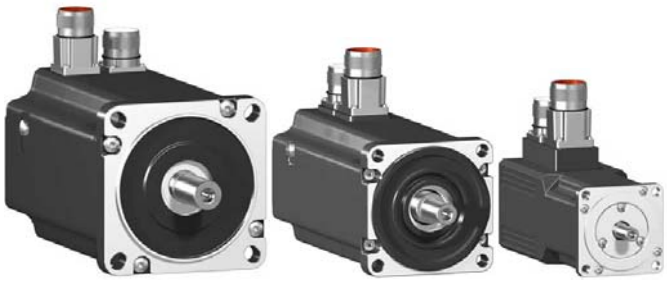
BRH

AC-synchron servo motor
Product manual

V2.00, 11.2008



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Important information

This manual is part of the product.

Carefully read this manual and observe all instructions.

Keep this manual for future reference.

Hand this manual and all other pertinent product documentation over to all users of the product.

Carefully read and observe all safety instructions and the chapter "Before you begin - safety information".

Some products are not available in all countries.
For information on the availability of products, please consult the catalog.

Subject to technical modifications without notice.

All details provided are technical data which do not constitute warranted qualities.

Most of the product designations are registered trademarks of their respective owners, even if this is not explicitly indicated.

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Writing conventions and symbols

Work steps

If work steps must be performed consecutively, this sequence of steps is represented as follows:

■ Special prerequisites for the following work steps

▶ Step 1

◁ Specific response to this work step

▶ Step 2

If a response to a work step is indicated, this allows you to verify that the work step has been performed correctly.

Unless otherwise stated, the individual steps must be performed in the specified sequence.

Bulleted lists

The items in bulleted lists are sorted alphanumerically or by priority. Bulleted lists are structured as follows:

- Item 1 of bulleted list
- Item 2 of bulleted list
  - Subitem for 2
  - Subitem for 2
- Item 3 of bulleted list

Making work easier

Information on making work easier is highlighted by this symbol:

Sections highlighted this way provide supplementary information on making work easier.

SI units

SI units are the original values. Converted units are shown in brackets behind the original value; they may be rounded.

Example:
Minimum conductor cross section: 1.5 mm^2 (AWG 14)

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1 Introduction

1.1 About this manual

This manual is valid for all BRH standard products. This chapter lists the type code for this product. The type code can be used to identify whether your product is a standard product or a customized model.

1.2 Motor family

The motors are AC synchronous servo motors with a very high power density. A drive system consists of the AC synchronous servo motor and the appropriate drive. Maximum performance requires the motor and drive to be tuned to each other.

Advanced drive technology is characterized by increasingly demanding requirements. The requirements comprise in particular:

- Positioning accuracy and speed accuracy
- Constant torque and broad control range
- Dynamics and overload capacity

Different motor series are available to meet the requirements of different applications. It is not possible to combine all motor versions with all drives.

Features

The AC synchronous servo motors excel with:

- High power density: the use of the latest magnetic materials and an optimized design result in motors with a shorter length at a comparable torque.
- High peak torque: the peak torque can be up to four times the continuous stall torque

1.3 Motor overview

			BRH057	**BRH085**	**BRH110**
Continuous stall torque	M_0	[Nm]	0.46 ... 1.30	1.86 ... 5.30	5.20 ... 12.0
Torque at maximum continuous power	$M_{P\ d\_max}$	[Nm]	0.28 ... 0.50	0.60 ... 1.80	3.50 ... 6.90
Maximum continuous power	P_{d_max}	[kW]	0.33 ... 0.63	0.38 ... 0.85	2.20 ... 2.40
Maximum torque	M_{max}	[Nm]	1.40 ... 4.90	5.70 ... 18.80	16.2 ... 43.0

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1.4 Options and accessories

The motors are available with various options such as:

- Various encoder systems
- Holding brake
- Various degrees of protection

For accessories see chapter 7 "Accessories and spare parts".

Accessories such as cables, gearboxes or holding brake controllers can be found in the product catalog.

All options can be found in the type code.

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1.5 Nameplate

The nameplate contains the following data:

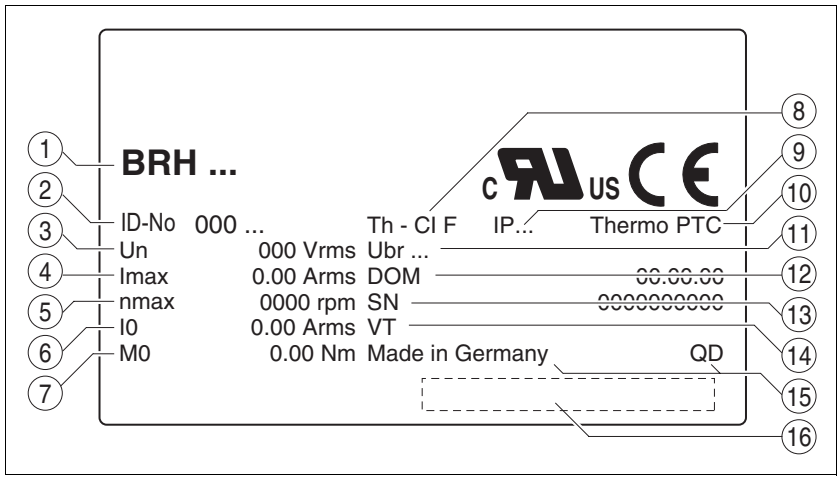

Figure 1.1 Nameplate

(1) Motor type, see type code
(2) Order no.
(3) Maximum nominal value of supply voltage
(4) Maximum current
(5) Maximum speed of rotation
(6) Phase current at standstill
(7) Nominal torque
(8) Temperature class
(9) Degree of protection
(10) Temperature sensor
(11) Holding brake data
(12) Date of manufacture
(13) Serial number
(14) Variable torque
(15) Country of manufacture, site
(16) Barcode

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1.6 Type code

BRH	057	1	P	0	0	A	1	A

Product family: Synchronous motor

Size (housing)
057 = 57 mm flange
085 = 85 mm flange
110 = 110 mm flange

Length
1 = 1 stack
2 = 2 stacks
3 = 3 stacks
4 = 4 stacks

Winding designation
M = Maximum torque
P = Medium speed of rotation, standard winding
T = Maximum speed of rotation

Mechanical interface - shaft and degree of protection
0 = Smooth shaft; degree of protection: shaft IP 41, housing IP 56
1 = Parallel key; degree of protection: shaft IP 41, housing IP 56
2 = Smooth shaft; degree of protection: shaft and housing IP 56
3 = Parallel key; degree of protection: shaft and housing IP 56

Encoder system
0 = Absolute singleturn 16 Sin/Cos periods per revolution
1 = Absolute singleturn 128 Sin/Cos periods per revolution
2 = Absolute multiturn 128 Sin/Cos periods per revolution

Holding brake
A = Without brake
F = With brake

Electrical interface
1 = Straight connector
2 = Angular connector 90°, can be rotated up to 310°

Mechanical interface - mounting
A = International IEC Standard

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1.7 Declaration of conformity

SCHNEIDER ELECTRIC MOTION DEUTSCHLAND GmbH & Co. KG
Breslauer Str. 7 D-77933 Lahr

EC DECLARATION OF CONFORMITY YEAR 2008

☐ according to EC Directive Machinery 98/37/EC
☐ according to EC Directive EMC 2004/108/EC
☒ according to EC Directive Low Voltage 2006/95/EC

We declare that the products listed below meet the requirements of the mentioned EC Directives with respect to design, construction and version distributed by us. This declaration becomes invalid with any modification on the products not authorized by us.

Designation:	3 phase servo motor
Type:	BRHxx
Product number:	01580xxxxxxxx, 01581xxxxxxxx, 01582xxxxxxxx, 01583xxxxxxxx
Applied harmonized standards, especially:	EN 60034-1:2005 Thermal class 155 EN 60034-5:2001 Degree of protection according product documentation EN 61800-5-1:2003
Applied national standards and technical specifications, especially:	UL 1004 Product documentation
Company stamp:	Schneider Electric Motion Deutschland GmbH & Co. KG Postfach 11 80 • D-77901 Lahr Breslauer Str. 7 • D-77933 Lahr
Date/ Signature:	28 August 2008
Name/ Department:	Wolfgang Brandstätter/Development

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2 Before you begin - safety information

2.1 Qualification of personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

2.2 Intended use

This product is an motor and intended for industrial use according to this manual.

The product must NEVER be operated in explosive atmospheres (hazardous locations, Ex areas).

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.

Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design).

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted is prohibited and can result in hazards.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

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2.3 Hazard categories

Safety instructions to the user are highlighted by safety alert symbols in the manual. In addition, labels with symbols and/or instructions are attached to the product that alert you to potential hazards.

Depending on the seriousness of the hazard, the safety instructions are divided into 4 hazard categories.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

CAUTION

CAUTION used without the safety alert symbol, is used to address practices not related to personal injury (e.g. **can result** in equipment damage).

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2.4 Basic information

⚠ DANGER

ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this drive system. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.

  Supplement the motor cable grounding conductor with an additional protective ground conductor to the motor housing.

- Do not touch unshielded components or terminals with voltage present.
- The motor generates voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors in the motor cable.
- Do not short across the DC bus terminals or the DC bus capacitors.
- Before performing work on the drive system:
  - Disconnect all power, including external control power that may be present.
  - Place a "DO NOT TURN ON" label on all power switches.
  - Lock all power switches in the open position.
  - Wait for the DC bus capacitors to discharge (see the product manual for the power stage). Then measure the DC bus voltage and verify it is less than < 42 V_{dc} (see the product manual for the power stage).
- Install and close all covers before applying voltage.

Failure to follow these instructions will result in death or serious injury.

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2.5 Standards and terminology

Technical terms, terminology and the corresponding descriptions in this manual are intended to use the terms or definitions of the pertinent standards.

In the area of drive systems, this includes, but is not limited to, terms such as "safety function", "safe state", "fault", "fault reset", "failure", "error", "error message", "warning", "warning message", etc.

Among others, these standards include:

- IEC 61800 series: "Adjustable speed electrical power drive systems"
- IEC 61800-7 series: "Adjustable speed electrical power drive systems - Part 7-1: Generic interface and use of profiles for power drive systems - Interface definition"
- IEC 61158 series: "Industrial communication networks - Fieldbus specifications"
- IEC 61784 series: "Industrial communication networks - Profiles"
- IEC 61508 series: "Functional safety of electrical/electronic/programmable electronic safety-related systems"

Also see the glossary at the end of this manual.

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3 Technical Data

This chapter contains information on the ambient conditions and on the mechanical and electrical properties of the product family and the accessories.

3.1 General features

Motor type	AC synchronous servo motor	
Number of pairs of poles	5	
Degree of protection motor housing	IP 56	as per IEC 60034-5
Degree of protection shaft bushing	IP 41, optional: IP 56 [1)]	as per IEC 60034-5
Thermal class	155	as per IEC 60034-1
Temperature variation		Maximum 30 K per hour
Vibration grade	A	as per IEC 60034-14
BRH 057 test voltage	> 1500 V	as per IEC 60034-1
BRH 085 and BRH 110 test voltage	> 2000 V	as per IEC 60034-1
Shaft wobble / perpendicularity	normal class	as per IEC 60072-1
Winding monitoring	integrated, thermal	As per IEC 61800-5-1 for "protective separation"
Housing color	Black RAL 9005	
Maximum angular acceleration	[rad/s^2]	200000

1) With shaft sealing ring the maximum speed of rotation limited to 6000 [min^{-1}; with mounting position IM V3 (shaft end upwards) only IP41; shaft sealing ring with initial lubrication, if the seal runs dry, this increases friction and reduces service life]

Ambient temperature during operation

Operating temperature [1)]	[°C]	-15 ... 40

1) Limit values with flanged motor (steel plate 300x300x10 mm)

Relative humidity

The following relative humidity is permissible during operation:

Relative humidity (non-condensing)	[%]	75 annual mean 85 on 30 days

Ambient conditions transportation and storage

The environment during transport and storage must be dry and free from dust. The maximum vibration and shock load must be within the specified limits.

The storage time is primarily determined by the service life of the bearing lubricants; do not store the product for more than 36 months. It is recommended to periodically operate the motor.

Temperature	[°C]	-25 ... +60

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Service life

The service life of the motors when operated correctly is limited primarily by the service life of the rolling bearing.

The following operating conditions significantly reduce the service life:

- Installation altitude >1000 m mean sea level
- Rotary movement exclusively within a fixed angle of <100°
- Operation under vibration load >20 m/s^2
- Allowing sealing rings to run dry
- Wetting of the seals with aggressive media

Shaft sealing ring / degree of protection

The motors can be equipped with an optional shaft sealing ring. With a shaft sealing ring, they have degree of protection IP56. However, this limits the allowed maximum speed to 6000 min^{-1}.

Note the following:

- The shaft sealing ring is factory-lubricated.
- If the seals to run dry, this increases friction and greatly reduces the service life of the sealing rings.
- In the case of mounting position IM V3 (drive shaft vertical, shaft end upward), the motor only has degree of protection IP 41.

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3.2 Motor-specific data

3.2.1 BRH057

Motor type			BRH057 1	BRH057 1	BRH057 2	BRH057 3	BRH057 4
Winding			**P**	**T**	**P**	**P**	**P**
Technical data - general							
Continuous stall torque [1]	M_0 [2]	[Nm]	0.46	0.46	0.76	1.05	1.30
Peak torque	M_{max}	[Nm]	1.40	1.40	2.60	3.90	4.90
With supply voltage U_n = 115 V [1]							
Nominal speed	n_N	[min^{-1}]	2000	4000	2000	2000	2000
Nominal torque	M_N	[Nm]	0.44	0.39	0.72	1.00	1.20
Nominal power	P_N	[kW]	0.09	0.16	0.15	0.21	0.25
With supply voltage U_n = 230 V [1]							
Nominal speed	n_N	[min^{-1}]	4000	6000	5000	4000	4000
Nominal torque	M_N	[Nm]	0.39	0.35	0.66	0.93	1.05
Nominal power	P_N	[kW]	0.16	0.22	0.35	0.39	0.44
With supply voltage U_n = 480 V [1]							
Nominal speed	n_N	[min^{-1}]	6000	6000	6000	6000	6000
Nominal torque	M_N	[Nm]	0.35	0.35	0.64	0.82	0.95
Nominal power	P_N	[kW]	0.22	0.22	0.40	0.52	0.60
Technical data - electrical							
Maximum winding voltage	U_{max}	[V_{ac}]	480	480	480	480	480
Maximum winding voltage	U_{max}	[V_{dc}]	680	680	680	680	680
Maximum voltage to ground		[V_{ac}]	300	300	300	300	300
Max. current	I_{max}	[A_{rms}]	5.40	8.66	8.00	10.00	11.35
Nominal current	I_N	[A_{rms}]	1.35	2.10	1.90	2.30	2.70
Stall current	I_0	[A_{rms}]	1.36	2.17	2.00	2.50	2.85
Voltage constant [3]	k_Eu-v	[V_{rms}]	20.90	13.12	24.29	27.23	29.27
Torque constant	k_t	[Nm/A]	0.338	0.212	0.38	0.42	0.456
Winding resistance	R_{20}u-v	[Ω]	12.73	5.02	6.68	5.18	4.34
Winding inductance	L_qu-v	[mH]	24.14	9.52	13.60	10.97	8.98
Winding inductance	L_du-v	[mH]	24.08	9.49	13.67	10.96	8.96
Technical data - mechanical							
Maximum permissible speed of rotation	n_{max}	[min^{-1}]	8000	8000	8000	8000	8000
Rotor inertia without brake [4]	J_M	[$kgcm^2$]	0.18	0.18	0.26	0.34	0.41
Rotor inertia with brake	J_M	[$kgcm^2$]	0.18	0.18	0.26	0.34	0.41
Mass	m	[kg]	1.0	1,0	1.3	1.6	1.9

1) Conditions for performance data: winding overtemperature 110K, aluminum flange plate 254*254*6 mm
2) M_0=Continuous stall torque at low speed of rotation and 100% duty cycle; at speeds of rotation of <20 min^{-1} the stall torque is reduced to 87%
3) rms value at 1000 min^{-1} and 20°C
4) With additional mass at the rotor in order to compensate the missing brake.

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3.2.2 BRH085

Motor type			BRH085 1	BRH085 1	BRH085 2	BRH085 2
Winding			**P**	**M**	**P**	**M**
Technical data - general						
Continuous stall torque [1]	M_0 [2]	[Nm]	1.86	1.86	3.10	3.10
Peak torque	M_{max}	[Nm]	5.65	5.65	10.80	10.80
With supply voltage U_n = 115 V [1]						
Nominal speed	n_N	[min^{-1}]	2500	1500	2500	1500
Nominal torque	M_N	[Nm]	1.69	1.76	2.55	2.78
Nominal power	P_N	[kW]	0.44	0.28	0.67	0.44
With supply voltage U_n = 230 V [1]						
Nominal speed	n_N	[min^{-1}]	5000	3000	5000	3000
Nominal torque	M_N	[Nm]	1.52	1.66	2.00	2.45
Nominal power	P_N	[kW]	0.80	0.52	1.05	0.77
With supply voltage U_n = 480 V [1]						
Nominal speed	n_N	[min^{-1}]	6000	6000	6000	5000
Nominal torque	M_N	[Nm]	1.45	1.45	1.80	2.00
Nominal power	P_N	[kW]	0.91	0.91	1.13	1.05
Technical data - electrical						
Maximum winding voltage	U_{max}	[V_{ac}]	480	480	480	480
Maximum winding voltage	U_{max}	[V_{dc}]	680	680	680	680
Maximum voltage to ground		[V_{ac}]	300	300	300	300
Max. current	I_{max}	[A_{rms}]	15.40	12.37	26.40	16.45
Nominal current	I_N	[A_{rms}]	3.65	2.65	5.80	2.63
Stall current	I_0	[A_{rms}]	3.85	3.09	6.60	4.11
Voltage constant [3]	k_Eu-v	[V_{rms}]	30.46	37.92	30.67	49.21
Torque constant	k_t	[Nm/A]	0.483	0.601	0.47	0.754
Winding resistance	R_{20}u-v	[Ω]	2.11	3.28	0.98	2.52
Winding inductance	L_qu-v	[mH]	7.96	12.34	3.68	9.48
Winding inductance	L_du-v	[mH]	6.94	10.76	3.17	8.16
Technical data - mechanical						
Maximum permissible speed of rotation	n_{max}	[min^{-1}]	6000	6000	6000	6000
Rotor inertia without brake	J_M	[$kgcm^2$]	1.06	1.06	2.01	2.01
Rotor inertia with brake	J_M	[$kgcm^2$]	1.59	1.59	2.54	2.54
Mass	m	[kg]	2.4	2.4	3.4	3.4

1) Conditions for performance data: winding overtemperature 110K, aluminum flange plate 254*254*6 mm
2) M_0=Continuous tall torque at low speed of rotation and 100% duty cycle; at speeds of rotation of <20 min^{-1} the stall torque is reduced to 87%
3) rms value at 1000 min^{-1} and 20 °C

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Motor type			BRH085 3	BRH085 3	BRH085 4	BRH085 4
Winding			**P**	**M**	**P**	**M**
Technical data - general						
Continuous stall torque [1]	M_0 [2]	[Nm]	4.20	4.18	5.30	5.30
Peak torque	M_{max}	[Nm]	14.6	14.6	18.8	18.8
With supply voltage U_n = 115 V [1]						
Nominal speed	n_N	[min^{-1}]	2500	1500	1500	1000
Nominal torque	M_N	[Nm]	3.30	3.65	4.71	4.91
Nominal power	P_N	[kW]	0.86	0.57	0.74	0.51
With supply voltage U_n = 230 V [1]						
Nominal speed	n_N	[min^{-1}]	5000	3000	4000	3000
Nominal torque	M_N	[Nm]	2.37	3.10	3.44	4.00
Nominal power	P_N	[kW]	1.24	0.97	1.44	1.26
With supply voltage U_n = 480 V [1]						
Nominal speed	n_N	[min^{-1}]	6000	5000	6000	5000
Nominal torque	M_N	[Nm]	2.00	2.37	2.20	2.87
Nominal power	P_N	[kW]	1.26	1.24	1.38	1.50
Technical data - electrical						
Maximum winding voltage	U_{max}	[V_{ac}]	480	480	480	480
Maximum winding voltage	U_{max}	[V_{dc}]	680	680	680	680
Maximum voltage to ground		[V_{ac}]	300	300	300	300
Max. current	I_{max}	[A_{rms}]	32.8	23.1	31.2	24.8
Stall current	I_0	[A_{rms}]	8.20	5.78	7.80	6.20
Nominal current	I_N	[A_{rms}]	6.60	3.04	6.15	2.83
Voltage constant [3]	k_Eu-v	[V_{rms}]	32.98	46.81	43.95	55.29
Torque constant	k_t	[Nm/A]	0.512	0.724	0.679	0.855
Winding resistance	R_{20}u-v	[Ω]	0.68	1.36	0.86	1.36
Winding inductance	L_qu-v	[mH]	2.75	5.54	3.59	5.69
Winding inductance	L_du-v	[mH]	2.34	4.71	3.01	4.76
Technical data - mechanical						
Maximum permissible speed of rotation	n_{max}	[min^{-1}]	6000	6000	6000	6000
Rotor inertia without brake	J_M	[$kgcm^2$]	2.96	2.96	3.91	3.91
Rotor inertia with brake	J_M	[$kgcm^2$]	3.49	3.49	4.44	4.44
Mass	m	[kg]	4.4	4.4	5.5	5.5

1) Conditions for performance data: winding overtemperature 110K, aluminum flange plate 254*254*6 mm
2) M_0=Continuous tall torque at low speed of rotation and 100% duty cycle; at speeds of rotation of <20 min^{-1} the stall torque is reduced to 87%
3) rms value at 1000 min^{-1} and 20°C

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3.2.3 BRH110

Motor type			BRH110 1	BRH110 2	BRH110 3
Winding			**P**	**P**	**P**
Technical data - general					
Continuous stall torque [1]	M_0 [2]	[Nm]	5.20	9.00	12.00
Peak torque	M_{max}	[Nm]	16.2	31.0	43.0
With supply voltage U_n = 115 V [1]					
Nominal speed	n_N	[min^{-1}]	1500	1000	1000
Nominal torque	M_N	[Nm]	4.89	8.25	10.80
Nominal power	P_N	[kW]	0.77	0.86	1.13
With supply voltage U_n = 230 V [1]					
Nominal speed	n_N	[min^{-1}]	3000	2500	2500
Nominal torque	M_N	[Nm]	4.50	6.90	8.45
Nominal power	P_N	[kW]	1.41	1.81	2.21
With supply voltage U_n = 480 V [1]					
Nominal speed	n_N	[min^{-1}]	6000	3000	3000
Nominal torque	M_N	[Nm]	3.50	6.35	7.50
Nominal power	P_N	[kW]	2.20	1.99	2.36
Technical data - electrical					
Maximum winding voltage	U_{max}	[V_{ac}]	480	480	480
Maximum winding voltage	U_{max}	[V_{dc}]	680	680	680
Maximum voltage to ground		[V_{ac}]	300	300	300
Max. current	I_{max}	[A_{rms}]	25.0	37.6	45.2
Nominal current	I_N	[A_{rms}]	5.50	7.10	7.60
Stall current	I_0	[A_{rms}]	6.25	9.40	11.30
Voltage constant [3]	k_Eu-v	[V_{rms}]	54.2	62.1	68.5
Torque constant	k_t	[Nm/A]	0.832	0.957	1.062
Winding resistance	R_{20}u-v	[Ω]	1.24	0.69	0.54
Winding inductance	L_qu-v	[mH]	8.09	4.87	3.88
Winding inductance	L_du-v	[mH]	7.14	4.21	3.28
Technical data - mechanical					
Maximum permissible speed of rotation	n_{max}	[min^{-1}]	6000	6000	4500
Rotor inertia without brake	J_M	[$kgcm^2$]	4.51	8.79	13.08
Rotor inertia with brake	J_M	[$kgcm^2$]	5.81	10.09	14.38
Mass	m	[kg]	4.9	7.7	10.5

1) Conditions for performance data: winding overtemperature 110K, aluminum flange plate 254*254*6 mm
2) M_0=Continuous tall torque at low speed of rotation and 100% duty cycle; at speeds of rotation of <20 min^{-1} the stall torque is reduced to 87%
3) rms value at 1000 min^{-1} and 20 °C

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3.3 Dimensions

Dimensions BRH057

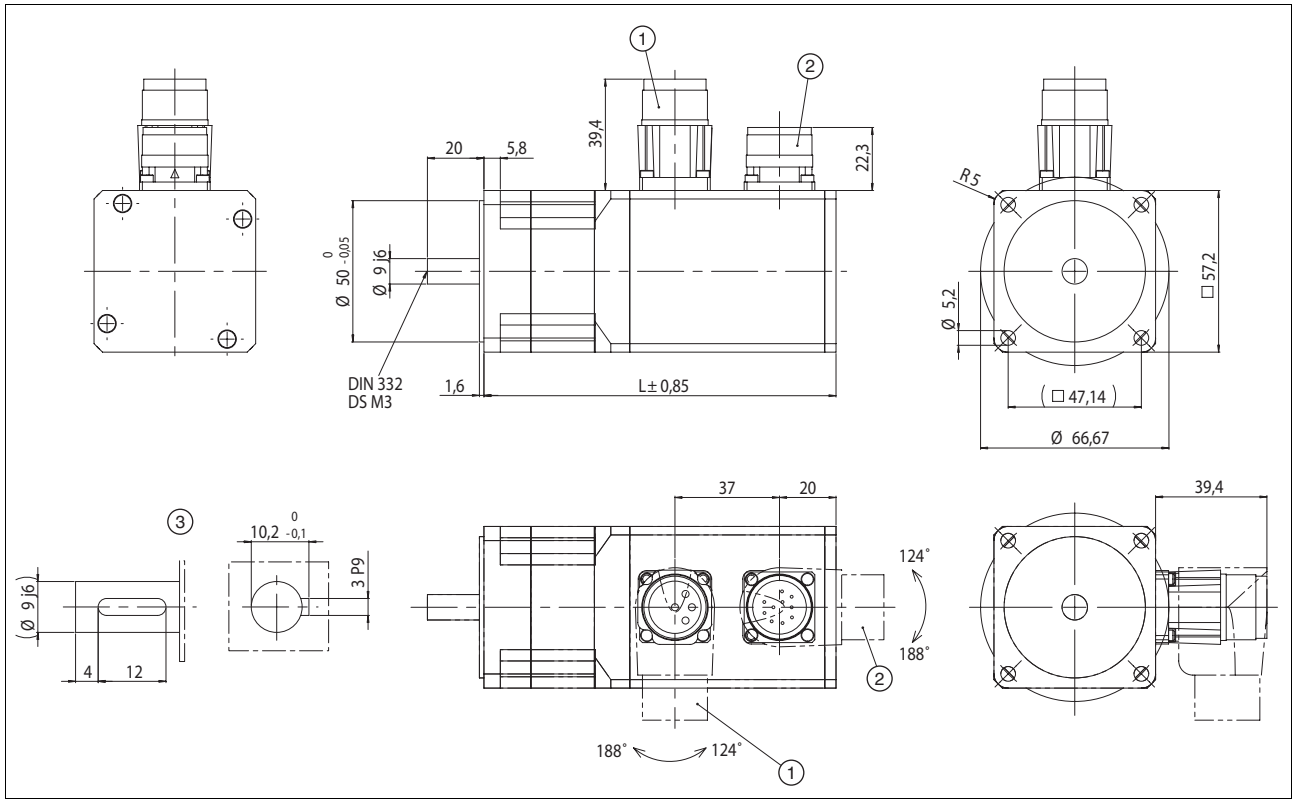

Figure 3.1 Dimensions BRH057

(1) Motor connector 8 poles
(2) Encoder connector 12 poles
(3) Parallel key, optional

		BRH057 1	BRH057 2	BRH057 3	BRH057 4
L	Length without brake [mm]	124.6	143.1	161.6	180.1
L	Length with brake [mm]	124.6	143.1	161.6	180.1

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Dimensions BRH085

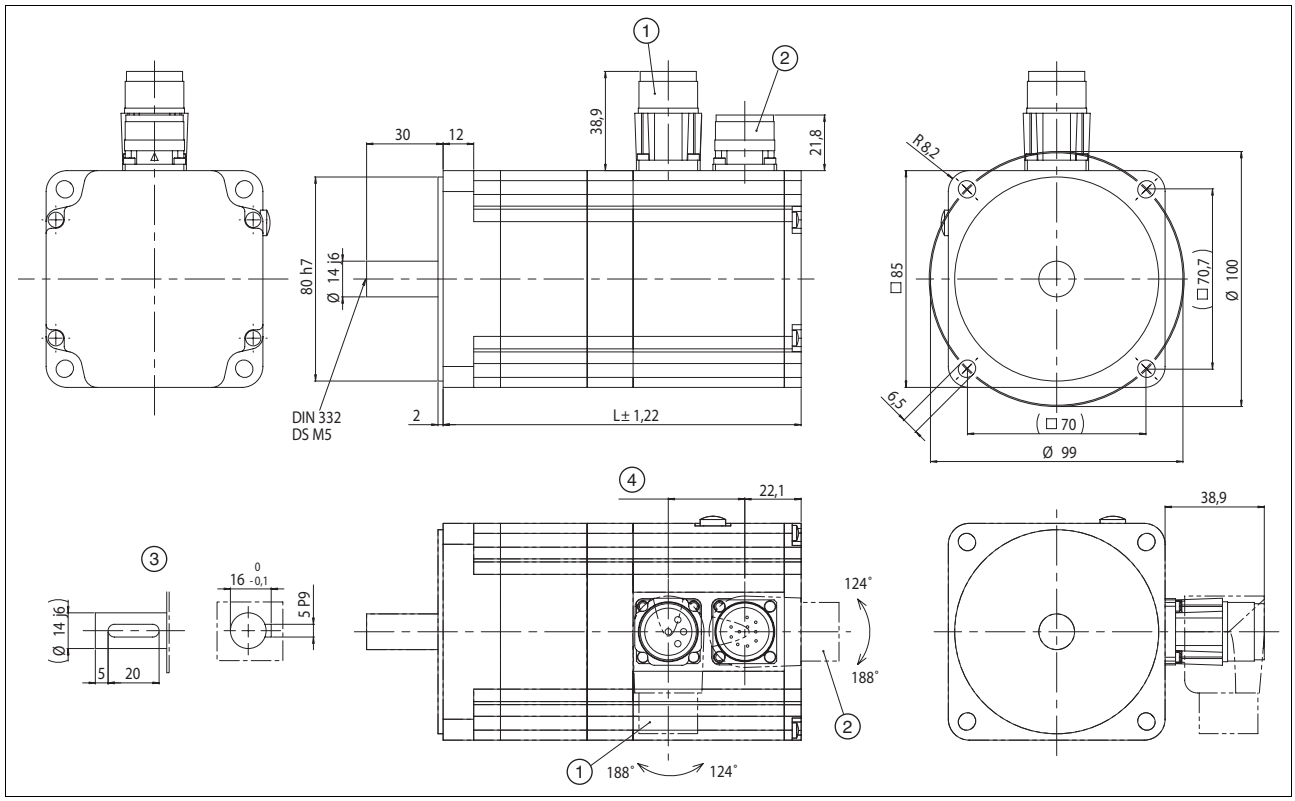

Figure 3.2 Dimensions BRH085

(1) Motor connector 8 poles
(2) Encoder connector 12 poles
(3) Parallel key, optional
(4) 30 = Motor without brake, 31 = Motor with brake

		BRH085 1	BRH085 2	BRH085 3	BRH085 4
L	Length without brake [mm]	140.4	170.4	200.4	230.4
L	Length with brake [mm]	162.6	192.6	222.6	252.6

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Dimensions BRH110

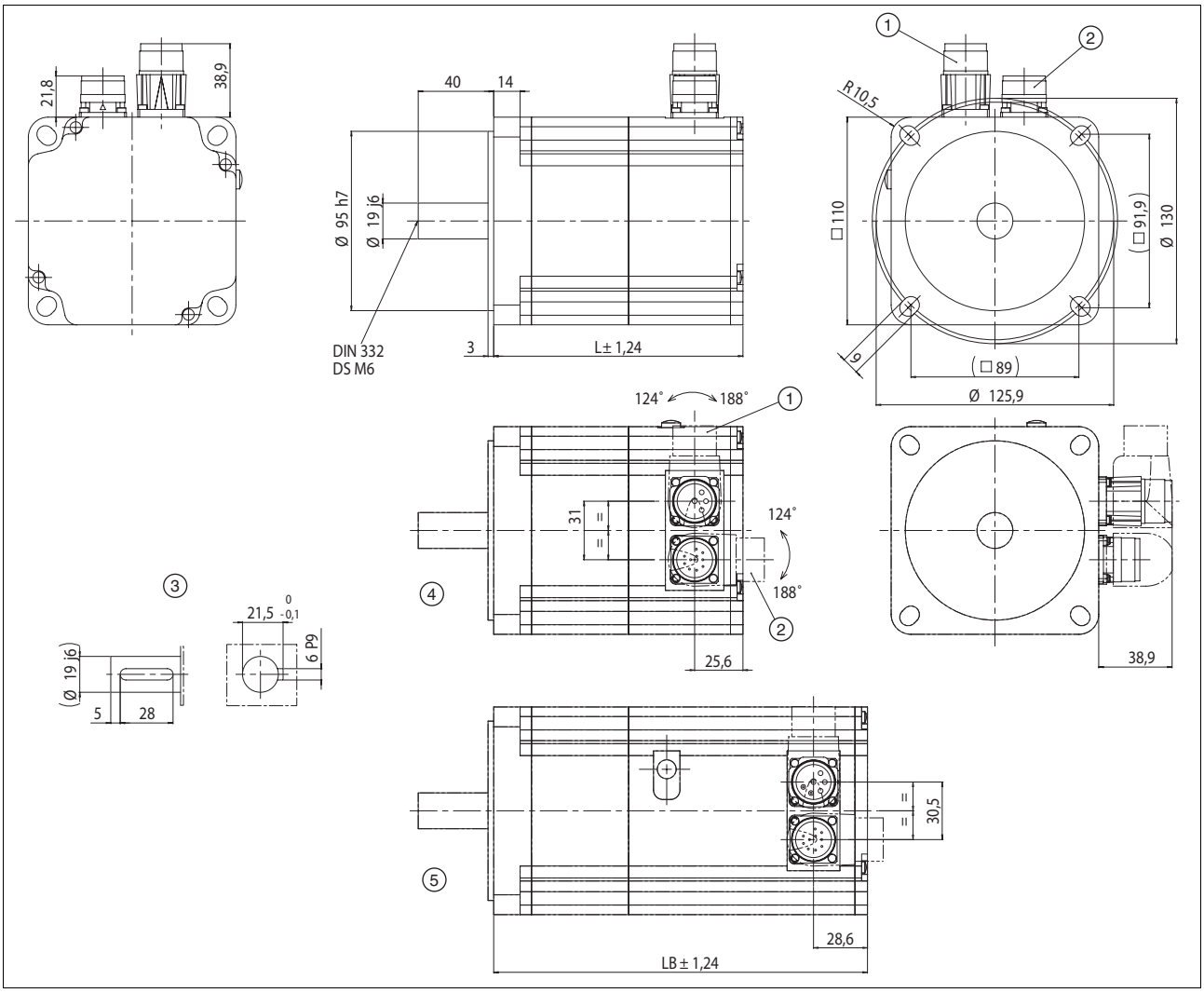

Figure 3.3 Dimensions BRH110

(1) Motor connector 8 poles
(2) Encoder connector 12 poles
(3) Parallel key, optional
(4) Motor without brake
(5) Motor with brake

		BRH110 1	BRH110 2	BRH110 3
L	Length without brake [mm]	132.1	180.1	228.1
L	Length with brake [mm]	198.1	246.1	294.1

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3.4 Shaft-specific data

⚠ WARNING

UNINTENDED BEHAVIOR CAUSED BY MECHANICAL DAMAGE TO THE MOTOR

If the maximum permissible forces at the shaft are exceeded, this will result in premature wear of the bearing, shaft breakage or damage to the encoder.

- Do not exceed the maximum permissible axial and radial forces.
- Protect the shaft from impact.
- Do not exceed the maximum permissible axial force when pressing on components.

Failure to follow these instructions can result in injury or equipment damage.

3.4.1 Press-on force

Maximum press-on force

The maximum press-on force is limited by the maximum permissible axial force that may act on the rolling bearing. Using assembly paste (such as Klüberpaste 46 MR 401) on the shaft and the component to be mounted reduces friction and mechanical impact on the surfaces.

If the shaft has a thread, it is recommend to use it to press on the component to be mounted. This way there is no axial force acting on the rolling bearing.

It is also possible to shrink-fit, clamp or glue the component to be mounted.

The following table shows the maximum permissible axial force F_A at standstill.

BRH ...		57	85	110
	[N]	104	305	600

3.4.2 Shaft load

The following conditions apply:

- Nominal bearing service life in operating hours at a probability of failure of 10%
- Mean speed of rotation n = 4000 min^{-1}
- Ambient temperature = 40 °C
- Peak torque = operating modes S3 - S8, 10% duty cycle
- Nominal torque = operating mode S1, 100% duty cycle

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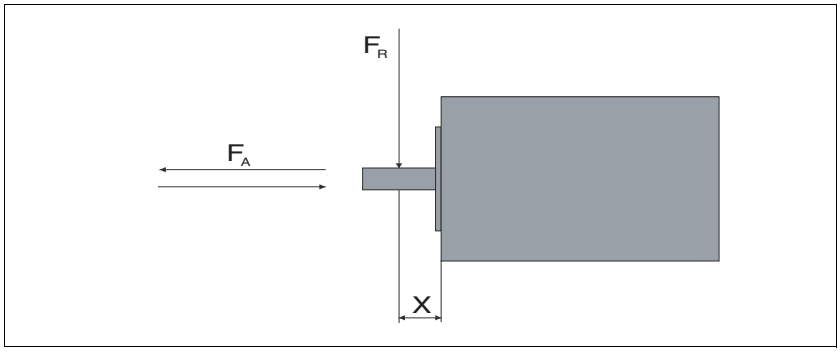

Figure 3.4 Shaft load

The point of application of the forces depends on the motor size:
BRH057: X=10 mm
BRH085: X=15 mm
BRH110: X= 20 mm

Note the following:

- Radial and axial limit loads must not be applied simultaneously
- The permissible press-on force applied to the shaft end must not be exceeded
- The shaft exit is corrosion-protected
- The rolling bearing must not be replaced by the customer.

The following table shows the maximum radial shaft load F_R.

BRH ...		57 1	57 2	57 3	57 4	85 1	85 2	85 3	85 4	110 1	110 2	110 3
1000 min^{-1}	[N]	109	130	143	152	226	265	287	300	729	848	908
2000 min^{-1}	[N]	81	96	106	112	193	226	244	256	709	824	883
3000 min^{-1}	[N]	76	91	100	106	187	219	237	248	697	811	869
4000 min^{-1}	[N]	74	89	98	103	181	213	230	241	688	800	857
5000 min^{-1}	[N]	73	87	96	101	176	207	223	234	655	762	
6000 min^{-1}	[N]	72	86	94	100	173	203	220	230	629	731	
7000 min^{-1}	[N]	71	85	93	98							
8000 min^{-1}	[N]	70	84	92	97							

The following table shows the maximum axial shaft load F_A.

BRH ...		57	85	110
1000 min^{-1}	[N]	104	305	600
2000 min^{-1}	[N]	104	279	600
3000 min^{-1}	[N]	104	273	600
4000 min^{-1}	[N]	104	268	600
5000 min^{-1}	[N]	103	264	568
6000 min^{-1}	[N]	102	261	535
7000 min^{-1}	[N]	101		
8000 min^{-1}	[N]	100		

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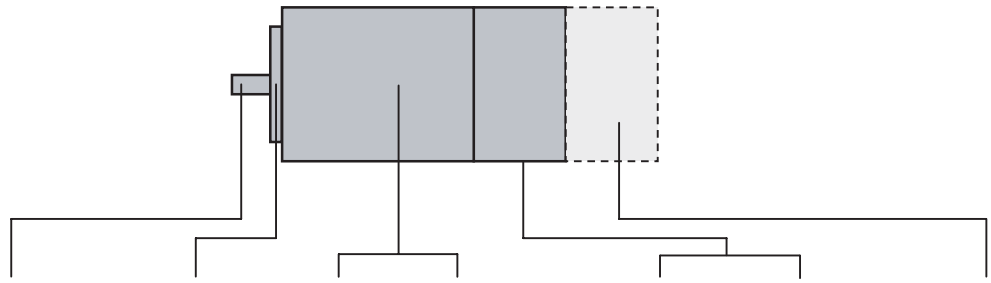
3.5 Motor versions

Due to the flexible modular system and an advanced variant management system, the versions described below can be offered. Below the schematic view, the type code shows all available versions of this motor size.

Overview



Motor	Shaft version	Centring collar	Size	Length	Voltage	Connection-type	Options
BRH057	∅9 mm	∅50 mm	057	1 2 3 4	480 V_{ac} / 680 V_{dc}	Connector	Holding brake Position capture [1)] Plug connection [2)]
BRH085	∅14 mm	∅80 mm	085	1 2 3 4	480 V_{ac} / 680 V_{dc}	Connector	Holding brake Position capture [1)] Plug connection [2)]
BRH110	∅19 mm	∅95 mm	110	1 2 3	480 V_{ac} / 680 V_{dc}	Connector	Holding brake Position capture [1)] Plug connection [2)]

1) Type of position capture (encoder system) Standard: Singleturn encoder 16 SinCos periods/revolution (SEK) Option: Singleturn encoder 128 SinCos periods/revolution (SKS), multiturn encoder 128 SinCos periods/revolution (SKM)
2) Plug connection: Standard = straight; option= 90° angled, can be rotated

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3.6 Options

3.6.1 Holding brake

⚠ WARNING

LOSS OF BRAKING FORCE DUE TO WEAR OR HIGH TEMPERATURE

Applying the holding brake while the motor is running will cause excessive wear and loss of the braking force. Heat decreases the braking force.

- Do not use the brake as a service brake.
- Note that "EMERGENCY STOPS" may also cause wear

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

MOVEMENT WITHOUT BRAKING EFFECT

If power outage and faults cause the power stage to be switched off, the motor is no longer stopped by the brake and may increase its speed even more until it reaches a mechanical stop.
Overload or faults can cause danger due to the failure of the holding brake.
Incorrect use of the holding brake results in premature wear and failure.

- Do not use the internal brake as a service brake.
- If necessary, use a damped mechanical stop or a service brake.
- Verify the function of the brake.
- In addition, secure the hazardous area so it cannot be accessed.
- The brake function must be checked again after frequent EMERGENCY STOP braking operations.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Holding brake

The motor holding brake has the task of blocking the motor shaft when no current is supplied to the motor (e.g. in the case of a vertical axis). The holding brake must not be used as a service brake.

For a description of the controller, see chapter 4.5.3 "Holding brake connection".

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Holding brake for BRH057

Holding torque	[Nm]	2.3
Brake release time	[ms]	30
Brake application time	[ms]	15
Nominal voltage	[V_{dc}]	24 ±10%
Electrical pull-in power	[W]	9
Moment of inertia	[$kgcm^2$]	0.09
Mass	[kg]	0.25

Holding brake for BRH085

Holding torque	[Nm]	9
Brake release time	[ms]	50
Brake application time	[ms]	25
Nominal voltage	[V_{dc}]	24 ±10%
Electrical pull-in power	[W]	15
Moment of inertia	[$kgcm^2$]	0.53
Mass	[kg]	0.6

Holding brake for BRH110

Holding torque	[Nm]	15
Brake release time	[ms]	80
Brake application time	[ms]	25
Nominal voltage	[V_{dc}]	24 ±10%
Electrical pull-in power	[W]	18
Moment of inertia	[$kgcm^2$]	1.3
Mass	[kg]	1.1

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3.6.2 Position capture (encoder)

The AC synchronous servo motors are fitted with a SinCos singleturn absolute encoder. Via the Hiperface interface between motor encoder and device, the motor parameters and current controller parameters are automatically initialized. This greatly simplifies commissioning.

3.6.2.1 Standard position capture

SEK52 Singleturn This motor encoder measures an absolute value within one revolution during switching on and continues to count incrementally from this point.

Resolution per revolution	16 sin/cos periods
Measurement range absolute	1 revolution
Error limit of the digital absolute value depending on the evaluation	±0.35 degrees
Accuracy of the incremental position evaluation	±0.08 degrees
Pulse shape	Sinusoidal
Supply voltage	7 ... 12 V_{dc} (recommended 8 V_{dc})
Maximum supply current	40 mA (without load)

3.6.2.2 Optional position capture

The motors can be ordered with the following motor encoder instead of the standard encoder system:

SKS36 Singleturn This motor encoder measures an absolute value within one revolution during switching on and continues to count incrementally from this point.

Resolution in increments	Depending on evaluation
Resolution per revolution	128 sin/cos periods
Measurement range absolute	1 revolution
Error limit of the digital absolute value depending on the evaluation	±0.0889 degrees
Accuracy of the incremental position evaluation	±0.0222 degrees
Pulse shape	Sinusoidal
Supply voltage	7 ... 12 V_{dc} (recommended 8 V_{dc})
Maximum supply current	60 mA (without load)

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SKM36 Multiturn This motor encoder measures an absolute value within 4096 revolutions during switching on and continues to count incrementally from this point.

Resolution in increments	Depending on evaluation
Resolution per revolution	128 sin/cos periods
Measurement range absolute	4096 revolutions
Error limit of the digital absolute value depending on the evaluation	±0.0889 degrees
Accuracy of the incremental position evaluation	±0.0222 degrees
Pulse shape	Sinusoidal
Supply voltage	7 ... 12 V_{dc} (recommended 8 V_{dc})
Maximum supply current	60 mA (without load)

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4 Installation

⚠ WARNING

STRONG ELECTROMAGNETIC FIELDS

Motors can generate strong local electrical and magnetic fields. This can cause interference in sensitive devices.

- Keep persons with implants such as pacemakers away from the motor.
- Do not place any sensitive devices close to the motor.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

UNEXPECTED BEHAVIOR CAUSED BY DAMAGE OR FOREIGN OBJECTS

Damage to the product as well as foreign objects, deposits or humidity can cause unexpected behavior.

- Do not use damaged products.
- Keep foreign objects from getting into the product.
- Verify correct seat of seals and cable entries.

Failure to follow these instructions can result in death, serious injury or equipment damage.

4.1 Electromagnetic compatibility, EMC

⚠ WARNING

SIGNAL AND DEVICE INTERFERENCE

Signal interference can cause unexpected responses of device.

- Install the wiring in accordance with the EMC requirements.
- Verify compliance with the EMC requirements.

Failure to follow these instructions can result in death, serious injury or equipment damage.

EMC requirement:Route motor cable separately

Pre-assembled motor and encoder system connections in many different lengths are available for the drive solutions. Contact your local sales office.

When planning the wiring, take into account the fact that the motor cable must be routed separately. The motor cable must be separate from the mains cable or the signal wires.

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Motor and encoder cables

Motor and encoder cables are especially critical in terms of EMC. Use only pre-assembled cables or cables that comply with the specifications and implement the EMC measures described below.

EMC measures	Effect
Keep cables as short as possible. Do not install unnecessary cable loops, use short cables from the star point in the control cabinet to the external ground connection.	Reduces capacitive and inductive interference.
Ground the product via the motor flange or with a ground strap to the ground connection at the cover of the connector housing.	Reduces emissions, increases immunity.
Connect large surface areas of cable shields, use cable clamps and ground straps	Reduces emissions.
Do not install switching elements in motor cables or encoder cables.	Reduces interference.
Route the motor cable at a distance of at least 20 cm from the signal cable or use shielding plates between the motor cable and signal cable.	Reduces mutual interference
Route the motor cable and encoder cable without cutting them. [1)]	Reduces emission.

1) If a cable has to be cut for the installation, it has to be connected with shield connections and a metal housing at the point of the cut.

Pre-assembled connector cable as accessories

We recommend using only the fully assembled connection cables that we supply to connect the motor and the encoder system. They are properly tuned to these drive solutions.

Place the female connector of the motor cable onto the male connector and tighten the union nut. Proceed in the same manner with the connection cable of the encoder system. Connect the motor and the encoder system cables to the drive according to the wiring diagram of the drive.

Protective ground conductor connection

For safety reasons, a redundant protective ground conductor connection is required. Directly connect the motor housing to ground (PE).

Equipotential bonding conductors

Potential differences can result in excessive currents on the cable shields. Use equipotential bonding conductors to reduce currents on the cable shields.

The equipotential bonding conductor must be rated for the maximum current flowing. Practical experience has shown that the following conductor cross sections can be used:

- 16 mm^2 (AWG 4) for equipotential bonding conductors up to a length of 200 m
- 20 mm^2 (AWG 4) for equipotential bonding conductors with a length of more than 200 m

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4.2 Before mounting

Checking for damage

Prior to mounting, check the drive system for visible damage. Damaged drive systems must neither be installed nor operated.

Cleaning the shaft

The shaft ends are factory-treated with an anti-corrosive. The anti-corrosive must be removed with a standard industrial cleaner and a soft cloth.

Avoid direct contact of the skin and the sealing material the anticorrosive or the industrial cleaner.

Mounting surface for flange

The mounting surface must be stable, clean and low-vibration.

Verify that the system side meets all requirements in terms of dimensions and tolerances.

Cable specifications

- Shielded motor cable with 4 x 1.5 mm² (AWG 14) and 2 x 0.5 mm² (AWG 20) wires, separate shielding of the signal wires
- Shielded encoder cable with 10*0.25 mm² (AWG 22) and 2*0.5 mm² (AWG 20) twisted pair wires
- Inner jacket
- Continuous temperature resistance: -20 °C ... 110 °C
- The cable diameter must be between 6 mm and 12 mm (clamping area of the cable entry)

Contact your sales office for the maximum permissible bending radius and the suitability for drag chain applications.

Space for connectors

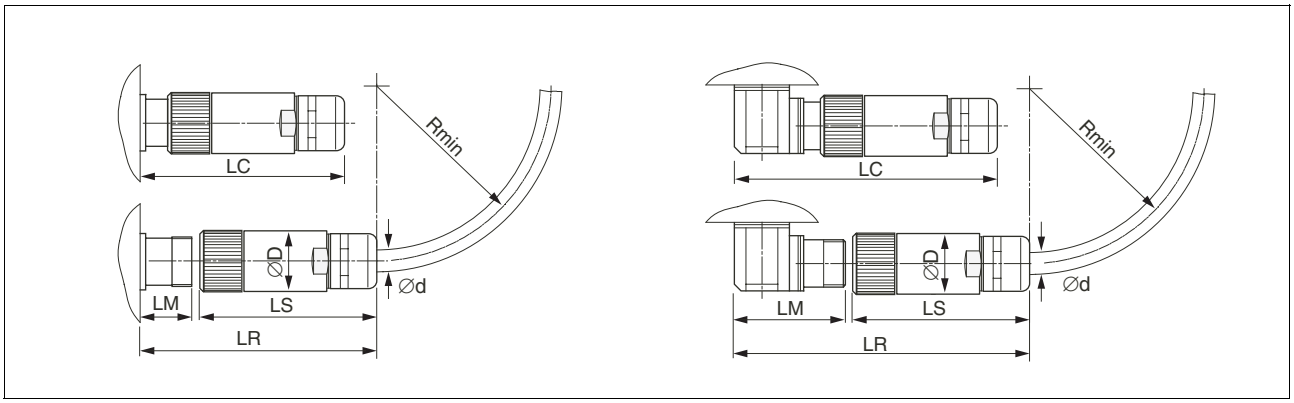

Figure 4.1 Connector installation space

Connector data

Dimensions		Motor connector	Encoder connector
D	[mm]	28	26
LS	[mm]	79	54
LR	[mm]	115	80
LC	[mm]	95	65
LM	[mm]	34	24

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Cable specifications

Dimensions		Motor cable	Encoder cable
d	[mm]	16.3	8.8

Contact your sales representative for the maximum permissible bending radius R_{min} and the suitability for drag chain applications.

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4.3 Overview of procedure

- ▶ Verify compliance with the EMC requirements, see page 35.
- ▶ Observe the information provided in chapter 4.2 "Before mounting".
- ▶ Connect the housing to the grounded neutral point of the system.
- ▶ Finally, verify proper installation.

Chapter	from page
4.4 "Installing the motor"	39
4.5.2 "Power and encoder connection"	44
4.5.3 "Holding brake connection"	47

4.4 Installing the motor

⚠ WARNING

UNEXPECTED MOVEMENT CAUSED BY ELECTROSTATIC DISCHARGE

In rare cases, electrostatic discharge to the shaft may cause incorrect operation of the encoder system and result in unexpected motor movements and damage to the bearing.

- Use conductive components (such as antistatic belts) or other suitable measures to avoid charge separation by motion.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

UNEXPECTED MOVEMENT

If the approved ambient conditions are exceeded, external substances from the environment may penetrate and cause unexpected movement or equipment damage.

- Verify that the ambient conditions are met.
- Do not allow seals to run dry.
- Keep liquids from getting to the shaft end (for example in mounting position IM V3).
- Do not expose the shaft sealing rings and cable entries to the direct spray of a pressure cleaner.

Failure to follow these instructions can result in death, serious injury or equipment damage.

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⚠ WARNING

UNINTENDED BEHAVIOR CAUSED BY MECHANICAL DAMAGE TO THE MOTOR

If the maximum permissible forces at the shaft are exceeded, this will result in premature wear of the bearing, shaft breakage or damage to the encoder.

- Do not exceed the maximum permissible axial and radial forces.
- Protect the shaft from impact.
- Do not exceed the maximum permissible axial force when pressing on components.

Failure to follow these instructions can result in injury or equipment damage.

⚠ CAUTION

HOT SURFACES

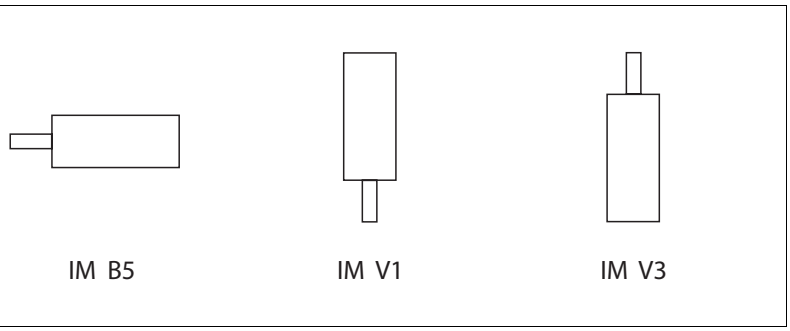
Depending on the operation, the surface may heat up to more than 100°C (212°F).

- Do not allow contact with the hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.
- Check the temperature during test runs.

Failure to follow these instructions can result in injury or equipment damage.

Mounting position

The following mounting positions are defined and approved as per IEC 60034-7:



Mounting

When the motor is mounted to the mounting flange, it must be accurately aligned axially and radially and evenly contact the surface. All mounting screws must be tightened with the specified torque. There must no tension. See chapter 3 "Technical Data" for data, dimensions and degrees of protection (IP).

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Mounting output components

If output components are not properly mounted, the encoder for position capture may be damaged. Output components such as pulleys, couplings must be mounted with suitable equipment and tools. The maximum axial and radial forces acting on the shaft must not exceed the maximum shaft load values specified.

Observe the mounting instructions provided by the manufacturer of the output component. Motor and output component must be accurately aligned both axially and radially. Failure to follow the instructions will cause runout, damage to the shaft bearings and premature wear.

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4.5 Electrical installation

4.5.1 Connectors and connector assignments

CN1 motor connection Motor connector for connection of motor phases and holding brake

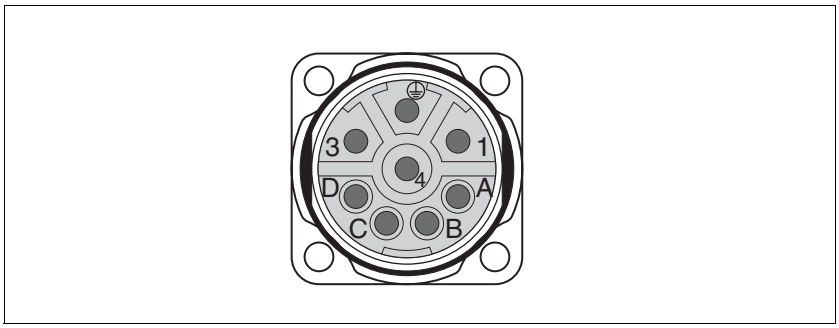

Figure 4.2 Pin assignment motor connector

Manufacturer: Coninvers,
motor connector 8 poles, BEGA089NN0000 0002 000

Pin	Assignment	Meaning
1	U	Motor cable
2	PE	Protective ground conductor
3	W	Motor cable
4	V	Motor cable
A	Brake +	Brake wire
B	Brake -	Brake wire
C	Not assigned	
D	Not assigned	
	SHLD	Shield (to connector housing)

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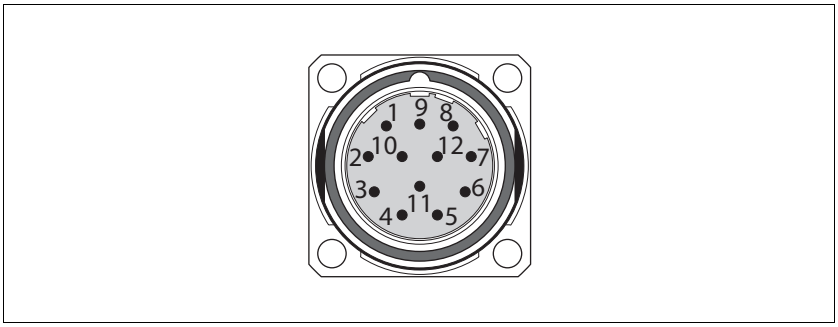
Encoder connectionSinCos Encoder

Encoder connector for connecting the SinCos encoder (singleturn and multiturn)



Manufacturer: Coninvers,
signal connector 12 poles, AEGA052NN0000 1250 000

Pin	Signal	Meaning	Pair [1]
1	T_MOT_OUT	Temperature sensor PTC	6
2	TMOT_0V	Reference potential to T_MOT_OUT	5
3		Not assigned	5
4	REFSIN_OUT	Reference for sine signal, 2.5 V	1
5	REFCOS_OUT	Reference for cosine signal, 2.5V	2
6	DATA	Receive data, transmit data	3
7	$\overline{\text{DATA}}$	Receive data and transmit data, inverted	3
8	SIN_OUT	Sine signal	1
9	COS_OUT	Cosine signal	2
10	ENC+10V	7...12 V supply voltage	6
11	ENC_0V	Ground connection [2]	4
12		Not assigned	4
	SHLD	Shield (to connector housing)	

1) Signal pairs must be twisted
2) The ENC_0V connection of the supply voltage has no connection to the encoder housing.

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4.5.2 Power and encoder connection

The motors are not suitable for direct connection to mains power. They must be operated with a suitable power stage.

⚠ DANGER

ELECTRIC SHOCK

High voltages at the motor connection may occur unexpectedly.

- The motor generates voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors in the motor cable.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment. Supplement the motor cable grounding conductor with an additional protective ground conductor to the motor housing.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNEXPECTED MOVEMENT

Drives may perform unexpected movements because of incorrect connection or other errors.

- Operate the motor with approved power stages only. Even if power stages are similar, different adjustment of the encoder system may be a source of hazards.
- Verify proper wiring. Even if the connectors for power connection and encoder system of a third-party power stage vendor match, this does not indicate compatibility.
- Only start the system if there are no persons or obstructions in the hazardous area.
- Run initial tests without coupled loads.
- Do not touch the motor shaft or the mounted output components.

Failure to follow these instructions can result in death, serious injury or equipment damage.

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⚠ CAUTION

FIRE HAZARD DUE TO POOR CONTACT

The motor connector may overheat and contacts may be destroyed by arcing if the connector is not properly connected and the union nut is not tightly screwed in place.

- Verify that the connector is properly plugged in and the union nut of the connector is tight.

Failure to follow these instructions can result in injury or equipment damage.

Motor and encoder system connectors must not be disconnected or reconnected as long as voltage is present.

Protective ground conductor connection

For safety reasons, a redundant protective ground conductor connection is required. Directly connect the motor housing to ground (PE).

Insulate unused wires individually.

Cable specifications

- Shielded cable
- Grounding of the shield at both ends
- Minimum cross section of the wires: see table
- Maximum cable diameter: see table
- Maximum cable length: depends on the required limit values for conducted interference

Motor cable BRH...		**057**	**085**	**110**
Maximum cable diameter	[mm]	16.3	16.3	16.3
Composition of the cable [1)]		4 x 1.5 mm^2 (4 x AWG 16) 2 x 0.5 mm^2 (2 x AWG 20)	4 x 1.5 mm^2 (4 x AWG 16) 2 x 0.5 mm^2 (2 x AWG 20)	4 x 1.5 mm^2 (4 x AWG 16) 2 x 0.5 mm^2 (2 x AWG 20)
Capacity of wires/shield		10 nF/100 m	10 nF/100 m	10 nF/100 m

1) Conductor cross section must be sufficient to allow the fuse at the mains connection to trip in case of fault

Encoder cable BRH... [1)]		**057**	**085**	**110**
Maximum cable diameter	[mm]	8.8	8.8	8.8
Composition of the cable (twisted pair)		10 x 2 x 0.25 mm^2 2 x 0.5 mm^2 (10 x 2 x AWG 23 2 x AWG 20)	10 x 2 x 0.25 mm^2 2 x 0.5 mm^2 (10 x 2 x AWG 23 2 x AWG 20)	10 x 2 x 0.25 mm^2 2 x 0.5 mm^2 (10 x 2 x AWG 23 2 x AWG 20)
Capacity of wires/shield		30 nF/100 m	30 nF/100 m	30 nF/100 m

1) Wiring and cable must meet the PELV requirements

- ▶ Note the EMC requirements for motor cable and encoder cable, page 36.
- ▶ Use equipotential bonding conductors for equipotential bonding.

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Assembling cables Follow the procedure and note the dimensions in Figure 4.3.

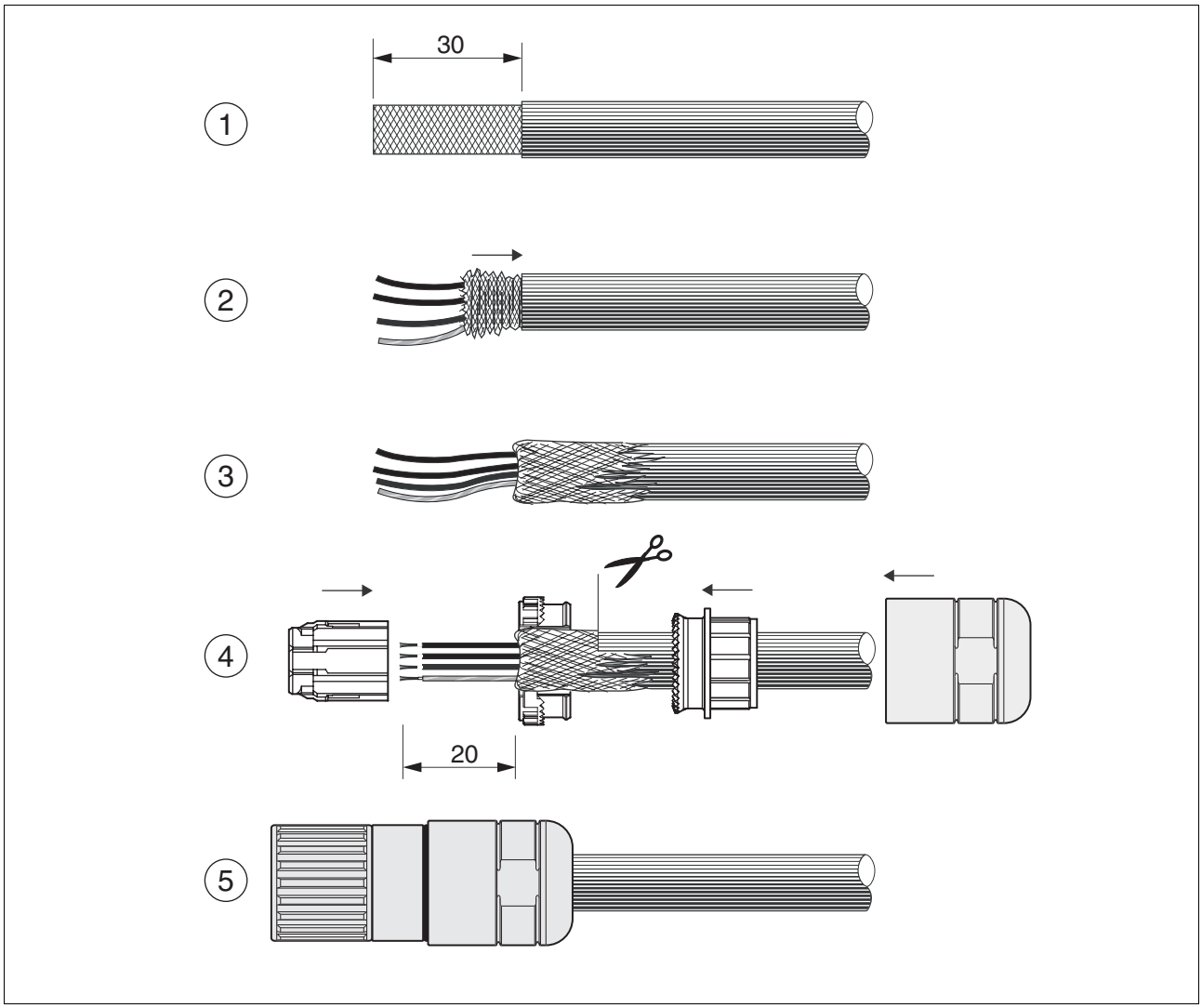

Figure 4.3 Assembly of the motor cable (same procedure for encoder cable)

- ▶ (1) Strip the cable jacket; length as specified.
- ▶ (2) Slide the shield braiding back over the cable jacket.
- ▶ (3)Insulate unused wires individually at both ends.
- ▶ (4) Shorten the wires to the specified length and solder or crimp them to the connector.
- ▶ (5) Slide the connector housing to the connector and screw them together.

Connecting the cables Place the female connector of the motor cable onto the male connector and tighten the union nut. Proceed in the same manner with the connection cable of the encoder system. Connect the motor cable and the encoder system cable to the drive according to the wiring diagram of the drive. Connect a large surface area of the shield to ground potential. If your motor is equipped with a holding brake, please follow the instructions in the next chapter.

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4.5.3 Holding brake connection

⚠ CAUTION

MISOPERATION OF THE HOLDING BRAKE CAUSED BY INCORRECT VOLTAGE

If the voltage is incorrect, the holding brake cannot be released which causes wear.

- Verify that the polarity of the voltage is correct. If the voltage polarity is incorrect, the holding brake cannot be released.
- Check the level of the voltage. If the voltage is higher than the specified value, there is a danger of the holding brake being re-applied.

Failure to follow these instructions can result in injury or equipment damage.

A motor with a holding brake requires a suitable holding brake controller which releases the brake exactly when the rotary movement starts and locks the motor shaft when the motor is stopped.

Holding brake controller

Use a suitable holding brake controller, such as HBC. A voltage reduction of the brake supply voltage is required after about 100 ms; otherwise the specified torque characteristic will not be reached due to the additional heat build-up. The holding brake controller must be galvanically isolated from the brake power supply and comply with the EMC standard IEC 618008-3.

Cable specifications

Two additional shielded wires in the motor cable are required for the brake:

- Minimum wire cross section: 2 * 1.0 mm^2 (AWG 17)
- Maximum cable length: depends on the required limit values for conducted interference

▶ Connect the wires to the matching connections.

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5 Commissioning

5.1 Preparing for commissioning

Before commissioning, check the following:

- Correct mechanical installation: in particular, verify proper mounting of the screws at the flange and tension-free alignment of the motor.
- Proper electrical installation: in particular, check the protective ground conductor connections and ground connections. Verify that all connections at the motor and the drive are correctly made and connected and that cable glands are properly tightened.
- Proper insulation of unused wires: unused wires must be properly insulated at both ends because induction currents may also flow in unused wires in drive systems.
- Contact protection: appropriate contact guards must be installed to avoid contact with electrical and mechanical or moving parts.
- Ambient and application conditions: verify that the specified ambient conditions are met and that the drive solution matches the operating conditions as specified on the nameplate.
- Drive elements: verify that any output components already installed are balanced and accurately aligned.
- Parallel key on the shaft end of the motor: if you have a motor with a parallel key groove and parallel key, the parallel key must not be inserted during commissioning without output component or it must be appropriately secured.
- Function of the holding brake: Verify that the holding brake really holds the maximum load. Verify that the holding brake is released when the brake voltage is applied.

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5.2 Performing commissioning

⚠ WARNING

UNEXPECTED MOVEMENT

Drives may perform unexpected movements because of incorrect connection or other errors.

- Operate the motor with approved power stages only. Even if power stages are similar, different adjustment of the encoder system may be a source of hazards.
- Verify proper wiring. Even if the connectors for power connection and encoder system of a third-party power stage vendor match, this does not indicate compatibility.
- Only start the system if there are no persons or obstructions in the hazardous area.
- Run initial tests without coupled loads.
- Do not touch the motor shaft or the mounted output components.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

MOVEMENT WITHOUT BRAKING EFFECT

If power outage and faults cause the power stage to be switched off, the motor is no longer stopped by the brake and may increase its speed even more until it reaches a mechanical stop.
Overload or faults can cause danger due to the failure of the holding brake.
Incorrect use of the holding brake results in premature wear and failure.

- Do not use the internal brake as a service brake.
- If necessary, use a damped mechanical stop or a service brake.
- Verify the function of the brake.
- In addition, secure the hazardous area so it cannot be accessed.
- The brake function must be checked again after frequent EMERGENCY STOP braking operations.

Failure to follow these instructions can result in death, serious injury or equipment damage.

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⚠ WARNING

ROTATING PARTS

Rotating parts may cause injuries and may catch clothing or hair. Loose parts or parts that are unbalanced may be flung.

- Verify correct mounting and installation of all rotating parts.
- Use a cover to help protect against rotating parts.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

FALLING PARTS

The motor may move, tip and crash down as a result of the reaction torque.

- Mount the motor securely so it will not break loose during strong acceleration.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ CAUTION

HOT SURFACES

Depending on the operation, the surface may heat up to more than 100°C (212°F).

- Do not allow contact with the hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.
- Check the temperature during test runs.

Failure to follow these instructions can result in injury or equipment damage.

Observe the information on commissioning in the product manual of the drive.

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6 Diagnostics and troubleshooting

6.1 Diagnostics and troubleshooting

6.1.1 Mechanical problems

Error	Cause	Troubleshooting
Excessive heat	Overload	Reduce load
	Holding brake not released	Check the holding brake controller
	Heavy pollution	Clean the motor
Whistling or knocking noise	Shaft bearing	Contact service
Grinding noise	Rotating output component grinds	Align output component
Radial oscillation	Poor alignment of output component	Align output component
	Output element out of balance	Balance output component
	Shaft bent	Contact service
	Resonance with mounting elements	Check the stiffness of the motor mounting
Axial oscillation	Poor alignment of output component	Align output component
	Shocks of the output component	Check output component
	Resonance with mounting elements	Check the stiffness of the motor mounting

6.1.2 Electrical problems

Error	Cause	Troubleshooting
Motor does not start or starts with problems	Overload	Reduce load
	Drive error	Check drive
	Connection cables, phases / winding short circuit	Check connection cable and connections
	Temperature sensor in the motor and temperature evaluation by drive do not match	Check, contact service
Excessive heat	Overload	Reduce power
Heat at connection terminals	Connector loose or not tightened	Tighten connector

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7 Accessories and spare parts

7.1 Holding brake controller

Designation	Order no.
Holding brake controller HBC	VW3M3103

7.2 Pre-assembled motor cables

Designation	Order no.
Motor cable 3 m for servo motor, 4*1.5 mm² and 2*1.0 mm² shielded; motor end 8 pole circular connector M23, other cable end open	VW3M5101R30
Motor cable 5 m for servo motor, 4*1.5 mm² and 2*1.0 mm² shielded; motor end 8 pole circular connector M23, other cable end open	VW3M5101R50
Motor cable 10 m for servo motor, 4*1.5 mm² and 2*1.0 mm² shielded; motor end 8 pole circular connector M23, other cable end open	VW3M5101R100
Motor cable 15 m for servo motor, 4*1.5 mm² and 2*1.0 mm² shielded; motor end 8 pole circular connector M23, other cable end open	VW3M5101R150
Motor cable 20 m for servo motor, 4*1.5 mm² and 2*1.0 mm² shielded; motor end 8 pole circular connector M23, other cable end open	VW3M5101R200

7.3 Pre-assembled encoder cables

Designation	Order no.
Encoder cable 3m for servo motor, 5*(2*0.25 mm²) and 1*(2*0.5 mm²) shielded; motor end 12 pole circular connector, device end 12 pole connector	VW3M8101R30
Encoder cable 5m for servo motor, 5*(2*0.25 mm²) and 1*(2*0.5 mm²) shielded; motor end 12 pole circular connector, device end 12 pole connector	VW3M8101R50
Encoder cable 10m for servo motor, 5*(2*0.25 mm²) and 1*(2*0.5 mm²) shielded; motor end 12 pole circular connector, device end 12 pole connector	VW3M8101R100
Encoder cable 15m for servo motor, 5*(2*0.25 mm²) and 1*(2*0.5 mm²) shielded; motor end 12 pole circular connector, device end 12 pole connector	VW3M8101R150
Encoder cable 20m for servo motor, 5*(2*0.25 mm²) and 1*(2*0.5 mm²) shielded; motor end 12 pole circular connector, device end 12 pole connector	VW3M8101R200

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8 Service, maintenance and disposal

⚠ DANGER

ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this drive system. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.

  Supplement the motor cable grounding conductor with an additional protective ground conductor to the motor housing.
- Do not touch unshielded components or terminals with voltage present.
- The motor generates voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors in the motor cable.
- Do not short across the DC bus terminals or the DC bus capacitors.
- Before performing work on the drive system:
  - Disconnect all power, including external control power that may be present.
  - Place a "DO NOT TURN ON" label on all power switches.
  - Lock all power switches in the open position.
  - Wait for the DC bus capacitors to discharge (see the product manual for the power stage). Then measure the DC bus voltage and verify it is less than < 42 V_{dc} (see the product manual for the power stage).
- Install and close all covers before applying voltage.

Failure to follow these instructions will result in death or serious injury.

8.1 Service address

If you have any questions please contact your sales office. Your sales office staff will be happy to give you the name of a customer service office in your area.

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8.2 Storage

The motors must be transported and stored in a dry, dust-free and vibration-free environment. The ambient conditions and application conditions specified in chapter 3.1 "General features" must be met; in case of doubt you must air-condition the storage location.

The storage time is primarily determined by the service life of the lubricants; do not store the product for more than 36 months. It is recommended to periodically operate the drive solution to maintain its operability.

8.3 Unpacking

- ▶ Check the parts supplied to make sure they are complete.
- ▶ Inspect all parts for damage.
- ▶ Check the motor nameplate to verify it is the correct motor. For an explanation of the structure of the information on the nameplate, see page 12.

8.4 Maintenance

Repairs may only be made by the manufacturer. No warranty or liability is accepted for repairs made by unauthorized persons.

Repairs cannot be made with the device installed.

Prior to any type of work on the drive system, consult the chapters on Installation and Commissioning for information on the precautions and processes to be observed.

The motor is maintenance-free. However, we recommend the following maintenance work at regular intervals:

Connections and fastening

- ▶ Check all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- ▶ Check that all output elements are firmly seated.
- ▶ Tighten all mechanical and electrical threaded connections to the specified torque. Check the union nuts at the connection cables.

Lubricating shaft sealing ring

In the case of motors with shaft sealing rings, lubricant must be applied between the sealing lip of the shaft sealing ring and the shaft with a suitable non-metallic tool. If the shaft sealing rings are allowed to run dry, the service life of the sealing rings will be significantly reduced.

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Cleaning

⚠ WARNING

UNEXPECTED MOVEMENT

If the approved ambient conditions are exceeded, external substances from the environment may penetrate and cause unexpected movement or equipment damage.

- Verify that the ambient conditions are met.
- Do not allow seals to run dry.
- Keep liquids from getting to the shaft end (for example in mounting position IM V3).
- Do not expose the shaft sealing rings and cable entries to the direct spray of a pressure cleaner.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Clean dust and dirt off the motor at regular intervals. Insufficient heat dissipation to the ambient air may excessively increase the temperature.

Motors are not suitable for cleaning with a high-pressure cleaner. The high pressure may force water into the motor.

When using solvents or cleaning agents, verify that the motor and encoder cables, cable entry seals, O rings and motor paint are not damaged.

Replacing the shaft bearing

The customer must not replace the shaft bearing. The motor will be partially demagnetized by this procedure and lose power.

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8.5 Changing the motor

- ▶ Switch off all supply voltages. Verify that no voltages are present (safety instructions).
- ▶ Label all connections and uninstall the product.
- ▶ Note the identification number and the serial number shown on the product nameplate for later identification.
- ▶ Install the new product as per chapter 4 "Installation".
- ▶ Commission the product as per chapter 5 "Commissioning".

8.6 Shipping, storage, disposal

Note the ambient conditions in chapter 3.1 "General features".

Shipping The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

Storage The product may only be stored in spaces where the specified permissible ambient conditions for room temperature and humidity are met. Protect the product from dust and dirt.

Disposal The product consists of various materials that can be recycled and must be disposed of separately. Dispose of the product in accordance with local regulations.

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9 Glossary

9.1 Units and conversion tables

The value in the specified unit (left column) is calculated for the desired unit (top row) with the formula (in the field).

Example: conversion of 5 meters [m] to yards [yd]
5 m / 0.9144 = 5.468 yd

9.1.1 Length

	in	ft	yd	m	cm	mm
in	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
ft	* 12	-	/ 3	* 0.30479	* 30.479	* 304.79
yd	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
m	/ 0.0254	/ 0.30479	/ 0.9144	-	* 100	* 1000
cm	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
mm	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

9.1.2 Mass

	lb	oz	slug	kg	g
lb	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
oz	/ 16	-	* $1.942559*10^{-3}$	* 0.02834952	* 28.34952
slug	/ 0.03108095	/ $1.942559*10^{-3}$	-	* 14.5939	* 14593.9
kg	/ 0.45359237	/ 0.02834952	/ 14.5939	-	* 1000
g	/ 453.59237	/ 28.34952	/ 14593.9	/ 1000	-

9.1.3 Force

	lb	oz	p	dyne	N
lb	-	* 16	* 453.55358	* 444822.2	* 4.448222
oz	/ 16	-	* 28.349524	* 27801	* 0.27801
p	/ 453.55358	/ 28.349524	-	* 980.7	* $9.807*10^{-3}$
dyne	/ 444822.2	/ 27801	/ 980.7	-	/ $100*10^{3}$
N	/ 4.448222	/ 0.27801	/ $9.807*10^{-3}$	* $100*10^{3}$	-

9.1.4 Power

	HP	W
HP	-	* 746
W	/ 746	-

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9.1.5 Rotation

	min^{-1} (RPM)	**rad/s**	**deg./s**
min^{-1} (RPM)	-	* π / 30	* 6
rad/s	* 30 / π	-	* 57.295
deg./s	/ 6	/ 57.295	-

9.1.6 Torque

	lb·in	**lb·ft**	**oz·in**	**Nm**	**kp·m**	**kp·cm**	**dyne·cm**
lb·in	-	/ 12	* 16	* 0.112985	* 0.011521	* 1.1521	* $1.129*10^{6}$
lb·ft	* 12	-	* 192	* 1.355822	* 0.138255	* 13.8255	* $13.558*10^{6}$
oz·in	/ 16	/ 192	-	* $7.0616*10^{-3}$	* $720.07*10^{-6}$	* $72.007*10^{-3}$	* 70615.5
Nm	/ 0.112985	/ 1.355822	/ $7.0616*10^{-3}$	-	* 0.101972	* 10.1972	* $10*10^{6}$
kp·m	/ 0.011521	/ 0.138255	/ $720.07*10^{-6}$	/ 0.101972	-	* 100	* $98.066*10^{6}$
kp·cm	/ 1.1521	/ 13.8255	/ $72.007*10^{-3}$	/ 10.1972	/ 100	-	* $0.9806*10^{6}$
dyne·cm	/ $1.129*10^{6}$	/ $13.558*10^{6}$	/ 70615.5	/ $10*10^{6}$	/ $98.066*10^{6}$	/ $0.9806*10^{6}$	-

9.1.7 Moment of inertia

	lb·in^2	**lb·ft^2**	**kg·m^2**	**kg·cm^2**	**kp·cm·s^2**	**oz·in^2**
lb·in^2	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	* 16
lb·ft^2	* 144	-	* 0.04214	* 421.4	* 0.429711	* 2304
kg·m^2	* 3417.16	/ 0.04214	-	* $10*10^{3}$	* 10.1972	* 54674
kg·cm^2	* 0.341716	/ 421.4	/ $10*10^{3}$	-	/ 980.665	* 5.46
kp·cm·s^2	* 335.109	/ 0.429711	/ 10.1972	* 980.665	-	* 5361.74
oz·in^2	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

9.1.8 Temperature

	°F	**°C**	**K**
°F	-	(°F - 32) * 5/9	(°F - 32) * 5/9 + 273.15
°C	°C * 9/5 + 32	-	°C + 273.15
K	(K - 273.15) * 9/5 + 32	K - 273.15	-

9.1.9 Conductor cross section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm^2	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm^2	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

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9.2 Terms and Abbreviations

Axial forces	Tension or compression forces acting longitudinally on the shaft
Centering collar	Centering device at the motor flange that allows for accurate motor mounting.
Degree of protection	The degree of protection is a standardized specification for electrical equipment that describes the protection against the ingress of foreign objects and water (for example: IP 20).
EMC	Electromagnetic compatibility
Encoder	Sensor for detection of the angular position of a rotating component. Installed in a motor, the encoder shows the angular position of the rotor.
Error	Discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition.
Error class	Classification of errors into groups. The different error classes allow for specific responses to faults, for example by severity.
Fatal error	In the case of fatal error, the product is not longer able to control the motor, so that an immediate deactivation of the power stage is necessary.
Fault	Operating state of the drive caused as a result of a discrepancy between a detected (computed, measured or signaled) value or condition and the specified or theoretically correct value or condition.
Fault reset	A function used to restore the drive to an operational state after a detected error is cleared by removing the cause of the error so that the error is no longer active (transition from operating state "Fault" to state "Operation Enable").
Length	Length of motor without optional equipment (such as holding brake or gearbox)
PTC	Resistor with positive temperature coefficient. Resistance value increases as the temperature rises.
Radial forces	Forces that act radially on the shaft
Size	Defined by the flange size in the type code
Warning	If the term is used outside the context of safety instructions, a warning alerts to a potential problem that was detected by a monitoring function. A warning is not an error and does not cause a transition of the operating state.

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