B&R Motion Control
Overview Catalog 7/2003

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Model No.: MAMSKAT-E

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1. Servo Drives

1.1 ACOPOS

With the ACOPOS product line, B&R provides the basis for complete and uniform automation solutions. Branch specific functions and intuitive tools allow for short development times and create more room for innovation.

1.1.1 Maximum Security

EMC was given special attention in order to guarantee proper operation in an industrial environment. Field tests have been carried out under difficult conditions in addition to the tests defined in the standard. The results confirm the excellent values measured by the testing laboratory and during operation. The filters required to meet the CE guidelines are also integrated in the device. This simplifies installation considerably.

Figure 1: Maximum security

The embedded parameter chip on the motor is one factor used to guarantee maximum security. It contains all mechanical and electronic data relevant to the functionality of the motor. Parameters no longer have to be set manually and start-up times are substantially reduced. Secure operation also means that relevant data can be requested during service and the cause of the problem can be determined.

1.1.2 Taking it to the Limit

Operational security is also improved by monitoring high temperature components (IGBT modules, brake resistor, motor windings). Computer-based simulation allows component temperatures which cannot be measured directly to be calculated. One example is the junction temperature. This is a decisive value for the maximum load of a semiconductor. Using these models, a sufficiently precise value can be determined for each IGBT. Hot spots can be ruled out and the full dynamic properties of the device can be used at low rpm values and when stalled. The brake resistor and motor windings are monitored in the same way.

This form of monitoring allows better use of absolute limits on the drive and provides the user with the advantages of higher performance at lower costs.

1.1.3 Individual I/O Configurations

The I/O points needed to operate a servo axis are part of the standard equipment for ACOPOS drives. The user is provided two trigger inputs for tasks requiring precise measurements or print mark control. Sensor and actuator configurations are made using modular plug-in modules. This modular concept allows the optimum configuration to be selected to meet the requirements of the application.

Figure 2: Individual I/O configurations

1.1.4 Configuring Instead of Programming

Long-term cooperation with our customers has provided us with fundamental knowledge in many positioning application areas. This knowledge can be passed on to our customers in the form of clear and easy to use function blocks. Industry specific functionality can be quickly and easily implemented in an application program.

1.1.5 Easy Service

All necessary data is placed in application memory on the controller so that service is limited to simply exchanging the device. The program does not have to be changed. After the system is started again, the controller installs the operating system that is used automatically (or when requested by the user). After this procedure is complete, the parameters are sent to the servo drive again. Problems resulting from different software versions or parameters can be ruled out.

1.1.6 Software and Hardware as a Unit

B&R integrates all relevant technologies in one tool - B&R Automation Studio™.

Adding a B&R ACOPOS servo drive is done in a Windows Look & Feel environment which becomes routine after using the program a few times. Wizards and selection boxes ease configuration of servo axis parameters. The target system is shown in a clear tree structure. Detailed information concerning the target system, with integrated hardware documentation ranging from software to terminal assignments, reduces project development times considerably.

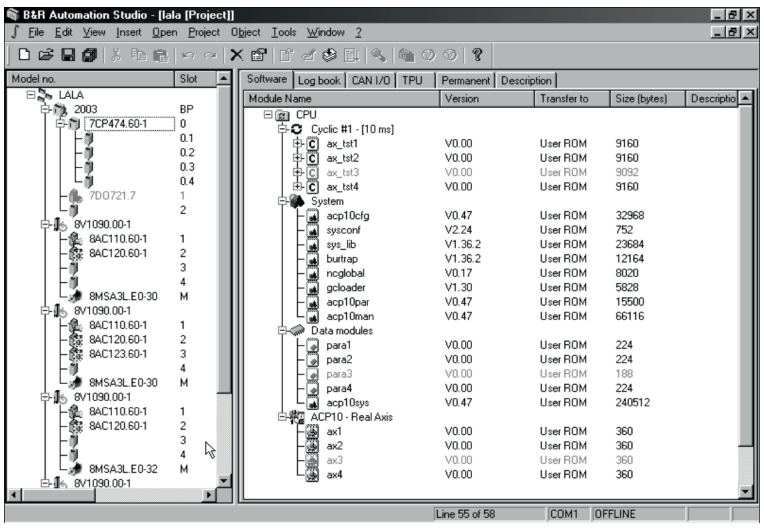


Figure 3: Software and hardware as a unit

1.1.7 Plain Text for Functions

NC Objects that can be accessed by the application program are also stored on the CPU (like the application program).

Creating NC Objects (for axes, a CNC system or a cam profile) takes place using dialog boxes and special data module editors. The individual hardware and software channels are assigned symbolic names. This eases use and increases clarity. The initial parameters are set in a separate editor in plain text.

1.1.8 Simple Function Test

The built-in NC test allows an axis to be used without a line of program code being written. As seen in the picture, several editors are grouped together as a single window. All movements, ranging from point-to-point movements to gear functions, can be carried out using an NC Action. The reaction of the axis can be seen online in the monitor window. If the trace function is turned on, relevant data - from position to motor temperature - is recorded on the drive. The multiple curve display in the trace window allows simple evaluation of the movement results.

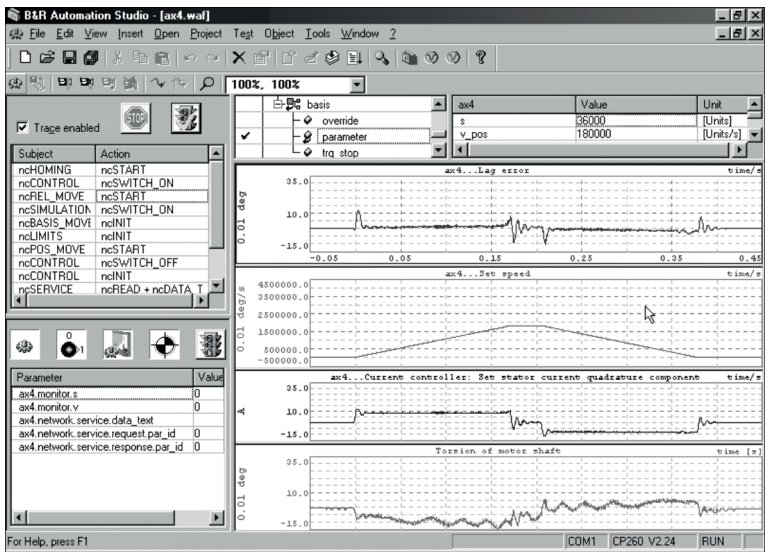


Figure 4: Simple function test

1.1.9 Control Trigger

The oscilloscope in the drive allows movements to be monitored in real time. Many trigger possibilities allow data required for analysis to be easily obtained. The graphic display of diagnosis data supports the user when making fine adjustments and when optimizing the movement. Measurement cursor and reference points allow µs precision.

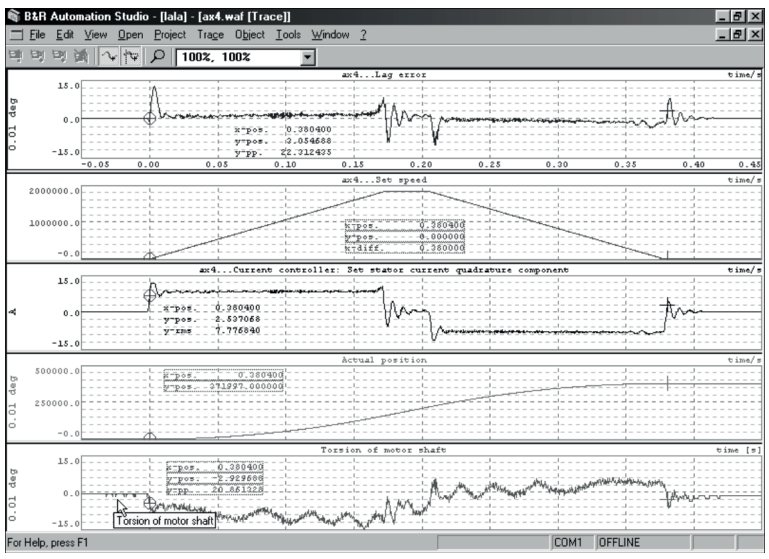


Figure 5: Control trigger

1.1.10 Cam Profiles for Everyone

Modular technology plug-ins allow homogenous integration of high performance tools such as the Cam Editor.

The mouse is used to define fixed points, synchronous sections or interpolations. Effects of positioning behavior on speed, acceleration and jolt for the slaves axes connected can be monitored directly.

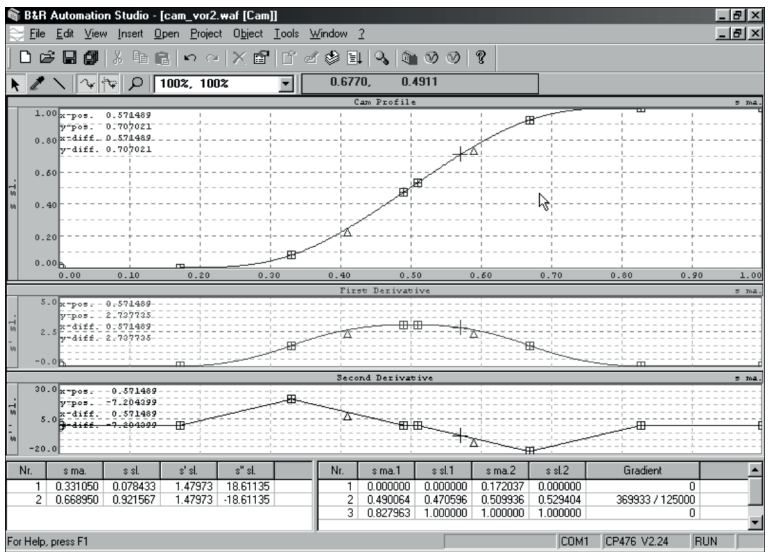


Figure 6: Cam profiles for everyone

1.1.11 Configurations

General Information

The ACOPOS servo drives can be used in various configurations depending on the network type (CAN, Powerlink) and the requirements of the application.

The following ACOPOS functions are possible with all ACOPOS configurations:

- Point-to-point
- Electronic gears
- Electronic compensation gears
- Electronic cam profiles
- Flying saw
- Line shaft
- CNC

CAN

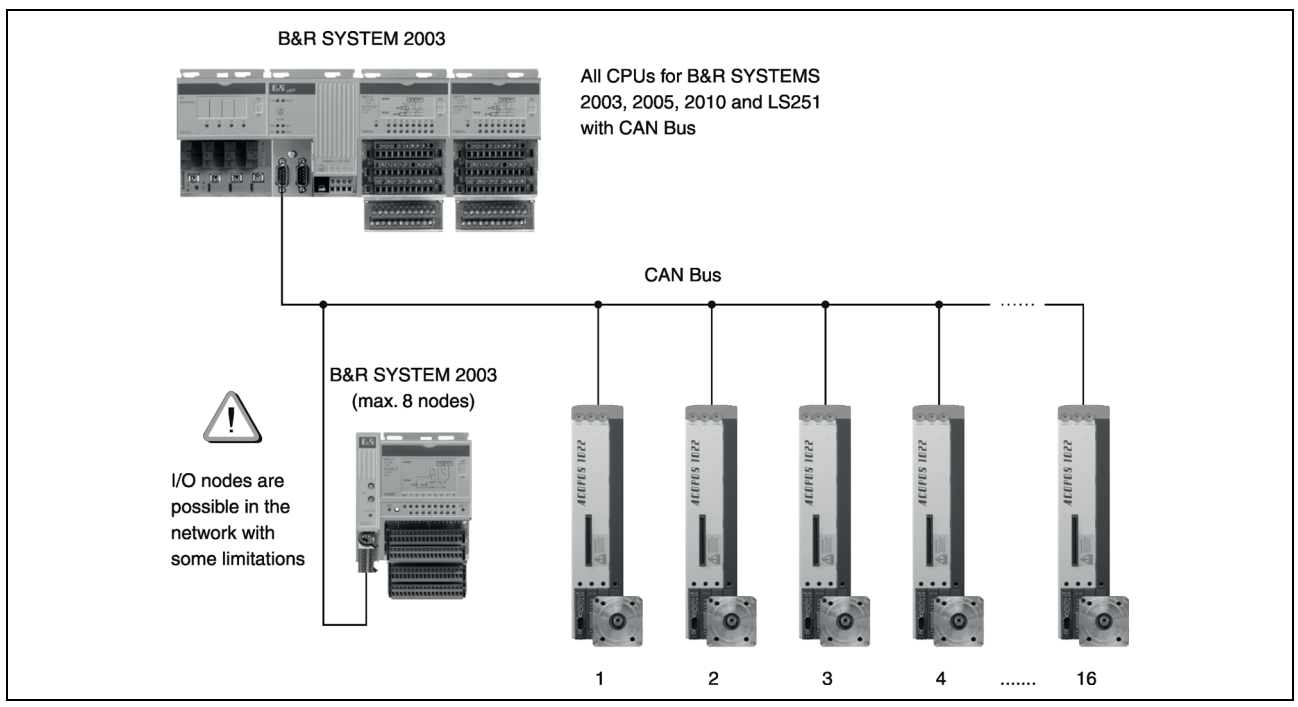


Figure 7: CAN configuration

Powerlink

Recommended Topology

In the Powerlink network (seen from the manager), the tree structure should always come first followed then by the line structure. Otherwise, the line structure delay affects the entire tree beneath it.

Information:

It should be noted that the longest path is allowed a maximum of 10 hubs by the manager.

Further Literature

Unless otherwise stated, the recommendations in the following documents apply:

- "Industrial Ethernet Planning and Installation Guide", Draft 2.0, IAONA (www.iaona-eu.com)
- "Guide to Understanding and Obtaining High Quality Generic Cabling", 3P Third Party Testing (www.3ptest.dk)

Configuration 1

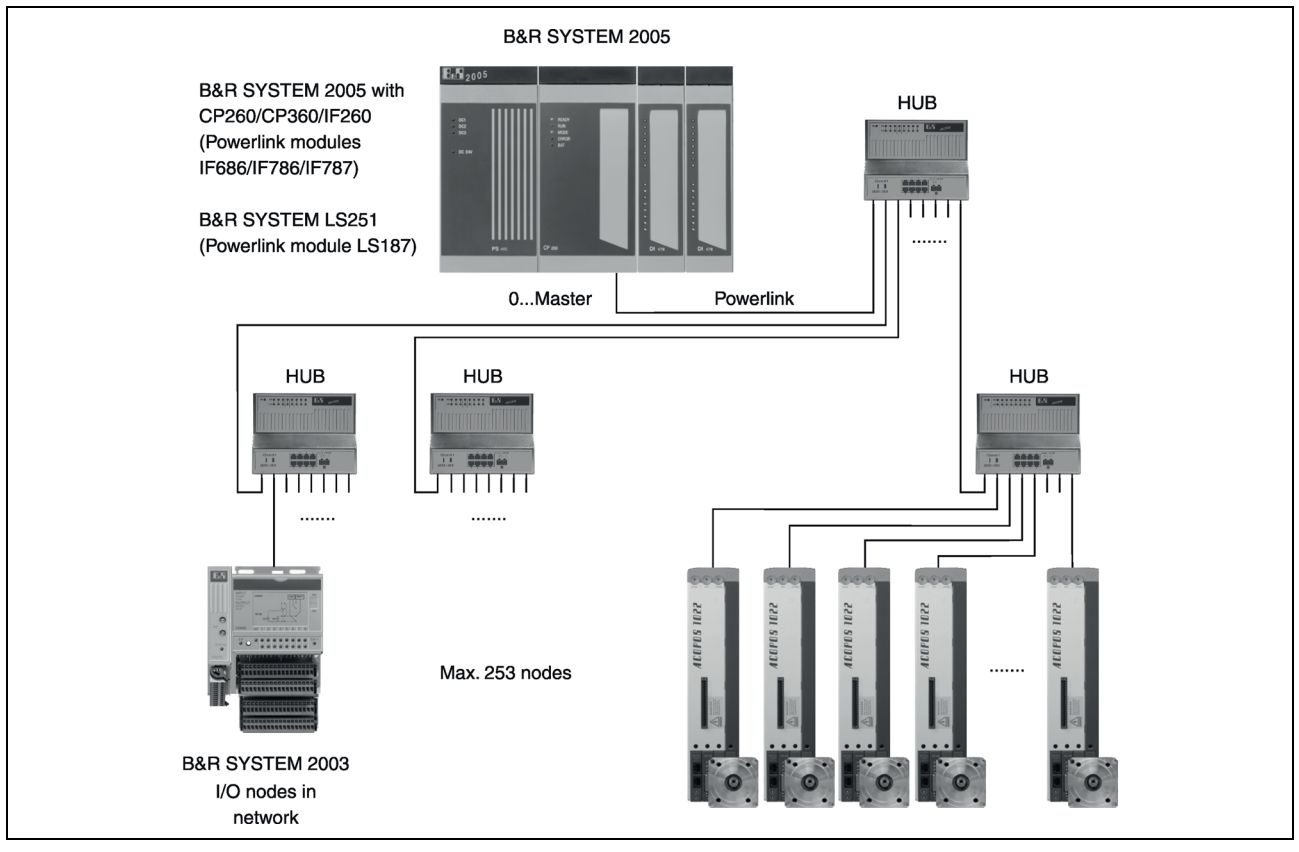


Figure 8: Powerlink configuration 1 - star topology

Configuration 2

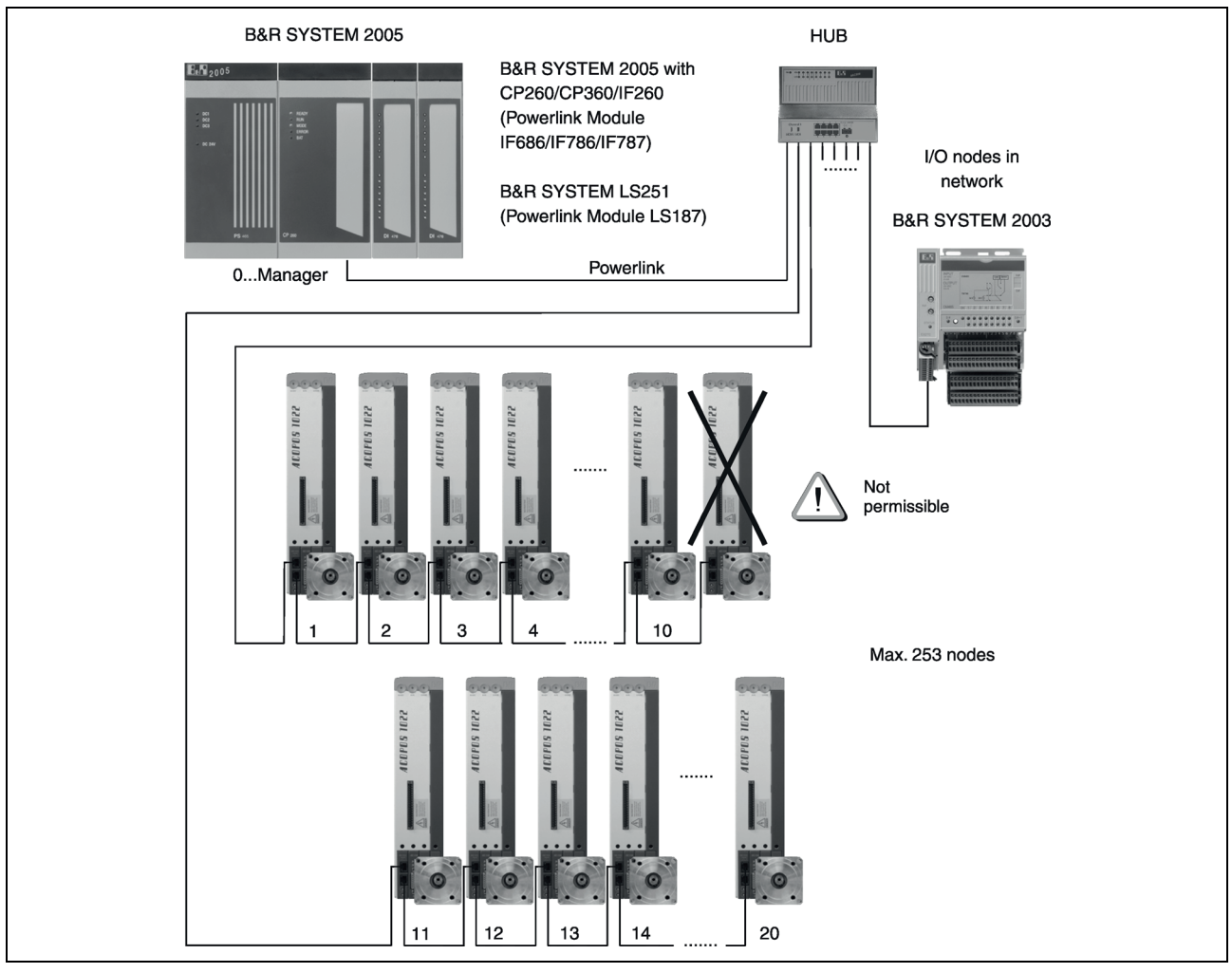


Figure 9: Powerlink configuration 2 - line topology

The functionality is the same as in configuration 1. The advantage compared to configuration 1 is the low cabling expenditure.

2. Servo Motors

2.1 Three-phase Synchronous Motors 8MS

B&R three-phase synchronous motors 8MS have been specially developed for use in high-performance applications. They are now being used to produce consumer goods and products in the plastic, packaging, metal, food and beverage industries and then pallet them with material handling systems.

Complete solutions from one source, this requires the right components and also the right configuration for the application environment. The large selection of available three-phase synchronous motors makes it possible to easily meet conditions such as reducing the variety of parts, guaranteeing ease of service and maintaining minimum requirements on space.

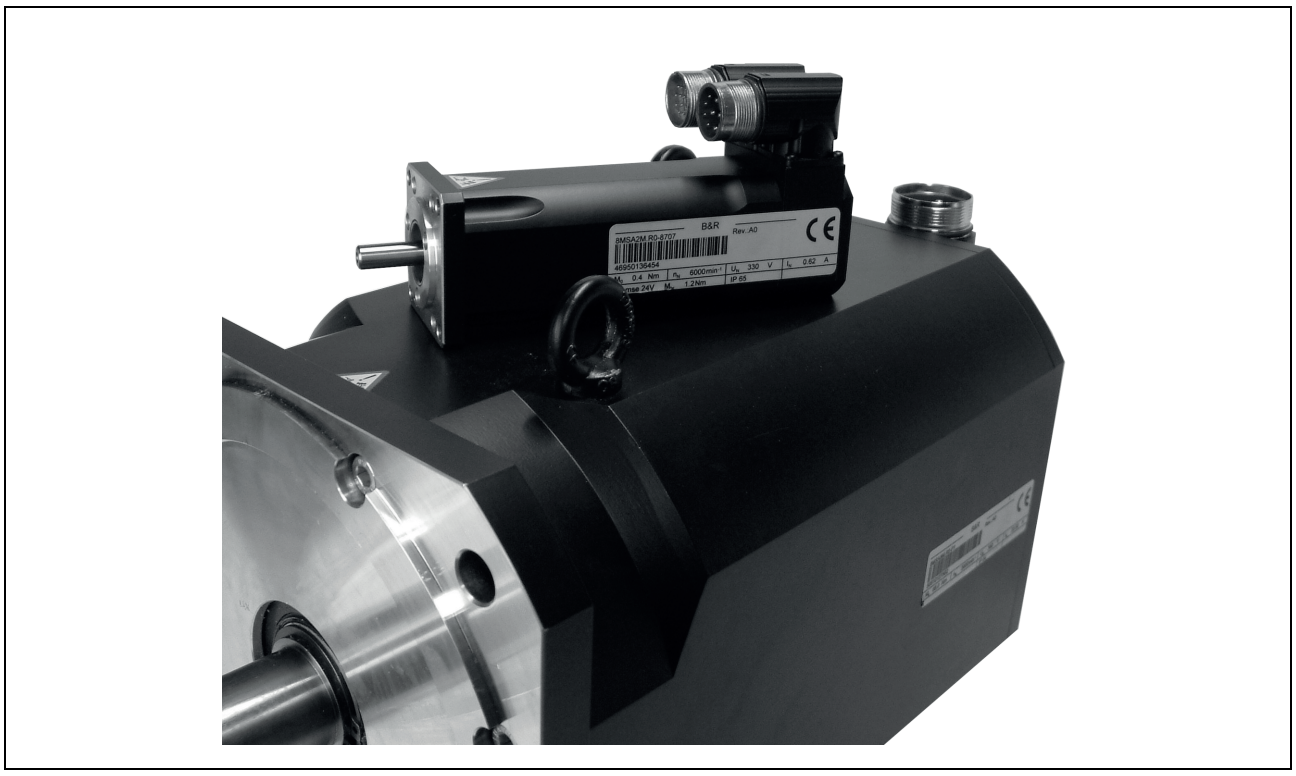


Figure 10: Three-phase synchronous motors 8MS

An optimally configured drive rounds off a successful construction. To meet this goal, specialists are available in B&R subsidiaries all over the world who are eager to share their know-how in the area of mechatronics.

B&R automation components, the economical combination of mechanics, electronics, technology and innovation.

2.1.1 Feedback Systems Specified to Meet your Needs

The three-phase synchronous motors 8MS are available with different encoder systems. As standard, they are equipped with Heidenhain encoders. Depending on the application, the customer can select between normal and high-resolution encoders. Both types are also available as multi-turn encoders. They allow operation without requiring homing procedures or additional measurement systems on the work piece. The absolute encoder functions without a battery and is therefore absolutely maintenance-free.

The three-phase synchronous motor are also available with resolvers for machines with lower precision and speed requirements.

2.1.2 Embedded Parameter Chip

All relevant mechanical and electrical information and data is stored in the encoder used for the three-phase synchronous motors 8MS. That means the user doesn't have to make settings on the servo drive in the field. As soon as the encoder is connected to the servo drive and the power is applied to the electronics, the motor is automatically identified. The motor sends the nominal and limit values to the servo drive. Then the drive automatically determines the current limits and current control parameters required for secure operation of the motor. The user only has to optimize the speed and position controller. The integrated start-up environment in B&R Automation Studio™ provides assistance.

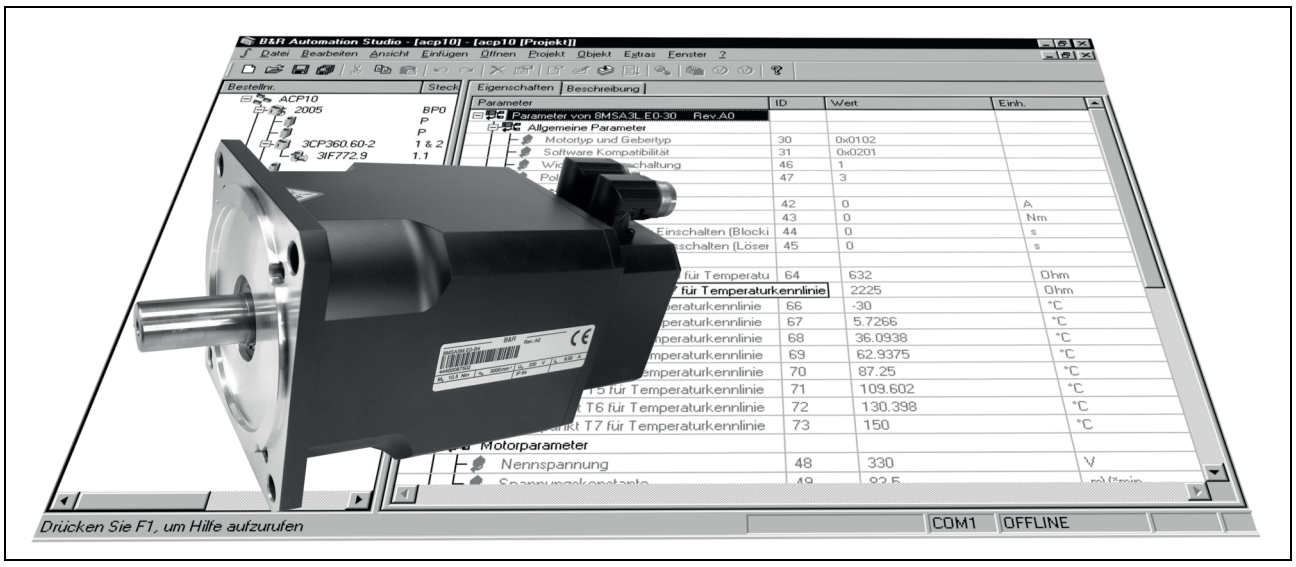


Figure 11: Start-up with B&R Automation Studio™

In addition to start-up assistance, routine service work is also made easier and motors can be exchanged without having to take extra time to set parameters.

2.1.3 Smooth Surface

The special construction of the surface of the three-phase synchronous motors 8MS allow them to be used in applications for the food and beverage branch. Depressions where liquid could collect were consciously avoided.

2.1.4 Connection Technology

The uniform connection technology, the prefabricated cables and the embedded parameter chip described above allow plug and play operation of the power transmission system.

2.1.5 Custom Configurations

B&R has already developed successful projects where a custom drive configuration was required. An example is direct attachment of a drive belt disk to the motor shaft. Using bearings that withstand the high radial forces required by the construction allows the motor and belt drive to be easily installed. High-alloy steel is used to keep the shaft diameter small for trouble free mounting of small belt disks (in spite of enormous loads).

An enthusiastic customer hit the nail on the head: "We are killing two birds with one stone by using this solution. Easier construction, smaller installation dimensions, exemplary friendly service and all that with lower costs!".

Chapter 2 • Servo Drives

1. ACOPOS

1.1 General Description

Controlling your power transmission system with B&R ACOPOS servo drives allows you to fully use the advantages of an optimized system architecture. Applications that require additional positioning tasks such as torque limitation or torque control can be created quickly and elegantly.

The flexible system concept for B&R servo drives is achieved using matched hardware and software components. You can select the optimal system configuration for your application and increase your competitiveness.

- Perfect integration in the B&R 2000 product family
- Object-oriented axis programming minimizes development time and increases reusability
- Integrated technology functions for branch specific tasks
- Operation of synchronous and asynchronous motors possible
- Current controller scan time up to 50 µs
- Reduced commissioning and service times using "embedded motor parameter chip"
- CAN and Powerlink network connection
- Input voltage range from 400 - 480 VAC (±10 %) for use worldwide
- Connection possibilities for all standard encoder systems
- 2 free slots for optional technology modules
- Electronic secure restart inhibit integrated

The ACOPOS servo drive series covers a current range from 2.2 - 128 A and a power range from 1 - 64 kW with 7 devices in 3 groups. The devices in a group are designed using the same basic concept.

Group	8V1022.00-2 8V1045.00-2 8V1090.00-2	8V1180.00-2 8V1320.00-2	8V1640.00-2 8V128M.00-2
Power Connections	Plug connection	Plug connection	Fixed
Integrated Line Filter	Yes	Yes	--- [1]
Mains Failure Monitoring	Yes	Yes	Yes
DC Bus Connection	Yes	Yes	Yes
24 VDC Supply	External [2]	External or using integrated DC bus power supply	External or using integrated DC bus power supply
24 VDC Output	No	24 V / 0.5 A	24 V / 0.5 A
Integrated Brake Chopper	Yes	Yes	Yes
Internal Braking Resistor	Yes	Yes	Yes [3]
Connection of External Braking Resistor Possible	No	Yes	Yes
Monitored Output for Motor Holding Brake	Yes	Yes	Yes
Monitored Input for Motor Temperature Sensor	Yes	Yes	Yes

Table 1: General description of the ACOPOS servo drive series

1) Integrated line filter in preparation.
2) External DC bus power supply 0PS320.1 (24V / 20A) can be used.
3) The braking resistor integrated in the ACOPOS servo drives 1640 and 128M is dimensioned so that it is possible to brake to a stop (in a typical drive situation).

ACOPOS servo drives are suitable for both synchronous and asynchronous servo motors and have built-in line filters to meet the limit values for CISPR11, Group 2, Class A.

The ACOPOS servo drives also provide a modular fieldbus interface in addition to connection possibilities for all standard encoder systems.

1.1.1 Secure Restart Inhibit

ACOPOS servo drives have a built-in secure restart inhibit to guarantee that the device is stopped securely and to prevent it from restarting unexpectedly. It is designed to correspond to safety category 3 according to EN 954-1. [1)]

In addition to preventing the device from restarting unexpectedly according to EN 1037, this safety function also meets the requirements of IEC 60204-1 regarding the stop function for categories 0 and 1. Both stop functions require the supply to the machine drives to be switched off (immediately for category 0 and after stopping for category 1).

The restart inhibit interrupts the supply to the motor by preventing the pulses to the IGBTs. In this way, a rotating field can no longer be creating in synchronous and asynchronous motors controlled by the ACOPOS servo drives. This fulfills the requirements of EN 1037 regarding preventing the device from starting unexpectedly and IEC 60204-1 regarding the stop function for categories 0 and 1.

1.1.2 24 VDC Supply during Power Failures

In order to be able to provide the stop function for category 1 according to IEC 60204-1 during a power failure, the 24 VDC supply voltage for the servo drives as well as encoders, sensors and the safety circuit must remain active during the entire stopping procedure.
The ACOPOS servo drives recognize a power failure and can immediately initiate active braking of the motor. The brake energy that occurs when braking is returned to the DC bus and the DC bus power supply can use it to create the 24 VDC supply voltage [2)] . An external DC bus power supply must be used for ACOPOS servo drives 8V1022 to 8V1090. A DC bus power supply is integrated in ACOPOS servo drives 8V1180 to 8V128M.
The ACOPOS servo drives with an integrated DC bus power supply provide the 24 VDC supply for the servo drive and also a 24 VDC output to supply encoders, sensors and the safety circuit. In may cases, it is not necessary to use an uninterruptible power supply (UPS) which is otherwise needed.

1.2 Order Data

Model Number	Short Description
8V1022.00-2	Servo drive 3 x 400-480V 2.2A 1kW, line filter, braking resistor and electronic secure restart inhibit integrated
8V1045.00-2	Servo drive 3 x 400-480V 4.4A 2kW, line filter, braking resistor and electronic secure restart inhibit integrated
8V1090.00-2	Servo drive 3 x 400-480V 8.8A 4kW, line filter, braking resistor and electronic secure restart inhibit integrated
8V1180.00-2	Servo drive 3 x 400-480V 18A 9kW, line filter, braking resistor, DC bus power supply and electronic secure restart inhibit integrated
8V1320.00-2	Servo drive 3 x 400-480V 32A 16kW, line filter, braking resistor, DC bus power supply and electronic secure restart inhibit integrated
8V1640.00-2	Servo drive 3 x 400-480V 64A 32kW, line filter, braking resistor, DC bus power supply and electronic secure restart inhibit integrated[1)]
8V128M.00-2	Servo drive 3 x 400-480V 128A 64kW, line filter, braking resistor, DC bus power supply and electronic secure restart inhibit integrated[1)]

Table 2: Order data for ACOPOS servo drives

1) Integrated line filter in preparation.

1) TÜV: Sample test for secure restart inhibit according to EN 954-1 category 3 is in preparation.
2) WARNING: In some applications, there is not enough brake energy provided to guarantee that the 24 VDC supply voltage remains active until the system is stopped.

1.3 ACOPOS 1022, 1045 and 1090

1.3.1 Order Data

Model Number	Short Description	Image
	Servo Drives	
8V1022.00-2	Servo drive 3 x 400-480V 2.2A 1kW, line filter, braking resistor and electronic secure restart inhibit integrated	
8V1045.00-2	Servo drive 3 x 400-480V 4.4A 2kW, line filter, braking resistor and electronic secure restart inhibit integrated	
8V1090.00-2	Servo drive 3 x 400-480V 8.8A 4kW, line filter, braking resistor and electronic secure restart inhibit integrated	
	Accessories	
8AC110.60-2	ACOPOS plug-in module, CAN interface	
8AC112.60-1	ACOPOS plug-in module, ETHERNET Powerlink interface	
8AC120.60-1	ACOPOS plug-in module, EnDat encoder interface	
8AC122.60-2	ACOPOS plug-in module, resolver interface	
8AC123.60-1	ACOPOS plug-in module, incremental encoder and SSI absolute encoder interface	
8AC130.60-1	ACOPOS plug-in module, 8 digital I/O configurable in pairs as 24V input or as output 400/100mA, 2 digital outputs 2A, Order TB712 terminal block separately	
8AC131.60-1	ACOPOS plug-in module, 2 analog inputs ±10V, 2 digital I/O points which can be configured as a 24V input or 45mA output, Order TB712 terminal block separately	
0PS320.1	24 VDC power supply, 3-phase, 20 A, input 400..500 VAC (3 phases), wide range, DIN rail mounting	

Table 3: Order data for ACOPOS 1022, 1045 and 1090

1.3.2 Technical Data

Product ID	8V1022.00-2	8V1045.00-2	8V1090.00-2
General Information			
C-UL-US Listed	Yes		
Power Mains Connection			
Mains Input Voltage	3 x 400 VAC to 480 VAC ±10 % Power filter according to IEC 61800-3-A11 second environment (Limits from CISPR11, Group 2, Class A)		
Frequency	50 / 60 Hz ± 4 %		
Rated Power	Max. 3 kVA	Max. 5 kVA	Max. 10 kVA
Starting Current at 400 VAC	4 A	7 A	7 A
Switch-on Interval	> 10 s		
Power Loss at Max. Device Power without Brake Resistor	Approx. 120 W	Approx. 180 W	Approx. 200 W
24 VDC Supply			
Input Voltage [1]	24 VDC +25 % / -20 %		
Input Capacitance	8200 µF		
Current Requirements [2]	Max. 2.5 A + current for motor holding brake		
Motor Connection			
Maximum Switching Frequency	20 kHz	20 kHz	10 kHz
Continuous Current at 400 VAC	2.2 A_{eff}	4.4 A_{eff}	8.8 A_{eff}
Continuous Current at 480 VAC	1.7 A_{eff}	3.3 A_{eff}	6.6 A_{eff}
Maximum Pulse Current	14 A_{eff}	24 A_{eff}	24 A_{eff}
Maximum Motor Line Length	25 m		
Protective Measures	Short circuit and ground fault protection		
Motor Holding Brake Connection			
Maximum Output Current	1 A		
Protective Measures	Short circuit and ground fault protection		

Table 4: Technical data for ACOPOS 1022, 1045 and 1090

Product ID	8V1022.00-2	8V1045.00-2	8V1090.00-2
Braking Resistor			
Peak Power Output	3.5 kW	7 kW	7 kW
Continuous Power Output	130 W	200 W	200 W
Operational Conditions			
Environmental Temp. during Operation	0 to +40 °C		
Relative Humidity during Operation	5 to 95 %, non-condensing		
Reduction of the Continuous Current at Installation Altitudes over 500 m above Sea Level	10 % per 1000 m		
Maximum Installation Altitude	2000 m [3)]		
Degree of Pollution acc. to IEC 60664-1	2 (non-conductive material)		
Over-voltage Category according to IEC 60364-4-443:1999	II		
Protection according to IEC 60529	IP20		
Storage and Transport Conditions			
Storage Temperature	-25 to +55 °C		
Relative Humidity during Storage	5 to 95 %, non-condensing		
Transport Temperature	-25 to +70 °C		
Relative Humidity during Transport	95 % at +40 °C		
Mechanical Characteristics			
Dimensions Width Height Depth	 70.5 mm 375 mm 235.5 mm		
Weight	4.0 kg	4.1 kg	4.4 kg

Table 4: Technical data for ACOPOS 1022, 1045 and 1090 (cont.)

1) When using motor holding brakes, the valid input voltage range is reduced. The input voltage range should be selected so that the proper supply voltage for the brake can be maintained (also see section "Technical Data for the Standard Holding Brake", on page 97).
2) The current requirements depend on the configuration of the ACOPOS servo drive.
3) Additional requirements are to be arranged with B&R.

1.4 ACOPOS 1180, 1320

1.4.1 Order Data

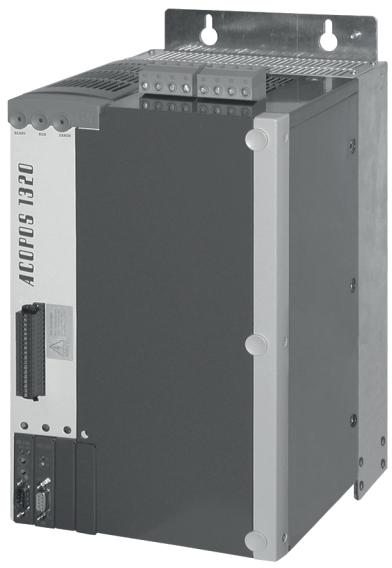
Model Number	Short Description	Image
	Servo Drives	
8V1180.00-2	Servo drive 3 x 400-480V 18A 9kW, line filter, braking resistor, DC bus power supply and electronic secure restart inhibit integrated	
8V1320.00-2	Servo drive 3 x 400-480V 32A 16kW, line filter, braking resistor, DC bus power supply and electronic secure restart inhibit integrated	
	Accessories	
8AC110.60-2	ACOPOS plug-in module, CAN interface	
8AC112.60-1	ACOPOS plug-in module, ETHERNET Powerlink interface	
8AC120.60-1	ACOPOS plug-in module, EnDat encoder interface	
8AC122.60-2	ACOPOS plug-in module, resolver interface	
8AC123.60-1	ACOPOS plug-in module, incremental encoder and SSI absolute encoder interface	
8AC130.60-1	ACOPOS plug-in module, 8 digital I/O configurable in pairs as 24V input or as output 400/100mA, 2 digital outputs 2A, Order TB712 terminal block separately	
8AC131.60-1	ACOPOS plug-in module, 2 analog inputs ±10V, 2 digital I/O points which can be configured as a 24V input or 45mA output, Order TB712 terminal block separately	
0PS320.1	24 VDC power supply, 3-phase, 20 A, input 400..500 VAC (3 phases), wide range, DIN rail mounting	

Table 5: Order data for ACOPOS 1180, 1320

1.4.2 Technical Data

Product ID	8V1180.00-2	8V1320.00-2
General Information		
C-UL-US Listed	Yes	
Power Mains Connection		
Mains Input Voltage	3 x 400 VAC to 480 VAC ±10 % Power filter according to IEC 61800-3-A11 second environment (Limits from CISPR11, Group 2, Class A)	
Frequency	50 / 60 Hz ± 4 %	
Rated Power	Max. 17 kVA	Max. 30 kVA
Starting Current at 400 VAC	13 A	
Switch-on Interval	> 10 s	
Power Loss at Max. Device Power without Brake Resistor	Approx. 500 W	Approx. 800 W
24 VDC Supply		
Input Voltage	24 VDC +25 % / -20 %	
Input Capacitance	40000 µF	
Current Requirements [1] Mains Input Voltage Applied Mains Input Voltage not Applied	---[2] Max. 2.8 A + current for the motor holding brake + current on the 24 VDC output	
Motor Connection		
Maximum Switching Frequency	10 kHz	
Continuous Current at 400 VAC	19 A_{eff}	34 A_{eff}
Continuous Current at 480 VAC	14 A_{eff}	25 A_{eff}
Maximum Pulse Current	50 A_{eff}	80 A_{eff}
Maximum Motor Line Length	25 m	
Protective Measures	Short circuit and ground fault protection	

Table 6: Technical data for ACOPOS 1180, 1320

Product ID	8V1180.00-2	8V1320.00-2
Motor Holding Brake Connection		
Maximum Output Current	1.5 A	
Protective Measures	Short circuit and ground fault protection	
Braking Resistor		
Peak Power Int. / Ext.	14 / 40 kW	
Continuous Power Int. / Ext.	0.4 / 8 kW	
Operational Conditions		
Environmental Temp. during Operation	0 to +40 °C	
Relative Humidity during Operation	5 to 95 %, non-condensing	
Reduction of the Continuous Current at Installation Altitudes over 500 m above Sea Level	10 % per 1000 m	
Maximum Installation Altitude	2000 m [3)]	
Degree of Pollution acc. to IEC 60664-1	2 (non-conductive material)	
Over-voltage Category according to IEC 60364-4-443:1999	II	
Protection according to IEC 60529	IP20	
Storage and Transport Conditions		
Storage Temperature	-25 to +55 °C	
Relative Humidity during Storage	5 to 95 %, non-condensing	
Transport Temperature	-25 to +70 °C	
Relative Humidity during Transport	95 % at +40 °C	
Mechanical Characteristics		
Dimensions Width Height Depth	 200 mm 375 mm 234 mm	
Weight	10.1 kg	10.6 kg

Table 6: Technical data for ACOPOS 1180, 1320 (cont.)

1) The current requirements depend on the configuration of the ACOPOS servo drive.
2) The 24 VDC supply voltage for the ACOPOS servo drive is created by the integrated DC bus power supply, which reduces the 24 VDC current requirements (I_{24VDC}) to 0. Mains Input Voltage: 3 x 400 VAC to 480 VAC ± 10 %.
3) Additional requirements are to be arranged with B&R.

1.5 ACOPOS 1640, 128M

1.5.1 Order Data

Model Number	Short Description	Image
	Servo Drives	
8V1640.00-2	Servo drive 3 x 400-480V 64A 32kW, line filter, braking resistor, DC bus power supply and electronic secure restart inhibit integrated [1]	
8V128M.00-2	Servo drive 3 x 400-480V 128A 64kW, line filter, braking resistor, DC bus power supply and electronic secure restart inhibit integrated [1]	
	Accessories	
8AC110.60-2	ACOPOS plug-in module, CAN interface	
8AC112.60-1	ACOPOS plug-in module, ETHERNET Powerlink interface	
8AC120.60-1	ACOPOS plug-in module, EnDat encoder interface	
8AC122.60-2	ACOPOS plug-in module, resolver interface	
8AC123.60-1	ACOPOS plug-in module, incremental encoder and SSI absolute encoder interface	
8AC130.60-1	ACOPOS plug-in module, 8 digital I/O configurable in pairs as 24V input or as output 400/100mA, 2 digital outputs 2A, Order TB712 terminal block separately	
8AC131.60-1	ACOPOS plug-in module, 2 analog inputs ±10V, 2 digital I/O points which can be configured as a 24V input or 45mA output, Order TB712 terminal block separately	
0PS320.1	24 VDC power supply, 3-phase, 20 A, input 400..500 VAC (3 phases), wide range, DIN rail mounting	

Table 7: Order data for ACOPOS 1640, 128M

1) Integrated line filter in preparation.

1.5.2 Technical Data

Product ID	8V1640.00-2	8V128M.00-2
General Information		
C-UL-US Listed	Yes	
Power Mains Connection		
Mains Input Voltage	3 x 400 VAC to 480 VAC ±10 % Power filter according to IEC 61800-3-A11 second environment (Limits from CISPR11, Group 2, Class A) [1]	
Frequency	50 / 60 Hz ± 4 %	
Rated Power	Max. 54 kVA	Max. 98 kVA
Starting Current at 400 VAC	26 A	
Switch-on Interval	> 10 s	
Power Loss at Max. Device Power without Brake Resistor	Approx. 1600 W	Approx. 3200 W
24 VDC Supply		
Input Voltage	24 VDC +25 % / -20 %	
Input Capacitance	32800 µF	
Current requirements at 24 VDC [2] Mains Input Voltage Applied Mains Input Voltage not Applied	 --- [3] Max. 6 A + 1.4 * (current for the motor holding brake + current on the 24 VDC output)	
Motor Connection		
Maximum Switching Frequency	10 kHz	5 kHz
Continuous Current at 400 VAC	64 A_{eff}	128 A_{eff}
Continuous Current at 480 VAC	48 A_{eff}	96 A_{eff}
Maximum Pulse Current	200 A_{eff}	300 A_{eff}
Maximum Motor Line Length	25 m	
Protective Measures	Short circuit and ground fault protection	

Table 8: Technical data for ACOPOS 1640, 128M

Product ID	8V1640.00-2	8V128M.00-2
Motor Holding Brake Connection		
Maximum Output Current	3 A	
Protective Measures	Short circuit and ground fault protection	
Braking Resistor		
Peak Power Int. / Ext.	7 / 250 kW	8.5 / 250 kW
Continuous Power Int. / Ext.	0.2 / 24 kW	0.24 / 24 kW
Operational Conditions		
Environmental Temp. during Operation	0 to +40 °C	
Relative Humidity during Operation	5 to 95 %, non-condensing	
Reduction of the Continuous Current at Installation Altitudes over 500 m above Sea Level	10 % per 1000 m	
Maximum Installation Altitude	2000 m 4)	
Degree of Pollution acc. to IEC 60664-1	2 (non-conductive material)	
Over-voltage Category according to IEC 60364-4-443:1999	II	
Protection according to IEC 60529	IP20	
Storage and Transport Conditions		
Storage Temperature	-25 to +55 °C	
Relative Humidity during Storage	5 to 95 %, non-condensing	
Transport Temperature	-25 to +70 °C	
Relative Humidity during Transport	95 % at +40 °C	
Mechanical Characteristics		
Dimensions Width Height Depth	 276 mm 460 mm 295 mm	 402 mm 460 mm 295 mm
Weight	24.1 kg	33.8 kg

Table 8: Technical data for ACOPOS 1640, 128M (cont.)

1) Integrated line filter in preparation.
2) The current requirements depend on the configuration of the ACOPOS servo drive.
3) The 24 VDC supply voltage for the ACOPOS servo drive is created by the integrated DC bus power supply, which reduces the 24 VDC current requirements (I_{24VDC}) to 0. Mains Input Voltage: 3 x 400 VAC to 480 VAC ± 10 %.
4) Additional requirements are to be arranged with B&R.

1.6 ACOPOS Plug-in Modules

1.6.1 General Information

The ACOPOS drives are equipped with four plug-in module slots. You can select the plug-in modules required for your application and insert them into the ACOPOS servo drive.

1.6.2 Order Data

Model Number	Short Description
8AC110.60-2	ACOPOS plug-in module, CAN interface
8AC112.60-1	ACOPOS plug-in module, ETHERNET Powerlink interface
8AC120.60-1	ACOPOS plug-in module, EnDat encoder interface
8AC122.60-2	ACOPOS plug-in module, resolver interface
8AC123.60-1	ACOPOS plug-in module, incremental encoder and SSI absolute encoder interface
8AC130.60-1	ACOPOS plug-in module, 8 digital I/O configurable in pairs as 24V input or as output 400/100mA, 2 digital outputs 2A, Order TB712 terminal block separately
8AC131.60-1	ACOPOS plug-in module, 2 analog inputs ±10V, 2 digital I/O points which can be configured as a 24V input or 45mA output, Order TB712 terminal block separately

Table 9: Order data for plug-in modules

1.6.3 AC110 - CAN Interface

General Description

The AC110 plug-in module can be used in an ACOPOS slot. The module is equipped with a CAN interface. This fieldbus interface is used for communication and setting parameters on the ACOPOS servo drive for standard applications.

Order Data

Model Number	Short Description	Image
	Plug-in Module	
8AC110.60-2	ACOPOS plug-in module, CAN interface	
	Accessories	
7AC911.9	Bus connector, CAN	
0AC912.9	Bus adapter, CAN, 1 CAN interface	
0AC913.92	Bus adapter, CAN, 2 CAN interfaces, including 30 cm connection cable	

Table 10: Order data for AC110

Technical Data

Product ID	8AC110.60-2
General Information	
C-UL-US Listed	Yes
Module Type	ACOPOS plug-in module
Slot	Slot 1
Power Consumption	Max. 0.7 W
CAN Interface	
Connection, Module Side	9 pin DSUB plug
Indication	RXD/TXD LEDs
Electrical Isolation CAN - ACOPOS	Yes
Maximum Distance	60 m
Baud Rate	500 kBit/s
Network Capable	Yes
Bus Termination Resistor	Externally wired
Operational Conditions	
Environmental Temp. during Operation	0 to +50 °C
Relative Humidity during Operation	5 to 95 %, non-condensing
Storage and Transport Conditions	
Storage Temperature	-25 to +55 °C
Relative Humidity during Storage	5 to 95 %, non-condensing
Transport Temperature	-25 to +70 °C
Relative Humidity during Transport	95 % at +40 °C

Table 11: Technical Data AC110

1.6.4 AC112 - ETHERNET Powerlink Interface

General Description

The AC112 plug-in module can be used in an ACOPOS slot. The module is equipped with an ETHERNET Powerlink interface. This fieldbus interface is used for communication and setting parameters on the ACOPOS servo drive for complex and time critical applications.

The plug-in module is set up as a 2x hub. This makes it easy to establish a device to device connection (line topology).

Order Data

Model Number	Short Description	Image
	Plug-in Module	
8AC112.60-1	ACOPOS plug-in module, ETHERNET Powerlink interface	

Table 12: Order data for AC112

Technical Data

Product ID	8AC112.60-1
General Information	
C-UL-US Listed	Yes
Module Type	ACOPOS plug-in module
Slot	Slot 1
Power Consumption	Max. 2.5 W
Powerlink Interface	
Connection, Module Side	2 x RJ45 socket
Indication	Status LEDs
Electrical Isolation ETHERNET - ACOPOS	Yes
Maximum Distance per Segment	100 m [1)]
Baud Rate	100 Mbit/s
Network Capable	Yes
Hub, 2x	Yes
Maximum Number of Hub Levels	10; see section 1.1.11 "Configurations", on page 16
Cabling Topology	Star or tree with level 2 hubs
Possible Station Operating Modes	Synchronous to Powerlink cycle
Watchdog Function Hardware Software	 Yes (via ACOPOS servo drive) Yes (via ACOPOS servo drive)

Table 13: Technical data for AC112

Product ID	8AC112.60-1
Operational Conditions	
Environmental Temp. during Operation	0 to +50 °C
Relative Humidity during Operation	5 to 95 %, non-condensing
Storage and Transport Conditions	
Storage Temperature	-25 to +55 °C
Relative Humidity during Storage	5 to 95 %, non-condensing
Transport Temperature	-25 to +70 °C
Relative Humidity during Transport	95 % at +40 °C

Table 13: Technical data for AC112 (cont.)

1) With a cycle time of 400 µs and 10 ACOPOS servo drives, the maximum total cable length is 200 m.

1.6.5 AC120 - EnDat Encoder Interface

General Description

The AC120 plug-in module can be used in an ACOPOS slot. The module has an EnDat encoder interface, but can also be used to evaluate simple incremental encoders with sine formed output signal [1)] .

This module can be used to evaluate encoders which are built into B&R servo motors and also encoders for external axes (encoders that evaluate any machine movement). The input signals are monitored. In this way, broken connections, shorted lines and encoder supply failure can be recognized.

EnDat Encoder:

EnDat is a standard developed by Johannes Heidenhain GmbH (www.heidenhain.de), incorporating the advantages of absolute and incremental position measurement and also offers a read/write parameter memory in the encoder. With absolute position measurement (absolute position is read in serially), the homing procedure is usually not required. When necessary, a multi-turn encoder (4096 revolutions) should be installed. To save costs, a single-turn encoder and a reference switch can also be used. In this case, a homing procedure must be carried out.

The incremental process allows the short delay times necessary for position measurement on drives with exceptional dynamic properties. With the sinusoidal incremental signal and the fine resolution in the EnDat module, a very high positioning resolution is achieved in spite of the moderate signal frequencies used.

The parameter memory in the EnDat encoder is used by B&R to store motor data (among other things). In this way, the ACOPOS servo drives are always automatically provided the correct motor parameters and limit values. This is referred to as the "embedded parameter chip".

During start-up, the module is automatically identified, configured and its parameters set by the ACOPOS servo drive operating system.

Incremental encoder with sine formed output signal:

When using the AC120 plug-in module to evaluate simple incremental encoders with sine formed output signal, only the incremental transfer channel is now used. The "embedded parameter chip" it not available in this case because this encoder does not have parameter memory. The absolute position is also not available immediately after switching the device on. In this situation, a homing procedure normally has to be carried out. The module is equipped with a reference pulse input for this purpose.

Order Data

Model Number	Short Description	Image
	Plug-in Module	
8AC120.60-1	ACOPOS plug-in module, EnDat encoder interface	
	Accessories	
8CE005.12-1	EnDat cable, length 5m, 10 x 0.14mm² + 2 x 0.5mm², EnDat connector 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE007.12-1	EnDat cable, length 7m, 10 x 0.14mm² + 2 x 0.5mm², EnDat connector 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE010.12-1	EnDat cable, length 10m, 10 x 0.14mm² + 2 x 0.5mm², EnDat connector 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE015.12-1	EnDat cable, length 15m, 10 x 0.14mm² + 2 x 0.5mm², EnDat connector 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE020.12-1	EnDat cable, length 20m, 10 x 0.14mm² + 2 x 0.5mm², EnDat connector 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE025.12-1	EnDat cable, length 25m, 10 x 0.14mm² + 2 x 0.5mm², EnDat connector 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	

Table 14: Order data for AC120

1) Starting with revision F0.

Technical Data

Product ID	8AC120.60-1
General Information	
C-UL-US Listed	Yes
Module Type	ACOPOS plug-in module
Slot [1]	Slots 2, 3 and 4
Power Consumption E0 ... EnDat single-turn, 512 lines E1 ... EnDat multi-turn, 512 lines E2 ... EnDat single-turn, 32 lines (inductive) E3 ... EnDat multi-turn, 32 lines (inductive) E4 ... EnDat single-turn, 512 lines E5 ... EnDat multi-turn, 512 lines	 Max. 1.8 W Max. 2.5 W Max. 2.2 W Max. 1.9 W Max. 1.7 W Max. 2.2 W
Encoder Input [2]	
Connection, Module Side	15 pin DSUB socket
Indication	UP/DN LEDs
Electrical Isolation Encoder - ACOPOS	 No
Encoder Monitoring	Yes
Encoder Supply Output Voltage Load Sense Lines	 Typ. 5 V 200 mA 2, compensation of max. 2 x 0.7 V
Sine-Cosine Inputs Signal Transfer Differential Voltage Common Mode Voltage Terminating Resistance Signal Frequency Resolution [3] Precision [4]	 Differential Signal, Symmetric 0.5 ... 1.25 V_{ss} Max. ±7 V 120 Ω DC ... 400 kHz 16384 * number of encoder lines ---
Reference Input Signal Transfer Differential Voltage for High Differential Voltage for Low Common Mode Voltage Terminating Resistance	 Differential signal, symmetric ≥ +0.2 V ≤ -0.2 V Max. ±7 V 120 Ω
Serial Interface Signal Transfer Baud Rate	Synchronous RS485 625 kBaud
Operational Conditions	
Environmental Temp. during Operation	0 to +50 °C
Relative Humidity during Operation	5 to 95 %, non-condensing
Storage and Transport Conditions	
Storage Temperature	-25 to +55 °C
Relative Humidity during Storage	5 to 95 %, non-condensing
Transport Temperature	-25 to +70 °C
Relative Humidity during Transport	95 % at +40 °C

Table 15: Technical data for AC120

1) The AC120 is an encoder module. Several encoder modules can also be inserted. In this case, the encoder module in the slot with the lowest number is automatically used for motor feedback.
2) The EnDat encoder must be wired using a cable with a single shield.
3) Noise on the encoder signal reduces the resolution that can be used by approx. 4 bits (factor of 16).
4) The precision is actually limited by the encoder.

1.6.6 AC122 - Resolver Interface

General Description

The AC122 plug-in module can be used in an ACOPOS slot. The module is equipped with a resolver interface.

The plug-in module handles the output from resolvers which are built into B&R servo motors or used as an encoder for external axes. This resolver delivers the absolute position over one revolution. Normally, the movement path is longer than one revolution. In this case, a reference switch must be used and a homing procedure carried out.

The encoder input signals are monitored. In this way, broken connections, shorted lines and encoder supply failure (reference signal) can be recognized.

During start-up, the AC122 module is automatically identified by the ACOPOS operating system. Making automatic adjustments to the motor (resolution parameter) and reading the motor parameters and limit values is not possible because the resolver does not have parameter memory like the EnDat encoder.

If the precision, resolution, bandwidth or ease of setting parameters is not sufficient with the resolver, the EnDat system should be used (see section 1.6.5 "AC120 - EnDat Encoder Interface", on page 33).

Order Data

Model Number	Short Description	Image
	Plug-in Module	
8AC122.60-2	ACOPOS plug-in module, resolver interface	
	Accessories	
8CR005.12-1	Resolver cable, length 5m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR007.12-1	Resolver cable, length 7m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR010.12-1	Resolver cable, length 10m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR015.12-1	Resolver cable, length 15m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR020.12-1	Resolver cable, length 20m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR025.12-1	Resolver cable, length 25m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	

Table 16: Order data for AC122

Technical Data

Product ID	8AC122.60-2
General Information	
C-UL-US Listed	Yes
Module Type	ACOPOS plug-in module
Slot [1]	Slots 2, 3 and 4
Power Consumption	Max. 1.2 W
Resolver Input [2]	
Resolver Type Number of Poles Nominal Voltage Ratio Input Frequency Input Voltage Max. Phase Shift Max. Elec. Angular Error	BRX [3] 2 pin 0.5 ± 5 % 10 kHz 3 to 7 V_{rms} ± 3° ± 10 angular minutes
Connection, Module Side	9 pin DSUB socket
Indication	UP/DN LEDs
Electrical Isolation Resolver - ACOPOS	No
Encoder Monitoring	Yes
Resolution	Depends on the maximum speed 14 bits/rev for n < 3900 min^{-1} 12 bits/rev for n < 15600 min^{-1}
Bandwidth	1.7 kHz for n < 3900 min^{-1} 2.5 kHz for n < 15600 min^{-1}
Precision	± 8 angular minutes
Reference Output Signal Transfer Differential Voltage Output Current Frequency	 Differential signals Typically 3.4 V_{eff} Max. 50 mA_{eff} 10 kHz
Sine-Cosine Inputs Signal Transfer Input Impedance at 10 kHz (per pin) Electrical Isolation Encoder-ACOPOS	 Differential signals 10.4 kΩ - j 11.1 kΩ No, common-mode voltage on the sine cosine inputs max ± 20 V
Operational Conditions	
Environmental Temp. during Operation	0 to +50 °C
Relative Humidity during Operation	5 to 95 %, non-condensing
Storage and Transport Conditions	
Storage Temperature	-25 to +55 °C
Relative Humidity during Storage	5 to 95 %, non-condensing
Transport Temperature	-25 to +70 °C
Relative Humidity during Transport	95 % at +40 °C

Table 17: Technical data for AC122

1) The AC122 is an encoder module. Several encoder modules can also be inserted. In this case, the encoder module in the slot with the lowest number is automatically used for motor feedback.
2) The resolver must be wired using a cable with a single shield and twisted pair signal lines.
3) BRX resolvers are fed with a sine signal (reference signal) from the module and provide two sine signals with a 90° phase shift as a result. The amplitudes of these signals change with the angular position of the resolver.
Unlike BRX resolvers, BRT resolvers can be fed with two sine signals which are offset by 90°. A single sine signal with constant amplitude is returned. The phase position of this signal changes with the angular position of the resolver.

1.6.7 AC123 - Incremental Encoder and SSI Absolute Encoder Interface

General Description

The ACOPOS plug-in module AC123 is used to connect standard industrial incremental or absolute encoders with a synchronous serial interface (SSI) to ACOPOS servo drives. For example, this allows electronic gears to be configured which read master movements using external encoders. If the encoder resolution is high enough, motor feedback for asynchronous motors is also possible.

With incremental encoders, the maximum counter frequency is 200 kHz. Single and multi-turn encoders with a maximum of 31 bits at 200 kBaud can be read as absolute SSI encoders.

The position is determined cyclically (initiated by the module) and is exactly synchronized with the ACOPOS controller clock. The input signals are monitored for both encoder types. In this way, broken connections, shorted lines and encoder supply failure can be recognized.

With incremental encoders the count frequency and distance between edges is also monitored. With absolute encoders, the parity bit is evaluated and a plausibility check carried out.

Order Data

Model Number	Short Description	Image
	Plug-in Module	
8AC123.60-1	ACOPOS plug-in module, incremental encoder and SSI absolute encoder interface	

Table 18: Order data for AC123

Technical Data

Product ID	8AC123.60-1
General Information	
C-UL-US Listed	Yes
Module Type	ACOPOS plug-in module
Slot [1]	Slots 2, 3 and 4
Power Consumption	Max. 7.5 W Depends on the current requirements for the encoder connected [2]
Encoder Input [3]	
Connection, Module Side	15 pin DSUB socket
Indication	UP/DN LEDs
Electrical Isolation Encoder - ACOPOS	Yes
Encoder Monitoring	Yes
Signal Transfer	Differential signal transfer
Cable Length [4]	Max. 50 m

Table 19: Technical data for AC123

Product ID	8AC123.60-1
Encoder Supply	
Supply Voltages	Internal, select between 5 V/15 V
Sense Lines for 5 V for 15 V	 Yes, 2, compensation of max. 2 V No
Load 5 V 15 V	 350 mA 350 mA
Short Circuit Protection, Overload Protection	Yes
Incremental Encoder [5]	
Signal Form	Square wave pulse
Evaluation	4-fold
Input Frequency	Max. 200 kHz
Count Frequency	Max. 800 kHz
Reference Frequency	Max. 200 kHz
Distance between Edges	Min. 0.6 µs
Counter Size	32-bit
Inputs	A, A\, B, B\, R, R\
Differential Voltage Inputs A, B, R Minimum Maximum	 2.5 V 6 V
SSI Absolute Encoder	
Baud Rate	200 kBaud
Word Size	Max. 31 bit
Differential Voltage Clock Output - 120 Ω Minimum Maximum	 2.5 V 5 V
Differential Voltage Data Input Minimum Maximum	 2.5 V 6 V
Operational Conditions	
Environmental Temp. during Operation	0 to +50 °C
Relative Humidity during Operation	5 to 95 %, non-condensing
Storage and Transport Conditions	
Storage Temperature	-25 to +55 °C
Relative Humidity during Storage	5 to 95 %, non-condensing
Transport Temperature	-25 to +70 °C
Relative Humidity during Transport	95 % at +40 °C

Table 19: Technical data for AC123 (cont.)

1) The AC123 is an encoder module. Several encoder modules can also be inserted. In this case, the encoder module in the slot with the lowest number is automatically used for motor feedback.
2) The power consumption of the plug-in module can be approximated using the following formula:

   P_{Module} [W] = $P_{Encoder}$ [W] * k + 0.6 W

   The power consumed by the encoder $P_{Encoder}$ is calculated from the selected encoder supply voltage (5 V / 15 V) and the current required:

   $P_{Encoder}$ [W] = $U_{Encoder}$ [V] * $I_{Encoder}$ [A]

   The following values must be used for k:

   k = 1.2 (with 15 V encoder supply)
   k = 1.75 (with 5 V encoder supply)
3) The encoder must be wired using a cable with a single shield and twisted pair signal lines (e.g. 4 x 2 x 0.14 mm² + 2 x 0.5 mm²).
4) A cable with at least 4 x 2 x 0.14 mm² + 2 x 0.5 mm² is required for the maximum cable length. The sense lines must be used.
5) Incremental encoders can be used as motor feedback only for asynchronous motors, but can only provide limited control quality for this purpose. An encoder with at least 1000 lines must be used for motor feedback.

1.6.8 AC130 - Digital Mixed Module

General Description

The AC130 plug-in module can be used in an ACOPOS slot. A maximum of 8 digital inputs or 10 digital outputs are available.

I/O points can be configured in pairs as inputs or outputs. The first three inputs have incremental encoder functionality (A, B, R). The first two outputs can be operated in pulse width modulation (PWM) mode.

The inputs are divided into 4 standard (max. 10 kHz) and 4 high speed (max. 100 kHz) inputs.

The outputs include 4 high speed (push-pull) outputs with a maximum current of 100 mA, 4 standard (high-side) outputs with a maximum current of 400 mA and 2 low speed (high-side) outputs with a maximum current of 2 A. All outputs can be read.

Order Data

Model Number	Short Description	Image
	Plug-in Module	
8AC130.60-1	ACOPOS plug-in module, 8 digital I/O configurable in pairs as 24V input or as output 400/100mA, 2 digital outputs 2A, Order TB712 terminal block separately	
	Accessories	
7TB712.9	Terminal block, 12 pin, screw clamps	
7TB712.91	Terminal block, 12 pin, cage clamps	
7TB712:90-02	Terminal block, 12 pin, 20 pcs., screw clamps	
7TB712:91-02	Terminal block, 12 pin, 20 pcs., cage clamps	

Table 20: Order data for AC130

Technical Data

Product ID	8AC130.60-1
General Information	
C-UL-US Listed	Yes
Module Type	ACOPOS plug-in module
Slot [1]	Slots 2, 3 and 4
Power Consumption	Max. 0.8 W
Inputs/Outputs	
Connection, Module Side	12 conductor pin-connector
Configuration of the Digital Inputs/Outputs	Configured in pairs as input or output
Display	24 V LED
Supply Voltage	
Supply Voltage Minimum Nominal Maximum	 18 VDC 24 VDC 30 VDC
Reverse Polarity Protection	Yes
Voltage Monitoring (24 V - LED)	Yes, supply voltage > 18 V
Digital Inputs [2]	
Number of Inputs	Max. 8
Wiring	Sink
Electrical Isolation Input - ACOPOS Input - Input	 Yes No
Input Voltage Nominal Maximum	 24 VDC 30 VDC
Switching Threshold LOW HIGH	 < 5 V > 15 V
Input Current at Nominal Voltage Inputs 1 -4 Inputs 5 - 8	 Approx. 10 mA Approx. 5.5 mA
Switching Delay Inputs 1 -4 Inputs 5 - 8	 Max. 5 µs Max. 35 µs
Event Counter	
Signal Form	Square wave pulse
Input Frequency	Max. 100 kHz
Counter Size	16-bit
Inputs Input 1 Input 2	 Counter 1 Counter 2
Incremental Encoder	
Signal Form	Square wave pulse
Evaluation	4-fold
Encoder Monitoring	No
Input Frequency	Max. 62.5 kHz
Count Frequency	Max. 250 kHz
Reference Frequency	Max. 62.5 kHz
Distance between Edges	Min. 2.5 µs
Counter Size	16-bit
Inputs Input 1 Input 2 Input 3	 Channel A Channel B Reference pulse R

Table 21: Technical data for AC130

Product ID	8AC130.60-1
Outputs	
Number of Outputs	Max. 10
Type Outputs 1 -4 Outputs 5 - 10	Transistor outputs Push-pull High-side
Electrical Isolation Output - ACOPOS Output - Output	 Yes No
Switching Voltage Minimum Nominal Maximum	 18 VDC 24 VDC 30 VDC
Continuous Current Outputs 1 -4 Outputs 5 -8 Outputs 9 - 10	 Max. 100 mA Max. 400 mA Max. 2 A
Switching Delay 0 -> 1 and 1 -> 0 Outputs 1 -4 Outputs 5 -8 Outputs 9 - 10	 Max. 5 µs Max. 50 µs Max. 500 µs
Switching Frequency (resistive load) Outputs 1 -2 Outputs 3 -4 Outputs 5 -8 Outputs 9 - 10	 Max. 10 kHz (max. 20 kHz in PWM mode) Max. 10 kHz Max. 5 kHz Max. 100 Hz
PWM Outputs 1 - 2 Resolution of the Pulse Width Period Duration	 13-bit 50 µs - 400 µs
Protection Short Circuit Protection Overload Protection	 Yes Yes
Short Circuit Current at 24 V (until cut-off) Outputs 1 -4 Outputs 5 -8 Outputs 9 - 10	 Approx. 1 A Approx. 1.2 A Approx. 24 A
Readable Outputs	Yes
Operational Conditions	
Environmental Temp. during Operation	0 to +50 °C
Relative Humidity during Operation	5 to 95 %, non-condensing
Storage and Transport Conditions	
Storage Temperature	-25 to +55 °C
Relative Humidity during Storage	5 to 95 %, non-condensing
Transport Temperature	-25 to +70 °C
Relative Humidity during Transport	95 % at +40 °C

Table 21: Technical data for AC130 (cont.)

1) The AC130 can also be used as an encoder module. Several encoder modules can also be inserted. In this case, the encoder module in the slot with the lowest number is automatically used for motor feedback.
2) Shielded cables must be used for inputs 1 - 4.

1.6.9 AC131 - Mixed Module

General Description

The AC131 plug-in module can be used in an ACOPOS slot. A maximum of 2 analog inputs (±10 V differential inputs or single-ended inputs) and 2 digital inputs or digital outputs are available.

The analog inputs have a resolution of 12 bits and are scanned synchronously using the 50 µs clock for the ACOPOS servo drive. The analog inputs have a 10 kHz analog input filter (low pass 3rd order).

The digital inputs and outputs can be configured individually as input or output. The digital inputs are equipped with a counter function. The digital outputs (push-pull) can be read.

Order Data

Model Number	Short Description	Image
	Plug-in Module	
8AC131.60-1	ACOPOS plug-in module, 2 analog inputs ±10V, 2 digital I/O points which can be configured as a 24V input or 45mA output, Order TB712 terminal block separately	
	Accessories	
7TB712.9	Terminal block, 12 pin, screw clamps	
7TB712.91	Terminal block, 12 pin, cage clamps	
7TB712:90-02	Terminal block, 12 pin, 20 pcs., screw clamps	
7TB712:91-02	Terminal block, 12 pin, 20 pcs., cage clamps	

Table 22: Order data for AC131

Technical Data

Product ID	8AC131.60-1
General Information	
C-UL-US Listed	Yes
Module Type	ACOPOS plug-in module
Slot	Slots 2, 3 and 4
Power Consumption	Max. 1 W
Inputs/Outputs	
Connection, Module Side	12 conductor pin-connector
Configuration of the Digital Inputs/Outputs	Can be configured individually as digital input or output
Display	24 V LED
Supply Voltage	
Supply Voltage Minimum Nominal Maximum	 18 VDC 24 VDC 30 VDC
Reverse Polarity Protection	Yes
Voltage Monitoring (24 V - LED)	Yes, supply voltage > 18 V
Digital Inputs	
Number of Inputs	Max. 2
Wiring	Sink
Electrical Isolation Input - ACOPOS Input - Input	 Yes No
Input Voltage Minimum Nominal Maximum	 18 VDC 24 VDC 30 VDC
Switching Threshold LOW HIGH	 < 5 V > 15 V
Input Current at Nominal Voltage	Approx. 8 mA
Switching Delay Counters Digital Input	 Max. 5 µs Max. 55 µs (digitally filtered)
Modulation Compared to Ground Potential	Max. ±50 V
Event Counter	
Signal Form	Square wave pulse
Input Frequency	Max. 100 kHz
Counter Size	16-bit
Inputs Input 1 Input 2	 Counter 1 Counter 2
Digital Outputs	
Number of Outputs	Max. 2
Type	Transistor outputs push-pull
Electrical Isolation Output - ACOPOS Output - Output	 Yes No
Switching Voltage Minimum Nominal Maximum	 18 VDC 24 VDC 30 VDC
Continuous Current	Max. 45 mA
Switching Delay 0 -> 1 and 1 -> 0	Max. 5 µs
Switching Frequency (resistive load)	Max. 100 kHz
Protection Short Circuit Protection Overload Protection	 Yes Yes
Short Circuit Current at 24 V (until cut-off)	Approx. 0.3 A
Readable Outputs	Yes

Table 23: Technical data for AC131

Product ID	8AC131.60-1
Analog Inputs	
Number of Inputs	2
Design	Differential input or single ended input
Electrical Isolation Input - ACOPOS Input - Input	 Yes No
Input Signal Nominal Maximum	 -10 V to +10 V -15 V to +15 V
Operating Mode	Cyclic measurement synchronous to 50 µs ACOPOS clock
Digital Converter Resolution	12-bit
Non-Linearity	±1 LSB
Output Format	INT16 $8000 - $7FF01 LSB = $0010 = 4.883 mV
Conversion Procedure	Successive approximation
Conversion Time for both Inputs	< 50 µs
Differential Input Impedance	> 10 MOhm
Input Filter	Analog low pass 3rd order / cut-off frequency: 10 kHz
Basic Accuracy at 25 °C	±0.05 % 1)
Offset Drift	Max. ±0.0005 % / °C 1)
Gain Drift	Max. ±0.006 % / °C 1)
Cross-talk between the Analog Inputs	Min. -90 dB at 1kHz
Common-Mode Rejection DC 50 Hz	 Min. -73 dB Min. -73 dB
Modulation Compared to Ground Potential	Max. ±50 V
Modulation between the Analog Input Channels	Max. ±5 V
Operational Conditions	
Environmental Temp. during Operation	0 to +50 °C
Relative Humidity during Operation	5 to 95 %, non-condensing
Storage and Transport Conditions	
Storage Temperature	-25 to +55 °C
Relative Humidity during Storage	5 to 95 %, non-condensing
Transport Temperature	-25 to +70 °C
Relative Humidity during Transport	95 % at +40 °C

Table 23: Technical data for AC131 (cont.)

1) Refers to the measurement range limit.

Chapter 3 • Servo Motors

1. Three-phase Synchronous Motors 8MS

1.1 General Description

The three-phase synchronous motors from the 8MSA and 8MSC series are permanently excited, electronically commutated synchronous motors for applications that require excellent dynamic properties and positioning precision as well as compact size and reduced weight.

- NdFeB permanent magnets
- Sinusoidal commutation with EnDat encoder or resolver as feedback unit
- Three-phase winding with star connection
- Compact sizes result in low weight
- Minimum moment of inertia because of favorable rotor construction results in very good dynamic properties
- High overload capability/maximum pulse torque
- Low torque ripple
- High dynamic torque at high speeds
- Long life-span, all motor parts except for bearings are free of wear
- Direct diversion of lost power generated in the stator over the housing to the flange
- Preloaded, grooved ball bearings which are sealed on both sides and greased
- Complete motor system with stall torque ranging from 0.2 Nm to 115 Nm
- Connection using two circular plugs
- Controlled by ACOPOS servo drives

Warning!

Three-phase synchronous motors 8MS are not allowed to be connected directly to the power mains, they are only allowed to be operated in combination with ACOPOS servo drives!

Warning!

High temperatures can occur on the surface of the three-phase synchronous motors 8MS (> 100 °C). If necessary, protection against accidental contact should be installed!

1.1.1 Cooling Types

The three-phase synchronous motors are available with different cooling types.

Cooling Type A

Three-phase synchronous motors with cooling type A are self-cooling and have a long, slim design. The motors must be installed on the cooling surface (= flange).

Caution!

Free convection on the motor housing must be guaranteed!

Cooling Type C

Three-phase synchronous motors with cooling type C are based on motors with cooling type A. They are separately cooled and the only difference is a fan module mounted in the area of the B-side bearing. The motors must be installed on the cooling surface (= flange).

Caution!

Make sure that the air inlet and outlet remain free and that heated air is not circulated back to the inlet area!

The built-in fan module increases the rated torque (M_N), rated current (I_N), stall torque (M_0) and stall current (I_0) by 30 % as compared to the respective motors with cooling type A.

1.1.2 Sizes

The three-phase synchronous motors are available in up to seven different sizes. They are different regarding dimensions (especially flange dimensions) and power rating.

The various sizes can be differentiated by a number in the model number. The larger the number, the larger the flange dimensions and power rating for the respective motor.

Overview

Cooling Type	Available Sizes (code)						
	2	3	4	5	6	7	8
A	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C	---	---	Yes	Yes	Yes	Yes	---

Table 24: Available sizes

1.1.3 Lengths

The three-phase synchronous motors are available in up to five different lengths. They have different power ratings with identical flange dimensions.

The various lengths can be differentiated by a letter in the model number.

Overview

Length		Available for Size						
Code	Description	2	3	4	5	6	7	8
S	Small rated torque	Yes	Yes	Yes	Yes	Yes	Yes	Yes
M	Medium rated torque	Yes	Yes	Yes	Yes	Yes	Yes	Yes
L	Large rated torque	Yes	Yes	Yes	Yes	Yes	Yes	Yes
X	Extra large rated torque	Yes	Yes	Yes	Yes	Yes	---	Yes
E	Exceptionally large rated torque	---	---	---	Yes	---	---	---

Table 25: Available lengths

1.2 Order Key

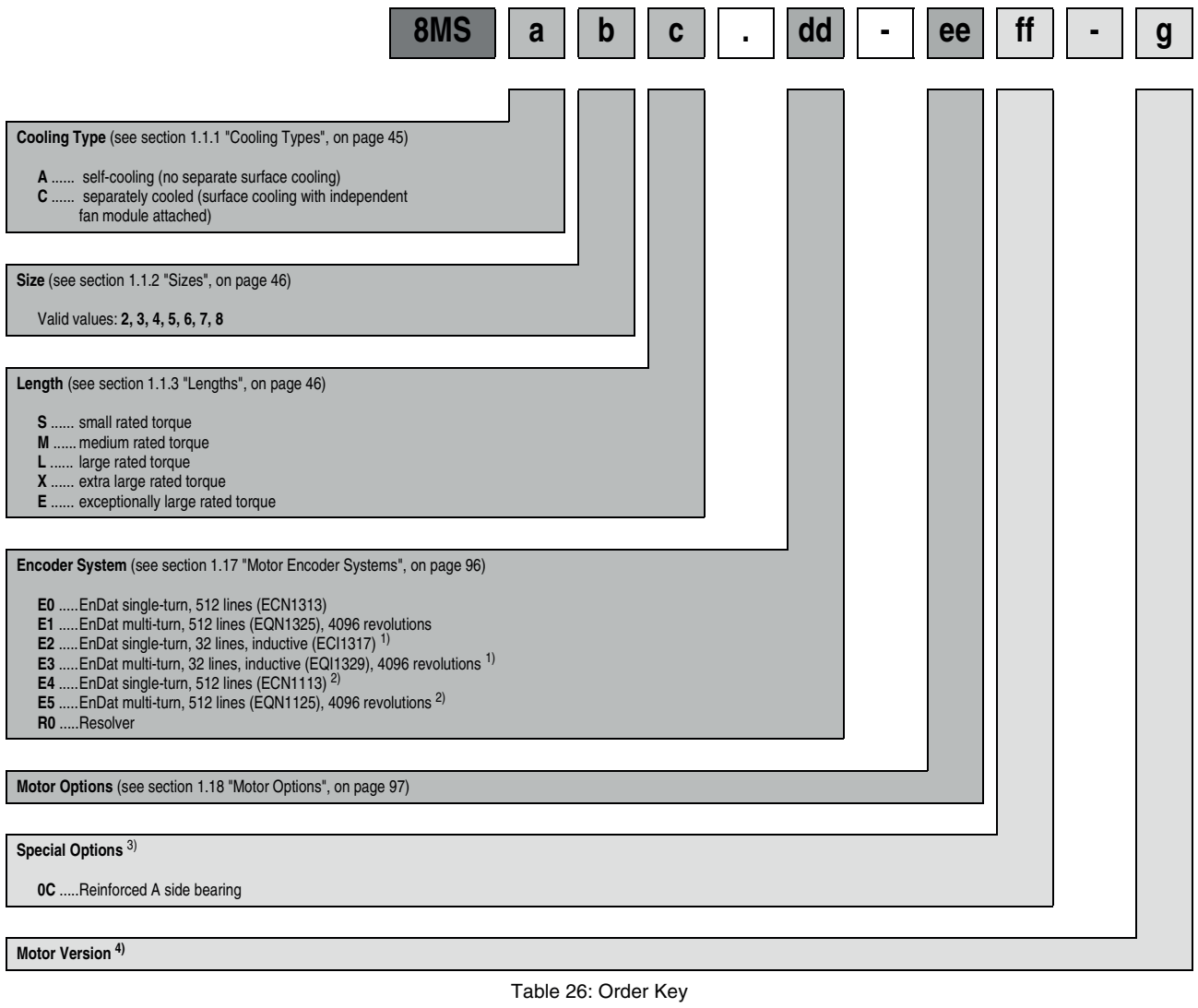


Table 26: Order Key

1) Option not available for size 8.
2) Option only available for size 2.
3) Special options must be arranged with B&R. If no special motor options are required, enter nothing or 00 for ff.
4) If a motor version does not exist for the motor, nothing should be entered for g.

1.2.1 Example Order

A three-phase synchronous motor of type **8MSA4L** with a rated speed of 3000 min^{-1} was selected for an application. Because of the construction, the cables can only be connected on the top of the motor ("top" connection direction). The motor should also be equipped with a holding brake, a keyed shaft end and a 512 line EnDat single-turn encoder.

The code (dd) for the encoder system is **E0** (see table 67 "Technical data for EnDat encoders", on page 96).

The code (ee) for the other options (rated speed, oil seal, holding brake, keyed shaft and connection direction) is **33** (see table 81 "Order key code (ee) for the motor options", on page 103).

Therefore the model number for the motor required is: **8MSA4L.E0-33**

1.3 General Motor Data

Description	Cooling Type	
	A	C
General Information		
C-UR-US Listed	Yes	
Electrical Characteristics		
Number of Poles	6 poles	
Mains Input Voltage on Servo Drive	3 x 400 VAC ... 3 x 480 VAC ± 10 %	
Connection Technology Motor Connection Encoder Connection	Circular connector from Intercontec Size 1 (8MSA8: Size 1.5) Size 1	
Thermal Characteristics		
Insulation Class according to IEC 60034-1	F	
Methods of Cooling according to IEC 60034-6 (IC code)	Self-cooling No separate surface cooling (IC4A0A0)	Separately cooled Surface cooling with independent cooling module attached (IC4A0A6)
Thermal Motor Protection according to IEC 60034-11	Maximum winding temperature is 140 °C (limited to 110 °C by the thermal motor protection in ACOPOS servo drive)	
Mechanical Characteristics		
Vibration Severity according to IEC 60034-14	Vibration severity grade R	
Rolling Bearing, Dynamic Load Ratings, Rating Life	Based on DIN ISO 281	
Eye Bolt according to DIN 580	For size 8	---
Shaft End according to DIN 748 [1)]	Form E	
Oil Seal according to DIN 3760	Form A	
Key and Keyway according to DIN 6885-1	Keyway form N1; key form A	
Balancing the Shaft according to DIN ISO 8821	Half-key arrangement	
Mounting Flange according to DIN 42948 [2)]	Form A	
Shaft End Concentricity, Coaxial Properties and Mounting Flange Plane according to DIN 42955	Tolerance R	
Paint Description Color	Polyurethane paint with plastic effect CHEMOPUR P U 2082 RAL 9005 flat; shaft end and flange front metallic glossy	
Operational Conditions		
Rating Class, Operation Mode acc. to IEC 60034-1	S1 - continuous operation	
Environmental Temp. during Operation	-15 °C to +40 °C	
Reduction of the Rated Current and Stall Current at Temperatures above 40 °C	10 % per 10 °C	
Maximum Environmental Temp. during Operation	+55 °C [3)]	
Relative Humidity during Operation	5 to 95 %, non-condensing	
Reduction of the Rated Current and Stall Current at Installation Altitudes over 1000 m above Sea Level	10 % per 1000 m	
Maximum Installation Altitude	2000 m [4)]	
Maximum Flange Temperature	65 °C	
Protection Standards according to IEC 60034-5 (IP code) With Optional Oil Seal	IP64 IP65	IP64 (IP20 fan module) IP65 (IP20 fan module)
Construction and Mounting Arrangement Type according to IEC 60034-7 (IM code)	Horizontal (IM3001) Vertical, motor hangs on the machine (IM3011) Vertical, motor stands on the machine (IM3031)	
Storage and Transport Conditions		
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	

Table 27: General technical data

1) Except sizes 2 and 7 as well as special option "reinforced A side bearing".
2) Centering diameter and hole pattern.
3) Continuous operation of the servo motors at environmental temperatures from +40 °C to max. +55 °C is possible, but results in a shorter lifespan.
4) Additional requirements are to be arranged with B&R.

1.4 Motor Data Overview Cooling Type A

The technical data listed in the following sections (K_E, K_T, I_N, I_0, I_{max}, R_{2PH}, L_{2Ph}, t_{el}, t_{therm}, m, J) has a theoretical tolerance range of ±10 %. This is also valid for the speed - torque characteristic curves represented in the following sections.

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8V\xxx.00-x 2)
8MSA2S.dd-eeff	6000	0.18	0.11	0.43	0.2	0.44	0.8	1.9	133333	12000	0.46	27.5	99.5	54	0.54	10	0.06	0.9	0.07	0.15	1.8	1.5	1022
8MSA2M.dd-eeff	6000	0.35	0.22	0.62	0.4	0.67	1.6	2.9	200000	12000	0.6	36	50	40	0.8	15	0.08	1.06	0.07	0.15	1.8	1.5	1022
8MSA2L.dd-eeff	6000	0.53	0.33	0.86	0.6	0.93	2.4	4	218182	12000	0.65	39	32	29	0.91	20	0.11	1.21	0.07	0.15	1.8	1.5	1022
8MSA2X.dd-eeff	6000	0.68	0.43	1.05	0.8	1.15	3.2	5	246154	12000	0.7	42	24.5	25	1.02	22	0.13	1.36	0.07	0.15	1.8	1.5	1022
8MSA3S.dd-eeff	6000	0.55	0.35	0.83	0.65	0.91	2.6	3.9	66667	12000	0.71	43	37.6	45	1.2	25	0.39	1.75	0.18	0.3	4	1.5	1022
8MSA3M.dd-eeff	6000	1	0.63	1.4	1.3	1.67	5.2	7.2	80000	12000	0.78	47	12.7	21.5	1.69	30	0.65	2.25	0.18	0.3	4	1.5	1022
8MSA3L.dd-eeff	3000	2.15	0.68	1.62	2.5	1.8	10	7.7	83333	12000	1.39	84	15	33.2	2.21	32	1.2	3.2	0.18	0.3	4	1.5	1022
	4500	2	0.94	2.2	2.5	2.61	10	11.2	83333	12000	0.96	58	7	15.4	2.2	32	1.2	3.2	0.18	0.3	4	1.5	1045
	6000	1.8	1.13	2.3	2.5	3.02	10	13	83333	12000	0.83	50	5.4	11.7	2.17	32	1.2	3.2	0.18	0.3	4	1.5	1045
8MSA3X.dd-eeff	3000	2.5	0.79	1.82	3	2.08	12	9	80000	12000	1.44	87	11.6	26.7	2.3	33	1.5	3.65	0.18	0.3	4	1.5	1022
	4500	2.1	0.99	2.1	3	2.9	12	12.4	80000	12000	1.04	63	6	14.2	2.37	33	1.5	3.65	0.18	0.3	4	1.5	1045
	6000	1.6	1.01	2.1	3	3.66	12	15.8	80000	12000	0.82	49.5	3.65	8.6	2.36	33	1.5	3.65	0.18	0.3	4	1.5	1045
8MSA4S.dd-eeff	3000	2.3	0.72	1.85	2.6	1.92	10.4	11.5	54737	12000	1.36	82	9.6	41.5	4.32	60	1.9	4.5	0.54	0.46	8	1.5	1022
	4500	1.9	0.9	2.25	2.6	2.76	10.4	16.5	54737	12000	0.94	57	4.55	20.5	4.51	60	1.9	4.5	0.54	0.46	8	1.5	1045
	6000	1.2	0.75	1.75	2.6	3.21	10.4	19.6	54737	12000	0.81	49	3.3	15	4.55	60	1.9	4.5	0.54	0.46	8	1.5	1045
8MSA4M.dd-eeff	3000	4.6	1.45	3.75	5.3	4.11	21.2	25.1	80000	12000	1.29	78	4.2	24	5.71	64	2.65	5.6	0.54	0.46	8	1.5	1045
	4500	4.1	1.93	4.4	5.3	5.34	21.2	32.6	80000	12000	0.99	60	2.55	14.5	5.69	64	2.65	5.6	0.54	0.46	8	1.5	1090
	6000	3	1.88	4.25	5.3	6.82	21.2	40.9	80000	12000	0.78	47	1.55	8.9	5.74	64	2.65	5.6	0.54	0.46	8	1.5	1090
8MSA4L.dd-eeff	3000	6.4	2.01	4.35	7.5	4.82	30	29.4	72289	12000	1.56	94	3	19.2	6.4	66	4.15	7.7	0.54	0.46	8	1.5	1045
	4500	5.6	2.64	5.6	7.5	6.98	30	41.9	72289	12000	1.08	65	1.45	9.2	6.34	66	4.15	7.7	0.54	0.46	8	1.5	1090
	6000	4.5	2.83	6	7.5	9.07	30	55.3	72289	12000	0.83	50	0.87	5.6	6.44	66	4.15	7.7	0.54	0.46	8	1.5	1090
8MSA4X.dd-eeff	3000	8.5	2.67	6	9.5	6.38	38	38.3	62810	12000	1.49	90	1.65	11.7	7.09	68	6.05	10.5	0.54	0.46	8	1.5	1090
	4500	7.5	3.53	6.5	9.5	7.76	38	46.6	62810	12000	1.22	74	1.13	7.9	6.99	68	6.05	10.5	0.54	0.46	8	1.5	1090
	6000	6	3.77	7.7	9.5	11.3	38	67.6	62810	12000	0.84	51	0.59	4.1	6.95	68	6.05	10.5	0.54	0.46	8	4	1180
8MSA5S.dd-eeff-1	3000	5.7	1.79	4	6.6	4.53	19.8	22.6	49500	9000	1.46	88	4.15	27.8	6.7	45	4	7.5	1.66	0.9	15	1.5	1045
	4500	5.2	2.45	5.2	6.6	6.44	19.8	32	49500	9000	1.03	62	2.05	13.8	6.73	45	4	7.5	1.66	0.9	15	1.5	1090
8MSA5M.dd-eeff-1	3000	8.8	2.76	5.5	10.5	6.35	31.5	31.6	50806	9000	1.65	100	2.25	20	8.89	50	6.2	10	1.66	0.9	15	1.5	1090
	4500	7.2	3.39	7.4	10.5	10.41	31.5	52	50806	9000	1.01	61	0.83	7.4	8.92	50	6.2	10	1.66	0.9	15	4	1180
8MSA5L.dd-eeff-1	3000	11	3.46	7.3	13.5	8.68	40.5	43.2	55479	9000	1.56	94	1.55	14.6	9.42	55	7.3	11.2	1.66	0.9	15	1.5	1090
	4500	9	4.24	8.9	13.5	12.96	40.5	64.5	55479	9000	1.04	63	0.68	6.5	9.56	55	7.3	11.2	1.66	0.9	15	4	1180
8MSA5X.dd-eeff-1	3000	14.5	4.56	8.6	17	9.88	51	49.2	53684	9000	1.72	104	1.26	13.3	10.56	60	9.5	13.7	1.66	0.9	15	4	1180
	4500	11	5.18	10.9	17	16.3	51	81	53684	9000	1.04	63	0.46	4.8	10.4	60	9.5	13.7	1.66	0.9	15	4	1180
8MSA5E.dd-eeff-1	3000	17.5	5.5	10.5	22	12.79	66	63.7	56410	9000	1.72	104	0.95	10.5	11.05	75	11.7	16.2	1.66	0.9	15	4	1180
	4500	13.5	6.36	14.6	22	21.81	66	108.6	56410	9000	1.01	61	0.33	3.6	10.91	75	11.7	16.2	1.66	0.9	15	4	1320
8MSA6S.dd-eeff-1	3000	13	4.08	8.2	13.5	8.16	47.3	40	36107	6000	1.65	100	1.1	13.5	12.27	45	13.1	13.9	5.56	1.6	32	1.5	1090
	4500	10	4.71	9.1	13.5	11.66	47.3	57	36107	6000	1.16	70	0.56	6.7	11.96	45	13.1	13.9	5.56	1.6	32	4	1180
8MSA6M.dd-eeff-1	3000	17	5.34	10.6	19	11.49	66.5	56	35562	6000	1.65	100	0.61	9	14.75	53	18.7	18.2	5.56	1.6	32	4	1180
	4500	10	4.71	9	19	15.95	66.5	79	35562	6000	1.19	72	0.32	4.7	14.69	53	18.7	18.2	5.56	1.6	32	4	1180
8MSA6L.dd-eeff-1	3000	19	5.97	12.3	22	13.71	77	67.2	35814	6000	1.6	97	0.46	7.3	15.87	60	21.5	20.3	5.56	1.6	32	4	1180
	4500	10	4.71	9.2	22	18.73	77	92	35814	6000	1.17	71	0.25	3.9	15.6	60	21.5	20.3	5.56	1.6	32	4	1180
8MSA6X.dd-eeff-1	3000	24	7.54	14.7	29	17.19	101.5	84	34407	6000	1.69	102	0.31	5.6	18.06	70	29.5	26.7	5.56	1.6	32	4	1180
	4500	6	2.83	5.7	29	23.69	101.5	116	34407	6000	1.22	74	0.16	3	18.75	70	29.5	26.7	5.56	1.6	32	4	1320
8MSA7S.dd-eeff	3000	20	6.28	14.1	26	16.9	78	65.9	11642	6000	1.54	93	0.46	5.1	11.09	60	67	22.3	5.56	1.6	32	4	1180
	4500	14.5	6.83	15.8	26	25.35	78	98.9	11642	6000	1.03	62	0.2	2.2	11	60	67	22.3	5.56	1.6	32	4	1320
8MSA7M.dd-eeff	3000	23	7.23	16.8	32	21.26	96	82.9	11852	6000	1.51	91	0.3	3.7	12.33	67	81	26.2	5.56	1.6	32	4	1320
	4500	15	7.07	14.5	32	26.87	96	104.8	11852	6000	1.19	72	0.19	2.2	11.58	67	81	26.2	5.56	1.6	32	4	1320
8MSA7L.dd-eeff	3000	26	8.17	17.3	40	23.94	120	93	11881	4500	1.67	101	0.27	3.4	12.59	70	101	32	5.56	1.6	32	4	1320
8MSA8S.dd-eeff	3000	30	9.42	17.8	40	21.79	120	85	15769	3600	1.84	111	0.25	5.7	22.8	47	76.1	41	53	5.35	130	4	1320
8MSA8M.dd-eeff	3000	50	15.71	27.8	68	35.75	204	139.4	17958	3600	1.9	115	0.13	3.3	25.38	65	113.6	56	53	5.35	130	4	1320
8MSA8L.dd-eeff	2000	70	14.66	29.1	93	37.99	279	148.2	18283	3600	2.45	148	0.12	3.7	30.83	79	152.6	73	53	5.35	130	10	1640
8MSA8X.dd-eeff	2000	85	17.8	35.8	115	46.66	345	182	18148	3600	2.46	149	0.09	2.8	31.11	90	190.1	89	53	5.35	130	10	1640

Table 28: Motor data overview for cooling type A

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.

2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.5 Motor Data 8MSA2

1.5.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxx.00-x 2)
8MSA2S.dd-eeff	6000	0.18	0.11	0.43	0.2	0.44	0.8	1.9	133333	12000	0.46	27.5	99.5	54	0.54	10	0.06	0.9	0.07	0.15	1.8	1.5	1022
8MSA2M.dd-eeff	6000	0.35	0.22	0.62	0.4	0.67	1.6	2.9	200000	12000	0.6	36	50	40	0.8	15	0.08	1.06	0.07	0.15	1.8	1.5	1022
8MSA2L.dd-eeff	6000	0.53	0.33	0.86	0.6	0.93	2.4	4	218182	12000	0.65	39	32	29	0.91	20	0.11	1.21	0.07	0.15	1.8	1.5	1022
8MSA2X.dd-eeff	6000	0.68	0.43	1.05	0.8	1.15	3.2	5	246154	12000	0.7	42	24.5	25	1.02	22	0.13	1.36	0.07	0.15	1.8	1.5	1022

Table 29: Technical data for 8MSA2

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.

2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.5.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSA2S.dd-eeff

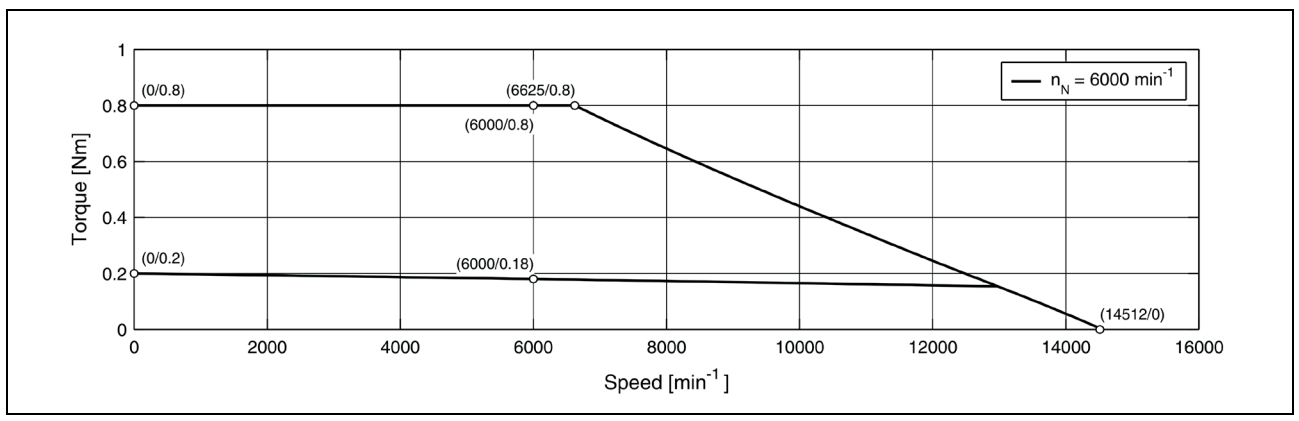


Figure 12: Characteristic curve for 8MSA2S.dd-eeff

8MSA2M.dd-eeff

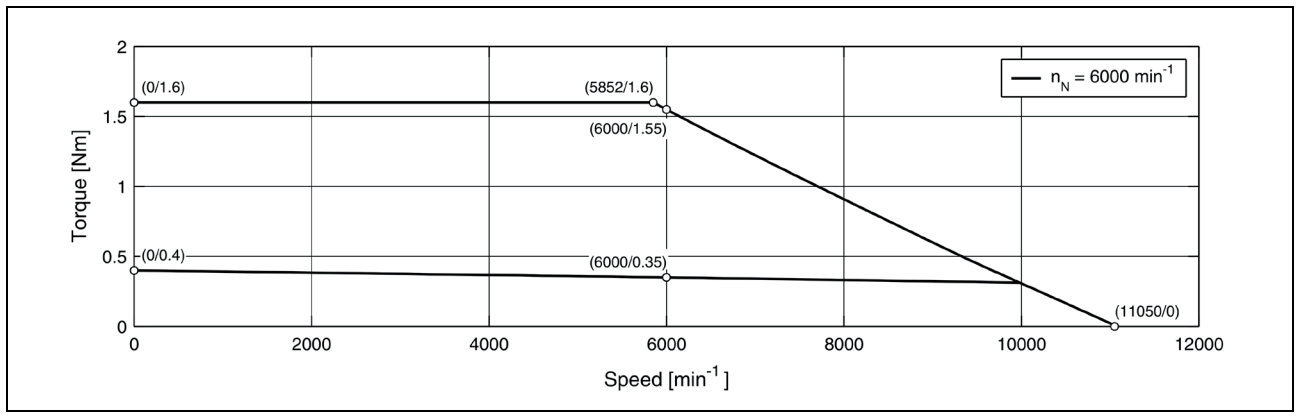


Figure 13: Characteristic curve for 8MSA2M.dd-eeff

8MSA2L.dd-eeff

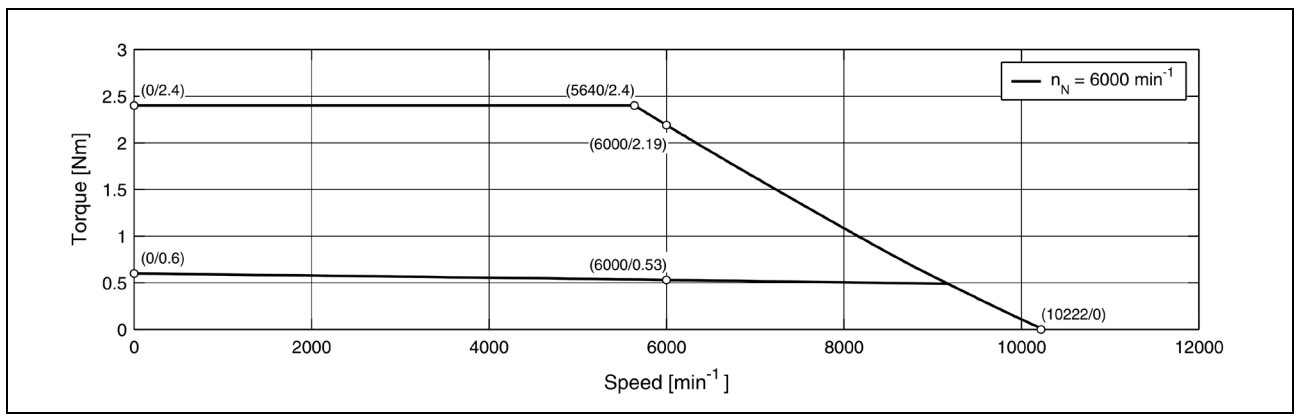


Figure 14: Characteristic curve for 8MSA2L.dd-eeff

8MSA2X.dd-eeff

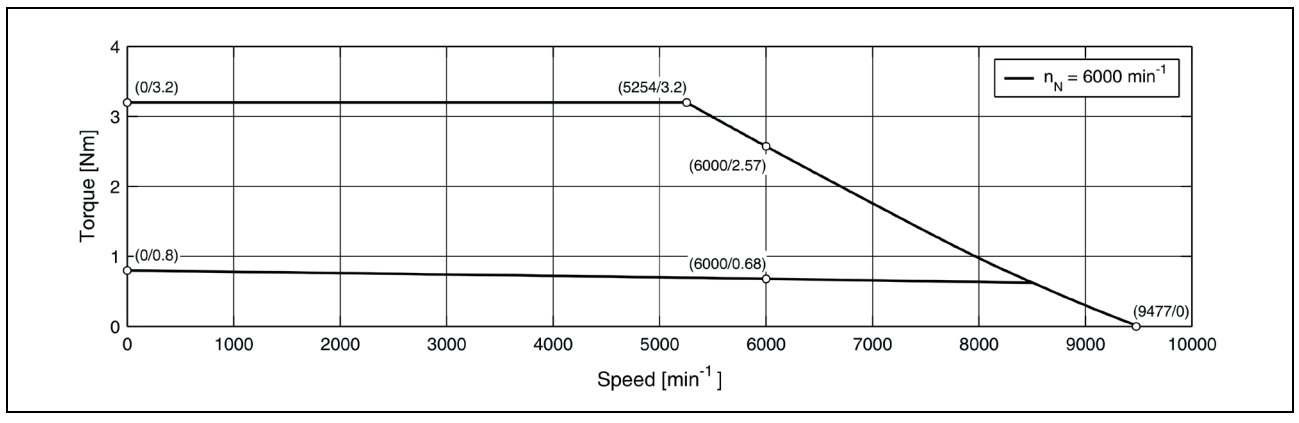
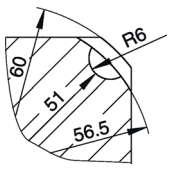


Figure 15: Characteristic curve for 8MSA2X.dd-eeff

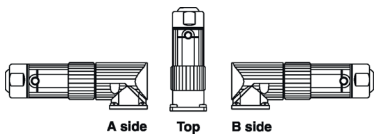
1.5.3 Dimensions

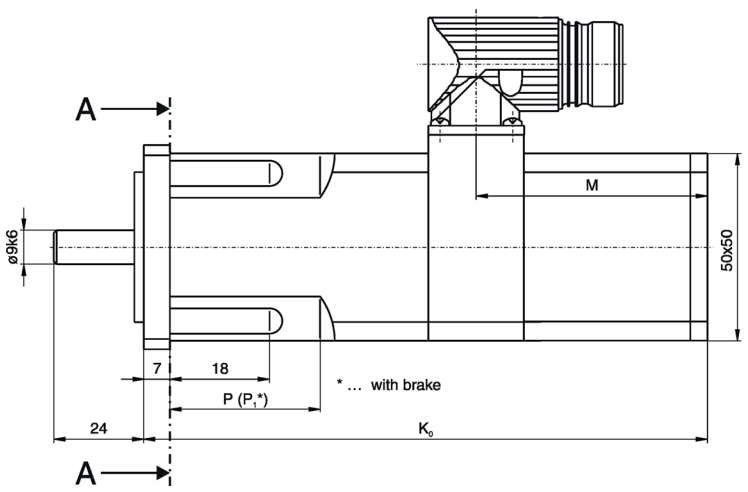
EnDat Feedback						Resolver Feedback						Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	P	P_1	Model Number	K_0	L	M	P	P_1	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSA2S.Ex-eeff	149.5	---	60,75	47	80	8MSA2S.R0-eeff	106	---	17,5	47	80	33	Approx. 10	---	
8MSA2M.Ex-eeff	164.5			62	95	8MSA2M.R0-eeff	121			62	95				
8MSA2L.Ex-eeff	179.5			77	110	8MSA2L.R0-eeff	136			77	110				
8MSA2X.Ex-eeff	194.5			92	125	8MSA2X.R0-eeff	151			92	125				

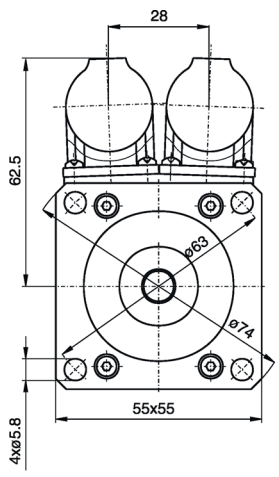
Section Detail A - A



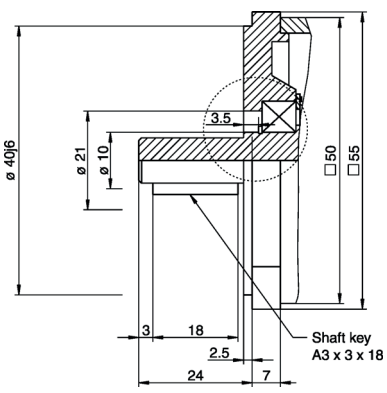
Possible Connection Directions



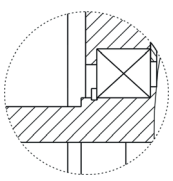




A Side Flange Detail (standard bearing)



Detail



Detail
(with oil seal)

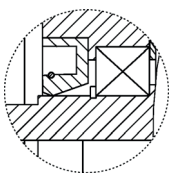
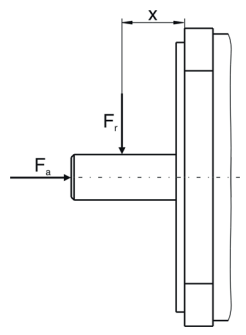


Table 30: Dimensions for servo motor 8MSA2

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.5.4 Maximum Shaft Load



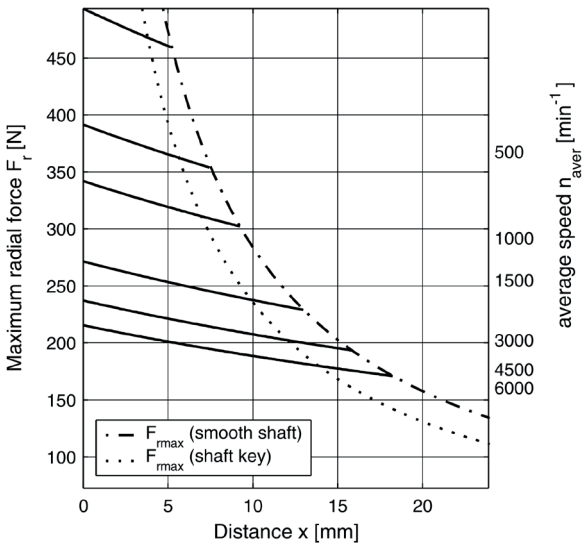
F_r .....Radial force

F_a .....Axial force

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

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Maximum axial force

Standard Bearing

$F_{a_{max}} = 44N$

Table 31: Maximum shaft load for 8MSA2

1.6 Motor Data 8MSA3

1.6.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxx.00-x 2)
8MSA3S.dd-eeff	6000	0.55	0.35	0.83	0.65	0.91	2.6	3.9	66667	12000	0.71	43	37.6	45	1.2	25	0.39	1.75	0.18	0.3	4	1.5	1022
8MSA3M.dd-eeff	6000	1	0.63	1.4	1.3	1.67	5.2	7.2	80000	12000	0.78	47	12.7	21.5	1.69	30	0.65	2.25	0.18	0.3	4	1.5	1022
8MSA3L.dd-eeff	3000	2.15	0.68	1.62	2.5	1.8	10	7.7	83333	12000	1.39	84	15	33.2	2.21	32	1.2	3.2	0.18	0.3	4	1.5	1022
	4500	2	0.94	2.2	2.5	2.61	10	11.2	83333	12000	0.96	58	7	15.4	2.2	32	1.2	3.2	0.18	0.3	4	1.5	1045
	6000	1.8	1.13	2.3	2.5	3.02	10	13	83333	12000	0.83	50	5.4	11.7	2.17	32	1.2	3.2	0.18	0.3	4	1.5	1045
8MSA3X.dd-eeff	3000	2.5	0.79	1.82	3	2.08	12	9	80000	12000	1.44	87	11.6	26.7	2.3	33	1.5	3.65	0.18	0.3	4	1.5	1022
	4500	2.1	0.99	2.1	3	2.9	12	12.4	80000	12000	1.04	63	6	14.2	2.37	33	1.5	3.65	0.18	0.3	4	1.5	1045
	6000	1.6	1.01	2.1	3	3.66	12	15.8	80000	12000	0.82	49.5	3.65	8.6	2.36	33	1.5	3.65	0.18	0.3	4	1.5	1045

Table 32: Technical data for 8MSA3

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.
2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.6.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSA3S.dd-eeff

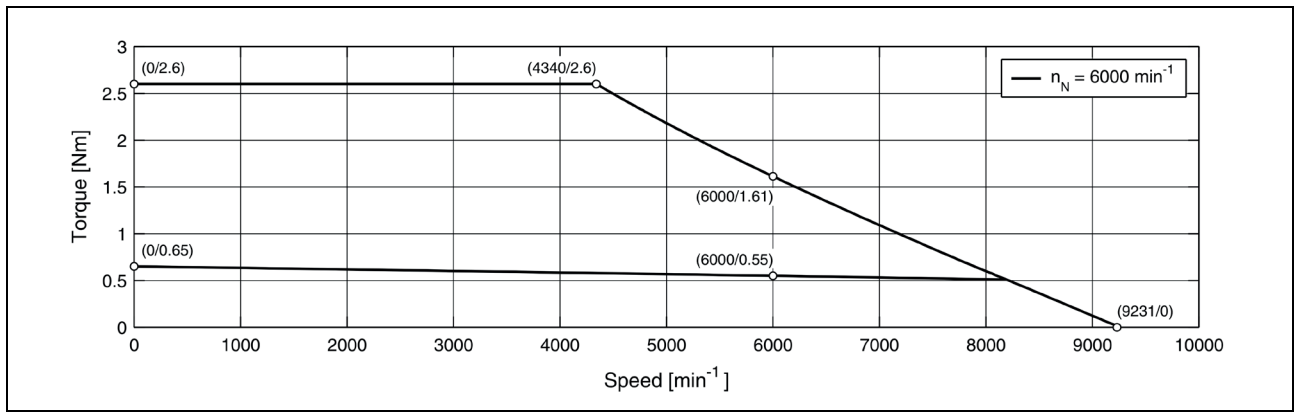


Figure 16: Characteristic curve for 8MSA3S.dd-eeff

8MSA3M.dd-eeff

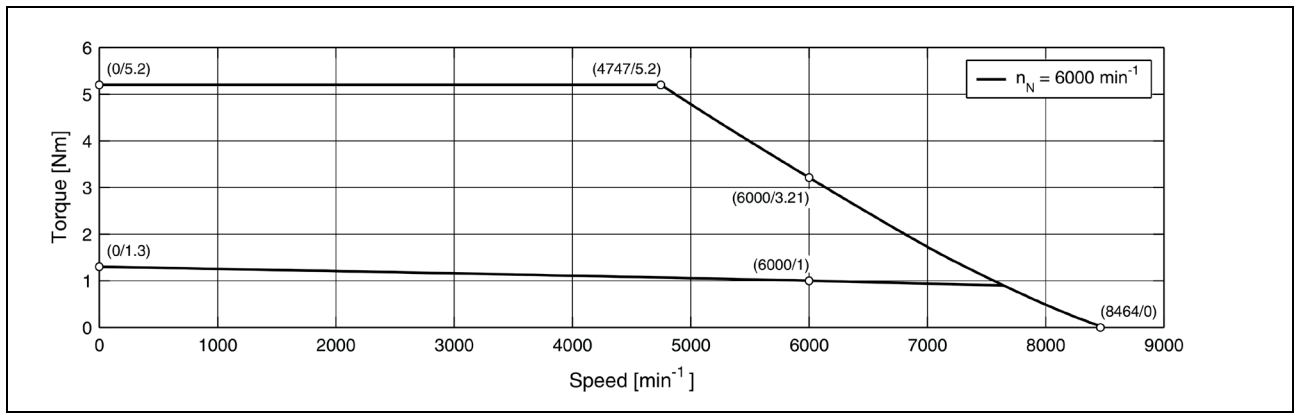


Figure 17: Characteristic curve for 8MSA3M.dd-eeff

8MSA3L.dd-eeff

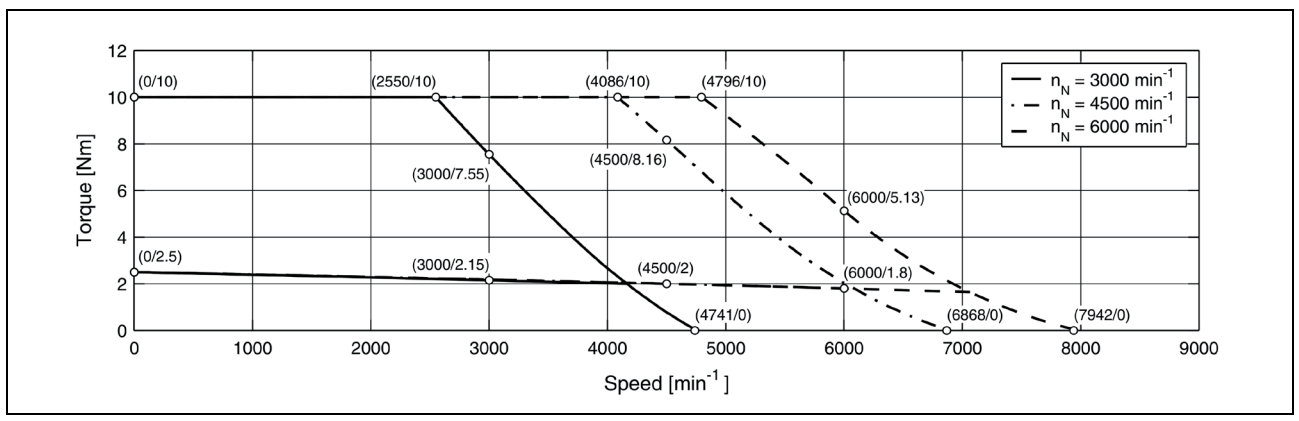


Figure 18: Characteristic curve for 8MSA3L.dd-eeff

8MSA3X.dd-eeff

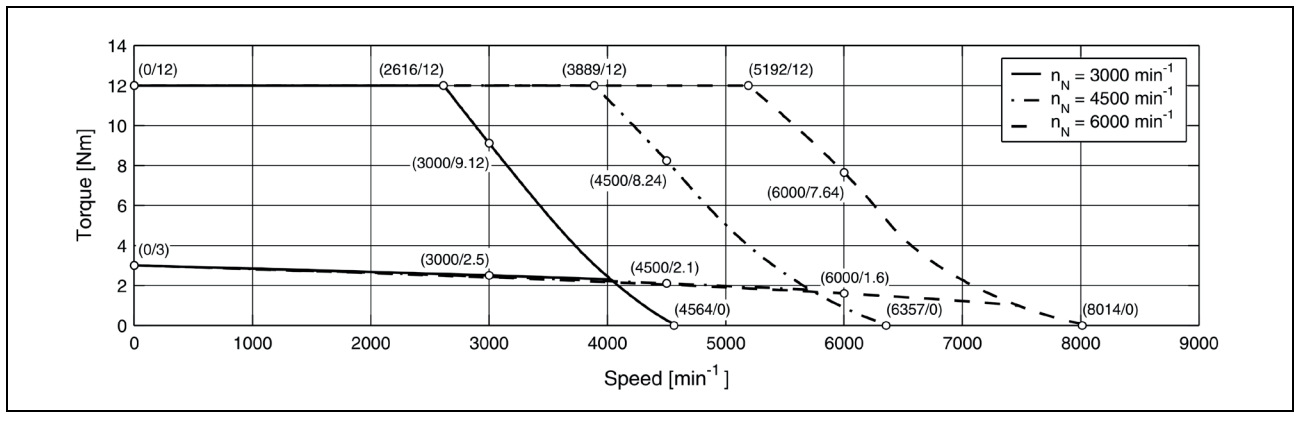
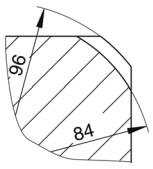


Figure 19: Characteristic curve for 8MSA3X.dd-eeff

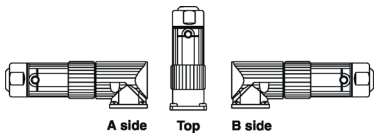
1.6.3 Dimensions

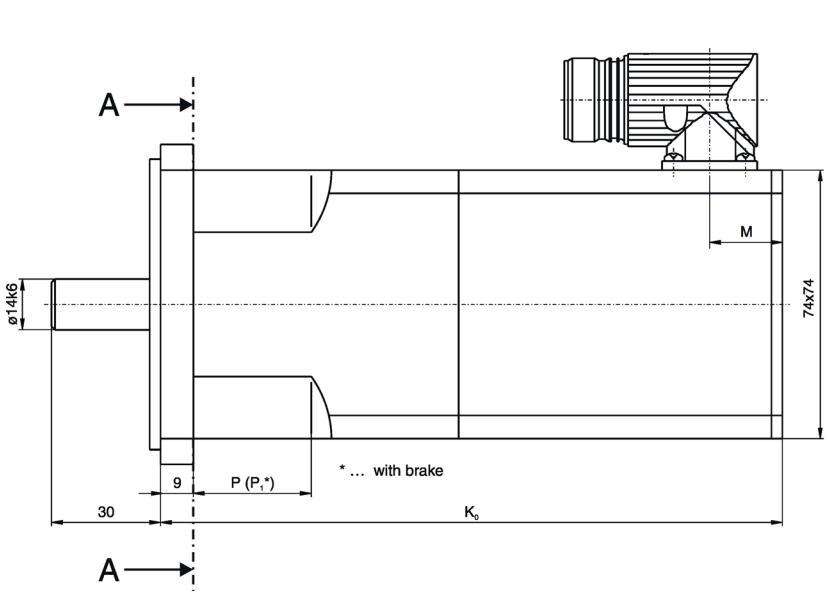
EnDat Feedback						Resolver Feedback						Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	P	P_1	Model Number	K_0	L	M	P	P_1	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSA3S.Ex-eeff	171	---	20	39	72	8MSA3S.R0-eeff	115	---	18	39	72	33	Approx. 10	---	
8MSA3M.Ex-eeff	189			57	90	8MSA3M.R0-eeff	133			57	90				
8MSA3L.Ex-eeff	225			93	126	8MSA3L.R0-eeff	169			93	126				
8MSA3X.Ex-eeff	243			111	144	8MSA3X.R0-eeff	187			111	144				

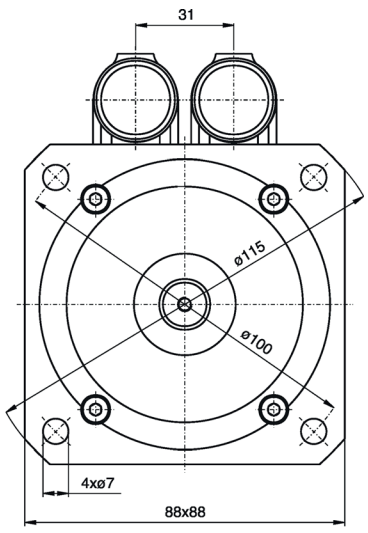
Section Detail A - A



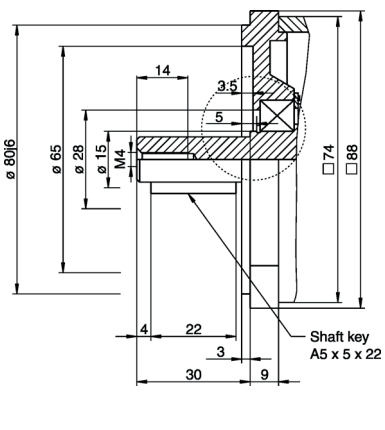
Possible Connection Directions



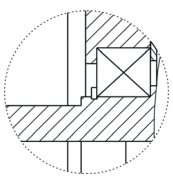




A Side Flange Detail (standard bearing)



Detail



Detail
(with oil seal)

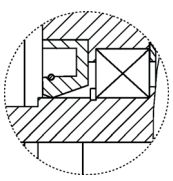
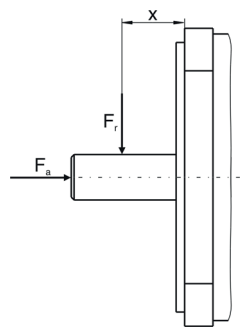


Table 33: Dimensions for servo motor 8MSA3

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.6.4 Maximum Shaft Load



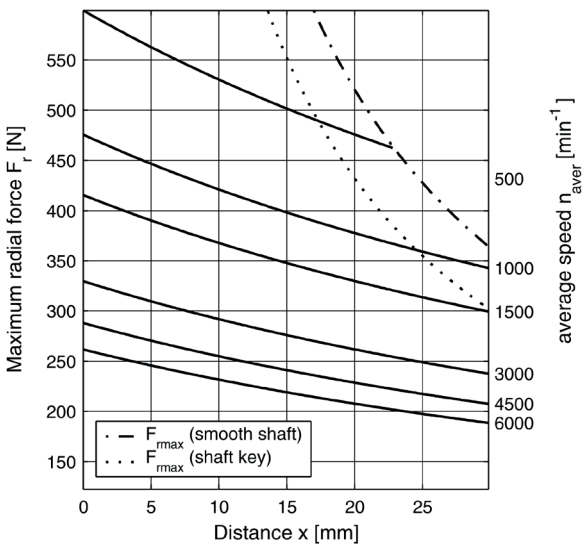
F_r .....Radial force

F_a .....Axial force

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

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Maximum axial force

Standard Bearing

$F_{a_{max}} = 52N$

Table 34: Maximum shaft load for 8MSA3

1.7 Motor Data 8MSA4

1.7.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [kgcm^2]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [kgcm^2]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxx.00-x 2)
8MSA4S.dd-eeff	3000	2.3	0.72	1.85	2.6	1.92	10.4	11.5	54737	12000	1.36	82	9.6	41.5	4.32	60	1.9	4.5	0.54	0.46	8	1.5	1022
	4500	1.9	0.9	2.25	2.6	2.76	10.4	16.5	54737	12000	0.94	57	4.55	20.5	4.51	60	1.9	4.5	0.54	0.46	8	1.5	1045
	6000	1.2	0.75	1.75	2.6	3.21	10.4	19.6	54737	12000	0.81	49	3.3	15	4.55	60	1.9	4.5	0.54	0.46	8	1.5	1045
8MSA4M.dd-eeff	3000	4.6	1.45	3.75	5.3	4.11	21.2	25.1	80000	12000	1.29	78	4.2	24	5.71	64	2.65	5.6	0.54	0.46	8	1.5	1045
	4500	4.1	1.93	4.4	5.3	5.34	21.2	32.6	80000	12000	0.99	60	2.55	14.5	5.69	64	2.65	5.6	0.54	0.46	8	1.5	1090
	6000	3	1.88	4.25	5.3	6.82	21.2	40.9	80000	12000	0.78	47	1.55	8.9	5.74	64	2.65	5.6	0.54	0.46	8	1.5	1090
8MSA4L.dd-eeff	3000	6.4	2.01	4.35	7.5	4.82	30	29.4	72289	12000	1.56	94	3	19.2	6.4	66	4.15	7.7	0.54	0.46	8	1.5	1045
	4500	5.6	2.64	5.6	7.5	6.98	30	41.9	72289	12000	1.08	65	1.45	9.2	6.34	66	4.15	7.7	0.54	0.46	8	1.5	1090
	6000	4.5	2.83	6	7.5	9.07	30	55.3	72289	12000	0.83	50	0.87	5.6	6.44	66	4.15	7.7	0.54	0.46	8	1.5	1090
8MSA4X.dd-eeff	3000	8.5	2.67	6	9.5	6.38	38	38.3	62810	12000	1.49	90	1.65	11.7	7.09	68	6.05	10.5	0.54	0.46	8	1.5	1090
	4500	7.5	3.53	6.5	9.5	7.76	38	46.6	62810	12000	1.22	74	1.13	7.9	6.99	68	6.05	10.5	0.54	0.46	8	1.5	1090
	6000	6	3.77	7.7	9.5	11.3	38	67.6	62810	12000	0.84	51	0.59	4.1	6.95	68	6.05	10.5	0.54	0.46	8	4	1180

Table 35: Technical data for 8MSA4

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.
2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.7.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSA4S.dd-eeff

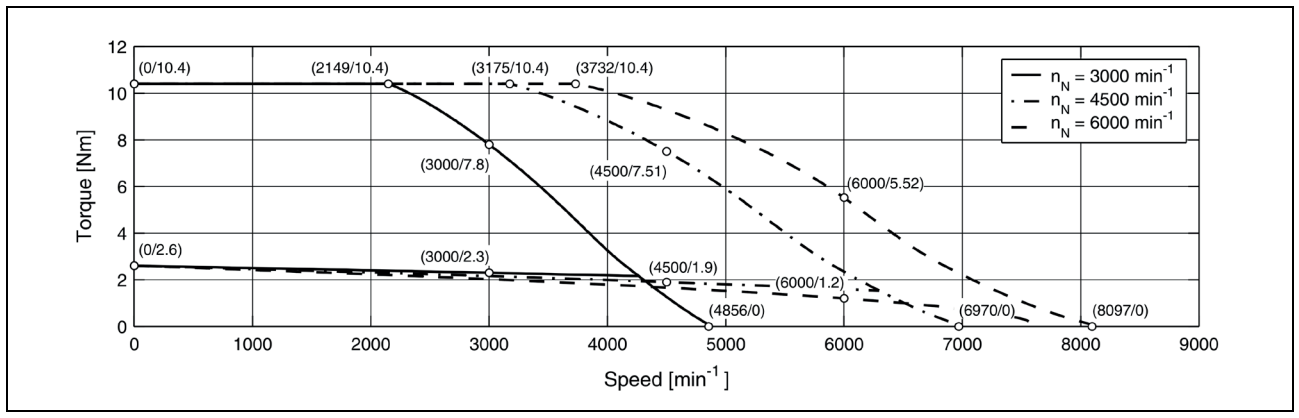


Figure 20: Characteristic curve for 8MSA4S.dd-eeff

8MSA4M.dd-eeff

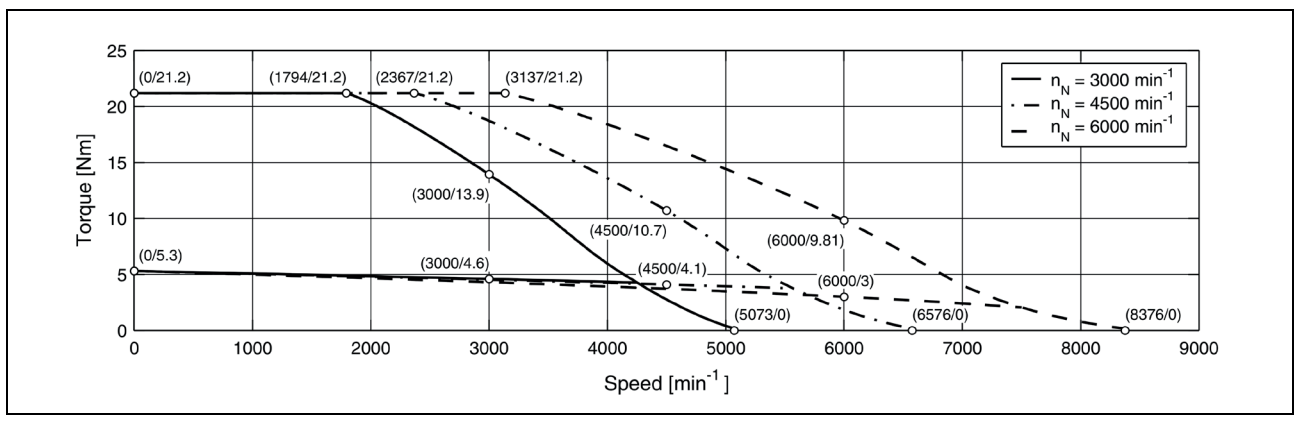


Figure 21: Characteristic curve for 8MSA4M.dd-eeff

8MSA4L.dd-eeff

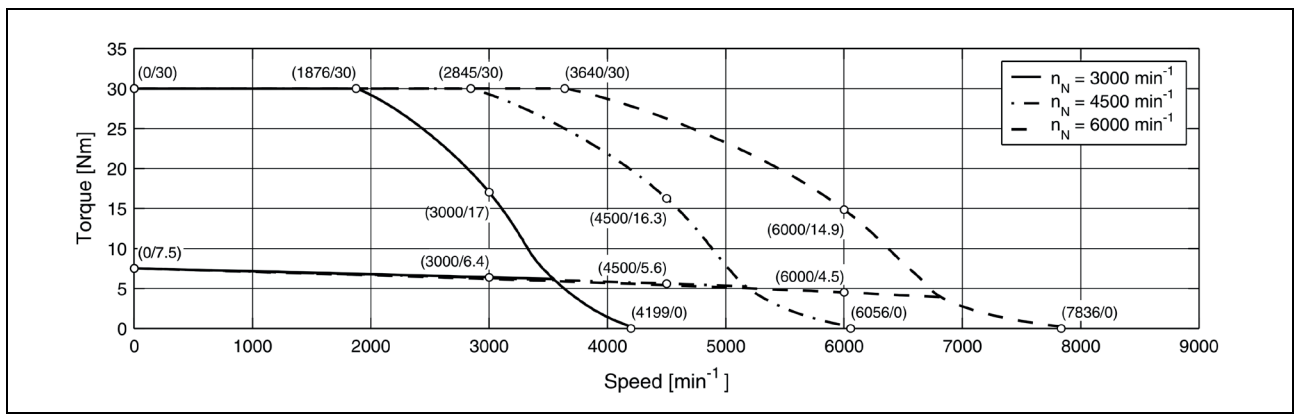


Figure 22: Characteristic curve for 8MSA4L.dd-eeff

8MSA4X.dd-eeff

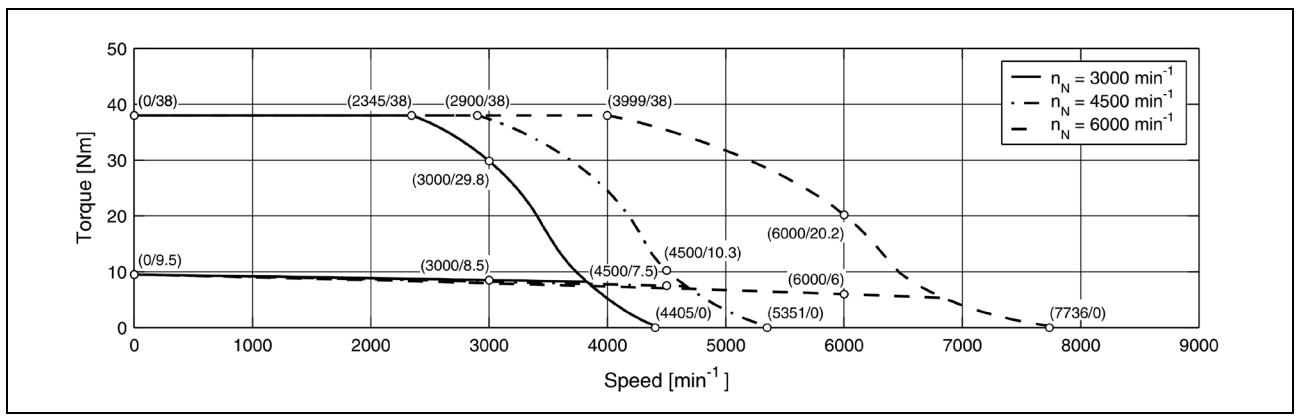
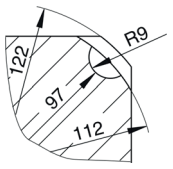


Figure 23: Characteristic curve for 8MSA4X.dd-eeff

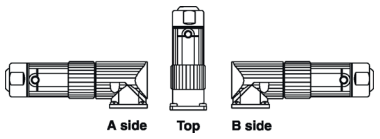
1.7.3 Dimensions

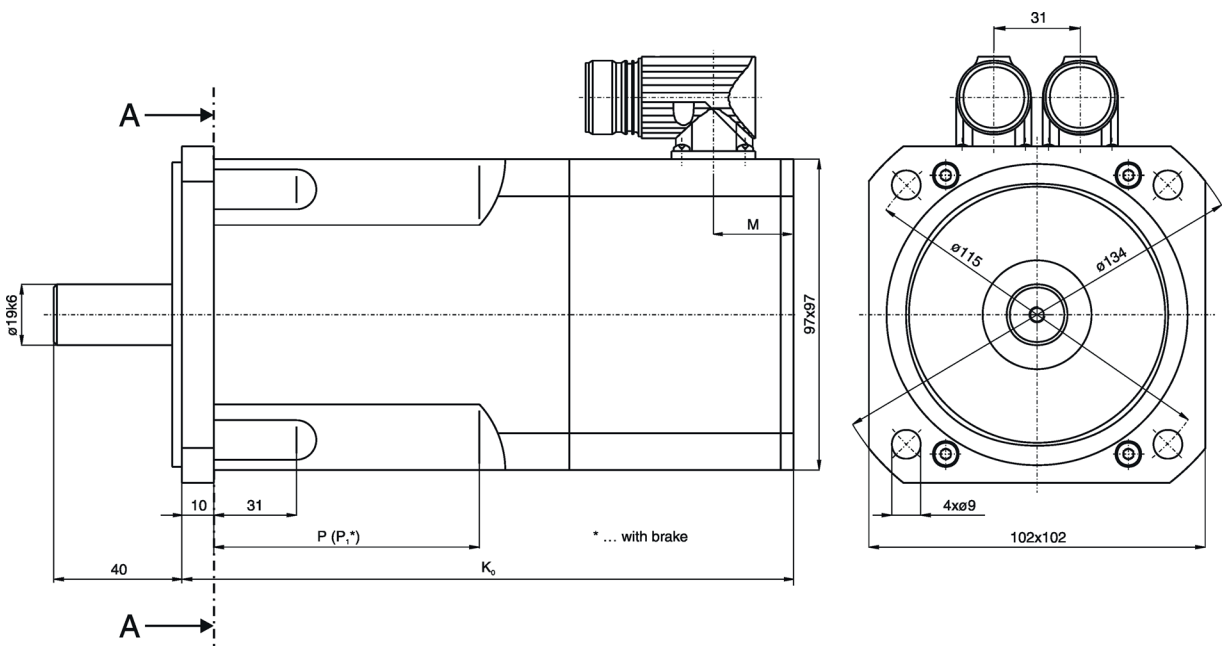
EnDat Feedback						Resolver Feedback						Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	P	P_1	Model Number	K_0	L	M	P	P_1	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSA4S.Ex-eeff	191	---	23	85	117	8MSA4S.R0-eeff	155	---	19	85	117	32	Approx. 10	28	
8MSA4M.Ex-eeff	221			115	147	8MSA4M.R0-eeff	185			115	147				
8MSA4L.Ex-eeff	266			160	192	8MSA4L.R0-eeff	230			160	192				
8MSA4X.Ex-eeff	321.5			215	247	8MSA4X.R0-eeff	285.5			215	247				

Section Detail A - A

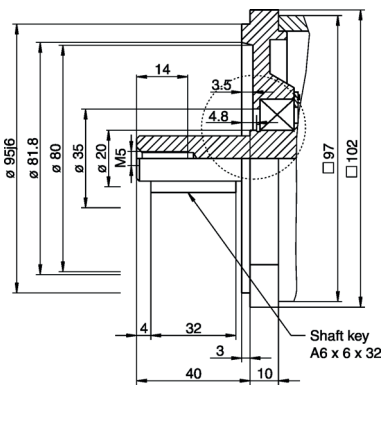


Possible Connection Directions

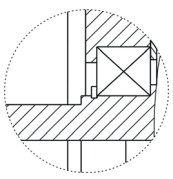




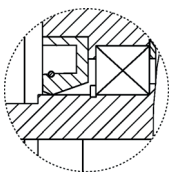
A Side Flange Detail (standard bearing)



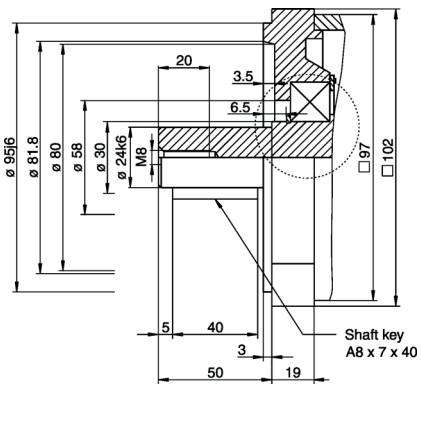
Detail



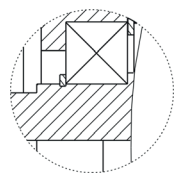
Detail
(with oil seal)



A Side Flange Detail (option "reinforced A side bearing")



Detail



Detail
(with oil seal)

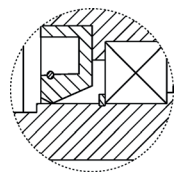
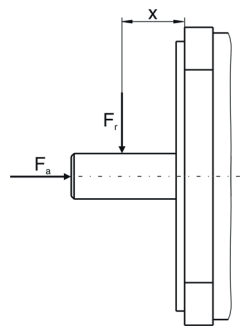


Table 36: Dimensions for servo motor 8MSA4

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.7.4 Maximum Shaft Load



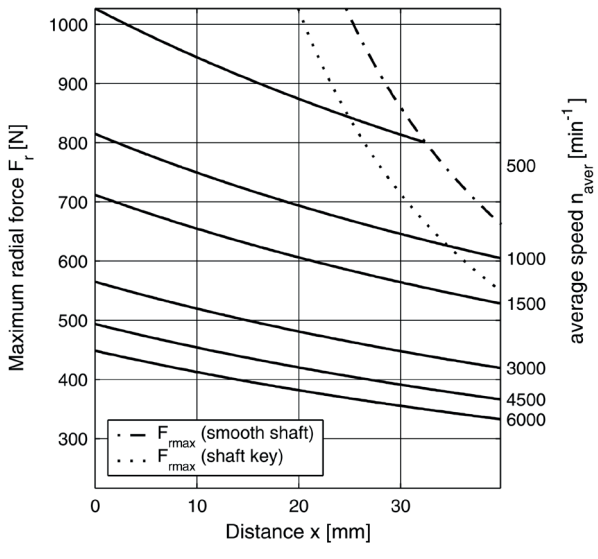
F_r .....Radial force

F_a .....Axial force

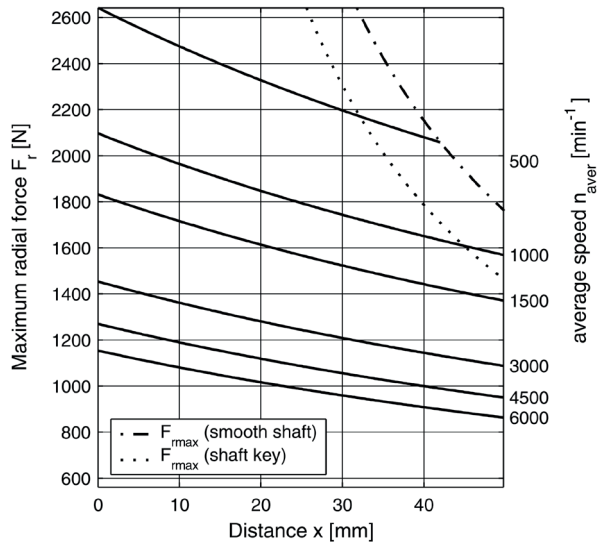
x .....Distance between motor flange and the point the radial force F_r is applied

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Option "Reinforced A Side Bearing"



Maximum axial force

Standard Bearing

$F_{a_{max}} = 91N$

Option "Reinforced A Side Bearing"

$F_{a_{max}} = 251N$

Table 37: Maximum shaft load for 8MSA4

1.8 Motor Data 8MSA5

1.8.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxx.00-x 2)
8MSA5S.dd-eeff-1	3000	5.7	1.79	4	6.6	4.53	19.8	22.6	49500	9000	1.46	88	4.15	27.8	6.7	45	4	7.5	1.66	0.9	15	1.5	1045
	4500	5.2	2.45	5.2	6.6	6.44	19.8	32	49500	9000	1.03	62	2.05	13.8	6.73	45	4	7.5	1.66	0.9	15	1.5	1090
8MSA5M.dd-eeff-1	3000	8.8	2.76	5.5	10.5	6.35	31.5	31.6	50806	9000	1.65	100	2.25	20	8.89	50	6.2	10	1.66	0.9	15	1.5	1090
	4500	7.2	3.39	7.4	10.5	10.41	31.5	52	50806	9000	1.01	61	0.83	7.4	8.92	50	6.2	10	1.66	0.9	15	4	1180
8MSA5L.dd-eeff-1	3000	11	3.46	7.3	13.5	8.68	40.5	43.2	55479	9000	1.56	94	1.55	14.6	9.42	55	7.3	11.2	1.66	0.9	15	1.5	1090
	4500	9	4.24	8.9	13.5	12.96	40.5	64.5	55479	9000	1.04	63	0.68	6.5	9.56	55	7.3	11.2	1.66	0.9	15	4	1180
8MSA5X.dd-eeff-1	3000	14.5	4.56	8.6	17	9.88	51	49.2	53684	9000	1.72	104	1.26	13.3	10.56	60	9.5	13.7	1.66	0.9	15	4	1180
	4500	11	5.18	10.9	17	16.3	51	81	53684	9000	1.04	63	0.46	4.8	10.4	60	9.5	13.7	1.66	0.9	15	4	1180
8MSA5E.dd-eeff-1	3000	17.5	5.5	10.5	22	12.79	66	63.7	56410	9000	1.72	104	0.95	10.5	11.05	75	11.7	16.2	1.66	0.9	15	4	1180
	4500	13.5	6.36	14.6	22	21.81	66	108.6	56410	9000	1.01	61	0.33	3.6	10.91	75	11.7	16.2	1.66	0.9	15	4	1320

Table 38: Technical data for 8MSA5

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.

2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.8.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSA5S.dd-eeff-1

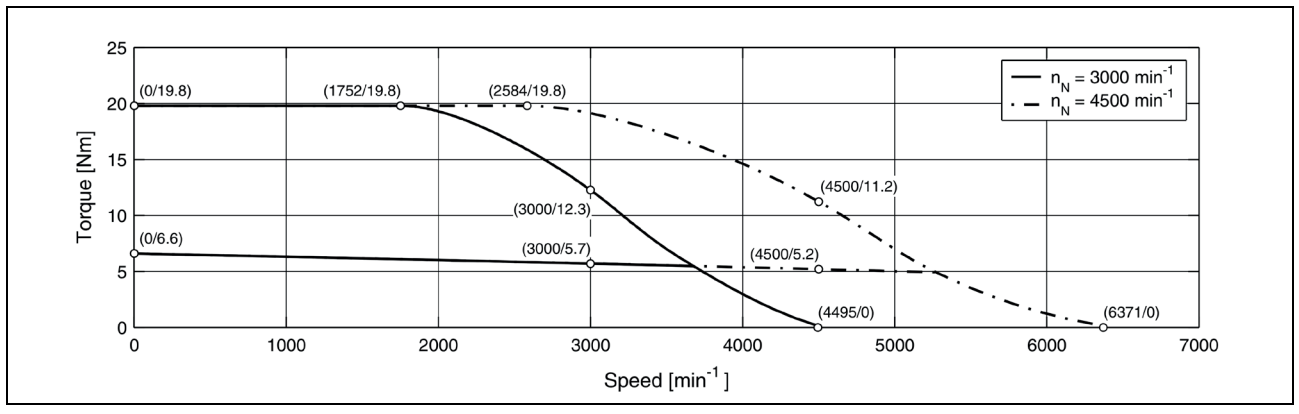


Figure 24: Characteristic curve for 8MSA5S.dd-eeff-1

8MSA5M.dd-eeff-1

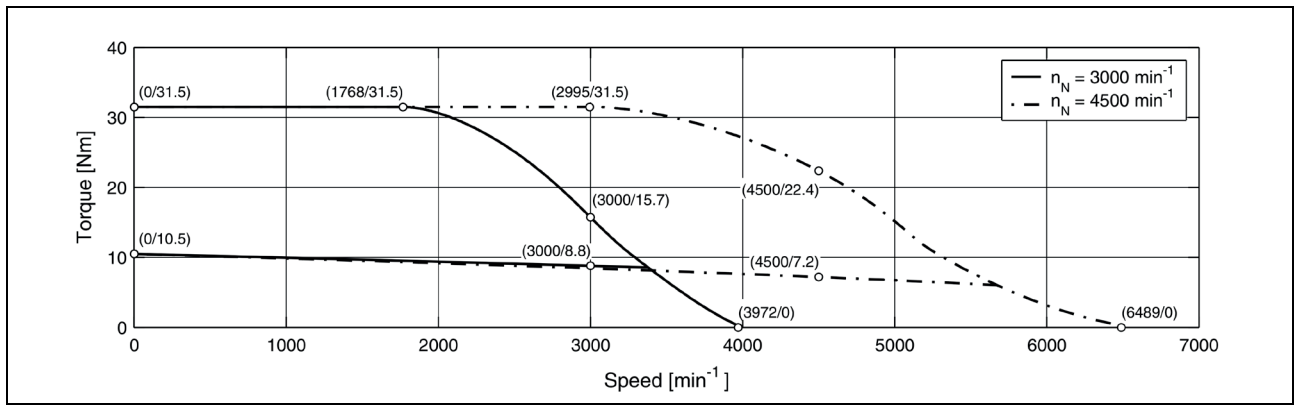


Figure 25: Characteristic curve for 8MSA5M.dd-eeff-1

8MSA5L.dd-eeff-1

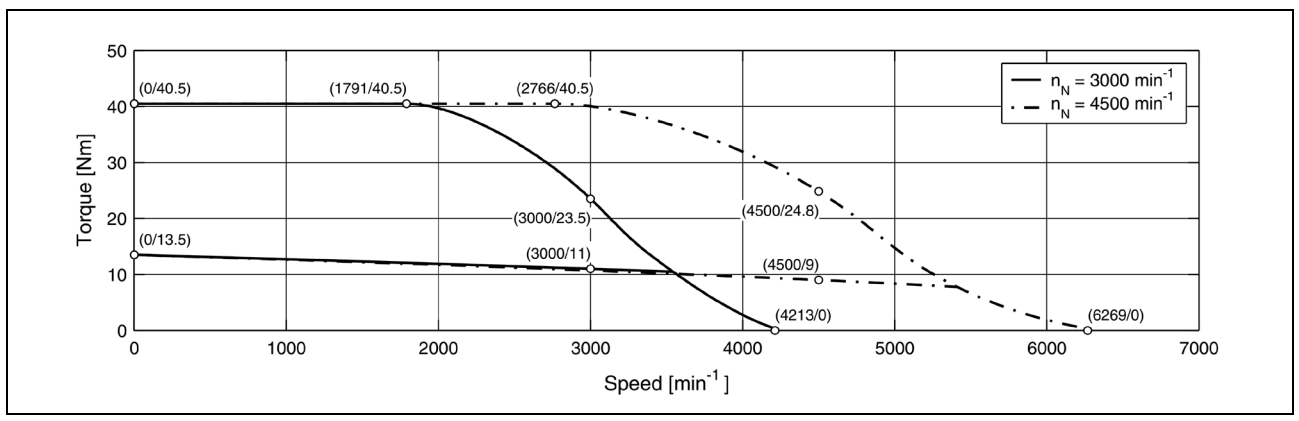


Figure 26: Characteristic curve for 8MSA5L.dd-eeff-1

8MSA5X.dd-eeff-1

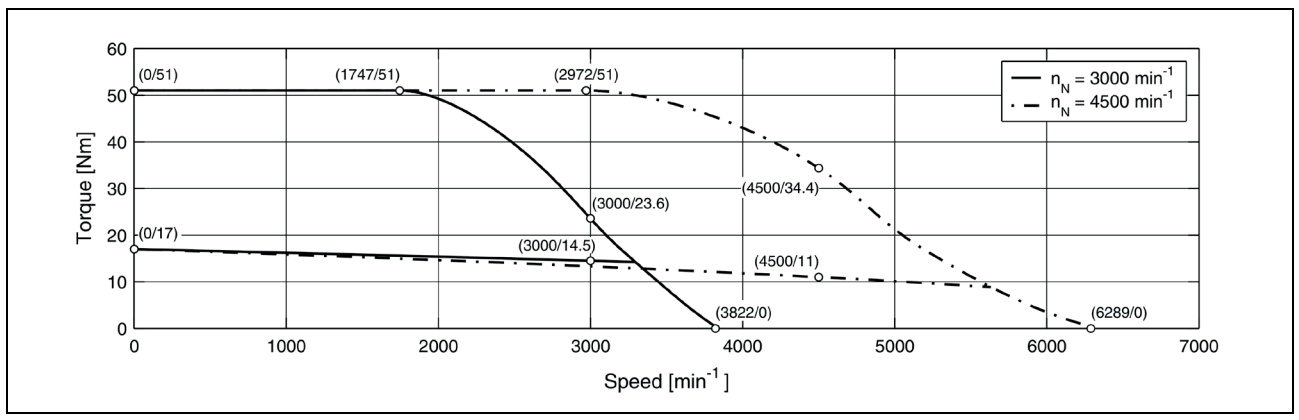


Figure 27: Characteristic curve for 8MSA5X.dd-eeff-1

8MSA5E.dd-eeff-1

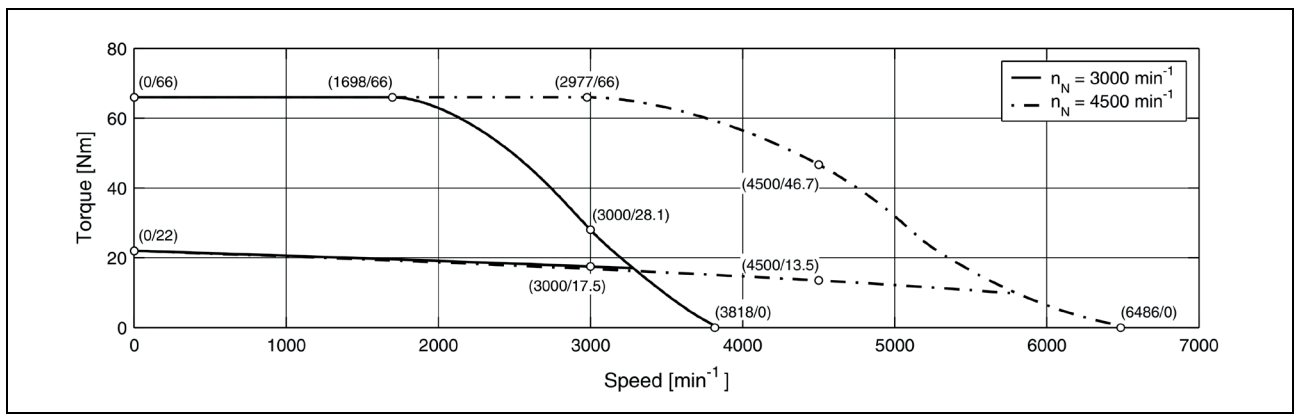
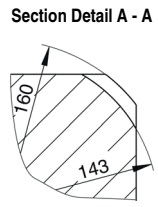
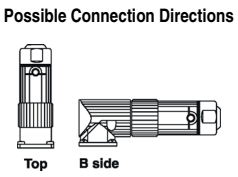


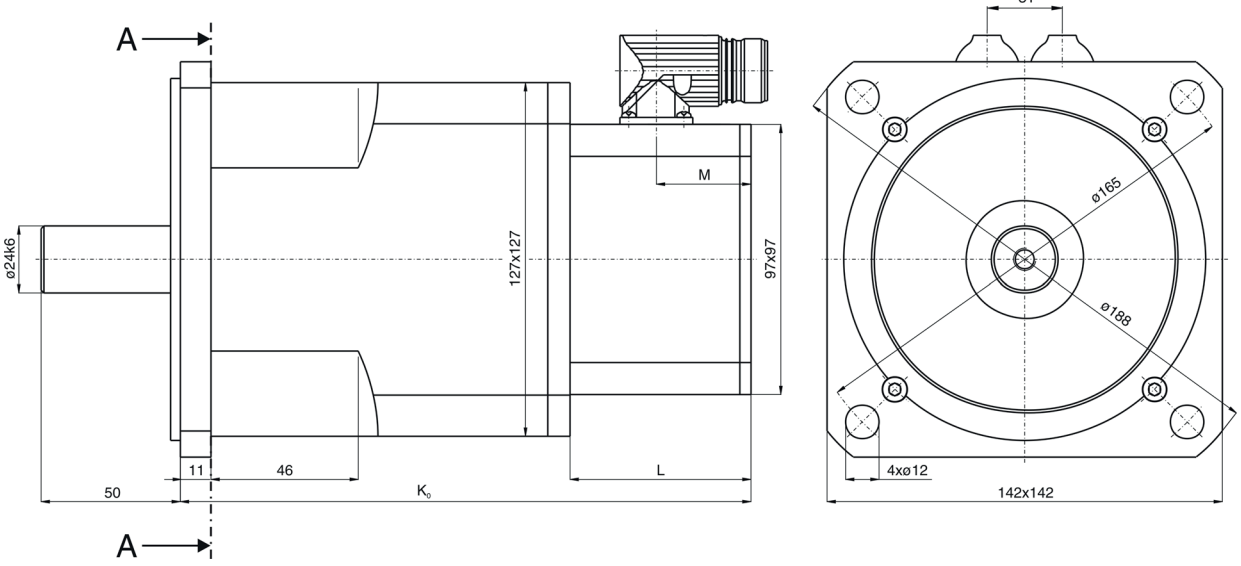
Figure 28: Characteristic curve for 8MSA5E.dd-eeff-1

1.8.3 Dimensions

EnDat Feedback				Resolver Feedback				Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	Model Number	K_0	L	M	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSA5S.Ex-eeff-1	205	65	26	8MSA5S.R0-eeff-1	186	46	20	43	Approx. 10	35	
8MSA5M.Ex-eeff-1	239			8MSA5M.R0-eeff-1	220						
8MSA5L.Ex-eeff-1	256			8MSA5L.R0-eeff-1	237						
8MSA5X.Ex-eeff-1	290			8MSA5X.R0-eeff-1	271						
8MSA5E.Ex-eeff-1	324			8MSA5E.R0-eeff-1	305						







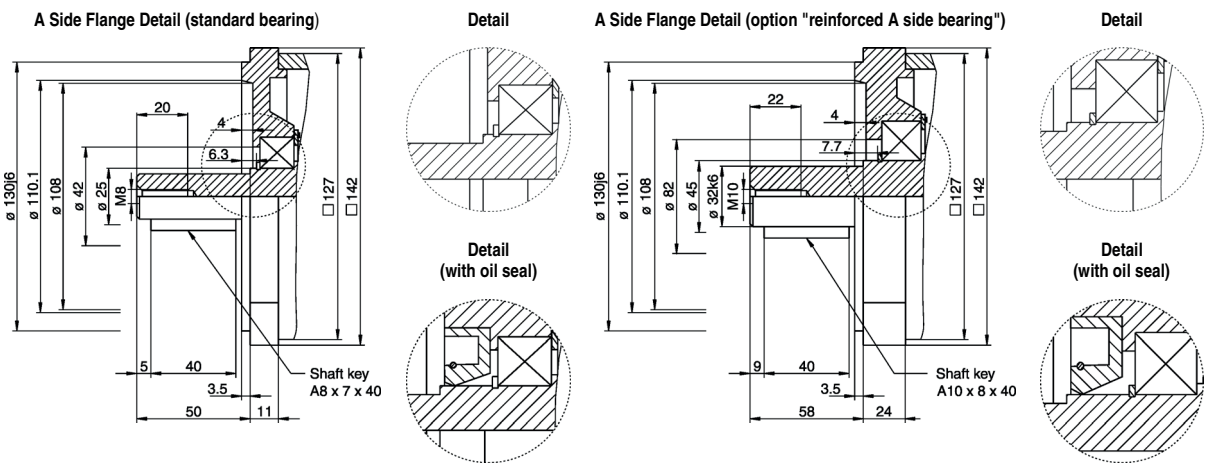
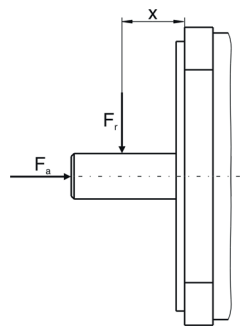


Table 39: Dimensions for servo motor 8MSA5

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.8.4 Maximum Shaft Load



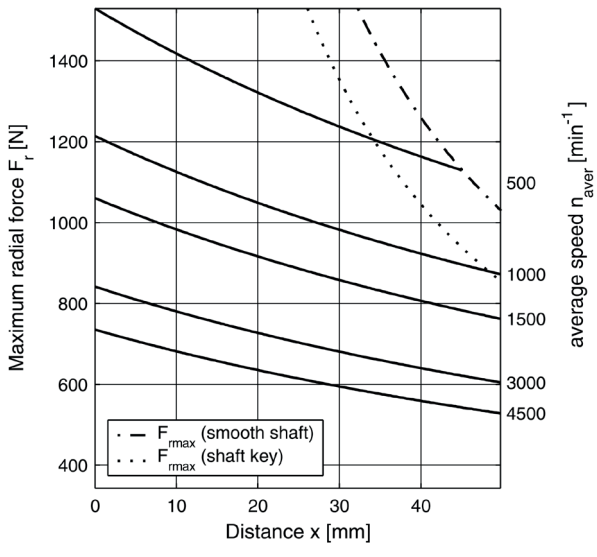
F_r .....Radial force

F_a .....Axial force

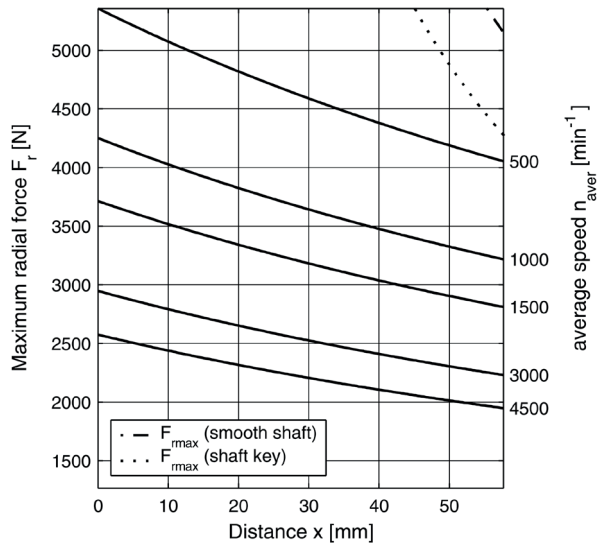
x .....Distance between motor flange and the point the radial force F_r is applied

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Option "Reinforced A Side Bearing"



Maximum axial force

Standard Bearing

$F_{a_{max}} = 132N$

Option "Reinforced A Side Bearing"

$F_{a_{max}} = 501N$

Table 40: Maximum shaft load for 8MSA5

1.9 Motor Data 8MSA6

1.9.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxx.00-x 2)
8MSA6S.dd-eeff-1	3000	13	4.08	8.2	13.5	8.16	47.3	40	36107	6000	1.65	100	1.1	13.5	12.27	45	13.1	13.9	5.56	1.6	32	1.5	1090
	4500	10	4.71	9.1	13.5	11.66	47.3	57	36107	6000	1.16	70	0.56	6.7	11.96	45	13.1	13.9	5.56	1.6	32	4	1180
8MSA6M.dd-eeff-1	3000	17	5.34	10.6	19	11.49	66.5	56	35562	6000	1.65	100	0.61	9	14.75	53	18.7	18.2	5.56	1.6	32	4	1180
	4500	10	4.71	9	19	15.95	66.5	79	35562	6000	1.19	72	0.32	4.7	14.69	53	18.7	18.2	5.56	1.6	32	4	1180
8MSA6L.dd-eeff-1	3000	19	5.97	12.3	22	13.71	77	67.2	35814	6000	1.6	97	0.46	7.3	15.87	60	21.5	20.3	5.56	1.6	32	4	1180
	4500	10	4.71	9.2	22	18.73	77	92	35814	6000	1.17	71	0.25	3.9	15.6	60	21.5	20.3	5.56	1.6	32	4	1180
8MSA6X.dd-eeff-1	3000	24	7.54	14.7	29	17.19	101.5	84	34407	6000	1.69	102	0.31	5.6	18.06	70	29.5	26.7	5.56	1.6	32	4	1180
	4500	6	2.83	5.7	29	23.69	101.5	116	34407	6000	1.22	74	0.16	3	18.75	70	29.5	26.7	5.56	1.6	32	4	1320

Table 41: Technical data for 8MSA6

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.
2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.9.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSA6S.dd-eeff-1

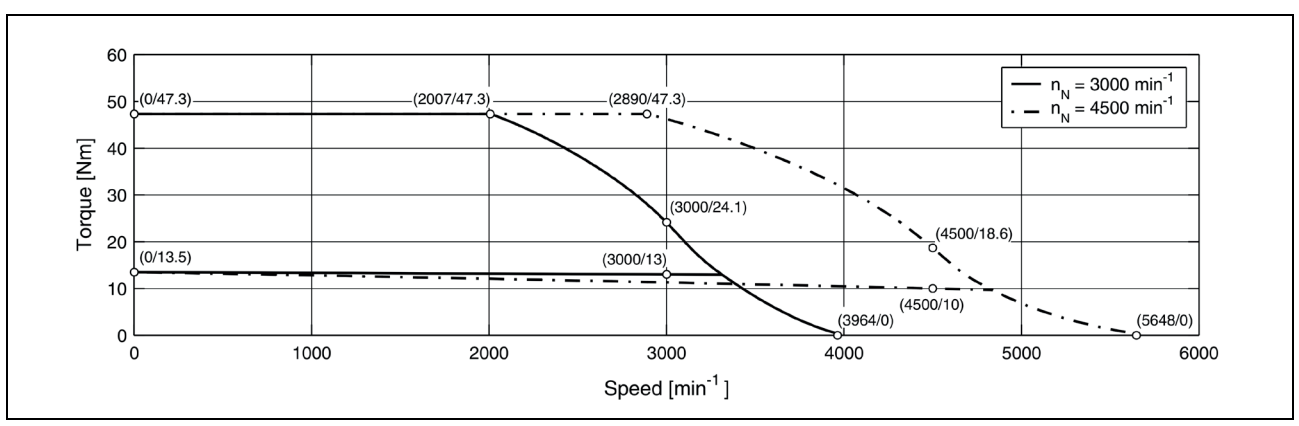


Figure 29: Characteristic curve for 8MSA6S.dd-eeff-1

8MSA6M.dd-eeff-1

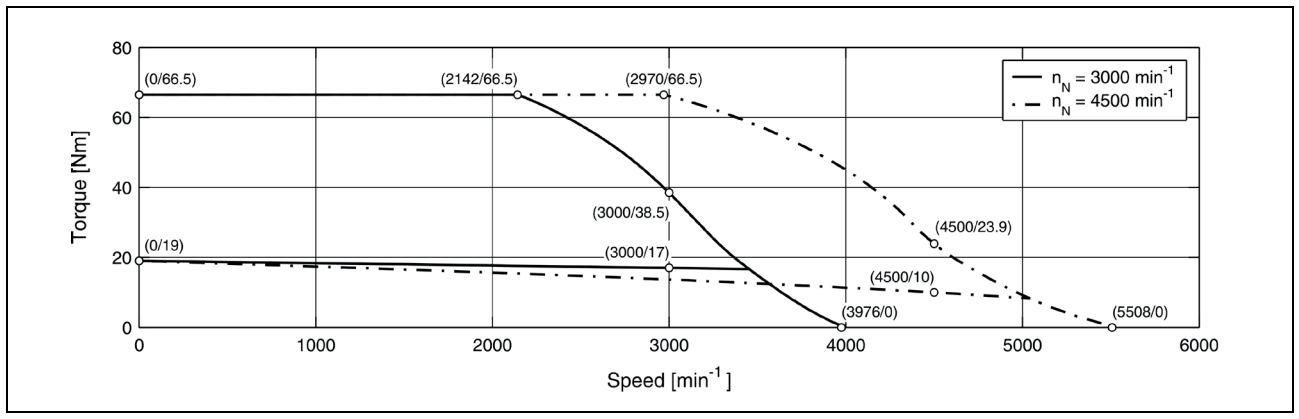


Figure 30: Characteristic curve for 8MSA6M.dd-eeff-1

8MSA6L.dd-eeff-1

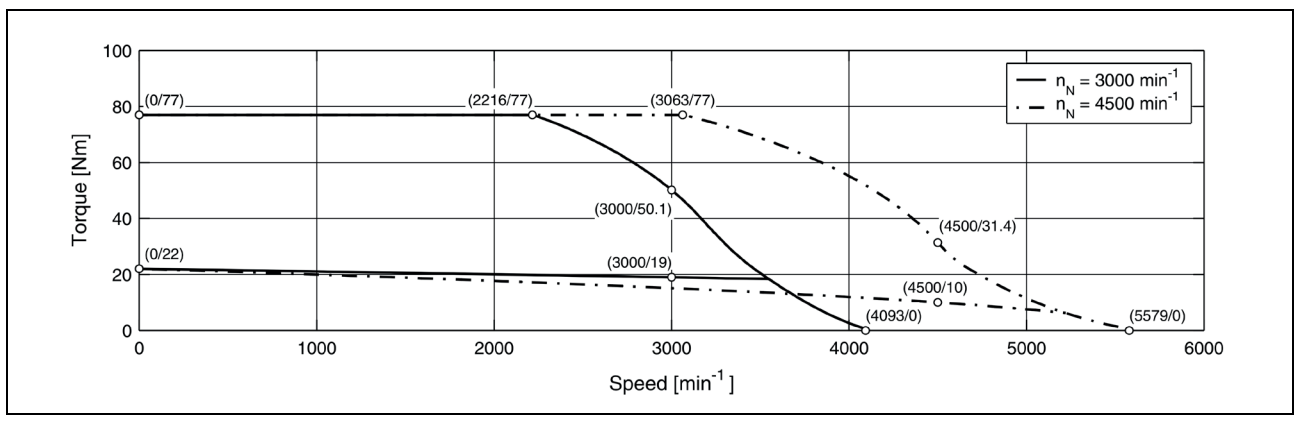


Figure 31: Characteristic curve for 8MSA6L.dd-eeff-1

8MSA6X.dd-eeff-1

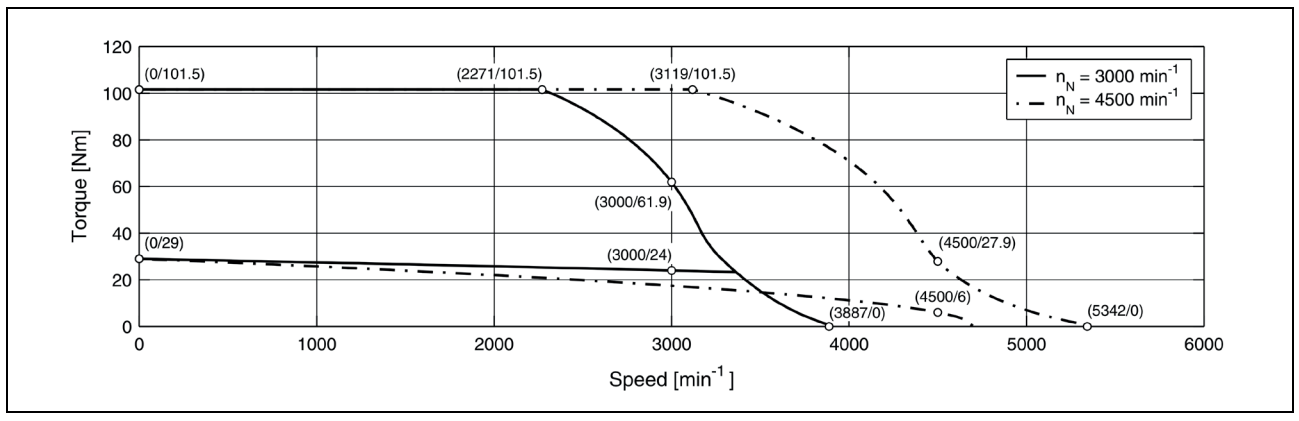


Figure 32: Characteristic curve for 8MSA6X.dd-eeff-1

1.9.3 Dimensions

EnDat Feedback				Resolver Feedback				Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	Model Number	K_0	L	M	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSA6S.Ex-eeff-1	221	65	26	8MSA6S.R0-eeff-1	202	46	20	53	Approx. 10	23	
8MSA6M.Ex-eeff-1	255			8MSA6M.R0-eeff-1	236						
8MSA6L.Ex-eeff-1	272			8MSA6L.R0-eeff-1	253						
8MSA6X.Ex-eeff-1	330			8MSA6X.R0-eeff-1	311					33	

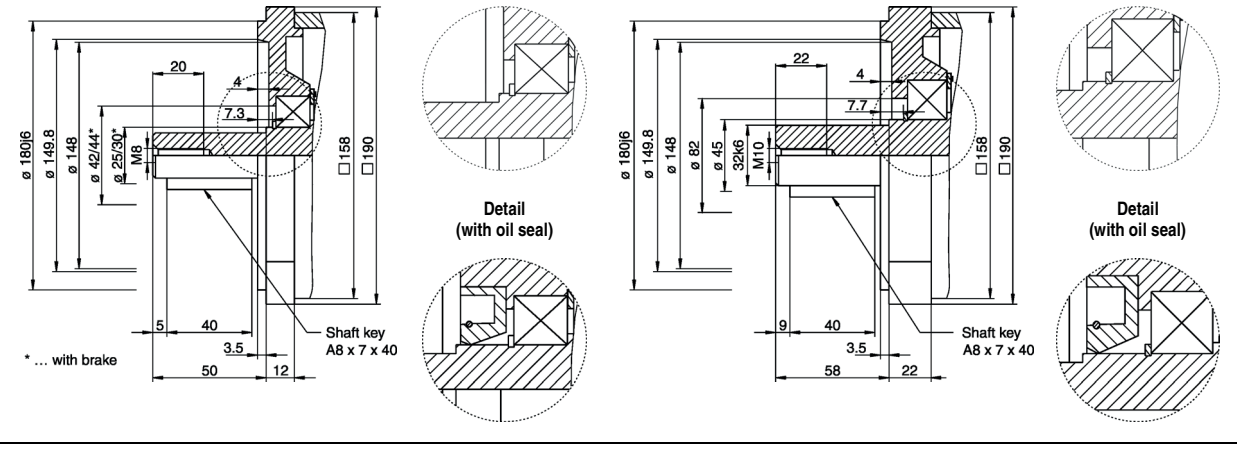
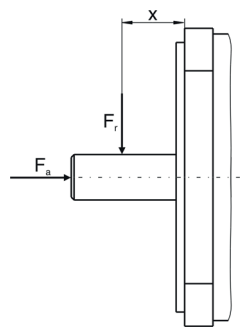


Table 42: Dimensions for servo motor 8MSA6

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.9.4 Maximum Shaft Load



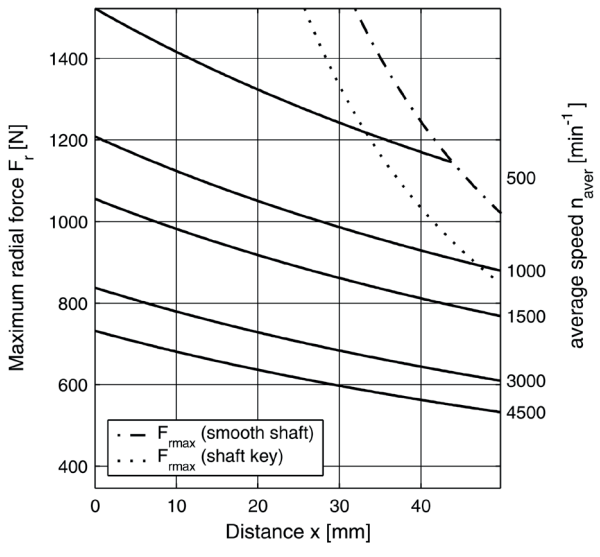
F_r .....Radial force

F_a .....Axial force

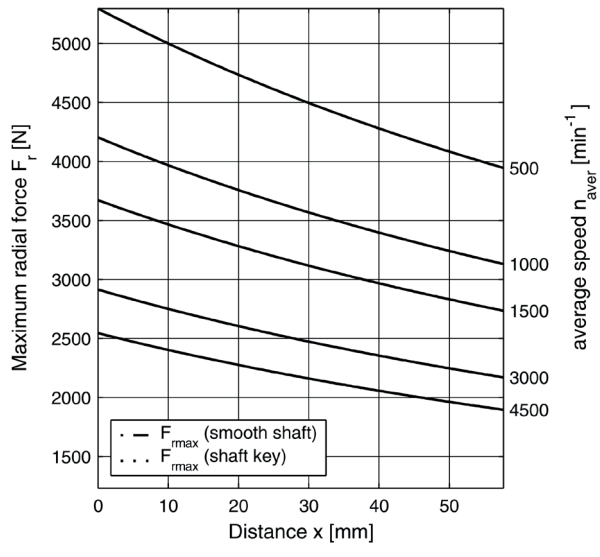
x .....Distance between motor flange and the point the radial force F_r is applied

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Option "Reinforced A Side Bearing"



Maximum axial force

Standard Bearing

$F_{a_{max}} = 135N$

Option "Reinforced A Side Bearing"

$F_{a_{max}} = 492N$

Table 43: Maximum shaft load for 8MSA6

1.10 Motor Data 8MSA7

1.10.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [kgcm^2]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [kgcm^2]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxx.00-x 2)
8MSA7S.dd-eeff	3000	20	6.28	14.1	26	16.9	78	65.9	11642	6000	1.54	93	0.46	5.1	11.09	60	67	22.3	5.56	1.6	32	4	1180
	4500	14.5	6.83	15.8	26	25.35	78	98.9	11642	6000	1.03	62	0.2	2.2	11	60	67	22.3	5.56	1.6	32	4	1320
8MSA7M.dd-eeff	3000	23	7.23	16.8	32	21.26	96	82.9	11852	6000	1.51	91	0.3	3.7	12.33	67	81	26.2	5.56	1.6	32	4	1320
	4500	15	7.07	14.5	32	26.87	96	104.8	11852	6000	1.19	72	0.19	2.2	11.58	67	81	26.2	5.56	1.6	32	4	1320
8MSA7L.dd-eeff	3000	26	8.17	17.3	40	23.94	120	93	11881	4500	1.67	101	0.27	3.4	12.59	70	101	32	5.56	1.6	32	4	1320

Table 44: Technical data for 8MSA7

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.

2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.10.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSA7S.dd-eeff

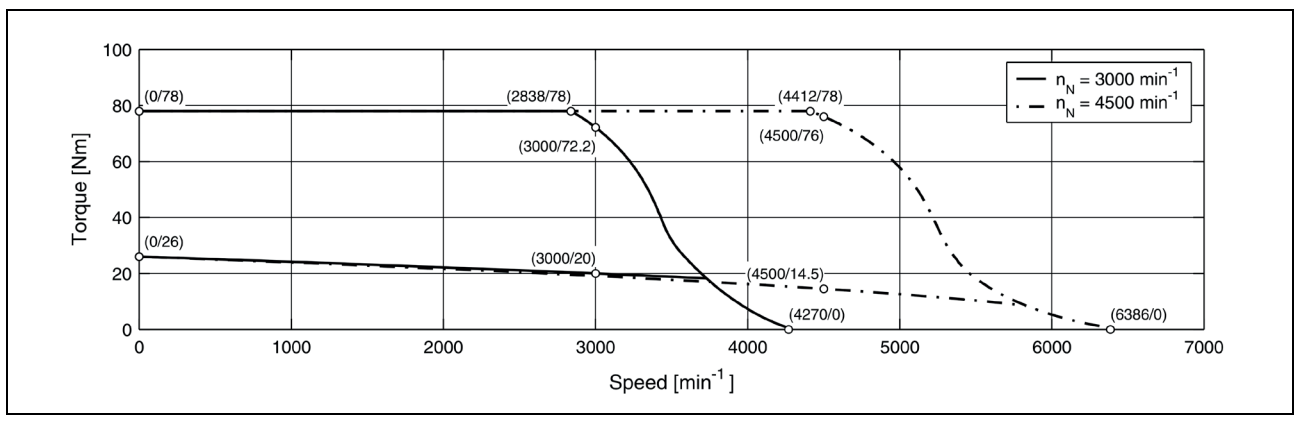


Figure 33: Characteristic curve for 8MSA7S.dd-eeff

8MSA7M.dd-eeff

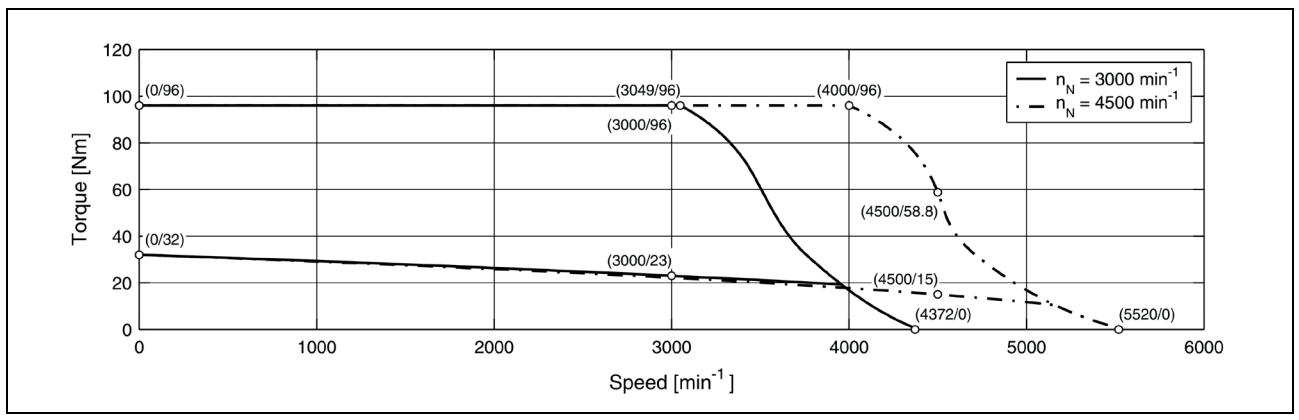


Figure 34: Characteristic curve for 8MSA7M.dd-eeff

8MSA7L.dd-eeff

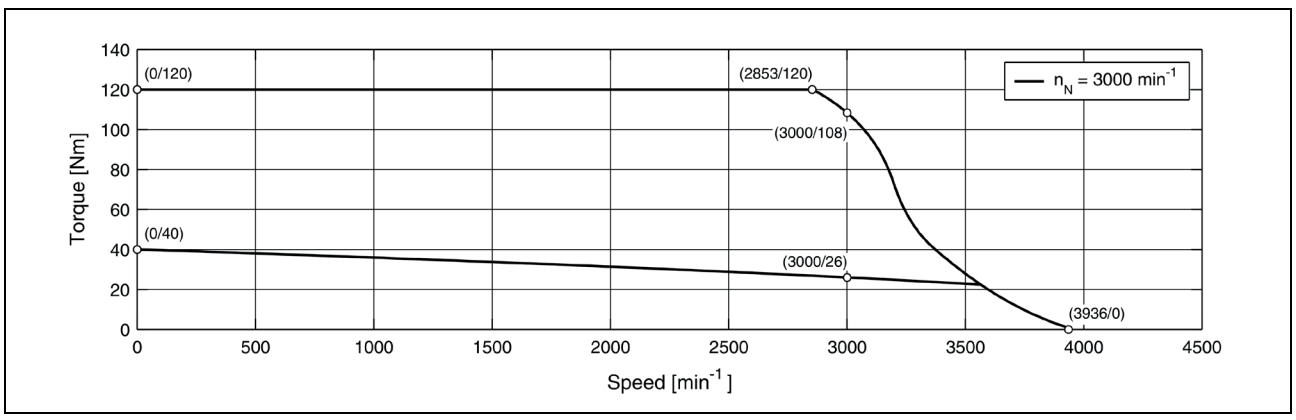
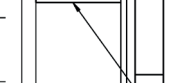


Figure 35: Characteristic curve for 8MSA7L.dd-eeff

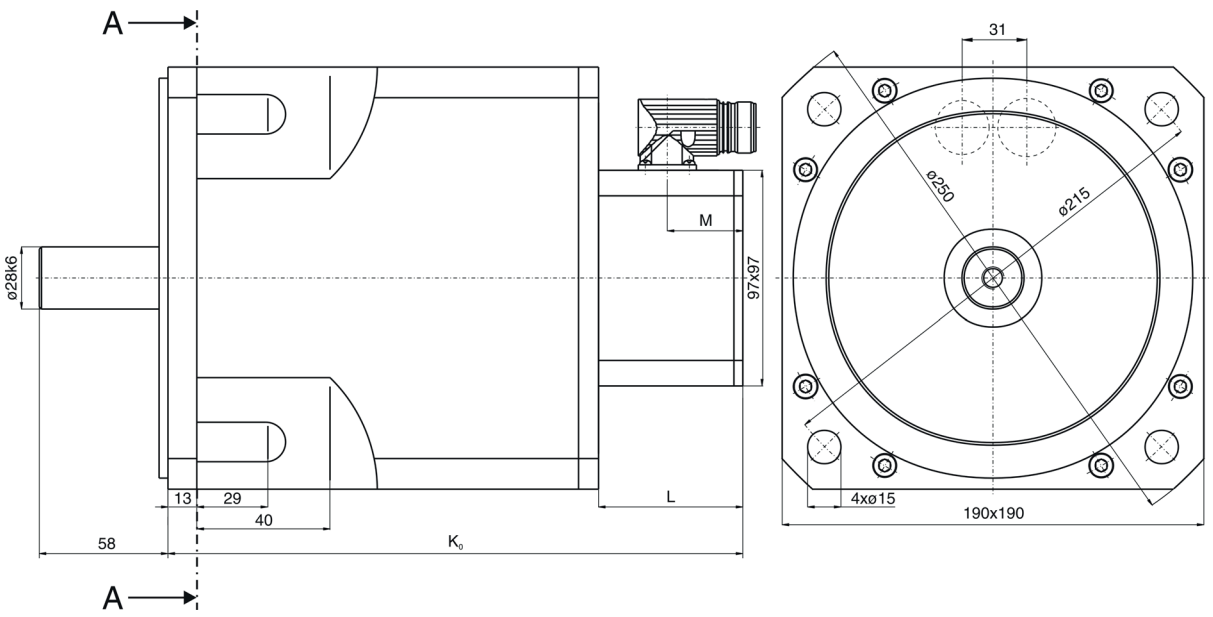
1.10.3 Dimensions

EnDat Feedback				Resolver Feedback				Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	Model Number	K_0	L	M	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSA7S.Ex-eeff	259	65	34	8MSA7S.R0-eeff	240	46	20	44	Approx. 10	---	
8MSA7M.Ex-eeff	282			8MSA7M.R0-eeff	263						
8MSA7L.Ex-eeff	316.5			8MSA7L.R0-eeff	297						

Section Detail A - A

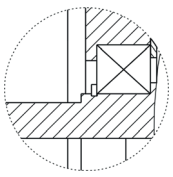


Possible Connection Directions



A Side Flange Detail (standard bearing)

Detail



Detail (with oil seal)

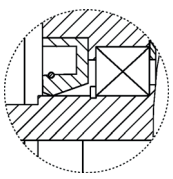
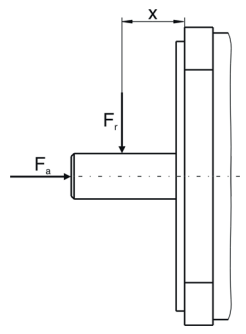


Table 45: Dimensions for servo motor 8MSA7

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.10.4 Maximum Shaft Load



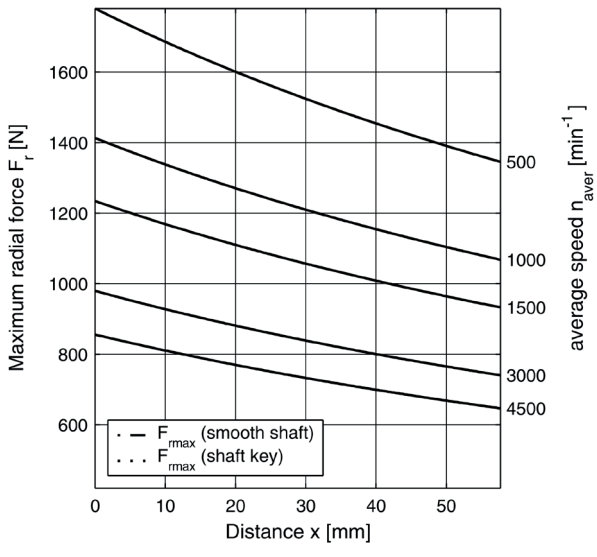
F_r .....Radial force

F_a .....Axial force

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

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Maximum axial force

Standard Bearing

$F_{a_{max}} = 160N$

Table 46: Maximum shaft load for 8MSA7

1.11 Motor Data 8MSA8

1.11.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxx.00-x 2)
8MSA8S.dd-eeff	3000	30	9.42	17.8	40	21.79	120	85	15769	3600	1.84	111	0.25	5.7	22.8	47	76.1	41	53	5.35	130	4	1320
8MSA8M.dd-eeff	3000	50	15.71	27.8	68	35.75	204	139.4	17958	3600	1.9	115	0.13	3.3	25.38	65	113.6	56	53	5.35	130	4	1320
8MSA8L.dd-eeff	2000	70	14.66	29.1	93	37.99	279	148.2	18283	3600	2.45	148	0.12	3.7	30.83	79	152.6	73	53	5.35	130	10	1640
8MSA8X.dd-eeff	2000	85	17.8	35.8	115	46.66	345	182	18148	3600	2.46	149	0.09	2.8	31.11	90	190.1	89	53	5.35	130	10	1640

Table 47: Technical data for 8MSA8

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.

2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.11.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSA8S.dd-eeff

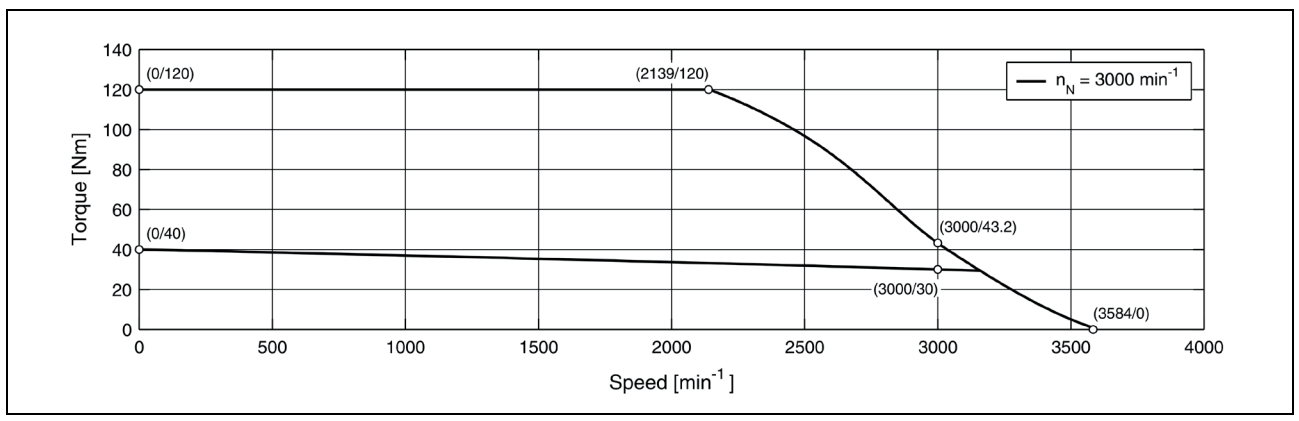


Figure 36: Characteristic curve for 8MSA8S.dd-eeff

8MSA8M.dd-eeff

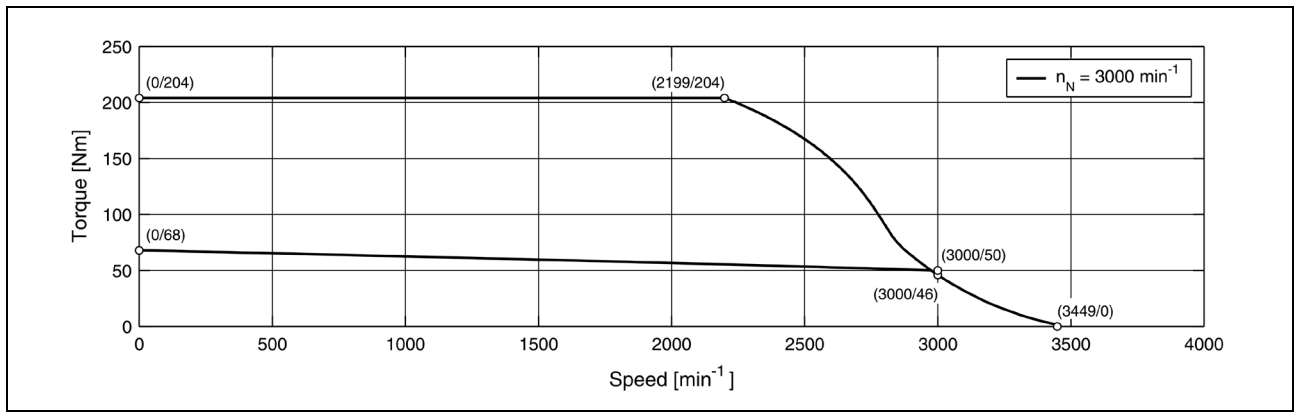


Figure 37: Characteristic curve for 8MSA8M.dd-eeff

8MSA8L.dd-eeff

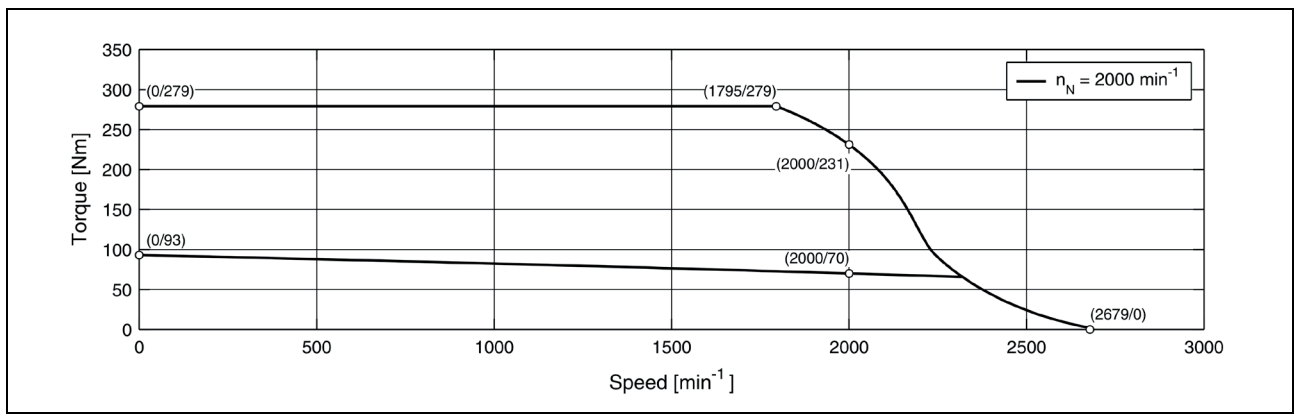


Figure 38: Characteristic curve for 8MSA8L.dd-eeff

8MSA8X.dd-eeff

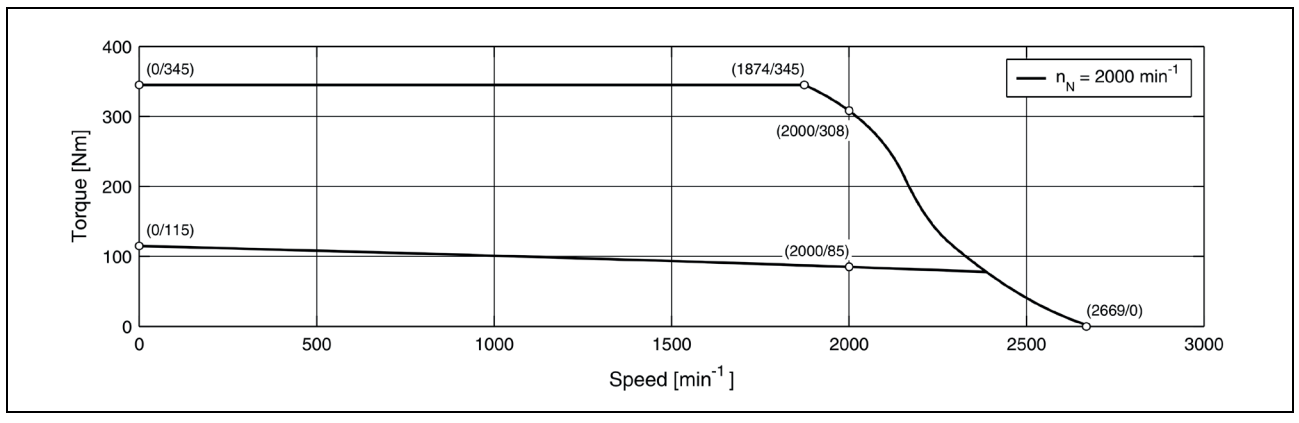


Figure 39: Characteristic curve for 8MSA8X.dd-eeff

1.11.3 Dimensions

EnDat Feedback						Resolver Feedback						Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	A	B	L	M	Model Number	K_0	A	B	L	M	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSA8S.Ex-eeff	322	38k6	80	66	35	8MSA8S.R0-eeff	311	38k6	80	55	30	68	Approx. 10	35	
8MSA8M.Ex-eeff	390					8MSA8M.R0-eeff	379								
8MSA8L.Ex-eeff	458	42k6	110			8MSA8L.R0-eeff	447	42k6	110						
8MSA8X.Ex-eeff	526					8MSA8X.R0-eeff	515								

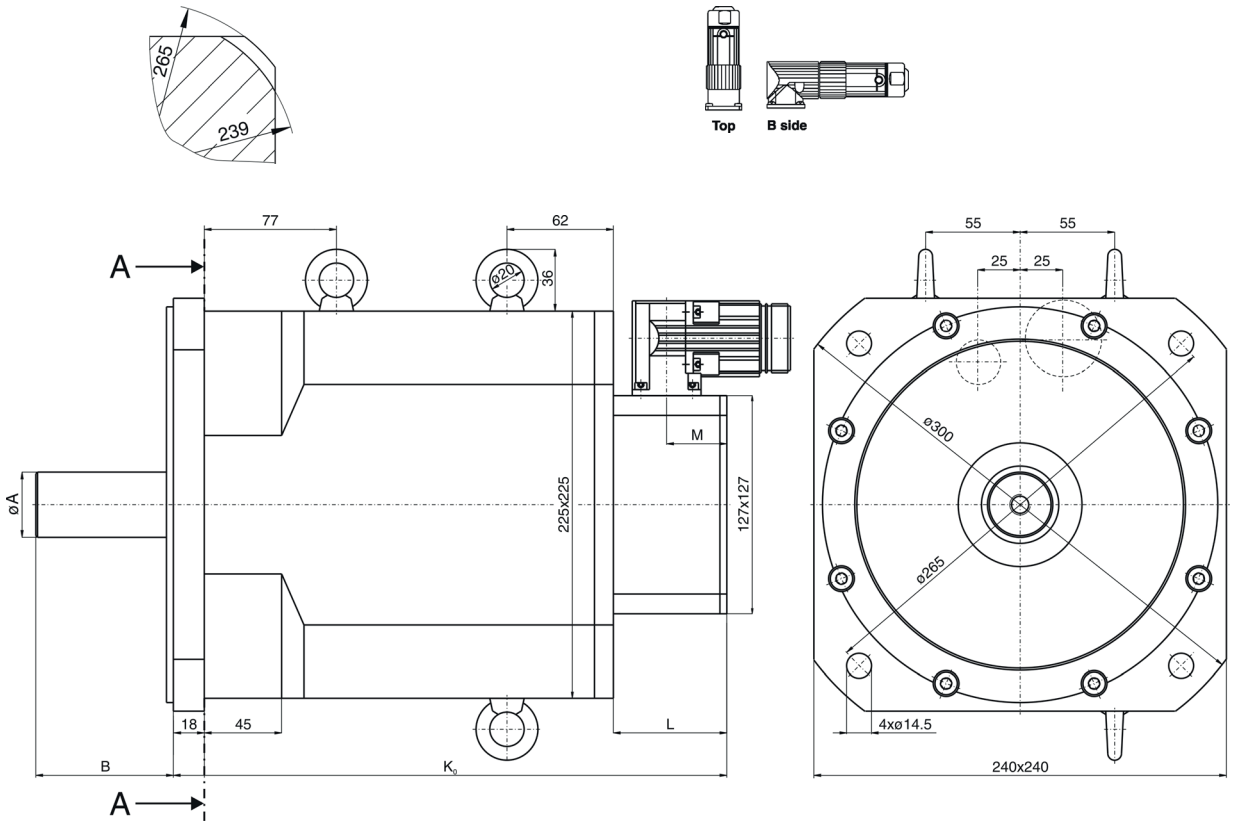
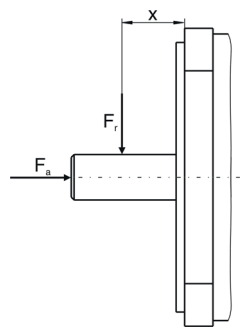


Table 48: Dimensions for servo motor 8MSA8

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.11.4 Maximum Shaft Load



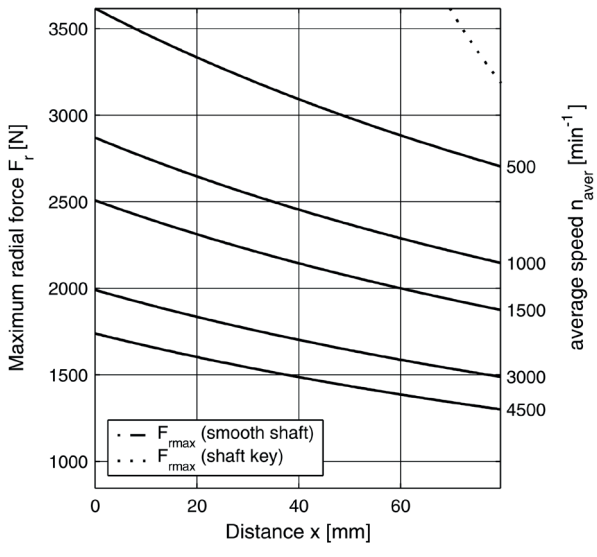
F_r .....Radial force

F_a .....Axial force

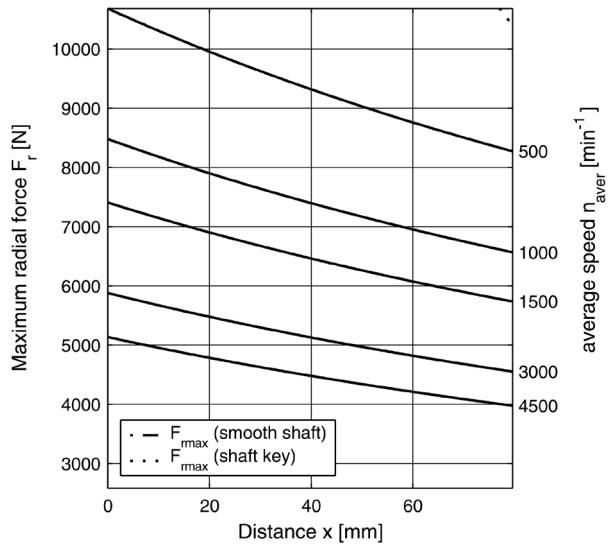
x .....Distance between motor flange and the point the radial force F_r is applied

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Option "Reinforced A Side Bearing"



Maximum axial force

Standard Bearing

$F_{a_{max}} = 323N$

Option "Reinforced A Side Bearing"

$F_{a_{max}} = 974N$

Table 49: Maximum shaft load for 8MSA8

1.12 Motor Data Overview for Cooling Type C

The technical data listed in the following sections (K_E, K_T, I_N, I_0, I_{max}, R_{2PH}, L_{2Ph}, t_{el}, t_{therm}, m, J) has a theoretical tolerance range of ±10 %. This is also valid for the speed - torque characteristic curves represented in the following sections.

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8V\xxxx.00-x 2)
8MSC4S.dd-eeff	3000	2.99	0.94	2.41	3.38	2.5	10.4	11.5	54737	12000	1.36	82	9.6	41.5	4.32	60	1.9	4.5	0.54	0.46	8	1.5	1045
	4500	2.47	1.16	2.93	3.38	3.59	10.4	16.5	54737	12000	0.94	57	4.55	20.5	4.51	60	1.9	4.5	0.54	0.46	8	1.5	1045
	6000	1.56	0.98	2.28	3.38	4.17	10.4	19.6	54737	12000	0.81	49	3.3	15	4.55	60	1.9	4.5	0.54	0.46	8	1.5	1045
8MSC4M.dd-eeff	3000	5.98	1.88	4.88	6.89	5.34	21.2	25.1	80000	12000	1.29	78	4.2	24	5.71	64	2.65	5.6	0.54	0.46	8	1.5	1090
	4500	5.33	2.51	5.72	6.89	6.94	21.2	32.6	80000	12000	0.99	60	2.55	14.5	5.69	64	2.65	5.6	0.54	0.46	8	1.5	1090
	6000	3.9	2.45	5.53	6.89	8.87	21.2	40.9	80000	12000	0.78	47	1.55	8.9	5.74	64	2.65	5.6	0.54	0.46	8	1.5	1090
8MSC4L.dd-eeff	3000	8.32	2.61	5.66	9.75	6.27	30	29.4	72289	12000	1.56	94	3	19.2	6.4	66	4.15	7.7	0.54	0.46	8	1.5	1090
	4500	7.28	3.43	7.28	9.75	9.07	30	41.9	72289	12000	1.08	65	1.45	9.2	6.34	66	4.15	7.7	0.54	0.46	8	1.5	1090
	6000	5.85	3.68	7.8	9.75	11.79	30	55.3	72289	12000	0.83	50	0.87	5.6	6.44	66	4.15	7.7	0.54	0.46	8	4	1180
8MSC4X.dd-eeff	3000	11.05	3.47	7.8	12.35	8.29	38	38.3	62810	12000	1.49	90	1.65	11.7	7.09	68	6.05	10.5	0.54	0.46	8	1.5	1090
	4500	9.75	4.59	8.45	12.35	10.09	38	46.6	62810	12000	1.22	74	1.13	7.9	6.99	68	6.05	10.5	0.54	0.46	8	4	1180
	6000	7.8	4.9	10.01	12.35	14.64	38	67.6	62810	12000	0.84	51	0.59	4.1	6.95	68	6.05	10.5	0.54	0.46	8	4	1180
8MSC5S.dd-eeff-2	3000	7.41	2.33	5.2	8.58	5.89	19.8	22.6	49500	9000	1.46	88	4.15	27.8	6.7	45	4	7.5	1.66	0.9	15	1.5	1090
	4500	6.76	3.19	6.76	8.58	8.37	19.8	32	49500	9000	1.03	62	2.05	13.8	6.73	45	4	7.5	1.66	0.9	15	1.5	1090
8MSC5M.dd-eeff-2	3000	11.44	3.59	7.15	13.65	8.26	31.5	31.6	50806	9000	1.65	100	2.25	20	8.89	50	6.2	10	1.66	0.9	15	1.5	1090
	4500	9.36	4.41	9.62	13.65	13.53	31.5	52	50806	9000	1.01	61	0.83	7.4	8.92	50	6.2	10	1.66	0.9	15	4	1180
8MSC5L.dd-eeff-2	3000	14.3	4.49	9.49	17.55	11.28	40.5	43.2	55479	9000	1.56	94	1.55	14.6	9.42	55	7.3	11.2	1.66	0.9	15	4	1180
	4500	11.7	5.51	11.57	17.55	16.85	40.5	64.5	55479	9000	1.04	63	0.68	6.5	9.56	55	7.3	11.2	1.66	0.9	15	4	1180
8MSC5X.dd-eeff-2	3000	18.85	5.92	11.18	22.1	12.84	51	49.2	53684	9000	1.72	104	1.26	13.3	10.56	60	9.5	13.7	1.66	0.9	15	4	1180
	4500	14.3	6.74	14.17	22.1	21.19	51	81	53684	9000	1.04	63	0.46	4.8	10.4	60	9.5	13.7	1.66	0.9	15	4	1320
8MSC5E.dd-eeff-2	3000	22.75	7.15	13.65	28.6	16.63	66	63.7	56410	9000	1.72	104	0.95	10.5	11.05	75	11.7	16.2	1.66	0.9	15	4	1180
	4500	17.55	8.27	18.98	28.6	28.35	66	108.6	56410	9000	1.01	61	0.33	3.6	10.91	75	11.7	16.2	1.66	0.9	15	4	1320
8MSC6S.dd-eeff-2	3000	16.9	5.31	10.66	17.55	10.61	47.3	40	36107	6000	1.65	100	1.1	13.5	12.27	45	13.1	13.9	5.56	1.6	32	4	1180
	4500	13	6.13	11.83	17.55	15.16	47.3	57	36107	6000	1.16	70	0.56	6.7	11.96	45	13.1	13.9	5.56	1.6	32	4	1180
8MSC6M.dd-eeff-2	3000	22.1	6.94	13.78	24.7	14.94	66.5	56	35562	6000	1.65	100	0.61	9	14.75	53	18.7	18.2	5.56	1.6	32	4	1180
	4500	13	6.13	11.7	24.7	20.74	66.5	79	35562	6000	1.19	72	0.32	4.7	14.69	53	18.7	18.2	5.56	1.6	32	4	1180
8MSC6L.dd-eeff-2	3000	24.7	7.76	15.99	28.6	17.82	77	67.2	35814	6000	1.6	97	0.46	7.3	15.87	60	21.5	20.3	5.56	1.6	32	4	1180
	4500	13	6.13	11.96	28.6	24.35	77	92	35814	6000	1.17	71	0.25	3.9	15.6	60	21.5	20.3	5.56	1.6	32	4	1320
8MSC6X.dd-eeff-2	3000	31.2	9.8	19.11	37.7	22.35	101.5	84	34407	6000	1.69	102	0.31	5.6	18.06	70	29.5	26.7	5.56	1.6	32	4	1320
	4500	7.8	3.68	7.41	37.7	30.8	101.5	116	34407	6000	1.22	74	0.16	3	18.75	70	29.5	26.7	5.56	1.6	32	4	1320
8MSC7S.dd-eeff-1	3000	26	8.17	18.33	33.8	21.97	78	65.9	11642	6000	1.54	93	0.46	5.1	11.09	60	67	22.3	5.56	1.6	32	4	1320
	4500	18.85	8.88	20.54	33.8	32.96	78	98.9	11642	6000	1.03	62	0.2	2.2	11	60	67	22.3	5.56	1.6	32	4	1320
8MSC7M.dd-eeff-1	3000	29.9	9.39	21.84	41.6	27.64	96	82.9	11852	6000	1.51	91	0.3	3.7	12.33	67	81	26.2	5.56	1.6	32	4	1320
	4500	19.5	9.19	18.85	41.6	34.93	96	104.8	11852	6000	1.19	72	0.19	2.2	11.58	67	81	26.2	5.56	1.6	32	4	1320
8MSC7L.dd-eeff-1	3000	33.8	10.62	22.49	52	31.12	120	93	11881	4500	1.67	101	0.27	3.4	12.59	70	101	32	5.56	1.6	32	4	1320

Table 50: Motor data overview for cooling type C

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.

2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.12.1 Fan Modules

The fan modules used are size-dependant and available for two different operating voltages .

Fans	For Motor 8MSC4	8MSC5	8MSC6	8MSC7
Manufacturer Internet Address	Papst www.papst.de			
Manufacturer's Product ID 220 VAC Operating Voltage 24 VDC Operating Voltage 1)	4650Z 4184NGX		5958 5214NM	

Table 51: Overview of fan modules

1) Fans with 24VDC operating voltage are special motor options. Special options must be arranged with B&R.

Manufacturer's Product ID	220 VAC Fan 4650Z	220 VAC Fan 5958	24 VDC Fan [1] 4184NGX	24 VDC Fan [1] 5214NM
General Information				
C-UL-US Listed	Yes			
Fan Type	AC fan with external rotor shaded-pole motor	AC fan with internal rotor shaded-pole motor	DC fan with electronically commutated external rotor motor	
Rotor Bearings	Sintec sleeve bearings	Ball bearings	Sintec sleeve bearings	Ball bearings
Protection	IP20			
Power Mains Connection				
Rated Voltage	230 VAC +6 % / -10 %		24 VDC +25 % / -50 %	24 VDC +16 % / -50 %
Nominal Frequency	50 Hz		---	
Power Consumption	19 W	18 W	3.5 W	4.6 W
Overload protection	Yes (impedance protection)		Protected against blocking and overloading by PTC resistor; partially impedance protected	Electronic protection against reverse polarity, blocking and overloading
Mechanical Characteristics				
Temperature Range	-10 ... +50 °C	-30 ... +60 °C	-10 ... +75 °C	-20 ... +75 °C
Operating Noise	40 dB(A)	44 dB(A)	44 dB(A)	43 dB(A)
Lifespan At 40 °C At maximum temperature	 37500 h 30000 h	 40000 h 25000 h	 85000 h 37500 h	 62500 h 27500 h

Table 52: Technical data for fans

Fan Connection

The fan connection is made using a terminal block in a terminal box on the fan housing next to the motor and encoder connection. To guarantee stress relief for the connection cable, the high-strength cable gland on the terminal box cover must be installed correctly.

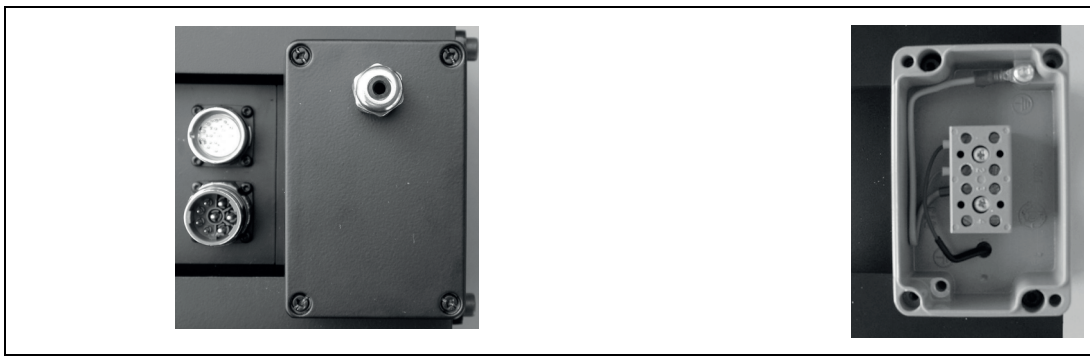


Figure 40: Terminal box for the fan power connection

Terminal Block Pin Assignments for 220 VAC Fan

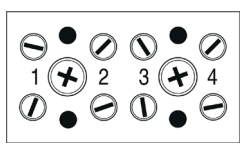
Image	Pin	Description	Function
	1	L1	Fan Connection 220 VAC
	2	N	Fan Connection 220 VAC
	3	PE	Protective ground conductor
	4	---	---

Table 53: Terminal block pin assignments for 220 VAC fan

Terminal Block Pin Assignments for 24 VDC Fan [1]

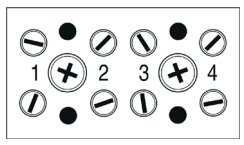
Image	Pin	Description	Function
	1	---	---
	2	---	---
	3	+24 V	Fan Connection + 24 VDC
	4	GND	Fan Connection 0 V

Table 54: Terminal block pin assignments for 24 VDC fan

1) Fans with 24VDC operating voltage are special motor options. Special options must be arranged with B&R.

1.13 Motor Data 8MSC4

1.13.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxxx.00-x 2)
8MSC4S.dd-eeff	3000	2.99	0.94	2.41	3.38	2.5	10.4	11.5	54737	12000	1.36	82	9.6	41.5	4.32	60	1.9	4.5	0.54	0.46	8	1.5	1045
	4500	2.47	1.16	2.93	3.38	3.59	10.4	16.5	54737	12000	0.94	57	4.55	20.5	4.51	60	1.9	4.5	0.54	0.46	8	1.5	1045
	6000	1.56	0.98	2.28	3.38	4.17	10.4	19.6	54737	12000	0.81	49	3.3	15	4.55	60	1.9	4.5	0.54	0.46	8	1.5	1045
8MSC4M.dd-eeff	3000	5.98	1.88	4.88	6.89	5.34	21.2	25.1	80000	12000	1.29	78	4.2	24	5.71	64	2.65	5.6	0.54	0.46	8	1.5	1090
	4500	5.33	2.51	5.72	6.89	6.94	21.2	32.6	80000	12000	0.99	60	2.55	14.5	5.69	64	2.65	5.6	0.54	0.46	8	1.5	1090
	6000	3.9	2.45	5.53	6.89	8.87	21.2	40.9	80000	12000	0.78	47	1.55	8.9	5.74	64	2.65	5.6	0.54	0.46	8	1.5	1090
8MSC4L.dd-eeff	3000	8.32	2.61	5.66	9.75	6.27	30	29.4	72289	12000	1.56	94	3	19.2	6.4	66	4.15	7.7	0.54	0.46	8	1.5	1090
	4500	7.28	3.43	7.28	9.75	9.07	30	41.9	72289	12000	1.08	65	1.45	9.2	6.34	66	4.15	7.7	0.54	0.46	8	1.5	1090
	6000	5.85	3.68	7.8	9.75	11.79	30	55.3	72289	12000	0.83	50	0.87	5.6	6.44	66	4.15	7.7	0.54	0.46	8	4	1180
8MSC4X.dd-eeff	3000	11.05	3.47	7.8	12.35	8.29	38	38.3	62810	12000	1.49	90	1.65	11.7	7.09	68	6.05	10.5	0.54	0.46	8	1.5	1090
	4500	9.75	4.59	8.45	12.35	10.09	38	46.6	62810	12000	1.22	74	1.13	7.9	6.99	68	6.05	10.5	0.54	0.46	8	4	1180
	6000	7.8	4.9	10.01	12.35	14.64	38	67.6	62810	12000	0.84	51	0.59	4.1	6.95	68	6.05	10.5	0.54	0.46	8	4	1180

Table 55: Technical data for 8MSC4

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.
2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.13.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSC4S.dd-eeff

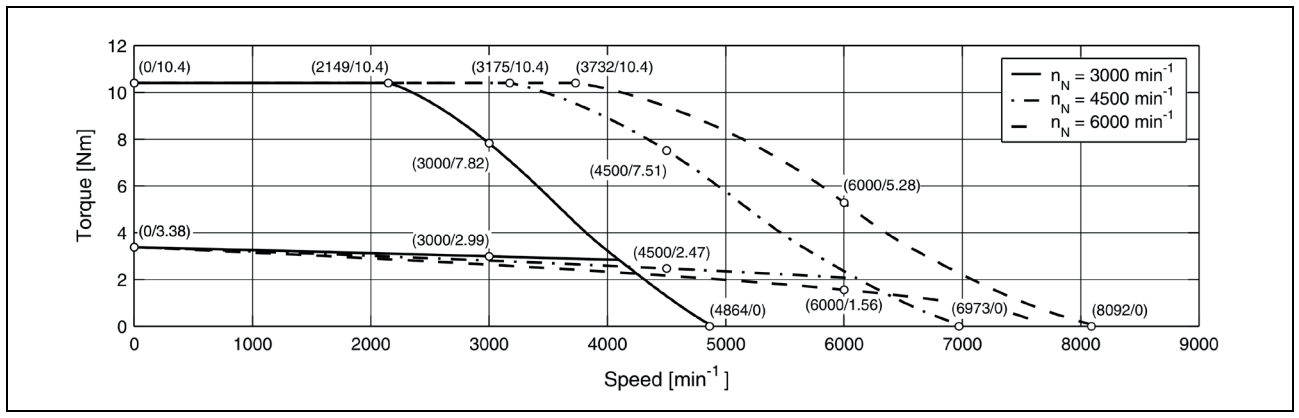


Figure 41: Characteristic curve for 8MSC4S.dd-eeff

8MSC4M.dd-eeff

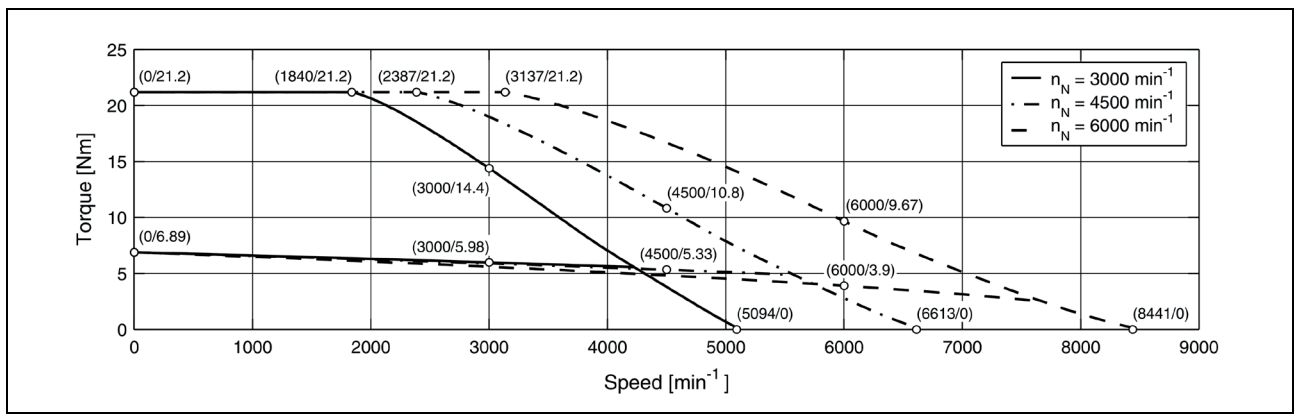


Figure 42: Characteristic curve for 8MSC4M.dd-eeff

8MSC4L.dd-eeff

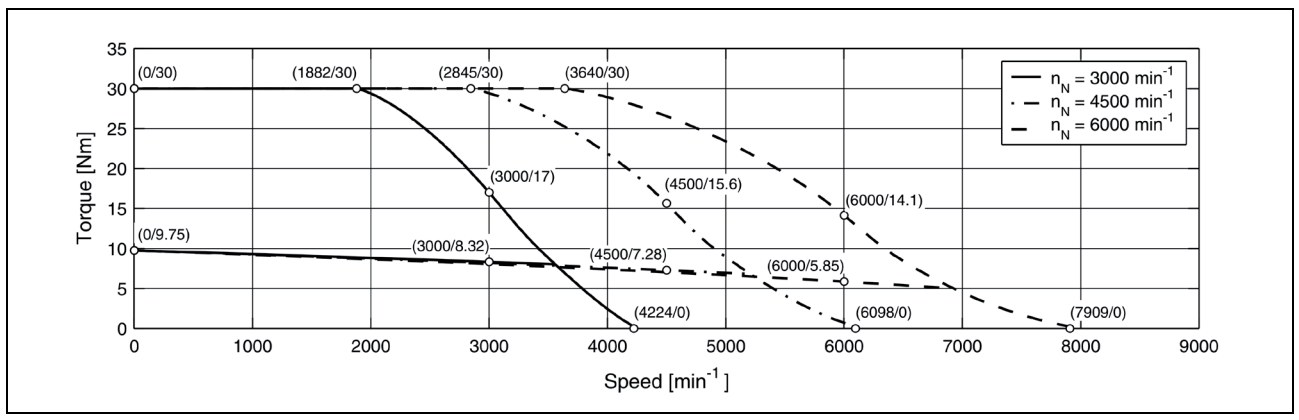


Figure 43: Characteristic curve for 8MSC4L.dd-eeff

8MSC4X.dd-eeff

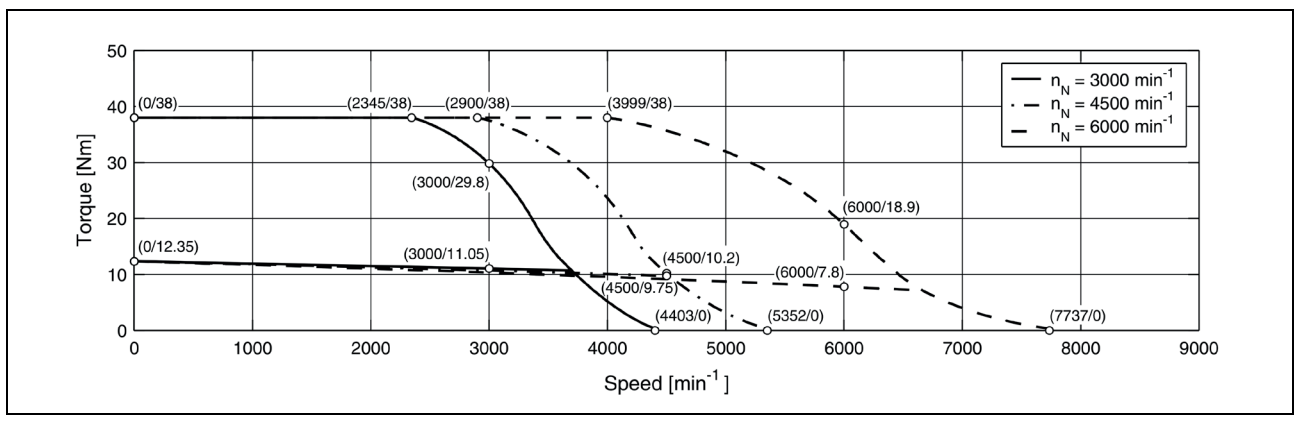
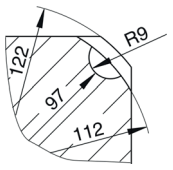


Figure 44: Characteristic curve for 8MSC4X.dd-eeff

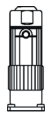
1.13.3 Dimensions

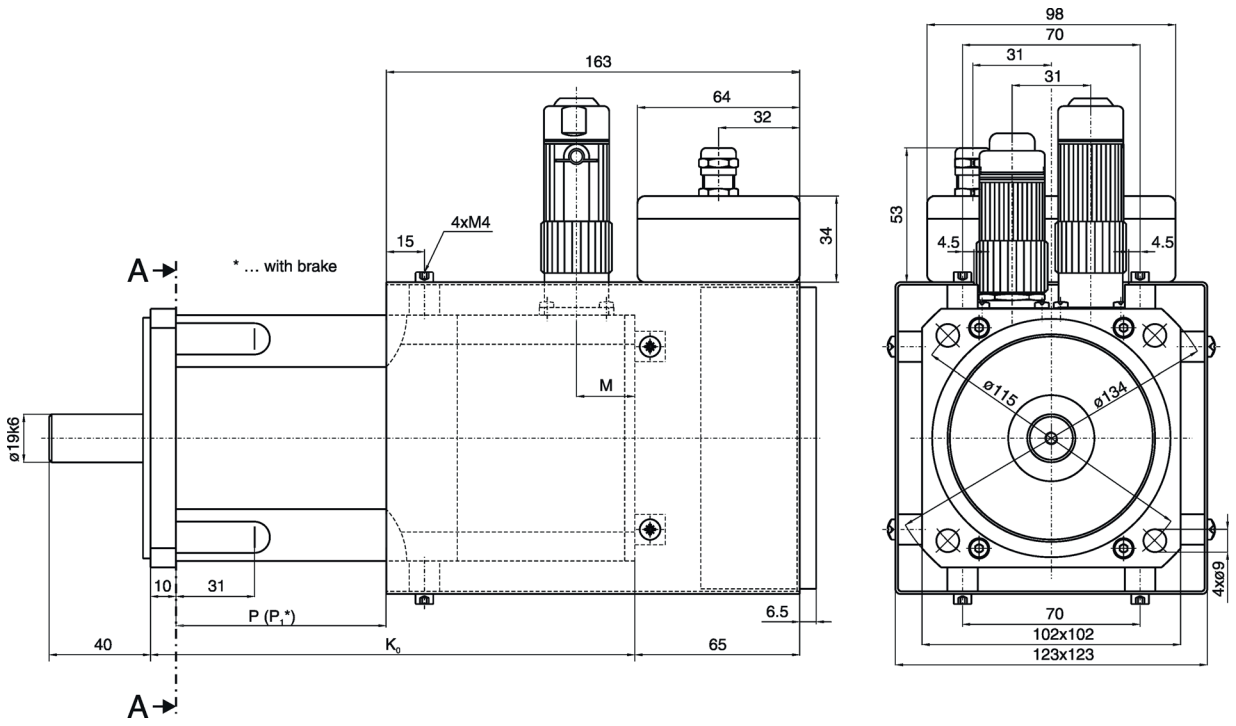
EnDat Feedback						Resolver Feedback						Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	P	P_1	Model Number	K_0	L	M	P	P_1	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSC4S.Ex-eeff	191	---	23	85	117	8MSC4S.R0-eeff	155	---	19	85	117	32	Approx. 10	28	
8MSC4M.Ex-eeff	221			115	147	8MSC4M.R0-eeff	185			115	147				
8MSC4L.Ex-eeff	266			160	192	8MSC4L.R0-eeff	230			160	192				
8MSC4X.Ex-eeff	321.5			215	247	8MSC4X.R0-eeff	285.5			215	247				

Section Detail A - A



Possible Connection Directions





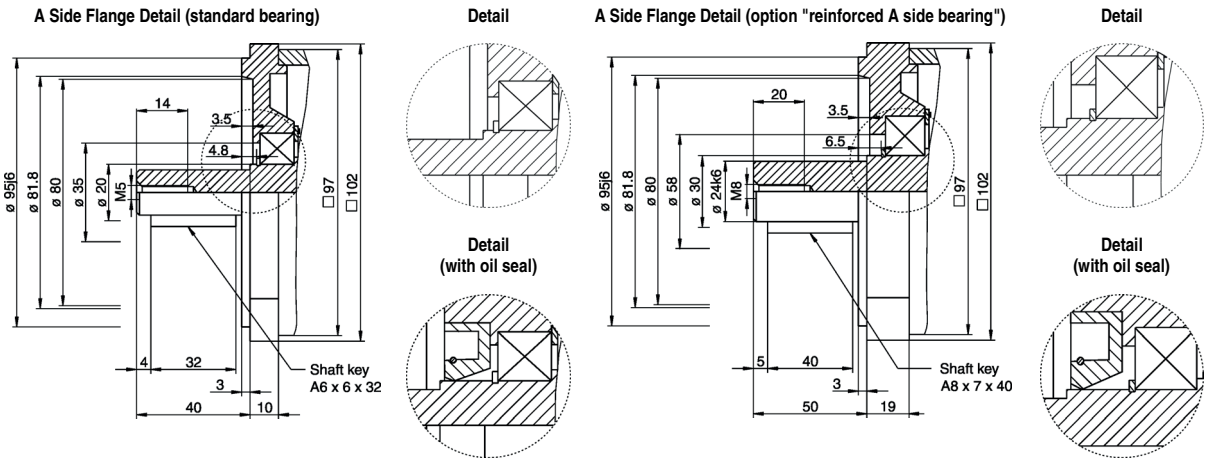
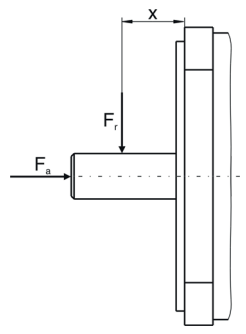


Table 56: Dimensions for servo motor 8MSC4

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.13.4 Maximum Shaft Load



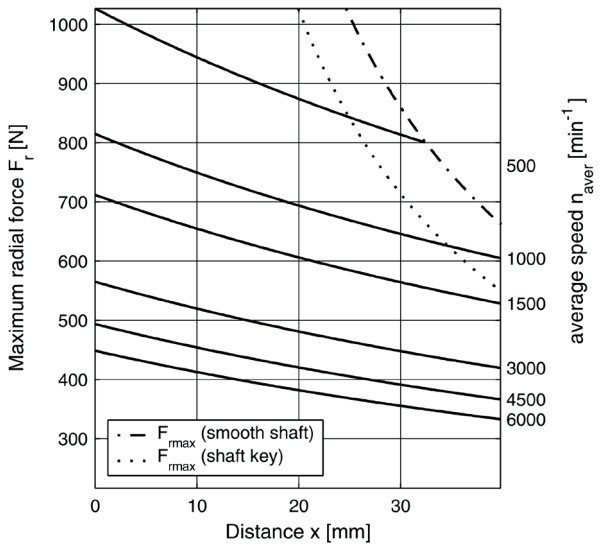
F_r .....Radial force

F_a .....Axial force

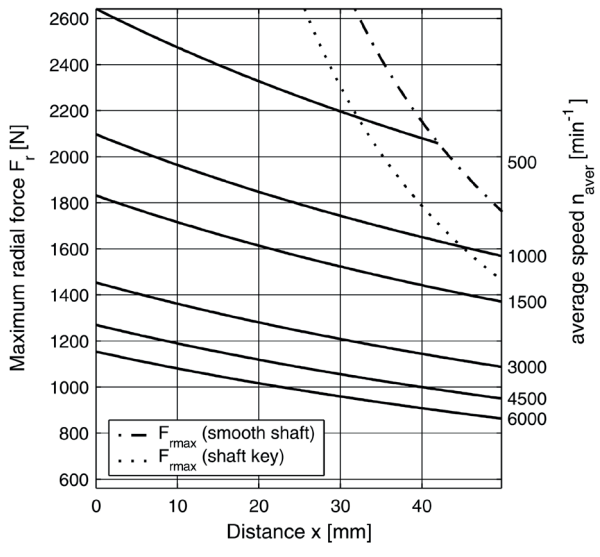
x .....Distance between motor flange and the point the radial force F_r is applied

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Option "Reinforced A Side Bearing"



Maximum axial force

Standard Bearing

$F_{a_{max}} = 91N$

Option "Reinforced A Side Bearing"

$F_{a_{max}} = 251N$

Table 57: Maximum shaft load for 8MSC4

1.14 Motor Data 8MSC5

1.14.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxxx.00-x 2)
8MSC5S.dd-eeff-2	3000	7.41	2.33	5.2	8.58	5.89	19.8	22.6	49500	9000	1.46	88	4.15	27.8	6.7	45	4	7.5	1.66	0.9	15	1.5	1090
	4500	6.76	3.19	6.76	8.58	8.37	19.8	32	49500	9000	1.03	62	2.05	13.8	6.73	45	4	7.5	1.66	0.9	15	1.5	1090
8MSC5M.dd-eeff-2	3000	11.44	3.59	7.15	13.65	8.26	31.5	31.6	50806	9000	1.65	100	2.25	20	8.89	50	6.2	10	1.66	0.9	15	1.5	1090
	4500	9.36	4.41	9.62	13.65	13.53	31.5	52	50806	9000	1.01	61	0.83	7.4	8.92	50	6.2	10	1.66	0.9	15	4	1180
8MSC5L.dd-eeff-2	3000	14.3	4.49	9.49	17.55	11.28	40.5	43.2	55479	9000	1.56	94	1.55	14.6	9.42	55	7.3	11.2	1.66	0.9	15	4	1180
	4500	11.7	5.51	11.57	17.55	16.85	40.5	64.5	55479	9000	1.04	63	0.68	6.5	9.56	55	7.3	11.2	1.66	0.9	15	4	1180
8MSC5X.dd-eeff-2	3000	18.85	5.92	11.18	22.1	12.84	51	49.2	53684	9000	1.72	104	1.26	13.3	10.56	60	9.5	13.7	1.66	0.9	15	4	1180
	4500	14.3	6.74	14.17	22.1	21.19	51	81	53684	9000	1.04	63	0.46	4.8	10.4	60	9.5	13.7	1.66	0.9	15	4	1320
8MSC5E.dd-eeff-2	3000	22.75	7.15	13.65	28.6	16.63	66	63.7	56410	9000	1.72	104	0.95	10.5	11.05	75	11.7	16.2	1.66	0.9	15	4	1180
	4500	17.55	8.27	18.98	28.6	28.35	66	108.6	56410	9000	1.01	61	0.33	3.6	10.91	75	11.7	16.2	1.66	0.9	15	4	1320

Table 58: Technical data for 8MSC5

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.

2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.14.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSC5S.dd-eeff-2

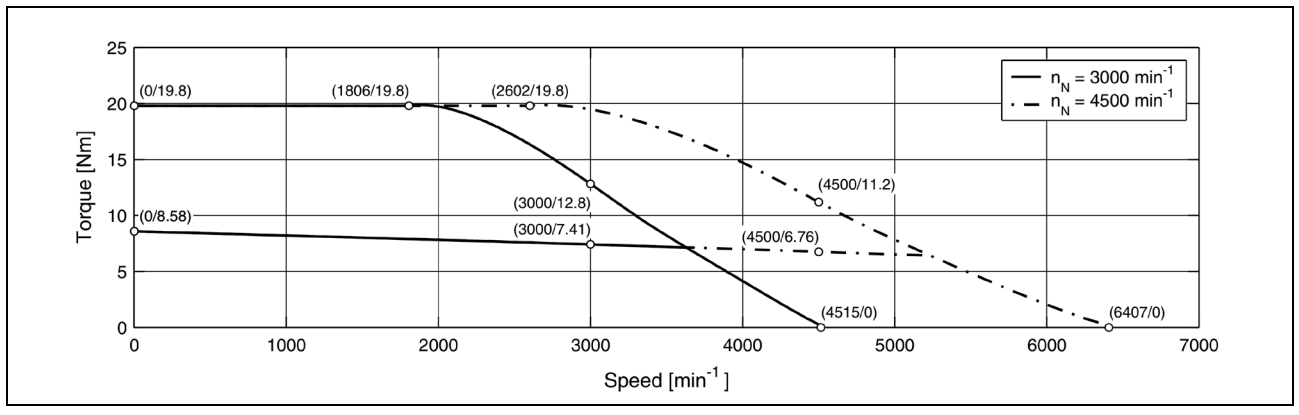


Figure 45: Characteristic curve for 8MSC5S.dd-eeff-2

8MSC5M.dd-eeff-2

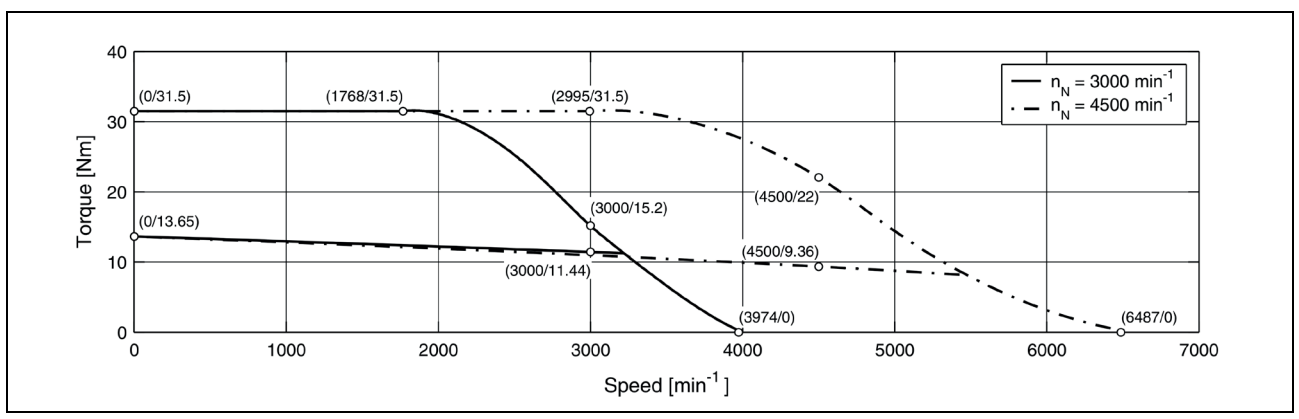


Figure 46: Characteristic curve for 8MSC5M.dd-eeff-2

8MSC5L.dd-eeff-2

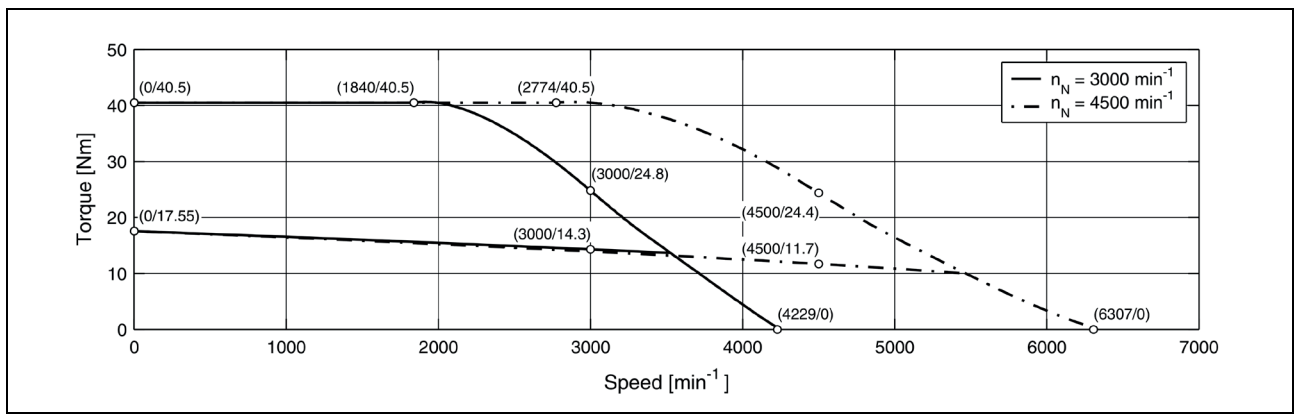


Figure 47: Characteristic curve for 8MSC5L.dd-eeff-2

8MSC5X.dd-eeff-2

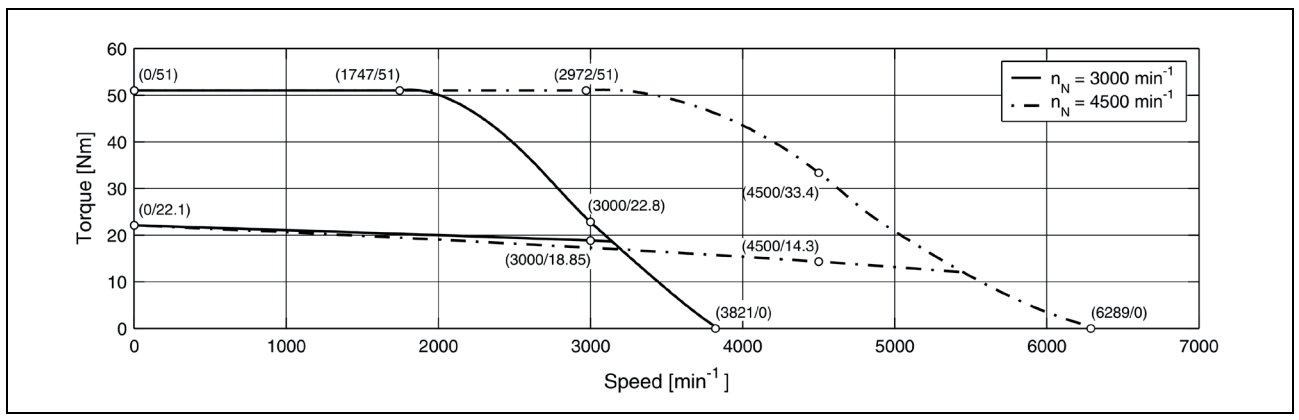


Figure 48: Characteristic curve for 8MSC5X.dd-eeff-2

8MSC5E.dd-eeff-2

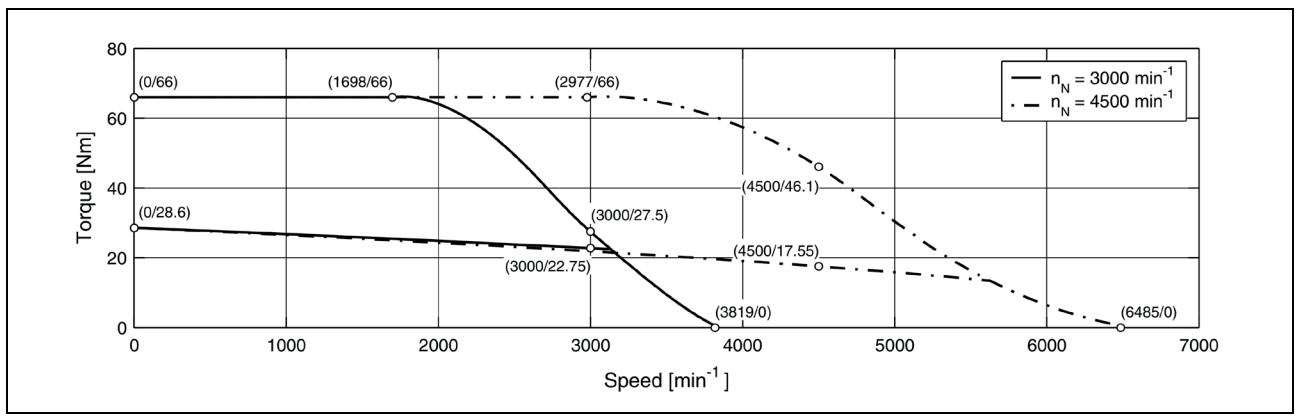
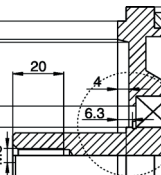


Figure 49: Characteristic curve for 8MSC5E.dd-eeff-2

1.14.3 Dimensions

EnDat Feedback				Resolver Feedback				Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	Model Number	K_0	L	M	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSC5S.Ex-eeff-2	205	65	26	8MSC5S.R0-eeff-2	186	46	20	43	Approx. 10	35	
8MSC5M.Ex-eeff-2	239			8MSC5M.R0-eeff-2	220						
8MSC5L.Ex-eeff-2	256			8MSC5L.R0-eeff-2	237						
8MSC5X.Ex-eeff-2	290			8MSC5X.R0-eeff-2	271						
8MSC5E.Ex-eeff-2	324			8MSC5E.R0-eeff-2	305						

Section Detail A - A



Possible Connection Directions

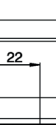
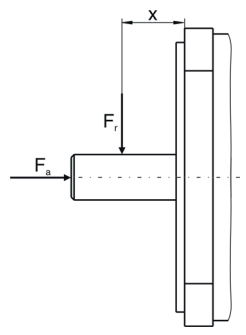


Table 59: Dimensions for servo motor 8MSC5

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.14.4 Maximum Shaft Load



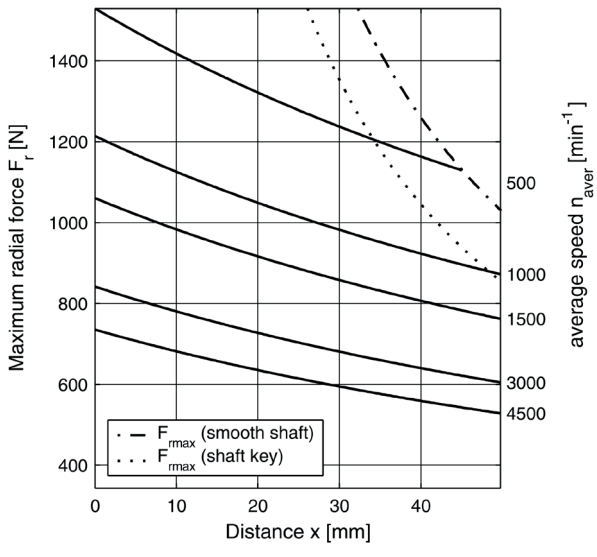
F_r .....Radial force

F_a .....Axial force

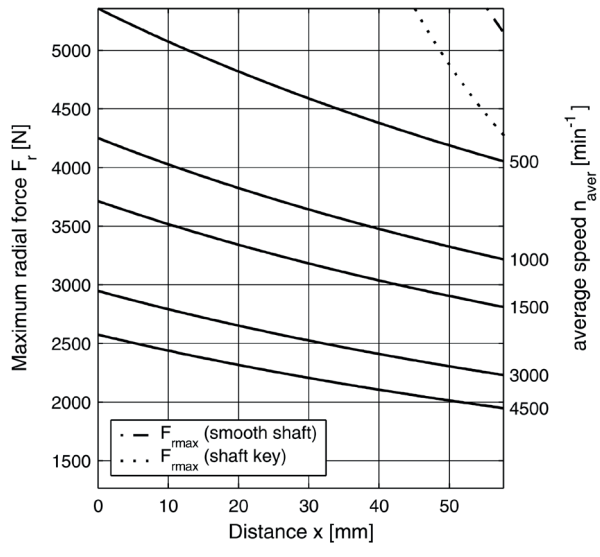
x .....Distance between motor flange and the point the radial force F_r is applied

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Option "Reinforced A Side Bearing"



Maximum axial force

Standard Bearing

$F_{a_{max}} = 132N$

Option "Reinforced A Side Bearing"

$F_{a_{max}} = 501N$

Table 60: Maximum shaft load for 8MSC5

1.15 Motor Data 8MSC6

1.15.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxxx.00-x 2)
8MSC6S.dd-eeff-2	3000	16.9	5.31	10.66	17.55	10.61	47.3	40	36107	6000	1.65	100	1.1	13.5	12.27	45	13.1	13.9	5.56	1.6	32	4	1180
	4500	13	6.13	11.83	17.55	15.16	47.3	57	36107	6000	1.16	70	0.56	6.7	11.96	45	13.1	13.9	5.56	1.6	32	4	1180
8MSC6M.dd-eeff-2	3000	22.1	6.94	13.78	24.7	14.94	66.5	56	35562	6000	1.65	100	0.61	9	14.75	53	18.7	18.2	5.56	1.6	32	4	1180
	4500	13	6.13	11.7	24.7	20.74	66.5	79	35562	6000	1.19	72	0.32	4.7	14.69	53	18.7	18.2	5.56	1.6	32	4	1180
8MSC6L.dd-eeff-2	3000	24.7	7.76	15.99	28.6	17.82	77	67.2	35814	6000	1.6	97	0.46	7.3	15.87	60	21.5	20.3	5.56	1.6	32	4	1180
	4500	13	6.13	11.96	28.6	24.35	77	92	35814	6000	1.17	71	0.25	3.9	15.6	60	21.5	20.3	5.56	1.6	32	4	1320
8MSC6X.dd-eeff-2	3000	31.2	9.8	19.11	37.7	22.35	101.5	84	34407	6000	1.69	102	0.31	5.6	18.06	70	29.5	26.7	5.56	1.6	32	4	1320
	4500	7.8	3.68	7.41	37.7	30.8	101.5	116	34407	6000	1.22	74	0.16	3	18.75	70	29.5	26.7	5.56	1.6	32	4	1320

Table 61: Technical data for 8MSC6

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.

2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.15.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSC6S.dd-eeff-2

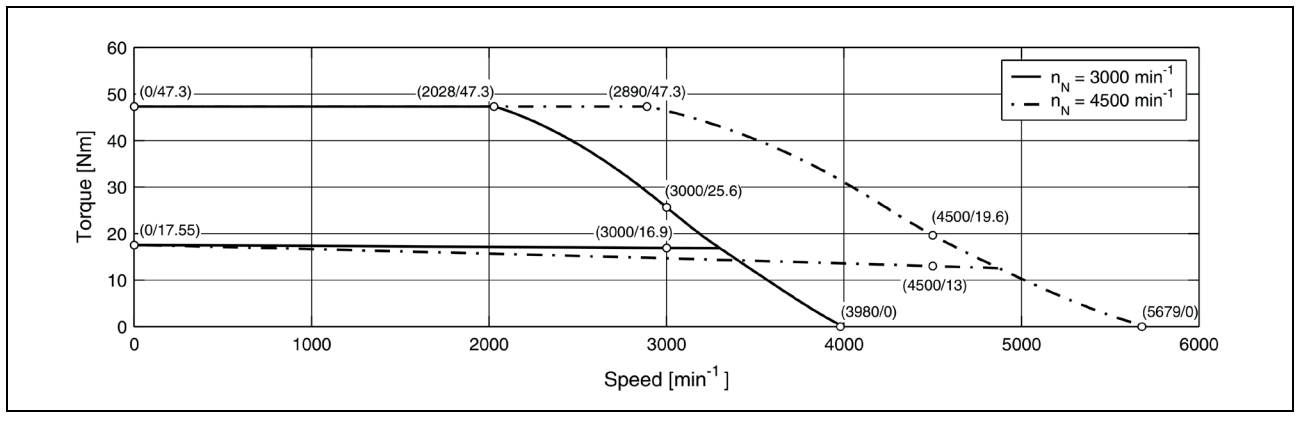


Figure 50: Characteristic curve for 8MSC6S.dd-eeff-2

8MSC6M.dd-eeff-2

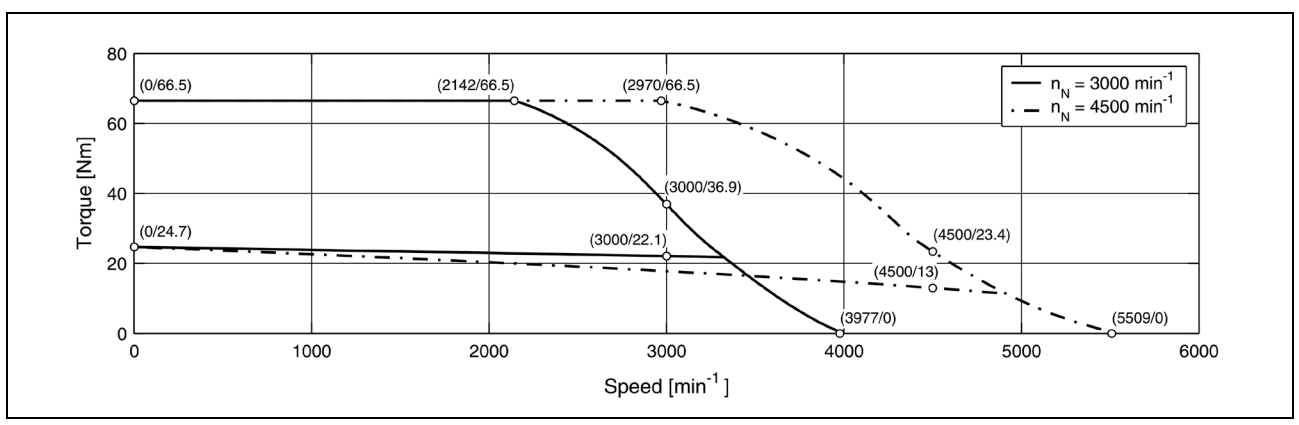


Figure 51: Characteristic curve for 8MSC6M.dd-eeff-2

8MSC6L.dd-eeff-2

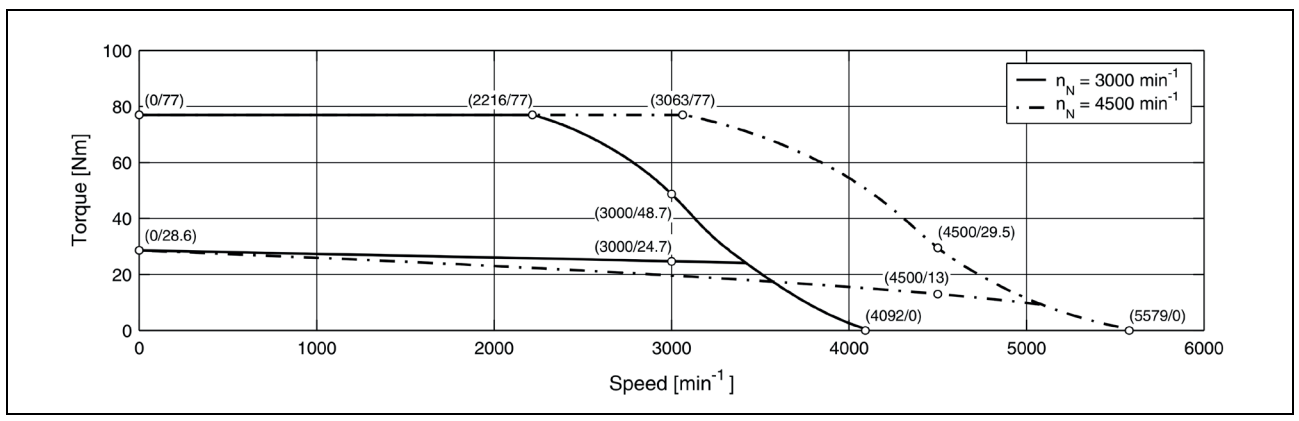


Figure 52: Characteristic curve for 8MSC6L.dd-eeff-2

8MSC6X.dd-eeff-2

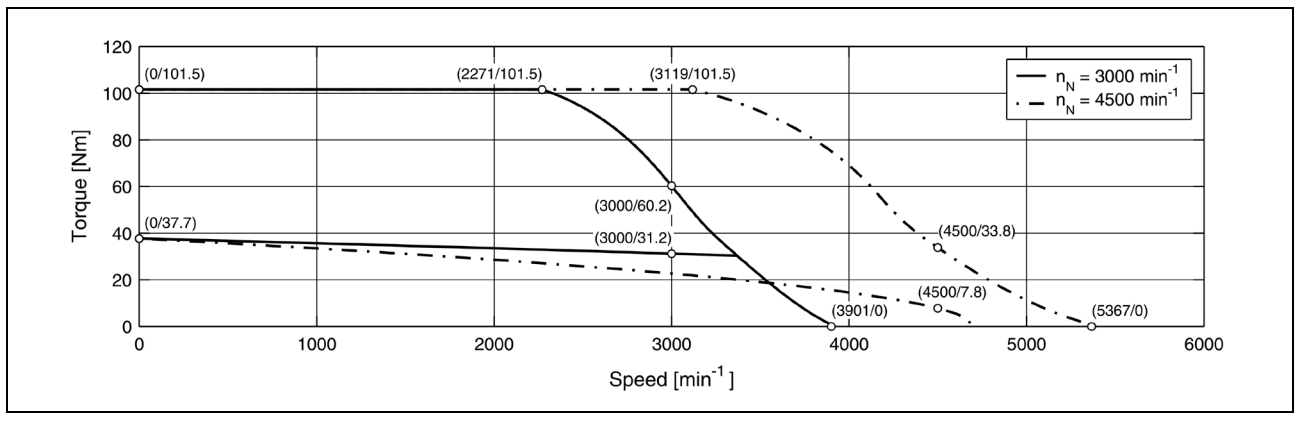


Figure 53: Characteristic curve for 8MSC6X.dd-eeff-2

1.15.3 Dimensions

EnDat Feedback				Resolver Feedback				Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	Model Number	K_0	L	M	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSC6S.Ex-eeff-2	221	65	26	8MSC6S.R0-eeff-2	202	46	20	53	Approx. 10	23	
8MSC6M.Ex-eeff-2	255			8MSC6M.R0-eeff-2	236						
8MSC6L.Ex-eeff-2	272			8MSC6L.R0-eeff-2	253						
8MSC6X.Ex-eeff-2	330			8MSC6X.R0-eeff-2	311					33	

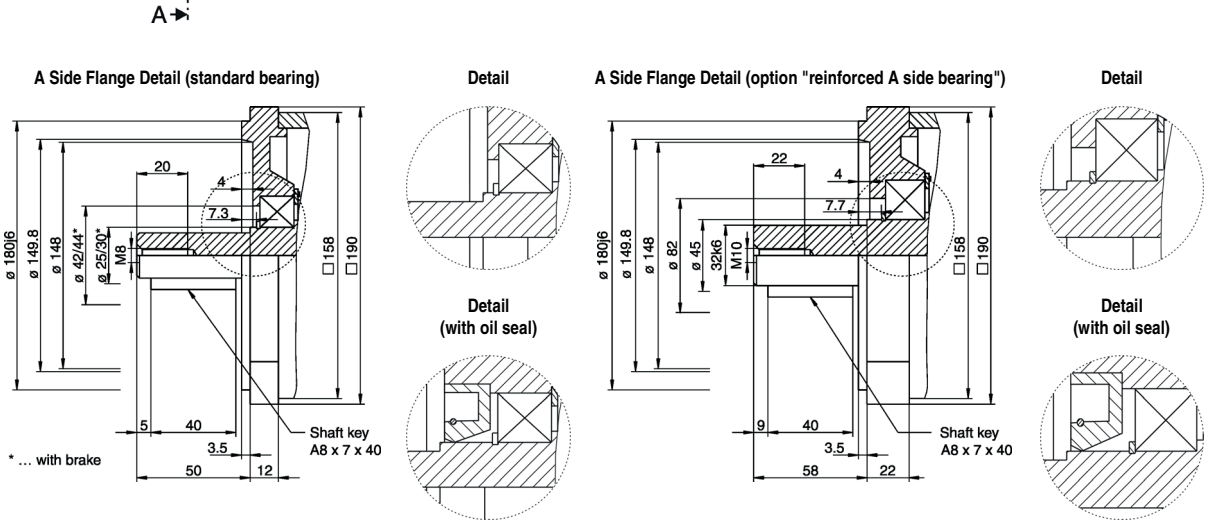
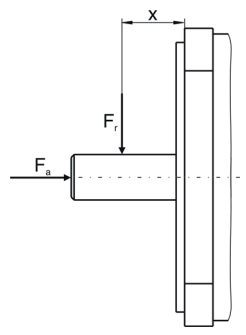


Table 62: Dimensions for servo motor 8MSC6

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.15.4 Maximum Shaft Load



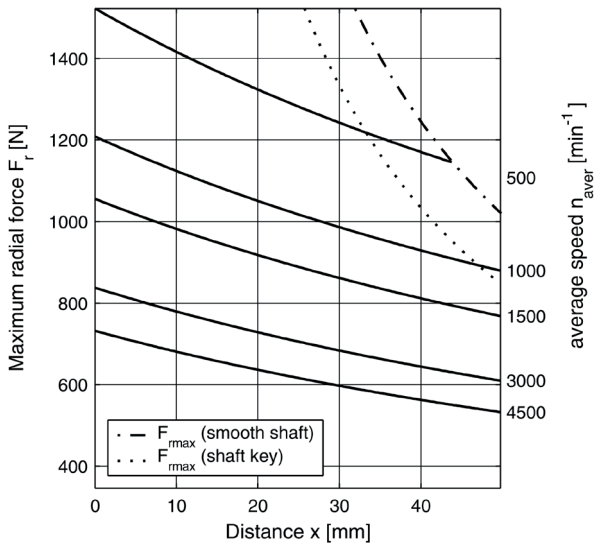
F_r .....Radial force

F_a .....Axial force

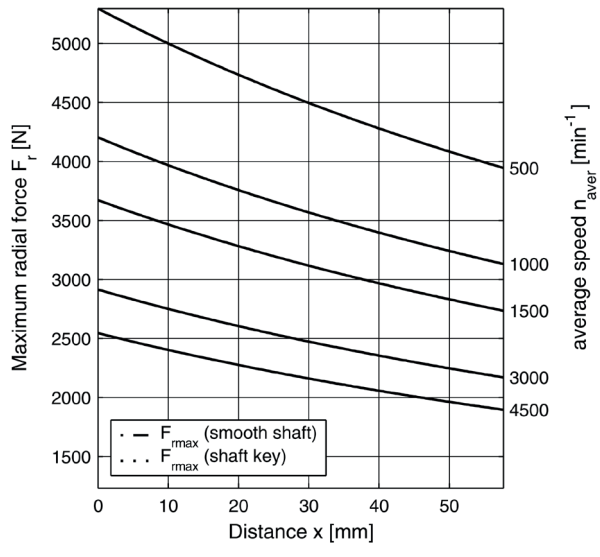
x .....Distance between motor flange and the point the radial force F_r is applied

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Option "Reinforced A Side Bearing"



Maximum axial force

Standard Bearing

$F_{a_{max}} = 135N$

Option "Reinforced A Side Bearing"

$F_{a_{max}} = 492N$

Table 63: Maximum shaft load for 8MSC6

1.16 Motor Data 8MSC7

1.16.1 Technical Data

Motor	Rated Speed n_N [min^{-1}]	Rated Torque M_N [Nm]	Rated Power P_N [kW]	Rated Current I_N [A]	Stall Torque M_0 [Nm]	Stall Current I_0 [A]	Maximum Pulse Torque M_{max} [Nm]	Maximum Pulse Current I_{max} [A]	Maximum Rotational Acceleration without Brake a [rad/s^2]	Maximum Speed n_{max} [min^{-1}]	Torque Constant K_T [Nm/A]	Voltage Constant K_E [V/1000 min^{-1}]	Stator Resistance R_{2ph} [Ω]	Stator Inductance L_{2ph} [mH]	Electrical Time Constant t_{el} [ms]	Thermal Time Constant t_{therm} [min]	Moment of Inertia without Brake J [$kgcm^2$]	Weight without Brake m [kg]	Moment of Inertia for Brake J_{Br} [$kgcm^2$]	Weight of Brake m_{Br} [kg]	Rated Holding Torque of the Brake M_{Br} [Nm]	Recommended Cable Cross Section for B&R Motor Cables [mm^2] 1)	Recommended ACOPOS Servo Drive 8Vxxxx.00-x 2)
8MSC7S.dd-eeff-1	3000	26	8.17	18.33	33.8	21.97	78	65.9	11642	6000	1.54	93	0.46	5.1	11.09	60	67	22.3	5.56	1.6	32	4	1320
	4500	18.85	8.88	20.54	33.8	32.96	78	98.9	11642	6000	1.03	62	0.2	2.2	11	60	67	22.3	5.56	1.6	32	4	1320
8MSC7M.dd-eeff-1	3000	29.9	9.39	21.84	41.6	27.64	96	82.9	11852	6000	1.51	91	0.3	3.7	12.33	67	81	26.2	5.56	1.6	32	4	1320
	4500	19.5	9.19	18.85	41.6	34.93	96	104.8	11852	6000	1.19	72	0.19	2.2	11.58	67	81	26.2	5.56	1.6	32	4	1320
8MSC7L.dd-eeff-1	3000	33.8	10.62	22.49	52	31.12	120	93	11881	4500	1.67	101	0.27	3.4	12.59	70	101	32	5.56	1.6	32	4	1320

Table 64: Technical data for 8MSC7

1) The B&R motor cables with this cable cross section are produced optimally (stripping length) for the recommended ACOPOS servo drives (see next column). B&R motor cables with other cable cross sections can also be used (within the specified terminal cross section range) and can be obtained from B&R in the desired design on request.
2) The recommended servo drive is defined for the stall current of the motor; if more than double the stall torque is required during the acceleration phase, the next larger servo drive should be selected. This recommendation is only a guideline, detailed inspection of the corresponding speed - torque characteristic curve can result in deviations of the servo drive size (one size larger or smaller). The speed - torque characteristic curves shown in the following sections always refer to the smallest recommended servo drive for the motor length!

1.16.2 Speed-Torque Characteristic Curves with 400 VAC Supply Voltage

8MSC7S.dd-eeff-1

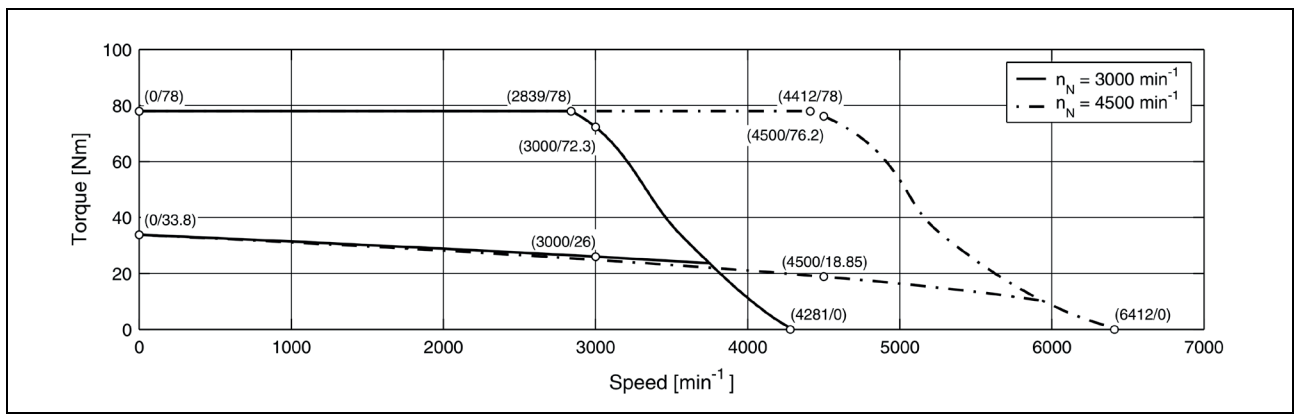


Figure 54: Characteristic curve for 8MSC7S.dd-eeff-1

8MSC7M.dd-eeff-1

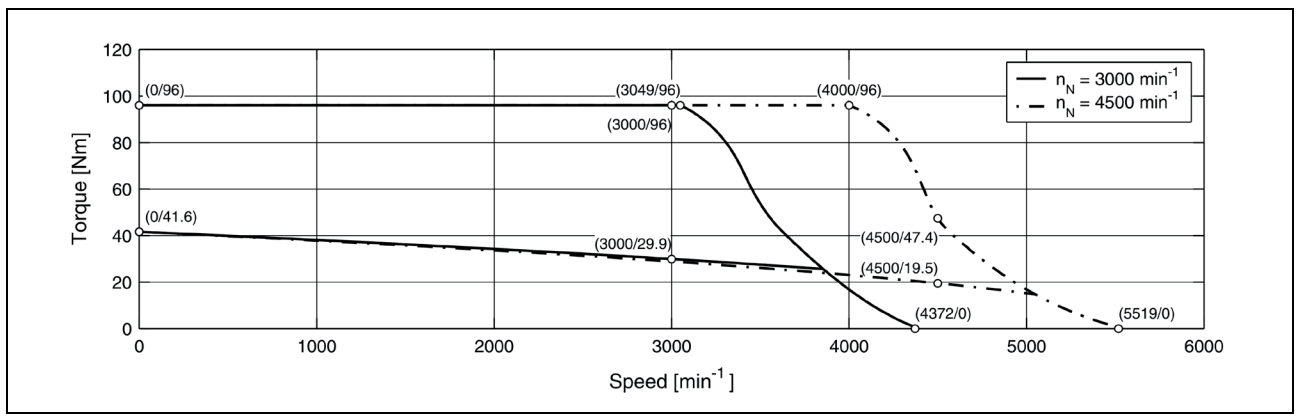


Figure 55: Characteristic curve for 8MSC7M.dd-eeff-1

8MSC7L.dd-eeff-1

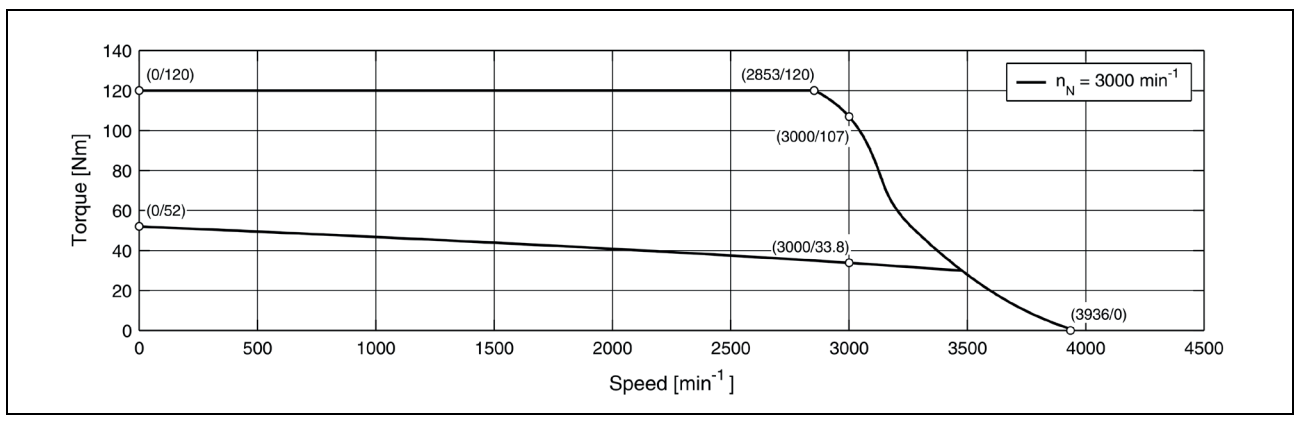
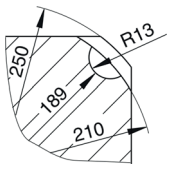


Figure 56: Characteristic curve for 8MSC7L.dd-eeff-1

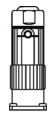
1.16.3 Dimensions

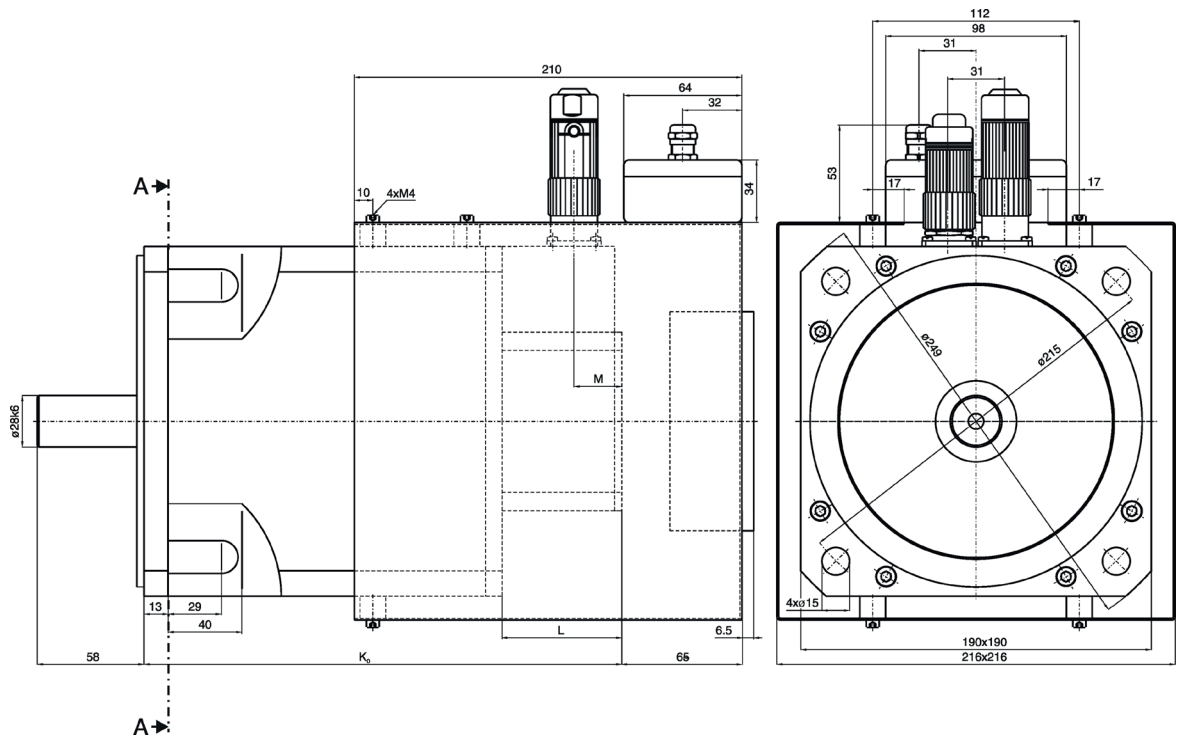
EnDat Feedback				Resolver Feedback				Extension of Dimension K_0 depending on the Motor Option [mm] 1)			
Model Number	K_0	L	M	Model Number	K_0	L	M	Holding Brake	Oil Seal	Reinforced A Side Bearing	
8MSC7S.Ex-eeff-1	259	65	34	8MSC7S.R0-eeff-1	240	46	20	44	Approx. 10	---	
8MSC7M.Ex-eeff-1	282			8MSC7M.R0-eeff-1	263						
8MSC7L.Ex-eeff-1	316.5			8MSC7L.R0-eeff-1	297						

Section Detail A - A

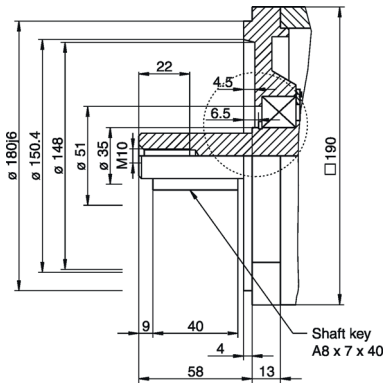


Possible Connection Directions

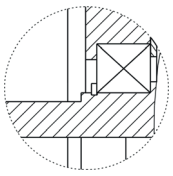




A Side Flange Detail (standard bearing)



Detail



Detail (with oil seal)

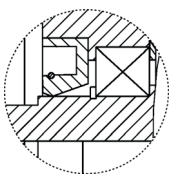
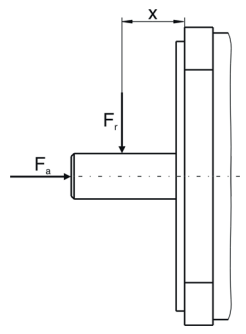


Table 65: Dimensions for servo motor 8MSC7

1) If a combination of motor options is used (e.g. holding brake and oil seal), the sum of the extensions for the individual motor options must be added to K_0.

1.16.4 Maximum Shaft Load



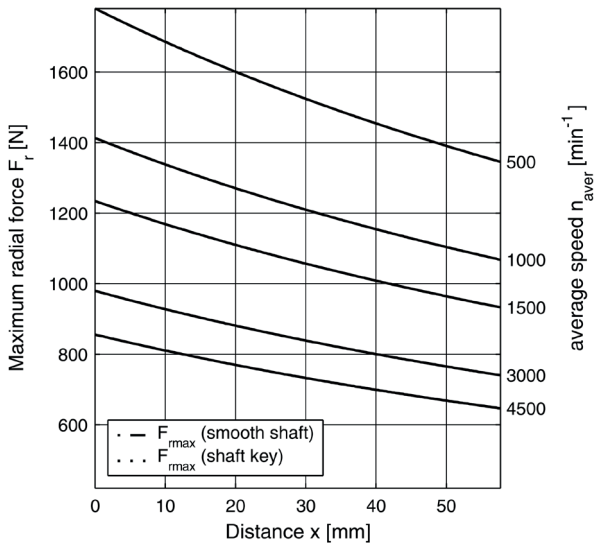
F_r .....Radial force

F_a .....Axial force

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

Maximum radial force (for a mechanical bearing lifespan of 20000 operating hours)

Standard Bearing



Maximum axial force

Standard Bearing

$F_{a_{max}} = 160N$

Table 66: Maximum shaft load for 8MSC7

1.17 Motor Encoder Systems

The three-phase synchronous motors 8MS are available with EnDat encoders and also with resolver encoders.

1.17.1 EnDat Encoder

General Information

EnDat is a standard developed by Johannes Heidenhain GmbH (www.heidenhain.de), incorporating the advantages of absolute and incremental position measurement and also offers a read/write parameter memory in the encoder. With absolute position measurement (absolute position is read in serially), the homing procedure is usually not required. When necessary, a multi-turn encoder (4096 revolutions) should be installed. To save costs, a single-turn encoder and a reference switch can also be used. In this case, a homing procedure must be carried out.

The incremental process allows the short delay times necessary for position measurement on drives with exceptional dynamic properties. With the sinusoidal incremental signal and the fine resolution in the EnDat module, a very high positioning resolution is achieved in spite of the moderate signal frequencies used.

Technical data

Different types of EnDat encoders can be used depending on the requirements:

Description	Order Code (dd)					
	E0 [1]	E1 [1]	E2 [1] [2]	E3 [1] [2]	E4 [3]	E5 [3]
Encoder Type	EnDat single-turn	EnDat multi-turn	EnDat single-turn	EnDat multi-turn	EnDat single-turn	EnDat multi-turn
Resolution	512 line		32 line		512 line	
Recognizable Revolutions	---	4096	---	4096	---	4096
Precision	±60"		±400"		±60"	
Frequency Limit	≥ 100 kHz (-3 dB)		≥ 6 kHz (-3 dB)		≥ 200 kHz (-3 dB)	
Manufacturer Internet Address	Dr. Johannes Heidenhain GmbH www.heidenhain.de					
Manufacturer's Product ID	ECN1313	EQN1325	ECI1317	EQI1329	ECN1113	EQN1125

Table 67: Technical data for EnDat encoders

1) Not available for 8MSA2 motors.
2) Not available for 8MSA8 motors.
3) Only available for 8MSA2 motors.

1.17.2 Resolver

General Information

BRX type resolvers are used in the servo motors. These resolvers are fed with a single sinusoidal signal (reference signal) and deliver two sinusoidal signals as the result. The amplitude of these signals change with the angular position (sine or cosine form).

Technical data

Description	Order Code (dd) R0
Precision	± 10 angular minutes
Non-Linearity	±1 angular minute

Table 68: Technical data for the resolver

1.18 Motor Options

1.18.1 Rated Speed

The three-phase synchronous motors can be delivered with up to four different rated speeds depending on the size.

Overview

Rated Speed n_N [min^{-1}] 1)	Available for Motor Size						
	8MSA2	8MSA3	8MSx4	8MSx5	8MSx6	8MSx7	8MSA8
2000	---	---	---	---	---	---	Yes 2)
3000	---	Yes 3)	Yes	Yes	Yes	Yes	Yes 4)
4500	---	Yes 3)	Yes	Yes	Yes	Yes	---
6000	Yes	Yes	Yes	---	---	---	---

Table 69: Available rated speeds

1) Other windings/rated speeds are possible after arrangements have been made with B&R.
2) Not available for 8MSA8S and 8MSA8M motors.
3) Only available for 8MSA3L motors.
4) Not available for 8MSA8L and 8MSA8X motors.

1.18.2 Oil Seal

All three-phase synchronous motors are available with a form A oil seal according to DIN 3760. When equipped with an oil seal, the motors have IP65 protection according to IEC 60034-5.

The length of the motors is increased by the oil seal by a max. of 10 mm. Proper lubrication of the oil seal must be guaranteed throughout the entire lifespan of the motor.

1.18.3 Holding Brake

All three-phase synchronous motors can be delivered with a holding brake that is installed directly behind the A flange on the motor. It is used to hold the motor shaft when no power is applied to the servo motor.

Functionality

The holding brake is controlled by the ACOPOS servo drive. It uses permanent magnets that are demagnetized when 24 VDC is applied to a magnet winding. This releases the brake.

The brake is designed as a holding brake. It is not allowed to be used to for operational braking! If these conditions are met, the brake has a lifespan of approximately 5,000,000 cycles (opening and closing the brake again is one cycle).

Loaded braking during an emergency stop is allowed - but reduces the lifespan.

> **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 rated holding torque for the brake.**

Technical Data for the Standard Holding Brake

Brake Data			Motor Size						
Description	Character	Unit	8MSA2	8MSA3	8MSx4	8MSx5	8MSx6	8MSx7	8MSA8
Rated Holding Torque	M_{Br}	Nm	1.8	4	8	15	32		130
Rated Power	P_{in}	W	11	12	18	24	26		50
Maximum Speed	n_{max}	min^{-1}	10000	10000	10000	10000	10000		8000
Rated Current	I_{in}	A	0.46	0.5	0.75	1	1.08		2.08
Rated Voltage	U_{in}	V	24 VDC +6 % / -10 %						
Engaging Delay	t_{on}	ms	25	35	40	50	90		190
Release Delay	t_{off}	ms	6	7	7	10	22		65
Moment of Inertia	J_{Br}	kgcm²	0.07	0.18	0.54	1.66	5.56		53
Mass	m_{Br}	kg	0.15	0.3	0.46	0.9	1.6		5.35

Table 70: Technical data for the standard holding brake

1.18.4 Shaft End

The three-phase synchronous motors have shaft ends that comply to DIN 748. They can be delivered with a smoothed shaft end or a keyed shaft end.

Smooth Shaft End

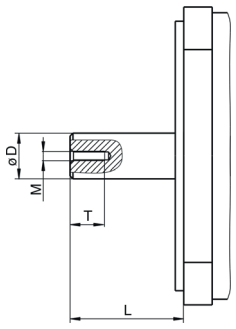
Smooth Shaft End	Motor	Standard Bearing				Option "Reinforced A Side Bearing"			
		D [mm]	L [mm]	M	T [mm]	D [mm]	L [mm]	M	T [mm]
	8MSA2	9k6	24	---	---	---	---	---	---
	8MSA3	14k6	30	M4	14	---	---	---	---
	8MSx4	19k6	40	M5	14	24k6	50	M8	20
	8MSx5	24k6	50	M8	20	32k6	58	M10	22
	8MSx6								
	8MSx7	28k6	58	M10	22	---	---	---	---
	8MSA8S	38k6	80	M12	30	42k6	80	M16	36
	8MSA8M								
	8MSA8L	42k6	110	M12	30	55k6	110	M16	36
	8MSA8X								

Table 71: Smooth shaft end dimensions

A smooth shaft end is used for a force-fit shaft-hub connection that guarantees a zero-play connection between shaft and hub as well as smooth operation.

Information:

For connection of pinion gears, belt disks or similar drive elements, please use suitible clamping sets, pressure sleeves or other fastening elements.

Drive elements must be protected against unintentional removal.

The end of the shaft has a threaded center hole which can be used to remove drive elements. [1)]

Keyed Shaft End

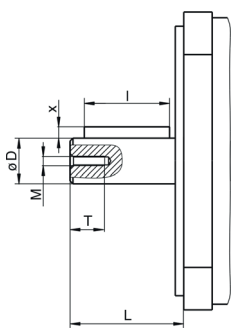
Keyed Shaft End	Motor	Standard Bearing							Option "Reinforced A Side Bearing"						
		D [mm]	L [mm]	M	T [mm]	x [mm]	l [mm]	Shaft Key	D [mm]	L [mm]	M	T [mm]	x [mm]	l [mm]	Shaft Key
	8MSA2	9k6	24	---	---	1.2	18	A3 x 3 x 18	---	---	---	---	---	---	---
	8MSA3	14k6	30	M4	14	2	22	A5 x 5 x 22	---	---	---	---	---	---	---
	8MSx4	19k6	40	M5	14	2.5	32	A6 x 6 x 32	24k6	50	M8	20	3	40	A8 x 7 x 40
	8MSx5	24k6	50	M8	20	3	40	A8 x 7 x 40	32k6	58	M10	22	3	40	A10 x 8 x 40
	8MSx6														
	8MSx7	28k6	58	M10	22				---	---	---	---	---	---	---
	8MSA8S	38k6	80	M12	30		63	A10 x 8 x 63	42k6	80	M16	36	3	63	A12 x 8 x 63
	8MSA8M														
	8MSA8L	42k6	110	M12	30			A12 x 8 x 63	55k6	110	M16	36	4	90	A16 x 10 x 90
	8MSA8X														

Table 72: Keyed shaft end dimensions

The keyed shaft end can be used for a form-fit torque transfer with low demands on the shaft-hub connection and for handling torques with a constant direction. The end of the shaft has a threaded center hole which can be used to mount drive elements with shaft end disks. [1)]

1) Not for 8MSA2 motors.

The keyways for the three-phase synchronous motors conform to keyway form N1 according to DIN 6885-1. Form A shaft keys that conform to DIN 6885-1 are used. Balancing motors with keyways is done using the half-key convention according to DIN ISO 8821.

Caution!

The shaft key can be deflected during heavy reverse operation. In extreme cases, this can cause the shaft end to break!

Smooth shaft ends should be used preferably.

Load on the Shaft End

The three-phase synchronous motors are equipped with grooved ball bearings which are sealed on both sides and greased. The radial and axial loads that occur on the shaft end during operation and installation must meet the conditions listed below.

Caution!

The bearing elements are not allowed to be subject to shocks or impacts!
Incorrect handling will cause the lifespan of the bearings to be reduced or the bearing to be damaged.

Radial Force

The radial force F_r on the shaft end is made up of the installation forces (e.g. belt tension on belt disks) and operational forces (e.g. load torque on the pinion). The maximum radial force F_r depends on the shaft end type, bearing type, average speed, position where the radial force is applied and the desired lifespan of the bearings.

Warning!

Excessive radial force can cause premature wear on the bearings or, in extreme cases, can cause the shaft end to break.

Caution!

When installing drive elements on the motor shaft, avoid a hyperstatic arrangement of the motor shaft bearings. The tolerances that occur cause additional force on the motor shaft bearings.
This can significantly reduce the bearing's lifespan or damage the bearing!

Axial Force, Shift in Shaft Position caused by Axial Force

The axial force F_a on the shaft end is made up of the installation forces (e.g. stress caused by installation) and operational forces (e.g. thrust caused by slanted tooth pinions). The maximum axial force F_a depends on the bearing type and the desired lifespan of the bearings.

The fixed bearing is secured on the A flange with a retaining ring. The floating bearing is preloaded on the B flange with a spring in the direction of the A flange. Axial forces in the direction of the B flange can cause the spring bias to be overcome and the shaft is shifted by the amount of axial play in the bearing (approx. 0.1 - 0.2 mm). This shift can cause problems on motors with holding brakes or motors with EnDat encoders (E2 and E3). Therefore, **no** axial force is permitted in the direction of the B flange when using these motors.

Danger!

The shaft ends of motors with holding brakes are not allowed to have axial loads applied. Especially axial forces in the direction of the B flange should be prevented because these forces can cause the brake to fail!

Information:

The shaft ends of motors with EnDat encoders (E2 and E3) are not allowed to have axial loads applied. Especially axial forces in the direction of the B flange should be prevented because these forces can cause encoder errors!

Determining Permissible Values for F_r and F_a

Information to determine permissible values of F_r and F_a can be taken from the motor data for the respective three-phase synchronous motors (see section 1.5 "Motor Data 8MSA2" to section 1.16 "Motor Data 8MSC7"). Permissible values are based on a bearing lifespan of 20000 h (bearing lifespan calculation based on DIN ISO 281).

1.18.5 Connection Direction

Three-phase synchronous motors with cooling type A are available with up to three different connection directions depending on the size. **For cooling type C, only the "top" connection direction is generally available**.

Overview

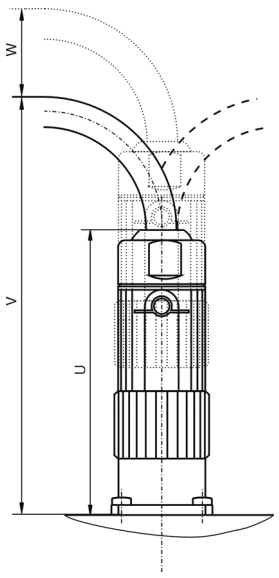
Connection Direction	Available for Motor Size						
	8MSA2	8MSA3	8MSA4	8MSA5	8MSA6	8MSA7	8MSA8
Top	Yes	Yes	Yes	Yes	Yes	Yes	Yes
A Side	Yes	Yes	Yes	---	---	---	---
B Side	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 73: Available Connection Directions

Caution!

The plug must be connected and fastened correctly.
Incorrectly connecting the plug and tightening the union nuts can cause problems on the servo motor or ACOPOS servo drive!

Detailed Dimensions for Top Connection Direction

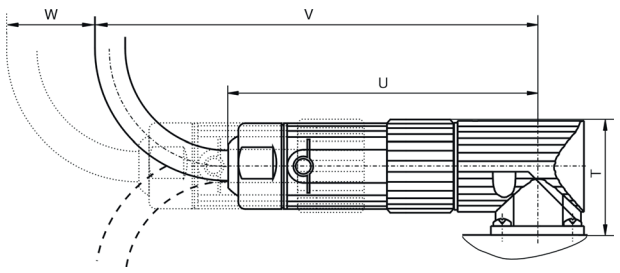


		Motor Size						
	Motor Connection (8PM001.00-1, 8PM002.00-1, 8PM003.00-1)	8MSA2	8MSA3	8MSx4	8MSx5	8MSx6	8MSx7	8MSA8
	U [mm]	87						142
	V [mm]	87 + min. flex radius of the connection cable [1]						142 + min. flex radius of the connection cable [1]
	W [mm] [2]	Min. 18						Min. 20
	Encoder Connection (8PE001.00-1, 8PR001.00-1)							
	U [mm]	68						
	V [mm]	68 + min. flex radius of the connection cable [1]						
	W [mm] [2]	Min. 17						

Table 74: Detailed dimensions for top connection direction

1) For B&R cables, the min. flex radius can be taken from chapter 4 "Cables".
2) This minimum distance must be met to ensure proper connection and removal of the connection cable.

Detailed Dimensions for A Side, B Side Connection Directions



		Motor Size						
Motor Connection (8PM001.00-1, 8PM002.00-1, 8PM003.00-1)		**8MSA2**	**8MSA3**	**8MSA4**	**8MSA5**	**8MSA6**	**8MSA7**	**8MSA8**
	T [mm]	32						55
	U [mm]	95						152
	V [mm]	95 + min. flex radius of the connection cable [1]						152 + min. flex radius of the connection cable [1]
	W [mm] [2]	Min. 18						Min. 20
Encoder Connection (8PE001.00-1, 8PR001.00-1)								
	T [mm]	32						
	U [mm]	86						
	V [mm]	86 + min. flex radius of the connection cable [1]						
	W [mm] [2]	Min. 17						

Table 75: Detailed dimensions for A side, B side connection directions

1) For B&R cables, the min. flex radius can be taken from chapter 4 "Cables".
2) This minimum distance must be met to ensure proper connection and removal of the connection cable.

Outer Dimensions of the Connectors

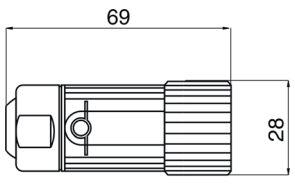
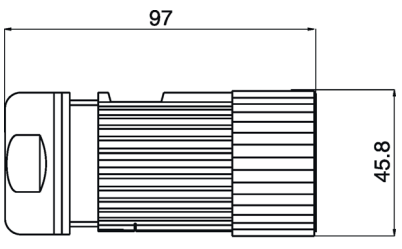
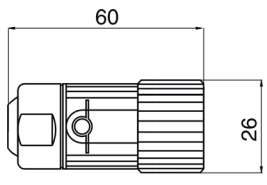
Motor Connector Size 1 (8PM001.00-1, 8PM002.00-1)	Motor Connector Size 1.5 (8PM003.00-1)	Encoder Connector Size 1 (8PE001.00-1, 8PR001.00-1)
 Not for 8MSA8	 Only for 8MSA8	 For all motors

Table 76: Outer dimensions of the connectors

Pin Assignments for the Motor Connector

Motors 8MSA2 ... 8MSx7

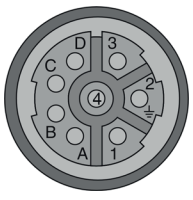
Size 1	Pin	Description	Function
	1	U	Motor connection U
	4	V	Motor connection V
	3	W	Motor connection W
	2	PE	Protective ground conductor
	A	T+	Temperature +
	B	T-	Temperature -
	C	B+	Brake +
	D	B-	Brake -

Table 77: Pin assignments for motor connector size 1

Motor 8MSA8

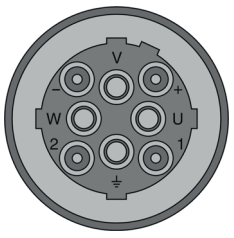
Size 1.5	Pin	Description	Function
	U	U	Motor connection U
	V	V	Motor connection V
	W	W	Motor connection W
	⏚	PE	Protective ground conductor
	1	T+	Temperature +
	2	T-	Temperature -
	+	B+	Brake +
	-	B-	Brake -

Table 78: Pin assignments for motor connector size 1.5

Pin Assignments for the Encoder Connector

EnDat

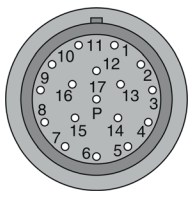
Size 1	Pin	Description	Function
	1	Sense +5V	Sense input +5 V
	2	---	---
	3	---	---
	4	Sense COM	Sense input 0 V
	5	---	---
	6	---	---
	7	+5V out / 0.25A	Encoder supply +5 V
	8	T	Clock output
	9	T\	Clock output inverted
	10	COM (1, 3 - 9, 11, 13 - 15)	Encoder supply 0 V
	11	---	---
	12	B	Channel B
	13	B\	Channel B inverted
	14	D	Data input
	15	A	Channel A
	16	A\	Channel A inverted
	17	D\	Data inverted

Table 79: Pin assignments for encoder connector size 1 (EnDat)

Resolver

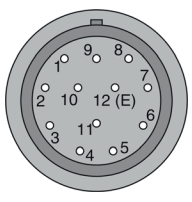
Size 1	Pin	Description	Function
	1	---	---
	2	---	---
	3	Cos	Cosine input
	4	Sin	Sine input
	5	Ref	Reference output
	6	---	---
	7	Cos\	Cosine input inverted
	8	Sin\	Sine input inverted
	9	Ref \	Reference output inverted
	10	---	---
	11	---	---
	12	---	---

Table 80: Pin assignments for encoder connector size 1 (Resolver)

1.18.6 Determining the Order Code for Motor Options (ee)

The respective code (ee) for the order key can be taken from the following table:

Motor Options				Code for Order Key (ee)		
				Connection Direction		
Rated Speed n_N [min-1]	Oil Seal	Holding Brake	Shaft End	A Side [1]	B Side	Top
2000 [2]	No	No	Smooth	---	M2	P0
			Keyed	---	M3	P1
		Normal	Smooth	---	M4	P2
			Keyed	---	M5	P3
	Yes [3]	No	Smooth	---	M8	P6
			Keyed	---	M9	P7
		Normal	Smooth	---	N0	P8
			Keyed	---	N1	P9
3000	No	No	Smooth	30	B4	D2
			Keyed	31	B5	D3
		Normal	Smooth	32	B6	D4
			Keyed	33	B7	D5
	Yes [3]	No	Smooth	72	C0	D8
			Keyed	73	C1	D9
		Normal	Smooth	74	C2	E0
			Keyed	75	C3	E1
4500	No	No	Smooth	66	V4	X2
			Keyed	67	V5	X3
		Normal	Smooth	68	V6	X4
			Keyed	69	V7	X5
	Yes [3]	No	Smooth	A2	W0	X8
			Keyed	A3	W1	X9
		Normal	Smooth	A4	W2	Y0
			Keyed	A5	W3	Y1
6000 [4]	No	No	Smooth	42	I6	K4
			Keyed	43	I7	K5
		Normal	Smooth	44	I8	K6
			Keyed	45	I9	K7
	Yes [3]	No	Smooth	84	J2	L0
			Keyed	85	J3	L1
		Normal	Smooth	86	J4	L2
			Keyed	87	J5	L3

Table 81: Order key code (ee) for the motor options

1) The "A Side" connection direction is only available for motors 8MSA2, 8MSA3 and 8MSx4.
2) A rated speed of 2000 min^{-1} is only available for motors 8MSx8.
3) The oil seal extends the motor length by a maximum of 10 mm (also see dimension K_0 in the respective dimensions image).
4) A rated speed of 6000 min^{-1} is only available for motors 8MSA2, 8MSA3 and 8MSx4.

1.19 Terminology and Formula Symbols

Connection Direction, Bearing

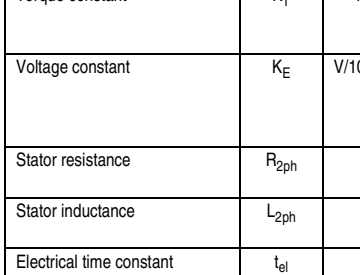
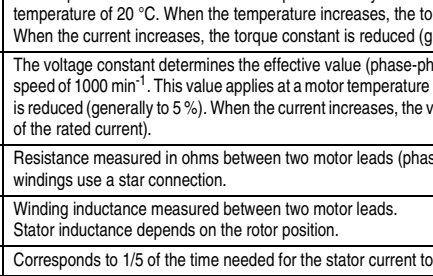
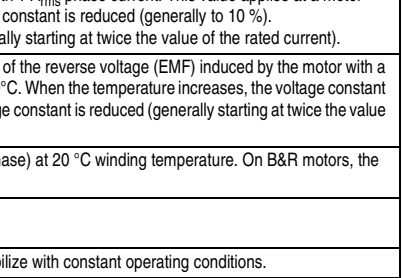
A Side	B Side	Top
		

Table 82: Connection direction terminology, bearings

Formula Symbols

Term	Sign	Unit	Description
Rated speed	n_N	min^{-1}	Rated speed of the motor
Rated torque	M_N	Nm	The rated torque is output by the motor ($n = n_N$) when the rated current is being drawn. This is possible for any length of time if the environmental conditions are correct.
Rated power	P_N	kW	The rated power is output by the motor when $n = n_N$. This is possible for any length of time if the environmental conditions are correct.
Rated current	I_N	A	The rated current is the effective value of the phase current (current in the motor supply line) for the generation of the rated torque at the rated speed. This is possible for any length of time if the environmental conditions are correct.
Stall torque	M_0	Nm	The "stall torque" is output by the motor at the speed n_0 and when the "stall current" is being drawn. This is possible for any length of time if the environmental conditions are correct. The speed n_0 must be high enough so that the winding temperature in all windings is uniform and stationary ($n_0 = 50\ min^{-1}$ for B&R motors). The continuous torque is reduced during actual 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 generation of the "stall torque" at the speed n_0. This is possible for any length of time if the environmental conditions are correct. The speed n_0 must be high enough so that the winding temperature in all windings is uniform and stationary ($n_0 = 50\ min^{-1}$ for B&R motors). The continuous current is reduced during actual standstill.
Maximum pulse torque	M_{max}	Nm	The maximum pulse torque is briefly output by the motor when the maximum pulse current is being drawn.
Maximum pulse current	I_{max}	A	The maximum pulse current is the effective value of the phase current (current in the motor supply line) for the generation of the maximum pulse torque. Only possible for a short time. The maximum pulse current is determined by the magnetic circuit. Exceeding this value for a short time can cause irreversible damage (demagnetize the magnet material).
Maximum rotational acceleration without brake	a	rad/s^2	Maximum acceleration of the motor without load and without brake. Value for the dynamics of the motor (corresponds to M_{max} / J).
Maximum speed	n_{max}	min^{-1}	Maximum motor speed. This is a mechanical condition (centrifugal force, bearing wear).
Average speed	n_{aver}	min^{-1}	Average speed for a cycle
Torque constant	K_T	Nm/A	The torque constant determines the torque created by the motor with 1 A_{rms} phase current. This value applies at a motor temperature of 20 °C. When the temperature increases, the torque constant is reduced (generally to 10 %). When the current increases, the torque constant is reduced (generally starting at twice the value of the rated current).
Voltage constant	K_E	$V/1000min^{-1}$	The voltage constant determines the effective value (phase-phase) of the reverse voltage (EMF) induced by the motor with a speed of 1000 min^{-1}. This value applies at a motor temperature of 20°C. When the temperature increases, the voltage constant is reduced (generally to 5 %). When the current increases, the voltage constant is reduced (generally starting at twice the value of the rated current).
Stator resistance	R_{2ph}	Ω	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. 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 the motor without holding brake.
Weight without brake	m	kg	Weight of the motor without holding brake.
Moment of inertia of brake	J_{Br}	$kgcm^2$	Moment of inertia for the built-in holding brake.
Weight of brake	m_{Br}	kg	Weight of the built-in holding brake.
Rated holding torque	M_{Br}	Nm	Minimum torque required to hold the rotor when the brake is activated.
Rated power	P_{in}	W	Rated power for the built-in holding brake.
Rated current	I_{in}	A	Rated current for the built-in holding brake.
Rated voltage	U_{in}	V	Operating voltage for the built-in holding brake.
Engaging 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 the operating voltage has been returned to the holding brake.

Table 83: Formula Symbols

Chapter 4 • Cables

1. General Description

B&R offers the cables for ACOPOS servo drives in six different lengths. All cables can be used for drag chain installations.

To prevent disturbances to encoder signals, the holding brake and temperature sensor wires are in the motor cable and not in the EnDat or resolver cable.

1.1 Prefabricated Cables

Using B&R cables guarantees that the EMC limits are not exceeded. The cables are prefabricated in the EU and are therefore subject to the strictest quality standards.

If other cables are used, make sure that they have the same wave parameters. If deviations exist, additional measures are necessary to ensure that EMC guidelines are met.

1.2 Order Data 1)

Model Number	Short Description
	Motor Cables
8CMxxx.12-1 1)	Motor cable, length xxx m, 4 x 1.5mm² + 2 x 2 x 0.75mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed
8CMxxx.12-3 2)	Motor cable, length xxx m, 4 x 4mm² + 2 x 2 x 1mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed
8CMxxx.12-5 3)	Motor cable, length xxx m, 4 x 10mm² + 2 x 2 x 1.5mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed
8CMxxx.12-8	Motor cable, length xxx m, 4 x 35mm² + 2 x 2 x 1.5mm², can be used in cable drag chains, UL/CSA listed
	EnDat Cables
8CExxx.12-1	EnDat cable, length xxx m, 10 x 0.14mm² + 2 x 0.5mm², EnDat plug 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed
	Resolver Cables
8CRxxx.12-1	Resolver cable, length xxx m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed

Table 84: Overview of order data for cables

1) Standard fabrication; designed for use with ACOPOS servo drives 8V1022.00-x, 8V1045.00-x and 8V1090.00-x and motor sizes 2 to 7.
2) Standard fabrication; designed for use with ACOPOS servo drives 8V1180.00-x and 8V1320.00-x and motor sizes 2 to 7.
3) Standard fabrication; designed for use with ACOPOS servo drives 8V1640.00-x and 8V128M.00-x and motor size 8.

1) Custom fabrication of motor cables is available on request. For custom fabrication of motor cables, the plug size must be matched to the motor used!

2. Motor Cables

2.1 Order Data

Model Number	Description	Image
	Motor Cables 1.5 mm² 1)	
8CM005.12-1	Motor cable, length 5 m, 4 x 1.5mm² + 2 x 2 x 0.75mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM007.12-1	Motor cable, length 7m, 4 x 1.5mm² + 2 x 2 x 0.75mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM010.12-1	Motor cable, length 10m, 4 x 1.5mm² + 2 x 2 x 0.75mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM015.12-1	Motor cable, length 15m, 4 x 1.5mm² + 2 x 2 x 0.75mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM020.12-1	Motor cable, length 20m, 4 x 1.5mm² + 2 x 2 x 0.75mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM025.12-1	Motor cable, length 25m, 4 x 1.5mm² + 2 x 2 x 0.75mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
	Motor Cables 4 mm² 2)	
8CM005.12-3	Motor cable, length 5 m, 4 x 4mm² + 2 x 2 x 1mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM007.12-3	Motor cable, length 7m, 4 x 4mm² + 2 x 2 x 1mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM010.12-3	Motor cable, length 10m, 4 x 4mm² + 2 x 2 x 1mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM015.12-3	Motor cable, length 15m, 4 x 4mm² + 2 x 2 x 1mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM020.12-3	Motor cable, length 20m, 4 x 4mm² + 2 x 2 x 1mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM025.12-3	Motor cable, length 25m, 4 x 4mm² + 2 x 2 x 1mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
	Motor Cables 10 mm² 3)	
8CM005.12-5	Motor cable, length 5 m, 4 x 10mm² + 2 x 2 x 1.5mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM007.12-5	Motor cable, length 7m, 4 x 10mm² + 2 x 2 x 1.5mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM010.12-5	Motor cable, length 10m, 4 x 10mm² + 2 x 2 x 1.5mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM015.12-5	Motor cable, length 15m, 4 x 10mm² + 2 x 2 x 1.5mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM020.12-5	Motor cable, length 20m, 4 x 10mm² + 2 x 2 x 1.5mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
8CM025.12-5	Motor cable, length 25m, 4 x 10mm² + 2 x 2 x 1.5mm², motor plug 8-pin Intercontec socket, can be used in cable drag chains, UL/CSA listed	
	Motor Cables 35 mm²	
8CM005.12-8	Motor cable, length 5m, 4 x 35mm² + 2 x 2 x 1.5mm², can be used in cable drag chains, UL/CSA listed	
8CM007.12-8	Motor cable, length 7m, 4 x 35mm² + 2 x 2 x 1.5mm², can be used in cable drag chains, UL/CSA listed	
8CM010.12-8	Motor cable, length 10m, 4 x 35mm² + 2 x 2 x 1.5mm², can be used in cable drag chains, UL/CSA listed	
8CM015.12-8	Motor cable, length 15m, 4 x 35mm² + 2 x 2 x 1.5mm², can be used in cable drag chains, UL/CSA listed	
8CM020.12-8	Motor cable, length 20m, 4 x 35mm² + 2 x 2 x 1.5mm², can be used in cable drag chains, UL/CSA listed	
8CM025.12-8	Motor cable, length 25m, 4 x 35mm² + 2 x 2 x 1.5mm², can be used in cable drag chains, UL/CSA listed	

Table 85: Order data for motor cables

1) Standard fabrication; designed for use with ACOPOS servo drives 8V1022.00-x, 8V1045.00-x and 8V1090.00-x and motor sizes 2 to 7.
2) Standard fabrication; designed for use with ACOPOS servo drives 8V1180.00-x and 8V1320.00-x and motor sizes 2 to 7.
3) Standard fabrication; designed for use with ACOPOS servo drives 8V1640.00-x and 8V128M.00-x and motor size 8.

2.2 Technical Data

2.2.1 1.5 and 4 mm² Motor Cables

Cable Type	Motor Cables 1.5 mm²	Motor Cables 4 mm²
General Information		
Cable Cross Section	4 x 1.5 mm² + 2 x 2 x 0.75 mm²	4 x 4 mm² + 2 x 2 x 1 mm²
Durability	Oil resistant according to VDE 0472 part 803, as well as standard hydraulic oil	
Certification	UL AWM Style 20669, 90 °C, 600 V, E63216 and CSA AWM I/II A/B, 90 °C, 600 V, FT1 LL46064	
Conductor		
Power Lines	1.5 mm², tinned Cu wire	4 mm², tinned Cu wire
Wire Insulation	Special thermoplastic material	
Wire Colors	Black, brown, blue, yellow/green	
Signal Lines	0.75 mm², tinned Cu wire	1 mm², tinned Cu wire
Wire Insulation	Special thermoplastic material	
Wire Colors	White, white/red, white/blue, white/green	
Cable Structure		
Power Lines		
Stranding	No	
Shield	No	
Signal Lines		
Stranding	White with white/red and white/blue with white/green	
Shield	Separate shielding for pairs, tinned Cu mesh, optical coverage > 85 % and foil banding	
Cable Stranding	With filler elements and foil banding	
Cable Shielding	Tinned Cu mesh, optical coverage > 85 % and wrapped in isolating fabric	
Outer Sheathing		
Material	PUR	
Color	Orange, similar to RAL 2003 flat	
Labeling	BERNECKER + RAINER 4x1.5+2x2x0.75 FLEX	BERNECKER + RAINER 4x4.0+2x2x1.5 FLEX
Electrical Characteristics		
Conductor Resistance		
Power Lines	≤ 14 Ω/km	≤ 5.2 Ω/km
Signal Lines	≤ 29 Ω/km	≤ 14 Ω/km
Insulation Resistance	> 200 MΩ per km	
Isolation Voltage		
Wire/Wire	3 kV	
Wire/Shield	1 kV	
Operating Voltage	Max. 600 V	
Mechanical Characteristics		
Temperature Range		
Moving	-10 °C to +70 °C	
Static	-20 °C to +90 °C	
Outer Diameter	12.8 mm ± 0.4 mm	15.8 mm ± 0.5 mm
Flex Radius	> 96 mm	> 118.5 mm
Speed	≤ 4 m/s	
Acceleration	< 60 m/s²	
Flex Cycles	≥ 3,000,000	
Weight	0.26 kg/m	0.45 kg/m

Table 86: Technical data for motor cables 1.5 and 4 mm²

2.2.2 10 and 35 mm² Motor Cables

Cable Type	Motor Cables 10 mm²	Motor Cables 35 mm²
General Information		
Cable Cross Section	4 x 10 mm² + 2 x 2 x 1.5 mm²	4 x 35 mm² + 2 x 2 x 1.5 mm²
Durability	Oil resistant according to VDE 0472 part 803, as well as standard hydraulic oil	
Certification	UL AWM Style 20669, 90 °C, 600 V, E63216 and CSA AWM I/II A/B, 90 °C, 600 V, FT1 LL46064	
Conductor		
Power Lines	10 mm², tinned Cu wire	35 mm², tinned Cu wire
Wire Insulation	Special thermoplastic material	
Wire Colors	Black, brown, blue, yellow/green	
Signal Lines	1.5 mm², tinned Cu wire	
Wire Insulation	Special thermoplastic material	
Wire Colors	White, white/red, white/blue, white/green	
Cable Structure		
Power Lines		
Stranding	No	
Shield	No	
Signal Lines		
Stranding	White with white/red and white/blue with white/green	
Shield	Separate shielding for pairs, tinned Cu mesh, optical coverage > 85 % and foil banding	
Cable Stranding	With filler elements and foil banding	
Cable Shielding	Tinned Cu mesh, optical coverage > 85 % and wrapped in isolating fabric	
Outer Sheathing		
Material	PUR	
Color	Orange, similar to RAL 2003 flat	
Labeling	BERNECKER + RAINER 4x10.0+2x2x1.5 FLEX	BERNECKER + RAINER 4x35.0+2x2x1.5 FLEX
Electrical Characteristics		
Conductor Resistance		
Power Lines	≤ 2.1 Ω/km	≤ 0.6 Ω/km
Signal Lines	≤ 14 Ω/km	≤ 14 Ω/km
Insulation Resistance	> 200 MΩ per km	
Isolation Voltage		
Wire/Wire	3 kV	
Wire/Shield	1 kV	
Operating Voltage	Max. 600 V	
Mechanical Characteristics		
Temperature Range		
Moving	-10 °C to +70 °C	
Static	-20 °C to +90 °C	
Outer Diameter	20.1 mm ± 0.7 mm	32.5 mm ± 1 mm
Flex Radius	> 150.8 mm	> 243.8 mm
Speed	≤ 4 m/s	
Acceleration	< 60 m/s²	
Flex Cycles	≥ 3,000,000	
Weight	0.77 kg/m	2.2 kg/m

Table 87: Technical data for motor cables 10 and 35 mm²

3. EnDat Cable

3.1 Order Data

Model Number	Description	Image
8CE005.12-1	EnDat cable, length 5m, 10 x 0.14mm² + 2 x 0.5mm², EnDat plug 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE007.12-1	EnDat cable, length 7m, 10 x 0.14mm² + 2 x 0.5mm², EnDat plug 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE010.12-1	EnDat cable, length 10m, 10 x 0.14mm² + 2 x 0.5mm², EnDat plug 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE015.12-1	EnDat cable, length 15m, 10 x 0.14mm² + 2 x 0.5mm², EnDat plug 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE020.12-1	EnDat cable, length 20m, 10 x 0.14mm² + 2 x 0.5mm², EnDat plug 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CE025.12-1	EnDat cable, length 25m, 10 x 0.14mm² + 2 x 0.5mm², EnDat plug 17-pin Intercontec socket, servo connector 15-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	

Table 88: Order data for EnDat cables

3.2 Technical Data

Cable Type	EnDat Cables
General Information	
Cable Cross Section	10 x 0.14 mm² + 2 x 0.50 mm²
Durability	Oil resistant according to VDE 0472 part 803, as well as standard hydraulic oil
Certification	UL AWM Style 20963, 80 °C, 30 V, E63216 and CSA AWM I/II A/B, 90 °C, 30 V, FT1 LL46064
Conductor	
Signal Lines Wire Insulation Wire Colors	0.14 mm², tinned Cu wire Special thermoplastic material Blue, brown, yellow, gray, green, pink, red, black, violet, white
Supply Lines Wire Insulation Wire Colors	0.5 mm², tinned Cu wire Special thermoplastic material White/green, white/red
Cable Structure	
Signal Lines Stranding Shield	 No No
Supply Lines Stranding Shield	 White/red with white/green and filler elements No
Cable Stranding	With foil banding
Cable Shielding	Cu mesh, optical coverage > 85 % and wrapped in isolating fabric
Outer Sheathing Material Color Labeling	 PUR Orange, similar to RAL 2003 flat BERNECKER + RAINER 10x0.14+2x0.50 FLEX
Electrical Characteristics	
Conductor Resistance Signal Lines Supply Lines	 ≤ 140 Ω/km ≤ 40 Ω/km
Insulation Resistance	> 200 MΩ per km
Isolation Voltage Wire/Wire Wire/Shield	 1.5 kV 0.8 kV
Operating Voltage	Max. 30 V

Table 89: Technical data for EnDat cables

Cable Type	EnDat Cables
Mechanical Characteristics	
Temperature Range Moving Static	 -10 °C to +70 °C -20 °C to +90 °C
Outer Diameter	7.3 mm ± 0.25 mm
Flex Radius	> 55 mm
Speed	≤ 4 m/s
Acceleration	< 60 m/s²
Flex Cycles	≥ 3,000,000
Weight	0.08 kg/m

Table 89: Technical data for EnDat cables (cont.)

4. Resolver Cables

4.1 Order Data

Model Number	Description	Image
8CR005.12-1	Resolver cable, length 5m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR007.12-1	Resolver cable, length 7m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR010.12-1	Resolver cable, length 10m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR015.12-1	Resolver cable, length 15m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR020.12-1	Resolver cable, length 20m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	
8CR025.12-1	Resolver cable, length 25m, 3 x 2 x 24 AWG/19, resolver plug 12-pin Intercontec socket, servo plug 9-pin DSUB plug, can be used in cable drag chains, UL/CSA listed	

Table 90: Order data for resolver cables

4.2 Technical Data

Cable Type	Resolver Cables
General Information	
Cable Cross Section	3 x 2 x 24 AWG/19
Durability	Oil resistant according to VDE 0472 part 803, as well as standard hydraulic oil
Certification	UL AWM Style 20671, 90 °C, 30 V, E63216 and CSA AWM, 90 °C, 30 V, I/II A/B FT1 LL46064
Conductor	
Signal Lines Wire Insulation Wire Colors	24 AWG/19, tinned Cu wire Special thermoplastic material White, brown, green, yellow, gray, pink
Cable Structure	
Signal Lines Stranding Shield	 White with brown, green with yellow, gray with pink No
Cable Stranding	The 3 pairs together covered by foil banding
Cable Shielding	Cu mesh, optical coverage ≥ 90 % and wrapped in isolating fabric
Outer Sheathing Material Color Labeling	 PUR Orange, similar to RAL 2003 flat BERNECKER + RAINER 3x2x24 AWG FLEX
Electrical Characteristics	
Conductor Resistance 24 AWG	≤ 86 Ω/km
Insulation Resistance	> 200 MΩ per km
Isolation Voltage Wire/Wire Wire/Shield	 1.5 kV 0.8 kV
Operating Voltage	Max. 30 V
Mechanical Characteristics	
Temperature Range Moving Static	 -10 °C to +80 °C -40 °C to +90 °C
Outer Diameter	6.5 mm ± 0.2 mm
Flex Radius	≥ 50 mm
Speed	≤ 4 m/s
Acceleration	< 60 m/s²
Flex Cycles	≥ 3,000,000
Weight	0.07 kg/m

Table 91: Technical data for resolver cables

Chapter 5 • Connectors

1. General Description

B&R offers five different motor/encoder connectors for AC servo motors. All connectors have IP67 protection. The metallic housing provides a protective ground connection on the housing according to VDE 0627. All plastic used in the connector is UL94/V0 listed. High quality, gold plated cage connector contacts guarantee a high level of contact security even when reinserted many times.

Using B&R connectors guarantees that the EMC limits for the connection are not exceeded. Make sure that connectors are put together correctly including a proper shield connection.

1.1 Order Data

Model Number	Short Description
	Motor connector for cable diameters 9 -17 mm
8PM001.00-1 [1)]	Motor plug 8-pin Intercontec socket, crimp range 4 x 0.5-2.5mm² + 4 x 0.06-1.0mm², for cable ø 9-14mm, IP67, UL/CSA listed
8PM002.00-1 [1)]	Motor plug 8-pin Intercontec socket, crimp range 4 x 0.5-4.0mm² + 4 x 0.06-1.0mm², for cable ø 14-17mm, IP67, UL/CSA listed
	Motor connector for cable diameters 17 - 26 mm
8PM003.00-1 [2)]	Motor plug 8-pin Intercontec socket, crimp range 4 x 1.5-10mm² + 4 x 0.5-2.5mm², for cable ø 17-26mm, IP67, UL/CSA listed
	EnDat Connector
8PE001.00-1	EnDat Connector 17 pin Intercontec socket, crimp range 17 x 0.06-1.0mm², for cable ø 9-12mm, IP67, UL/CSA listed
	Resolver Connector
8PR001.00-1	Resolver connector 12 pin Intercontec socket, crimp range 12 x 0.06-1.0mm², for cable ø 5.5-10.5mm, IP67, UL/CSA listed

Table 92: Overview of order data for connectors

1) For motor sizes 2 to 7.
2) For motor size 8.

2. Motor Connectors

2.1 8PM001.00-1, 8PM002.00-1

2.1.1 Order Data

Model Number	Description	Image
	Cable Diameter 9 - 17 mm	
8PM001.00-1	Motor plug 8-pin Intercontec socket, crimp range 4 x 0.35-2.5mm² + 4 x 0.06-1.0mm², for cable ø 9-14mm, IP67, UL/CSA listed	
8PM002.00-1	Motor plug 8-pin Intercontec socket, crimp range 4 x 2.5-4.0mm² + 4 x 0.06-1.0mm², for cable ø 14-17mm, IP67, UL/CSA listed	

Table 93: Order data for motor connector size 1

2.1.2 Technical Data

Product ID	8PM001.00-1	8PM002.00-1
General Information		
Connector Size	Size 1	
Contacts	8 (4 power and 4 signal contacts)	
Degree of Pollution	3	
Installation Altitude	Up to 2,000 m	
Insulator	PA 6.6 / PBT, UL94/V0 listed	
Contacts	Gold plated brass	
Protective Ground Connection on Housing	According to VDE 0627	
Protection according to DIN 40050	IP67 when connected	
Certifications	UL/CSA	
Electrical Characteristics		
Overvoltage Category	3	
Power Contacts Rated Current Rated Voltage Isolation Voltage (L-L) Contact Resistance	 30 A 630 VAC / VDC 6000 V < 3 mΩ	
Signal Contacts Rated Current Rated Voltage Isolation Voltage (L-L) Contact Resistance	 10 A 250 VAC / VDC 2500 V < 5 mΩ	
Mechanical Characteristics		
Temperature Range	-20 °C to +130 °C	
Housing Material	Zinc die cast / brass, nickel plated	
Gaskets	FPM / HNBR	
Mating Cycles	> 50	
Crimp Range	4 x 0.35 -2.5 mm² + 4 x 0.06 - 1 mm²	4 x 2.5 -4 mm² + 4 x 0.06 - 1 mm²
Cable ø	9.5 -14.5 mm	14 -17 mm
Manufacturer Information		
Manufacturer Internet Address	INTERCONTEC www.intercontec.biz	
Manufacturer's Product ID	BSTA 108 FR 05 58 0036 000	BSTA 108 FR 35 59 0036 000

Table 94: Technical data for motor connectors 8PM001.00-1, 8PM002.00-1

2.2 8PM003.00-1

2.2.1 Order Data

Model Number	Description	Image
	Cable Diameter 17 -26 mm	
8PM003.00-1	Motor plug 8-pin Intercontec socket, crimp range 4 x 1.5-10mm² + 4 x 0.5-2.5mm², for cable ø 17-26mm, IP67, UL/CSA listed	

Table 95: Order data for motor connector size 1.5

2.2.2 Technical data

Product ID	8PM003.00-1
General Information	
Connector Size	Size 1.5
Contacts	8 (4 power and 4 signal contacts)
Degree of Pollution	3
Installation Altitude	Up to 2,000 m
Insulator	PA 6.6 / PBT, UL94/V0 listed
Contacts	Gold plated brass
Protective Ground Connection on Housing	According to VDE 0627
Protection according to DIN 40050	IP67 when connected
Certifications	UL/CSA
Electrical Characteristics	
Overvoltage Category	3
Power Contacts Rated Current Rated Voltage Isolation Voltage (L-L) Contact Resistance	 75 A 630 VAC / VDC 6000 V < 1 mΩ
Signal Contacts Rated Current Rated Voltage Isolation Voltage (L-L) Contact Resistance	 30 A 630 VAC / VDC 4000 V < 3 mΩ
Mechanical Characteristics	
Temperature Range	-20 °C to +130 °C
Housing Material	Magnesium die cast / aluminum, nickel plated
Gaskets	FPM / HNBR
Mating Cycles	> 50
Crimp Range	4 x 1.5 - 10 mm² + 4 x 0.5 - 2.5 mm²
Cable ø	17 -26 mm
Manufacturer Information	
Manufacturer Internet Address	INTERCONTEC www.intercontec.biz
Manufacturer's Product ID	CSTA 264 FR 48 25 0001 000

Table 96: Technical data for motor connector 8PM003.00-1

3. Encoder Connectors

3.1 EnDat Connector

3.1.1 Order Data

Model Number	Description	Image
	EnDat Connector	
8PE001.00-1	EnDat plug 17-pin Intercontec socket, crimp range 17 x 0.06-1.0mm², for cable ø 9-12mm, IP67, UL/CSA listed	

Table 97: Order data for EnDat connector size 1

3.1.2 Technical Data

Product ID	8PE001.00-1
General Information	
Connector Size	Size 1
Contacts	17 signal contacts
Degree of Pollution	3
Installation Altitude	Up to 2,000 m
Insulator	PA 6.6 / PBT, UL94/V0 listed
Contacts	Gold plated brass
Protective Ground Connection on Housing	According to VDE 0627
Protection according to DIN 40050	IP67 when connected
Certifications	UL/CSA
Electrical Characteristics	
Overvoltage Category	3
Signal Contacts Rated Current Rated Voltage Isolation Voltage (L-L) Contact Resistance	 9 A 125 VAC / VDC 2500 V < 5 mΩ
Mechanical Characteristics	
Temperature Range	-20 °C to +130 °C
Housing Material	Zinc die cast / brass, nickel plated
Gaskets	FPM / HNBR
Mating Cycles	> 50
Crimp Range	17 x 0.06 - 1 mm²
Cable ø	9 -12 mm
Manufacturer Information	
Manufacturer Internet Address	INTERCONTEC www.intercontec.biz
Manufacturer's Product ID	ASTA 035 FR 11 12 0035 000

Table 98: Technical data for EnDat connector 8PE001.00-1

3.2 Resolver Connector

3.2.1 Order Data

Model Number	Description	Image
	Resolver Connector	
8PR001.00-1	Resolver plug 12-pin Intercontec socket, crimp range 12 x 0.06-1.0mm², for cable ø 5.5-10.5mm, IP67, UL/CSA listed	

Table 99: Order data for resolver connector size 1

3.2.2 Technical Data

Product ID	8PR001.00-1
General Information	
Connector Size	Size 1
Contacts	12 signal contacts
Degree of Pollution	3
Installation Altitude	Up to 2,000 m
Insulator	PA 6.6 / PBT, UL94/V0 listed
Contacts	Gold plated brass
Protective Ground Connection on Housing	According to VDE 0627
Protection according to DIN 40050	IP67 when connected
Certifications	UL/CSA
Electrical Characteristics	
Overvoltage Category	3
Signal Contacts Rated Current Rated Voltage Isolation Voltage (L-L) Contact Resistance	 9 A 160 VAC / VDC 2500 V < 5 mΩ
Mechanical Characteristics	
Temperature Range	-20 °C to +130 °C
Housing Material	Zinc die cast / brass, nickel plated
Gaskets	FPM / HNBR
Mating Cycles	> 50
Crimp Range	12 x 0.06 - 1 mm²
Cable ø	5.5 -10.5 mm
Manufacturer Information	
Manufacturer Internet Address	INTERCONTEC www.intercontec.biz
Manufacturer's Product ID	ASTA 021 FR 11 10 0035 000

Table 100: Technical data for resolver connector 8PR001.00-1

Chapter 6 • Manuals and Catalogs

1. User's Manuals

1.1 Order Data

Model Number	Short Description	Image
	User's Manual	
MAACP2-0	ACOPOS User's Manual German	
MAACP2-E	ACOPOS User's Manual English	

Table 101: Order data for user's manuals

2. Catalogs

2.1 Order Data

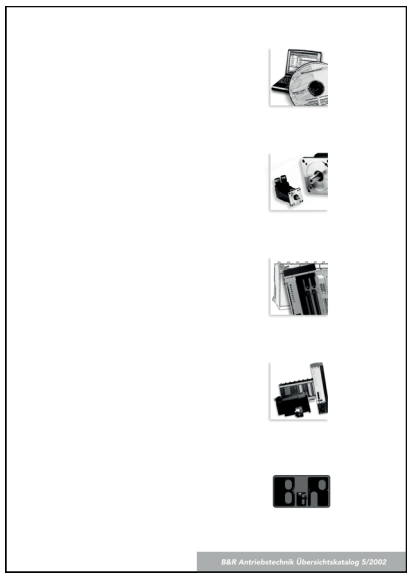
Model Number	Short Description	Image
	Catalog	
MAMSKAT-0	B&R Motion Control Overview Catalog German	
MAMSKAT-E	B&R Motion Control Overview Catalog English	

Table 102: Order data for catalogs

Chapter 7 • Standards and Certifications

1. Valid European Guidelines

- EMC guidelines 89/336/EWG
- Low-voltage guidelines 73/23/EWG
- Machine guidelines 98/37/EG

2. Valid Standards for Servo Drives

Standard	Description
IEC/EN 61800-2	Adjustable speed electrical power drive systems • Part 2: General requirements; Rating specifications for low voltage adjustable frequency AC power drive systems
IEC/EN 61800-3	Adjustable speed electrical power drive systems • Part 3: EMC product standard including specific test methods
IEC 61800-5 (draft)	Adjustable speed electrical power drive systems • Part 5: Electrical, thermal and functional safety aspects; drive systems with electrically adjustable speed (IEC 22G/CD:1998)
IEC/EN 61131-2	Programmable logic controllers • Part 2: Equipment requirements and tests
IEC 60204-1	Safety of machinery - electrical equipment on machines • Part 1: General requirements
EN 1037	Safety of machinery - prevention of unexpected start-up
IEC 61508	Functional safety of electrical, electronic, programmable electronic systems
EN 954-1	Safety of machinery - safety-related parts of control systems • Part 1: General design principles [1)]
UL 508 C	Industrial control equipment • Part 6: Solid-state AC Motor Controllers

Table 103: Valid Standards for Servo Drives

1) TÜV: Sample test for secure restart inhibit according to EN 954-1 category 3 is in preparation.

The limit values specified from section 2.1 "Environmental Limits" to section 2.4 "Other Environmental Limit Values according to IEC 61800-2" are taken from product standard IEC 61800 for servo drives in industrial environments (2nd environment). Stricter test procedures and limit values are used during the type tests for ACOPOS servo drives. Additional information is available from B&R.

2.1 Environmental Limits

2.1.1 Mechanical Conditions according to IEC 61800-2

Operation

IEC 60721-3-3, class 3M1	
	IEC 61800-2
Vibration during operation 2 ≤ f < 9 Hz 9 ≤ f < 200 Hz	 0.3 mm amplitude 1 m/s² acceleration

Table 104: Mechanical conditions during operation

Transport

IEC 60721-3-2, class 2M1	
	IEC 61800-2
Vibration during transport 2 ≤ f < 9 Hz 9 ≤ f < 200 Hz 200 ≤ f < 500 Hz	 3.5 mm amplitude 10 m/s² acceleration 15 m/s² acceleration

Table 105: Mechanical conditions during transport

2.1.2 Climate Conditions according to IEC 61800-2

Operation

IEC 60721-3-3, class 3K3	
	IEC 61800-2
Environmental temp. during operation	5 to 40 °C
Relative humidity during operation	5 -85 %, non-condensing

Table 106: Climate conditions during operation

Storage

IEC 60721-3-1, class 1K4	
	IEC 61800-2
Storage temperature	-25 to +55 °C

Table 107: Climate conditions (temperature) during storage

IEC 60721-3-1, class 1K3	
	IEC 61800-2
Relative humidity during storage	5 - 95 %, non-condensing

Table 108: Climate conditions (humidity) during storage

Transport

IEC 60721-3-2, class 2K3	
	IEC 61800-2
Transport temperature	-25 to +70 °C
Relative humidity during transport	95 % at 40 °C

Table 109: Climate conditions during transport

2.2 Requirements for Immunity to Disturbances (EMC)

2.2.1 Evaluation Criteria (performance criteria)

Criteria A ..... Test object not influenced during test.

Criteria B ..... Test object only temporarily influenced during test.

Criteria C ..... The system does not reboot automatically (reset required).

2.2.2 Low Frequency Disturbances according to IEC 61800-3

The following limits are valid for industry (2nd environment).

Power Mains Harmonics and Commutation Notches / Voltage Distortions

IEC 61000-2-4, class 3		
	IEC 61800-3	**Performance Criteria**
Harmonics	THD = 10 %	A
Short harmonics (< 15 s)	1.5x continuous level	B

Table 110: Limits for power mains harmonics

IEC 60146-1-1, class 3		
	IEC 61800-3	**Performance Criteria**
Commutation notches	Depth = 40 %, total area = 250 % x degree	A

Table 111: Limit values for commutation notches / voltage distortions

Voltage Changes, Deviations, Dips and Short-term Interruptions

IEC 61000-2-4, class 3		
	IEC 61800-3	**Performance Criteria**
Voltage changes and deviations	±10 %	A
Voltage changes and deviations (< 1 min)	+10 % to -15 %	

Table 112: Limit values for voltage changes and deviations

IEC 61000-2-1		
	IEC 61800-3	**Performance Criteria**
Voltage dips and short-term interruptions	10 % to 100 %	C

Table 113: Limit values for voltage dips and short-term interruptions

Asymmetric Voltage und Frequency Changes

IEC 61000-2-4, class 3		
	IEC 61800-3	**Performance Criteria**
Asymmetric voltages	3 % negative component	A
Frequency change and change rate	± 2 %, 1 %/s (±4 %, 2 %/s if the power supply is isolated from general power mains)	

Table 114: Limit values for asymmetric voltages and frequency changes

2.2.3 High Frequency Disturbances according to IEC 61800-3

These immunity tests are valid for industrial environments (2nd environment).

Electrostatic Discharge

Tests according to IEC 61000-4-2		
	IEC 61800-3	**Performance Criteria**
Contact discharge to powder-coated and bare metal housing parts	6 kV	B
Discharge through the air to plastic housing parts	8 kV	

Table 115: Limits for electrical discharge

Electromagnetic Fields

Tests according to IEC 61000-4-3		
	IEC 61800-3	**Performance Criteria**
Housing, completely wired	80 MHz - 1 GHz, 10 V/m, 80 % amplitude modulation at 1 kHz	A

Table 116: Limits for electromagnetic fields

Burst

Tests according to IEC 61000-4-4		
	IEC 61800-3	**Performance Criteria**
Power connection	2 kV, 1 min, direct coupling	B
Lines for measurement and control functions near the process	2 kV, 1 min	
Signal interfaces, other lines	1 kV, 1 min	

Table 117: Limits for burst

Surge

Tests according to IEC 61000-4-5		
	IEC 61800-3	**Performance Criteria**
Power connection	1 kV (2 Ω) 1), DM, symmetrical 2 kV (12 Ω) 1), CM, unsymmetrical	B

Table 118: Limits for surge

1) The impedance was added from IEC 61000-4-5 because it is not defined in IEC 61800-3.

High Frequency Conducted Disturbances

Tests according to IEC 61000-4-6		
	IEC 61800-3	**Performance Criteria**
Power connection	0.15 - 80 MHz, 10 V, 80 % amplitude modulation at 1 kHz	A
Lines for measurement and control functions near the process		
Signal interfaces, other lines		

Table 119: Limits for conducted disturbances (radio frequency)

2.3 Requirements for Emissions (EMC)

2.3.1 High Frequency Emissions according to IEC 61800-3

These emissions tests are valid for industrial environments (2nd environment).

Emissions on the Power Connections

Tests according to IEC 55011			
Continuous Current on Motor	Frequency Range [MHz]	Quasi-peak Value	Average
I ≤ 100 A	0.15 ≤ f < 0.5	100 dB (µV)	90 dB (µV)
	0.5 ≤ f < 5	86 dB (µV)	76 dB (µV)
	5 ≤ f < 30	90 dB (µV)	80 dB (µV)
100 A < I	0.15 ≤ f < 0.5	130 dB (µV)	120 dB (µV)
	0.5 ≤ f < 5	125 dB (µV)	115 dB (µV)
	5 ≤ f < 30	115 dB (µV)	105 dB (µV)

Table 120: Limits for emissions on the power connections

Electromagnetic Emissions

Tests according to IEC 55011	
Frequency Range [MHz]	Quasi-peak Value
30 ≤ f ≤ 230	40 dB (µV/m), measured at distance of 30 m 1)
230 < f ≤ 1000	50 dB (µV/m), measured at distance of 30 m 1)

Table 121: Limits for electromagnetic emissions

1) The limit values were increased by 10 dB (µV/m) when measuring from distances of 10m.

2.4 Other Environmental Limit Values according to IEC 61800-2

	IEC 61800-2
Degree of pollution according to IEC 61800-2, 4.1.2.1.	2
Over-voltage category according to IEC 60364-4-443:1999	II
Protection according to IEC 60529	IP20
Reduction of the continuous current at installation altitudes over 500 m above sea level	10 % per 1000 m
Maximum Installation Altitude	2000 m 1)

Table 122: Additional environmental limits

1) Additional requirements are to be arranged with B&R.

3. Valid Standards for Servo Motors

Standard	Description
IEC 60034-1	Rotating electrical machines • Part 1: measurement and operational behavior
IEC 60034-5	Rotating electrical machines • Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code)
IEC 60034-6	Rotating electrical machines • Part 6: Methods of cooling (IC code)
IEC 60034-7	Rotating electrical machines • Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM code)
IEC 60034-11	Rotating electrical machines • Part 11: Built-in thermal protection
IEC 60034-14	Rotating electrical machines • Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher; measurement, evaluation and limits of vibration
DIN ISO 281	Rolling Bearing, Dynamic Load Ratings and Rating Life
DIN 580	Lifting eye bolts
DIN 748	Cylindrical shaft ends for electrical machines
DIN 3760	Rotary oil seals
DIN 6885-1	Drive type fastenings without taper action; keys, keyways, deep pattern
DIN ISO 8821	Mechanical vibration; convention for balancing shaft/fittings and key type
DIN 42948	Mounting flanges for electrical machines
DIN 42955	Concentricity of the shaft end, coaxial mounting flanges for rotary electrical machines; tolerances, tests
UL 1004	Standard for Electric Motors

Table 123: Valid standards for servo motors

4. International Certifications

B&R products and services comply with the applicable standards. They are international standards from organizations such as ISO, IEC and CENELEC, as well as national standards from organizations such as UL, CSA, FCC, VDE, ÖVE, etc. We give special consideration to the reliability of our products in an industrial environment.

Certifications	
USA and Canada	All important B&R products are tested and listed by Underwriters Laboratories and are checked quarterly by a UL inspector. This mark is valid for the USA and Canada and eases certification of your machines and systems in these areas.
USA and Canada	All three-phase synchronous motors 8MS are tested and listed by Underwriters Laboratories. This mark is valid for the USA and Canada and eases certification of your machines and systems in these areas.
Europe	All harmonized EN standards for the valid guidelines are met.
Russian Federation	GOST-R certification is available for the export of all B&R ACOPOS servo drives in the Russian Federation.

Table 124: International Certifications

5. Standards, Definitions for Safety Techniques

Stop Functions according to IEC 60204-1/11.98 (electrical equipment for machines, part 1: general requirements)

The following three stop function categories exist:

Category	Description
0	Stop by immediately switching off the power to the machine drive elements (i.e. uncontrolled stop).
1	A controlled stop, the power to the machine drive elements remains on until the stop procedure is completed. The power is switched off after the stop is complete.
2	A controlled stop, the power to the machine drive elements is not switched off.

Table 125: Overview of stop function categories

The necessary stop functions must be determined based on a risk evaluation for the machine. Stop functions in category 0 and category 1 must be able to function regardless of the operating mode. A category 0 stop must have priority. Stop functions must have priority over assigned start functions. Resetting the stop function is not allowed to cause a dangerous state.

Emergency stops according to IEC 60204-1/11.98 (electrical equipment for machines, part 1: general requirements)

The following requirements are valid for emergency stops in addition to the requirements for the stop functions:

- It must have priority over all other functions and operations in all operating modes.
- The power to the machine drive elements which can cause a dangerous state must be switched off as quickly as possible without creating other dangers.
- Resetting is not allowed to cause a restart.

Emergency stops must be category 0 or category 1 stop functions. The necessary stop function must be determined based on a risk evaluation for the machine.

For emergency stop function in stop category 0, only hard wired, electromechanical equipment can be used. Additionally, the function is not allowed to depend on electronic switching logic (hardware or software) or the transfer of commands via a communication network or data connection. [1)]

When using a category 1 stop function for the emergency stop function, it must be guaranteed that the power to the machine drive elements is completely switched off. These elements must be switched off using electromechanical equipment . [1)]

Safety category according to EN 954-1/03.97 (safety of machines - safety related parts of control systems, part 1: general design principles) [2)]

The safety related parts of control systems must meet one or more of the requirements for five defined safety categories. The safety categories define the required behavior of safety related controller parts regarding their resistance to errors.

Safety Category (according to EN 954-1)	Safety Integrity Level - SIL (according to IEC 61508-2)	Short Description	System Behavior
B	---	Safety related parts must be designed and built so that they can meet the expected operational requirements. (No specific safety measures are implemented.)	**Caution!** **An error can cause the safety function to fail.**
1	1	Safety related parts must be designed and built so that only reliable components and safety principles are used. (e.g. preventing short circuits by using sufficient distances, reducing the probability of errors by over-dimensioning components, defining the failure route - closed-circuit current principle, etc.)	**Caution!** **An error can cause the safety function to fail.**
2	1	Safety related parts must be designed so that their safety functions are checked in suitable intervals by the machine controller. (e.g. automatic or manual check during start-up)	**Caution!** **An error between checks can cause the safety function to fail. If the safety function fails, it will be recognized during the check.**
3	2	Safety related parts must be designed so that individual errors do not cause the safety function to fail. Individual errors should - if possible - be recognized the next time (or before) the safety function is required.	**Caution!** **The safety function remains active when an error occurs. Some, but not all errors are recognized. A buildup of errors can cause the safety function to fail.**

Table 126: Safety category overview

1) In accordance to the national foreword for the valid German version of IEC 60204-1/11.98, it is determined that electronic equipment (and also especially for emergency stop systems) can be used regardless of the stop category, if e.g. it provides the same safety using the standards EN 954-1 and/or IEC 61508 as required by IEC 60204-1.
2) To prevent confusing EN 951-1 categories with IEC 60204-1 stop categories, the term "safety categories" was used in the text shown above for EN 954-1 categories.

Safety Category (according to EN 954-1)	Safety Integrity Level - SIL (according to IEC 61508-2)	Short Description	System Behavior
4	3	Safety related parts must be designed so that individual errors do not cause the safety function to fail. Individual errors must be recognized the next time (or before) the safety function is required. If this type of recognition is not possible, a buildup of errors is not allowed to cause the safety function to fail.	**Information:** **The safety function remains active when an error occurs. Errors are recognized in time to prevent the safety function from failing.**

Table 126: Safety category overview (cont.)

Selecting the suitable safety category must be done separately for each ACOPOS servo drive (or for each shaft) based on a risk evaluation. This risk evaluation is a part of the total risk evaluation for the machine.

The following risk graph (according to EN 954-1, Appendix B) provides a simplified procedure for risk evaluation:

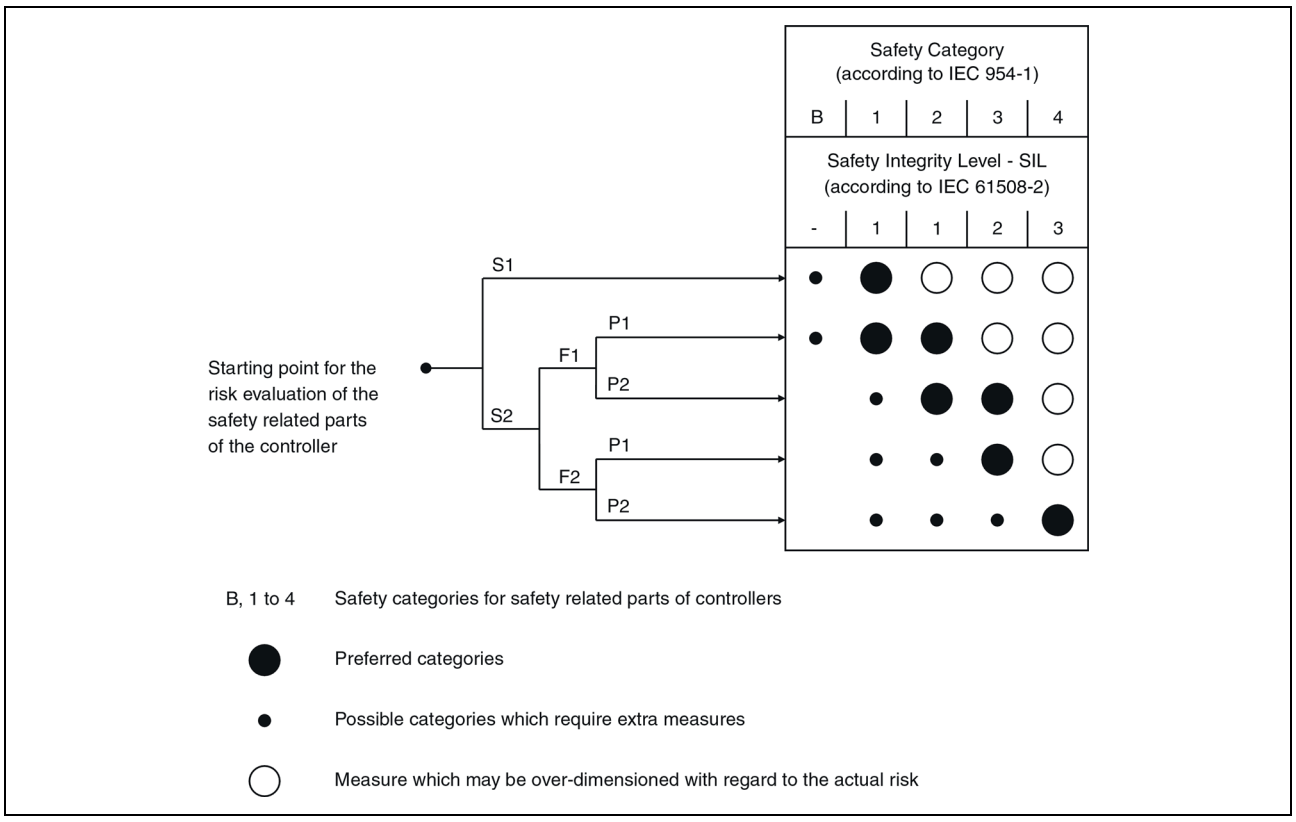


Figure 57: Risk graph according to EN 954-1, Appendix B

Begin at the starting point shown and follow the parameters S, F and P to the safety category to be used.

Parameter S ... Seriousness of injury	
S1	Light (usually reversible) injury.
S2	Serious (usually irreversible) injury.
Parameter F ... Frequency and/or duration of the danger exposure	
F1	Seldom to slightly more frequent and/or short exposure duration.
F2	Frequent to continuous and/or long exposure duration.
Parameter P ... Possibility to prevent danger	
P1	Possible under some conditions.
P2	Nearly impossible.

Table 127: Parameters S, F and P lead you to the safety category to be used

Restart inhibit according to EN 1037/04.96 (Safety of machinery - prevention of unexpected start-up)

Keeping a machine in an idle state when people are working in the danger zone is one of the most important requirements for safe operation of machines.

Starting refers to the transition of a machine or its parts from an idle state to moving state. Any start is unexpected if it is caused by:

- A start command sent because of a controller failure or because of external influences on the controller.
- A start command sent because of incorrect operation of a start element or another part of the machine.
- Restoration of power supply after an interruption.
- External/internal influences on parts of the machine.

To prevent unexpected starting of machines or parts of machines, power should be removed and dissipated. If this is not practical (e.g. frequent, short work in danger zone), other measures must be taken:

- Measures to prevent random start commands.
- Measures to prevent that random start commands cause unexpected starting.
- Measures to automatically stop dangerous parts of the machine before a dangerous situation can be caused by unexpected starting.

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