8WS compact servo motors

User's manual

Version: **1.0 (2018-07-20)**
Model no.: **MA8WSBA-ENG**

1 General information

1.1 Manual history

Version	Date	Comment
1.00	2018-07-20	First edition

Information:

B&R makes every effort to keep user's manuals as current as possible. New versions are made available in electronic form on the B&R website at www.br-automation.com. Check regularly whether you have the latest version.

1.2 About this user's manual

This user's manual describes the product, informs you how to use it and warns of possible dangers.

The personnel responsible for installation, operation, fault rectification, maintenance and cleaning must read and understand this manual before starting any work. The machine documentation must also be taken into account; the product described here is a component of this. This, along with observing all specifications and safety guidelines, will ensure safe operation and a long service life.

As a component of the machine, this manual is to be made freely accessible and stored in the immediate vicinity of the machine.

In addition to the information in this manual, local accident prevention regulations and national industrial safety regulations apply.

Information:

This document is not intended for end customers! It is the responsibility of the machine manufacturer or system provider to provide the safety guidelines relevant to end customers in the operating instructions for the end customer in the respective local language.

1.3 Safety

This chapter provides you with safety-related information about working with the product.

Safety guidelines relevant to certain phases of the product's service life have been documented in the relevant chapters in this manual.

1.3.1 Organization of safety notices

Safety notices in this manual are organized as follows:

Safety notice	Description
Danger!	Failure to observe these safety guidelines and notices can result in death.
Warning!	Failure to observe these safety guidelines and notices can result in severe injury or substantial damage to property.
Caution!	Failure to observe these safety guidelines and notices can result in injury or damage to property.
Note:	These instructions are important for avoiding malfunctions.

1.3.2 Intended use

B&R motors and gear motors are components designed for installation in electrical systems or machines. They were designed, developed and manufactured for general industrial use. They are intended to be operated in covered rooms and under normal climatic conditions, which is usually the case in modern production halls. When used in residential areas, commercial areas or small businesses, additional filtering measures are required or must be provided by the user. Only operate the motor with B&R drive systems.

Use in accordance with the intended purpose is prohibited until:

- It has been determined that the machine complies with the provisions of EC directive 2006/42/EC (Machinery Directive) and EMC Directive 2014/30/EU.
- All values specified on the nameplate and in the user's manual (e.g. connection and environmental conditions) have been observed.

1.3.3 Drive system

Only use the 8WS motor series in combination with a B&R ACOPOSmicro drive system.

For the required settings, see chapter Commissioning and operation (see "Settings in Automation Studio" on page 54).

> **Warning!**
>
> **Risk of injury due to electric shock!**
>
> **If there is damage to the insulation on the motor, which does not have a ground connection, touching it can result in an electric shock and possibly death.**
>
> **For safety reasons, set the supply voltage of the B&R ACOPOSmicro drive system to max. 60 VDC.**

1.3.4 Reasonably foreseeable misuse

Use of this product in areas with fatal risks or dangers is prohibited!

Danger!

Severe personal injury and damage to property due to failure!

When used without ensuring exceptionally high safety measures, death, injury, severe physical impairments or other serious losses are possible.

Do not use the product in the following areas, as well as other areas associated with fatal risks or dangers:

- **Explosive areas**
- **Monitoring nuclear reactions in nuclear power plants**
- **Flight control systems and air traffic control**
- **Managing mass transport systems**
- **Medical life support systems**
- **Controlling weapons systems**

In special cases – use in non-commercial installations – with additional requirements (e.g. protection of children's fingers), these requirements must be satisfied during setup on the system side.

1.3.5 General sources of danger

Tampering of protection or safety devices

Protective and/or safety devices protect you and other persons from dangerous voltage, rotating or moving elements and hot surfaces.

Danger!

Personal injury and damage to property due to tampering of protective equipment!

If protective or safety devices are removed or put out of operation, there is no longer any personal protection and serious personal injury and damage to property can occur.

- **Do not remove any safety devices.**
- **Do not put any safety devices out of operation.**
- **Always use all safety devices during short-term test and trial operations!**

Dangerous voltage

To operate the motors, dangerous voltage must be applied to certain parts.

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the wrong order or when the power is switched on, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive when the power is switched on!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments when the power is switched off!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, drives and motors.

Danger!

Danger to health due to electromagnetic fields!

The functionality of a heart pacemaker can be impaired by electromagnetic fields to such an extent that the wearer experiences harm to his or her health, possibly with a fatal outcome.

- **Persons with pacemakers are not allowed to be in endangered areas.**
- **Warn staff by providing information, warnings and safety identification.**
- **Secure the danger zone by means of barriers.**
- **Reduce electromagnetic fields at their source (using shielding, for example).**

Dangerous motion

By rotating and positioning motions of the motors, machine elements are moved or driven and loads conveyed.

After switching on the machine, movements of the motor shaft must always be expected! For this reason, higher-level safety precautions need to be put in place to ensure that personnel and machines are protected. This type of protection can be achieved, for example, by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or photoelectric sensors.

In the immediate vicinity of the machine, provide sufficient and easily accessible emergency switching-off devices to stop the machine as quickly as possible in the event of an accident.

Danger!

Danger of injury due to rotating or moving elements and loads!

By rotating or moving elements, body parts can be drawn in or severed or subjected to impacts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Before working on the machine, secure it against unwanted movements. Any holding brake present is not suitable for this!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Motors can be started automatically via remote control! If appropriate, a corresponding warning symbol must be applied, and protective measures must be implemented to prevent entry into the high-risk area.**

Warning!

Danger of injury due to incorrect control or a defect.

Improper control of motors or a defect can result in injuries and unintended and hazardous movements of motors.

Such incorrect behavior can be triggered by:

- **Incorrect installation or faults when handling components**
- **Improper or incomplete wiring**
- **Defective devices (servo drive, motor, position encoder, cables, brake)**
- **Incorrect control (e.g. caused by software error)**

Risk due to hot surfaces

Due to the power dissipation from the motor and friction in the gearbox, these components as well as their environment can reach a temperature of more than 100°C.

The resulting heat is released to the environment via the housing and the flange.

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can lead to very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

1.3.6 Provisions and safety guidelines

To ensure proper commissioning and safe operation, be sure to observe the following:

- General safety regulations
- The applicable work safety regulations
- National accident prevention regulations (e.g. VBG 4) for working with high-voltage systems

- National, local and plant-specific regulations for your end product
- Relevant regulations for electrical installations (e.g. cable cross section, fuses, protective conductor connection). The values provided in chapter "Technical data" must also be taken into account here.

The operator is solely responsible for these and all other regulations applicable at the place of use.

1.3.7 Responsibilities of the operator

The operator is the person who uses the motor for commercial purposes or who provides it for use by a 3rd party while carrying legal product responsibility for the protection of the user, personnel or other 3rd parties.

Obligations of the operator:

- To know and implement the applicable industrial safety regulations.
- To know and implement national, local and plant-specific regulations.
- To identify in a risk assessment hazards that can arise due to on-site working conditions.
- To prepare documentation for operation of the finished system (with motors, gearboxes, servo drives, etc.) including safety notices.
- To regularly check whether the operating instructions and manuals issued correspond to current rules and standards.
- To clearly define and manage responsibilities for installation, operation, fault correction, maintenance and cleaning.
- To ensure that affected personnel have read and understood this user's manual.
- To regularly train and inform personnel about hazards.
- To provide personnel with the necessary protective equipment

1.3.8 Qualified personnel

All tasks such as the transport, installation, commissioning and servicing of devices are only permitted to be carried out by qualified personnel. Qualified personnel are those familiar with the transport, mounting, installation, commissioning and operation of devices who also have the appropriate qualifications to perform these tasks (e.g. IEC 60364). National accident prevention regulations must be observed.

The safety notices, information about connection conditions (nameplate and documentation) and limit values specified in the technical data must be read carefully before installation and commissioning and are to be observed in all cases.

1.3.9 Safety notices

A "hot surface" warning label is provided with the product. Attach it to the assembled product so that it is visible at all times.

"Hot surface" warning label

1.3.10 Protective equipment

Always wear suitable safety clothing and equipment for your personal protection.

1.4 8WS - Advanced servo technology in the smallest spaces

8WSA servo motors

8WSB gear motors

Compact servo motors allow precise positioning

The 8WS motor series makes it possible to implement servo applications that require highly precise synchronization and accurate positioning in limited space. Potential applications include gluing and dosing systems, grippers, measurement and testing equipment, filling systems and robot axes.

Protection up to IP69K

These brushless motors are offered in four different diameters ranging from 17 to 40 millimeters. The robust, compact 8WS-series motors are specially designed for harsh industrial environments and are available in all sizes with IP54 or IP66/67 protection. Size 4 (ø 40 mm) is available in a hygienic design with IP69K protection for use in food and beverage production.

Full functionality

The motors are designed for 60 VDC and cover a power range from 7 to 205 watts of continuous power. The integrated absolute encoder has a resolution of 4096 positions per revolution. The double-shielded hybrid motor cable – available in 2 lengths – is connected directly to the motor and can be used in cable drag chains.

8WSB direct gearbox mounting

8WSB gear motors are 8WSA servo motors with a directly mounted 1- to 3-stage planetary gearbox. The seamlessly welded housing allows for a compact design of the motor-gearbox unit and opens up additional application possibilities.

1.4.1 Standards and guidelines

The motors are intended for use in commercial plants and subject to the following standards and guidelines:

Standards

EN 60034- 1	Rotating electrical machines - measurement and operating behavior
EN 60034- 5	Degrees of protection provided by the integral design of rotating electrical machines
EN 60034- 6	Rotating electrical machines - Cooling types
EN 60034- 7	Rotating electrical machines - Classification of types of construction, mounting arrangements

Guidelines

Low Voltage Directive 2014/35/EU	The motors correspond to the low voltage directive (conformity).
EMC Directive 2014/30/EU	To operate the motor in accordance with its intended use, it must comply with the protection requirements of the EMC directive. Proper installation (e.g. spatial separation of signal lines and power cables, shielded lines and cables) is the responsibility of the plant installer and system provider. If operating with a power converter, then the EMC guidelines of the power converter, encoder and brake manufacturers must be observed.
RoHS Directive 2011/65/EU	The motors in this series comply with the RoHS Directive (2011/65/EU) for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Note:

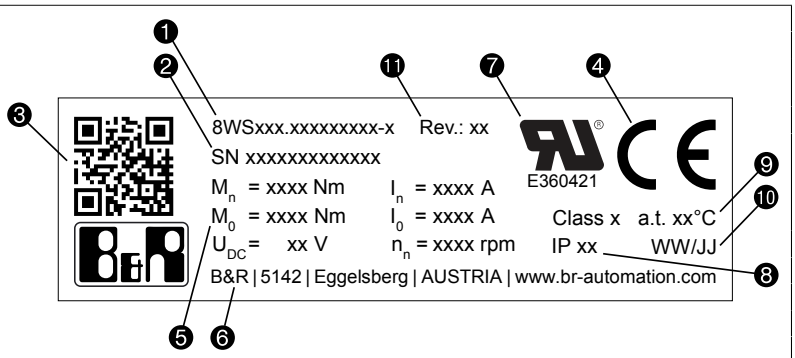
National, local and plant-specific regulations must also be taken into account!

1.4.2 Nameplate

The nameplate clearly identifies each motor. The serial number ensures traceability.

The laser marking on the motor housing includes the following information:

1	Order code
2	Serial number (13-digit)
3	Serial number as a Data Matrix code (DMC) Format: C18x18 per ECC200
4	CE marking
5	Technical data (M_n rated torque, I_n rated current, M_0 continuous stall torque, I_0 continuous stall current, U_{DC} DC bus voltage, n_n rated speed)
6	Manufacturer
7	UL-recognized component mark
8	Protection class
9	Insulation class
10	Production period (week/year)
11	Revision



Note:

The nameplate must be visible at all times when the motor is installed.

2 Technical data

2.1 General description

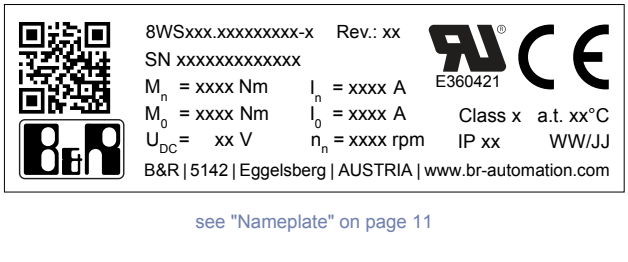
The compact design of the 8WS servo motors makes it possible to implement servo applications that require highly precise synchronization and accurate positioning in limited space.

- Available as 8WSA servo motor or 8WSB gear motor
- Ultra compact and highly dynamic
- Power range from 7 to 205 watts for 60 VDC DC bus voltage
- Can be used with the B&R ACOPOSmicro drive system
- Robust industrial connectors with optimal EMC shielding
- Size 4 (ø 40 mm) optionally available in hygienic design with IP69K protection
- Pre-assembled hybrid motor cable permanently connected to the motor [1]

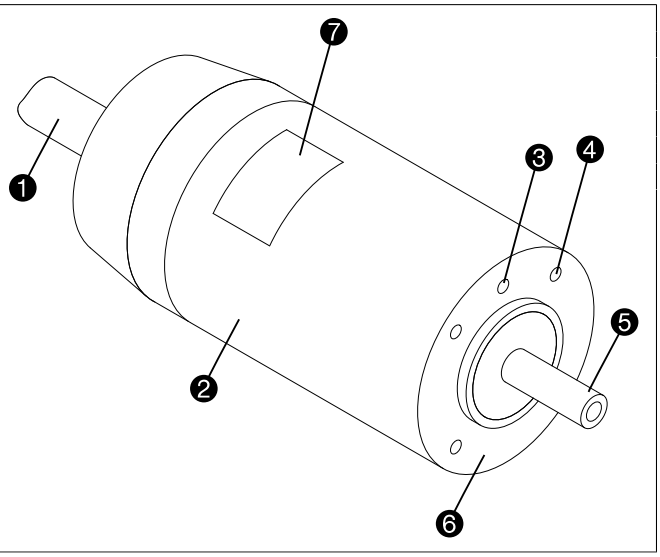
1) A separately available Y-cable is required to connect to a B&R ACOPOSmicro drive system. An extension cable is available for the hybrid motor cable. (see "8WSA / 8WSB accessories" on page 39)

2.2 Motor overview

1	Integrated hybrid motor cable
2	Motor housing
3	Orientation drill hole (only 8WSA)
4	Mounting threads
5	Shaft end
6	Mounting flange
7	Nameplate



see "Nameplate" on page 11



2.3 8WSA - Order key

8WS	b	c	d	.	ee	nnn	ff	gg	-	h

Cooling / Construction type

A ... Self-cooling

Size

1 ... ø 17 mm
2 ... ø 22 mm
3 ... ø 32 mm
4 ... ø 40 mm

Length

1 ... 10
2 ... 20
3 ... 30

Motor encoder system

F0 ... SSI encoder, single-turn

Nominal speed

055 ... 5,500 rpm
085 ... 8,500 rpm

Motor options (degree of protection / connection type / shaft end)

All options (**Vx**) have a hybrid motor cable permanently connected to the motor and a smooth shaft end.

V0 ... IP54
V4 ... IP66/67 INOX
V8 ... IP69K hygienic design (only available for size 4)

Cable length

LB ... 0.5 m
LE ... 3.0 m

Motor version

0 ... Version 0 (motor version 0 is currently valid)

Note:

Order codes only provide information about possible combinations in exceptional cases. Information about possible combinations is available in the CAD configurator under cad.br-automation.com.

2.3.1 Example orders

2.3.1.1 Example order 1

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

A servo motor of type **8WSA32** with a nominal speed of **8,500 rpm** was selected for an application. Protection class **IP66/67** is required. The hybrid motor cable on the motor should be **3 m** long.

The code (c) for the selected size (**3** = ø 32 mm) is **3**.

The code (d) for the selected length (**2** = 20) is **2**.

The code (ee) for the encoder system (SSI encoder, single-turn) is **F0**.

The code (nnn) for the selected nominal speed (**8,500 rpm**) is **085**.

The code (ff) for the selected motor options (protection class **IP66/67**) is **V4**.

The code (gg) for the selected cable length (**3.0 m**) is **LE**.

The code (h) for the motor version (0) is **0**.

The model number for the necessary motor is therefore **8WSA32.F0085V4LE-0**.

2.3.1.2 Example order 2

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

A servo motor of type **8WSA43** with a nominal speed of **5,500 rpm** was selected for an application. A hygienic design with protection class **IP69K** is required. The hybrid motor cable on the motor should be **0.5 m** long.

The code (c) for the selected size (**4** = ø 40 mm) is **4**.

The code (d) for the selected length (**3** = 30) is **3**.

The code (ee) for the encoder system (SSI encoder, single-turn) is **F0**.

The code (nnn) for the selected nominal speed (**5,500 rpm**) is **055**.

The code (ff) for the selected motor options (protection class **IP69K**) is **V8**.

The code (gg) for the selected cable length (**0.5 m**) is **LB**.

The code (h) for the motor version (0) is **0**.

The model number for the necessary motor is therefore **8WSA43.F0055V8LB-0**.

2.3.2 Cooling / Construction type A

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

8WS servo motors with cooling / construction type A are self-cooling and have a long, slim design. The motors must be installed with the mounting flange (cooling surface).

Valid code: A

2.3.3 Size (c) 8WSA

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

8WS servo motors are available in various sizes (1, 2, 3, 4). These differ in dimensions (especially flange dimensions) and power data. The different sizes are distinguished by a number (**c**) in the model number. The larger this number, the larger the flange dimensions and power data of the respective motor.

	Available sizes (c)			
	1 (ø 17 mm)	2 (ø 22 mm)	3 (ø 32 mm)	4 (ø 40 mm)
8WSA	Yes	Yes	Yes	Yes

2.3.4 Length (d) 8WSA

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

The available lengths have different performance data and are distinguished by a character (**d**) in the model number.

	Available lengths (d)		
	1 (Length 10)	2 (Length 20)	3 (Length 30)
8WSA1	Yes	---	---
8WSA2	Yes	---	---
8WSA3	---	Yes	---
8WSA4	---	---	Yes

2.3.5 Motor encoder (ee) 8WSA

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

The encoder system is listed as part of the model number in the form of a 2-digit code (**ee**).

The order code (**ee**) for the SSI encoder (single-turn) is **F0**.

Technical data

	Order code (ee)
	F0 (SSI encoder, single-turn)
Supply voltage	5 V ±10%
Current consumption	60 mA effective
Number of outputs	3 SSI serial / CLK / Data differential, max. 60 mA
Absolute value generation	Digital absolute position information within one rotor revolution
Resolution	4096 positions per revolution (12-bit)
Precision	±1° (up to ±0.4° possible on request)
Maximal speed	30,000 rpm
Temperature of workspace	-40°C to 125°C

2.3.6 Nominal speed (nnn) 8WSA

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

The nominal speed is listed as part of the model number in the form of a 3-digit code (**nnn**).

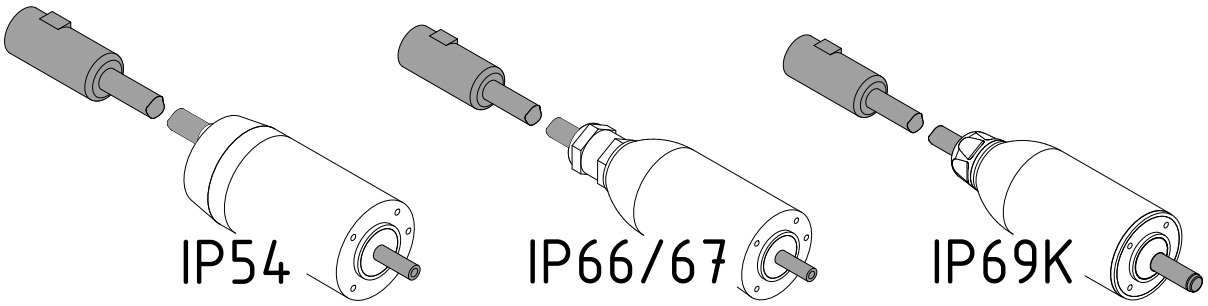
	Available nominal speeds n_N [rpm] at 60 VDC operation	
	5,500	8,500
	Order code (nnn)	
	055	085
8WSA11	---	Yes
8WSA21	---	Yes
8WSA32	---	Yes
8WSA43	Yes	---

2.3.7 Motor options (ff) 8WSA

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

The available motor options are summarized in the following table; they are distinguished by a code (**ff**) in the model number.

	Protection class			Shaft end	Connection type
	IP54	IP66/67	IP69K		
	Order code (ff)				
8WSA11	**V0**	**V4**	---	Smooth	Hybrid motor cable attached to the motor
8WSA21	**V0**	**V4**	---		
8WSA32	**V0**	**V4**	---		
8WSA43	**V0**	**V4**	**V8**		

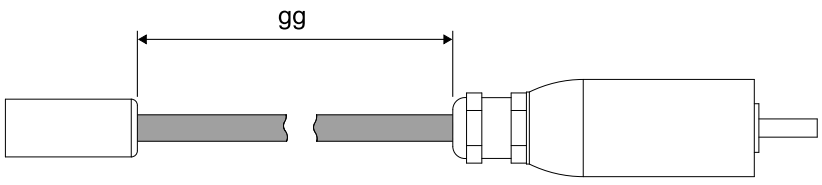


2.3.8 Cable length (gg) 8WSA

8WS	A	c	d	.	ee	nnn	ff	gg	-	h

The code (**gg**) in the model number provides information about the cable length. The available cable lengths are summarized in the following table.

	Available cable lengths					
	0.3 m	0.5 m	1.0 m	2.0 m	3.0 m	5.0 m
	Order code (gg)					
	LA	LB	LC	LD	LE	LF
8WSA11	---	Yes	---	---	Yes	---
8WSA21	---	Yes	---	---	Yes	---
8WSA32	---	Yes	---	---	Yes	---
8WSA43	---	Yes	---	---	Yes	---



2.4 8WSB - Order key

8WS	b	c	d	.	ee	iii	jj	n	o	p	v

Cooling / Construction type

B ... Motor-gearbox direct mounting, self-cooling

Size

1 ... ø 17 mm
2 ... ø 22 mm
3 ... ø 32 mm
4 ... ø 40 mm

Length

1 ... 10
2 ... 20
3 ... 30

Motor encoder system

F0 ... SSI encoder, single-turn

Gear ratio

004 ... i = 4
012 ... i = 12.25
016 ... i = 16
021 ... i = 21
049 ... i = 49
050 ... i = 50
064 ... i = 64

Motor options (protection class / shaft end)

S0 ... IP54, smooth shaft end (8WSB**32**)
S1 ... IP54, flat-sided shaft end (8WSB**11/21**)
S1 ... IP54, keyed shaft end (8WSB**43**)
S2 ... IP66/67, smooth shaft end (8WSB**32**)
S3 ... IP66/67, flat-sided shaft end (8WSB**11/21**)
S3 ... IP66/67, keyed shaft end (8WSB**43**)
S5 ... IP69K, keyed shaft end (8WSB**43**)

Nominal speed

K ... 5,500 rpm
Q ... 8,500 rpm

Connection type

K ... Hybrid motor cable, permanently connected to the motor

Cable length

B ... 0.5 m
E ... 3.0 m

Motor version

0 ... Version 0 (motor version 0 is currently valid)

Note:

Order codes only provide information about possible combinations in exceptional cases. Information about possible combinations is available in the CAD configurator under cad.br-automation.com.

2.4.1 Example orders

2.4.1.1 Example order 1

8WS	B	c	d	.	ee	iii	jj	n	o	p	v

A gear motor of type **8WSB32** with a nominal speed of **8,500 rpm** was selected for an application. The gearbox should have a gear ratio of **i = 4**. Protection class **IP66/67** is required. The **shaft end** should be **smooth**, and the hybrid motor cable on the motor should be **0.5 m** long.

The code (c) for the selected size (**3** = ø 32 mm) is **3**.

The code (d) for the selected length (**2** = 20) is **2**.

The code (ee) for the encoder system (SSI encoder, single-turn) is **F0**.

The code (ee) for the selected gear ratio (**i = 4** = 004) is **004**.

The code (ff) for the selected motor options (protection class **IP66/67** and **smooth shaft end**) is **S2**.

The code (nnn) for the selected nominal speed (**8,500 rpm**) is **Q**.

The code (ff) for the connection type (hybrid motor cable permanently connected to the motor) is **K**.

The code (gg) for the selected cable length (**0.5 m**) is **B**.

The code (h) for the motor version (0) is **0**.

The model number for the necessary motor is therefore **8WSB32.F0004S2QKB0**.

2.4.1.2 Example order 2

8WS	B	c	d	.	ee	iii	jj	n	o	p	v

A gear motor of type **8WSB43** with a nominal speed of **5,500 rpm** was selected for an application. The gearbox should have a gear ratio of **i = 50**. A hygienic design with protection class **IP69K** is required. The shaft end should be **keyed**, and the hybrid motor cable on the motor should be **3.0 m** long.

The code (c) for the selected size (**4** = ø 40 mm) is **4**.

The code (d) for the selected length (**3** = 30) is **3**.

The code (ee) for the encoder system (SSI encoder, single-turn) is **F0**.

The code (ee) for the selected gear ratio (**i = 50**) is **050**.

The code (ff) for the selected motor options (protection class **IP69K** and **keyed shaft end**) is **S5**.

The code (nnn) for the selected nominal speed (**5,500 rpm**) is **K**.

The code (ff) for the connection type (hybrid motor cable permanently connected to the motor) is **K**.

The code (gg) for the selected cable length (**3.0 m**) is **E**.

The code (h) for the motor version (0) is **0**.

The model number for the necessary motor is therefore **8WSB43.F0050S5KKE0**.

2.4.2 Cooling / Construction type B

8WS	B	c	d	.	ee	iii	jj	n	o	p	v

8WS servo motors with cooling type / size B are based on motors with cooling type A. The motors must be installed with the mounting flange (cooling surface). They are directly mounted to the gearbox with seamlessly welded housings.

Valid code: B

2.4.3 Size (c) 8WSB

8WS	B	c	d	.	ee	iii	jj	n	o	p	v

8WS servo motors are available in various sizes (1, 2, 3, 4). These differ in dimensions (especially flange dimensions) and power data. The different sizes are distinguished by a number (**c**) in the model number. The larger this number, the larger the flange dimensions and power data of the respective motor.

	Available sizes (c)			
	1 (ø 17 mm)	2 (ø 22 mm)	3 (ø 32 mm)	4 (ø 40 mm)
8WSB	---	---	---	Yes

2.4.4 Length (d) 8WSB

8WS	B	c	d	.	ee	iii	jj	n	o	p	v

The available lengths have different performance data and are distinguished by a character (**d**) in the model number.

	Available lengths (d)		
	1 (Length 10)	2 (Length 20)	3 (Length 30)
8WSB1	Yes	---	---
8WSB2	Yes	---	---
8WSB3	---	Yes	---
8WSB4	---	---	Yes

2.4.5 Motor encoder (ee) 8WSB

8WS	B	c	d	.	ee	iii	jj	n	o	p	v

The encoder system is listed as part of the model number in the form of a 2-digit code (**ee**).

The order code (**ee**) for the SSI encoder (single-turn) is **F0**.

	Order code (ee)
	F0 (SSI encoder, single-turn)
Supply voltage	5 V ±10%
Current consumption	60 mA effective
Number of outputs	3 SSI serial / CLK / Data differential, max. 60 mA
Absolute value generation	Digital absolute position information within one rotor revolution
Resolution	4096 positions per revolution (12-bit)
Precision	±1° (up to ±0.4° possible on request)
Maximal speed	30,000 rpm
Temperature of workspace	-40°C to 125°C

2.4.6 Gear ratios (iii) 8WSB

8WS	B	c	d	.	ee	iii	jj	n	o	p	v

The code (**iii**) in the model number contains the gear ratio.

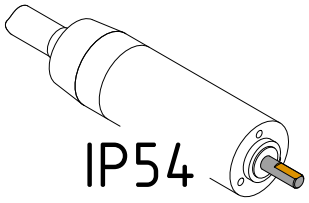
	Available gear ratios (gear stages)						
	i = 4 (1)	i = 12.25 (2)	i = 16 (2)	i = 21 (2)	i = 49 (3)	i = 50 (2)	i = 64 (3)
	Order code (iii)						
	004	012	016	021	049	050	064
8WSB11	Yes	---	---	Yes	---	---	Yes
8WSB21	Yes	---	Yes	---	---	---	Yes
8WSB32	Yes	---	Yes	---	---	---	Yes
8WSB43	Yes	Yes	---	---	Yes	---	---
8WSB43 (hygienic design)	Yes	---	Yes	---	---	Yes	---

2.4.7 Motor options (jj) 8WSB

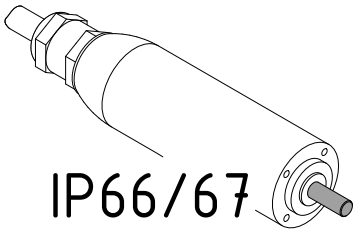
8WS	B	c	d	.	ee	iii	jj	n	o	p	v

The available motor options are summarized in the following table; they are distinguished by a code (**jj**) in the model number.

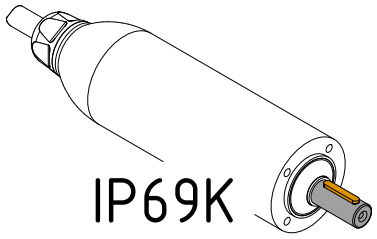
	Protection class			Shaft end
	IP54	IP66/67	IP69K	
	Order code (jj)			
8WSB11	**S1**	**S3**	---	Flat-sided
8WSB21	**S1**	**S3**	---	Flat-sided
8WSB32	**S0**	**S2**	---	Smooth
8WSB43	**S1**	**S3**	**S5**	With key



Shaft end per table (figure: 8WSB21, flat-sided shaft)



Shaft end per table (figure: 8WSB32, smooth shaft)



Shaft end per table (figure: 8WSB43, keyed shaft)

2.4.8 Nominal speed (n) 8WSB

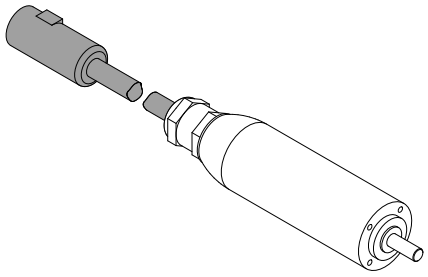
8WS	B	c	d	.	ee	iii	jj	n	o	p	v

The nominal speed is specified as part of the model number in the form of a 1-digit code (**n**).

	Available nominal speeds n_N [rpm] at 60 VDC operation	
	5,500	8,500
	Order code (n)	
	K	Q
8WSB11	---	Yes
8WSB21	---	Yes
8WSB32	---	Yes
8WSB43	Yes	---

2.4.9 Connection type (o) 8WSB

8WS	B	c	d	.	ee	iii	jj	n	**o**	p	v



8WS servomotors have a hybrid motor cable permanently connected to the motor. The connection type is defined with a letter in the order code (**o**).

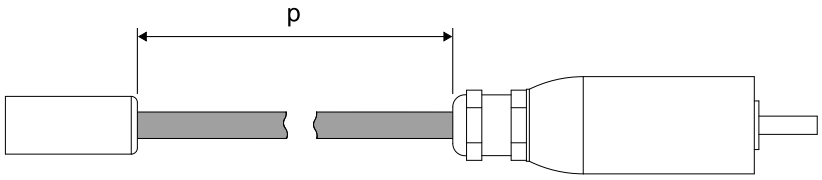
Valid code: K

2.4.10 Cable length (p) 8WSB

8WS	B	c	d	.	ee	iii	jj	n	o	**p**	v

The code (**p**) in the model number provides information about the cable length. The available cable lengths are summarized in the following table.

	Available cable lengths					
	0.3 m	0.5 m	1.0 m	2.0 m	3.0 m	5.0 m
	Order code (p)					
	A	B	C	D	E	F
8WSB11	---	Yes	---	---	Yes	---
8WSB21	---	Yes	---	---	Yes	---
8WSB32	---	Yes	---	---	Yes	---
8WSB43	---	Yes	---	---	Yes	---



2.5 8WSA / 8WSB - General motor data

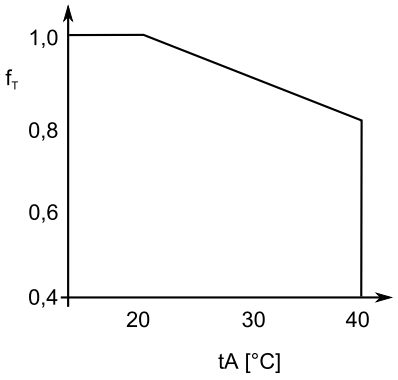
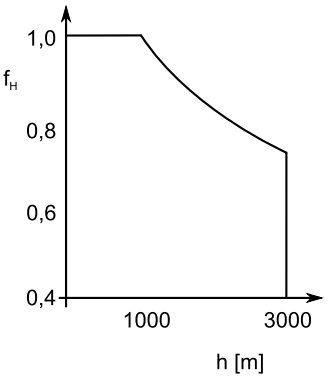
General information	
CE certification	Yes
UR listed	Yes (8WSA3, 8WSA4, 8WSB3, 8WSB4)
UL file number	E360421

Electrical characteristics	
DC bus voltage on the ACOPOSmicro	60 VDC[1)]
Type of connection - Pre-assembled hybrid motor cable	i-tec springtec circular connector (Intercontec)

Support	
Automation Studio	V4.4.6 and higher
Motion system (mapp Motion, ACP10)	V5.04 and higher[2)]
ACOPOSmicro hardware upgrade	V2.3.0.0 and higher

Thermal properties	
Insulation class per EN 60034-1	B
Methods of cooling per EN 60034-6 (IC code)	Self-cooling, free circulation surface cooling (IC4A0A0, IC400)
Thermal motor protection	No

Mechanical properties	
Roller bearing, dynamic load rating and nominal service life	Based on DIN ISO 281
Oil seal, standard motor: Oil seal, hygienic design with IP69K:	No oil seal PTFE 92 oil seal
Key and keyway per DIN 6885-1	Dimensions deviate from DIN 6885-1
Radial runout of shaft end: Concentricity of shaft end to mounting flange: Axial runout of shaft end to mounting flange:	Max. 15 µm / Typ. <10 µm Max. 35 µm / Typ. <20 µm Max. 20 µm / Typ. <10 µm
Surface, standard motor: Surface, hygienic design with IP69K: Plastic cover, standard motor:	Stainless steel RZ 6.3 Stainless steel Ra <0.8 Surface per VDI 3400 Ref. 33
Output shaft, standard motor: Output shaft, hygienic design with IP69K:	Steel Stainless steel
Lubrication, standard motor: Lubrication, hygienic design with IP69K:	Standard Food-safe

Operating conditions	
Rating class, operating mode per EN 60034-1	S1 - Continuous operation
Ambient temperature during operation	0°C to +40°C
Reduction of nominal and stall current as well as nominal and stall torque at temperatures above 20°C **f_T** ... Operating factor for the influence of ambient temperature **tA** ... Ambient temperature (°C)	
Temperature change rate	0.5 °C/min
Relative humidity during operation	5 to 95%, relative, non-condensing 1 to 29 g/m³, absolute
Reduction of nominal and stall current as well as nominal and stall torque at installation elevations starting at 1,000 m above sea level **f_H** ... Operating factor for the influence of installation elevation	
Maximum installation elevation	2000 m [3)]
Max. winding temperature	120°C

1) For safety reasons, set the supply voltage of the B&R ACOPOSmicro drive system to max. 60 VDC.
2) Important: With older versions, the supply voltage is not checked for a maximum value of 60 VDC and incorrect settings may occur.
3) Requirements that go beyond this must be arranged with B&R.

Operating conditions	
EN 60034-5 protection (IP code)	IP54, IP66/67, IP69K
Type of construction and mounting arrangement per EN 60034-7 (IM code)	Horizontal (IM3001) Vertical, motor hangs on the machine (IM3011) Vertical, motor stands on the machine (IM3031)
Max. permissible vibration stress (55-2000 Hz) [6)]	10 m/s^2
Max. permissible shock load (11 ms) [7)]	Axial 10 m/s^2 Radial 150 m/s^2

Storage and transport conditions	
Storage temperature	5 to +40°C
Relative humidity during storage	5 to 95%, non-condensing
Transport temperature	5 to +40°C
Relative humidity during transport	5 to 95%, non-condensing

Information:

All nominal data is based on a supply voltage of 60 VDC of the B&R ACOPOSmicro drive system.

6) Based on sinusoidal oscillations in stationary applications, the limit value is based on DIN EN 60721-3-3:1995 and DIN EN 60068-2-6:2007.
7) For the maximum permissible shock load (short-term acceleration), the limit values are based on DIN EN 60721-3-3:1995 and DIN EN 60068-2-27:2009.

2.6 8WSA - Technical data

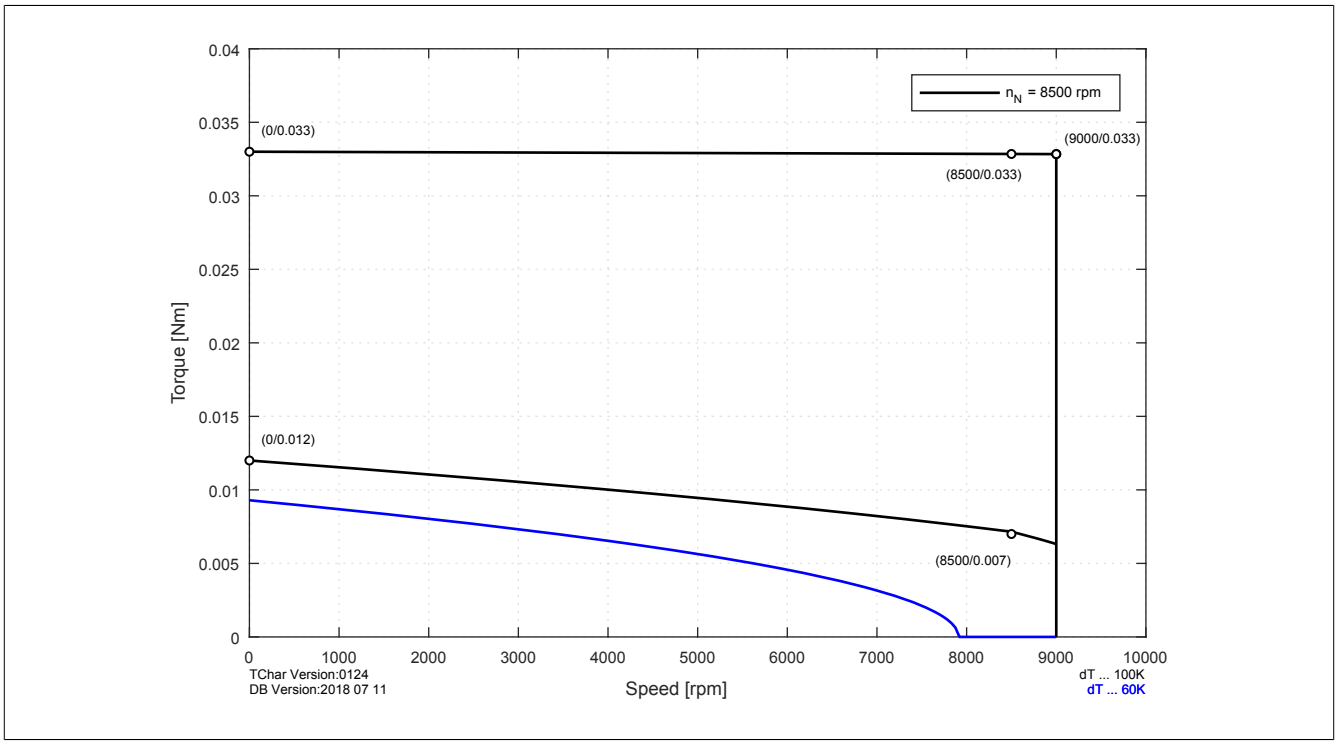
Model number	8WSA11.ee085ffgg-0	8WSA21.ee085ffgg-0	8WSA32.ee085ffgg-0	8WSA43.ee055ffgg-0	8WSA43. ee055V8gg-0
Motor					
Nominal speed n_N [rpm]	8500			5500	
Number of pole pairs	4				
Nominal torque M_n [Nm]	0.007	0.031	0.13	0.3	
Nominal current I_N [A]	0.43	0.9	2.3	3.3	
Stall torque M_0 [Nm]	0.012	0.034	0.14	0.35	
Stall current I_0 [A]	0.52	0.96	2.6	3.8	
Maximum torque M_{max} [Nm]	0.03	0.07	0.31	0.96	
Maximum current I_{max} [A]	1.5	2.1	6.5	11.4	
Maximum speed n_{max} [rpm]	9000			7000	
Torque constant K_T [Nm/A]	0.023	0.037	0.056	0.095	
Voltage constant K_E [V/1000 rpm]	1.48	2.37	3.55	6.07	
Stator resistance R_{2ph} [Ω]	13.3	5.23	1.3	0.72	
Stator inductance L_{2ph} [mH]	2.47	2.22	1.75	1.34	
Electrical time constant t_{el} [ms]	0.18	0.43	1.35	1.87	
Thermal time constant t_{therm} [min]	1.6	2.7	6.7	11.3	
Moment of inertia J [kgcm²]	0.0005	0.0012	0.0057	0.025	
Weight without brake m [kg]	0.11 1)	0.15 1)	0.33 2)	0.54 2)	0.66 2)
Recommendations					
ACOPOSmicro 80VD100Px.xxxx-01	C03X				
Connector type	I-Tec				

1) The value is valid for motors with a **cable length** of **0.5 m**. For motors with a cable length of 3.0 m, the value increases by 0.189 kg.
2) The value is valid for motors with a **cable length** of **0.5 m**. For motors with a cable length of 3.0 m, the value increases by 0.316 kg.

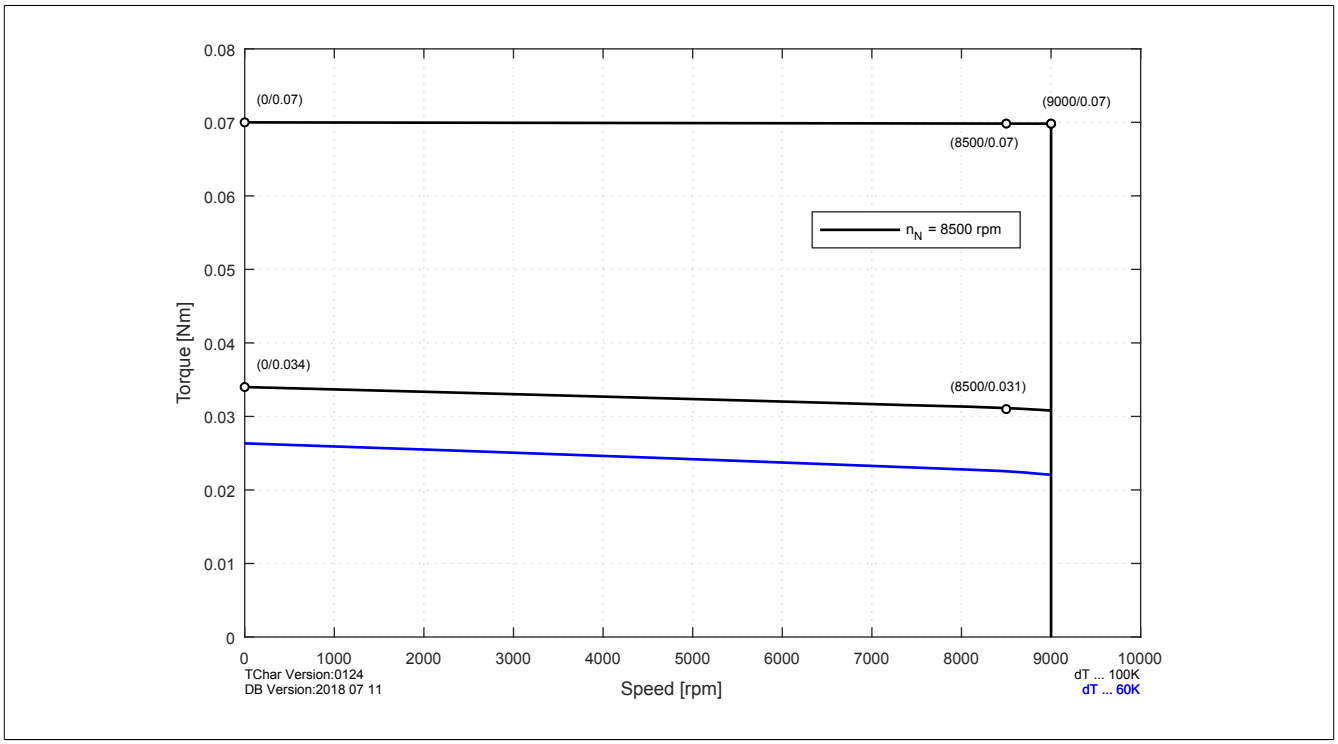
Information: All nominal data is based on a supply voltage of 60 VDC of the B&R ACOPOSmicro drive system.

2.6.1 Speed-torque characteristics at DC bus voltage of 60 VDC

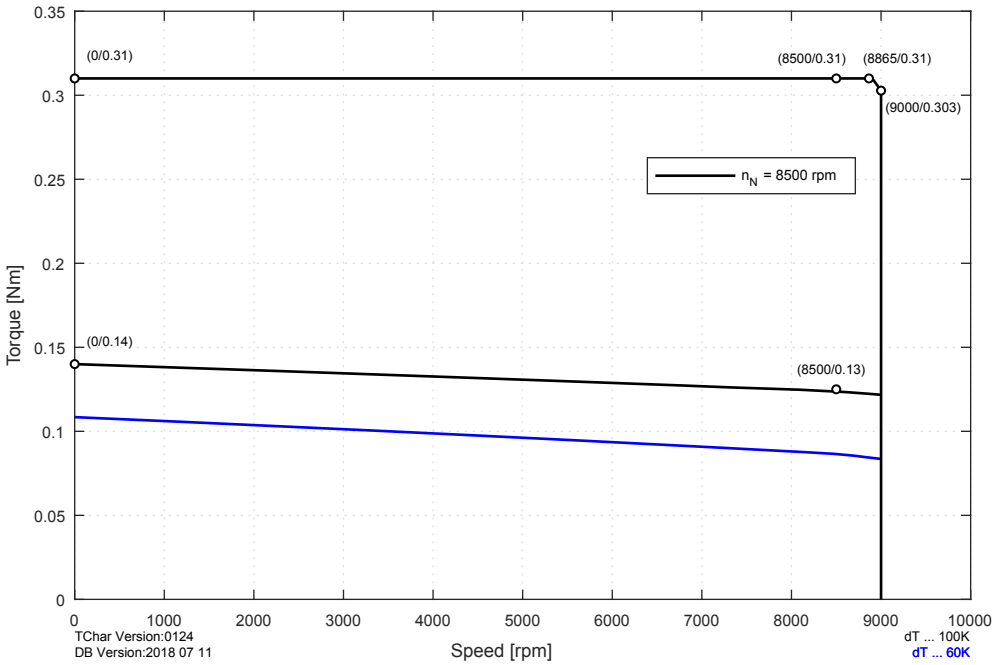
8WSA11



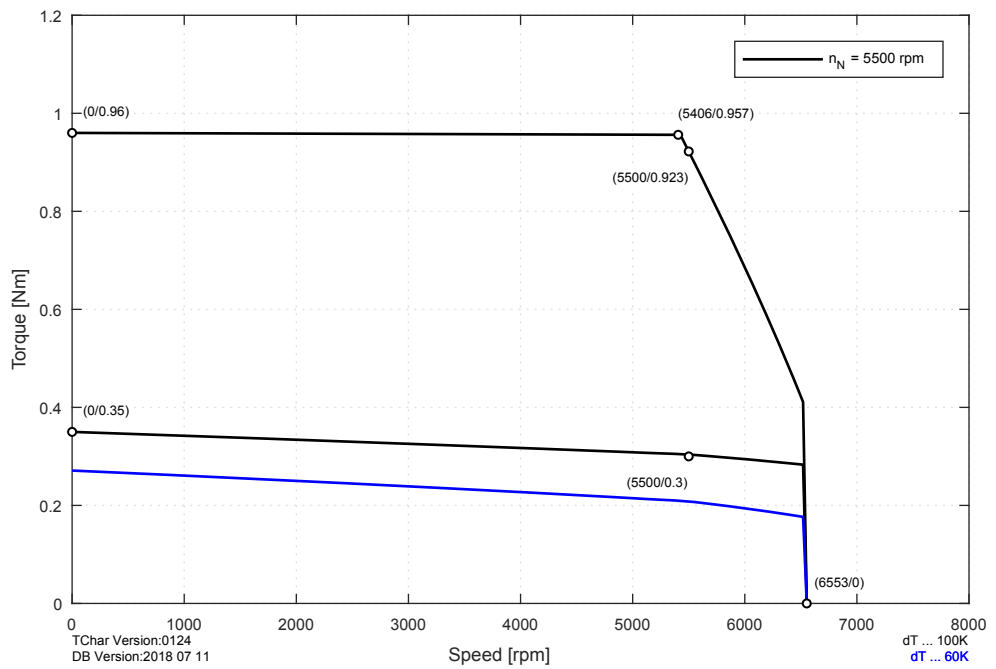
8WSA21



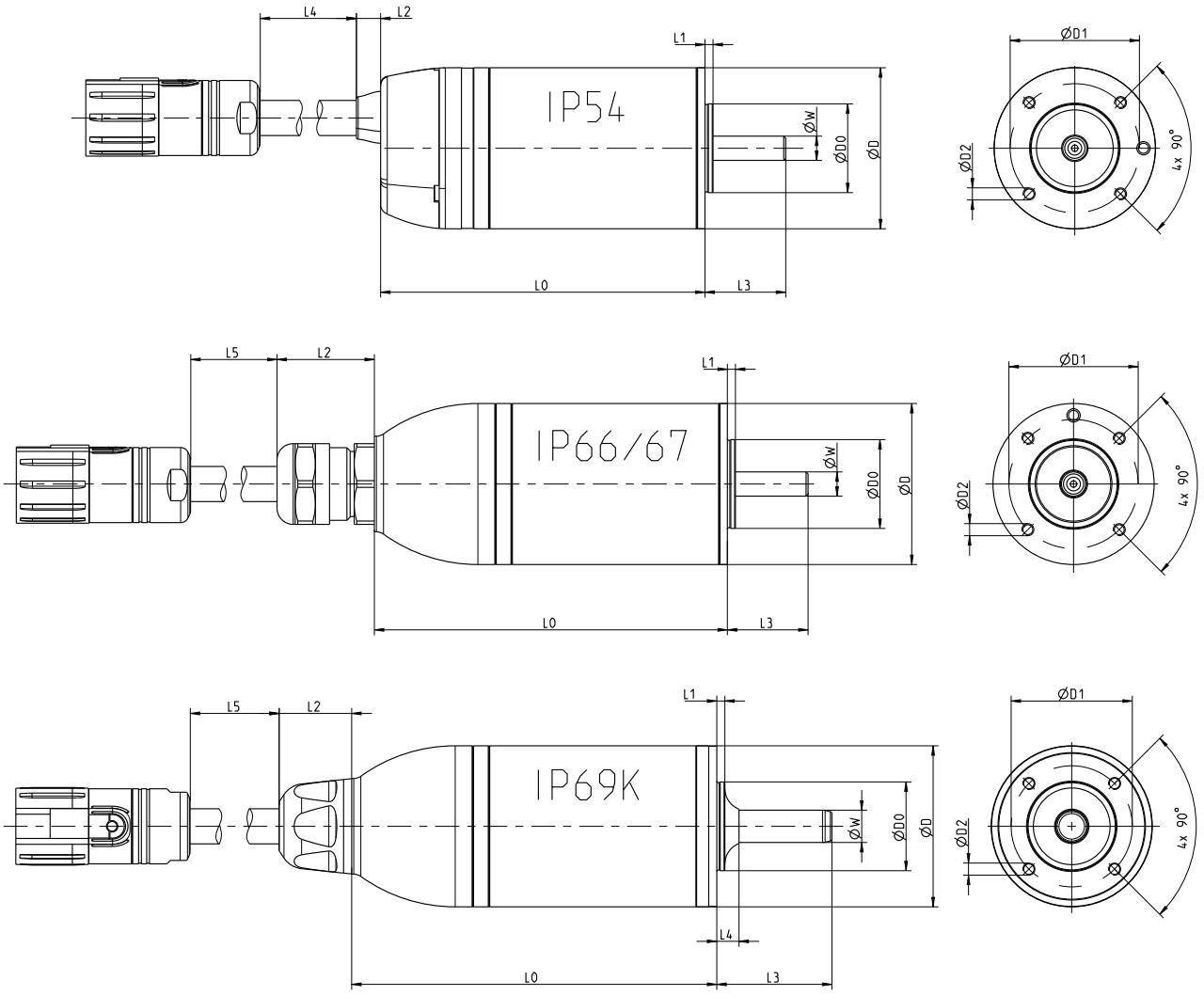
8WSA32



8WSA43



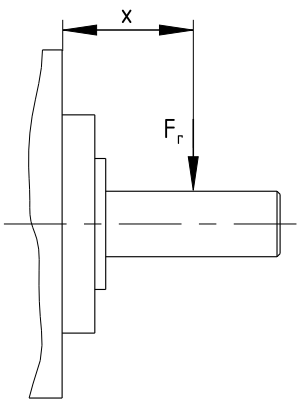
2.6.2 8WSA dimensions



	Protection	D	W	D0	D1	D2	L0	L1	L2	L3	L4	L5 [1]
8WSA11.eennnV0gg-0	IP54	17	3 -0.004	10 -0.05	12.5	M1.6 x 2.5	47	1.2	6	10	---	---
8WSA11.eennnV4gg-0	IP66/67	17	3 -0.004	10 -0.05	12.5	M1.6 x 2.5	54.5	1.2	20.5	10	---	---
8WSA21.eennnV0gg-0	IP54	22	4 -0.005	13 -0.05	17	M2 x 3.5	49	1.5	6	12	---	---
8WSA21.eennnV4gg-0	IP66/67	22	4 -0.005	13 -0.05	17	M2 x 3.5	58	1.5	20.5	12	---	---
8WSA32.eennnV0gg-0	IP54	32	6 -0.012	16 -0.05	22	M3 x 4.5	66	1.5	6	20.6	---	---
8WSA32.eennnV4gg-0	IP66/67	32	6 -0.012	16 -0.05	22	M3 x 4.5	75	1.5	24	20.6	---	---
8WSA43.eennnV0gg-0	IP54	40	6 -0.012	22 -0.05	32	M3 x 4.5	80.5	2	6	20	---	---
8WSA43.eennnV4gg-0	IP66/67	40	6 -0.012	22 -0.05	32	M3 x 4.5	87.5	2	24	20	---	---
8WSA43.eennnV8gg-0	IP69K	40	8 -0.015	22 -0.05	30	M3 x 4	90.5	2	18	28.5	5.5	---

1) see "Cable length (gg) 8WSA" on page 17

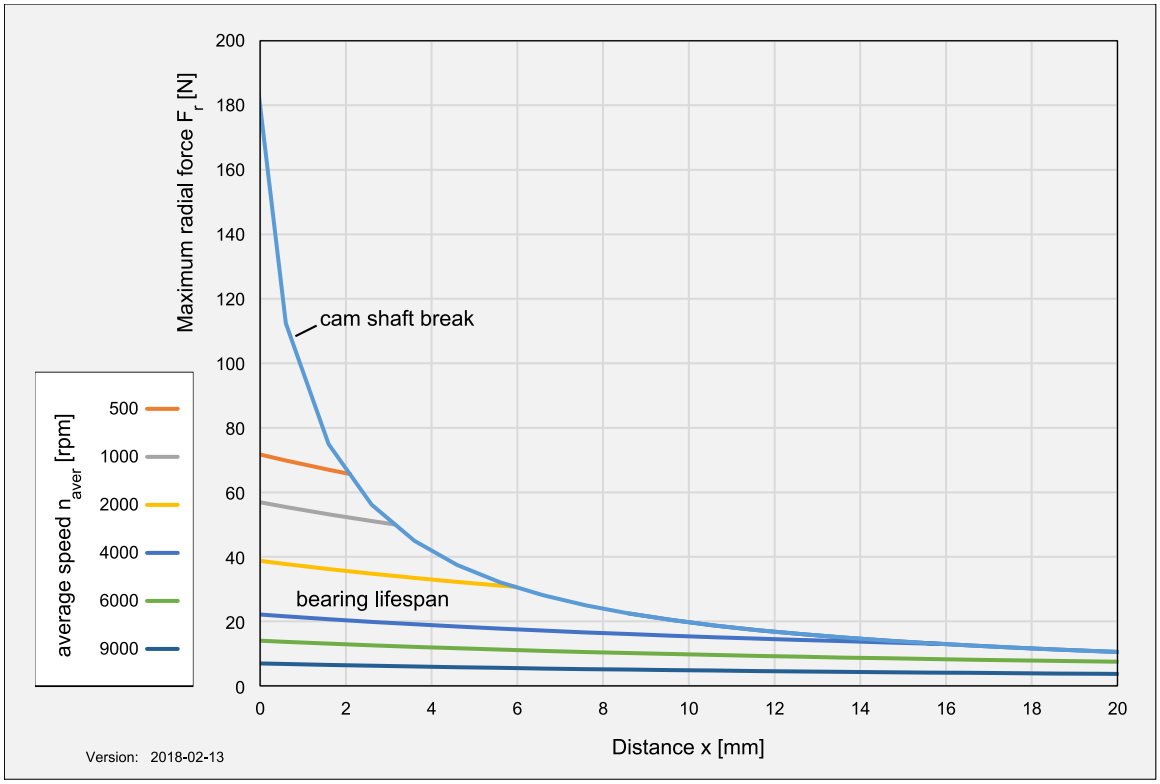
2.6.3 8WSA - Maximum shaft load



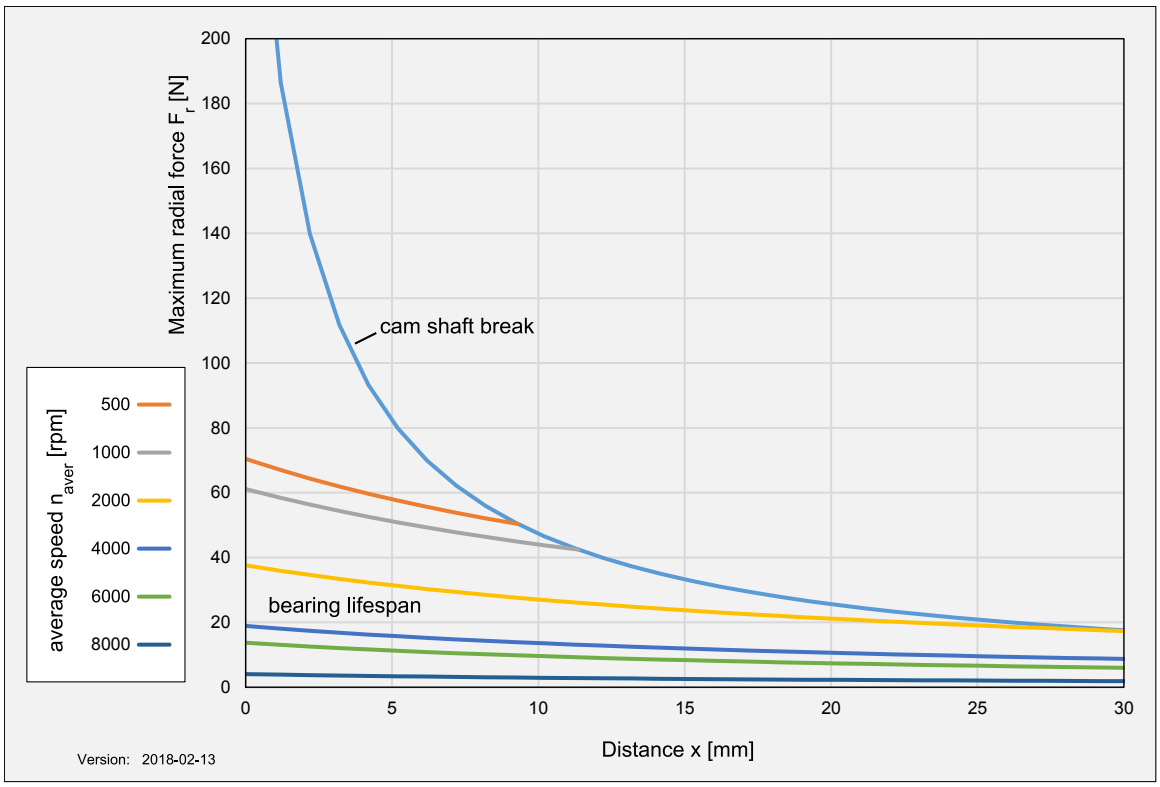
The values shown are based on a mechanical service life of the bearings of 20,000 operating hours.

F_r Radial force
x Distance between the motor flange and the point where radial force F_r is applied.

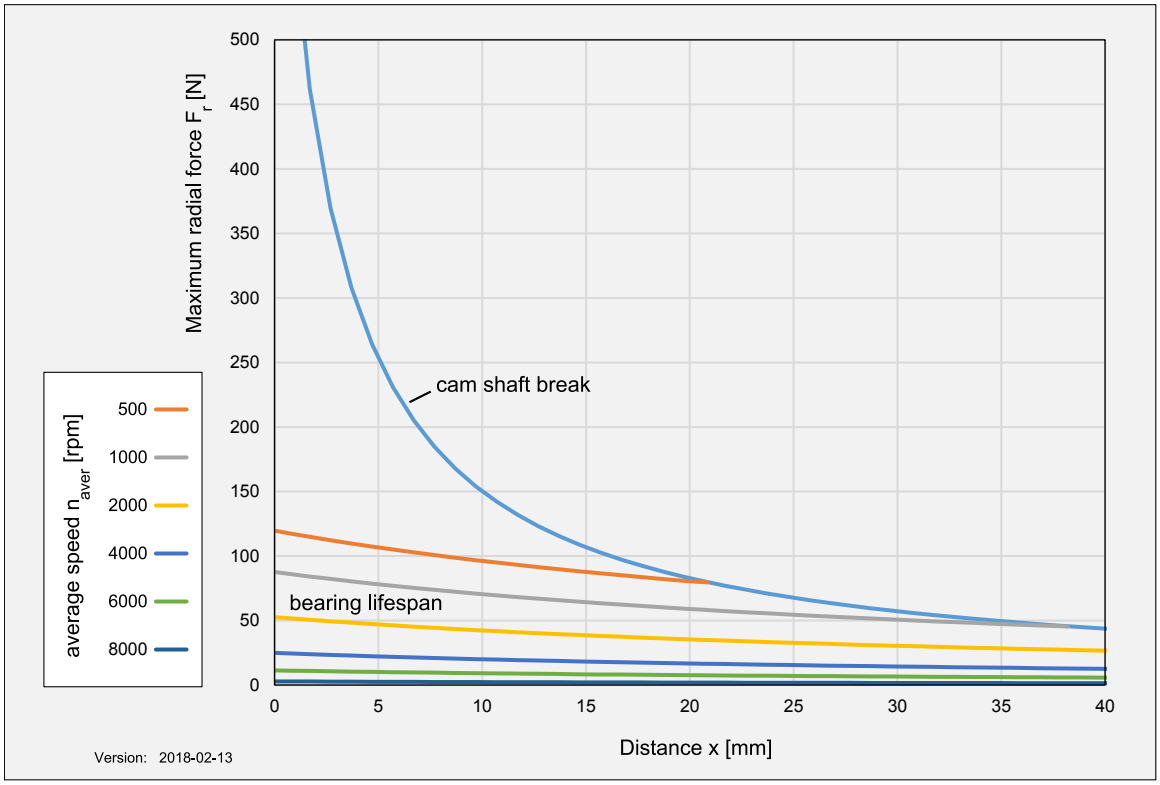
8WSA11



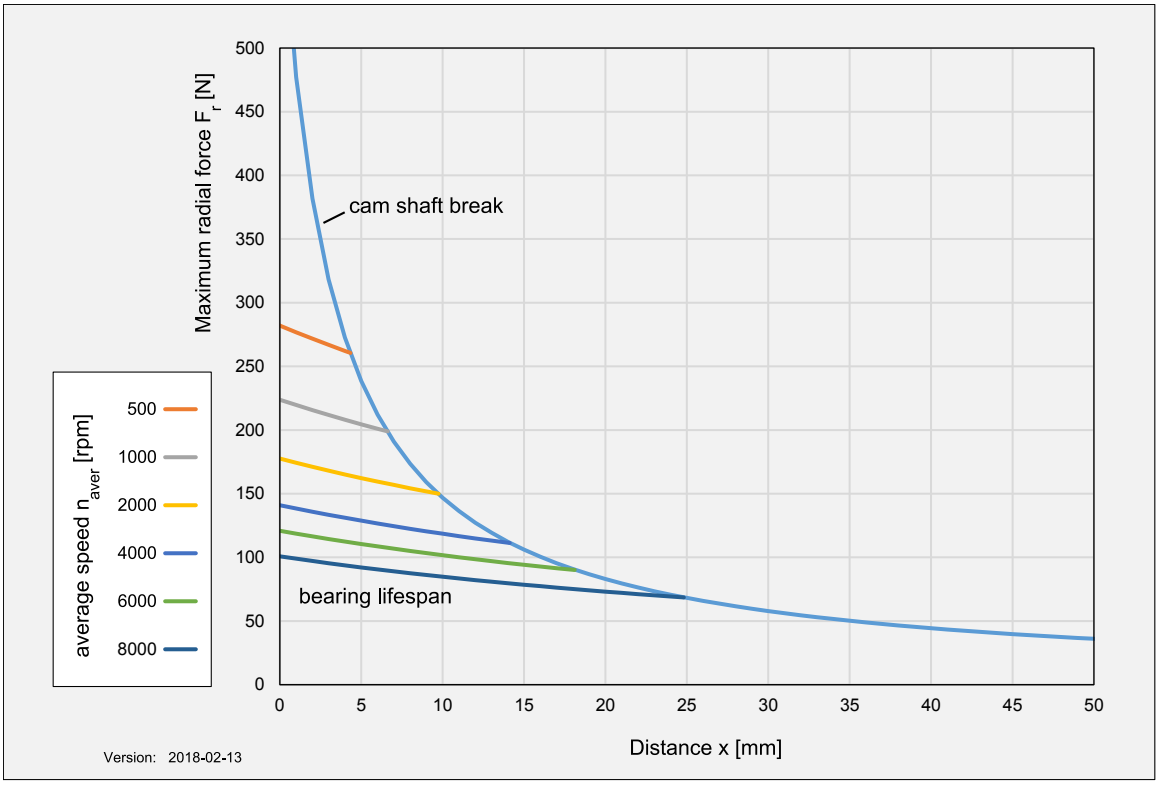
8WSA21



8WSA32



8WSA43


Maximum radial force F_r [N]
500
450
400
350
300
250
200
150
100
50
0
cam shaft break
bearing lifespan
average speed n_{aver} [rpm]
500
1000
2000
4000
6000
8000
0
5
10
15
20
25
30
35
40
45
50
Distance x [mm]
Version: 2018-02-13

2.7 8WSB - Technical data

Model number	8WSB11. ee004jjQop0	8WSB11. ee021jjQop0	8WSB11. ee064jjQop0	8WSB21. ee004jjQop0	8WSB21. ee016jjQop0	8WSB21. ee064jjQop0
Motor						
Nominal speed n_N [rpm]	6000	5985	5760	6000		5760
Number of pole pairs	4					
Nominal torque M_n [Nm]	0.005		0.004	0.025	0.024	0.019
Nominal current I_N [A]	0.32			0.78		0.7
Stall torque M_0 [Nm]	0.008	0.007	0.006	0.025	0.027	0.019
Stall current I_0 [A]	0.37			0.74	0.84	0.87
Maximum torque M_{max} [Nm]	0.03	0.02		0.05	0.06	0.04
Maximum current I_{max} [A]	1.2		1	1.6	1.9	1.2
Maximum speed n_{max} [rpm]	9000	8925	8960	9000	8960	
Torque constant K_T [Nm/A]	0.023				0.037	
Voltage constant K_E [V/1000 rpm]	1.48				2.37	
Stator resistance R_{2ph} [Ω]	13.3				5.23	
Stator inductance L_{2ph} [mH]	2.47				2.22	
Electrical time constant t_{el} [ms]	0.18				0.43	
Thermal time constant t_{therm} [min]	1.6				2.7	
Moment of inertia J [kgcm²]	0.0055	0.0021	0.0017	0.0092	0.0072	0.0052
Weight without brake m [kg]	0.13 [1]			0.18 [1]		0.16 [1]
Gearbox						
Number of gear stages	1	2	3	1	2	3
Gear ratio i	4	21	64	4	16	64
Max. drive speed n_{1max} [rpm]	10000					
Max. backlash J_t [arcmin]	20	35	50	20	35	50
Torsional rigidity C_{t21} [Nm/arcmin]	0.1				0.2	
Efficiency at full load η [%]	95	90	85	96	90	85
Weight m [kg]	0.02 [2]	0.03 [2]	0.03 [2]	0.04 [2]	0.05 [2]	0.06 [2]
Moment of inertia J_1 [kgcm²]	0.005	0.002	0.001	0.008	0.006	0.004
Recommendations						
ACOPOSmicro 80VD100Px.xxxx-01	C03X					
Connector type	I-Tec					

1) The value is valid for motors **without a gearbox** and with a **cable length** of **0.5** m.
To determine the total weight, the weight of the gearbox must be added to this value.
For motors with a cable length of 3.0 m, the value increases by 0.189 kg.

2) The value is valid for the **gearbox**. To determine the total weight, the weight of the motor must be added to this value.

Information: All nominal data is based on a supply voltage of 60 VDC of the B&R ACOPOSmicro drive system.

Model number	8WSB32. ee004jjQop0	8WSB32. ee016jjQop0	8WSB32. ee064jjQop0	8WSB43. ee004jjKop0	8WSB43. ee004S5Kop0	8WSB43. ee012jjKop0
Motor						
Nominal speed n_N [rpm]	5000	4960	4800	5000	4000	4900
Number of pole pairs	4					
Nominal torque M_n [Nm]	0.093	0.088	0.063	0.175	0.225	0.204
Nominal current I_N [A]	1.9		1.5	2.1	2.7	2.5
Stall torque M_0 [Nm]	0.1	0.094		0.175	0.275	0.253
Stall current I_0 [A]	2		1.5	2	3.1	
Maximum torque M_{max} [Nm]	0.2	0.25	0.09	0.35	0.8	0.65
Maximum current I_{max} [A]	4.1	5.6	2.1	4	10	8.4
Maximum speed n_{max} [rpm]	8000			7000		6980
Torque constant K_T [Nm/A]	0.056			0.095		
Voltage constant K_E [V/1000 rpm]	3.55			6.07		
Stator resistance R_{2ph} [Ω]	1.3			0.72		
Stator inductance L_{2ph} [mH]	1.75			1.34		
Electrical time constant t_{el} [ms]	1.35			1.87		
Thermal time constant t_{therm} [min]	6.7			11.3		
Moment of inertia J [kgcm²]	0.0207	0.0177	0.0167	0.055	0.065	0.049
Weight without brake m [kg]	0.36 [1]			0.64 [1]	0.66 [1]	0.64 [1]
Gearbox						
Number of gear stages	1	2	3	1		2
Gear ratio i	4	16	64	4		12
Max. drive speed n_{1max} [rpm]	10000			8000		
Max. backlash J_t [arcmin]	20	35	50	20		35
Torsional rigidity C_{t21} [Nm/arcmin]	0.3			0.4	0.6	0.4
Efficiency at full load ŋ [%]	96	90	85	96	97	90
Weight m [kg]	0.12 [2]	0.16 [2]	0.2 [2]	0.22 [2]	0.26 [2]	0.31 [2]
Moment of inertia J_1 [kgcm²]	0.015	0.012	0.011	0.03	0.04	0.024
Recommendations						
ACOPOSmicro 80VD100Px.xxxx-01	C03X					
Connector type	I-Tec					

1) The value is valid for motors **without a gearbox** and with a **cable length** of **0.5** m.
To determine the total weight, the weight of the gearbox must be added to this value.
For motors with a cable length of 3.0 m, the value increases by 0.316 kg.

2) The value is valid for the **gearbox**. To determine the total weight, the weight of the motor must be added to this value.

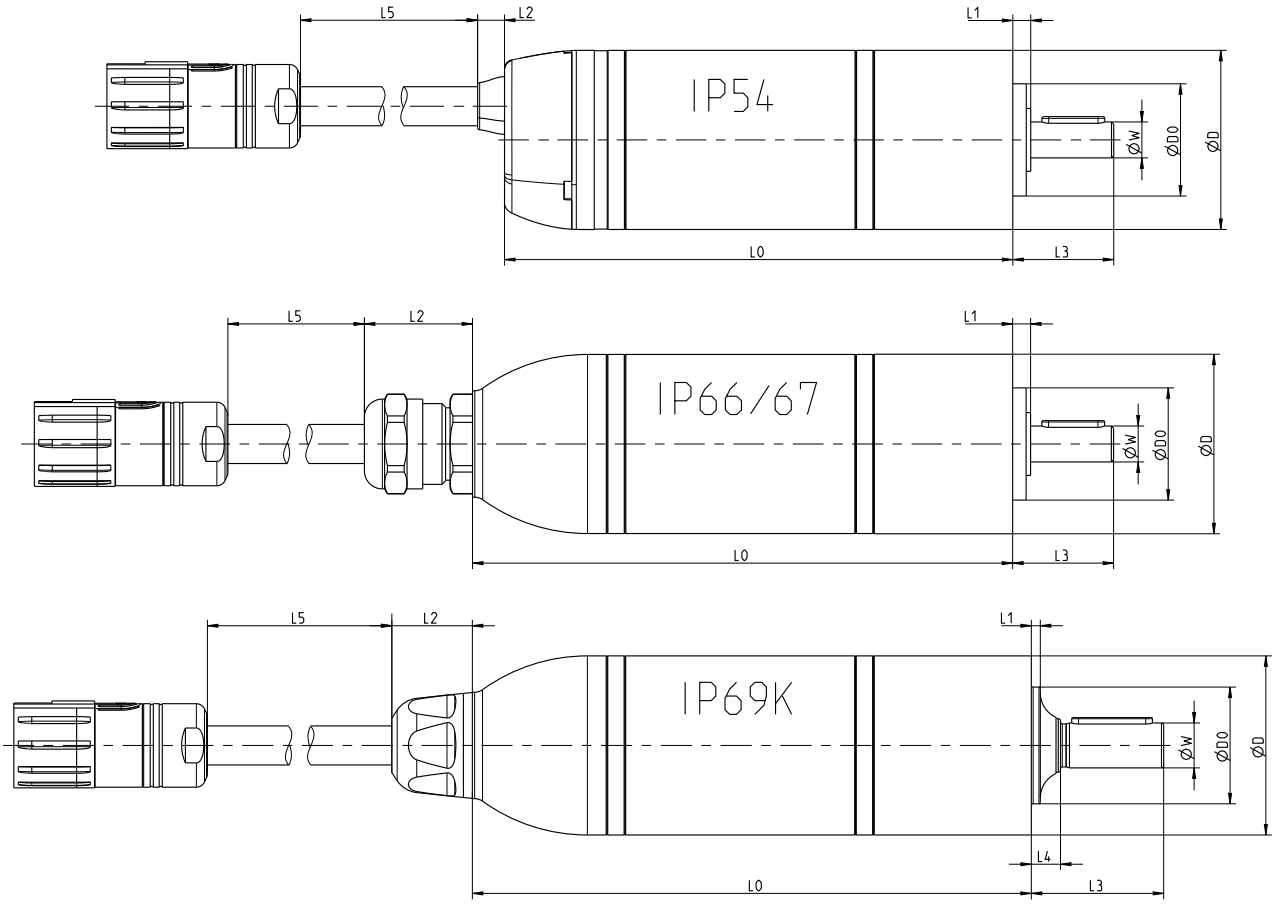
Information: All nominal data is based on a supply voltage of 60 VDC of the B&R ACOPOSmicro drive system.

Model number	8WSB43.ee016S5Kop0	8WSB43.ee049jjKop0	8WSB43.ee050S5Kop0
Motor			
Nominal speed n_N [rpm]	4000	4900	4000
Number of pole pairs		4	
Nominal torque M_n [Nm]	0.231	0.122	0.084
Nominal current I_N [A]	2.7	1.7	1.1
Stall torque M_0 [Nm]	0.263	0.122	0.084
Stall current I_0 [A]	3	1.6	1.1
Maximum torque M_{max} [Nm]	0.53	0.25	0.17
Maximum current I_{max} [A]	6.2	3.2	2
Maximum speed n_{max} [rpm]	6880	6860	7000
Torque constant K_T [Nm/A]		0.095	
Voltage constant K_E [V/1000 rpm]		6.07	
Stator resistance R_{2ph} [Ω]		0.72	
Stator inductance L_{2ph} [mH]		1.34	
Electrical time constant t_{el} [ms]		1.87	
Thermal time constant t_{therm} [min]		11.3	
Moment of inertia J [kgcm²]	0.065	0.049	0.065
Weight without brake m [kg]	0.66 [1)]	0.64 [1)]	0.66 [1)]
Gearbox			
Number of gear stages	2	3	2
Gear ratio i	16	49	50
Max. drive speed n_{1max} [rpm]		8000	
Max. backlash J_t [arcmin]	25	50	25
Torsional rigidity C_{t21} [Nm/arcmin]	0.6	0.4	0.6
Efficiency at full load ŋ [%]	95	85	95
Weight m [kg]	0.47 [2)]	0.38 [2)]	0.47 [2)]
Moment of inertia J_1 [kgcm²]	0.04	0.024	0.04
Recommendations			
ACOPOSmicro 80VD100Px.xxxx-01		C03X	
Connector type		I-Tec	

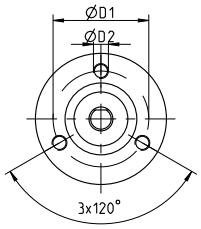
1) The value is valid for motors **without a gearbox** and with a **cable length** of **0.5** m.
To determine the total weight, the weight of the gearbox must be added to this value.
For motors with a cable length of 3.0 m, the value increases by 0.316 kg.
2) The value is valid for the **gearbox**. To determine the total weight, the weight of the motor must be added to this value.

Information: All nominal data is based on a supply voltage of 60 VDC of the B&R ACOPOSmicro drive system.

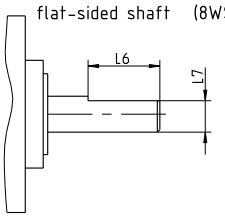
2.7.1 8WSB dimensions



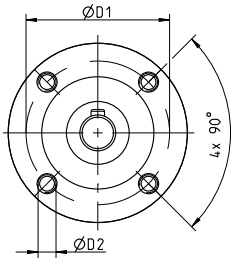
8WSB1 / 8WSB2



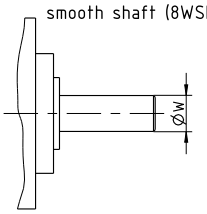
abgeflachte Welle (8WSB1 / 8WSB2)
flat-sided shaft (8WSB1 / 8WSB2)



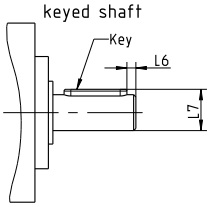
8WSB3 / 8WSB4



glatte Welle (8WSB3)
smooth shaft (8WSB3)



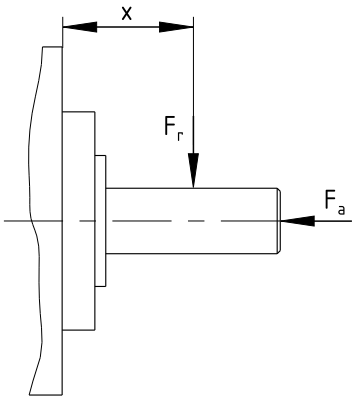
Welle mit Passfeder (8WSB4)
keyed shaft (8WSB4)



	Protection	D	W	D0	D1	D2	L0			L1	L2	L3	L4	L5 [1]	L6	L7	Key
							1-stage	2-stage	3-stage								
8WSB11.eeiiiS1QKp0	IP54	17	3 h6	10 h8	13	M2 x 4 (3x)	64.5	69.5	74.5	2	6	12.5	---	---	8	2.8	---
8WSB11.eeiiiS3QKp0	IP66/67	17	3 h6	10 h8	13	M2 x 4 (3x)	72	77	82	2	20.5	12.5	---	---	8	2.8	---
8WSB21.eeiiiS1QKp0	IP54	22	4 h6	12 h8	16	M2.5 x 4 (3x)	69	76	83	2.5	6	15	---	---	8	3.5	---
8WSB21.eeiiiS3QKp0	IP66/67	22	4 h6	12 h8	16	M2.5 x 4 (3x)	78	85	92	2.5	20.5	15	---	---	8	3.5	---
8WSB32.eeiiiS0QKp0	IP54	32	6 h6	20 h8	26	M3 x 5 (4x)	92.5	101.5	110.5	4	6	20	---	---	---	---	---
8WSB32.eeiiiS2QKp	IP66/67	32	6 h6	20 h8	26	M3 x 5 (4x)	101	110	119	4	24	20	---	---	---	---	---
8WSB43.eeiiiS1NKp0	IP54	40	8 h6	25 h8	32	M4 x 8 (4x)	113.5	126	138.5	4	6	22.5	---	---	2	9.2	3 x 3 x 14
8WSB43.eeiiiS3NKp0	IP66/67	40	8 h6	25 h8	32	M4 x 8 (4x)	120.5	133	145.5	4	24	22.5	---	---	2	9.2	3 x 3 x 14
8WSB43.eeiiiS5NKp	IP69K	40	10 j7	26 h7	32	M4 x 6 (4x)	124.5	140	---	2	18	29.5	6.5	---	2.5	11.2	3 x 3 x 18

1) see "Cable length (p) 8WSB" on page 22

2.7.2 8WSB - Maximum shaft load



The values in the table are based on a mechanical service life of the bearings of 10,000 operating hours.

F_r Radial force
F_a Axial force
x Distance between the motor flange and the point where radial force F_r is applied.

	Protection class	Permissible radial force F_r [N]	Permissible axial force F_a [N]	x [mm]
8WSB11	IP54, IP66/67	30	10	1.5
8WSB21	IP54, IP66/67	30	24	2
8WSB32	IP54, IP66/67	80	65	3
8WSB43	IP54, IP66/67	150	120	4
	IP69K	155	230	5

2.8 8WSA / 8WSB accessories

Hybrid motor cable 8BCM00X5.1B48E-0

Model number	Short description	Figure
	Accessories	
8BCM00X5.1B48E-0	8WS/ACOPOSmicro hybrid motor cable, length 0.5 m, ((2x(2x26AWG) + 2x24AWG)C + 3x16AWG)C, female 12+3-pin Itec hybrid motor connector, can be used in cable drag chains	

8BCM00xx.1B470-0 cable extensions

Model number	Short description
	Accessories
8BCM0003.1B470-0	8WS hybrid motor cable extension, length 3 m, ((3x(2x26AWG)+(2x24AWG))C+3x26AWG +3x16AWG)C, 12+3-pin Itec hybrid motor connector, can be used in cable drag chains
8BCM0005.1B470-0	8WS hybrid motor cable extension, length 5 m, ((3x(2x26AWG)+(2x24AWG))C+3x26AWG +3x16AWG)C, 12+3-pin Itec hybrid motor connector, can be used in cable drag chains
8BCM0010.1B470-0	8WS hybrid motor cable extension, length 10 m, ((3x(2x26AWG)+(2x24AWG))C+3x26AWG +3x16AWG)C, 12+3-pin Itec hybrid motor connector, can be used in cable drag chains
8BCM0015.1B470-0	8WS hybrid motor cable extension, length 15 m, ((3x(2x26AWG)+(2x24AWG))C+3x26AWG +3x16AWG)C, 12+3-pin Itec hybrid motor connector, can be used in cable drag chains

3 Transport and storage

During transport and storage, the product must be protected against undue stress (mechanical loads, temperature, moisture, corrosive atmospheres, etc.).

If necessary, also protect existing electrostatically sensitive components such as the encoders in motors against electrostatic discharge (ESD).

Never use attachment parts (cable connection, terminal boxes, fans, etc.) for securing during transport or as supporting surfaces.

Transport and storage conditions

- The room must be dry, dust-free and free of vibrations.
- The room must be well ventilated and free from drafts.
- The air in the room is not permitted to contain aggressive or hazardous gases.

Storage and transport conditions	
Storage temperature	5 to +40°C
Relative humidity during storage	5 to 95%, non-condensing
Transport temperature	5 to +40°C
Relative humidity during transport	5 to 95%, non-condensing

Radial or axial forces on the shaft

Caution!

Damage to property due to excessive radial or axial forces on the shaft.

Excessive radial or axial forces on the shaft can damage the bearing and impair the effect of any holding brake present to such an extent that the braking effect is non-existent or reduced. Similarly, encoder errors or damage to the gearbox can occur as a result.

- **Transport and store the product only in its original packaging and lying on the housing.**
- **Avoid pressure and impact on the shaft end and housing.**
- **Do not use the shaft for securing during transport.**
- **Transport and lift heavy output shaft components separately and not mounted on the shaft end.**

Transport

Check product deliveries immediately for transport damage and report any damage immediately to the carrier. In the event of damage, discontinue use where applicable.

Danger!

Danger of injury due to loads!

Suspended loads can lead to personal injury or death if they fall down. Heavy loads can tilt and trap people or severely injure them.

Failure to comply with instructions, guidelines and regulations or use of unsuitable or damaged tools and devices can result in serious injury and/or material damage.

- **Motors should only be lifted without any additional load from other products (e.g. gears, pulleys, couplings, etc.).**
- **If motors have eye bolts, only lift the motors using the eye bolts.**
- **Only use permitted lifting, transport and aids with sufficient lifting capacity.**
- **Never stand in the danger zone or under suspended loads.**
- **Secure the product against dropping and tilting.**
- **Wear safety shoes, protective clothing and a safety helmet.**
- **Comply with the national and local regulations.**

Storage

Caution!

Damage caused by degraded material properties.

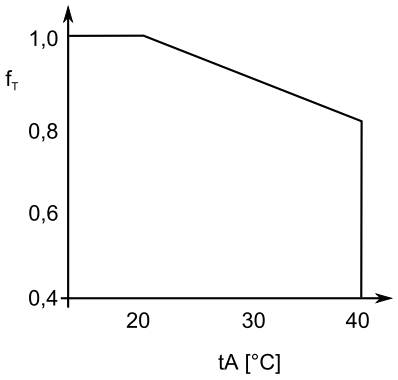
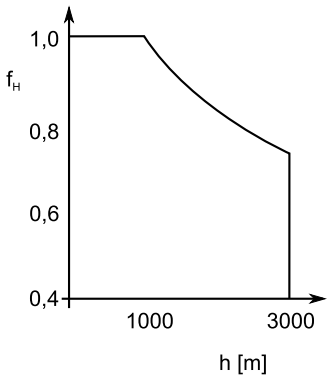
Storage for long periods of time or storage under improper conditions can cause certain materials to age prematurely, to have degraded properties and to become damaged. Damaged components can then result in further damage.

Recommendations to avoid damage during storage:

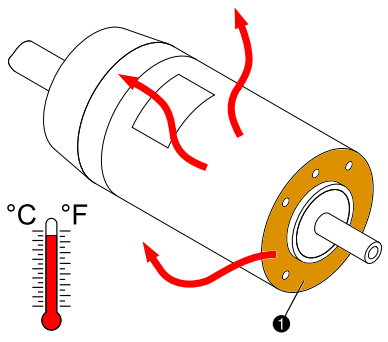
- **Reduce the storage time to a minimum and do not exceed the maximum storage time of 2 years.**
- **Rotate the motor shaft a few turns at least every 6 months either by hand or at a low speed (max. 50 rpm). Bearing noise can occur during the run-in phase, which is perfectly normal and is not a sign of bearing damage.**
- **Apply a preservative coating to unprotected components such as the shaft end.**
- **Avoid contact corrosion.**
- **Use the original packaging.**
- **Use covers to protect against dust.**
- **Check the seals for damage when the item is issued or prior to use.**

4 Installation conditions

Before every commissioning procedure, the motor must be checked by qualified personnel. The check must include the proper condition in terms of mounting and installation, the installation conditions and safe operation.

Operating conditions	
Rating class, operating mode per EN 60034-1	S1 - Continuous operation
Ambient temperature during operation	0°C to +40°C
Reduction of nominal and stall current as well as nominal and stall torque at temperatures above 20°C f_T ... Operating factor for the influence of ambient temperature **tA** ... Ambient temperature (°C)	
Temperature change rate	0.5 °C/min
Relative humidity during operation	5 to 95%, relative, non-condensing 1 to 29 g/m³, absolute
Reduction of nominal and stall current as well as nominal and stall torque at installation elevations starting at 1,000 m above sea level f_H ... Operating factor for the influence of installation elevation	
Maximum installation elevation	2000 m [3]
Max. winding temperature	120°C
EN 60034-5 protection (IP code)	IP54, IP66/67, IP69K
Type of construction and mounting arrangement per EN 60034-7 (IM code)	Horizontal (IM3001) Vertical, motor hangs on the machine (IM3011) Vertical, motor stands on the machine (IM3031)
Max. permissible vibration stress (55-2000 Hz) [6]	10 m/s²
Max. permissible shock load (11 ms) [7]	Axial 10 m/s² Radial 150 m/s²

4.1 Flange installation and cooling



Ensure unobstructed air circulation and cooling so that no heat accumulation can build up on the motor.

Attach the motor with the **motor flange** (1), which also serves as a **cooling surface**, directly on the machine.

The following points must be observed:

[3] Requirements that go beyond this must be arranged with B&R.
[6] Based on sinusoidal oscillations in stationary applications, the limit value is based on DIN EN 60721-3-3:1995 and DIN EN 60068-2-6:2007.
[7] For the maximum permissible shock load (short-term acceleration), the limit values are based on DIN EN 60721-3-3:1995 and DIN EN 60068-2-27:2009.

- The opposite side of the mounting flange is not permitted to be thermally insulated. Heat from the motor must be allowed to dissipate sufficiently.
- Air circulation must not be impeded. There must be sufficient cooling air on the motor housing.
- Exceeding the specified maximum values for motor temperature is not permitted.

It is important to note the following:

- Power or heat from the motors is dissipated via the mounting flange and surface of the motor housing.
- The motor can heat up due to external heat sources.

Caution!

Personal injury and damage to property due to failure or overheating of the drive.

If the maximum permissible operating temperature is exceeded, a drive defect with consequential damage is very probable.

The cause of a defect could insufficient lubrication due to overheating, for example.

- **For safety reasons, switch off the machine if the maximum permissible temperature is exceeded.**
- **Ensure unobstructed air circulation and cooling so that no heat accumulation can build up in the drive or machine.**

4.2 Load capacity of the shaft end and bearing

8WS servo motors are equipped with grooved ball bearings that are sealed on both sides and lubricated. Radial and axial forces (F_r, F_a) applied to the shaft end during operation and installation must be within the specifications listed below. Bearing elements are not permitted to be subjected to shocks or impacts! Incorrect handling will reduce the service life and result in damage to the bearings.

Radial force

The radial force F_r on the shaft end is a function of the loads during installation (e.g. belt tension on pulleys) and operation (e.g. load torque on the pinion). The maximum radial force F_r depends on the shaft end type, bearing type, average speed, the position where the radial force is applied and the desired service life of the bearings.

Axial force, shift in shaft position caused by axial force

The axial force F_a on the shaft end is a function of the loads during installation (e.g. stress caused by mounting) and operation (e.g. thrust caused by slanted tooth pinions). The maximum axial force F_a depends on the bearing type and the desired service life of the bearings.

Determining permissible values of F_r and F_a

For information about determining permissible values for F_r and F_a, see the motor data for the respective servo motor.

see "8WSA - Maximum shaft load" on page 30

see "8WSB - Maximum shaft load" on page 38

5 Installation and connection

5.1 Before installation

Read this user's manual completely before performing any work activities.

In addition, take into account the technical documentation for all other machine components as well as the finished machine.

5.2 Safety

Work on motors and their cabling is only permitted to be carried out by qualified personnel [2)] without voltage applied. Before installation, voltage to the control cabinet must be switched off and prevented from being switched on again.

Only use appropriate equipment and tools. Protect yourself with safety equipment.

Warning!

Personal injury and damage to property due to unauthorized modifications!

As a result of unauthorized modifications to the product, the performance and limit values can be negatively affected and dangers can arise. Due to this, severe damage to property and injuries cannot be excluded.

Unauthorized modifications are therefore prohibited!

- **Do not carry out any unauthorized modifications or alterations to the product.**
- **If necessary, contact B&R.**

5.2.1 General sources of danger

Tampering of protection or safety devices

Protective and/or safety devices protect you and other persons from dangerous voltage, rotating or moving elements and hot surfaces.

Danger!

Personal injury and damage to property due to tampering of protective equipment!

If protective or safety devices are removed or put out of operation, there is no longer any personal protection and serious personal injury and damage to property can occur.

- **Do not remove any safety devices.**
- **Do not put any safety devices out of operation.**
- **Always use all safety devices during short-term test and trial operations!**

Dangerous voltage

To operate the motors, dangerous voltage must be applied to certain parts.

2) see "Qualified personnel" on page 9

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the wrong order or when the power is switched on, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive when the power is switched on!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments when the power is switched off!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, drives and motors.

Danger!

Danger to health due to electromagnetic fields!

The functionality of a heart pacemaker can be impaired by electromagnetic fields to such an extent that the wearer experiences harm to his or her health, possibly with a fatal outcome.

- **Persons with pacemakers are not allowed to be in endangered areas.**
- **Warn staff by providing information, warnings and safety identification.**
- **Secure the danger zone by means of barriers.**
- **Reduce electromagnetic fields at their source (using shielding, for example).**

Dangerous motion

By rotating and positioning motions of the motors, machine elements are moved or driven and loads conveyed.

After switching on the machine, movements of the motor shaft must always be expected! For this reason, higher-level safety precautions need to be put in place to ensure that personnel and machines are protected. This type of protection can be achieved, for example, by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or photoelectric sensors.

In the immediate vicinity of the machine, provide sufficient and easily accessible emergency switching-off devices to stop the machine as quickly as possible in the event of an accident.

Danger!

Danger of injury due to rotating or moving elements and loads!

By rotating or moving elements, body parts can be drawn in or severed or subjected to impacts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Before working on the machine, secure it against unwanted movements. Any holding brake present is not suitable for this!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Motors can be started automatically via remote control! If appropriate, a corresponding warning symbol must be applied, and protective measures must be implemented to prevent entry into the high-risk area.**

Danger!

Danger of injury due to loads!

Suspended loads can lead to personal injury or death if they fall down. Heavy loads can tilt and trap people or severely injure them.

Failure to comply with instructions, guidelines and regulations or use of unsuitable or damaged tools and devices can result in serious injury and/or material damage.

- **Motors should only be lifted without any additional load from other products (e.g. connection elements).**
- **Only use permitted lifting, transport and aids with sufficient lifting capacity.**
- **Never stand in the danger zone or under suspended loads.**
- **Secure the product against dropping and tilting.**
- **Wear safety shoes, protective clothing and a safety helmet.**
- **Comply with the national and local regulations.**

Warning!

Danger of injury due to incorrect control or a defect.

Improper control of motors or a defect can result in injuries and unintended and hazardous movements of motors.

Such incorrect behavior can be triggered by:

- **Incorrect installation or faults when handling components**
- **Improper or incomplete wiring**
- **Defective devices (servo drive, motor, position encoder, cables, brake)**
- **Incorrect control (e.g. caused by software error)**

Risk due to hot surfaces

Due to the power dissipation from the motor and friction in the gearbox, these components as well as their environment can reach a temperature of more than 100°C.

The resulting heat is released to the environment via the housing and the flange.

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can lead to very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

5.2.2 Noise emissions

Take into account the health of personnel in proximity to the machine.

Warning!

Hearing damage due to noise levels.

During operation, the motor can exceed the permissible workplace noise level and also cause hearing damage.

- **Implement suitable noise reduction measures (e.g. housings, covers or other sound-insulating measures).**
- **Take into account applicable industrial safety regulations.**

5.3 Shaft end and bearing

The motor shaft is supported on both sides with grease-lubricated grooved ball bearings. Protect the motor from damage due to excessive radial and axial forces!

Under all circumstances, avoid the following loads on the front shaft end or the rear motor housing cover:

- Excessive pressure
- Impacts
- Hammer blows

Warning!

Damage due to excessive axial forces!

The motor bearings can be damaged or the service life reduced by excessive axial forces (e.g. by impacting or pressing) on the shaft. Damage to the encoder or any installed options (holding brake, gearbox) is also possible.

- **Do not hit the motor or output shaft with a hammer. The impact of a hammer certainly exceeds the permissible values.**
- **In addition, avoid impact and excessive pressure on the motor and output shaft.**

Overdetermined bearing

Avoid an overdetermined bearing when attaching drive elements onto the output shaft! The necessarily occurring tolerances cause additional forces on the output shaft bearing. This can damage or significantly reduce the service life of the bearings!

Lifting and transporting

The weight of attachment elements (toothed gears, pulleys, couplings, etc.) can have a harmful effect on the bearing during lifting and transportation from the motor. Take into account these radial and axial loads during these operations!

Installing and removing attachment elements

Always install and remove the attachment elements (toothed gears, pulleys, couplings, etc.) at the shaft end without any axial load on the motor bearings and all other parts installed in the motor. For this, use suitable clamping sets, pressure sleeves, other tensioning elements, retractors, etc. The centering hole on the face side of the shaft end can be used for this work.

Pay attention to balanced connection elements or corresponding assembly.

Secure the attachments against unintended loosening after installation and before operation.

5.4 Installing in the system

Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system and secure them against being switched on again by other persons or automatic systems.

Inspection

Before installation, inspect the components to determine whether they are suitable and undamaged.

Warning!

Personal injury and damage to property due to damaged or unsuitable machine components!

Operating a machine with damaged or unsuitable components is a safety risk and can lead to failures. Severe damage to property and injuries cannot be excluded.

- **Never operate a machine with a damaged motor or gearbox or any other damaged component.**
- **Never install a damaged component in a machine.**
- **Do not use motors or gearboxes that have already been overloaded during operation.**
- **Before installation, ensure that the motor or gearbox is suitable for the machine.**
- **It is better not to carry out short-term test and trial operations with damaged or inappropriate machine components.**
- **Label damaged or non-operational components in a readily visible location and clearly.**

Cleaning

Clean anti-corrosive agents and dirt off the output shaft and flange of the motor as well as the opposite side of the shaft and flange.

Caution!

Damage to property caused by improper cleaning.

Contact with cleaning agents can damage oil seals, sealing lips and gaskets.

- **Only use suitable and material-friendly cleaning agents.**
- **Ensure that oil seals, sealing lips and gaskets do not come into contact with cleaning agents.**

Installation with the mounting flange

Attach the motor with the mounting flange, which also serves as a cooling surface, directly to the machine.

For this, the motor must be screwed to the machine via the flange.

Apply tightening torque in accordance with the standard when tightening the screws and use a screw locking mechanism.

Note:

The nameplate must be visible at all times when the motor is installed.

Mounting materials

Use screws of property class A2-70. Washers are not permitted.

Note:

Screwing the mounting screws too deeply into the motor can damage the motor.

It is therefore necessary to pay attention to the maximum screw-in depth. To determine the length value, see the technical drawing for the motor being used.

Tightening torque

Take the tightening torque for screws in the motor flange into account.

The values given for screws are calculated values and are based on the following requirements:

- Calculation per VDI 2230 (Edition - February 2003)
- Coefficient of friction for threads and bearing surfaces μ = 0.10
- Utilization of yield strength 90%.
- Torque tools type II classes A and D per ISO 6789

The setting values are rounded to commercially available scales or setting options.

	Thread size / Tightening torque					
Property class	**M1.6**	**M2**	**M2.5**	**M3**	**M4**	**M5**
A2-70	0.109	0.227	0.460	0.806	1.86	3.68

5.5 Connecting and disconnecting the motor

Observe the following safety guidelines and instructions when connecting and disconnecting the motor:

The protective ground conductor must be connected via the power connection or motor connector.

Danger!

Personal injury and damage to property due to missing ground potential!

If there is no proper ground potential on the motor housing or servo drive, fault currents can lead to serious personal injury and damage to property.

- **Properly (also during short-term test and trial operation!) connect the motor housing and the servo drive to the ground potential (PE rail).**

Danger!

Personal injury and damage to property due to direct mains connection!

Connecting the motor directly to the mains leads to severe personal injury and damage to property.

- **Only operate the motor with B&R drive systems.**

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the wrong order or when the power is switched on, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive when the power is switched on!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments when the power is switched off!**

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can lead to very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

5.5.1 Cables and connectors

Information:

To find the technical data and order data for the cables, see the current user's manual for the B&R drive system being used.
They are available in the Downloads section of the B&R website www.br-automation.com.

5.5.1.1 Cables from other manufacturers

Caution!

Damage caused by voltage rise!

Cables from other manufacturers can have a negative effect on voltage rise on the winding. The winding can become damaged as a result of voltage rise.

- **If non-B&R cables are used, you must provide documented evidence of conformity with voltage class A per EN 60034-25.**
- **If this evidence has not been provided, there is no claim to warranty due to winding damage that can be attributed to a rise in voltage on the winding.**

5.5.1.2 Connectors from other manufacturers

Note:

Disturbances caused by electrical or electromagnetic effects!

When using connectors from other manufacturers, EMC faults cannot be excluded.

- **Use B&R connectors to ensure compliance with the EMC limit values of the connection.**
- **Ensure proper assembly and that cable shields are connected correctly.**

5.5.1.3 Cable routing

Improperly routed cables can be damaged.

Always route the power supply cable to the motor in such a way that a minimum bending radius of 10x the outer diameter (moving) or 5x outer diameter (rigid) is maintained.

Avoid twisting the cables by more than ±30° over a length of 1 m.

The maximum strain permitted on the power supply cable depends on the motor and is specified as follows:

Motor		F_{max} [N]
Size	**Motor diameter**	
1	ø 17 mm	10
2	ø 22 mm	15
3	ø 32 mm	17
4	ø 40 mm	20

5.5.2 Order of connection

When connecting or disconnecting the servo motor, the following safety guidelines and orders must be observed.

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

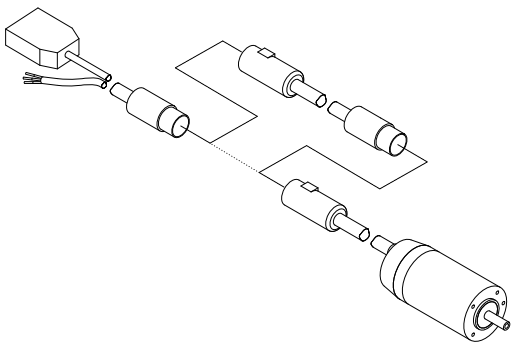
If connections are connected or disconnected in the wrong order or when the power is switched on, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive when the power is switched on!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments when the power is switched off!**

Danger!

After switching off the servo drive, wait for the DC bus to discharge for at least five minutes. To avoid a hazard, the current voltage on the DC bus must be measured between -DC1 and +DC1 and less than 42 VDC before starting work with a suitable measuring instrument. An unlit operating LED does not indicate that the device is de-energized!



Connecting

1. Disconnect the machine from the power system and secure it against being switched on again.
2. Connect the Y-cable (and extension cable if required) to the motor connector.
3. Connect the power supply (Y-cable / motor phases U V W) to the ACOPOSmicro drive.
4. Connect the encoder connector to the ACOPOSmicro drive.

Disconnecting

1. Disconnect the machine from the power system and secure it against being switched on again.
2. Disconnect the encoder connector from the ACOPOSmicro drive.
3. Disconnect the power supply (Y-cable / motor phases U V W) from the ACOPOSmicro drive.
4. Disconnect the Y-cable (and extension cable if required) from the motor connector.

5.5.3 Ensure proper connections

The SpringTec system offers a quick-release fastener for automatic locking.

Caution!

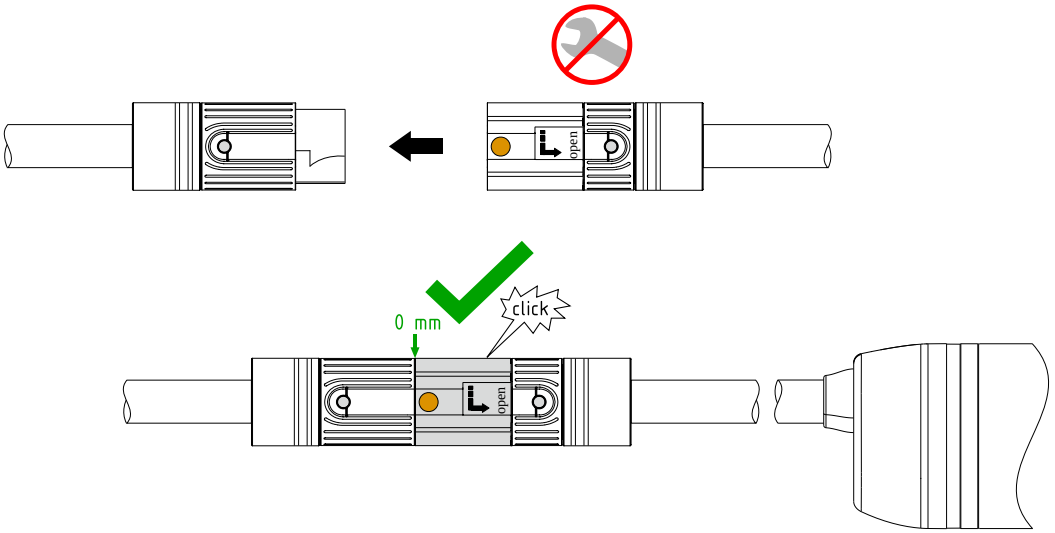
Damage due to improper connector installation!

Incorrectly attached connectors can lead to malfunctions and damage to the motor and encoder!

- **Always attach the connectors without excessive force or the use of tools.**
- **Make sure that the connectors are fully attached and locked if necessary.**

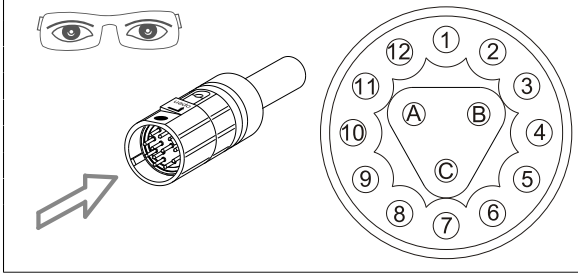
5.5.3.1 SpringTec system

The self-locking SpringTec system twists the first ring when attached and returns it to the middle position after it has been locked.



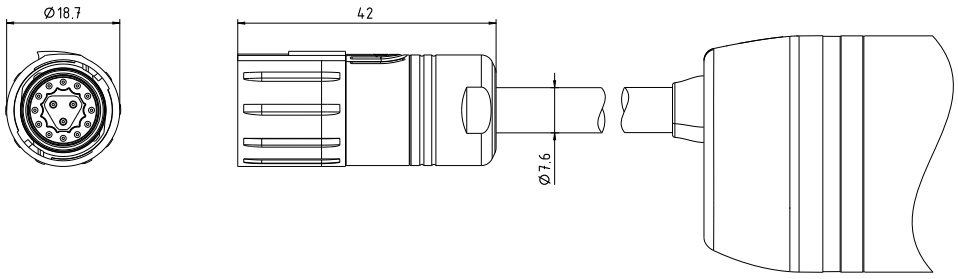
5.5.4 Connection type

5.5.4.1 Pinout



Pin	Function
A	Motor connection U
B	Motor connection V
C	Motor connection W
1	Encoder power supply GND
2	Encoder power supply +5 V
3	Clock
4	Clock inverted
5	Data
6	Data inverted

5.5.4.2 Connector dimensions



6 Commissioning and operation

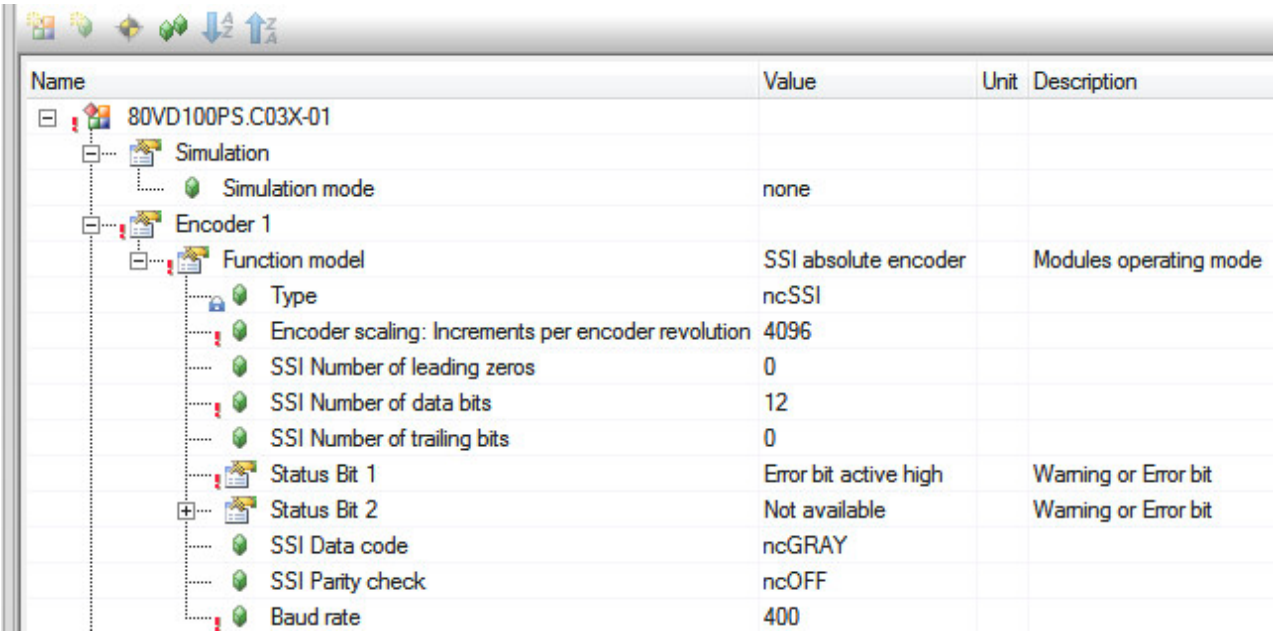
6.1 Before commissioning and operation

Read this user's manual completely before starting any commissioning activities or operation.

In addition, take into account the technical documentation for all other machine components (e.g. the ACOPOS drive system) as well as the finished machine.

6.1.1 Settings in Automation Studio

Make the necessary motor encoder adjustments in Automation Studio before commissioning.



Software support

Support	
Automation Studio	V4.4.6 and higher
Motion system (mapp Motion, ACP10)	V5.04 and higher[3)]
ACOPOSmicro hardware upgrade	V2.3.0.0 and higher

Danger!

Risk of injury due to electric shock!

When using unsupported versions of mapp Motion and ACP10, the supply voltage is not checked to determine if the maximum value of 60 VDC has been exceeded. If live parts >60 VDC are touched, there is immediate danger of fatal electric shock.

- **Only use supported versions of mapp Motion and ACP10.**
- **For safety reasons, set the supply voltage of the B&R ACOPOSmicro drive system to max. 60 VDC.**
- **Do not touch any live parts even with supply voltages <60 VDC and disconnect the machine completely from the power system when working on it and secure it against being switched on again by other persons or automatic systems.**

6.2 Safety

Commissioning is only permitted to be carried out by qualified personnel [1)]

[3)] Important: With older versions, the supply voltage is not checked for a maximum value of 60 VDC and incorrect settings may occur.
[1)] You can find the definition of "qualified personnel" in chapter "General", subchapter "Safety".

Only use appropriate equipment and tools. Protect yourself with safety equipment.

Caution!

Severe personal injury and damage to property due to failure of the servo drive!

If the servo drive fails, an uncontrolled motor can cause damage.

Electronic devices are never completely failsafe!

- **Ensure that the motor is brought into a safe state if the servo drive fails.**

6.2.1 General sources of danger

Tampering of protection or safety devices

Protective and/or safety devices protect you and other persons from dangerous voltage, rotating or moving elements and hot surfaces.

Danger!

Personal injury and damage to property due to tampering of protective equipment!

If protective or safety devices are removed or put out of operation, there is no longer any personal protection and serious personal injury and damage to property can occur.

- **Do not remove any safety devices.**
- **Do not put any safety devices out of operation.**
- **Always use all safety devices during short-term test and trial operations!**

Dangerous voltage

To operate the motors, dangerous voltage must be applied to certain parts.

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the wrong order or when the power is switched on, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive when the power is switched on!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments when the power is switched off!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, drives and motors.

Danger!

Danger to health due to electromagnetic fields!

The functionality of a heart pacemaker can be impaired by electromagnetic fields to such an extent that the wearer experiences harm to his or her health, possibly with a fatal outcome.

- **Persons with pacemakers are not allowed to be in endangered areas.**
- **Warn staff by providing information, warnings and safety identification.**
- **Secure the danger zone by means of barriers.**
- **Reduce electromagnetic fields at their source (using shielding, for example).**

Dangerous motion

By rotating and positioning motions of the motors, machine elements are moved or driven and loads conveyed.

After switching on the machine, movements of the motor shaft must always be expected! For this reason, higher-level safety precautions need to be put in place to ensure that personnel and machines are protected. This type of protection can be achieved, for example, by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or photoelectric sensors.

In the immediate vicinity of the machine, provide sufficient and easily accessible emergency switching-off devices to stop the machine as quickly as possible in the event of an accident.

Danger!

Danger of injury due to rotating or moving elements and loads!

By rotating or moving elements, body parts can be drawn in or severed or subjected to impacts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Before working on the machine, secure it against unwanted movements. Any holding brake present is not suitable for this!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Motors can be started automatically via remote control! If appropriate, a corresponding warning symbol must be applied, and protective measures must be implemented to prevent entry into the high-risk area.**

Danger!

Danger of injury due to loads!

Suspended loads can lead to personal injury or death if they fall down. Heavy loads can tilt and trap people or severely injure them.

Failure to comply with instructions, guidelines and regulations or use of unsuitable or damaged tools and devices can result in serious injury and/or material damage.

- **Motors should only be lifted without any additional load from other products (e.g. connection elements).**
- **Only use permitted lifting, transport and aids with sufficient lifting capacity.**
- **Never stand in the danger zone or under suspended loads.**
- **Secure the product against dropping and tilting.**
- **Wear safety shoes, protective clothing and a safety helmet.**
- **Comply with the national and local regulations.**

Warning!

Danger of injury due to incorrect control or a defect.

Improper control of motors or a defect can result in injuries and unintended and hazardous movements of motors.

Such incorrect behavior can be triggered by:

- **Incorrect installation or faults when handling components**
- **Improper or incomplete wiring**
- **Defective devices (servo drive, motor, position encoder, cables, brake)**
- **Incorrect control (e.g. caused by software error)**

Risk due to hot surfaces

Due to the power dissipation from the motor and friction in the gearbox, these components as well as their environment can reach a temperature of more than 100°C.

The resulting heat is released to the environment via the housing and the flange.

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can lead to very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

6.2.2 Reversing operation

Warning!

Personal injury and damage to property due to shaft breakage!

The shaft key can become dislodged during heavy reverse operation. In extreme cases, this can cause the shaft end to break, which can lead to severe damage!

- **It is therefore preferable to use a smooth shaft during heavy reversing operation.**

6.2.3 Freely rotating motors

With freely rotating motors, remove any existing shaft keys (or mounting screws or other mounting elements) before operation or implement measures to prevent their ejection. Any shaft protection sleeve present, such as used for transport and storage, is not appropriate protection and must also be removed.

Warning!

Personal injury and damage to property due to ejected elements!

With freely rotating motors, an existing shaft key (or mounting screws or other mounting elements) can be ejected and cause personal injury and damage to property.

- **Remove or secure shaft keys (or mounting screws or other assembly elements) before operation (even during short-term testing and trial operations!).**
- **Any shaft protection sleeve present, such as used for transport and storage, is not appropriate protection and must also be removed.**

6.3 Verification

6.3.1 To verify before commissioning

Before commissioning, ensure the following:

- The drive is not damaged and the motor is not in the danger zone for other devices.
- The motor is properly set up and mounted.
- The screw connections are tightened correctly.
- Any unused connection threads on the flanged end shield are sealed.
- All components attached to the output shaft are secured against unintentional release.
- Shaft keys and other mounting elements have been removed from freely rotating motors. They can be ejected due to centrifugal force.
- All the necessary protective equipment (mechanical, thermal, electrical) is installed.
- The motor connections are properly installed.
- The protective ground conductor is installed properly and verified.
- The wires are not touching the motor surface.
- The drive is free (release brake).
- The emergency switch-off functions have been checked.
- The fan, if present, has been properly connected and checked to ensure that it is operational.

Warning!

Personal injury and damage to property due to damaged or unsuitable machine components!

Operating a machine with damaged or unsuitable components is a safety risk and can lead to failures. Severe damage to property and injuries cannot be excluded.

- **Never operate a machine with a damaged motor or gearbox or any other damaged component.**
- **Never install a damaged component in a machine.**
- **Do not use motors or gearboxes that have already been overloaded during operation.**
- **Before installation, ensure that the motor or gearbox is suitable for the machine.**
- **It is better not to carry out short-term test and trial operations with damaged or inappropriate machine components.**
- **Label damaged or non-operational components in a readily visible location and clearly.**

6.3.2 To verify during commissioning

During commissioning, check the following:

- The functionality of all the motor's components (e.g. protective equipment, encoder, brake, cooling, gearbox, etc.) has been verified.
- The operating conditions (see chapter "Installation conditions") are observed.
- The holding brake, if present, is released.
- All electrical attachments and connections are properly designed and secured.
- All protective measures have been implemented in order to prevent contact with voltage-carrying components, hot surfaces and rotating or moving parts and assemblies. Also check whether these protective measures are working properly.
- All output elements have been installed and set up in accordance with the manufacturer's specifications.
- Measures are in place to ensure that the maximum permissible speed n_{max} of the motor cannot be exceeded. The maximum permissible speed n_q is the maximum speed that is permissible for short-time duty.

6.3.3 During operation

During operation, be aware of the following signs that can indicate a malfunction:

- Unusual noises
- Unusual vibrations
- Unusual odors
- Smoke generation
- Unusual temperature development
- Increased power consumption
- Lubricant outlet
- The monitoring or safety device responds

If possible, switch off the machine as soon as possible in order to avoid damage or accidents. Always ensure the safety of other persons as well as your own safety during shutdowns and causal investigation!

In the case of shutdowns, please inform the responsible specialized personnel immediately.

6.4 Faults during operation

In the following table, you can find possible causes of error broken down by malfunction as well as information about how to fix them.

Fault	Possible cause	Fix
Motor will not start	Settings not make in Automation Studio	Check the settings in Automation Studio. see "Settings in Automation Studio" on page 54
	Connector is not attached correctly	Check the connection. see "Ensure proper connections" on page 52
	Incorrectly connected	Check the connections using the signal list. see "Pinout" on page 53
	Connector pin pressed in	Check the connections.
	Parameter set does not match the motor	Check the motor data record in the power electronics.
Increased operating temperature	Motor heavily soiled	Clean the outside of the motor.
	Ambient temperature too high / low air pressure due to altitude	Ensure sufficient cooling.
	Motor heats up excessively	Check the motor's power electronics motor and the supply voltage.
Increased operating noise	Bearing damage	If necessary, contact B&R.
	Gearbox damage	If necessary, contact B&R.
Sporadic failure	Open circuit	If necessary, contact B&R.

If necessary, contact B&R.

For this, the following information should be provided:

- Order description and serial number (see nameplate)
- Type and extent of fault

- Circumstances under which the fault occurred
- Application data (cycle of torque, speed and forces over time, environmental conditions)

7 Inspection and maintenance

Various operating conditions (e.g. operating mode, temperature, speed, load, mounting orientation), can have a significant impact on the service life of lubricants, seals and bearings.

Depending on the pollution degree, clean regularly on site to ensure heat is being dissipated properly, for example.

The following tasks are the responsibility of the operator:

- A maintenance plan and the documentation of inspections and maintenance work is created.
- Motors and cooling air-supplying construction are checked for dirt, moisture and leaks.
- Motors and cooling air-supplying construction are cleaned.
- Checking cables and connectors for damage.
- All safety devices are tested for safe operation.

7.1 Motor bearing

Motor bearing

In the case of trouble-free operation, we recommend changing the motor bearing after approx. 10,000 (8WSB) or 20,000 (8WSA) operating hours as a general maintenance guideline (calculated bearing mission time L_{h10}: 10,000 or 20,000 operating hours).

7.2 Safety

Work on motors and their cabling is only permitted to be carried out by qualified personnel [2)] without voltage applied. Before installation, voltage to the control cabinet must be switched off and prevented from being switched on again.

Only use appropriate equipment and tools. Protect yourself with safety equipment.

Warning!

Personal injury and damage to property due to unauthorized modifications!

As a result of unauthorized modifications to the product, the performance and limit values can be negatively affected and dangers can arise. Due to this, severe damage to property and injuries cannot be excluded.

Unauthorized modifications are therefore prohibited!

- **Do not carry out any unauthorized modifications or alterations to the product.**
- **If necessary, contact B&R.**

7.2.1 General sources of danger

Tampering of protection or safety devices

Protective and/or safety devices protect you and other persons from dangerous voltage, rotating or moving elements and hot surfaces.

Danger!

Personal injury and damage to property due to tampering of protective equipment!

If protective or safety devices are removed or put out of operation, there is no longer any personal protection and serious personal injury and damage to property can occur.

- **Do not remove any safety devices.**
- **Do not put any safety devices out of operation.**
- **Always use all safety devices during short-term test and trial operations!**

[2)] see "Qualified personnel" on page 9

Dangerous voltage

To operate the motors, dangerous voltage must be applied to certain parts.

Danger!

Risk of injury due to electric shock!

If live parts are touched, there is immediate danger of fatal electric shock.

If connections are connected or disconnected in the wrong order or when the power is switched on, electric arcs can occur and persons and contacts can be damaged.

Even if the motor is not rotating or is running as a generator driven externally, the control and power connections can still carry voltage!

- **Never touch connections when the power is switched on.**
- **Never disconnect or connect electrical connections to the motor and servo drive when the power is switched on!**
- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the power system and secure them against being switched on again by other persons or automatic systems.**
- **Note the discharge time of any existing DC bus.**
- **Only connect measuring instruments when the power is switched off!**

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, drives and motors.

Danger!

Danger to health due to electromagnetic fields!

The functionality of a heart pacemaker can be impaired by electromagnetic fields to such an extent that the wearer experiences harm to his or her health, possibly with a fatal outcome.

- **Persons with pacemakers are not allowed to be in endangered areas.**
- **Warn staff by providing information, warnings and safety identification.**
- **Secure the danger zone by means of barriers.**
- **Reduce electromagnetic fields at their source (using shielding, for example).**

Dangerous motion

By rotating and positioning motions of the motors, machine elements are moved or driven and loads conveyed.

After switching on the machine, movements of the motor shaft must always be expected! For this reason, higher-level safety precautions need to be put in place to ensure that personnel and machines are protected. This type of protection can be achieved, for example, by using stable mechanical protective equipment such as protective covers, protective fences, protective gates or photoelectric sensors.

In the immediate vicinity of the machine, provide sufficient and easily accessible emergency switching-off devices to stop the machine as quickly as possible in the event of an accident.

Danger!

Danger of injury due to rotating or moving elements and loads!

By rotating or moving elements, body parts can be drawn in or severed or subjected to impacts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Before working on the machine, secure it against unwanted movements. Any holding brake present is not suitable for this!**
- **Keep all covers and control cabinet doors closed during operation and as long as the machine is not disconnected from the power system.**
- **Always operate the motor with all safety equipment. Do this even during short testing and trial operations!**
- **Motors can be started automatically via remote control! If appropriate, a corresponding warning symbol must be applied, and protective measures must be implemented to prevent entry into the high-risk area.**

Danger!

Danger of injury due to loads!

Suspended loads can lead to personal injury or death if they fall down. Heavy loads can tilt and trap people or severely injure them.

Failure to comply with instructions, guidelines and regulations or use of unsuitable or damaged tools and devices can result in serious injury and/or material damage.

- **Motors should only be lifted without any additional load from other products (e.g. connection elements).**
- **Only use permitted lifting, transport and aids with sufficient lifting capacity.**
- **Never stand in the danger zone or under suspended loads.**
- **Secure the product against dropping and tilting.**
- **Wear safety shoes, protective clothing and a safety helmet.**
- **Comply with the national and local regulations.**

Warning!

Danger of injury due to incorrect control or a defect.

Improper control of motors or a defect can result in injuries and unintended and hazardous movements of motors.

Such incorrect behavior can be triggered by:

- **Incorrect installation or faults when handling components**
- **Improper or incomplete wiring**
- **Defective devices (servo drive, motor, position encoder, cables, brake)**
- **Incorrect control (e.g. caused by software error)**

Risk due to hot surfaces

Due to the power dissipation from the motor and friction in the gearbox, these components as well as their environment can reach a temperature of more than 100°C.

The resulting heat is released to the environment via the housing and the flange.

Warning!

Risk of burns due to hot surfaces!

Touching hot surfaces (e.g. motor and gearbox housings, as well as connected components), can lead to very severe burns due to the very high temperature of these parts.

- **Do not stay in the danger zone during operation and secure it against access by unauthorized persons.**
- **Never touch the motor or gearbox housing as well as adjacent surfaces during nominal load operation.**
- **Be aware of hot surfaces also during downtime.**
- **Allow motor and gearbox to cool sufficiently before working on it. This is because there is still a risk of burning for a prolonged period of time even after shutting down.**
- **Always operate the motor or gearbox with all safety devices. Do this even during short testing and trial operations!**

8 Disposal

8.1 National and local regulations

Note:

The motor must be disposed of and/or recycled in accordance with applicable national and local regulations. Encoder electronics must be appropriately disposed of as electronic waste.

8.2 Rare-earth magnets

Caution!

B&R servo motors contain rare-earth magnets with increased density of magnetic energy!

8.3 Magnetized rotor

Warning!

A magnetized rotor is not permitted to be transported or delivered outside the stator under any circumstances!