

8LVA three-phase synchronous motors

User's manual

Version: **1.10 (January 2024)**
Order no.: **MAMOT7-ENG**

Translation of the original documentation

All information in this manual is current as of its creation. We reserve the right to change the contents of this manual without notice. B&R Industrial Automation GmbH is not liable for technical or editorial errors and defects in this manual. In addition, B&R Industrial Automation GmbH assumes no liability for damages that are directly or indirectly attributable to the delivery, performance or use of this material. We note that the software and hardware designations and brand names of the respective companies used in this document are subject to general trademark, brand or patent protection.

1 General information.....	4
1.1 Manual history.....	4
1.2 About this user's manual.....	4
1.3 Safety.....	5
1.3.2 Intended use.....	5
1.3.3 Reasonably foreseeable misuse.....	5
1.3.4 General sources of danger.....	6
1.3.5 Regulations and safety guidelines.....	8
1.3.6 Responsibility of the operator.....	9
1.3.7 Qualified personnel.....	9
1.3.8 Safety notices.....	9
1.3.9 Protective equipment.....	9
1.4 8LVA - Compact servo technology.....	10
1.4.1 Nameplate.....	10
2 Technical data.....	11
2.1 General description.....	11
2.2 8LVA order key.....	12
2.2.1 Example order 1.....	13
2.2.2 Example order 2.....	13
2.3 Cooling type / Construction type (b).....	14
2.4 Sizes (c).....	14
2.5 Length (d).....	14
2.6 Motor encoder systems (ee).....	15
2.6.1 EnDat 2.2.....	15
2.6.2 General safety encoder.....	15
2.6.3 Information: SafeMOTION.....	15
2.7 Nominal speed (nnn).....	17
2.8 Motor options (ff).....	18
2.8.1 Connection direction (ff).....	18
2.8.2 Oil seal (ff).....	19
2.8.3 Holding brake (ff).....	19
2.8.4 Shaft end (ff).....	20
2.9 General motor data.....	22
2.9.1 Formula symbols.....	23
2.9.2 Power dissipation.....	24
2.10 8LVA standard motors.....	25
2.11 8LVA1 - Technical data.....	26
2.11.1 8LVA13 dimensions.....	26
2.11.2 Permissible shaft load 8LVA13.....	27
2.11.3 Speed-Torque characteristic curve at 80 VDC DC bus voltage.....	28
2.11.4 Speed-Torque characteristic curve at 325 VDC DC bus voltage.....	28
2.12 8LVA2 - Technical data.....	29
2.12.1 8LVA2x dimensions.....	29
2.12.2 Permissible shaft load 8LVA2.....	31
2.12.3 Speed-Torque characteristic curve at 80 VDC DC bus voltage.....	32
2.12.4 Speed-Torque characteristic curve at 325 VDC DC bus voltage.....	34
2.13 8LVA3 - Technical data.....	36
2.13.1 8LVA33 dimensions.....	36
2.13.2 Permissible shaft load 8LVA33.....	38
2.13.3 Speed-Torque characteristic curve at 80 VDC DC bus voltage.....	39
2.13.4 Speed-Torque characteristic curve at 325 VDC DC bus voltage.....	40
3 Transport and storage.....	41
4 Installation conditions.....	43
4.1 Flange installation and cooling.....	43

4.2 Load due to radial and axial force.....	44
5 Installation and connection.....	46
5.1 Before installation.....	46
5.2 Safety.....	46
5.2.1 General sources of danger.....	46
5.2.2 Noise emissions.....	49
5.3 Shaft end and bearing.....	49
5.4 Installing in the system.....	51
5.4.1 Fasteners and tightening torques.....	52
5.5 Connecting and disconnecting the motor.....	53
5.5.1 Cables and connectors.....	54
5.5.2 Order of connection.....	55
5.5.3 Connecting connectors properly.....	57
5.5.4 Connection type.....	61
6 Commissioning and operation.....	63
6.1 Before commissioning and operation.....	63
6.2 Safety.....	63
6.2.1 General sources of danger.....	63
6.2.2 Reversing operation.....	66
6.2.3 Freely rotating motors.....	66
6.2.4 Holding brake.....	66
6.3 Verification.....	67
6.3.1 To verify before commissioning.....	67
6.3.2 To verify during commissioning.....	68
6.3.3 During operation.....	68
6.4 Faults during operation.....	69
7 Inspection and maintenance.....	70
7.1 Safety.....	70
7.1.1 General sources of danger.....	70
7.2 Motor bearing and holding brake.....	73
7.3 Oil seal.....	74
7.4 Cleaning.....	74
8 Standards and certifications.....	75
8.1 International and national certifications.....	75
8.1.1 Mark.....	75
8.1.2 EU directives and standards (CE).....	75
8.1.3 UK regulation.....	76
8.1.4 UL / CSA.....	77
9 Disposal.....	78
9.1 Safety.....	78
9.1.1 Protective equipment.....	78
9.1.2 Rotor with rare earth magnets.....	78

1 General information

1.1 Manual history

Version	Date	Comment
1.10	January 2024	General revision Updated chapter "Standards and certifications".
1.00	June 2017	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.

Organization of safety notices

Safety notices in this manual are organized as follows:

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

1.3.2 Intended use

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 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.

1.3.4 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 while voltage is applied, 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 while voltage is applied!
- 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 in a current- and voltage-free state!

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, inverters 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 switch-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!

1.3.5 Regulations 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!

1.3.6 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.

1.3.7 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.

1.3.8 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

1.3.9 Protective equipment

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

1.4 8LVA - Compact servo technology



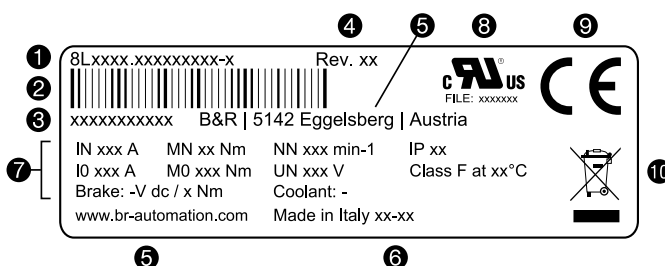
The 8LVA motor series is the perfect choice when it comes to installing servo motors in extremely tight spaces. Equipped with either a resolver or digital EnDat 2.2 interface, these motors can meet the absolute highest demands. With their low moment of inertia, motors in the 8LVA series are designed to be highly dynamic and distinguished by their outstanding intrinsic acceleration characteristics. Additional noteworthy features include low cogging and a high overload capability. By default, these motors have IP54 protection but are also available with IP65 protection. They can optionally be equipped with a holding brake. Designed for use with ACOPOSmicro servo drives, these motors offer extremely high performance and are some of the most compact on the market. 8LVA servo motors are recommended for a wide range of applications and provide an optimal price/performance ratio in the power range up to 1 kW.

1.4.1 Nameplate

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

The nameplate adhesive label on the motor housing contains the following information:

1	Order code
2	Serial number as a barcode (Code 128)
3	11-digit serial number
4	Revision
5	Manufacturer
6	Production period (week/year)
7	Technical data: I _n Rated current M _n Rated torque n _n Rated speed IP protection class I ₀ Continuous stall current M ₀ continuous stall torque U _N rated voltage Holding brake Coolant
8	UL Recognized Component mark
9	CE marking
10	WEEE mark



Note:

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

1.4.1.1 Embedded parameter chip

All relevant mechanical and electrical information and data is stored in the EnDat encoder used for B&R motors. This means that the user does not have to configure settings on the servo drive. As soon as the encoder is connected to the servo drive and the power supply to the electronics is switched on, the motor is automatically identified. The motor sends its nominal parameters and limit parameters to the servo drive. The drive then automatically determines the current limits and current control parameters required for optimal control of the motor. Only the speed and position controllers must still be optimized by the user. Support for this is provided by the integrated commissioning environment of B&R Automation Studio™.

In addition to assistance during commissioning, routine service work is also simplified, and motors can be replaced without having to take extra time to set parameters.

2 Technical data

2.1 General description

The special design of the surface allows it to be used in the food sector. Recesses in which liquids can accumulate were deliberately avoided.

- Ultra compact and highly dynamic
- High overload capability and low cogging
- Power range up to 1 kW for 80 VDC and 320 VDC DC bus voltage
- Self-locking connector system
- Robust industrial connectors with optimal EMC shielding
- 300° rotatable built-in double angular connector and single-cable solution (hybrid)
- Optionally available with gearbox or as direct gearbox attachment (8LVB)

2.2 8LVA order key

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

Cooling / Construction type

A ... Self-cooling
see "Cooling type / Construction type (b)" on page 14

Size

Valid values: **1, 2, 3** see "Sizes (c)" on page 14

Length

Valid values: **2, 3** see "Length (d)" on page 14

Motor encoder system

Resolver: **R0**
Inductive EnDat encoders: **B1, B8, B9, Z8, Z9**
see "Motor encoder systems (ee)" on page 15

Nominal speed

005 ... 500 rpm **015** ... 1500 rpm **030** ... 3000 rpm
A95 ... 950 rpm **021** ... 2100 rpm
see "Nominal speed (nnn)" on page 17

Motor options

Dx ... Built-in double angular connector (swivel)
Sx ... Single-cable solution (hybrid), angled (swivel)
Ux ... Single-cable solution (hybrid), straight
x0 ... Smooth shaft
x1 ... Keyed shaft
x2 ... Smooth shaft, holding brake
x3 ... Keyed shaft, holding brake
x6 ... Smooth shaft, oil seal
x7 ... Keyed shaft, oil seal
x8 ... Smooth shaft, holding brake, oil seal
x9 ... Keyed shaft, holding brake, oil seal
see "Motor options (ff)" on page 18

Special motor options

00 ... No special motor options

Motor version

0 ... Version 0 (The motor version is specified as a code (h) in the order number. 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).

2.2.1 Example order 1

A three-phase synchronous motor of type **8LVA22** with a nominal speed of 3000 rpm was selected for an application.

The connection should be designed as a single-cable solution (hybrid). The motor should be equipped with a holding brake, keyed shaft end and EnDat encoder.

The code (ee) for the encoder system is **B1**.

The (nnn) code for a nominal speed of 3000 rpm is **030**.

The (ff) code for the other options is **S3**.

The order number for the necessary motor is therefore **8LVA22.B1030S300-0**.

2.2.2 Example order 2

A three-phase synchronous motor of type **8LVA33** with a nominal speed of 1500 rpm was selected for an application.

The connection should be designed as a built-in double angular connector. The motor should be equipped without a holding brake, with a smooth shaft end and resolver encoder. The motor should also be equipped with a oil seal.

The code (ee) for the encoder system is **R0**.

The code (nnn) for a nominal speed of 1500 rpm is **015**.

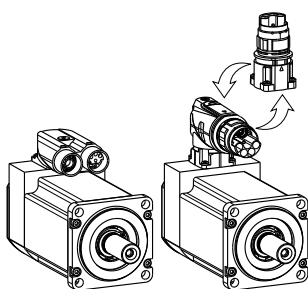
The (ff) code for the other options is **D6**.

The order number for the necessary motor is therefore **8LVA33.R0015D600-0**.

2.3 Cooling type / Construction type (b)

8LV **b** **c** **d** . **ee** **nnn** **ff** **gg** - **h**

see "Order key" on page 12



8LV motors are available with self-cooling type **A** (8LV**A**).

(Based on the 8LV**A** servomotors, 8LV**B** gear motors with directly mounted planetary gearboxes are also available. For additional information, see the B&R website (www.br-automation.com).)

These motors have a long, slender form and must be attached to the machine using the mounting flange, which also serves as a cooling surface.

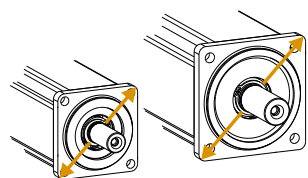
The cooling type is identified by a character (**b**) in the order number.

Cooling type (b)		Connection technology (see motor options)
8LV A	Self-cooling	Built-in double angular connector
		Single-cable solution (hybrid) - Angled
		Single-cable solution (hybrid) - Straight

2.4 Sizes (c)

8LV **b** **c** **d** . **ee** **nnn** **ff** **gg** - **h**

see "Order key" on page 12



8LV**A** servo motors are available in various sizes (1, 2, 3). These differ in dimensions (especially flange dimensions) and power data.

The sizes are differentiated by a digit (**c**) in the order number. The larger this number, the larger the flange dimensions and power data of the respective motor.

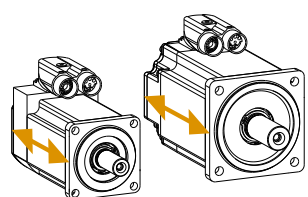
Availability

	Available sizes (c)		
	8LV A 1	8LV A 2	8LV A 3
8LV A	Yes	Yes	Yes

2.5 Length (d)

8LV **b** **c** **d** . **ee** **nnn** **ff** **gg** - **h**

see "Order key" on page 12



8LV**A** servo motors are available in various lengths. These differ in the power data with identical flange dimensions.

The lengths are differentiated by a number (**d**) in the order number. The larger this number, the longer the respective motor.

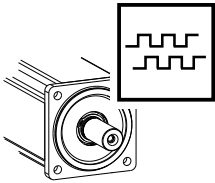
Availability

	Available lengths (d)	
	8LV A x2	8LV A x3
8LV A 1	---	Yes
8LV A 2	Yes	Yes
8LV A 3	---	Yes

2.6 Motor encoder systems (ee)

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

see "Order key" on page 12



The motors are available with EnDat encoders as well as resolvers. The encoder system is specified as part of the order number in the form of a 2-digit code (**ee**).

Analog and digital transfer

A resolver is an analog encoder system. Resolvers are particularly robust against vibrations and high operating temperatures. Their disadvantage is the low precision of 6-10 arcminutes. There is still no multi-turn variant with resolvers.

Digital encoders use a serial transfer protocol. This protocol is called EnDat. The EnDat protocol is a developed standard that incorporates the advantages of absolute and incremental position measurement and also offers a read/write parameter memory in the encoder. The embedded parameter chip is stored by B&R in this encoder memory. This data and the B&R ACOPOS systems form a "plug-and-play" drive solution. Absolute positioning can be used within a revolution with the "single-turn" variants. A homing procedure is not required because of the absolute position measurement. For applications where the motor covers several revolutions for positioning, a "multi-turn" encoder that can save up to 65535 revolutions can be used. A solution with a single-turn encoder variant with a homing procedure is also possible.

2.6.1 EnDat 2.2

For the advanced, fully digital EnDat 2.2 protocol, the positions are generated directly in the encoder and communicated serially with the drive system. This transfer is very robust in relation to disturbances and is even certified for safety applications.

2.6.2 General safety encoder

Safety-related position measurement systems

In machine and system manufacturing, the topic of safety is becoming more and more important. This is mirrored in legislation and stricter safety criteria in national and international standards. Most importantly, stricter requirements serve to protect personnel, but they also increasingly serve to protect property and the environment. The goal of functional safety is to minimize or eliminate dangerous situations that can occur in machines and systems either with or without operational errors. This is generally achieved by implementing redundant systems. Moving axes in safety applications require position information in order to be able to carry out their corresponding safety functions. Different system configurations can be implemented to get independent position values. One possibility is using two measuring instruments per axis. To keep costs down, the aim is often to create a solution with only one position measuring instrument. Until now, analog measuring instruments with sine/cosine signals were used for this purpose. The encoder manufacturer Heidenhain – as the first manufacturer with the purely serial EnDat 2.2 protocol for safety position measurement systems – offers a serial single-encoder solution per IEC 61 508 SIL 2. All the advantages of serial data transfer – such as cost optimization, diagnostics possibilities, automatic commissioning and high-speed generation of position values – can now benefit safety applications as well.

100% inspection during production and additional measures during final testing ensure errors have not occurred related to shaft and coupling connections on rotary encoders when using motors with safety encoders (per EN ISO 13849-2).

2.6.3 Information: SafeMOTION

For information about the area of application and procedure for setting up the various safety functions, see the SafeMOTION user's manual (MAACPMSAFEMC-ENG) in the Downloads section of the B&R website (www.br-automation.com).

2.6.4.1 Resolver

Technical data	Resolver / Order code (ee)
	R0
Type	RE-15-1-J04
Accuracy	10 angular minutes
Vibration during operation 10 < f ≤ 500 Hz	≤500 m/s ²
Shock during operation Duration 11 ms	≤1000 m/s ²
Availability	Available resolvers / Order code (ee)
	R0
8LVA1	Yes
8LVA2	Yes
8LVA3	Yes

2.6.4.2 EnDat 2.2 encoder

Technical data	Encoder type / Order code (ee)				
	B1	B8	Z8	B9	Z9
Operating principle	Inductive				
EnDat protocol	2.2				
Functional safety ¹⁾	---	---	Yes	---	Yes
Single-turn/Multi-turn	M	S		M	
Battery-backed	Yes	---			
Revolutions	65536	1		4096	
Resolution [bits single-turn / bits multi-turn]	19/16	19/0		19/12	
Accuracy ["]	±120				
Cutoff frequency ≥ [kHz]	Digital pos. in the encoder				
Stator - Vibration during operation Max. [m/s2]	300	400			
Rotor - Vibration during operation Max. [m/s2]	300	600			
Max. shock during operation [m/s2]	1000	2000			
Manufacturer's product ID	EBI 1135	ECI 1119 FS EnDat22		EQI 1131 FS EnDat22	
Availability	Available encoders / Order code (ee)				
	B1	B8	Z8	B9	Z9
8LVA1	Yes	---	---	---	---
8LVA2	Yes	Yes	Yes	Yes	Yes
8LVA3	Yes	Yes	Yes	Yes	Yes

¹⁾ See appendix B "Safety level overview for ACOPOS product family safety functions" in the SafeMOTION user's manual (MAACPMSAFEMC-ENG) in the Downloads section of the B&R website.

2.7 Nominal speed (nnn)

8LV

b

c

d

.

ee

nnn

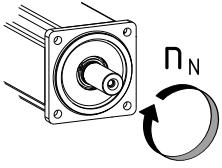
ff

gg

-

h

see "Order key" on page 12



8LVA servo motors are available with various nominal speeds.

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

	Order code (nnn)				
	005	A95	015	021	030
Nominal speeds n_N [rpm]	500	950	1500	2100	3000

Availability

Size/Length	Available nominal speeds n_N [rpm] at 80 VDC operation				
	500	950	1500	2100	3000
8LVA13	---	---	Yes	---	Yes
8LVA22	---	---	Yes	---	Yes
8LVA23	---	Yes	Yes	---	Yes
8LVA33	Yes	---	Yes	Yes	---

2.8 Motor options (ff)

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

see "Order key" on page 12

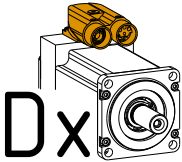


Motor options (ff) - Order code

See the following table for the corresponding code (ff) in the order key.

The first position in the code (ff) defines the connection direction with options **Dx**, **Sx** and **Ux**. The second position (e.g. x1, x2, x3) defines all other motor options according to the table.

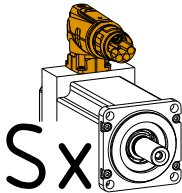


Built-in double angular connector (swivel)

Encoder and power cable: Separated with their own connections

Connection direction	Motor option			Availability			Order code (ff)
	Oil seal	Holding brake	Shaft end	8LVA1	8LVA2	8LVA3	
	---	---	Smooth shaft	Yes	Yes	Yes	D0
	---	---	Keyed shaft	---	Yes	Yes	D1
	---		Smooth shaft	Yes	Yes	Yes	D2
	---		Keyed shaft	---	Yes	Yes	D3
	Yes	---	Smooth shaft	Yes	Yes	Yes	D6
	Yes	---	Keyed shaft	---	Yes	Yes	D7
	Yes		Smooth shaft	Yes	Yes	Yes	D8
	Yes		Keyed shaft	---	Yes	Yes	D9

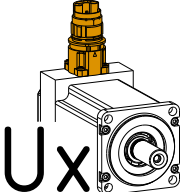


Single-cable solution (hybrid), angled (swivel)

Encoder and power cable: Combined in one cable

Connection direction	Motor option			Availability			Order code (ff)
	Oil seal	Holding brake	Shaft end	8LVA1	8LVA2	8LVA3	
	---	---	Smooth shaft	---	Yes	Yes	S0
	---	---	Keyed shaft	---	Yes	Yes	S1
	---		Smooth shaft	---	Yes	Yes	S2
	---		Keyed shaft	---	Yes	Yes	S3
	Yes	---	Smooth shaft	---	Yes	Yes	S6
	Yes	---	Keyed shaft	---	Yes	Yes	S7
	Yes		Smooth shaft	---	Yes	Yes	S8
	Yes		Keyed shaft	---	Yes	Yes	S9

Single-cable solution (hybrid) - Straight

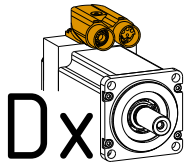
Encoder and power cable: Combined in one cable

Connection direction	Motor option			Availability			Order code (ff)
	Oil seal	Holding brake	Shaft end	8LVA1	8LVA2	8LVA3	
	---	---	Smooth shaft	---	Yes	Yes	U0
	---	---	Keyed shaft	---	Yes	Yes	U1
	---		Smooth shaft	---	Yes	Yes	U2
	---		Keyed shaft	---	Yes	Yes	U3
	Yes	---	Smooth shaft	---	Yes	Yes	U6
	Yes	---	Keyed shaft	---	Yes	Yes	U7
	Yes		Smooth shaft	---	Yes	Yes	U8
	Yes		Keyed shaft	---	Yes	Yes	U9

2.8.1 Connection direction (ff)

Power and encoder connections

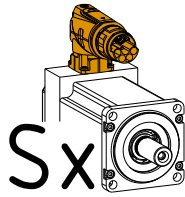
8LVA servo motors are available with 3 different connection options.



Built-in double angular connector

Connection direction: Angled (swivel¹⁾)

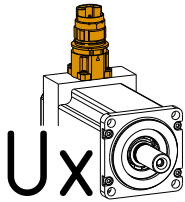
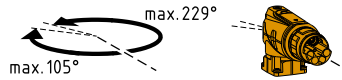
Encoder and power cable: Separated with their own connections



Single-cable solution (hybrid)

Connection direction: Angled (swivel¹⁾)

Encoder and power cable: Combined in one cable



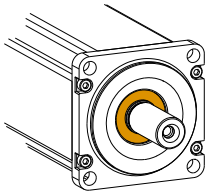
Single-cable solution (hybrid)

Connection direction: Straight

Encoder and power cable: Combined in one cable

1) Check the angle specifications and the feasibility with regard to requirements using the CAD configurator (cad.br-automation.com).

2.8.2 Oil seal (ff)



8LVA servo motors are available with a form A oil seal per DIN 3760.

Degree of protection per EN 60034-5 (IP code)	8LVA
8LVA1 with and without oil seal:	IP54 ⁵⁾ 6)
8LVA2 / 8LVA3 without oil seal:	IP64 ⁵⁾ 7)
8LVA2 / 8LVA3 with oil seal:	IP65 ⁵⁾

Servicing

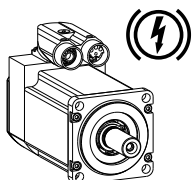
To maintain functionality of the oil seal, it must be lubricated regularly with oil. An oil seal that is not lubricated will harden due to increased frictional heat and will eventually provide only dust protection.

Note:

Proper lubrication of the oil seal must be ensured throughout the entire service life of the motor.

For this reason, mounting a gearbox on motors with an oil seal is not permitted!

2.8.3 Holding brake (ff)



8LVA motors are available with a standard holding brake. It is installed directly behind the A-side flange on the motor and used to hold the motor shaft in a voltage-free state of the servo motor.

⁵⁾ The degrees of protection are only achieved if the power and signal connections are fully installed.

⁶⁾ For IP54, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP54 protection.

⁷⁾ For IP64, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP64 protection.

Technical data

	8LVA1	8LVA2	8LVA3
Holding torque M_{Br} [Nm]	0.35	2.2	4.0
Connected load P_{On} [W]	8	8.2	13.4
Maximum speed n_{max} [rpm]	6000	12000	10000
Supply current I_{On} [A]	0.33	0.35	0.56
Supply voltage U_{On} [VDC]	24 (+6% / -10%)		
Moment of inertia J_{Br} [kgcm ²]	0.013	0.12	0.38

Operating principle

The holding brake is a permanent magnet brake and can be controlled by the B&R drive system. Based on principle, this type of holding brake exhibits a minimal amount of backlash. Voltage (see the technical data) must be applied to release the brake.

The brake is designed as a holding brake. It not permitted to be used for operational braking! Under these conditions, the brake has a service life of approximately 5,000,000 cycles (opening and closing the brake is one cycle). Loaded braking during an emergency stop is permitted but reduces its service life.

Information:

The required brake holding torque is determined based on the actual load torque. It is recommended by the brake manufacturer to take into account a safety factor of 2.

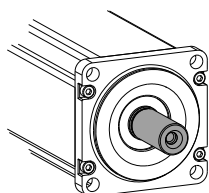
Warning!

The holding brake is not intended for normal braking. The holding brake does not provide protection for personnel. The maximum motor torque far exceeds the holding torque for the brake.

2.8.4 Shaft end (ff)

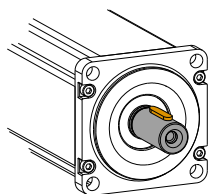
8LVA motors have shaft ends per DIN 748.

Variants



Smooth shaft end

A smooth shaft end is used for a force-fit shaft-hub connection and guarantees a backlash-free connection between the shaft and hub as well as a high degree of operating smoothness. The end of the shaft has a threaded center hole.



Keyed shaft end

A keyed shaft end is used for a form-fit torque transfer with low demands on the shaft-hub connection and for handling torque in a constant direction.

The keyways conform to keyway form N1 per DIN 6885-1. Form A keyed shafts that conform to DIN 6885-1 are used. Balancing motors with keyways is done using the shaft and fitment key convention per DIN ISO 8821.

The end of the shaft has a threaded center hole that can be used to install machine actuators with shaft end cover plates.

Caution!

Shaft breakage due to heavy reverse operation.

The shaft key can become dislodged during heavy reverse operation. In extreme cases, the shaft could brake!

- Preferably use smooth shaft ends with clamping elements.

Caution!

Motor damage due to imbalance.

If motors with a keyed shaft end are operated without the shaft key, this can result in imbalances and subsequently motor damage.

- **In these cases, use a smooth shaft end.**

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.**

2.9 General motor data

General information		8LVA	
CE certification	Yes		
C-UR-US listed	Yes		
UL file number	PRHZ2.E235396		
Electrical properties		8LVA	
DC bus voltage on the ACOPOSmicro	80 VDC ¹⁾		
Conventional connection type (power connection / encoder connection)	ytec circular connector		
Connection type - Single-cable solution (hybrid)	htec circular connector		
Thermal properties		8LVA1	8LVA2 / 8LVA3
Insulation class per EN 60034-1	F		
Cooling method per EN 60034-6 (IC code)	Self-cooling, free circulation surface cooling (IC4A0A0)		
Thermal motor protection per EN 60034-11	--- ²⁾	Temperature sensor KTY83-110 (up to revision C7) / AM-LPTC1000 (revision C8 or later) Maximum winding temperature 155°C (limited by the thermal motor protection in the ACOPOSmicro drive system to 110°C with EnDat feedback and 130°C with resolver feedback)	
Mechanical properties		8LVA	
Vibration severity per EN 60034-14	Vibration severity level A		
Roller bearing, dynamic load rating and nominal service life	Based on DIN ISO 281		
Shaft end per DIN 748	Form E		
Oil seal per DIN 3760	Form A		
Key and keyway per DIN 6885-1	Form A keys, form N1 keyway		
Shaft balancing per ISO 1940/1, G6.3	Shaft and fitment key convention		
Mounting flange	IEC 72-1		
Radial runout, concentricity and axial runout of mounting flange per DIN 42955	Tolerance R		
Coating	Water-based coating		
Color	RAL 9005 flat		
Operating conditions		8LVA	
Rating class, operating mode per EN 60034-1	S1 - Continuous operation		
Ambient temperature during operation	-15°C to +40°C		
Maximum ambient temperature during operation	+50°C ³⁾		
Relative humidity during operation	5 to 95%, non-condensing		
Reduction of the nominal current and stall current at temperatures above 40°C	5% per 5°C		
Reduction of the nominal current and stall current at installation elevations over 1000 m above sea level	10% per 1000 m		
Maximum installation elevation	2000 m ⁴⁾		
Max. flange temperature	65°C		
Degree of protection per EN 60034-5 (IP code)			
8LVA1 with and without oil seal:	IP54 ⁵⁾ ⁶⁾		
8LVA2 / 8LVA3 without oil seal:	IP64 ⁵⁾ ⁷⁾		
8LVA2 / 8LVA3 with oil seal:	IP65 ⁵⁾		
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) ⁸⁾		
Storage and transport conditions		8LVA	
Storage temperature	-20 to +60°C		
Relative humidity during storage	Max. 90%, non-condensing		
Transport temperature	-20 to +60°C		
Relative humidity during transport	Max. 90%, non-condensing		

¹⁾ Permissible DC bus voltage on the ACOPOS single-phase: 320 VDC

²⁾ The 8LVA1 motor does not have a thermal temperature sensor and is protected by the motor temperature model in the servo drive.

³⁾ Continuous operation at an ambient temperature of +40°C to max. +50°C is possible, but this results in premature aging.

⁴⁾ Requirements that go beyond this must be arranged with B&R.

⁵⁾ The degrees of protection are only achieved if the power and signal connections are fully installed.

⁶⁾ For IP54, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP54 protection.

⁷⁾ For IP64, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP64 protection.

⁸⁾ The IM3031 type of construction and mounting arrangement (vertical, motor hanging on the machine) must be avoided since production fluids or oils, e.g. from a gearbox, can penetrate the motor and damage it. If this is not possible, it is mandatory to select the oil seal option and to ensure that no production fluids or oils get onto the seal.

2.9.1 Formula symbols

Term	Symbol	Unit	Description
Nominal speed	n_N	rpm	Nominal speed of the motor
Nominal torque	M_N	Nm	The nominal torque is output by the motor with $n = n_N$ when the nominal current is absorbed. This is possible for any length of time if the ambient conditions are correct.
Nominal power	P_N	kW	The nominal power is supplied by the motor when $n = n_N$. This is possible for any length of time if the ambient conditions are correct.
Nominal current	I_N	A	The nominal current is the effective value of the phase current (current in the motor supply line) for the development of the nominal torque at nominal speed. This is possible for any length of time if the ambient conditions are correct.
Stall torque	M_0	Nm	The stall torque is output by the motor at speed n_0 and when the stall current is absorbed. This is possible for any length of time if the ambient conditions are correct. Speed n_0 must be high enough for the temperature in all windings to be homogeneous and stationary (for B&R motors, $n_0 = 50$ rpm). The continuous torque is reduced at a real standstill.
Stall current	I_0	A	The stall current is the effective value of the phase current (current in the motor supply line) for the development of the standstill torque at speed n_0 . This can be output for any length of time if the ambient conditions are maintained. Speed n_0 must be high enough for the temperature in all windings to be homogeneous and stationary (for B&R motors, $n_0 = 50$ rpm).
Peak torque	M_{\max}	Nm	The peak torque is briefly output by the motor when the peak current is absorbed.
Peak current	I_{\max}	A	The peak current is the effective value of the phase current (current in the motor supply line) for the development of the peak torque. This is only permitted to be used for a short time. The peak current is determined by the magnetic circuit. Exceeding this value for a short time can cause irreversible damage (demagnetization of the magnet material).
Maximum speed	n_{\max}	rpm	Maximum motor speed. This is a mechanical condition (centrifugal force, bearing wear).
Average speed	n_{average}	rpm	Average speed for one cycle.
Torque constant	K_T	Nm/A	The torque constant specifies the torque generated by the motor at 1 Arms phase current. This value applies at a motor temperature of 20°C. If the temperature increases, the torque constant is reduced (typically down to 10%). If the current increases, the torque constant is reduced (typically starting at twice the value of the nominal current).
Voltage constant	K_E	V/1000 rpm	The voltage constant specifies the RMS value (phase-phase) of the reverse voltage induced by the motor at a speed of 1000 rpm (EMF). This value applies at a motor temperature of 20°C. When the temperature increases, the voltage constant is reduced (usually down to 5%). If the current increases, the voltage constant is reduced (typically starting at twice the value of the nominal current).
Stator resistance	R_{2ph}	Ω (Ohm)	Resistance measured in ohms between two motor leads (phase-phase) at 20°C winding temperature. On B&R motors, the windings use a star connection.
Stator inductance	L_{2ph}	mH	Winding inductance measured between two motor leads. The stator inductance depends on the rotor position.
Electrical time constant	t_{el}	ms	Corresponds to 1/5 of the time needed for the stator current to stabilize with constant operating conditions.
Thermal time constant	t_{therm}	min	Corresponds to 1/5 of the time needed for the motor temperature to stabilize with constant operating conditions.
Moment of inertia without brake	J	kgcm ²	Moment of inertia for a motor without a holding brake.
Weight without brake	m	kg	Mass of motor without holding brake.
Moment of inertia of brake	J_{Br}	kgcm ²	Moment of inertia for the built-in holding brake.
Mass of brake	m_{Br}	kg	Mass of built-in holding brake.
Brake holding torque	M_{Br}	Nm	Minimum torque required to hold the rotor when the brake is activated.
Installed load	P_{On}	W	Installed load for the built-in holding brake.
Installed current	I_{on}	A	Installed current for the built-in holding brake.
Connection voltage	U_{on}	V	Operating voltage for the built-in holding brake.
Activation delay	t_{on}	ms	Delay time required for the holding torque of the brake to be established after the operating voltage has been removed from the holding brake.
Release delay	t_{off}	ms	Delay time required until the holding torque of the holding brake is reduced by 90% (the brake is released) after operating voltage has been returned to the holding brake.

2.9.2 Power dissipation

Power dissipation from the motors takes place via the mounting flange and surface of the motor. The following factors are important to ensure optimal heat dissipation:

- Thermally open installation
- Free convection

The motor data specified for the nominal operating point apply to a motor installed in a thermally open system. The dimensions of the flange plates used for the measurement are shown in the table below.

Generally speaking, the larger the flange, the better the heat dissipation.

Size	Dimensions [mm]	Material
8Lxx1, 8Lxx2, 8Lxx3	250 x 250 x 6	Aluminum

2.10 8LVA standard motors



A selection of motors from the 8LVA series is available as standard motors (preferred motors). If required, these motors are available on short notice using express delivery.

8LVA standard motors - Overview

	Nominal speed nN [rpm]	Encoder	EnDat (inductive)	Holding brake	Connection	Shaft end
8LVA13.B1030D000-0	3000	B1	2.2 multi-turn	---	Built-in double angular connector (swivel)	Smooth shaft
8LVA13.B1030D200-0				Yes		
8LVA23.B1030D000-0				---		
8LVA23.B1030D200-0				Yes		
8LVA33.B1021D000-0	2100			---		
8LVA33.B1021D200-0				Yes		

8LVA standard motors - Technical data

Order number	8LVA13.ee030ffgg-0		8LVA23.ee030ffgg-0	8LVA33.ee021ffgg-0
Motor				
Nominal speed n_N [rpm]	3000		2100	
Number of pole pairs	4			
Nominal torque M_N [Nm]	0.320	1.300	2.450	
Nominal power P_N [W]	101	408	539	
Nominal current I_N [A]	1.400	5.800	7.300	
Stall torque M_0 [Nm]	0.360	1.350	2.600	
Stall current I_0 [A]	1.600	6.000	7.900	
Maximum torque M_{max} [Nm]	1.00	4.00	7.20	
Maximum current I_{max} [A]	5.20	20.70	26.00	
Maximum speed n_{max} [rpm]	6600			
Torque constant K_T [Nm/A]	0.230		0.330	
Voltage constant K_E [V/1000 rpm]	13.61		19.90	
Stator resistance R_{2ph} [Ω]	5.800	0.830	0.503	
Stator inductance L_{2ph} [mH]	10.20000	2.00000		
Electrical time constant t_{el} [ms]	1.800	2.400	4.000	
Thermal time constant t_{therm} [min]	15.0	38.0	34.0	
Moment of inertia J [kgcm ²]	0.0300	0.2600	0.9500	
Weight without brake m [kg]	0.60	1.45	2.45	
Holding brake				
Holding torque of brake M_{Br} [Nm]	0.35	2.20	3.20	
Mass of brake [kg]	0.10	0.25	0.57	
Moment of inertia of brake J_{Br} [kgcm ²]	0.0130	0.1200	0.3800	
Recommendations				
ACOPOS 8Vxxx.xx...	1010.50	1090		
ACOPOSmicro 80VD100Px.xxxx-01		C02X		
ACOPOS P3 8EIxxx...	2X2M	8X8M		
Cross section for B&R motor cables [mm ²]	0.7500			
Connector size	1.0			

Servo drives: The recommended servo drive / inverter module is designed for 1.1x the stall current. If more than double the amount is needed during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guide value; detailed inspection of the corresponding speed/torque characteristic curve can result in deviations of the servo drive size (larger or smaller).

ACOPOSmulti: Operation on ACOPOSmulti inverter modules is not possible with voltage from the mains due to the high DC bus voltage.

2.11 8LVA1 - Technical data

Size 1

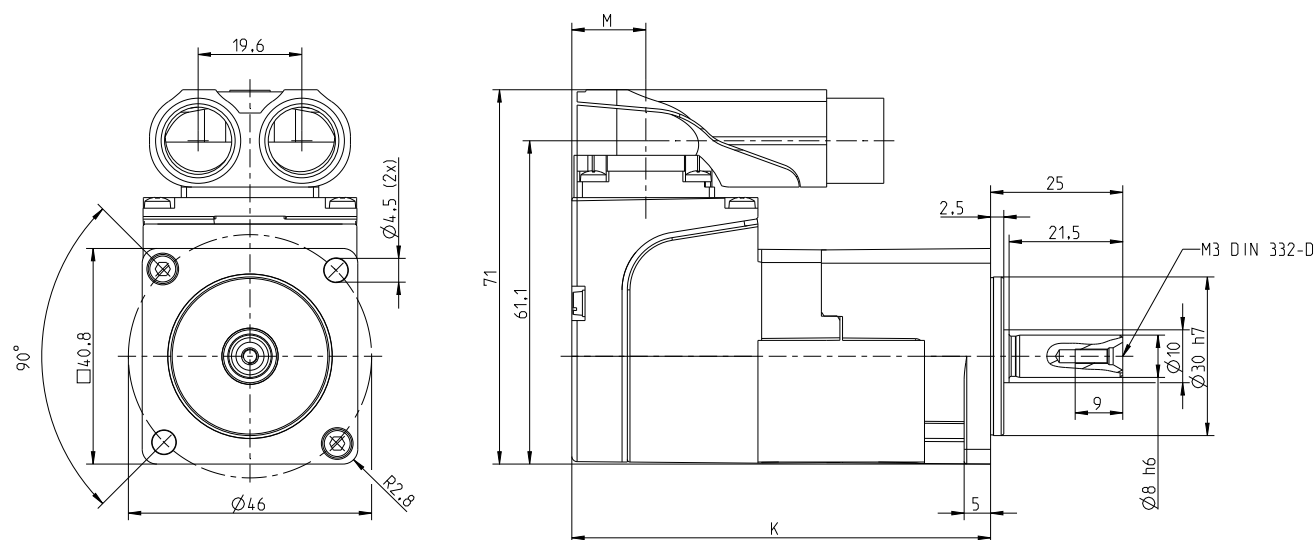
Order number	8LVA13.ee015ffgg-0	8LVA13.ee030ffgg-0
Motor		
Nominal speed n_N [rpm]	1500	3000
Number of pole pairs	4	
Nominal torque M_n [Nm]	0.340	0.320
Nominal power P_N [W]	53	101
Nominal current I_N [A]	0.800	1.400
Stall torque M_0 [Nm]	0.360	
Stall current I_0 [A]	0.900	1.600
Maximum torque M_{max} [Nm]	1.00	
Maximum current I_{max} [A]	2.80	5.20
Maximum speed n_{max} [rpm]	6600	
Torque constant K_T [Nm/A]	0.420	0.230
Voltage constant K_E [V/1000 rpm]	25.13	13.61
Stator resistance R_{2ph} [Ω]	17.400	5.800
Stator inductance L_{2ph} [mH]	30.70000	10.20000
Electrical time constant t_{el} [ms]	1.800	
Thermal time constant t_{therm} [min]	15.0	
Moment of inertia J [kgcm ²]	0.0300	
Weight without brake m [kg]	0.60	
Holding brake		
Holding torque of brake M_{Br} [Nm]	0.35	
Mass of brake [kg]	0.10	
Moment of inertia of brake J_{Br} [kgcm ²]	0.0130	
Recommendations		
ACOPOS 8Vxxxx.xx...	1010.50	
ACOPOSmicro 80VD100Px.xxxx-01	C02X	
ACOPOS P3 8Elxxxx...	2X2M	
Cross section for B&R motor cables [mm ²]	0.7500	
Connector size	1.0	

Servo drives: The recommended servo drive / inverter module is designed for 1.1x the stall current. If more than double the amount is needed during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guide value; detailed inspection of the corresponding speed/torque characteristic curve can result in deviations of the servo drive size (larger or smaller).

ACOPOSmulti: Operation on ACOPOSmulti inverter modules is not possible with voltage from the mains due to the high DC bus voltage.

NOTE about cables: For the appropriate cables, see the ACOPOSmicro servo drive chapter in the catalog (book 1).

2.11.1 8LVA13 dimensions

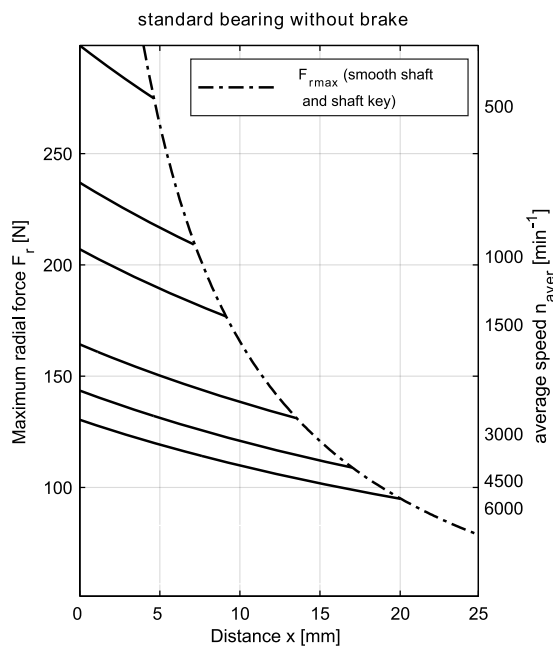


Built-in double angular connector

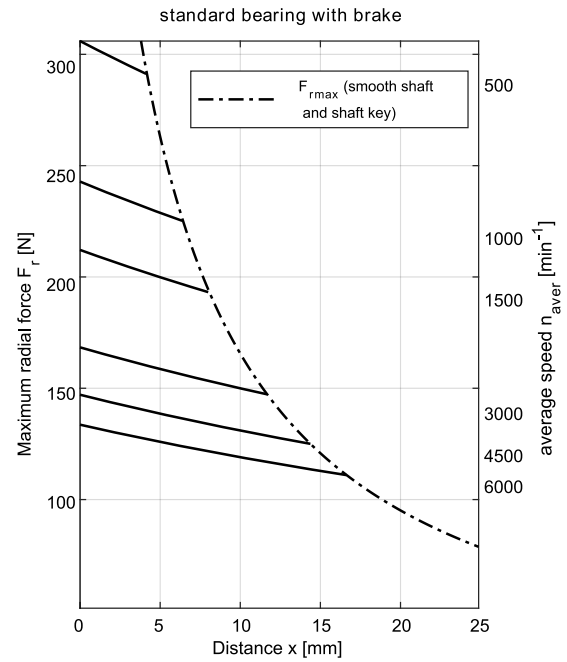
EnDat/Resolver feedback			Extension of K depending on motor option
	K	M	Holding brake
Encoder assignments	R0, B1	R0, B1	
8LVA13	79.5	14	28

2.11.2 Permissible shaft load 8LVA13

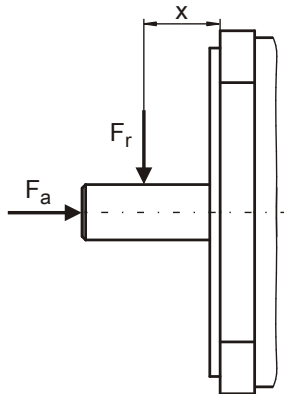
The values in the diagram below are based on a mechanical service life of the bearings of 20000 operating hours.



maximum allowed axial force: $F_{amax} = 25$ N



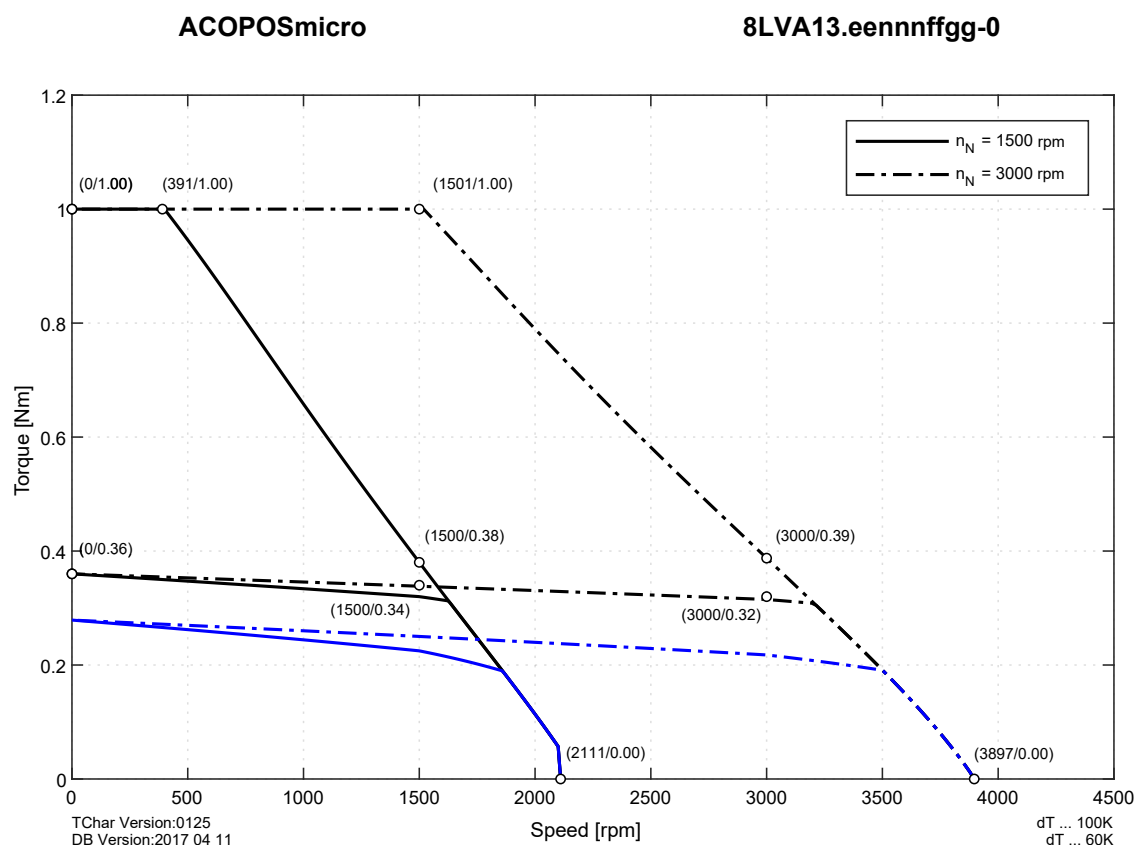
maximum allowed axial force: $F_{amax} = 28$ N



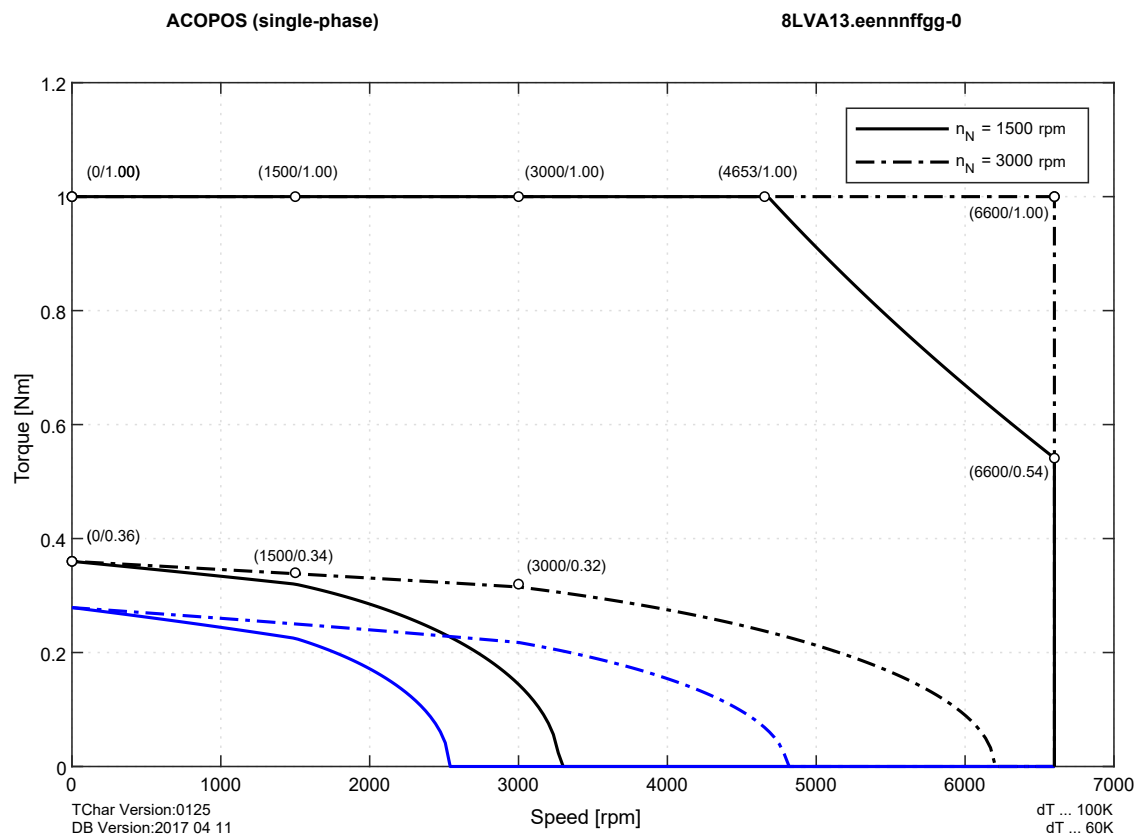
F_r Radial force
 F_a Axial force
 x Distance between the motor flange and the point where radial force F_r is applied.

Figure 1: Definition of shaft load

2.11.3 Speed-Torque characteristic curve at 80 VDC DC bus voltage



2.11.4 Speed-Torque characteristic curve at 325 VDC DC bus voltage



2.12 8LVA2 - Technical data

Size 2

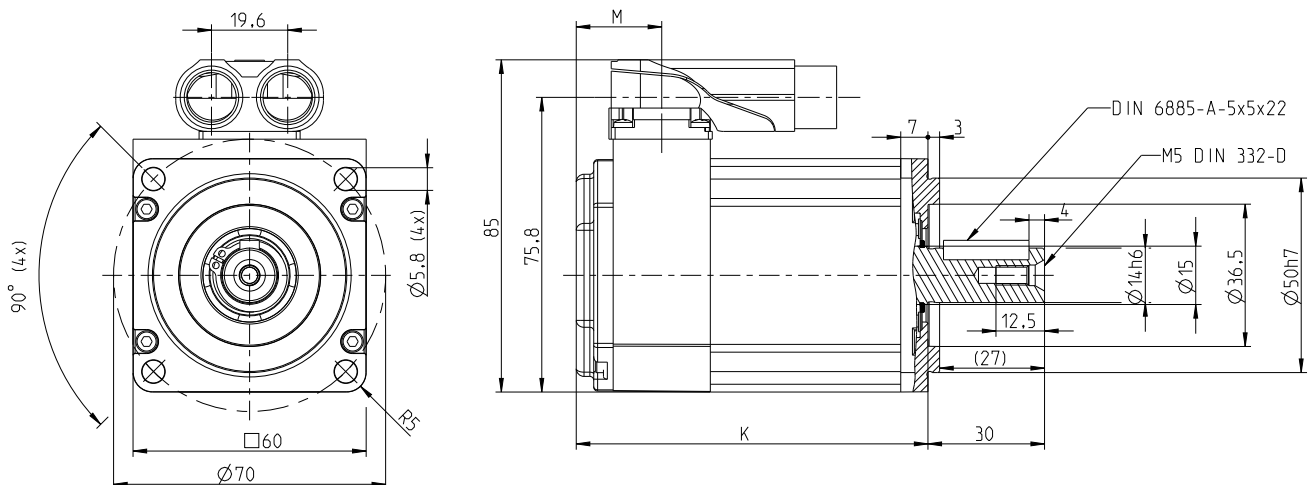
Order number	8LVA22.ee015ffgg-0	8LVA22.ee030ffgg-0	8LVA23.eeA95ffgg-0	8LVA23.ee015ffgg-0	8LVA23.ee030ffgg-0
Motor					
Nominal speed n_N [rpm]	1500	3000	950	1500	3000
Number of pole pairs	4				
Nominal torque M_N [Nm]	0.670	0.650	1.330		1.300
Nominal power P_N [W]	105	204	132	209	408
Nominal current I_N [A]	1.610	2.900	2.020	3.200	5.800
Stall torque M_0 [Nm]	0.680		1.350		
Stall current I_0 [A]	1.640	3.000	2.050	3.250	6.000
Maximum torque M_{max} [Nm]	2.00		4.00		
Maximum current I_{max} [A]	5.60	10.30	7.80	11.20	20.70
Maximum speed n_{max} [rpm]	6600				
Torque constant K_T [Nm/A]	0.420	0.230	0.660	0.420	0.230
Voltage constant K_E [V/1000 rpm]	25.13	13.61	39.79	25.13	13.61
Stator resistance R_{2ph} [Ω]	6.020	2.000	6.360	2.600	0.830
Stator inductance L_{2ph} [mH]	12.20000	4.10000	15.30000	6.30000	2.00000
Electrical time constant t_{el} [ms]	2.000	2.100	2.400		
Thermal time constant t_{therm} [min]	35.0			38.0	
Moment of inertia J [kgcm ²]	0.1400			0.2600	
Weight without brake m [kg]	1.05			1.45	
Holding brake					
Holding torque of brake M_{Br} [Nm]	2.20				
Mass of brake [kg]	0.29		0.25		
Moment of inertia of brake J_{Br} [kgcm ²]	0.1200				
Recommendations					
ACOPOS 8Vxxx.xx...	1010.50	1016.50	1010.50	1016.50	1090
ACOPOSmicro 80VD100Px.xxxx-01	C02X				
ACOPOS P3 8Elxxx...	2X2M	4X5M			8X8M
Cross section for B&R motor cables [mm ²]	0.7500				
Connector size	1.0				

Servo drives: The recommended servo drive / inverter module is designed for 1.1x the stall current. If more than double the amount is needed during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guide value; detailed inspection of the corresponding speed/torque characteristic curve can result in deviations of the servo drive size (larger or smaller).

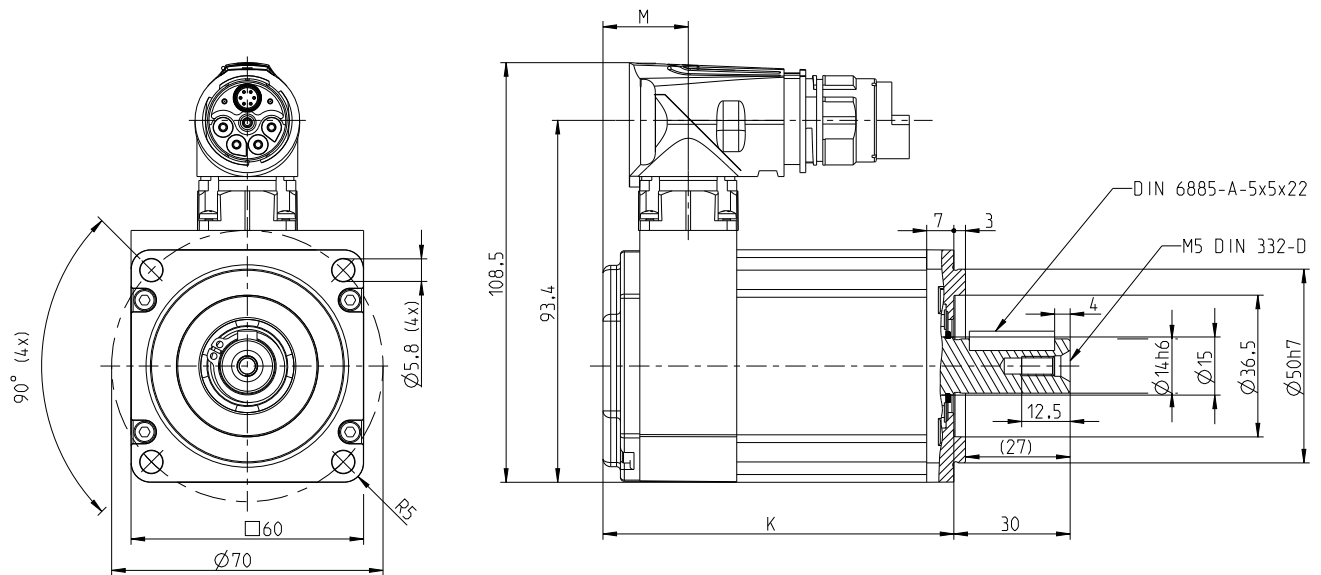
ACOPOSmulti: Operation on ACOPOSmulti inverter modules is not possible with voltage from the mains due to the high DC bus voltage.

NOTE about cables: For the appropriate cables, see the ACOPOSmicro servo drive chapter in the catalog (book 1).

2.12.1 8LVA2x dimensions



Built-in double angular connector



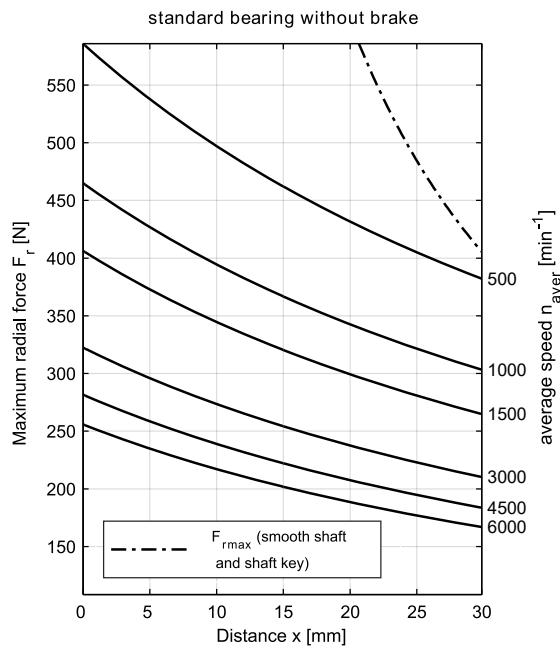
Single-cable solution

EnDat/Resolver feedback				Extension of K depending on motor option		
Encoder assignments	K R0, B1	K B8, B9	M R0, B1	M B8, B9	Holding brake	Oil seal
8LVA22	85.5	90.5	17	22	33	7
8LVA23	106	111	17	22	33	7

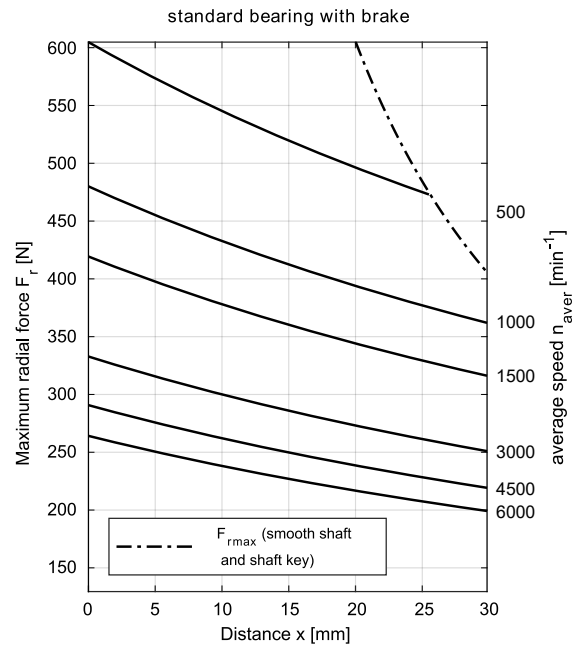
IMPORTANT: Dimensions K and M depend on the length of the encoder cover.

2.12.2 Permissible shaft load 8LVA2

The values in the diagram below are based on a mechanical service life of the bearings of 20000 operating hours.
8LVA22

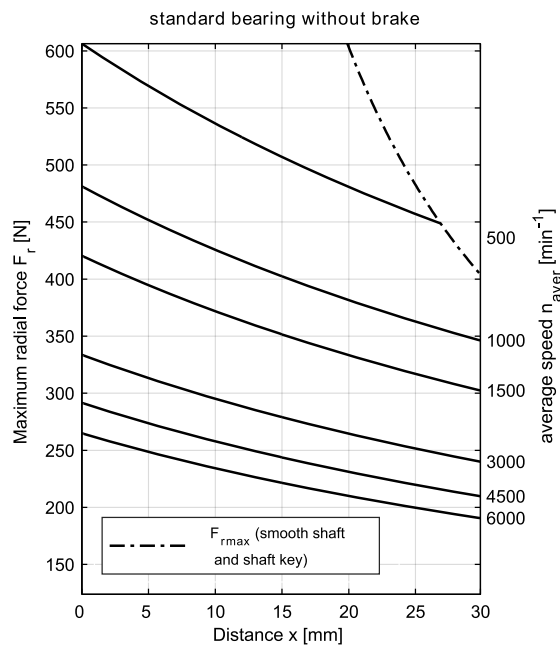


maximum allowed axial force: $F_{amax} = 48 \text{ N}$

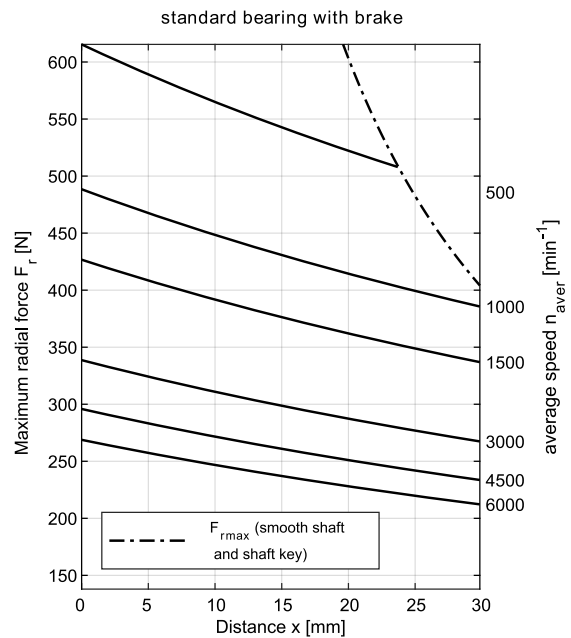


maximum allowed axial force: $F_{amax} = 54 \text{ N}$

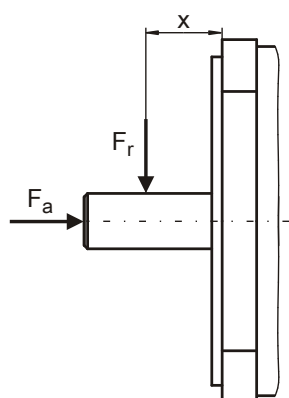
8LVA23



maximum allowed axial force: $F_{amax} = 53 \text{ N}$



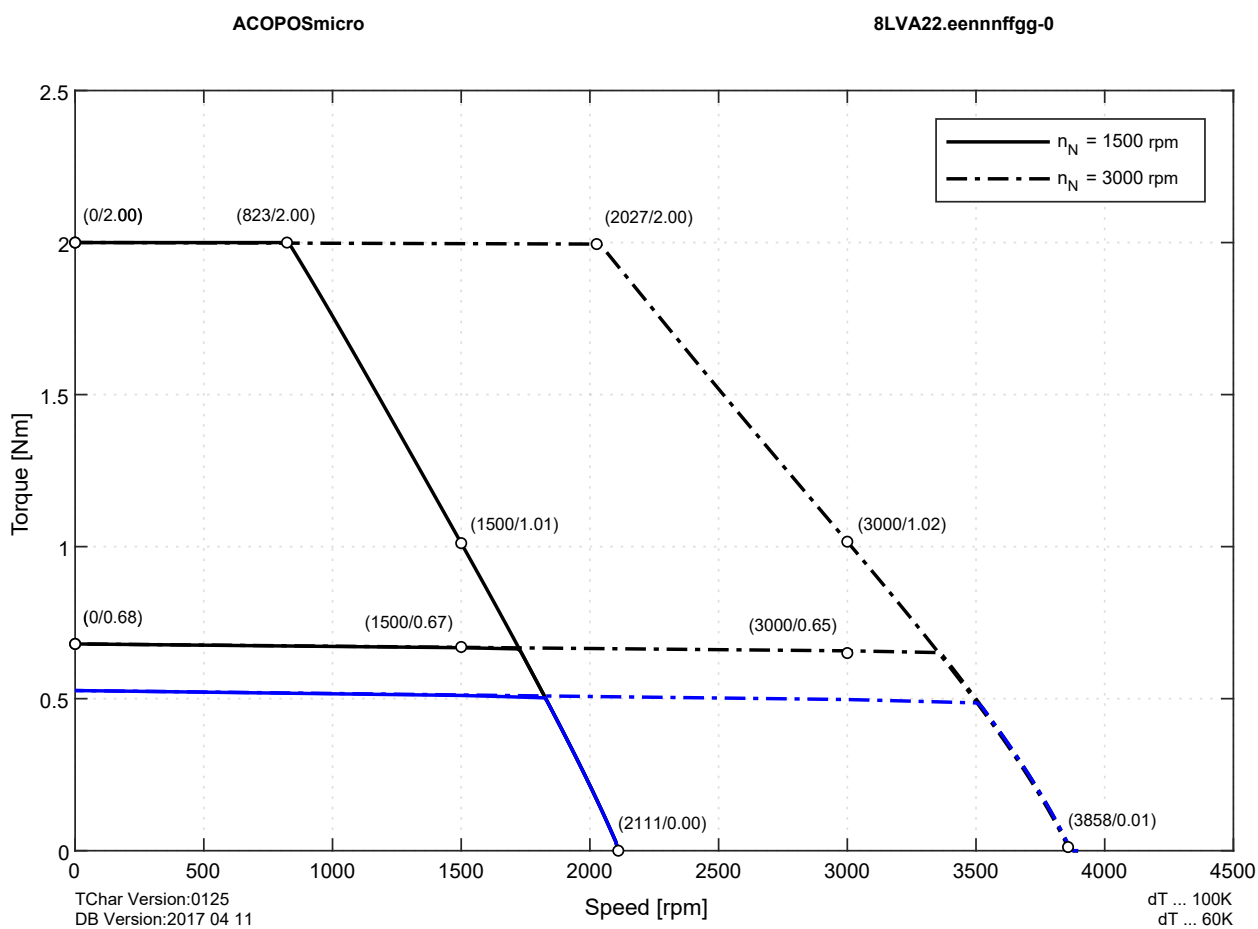
maximum allowed axial force: $F_{amax} = 57 \text{ N}$



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

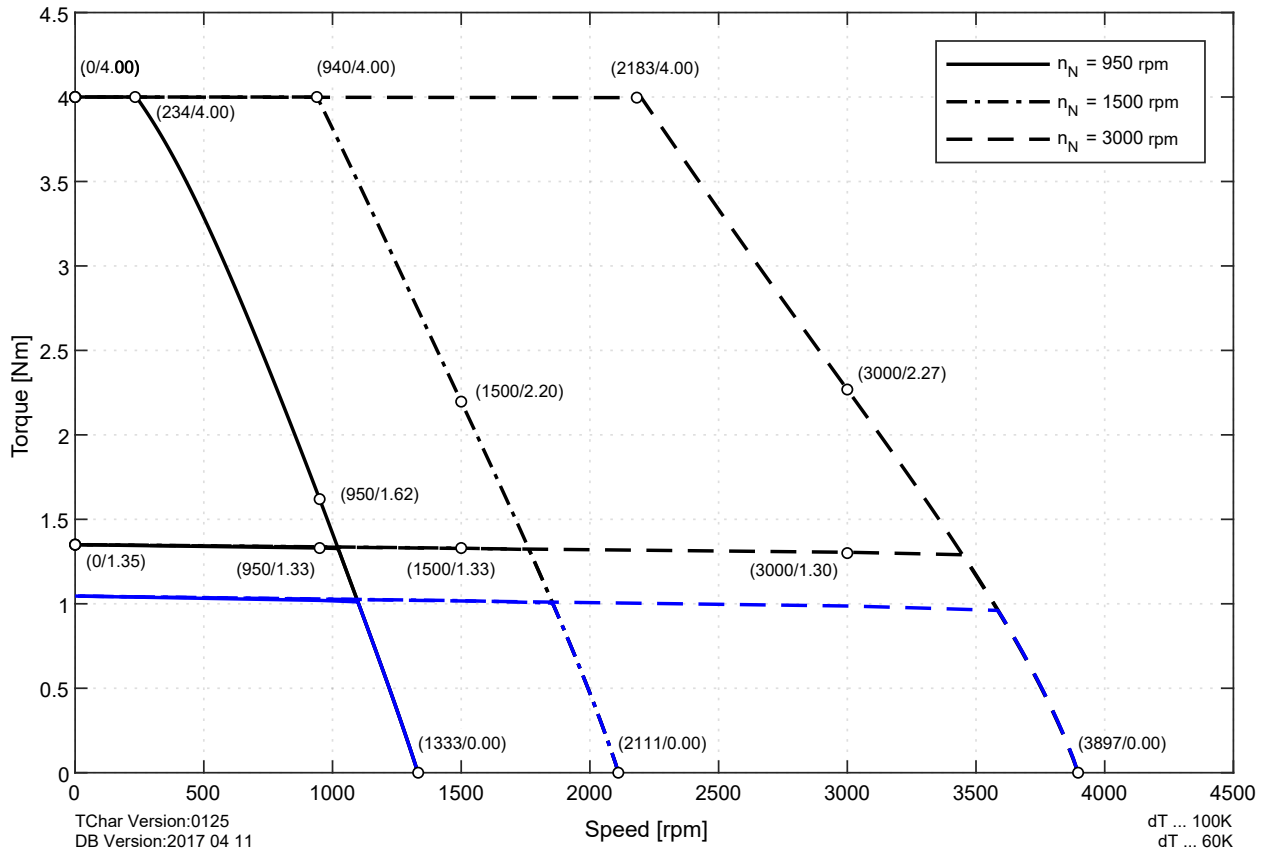
Figure 2: Definition of shaft load

2.12.3 Speed-Torque characteristic curve at 80 VDC DC bus voltage

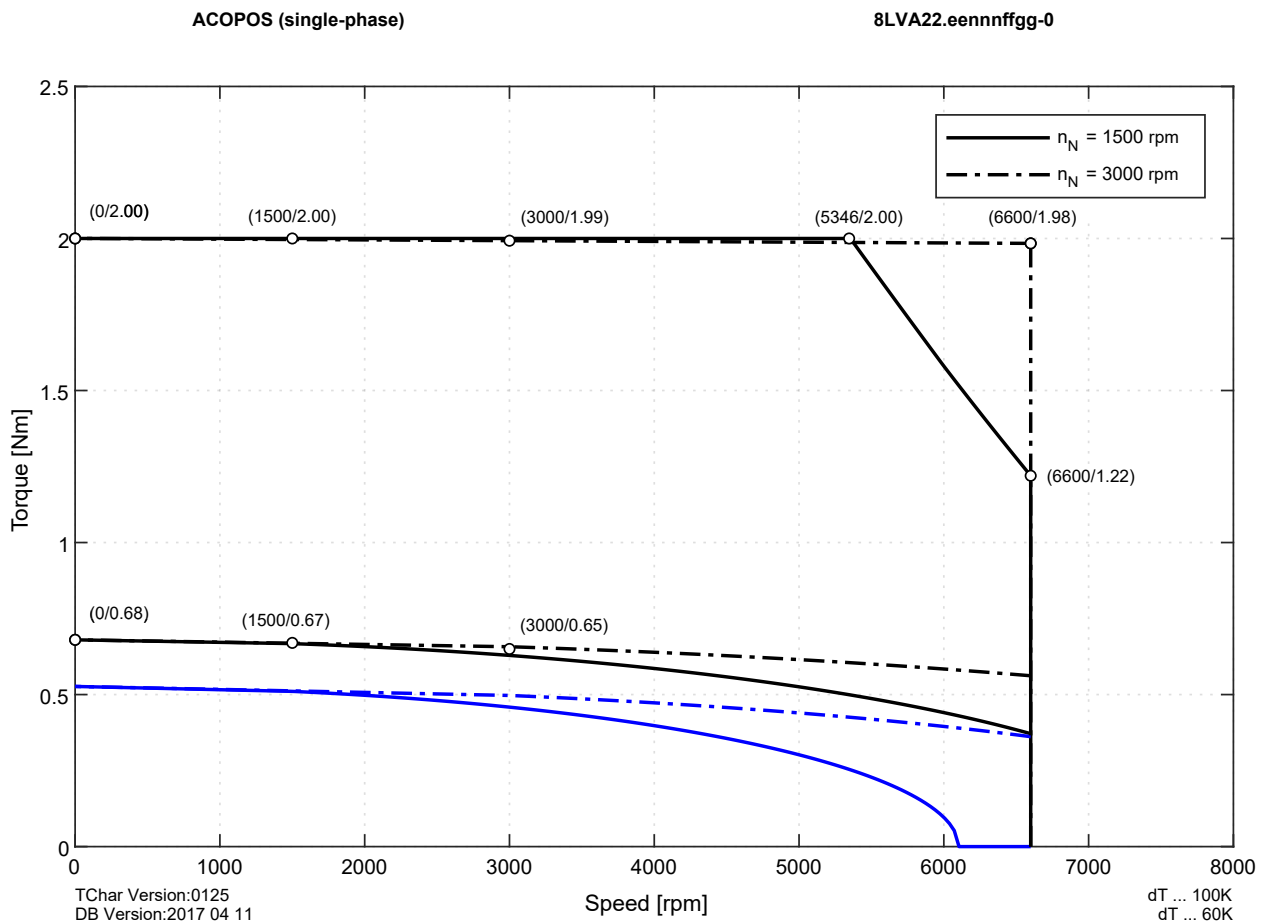


ACOPOSmicro

8LVA23.eennnffgg-0

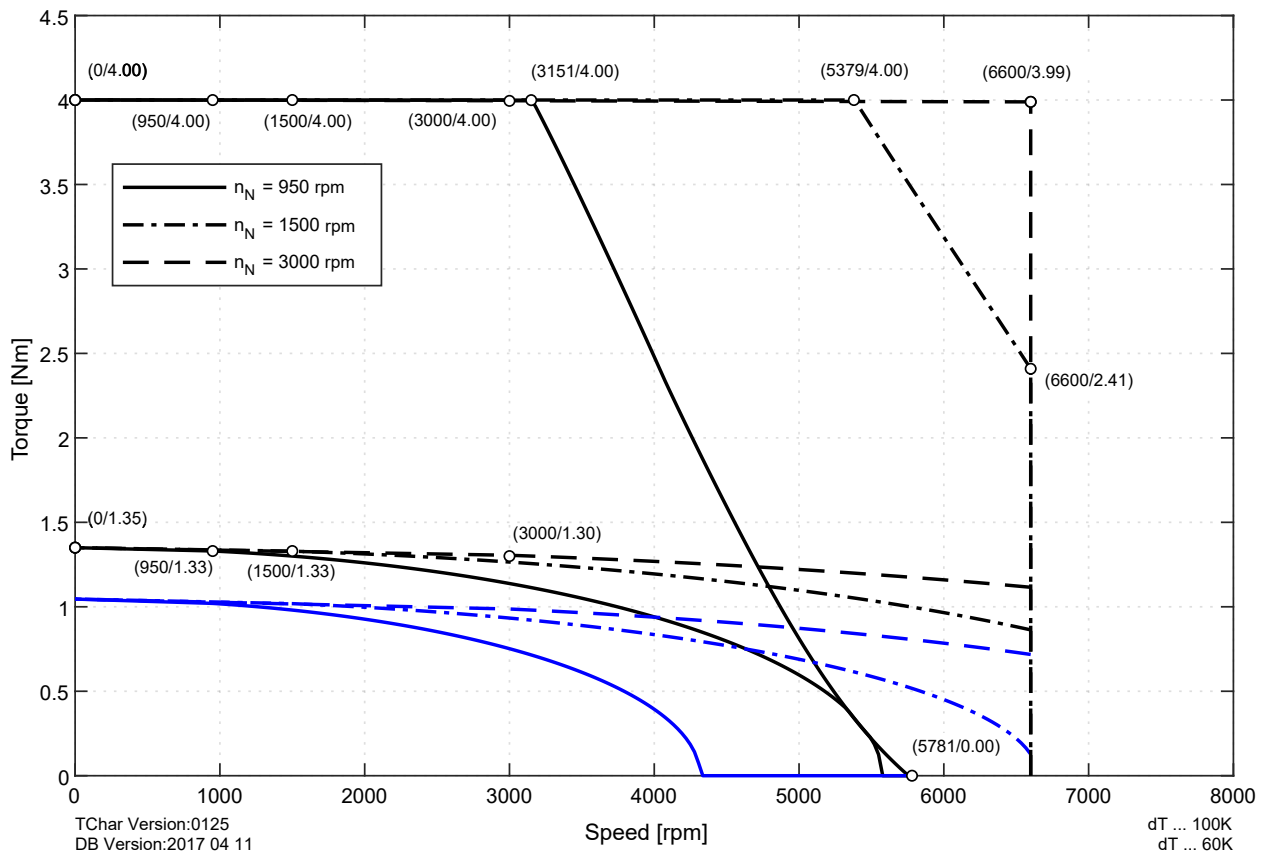


2.12.4 Speed-Torque characteristic curve at 325 VDC DC bus voltage



ACOPOS (single-phase)

8LVA23.eennnffgg-0



2.13 8LVA3 - Technical data

Size 3

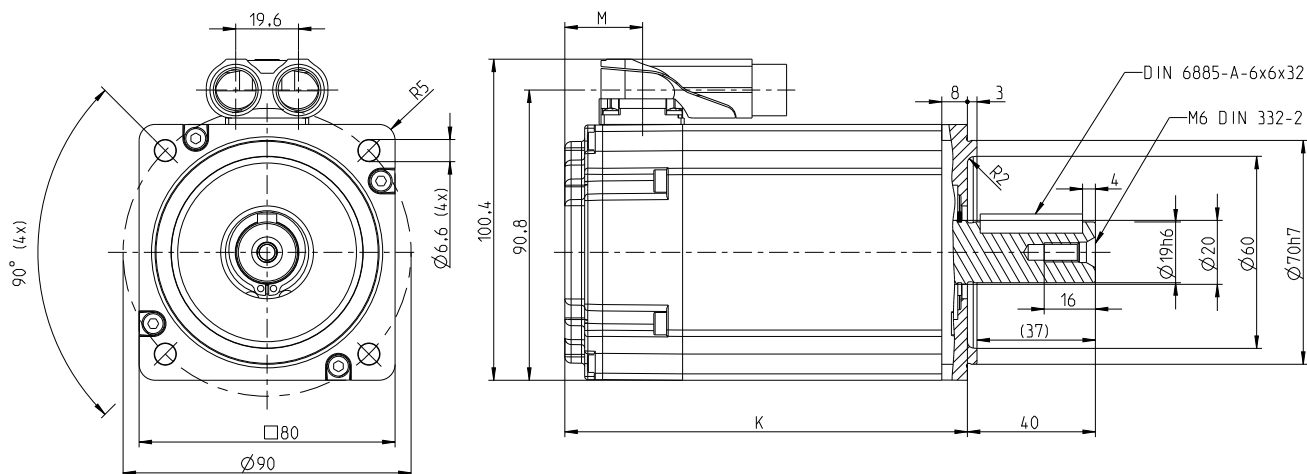
Order number	8LVA33.ee005ffee-0	8LVA33.ee015ffgg-0	8LVA33.ee021ffgg-0
Motor			
Nominal speed n_N [rpm]	500	1500	2100
Number of pole pairs		4	
Nominal torque M_n [Nm]	2.570	2.500	2.450
Nominal power P_N [W]	135	393	539
Nominal current I_N [A]	2.180	6.000	7.300
Stall torque M_0 [Nm]		2.600	
Stall current I_0 [A]	2.200	6.300	7.900
Maximum torque M_{max} [Nm]		7.20	
Maximum current I_{max} [A]	7.60	20.40	26.00
Maximum speed n_{max} [rpm]		6600	
Torque constant K_T [Nm/A]	1.180	0.420	0.330
Voltage constant K_E [V/1000 rpm]	71.21	25.13	19.90
Stator resistance R_{2ph} [Ω]	6.240	0.808	0.503
Stator inductance L_{2ph} [mH]	24.12000	3.30000	2.00000
Electrical time constant t_{el} [ms]	3.900	4.100	4.000
Thermal time constant t_{therm} [min]		34.0	
Moment of inertia J [kgcm ²]		0.9500	
Weight without brake m [kg]		2.45	
Holding brake			
Holding torque of brake M_{Br} [Nm]	2.20		3.20
Mass of brake [kg]		0.57	
Moment of inertia of brake J_{Br} [kgcm ²]	0.1200		0.3800
Recommendations			
ACOPOS 8Vxxx.xx...	1016.50		1090
ACOPOSmicro 80VD100Px.xxx-01		C02X	
ACOPOS P3 8Elxxx...	4X5M		8X8M
Cross section for B&R motor cables [mm ²]		0.7500	
Connector size		1.0	

Servo drives: The recommended servo drive / inverter module is designed for 1.1x the stall current. If more than double the amount is needed during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guide value; detailed inspection of the corresponding speed/torque characteristic curve can result in deviations of the servo drive size (larger or smaller).

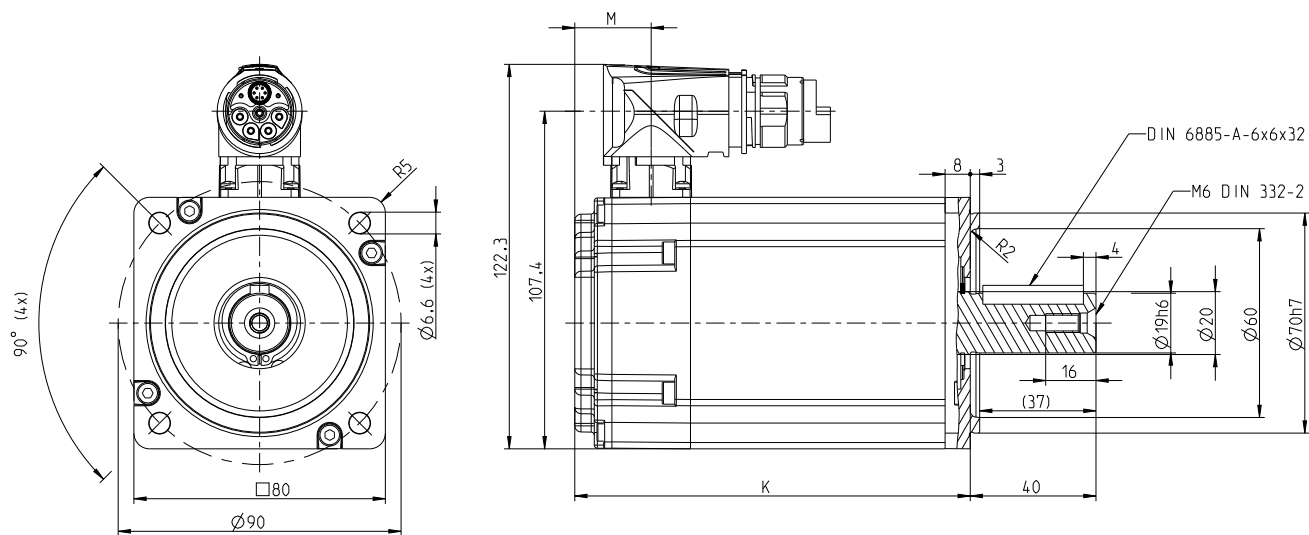
ACOPOSmulti: Operation on ACOPOSmulti inverter modules is not possible with voltage from the mains due to the high DC bus voltage.

NOTE about cables: For the appropriate cables, see the ACOPOSmicro servo drive chapter in the catalog (book 1).

2.13.1 8LVA33 dimensions



Built-in double angular connector



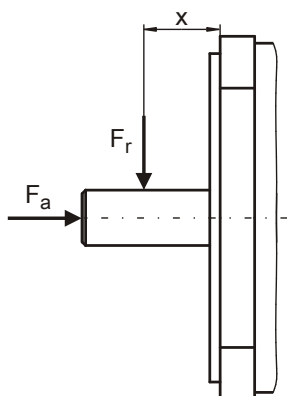
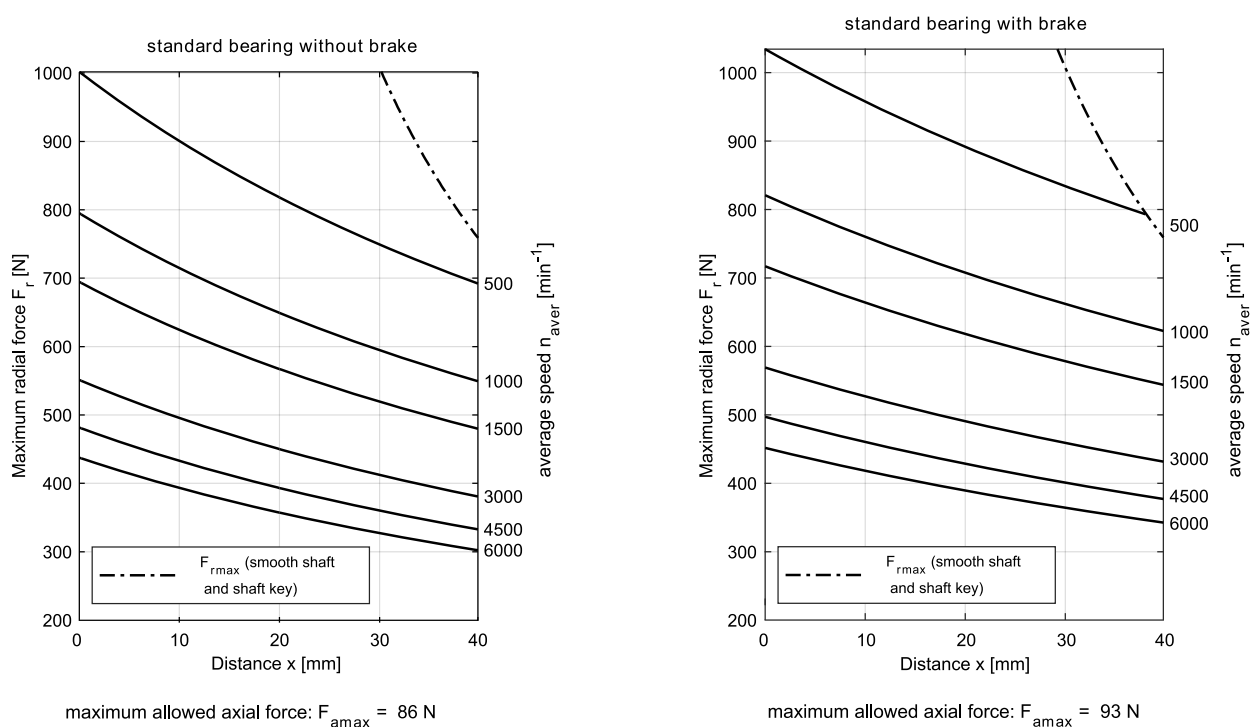
Single-cable solution

EnDat/Resolver feedback					Extension of K depending on motor option	
Order number	K	K	M	M	Holding brake	Oil seal
Encoder assignments	R0, B1	B8, B9	R0, B1	B8, B9		
8LVA33	119	126	17.5	24.5	36	5

IMPORTANT: Dimensions K and M depend on the length of the encoder cover.

2.13.2 Permissible shaft load 8LVA33

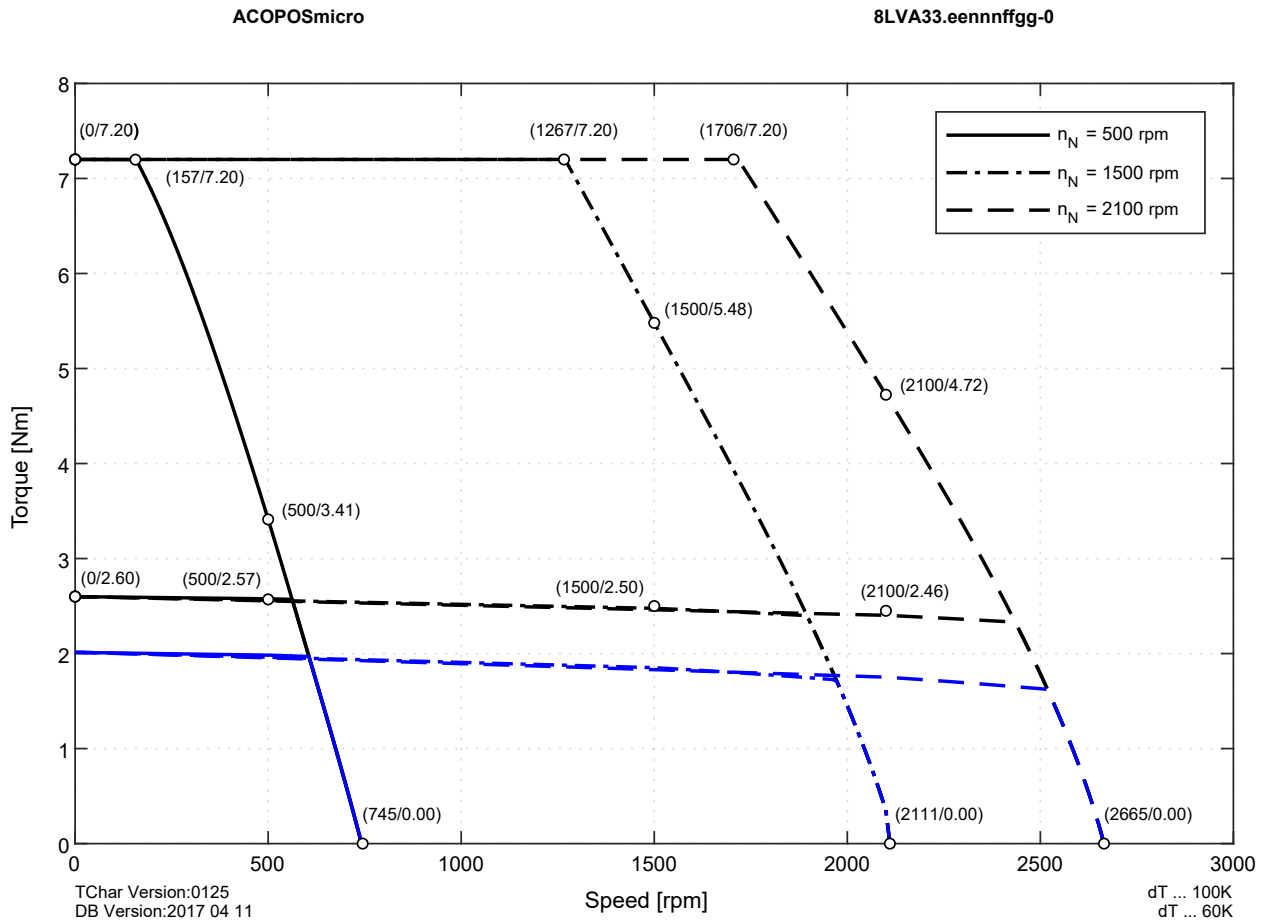
The values in the diagram below are based on a mechanical service life of the bearings of 20000 operating hours.



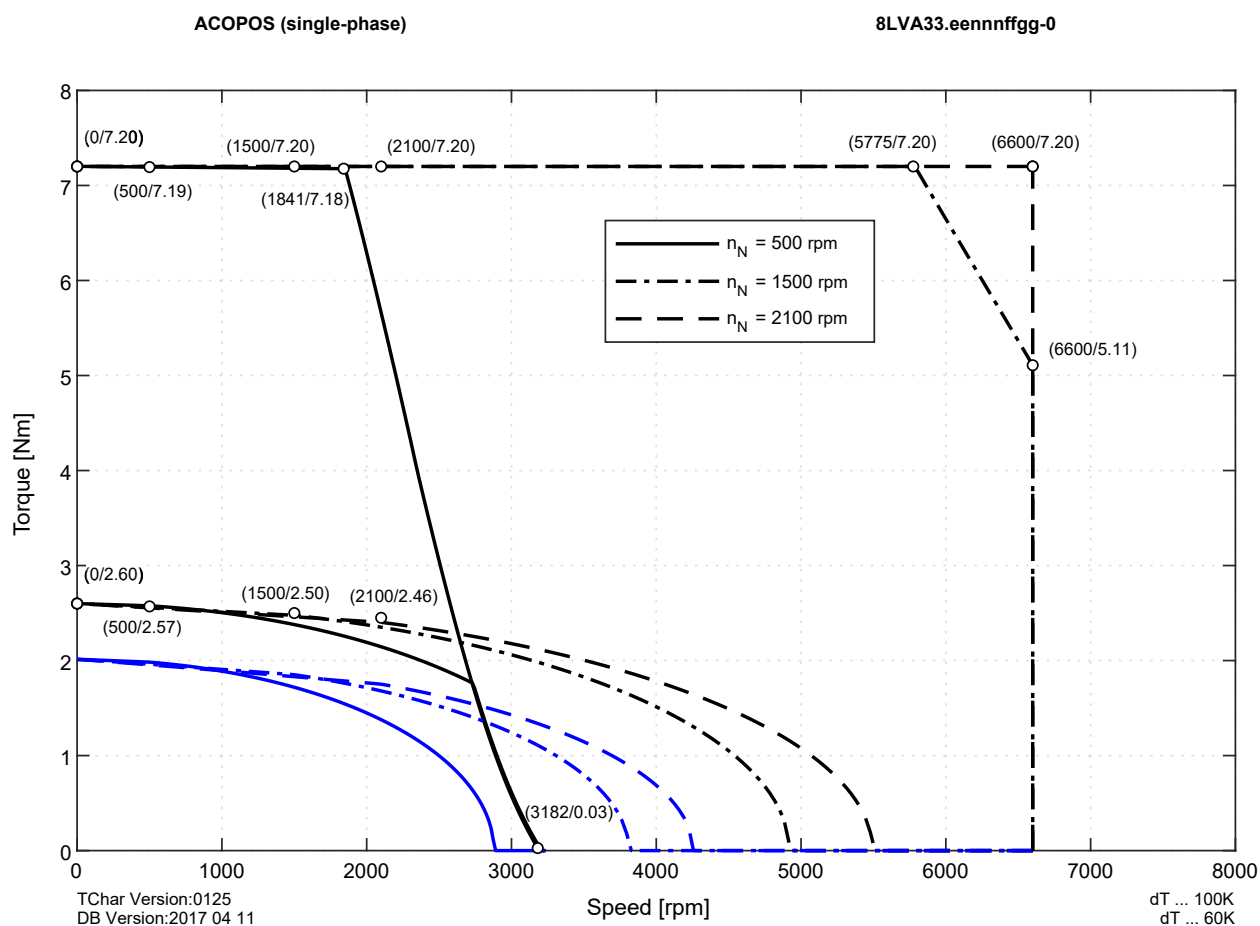
F_r Radial force
 F_a Axial force
 x Distance between the motor flange and the point where radial force F_r is applied.

Figure 3: Definition of shaft load

2.13.3 Speed-Torque characteristic curve at 80 VDC DC bus voltage



2.13.4 Speed-Torque characteristic curve at 325 VDC DC bus voltage



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	8LVA
Storage temperature	-20 to +60°C
Relative humidity during storage	Max. 90%, non-condensing
Transport temperature	-20 to +60°C
Relative humidity during transport	Max. 90%, 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

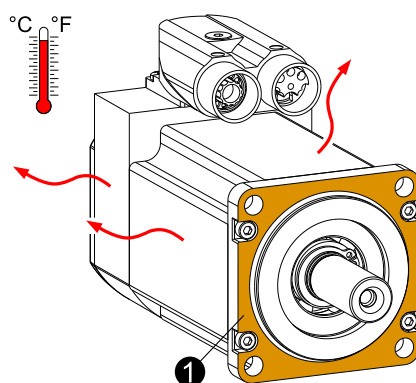
Before every commissioning procedure, the motor must be checked by qualified personnel. The check must include the proper condition in terms of mounting and installation, the installation conditions and safe operation.

Operating conditions	8LVA
Rating class, operating mode per EN 60034-1	S1 - Continuous operation
Ambient temperature during operation	-15°C to +40°C
Maximum ambient temperature during operation	+50°C ³⁾
Relative humidity during operation	5 to 95%, non-condensing
Reduction of the nominal current and stall current at temperatures above 40°C	5% per 5°C
Reduction of the nominal current and stall current at installation elevations over 1000 m above sea level	10% per 1000 m
Maximum installation elevation	2000 m ⁴⁾
Max. flange temperature	65°C
Degree of protection per EN 60034-5 (IP code)	
8LVA1 with and without oil seal:	IP54 ⁵⁾ 6)
8LVA2 / 8LVA3 without oil seal:	IP64 ⁵⁾ 7)
8LVA2 / 8LVA3 with oil seal:	IP65 ⁵⁾
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) ⁸⁾

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.

³⁾ Continuous operation at an ambient temperature of +40°C to max. +50°C is possible, but this results in premature aging.

⁴⁾ Requirements that go beyond this must be arranged with B&R.

⁵⁾ The degrees of protection are only achieved if the power and signal connections are fully installed.

⁶⁾ For IP54, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP54 protection.

⁷⁾ For IP64, the motor must be mounted with the mounting flange and this mounting must correspond at least to IP64 protection.

⁸⁾ The IM3031 type of construction and mounting arrangement (vertical, motor hanging on the machine) must be avoided since production fluids or oils, e.g. from a gearbox, can penetrate the motor and damage it. If this is not possible, it is mandatory to select the oil seal option and to ensure that no production fluids or oils get onto the seal.

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 due to radial and axial force

Radial and axial forces (F_r , F_a) applied to the shaft end during operation and installation must observe the conditions listed below.

Simultaneously **loading the shaft** end with the maximum values of F_r and F_a is not permitted! Contact B&R if this occurs.

Radial force

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

8LxA1 (with/without holding brake)

8LxA2 (with holding brake)

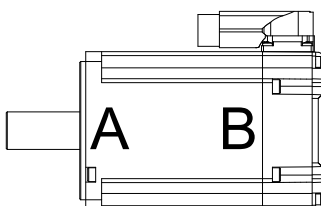
The **fixed bearing** is secured on the **B-side flange** with a retaining ring. The floating bearing on the A-side flange is preloaded with a spring in the direction of the B-side flange. Axial forces in the direction of the A-side flange can cause the spring bias to be overcome, which shifts the shaft by the amount of axial backlash in the bearing (approx. 0.1 - 0.2 mm). This shift can cause problems on motors with holding brakes or all motors with inductive encoder systems. As a result, no axial force in excess of the calculated values is permitted in the direction of the A-side flange when using these motor (see "Determining permissible values of F_r and F_a ").

8LxA2 (without holding brake)

8LxA3 (with/without holding brake)

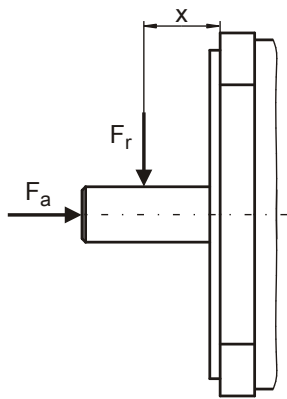
The **fixed bearing** is secured on the **A-side flange** with a retaining ring. The floating bearing on the B-side flange is preloaded with a spring in the direction of the A-side flange. Axial forces in the direction of the B-side flange can cause the spring bias to be overcome, which shifts the shaft by the amount of axial backlash in the bearing (approx. 0.1 - 0.2 mm). This shift can cause problems on motors with holding brakes or all motors with inductive encoder systems. As a result, no axial force in excess of the calculated values is permitted in the direction of the B-side flange when using these motor (see "Determining permissible values of F_r and F_a ").

A- and B-side flange position



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 (section "Technical data", "Permissible shaft load"). Permissible values are based on a bearing service life of 20,000 h (bearing service life calculation based on DIN ISO 281).



F_r Radial force

F_a Axial force

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

Figure 4: Definition of shaft load

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!

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 de-energized 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 9

Danger!

Risk of injury due to electric shock!

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

If connections are connected or disconnected in the incorrect order or while voltage is applied, 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 while voltage is applied!
- 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 in a current- and voltage-free state!

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, inverters 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 switch-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. Gearboxes must also be checked for leak tightness.

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.

Only fasten and loosen gear wheels, pulleys, couplings, etc. on the output shaft using suitable clamping sets, pressure sleeves, etc.

Note:

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

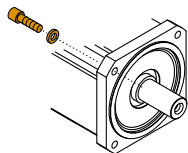
Safety notices

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

5.4.1 Fasteners and tightening torques



Use hexagon socket head cap screws and also washers for sizes 2 and 3.

Tighten the screws evenly in diagonally opposite sequence and with the correct tightening torque to avoid distorting the flange and excessively straining screws.

If the motor is screwed onto other materials or if there are different surface roughnesses, the user must determine the correct tightening torque.

	Screw (ISO 4762 - Property class at least 8.8)	Flat washer [mm] (UNI 6592)	Tightening torque [Nm] (in steel, coefficient of friction $\mu = 0.14$)
8LVA1	M4	---	3
8LVA2	M5	5.3 x 9	6
8LVA3	M6	6.4 x 11	10

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 while voltage is applied, 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 while voltage is applied!
- 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 in a current- and voltage-free state!

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:

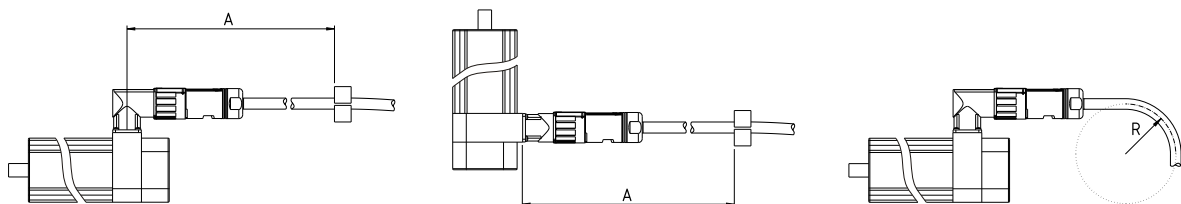
Disturbances caused by electrical or electromagnetic effects!

When using connectors from other manufacturers, EMC interference 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 clamp and bend radius

To ensure that cables and connectors are not exposed to harmful loads, the cable clamp (**A**) and minimum bend radius (**R**) must be observed during installation.



Cable clamp (A)

- A = Max. 300 mm along longitudinal axis of connector
- The connection must be free of force and torque.

- Movement relative to the connector is not permitted!
- Tensile stress on cables and connectors is not permitted!

Bend radius (R)

- For the minimum radius values, see the current technical data sheet for the cable.

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 while voltage is applied, 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 while voltage is applied!
- 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 in a current- and voltage-free state!

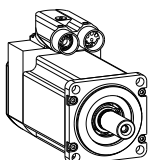
Danger!

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!

Caution!

The temperature sensor on the motor is sensitive to electrostatic discharge (ESD). For this reason, the attachment cables on the drive system side (ACOPOS) must first be completely assembled and connected. Only then are the connectors permitted to be connected to the motor in the order described.

Built-in double angular connector



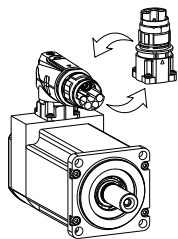
Connecting

1. Connect the orange power connector.
2. Connect the green encoder connector.

Disconnecting

1. Disconnect the green encoder connector.
2. Disconnect the orange power connector.

Single-cable solution (hybrid)



Connecting

1. Connect the connector to the motor.

Disconnecting

1. Disconnect the connector from the motor.

5.5.3 Connecting connectors properly

The connectors for the power and encoder connection of B&R motors are available as [speedtec system](#)¹ and [ytec system](#). The systems differ in the type of locking mechanism.

- 1) The speedtec system on the motor side is backward compatible with wiring with a screw terminal. Existing wiring with screw terminals can therefore continue to be used when replacing motors. For the proper connection, see "Screw terminal (for motors with speedtec connection)" on page 60.

Caution!

Damage due to improperly connected connectors!

Incorrectly connected connectors can result in disturbances and damage to the motor and encoder!

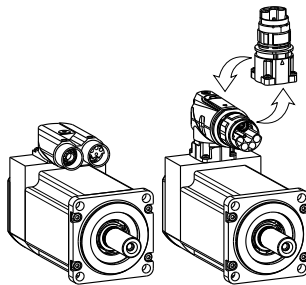
- **Always connect or disconnect the connector straight in/out, without force and without tools.**
- **It is important to ensure that connectors are fully connected and locked.**

5.5.3.1 System overview

The available connectors have different locking systems and are therefore operated in different ways.

The built-in double angular connector is designed as a [ytec system](#).

The connector locks automatically when connected.



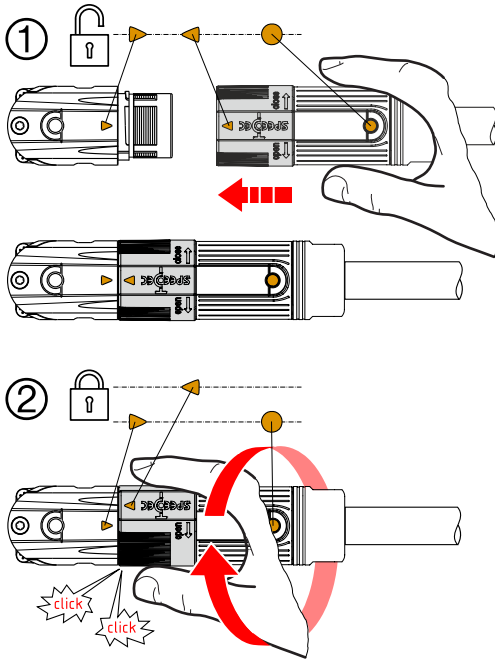
The single-cable solution (hybrid) is designed as a [speedtec system](#).

The connector must be locked manually when connected.

5.5.3.2 speedtec system

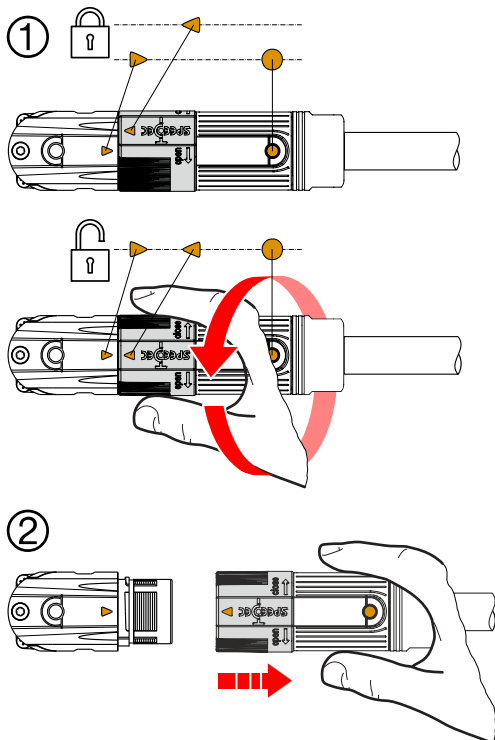
The speedtec system is equipped with a tool-free quick-release fastener and an internal thread, making it compatible with built-in connectors that use a screw terminal.

Connecting and locking



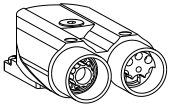
1. Align the ►◄• markings with each other. Push the connector straight and without gaps onto the built-in connector.
2. Tighten the locking ring clockwise (direction of arrow "close"). The locking mechanism must be turned until at least 2 "click" sounds can be heard. To ensure correct locking, the ►◄• markings must also be **offset** from each other (see step 2 in the figure on the left).

Unlocking and disconnecting the connector



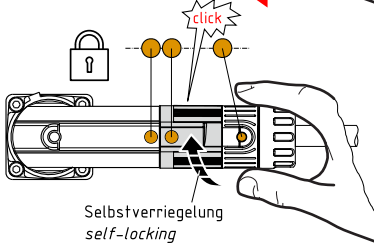
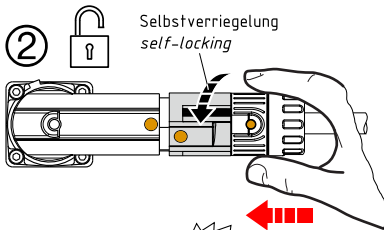
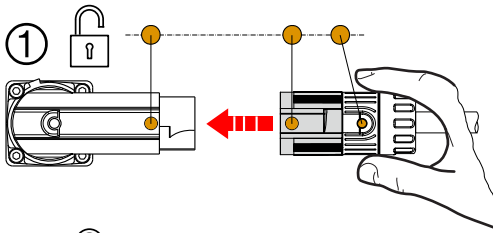
1. Turn the locking ring counterclockwise (direction of arrow "open") until the ►◄• markings are aligned with each other.
2. Disconnect the connector straight out and without force from the built-in connector. It is only permitted to pull the connector during removal, not the cable.

5.5.3.3 ytec system



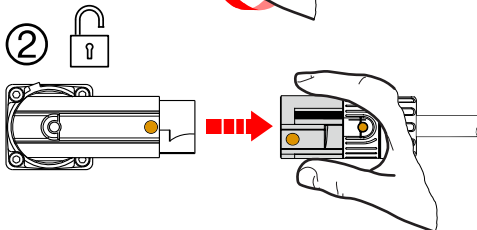
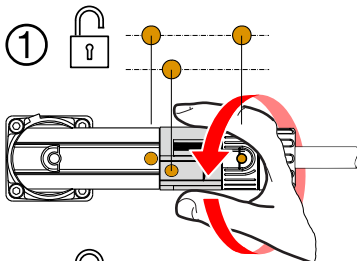
The tool-free self-locking ytec system twists the frontmost ring of the connector during connection and returns it to the middle position after it has been locked.

Connecting and locking



1. Align the ••• markings with each other. Push the connector straight and without gaps.
2. While pushing, the front ring of the connector turns counterclockwise and jumps back to the middle position after locking. Correct locking is indicated by the middle position of the front ring and a "**click**" sound.

Unlocking and disconnecting the connector



1. Turn the front ring of the connector one eighth of a turn counterclockwise and hold it in this position.
2. Disconnect the connector straight out and without force. It is only permitted to pull the connector during removal, not the cable.

5.5.3.4 Screw terminal (for motors with speedtec connection)

The screw terminal is used when an existing motor with a screw terminal is replaced by a new motor (of the same series with a backward compatible speedtec connection). The existing wiring with screw terminals can therefore continue to be used.

The connection is made without tools; it is important to ensure installation without tilting.

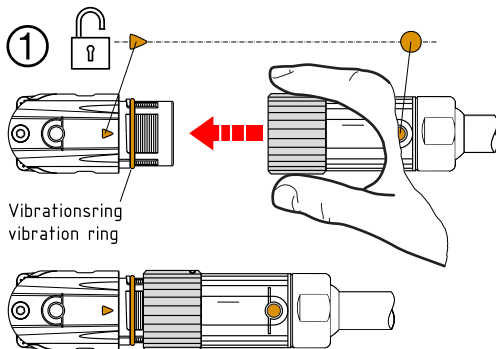
Vibration ring

If strong vibrations ($>4-6\text{ g}$) are expected during operation, the screw terminal must be secured with a vibration ring. This prevents the screw connection from coming loose. The vibration ring does not provide a sealing function.

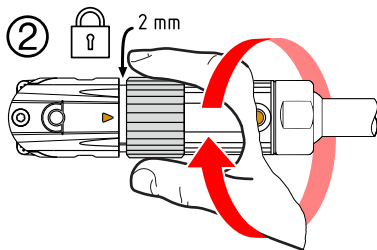
Installation is performed without tools by sliding onto the built-in connector on the motor side. The corresponding nut for the vibration ring is located just after the fine thread.

Order number for the vibration ring:	Content of delivery:	
8PX000.00-1	Vibration ring, size 1, 50 pieces	(for motors with speedtec connection)
8PX001.00-1	Vibration ring, size 1.5, 10 pieces	(for motors with speedtec connection)

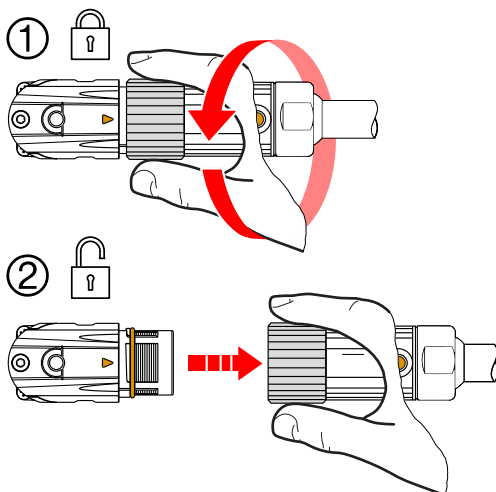
Connecting and locking



1. Attach a vibration ring if necessary.
Align the ►• markings with each other.
Push the connector straight onto the built-in connector.
2. Turn the locking ring clockwise and tighten it until the end stop.
The gap between the connector and the built-in connector should be approx. 2 mm.



Unlocking and disconnecting the connector

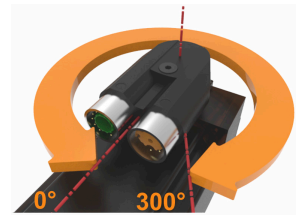


1. Turn the locking ring counterclockwise until it is completely detached from the thread of the built-in connector.
2. Disconnect the connector straight out and without force from the built-in connector.
It is only permitted to pull the connector during removal, not the cable.

5.5.4 Connection type

5.5.4.1 Built-in double angular connector

- 300° rotatable built-in double angular connector
- Quick-release self-locking connector system
- Robust industrial connectors with optimal EMC shielding
- Robust metal housing



5.5.4.1.1 Resolver connection - Pinout

		Pin	Description	Function
		1	---	---
		2	---	---
		3	---	---
		4	---	---
		5	---	---
		6	R1	Reference signal inverted
		7	---	---
		8	S4	Sine output signal
		9	S2	Sine output signal inverted
		10	S3	Cosine output signal inverted
		11	S1	Cosine output signal inverted
		12	R2	Reference signal

5.5.4.1.2 EnDat 2.2 connection - Pinout

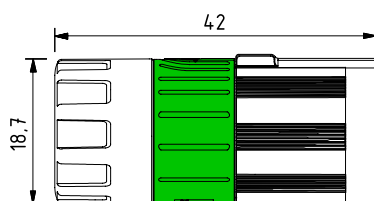
		Pin	Description	Function
		1	U+	Encoder power supply +12.5 V
		2	D	Data output
		3	D\	Data output inverted
		4	T	Clock input
		5	T\	Clock input inverted
		6	COM (12)	Battery supply 0 V
		7	COM (1)	Encoder power supply 0 V
		8	---	---
		9	---	---
		10	---	---
		11	---	---
		12	VBATT	Battery supply

5.5.4.1.3 Power connection - Pinout

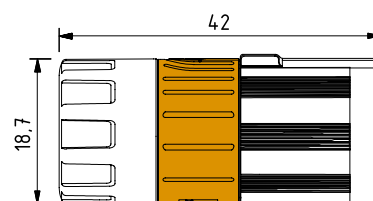
		Pin	Description	Function
		A	U	Motor connection U
		B	V	Motor connection V
		C	W	Motor connection W
		PE	PE	Grounding
		1	T+	Temperature +
		2	T-	Temperature -
		3	B+	Brake +
		4	B-	Brake -

5.5.4.1.4 ytec connector - Dimensions

The ytec connectors, compatible with the **built-in double angular connector**, have the same dimensions and can be distinguished by the colors green and orange. The connection to the motor is made without tools.



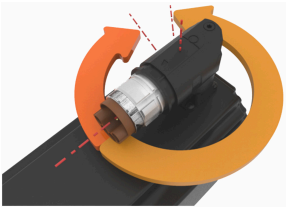
Encoder connector (green)



Power connector (orange)

5.5.4.2 Single-cable solution (hybrid) - (speedtec system)

- 300° swivel speedtec connection
- Encoder and power cable: Combined in one cable
- Quick-release self-locking connector system
- Robust industrial connectors with optimal EMC shielding
- Robust metal housing



Note:

In the case of motors with the single-cable solution (hybrid), the temperature signal is not transmitted via two separate lines in the motor cable as before. Instead, it is transmitted digitally via the encoder interface.

The following conditions must be met by the drives in order to operate a motor with a single-cable solution (hybrid).

- For ACOPOSmulti: The cable cover must be designed for operation with a hybrid cable (cable cutout present, delivered 2015 or later)
- For ACOPOSmulti with SafeMC: The configured operating system version (NC version) must be set to version 2.48.0 or later; the Safety Release must be version 1.9 or later.
- For all drives: The configured operating system version (NC version) must be set to version 2.42.2 or later.

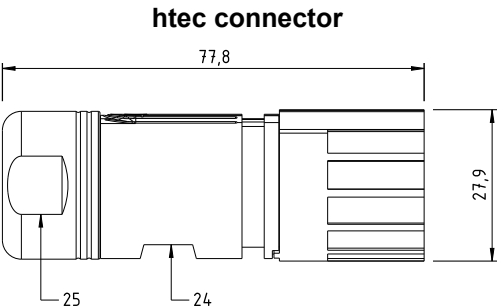
If the conditions listed above are not met, temperature evaluation on the drive will not work.

5.5.4.2.1 Single-cable solution (hybrid) - Pinout

		Pin	Signal
		A	Motor connection U
		B	Motor connection V
		C	Motor connection W
		D	---
		7	Brake -
		8	Brake +
		PE	Grounding
		1	Encoder connection
		2	Ground
		3	Data
		4	Data inverted
		5	Clock input
		6	Clock input inverted

5.5.4.2.2 htec connector - Dimensions

The htec connector can be connected without tools.



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.

6.2 Safety

Commissioning is only permitted to be carried out by qualified personnel²⁾.

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

Caution!

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

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

Electronic devices are 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.

²⁾ see "Qualified personnel" on page 9

Danger!

Risk of injury due to electric shock!

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

If connections are connected or disconnected in the incorrect order or while voltage is applied, 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 while voltage is applied!
- 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 in a current- and voltage-free state!

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, inverters 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 switch-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.

6.2.4 Holding brake

The motors can be equipped with an optional holding brake. This is only used to hold the motor shaft in place when the motor is in a voltage-free state.

The maximum motor torque far exceeds the holding torque of the brake.

Danger!

Personal injury and damage to property due to non-intended use of the holding brake!

If the holding brake is used differently than intended, functional failures and accidents involving personal injury or damage to property are possible.

- **Do not use the holding brake for braking under normal operating conditions! It is not intended for normal braking.**
- **Do not use the holding brake to protect personnel! The holding brake does not provide protection for personnel!**
- **Do not use the holding brake to hold loads! They do not ensure a securing function (e.g. against lowering in the case of lifted loads).**
- **Do not load motors with holding brakes axially either during assembly or during operation. It is especially important to prevent axial forces in the direction of the B flange since these forces can cause the brake to fail!**

Note:

Loaded braking during an emergency stop is permitted but reduces its service life.

For additional information about the holding brake, see chapter "Technical data".

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	Run enable missing	Activate controller enable
	Controller error, encoder error	Read error listing on inverter/controller, correct error Check the connector for correct installation (see section "Connecting connectors properly" in chapter "Installation and connection")
	Power supply not present	Check the connection and power supply. Check the connector for correct installation (see section "Connecting connectors properly" in chapter "Installation and connection")
	Rotating field	Check the phase sequence; replace the attachment cable if necessary.
	Brake will not release (optional equipment may be available).	Check the control, connections and power supply.
	Brake defective (optional equipment may be available)	If necessary, contact B&R.
Runs noisily	Insufficient shielding in connection lines	Check the shielding connection and grounding.
	Controller parameters too high	Optimize the controller parameters.
Vibrations	Coupling element or machine not properly balanced	Adjust the balance.
	Power transmission system misaligned	Realign the power transmission system.
	Mounting screws loose	Check and tighten the screw connections.
Noise during operation	Foreign bodies in the motor	If necessary, contact B&R.
	Bearing damage	If necessary, contact B&R.
The motor becomes too warm - the temperature monitoring responds	Power transmission system overloaded	Check the motor load and compare with the data on the nameplate.
	Insufficient heat dissipation	Ensure sufficient heat dissipation.
	Brake will not release sufficiently - Grinding brake (optional equipment may be available)	If necessary, contact B&R.
Current consumption too high - motor torque too low	Incorrect rest angle	Check the rest angle and adjust as needed.

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 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 de-energized 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.

7.1.1 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 9

Danger!

Risk of injury due to electric shock!

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

If connections are connected or disconnected in the incorrect order or while voltage is applied, 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 while voltage is applied!
- 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 in a current- and voltage-free state!

Danger due to electromagnetic fields

Electromagnetic fields are generated by the operation of electrical power engineering equipment such as transformers, inverters 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 switch-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!

7.2 Motor bearing and holding brake

Motor bearing

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

Holding brake

Over time, exposure to moisture and contamination can reduce the braking torque. The application should therefore check the braking torque from time to time using the brake test function with the safety factor required for the application.

If the brake is no longer achieving the necessary torque, a refresh cycle can help it achieve the necessary torque again.

- The brake test function in the ACOPOS servo drive used must be enabled.
- During a refresh cycle, the motor is allowed to turn one revolution at a speed of 50 rpm with the brake engaged. This cleans the brake pads and generally helps the brake to once again achieve the torque it needs.
- After the refresh cycle, the brake should be tested again.
- If the brake is still not achieving the necessary torque after 5 refresh cycles, the motor must be replaced.

Replace the motor when the brake no longer reaches its required torque.

If necessary, contact B&R. Repairs to the motor and brake are only permitted to be carried out by B&R!

Note:

The motors can be equipped with an optional holding brake. This is used to hold the motor shaft in place when the motor is in a voltage-free state. The maximum motor torque far exceeds the holding torque of the brake.

Danger!

Personal injury and damage to property due to non-intended use of the holding brake!

If the holding brake is used differently than intended, functional failures and accidents involving personal injury or damage to property are possible.

- Do not use the holding brake for braking under normal operating conditions! It is not intended for normal braking.
- Do not use the holding brake to protect personnel! The holding brake does not provide protection for personnel!
- Do not use the holding brake to hold loads! They do not ensure a securing function (e.g. against lowering in the case of lifted loads).
- Do not load motors with holding brakes axially either during assembly or during operation. It is especially important to prevent axial forces in the direction of the B flange since these forces can cause the brake to fail!

Note:

Loaded braking during an emergency stop is permitted but reduces its service life.

7.3 Oil seal

Motors can optionally be equipped with an oil seal (form A per DIN 3760). The motors thus satisfy the requirements for IP65 protection per EN 60034-5.

Note:

Gearbox mounting is not permitted as a result, however, since maintenance of the oil seal is impeded by the gearbox.

- Ensure sufficient lubrication of the oil seal throughout the entire service life of the motor.

7.4 Cleaning

Clean the motors regularly to ensure good heat dissipation.

Information:

- During cleaning work, hold the drive cable/connector in place.
- Remove fibers and foreign bodies from the motor housing by hand without damaging the motor surface or shaft end.
- Use a cloth moistened with water to remove dust and dirt from the motor housing (excluding the shaft end).

Caution!

- Cleaning is only permitted to be carried out by qualified personnel.
- Before starting cleaning work, make sure that the motor is switched off, disconnected from power, stopped and cooled down.
- Compressed air tools, high-pressure cleaners, wire brushes, scrapers, etc. are not suitable for cleaning the motor and cables.

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 Mark

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.

EMC Directive 2014/30/EU

All devices meet the protection requirements of the "Electromagnetic Compatibility" directive and are designed for typical industrial use.

Applicable standards from this directive:

EN 61800-3

Adjustable speed electrical power drive systems
- Part 3: EMC requirements and specific test methods

Low Voltage Directive 2014/35/EU

The low voltage directive applies to electrical equipment with a nominal voltage from 50 to 1000 VAC and from 75 to 1500 VDC.

All devices within the area of application of this directive satisfy the its protection requirements.

Applicable standard from this directive:

EN 60034-1

Rotating electrical machines - Part 1: Rating and performance

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



Declaration of conformity

[Website > Downloads > Certificates > Declarations of conformity > Motors > Declaration motors dreh-sync](#)

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.

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 60034-1	Rotating electrical machines - Rating and performance
EN 60034-5	Degrees of protection provided by integral design of rotating electrical machines
EN 60034-6	Rotating electrical machines - Cooling types
EN 60034-7	Rotating electrical machines - Classification of types of construction, installation arrangements
EN 60034-11	Rotating electrical machines - Thermal protection
EN 60034-14	Mechanical vibration of certain machines with shaft heights 56 mm and higher
UL 1004-1	Rotating electrical machines, general requirements
UL 1004-6	Servo and stepper motors
C22.2 No.100-14	Motors and Generators

8.1.2.2 Climate conditions

For operating conditions and the conditions for transport and storage per **EN 60034-1**, see the following chapters:

[see "Operating conditions" on page 43](#)

[see "Transport and storage conditions" on page 41](#)

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 declaration motors dreh-sync](#)

8.1.4 UL / CSA



Underwriters Laboratories (UL)

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

The mark is valid for the **USA and Canada** and simplifies the certification of your machines and systems in this economic area.

Standards applied:

UL 1004-1
UL 1004-6
CSA-C22.2 No. 100-14

Rotating electrical machines - General requirements
Servo and stepper motors
Motors and generators



Certificate

[Website > Downloads > Certificates > UL > 8LS synchronous motors > E360421 UL certificate of compliance 8LS/8LT/8LV](#)

9 Disposal

Separation of materials

To ensure that devices can be recycled in an environmentally friendly manner, it is necessary to separate out the different materials. Disposal must be carried out in accordance with applicable legal regulations.

Component	Disposal	Note
Motors	Electronic recycling	A magnetized rotor is not permitted to be transported or delivered outside the stator under any circumstances!
Gearbox (without oil)	Metal waste	
Waste oil (gearbox)	Special waste	
Coolant	Special waste	For liquid-cooled motors only. Consists of water / oil with additives.
Modules, cables	Electronic recycling	
Batteries	Special waste	Danger of fire: Do not store batteries together with conductive materials during disposal.
Cardboard/Paper packaging	Paper/Cardboard recycling	

9.1 Safety

9.1.1 Protective equipment

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

9.1.2 Rotor with rare earth magnets

In B&R motors, rotors are installed with rare earth magnets with high magnetic energy densities.

Warning!

Personal injury and damage to property due to rare earth magnets!

The motors are not permitted to be disassembled into individual parts.

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

- Due to the surrounding magnetic fields, the functionality of a pacemaker can be impaired in such a way that it can result in bodily harm or even death of the carrier.
- The surrounding magnetic fields can affect or destroy electronic and mechanical measuring instruments.
- The strong magnetic attractive force can result in uncontrolled movements of the magnet or the attraction of other objects. Personal injury due to impacts or trapping is possible. If magnets are splintered during collision, personal injury cannot be ruled out.
- In potentially explosive atmospheres, a spark generated by magnets can result in serious explosions and cause personal injury and damage to property.

Publishing information

B&R Industrial Automation GmbH

B&R Strasse 1

5142 Eggelsberg

Austria

Telephone: +43 7748 6586-0

Fax: +43 7748 6586-26

office@br-automation.com