

8WS compact servo motors

User's manual

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1 General information

1.1 Manual history

| Version | Date | Notes |
|---------|------------|---|
| 1.10 | April 2023 | General revision Updated chapter "Standards and certifications". |
| 1.00 | July 2018 | First edition |

Information:

B&R makes every effort to keep user's manuals as current as possible. New versions are available in electronic form on the B&R website (www.br-automation.com). Check regularly to determine if you have the most current 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 functionality and a long service life.

As a component of the machine, this manual must 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.

This document is not intended for end customers! The safety guidelines required for end customers must be incorporated into the operating instructions for end customers in the respective national language by the machine manufacturer or system provider.

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

The 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

In all cases, applicable national and international standards, regulations and safety measures must be taken into account and observed!

The B&R products described in this manual are intended for use in industry and industrial applications. The intended use includes drive tasks as part of automation processes in machines and systems.

B&R products are only permitted to be used in their original condition. Modifications and extensions are only permitted if they are described in this manual.

B&R excludes liability for damage of any kind resulting from the use of B&R products in any intended way.

B&R products have not been designed, developed and manufactured for use that involves fatal risks or hazards that could result in death, injury, serious physical harm or other loss without the assurance of exceptionally stringent safety precautions.

B&R products are explicitly not intended for use in the following applications:

- Monitoring and control of thermonuclear processes
- Weapon systems control
- Flight and traffic control systems for passenger and freight transport
- Health monitoring and life support systems

The B&R products described in this manual are intended for operation with B&R drive systems.

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 57](#)).

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
- Controlling 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 also for temporary testing 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 incorrect 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 also for temporary 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 mains.
- Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains 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.

- Observe relevant national health and safety regulations.
- 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.
- Ensure that electromagnetic fields are reduced at their source (using shields, 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, high-level protective measures must be put in place to ensure that personnel and the machine 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. A holding brake 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 mains.
- Always operate the motor with all safety equipment. Do this also for temporary 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 result in 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 standstill.
- Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.
- Always operate the motor or gearbox with all safety devices. Do this also for temporary 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. line 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 Responsibility 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

- Applicable industrial safety regulations must be observed.
- National, local and plant-specific regulations must be observed.
- A risk assessment must identify hazards that can arise due to on-site working conditions.
- Documentation including safety guidelines must be prepared for operating the finished system (with motors, gearboxes, servo drives, etc.).
- Whether the applicable operating instructions and manuals correspond to current rules and standards must be checked regularly.
- Responsibilities for installation, operation, fault correction, maintenance and cleaning must be clearly regulated and defined.
- It must be ensured that responsible personnel have read and understood this user's manual.
- Personnel must receive training on a regular basis and be informed of hazards.
- Personnel must be provided with the required 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 guidelines, information about connection conditions (nameplate and documentation) and limit values specified in the technical data must be read carefully before installation and commissioning and must be strictly observed.

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 (\varnothing 40 mm) is optionally available in hygienic design with IP69K protection.

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 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: C18 x 18 per ECC200 | |
| 4 | CE marking | |
| 5 | Technical data (rated torque M_n , rated current I_n , continuous stall torque M_0 , continuous stall current I_0 , DC bus voltage U_{DC} , n_n nominal speed ¹⁾) | |
| 6 | Manufacturer | |
| 7 | UL-recognized component mark | |
| 8 | Protection class | |
| 9 | Insulation class | |
| 10 | Production period (week/year) | |
| 11 | Revision | |
| 12 | UKCA marking (UK Conformity Assessed) | |
| 13 | WEEE mark | |

1) **Rated speed**

8WSA: Rated speed on the motor output shaft

8WSB: Rated speed on the gearbox output shaft but limited by the **max. gearbox input speed**

Note:

The nameplate should be visible at all times in installed state.

2 Technical data

2.1 General description

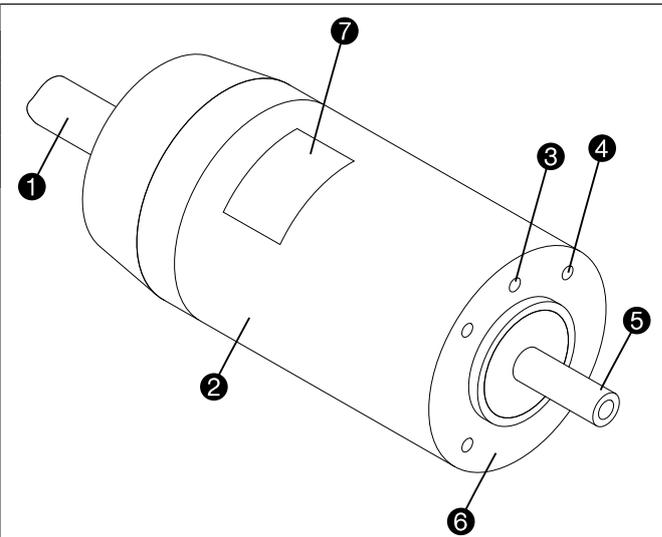
The compact design of the 8WS servo motors makes it possible to implement servo applications that require highly precise synchronization and accurate positioning in limited space.

- 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 41)

2.2 Motor overview

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





8WSxxx.xxxxxxxxxx-x Rev.: xx
 SN xxxxxxxxxxxxxxxx
 $M_n = \text{xxxx Nm}$ $I_n = \text{xxxx A}$
 $M_o = \text{xxxx Nm}$ $I_o = \text{xxxx A}$
 $U_{DC} = \text{xx V}$ $n_n = \text{xxxx rpm}$
 Class x a.t. xx°C IP xx WW/JJ

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see "Nameplate" on page 12

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 **3** ... ø 32 mm
2 ... ø 22 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 (protection class / 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 keys only provide information about possible combinations in exceptional cases. Information about possible combinations is available in the CAD configurator (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** = \varnothing 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 order 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** = \varnothing 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 order 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 character (c) in the order 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 digit (d) in the order 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 specified as part of the order number in the form of a 2-digit code (ee).

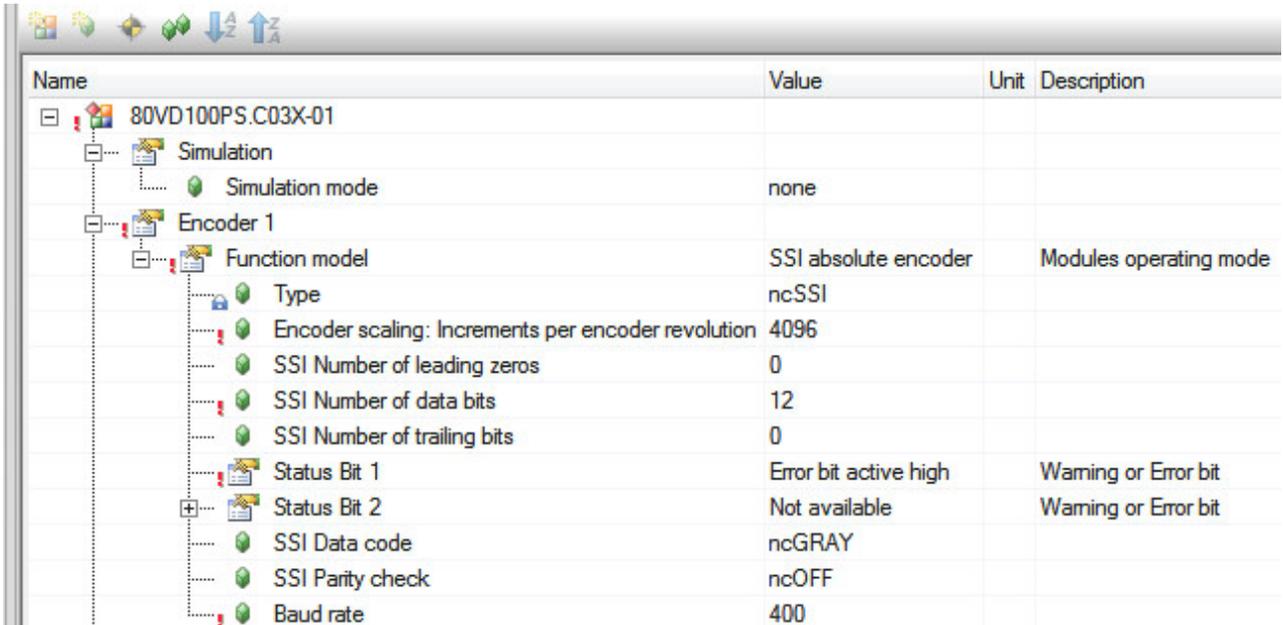
The order code (ee) for the SSI encoder (single-turn) is **F0**.

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) |
| Accuracy | ±1° (up to ±0.4° possible on request) |
| Maximum speed | 30,000 rpm |
| Temperature of workspace | -40°C to 125°C |

Settings in Automation Studio

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



| Name | Value | Unit | Description |
|--|-----------------------|------|------------------------|
| 80VD100PS.C03X-01 | | | |
| Simulation | | | |
| Simulation mode | none | | |
| Encoder 1 | | | |
| Function model | SSI absolute encoder | | Modules operating mode |
| Type | ncSSI | | |
| Encoder scaling: Increments per encoder revolution | 4096 | | |
| SSI Number of leading zeros | 0 | | |
| SSI Number of data bits | 12 | | |
| SSI Number of trailing bits | 0 | | |
| Status Bit 1 | Error bit active high | | Warning or Error bit |
| Status Bit 2 | Not available | | Warning or Error bit |
| SSI Data code | ncGRAY | | |
| SSI Parity check | ncOFF | | |
| Baud rate | 400 | | |

2.3.6 Nominal speed (nnn) 8WSA

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

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

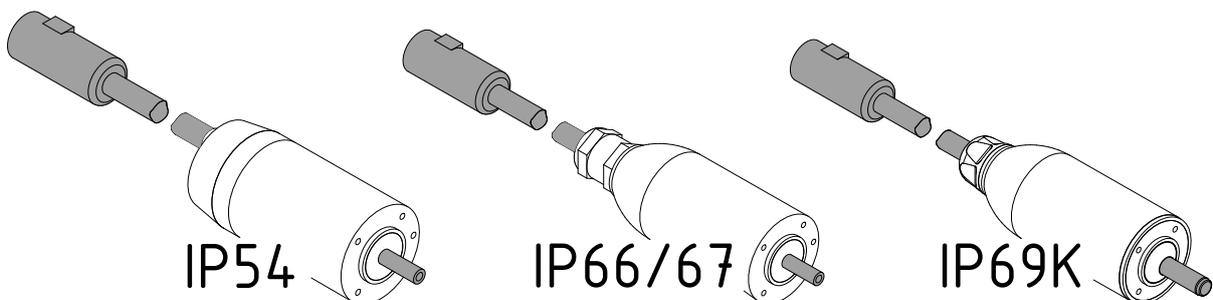
| | Available nominal speeds n_n [rpm] at 60 VDC operation | |
|--------|--|-------|
| | 5,500 | 8,500 |
| | Order code (nnn) | |
| | 055 | 085 |
| 8WSA11 | --- | Yes |
| 8WSA21 | --- | Yes |
| 8WSA32 | --- | Yes |
| 8WSA43 | Yes | --- |

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 order 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 | | |

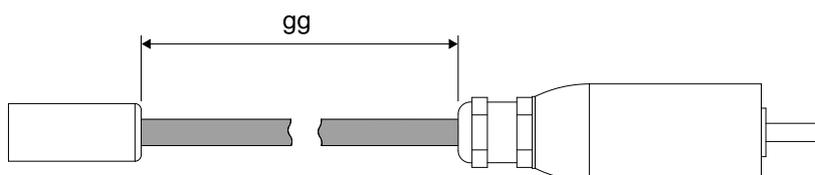


2.3.8 Cable length (gg) 8WSA

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

The code (**gg**) in the order 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 **3** ... ø 32 mm
2 ... ø 22 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 **016** ... i = 16 **049** ... i = 49 **064** ... i = 64
012 ... i = 12.25 **021** ... i = 21 **050** ... i = 50

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**)

Rated speed (nominal speed of motor)¹⁾

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)

1) The specified motor nominal speed is limited by the max. gearbox input speed; for the resulting max. permissible motor speed, see the technical motor data.

Note:

Order keys only provide information about possible combinations in exceptional cases. Information about possible combinations is available in the CAD configurator (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** = \varnothing 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 order 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** = \varnothing 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 order number for the necessary motor is therefore **8WSB43.F0050S5KKE0**.

2.4.2 Cooling type / 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 character (**c**) in the order 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 | Yes | Yes | 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 digit (**d**) in the order 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 specified as part of the order 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) |
| Accuracy | ±1° (up to ±0.4° possible on request) |
| Maximum speed | 30,000 rpm |
| Temperature of workspace | -40°C to 125°C |

Settings in Automation Studio

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

| Name | Value | Unit | Description |
|--|-----------------------|------|------------------------|
| 80VD100PS.C03X-01 | | | |
| Simulation | | | |
| Simulation mode | none | | |
| Encoder 1 | | | |
| Function model | SSI absolute encoder | | Modules operating mode |
| Type | ncSSI | | |
| Encoder scaling: Increments per encoder revolution | 4096 | | |
| SSI Number of leading zeros | 0 | | |
| SSI Number of data bits | 12 | | |
| SSI Number of trailing bits | 0 | | |
| Status Bit 1 | Error bit active high | | Warning or Error bit |
| Status Bit 2 | Not available | | Warning or Error bit |
| SSI Data code | ncGRAY | | |
| SSI Parity check | ncOFF | | |
| Baud rate | 400 | | |

2.4.6 Gear ratios (iii) 8WSB

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

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

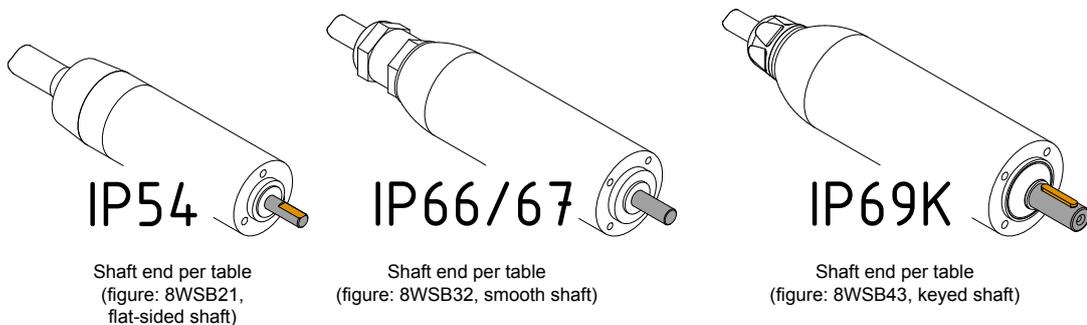
| | Available gear ratios (gear stages) | | | | | | |
|--------------------------|-------------------------------------|---------------|------------|------------|------------|------------|------------|
| | i = 4 (1) | i = 12.25 (2) | i = 16 (2) | i = 21 (2) | i = 49 (3) | i = 50 (2) | i = 64 (3) |
| | 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 order 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 |



2.4.8 Nominal speed (n) 8WSB

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

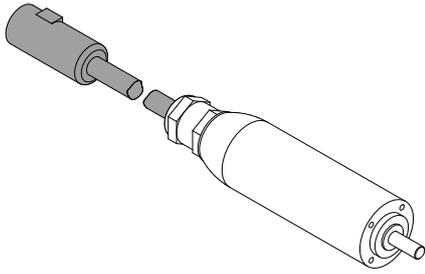
The nominal speed is specified as part of the order number in the form of a one-digit code (**n**).

| | Available nominal speeds n_N [rpm] at 60 VDC operation | |
|--------|--|---------------------|
| | 5,500 ¹⁾ | 8,500 ¹⁾ |
| | Order code (n) | |
| | K | Q |
| 8WSB11 | --- | Yes |
| 8WSB21 | --- | Yes |
| 8WSB32 | --- | Yes |
| 8WSB43 | Yes | --- |

1) The specified **motor nominal speed** is limited by the **max. gearbox input speed**; for the resulting **max. permissible motor speed**, see the technical motor data.

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).

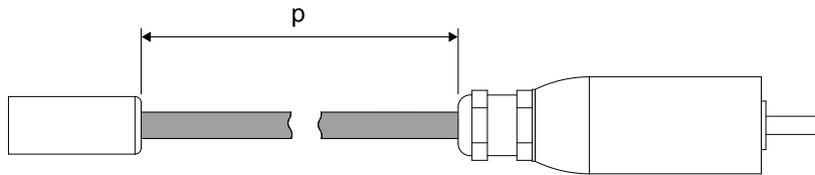
Valid code: K

2.4.10 Cable length (p) 8WSB

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

The code (p) in the order 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 (8WSA32.xxxxxV4xx-x, 8WSA43.xxxxxV4xx-x, 8WSB32.xxxxxS3xxx, 8WSB43.xxxxxS3xxx) |
| UL file number | E360421 |
| Electrical properties | |
| DC bus voltage on the ACOPOSmicro | 60 VDC ¹⁾ |
| Type of connection - Pre-assembled hybrid motor cable | Hybrid connector series 915 |
| Support | |
| Automation Studio | V4.4.6 and higher |
| Motion system (mapp Motion, ACP10) | V5.04 and higher ²⁾ |
| ACOPOSmicro hardware upgrade | Version 2.3.0.0 and higher |
| Thermal properties | |
| Insulation class per EN 60034-1 | B |
| Cooling method 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: | No oil seal |
| Oil seal, hygienic design with IP69K: | PTFE 92 oil seal |
| Key and keyway per DIN 6885-1 | Dimensions deviate from DIN 6885-1 |
| Radial runout of shaft end: | Max. 15 µm / Typ. <10 µm |
| Concentricity of shaft end to mounting flange: | Max. 35 µm / Typ. <20 µm |
| Axial runout of shaft end to mounting flange: | Max. 20 µm / Typ. <10 µm |
| Surface, standard motor: | Stainless steel RZ 6.3 |
| Surface, hygienic design with IP69K: | Stainless steel Ra <0.8 |
| Plastic cover, standard motor: | Surface per VDI 3400 Ref. 33 |
| Output shaft, standard motor: | Steel |
| Output shaft, hygienic design with IP69K: | Stainless steel |
| Lubrication, standard motor: | Standard |
| Lubrication, hygienic design with IP69K: | Food-safe |
| Operating conditions | |
| Rating class, operating mode per EN 60034-1 | S1 - Continuous operation |
| Ambient temperature during operation | 0 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 t _A ... Ambient temperature (°C) | |
| Temperature change rate | 0.5°C/min |
| Relative humidity during operation | 5 to 95%, relative, non-condensing 1 to 29 g/m ³ , 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. flange temperature | 50°C (at 120°C winding temperature and 20°C ambient temperature) |
| 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 | |
|---|---|
| Degree of protection per EN 60034-5 (IP code) Motor option IP54: Motor option IP66/67: Motor option IP69K: | IP54 (IP20) ⁴⁾ IP66/67 (IP20) ⁵⁾ IP69K (IP67) ⁶⁾ |
| Type of construction and mounting arrangement per EN 60034-7 (IM code) | Horizontal, motor shaft aligned horizontally (IM 3001) Vertical, motor standing on the machine (IM 3011) Vertical, motor hanging on the machine (IM 3031) ⁹⁾ |
| Max. permissible vibration stress ¹⁰⁾ | 50 m/s ² (10-150 Hz) |
| Max. permissible shock load ¹¹⁾ | Axial 150 m/s ² for 11 ms Radial 150 m/s ² for 11 ms |
| 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.

- ⁴⁾ For IP54, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP54 protection. Otherwise, only IP20 applies instead of IP54.
- ⁵⁾ For IP66/67, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP66/67 protection. Otherwise, only IP20 applies instead of IP66/67.
- ⁶⁾ For IP69K, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP69K protection. Otherwise, only IP67 applies instead of IP69K.
- ⁹⁾ With the IM 3031 type of construction and mounting arrangement (vertical, motor hanging on the machine), there is a risk of production fluids or oils penetrating the motor on the flange side. Motors or motor-gearbox combinations that should be used with this mounting arrangement must therefore have at least IP65 protection on the flange side.
- ¹⁰⁾ 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.
- ¹¹⁾ 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

| Order number | 8WSA11.ee085ffgg-0 | 8WSA21.ee085ffgg-0 | 8WSA32.ee085ffgg-0 | 8WSA43.ee055ffgg-0 | 8WSA43.ee055V8gg-0 |
|--|--------------------|--------------------|--------------------|--------------------|--------------------|
| General information | | | | | |
| Certifications | | | | | |
| CE | Yes | | | | |
| 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 [kgcm ²] | 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, C033 | | | | |

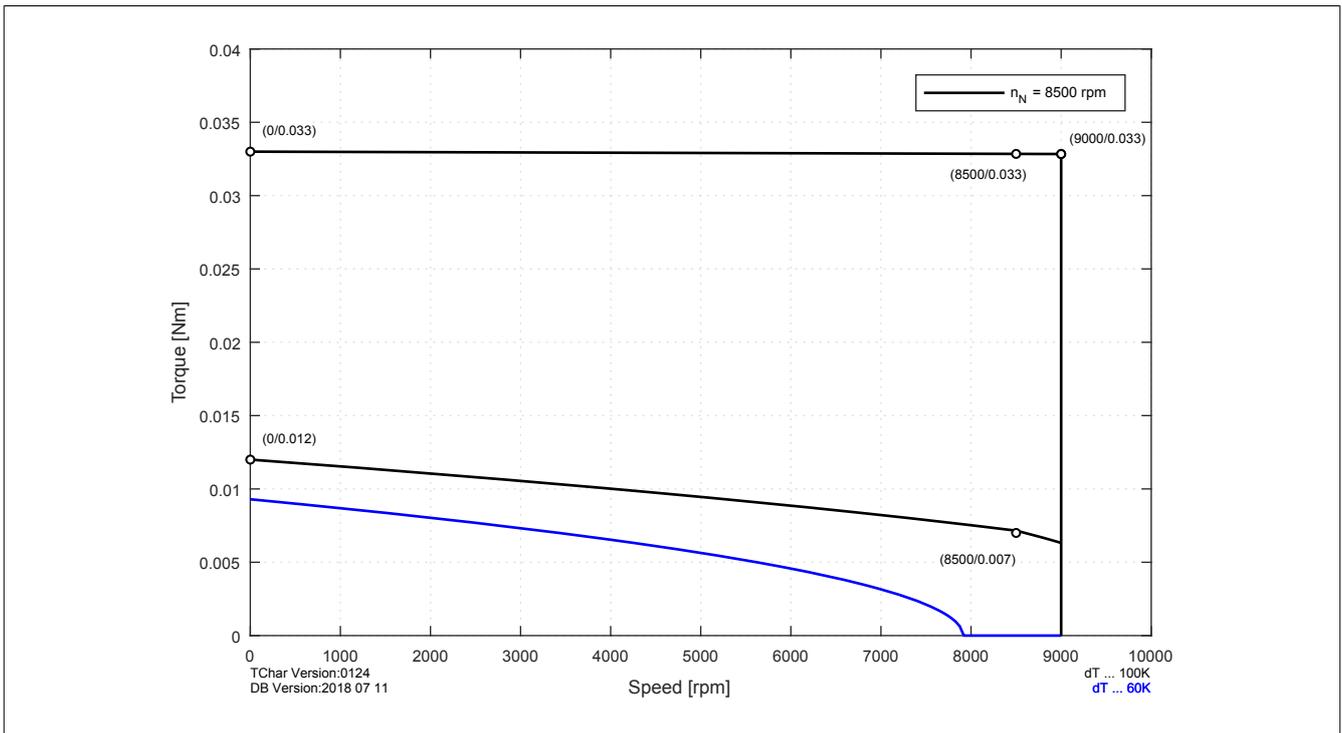
1) The value is valid for motors with a **cable length** of **0.5 m**. For motors with a cable length of 3.0 m, the value increases by 0.189 kg.

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.

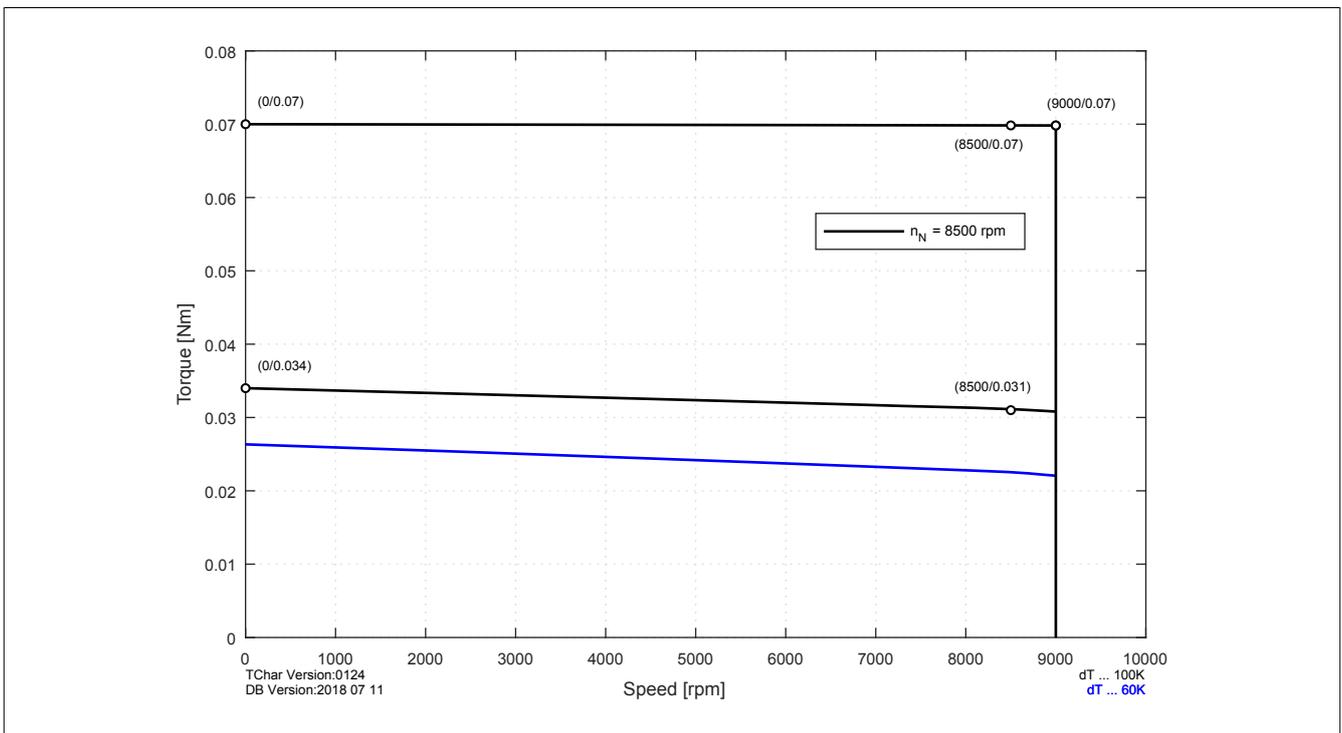
Information: All nominal data is based on a supply voltage of 60 VDC of the B&R ACOPOSmicro drive system.

2.6.1 Speed-Torque characteristic curves at 60 VDC DC bus voltage

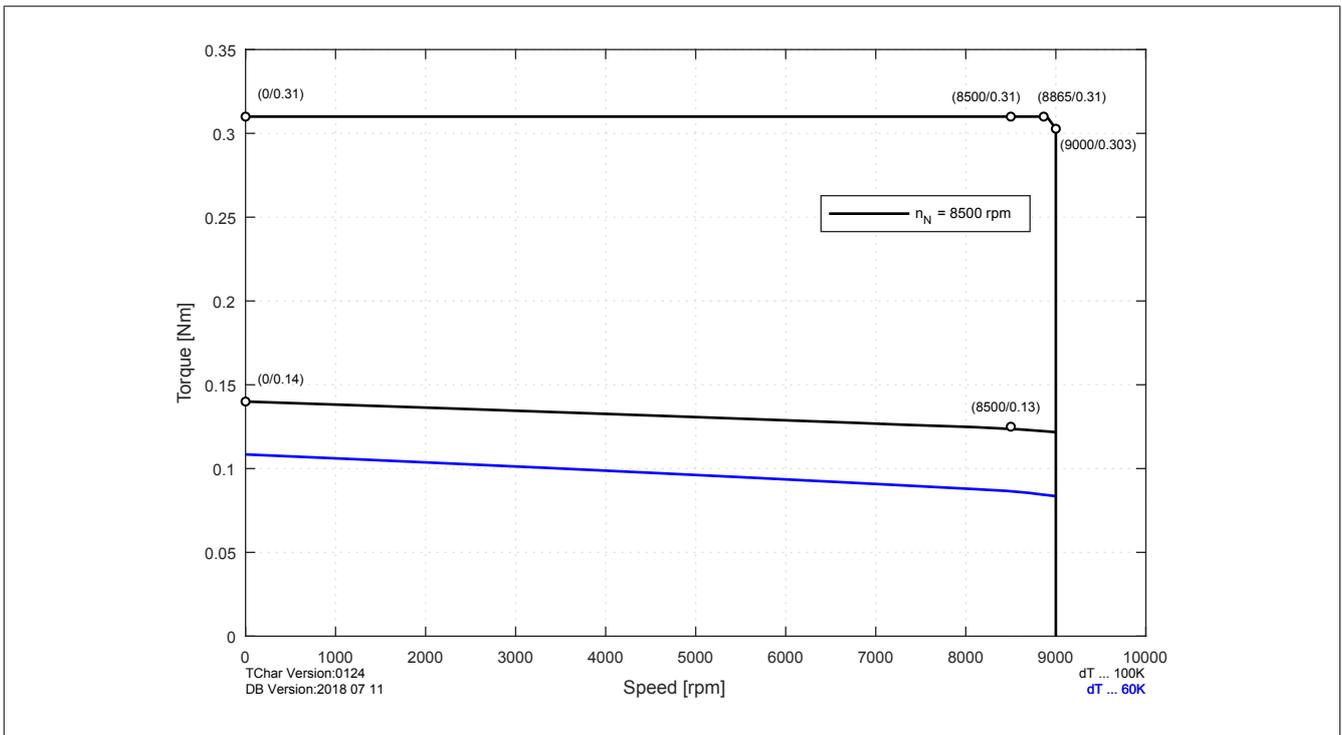
8WSA11



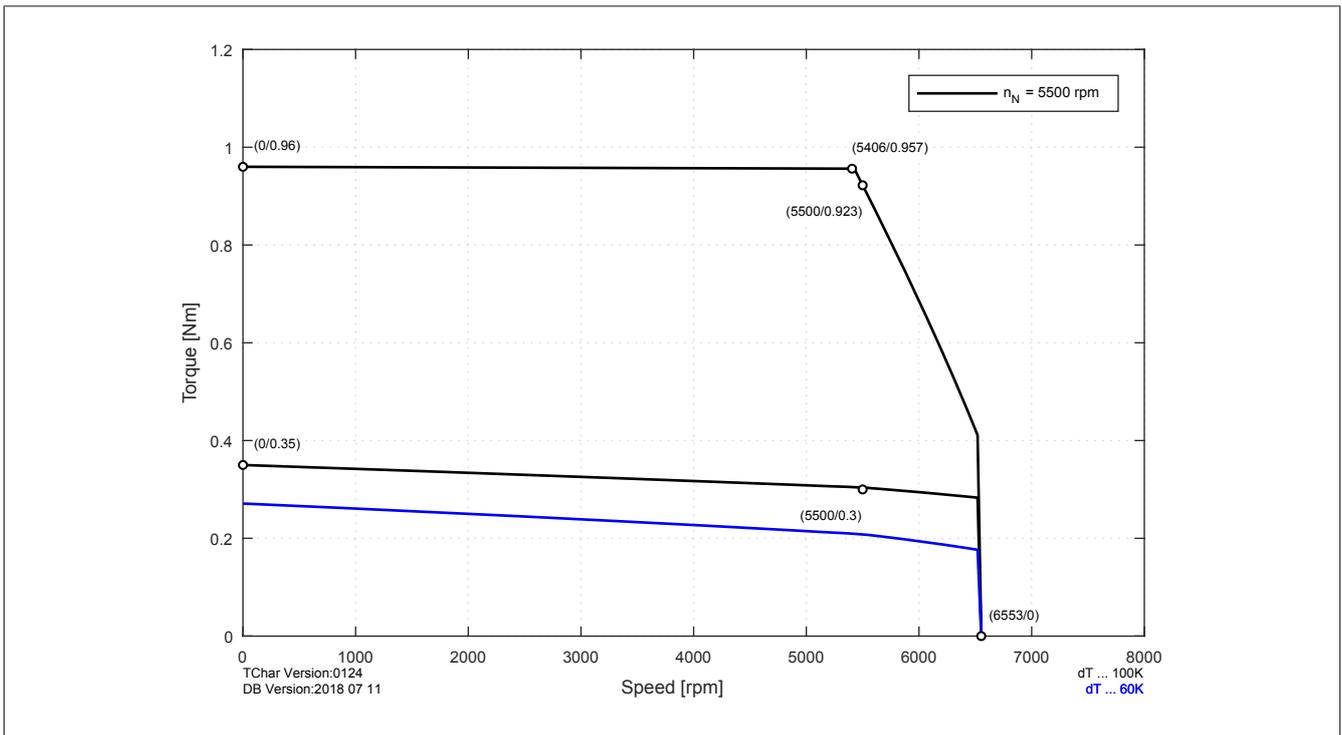
8WSA21



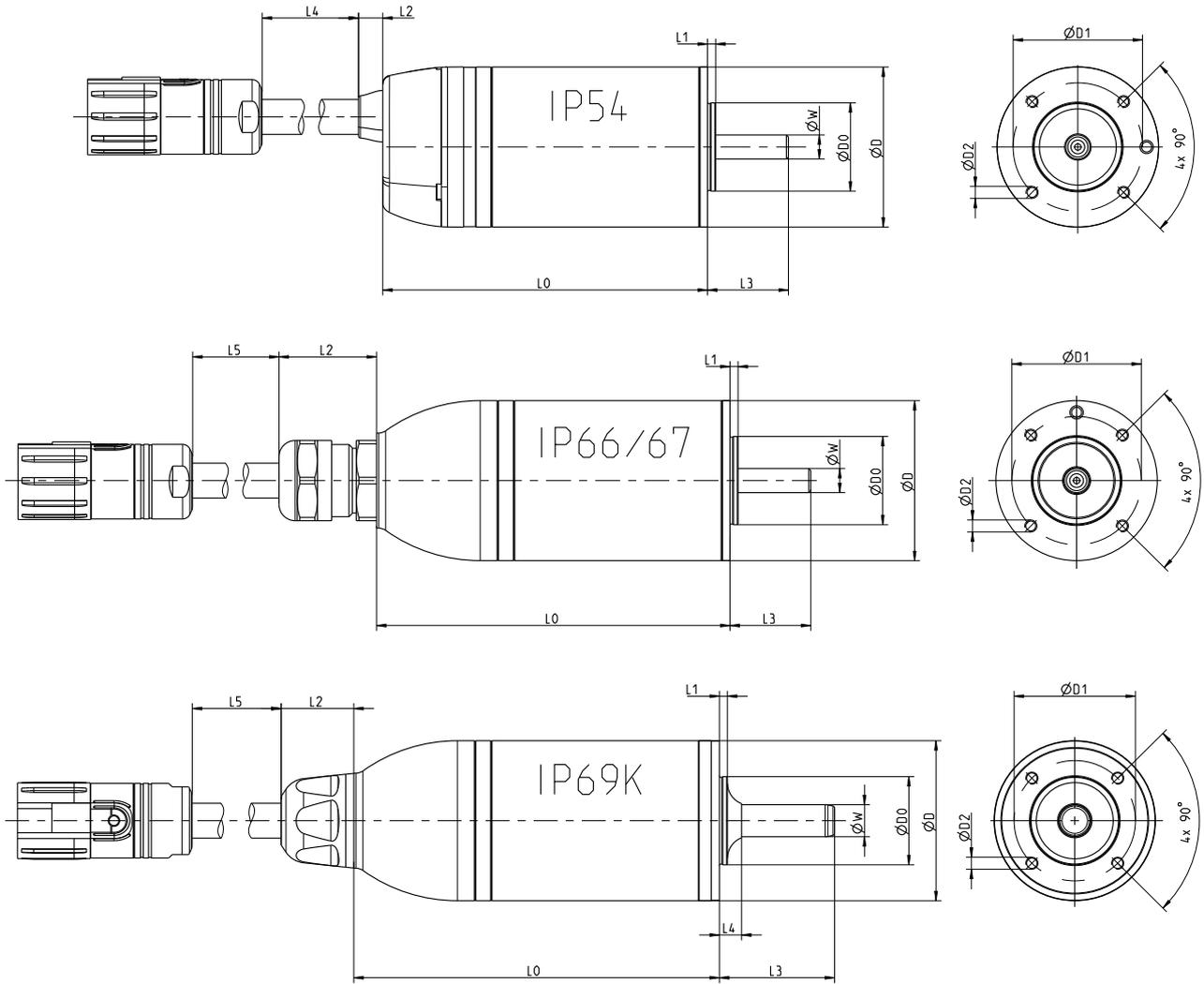
8WSA32



8WSA43



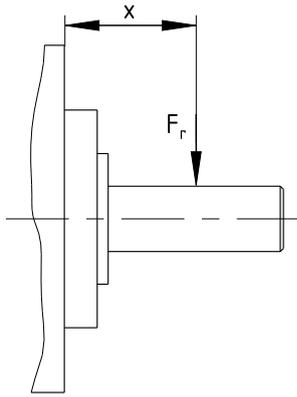
2.6.2 8WSA dimensions



| | Degree of 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 18

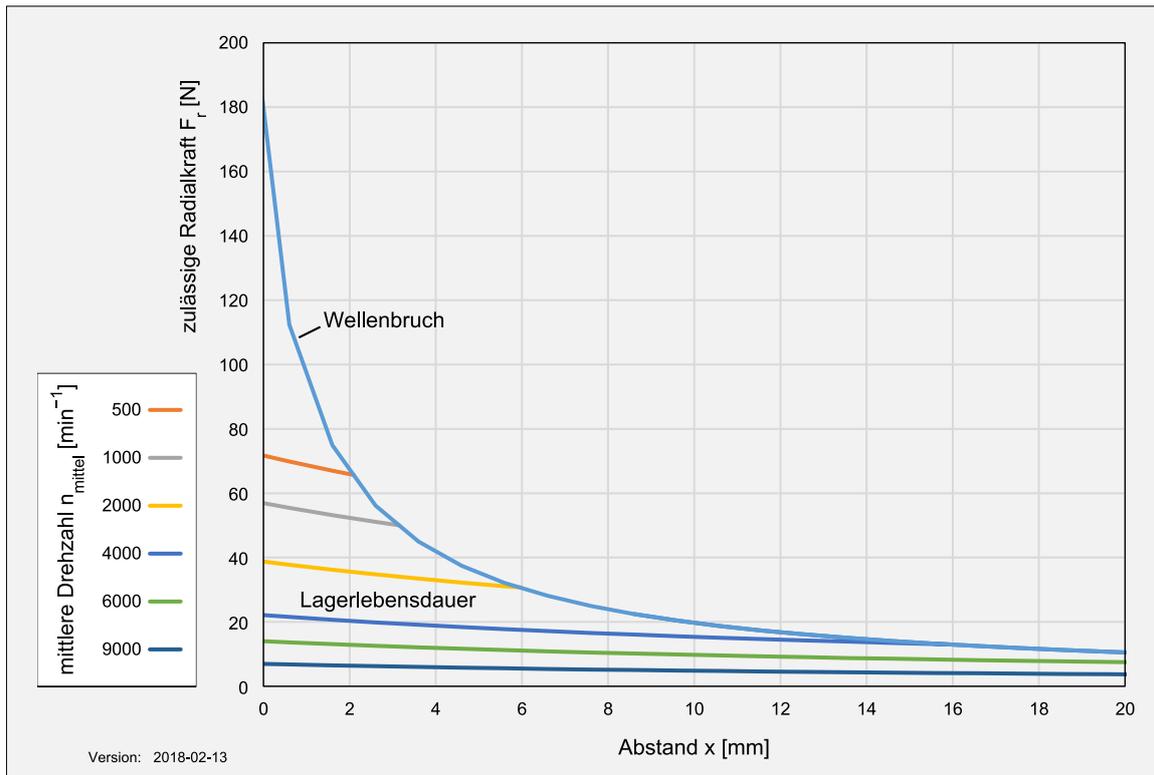
2.6.3 8WSA - Permissible shaft load



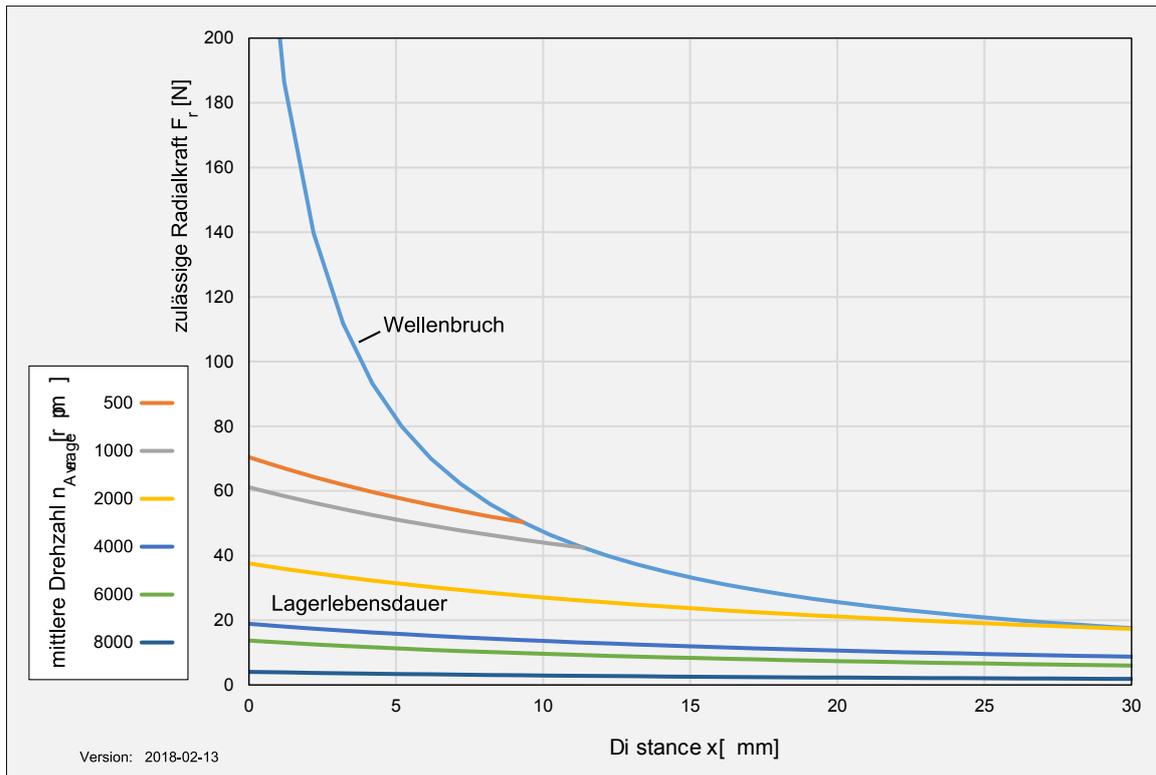
The values shown are based on a mechanical service life of the bearings of 20,000 operating hours.

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

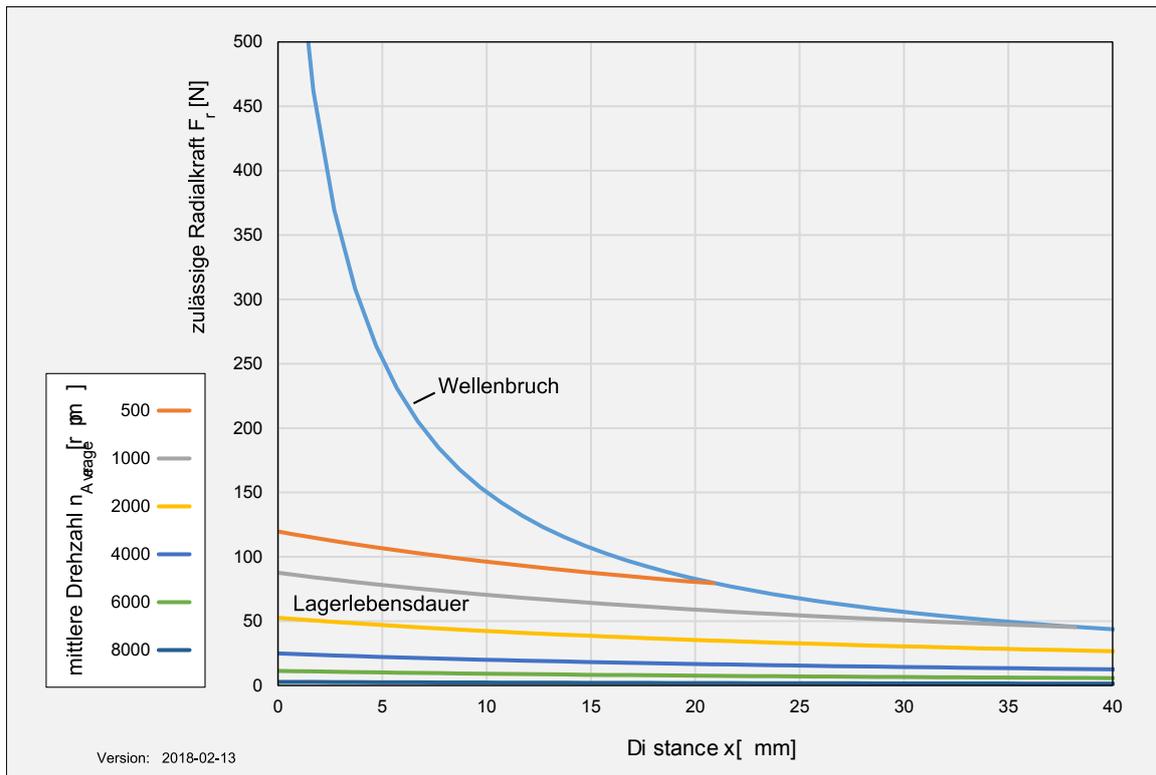
8WSA11



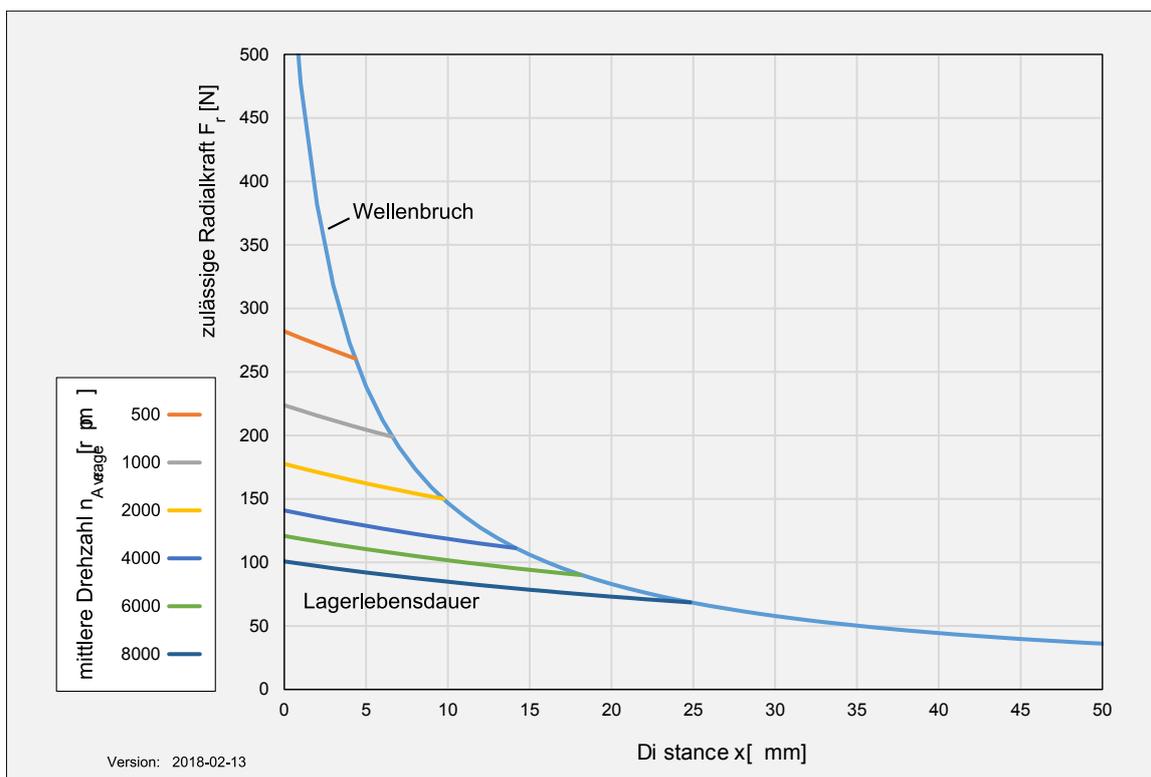
8WSA21



8WSA32



8WSA43



2.7 8WSB - Technical data

| Order number | 8WSB11. ee004jjQop0 | 8WSB11. ee021jjQop0 | 8WSB11. ee064jjQop0 | 8WSB21. ee004jjQop0 | 8WSB21. ee016jjQop0 | 8WSB21. ee064jjQop0 |
|--|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| General information | | | | | | |
| Certifications | | | | | | |
| CE | Yes | | | | | |
| Motor | | | | | | |
| Nominal speed n_N [rpm] | 6000 ¹⁾ | 5985 ¹⁾ | 5760 ¹⁾ | 6000 ¹⁾ | | 5760 ¹⁾ |
| 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 | | 0.67 |
| 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_{zph} [Ω] | 13.3 | | | 5.23 | | |
| Stator inductance L_{zph} [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 [kgcm ²] | 0.0055 | 0.0021 | 0.0017 | 0.0092 | 0.0072 | 0.0052 |
| Weight without brake m [kg] | 0.13 ²⁾ | | | 0.18 ²⁾ | | |
| Gearbox | | | | | | |
| Number of gear stages | 1 | 2 | 3 | 1 | 2 | 3 |
| Gear ratio i | 4 | 21 | 64 | 4 | 16 | 64 |
| Gear ratio i | 4 | 21 | 64 | 4 | 16 | 64 |
| Max. drive speed n_{1max} [rpm] | 10000 | | | | | |
| Max. backlash J_1 [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 ³⁾ | 0.03 ³⁾ | | 0.04 ³⁾ | 0.05 ³⁾ | 0.06 ³⁾ |
| Moment of inertia J_1 [kgcm ²] | 0.005 | 0.002 | 0.001 | 0.008 | 0.006 | 0.004 |
| Recommendations | | | | | | |
| ACOPOSmicro 80VD100Px.xxxx-01 | C03X, C033 | | | | | |

- 1) The **nominal motor speed** is limited by the **max. gearbox input speed**.
The following values are also affected:
Nominal torque M_N , nominal current I_N , stall torque M_0 , stall current I_0 , maximum torque M_{max} , maximum current I_{max} , maximum speed n_{max}
- 2) 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.
- 3) 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.

| Order number | 8WSB32. ee004jjQop0 | 8WSB32. ee016jjQop0 | 8WSB32. ee064jjQop0 | 8WSB43. ee004jjKop0 | 8WSB43. ee004S5Kop0 | 8WSB43. ee012jjKop0 |
|--|------------------------|------------------------|------------------------|---|------------------------|---|
| General information | | | | | | |
| Certifications | | | | | | |
| CE | Yes | | | | | |
| UL | - | | | cURus E235396 Servo and step- per motors - Component | - | cURus E235396 Servo and step- per motors - Component |
| Motor | | | | | | |
| Nominal speed n_N [rpm] | 5000 ¹⁾ | 4960 ¹⁾ | 4800 ¹⁾ | 5000 ¹⁾ | 4000 ¹⁾ | 4900 ¹⁾ |
| 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_{zph} [Ω] | 1.3 | | | 0.72 | | |
| Stator inductance L_{zph} [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 [kgcm ²] | 0.0207 | 0.0177 | 0.0167 | 0.055 | 0.065 | 0.049 |
| Weight without brake m [kg] | 0.36 ²⁾ | | | 0.64 ²⁾ | 0.66 ²⁾ | 0.64 ²⁾ |
| Gearbox | | | | | | |
| Number of gear stages | 1 | 2 | 3 | 1 | | 2 |
| Gear ratio i | 4 | 16 | 64 | 4 | | 12 |
| Gear ratio i | 4 | 16 | 64 | 4 | | 12.25 |
| Max. drive speed n_{1max} [rpm] | 10000 | | | 8000 | | |
| Max. backlash J_i [arcmin] | 20 | 35 | 50 | 20 | | 35 |
| Torsional rigidity C_{i21} [Nm/arcmin] | 0.3 | | | 0.4 | 0.6 | 0.4 |
| Efficiency at full load η [%] | 96 | 90 | 85 | 96 | 97 | 90 |
| Weight m [kg] | 0.12 ³⁾ | 0.16 ³⁾ | 0.2 ³⁾ | 0.22 ³⁾ | 0.26 ³⁾ | 0.31 ³⁾ |
| Moment of inertia J_1 [kgcm ²] | 0.015 | 0.012 | 0.011 | 0.03 | 0.04 | 0.024 |
| Recommendations | | | | | | |
| ACOPOSmicro 80VD100Px.xxxx-01 | C03X, C033 | | | | | |

- 1) The **nominal motor speed** is limited by the **max. gearbox input speed**.
The following values are also affected:
Nominal torque M_N , nominal current I_N , stall torque M_0 , stall current I_0 , maximum torque M_{max} , maximum current I_{max} , maximum speed n_{max}
- 2) 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.
- 3) 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.

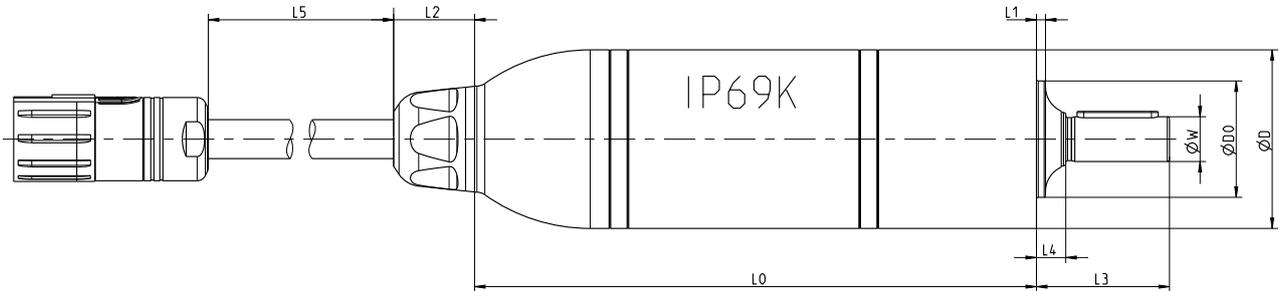
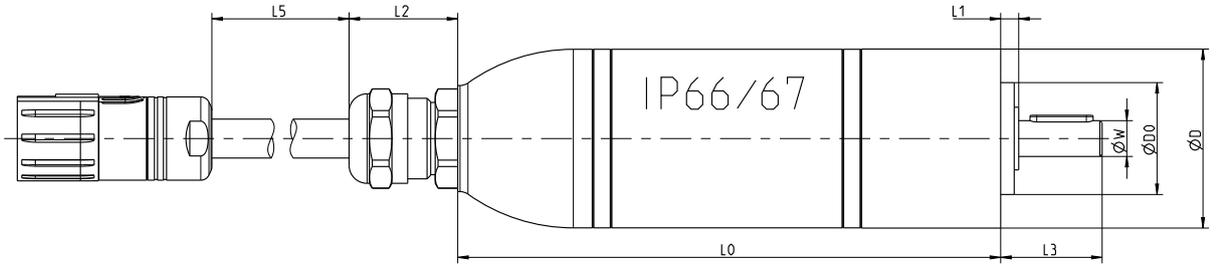
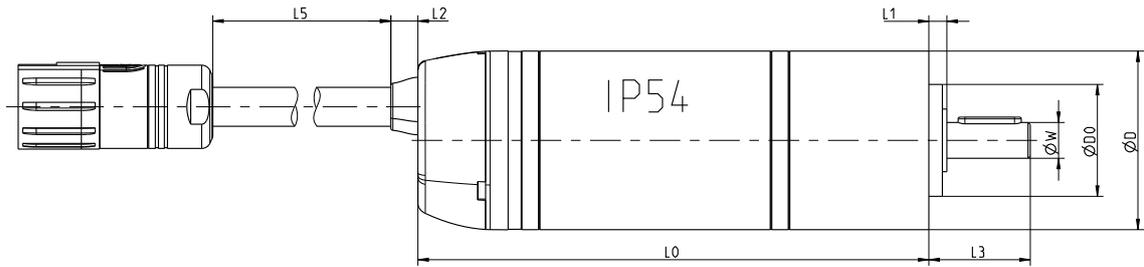
Technical data

| Order number | 8WSB43.ee016S5Kop0 | 8WSB43.ee049jjKop0 | 8WSB43.ee050S5Kop0 |
|--|--------------------|--|--------------------|
| General information | | | |
| Certifications | Yes | | |
| CE | | | |
| UL | - | cURus E235396 Servo and stepper motors - Component | - |
| Motor | | | |
| Nominal speed n_N [rpm] | 4000 ¹⁾ | 4900 ¹⁾ | 4000 ¹⁾ |
| 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 | 0.24 | 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 [kgcm ²] | 0.065 | 0.049 | 0.065 |
| Weight without brake m [kg] | 0.66 ²⁾ | 0.64 ²⁾ | 0.66 ²⁾ |
| Gearbox | | | |
| Number of gear stages | 2 | 3 | 2 |
| Gear ratio i | 16 | 49 | 50 |
| Gear ratio i | 16 | 49 | 50 |
| Max. drive speed n_{1max} [rpm] | 8000 | | |
| Max. backlash J_1 [arcmin] | 25 | 50 | 25 |
| Torsional rigidity C_{t21} [Nm/arcmin] | 0.6 | 0.4 | 0.6 |
| Efficiency at full load η [%] | 95 | 85 | 95 |
| Weight m [kg] | 0.47 ³⁾ | 0.38 ³⁾ | 0.47 ³⁾ |
| Moment of inertia J_1 [kgcm ²] | 0.04 | 0.024 | 0.04 |
| Recommendations | | | |
| ACOPOSmicro 80VD100Px.xxxx-01 | C03X, C033 | | |

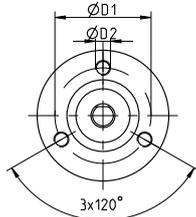
- 1) The **nominal motor speed** is limited by the **max. gearbox input speed**.
The following values are also affected:
Nominal torque M_N , nominal current I_N , stall torque M_0 , stall current I_0 , maximum torque M_{max} , maximum current I_{max} , maximum speed n_{max}
- 2) The value is valid for 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.
- 3) 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.

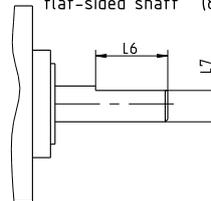
2.7.1 8WSB dimensions



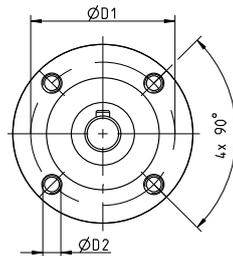
8WSB1 / 8WSB2



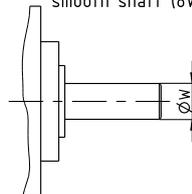
abgeflachte Welle (8WSB1 / 8WSB2)
flat-sided shaft (8WSB1 / 8WSB2)



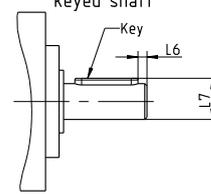
8WSB3 / 8WSB4



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



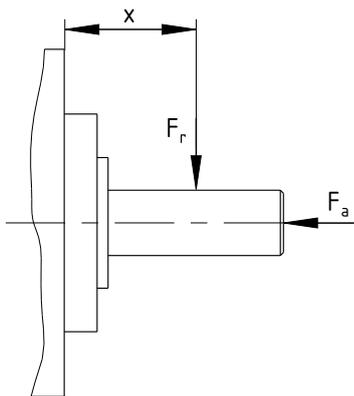
Welle mit Passfeder (8WSB4)
keyed shaft (8WSB4)



| | Degree of 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 25

2.7.2 8WSB - Permissible 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

| Order number | Short description | Figure |
|------------------|--|---|
| | Accessories |  |
| 8BCM00X5.1B48E-0 | 8WS/ACOPOSmicro hybrid motor cable, length 0.5 m, ((2x(2x26AWG) + 2x24AWG)C + 3x16AWG)C, 12+3-pin female series 915 hybrid connector, can be used in cable drag chains | |

8BCM00xx.1B470-0 cable extensions

| Order 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.) as transport locks or 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 as a transport lock.
- Transport and lift heavy output shaft components separately and not installed 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 result in 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 damage to property.

- Motors should only be lifted without any additional load from other products (e.g. gears, pulleys, couplings).
- 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 to property.

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 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 t_A ... Ambient temperature (°C) | |
| Temperature change rate | 0.5°C/min |
| Relative humidity during operation | 5 to 95%, relative, non-condensing 1 to 29 g/m ³ , 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. flange temperature | 50°C (at 120°C winding temperature and 20°C ambient temperature) |
| Max. winding temperature | 120°C |
| Degree of protection per EN 60034-5 (IP code) Motor option IP54: Motor option IP66/67: Motor option IP69K: | IP54 (IP20) ⁴⁾ IP66/67 (IP20) ⁵⁾ IP69K (IP67) ⁶⁾ |
| Type of construction and mounting arrangement per EN 60034-7 (IM code) | Horizontal, motor shaft aligned horizontally (IM 3001) Vertical, motor standing on the machine (IM 3011) Vertical, motor hanging on the machine (IM 3031) ⁹⁾ |
| Max. permissible vibration stress ¹⁰⁾ | 50 m/s ² (10-150 Hz) |
| Max. permissible shock load ¹¹⁾ | Axial 150 m/s ² for 11 ms Radial 150 m/s ² for 11 ms |

3) Requirements that go beyond this must be arranged with B&R.

4) For IP54, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP54 protection. Otherwise, only IP20 applies instead of IP54.

5) For IP66/67, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP66/67 protection. Otherwise, only IP20 applies instead of IP66/67.

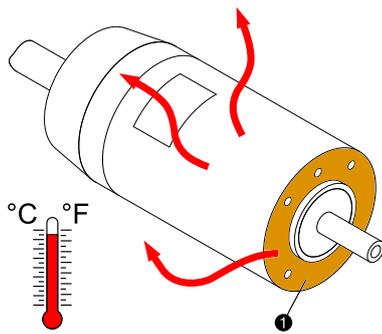
6) For IP69K, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP69K protection. Otherwise, only IP67 applies instead of IP69K.

9) With the IM 3031 type of construction and mounting arrangement (vertical, motor hanging on the machine), there is a risk of production fluids or oils penetrating the motor on the flange side. Motors or motor-gearbox combinations that should be used with this mounting arrangement must therefore have at least IP65 protection on the flange side.

10) 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.

11) 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.

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 onto the machine.

The following points must be observed:

- 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

Radial force F_r acting on the shaft end is composed of the assembly forces (e.g. belt tension on the pulley) and forces due to operation (e.g. load torque on the pinion). Maximum permissible radial force F_r depends on the shaft end variant, 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

Axial force F_a acting on the shaft end is composed of the assembly forces (e.g. stress caused by mounting) and forces due to 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 of F_r and F_a , see the motor data for the respective servo motors.

[see "8WSA - Permissible shaft load" on page 32](#)

[see "8WSB - Permissible shaft load" on page 40](#)

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 wiring is only permitted to be carried out by qualified personnel ²⁾ in a voltage-free state. The control cabinet must first be disconnected from the power supply and secured against 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 also for temporary testing and trial operations!

Dangerous voltage

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

²⁾ see "Qualified personnel" on page 10

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 incorrect 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 also for temporary 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 mains.
- Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains 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.

- Observe relevant national health and safety regulations.
- 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.
- Ensure that electromagnetic fields are reduced at their source (using shields, 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, high-level protective measures must be put in place to ensure that personnel and the machine 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. A holding brake 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 mains.
- Always operate the motor with all safety equipment. Do this also for temporary 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 result in 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 damage to property.

- 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 result in 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 standstill.
- Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.
- Always operate the motor or gearbox with all safety devices. Do this also for temporary 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 clamping 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 mains 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 result in 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 on the machine.

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 motor flange, which also serves as a cooling surface, directly onto 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 should be visible at all times in installed state.

Fasteners

Use screws of property class A2-70. Flat 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 diagram for the motor being used.

Tightening torque

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

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

- Calculation per VDI 2230 (Edition - February 2003)
- Coefficient of friction for threads and bearing surfaces $\mu = 0.10$

- 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.

| Property class | Thread size / Tightening torque [Nm] | | | | | |
|----------------|--------------------------------------|-------|-------|-------|------|------|
| | 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 result in serious personal injury and damage to property.

- Connect (also for temporary testing and trial operations!) the motor housing and servo drive properly to ground potential (PE rail).

Danger!

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

Connecting the motor directly to the mains results in 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 incorrect 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 also for temporary 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 mains.
- Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains 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 result in 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 standstill.
- Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.
- Always operate the motor or gearbox with all safety devices. Do this also for temporary 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.

This is 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 so that a minimum bend radius of 10 x outer diameter (moving) or 5 x outer diameter (rigid) is maintained.

Avoid twisting the cables by more than $\pm 30^\circ$ over a length of 1 m.

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

| Size | Motor | | F _{max} [N] |
|------|-------|----------------|----------------------|
| | | 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.

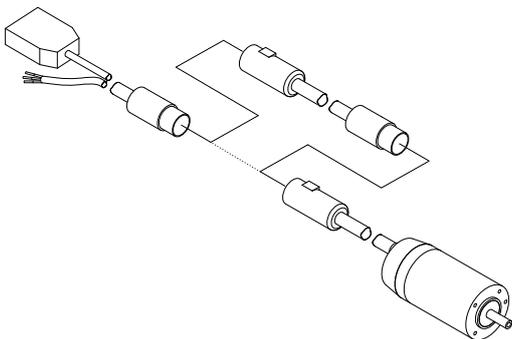
If connections are connected or disconnected in the incorrect order or when the power is switched on, electric arcs can occur and persons and contacts can be damaged.

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 also for temporary 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 mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains 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 with a suitable measuring instrument between -DC1 and +DC1 and less than 42 VDC before starting work. An unlit operating LED does not indicate that the device is de-energized!



Connecting

1. Disconnect the machine from the mains 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 mains 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 Connecting connectors properly

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

Caution!

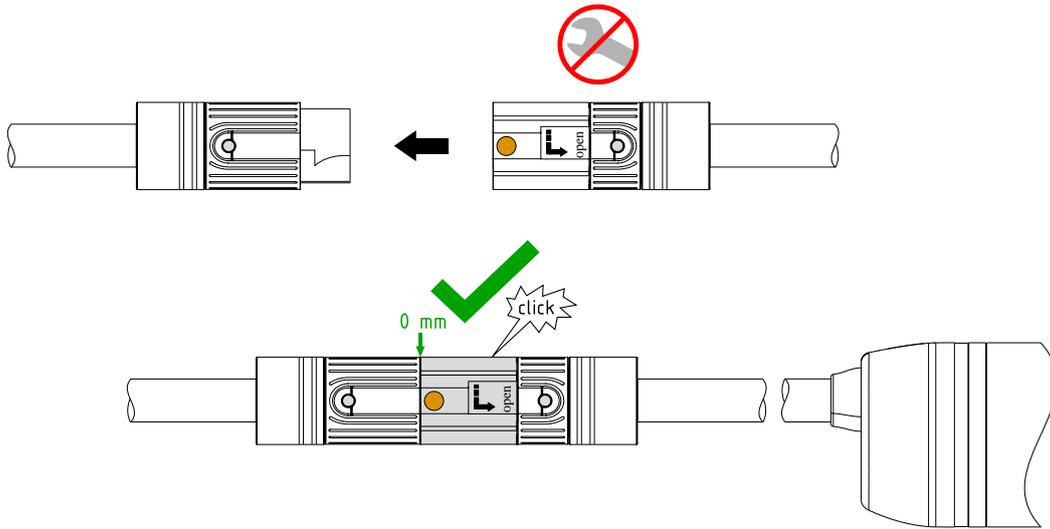
Damage due to improper connector installation!

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

- Always attach the connectors without force and without 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.

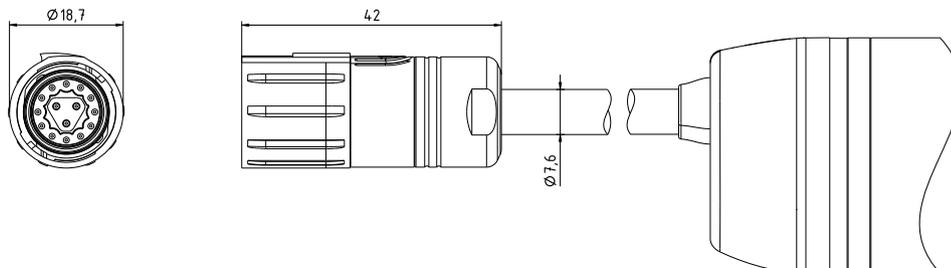


5.5.4 Connection type

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

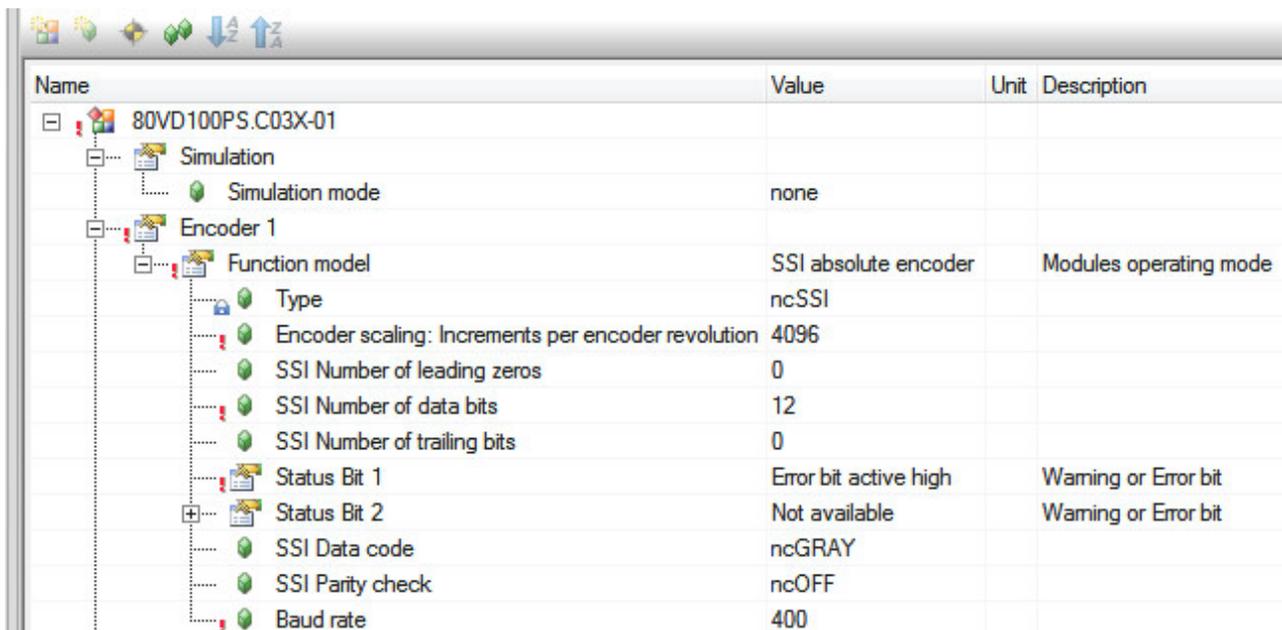
6.1 Before commissioning and operation

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 B&R 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.



| Name | Value | Unit | Description |
|--|-----------------------|------|------------------------|
| 80VD100PS.C03X-01 | | | |
| Simulation | | | |
| Simulation mode | none | | |
| Encoder 1 | | | |
| Function model | SSI absolute encoder | | Modules operating mode |
| Type | ncSSI | | |
| Encoder scaling: Increments per encoder revolution | 4096 | | |
| SSI Number of leading zeros | 0 | | |
| SSI Number of data bits | 12 | | |
| SSI Number of trailing bits | 0 | | |
| Status Bit 1 | Error bit active high | | Warning or Error bit |
| Status Bit 2 | Not available | | Warning or Error bit |
| SSI Data code | ncGRAY | | |
| SSI Parity check | ncOFF | | |
| Baud rate | 400 | | |

Software support

| Support | |
|------------------------------------|--------------------------------|
| Automation Studio | V4.4.6 and higher |
| Motion system (mapp Motion, ACP10) | V5.04 and higher ³⁾ |
| ACOPOSmicro hardware upgrade | Version 2.3.0.0 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 mains 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 personnel²⁾.

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

³⁾ Important: With older versions, the supply voltage is not checked for a maximum value of 60 VDC and incorrect settings may occur.

²⁾ see "Qualified personnel" on page 10

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 generally not 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 also for temporary testing 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 incorrect 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 also for temporary 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 mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains 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.

- Observe relevant national health and safety regulations.
- 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.
- Ensure that electromagnetic fields are reduced at their source (using shields, 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 protective measures must be put in place to ensure that personnel and the machine 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. A holding brake 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 mains.
- Always operate the motor with all safety equipment. Do this also for temporary 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 result in 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 damage to property.

- 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 result in 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 standstill.
- Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.
- Always operate the motor or gearbox with all safety devices. Do this also for temporary 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 result in 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, measures must be taken to prevent the key (if present) from being ejected. Measures must be taken to prevent mounting screws or other mounting elements from being ejected or removed prior to operation. A shaft protection sleeve 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, ejected elements can cause personal injury and damage to property.

- The following safety precautions apply also for temporary testing and trial operations!
- Secure the keys.
- Secure or remove mounting screws or other mounting elements.
- A shaft protection sleeve for transport and storage must also be removed.

6.3 Verification

6.3.1 To verify before commissioning

The following must be ensured before commissioning:

- The drive is not permitted to be damaged.
- The motor must be properly aligned and secured and is not permitted to be within the danger zone of other equipment.
- The screw connections must be tightened correctly.
- Any unused connection threads on the flanged end shield must be sealed.
- All components attached to the output shaft must be secured against unintentional detachment.
- Motors that have a keyed shaft end are not permitted to be operated without a key. The resulting imbalance can result in motor damage.
- For freely rotating motors, keys must be secured against ejection and mounting screws; other mounting elements must be secured or removed.
- All the necessary protective equipment (mechanical, thermal, electrical) must be installed.
- All motor connections must be properly made.
- The protective ground conductor must be installed properly and verified.
- The lines are not permitted to touch the motor surface.
- The drive must be free (release brake).
- The emergency switch-off functions must be checked.
- A holding brake must be functional if available.
- If a fan is present, it must be properly connected and functional.
- If a liquid cooling system is present, it must be properly connected, functional and leak-proof.

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 result in 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

The following must be ensured during commissioning:

- The functionality of all the motor's components and assemblies (protective equipment, encoder, brake, cooling, gearbox, etc.) must have been verified.
- The operating conditions (see chapter "Installation conditions") must be observed.
- A holding brake, if present, must be released when the motor is rotating.
- If a liquid cooling system is present, it must be functional and leak-proof.
- All electrical attachments and connections must be properly designed and secured.
- All protective measures must 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 must be installed and set up in accordance with the manufacturer's specifications.
- The max. permissible speed n_{\max} of the motor must be limited and is not permitted to 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 qualified 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 of error | Correction |
|---------------------------------|---|--|
| Motor will not start | Settings not made in Automation Studio | Check the settings in Automation Studio. see "Settings in Automation Studio" on page 57 |
| | Connector is not attached correctly | Check the connection. see "Connecting connectors properly" on page 55 |
| | Incorrectly connected | Check the connections using the signal list. see "Pinout" on page 56 |
| | 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 number 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, ambient 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:

- Creating a maintenance plan and documentation of inspections and maintenance tasks.
- Checking motors and the structure supplying cooling air for contamination, moisture and leaks.
- Cleaning motors and the structure supplying cooling air.
- Checking connectors and lines for damage.
- Testing all safety measures 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 guide value (calculated bearing service life L_{h10} : 10,000 or 20,000 operating hours).

7.2 Safety

Work on motors and their wiring is only permitted to be carried out by qualified personnel ²⁾ in a voltage-free state. The control cabinet must first be disconnected from the power supply and secured against 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 also for temporary testing and trial operations!

²⁾ see "Qualified personnel" on page 10

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 incorrect 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 also for temporary 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 mains.**
- **Before working on motors, gearboxes or servo drives or in the danger zone of your machine, disconnect them completely from the mains 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.

- **Observe relevant national health and safety regulations.**
- **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.**
- **Ensure that electromagnetic fields are reduced at their source (using shields, 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 protective measures must be put in place to ensure that personnel and the machine 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. A holding brake 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 mains.
- Always operate the motor with all safety equipment. Do this also for temporary 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 result in 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 damage to property.

- 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 result in 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 standstill.**
- **Allow the motor and gearbox to cool down sufficiently before working on them; there remains the risk of burns for a long period of time after they are switched off.**
- **Always operate the motor or gearbox with all safety devices. Do this also for temporary testing and trial operations!**

8 Standards and certifications

8.1 International and national certifications

Products and services from B&R comply with applicable regulations, directives and standards. These are national, European and international regulations, mainly from organizations such as ISO, IEC and CENELEC. We are committed to ensuring the reliability of our products in industrial environments.

Information:

Certifications that apply to a particular motor are available at the following places:

- Under "General motor data → General information" in the user's manual
- On the website (www.br-automation.com) and corresponding product page under "General motor data → General information"
- On the nameplate of the motor.

8.1.1 Marks

| Mark | Explanation | Region |
|---|-------------------------------------|---------------------|
|  | CE marking | Europe (EU) |
|  | UK Conformity Assessed (UKCA) | United Kingdom (UK) |
|  | Underwriters Laboratories Inc. (UL) | USA |

8.1.2 EU directives and standards (CE)

CE marking



Europe (EU)

The respective product complies with all applicable EU directives and relevant harmonized standards.

Certification of these products is performed in cooperation with accredited testing laboratories.

RoHS Directive 2011/65/EU

Restrictions of certain hazardous substances in electrical and electronic devices (RoHS Directive).

The corresponding declaration of conformity for this directive is available for download on the B&R website.



Declaration of conformity

[Website > Downloads > Certificates > Declarations of conformity > Motors > EU Declaration of conformity 8WS](#)

Ecodesign Directive (EU) No. 2019/1781

B&R motors are not induction motors, but servo and synchronous motors. These cannot be connected directly to the public power grid and also cannot be operated with a sinusoidal voltage with a frequency of 50 Hz, 60 Hz or 50/60Hz. B&R motors are used exclusively in combination with B&R drives and are operated with variable voltage and frequency.

B&R motors are therefore excluded from the scope of Regulation (EU) 2019/1781.

Machinery Directive 2006/42/EC

8WS motors are considered partly completed machinery as defined by the 2006/42/EC Machinery Directive. These comply with the fundamental health and safety requirements listed in the annex of the declaration of incorporation in accordance with Annex I of this directive.

The declaration of incorporation is available for download on the B&R website. The editions of the applied standards are located in the declaration of incorporation.



CE declaration of incorporation

[Website > Downloads > Certificates > Declarations of conformity > Motors > EU Declaration of conformity 8WS](#)

8.1.2.1 Overview of standards

The following overview contains standards that are partially or completely taken into account for product certification.

| Standard | Description |
|----------------------|--|
| EN 60204-1 | Safety of machinery - Electrical equipment of machines - Part 1: General requirements |
| EN 60034-1 | Rotating electrical machines - Part 1: Rating and performance |
| EN 60034-5 | Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines |
| EN 60034-8 | Rotating electrical machines - Part 8: Terminal markings and direction of rotation |
| Directive 2006/42/EG | Machinery directive |
| Directive 2011/65/EU | RoHS Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment |

8.1.2.2 8WS - Mechanical conditions

| Test | Testing performed per | Requirements per |
|---|-----------------------|--|
| Vibration (sinusoidal) / Operation | EN 60068-2-6 | EN 61800-2: Product standard - Adjustable speed electrical power drive systems EN 60721-3-3 / class 3M8 |
| Vibration (sinusoidal) / Transport (packaged) | EN 60068-2-6 | EN 61800-2: Product standard - Adjustable speed electrical power drive systems EN 60721-3-2 / Class 2M4 |

8.1.2.3 Climate conditions

| Test | Testing performed per | Requirements per |
|-----------|-----------------------|---|
| Operation | --- | EN 60721-3-3 / class 3K3 ¹⁾ |
| Storage | --- | EN 60721-3-1 / class 1K21 ²⁾ |
| Transport | --- | EN 60721-3-2 / class 2K11 ³⁾ |

Operation

| | Requirements per EN 60721-3-3 / class 3K3 ¹⁾ |
|--------------------------------------|---|
| Ambient temperature during operation | 0 to 40°C |
| Relative humidity during operation | 5 to 95%, relative, non-condensing 1 to 29 g/m ³ , absolute |

Storage

| | Requirements per EN 60721-3-1 / class 1K21 ²⁾ |
|----------------------------------|--|
| Storage temperature | 5 to 40°C |
| Relative humidity during storage | 5 to 95%, non-condensing |

Transport

| | Requirements per EN 60721-3-2 / class 2K11 ³⁾ |
|------------------------------------|--|
| Transport temperature | 5 to 40°C |
| Relative humidity during transport | 5 to 95%, non-condensing |

¹⁾ 3K3 with extension of low air temperature from 5°C to 0°C, high relative humidity from 85% to 95% and high absolute humidity from 25 g/m³ to 29 g/m³

²⁾ 1K21 with extension of high relative humidity from 85% to 95%

³⁾ 2K11 with extension of high relative humidity from 85% to 95%

8.1.3 UK regulation

Restriction of the use of certain hazardous substances

Restriction of the use of certain hazardous substances in electrical and electronic equipment regulations 2012 no. 3032 [as amended]

UK Conformity Assessed (UKCA)



All directives applicable to the respective product and their relevant standards are met. Products with this marking are permitted to be imported into Great Britain (England, Wales, Scotland).

The corresponding UK declaration of conformity is available for download on the B&R website. For information about the editions of applicable standards, see the UK declaration of conformity.



UK Conformity Assessed (UKCA)

[Website > Downloads > Certificates > Declarations of conformity > Motors > UK Conformity Assessed \(UKCA\) 8WS](#)

Supply of machinery (safety) regulations 2008

8WS motors are considered partly completed machinery as defined by Supply of Machinery (Safety) Regulations 2008. These comply with the fundamental health and safety requirements listed in the annex of the declaration of incorporation in accordance with Annex I of this directive.

The declaration of incorporation is available for download on the B&R website. The editions of the applied standards are located in the declaration of incorporation.



UK declaration of incorporation

[Website > Downloads > Certificates > Declarations of conformity > Motors > UK Conformity Assessed \(UKCA\) 8WS](#)

8.1.4 UL



Underwriters Laboratories (UL)

Products with this mark are tested by Underwriters Laboratories and listed with the file number E360421.

The UL Recognized Component mark indicates that the UL recognized component can be used in a product or system that bears the UL Listed mark.

Standards applied:

UL 1004-1
UL 1004-6

Rotating Electrical Machines - General Requirements
Servo and Stepper Motors



Certificate

[Website > Downloads > Certificates > UL > 8WSA servo motors > E360421 UL certificate of compliance for 8WS](#)
[Website > Downloads > Certificates > UL > 8WSB gear motors > E360421 UL certificate of compliance for 8WS](#)

9 Disposal

9.1 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.

9.2 Rare-earth magnets

Caution!

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

9.3 Magnetized rotor

Warning!

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