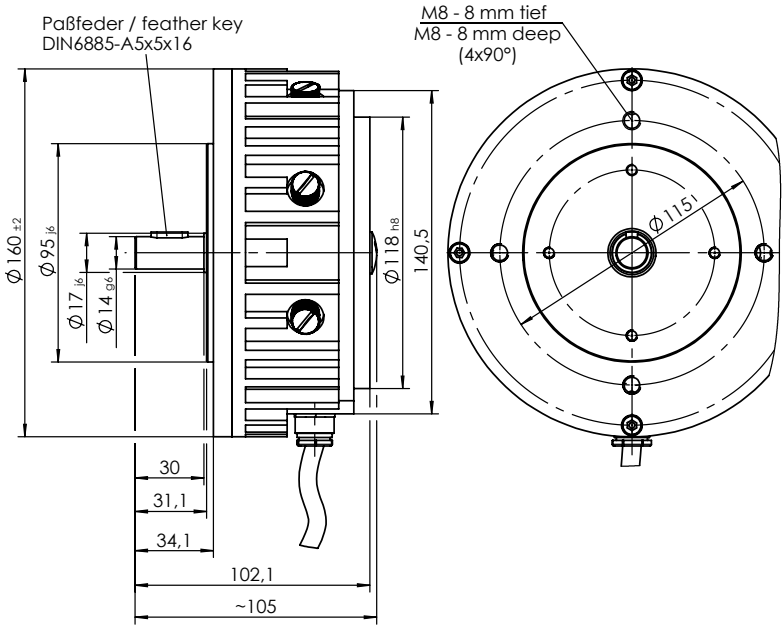


Technical Data

	Rated voltage	Rated power	Rated speed	Rated load	Rated current	Back-EMF constant (25 °C)	Torque constant (25 °C)
Coil	U [VDC]	P [W]	n [rpm]	M [Ncm]	I [A]	K _E [V/1000 rpm]	K _T [Ncm/A]
3/90	24	280	2000	135	16.0	11.0	10.0
	36	410	3300	120	14.0		
6/71	48	310	4600	64	8.6	21.0	20.0
	60	480	2700	170	9.8		
9/60	80	530	3800	132	7.9	32.0	31.0
	60	360	1700	200	7.6		
12/50	80	490	2400	196	7.4	42.0	40.0
	96	570	3000	180	6.9		
15/47,5	110	590	3500	160	6.2	53.0	50.0
	80	330	1700	185	5.3		
15/47,5	96	410	2100	185	5.3	53.0	50.0
	110	480	2500	185	5.3		
15/47,5	96	370	1600	220	4.9	53.0	50.0
	110	430	1900	215	4.8		
15/47,5	120	460	2100	210	4.8		

► m = 4.9 kg ► J = 4.9 kg · cm²

Dimensions



Drive Systems

Applications

Synchronous Motors & Generators

Wheel Hub Motors

DC Disc Motors

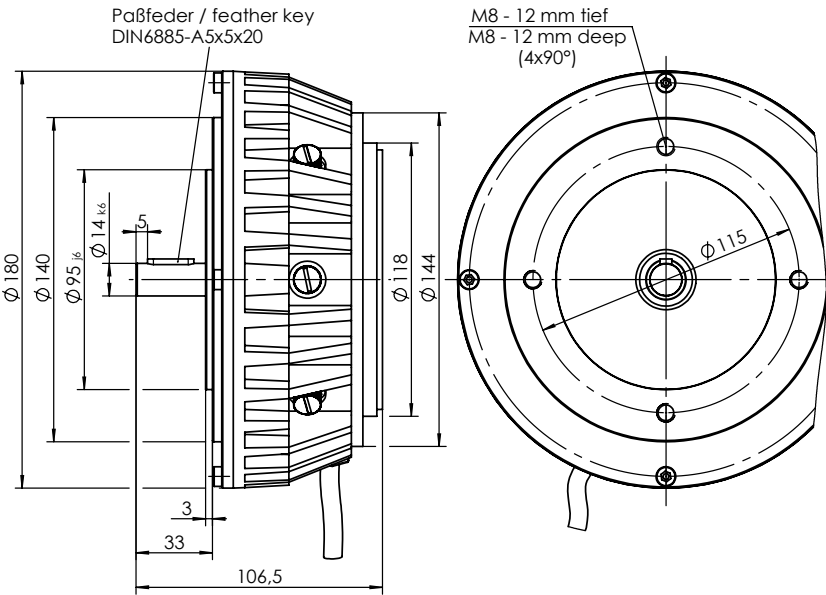
Series of SL Motors

SL 160-2NFB

The SL 160-2NFB is a disc motor with brushes, enlarged rotor and larger neodymium iron boron magnets.



Dimensions



Technical Data

	Rated voltage	Rated power	Rated speed	Rated load	Rated current	Back-EMF constant (25 °C)	Torque constant (25 °C)
Coil	U [VDC]	P [W]	n [rpm]	M [Ncm]	I [A]	K _E [V/1000 rpm]	K _T [Ncm/A]
3/90	36	440	2800	150	16.0	12.0	11.0
	48	420	4000	100	12.0		
6/80	48	510	1800	270	13.0	24.0	23.0
	60	600	2300	250	12.0		
	72	680	2900	225	11.0		
9/63	72	460	1800	245	8.1	36.0	35.0
	96	640	2500	245	8.2		
	120	710	3300	205	7.0		
12/60	96	570	1800	300	7.3	48.0	46.0
	110	630	2100	285	7.1		
	120	690	2400	275	6.8		
15/53	110	500	1600	300	5.8	61.0	58.0
	120	570	1800	300	5.9		
17/50	110	460	1400	315	5.4	69.0	66.0
	120	520	1600	310	5.3		

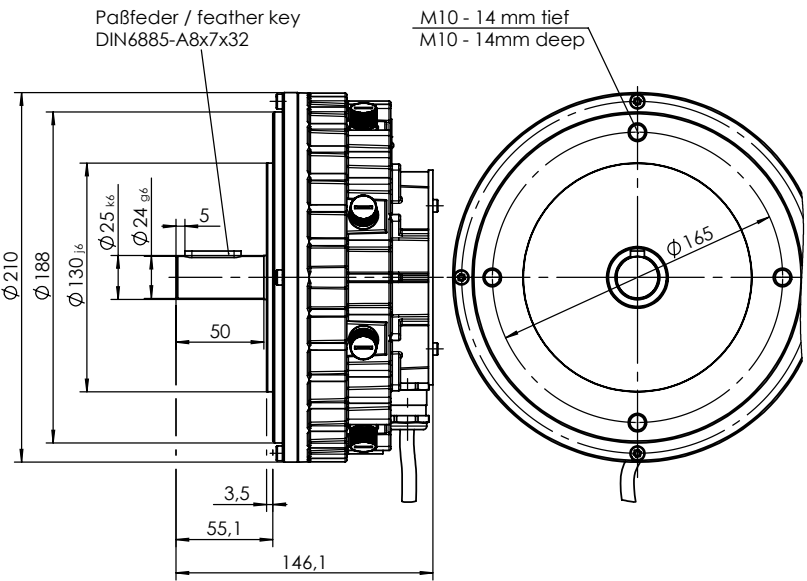
► m = 5.5 kg ► J = 11.3 kg · cm²

SL 180-2NFB

The SL 180-2NFB is the largest disc motor with brushes and large neodymium iron boron magnets.



Dimensions



Technical Data

	Rated voltage	Rated power	Rated speed	Rated load	Rated current	Back-EMF constant (25 °C)	Torque constant (25 °C)
Coil	U [VDC]	P [W]	n [rpm]	M [Ncm]	I [A]	K _E [V/1000 rpm]	K _T [Ncm/A]
3/90	60	770	2100	350	16.0	27.0	26.0
	80	910	2900	300	14.0		
6/63	125	830	2200	360	8.1	54.0	52.0
	150	930	2700	330	7.6		
	190	940	3600	250	5.9		
9/56	150	780	1700	440	6.5	81.0	77.0
	190	960	2300	400	5.9		
	220	1100	2700	375	5.7		
12/45	190	700	1600	415	4.6	110.0	100.0
	220	800	1900	400	4.5		
15/45	220	750	1500	480	4.2	130.0	120.0

► m = 10.2 kg ► J = 23.5 kg · cm²

Technical Data and Information

Motor type	Permanently excited DC motor in disc armature technology
General regulations	Complying with IEC 60034
Operational mode	S1 (continuous duty)
Cooling	Without cooling fan, without cooling circuit, mounting at adequate cooling surface is recommended
Permissible ambient temperature	-10 ... +40 °C
Pairs of poles	4
Magnetic material	Ferrite (F) Neodymium iron boron (1 NFB, 2 NFB), 1, 2 indicates size of magnets
Electrical connection	According to motor size and customer's request: flat connectors, terminal box, free cable
Electric strength	According to IEC 60034
Thermal class	F (155 °C)
Degree of protection	IP44, alternatives obtainable on request
Constructional type and fastening	On customer's request
Mounting orientation	Arbitrary
Shaft	On customer's request, hollow shaft optional
Optional extensions	Gearbox, tachometer generator, encoder, holding break
Temperature sensor	On request
Kind of surface	Steel: zinc coating Aluminium: uncoated
Rating	<p>All given characteristics of the motors are calculated data which may differ slightly, subject to alterations</p> <p>Without exception for the operating temperature status, based on: armature temperature ~ 125 °C solenoid temperature ~ 105 °C housing temperature ~ 85 °C</p> <p>Tolerances: Back-EMF constant and torque constant: ±6 % of nominal value Speed: ±8 % of nominal value Efficiency: 1.15 % of nominal value - 15 %</p> <p>Alternative voltage, speed, torque or power for customised applications obtainable on request.</p>

Permissible Forces

for 20,000 hours lifespan

Radial force F _R [N] at n rpm						
Speed	1500	3000	4500	6000	7000	Bearing A-side
Motor type						
SL 80-F	210	165	145	127	108	626
SL 100-F	303	263	223	183	156	6000
SL 120-F	303	263	223	183	156	6000
SL 100-1NFB	303	263	223	183	156	6000
SL 100-2NFB	360	300	260	230	220	6000
SL 120-1NFB	303	263	223	183	156	
SL 120-2NFB	360	300	260	230	220	
SL 140-2NFB	480	380	340	310	290	6003
SL 160-2NFB	480	380	340	310	290	6003
SL 180-2NFB	1150	900	780	720	680	6205

Axial force F _A [N] at n rpm					
Speed	1500	3000	4500	6000	7000
Motor type					
SL 80-F	42	36	31	25	22
SL 100-F	61	53	45	37	31
SL 120-F	61	53	45	37	31
SL 100-1NFB	61	53	45	37	31
SL 100-2NFB	87	75	64	52	45
SL 120-1NFB	104	90	77	63	54
SL 120-2NFB	104	90	77	63	54
SL 140-2NFB	144	125	106	87	74
SL 160-2NFB	144	125	106	87	74
SL 180-2NFB	345	299	254	208	178

Selection Diagrams

The operational characteristics of the HEINZMANN disc motors are best illustrated through motor diagrams. They enable the ideal motor variant to be selected to suit a particular application. The procedure for this is described below.

HEINZMANN offers a wide range of disc motor variants. You can access the full range of selection diagrams from our home page: www.heinzmann.com/en/e-motor.

How to use the selection diagrams

Each selection diagram consists of 2 subdiagrams.

The upper diagram in each case shows these characteristics:

- ▶ Speed - Torque (blue wide)
- ▶ Current - Torque (red narrow)

The lower diagram in each case shows these characteristics:

- ▶ Output - Torque (green wide)
- ▶ Efficiency - Torque (orange narrow)

The characteristics are shown for several voltages.

For overview purposes, the characteristics for the current and efficiency show only the lowest and the highest practical voltage (in this example, 36 V and 72 V). Characteristic values for voltages in between (in this instance, 48 V and 60 V) must be estimated.

The area highlighted in white on the diagram represents the safe operating range for the S1 operation of an uncooled motor mounted to a sufficiently sized cooling area. The wide red line represents the limit for a power loss that is just on the borderline (in this example 75 W).

The section highlighted in light grey in the diagram represents the range for which additional cooling measures are required to operate motors. Without them this operating range must be avoided. Depending on the type of motor and the winding design, there is a borderline for the maximum permissible speed (n_g). The relevant value is also specified in case it does not coincide with the borderline for power loss.

The diagrams are valid without exception for the operating temperature status, based on:

- ▶ Armature temperature ~ 125 °C
- ▶ Magnet temperature ~ 105 °C
- ▶ Ambient temperature 25 °C

Application example:

Given: Voltage $U = 48 \text{ V}$
Torque $M = 115 \text{ Ncm}$

Required: Speed n
Current I
Output P
Efficiency η

Readings in upper diagram:

- ▶ Starting from $M = 115 \text{ Ncm}$, go vertically (1) to the speed characteristic for $U = 48 \text{ V}$. Intersecting point A is on the borderline, i.e. still in the permitted area.
- ▶ From A, go left horizontally (2) to the left to the speed scale and then read off the relevant speed (here: ~2800 rpm).
- ▶ Continue from A vertically into the range between the two current characteristics (between 36 V and 72 V) and estimate point B.
- ▶ From B, go right horizontally (3) to the right to the current scale and then read off the relevant amperage (here: ~8.7 A).

Readings in lower diagram:

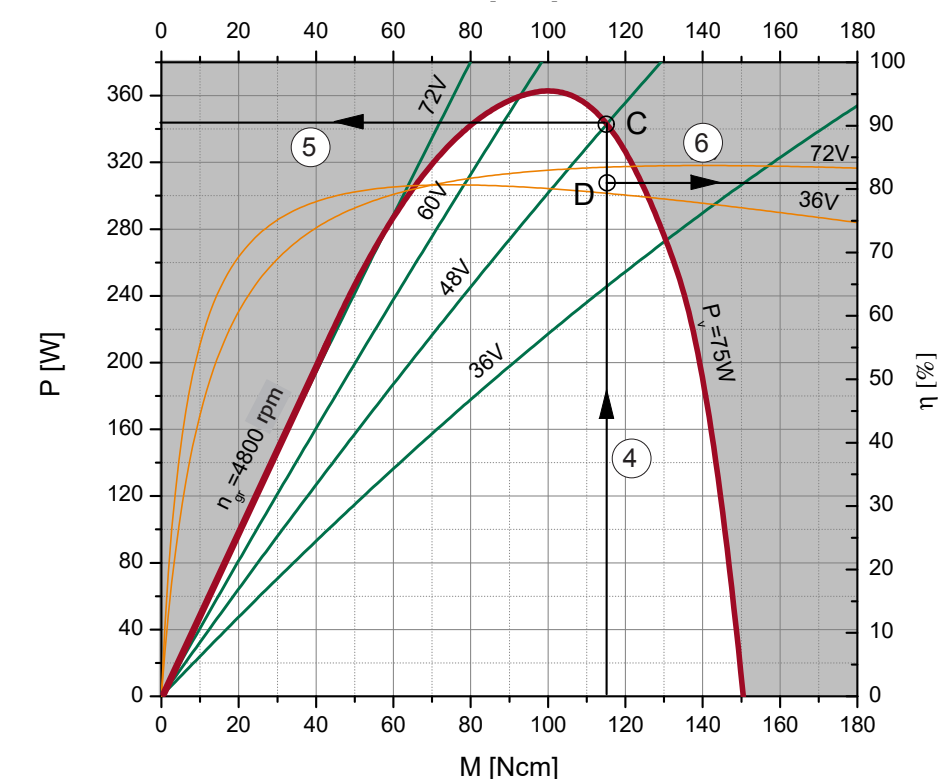
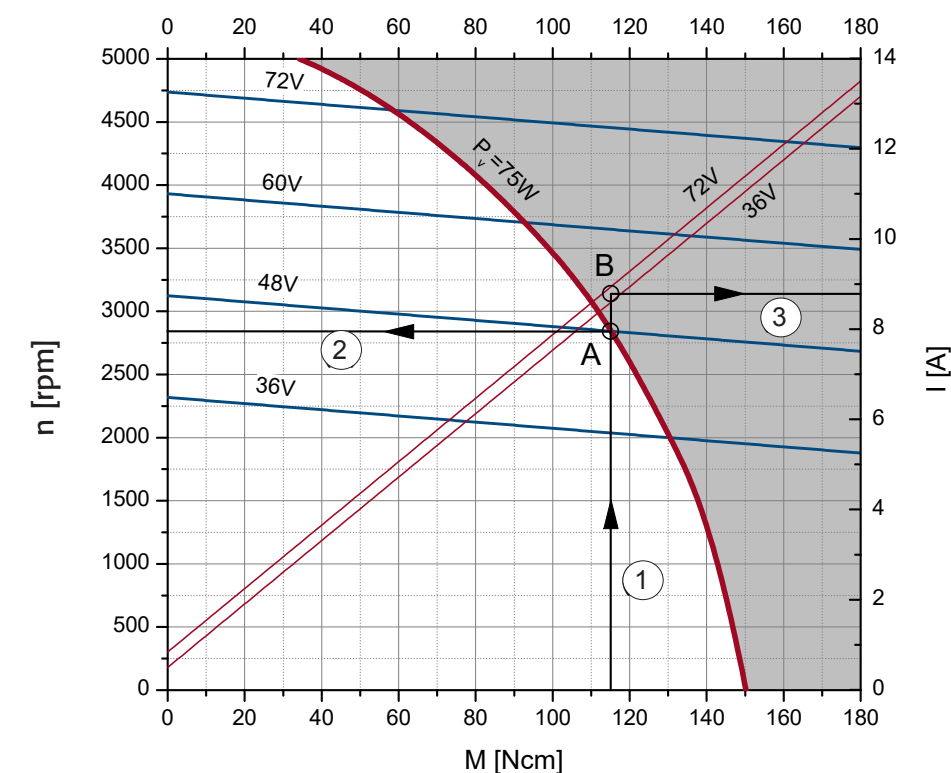
- ▶ Starting from $M = 115 \text{ Ncm}$, go vertically (4) to the output characteristic for $U = 48 \text{ V}$. Intersecting point C is also on the borderline, i.e. still in the permitted area.
- ▶ From C, go left horizontally (5) to the left to the output scale and then read off the relevant output (here: ~340 W).
- ▶ Continue from C vertically into the range between the two efficiency characteristics and estimate point D.
- ▶ From D, go right horizontally (6) to the right to the efficiency scale and then read off the relevant efficiency (here ~81 %).

Unknown values can be determined for other given variables in the same manner.

Additional example:

Appointed: Speed $n = 2000 \text{ rpm}$
Torque $M = 120 \text{ Ncm} = 1.2 \text{ Nm}$
(i.e. $P = 0.104 \cdot M \cdot n = 250 \text{ W}$)

Required: The relevant required operating voltage
Result: $U \approx 36 \text{ V}$



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