MCS synchronous servo motors

Dynamic, compact, reliable

Lenze

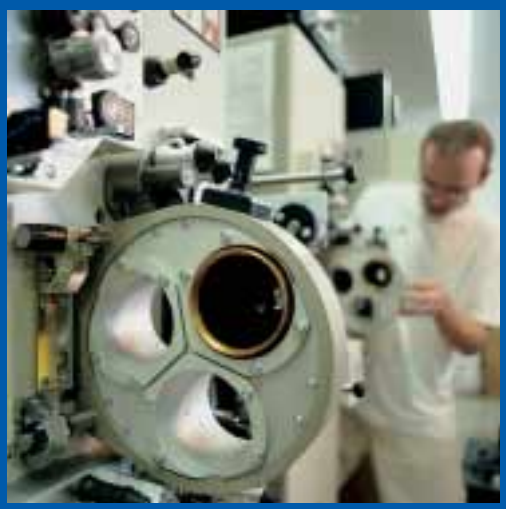
No matter which drive solution you imagine, we make your dreams come true.

True to our slogan (one stop shopping) we offer you a complete program of electronic and mechanical drive systems which is distinguished by reliability and efficiency.

The scope of our program includes frequency inverters, servo controllers, variable-speed drives, speed reduction gearboxes, motors, brakes, clutches, decentralised I/O and operator and display units.











Many well-known companies use Lenze products in various applications.

Overview

MCS synchronous servo motors

System cables
Page 3-1

System connectors
Page 3-8

Terminal box
Page 2-72

MCS synchronous servo motors
Product overview page 1-7

Resolvers/SinCos absolute value encoders
Page 2-69

PM holding brake

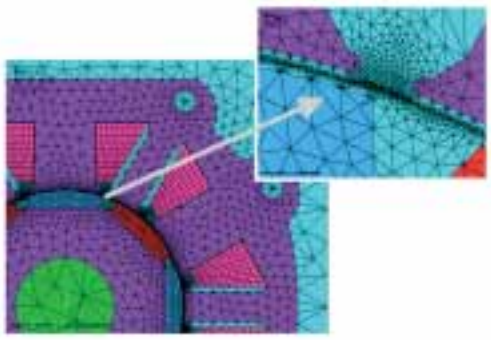
MCS synchronous servo motors

Dynamic, compact, reliable

MCS synchronous servo motors are the ideal solution wherever maximum dynamics and maximum precision need to be combined with minimum dimensions.

The stator winding on the MCS motors has been created in accordance with a new production method based on the SEpT design *). When combined with high-quality neodymium iron boron magnets, outstanding drive characteristics can be achieved. On the one hand, this design ensures a significant increase in power density whilst at the same time reducing the moment of inertia and therefore achieves excellent dynamic characteristics and on the other hand, smooth running characteristics can be optimised and detent torques minimised. The robust design with large bearings and the high degree of protection also ensures high operational reliability and long service life even in harsh ambient conditions.

SEpT stator winding for MCS servo motor



FEM calculation

MCS 14 servo motor

*) SEpT: Single Element Pole Technology

Lenze | An introduction

Lenze is the competent partner for your application. Lenze is not only a supplier for single components but also offers solutions for complete drive systems including planning, execution and commissioning.

Furthermore, a worldwide service and distribution network lets you engage a qualified customer advisory service and an after sales service that is fast and extensive.

Our quality assurance system for design, production, sales and service is certified according to DIN ISO 9001 : 2000. Our environmental management system is also certified to DIN EN ISO 14001.
Our customers set the standards for measuring the quality of our products.
Our task is to meet your requirements, since customer orientation is a Lenze principle demanding the best quality.

See for yourself.






A worldwide service –
Our team of experts provides reliable and professional assistance.

A true system

Drive and automation technology

Products which are setting the pace in terms of technology and complete drive solutions for machine and system production - just what Lenze is all about. We provide our customers with frequency and servo inverters with powers up to 400 kW. We support both central control cabinet solutions and decentralised drive concepts, e.g. with motor inverters with IP65 type of protection.

Both standard three-phase AC motors and synchronous and asynchronous servo motors are available to complement the various controllers, all of which can be combined with various types of gearboxes. Human Machine Interfaces, decentralised I/O systems and modules for fieldbus interfacing are also available for exchanging information.

Lenze boasts extensive application know-how in all manner of industries. This knowledge has been applied in the design of the controller and PC software, providing an efficient means of implementing numerous standard applications using simple parameter settings.

An all-round service comprising component selection advice, training, commissioning support and even a helpline which can be accessed all over the world and independent system engineering complete the offer.

9300 servo inverter

ECS servo system for multi-axis application

9300 vector frequency inverter

8200 vector frequency inverter

8200 motec motor inverter

starttec motor starter

Communication modules

PC software

Software packages

Servo motors

Small drives

Brakes and clutches


Lenze

Contents

MCS synchronous servo motors

General | MCS synchronous servo motors

List of abbreviations

Product information

Designations used

h	[mm]	Axis height
n_r	[rpm]	Rated speed
M_r	[Nm]	Rated torque
P_r	[kW]	Rated power
I_r	[A]	Rated current
U_r	[V]	Rated voltage
I_0	[A]	Continuous standstill current
f_r	[Hz]	Rated frequency
M_{max}	[Nm]	Maximum torque
I_{max}	[A]	Maximum current
n_{max}	[rpm]	Maximum speed
J_{load}	[kgcm²]	Moment of inertia of load machine
M_{load}	[Nm]	Torque of load machine
M_0	[Nm]	Continuous standstill torque
M_{cont}	[Nm]	Continuous torque
M_{perm}	[Nm]	Permissible torque
$\eta_{gearbox}$		Gearbox efficiency
i		Transmission ratio
J_{mot}	[kgcm²]	Moment of inertia of motor
m	[kg]	Mass
F_a	[N]	Permissible axial force
F_{r1}	[N]	Permissible radial force in centre of shaft
F_{r2}	[N]	Permissible radial force at shaft end
M_B	[Nm]	Holding torque of brake
U_B	[V]	Rated voltage of brake
I_B	[A]	Rated current of brake
J_B	[kgcm²]	Moment of inertia of brake
AC		Alternating current/voltage
DC		Direct current/voltage
η	[%]	Efficiency
KE_{LL}	[V/1000 rpm]	Voltage constant (phase-to-phase)
R_{UV}	[Ω]	Winding resistance
L_{phase}	[mH]	Winding inductance per phase
Kt_0	[Nm/A]	Standstill torque constant

DIN	Deutsches Institut für Normung
EMC	Electromagnetic compatibility
EN	European standard
IEC	International Electrotechnical Commission
IP	International Protection Code
NEMA	National Electrical Manufacturers Association
VDE	Verband deutscher Elektrotechniker
CE	Communauté Européene
IM	International Mounting Code
UL	Underwriters Laboratory listed component
UR	Underwriters Laboratory recognised component
CSA	Canadian Standards Association

MCS synchronous servo motors

Today, servo drive systems must be able to meet very exacting requirements. Lenze's Global Drive System succeeds in providing a means of optimising the matching of the various drive unit components. In this respect, Lenze's ranges of servo motors are an essential component of this system. Tailored to meet the requirements of the various applications in which they will be used, synchronous and asynchronous motors are available in a wide torque and power range optimised to meet the various requirements in terms of dynamics, accuracy and drive characteristics.

The MCS range adds a range of synchronous servo motors in innovative SEpT design *) to the offer.

Dynamic
MCS servo motors are characterised by an extremely low moment of inertia and an incredibly high overload capacity. Continuous temperature measurement with a built-in temperature sensor ensures temperature-independent optimum control characteristics.

When combined with 9300 range servo inverters or the ECS servo system, high speed precision, ideal smooth running characteristics and high angular accelerations can be achieved.

Precise
In combination with the specially designed neodymium iron boron (NdFeB) high-energy magnets, the new SEpT design *) enables a distortion-free, entirely sinusoidal field to be generated on MCS synchronous servo motors. This ensures both excellent smooth running characteristics (due to the absence of field distortion) and maximum power density (as the induced energy is solely used to generate the field). This optimised field form also prevents distorting cogging and detention torques.

Long service life
The high level of component quality Lenze strives for meets the requirements of modern drive technology in terms of operational reliability and service life. A reinforced insulation system with thermal reserve (enamel-insulated wire to temperature class H, for class F use) ensures the long operating life of the winding.
Large prestressed roller bearings with high-temperature resistant grease ensure a long service life.

*) SEpT: Single Element Pole Technology

Operational reliability
The IP54 enclosure provides effective protection for the motors against dust and water. If the drive has to meet more exacting requirements in terms of protection, MCS motors can also be supplied in IP65 enclosures.

CE conformance
All Lenze servo motors naturally meet the requirements of the following EU guidelines:
- CE conformance with the Low Voltage Directive
- CE conformance with the Electromagnetic Compatibility Directive for a generic drive configuration with inverter

The use of prefabricated system cables makes it easy to maintain electromagnetic compatibility.

UL certification
All Lenze servo motors are compatible for use on the American Continent and are supplied with UR certification.

No compromises where output speed is concerned
The wide ratio range of Lenze gearboxes, combined with the small ratio step of 1.12, enables the precise selection of the required output speed range. As the gearboxes can be mounted directly on the MCS servo motors, the drive unit is extremely compact and dimensions are minimised. MCS synchronous servo motors can of course also be combined with gearboxes in the conventional way.

Adaptable
The modular structure of the motors and the concept-based variants will help you to choose the right solution for any application.

The numerous output designs of the motors and geared motors mean that the drives can be adapted to almost any drive task:
- Servo motors with parallel shaft end with or without featherkey
- Geared servo motors with solid shaft, hollow shaft or hollow shaft with shrink disk
- Servo geared motors with or without flange, foot or centring
- Various built-in angle sensors enable the drives to be adapted to the required accuracy: Resolver as standard solution with optimised performance due to internally improved resolver accuracy, SinCos absolute value encoder for maximum accuracy
- Permanent-magnet holding brakes with a variety of torque ranges ensure exact position control in all applications even if the drive has been disconnected from the power supply

Quiet
High inverter switching frequencies (up to 16 kHz) reduce noise generation. The optimum teeth geometry of the Lenze gearboxes reduces the generation of noise and the gearbox cast-iron housings with internal ribbing also have a noise-reducing effect.

Compact
The high power density of the MCS synchronous servo motors reduces the size and increases the dynamics of the drive units. The use of geared servo motors with direct mounting of the motors makes for particularly compact drives.

Reduced backlash
The use of backlash-free permanent-magnet holding brakes enables defined holding of a position even if the drive has been disconnected from the power supply.

The low-backlash joining elements on the Lenze gearboxes and high teeth quality due to precision manufacturing minimise output backlash on the geared servo motors in comparison with similar gearboxes.

Special models
We can also provide special models tailored to meet the requirements of specific applications.

Please contact us should you require more information.

Easy to install
MCS synchronous servo motors can be installed in next to no time and minimum downtimes are assured in the case of replacements. All the motor connections simply plug in. All motors can be installed and removed from the non-drive end with a very simple tool.

Easy-to-install housing format on MCS synchronous servo motors

Version overview

Version		MCS synchronous servo motors				
		MCS06	MCS09	MCS12	MCS14	MCS19
Speed	1000 ... 1500/min				●	●
	1500 ... 2500/min			●	●	
	3000 ... 4000/min		●	●	●	●
	4000 ... 5000/min	●	●	●		
	6000 ... 8000/min	●	●			
Speed/ position encoder	Resolver	●	●	●	●	●
	SinCos absolute value encoder single-turn Hiperface SRS	●	●	●	●	●
	SinCos absolute value encoder multi-turn Hiperface SRM	●	●	●	●	●
Brake	Without brake	●	●	●	●	●
	With PM brake 24 V	●	●	●	●	●
	With PM brake, reinforced		●	●	●	
Mounting position/shaft end	B5 FF75 11x23 without featherkey	●				
	B5 FF75 11x23 with featherkey	●				
	B5 A120 FF100 14x30 without featherkey		●			
	B5 A120 FF100 14x30 with featherkey		●			
	B5 A160 FF130 19x40 without featherkey			●		
	B5 A160 FF130 19x40 with featherkey			●		
	B5 A200 FF165 24x50 without featherkey				●	
	B5 A200 FF165 24x50 with featherkey				●	
	B5 A250 FF215 28x60 without featherkey					●
	B5 A250 FF215 28x60 with featherkey					●
	Gearbox mounted directly with tapered shaft	●	●	●	●	●
Connection method	Circular connector for power and encoder	●	●	●	●	●
	Terminal box for power and encoder		●	●	●	●
Enclosure	IP54	●	●	●	●	●
	IP65, with shaft sealing ring	●	●	●	●	●
Cooling	Self-ventilated without fan	●	●	●	●	●
Approvals	UR approval	●	●	●	●	●

MCS 06F

MCS 09H

MCS 12L

MCS synchronous servo motors product overview

Motor	M_r	n_r	P_r	I_r	M_0	I_0	M_{max}	I_{max}	J_{mot} (or brake)	Motor data
	Nm	rpm	kW	A	Nm	A	Nm	A	kgcm²	
MCS 06C41	0.6	4050	0.25	1.3	0.8	1.3	2.4	5.4	0.14	
MCS 06C60	0.5	6000	0.31	2.4	0.8	2.5	2.4	10.8	0.14	
MCS 06F41	1.2	4050	0.51	1.5	1.5	1.5	4.4	5.3	0.22	Page 2-3
MCS 06F60	0.9	6000	0.57	2.5	1.5	2.9	4.4	10.5	0.22	
MCS 06I41	1.5	4050	0.64	1.6	2.0	1.7	6.2	5.9	0.30	
MCS 06I60	1.2	6000	0.75	2.9	2.0	3.4	6.2	11.8	0.30	
MCS 09F38	3.1	3750	1.2	2.5	4.2	3.0	15	15	1.50	
MCS 09F60	2.4	6000	1.5	4.5	4.2	6.0	15	30	1.50	Page 2-17
MCS 09H41	3.8	4050	1.6	3.4	5.5	4.3	20	20	1.90	
MCS 09H60	3.0	6000	1.9	6.0	5.5	8.5	20	40	1.90	
MCS 12H15	10.0	1500	1.9	3.8	11.4	4.1	29	12	7.3	
MCS 12H35	7.5	3525	2.8	5.7	11.4	8.2	29	24	7.3	Page 2-29
MCS 12L20	13.5	1950	2.8	5.9	15.0	6.2	56	28	10.6	
MCS 12L41	11.0	4050	4.7	10.2	15.0	12.4	56	57	10.6	
MCS 14D15	9.2	1500	1.45	4.5	11	5.0	29	17	8.1	
MCS 14D36	7.5	3600	2.8	7.5	11	10.0	29	33	8.1	
MCS 14H15	16.0	1500	2.5	6.6	21	8.5	55	26	14.2	
MCS 14H32	14.0	3225	4.7	11.9	21	16.9	55	52	14.2	Page 2-41
MCS 14L15	23.0	1500	3.6	9.7	28	12.0	77	37	23.4	
MCS 14L32	17.2	3225	5.8	15	28	24.0	77	75	23.4	
MCS 14P14	30.0	1350	4.2	10.8	37	12.2	105	46	34.7	
MCS 14P32	21.0	3225	7.1	15.6	37	24.3	105	92	34.7	
MCS 19F14	27	1425	4.0	8.6	32	9.9	86	31	65.0	
MCS 19F30	21	3000	6.6	14.0	32	19.8	86	63	65.0	
MCS 19J14	40	1425	6.0	12.3	51	15.2	129	45	105.0	Page 2-55
MCS 19J30	29	3000	9.1	18.5	51	30.5	129	90	105.0	
MCS 19P14	51	1350	7.2	14.3	64	17.5	190	60	160.0	
MCS 19P30	32	3000	10.0	19.0	64	34.9	190	120	160.0	

MCS 14H

MCS 19F

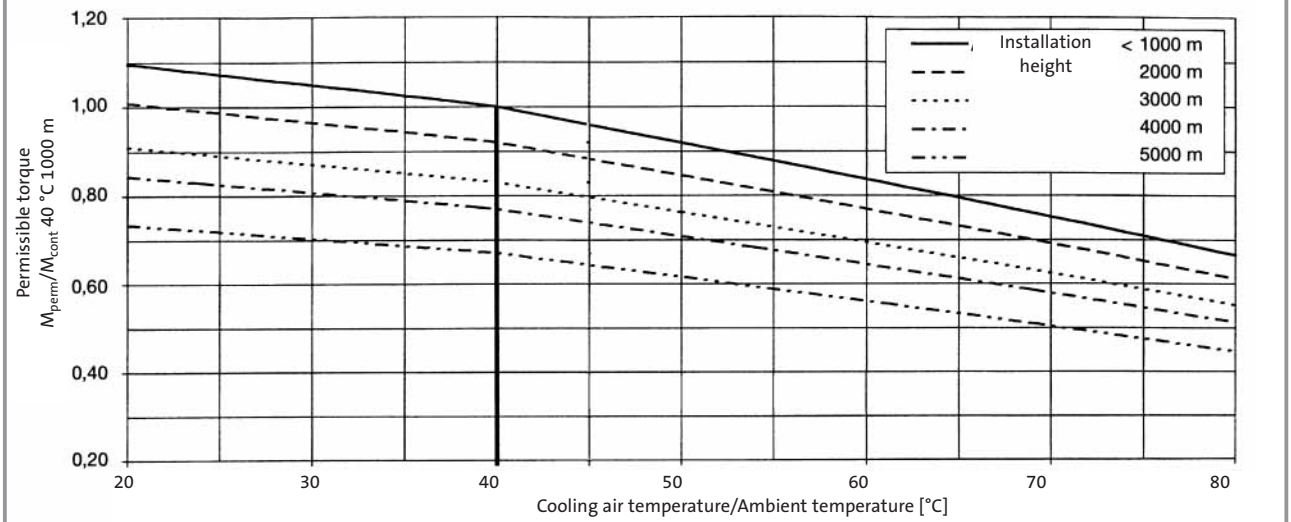
General data

Enclosure	IP54/IP65
Thermal class (VDE 0530)	Utilisation to temperature class F Insulation system (enamel-insulated wire) to thermal class H
UL conformance	UR, recognised component
Insulation resistance	Maximum voltage amplitude $\hat{U}$ = 1.5 kV Maximum rate of voltage rise du/dt = 5 kV/µs
Vibration level	N
Smooth running, run-out, concentricity (DIN 2955)	N
Mechanical tolerance	Diameter of shaft end d Ø11 to Ø28: k6, Diameter of centring flange: J6
Temperature monitoring	Continuous temperature sensor (KTY 83-110), combined with 2 x PTC 150°C (KTY only on MCS 06)
Connection	2 circular connectors which can be rotated by 180° for a) motor and brake b) resolver and temperature sensor or terminal box (terminal box not possible on MCS 06)
Temperature range	-20 to +40 °C without power derating (without brake) -10 to +40 °C without power derating (with brake)
Surface temperature	Up to 140 °C
Installation height	Up to 1000 m amsl without power derating
Demagnetising limit	$> 5 \cdot I_r$
Maximum torque	$> 4 \cdot M_r$
Angle sensor	Resolver SinCos encoder
Design	B5, (B14 on request)
Bearing	Deep-groove ball bearing with high-temperature resistance grease, 2 sealing disks locating bearing on non-drive end
Shaft end	With/without featherkey
Brake	With or without permanent-magnet holding brake on non-drive end
Fan	–
Colour	Black, RAL 9005

Influence of ambient temperature and installation height

All values given in tables and diagrams for the MCS synchronous servo motors are valid for a maximum ambient temperature of 40 °C and an installation height up to 1000 m amsl.

If installation conditions differ, the correction factors below should be taken into account.



MCS synchronous servo motors have been developed in particular for dynamic drive tasks and therefore feature very high standstill and maximum torques. These optimised characteristics enable a smaller motor to be selected for many applications than if the motor was dimensioned in accordance with the rated data.

A brief overview of the most important data and relationships for dimensioning a servo motor appears below:

Gearbox ratio:

▶ for **optimum dynamics**

$$i \approx \sqrt{\frac{J_{load}}{J_{mot}}}$$

▶ for optimum utilisation in **continuous operation**

$$i \approx \frac{n_r}{n_{load}}$$

Maximum torque:

$$M_{max} = M_{accel} + \frac{1}{i}\frac{1}{\eta_{gearbox}} M_{load}$$

$$M_{accel} = 2 \cdot \pi \frac{\Delta n}{\Delta t}\left(J_{mot} + \frac{1}{i^2} J_{load}\right)$$

The thermal dimensions of the motor are calculated taking into account the r.m.s. torque and the average speed:

r.m.s. torque:

$$M_{rms} = \sqrt{\frac{1}{T}\sum_i M_i^2 \cdot t_i}$$

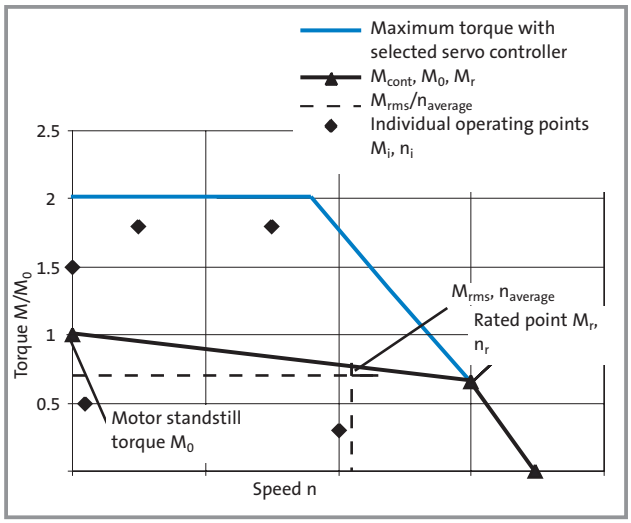
Average speed:

$$n_{average} = \frac{1}{T}\sum \left| n_i \cdot t_i \right|$$

If $n_{average}$, M_{rms} are located below the characteristic for continuous operation or the following relationship is true

$$M_{rms} \le M_0 + (M_r - M_0) \cdot \frac{n_{average}}{n_r}$$

and all operating points M_i, n_i are located below the torque boundary, the thermal dimensioning of the motor is correct.

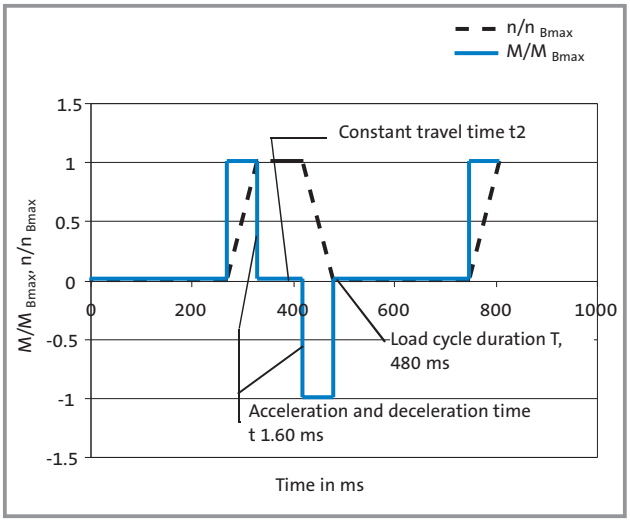


Example diagram for correct thermal motor dimensioning: The point of intersection between the lines M_{rms} and $n_{average}$ is located below the characteristic for continuous operation, and all operating points M_i, n_i are located below the torque boundary (depending on the motor and servo controller selected).

If the drive task involves a **cyclic motion sequence** (this is true of most servo applications), the following relationships apply for
M_{rms} and $n_{average}$:

$$M_{rms} = \sqrt{\frac{2t_1}{T} M^2_{max}} \qquad n_{average} = \frac{t_1 + t_2}{T} n_{max}$$

To illustrate an example calculation for an MCS 19 servo motor connected to an EVS 9328 servo controller:



Motion diagram for example calculation

Example calculation
Values for the example illustrated in the diagram:

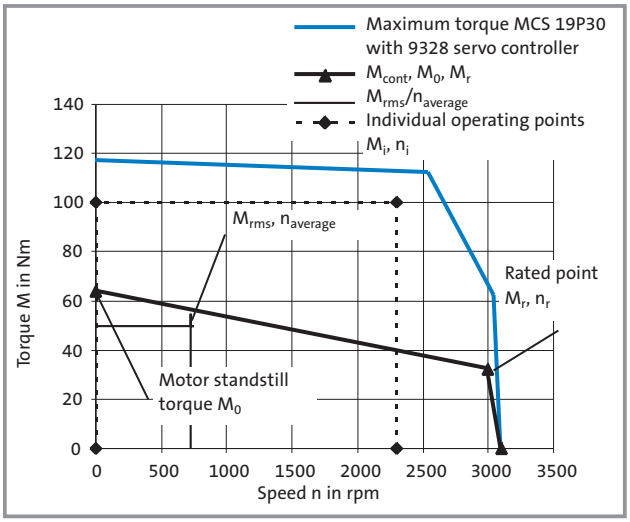
$t_1 = 60\ ms$ $t_2 = 90\ ms$ $T = 480\ ms$

$n_{Bmax} = 2300\ rpm$ $M_{Bmax} = 100\ Nm$

$$M_{rms} = \sqrt{\frac{2 \cdot 60\ ms}{480\ ms} \cdot M^2_{Bmax}} = 0.5 \cdot M_{Bmax} = 50\ Nm$$

$$n_{average} = \frac{60 + 90}{480}\ n_{Bmax} = 0.3125 \cdot n_{Bmax} = 720\ rpm$$

Selected motor:
MCS 19P30 with data
$M_0 = 64\ Nm$ *and* $M_r = 32\ Nm$



The motor is suitable for the drive, although the value of the rated torque (32 Nm) is less than 1/3 of the drive torques required in the example:

1) The operating point resulting from the r.m.s. torque (50 Nm) and the average speed (720 rpm) is located below the characteristic for continuous operation.
2) All operating points are located below the torque boundary of the MCS 19P30 with the EVS 9328 servo controller ($I_{max\ controller} = 70.5$ A).

Technical data

MCS synchronous servo motors

Synchronous servo motors MCS 06

Synchronous servo motors MCS 09

Synchronous servo motors MCS 12

Synchronous servo motors MCS 14

Synchronous servo motors MCS 19

Options

Rated data

Motor	M_r Nm	n_r rpm	P_r kW	U_r V	f_r Hz	I_r A	η %	M_0 Nm	I_0 A	M_{max} Nm	I_{max} A	J_{mot} without brake kgcm²
MCS 06C41	0.6	4050	0.25	225	270	1.3	65	0.8	1.3	2.4	5.4	0.14
MCS 06C60	0.5	6000	0.31	135	400	2.4	70	0.8	2.5	2.4	10.8	0.14
MCS 06F41	1.2	4050	0.51	320	270	1.5	77	1.5	1.5	4.4	5.3	0.22
MCS 06F60	0.9	6000	0.57	180	400	2.5	81	1.5	2.9	4.4	10.5	0.22
MCS 06I41	1.5	4050	0.64	325	270	1.6	81	2.0	1.7	6.2	5.9	0.30
MCS 06I60	1.2	6000	0.75	190	400	2.9	84	2.0	3.4	6.2	11.8	0.30

Motor	ke_{LL}-factor at 150 °C V/1000 rpm	R_{UV} at 20 °C Ω	R_{UV} at 150 °C Ω	L_{phase} mH	kt_0 factor at 150 °C Nm/A	Power connector type	Weight without brake kg	Maximum speed mech. rpm
MCS 06C41	36.6	27.1	36.5	51.0	0.66		1.8	8000
MCS 06C60	18.3	6.8	9.1	12.8	0.33		1.8	8000
MCS 06F41	60.1	21.9	29.5	63.5	1.05	EWS0001	2.2	8000
MCS 06F60	30.0	5.5	7.4	15.9	0.53		2.2	8000
MCS 06I41	73.4	18.8	25.4	60.2	1.21		2.9	8000
MCS 06I60	36.7	4.7	6.3	15.1	0.60		2.9	8000

MCS 06C

MCS 06F

MCS 06I

Servo controller assignment

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 4 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		2	4	8	12.7	17	20
Maximum current 0 Hz [1) 2)] [A]		2.3	4.6	9.1	18.1	27.2	36.3
Maximum current > 5 Hz [1) 2)] [A]		4	8	16	32	48	64
Motor type							
MCS 06C41	M_r	0.6					
	M_0	0.8					
	M_{max} n=0	1.2					
	M_{max}	1.9					
MCS 06C60	M_r	0.4	0.5				
	M_0	0.6	0.8				
	M_{max} n=0	0.6	1.2				
	M_{max}	1.0	1.9				
MCS 06F41	M_r	1.2					
	M_0	1.5					
	M_{max} n=0	2.0					
	M_{max}	3.5					
MCS 06F60	M_r	0.7	0.9				
	M_0	1.0	1.5				
	M_{max} n=0	1.0	2.0				
	M_{max}	1.8	3.5				
MCS 06I41	M_r	1.5	1.5				
	M_0	2.0	2.0				
	M_{max} n=0	2.6	5.0				
	M_{max}	4.4	6.2				
MCS 06I60	M_r	0.8	1.2	1.2			
	M_0	1.2	2.0	2.0			
	M_{max} n=0	1.3	2.6	4.9			
	M_{max}	2.2	4.4	6.2			

1) Caution: Limit I_{max} controller to I_{max} motor
2) Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 8 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		1.4	2.7	5.3	8.5	11.3	13.3
Maximum current 0 Hz [1) 2) 3)] [A]		1.5	3	6	12.1	18.1	24.2
Maximum current > 5 Hz [1) 2) 3)] [A]		2.7	5.3	10.7	21.3	32	42.7
Motor type							
MCS 06C41	M_r	0.6	0.6				
	M_0	0.8	0.8				
	M_{max} n=0	0.8	1.5				
	M_{max}	1.4	2.4				
MCS 06C60	M_r		0.5	0.5			
	M_0		0.8	0.8			
	M_{max} n=0		0.8	1.5			
	M_{max}		1.3	2.4			
MCS 06F41	M_r	1.1	1.2				
	M_0	1.4	1.5				
	M_{max} n=0	1.3	2.7				
	M_{max}	2.4	4.4				
MCS 06F60	M_r		0.9	0.9			
	M_0		1.4	1.5			
	M_{max} n=0		1.3	2.7			
	M_{max}		2.4	4.4			
MCS 06I41	M_r	1.3	1.5				
	M_0	1.6	2.0				
	M_{max} n=0	1.7	3.3				
	M_{max}	3.0	5.6				
MCS 06I60	M_r		1.1	1.2			
	M_0		1.6	2.0			
	M_{max} n=0		1.7	3.3			
	M_{max}		3.0	5.7			

1) Caution: Limit I_{max} controller to I_{max} motor
2) Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
3) Caution: On the ECS automatic switching to 4 kHz not taken into account; when using automatic switching to 4 kHz, the maximum torques at 4 kHz apply

Servo controller assignment

Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 8 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.5	2.5	3.9	7	13	23.5	32	47	59	89
Maximum current 0 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	23.5	32	47	52	80
Maximum current > 5 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	35.25	48	70.5	88.5	133.5
Motor type											
MCS 06C41	M_r	0.6	0.6	0.6							
	M_0 [4)]	0.8	0.8	0.8							
	M_{max} n=0	1.2	1.8	2.4							
	M_{max}	1.2	1.8	2.4							
MCS 06C60	M_r		0.5	0.5	0.5						
	M_0 [4)]		0.8	0.8	0.8						
	M_{max} n=0		1.0	1.5	2.4						
	M_{max}		1.0	1.5	2.4						
MCS 06F41	M_r	1.2	1.2	1.2							
	M_0 [4)]	1.5	1.5	1.5							
	M_{max} n=0	2.0	3.3	4.4							
	M_{max}	2.0	3.3	4.4							
MCS 06F60	M_r		0.9	0.9	0.9						
	M_0 [4)]		1.3	1.5	1.5						
	M_{max} n=0		1.7	2.6	4.4						
	M_{max}		1.7	2.6	4.4						
MCS 06I41	M_r	1.4	1.5	1.5							
	M_0 [4)]	1.8	2.0	2.0							
	M_{max} n=0	2.6	4.2	6.2							
	M_{max}	2.6	4.2	6.2							
MCS 06I60	M_r		1.0	1.2	1.2						
	M_0 [4)]		1.5	2.0	2.0						
	M_{max} n=0		2.1	3.3	5.6						
	M_{max}		2.1	3.3	5.6						

[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

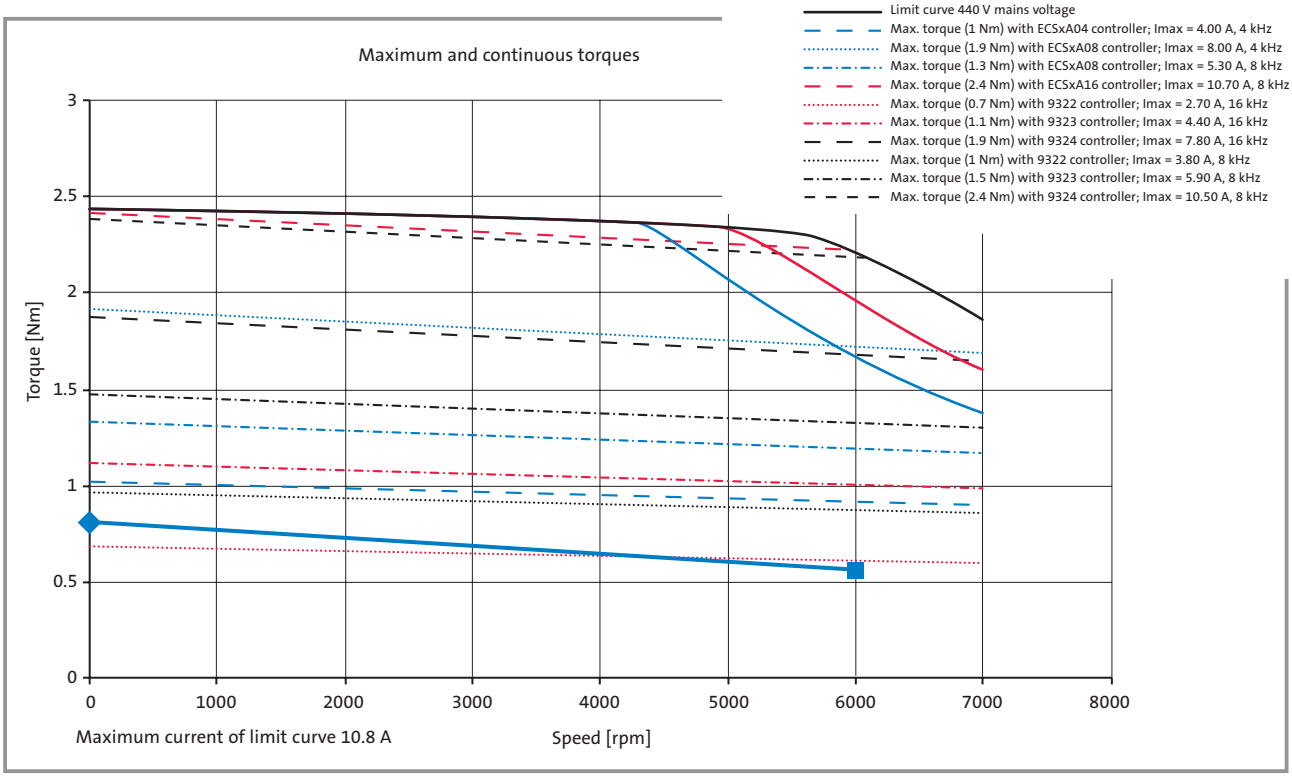
Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 16 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.1	1.8	2.9	5.2	9.7	15.3	20.8	30.6	38	58
Maximum current 0 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	15.3	20.8	30.6	33	45
Maximum current > 5 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	23	31.2	45.9	57	87
Motor type											
MCS 06C41	M_r	0.5	0.6	0.6							
	M_0 [4)]	0.7	0.8	0.8							
	M_{max} n=0	0.9	1.4	2.1							
	M_{max}	0.9	1.4	2.1							
MCS 06C60	M_r		0.4	0.5	0.5						
	M_0 [4)]		0.6	0.8	0.8						
	M_{max} n=0		0.7	1.1	1.9						
	M_{max}		0.7	1.1	1.9						
MCS 06F41	M_r	0.9	1.2	1.2							
	M_0 [4)]	1.1	1.5	1.5							
	M_{max} n=0	1.5	2.4	3.8							
	M_{max}	1.5	2.4	3.8							
MCS 06F60	M_r		0.6	0.9	0.9						
	M_0 [4)]		0.9	1.5	1.5						
	M_{max} n=0		1.2	2.0	3.4						
	M_{max}		1.2	2.0	3.4						
MCS 06I41	M_r	1.0	1.5	1.5	1.5						
	M_0 [4)]	1.3	2.0	2.0	2.0						
	M_{max} n=0	1.9	3.0	4.8	6.2						
	M_{max}	1.9	3.0	4.8	6.2						
MCS 06I60	M_r			1.2	1.2	1.2					
	M_0 [4)]			1.7	2.0	2.0					
	M_{max} n=0			2.4	4.3	6.2					
	M_{max}			2.4	4.3	6.2					

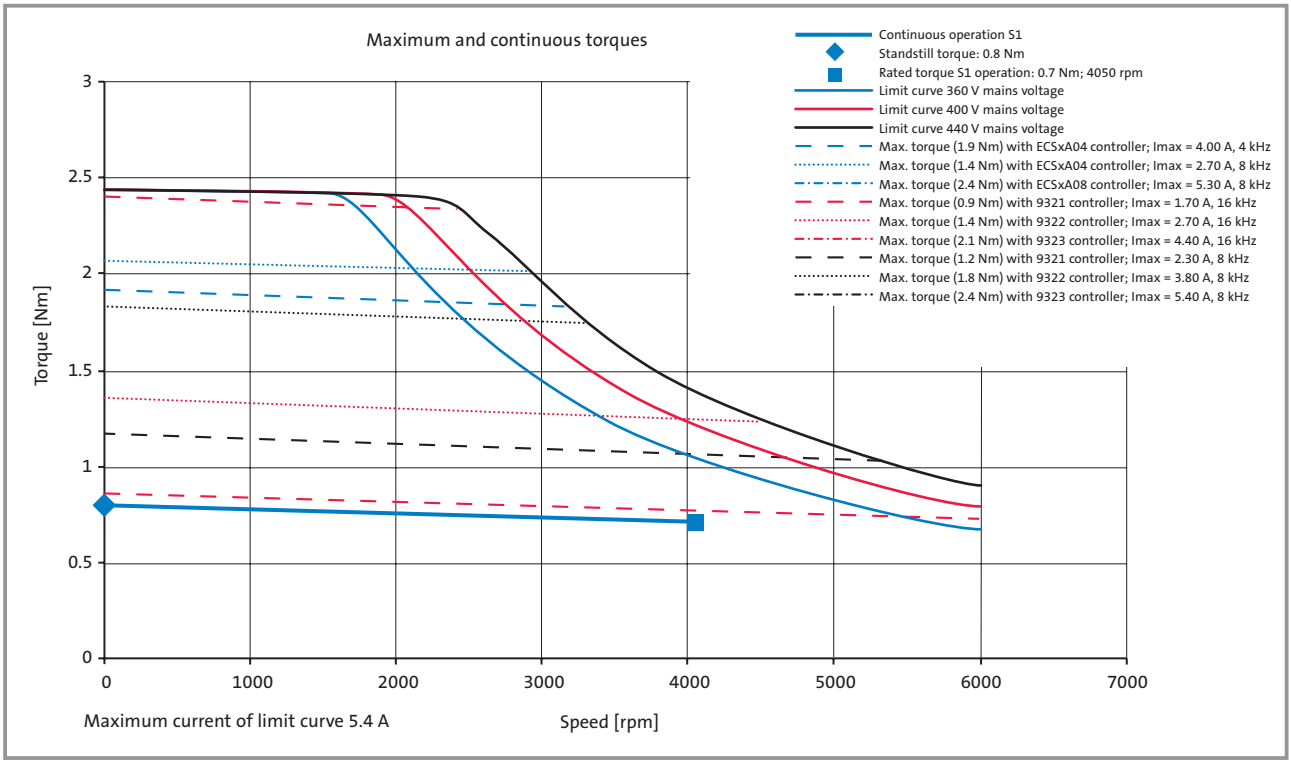
[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

Torque characteristics

MCS 06C60

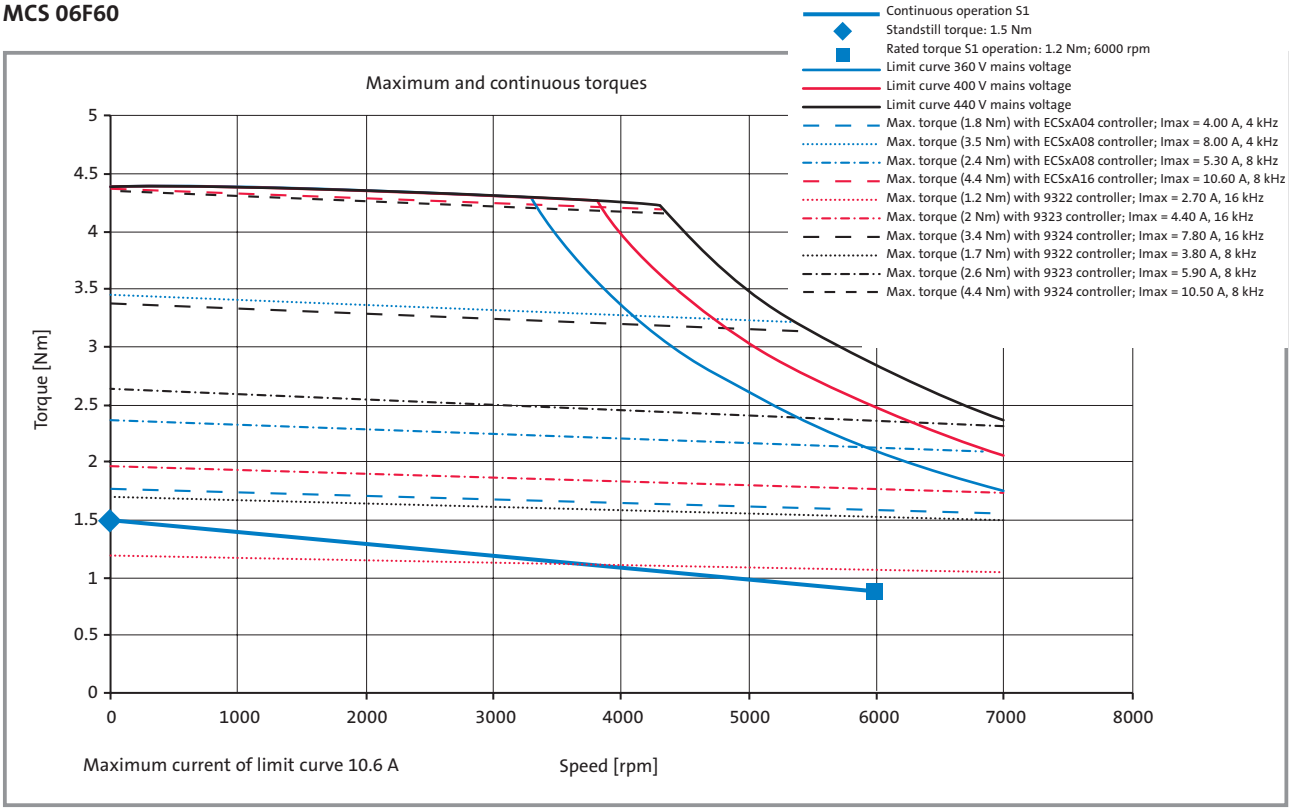


MCS 06C41

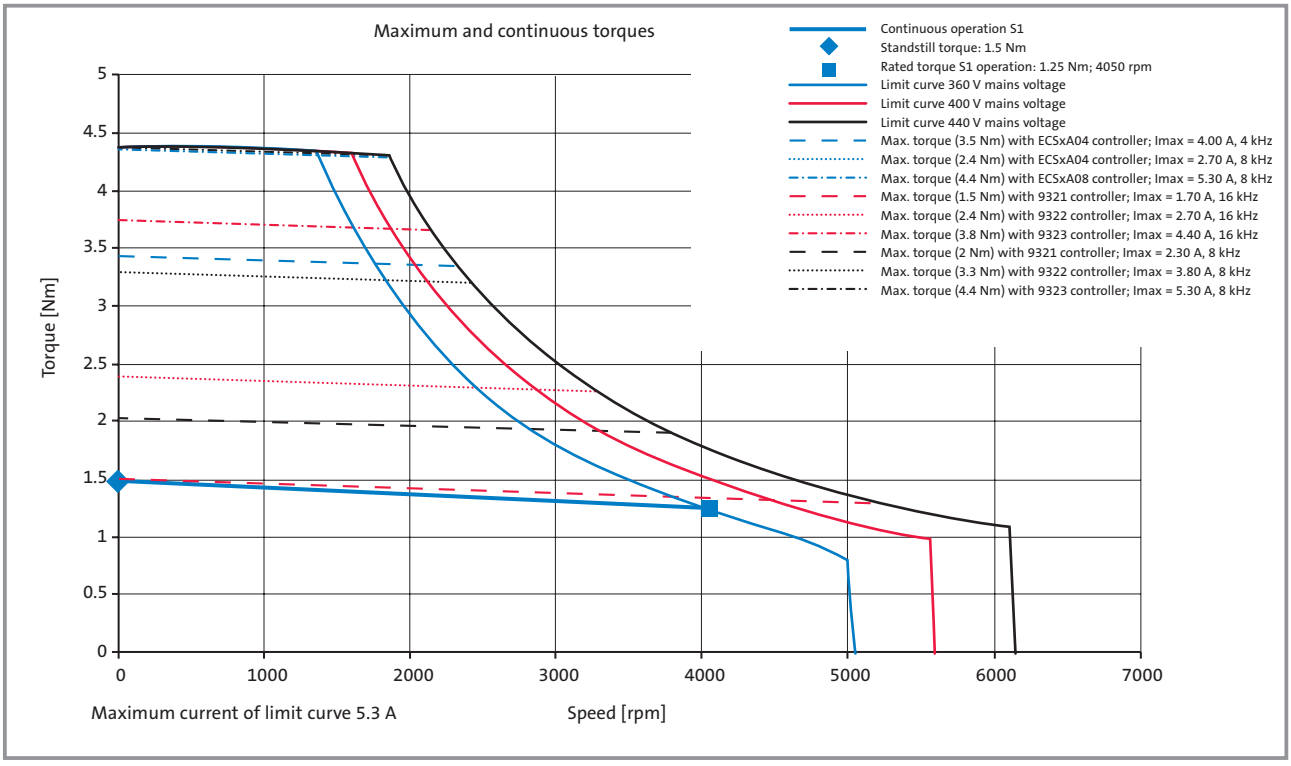


At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

MCS 06F60



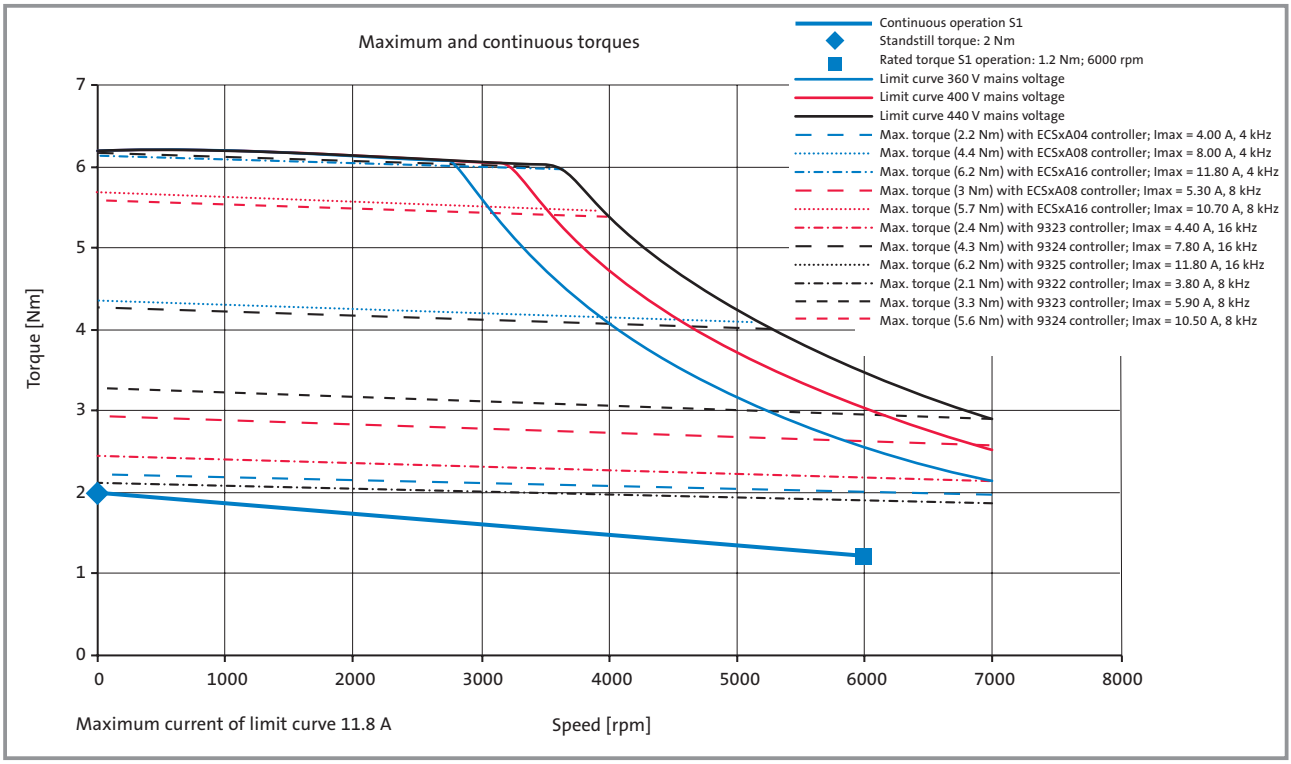
MCS 06F41



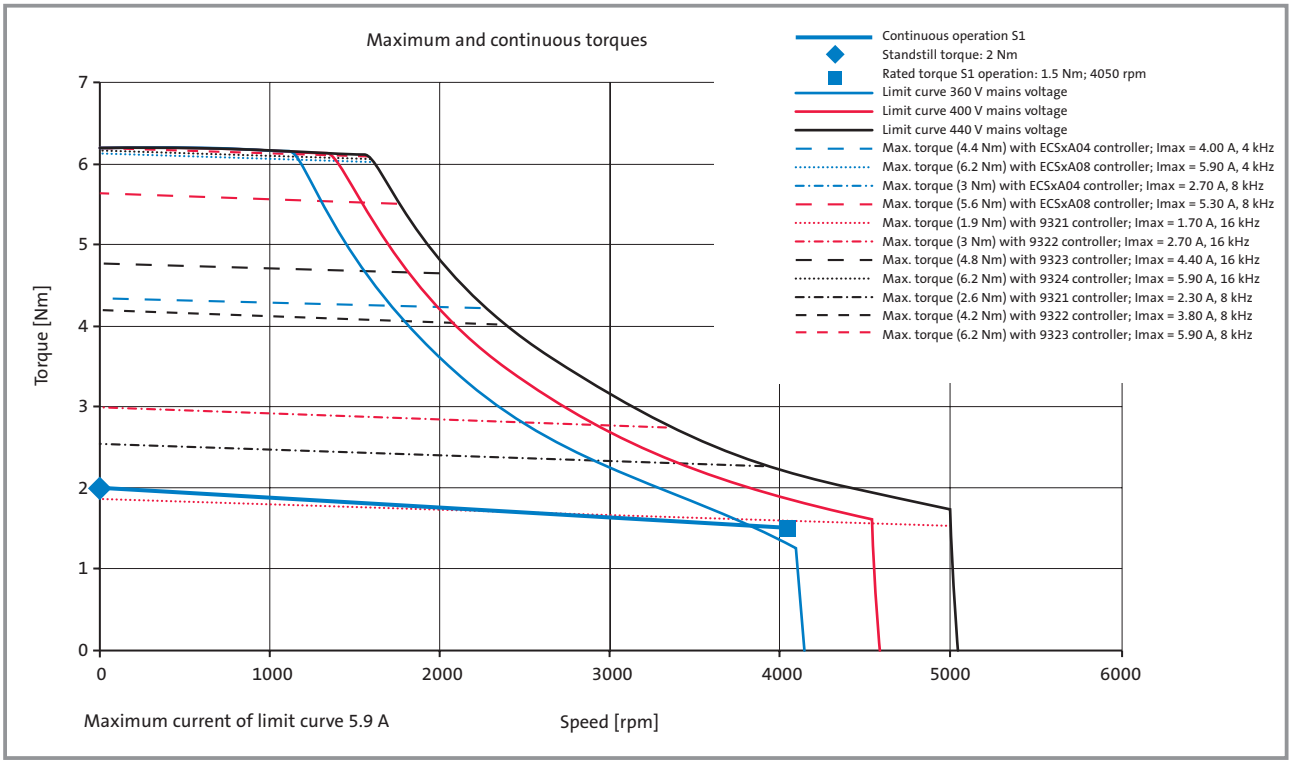
At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

Torque characteristics

MCS 06I60



MCS 06I41



At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

Brake assignment

MCS synchronous servo motors can be fitted with integrated permanent-magnet holding brakes for 24 V DC.

The brakes are activated when the supply voltage is disconnected (closed-circuit principle).

If the brakes are used purely as holding brakes, there will be virtually no evidence of wear on the friction surfaces. As long as the permissible switching rate is not exceeded, at least 2000 emergency stop functions will be possible.

MCS 06C41, MCS 06C60
MCS 06F41, MCS 06F60
MCS 06I41, MCS 06I60

Type	Size	Holding torque M_4 20 °C Nm	Holding torque M_4 120 °C Nm	Average dynamic torque M_{1m} 120 °C Nm	U_B [3] +5 %. -10 % V	I_B [2] A	J_B kgcm²	Engagement time t1 [1] ms	Disengage-ment time t2 [1] ms	Maximum switching rate per emergency stop with n=3000 rpm J	Weight kg
P1	04H	2.2	2	0.6	24	0.34	0.12	15	30	29.6	0.27

[1] Engagement and disengagement times valid for rated voltage (± 0 %) and protective circuit for brakes with varistor for DC-side switching. The times may increase without a protective circuit.
[2] The currents are maximum values for a cold brake (data for dimensioning the power supply). The values for a motor at operating temperature are considerably lower.
[3] Smoothed DC voltage, ripple < 1 %

Permissible moments of inertia

Motor	Brake type	J_{mot} with brake kgcm²	Permissible J_{load}/J_{mot}
MCS 06C	P1	0.26	22.1
MCS 06F	P1	0.34	16.6
MCS 06I	P1	0.42	13.3

If the permissible moments of inertia opposite are adhered to, the permissible maximum switching rate of the brake will not be exceeded and up to 2000 emergency stop functions will be possible at a speed of 3000 rpm.

Caution:
The brakes used are not fail-safe brakes in the true sense because certain types of faults, e.g. oil leakage, can cause a loss of torque.

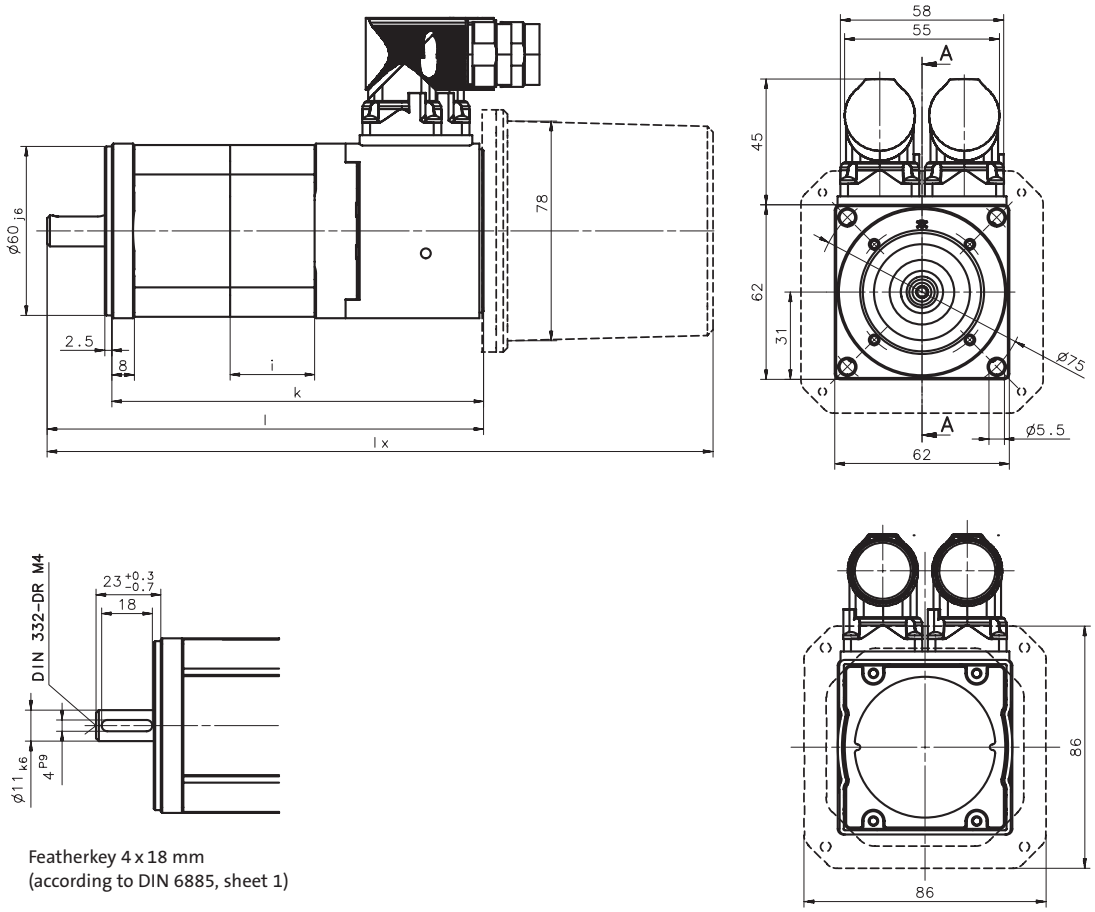
If long motor cables are being used, the ohmic voltage drop along the cable should be taken into account and compensated by applying a higher voltage at the cable input. The equation below is valid for Lenze system cables:

$U_B\,[V] = 0.08 \times I_{cable}\,[m] \times I_B\,[A]$

If an appropriate voltage is not supplied to the brake (incorrect dimension, incorrect polarity), the brake will engage and the continuing rotation of the motor could cause it to overheat, leading to irreparable damage.

DC-side switching helps to minimise brake response times. A spark suppressor is required for interference suppression and to increase the service life of the relay contacts.

Mechanical dimensions



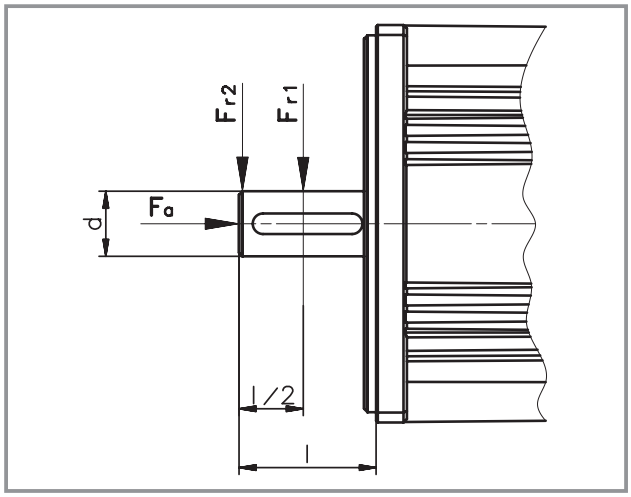
Featherkey 4 x 18 mm
(according to DIN 6885, sheet 1)

Motor type	Motor **without** holding brake				Motor **with** holding brake			
	i [mm]	k [mm]	l [mm]	lx [mm]	i [mm]	k [mm]	l [mm]	lx [mm]
MCS 06C	30	132	155	236.5	30	150.5	173.5	255
MCS 06F	60	162	185	266.5	60	180.5	203.5	285
MCS 06I	90	192	215	296.5	90	210.5	233.5	315

l Motor length with installation of a resolver as feedback
lx Motor length with installation of an absolute value encoder as feedback
i Length of coil module

Permissible shaft loads

Forces on the motor shaft



The following diagrams provide a simple means of determining:

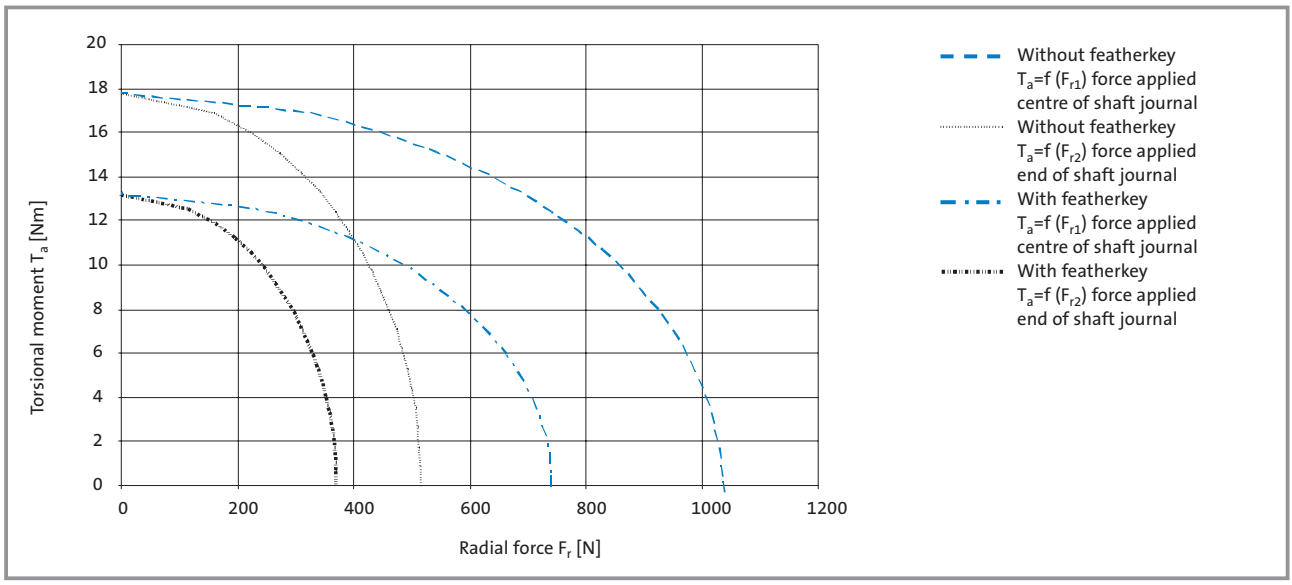
a) The maximum permissible radial force along with the corresponding maximum permissible torsional moment on the motor shaft.

b) The service life of the roller bearings on the basis of the forces and torques calculated.

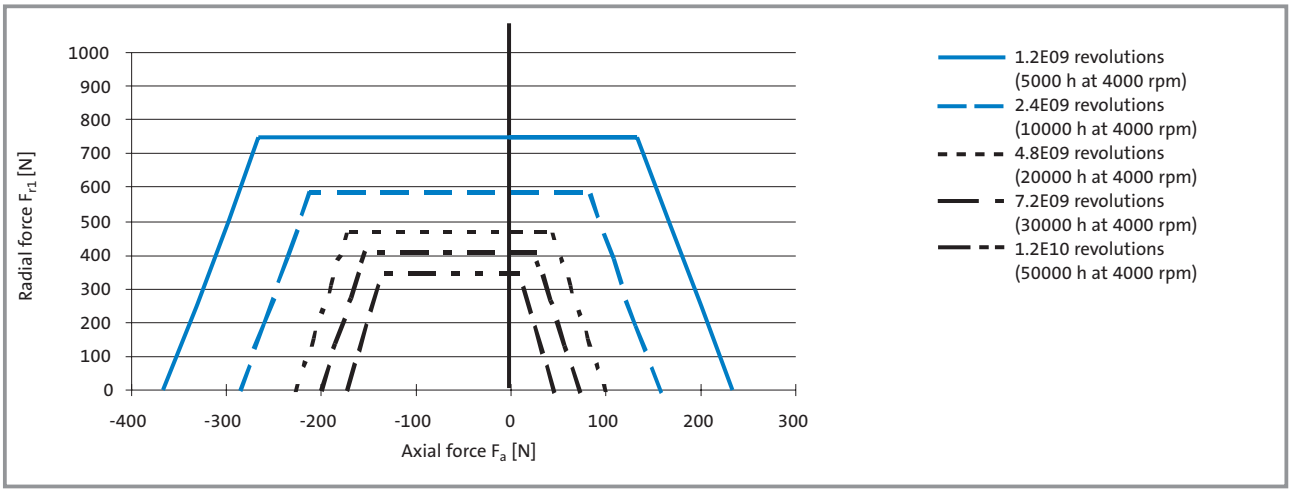
Service life is calculated as follows:

$$\frac{\text{No. of bearing revolutions}}{\text{n [rpm] x 60}} = \text{Bearing service life [h]}$$

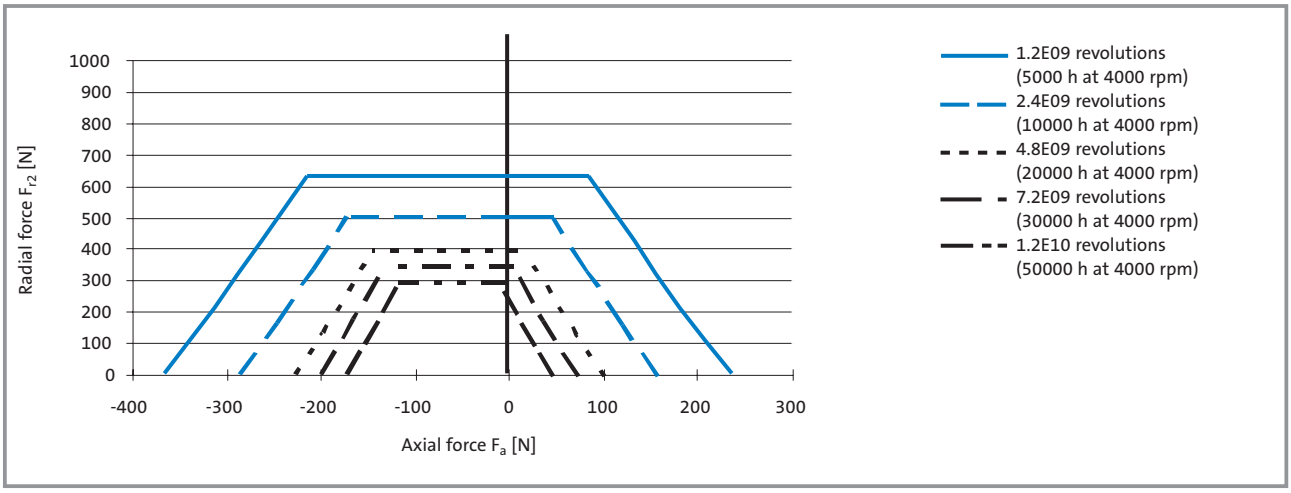
The characteristics are valid for all MCS 06 frame sizes



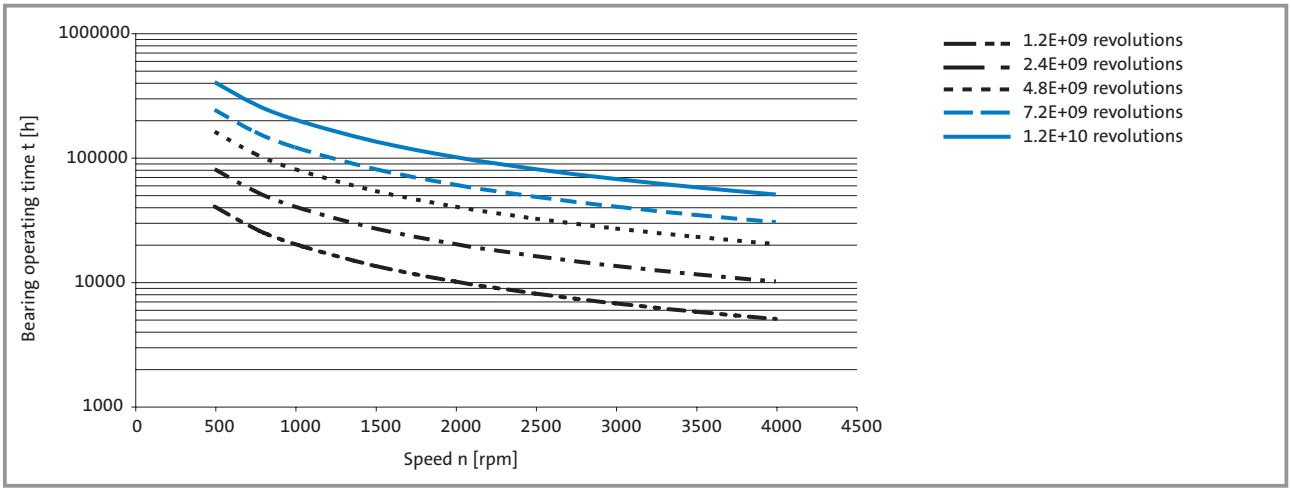
Relationship between radial force and torsional moment on shaft



Permissible radial force F_{r1} and axial force F_a on shaft



Permissible radial force F_{r2} and axial force F_a on shaft



Relationship between the number of total bearing revolutions,
bearing service life and the average speed of the drive

Rated data

Motor	M_r Nm	n_r rpm	P_r kW	U_r V	f_r Hz	I_r A	η %	M_0 Nm	I_0 A	M_{max} Nm	I_{max} A	J_{mot} without brake kgcm²
MCS 09F38	3.1	3750	1.2	330	250	2.5	90	4.2	3.0	15	15	1.50
MCS 09F60	2.4	6000	1.5	230	400	4.5	90	4.2	6.0	15	30	1.50
MCS 09H41	3.8	4050	1.6	300	270	3.4	91	5.5	4.3	20	20	1.90
MCS 09H60	3.0	6000	1.9	190	400	6.0	91	5.5	8.5	20	40	1.90

Motor	ke_{LL}-factor at 150°C V/1000 rpm	R_{UV} at 20°C Ω	R_{UV} at 150°C Ω	L_{phase} mH	kt_0 factor at 150°C Nm/A	Power connector type	Weight without brake kg	Maximum speed mech. rpm
MCS 09F38	79.8	5.2	7.0	24.6	1.40	EWS0001	5.2	7000
MCS 09F60	39.9	1.3	1.8	6.2	0.70		5.2	7000
MCS 09H41	75.7	3.2	4.3	16.1	1.29		6.1	7000
MCS 09H60	37.8	0.8	1.1	4.0	0.64		6.1	7000

MCS 09F

MCS 09H

Servo controller assignment

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 4 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		2	4	8	12.7	17	20
Maximum current 0 Hz [1) 2)] [A]		2.3	4.6	9.1	18.1	27.2	36.3
Maximum current > 5 Hz [1) 2)] [A]		4	8	16	32	48	64
Motor type							
MCS 09F38	M_r	2.5	3.1	3.1			
	M_0	2.8	4.2	4.2			
	M_{max} n=0	3.2	6.2	10.8			
	M_{max}	5.5	9.8	14.9			
MCS 09F60	M_r		2.1	2.4	2.4		
	M_0		2.8	4.2	4.2		
	M_{max} n=0		3.2	6.1	10.8		
	M_{max}		5.5	9.8	14.9		
MCS 09H41	M_r		3.8	3.8			
	M_0		5.2	5.5			
	M_{max} n=0		5.9	11.1			
	M_{max}		9.9	17.5			
MCS 09H60	M_r			3.0	3.0	3.0	
	M_0			5.2	5.5	5.5	
	M_{max} n=0			5.9	11.1	15.5	
	M_{max}			10.0	17.5	20.5	

1) Caution: Limit I_{max} controller to I_{max} motor
2) Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C
and 400 V mains supply

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 8 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		1.4	2.7	5.3	8.5	11.3	13.3
Maximum current 0 Hz [1) 2) 3)] [A]		1.5	3	6	12.1	18.1	24.2
Maximum current > 5 Hz [1) 2) 3)] [A]		2.7	5.3	10.7	21.3	32	42.7
Motor type							
MCS 09F38	M_r		3.1	3.1			
	M_0		3.8	4.2			
	M_{max} n=0		4.1	7.8			
	M_{max}		7.0	12.2			
MCS 09F60	M_r			2.4	2.4	2.4	
	M_0			3.7	4.2	4.2	
	M_{max} n=0			4.1	7.8	10.8	
	M_{max}			7.1	12.1	14.9	
MCS 09H41	M_r		3.0	3.8	3.8		
	M_0		3.5	5.5	5.5		
	M_{max} n=0		3.9	7.6	14.1		
	M_{max}		6.8	12.7	20.5		
MCS 09H60	M_r			2.7	3.0	3.0	3.0
	M_0			3.4	5.5	5.5	5.5
	M_{max} n=0			3.9	7.7	11.1	14.1
	M_{max}			6.9	12.7	17.5	20.5

[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[3)] Caution: On the ECS automatic switching to 4 kHz not taken into account; when using automatic switching to 4 kHz, the maximum torques at 4 kHz apply

Servo controller assignment

Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 8 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.5	2.5	3.9	7	13	23.5	32	47	59	89
Maximum current 0 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	23.5	32	47	52	80
Maximum current > 5 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	35.25	48	70.5	88.5	133.5
Motor type											
MCS 09F38	M_r		3.1	3.1	3.1						
	M_0 [4)]		3.5	4.2	4.2						
	M_{max} n=0		5.2	7.7	12.0						
	M_{max}		5.2	7.7	12.0						
MCS 09F60	M_r			2.1	2.4	2.4					
	M_0 [4)]			2.7	4.2	4.2					
	M_{max} n=0			4.1	6.9	11.4					
	M_{max}			4.1	6.9	11.4					
MCS 09H41	M_r		2.8	3.8	3.8	3.8					
	M_0 [4)]		3.2	5.0	5.5	5.5					
	M_{max} n=0		4.9	7.5	12.5	20.1					
	M_{max}		4.9	7.5	12.5	20.1					
MCS 09H60	M_r				3.0	3.0	3.0				
	M_0 [4)]				4.5	5.5	5.5				
	M_{max} n=0				6.8	11.8	13.8				
	M_{max}				6.8	11.8	18.8				

[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

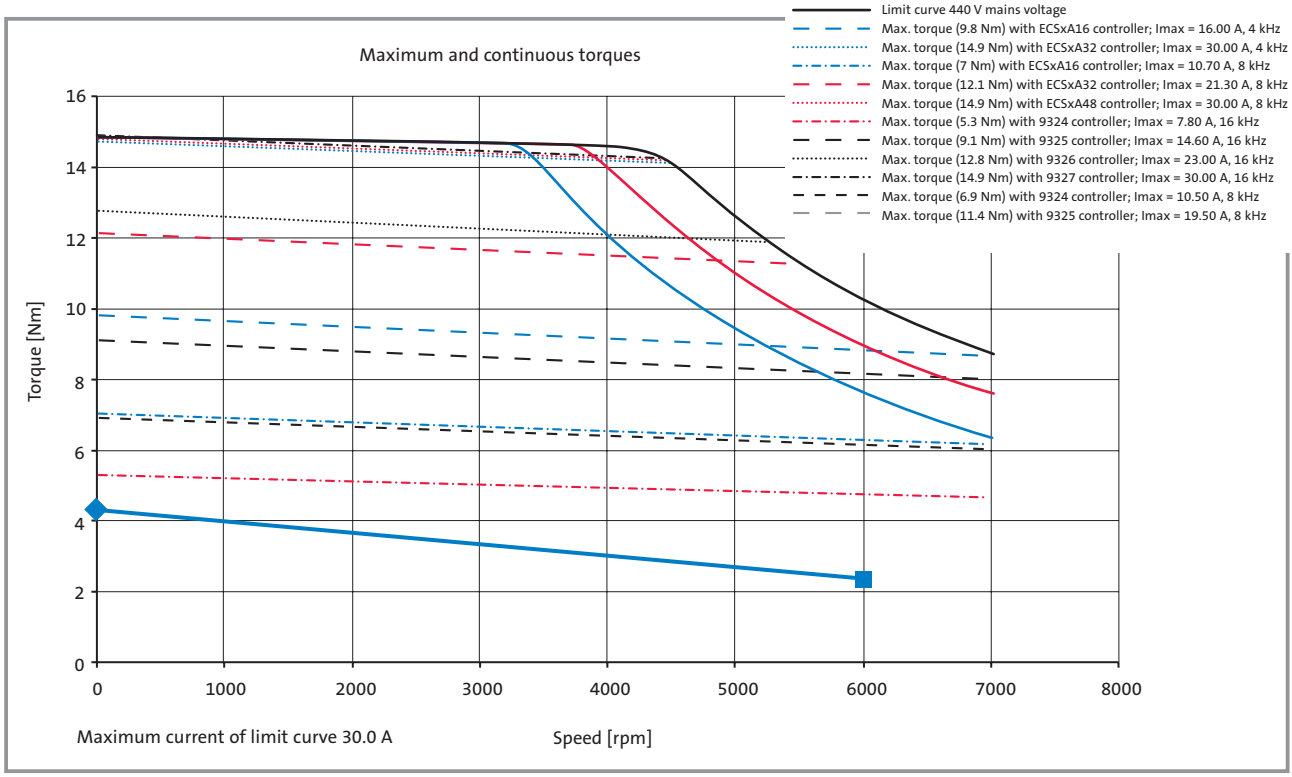
Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 16 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.1	1.8	2.9	5.2	9.7	15.3	20.8	30.6	38	58
Maximum current 0 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	15.3	20.8	30.6	33	45
Maximum current > 5 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	23	31.2	45.9	57	87
Motor type											
MCS 09F38	M_r		2.2	3.1	3.1	3.1					
	M_0 [4)]		2.5	4.1	4.2	4.2					
	M_{max} n=0		3.7	5.9	9.6	14.7					
	M_{max}		3.7	5.9	9.6	14.7					
MCS 09F60	M_r				2.4	2.4	2.4				
	M_0 [4)]				3.6	4.2	4.2				
	M_{max} n=0				5.3	9.1	9.5				
	M_{max}				5.3	9.1	12.8				
MCS 09H41	M_r			3.2	3.8	3.8					
	M_0 [4)]			3.7	5.5	5.5					
	M_{max} n=0			5.7	9.7	16.3					
	M_{max}			5.7	9.7	16.3					
MCS 09H60	M_r				2.6	3.0	3.0	3.0			
	M_0 [4)]				3.4	5.5	5.5	5.5			
	M_{max} n=0				5.1	9.2	9.6	12.5			
	M_{max}				5.1	9.2	13.6	17.2			

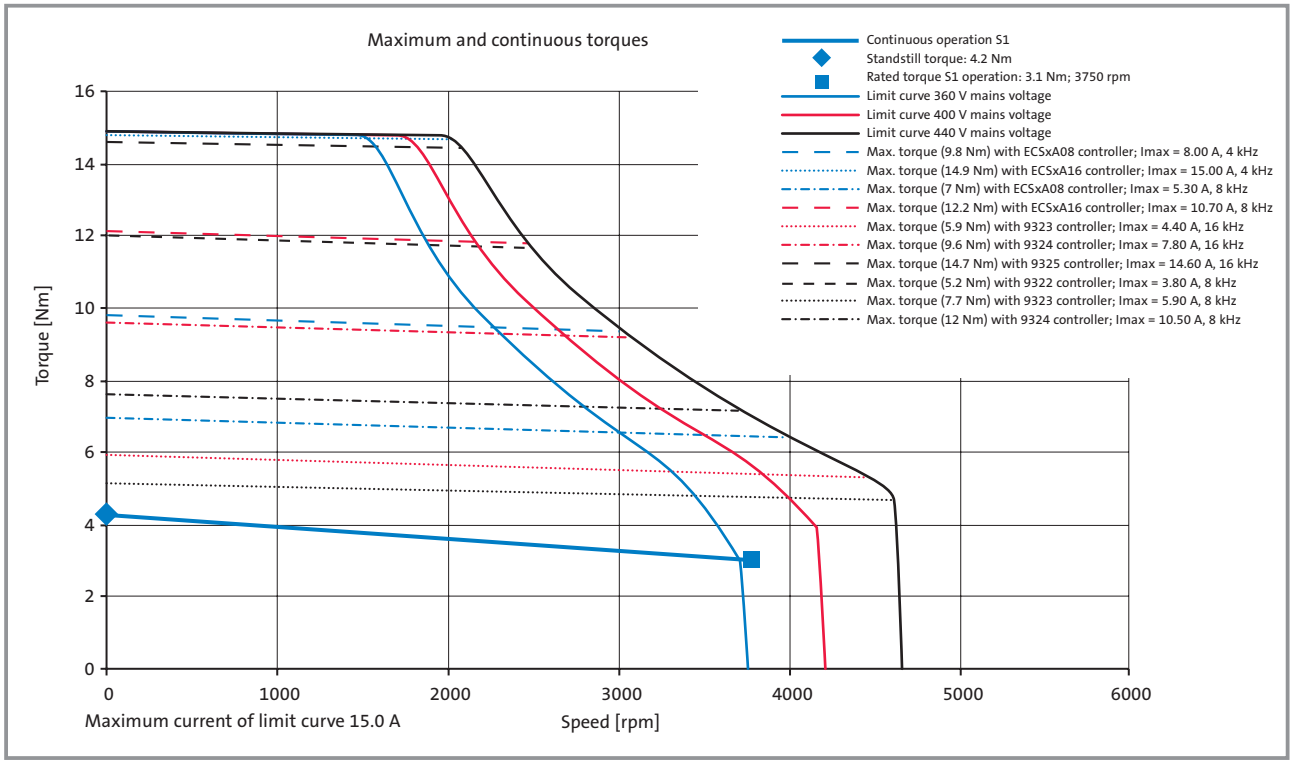
[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C
and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

Torque characteristics

MCS 09F60

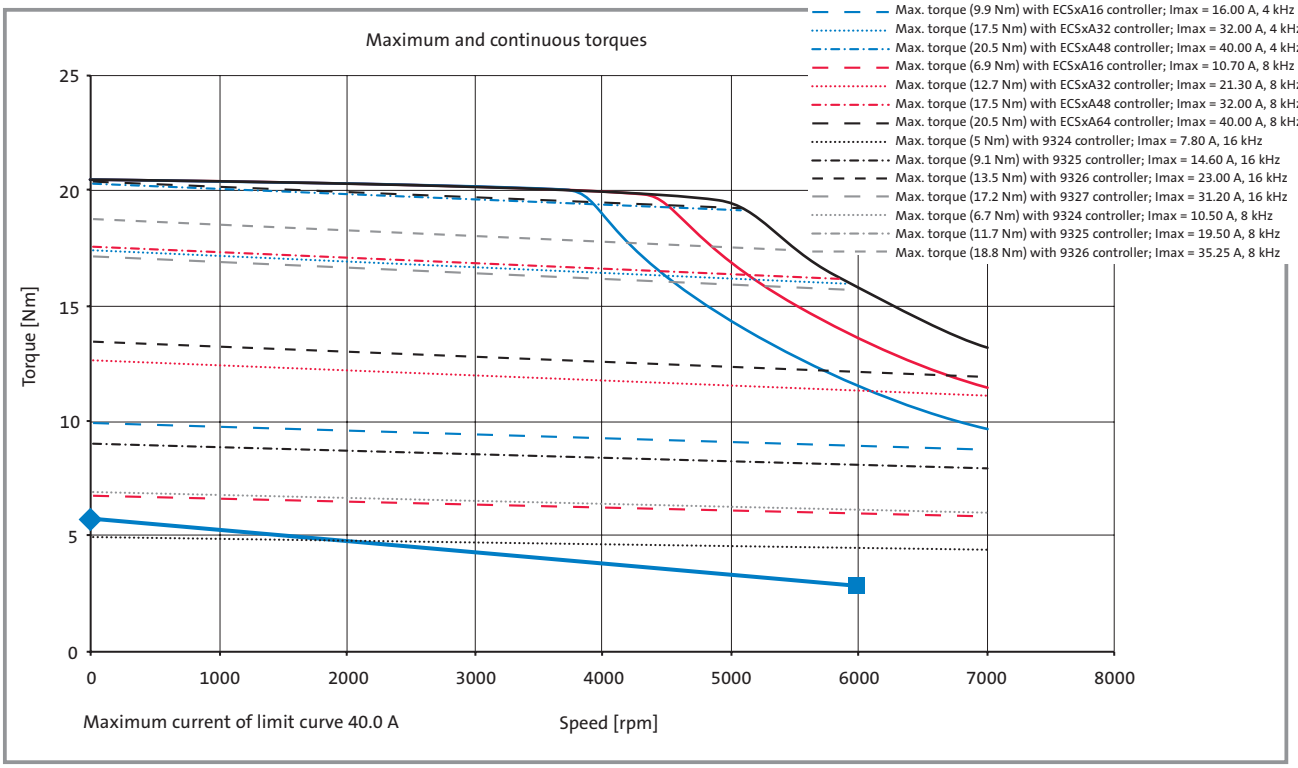


MCS 09F38

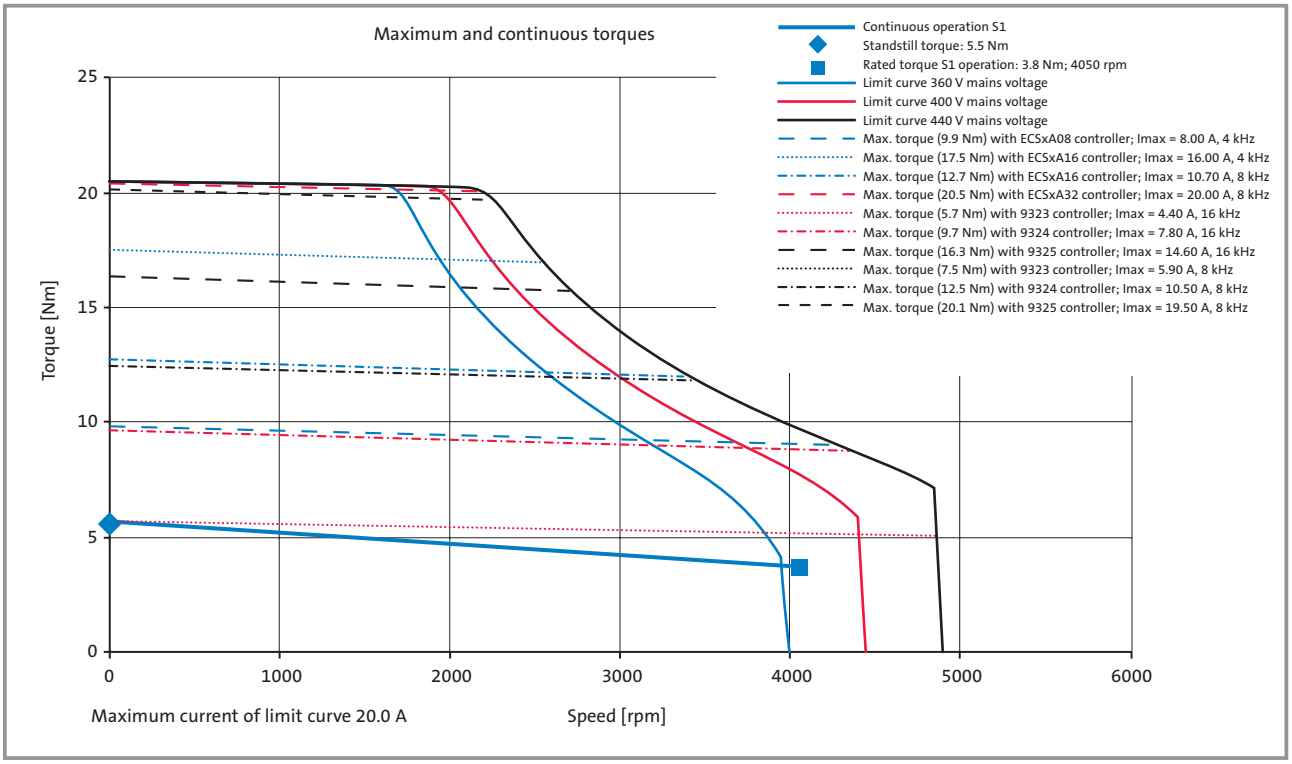


At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

MCS 09H60



MCS 09H41



At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

Brake assignment

MCS synchronous servo motors can be fitted with integrated permanent-magnet holding brakes for 24 V DC.

The brakes are activated when the supply voltage is disconnected (closed-circuit principle).

If the brakes are used purely as holding brakes, there will be virtually no evidence of wear on the friction surfaces. As long as the permissible switching rate is not exceeded, at least 2000 emergency stop functions will be possible.

MCS 09F
MCS 09H

Type	Size	Holding torque M_4 20 °C Nm	Holding torque M_4 120 °C Nm	Average dynamic torque M_{1m} 120 °C Nm	U_B [3] +5 %. -10 % V	I_B [2] A	J_B kgcm²	Engagement time t1 [1] ms	Disengage-ment time t2 [1] ms	Maximum switching rate per emergency stop with n=3000 rpm J	Weight kg
P1	07H	8.0	6	4.5	24	0.65	1.07	20	40	400	0.8
P2	07H	12	10	7.0	24	0.65	1.07	20	40	400	0.8

P1 Standard brake
P2 Uprated brake
[1] Engagement and disengagement times valid for rated voltage (± 0 %) and protective circuit for brakes with varistor for DC-side switching. The times may increase without a protective circuit.
[2] The currents are maximum values for a cold brake (data for dimensioning the power supply). The values for a motor at operating temperature are considerably lower.
[3] Smoothed DC voltage, ripple < 1 %

Permissible moments of inertia

Motor	Brake type	J_{mot} with brake kgcm²	Permissible J_{load}/J_{mot}
MCS 09F	P1	2.57	30.5
MCS 09H	P1	2.97	26.3
MCS 09F	P2	2.57	30.5
MCS 09H	P2	2.97	26.3

If the permissible moments of inertia opposite are adhered to, the permissible maximum switching rate of the brake will not be exceeded and up to 2000 emergency stop functions will be possible at a speed of 3000 rpm.

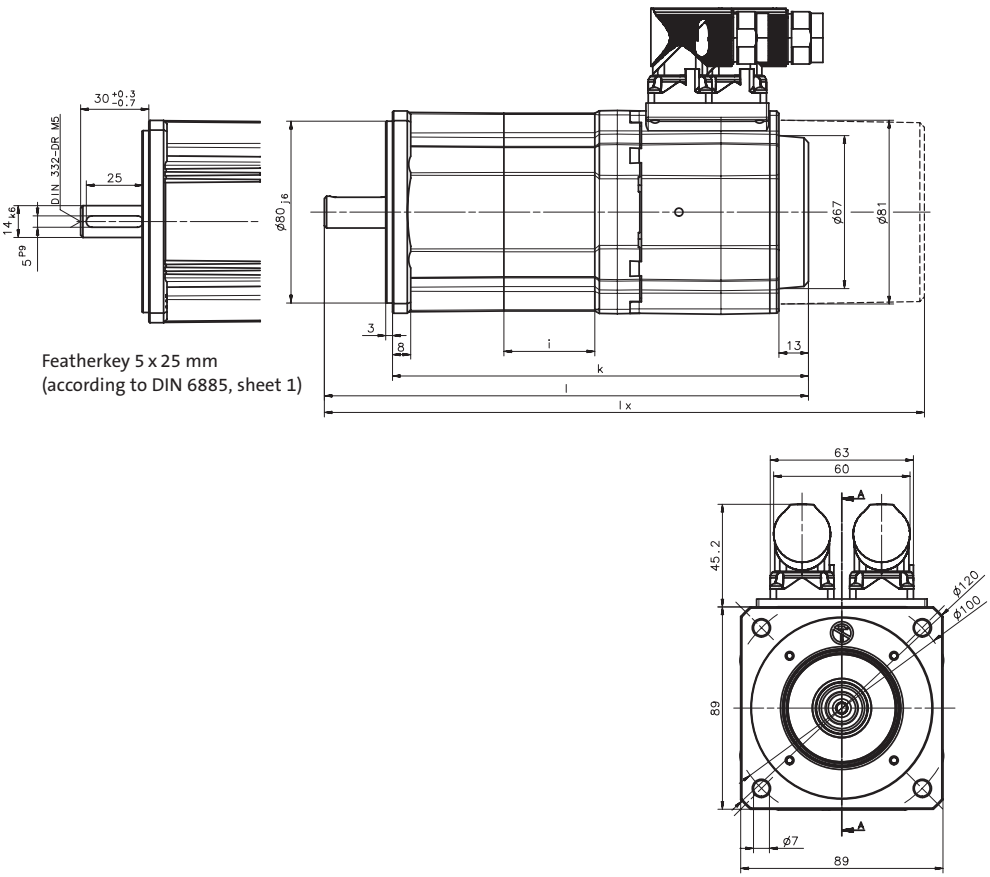
Caution:
The brakes used are not fail-safe brakes in the true sense because certain types of faults, e.g. oil leakage, can cause a loss of torque.

If long motor cables are being used, the ohmic voltage drop along the cable should be taken into account and compensated by applying a higher voltage at the cable input. The equation below is valid for Lenze system cables:
U_B [V] = 0.08 x I_{cable} [m] x I_B [A]

If an appropriate voltage is not supplied to the brake (incorrect dimension, incorrect polarity), the brake will engage and the continuing rotation of the motor could cause it to overheat, leading to irreparable damage.

DC-side switching helps to minimise brake response times. A spark suppressor is required for interference suppression and to increase the service life of the relay contacts.

Mechanical dimensions

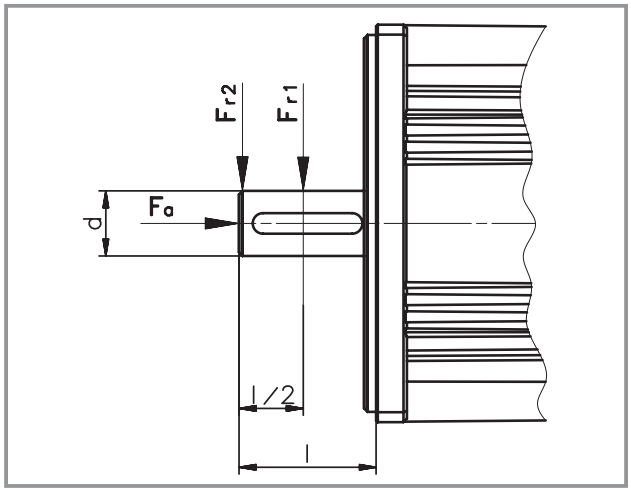


Motor type	Motor **without** holding brake				Motor **with** holding brake			
	i [mm]	k [mm]	l [mm]	lx [mm]	i [mm]	k [mm]	l [mm]	lx [mm]
MCS 09F	60	203	233	284	60	223	253	304
MCS 09H	80	223	253	304	80	243	273	324

l Motor length with installation of a resolver as feedback
lx Motor length with installation of an absolute value encoder as feedback
i Length of coil module

Permissible shaft loads

Forces on the motor shaft



The following diagrams provide a simple means of determining:

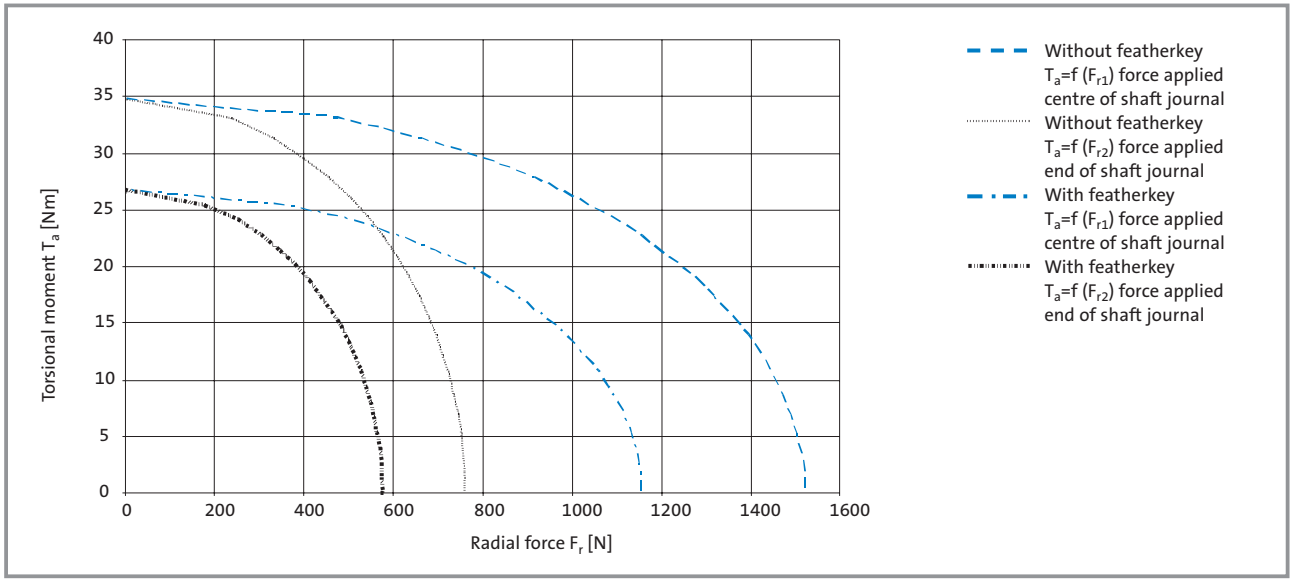
a) The maximum permissible radial force along with the corresponding maximum permissible torsional moment on the motor shaft.

b) The service life of the roller bearings on the basis of the forces and torques calculated.

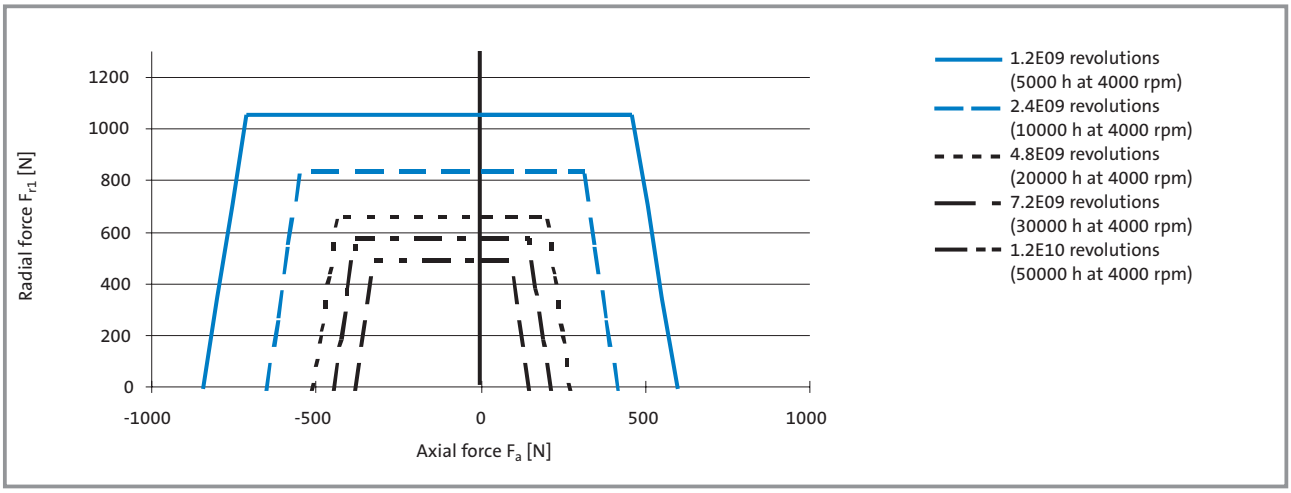
Service life is calculated as follows:

$$\frac{\text{No. of bearing revolutions}}{\text{n [rpm] x 60}} = \text{Bearing service life [h]}$$

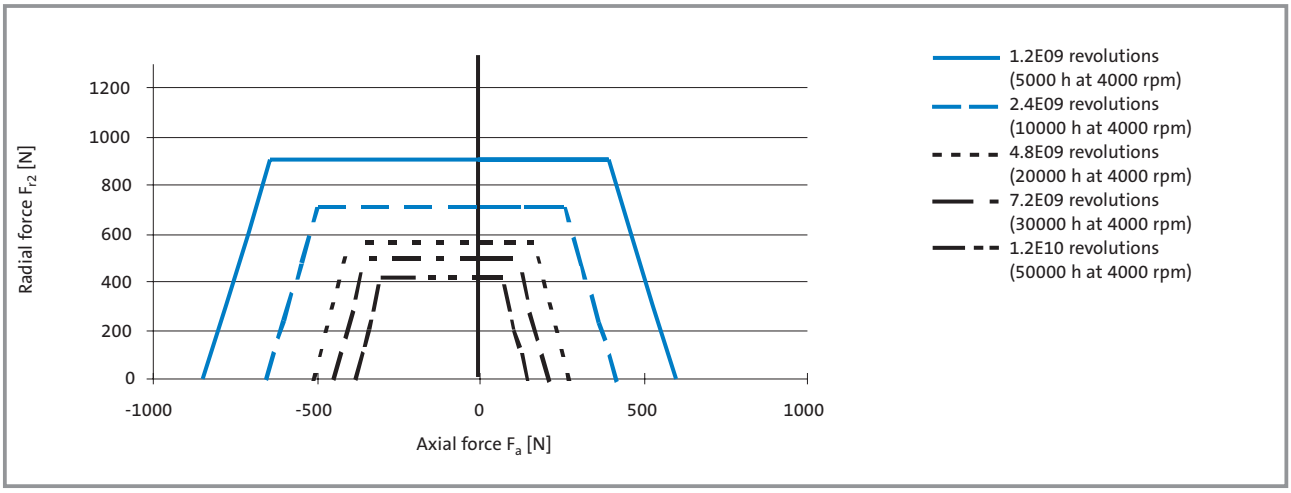
The characteristics are valid for all MCS 09 frame sizes



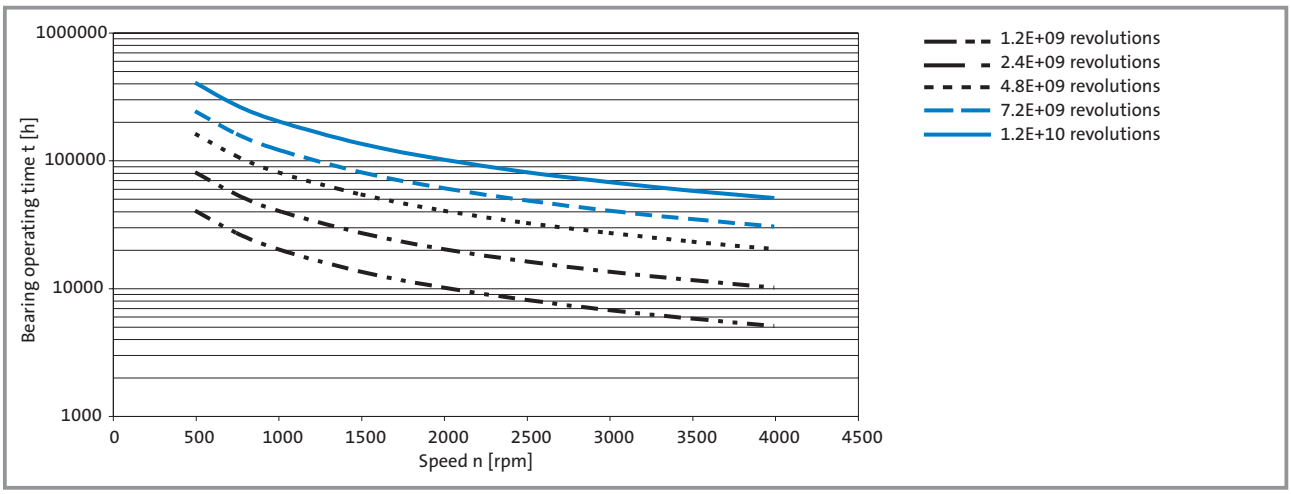
Relationship between radial force and torsional moment on shaft



Permissible radial force F_{r1} and axial force F_a on shaft



Permissible radial force F_{r2} and axial force F_a on shaft



Relationship between the number of total bearing revolutions, bearing service life and the average speed of the drive

Rated data

Motor	M_r Nm	n_r rpm	P_r kW	U_r V	f_r Hz	I_r A	η %	M_0 Nm	I_0 A	M_{max} Nm	I_{max} A	J_{mot} without brake kgcm²
MCS 12H15	10.0	1500	1.6	300	100	3.8	88	11.4	4.1	29	12	7.3
MCS 12H35	7.5	3525	2.8	325	235	5.7	91	11.4	8.2	29	24	7.3
MCS 12L20	13.5	1950	2.8	330	130	5.9	90	15.0	6.2	56	28	10.6
MCS 12L41	11	4050	4.7	300	270	10.2	91	15.0	12.4	56	57	10.6

Motor	ke_{LL}-factor at 150 °C V/1000 rpm	R_{UV} at 20 °C Ω	R_{UV} at 150 °C Ω	L_{phase} mH	kt_0 factor at 150 °C Nm/A	Power connector type	Weight without brake kg	Maximum speed mech. rpm
MCS 12H15	172.9	5.7	7.7	42.1	2.79	EWS0001	9.5	6000
MCS 12H35	86.5	1.4	1.9	10.5	1.40			6000
MCS 12L20	149.2	2.2	3.0	21.8	2.42		12.6	6000
MCS 12L41	74.6	0.5	0.7	5.5	1.21			6000

MCS 12H

MCS 12L

Servo controller assignment

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 4 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		2	4	8	12.7	17	20
Maximum current 0 Hz [1) 2)] [A]		2.3	4.6	9.1	18.1	27.2	36.3
Maximum current > 5 Hz [1) 2)] [A]		4	8	16	32	48	64
Motor type							
MCS 12H15	M_r		10.0	10.0			
	M_0		11.2	11.4			
	M_{max} n=0		11.9	22.6			
	M_{max}		20.1	29.0			
MCS 12H35	M_r		5.3	7.5	7.5		
	M_0		5.6	11.2	11.4		
	M_{max} n=0		6.0	11.8	22.5		
	M_{max}		10.4	20.1	29.0		
MCS 12L20	M_r			13.5	13.5		
	M_0			15.0	15.0		
	M_{max} n=0			21.4	39.4		
	M_{max}			35.5	56.4		
MCS 12L41	M_r			8.6	11.0	11.0	11.0
	M_0			9.7	15.0	15.0	15.0
	M_{max} n=0			10.8	21.3	30.8	39.5
	M_{max}			19.0	35.5	49.6	56.4

[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C
and 400 V mains supply

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 8 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		1.4	2.7	5.3	8.5	11.3	13.3
Maximum current 0 Hz [1) 2) 3)] [A]		1.5	3	6	12.1	18.1	24.2
Maximum current > 5 Hz [1) 2) 3)] [A]		2.7	5.3	10.7	21.3	32	42.7
Motor type							
MCS 12H15	M_r		7.1	10.0			
	M_0		7.5	11.4			
	M_{max} n=0		7.8	15.4			
	M_{max}		13.7	26.2			
MCS 12H35	M_r			7.0	7.5	7.5	
	M_0			7.4	11.4	11.4	
	M_{max} n=0			7.8	15.5	22.5	
	M_{max}			13.8	26.1	29.0	
MCS 12L20	M_r			12.1	13.5	13.5	
	M_0			12.8	15.0	15.0	
	M_{max} n=0			14.3	27.7	39.4	
	M_{max}			24.8	45.1	56.4	
MCS 12L41	M_r				9.2	11.0	11.0
	M_0				10.3	13.7	15.0
	M_{max} n=0				14.4	21.3	27.7
	M_{max}				24.7	35.5	45.2

1) Caution: Limit I_{max} controller to I_{max} motor
2) Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
3) Caution: On the ECS automatic switching to 4 kHz not taken into account; when using automatic switching to 4 kHz, the maximum torques at 4 kHz apply

Servo controller assignment

Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 8 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.5	2.5	3.9	7	13	23.5	32	47	59	89
Maximum current 0 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	23.5	32	47	52	80
Maximum current > 5 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	35.25	48	70.5	88.5	133.5
Motor type											
MCS 12H15	M_r			10.0	10.0						
	M_0 [4)]			10.9	11.4						
	M_{max} n=0			15.1	25.8						
	M_{max}			15.1	25.8						
MCS 12H35	M_r				7.5	7.5					
	M_0 [4)]				9.8	11.4					
	M_{max} n=0				13.6	24.1					
	M_{max}				13.6	24.1					
MCS 12L20	M_r				13.5	13.5					
	M_0 [4)]				15.0	15.0					
	M_{max} n=0				24.4	41.9					
	M_{max}				24.4	41.9					
MCS 12L41	M_r					11.0	11.0	11.0			
	M_0 [4)]					15.0	15.0	15.0			
	M_{max} n=0					22.8	27.0	35.5			
	M_{max}					22.8	38.5	49.6			

[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

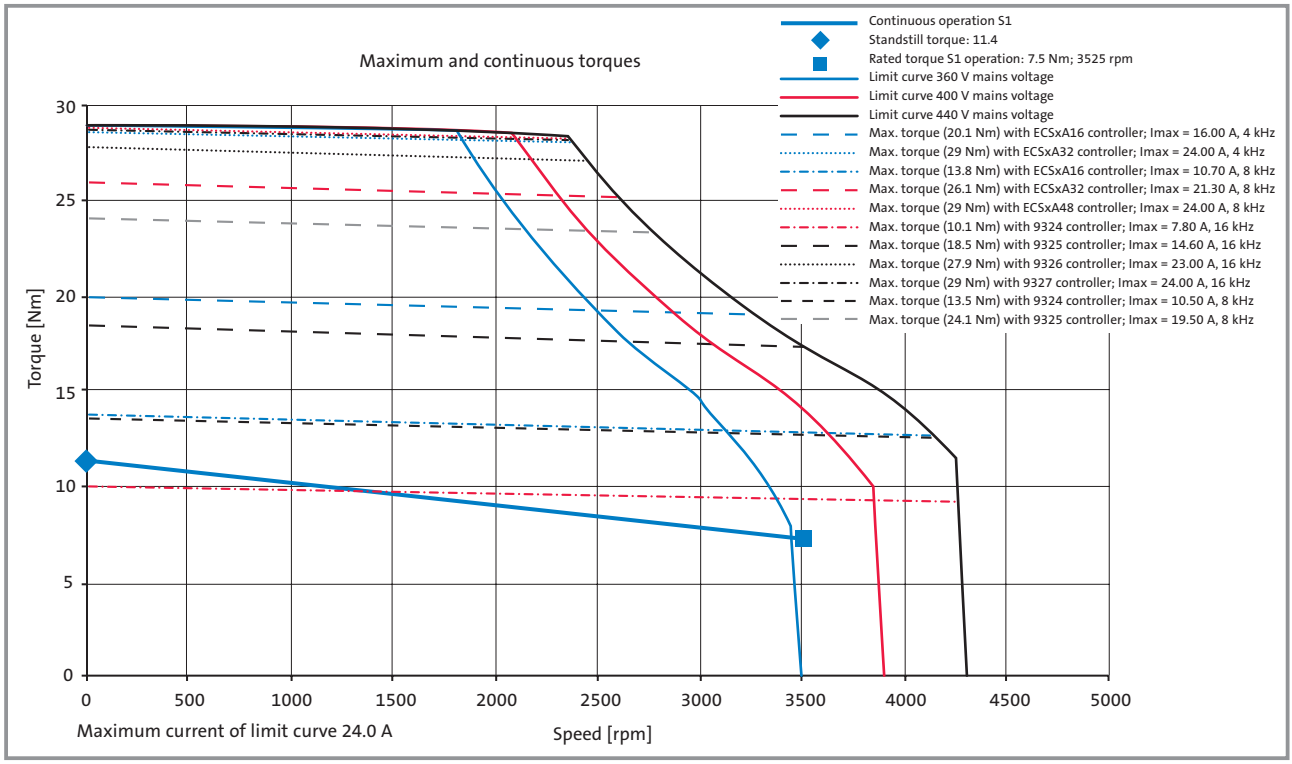
Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 16 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.1	1.8	2.9	5.2	9.7	15.3	20.8	30.6	38	58
Maximum current 0 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	15.3	20.8	30.6	33	45
Maximum current > 5 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	23	31.2	45.9	57	87
Motor type											
MCS 12H15	M_r			7.6	10.0	10.0					
	M_0 [4)]			8.1	11.4	11.4					
	M_{max} n=0			11.4	19.6	29.0					
	M_{max}			11.4	19.6	29.0					
MCS 12H35	M_r				6.8	7.5	7.5				
	M_0 [4)]				7.3	11.4	11.4				
	M_{max} n=0				10.1	18.5	19.3				
	M_{max}				10.1	18.5	27.9				
MCS 12L20	M_r				11.9	13.5	13.5	13.5			
	M_0 [4)]				12.6	15.0	15.0	15.0			
	M_{max} n=0				18.5	32.8	34.1	44.2			
	M_{max}				18.5	32.8	47.9	56.4			
MCS 12L41	M_r					10.5	11.0	11.0	11.0		
	M_0 [4)]					11.7	15.0	15.0	15.0		
	M_{max} n=0					17.4	18.2	24.2	34.1		
	M_{max}					17.4	26.5	34.7	47.8		

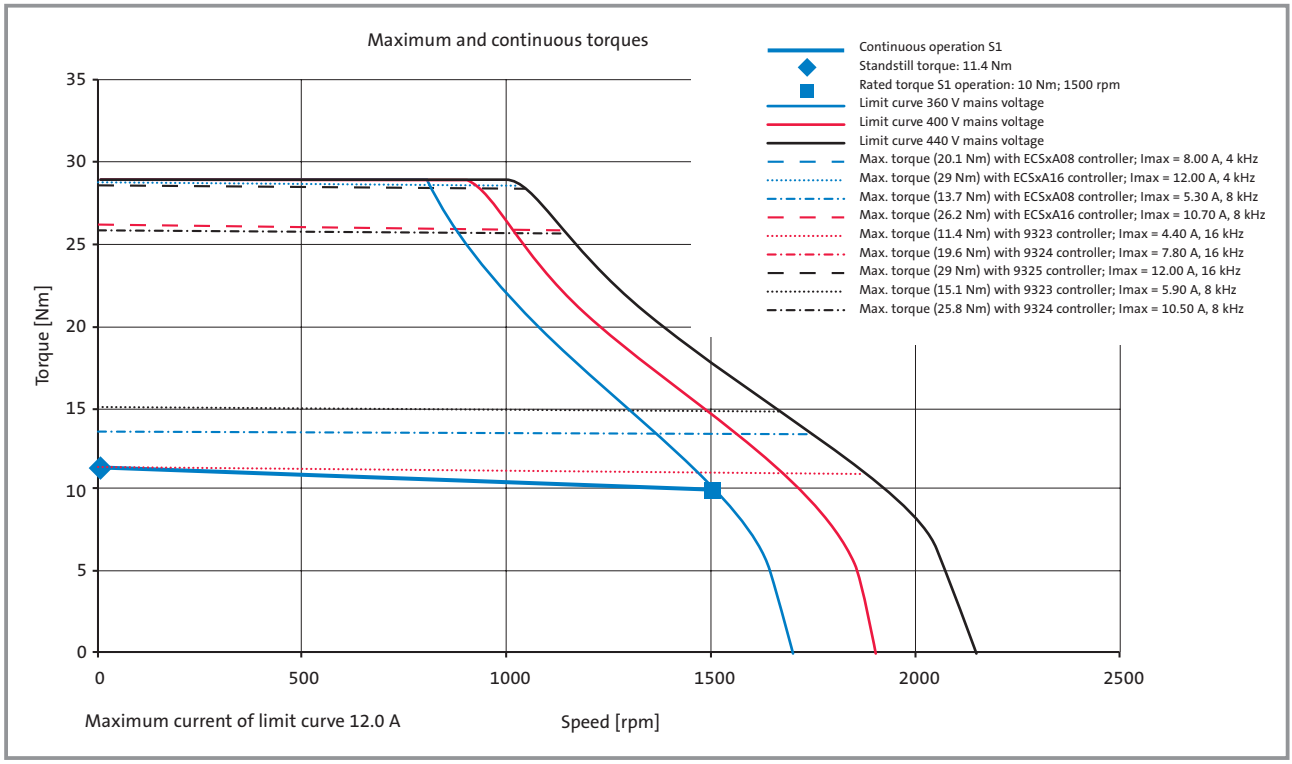
[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C
and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

Torque characteristics

MCS 12H35

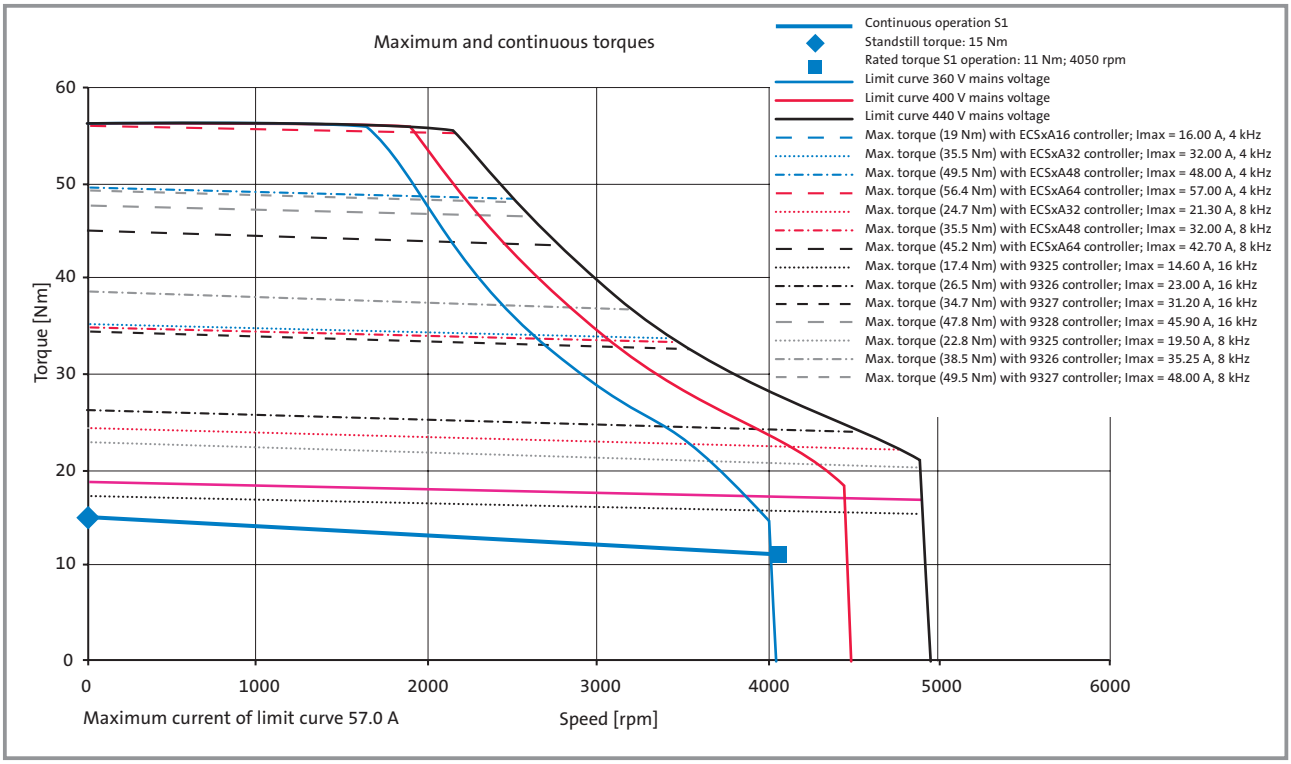


MCS 12H15

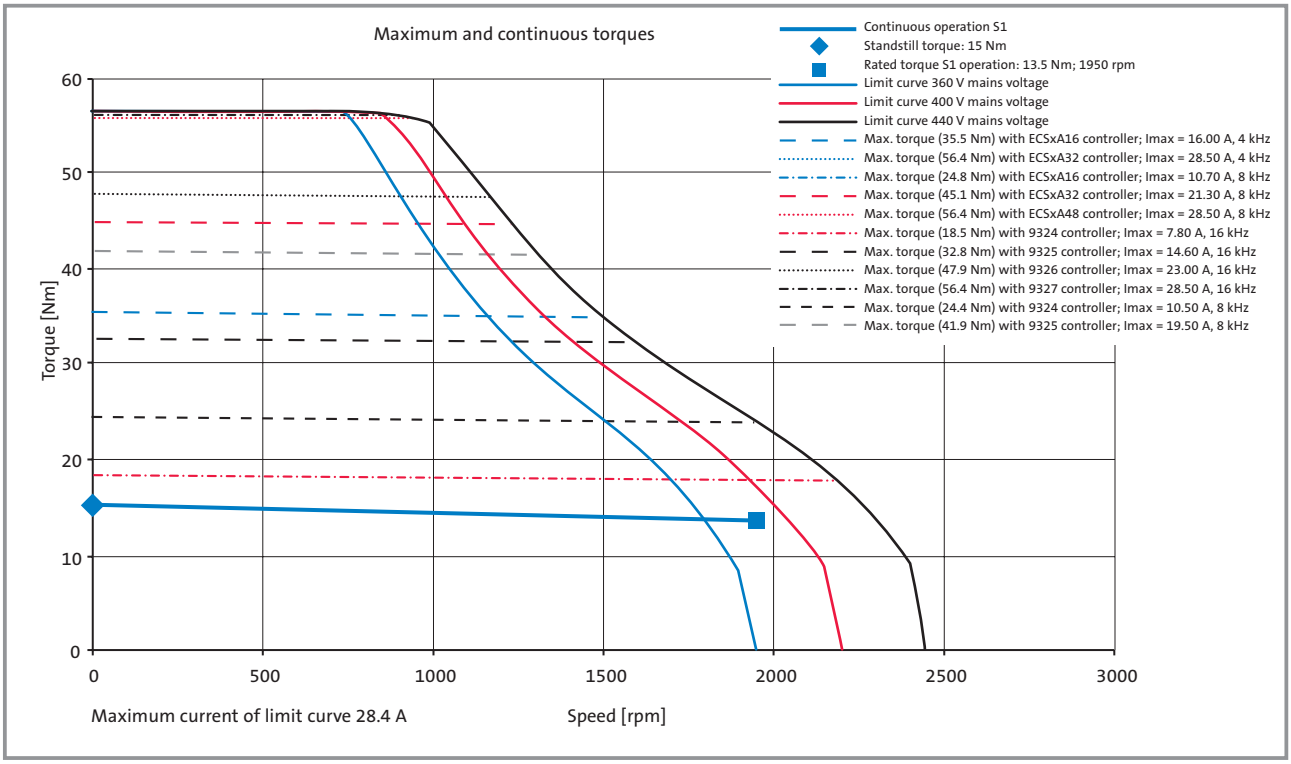


At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

MCS 12L41



MCS 12L20



At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

Brake assignment

MCS synchronous servo motors can be fitted with integrated permanent-magnet holding brakes for 24 V DC.

The brakes are activated when the supply voltage is disconnected (closed-circuit principle).

If the brakes are used purely as holding brakes, there will be virtually no evidence of wear on the friction surfaces. As long as the permissible switching rate is not exceeded, at least 2000 emergency stop functions will be possible.

MCS 12H
MCS 12L

Type	Size	Holding torque M_4 20 °C Nm	Holding torque M_4 120 °C Nm	Average dynamic torque M_{1m} 120 °C Nm	U_B [3] +5 %. -10 % V	I_B [2] A	J_B kgcm²	Engagement time t1 [1] ms	Disengage-ment time t2 [1] ms	Maximum switching rate per emergency stop with n=3000 rpm J	Weight kg
P1	07H	12	10	7	24	0.65	1.07	13	43	400	0.9
P2	09H	24	19	12	24	0.71	3.13	16	90	890	1.2

P1 Standard brake
P2 Uprated brake
1) Engagement and disengagement times valid for rated voltage (± 0 %) and protective circuit for brakes with varistor for DC-side switching. The times may increase without a protective circuit.
2) The currents are maximum values for a cold brake (data for dimensioning the power supply). The values for a motor at operating temperature are considerably lower.
3) Smoothed DC voltage, ripple < 1 %

Permissible moments of inertia

Motor	Brake type	J_{mot} with brake kgcm²	Permissible J_{load}/J_{mot}
MCS 12H	P1	8.4	8.7
MCS 12L	P1	11.7	6.0
MCS 12H	P2	10.4	16.3
MCS 12L	P2	13.7	12.1

If the permissible moments of inertia opposite are adhered to, the permissible maximum switching rate of the brake will not be exceeded and up to 2000 emergency stop functions will be possible at a speed of 3000 rpm.

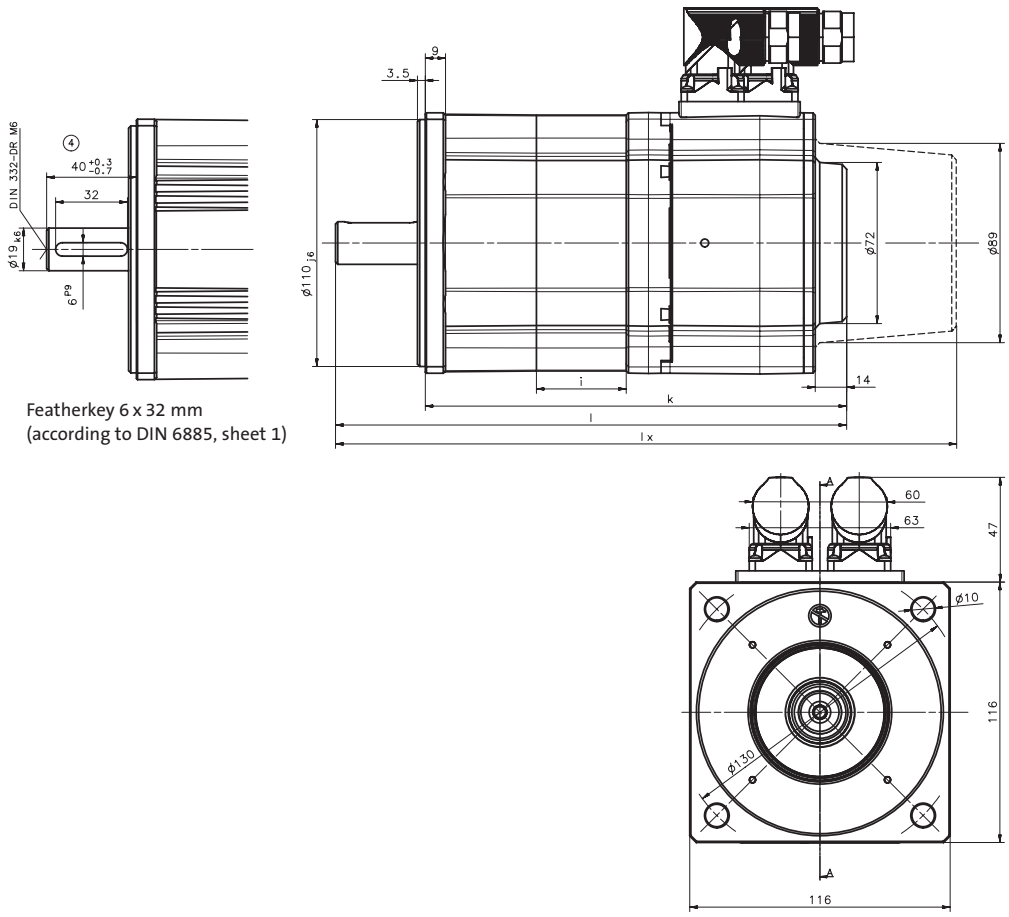
Caution:
The brakes used are not fail-safe brakes in the true sense because certain types of faults, e.g. oil leakage, can cause a loss of torque.

If long motor cables are being used, the ohmic voltage drop along the cable should be taken into account and compensated by applying a higher voltage at the cable input. The equation below is valid for Lenze system cables:
U_B [V] = 0.08 x l_{cable} [m] x I_B [A]

If an appropriate voltage is not supplied to the brake (incorrect dimension, incorrect polarity), the brake will engage and the continuing rotation of the motor could cause it to overheat, leading to irreparable damage.

DC-side switching helps to minimise brake response times. A spark suppressor is required for interference suppression and to increase the service life of the relay contacts.

Mechanical dimensions

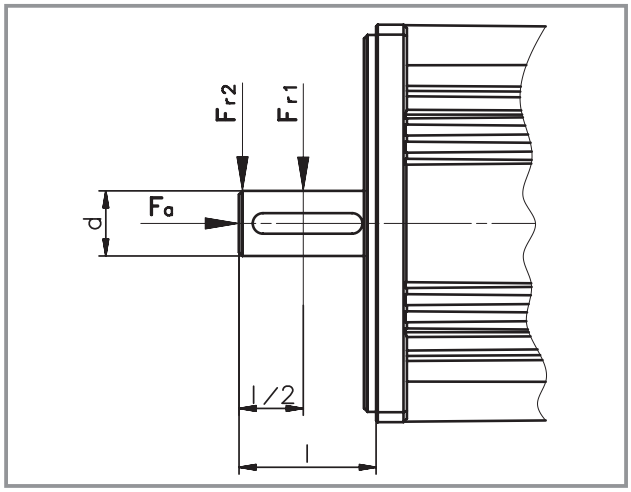


Motor type	Motor **without** holding brake				Motor **with** holding brake			
	i [mm]	k [mm]	l [mm]	lx [mm]	i [mm]	k [mm]	l [mm]	lx [mm]
MCS 12H	80	228	268	317	80	248	288	337
MCS 12L	120	268	308	357	120	288	328	377

l Motor length with installation of a resolver as feedback
lx Motor length with installation of an absolute value encoder as feedback
i Length of coil module

Permissible shaft loads

Forces on the motor shaft



The following diagrams provide a simple means of determining:

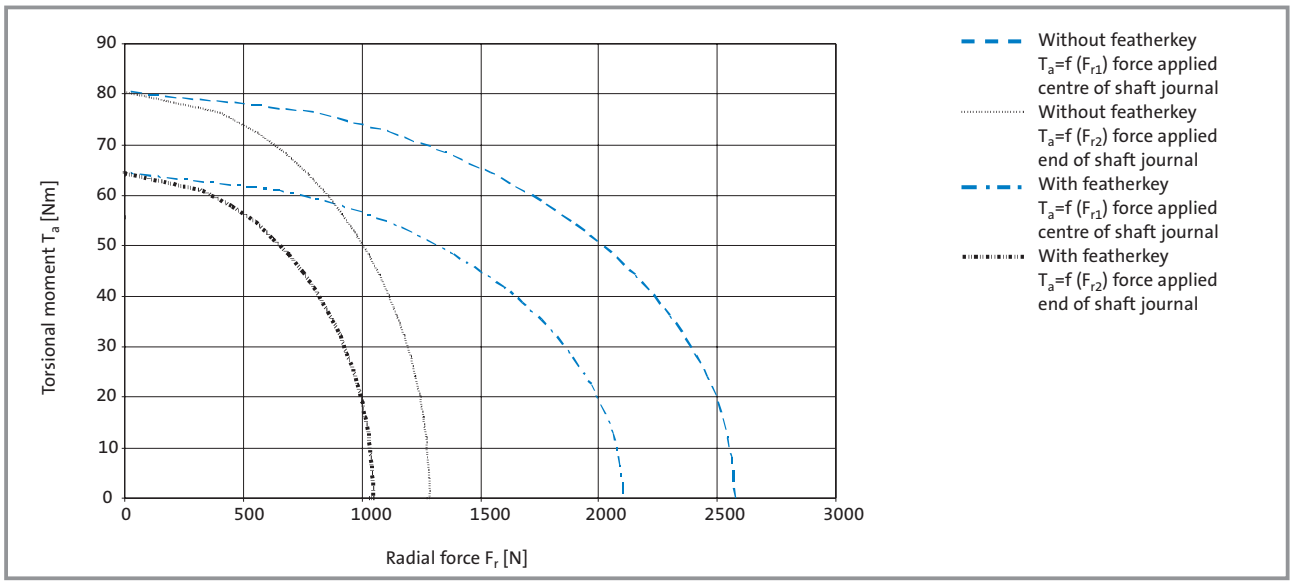
a) The maximum permissible radial force along with the corresponding maximum permissible torsional moment on the motor shaft.

b) The service life of the roller bearings on the basis of the forces and torques calculated.

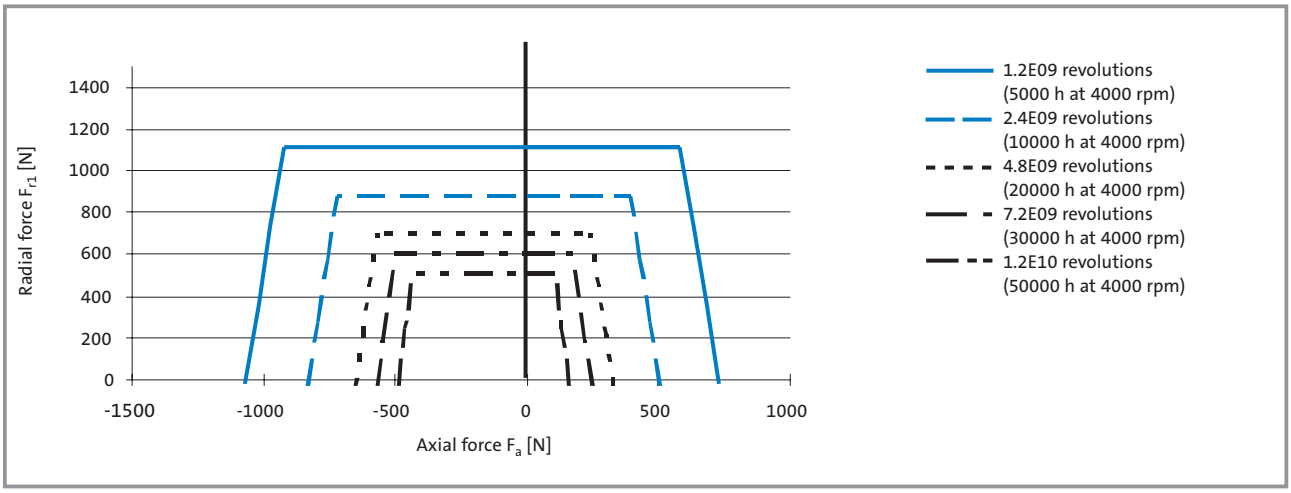
Service life is calculated as follows:

$$\frac{\text{No. of bearing revolutions}}{\text{n [rpm] x 60}} = \text{Bearing service life [h]}$$

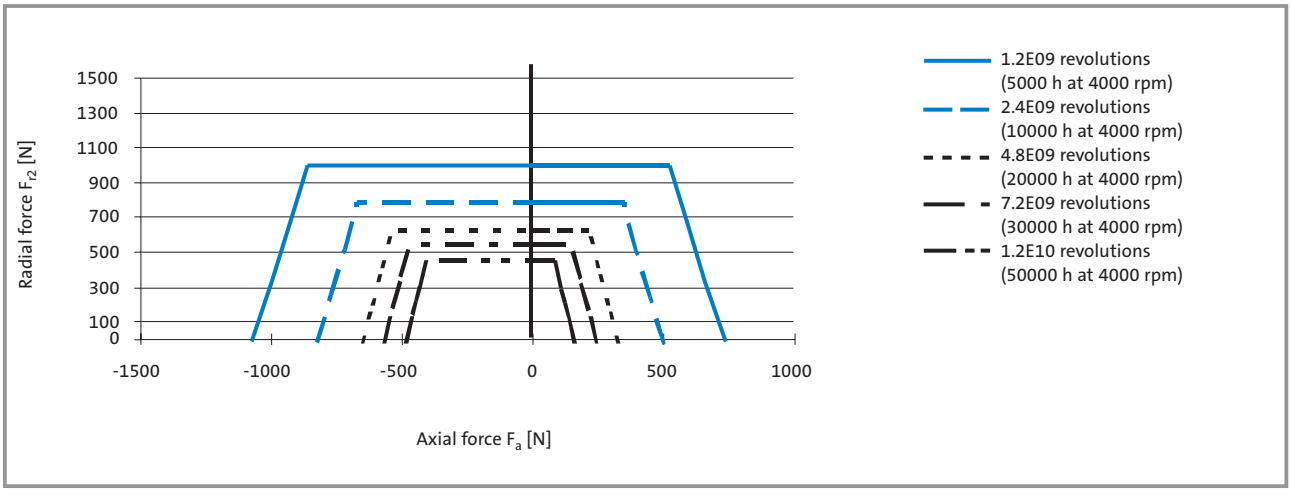
The characteristics are valid for all MCS 12 frame sizes



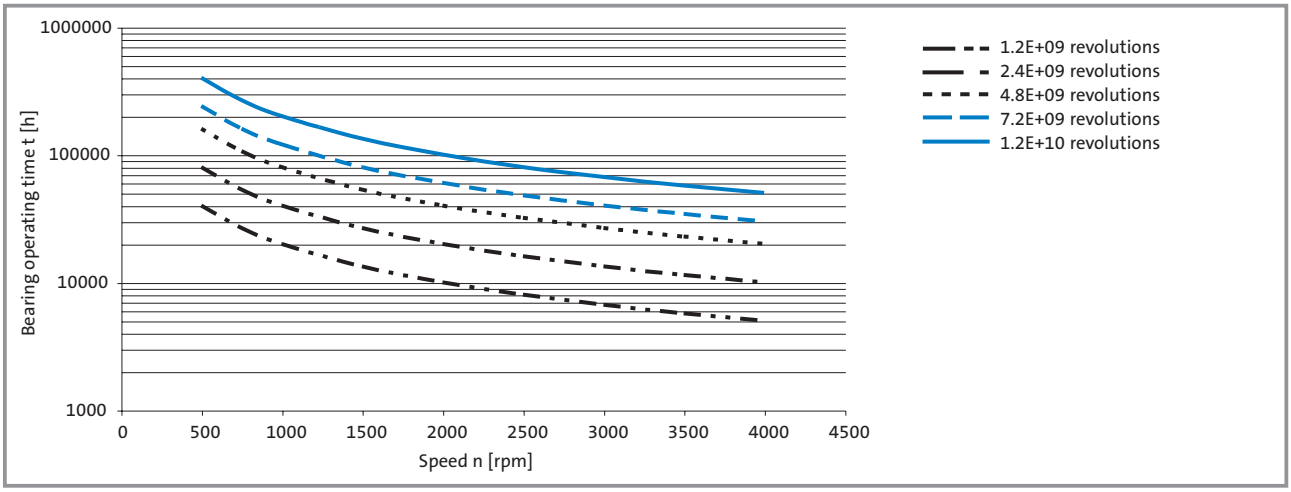
Relationship between radial force and torsional moment on shaft



Permissible radial force F_{r1} and axial force F_a on shaft



Permissible radial force F_{r2} and axial force F_a on shaft



Relationship between the number of total bearing revolutions, bearing service life and the average speed of the drive

MCS 14D

Rated data

Motor	M_r Nm	n_r rpm	P_r kW	U_r V	f_r Hz	I_r A	η %	M_0 Nm	I_0 A	M_{max} Nm	I_{max} A	J_{mot} without brake kgcm²
MCS 14D15	9.2	1500	1.45	305	100	4.5	88	11	5.0	29	17	8.1
MCS 14D36	7.5	3600	2.8	295	240	7.5	92	11	10.0	29	33	8.1
MCS 14H15	16.0	1500	2.5	325	100	6.6	92	21	8.5	55	26	14.2
MCS 14H32	14.0	3225	4.7	295	215	11.9	93	21	16.9	55	52	14.2
MCS 14L15	23.0	1500	3.6	315	100	9.7	90	28	12.0	77	37	23.4
MCS 14L32	17.2	3225	5.8	275	215	15	93	28	24.0	77	75	23.4
MCS 14P14	30.0	1350	4.2	340	90	10.8	90	37	12.2	105	46	34.7
MCS 14P32	21.0	3225	7.1	315	215	15.6	93	37	24.3	105	92	34.7

Motor	ke_{LL}-factor at 150 °C V/1000 rpm	R_{UV} at 20 °C Ω	R_{UV} at 150 °C Ω	L_{phase} ⅄ mH	kt_0 factor at 150 °C Nm/A	Power connector type	Weight without brake kg	Maximum speed mech. rpm
MCS 14D15	128.5	4.00	5.40	49.8	2.19	EWS0001	10.7	6000
MCS 14D36	64.2	1.00	1.35	12.5	1.09		10.7	6000
MCS 14H15	152.6	1.94	2.61	34.1	2.48	EWS0001	15.5	6000
MCS 14H32	76.3	0.48	0.65	8.5	1.24		15.5	6000
MCS 14L15	152.3	1.21	1.64	22.0	2.33	EWS0001	20.1	6000
MCS 14L32	76.2	0.30	0.41	5.5	1.16	EWS0013	20.1	6000
MCS 14P14	178.8	1.10	1.49	23.9	3.04	EWS0001	24.9	6000
MCS 14P32	89.4	0.28	0.37	6.0	1.52	EWS0013	24.9	6000

MCS 14H

MCS 14L

MCS 14P

Servo controller assignment

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 4 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		2	4	8	12.7	17	20
Maximum current 0 Hz [1) 2)] [A]		2.3	4.6	9.1	18.1	27.2	36.3
Maximum current > 5 Hz [1) 2)] [A]		4	8	16	32	48	64
Motor type							
MCS 14D15	M_r		8.2	9.2			
	M_0		8.8	11.0			
	M_{max} n=0		9.6	17.9			
	M_{max}		16.0	28.3			
MCS 14D36	M_r			7.5	7.5		
	M_0			8.8	11.0		
	M_{max} n=0			9.5	17.8		
	M_{max}			16.0	28.3		
MCS 14H15	M_r			16.0	16.0		
	M_0			19.8	21.0		
	M_{max} n=0			22.3	41.2		
	M_{max}			37.1	54.8		
MCS 14H32	M_r				14.0	14.0	14.0
	M_0				15.8	21.0	21.0
	M_{max} n=0				22.2	32.1	41.3
	M_{max}				37.1	51.9	54.8
MCS 14L15	M_r			19.0	23.0	23.0	
	M_0			18.7	28.0	28.0	
	M_{max} n=0			21.9	42.1	59.9	
	M_{max}			37.6	68.5	77.1	
MCS 14L32	M_r				14.6	17.2	17.2
	M_0				14.8	19.8	23.3
	M_{max} n=0				21.8	32.4	42.2
	M_{max}				37.6	53.9	68.5
MCS 14P14	M_r				30.0	30.0	
	M_0				37.0	37.0	
	M_{max} n=0				49.1	70.0	
	M_{max}				80.0	105.1	
MCS 14P32	M_r				17.1	21.0	21.0
	M_0				19.3	25.9	30.5
	M_{max} n=0				25.4	37.9	49.3
	M_{max}				43.9	63.0	80.0

1) Caution: Limit I_{max} controller to I_{max} motor
2) Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 8 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		1.4	2.7	5.3	8.5	11.3	13.3
Maximum current 0 Hz [1) 2) 3)] [A]		1.5	3	6	12.1	18.1	24.2
Maximum current > 5 Hz [1) 2) 3)] [A]		2.7	5.3	10.7	21.3	32	42.7
Motor type							
MCS 14D15	M_r			9.2	9.2		
	M_0			11.0	11.0		
	M_{max} n=0			12.3	22.7		
	M_{max}			20.5	29.0		
MCS 14D36	M_r				7.5	7.5	7.5
	M_0				9.3	11.0	11.0
	M_{max} n=0				12.4	17.8	22.7
	M_{max}				20.5	28.3	29.0
MCS 14H15	M_r			12.8	16.0	16.0	
	M_0			13.1	21.0	21.0	
	M_{max} n=0			14.8	29.0	41.2	
	M_{max}			25.9	47.2	54.8	
MCS 14H32	M_r					13.3	14.0
	M_0					14.0	16.5
	M_{max} n=0					22.2	28.9
	M_{max}					37.1	47.3
MCS 14L15	M_r				20.2	23.0	23.0
	M_0				19.8	26.4	28.0
	M_{max} n=0				29.1	42.1	54.3
	M_{max}				48.6	68.5	77.1
MCS 14L32	M_r					13.0	15.3
	M_0					13.2	15.5
	M_{max} n=0					21.8	29.1
	M_{max}					37.6	48.7
MCS 14P14	M_r				23.6	30.0	30.0
	M_0				25.8	34.3	37.0
	M_{max} n=0				34.0	49.1	63.4
	M_{max}				56.8	80.0	99.7
MCS 14P32	M_r						17.9
	M_0						20.3
	M_{max} n=0						34.0
	M_{max}						56.9

1) Caution: Limit I_{max} controller to I_{max} motor
2) Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
3) Caution: On the ECS automatic switching to 4 kHz not taken into account; when using automatic switching to 4 kHz, the maximum torques at 4 kHz apply

Servo controller assignment

Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 8 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.5	2.5	3.9	7	13	23.5	32	47	59	89
Maximum current 0 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	23.5	32	47	52	80
Maximum current > 5 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	35.25	48	70.5	88.5	133.5
Motor type											
MCS 14D15	M_r			8.0	9.2	9.2					
	M_0 [4)]			8.5	11.0	11.0					
	M_{max} n=0			12.1	20.2	29.0					
	M_{max}			12.1	20.2	29.0					
MCS 14D36	M_r				7.0	7.5	7.5				
	M_0 [4)]				7.7	11.0	11.0				
	M_{max} n=0				10.9	19.0	22.2				
	M_{max}				10.9	19.0	29.0				
MCS 14H15	M_r				16.0	16.0					
	M_0 [4)]				17.3	21.0					
	M_{max} n=0				25.4	43.9					
	M_{max}				25.4	43.9					
MCS 14H32	M_r					14.0	14.0	14.0			
	M_0 [4)]					16.2	21.0	21.0			
	M_{max} n=0					23.8	28.2	37.1			
	M_{max}					23.8	40.3	51.9			
MCS 14L15	M_r					23.0	23.0				
	M_0 [4)]					28.0	28.0				
	M_{max} n=0					45.0	52.9				
	M_{max}					45.0	73.9				
MCS 14L32	M_r					14.9	17.2	17.2	17.2		
	M_0 [4)]					15.2	27.4	28.0	28.0		
	M_{max} n=0					23.5	28.3	37.6	52.9		
	M_{max}					23.5	41.1	53.9	73.9		
MCS 14P14	M_r					30.0	30.0	30.0			
	M_0 [4)]					37.0	37.0	37.0			
	M_{max} n=0					52.5	61.8	80.0			
	M_{max}					52.5	86.4	105.1			
MCS 14P32	M_r					17.5	21.0	21.0	21.0		
	M_0 [4)]					19.8	35.8	37.0	37.0		
	M_{max} n=0					27.4	33.0	43.9	61.8		
	M_{max}					27.4	48.0	63.0	86.4		

[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

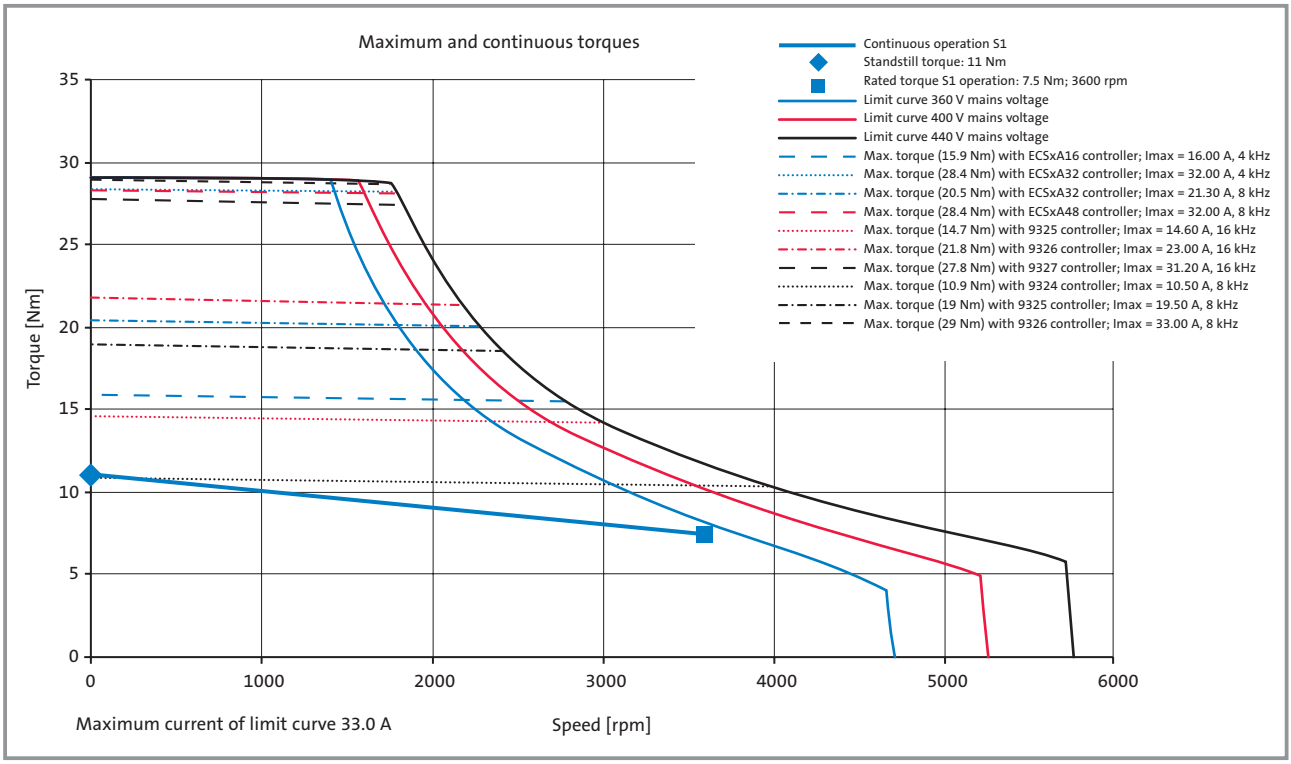
Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 16 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.1	1.8	2.9	5.2	9.7	15.3	20.8	30.6	38	58
Maximum current 0 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	15.3	20.8	30.6	33	45
Maximum current > 5 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	23	31.2	45.9	57	87
Motor type											
MCS 14D15	M_r				9.2	9.2	9.2				
	M_0 [4)]				11.0	11.0	11.0				
	M_{max} n=0				15.6	26.4	27.4				
	M_{max}				15.6	26.4	29.0				
MCS 14D36	M_r					7.5	7.5	7.5			
	M_0 [4)]					10.6	11.0	11.0			
	M_{max} n=0					14.7	15.3	20.0			
	M_{max}					14.7	21.8	27.8			
MCS 14H15	M_r				12.6	16.0	16.0	16.0			
	M_0 [4)]				12.8	21.0	21.0	21.0			
	M_{max} n=0				19.2	34.2	35.7	46.3			
	M_{max}				19.2	34.2	50.2	54.8			
MCS 14H32	M_r					11.4	14.0	14.0	14.0	14.0	
	M_0 [4)]					12.1	19.0	21.0	21.0	21.0	
	M_{max} n=0					18.0	18.8	25.2	35.7	38.1	
	M_{max}					18.0	27.6	36.3	50.1	54.8	
MCS 14L15	M_r					23.0	23.0	23.0	23.0		
	M_0 [4)]					22.6	28.0	28.0	28.0		
	M_{max} n=0					34.6	36.1	47.6	66.0		
	M_{max}					34.6	52.0	67.1	77.1		
MCS 14L32	M_r						17.2	17.2	17.2	17.2	
	M_0 [4)]						17.9	24.3	28.0	28.0	
	M_{max} n=0						18.4	25.0	36.1	38.7	
	M_{max}						27.7	36.8	51.9	62.3	
MCS 14P14	M_r					26.9	30.0	30.0	30.0		
	M_0 [4)]					29.4	37.0	37.0	37.0		
	M_{max} n=0					40.4	42.2	55.6	77.2		
	M_{max}					40.4	60.7	78.4	104.9		
MCS 14P32	M_r						20.6	21.0	21.0	21.0	
	M_0 [4)]						23.3	31.7	37.0	37.0	
	M_{max} n=0						21.5	29.2	42.2	45.2	
	M_{max}						32.3	42.9	60.6	72.8	

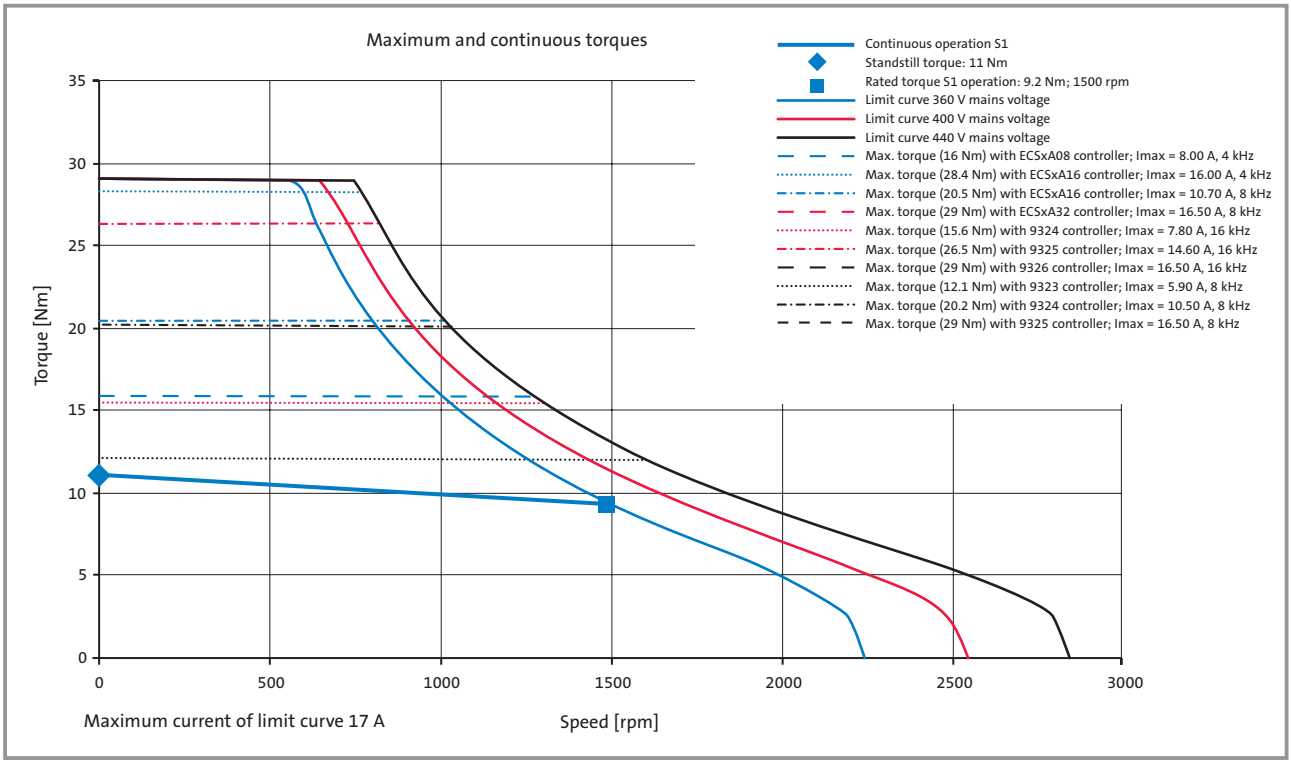
[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

Torque characteristics

MCS 14D36

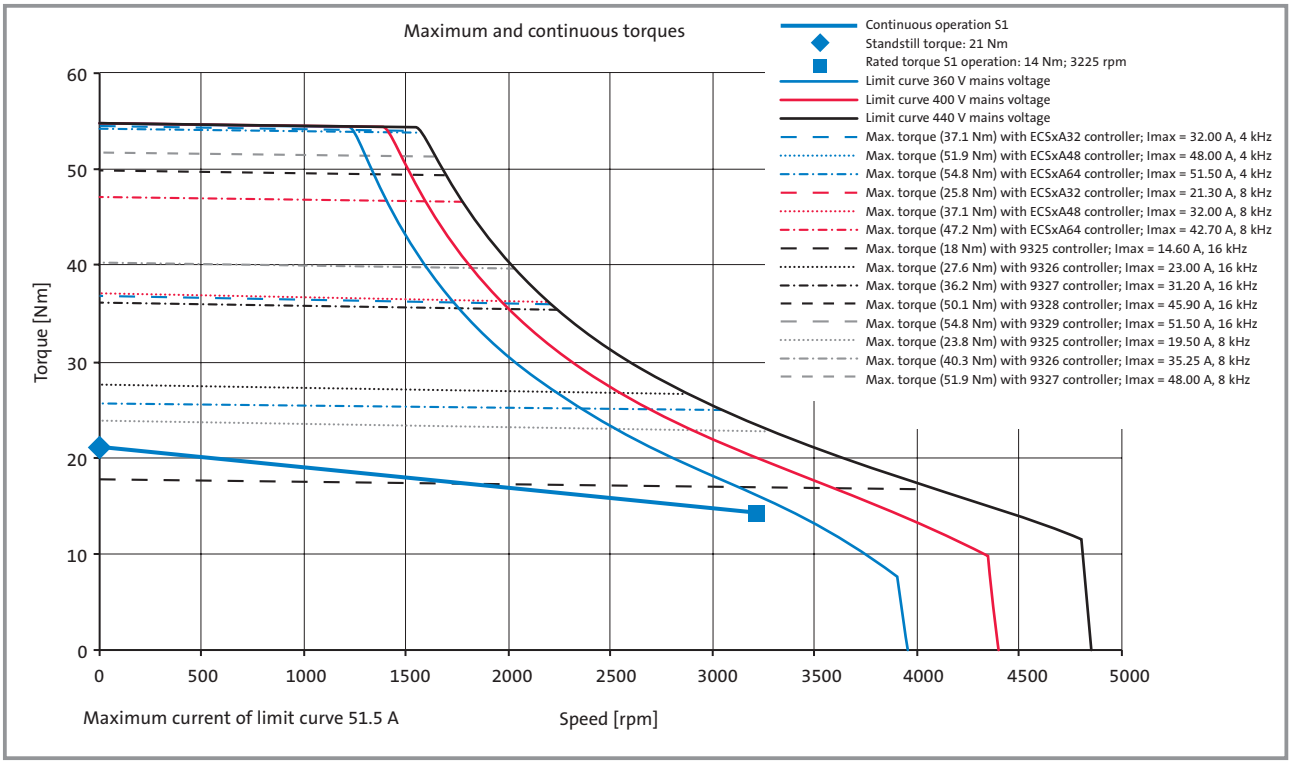


MCS 14D15

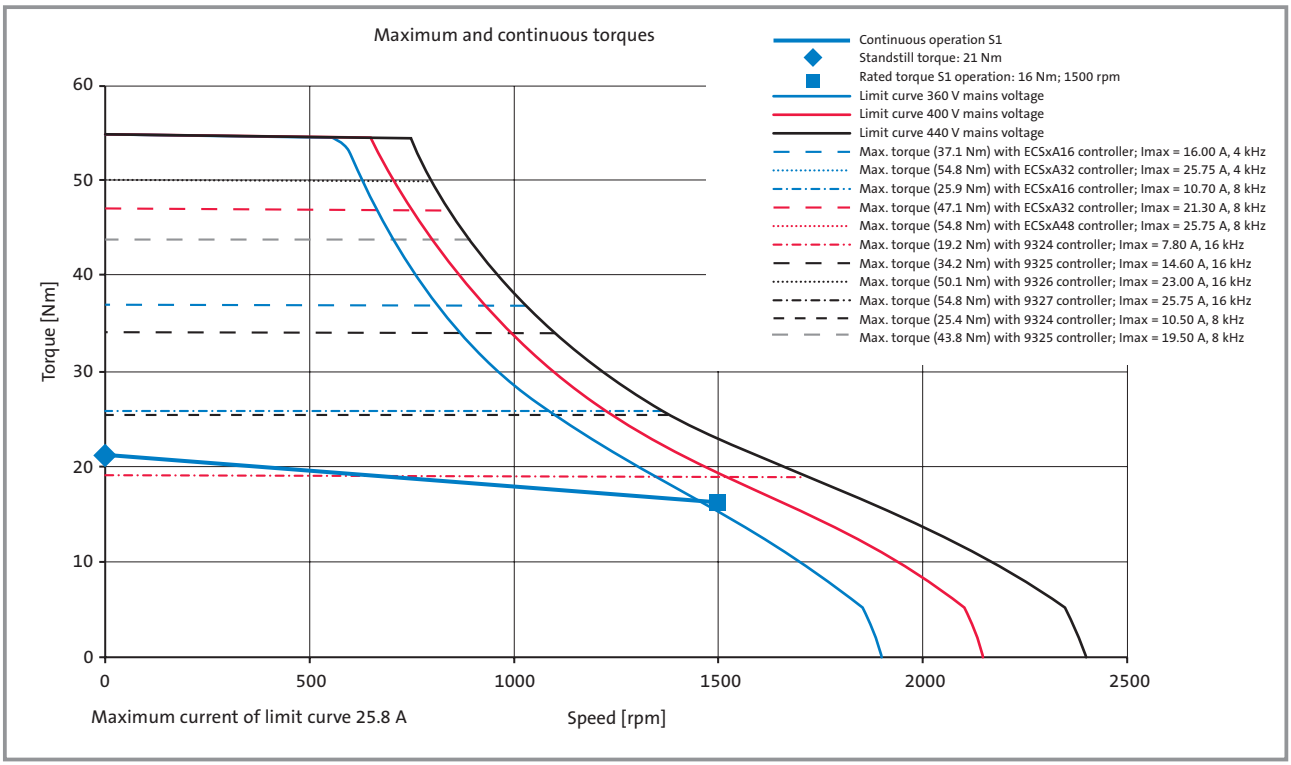


At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

MCS 14H32



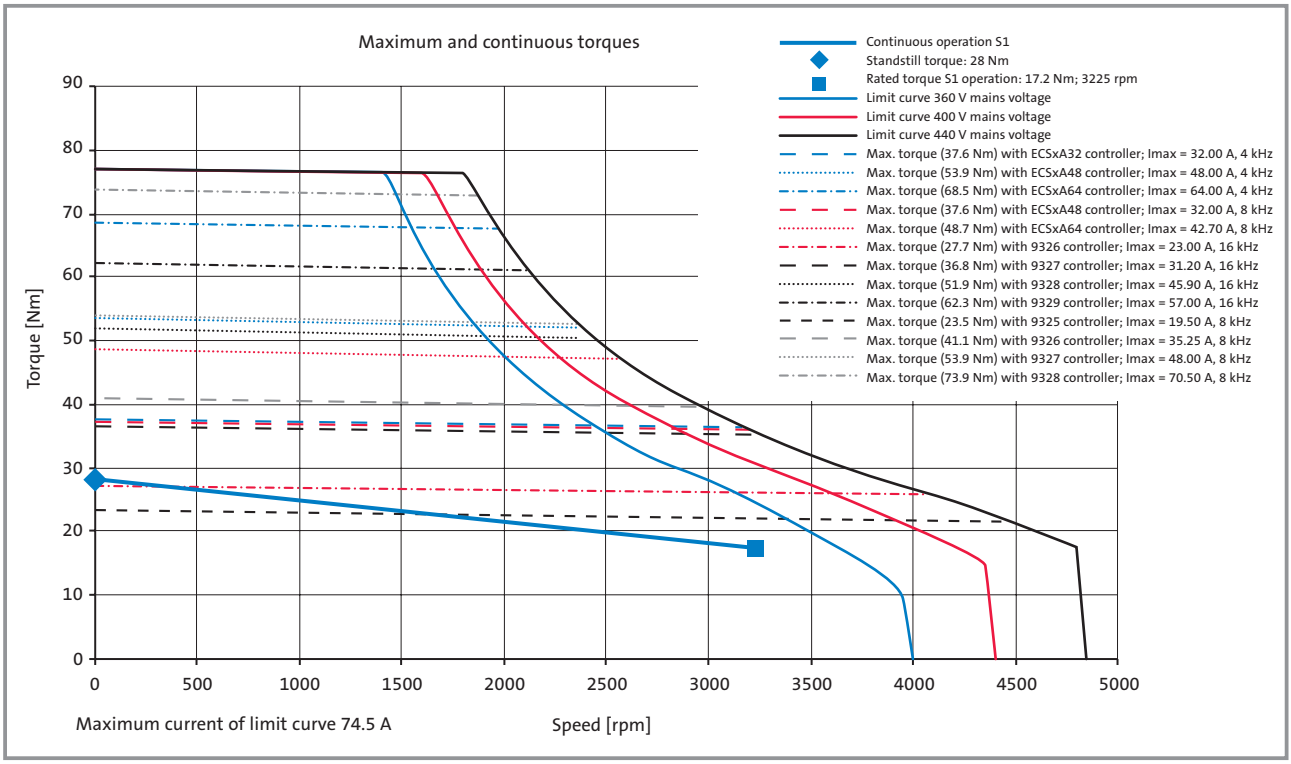
MCS 14H15



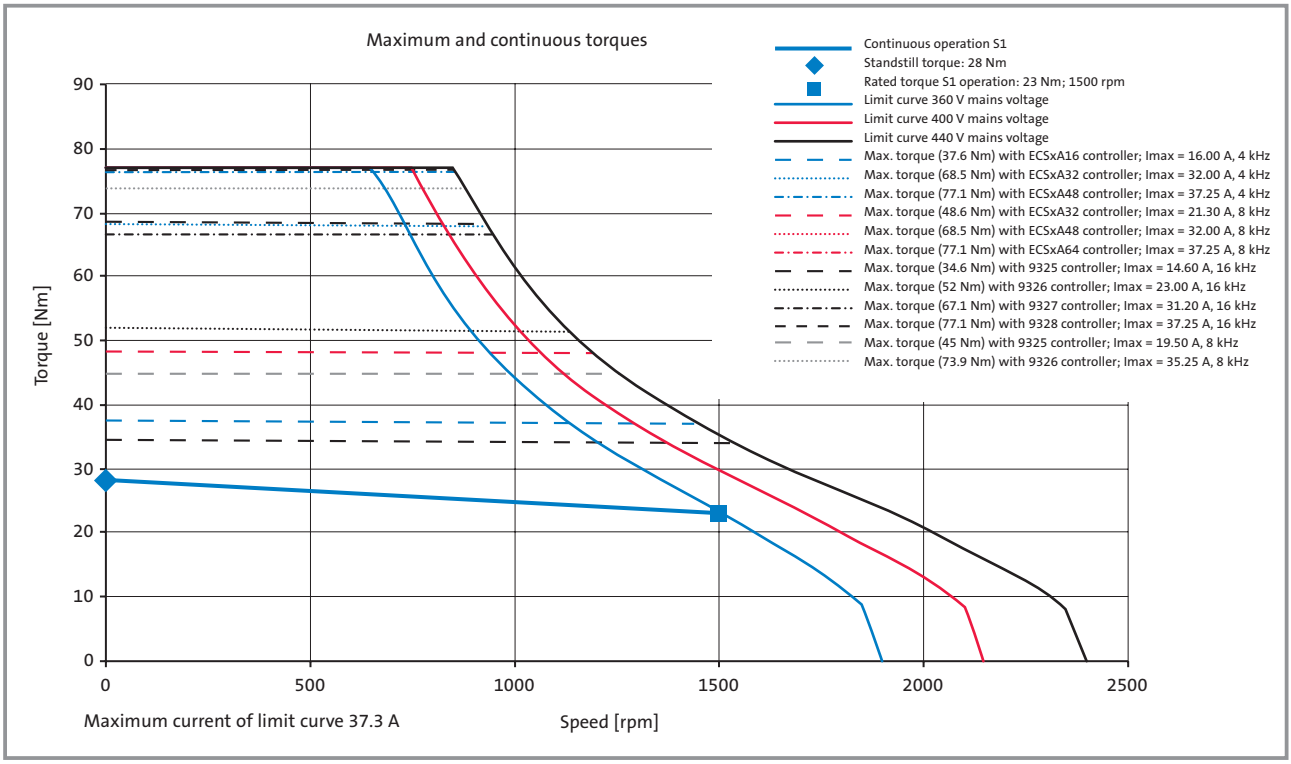
At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

Torque characteristics

MCS 14L32

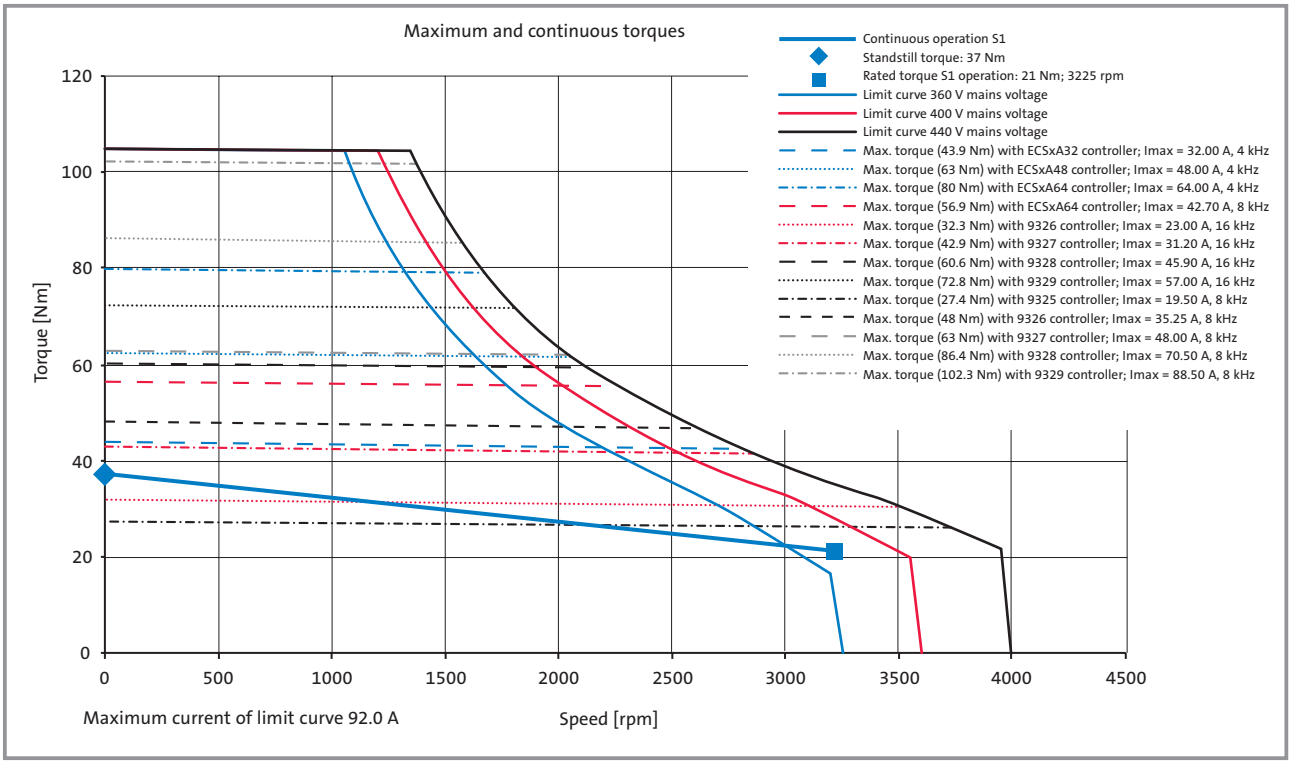


MCS 14L15

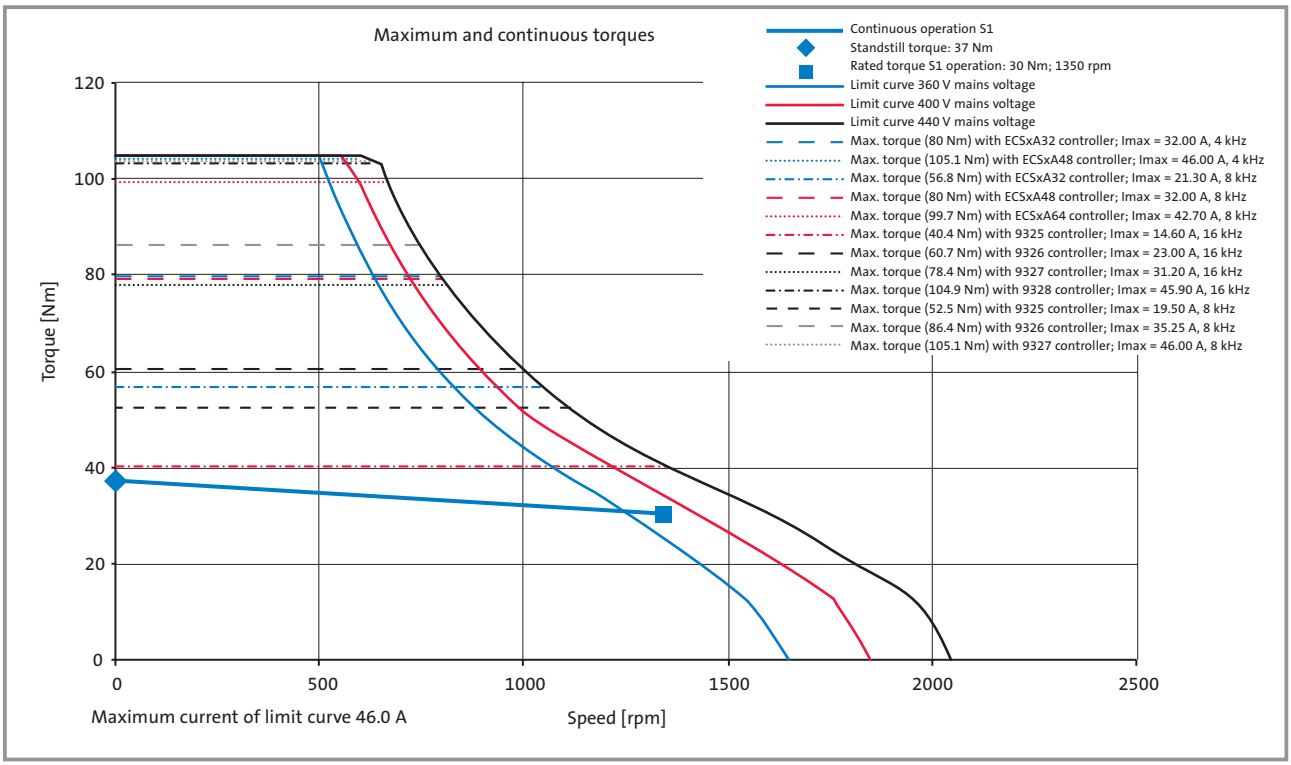


At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

MCS 14P32



MCS 14P14



At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

Brake assignment

MCS synchronous servo motors can be fitted with integrated permanent-magnet holding brakes for 24 V DC.

The brakes are activated when the supply voltage is disconnected (closed-circuit principle).

If the brakes are used purely as holding brakes, there will be virtually no evidence of wear on the friction surfaces. As long as the permissible switching rate is not exceeded, at least 2000 emergency stop functions will be possible.

MCS 14D36, MCS 14D15
MCS 14H32, MCS 14H15
MCS 14L32, MCS 14L15
MCS 14P32, MCS 14P14

Type	Size	Holding torque M_4 20 °C Nm	Holding torque M_4 120 °C Nm	Average dynamic torque M_{1m} 120 °C Nm	U_B [3] +5 %. -10 % V	I_B [2] A	J_B kgcm²	Engagement time t1 [1] ms	Disengage-ment time t2 [1] ms	Maximum switching rate per emergency stop with n=3000 rpm J	Weight kg
P1	09H	22	18	8	24	0.88	3.20	15	150	640	1.9
P2	11H	37	32	15	24	0.93	12.4	96	113	2350	3.1

P1 Standard brake
P2 Uprated brake

1) Engagement and disengagement times valid for rated voltage (±0 %) and protective circuit for brakes with varistor for DC-side switching. The times may increase without a protective circuit.

2) The currents are maximum values for a cold brake (data for dimensioning the power supply). The values for a motor at operating temperature are considerably lower.

3) Smoothed DC voltage, ripple < 1 %

Permissible moments of inertia

Motor	Brake type	J_{mot} with brake kgcm²	Permissible J_{load}/J_{mot}
MCS 14D	P1	11.3	10.5
MCS 14H	P1	17.4	6.5
MCS 14L	P1	26.6	3.9
MCS 14P	P1	37.9	2.4
MCS 14D	P2	20.5	22.2
MCS 14H	P2	26.6	16.9
MCS 14L	P2	35.8	12.3
MCS 14P	P2	47.1	9.1

If the permissible moments of inertia opposite are adhered to, the permissible maximum switching rate of the brake will not be exceeded and up to 2000 emergency stop functions will be possible at a speed of 3000 rpm.

Caution:
The brakes used are not fail-safe brakes in the true sense because certain types of faults, e.g. oil leakage, can cause a loss of torque.

If long motor cables are being used, the ohmic voltage drop along the cable should be taken into account and compensated by applying a higher voltage at the cable input. The equation below is valid for Lenze system cables:

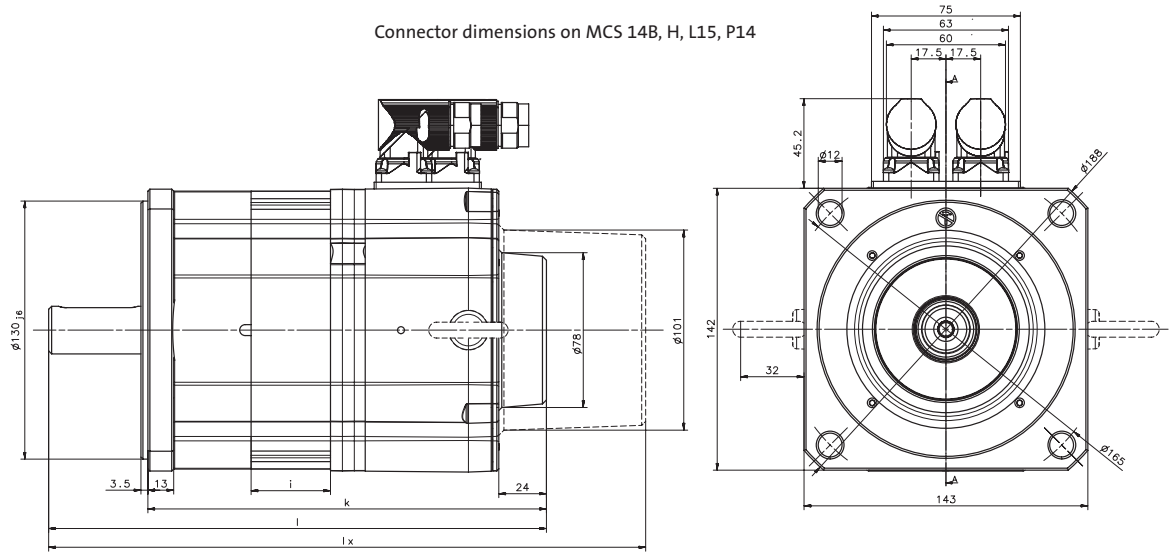
U_B [V] = 0.08 x l_{cable} [m] x I_B [A]

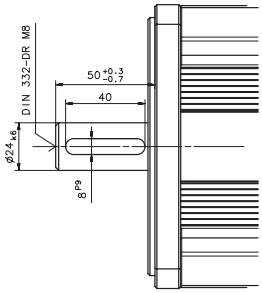
If an appropriate voltage is not supplied to the brake (incorrect dimension, incorrect polarity), the brake will engage and the continuing rotation of the motor could cause it to overheat, leading to irreparable damage.

DC-side switching helps to minimise brake response times. A spark suppressor is required for interference suppression and to increase the service life of the relay contacts.

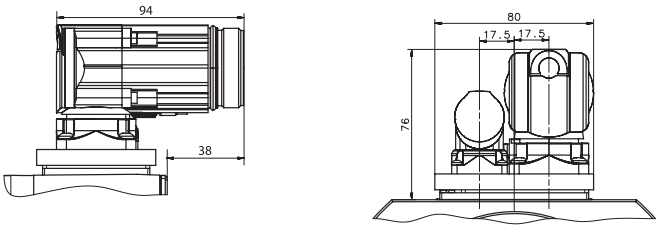
Mechanical dimensions

Connector dimensions on MCS 14B, H, L15, P14





Featherkey 8 x 40 mm
(according to DIN 6885, sheet 1)



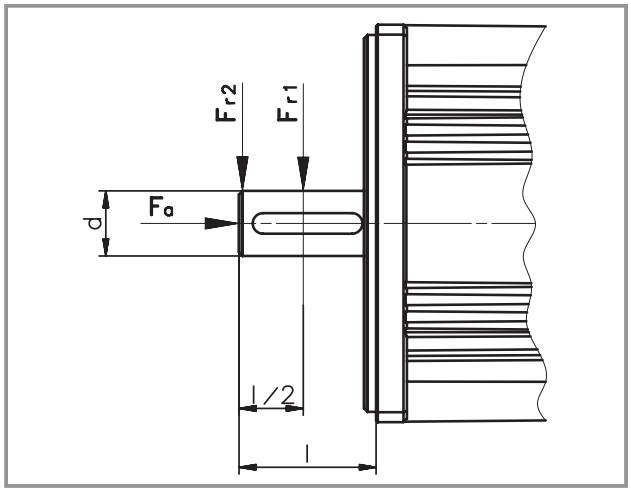
Connector dimensions on MCS 14L32, P32

Motor type	Motor **without** holding brake				Motor **with** holding brake			
	i [mm]	k [mm]	l [mm]	lx [mm]	i [mm]	k [mm]	l [mm]	lx [mm]
MCS 14D	40	201	251	301	40	229	279	329
MCS 14H	80	241	291	341	80	269	319	369
MCS 14L	120	281	331	381	120	309	359	409
MCS 14P	160	321	371	421	160	349	399	449

l Motor length with installation of a resolver as feedback
lx Motor length with installation of an absolute value encoder as feedback
i Length of coil module

Permissible shaft loads

Forces on the motor shaft



The following diagrams provide a simple means of determining:

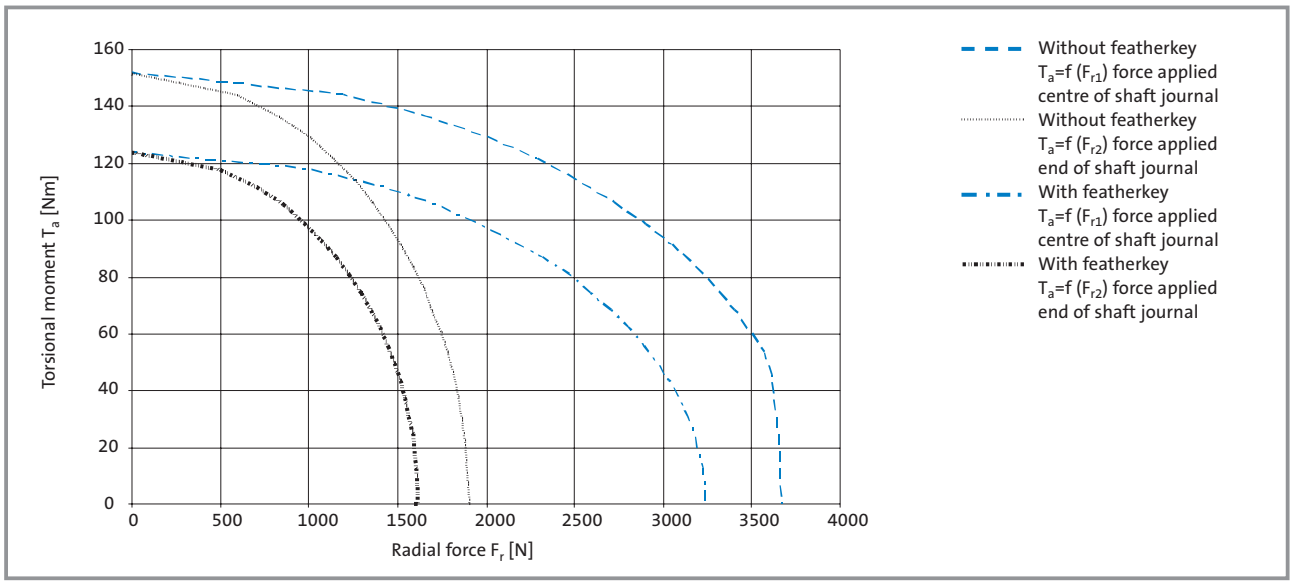
a) The maximum permissible radial force along with the corresponding maximum permissible torsional moment on the motor shaft.

b) The service life of the roller bearings on the basis of the forces and torques calculated.

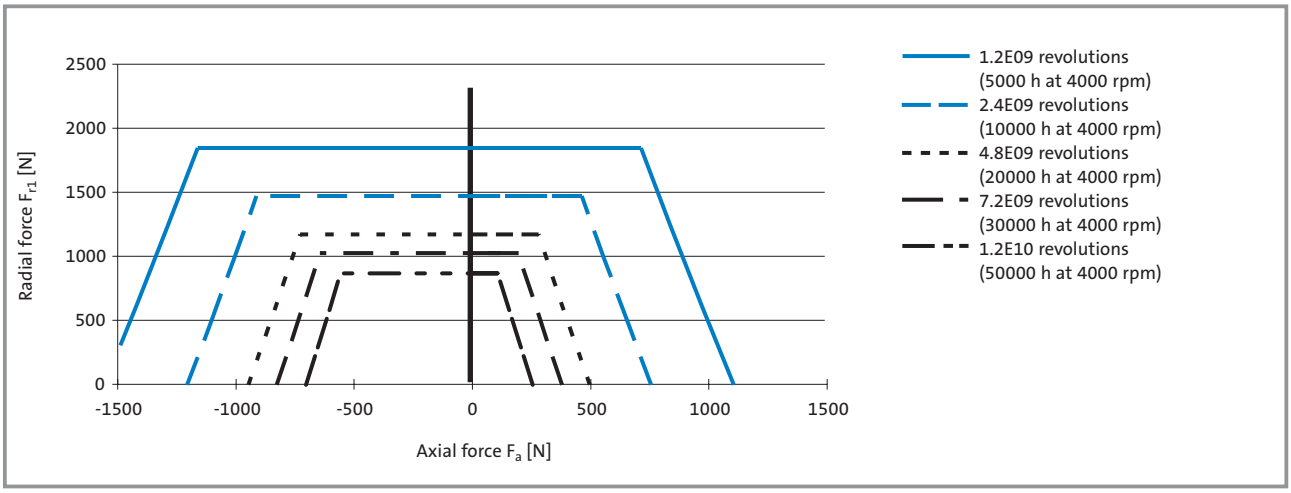
Service life is calculated as follows:

$$\frac{\text{No. of bearing revolutions}}{\text{n [rpm] x 60}} = \text{Bearing service life [h]}$$

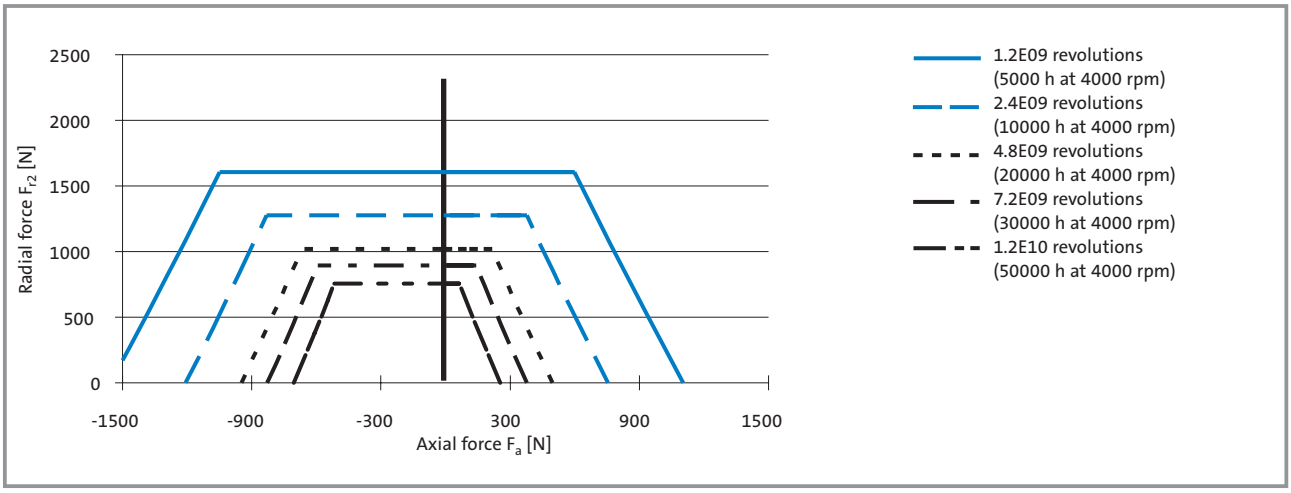
The characteristics are valid for all MCS 14 frame sizes



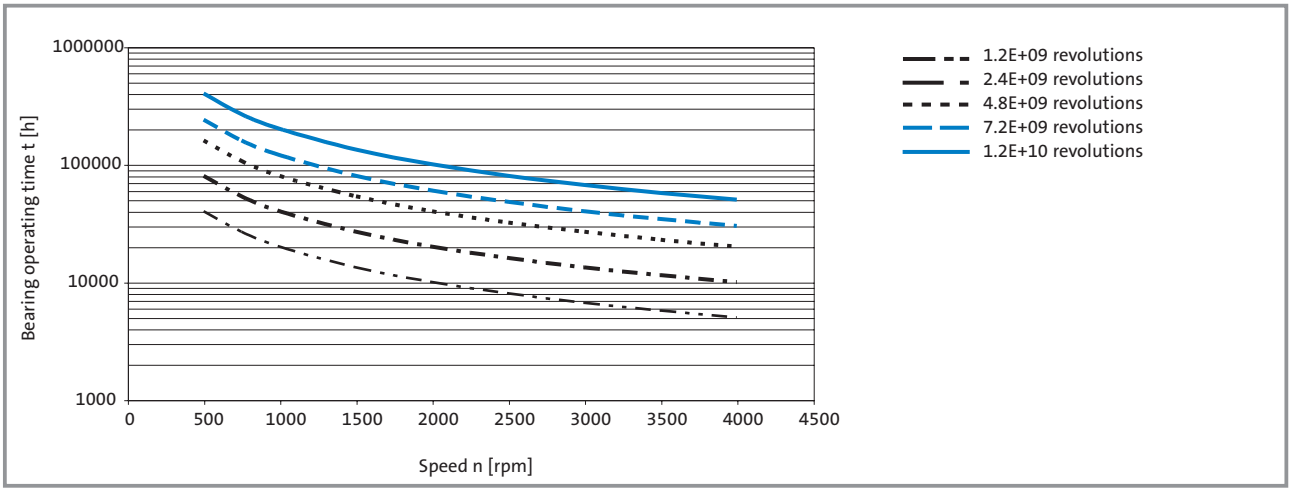
Relationship between radial force and torsional moment on shaft



Permissible radial force F_{r1} and axial force F_a on shaft



Permissible radial force F_{r2} and axial force F_a on shaft



Relationship between the number of total bearing revolutions, bearing service life and the average speed of the drive

Rated data

Motor	M_r Nm	n_r rpm	P_r kW	U_r V	f_r Hz	I_r A	η %	M_0 Nm	I_0 A	M_{max} Nm	I_{max} A	J_{mot} without brake kgcm²
MCS 19F14	27	1425	4.0	335	95	8.6	92	32	9.9	86	31	65.0
MCS 19F30	21	3000	6.6	300	200	14.0	93	32	19.8	86	63	65.0
MCS 19J14	40	1425	6.0	330	95	12.3	92	51	15.2	129	45	105.0
MCS 19J30	29	3000	9.1	300	200	18.5	93	51	30.5	129	90	105.0
MCS 19P14	51	1350	7.2	330	90	14.3	92	64	17.5	190	60	160.0
MCS 19P30	32	3000	10.0	320	200	19.0	93	64	34.9	190	120	160.0

Motor	ke_{LL}-factor at 150 °C V/1000 rpm	R_{UV} at 20 °C Ω	R_{UV} at 150 °C Ω	L_{phase} mH	kt_0 factor at 150 °C Nm/A	Power connector type	Weight without brake kg	Maximum speed mech. rpm
MCS 19F14	194.5	1.30	1.75	20.8	3.23	EWS0001	23	4000
MCS 19F30	97.2	0.32	0.44	5.2	1.62	EWS0012	23	4000
MCS 19J14	199.1	0.65	0.88	12.8	3.31	EWS0001	30	4000
MCS 19J30	99.5	0.16	0.22	3.2	1.65	EWS0013	30	4000
MCS 19P14	216.4	0.54	0.73	9.6	3.66	EWS0001	40	4000
MCS 19P30	108.2	0.14	0.18	2.4	1.83	EWS0013	40	4000

MCS 19F

MCS 19J

MCS 19P

Servo controller assignment

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 4 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		2	4	8	12.7	17	20
Maximum current 0 Hz [1) 2)] [A]		2.3	4.6	9.1	18.1	27.2	36.3
Maximum current > 5 Hz [1) 2)] [A]		4	8	16	32	48	64
Motor type							
MCS 19F14	M_r			25.1	27.0		
	M_0			25.9	32.0		
	M_{max} n=0			28.6	54.6		
	M_{max}			48.9	86.0		
MCS 19F30	M_r				19.1	21.0	21.0
	M_0				20.5	27.5	32.0
	M_{max} n=0				27.2	40.5	53.0
	M_{max}				47.2	68.3	86.0
MCS 19J14	M_r				40.0	40.0	
	M_0				42.6	51.0	
	M_{max} n=0				58.9	85.0	
	M_{max}				97.9	129.0	
MCS 19J30	M_r					26.6	29.0
	M_0					28.4	33.4
	M_{max} n=0					42.6	56.9
	M_{max}					73.9	96.1
MCS 19P14	M_r				45.3	51.0	51.0
	M_0				46.4	62.2	64.0
	M_{max} n=0				64.6	95.3	123.8
	M_{max}				110.5	157.9	190.0
MCS 19P30	M_r					28.6	32.0
	M_0					31.2	36.7
	M_{max} n=0					45.8	61.1
	M_{max}					80.5	106.0

1) Caution: Limit I_{max} controller to I_{max} motor
2) Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply

Assignment of ECS servo system – axis modules

Rated and maximum torques at a switching frequency of 8 kHz							
Controller type		**ECS□A04**	**ECS□A08**	**ECS□A16**	**ECS□A32**	**ECS□A48**	**ECS□A64**
Continuous current [A]		1.4	2.7	5.3	8.5	11.3	13.3
Maximum current 0 Hz [1) 2) 3)] [A]		1.5	3	6	12.1	18.1	24.2
Maximum current > 5 Hz [1) 2) 3)] [A]		2.7	5.3	10.7	21.3	32	42.7
Motor type							
MCS 19F14	M_r				26.7	27.0	
	M_0				27.5	32.0	
	M_{max} n=0				37.9	54.6	
	M_{max}				62.9	86.0	
MCS 19F30	M_r					17.0	20.0
	M_0					18.3	21.5
	M_{max} n=0					27.2	36.3
	M_{max}					47.2	61.5
MCS 19J14	M_r					36.7	40.0
	M_0					37.9	44.6
	M_{max} n=0					58.9	76.7
	M_{max}					97.9	124.2
MCS 19J30	M_r						
	M_0						
	M_{max} n=0						
	M_{max}						
MCS 19P14	M_r					40.3	47.4
	M_0					41.3	48.6
	M_{max} n=0					64.6	85.5
	M_{max}					110.5	142.8
MCS 19P30	M_r						
	M_0						
	M_{max} n=0						
	M_{max}						

1) Caution: Limit I_{max} controller to I_{max} motor
2) Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
3) Caution: On the ECS automatic switching to 4 kHz not taken into account; when using automatic switching to 4 kHz, the maximum torques at 4 kHz apply

Servo controller assignment

Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 8 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.5	2.5	3.9	7	13	23.5	32	47	59	89
Maximum current 0 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	23.5	32	47	52	80
Maximum current > 5 Hz [1) 2)] [A]		2.3	3.8	5.9	10.5	19.5	35.25	48	70.5	88.5	133.5
Motor type											
MCS 19F14	M_r				22.0	27.0	27.0				
	M_0 [4)]				22.6	32.0	32.0				
	M_{max} n=0				33.0	58.2	68.3				
	M_{max}				33.0	58.2	86.0				
MCS 19F30	M_r					19.5	21.0	21.0			
	M_0 [4)]					21.0	32.0	32.0			
	M_{max} n=0					29.3	35.3	47.2			
	M_{max}					29.3	51.6	68.3			
MCS 19J14	M_r					40.0	40.0	40.0			
	M_0 [4)]					43.6	51.0	51.0			
	M_{max} n=0					63.1	74.7	97.9			
	M_{max}					63.1	106.2	129.0			
MCS 19J30	M_r						29.0	29.0	29.0	29.0	
	M_0 [4)]						39.3	51.0	51.0	51.0	
	M_{max} n=0						36.8	50.2	72.5	79.6	
	M_{max}						55.3	73.9	104.7	127.7	
MCS 19P14	M_r					46.4	51.0	51.0			
	M_0 [4)]					47.5	64.0	64.0			
	M_{max} n=0					69.5	83.2	110.5			
	M_{max}					69.5	120.6	157.9			
MCS 19P30	M_r						32.0	32.0	32.0	32.0	
	M_0 [4)]						43.1	58.7	64.0	64.0	
	M_{max} n=0						39.6	53.9	78.8	86.9	
	M_{max}						59.4	80.5	116.1	143.7	

[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

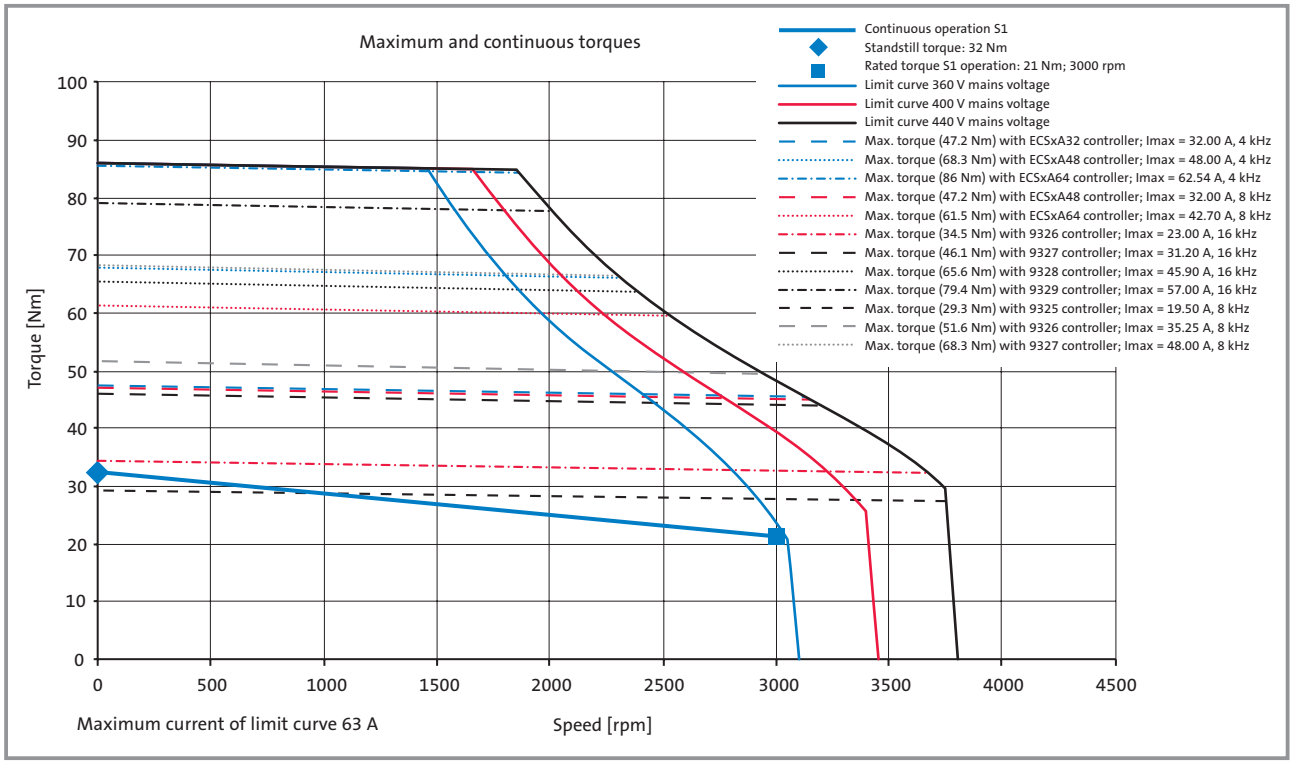
Servo controller 93□□ assignment

Rated and maximum torques at a switching frequency of 16 kHz											
Controller type		**9321**	**9322**	**9323**	**9324**	**9325**	**9326**	**9327**	**9328**	**9329**	**9330**
Continuous current [A]		1.1	1.8	2.9	5.2	9.7	15.3	20.8	30.6	38	58
Maximum current 0 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	15.3	20.8	30.6	33	45
Maximum current > 5 Hz [1) 2)] [A]		1.7	2.7	4.4	7.8	14.6	23	31.2	45.9	57	87
Motor type											
MCS 19F14	M_r					27.0	27.0	27.0			
	M_0 [4)]					31.4	32.0	32.0			
	M_{max} n=0					45.0	47.0	61.6			
	M_{max}					45.0	67.1	85.9			
MCS 19F30	M_r						21.0	21.0	21.0	21.0	
	M_0 [4)]						24.7	32.0	32.0	32.0	
	M_{max} n=0						23.0	31.2	45.2	48.5	
	M_{max}						34.5	46.1	65.6	79.4	
MCS 19J14	M_r					31.5	40.0	40.0	40.0		
	M_0 [4)]					32.5	51.0	51.0	51.0		
	M_{max} n=0					47.5	49.8	66.9	94.2		
	M_{max}					47.5	73.3	95.8	129.0		
MCS 19J30	M_r						24.0	29.0	29.0	29.0	29.0
	M_0 [4)]						25.6	34.8	51.0	51.0	51.0
	M_{max} n=0						24.0	32.6	48.0	51.7	69.6
	M_{max}						36.1	48.9	70.9	86.5	125.8
MCS 19P14	M_r						51.0	51.0	51.0	51.0	
	M_0 [4)]						56.0	64.0	64.0	64.0	
	M_{max} n=0						54.6	74.2	106.1	113.6	
	M_{max}						81.6	108.0	152.0	182.3	
MCS 19P30	M_r						25.8	32.0	32.0	32.0	32.0
	M_0 [4)]						28.1	38.1	56.1	64.0	64.0
	M_{max} n=0						25.8	35.0	51.5	55.6	75.6
	M_{max}						38.7	52.5	77.1	94.9	141.5

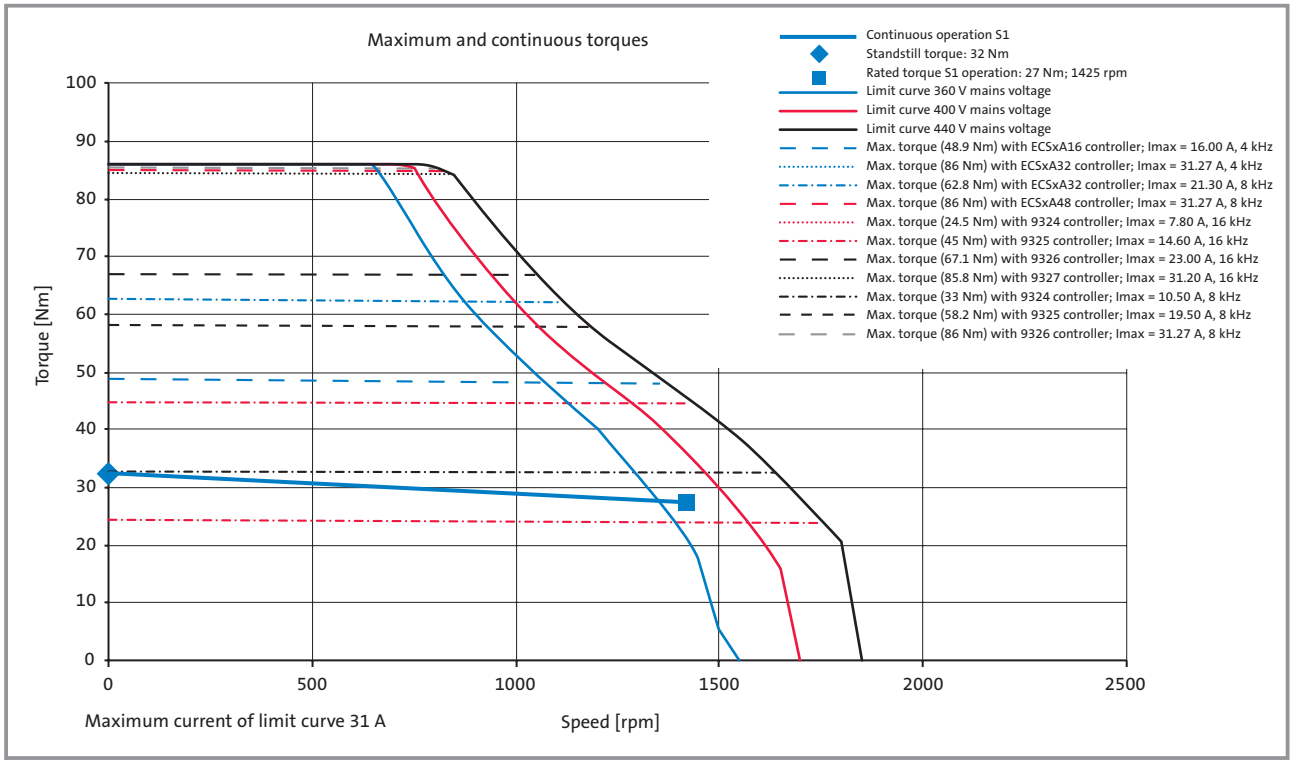
[1)] Caution: Limit I_{max} controller to I_{max} motor
[2)] Caution: Max. heatsink temperature 9300 = 80 °C/ECS = 90 °C and 400 V mains supply
[4)] On the 9329 and 9330 at frequencies > 5 Hz, derating below 5 Hz

Torque characteristics

MCS 19F30

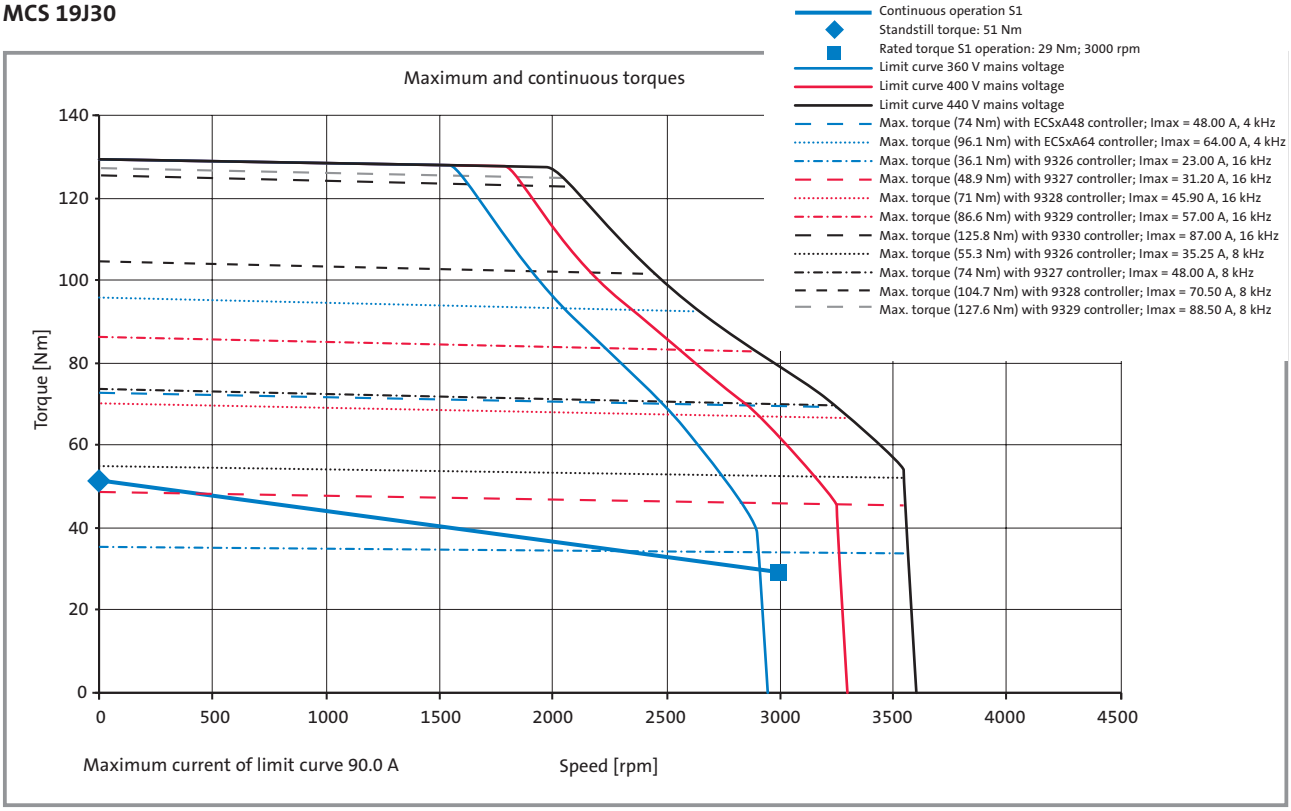


MCS 19F14

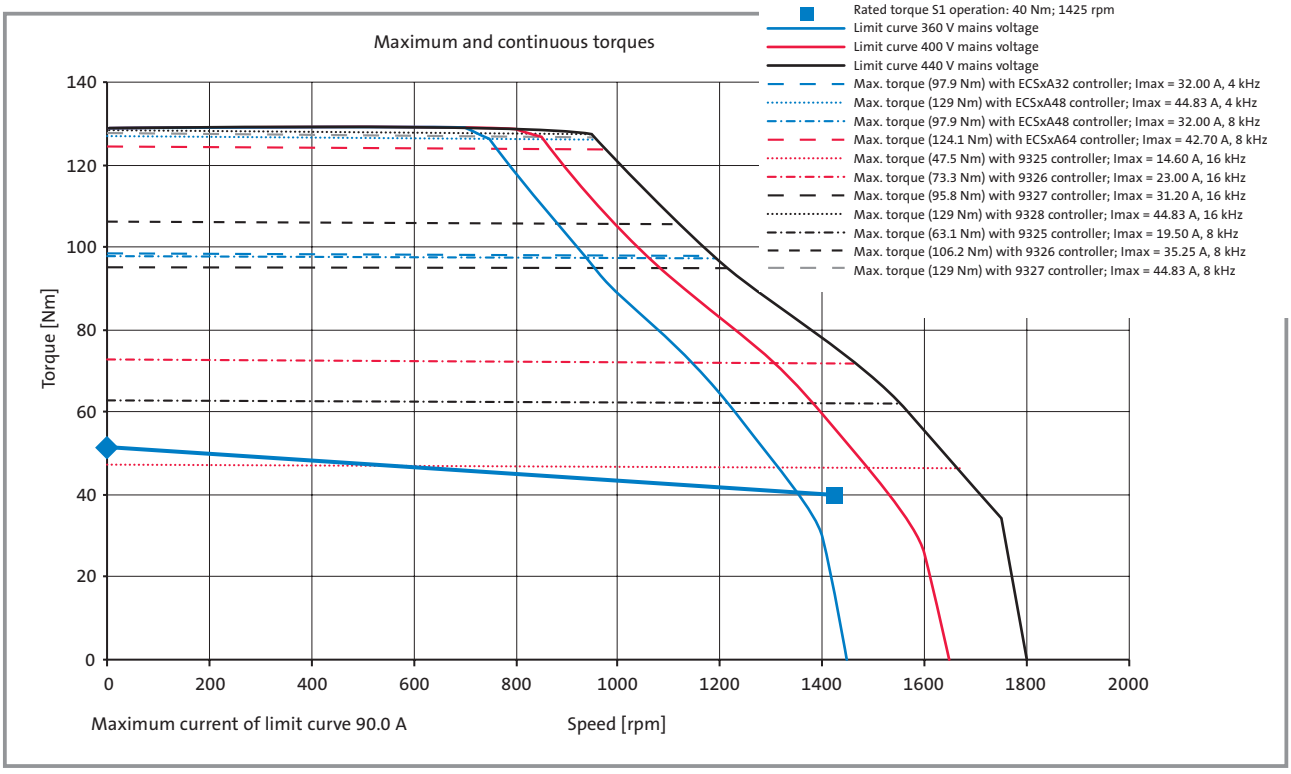


At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

MCS 19J30



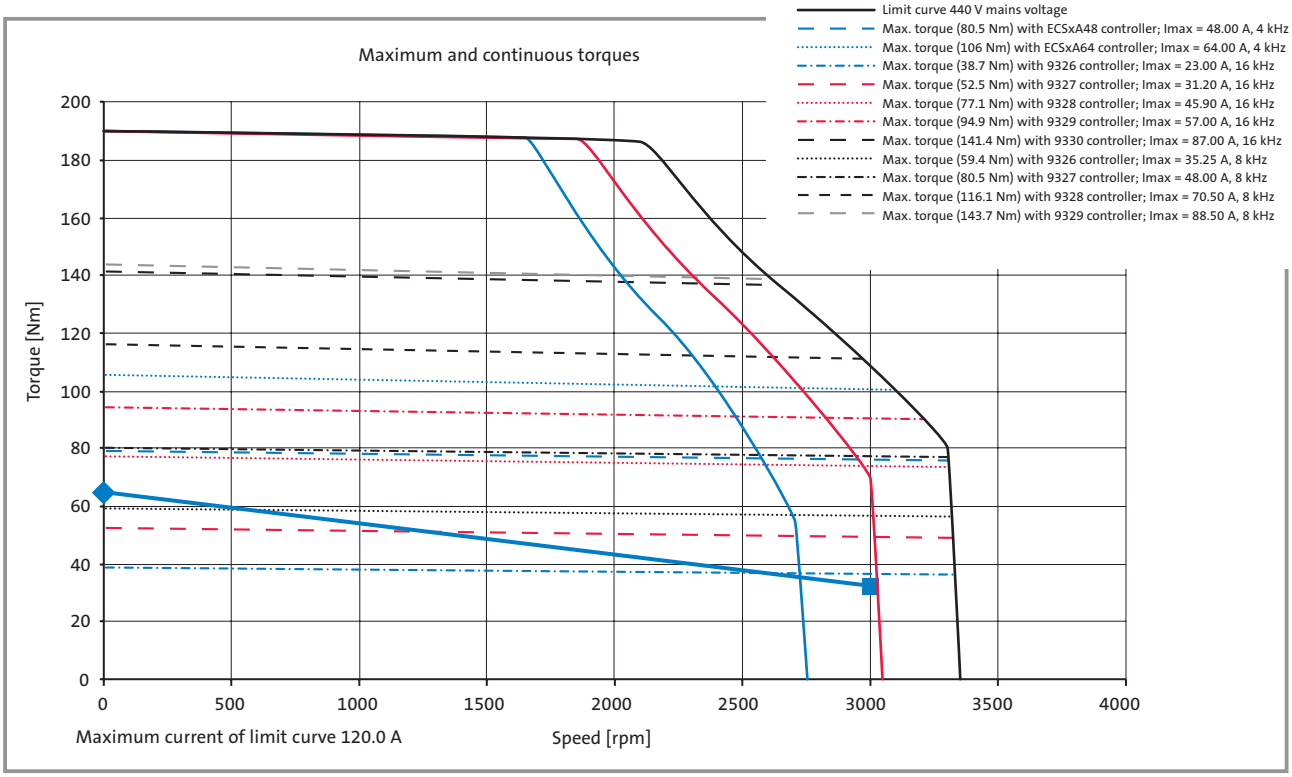
MCS 19J14



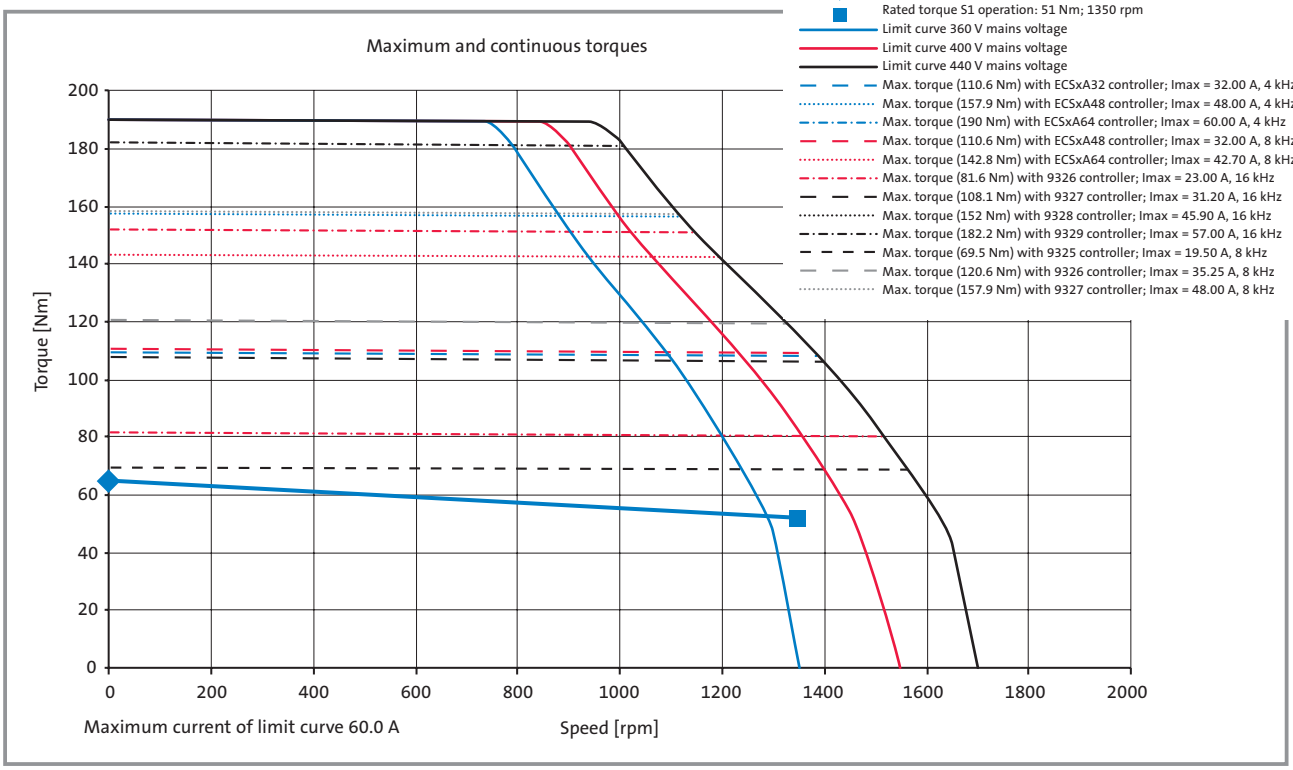
At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

Torque characteristics

MCS 19P30



MCS 19P14



At speeds < 75 rpm, servo controller derating may need to be taken into account. See "Servo controller assignment" tables.

Brake assignment

MCS synchronous servo motors can be fitted with integrated permanent-magnet holding brakes for 24 V DC.

The brakes are activated when the supply voltage is disconnected (closed-circuit principle).

If the brakes are used purely as holding brakes, there will be virtually no evidence of wear on the friction surfaces. As long as the permissible switching rate is not exceeded, at least 2000 emergency stop functions will be possible.

MCS 19F30, MCS 19F14

Type	Size	Holding torque M_4 20 °C Nm	Holding torque M_4 120 °C Nm	Average dynamic torque M_{1m} 120 °C Nm	U_B [3] +5 %. -10 % V	I_B [2] A	J_B kgcm²	Engagement time t1 [1] ms	Disengagement time t2 [1] ms	Maximum switching rate per emergency stop with n=3000 rpm J	Weight kg
P1	11H	37	32	15	24	0.93	12.4	96	113	2350	1.5

[1] Engagement and disengagement times valid for rated voltage (±0 %) and protective circuit for brakes with varistor for DC-side switching. The times may increase without a protective circuit.
[2] The currents are maximum values for a cold brake (data for dimensioning the power supply). The values for a motor at operating temperature are considerably lower.
[3] Smoothed DC voltage, ripple < 1 %

Permissible moments of inertia

Motor	Brake type	J_{mot} with brake kgcm²	Permissible J_{load}/J_{mot}
MCS 19F	P1	77.4	5.2

If the permissible moments of inertia opposite are adhered to, the permissible maximum switching rate of the brake will not be exceeded and up to 2000 emergency stop functions will be possible at a speed of 3000 rpm.

Caution:
The brakes used are not fail-safe brakes in the true sense because certain types of faults, e.g. oil leakage, can cause a loss of torque.

If long motor cables are being used, the ohmic voltage drop along the cable should be taken into account and compensated by applying a higher voltage at the cable input. The equation below is valid for Lenze system cables:

U_B [V] = 0.08 x I_{cable} [m] x I_B [A]

If an appropriate voltage is not supplied to the brake (incorrect dimension, incorrect polarity), the brake will engage and the continuing rotation of the motor could cause it to overheat, leading to irreparable damage.

DC-side switching helps to minimise brake response times. A spark suppressor is required for interference suppression and to increase the service life of the relay contacts.

Brake assignment MCS 19

Motor	Brake P1	Brake P2
MCS 19F□□	●	
MCS 19J□□		●
MCS 19P□□		●

Brake assignment

MCS 19J30, MCS 19J14
MCS 19P30, MCS 19P14

Type	Size	Holding torque M_4 20 °C Nm	Holding torque M_4 120 °C Nm	Average dynamic torque M_{1m} 120 °C Nm	U_B [3] +5 %. -10 % V	I_B [2] A	J_B kgcm²	Engagement time t1 [1] ms	Disengage-ment time t2 [1] ms	Maximum switching rate per emergency stop with n=3000 rpm J	Weight kg
P2	14H	100	80	43	24	1.29	30	30	90	2100	4.3

P2 Standard brake

1) Engagement and disengagement times valid for rated voltage (±0 %) and protective circuit for brakes with varistor for DC-side switching. The times may increase without a protective circuit.

2) The currents are maximum values for a cold brake (data for dimensioning the power supply). The values for a motor at operating temperature are considerably lower.

3) Smoothed DC voltage, ripple < 1 %

2

Permissible moments of inertia

Motor	Brake type	J_{mot} with brake kgcm²	Permissible J_{load}/J_{mot}
MCS 19J	P2	135	2.2
MCS 19P	P2	190	1.2

If the permissible moments of inertia opposite are adhered to, the permissible maximum switching rate of the brake will not be exceeded and up to 2000 emergency stop functions will be possible at a speed of 3000 rpm.

Caution:
The brakes used are not fail-safe brakes in the true sense because certain types of faults, e.g. oil leakage, can cause a loss of torque.

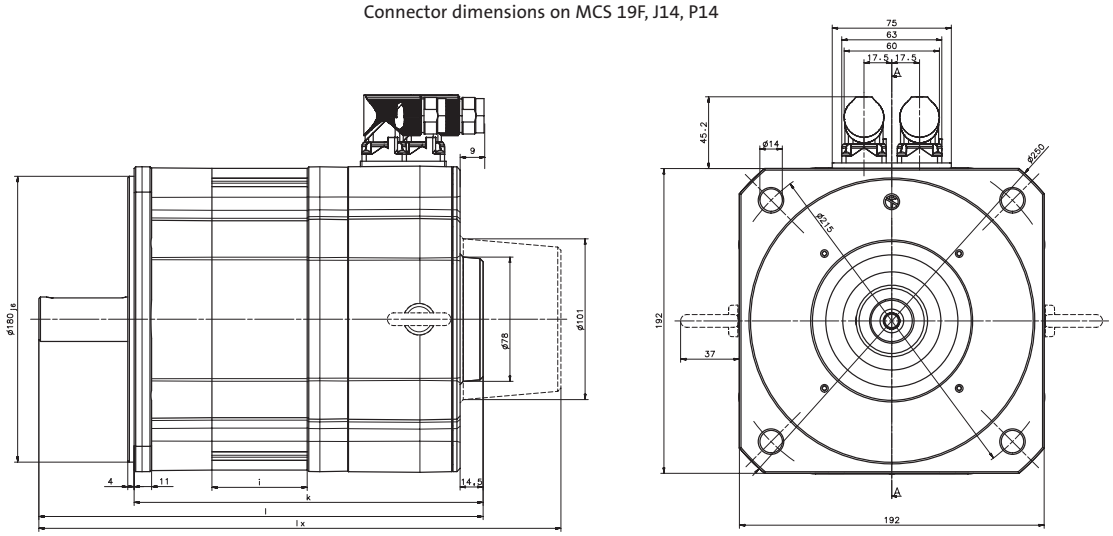
If long motor cables are being used, the ohmic voltage drop along the cable should be taken into account and compensated by applying a higher voltage at the cable input. The equation below is valid for Lenze system cables:
U_B [V] = 0.08 x I_{cable} [m] x I_B [A]

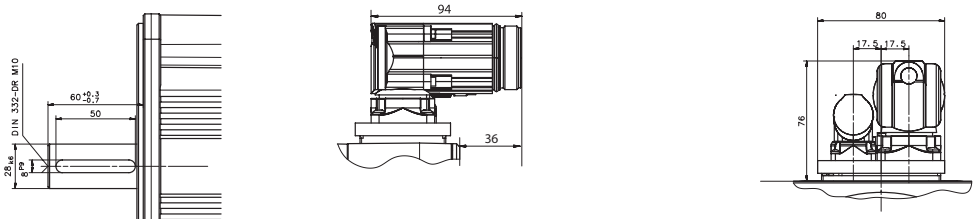
If an appropriate voltage is not supplied to the brake (incorrect dimension, incorrect polarity), the brake will engage and the continuing rotation of the motor could cause it to overheat, leading to irreparable damage.

DC-side switching helps to minimise brake response times. A spark suppressor is required for interference suppression and to increase the service life of the relay contacts.

Mechanical dimensions

Connector dimensions on MCS 19F, J14, P14





Connector dimensions on MCS 19J30, P30

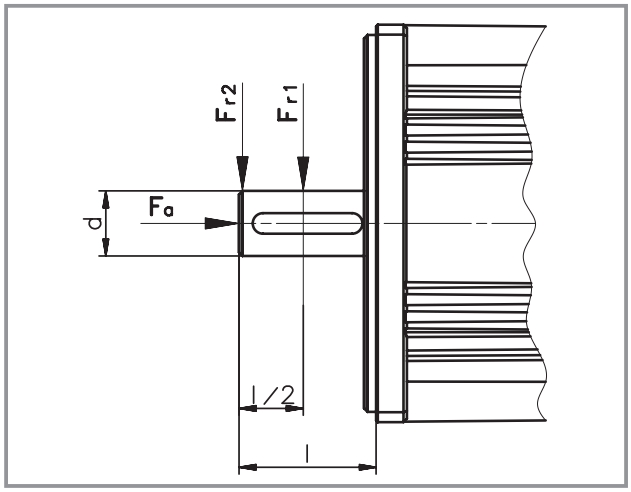
Featherkey 8 x 50 mm
(according to DIN 6885, sheet 1)

Motor type	Motor **without** holding brake				Motor **with** holding brake			
	i [mm]	k [mm]	l [mm]	lx [mm]	i [mm]	k [mm]	l [mm]	lx [mm]
MCS 19F	60	220	280	329	60	254	314	363
MCS 19J	100	260	320	369	100	304	364	413
MCS 19P	160	320	380	429	160	364	424	473

l Motor length with installation of a resolver as feedback
lx Motor length with installation of an absolute value encoder as feedback
i Length of coil module

Permissible shaft loads

Forces on the motor shaft



The following diagrams provide a simple means of determining:

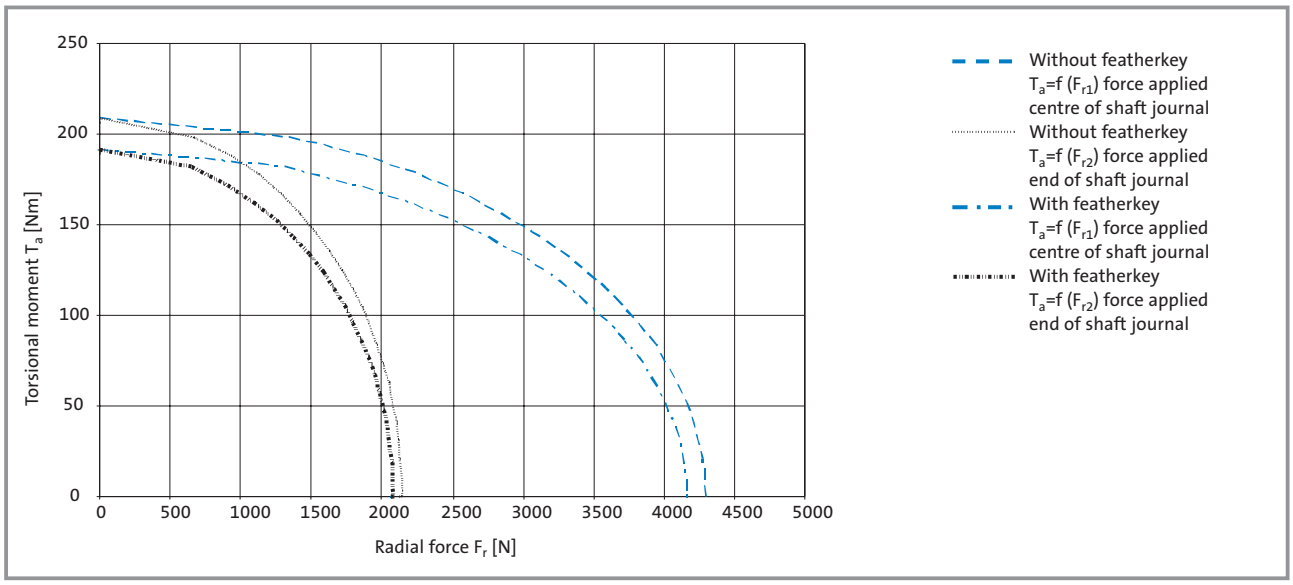
a) The maximum permissible radial force along with the corresponding maximum permissible torsional moment on the motor shaft.

b) The service life of the roller bearings on the basis of the forces and torques calculated.

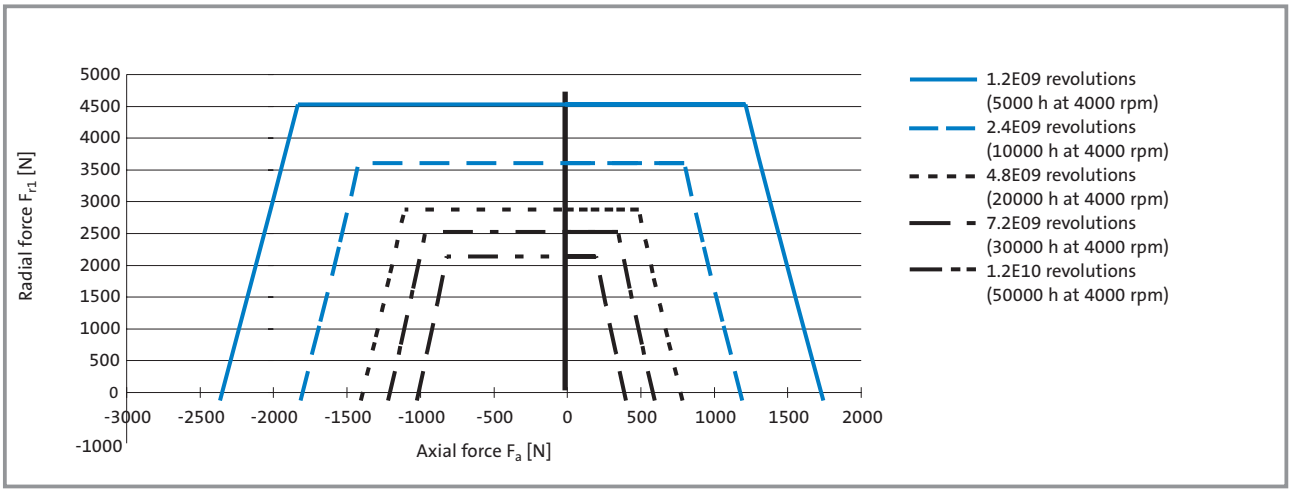
Service life is calculated as follows:

$$\frac{\text{No. of bearing revolutions}}{\text{n [rpm] x 60}} = \text{Bearing service life [h]}$$

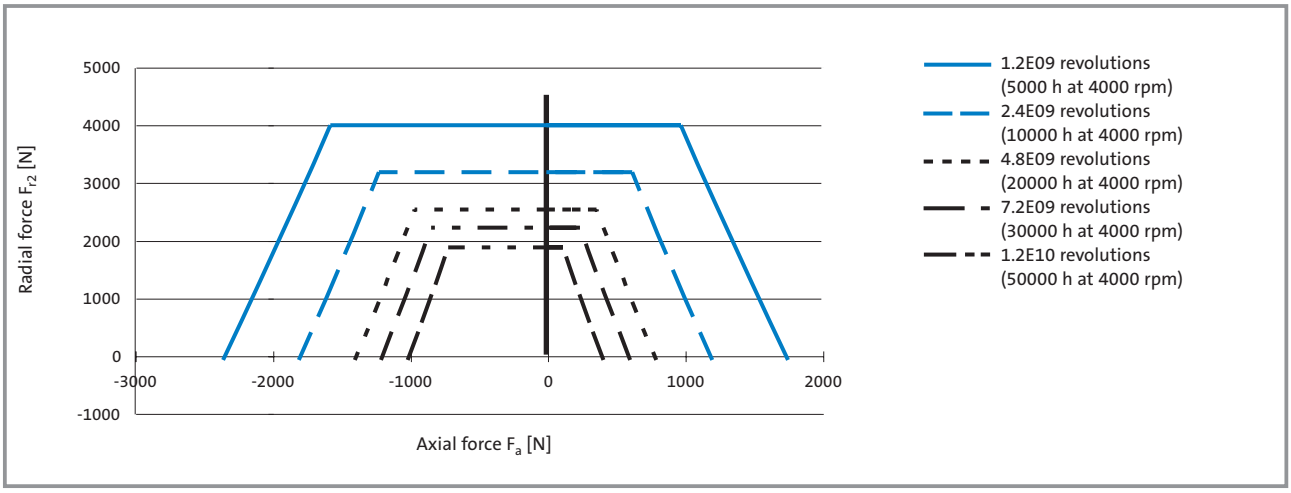
The characteristics are valid for all MCS 19 frame sizes



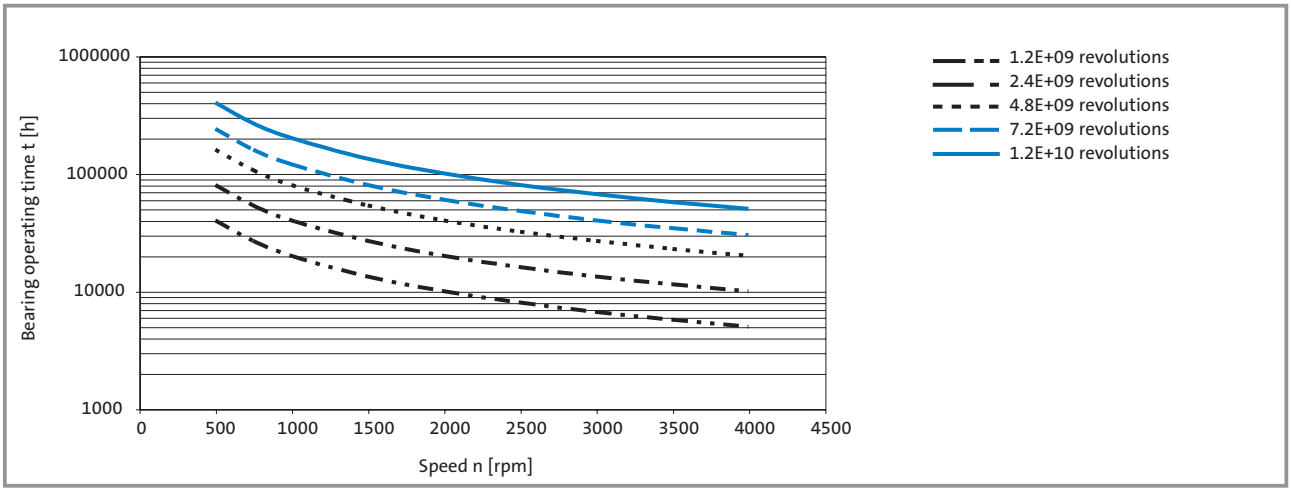
Relationship between radial force and torsional moment on shaft



Permissible radial force F_{r1} and axial force F_a on shaft



Permissible radial force F_{r2} and axial force F_a on shaft



Relationship between the number of total bearing revolutions, bearing service life and the average speed of the drive

Tailored to meet the requirements of the various applications and necessary accuracies, the following feedback systems are available for the MCS range of motors.

Controller type	Resolver	Single-turn SinCos encoder SRS 50	Multi-turn SinCos encoder SRM 50
93□□	●		
ECS servo system	●	●	●

SinCos single-turn (SCS70) and multi-turn (SCM70) absolute value encoders for 93□□ on request.

Resolvers

Stator-fed resolver with two stator windings offset by 90° and one rotor winding with transformer winding.

Abbreviation	RS0
Resolution	0.8‘
Accuracy	±10‘
Absolute position control	1 revolution
Design	Brushless hollow shaft "pancake" resolver
Max. speed (continuous)	8000 rpm
Max. speed (short-time)	10000 rpm
Input voltage	10 V amplitude
Input frequency	4 kHz
Stator/rotor ratio	0.3 ± 5%
Rotor impedance Z_{ro}	51 Ω + j90 Ω
Stator impedance Z_{s0}	102 Ω + j150 Ω
Impedance Z_{rs}	44 Ω + j76 Ω
Insulation resistance	>10 MΩ at 500 V DC
Number of pole pairs	1
Max. angle error	±10 angular minutes

SinCos absolute value encoders

SinCos absolute value encoder SRS 50/SRM 50
These types of encoder are needed if high accuracies are required when using MCS motors with ECS servo system axis modules.

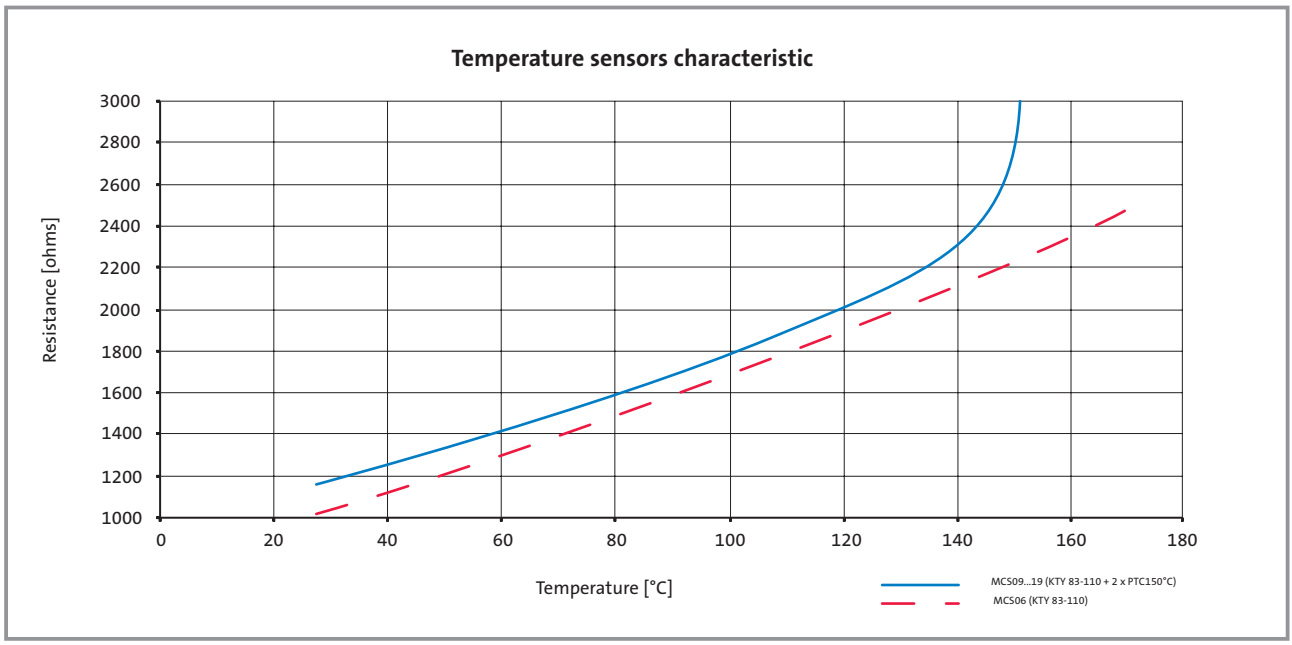
Absolute encoder with two sinusoidal signals offset by 90° with 1024 pulses per revolution and RS485 serial interface for transmitting parameters and the absolute position within one (SRS 50) or 4096 (SRM 50) revolutions.

Abbreviation	SRS/SRM 50
Resolution	0.4‘
Accuracy	±0.8‘
Absolute position control	1 revolution/4096 revolutions
Design	Brushless hollow shaft encoder
Max. speed	9000 rpm
No. of pulses	1024 pulses/revolution
Output signals	two sinusoidal signals offset by 90° with 1 V_{pp}, RS485 serial interface, asynchronous, half-duplex
Limit frequency	100 kHz
Supply voltage	7 ... 12 V
Current consumption	50 ... 100 mA

The temperature sensors used in the MCS motors ensure the absolute and reliable detection of excess winding temperatures on every type of motor and in every operational situation. The temperature information is transmitted to the servo controller via the feedback system's system cable. Due to differing physical conditions, MCS motors feature two different types of temperature monitoring mechanism:

MCS 06
On this motor, the winding temperature of a winding phase is monitored using a KTY 83-110 type temperature sensor. In addition, the overall motor temperature is determined/ monitored using a temperature model in the connected controller. This calculation model, which has been designed specifically for this motor, also ensures that the overtemperature response configured in the controller will be triggered reliably and in good time should excess temperatures occur in winding phases not monitored by the KTY.

MCS 09-MCS 19
These motors are monitored using three temperature sensors connected in series (1x KTY 83-110 + 2xPTC 150 °C). This ensures that the temperature of the motor can be detected with a high degree of accuracy in the permitted operating range and that the overtemperature response configured in the controller will be triggered reliably and in good time should an overtemperature occur in one of the winding phases.

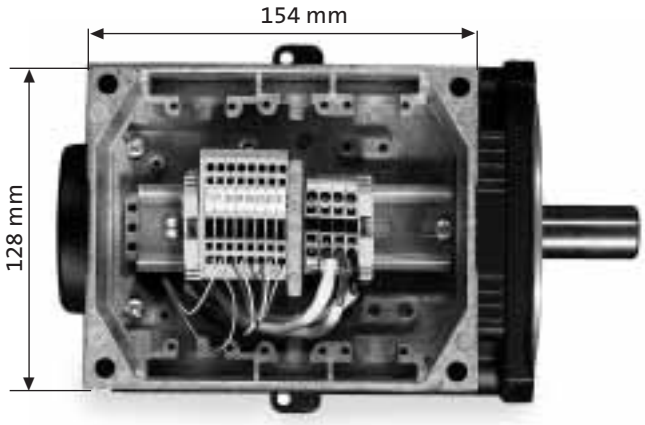


If the detector is supplied with a measured current of 1 mA, the above relationship between the temperature and the resistance applies.

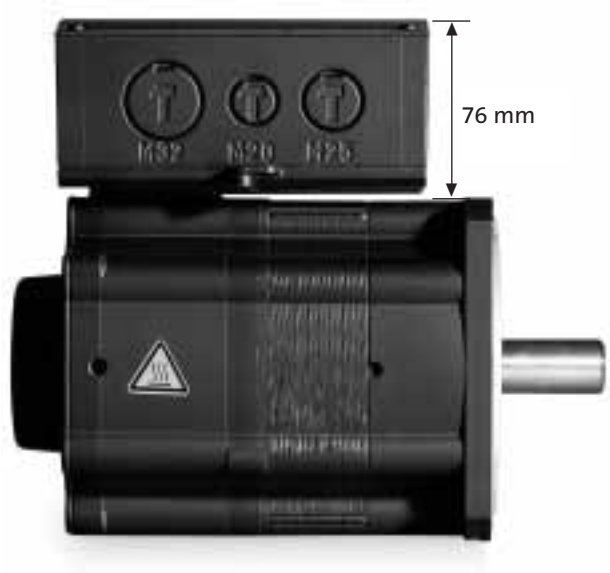
Note:
To ensure trouble-free operation, the temperature sensor must be connected to the servo controller with the correct polarity.

If an MCS servo motor is to be connected to an existing cable or plug connectors are not to be used for other reasons, the connection can also be made via a terminal box. In order to ensure the required vibration resistance of the cable connectors in the long term with sufficient contact pressure, tension spring terminals are used.

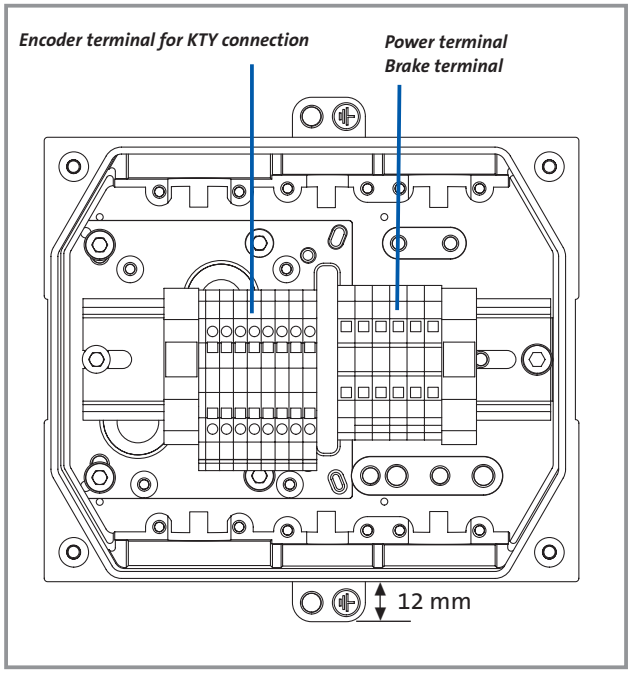
The terminal box features sufficient space for customer wiring and large shield connection surfaces for a safe EMC-compliant connection. The outgoing cable can be routed to the right or left-hand side according to requirements.



View from above of the MCS 14D with terminal box



Side view of the MCS 14D with terminal box



Internal view of terminal box

Openings for cable glands:

- 2 x M20, 2 x M25, 2 x M32
- Openings are cast-closed and can be opened by the customer if required

Terminal assignment for power connection

Terminal	Connection	Wire colour
U	Motor phase	red or black
V	Motor phase	blue
W	Motor phase	black or red
PE	Brake	green/yellow
Y1	Brake	–
Y2	Brake	–

Permissible cable cross-sections for power connection terminals

Motor	2.5 mm²	4 mm²	10 mm²
MCS 09 (all frame sizes)	●	●*)	
MCS 12 (all frame sizes)	●	●*)	
MCS 14D, H	●	●*)	
MCS 14 L15	●	●*)	
MCS 14L32			●
MCS 14P14	●	●*)	
MCS 14P32			●
MCS 19F15	●	●*)	
MCS 19F30			●
MCS 19J15	●	●*)	
MCS 19J30			●
MCS 19P			●

*) If wire end ferrules are not used

Terminal assignment for feedback and temperature monitoring

Resolver			Absolute value encoder (SRX50)			Cross-section
Terminal	Connection	Wire colour	Terminal	Connection	Wire colour	mm²
S1	Thermostat		S1	Thermostat		0.14/0.21
S2	Thermostat		S2	Thermostat		0.14/0.21
T1	KTY temp. sensor (+)		T1	KTY temp. sensor (+)		0.14/0.21
T2	KTY temp. sensor (-)		T2	KTY temp. sensor (-)		0.14/0.21
P1	PTC thermistor		P1	PTC thermistor		0.14/0.21
P2	PTC thermistor		P2	PTC thermistor		0.14/0.21
B1	+REF	red/white	B1	VCC power supply	red	0.14/0.21
B2	-REF	yellow/white	B2	Earth GND	blue	0.14/0.21
B3	–	–	B3	+COS	pink	0.14/0.21
B4	+ COS	red	B4	-COS	black	0.14/0.21
B5	- COS	black	B5	+SIN	white	0.14/0.21
B6	+ SIN	yellow	B6	-SIN	brown	0.14/0.21
B7	- SIN	blue	B7	Data+ RS485	grey	0.14/0.21
–	–	–	B8	Data- RS485	green	0.14/0.21

Accessories

MCS synchronous servo motors

General

In order to ensure a trouble-free, safe and time-saving connection for the power supply, brakes and feedback systems for all MCS servo motor applications, an extensive selection of prefabricated system cables in lengths from 1 m to 100 m (other lengths on request) is available.

Motor cables

Lenze can provide an extensive selection of prefabricated cables for the trouble-free and EMC-compliant connection of MCS servo motors to Lenze 93□□ servo controllers and the ECS servo system.

Use the tables below to select the optimum cable type for your motor:

Motor	Connector type	Core cross-section [mm²]	Length [m]	Order designation motor cable	Cable diameter [mm]	Bend radius laying fixed	Bend radius laying flexible*
MCS 06C41 MCS 06C60 MCS 06I41 MCS 06I60 MCS 09F38 MCS 09F60 MCS 09H41 MCS 09H60 MCS 12H15 MCS 12H35 MCS 12L20 MCS 14D15 MCS 14D36 MCS 14H15 MCS 19F14	EWS0001	1.5	1	EWLM001GM-015C	13.5	7.5 x d	15 x d
			2.5	EWLM002GM-015C	13.5	7.5 x d	15 x d
			5	EWLM005GM-015C	13.5	7.5 x d	15 x d
			10	EWLM010GM-015C	13.5	7.5 x d	15 x d
			15	EWLM015GM-015C	13.5	7.5 x d	15 x d
			20	EWLM020GM-015C	13.5	7.5 x d	15 x d
			25	EWLM025GM-015C	13.5	7.5 x d	15 x d
			30	EWLM030GM-015C	13.5	7.5 x d	15 x d
			35	EWLM035GM-015C	13.5	7.5 x d	15 x d
			40	EWLM040GM-015C	13.5	7.5 x d	15 x d
			45	EWLM045GM-015C	13.5	7.5 x d	15 x d
			50	EWLM050GM-015C	13.5	7.5 x d	15 x d
			75	EWLM075GM-015C	13.5	7.5 x d	15 x d
			100	EWLM100GM-015C	13.5	7.5 x d	15 x d
MCS 12L41 MCS 14H32 MCS 14L15 MCS 14P14 MCS 19J14 MCS 19P14	EWS0001	2.5	1	EWLM001GM-025	11.3	7.5 x d	15 x d
			2.5	EWLM002GM-025	11.3	7.5 x d	15 x d
			5	EWLM005GM-025	11.3	7.5 x d	15 x d
			10	EWLM010GM-025	11.3	7.5 x d	15 x d
			15	EWLM015GM-025	11.3	7.5 x d	15 x d
			20	EWLM020GM-025	11.3	7.5 x d	15 x d
			25	EWLM025GM-025	11.3	7.5 x d	15 x d
			30	EWLM030GM-025	11.3	7.5 x d	15 x d
			35	EWLM035GM-025	11.3	7.5 x d	15 x d
			40	EWLM040GM-025	11.3	7.5 x d	15 x d
			45	EWLM045GM-025	11.3	7.5 x d	15 x d
			50	EWLM050GM-025	11.3	7.5 x d	15 x d
			75	EWLM075GM-025	11.3	7.5 x d	15 x d
			100	EWLM100GM-025	11.3	7.5 x d	15 x d

Motor type	Connector type	Core cross-section [mm²]	Length [m]	Order designation motor cable	Cable diameter [mm]	Bend radius laying fixed	Bend radius laying flexible*
MCS 19F30	EWS0012	4	1	EWLM001GM-040I	13.5	7.5 x d	15 x d
			2.5	EWLM002GM-040I	13.5	7.5 x d	15 x d
			5	EWLM005GM-040I	13.5	7.5 x d	15 x d
			10	EWLM010GM-040I	13.5	7.5 x d	15 x d
			15	EWLM015GM-040I	13.5	7.5 x d	15 x d
			20	EWLM020GM-040I	13.5	7.5 x d	15 x d
			25	EWLM025GM-040I	13.5	7.5 x d	15 x d
			30	EWLM030GM-040I	13.5	7.5 x d	15 x d
			35	EWLM035GM-040I	13.5	7.5 x d	15 x d
			40	EWLM040GM-040I	13.5	7.5 x d	15 x d
			45	EWLM045GM-040I	13.5	7.5 x d	15 x d
			50	EWLM050GM-040I	13.5	7.5 x d	15 x d
			75	EWLM075GM-040I	13.5	7.5 x d	15 x d
			100	EWLM100GM-040I	13.5	7.5 x d	15 x d
MCS 14 L32 MCS 14 P32 MCS 19 J30 MCS 19 P30	EWS0013	10	1	EWLM001GM-100I	19.5	7.5 x d	15 x d
			2.5	EWLM002GM-100I	19.5	7.5 x d	15 x d
			5	EWLM005GM-100I	19.5	7.5 x d	15 x d
			10	EWLM010GM-100I	19.5	7.5 x d	15 x d
			15	EWLM015GM-100I	19.5	7.5 x d	15 x d
			20	EWLM020GM-100I	19.5	7.5 x d	15 x d
			25	EWLM025GM-100I	19.5	7.5 x d	15 x d
			30	EWLM030GM-100I	19.5	7.5 x d	15 x d
			35	EWLM035GM-100I	19.5	7.5 x d	15 x d
			40	EWLM040GM-100I	19.5	7.5 x d	15 x d
			45	EWLM045GM-100I	19.5	7.5 x d	15 x d
			50	EWLM050GM-100I	19.5	7.5 x d	15 x d
			75	EWLM075GM-100I	19.5	7.5 x d	15 x d
			100	EWLM100GM-100I	19.5	7.5 x d	15 x d

The motor cable assignments have been dimensioned according to the current capacities specified in IEC 60204-1, laying system C, for continuous operation conditions with motor standstill current (I_0) at an ambient air temperature of 40 °C for PVC-insulated cables. Should conditions differ (laying system, ambient conditions, cable type, motor load), it is the responsibility of the user to install a cable set which is appropriate for the prevailing conditions and the applicable standards and legislation.

Motor cables suitable for trailing

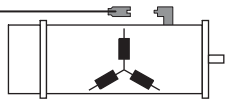
Motor type	Connector type	Core cross-section [mm²]	Length [m]	Order designation motor cable	Cable diameter [mm]	Bend radius laying	
						fixed	trailing cable
MCS 06C41 MCS 06C60 MCS 06I41 MCS 06I60 MCS 09F38 MCS 09F60 MCS 09H41 MCS 09H60 MCS 12H15 MCS 12H35 MCS 12L20 MCS 12L41 MCS 14D15 MCS 14D36 MCS 14H15 MCS 14H32 MCS 14L15 MCS 14P14 MCS 19F14 MCS 19J14 MCS 19P14	EWS0001	2.5					
			2.5	EWLM002GMS025	12.8	5 x d	10 x d
			5	EWLM005GMS025	12.8	5 x d	10 x d
			10	EWLM010GMS025	12.8	5 x d	10 x d
			15	EWLM015GMS025	12.8	5 x d	10 x d
			20	EWLM020GMS025	12.8	5 x d	10 x d
			25	EWLM025GMS025	12.8	5 x d	10 x d
			30	EWLM030GMS025	12.8	5 x d	10 x d
			40	EWLM040GMS025	12.8	5 x d	10 x d
			50	EWLM050GMS025	12.8	5 x d	10 x d
			75	EWLM075GMS025	12.8	5 x d	10 x d
			100	EWLM100GMS025	12.8	5 x d	10 x d

The motor cable assignments have been dimensioned according to the current capacities specified in IEC 60204-1, laying system C, for continuous operation conditions with motor standstill current (I_0) at an ambient air temperature of 40 °C for PVC-insulated cables. Should conditions differ (laying system, ambient conditions, cable type, motor load), it is the responsibility of the user to install a cable set which is appropriate for the prevailing conditions and the applicable standards and legislation.

Other cables suitable for trailing are available on request.

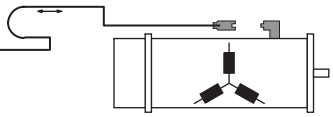
Motor cable
Standard cable

1.5 mm² EWLM□□□GM-015
2.5 mm² EWLM□□□GM-025
4.0 mm² EWLM□□□GM-040I
10.0 mm² EWLM□□□GM-100I



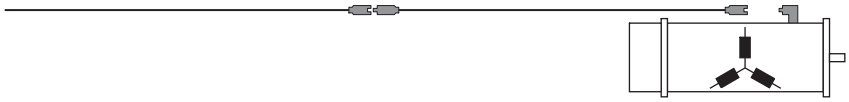
Cable suitable for trailing

2.5 mm² EWLM□□□GMS025



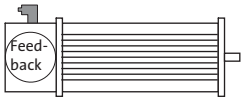
Intermediate cable

1.5 mm² EWLM□□□GZ-015 EWLM□□□ZM-015



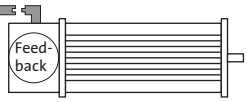
Resolver and encoder cable
Standard cable

ECS□A
93□□
X7
X8
EWLR□□□GM-T or
EWLE□□□GM-T



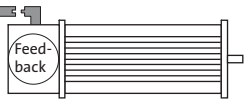
Intermediate cable

EWLR□□□GM-T
or EWLR□□□GM
EWLR□□□ZM-T



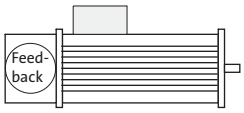
Intermediate cable suitable for trailing

EWLR□□□GM-T
or EWLR□□□GM
EWLR□□□ZMST



Standard cable for terminal box connection
Controller-side connector

ECS□A
93□□
X7
X8
EWLR□□□GX or
EWLE□□□GX



Cables for feedback systems

Cable for resolver – servo controller, including temperature monitoring

Cable length [m]	Order designation
2.5	EWLR002GM-T
5.0	EWLR005GM-T
10.0	EWLR010GM-T
15.0	EWLR015GM-T
20.0	EWLR020GM-T
25.0	EWLR025GM-T
30.0	EWLR030GM-T
35.0	EWLR035GM-T
40.0	EWLR040GM-T
45.0	EWLR045GM-T
50.0	EWLR050GM-T
75.0	EWLR075GM-T
100.0	EWLR100GM-T

Cable for resolver – controller, motor-side terminal connection, including temperature monitoring

Cable length [m]	Order designation
2.5	EWLR002GX-T
5.0	EWLR005GX-T
10.0	EWLR010GX-T
15.0	EWLR015GX-T
20.0	EWLR020GX-T
25.0	EWLR025GX-T
30.0	EWLR030GX-T
35.0	EWLR035GX-T
40.0	EWLR040GX-T
45.0	EWLR045GX-T
50.0	EWLR050GX-T
75.0	EWLR075GX-T
100.0	EWLR100GX-T

Cable for resolver – adapter plug, including temperature monitoring

Cable length [m]	Order designation
2.5	EWLR002ZM-T
5.0	EWLR005ZM-T
10.0	EWLR010ZM-T
15.0	EWLR015ZM-T
20.0	EWLR020ZM-T
25.0	EWLR025ZM-T
30.0	EWLR030ZM-T
35.0	EWLR035ZM-T
40.0	EWLR040ZM-T
45.0	EWLR045ZM-T
50.0	EWLR050ZM-T

Cable suitable for trailing for resolver – adapter plug, including temperature monitoring

Cable length [m]	Order designation
5.0	EWLR005ZMST
10.0	EWLR010ZMST
15.0	EWLR015ZMST
20.0	EWLR020ZMST
25.0	EWLR025ZMST
30.0	EWLR030ZMST
35.0	EWLR035ZMST
40.0	EWLR040ZMST
45.0	EWLR045ZMST
50.0	EWLR050ZMST
75.0	EWLR075ZMST
100.0	EWLR100ZMST

Cable for absolute value encoder – controller, including temperature monitoring

Cable length [m]	Order designation
2.5	EWLE002GM-T
5.0	EWLE005GM-T
10.0	EWLE010GM-T
15.0	EWLE015GM-T
20.0	EWLE020GM-T
25.0	EWLE025GM-T
30.0	EWLE030GM-T
35.0	EWLE035GM-T
40.0	EWLE040GM-T
45.0	EWLE045GM-T
50.0	EWLE050GM-T
75.0	EWLE075GM-T
100.0	EWLE100GM-T

Cable for absolute value encoder – controller, motor-side terminal connection, including temperature monitoring

Cable length [m]	Order designation
2.5	EWLE002GX-T
5.0	EWLE005GX-T
10.0	EWLE010GX-T
15.0	EWLE015GX-T
20.0	EWLE020GX-T
25.0	EWLE025GX-T
30.0	EWLE030GX-T
35.0	EWLE035GX-T
40.0	EWLE040GX-T
45.0	EWLE045GX-T
50.0	EWLE050GX-T
75.0	EWLE075GX-T
100.0	EWLE100GX-T

Cable suitable for trailing for absolute value encoder – adapter plug, including temperature monitoring

Cable length [m]	Order designation
5.0	EWLE005ZMST
10.0	EWLE010ZMST
15.0	EWLE015ZMST
20.0	EWLE020ZMST
25.0	EWLE025ZMST
30.0	EWLE030ZMST

Power connectors

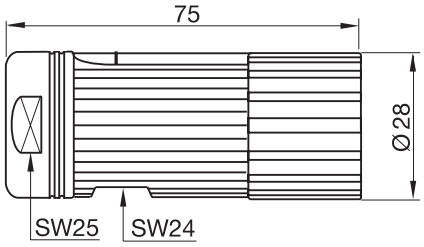
For applications in which Lenze system cables cannot be used but motors with plug connectors are to be used, Lenze can provide appropriate connectors for the assembly of cable sets by the customer.

In accordance with the power requirements of the motors, two different frame sizes are available. Please see the table on pages 3-2 to 3-4 for the assignment of the connector type to the motor frame size.

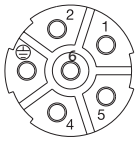
Power connector EWS0001

Power connector EWS0012, EWS0013

Main dimensions
Connector EWS0001



Pin diagram EWS0001
View from connector side

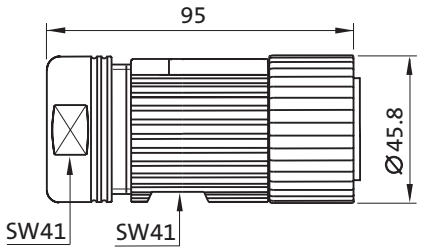


	Pin no.	Terminal designation
Holding brake +UB	1	Y1/BD1
Holding brake -UB	2	Y2/BD2
Earthing PE	⊥	⊥
Motor phase U	4	U
Motor phase V	5	V
Motor phase W	6	W

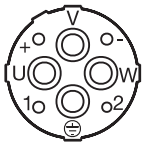
Contact assignment EWS0001

Order number: **EWS0001**

Main dimensions
Connector EWS0012, EWS0013



Pin diagram EWS0012, EWS0013
View from connector side



	Pin no.	Terminal designation
Holding brake +UB	+	Y1/BD1
Holding brake -UB	-	Y2/BD2
Earthing PE	⊥	⊥
Motor phase U	U	U
Motor phase V	V	V
Motor phase W	W	W

Contact assignment EWS0012, EWS0013

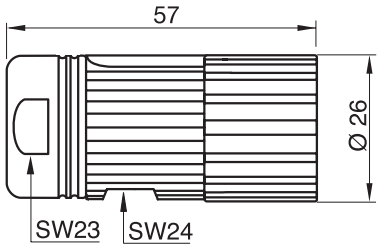
Order number: **EWS0012** (for 4 mm²)
EWS0013 (for 6-16 mm²)

Connectors for feedback systems

Resolver

Connector for resolver EWS 0006

Main dimensions
Connector



Pin diagram
View from connector side

Pin no.	Terminal designation	Meaning
1 2	+Ref -Ref	Transformer windings (reference windings)
3		Not used
4 5	+Cos -Cos	Stator windings Cosine
6 7	+Sin -Sin	Stator windings Sine
8 9 10		Not used
11 12	+KTY -KTY	Temperature sensor + Temperature sensor -

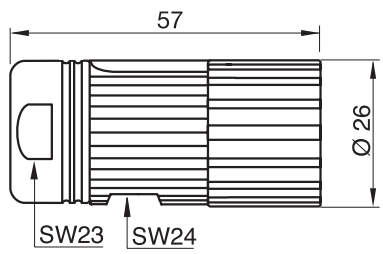
Contact assignment EWS0006

Order number: **EWS0006**

SinCos absolute value encoder

Connector for SinCos encoder EWS 0018

Main dimensions
Connector



Pin diagram
View from connector side

Pin no.	Terminal designation	Meaning
1	B	Track B/+Sin
2 3	$\overline{A}$ A	Track A inverse/-COS Track A/+COS
4 5	+5 V GND	Power supply +5 V/+8 V Earth
6 7	$\overline{Z}$ Z	Zero track inverse/-RS485 Zero track/+RS485
8		Not used
9	$\overline{B}$	Track B inverse/-SIN
10		Not used
11 12	+KTY -KTY	Temperature sensor + Temperature sensor -

Contact assignment EWS0018

Order number: **EWS0018**

Services | MCS synchronous servo motors

For us, service is more than just supporting the use of our drives. The Lenze system approach begins with your enquiry. Next you get technical information and advice from a network of sales outlets staffed by knowledgeable engineers. If you want, we follow up with training, commissioning, maintenance and repair. Our service is always at your disposal.

With passion
The Lenze team does not just offer the necessary manpower and technical know-how – we are passionate and meticulous about what we do. We will only be happy once you are entirely satisfied with our work. Our team of professionals provides assistance over the telephone or on site, ensures the express delivery of spare parts and carries out repairs with incredible urgency. We're fast and reliable.

Someone to talk to
Expert advice is available for all your technical queries via our helpline. In cases of urgent need, call 008000 24 hours (008000 24 46877), Lenze's worldwide expert helpline – 24 hours a day, 365 days a year. For more direct assistance, you can of course contact your local Lenze service support centre. We can tell you where it is – or you can find out for yourself by visiting us on the Internet at www.Lenze.com.

Around the world
Our products are available for speedy delivery worldwide. Lenze companies, Lenze factories and sales agencies are based in major industrial countries around the world. Contact them through our website **www.Lenze.com**, which also gives you 24-hour access to technical instructions and product manuals. Local support, on site if you need it, is available.

Technical documentation

The technical documentation provides more detailed information about our products:

- Mounting Instructions in three languages are supplied with our products.
- Our System Manuals for controllers, our Communication Manuals for bus systems and our Operating Instructions for electromechanical products and accessories provide the information required for planning, designing and developing machines and systems. System Manuals and Communication Manuals are supplied in loose-leaf format. Operating Instructions are bound.
- Our User's Manuals for our controllers are designed for the operators and users of machines and systems. The information in User's Manuals has been put together so that it can be integrated directly into the machine or system documentation.

All our technical documentation is available free of charge in PDF format

- Via Internet download from "www.lenze.de", "Downloads" area
- On the "Lenze Library" CD

System Manuals and Communication Manuals can also be supplied in ring binder format for a nominal fee.

Technical documentation at a glance

Documentation	Contents	Target group	Available languages
Mounting Instructions	Safety instructions, handling and installation	Installation personnel	In three languages: German, English, French
System manual **Communication manual** **Operating instructions**	Extensive and comprehensive information for design, construction, development and programming	Planning engineers, design engineers and developers of machines and systems	Single-language version: German, English or French
User's manual	Safety instructions, handling, troubleshooting and fault elimination	Operators and users of machines and systems	Single-language version German, English or French. Other languages will shortly be available on request

MCS □□ □ □□ - □□□ □□ - □ □□ □

Square dimensions, motor length and winding — □□ □ □□

Square dimensions 62 mm	06	
Square dimensions 89 mm	09	
Square dimensions 116 mm	12	
Square dimensions 142 mm	14	
Square dimensions 192 mm	19	
Length of coil module		
30 mm		C
40 mm		D
60 mm		F
80 mm		H
90 mm		I
100 mm		J
120 mm		L
160 mm		P
Rated speed, value in 100 rpm		
Example: 1500 rpm		15

Speed encoder/angle sensor — □□□

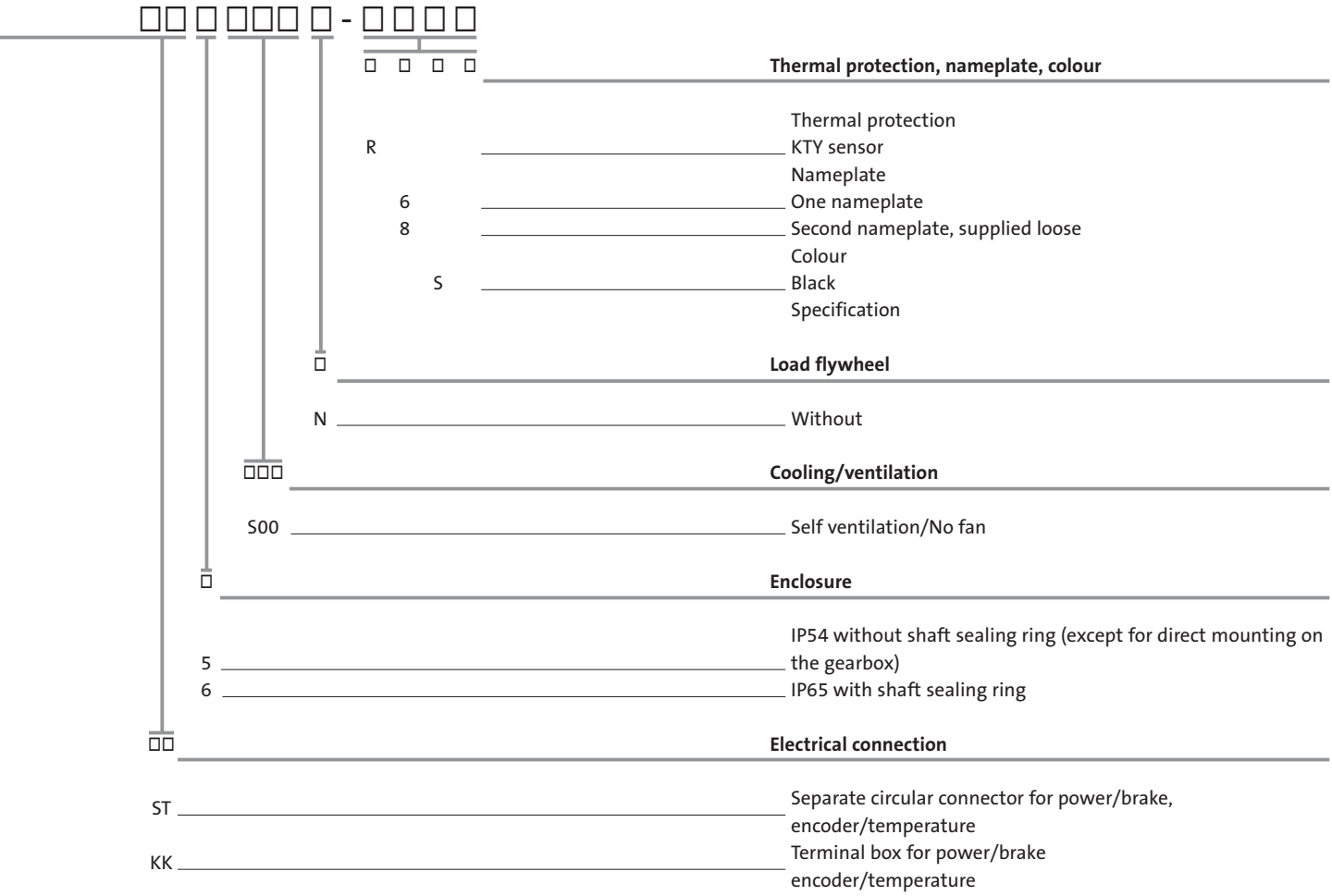
Resolver p=1 for 9300 and ECS	RS0
Single-turn absolute value encoder with SinCos signals, Hiperface, for ECS	SRS
Multi-turn absolute value encoder with SinCos signals, Hiperface, for ECS	SRM

Brake — □□

No brake	B0
PM brake 24 V DC	P1
PM brake 24 V DC uprated	P2

Design and shaft — □ □□ □

Standard design			
Standard flange form A/FF with through holes, Parallel shaft without featherkey	A		
Standard flange form A/FF with through holes, Parallel shaft with featherkey	B		
Shaft 11x23 (MCS 06)		11	
Shaft 14x30 (MCS 09)		14	
Shaft 19x40 (MCS 12)		19	
Shaft 24x50 (MCS 14)		24	
Shaft 28x60 (MCS 19)		28	
Concentricity/Vibration level			N



Example: Motor 14 Nm, 2000 rpm, resolver, PM standard brake, B5, standard shaft without featherkey, connector, IP54, no fan, no load flywheel: MCS 12L20-RS0P1-A24N-ST5S00N-R6S0

Motor 1.5 Nm, 4050 rpm, SRM multi-turn encoder, no brake, B5, standard shaft with featherkey, connector, IP65, no fan, no load flywheel, with 2nd nameplate: MCS 06I41-SRMB0-B24N-ST6S00N-R8S0

To the Lenze sales office

Page __ of __

☐ **Order**

☐ **Quotation**

Fax no. _____

From

_____
Company

_____
Street/PO Box

_____
Postcode City

_____
Date Signature

Customer no.

_____
Order no.

_____
Name

_____
Department

_____
Tel. no.

Delivery address (if different)

_____
Street

_____
Postcode City

Invoice to (if different)

_____
Street/PO Box

_____
Postcode City

Requested delivery date _____

Despatch information _____

_____

_____

Customer no.

Order no. _____

MCS synchronous servo motors

☐ **MCS 06C41** 0.6 Nm/0.25 kW 4050 rpm	☐ **MCS 06F41** 1.2 Nm/0.51 kW 4050 rpm	☐ **MCS 06I41** 1.5 Nm/0.64 kW 4050 rpm	
☐ **MCS 06C60** 0.5 Nm/0.31 kW 6000 rpm	☐ **MCS 06F60** 0.9 Nm/0.57 kW 6000 rpm	☐ **MCS 06I60** 1.2 Nm/0.75 kW 6000 rpm	
☐ **MCS 09F38** 3.1 Nm/1.2 kW 3750 rpm	☐ **MCS 09H41** 3.8 Nm/1.6 kW 4050 rpm	☐ **MCS 12H15** 10.0 Nm/1.6 kW 1500 rpm	☐ **MCS 12L20** 14.0 Nm/4.9 kW 1950 rpm
☐ **MCS 09F60** 2.4 Nm/1.5 kW 6000 rpm	☐ **MCS 09H60** 3.0 Nm/1.9 kW 6000 rpm	☐ **MCS 12H35** 8.0 Nm/3.0 kW 3525 rpm	☐ **MCS 12L41** 11.5 kW/4.9 Nm 4050 rpm
☐ **MCS 14D15** 9.2 Nm/1.45 kW 1500 rpm	☐ **MCS 14H15** 16.0 Nm/2.5 kW 1500 rpm	☐ **MCS 14L15** 23.0 Nm/3.6 kW 1500 rpm	☐ **MCS 14P14** 30.0 Nm/4.2 kW 1350 rpm
☐ **MCS 14D36** 7.5 Nm/2.8 kW 3600 rpm	☐ **MCS 14H32** 14.0 Nm/4.7 kW 3225 rpm	☐ **MCS 14L32** 17.2 Nm/5.8 kW 3225 rpm	☐ **MCS 14P32** 21.0 Nm/7.1 kW 3225 rpm
☐ **MCS 19F14** 27.0 Nm/4.0 kW 1425 rpm	☐ **MCS 19J14** 40.0 Nm/6.0 kW 14250 rpm	☐ **MCS 19P14** 51.0 Nm/7.2 kW 1350 rpm	
☐ **MCS 19F30** 21.0 Nm/6.6 kW 3000 rpm	☐ **MCS 19J30** 29.0 Nm/9.1 kW 3000 rpm	☐ **MCS 19P30** 32.0 Nm/10.0 kW 3000 rpm	

Encoder

☐ **Resolver**

☐ **SRS SinCos encoder**
Single-turn for ECS

☐ **SRM SinCos encoder**
Multi-turn for ECS

(SCS70/SCM70 SinCos encoder for 93□□ on request)

Brake

☐ **Without brake**

☐ **With PM brake**
24 V DC

☐ **With PM brake, uprated**
24 V DC (not on MCS 06, MCS 19)

Flange and shaft

☐ **B5 standard flange form A/FF**
Shaft without featherkey

☐ **B5 Standard flange form A/FF**
Shaft with featherkey

Electrical connection

☐ **Separate plug connectors for**
power/brake
encoder/temperature

☐ **Terminal box for**
power/brake/encoder/temperature
(not on MCS 06)

Enclosure

☐ **IP 54 without shaft sealing ring**

☐ **IP65 with shaft sealing ring**

Thermal protection

☒ **KTY sensor**

Nameplate

☐ **1 Nameplate**

☐ **Second nameplate**
supplied loose

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