



Servo motors

Synchronous servo motor MCM

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About this document

Document description




This document addresses to all persons who want to carry out any configurations with the products described.

The data and information compiled in this document serve to support you in the dimensioning and selection processes and in carrying out the electrical and mechanical installation. You will receive information regarding product extensions and accessories.

- The document includes safety instructions which must be observed.
- All persons working on and with the drives must have the documentation at hand during work and observe the information and notes relevant for it.
- The documentation must always be complete and in a perfectly readable state.

NOTICE

Please observe the notes in the following chapters!

- ▶ [Safety instructions](#)  9
 - ▶ [Information on mechanical installation](#)  16
 - ▶ [Information on electrical installation](#)  17
-

Further documents



Information and tools with regard to the Lenze products can be found on the Internet: <http://www.lenze.com> → Download

About this document

Notations and conventions



Notations and conventions

This document uses the following conventions to distinguish different types of information:

Numeric notation			
	Decimal separator	Point	The decimal point is always used. Example: 1 234.56
Warning			
	UL warning	UL	Are used in English and French.
	UR warning	UR	
Text			
	Engineering tools	» «	Software Example: »Engineer«, »EASY Starter«
Icons			
	Page reference		Reference to another page with additional information Example: 16 = see page 16
	Documentation reference		Reference to another documentation with additional information Example: EDKxxx = see documentation EDKxxx

Layout of the safety instructions

DANGER!

Indicates an extremely hazardous situation. Failure to comply with this instruction will result in severe irreparable injury and even death.

WARNING!

Indicates an extremely hazardous situation. Failure to comply with this instruction may result in severe irreparable injury and even death.

CAUTION!

Indicates a hazardous situation. Failure to comply with this instruction may result in slight to medium injury.

NOTICE

Indicates a material hazard. Failure to comply with this instruction may result in material damage.



Product information

Product description

MCM - the servo motor for a medium dynamic performance in compact design.

The compact synchronous servo motor for applications in the fields of positioning, robotics, and packaging technology as well as for handling systems.

In connection with the Servo-Inverters i700, Servo Drives 9400, and Inverter Drives 8400 TopLine, high-performance drive solutions in the torque range from 0.6 to 26.4 Nm can be obtained.

Customer benefit

- Compact design
- Easy controllability by an advantageous ratio of the mass inertia of the load and that of the motor
- Optimum smooth running characteristics for accurate work results
- The smooth housing surface makes it perfect for the use in the food industry
- Robust resolvers are included as a standard, and multiturn SinCos encoders ensure a high precision
- Easy assembly and easy servicing by SpeedTec connectors with swivel connector boxes



Synchronous servo motor MCM09E30-RS0B0

Identification of the products

Product name of the motor

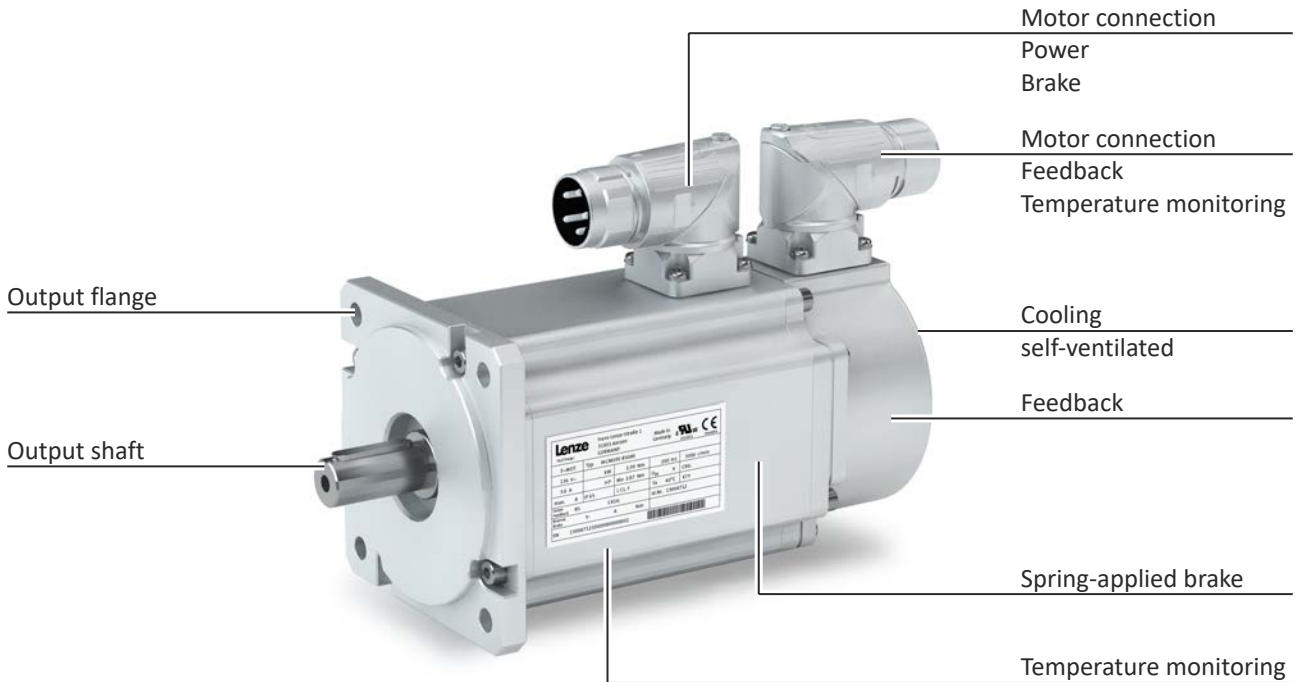
		Motor				
Example		MCM	06	C	30	-
Meaning	Variant					
Product family		MCM				
Size			06 09 12			
Overall length				C ... J		
Rated speed	rpm x 100				30	
Mains voltage	3 x 400 V, IP54/IP65					-

Product information

The modular system



Features



The modular system



Values printed in bold are standard designs. Values that are not printed in bold are potential extensions, some of them including a surcharge.

Motor		MCM06	MCM09	MCM12
Technical data				
Rated power	kW	0.19 ... 0.38	0.40 ... 0.75	0.75 ... 2.5
Rated torque	Nm	0.6 ... 1.2	1.3 ... 2.4	2.4 ... 8.0
Max. torque	Nm	1.8 ... 3.1	3.5 ... 6.5	6.5 ... 26.4
Rated speed	rpm	3000	3000	3000
Colour		Unpainted		Primed
Surface and corrosion protection		Without		
Output shaft				
Solid shaft without keyway	mm	11 x 23	14 x 30	19 x 40
Solid shaft with featherkey	mm	11 x 23	14 x 30	19 x 40
Shaft material		Steel		
Shaft sealing ring material		FKM		
Design				
		With flange (B5)		
Output flange	mm	FF75	FF100	FF130
Cooling		Self-ventilated IP54 IP65 without considering the shaft feedthrough, with mounted ICN connectors		
Motor connection		ICN connector		
Spring-applied brake		Without With		
Characteristic torque	Nm	1.3	2.5	7.0 ... 11
DC brake voltage	V	24		
Feedback		Resolver Absolute value encoder		
Temperature monitoring		KTY thermal detector		



Information on project planning

Safety instructions

Disregarding the following basic safety measures and safety information may lead to severe personal injury and damage to property!

Observe all specifications of the corresponding documentation supplied. This is the precondition for safe and trouble-free operation and for obtaining the product features specified.

Please observe the specific safety information in the other sections!

Basic safety instructions

Personnel

The product must only be used by qualified personnel. IEC 60364 or CENELEC HD 384 define the skills of these persons:

- They are familiar with installing, mounting, commissioning, and operating the product.
- They have the corresponding qualifications for their work.
- They know and can apply all regulations for the prevention of accidents, directives, and laws applicable at the place of use.

Process engineering

The procedural notes and circuit details described are only proposals. It is up to the user to check whether they can be adapted to the particular applications. Lenze does not take any responsibility for the suitability of the procedures and circuit proposals described.

Application as directed

- The product must only be actuated under the operating conditions and power limits specified in this documentation.
- The product meets the protection requirements of 2014/35/EU: Low-Voltage Directive.
- The product is not a machine in terms of 2006/42/EU: Machinery Directive.
- Commissioning or starting the operation as directed of a machine with the product is not permitted until it has been ensured that the machine meets the regulations of the EC Directive 2006/42/EU: Machinery Directive; observe EN 60204-1.
- Commissioning or starting operation as directed is only permissible if the EMC Directive 2014/30/EU is complied with.
- The product is not a household appliance, but is only designed as a component for commercial or professional use in terms of EN 61000-3-2.
- The product can be used according to the technical data if drive systems have to comply with categories according to EN 61800-3.
- In residential areas, the product may cause EMC interferences. The operator is responsible for taking interference suppression measures.
- Do not use the built-in brakes as fail-safe brakes. Disruptive factors that cannot be influenced may cause the braking torque to be reduced.
- The product must only be actuated with inverters.

Foreseeable misuse

- Actuate directly on the mains voltage
- Use in potentially explosive areas
- Use in aggressive environments
- Use under water
- Use under radiation
- Use in generator mode

Information on project planning

Safety instructions
Residual hazards



Residual hazards

Even if notes given are taken into consideration and protective measures are implemented, the occurrence of residual risks cannot be fully prevented.

The user must take the residual hazards mentioned into consideration in the risk assessment for his/her machine/system.

If the above is disregarded, this can lead to severe injuries to persons and damage to property!

Protection of persons

- The product does not provide safety-related functions.
 - A higher-level safety system must be implemented.
 - Additional monitoring and protective equipment complying with the safety regulations applicable in each case must be used.
- The power terminals may carry voltage in the switched-off state or when the motor is stopped.
 - Before working, check whether all power terminals are deenergised.
- Voltages may occur on the drive components (e.g. capacitive, caused by inverter supply).
 - Careful earthing in the marked positions of the components must be carried out.
- Risk of burns may be caused by hot surfaces!
 - Provide for a protection against accidental contact.
 - Use the personal protective equipment or wait until the components have cooled down completely!
 - Prevent contact with flammable substances.
- There is a risk of injury due to rotating parts.
 - Before working on the drive system, ensure that the motor is at a standstill.
- There is a danger of unintentional starting or electrical shocks!
- Installed brakes are no fail-safe brakes.
 - The torque may be reduced by disruptive factors that cannot be influenced such as ingressing oil.

Motor protection

- Design with plug:
 - Never disconnect the plug when energised! Otherwise, the plug can be destroyed.
 - Switch off power supply and disable inverter prior to disconnecting the plug.
- Installed thermal detectors are no full protection for the machine.
 - If required, limit the maximum current. Parameterise the inverter so that it will be switched off after seconds of operation with $I > I_N$, especially if there is the danger of blocking.
 - The installed overload protection does not prevent an overload under any conditions.
- The fuses are no motor protection.
 - Use a current-dependent motor protection switch.
 - Use the built-in thermal detectors.
- Too high torques cause a fraction of the motor shaft.
 - The maximum torques according to catalogue must not be exceeded.
- Lateral forces from the motor shaft may occur.
 - Align the shafts of motor and driven machine exactly to each other.



Drive dimensioning

The dimensioning is suitable for:

- kinematic profiles
- operating modes S1, S2, S3, S6
- simple linear speed profiles, not for S-curves or similar

The following 3 elements are taken into consideration in the dimensioning process :

Drive function

On the basis of the values required for the process that are specified, a drive is selected, for which all operating points are within the speed-torque characteristic curve of the motor.

As a result, a motor with a suitable speed with an inverter with a sufficient maximum current is selected. Further limits (maximum speed, installation height...) are specified in tables.

Mechanical strength

On the basis of the forces and torques which build, a drive is selected that has a sufficient mechanic strength (endurance strength for the periodically occurring torques and fatigue strength for the sporadically occurring torques).

Thermal dimensioning

For the inverter, the thermal dimensioning process is carried out on the basis of the continuous inverter current or on the basis of the continuous torque from the motor-inverter combination, which can be reached.

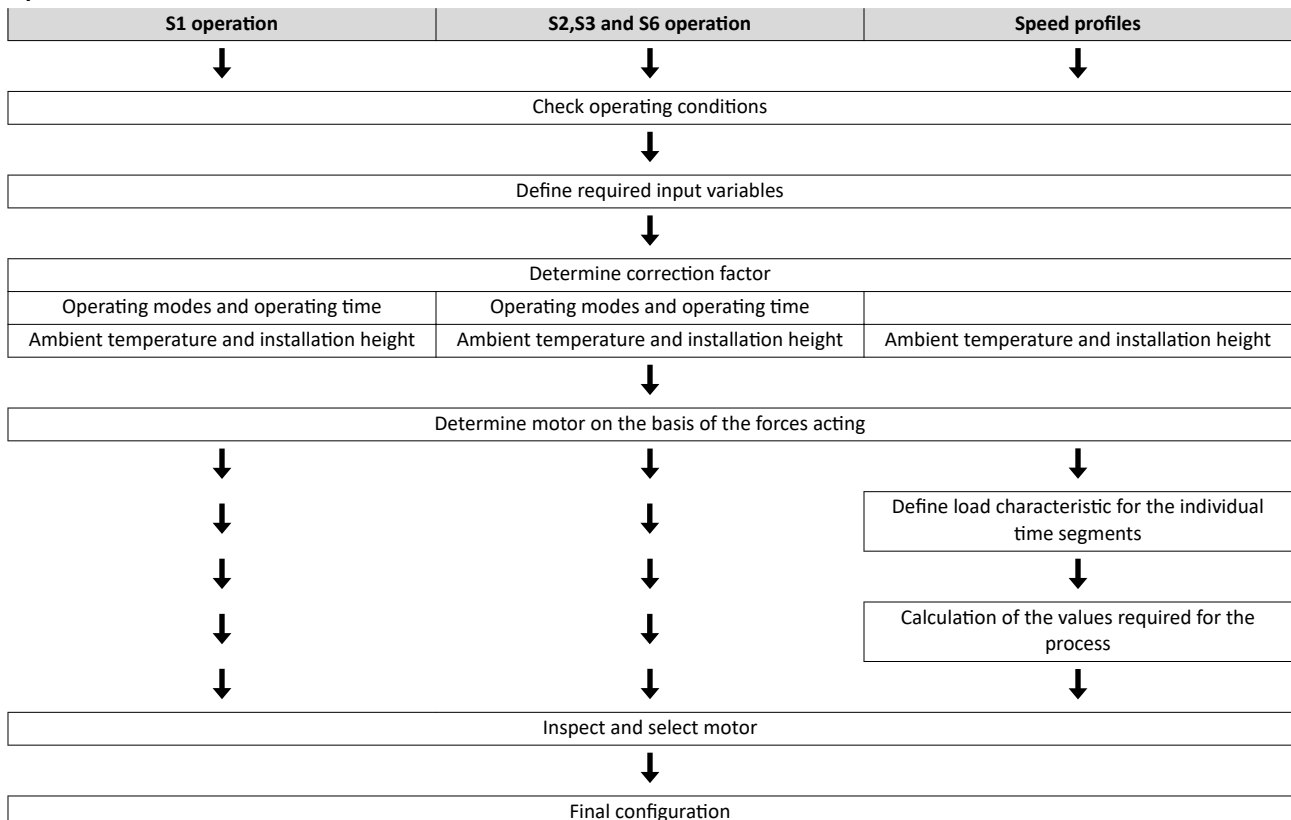
The motor is thermally dimensioned on the basis of the mean speed and the effective torque.

The mean speed of the drive should not exceed the values specified.



If dimensioning processes are complex or reach limit loads, please refer to your Lenze branch office

Operation chart



Information on project planning

Drive dimensioning



Check operating conditions

Check
Approvals
Conformity declarations
Supply voltage
Enclosure
Ambient temperature
Surface protection

▶ Conformities/approvals [19](#)

▶ Environmental conditions [15](#)

Define required input variables

Necessary input variables	Note	Symbol	Unit
Mean speed utilisation	Relating to the load speed n_L		%
Ambient temperature		T_U	°C
Site altitude Amsl		H	m
Radial force		F_{rad}	N
Axial force		F_{ax}	N
Transmission element at the output	Gear wheels, sprockets ...		
Effective diameter of the transmission element		d_w	mm
Load torque	Only with S1, S2, S3, and S6 operating modes	M_L	Nm
Load speed	Only with S1, S2, S3, and S6 operating modes	n_L	rpm
Short-time maximum torque	Emergency off, quick stop, occasional high starting duty	$M_{L,max}$	Nm
Runtime with maximum torque		t_L	%

Determine correction factor

Operating modes S1, S2, S3, S6, and operating time							
Operating mode S1		Operating mode S2		Operating mode S3		Operating mode S6	
ED	k_L	ED	k_L	ED	k_L	ED	k_L
%		min		%		%	
100	1.0	10	1.4 - 1.5	15	1.4 - 1.5	15	1.5 - 1.6
		30	1.15 - 1.2	25	1.3 - 1.4	25	1.4 - 1.5
		60	1.07 - 1.1	40	1.15 - 1.2	40	1.3 - 1.4
		90	1.0 - 1.05	60	1.05 - 1.1	60	1.15 - 1.2

Ambient temperature and installation height		
Ambient temperature	Installation height amsl	
	≤ 1000 m	≤ 2000 m
	Correction factor	
T_U	k_H	k_H
≤ 20 °C	1.10	1.04
30 °C	1.05	1.00
40 °C	1.00	0.95
50 °C	0.80	0.76
60 °C	0.60	0.57



Determine product on the basis of the forces

Transmission element			Gear wheels	Sprockets	Toothed belt pulleys (depending on the preloading)	Narrow V-belt (depending on the preloading)
Additional radial force factor	f_z		≥ 17 teeth = 1.0	≥ 20 teeth = 1.0	With belt tightener= 2.0 - 2.5	1.5 - 2.0
			< 17 teeth = 1.15	< 20 teeth = 1.25	Without belt tightener= 2.5 - 3.0	
				< 13 teeth = 1.4		
			Calculation			Check
Radial force	F_{rad}	N	$F_{rad} = 2000 \times \frac{M_{L,max} \times f_z}{dw}$			$F_{rad} \leq F_{rad,max}$
Axial force	F_{ax}	N				$F_{ax} \leq F_{rad,max}$

dw Effective diameter of transmission element

▶ [Radial forces and axial forces](#) 20

Operating mode S1

Check and select servo motor-inverter combination			
	Check	Selection	Unit
Output torque	$M_N \geq M_L / (k_L \times k_H)$	M_N	Nm
Output speed	$n_N \geq n_L$	n_N	rpm

▶ [Rated data](#) 21

Operating modes S2, S3, and S6

Check and select servo motor-inverter combination			
	Check	Selection	Unit
Output torque	$M_N \geq M_L / (k_L \times k_H)$	M_N	Nm
Output speed (recommendation)	$n_N \geq n_L$	n_N	rpm
Max. output torque	$M_{max} \geq M_L$	M_{max}	Nm
Max. output speed	$n_{max} \geq n_L$	n_{max}	rpm
All operating points (●)		n_L	
Below the maximum torque characteristic of the servo motor-inverter combination, taking $M_{L,max}$ into consideration		M_L	
Thermally effective operating point (○)		n_L	$M_L / (k_L \times k_H)$
Below the S1 torque characteristic of the servo motor			

▶ [Rated data](#) 21

▶ [Torque characteristics](#) 27



Speed profiles

Temporal load characteristic for the individual time segments z							
Total time	Individual time segments	Load speed	Load speed variation	Steady-state load torque	Torque	Acceleration torque	Moment of inertia
t	Δt_z	$n_{L,z}$	$\Delta n_{L,z}$	$M_{L,z}$	M_z	$M_{S,z}$	J_L
s	s	rpm	rpm	Nm	Nm	Nm	kgcm ²

	Calculation	Symbol	Unit
Load cycle duration	$T = \sum \Delta t_z$	T	s

Calculation of the values required for the process			
	Calculation	Symbol	Unit
Torque per time segment	$M_z = M_{L,z} + J_L \frac{2\pi \times \Delta n_{L,z}}{60 \times \Delta t_z}$	M_z	Nm
Maximum torque of the profile	$M_{p,max} = \max(M_z)$	$M_{p,max}$	Nm
Effective torque	$M_{eff} = \sqrt{\frac{1}{T} \sum_z M_z^2 \times \Delta t_z}, T \leq 1 \text{min}$	M_{eff}	Nm
Mean speed	$n_m = \overline{n_{L,z}} = \frac{1}{T} \sum_z n_{L,z} \times \Delta t_z$	n_m	rpm
Maximum load speed	$n_{L,max} = \max(n_{L,z})$	$n_{L,max}$	rpm

Check and select servo motor-inverter combination			
	Check	Preselection	Unit
Output torque	$M_N > M_{eff} / k_H$	M_N	Nm
Output speed	$n_N \geq n_m$	n_N	rpm
Load-matching factor			
for an optimum dynamic performance/ control properties	Requirement $k_j = 0.5 \dots 10$ Optimum $k_j = 1$	$k_j = J_L / (J_M + J_B)$	
Checking the motor torques			
Acceleration torque	$M_{S,z} = M_z + (J_M + J_B) \times \frac{2\pi \times \Delta n_{L,z}}{60 \times \Delta t_z}$	$M_{S,z}$	Nm
Effective torque	$M_{S,eff} = \sqrt{\frac{1}{T} \sum_z M_{S,z}^2 \times \Delta t_z}$	$M_{S,eff}$	
All operating points (●)		$n_{L,z}$	
Below the maximum torque characteristic of the servo motor-inverter combination, taking $M_{L,max}$ into consideration		$M_{S,z}$	
Thermally effective operating point (○)		n_m	
Below the S1 torque characteristic of the servo motor		$M_{S,eff} / k_H$	

▶ [Rated data](#) 21

▶ [Torque characteristics](#) 27



Final configuration

	Check
Connection dimensions	Output shaft Output flange
Product extensions	Motor connection (connector/terminal box) Brake Feedback

More information about the final configuration:

▶ [The modular system](#) 8

▶ [Product extensions](#) 34

Environmental conditions

Surface and corrosion protection

The motors can be used for the following ambient conditions:

- Indoor installation, no special corrosion protection necessary
- Painting by customer possible



Information on mechanical installation

Important notes

- You must install the product according to specifications in the chapter "standard and operating" conditions.
 - ▶ [Standards and operating conditions](#) 19
- The technical data and the data regarding the supply conditions can be found on the nameplate and in this documentation.
- Observe the information relating to the surface and corrosion protection.
 - ▶ [Environmental conditions](#) 15
- Ambient media – especially chemically aggressive ones – may damage shaft sealing rings, lacquers and plastics. If required, contact your responsible Lenze subsidiary.

NOTICE

Bearing damage caused by unbalance!

Shafts with keyway are balanced with a half featherkey!

- ▶ Balance transmission elements with a half featherkey!
-

Transport

- Ensure appropriate handling.
- Make sure that all component parts are safely mounted. Secure or remove loose component parts.
- Only use safely fixed transport aids (e.g. eye bolts or support plates).
- Do not damage any components during the transport.
- Avoid electrostatic discharge on electronic components and contacts.
- Avoid impacts.
- Check the carrying capacity of the hoists and load handling devices. The weights can be obtained from the shipping documents.
- Secure the load against tipping and falling down.
- Standing under a suspended load is forbidden.

Installation

- Avoid resonances with the rotational frequency and double mains frequency.
- The mounting surfaces must be plane, torsionally rigid and free from vibrations.
- The mounting areas must be suited to absorb the forces and torques generated during operation.
- Ensure an unhindered ventilation.
- For versions with a fan, keep a minimum distance of 10 % from the outside diameter of the fan cover in intake direction.



Information on electrical installation

Important notes

DANGER!

Hazardous voltage!

On the power connections even when disconnected from the mains: residual voltage >60 V!

- ▶ Disconnect the product from the mains and wait until the motor is at a standstill.
- ▶ Make sure that the product is safely isolated from supply!

-
- When working on energised products, comply with the applicable national accident prevention regulations.
 - Carry out the electrical installation in compliance with the relevant regulations (e.g. cable cross-sections, fuses, PE connection).
 - The manufacturer of the system or machine is responsible for adherence to the limits required in connection with EMC legislation.

Preparation



The notes for the electrical connection can be found in the enclosed mounting instructions.

EMC-compliant wiring



The EMC-compliant wiring is described in detail in the documentation of the Lenze inverters.

Technical data

Notes regarding the given data



Technical data

Notes regarding the given data

The power values, torques and speeds specified in the configuration are rounded values and apply to

- Ambient temperature $T_U = 40\text{ °C}$ for motors (in accordance with EN 60034)
- Site altitude $\leq 1000\text{ m}$ above sea level

The selection tables specify the inverter/ motor combination with the attainable torque values.

The rated data applies to the S1 operating mode S1 (in accordance with EN 60034) and the operation on an inverter with a switching frequency of at least 4 kHz.

NOTICE

In case of other operating conditions, the achievable values can differ for those mentioned.

- ▶ In case of extreme operating conditions, please contact your responsible Lenze sales company.
-



Standards and operating conditions

Conformities/approvals

Conformity		
CE	2014/35/EU	Low-Voltage Directive
	2014/30/EU	EMC Directive (reference: CE-typical drive system)
Approval		
cURus	UL 1004-1 UL 1004-6	for USA and Canada (requirements of the CSA 22.2 No.100) Servo motor, Lenze file no. E210321

Protection of persons and device protection

Degree of protection		
IP54	EN 60034-5	At the shaft feedthrough IP65 without considering the shaft feedthrough, with mounted ICN connectors
Temperature class		
F (155 °C)	EN 60034-1	
Max. voltage load		
Limit curve A of the pulse voltage	IEC/TS 60034-25:2007	
IVIC C@500V	IEC 60034-18-41	

EMC data

Noise emission	EN 60034-1	A final overall assessment of the drive system is indispensable
Noise immunity	EN 60034-1	A final overall assessment of the drive system is indispensable

Environmental conditions

Climate		
1K3 (-20 °C ... +60 °C)	EN 60721-3-1	Storage, < 3 months
1K3 (-20 °C ... +40 °C)	EN 60721-3-1	Storage, > 3 months
2K3 (-20 °C ... +70 °C)	EN 60721-3-2	Transport
3K3 (-15 °C ... +40 °C)	EN 60721-3-3	Operation, without brake
3K3 (-10 °C ... +40 °C)	EN 60721-3-3	Operation, with brake
Relative humidity ≤ 85 %		Without condensation
Site altitude		
0 ... 1000 m amsl		Without power reduction
1000 ... 2000 m amsl		Pay attention to the drop in power of the inverter and servo motor
Vibration resistance		
3M6	EN 60721-3-3	Operation
Vibration severity		
A	EN 60034-14	
Vibration velocity		
1.6 mm/s		Free suspension
Smooth running, axial runout, concentricity		
Normal Class	IEC 60072	

Technical data

Radial forces and axial forces



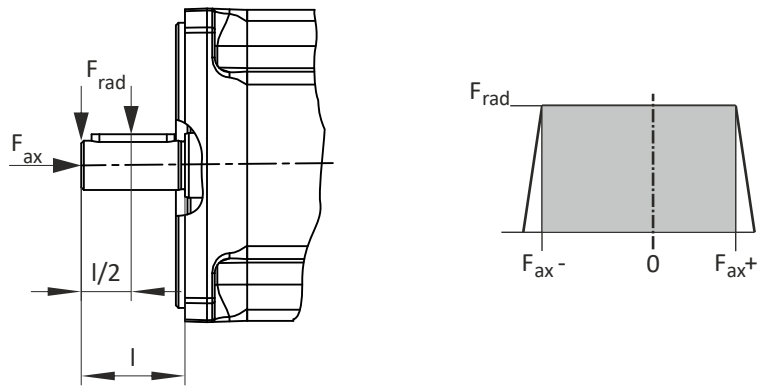
Radial forces and axial forces



The values of the bearing service life L_{10h} refer to the rated motor speed specified. Depending on the ambient temperatures, they are additionally limited by the grease lifetime.

► [Rated data](#) 21

Application of forces



Application of force at I/2

Bearing service life L_{10h}			Motor		
			MCM06	MCM09	MCM12
20000 h					
Radial force	F_{rad}	N	245	392	490
Axial tensile force	$F_{ax, -}$	N	-98	-147	-196
Axial compression force	$F_{ax, +}$	N	98	147	196

Application of force at I

Bearing service life L_{10h}			Motor		
			MCM06	MCM09	MCM12
20000 h					
Radial force	F_{rad}	N	196	294	294
Axial tensile force	$F_{ax, -}$	N	-98	-147	-196
Axial compression force	$F_{ax, +}$	N	98	147	196



Technical data

Rated data
Inverter mains connection 400 V, Self-ventilated

Rated data

Inverter mains connection 400 V, Self-ventilated

Product name			MCM06C30-	MCM06E30-	MCM09C30-
Standstill torque	M_0	Nm	0.70	1.40	1.50
Rated torque	M_N	Nm	0.60	1.20	1.30
Max. torque	$M_{Max.}$	Nm	1.80	3.10	3.50
Rated speed	n_N	rpm	3000	3000	3000
Max. speed	$n_{Max.}$	rpm	6000	6000	6000
Rated power	P_N	kW	0.19	0.38	0.40
Standstill current	I_0	A	1.00	1.20	1.10
Rated current	I_N	A	0.90	1.10	1.10
Max. current	$I_{Max.}$	A	2.50	2.60	2.60
Rated voltage	$U_{N, AC}$	V	183	273	300
Rated frequency	f_N	Hz	200	200	200
Moment of inertia	J	kgcm ²	0.19	0.34	0.61
Efficiency	$\eta_{100\%}$		0.681	0.775	0.790
Torque constant	$Kt_{0\ 150^\circ C}$	Nm/A	0.70	1.17	1.36
Voltage constant	$KE_{LL\ 150^\circ C}$	V/1000 rpm	45.0	71.6	82.5
Stator terminal resistance	$R_{UV\ 20^\circ C}$	Ω	27.6	26.8	20.0
Stator terminal resistance	$R_{UV\ 150^\circ C}$	Ω	41.6	40.4	30.1
Stator inductance	L	mH	25.0	30.0	31.0
Mass	m	kg	1.40	1.80	2.30

Product name			MCM09E30-	MCM12C30-	MCM12F30-
Standstill torque	M_0	Nm	2.90	2.90	5.50
Rated torque	M_N	Nm	2.40	2.40	4.80
Max. torque	$M_{Max.}$	Nm	6.50	6.50	14.1
Rated speed	n_N	rpm	3000	3000	3000
Max. speed	$n_{Max.}$	rpm	6000	5000	5000
Rated power	P_N	kW	0.75	0.75	1.50
Standstill current	I_0	A	2.10	2.10	3.80
Rated current	I_N	A	1.90	1.80	3.50
Max. current	$I_{Max.}$	A	4.80	4.80	10.0
Rated voltage	$U_{N, AC}$	V	296	283	291
Rated frequency	f_N	Hz	200	250	250
Moment of inertia	J	kgcm ²	0.88	1.54	2.80
Efficiency	$\eta_{100\%}$		0.849	0.913	0.930
Torque constant	$Kt_{0\ 150^\circ C}$	Nm/A	1.38	1.38	1.45
Voltage constant	$KE_{LL\ 150^\circ C}$	V/1000 rpm	80.0	78.8	83.6
Stator terminal resistance	$R_{UV\ 20^\circ C}$	Ω	11.2	6.68	3.04
Stator terminal resistance	$R_{UV\ 150^\circ C}$	Ω	16.9	10.1	4.58
Stator inductance	L	mH	19.0	18.0	9.60
Mass	m	kg	2.80	3.50	4.80

Technical data

Rated data

Inverter mains connection 400 V, Self-ventilated



Product name			MCM12J30-
Standstill torque	M_0	Nm	9.60
Rated torque	M_N	Nm	8.00
Max. torque	$M_{Max.}$	Nm	26.4
Rated speed	n_N	rpm	3000
Max. speed	$n_{Max.}$	rpm	5000
Rated power	P_N	kW	2.50
Standstill current	I_0	A	6.80
Rated current	I_N	A	5.80
Max. current	$I_{Max.}$	A	19.0
Rated voltage	$U_{N, AC}$	V	274
Rated frequency	f_N	Hz	250
Moment of inertia	J	kgcm ²	4.49
Efficiency	$\eta_{100\%}$		0.943
Torque constant	$K_{t_0 150^\circ C}$	Nm/A	1.41
Voltage constant	$K_{E_{LL 150^\circ C}}$	V/1000 rpm	81.4
Stator terminal resistance	$R_{UV 20^\circ C}$	Ω	1.56
Stator terminal resistance	$R_{UV 150^\circ C}$	Ω	2.35
Stator inductance	L	mH	5.30
Mass	m	kg	6.70



Selection tables

Notes on the selection tables

The selection tables represent the combinations of servo motors and inverters. The only serve as a rough overview.

In the case of the servo inverters, the overload capacity depending on the switching frequency in the default setting is taken into consideration. For more information, please refer to the servo inverter documentation.

Graphical representation of the operating points		Explanation	Notes
	M_0	Standstill torque	With a zero speed rpm, the standstill torque and standstill current are to be reduced by 30 % after 2 % seconds. For applications requiring holding the standstill torque for a longer time, we recommend holding the drive via the holding brake and, for instance, reducing the current by controller inhibit.
	$M_{0,max}$	Max. standstill torque	With an active load observe (e. g. vertical drive axes, hoists, test benches, unwinders).
	M_N	Rated torque	
	n_N	Rated speed	
	M_{max}	Max. torque	Can usually be used with a passive load (e. g. horizontal drive axes).
	n_{eto}	Transition speed	
	n_k	Derating speed	Due to a derating of the inverter output current to the derating speed, for some inverters the attainable max. standstill torque is smaller than the max. speed when the value of 5 Hz is not reached.

Derating speed

Motor	Derating speed
	n_k
	rpm
MCM06C30-	75
MCM06E30-	
MCM09C30-	
MCM09E30-	
MCM12C30-	
MCM12F30-	
MCM12J30-	

Technical data

Selection tables



8400 TopLine inverter drives



The data apply to an inverter mains voltage of 3x 400 V and an inverter switching frequency of 8 kHz.

Motor			Inverter						
			E84AVTC□						
			3714	7514	1524	2224	3024	4024	5524
MCM06C30-									
Standstill torque	M_0	Nm	0.7						
Rated torque	M_N	Nm	0.6						
Max. standstill torque	$M_{0,max}$	Nm	1.8						
Max. torque	M_{max}	Nm	1.8						
MCM06E30-									
Standstill torque	M_0	Nm	1.4						
Rated torque	M_N	Nm	1.2						
Max. standstill torque	$M_{0,max}$	Nm	3.1						
Max. torque	M_{max}	Nm	3.1						
MCM09C30-									
Standstill torque	M_0	Nm	1.5						
Rated torque	M_N	Nm	1.3						
Max. standstill torque	$M_{0,max}$	Nm	3.5						
Max. torque	M_{max}	Nm	3.5						
MCM09E30-									
Standstill torque	M_0	Nm		2.9					
Rated torque	M_N	Nm		2.4					
Max. standstill torque	$M_{0,max}$	Nm		6.5					
Max. torque	M_{max}	Nm		6.5					
MCM12C30-									
Standstill torque	M_0	Nm		2.9					
Rated torque	M_N	Nm		2.4					
Max. standstill torque	$M_{0,max}$	Nm		6.5					
Max. torque	M_{max}	Nm		6.5					
MCM12F30-									
Standstill torque	M_0	Nm			5.5	5.5	5.5		
Rated torque	M_N	Nm			4.8	4.8	4.8		
Max. standstill torque	$M_{0,max}$	Nm			8.4	11.8	14.1		
Max. torque	M_{max}	Nm			11.1	14.1	14.1		
MCM12J30-									
Standstill torque	M_0	Nm					9.6	9.6	9.6
Rated torque	M_N	Nm					8.0	8.0	8.0
Max. standstill torque	$M_{0,max}$	Nm					15.4	19.9	26.4
Max. torque	M_{max}	Nm					20.4	26.4	26.4



i700 servo inverters



The data apply to an inverter mains voltage of 3x 400 V and an inverter switching frequency of 4 kHz.

Motor			Inverter		
			E70ACMS□		
			0054	0104	0204
MCM06C30-					
Standstill torque	M_0	Nm	0.7		
Rated torque	M_N	Nm	0.6		
Max. standstill torque	$M_{0,max}$	Nm	1.8		
Max. torque	M_{max}	Nm	1.8		
MCM06E30-					
Standstill torque	M_0	Nm	1.4		
Rated torque	M_N	Nm	1.2		
Max. standstill torque	$M_{0,max}$	Nm	3.1		
Max. torque	M_{max}	Nm	3.1		
MCM09C30-					
Standstill torque	M_0	Nm	1.5		
Rated torque	M_N	Nm	1.3		
Max. standstill torque	$M_{0,max}$	Nm	3.5		
Max. torque	M_{max}	Nm	3.5		
MCM09E30-					
Standstill torque	M_0	Nm	2.9		
Rated torque	M_N	Nm	2.4		
Max. standstill torque	$M_{0,max}$	Nm	6.5		
Max. torque	M_{max}	Nm	6.5		
MCM12C30-					
Standstill torque	M_0	Nm	2.9		
Rated torque	M_N	Nm	2.4		
Max. standstill torque	$M_{0,max}$	Nm	6.5		
Max. torque	M_{max}	Nm	6.5		
MCM12F30-					
Standstill torque	M_0	Nm		5.5	
Rated torque	M_N	Nm		4.8	
Max. standstill torque	$M_{0,max}$	Nm		14.1	
Max. torque	M_{max}	Nm		14.1	
MCM12J30-					
Standstill torque	M_0	Nm			9.6
Rated torque	M_N	Nm			8.0
Max. standstill torque	$M_{0,max}$	Nm			26.4
Max. torque	M_{max}	Nm			26.4

Technical data

Selection tables



9400 HighLine servo drives



The data apply to an inverter mains voltage of 3x 400 V and an inverter switching frequency of 4 kHz.

Motor			Inverter						
			E94A□□						
			E0024	E0034	E0044	E0074	E0094	E0134	
MCM06C30-									
Standstill torque	M_0	Nm	0.7						
Rated torque	M_N	Nm	0.6						
Max. standstill torque	$M_{0,max}$	Nm	1.8						
Max. torque	M_{max}	Nm	1.8						
MCM06E30-									
Standstill torque	M_0	Nm	1.4						
Rated torque	M_N	Nm	1.2						
Max. standstill torque	$M_{0,max}$	Nm	3.1						
Max. torque	M_{max}	Nm	3.1						
MCM09C30-									
Standstill torque	M_0	Nm	1.5						
Rated torque	M_N	Nm	1.3						
Max. standstill torque	$M_{0,max}$	Nm	3.5						
Max. torque	M_{max}	Nm	3.5						
MCM09E30-									
Standstill torque	M_0	Nm	2.6	2.9					
Rated torque	M_N	Nm	2.4	2.4					
Max. standstill torque	$M_{0,max}$	Nm	5.4	6.5					
Max. torque	M_{max}	Nm	6.5	6.5					
MCM12C30-									
Standstill torque	M_0	Nm	2.6	2.9					
Rated torque	M_N	Nm	2.4	2.4					
Max. standstill torque	$M_{0,max}$	Nm	5.4	6.5					
Max. torque	M_{max}	Nm	6.5	6.5					
MCM12F30-									
Standstill torque	M_0	Nm			5.5				
Rated torque	M_N	Nm			4.8				
Max. standstill torque	$M_{0,max}$	Nm			14.1				
Max. torque	M_{max}	Nm			14.1				
MCM12J30-									
Standstill torque	M_0	Nm				9.6	9.6	9.6	
Rated torque	M_N	Nm				8.0	8.0	8.0	
Max. standstill torque	$M_{0,max}$	Nm				19.3	25.7	26.4	
Max. torque	M_{max}	Nm				26.4	26.4	26.4	



Torque characteristics

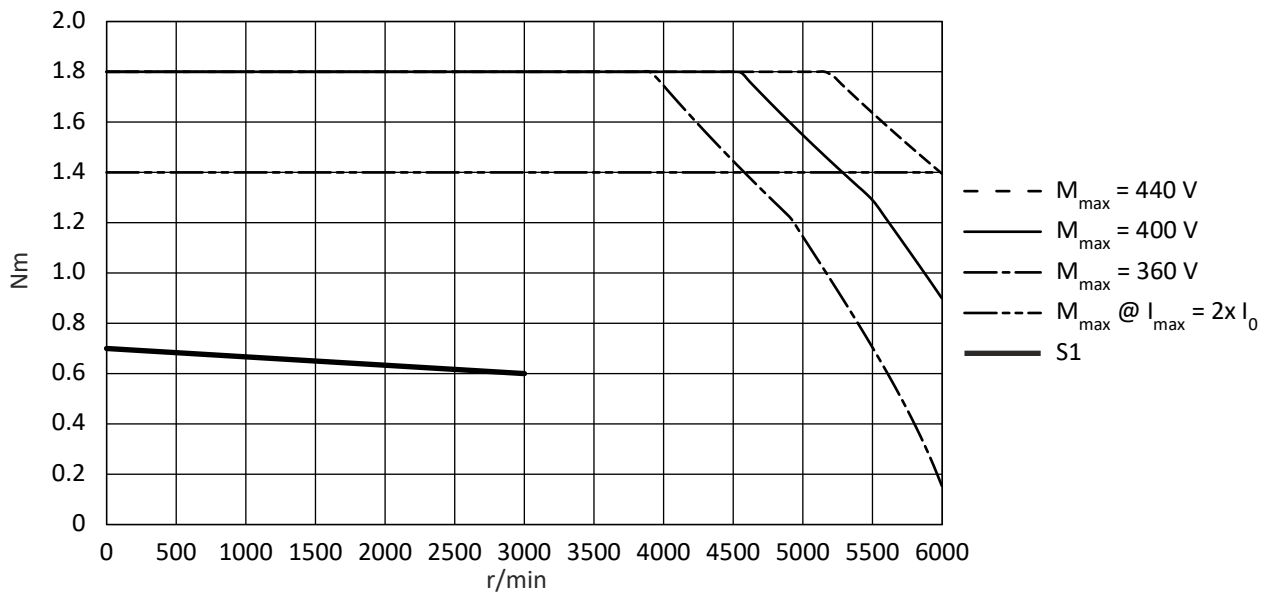


m-n characteristics for your motor-inverter combination can be found on the Internet: <http://www.lenze.com> → Product Finder → M-n characteristics

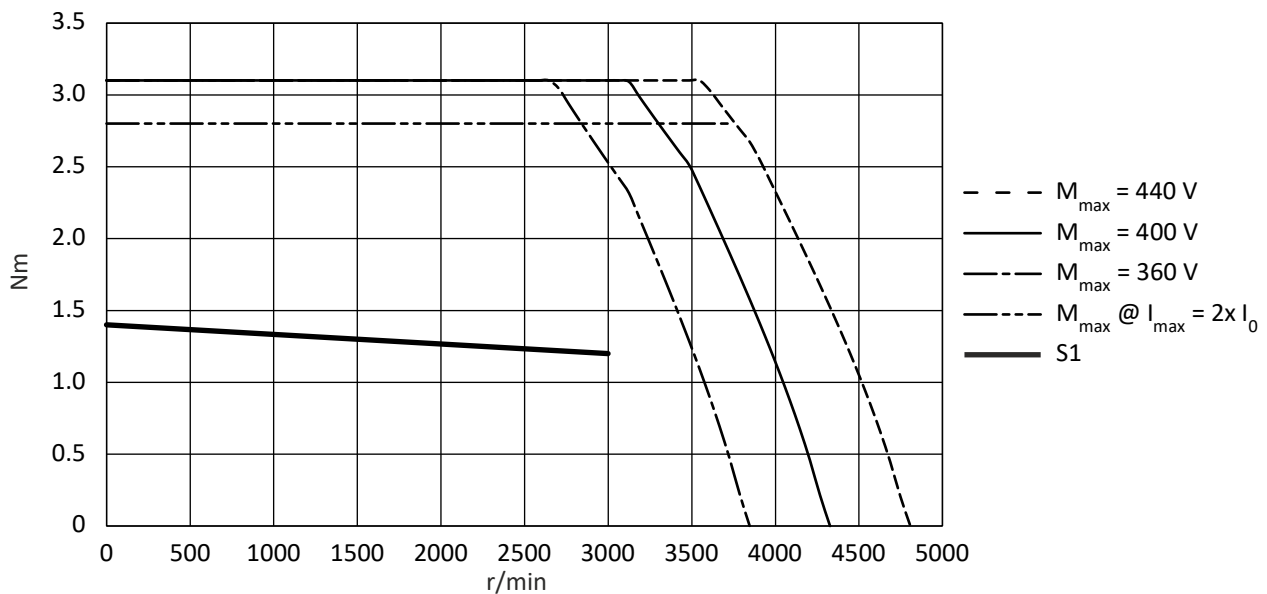


The data apply to an inverter mains voltage of 3 x 400 V.

MCM06C30-



MCM06E30-

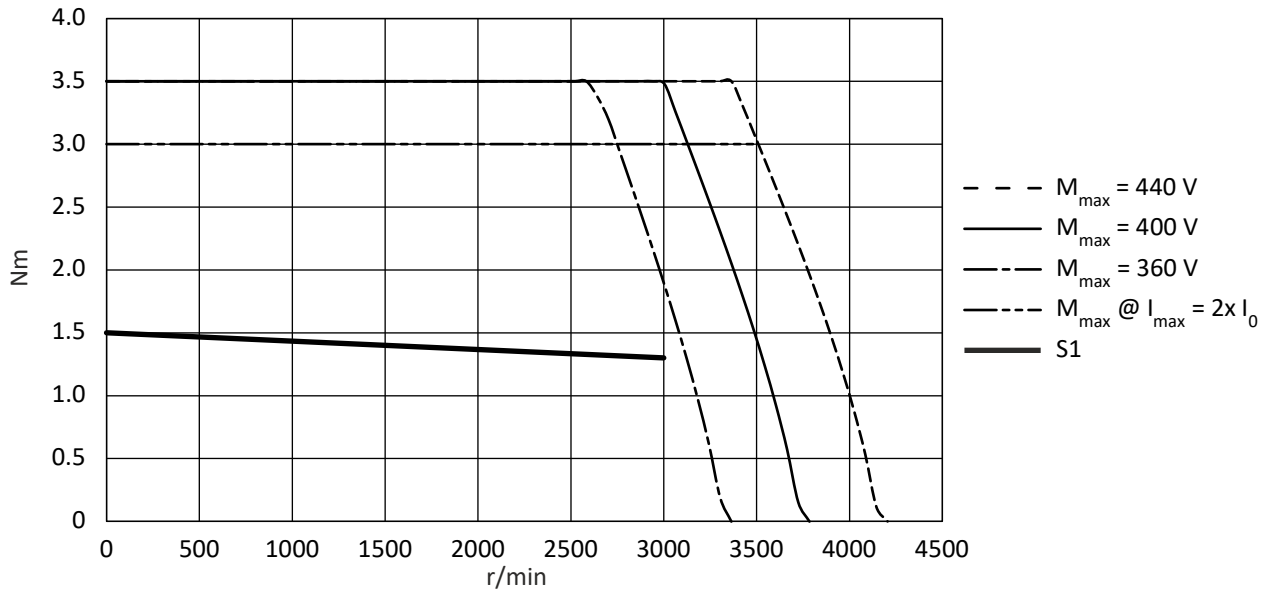


Technical data

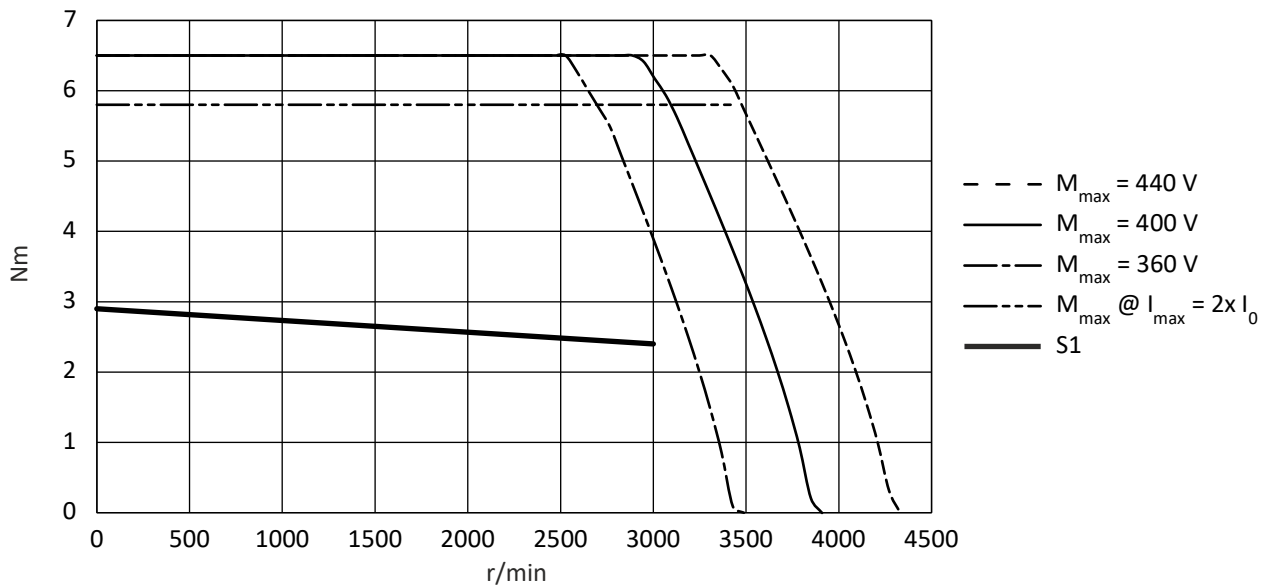
Torque characteristics



MCM09C30-



MCM09E30-

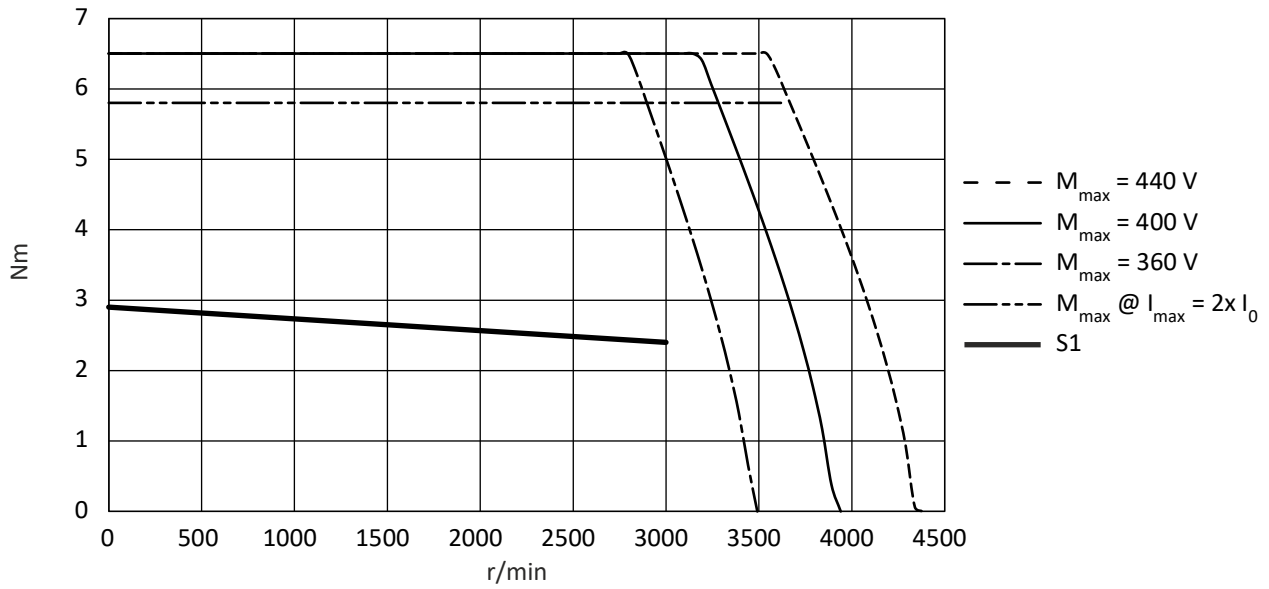




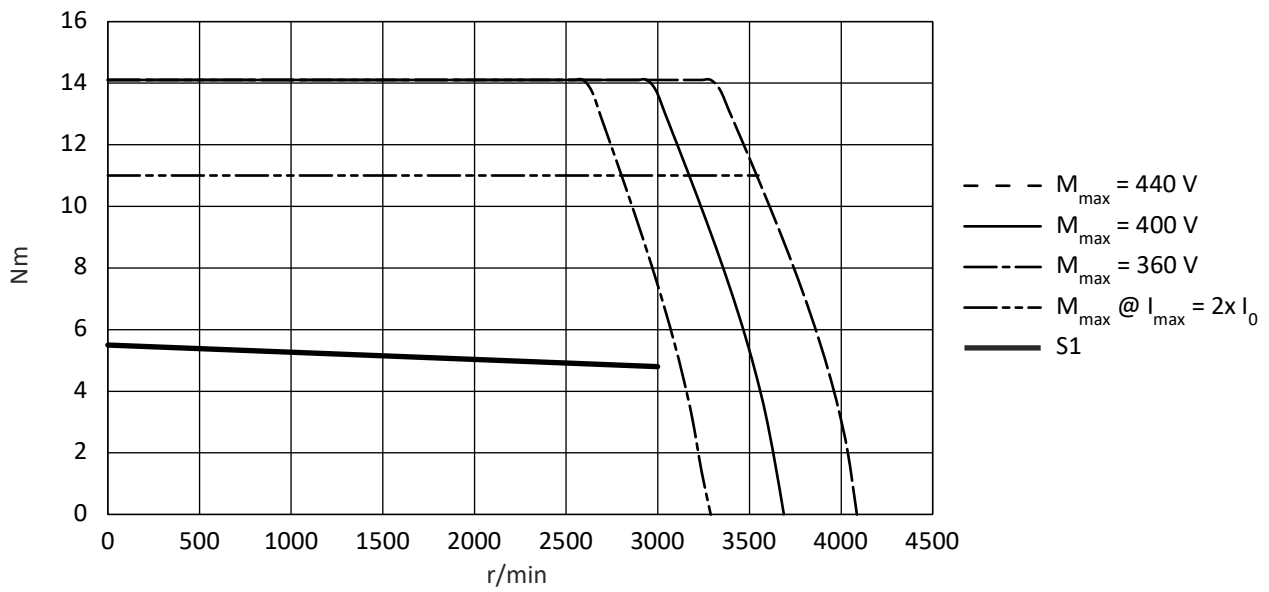
Technical data

Torque characteristics

MCM12C30-

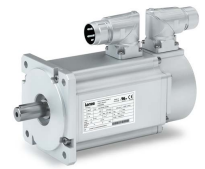


MCM12F30-

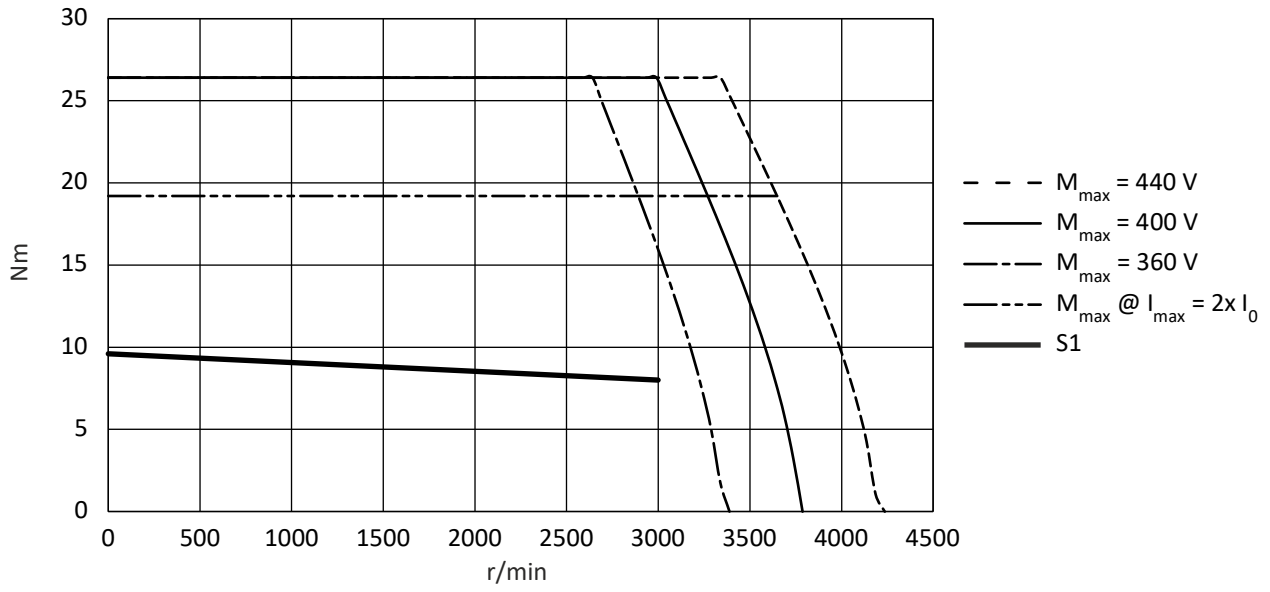


Technical data

Torque characteristics



MCM12J30-





Technical data

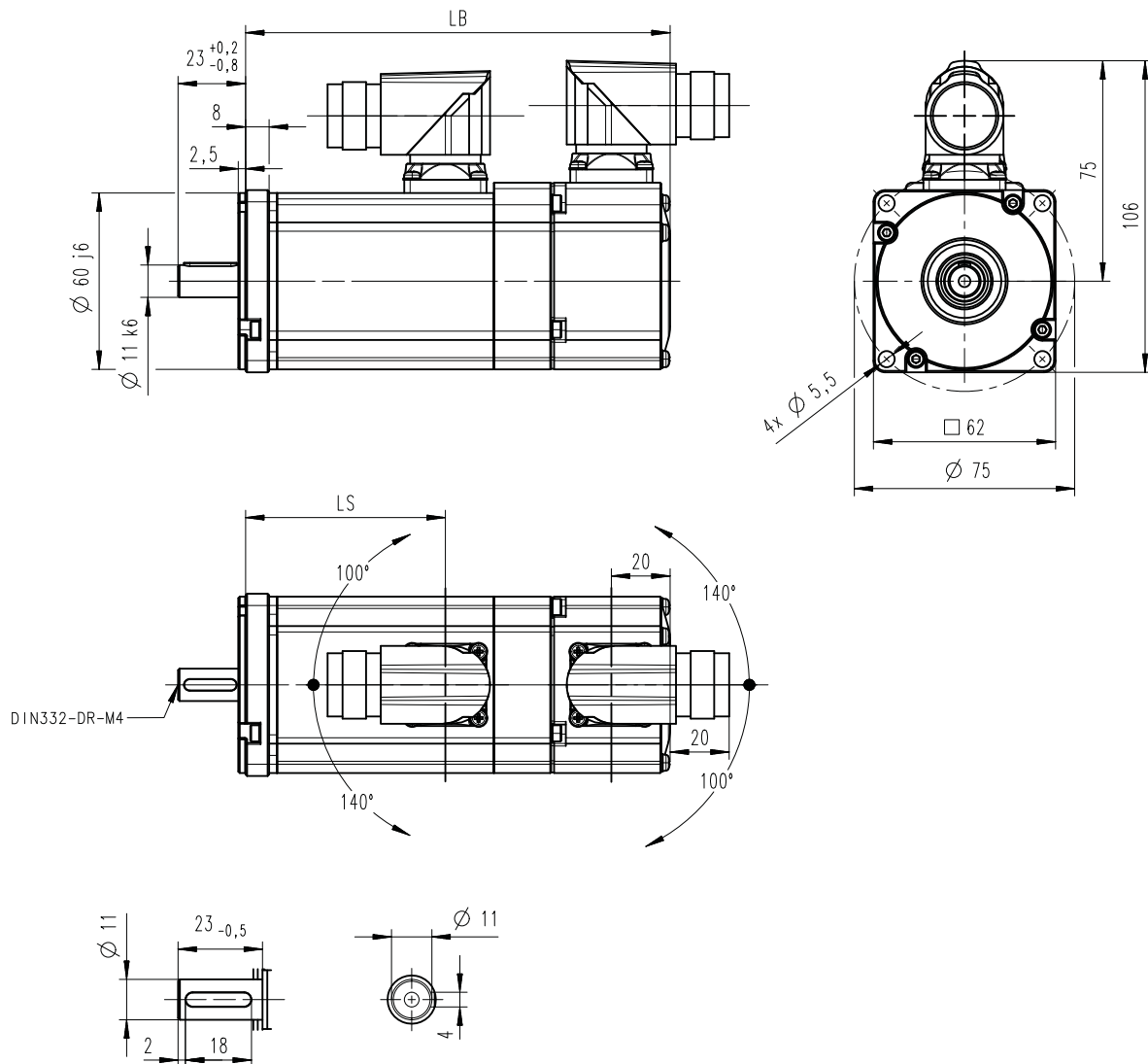
Dimensions
Basic dimensions

Dimensions

Basic dimensions

Self-ventilated motors MCM06

Output flange FF75



8800266-03

Motor			MCM06C	MCM06E
Total length without brake	LB	mm	146	171
Total length with brake	LB	mm	182	207
Motor/connection distance	LS	mm	69.0	94.0

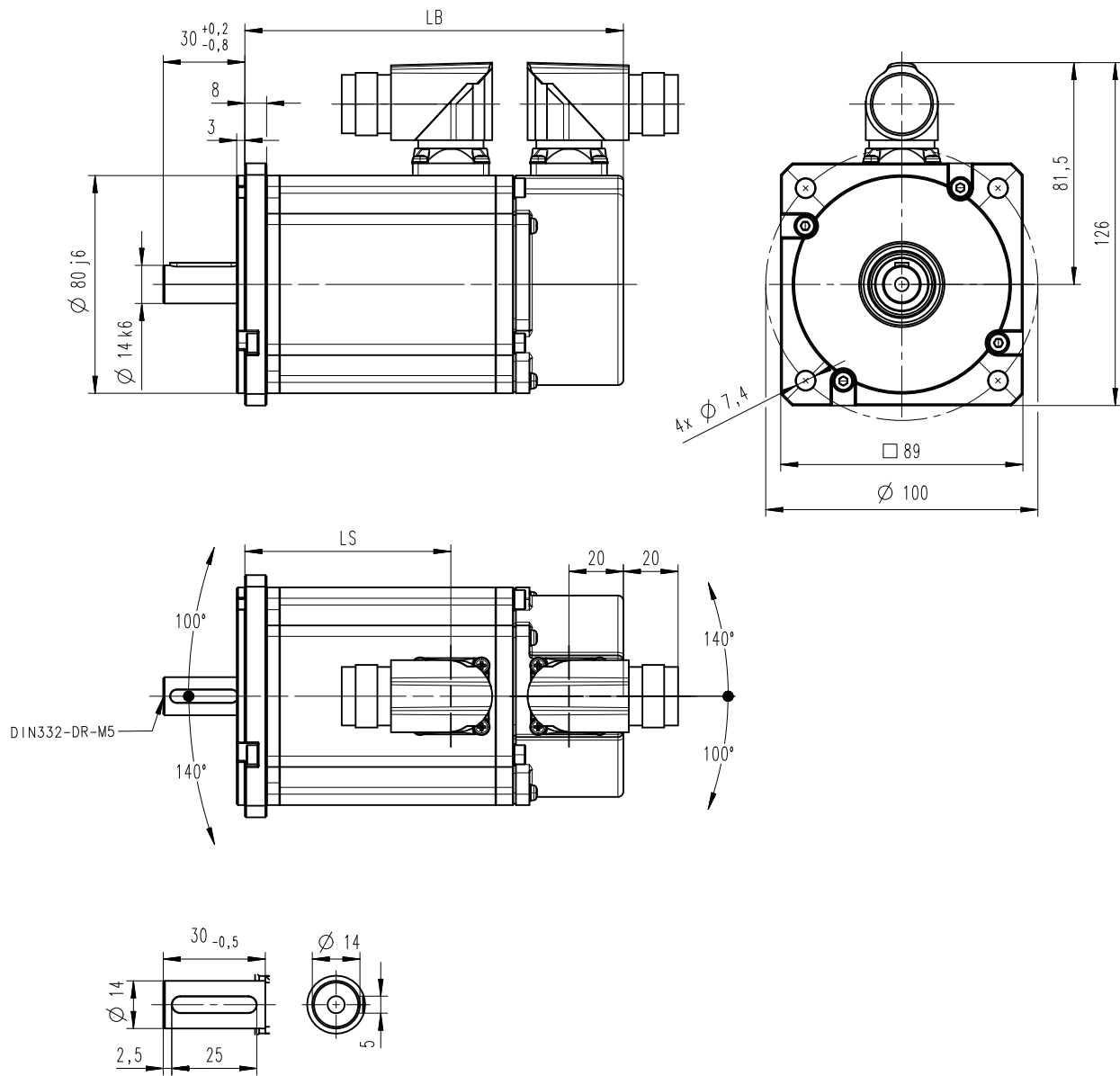
Technical data

Dimensions
Basic dimensions



Self-ventilated motors MCM09

Output flange FF100



8800267-03

Motor			MCM09C	MCM09E
Total length without brake	LB	mm	140	155
Total length with brake	LB	mm	176	191
Motor/connection distance	LS	mm	76.5	91.5

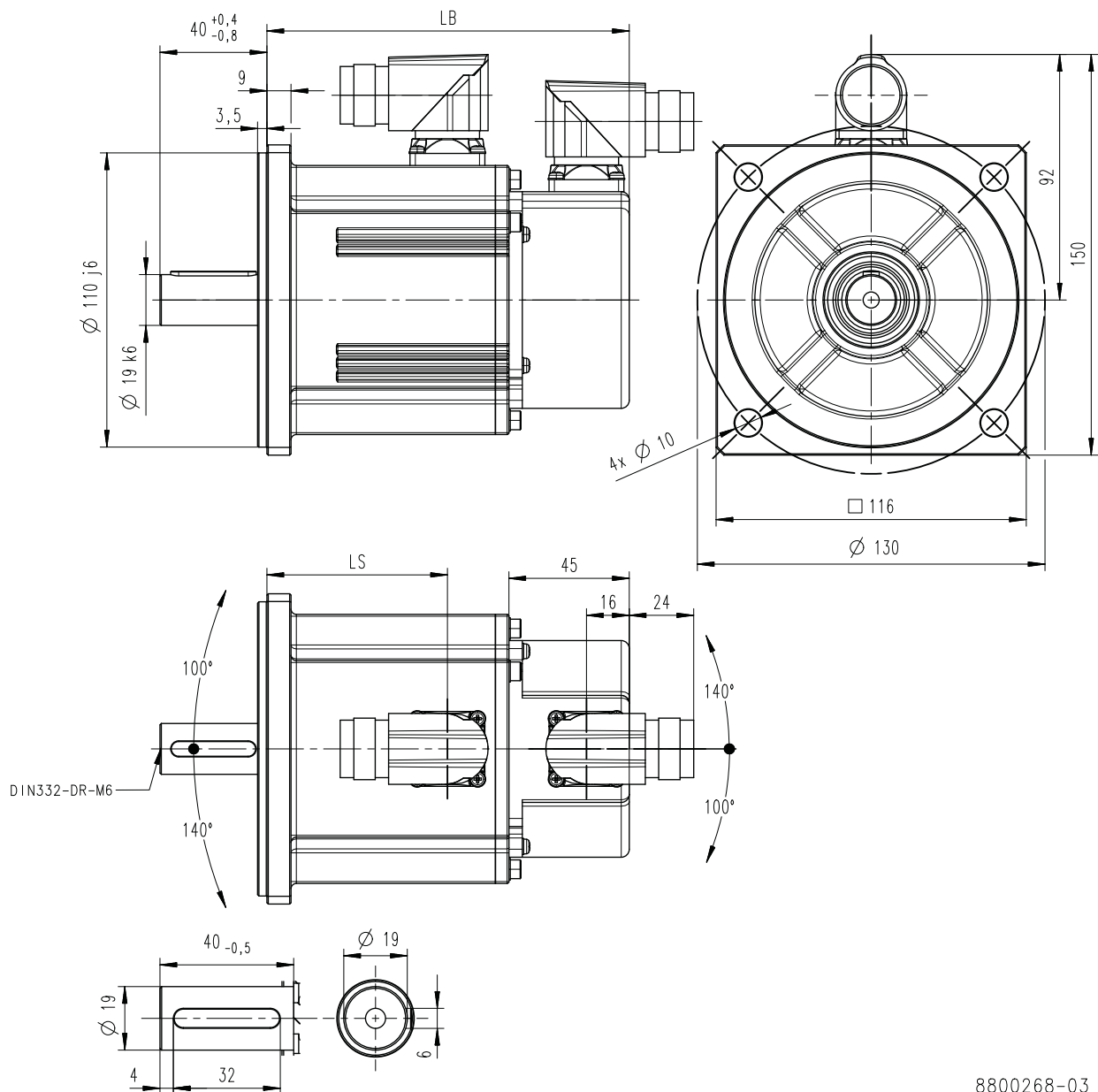


Technical data

Dimensions
Basic dimensions

Self-ventilated motors MCM12

Output flange FF130



8800268-03

Motor			MCM12C	MCM12F	MCM12J
Total length without brake	LB	mm	136	164	201
Total length with brake	LB	mm	178	206	243
Motor/connection distance	LS	mm	68.0	96.0	133



Product extensions

Motor connection

Connection via ICN connector

The electrical connection to the servo motors as a standard is established via ICN connectors.

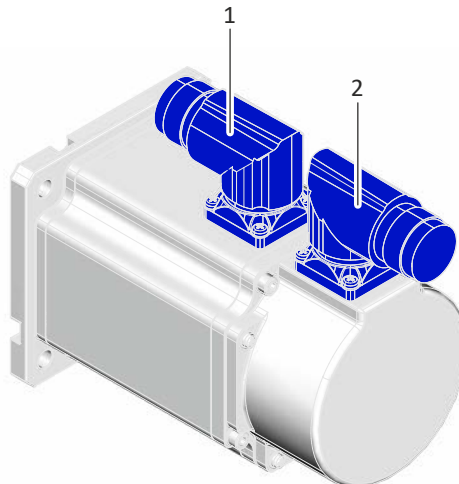
The connector can be rotated by 270 ° and are provided with a bayonet catch for SpeedTec connectors. Since the catch of the connector is compatible with conventional box nuts, existing counter plugs with a screw plug can be continued to use without any problems.



In order to provide for a quick and error-free connection of Lenze motors to Lenze inverters, we recommend using prefabricated Lenze system cables. In this way, proper functioning and the compliance with statutory provisions such as EMC, UL, etc. are ensured.

The use of different cables may cause unexpected faults and may void the warranty.

Position of the connections



Position	Meaning
1	Power connection Brake connection PE connection
2	Feedback connection Connection of temperature monitoring

Power and brake connection

ICN-M23 connector assignment 6-pole		
Contact	Name	Meaning
1	BD1	Holding brake +
2	BD2	Holding brake -
PE	PE	PE conductor
4	U	Power phase U
5	V	Power phase V
6	W	Power phase W

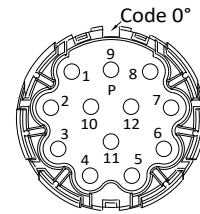


Product extensions

Motor connection
Connection via ICN connector

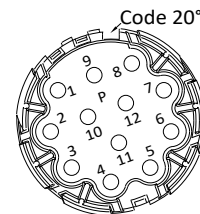
Feedback and temperature monitoring connection

ICN-M23 connector assignment Resolver		
Contact	Name	Meaning
1	+Ref	Transformer windings
2	-Ref	
3	+VCC ETS	Power supply: electronic nameplate
4	+COS	Stator windings cosine
5	-COS	
6	+SIN	Stator windings Sine
7	-SIN	
8		Not assigned
9		
10	Shield	Encoder housing shield
11	+	Temperature monitoring: KTY/PT1000
12	-	



Contact 3: only for motors and inverters which support this function.

ICN-M23 connector assignment Incremental and SinCos absolute value encoder Hiperface		
Contact	Name	Meaning
1	B	Track B / + SIN
2	A ⁻	Track A inverse / - COS
3	A	Track A / + COS
4	+ UB	Supply +
5	GND	Mass
6	Z ⁻	Zero track inverse / - RS485
7	Z	Zero track / + RS485
8		Not assigned
9	B ⁻	Track B inverse/-SIN
10	Shield	Encoder housing shield
11	+	Temperature monitoring: KTY/PT1000
12	-	



Product extensions

Brakes



Brakes

Optionally the motors can be ordered with a spring-applied brake as holding brake.

⚠ CAUTION!

They may not be used as safety elements (particularly with hoist axes) without additional measures being implemented.

The brakes used are not fail-safe brakes in the sense that prospective disruptive factors, e.g. oil ingress, can lead to a reduction in torque!

- ▶ The brakes must only be used as holding brakes for holding the axes at a standstill or in the deenergised state.
- ▶ The brake must not be used as a service brake.

⚠ CAUTION!

If no suitable voltage (incorrect value, incorrect polarity) is applied to the brake, the brake will be applied and can be overheated and destroyed by the motor continuing to rotate.

If long motor supply cables are used, pay attention to the ohmic voltage drop along the cable and compensate for it with a higher voltage at the input end of the cable.

The following applies to Lenze system cables:

$U[V] = U_B[V] + 0.08 \frac{[V]}{[A] \times [m]} \times I_{Lg}[m] \times I_B[A]$	V	V	Resulting supply voltage
	U_B	V	Rated voltage of the brake
	I_{Lg}	m	Cable length
	I	A	Rated current of the brake

NOTICE

- ▶ The brakes become active when the supply voltage has been switched off (closed-circuit principle).
- ▶ When using the brakes purely as holding brakes, virtually no wear occurs on the friction surfaces.
- ▶ The friction surfaces must always be free from oil and grease because even small amounts of grease or oil will considerably reduce the braking torque.

NOTICE

In case of travel axes, the compliance of the permissible ratio of mass inertia load/brake motor (J_L/J_{MB}) ensures that the permissible maximum switching energy of the brake will not be exceeded and at least the values given for the emergency stop functions from the given speed (see rated data) are applied.

For hoist axes, the load torque resulting from the weight acts additionally. In this case, the specifications for (J_L/J_{MB}) do not apply.



To simplify matters, the friction energy per switching cycle can be calculated using the formula below and must not exceed the limit value for emergency stops, which depends on the switching rate:

$Q = \frac{1}{2} \times J_{ges} \times \left(2\pi \times \frac{\Delta n}{60} \right)^2 \times \frac{M_N}{M_N - M_L}$	Q	J	Friction energy
	J_{total}	kgm ²	Total mass inertia (motor + load)
	Δn	rpm	Differential speed
	M_N	Nm	Rated torque of the brake
	M_L	nM	Load torque



The shortest operating times of the brakes are achieved by DC switching of the voltage and an external suppressor circuit (varistor or spark suppressor).

Without suppressor circuit, the operating times may increase. A varistor/ spark suppressor limits the breaking voltage peaks. It must be ensured that the power limit of the suppressor circuit is not exceeded. This limit depends on the brake current, brake voltage, disengagement time and the switching operations per time unit.

Furthermore the suppressor circuit is necessary for interference suppression and for increasing the service life of the relay contacts (external, is not integrated into the motor).



It is not possible to readjust the brake.

Product extensions

Brakes
Spring-applied brakes



Spring-applied brakes

Rated data

NOTICE

Engagement and disengagement times apply to rated voltage ($\pm 0\%$) and suppressor circuit of the brakes with a varistor with DC switching. Without a suppressor circuit, the times may be longer.

The currents are the maximum values when the brake is cold (value used for dimensioning the current supply). The values for a motor at operating temperature are considerably lower.

Requirements with regard to the DC 24 V brake: smoothed DC voltage, ripple $\leq 1\%$.

Maximum switching energy per emergency stop with $n = 3000$ rpm for at least 2000 emergency stops.

Motor			MCM06C30-	MCM06E30-	MCM09C30-	MCM09E30-
Supply voltage range	$U_{in,DC}$	V	22.8 ... 25.2		22.8 ... 25.2	
Rated voltage	$U_{N,DC}$	V	24		24	
Rated torque						
At 20 °C	M_N	Nm	1.35		2.9	
At 120 °C	M_N	Nm	1.30		2.5	
Rated current	I_N	A	0.36		0.42	
Engagement time	t_1	ms	15		20	
Disengagement time	t_2	ms	50		70	
Maximum switching energy	Q_E	J	30000		115000	
Mass	m	kg	0.30		0.50	
Moment of inertia						
Brake	J	kgcm ²	0.018		0.075	
Brake motor	J_{MB}	kgcm ²	0.21	0.36	0.69	0.97

Motor			MCM12C30-	MCM12F30-	MCM12J30--
Supply voltage range	$U_{in,DC}$	V	21.6 ... 26.4		
Rated voltage	$U_{N,DC}$	V	24		
Rated torque					
At 20 °C	M_N	Nm	8.0		12.0
At 120 °C	M_N	Nm	7.0		11.0
Rated current	I_N	A	0.81		
Engagement time	t_1	ms	15		
Disengagement time	t_2	ms	50		80
Maximum switching energy	Q_E	J	490000		
Mass	m	kg	0.75		
Moment of inertia					
Brake	J	kgcm ²	0.17		
Brake motor	J_{MB}	kgcm ²	2.00	3.25	4.95



Feedback

For speed control with a servo inverter, the servo motor can be equipped with the following feedback systems:

Feedback	Inverter			
	Connectable			Supports safety functions
Resolver				
RSO	i700	E84AVTC	E94A	-
Absolute value encoder				
AM128-8V-H	i700	E84AVTC	E94A	-

Resolver

The stator-supplied, 2-pole resolver with two stator windings shifted by 90 degrees and a rotor winding with a transformer winding can record both the speed and the rotor position, just like a single-turn absolute value encoder. The rotor position can be determined within one mechanical motor revolution after a voltage failure.

Feedback type	Resolver		
Feedback	RSO		
Speed-dependent safety functions			No
Resolution			
Angle		'	0.80
Accuracy		'	-10 ... 10
Absolute positioning			1 revolution
Max. speed	n_{max}	rpm	8000
Max. input voltage			
DC	$U_{in,max}$	V	10.0
Max. input frequency	$f_{in,max}$	kHz	4.00
Ratio			
Stator / rotor			$0.30 \pm 5 \%$
Rotor impedance	Z_{ro}	Ω	$51 + j90$
Stator impedance	Z_{so}	Ω	$102 + j150$
Impedance	Z_{rs}	Ω	$44 + j76$
Min. insulation resistance			
With DC 500 V	R_{min}	M Ω	10.0
Number of pole pairs			1
Max. angle error		'	-10 ... 10

Product extensions

Temperature monitoring
KTY temperature sensor



Absolute value encoder

Absolute value encoders can detect the speed, the rotor position, and the machine position with a very high resolution. They are used for the positioning of dynamic applications and do not require homing.

Feedback type			SinCos absolute value
Feedback			AM128-8V-H
Speed-dependent safety functions			No
Encoder type			Multi-turn
Pulses			128
Output signals			1 Vss
Interfaces			Hiperface
Absolute revolution			4096
Resolution (angle)		'	0.40
Accuracy		'	-1.3 ... 1.3
Min. DC input voltage	$U_{in,min}$	V	7.00
Max. DC input voltage	$U_{in,max}$	V	12.0
Max. speed	n_{max}	rpm	9000
Max. current consumption	I_{max}	A	0.060
Limit frequency	f_{max}	kHz	200

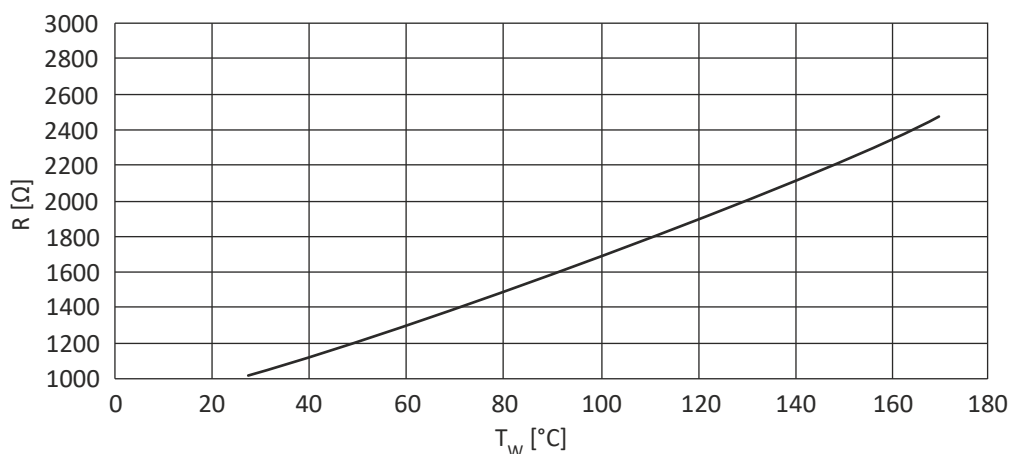
Temperature monitoring

KTY temperature sensor

In case of this motor, the winding temperature of a winding phase is monitored with a thermal sensor KTY83-110.



When supplying the thermal sensors with a measurement current of 1 mA, the connection between the temperature and the resistance measured applies.



R Resistance
 T_w Winding temperature



Product codes

Motor product code

Example		MCM	06	C	30	-	RS0	B0
Meaning	Variant	Motor code						
Product family		MCM						
Size			06 09 12					
Overall length				C ... J				
Rated speed	rpm x 100				30			
Mains voltage	3 x 400 V, IP54/IP65					-		
Feedback	SinCos absolute value encoder AM128-8V-H						SKM	
	Resolver RS0						RS0	
Brake	Without							B0
	Spring-applied brake DC 24 V							F1



Appendix

Good to know

Approvals/directives

CCC	China Compulsory Certification documents the compliance with the legal product safety requirements of the PR of China - in accordance with Guobiao standards.
c _{CSA} _{US}	CSA certificate, tested according to US and Canada standards
UE	Union Européenne documents the declaration of the manufacturer that EU Directives are complied with.
CEL	China Energy Label documents the compliance with the legal energy efficiency requirements for motors, tested according to the PR of China and Guobiao standards
CSA	CSA Group (Canadian Standards Association) CSA certificate, tested according to Canada standards
UL ^{Energy} _{US CA}	Energy Verified Certificate Determining the energy efficiency according to CSA C390 for products within the scope of energy efficiency requirements in the USA and Canada
c _{UL} _{US}	UL certificate for products, tested according to US and Canada standards
c _{UR} _{US}	UL certificate for components, tested according to US and Canada standards
EAC	Customs union Russia / Belarus / Kazakhstan certificate documents the declaration of the manufacturer that the specifications for the Eurasian conformity (EAC) required for placing electronic and electromechanical products on the market of the entire territory of the Customs Union (Russia, Belarus, Kazakhstan, Armenia and Kyrgyzstan) are complied with.
UL	Underwriters Laboratory Listed Product
UL _{LISTED}	UL Listing approval mark as proof that the product has been tested and the applicable safety requirements have been confirmed by UL (Underwriters Laboratory).
UR	UL Recognized Component approval mark as proof that the UL approved component can be used in a product or system bearing the UL Listing approval mark.

Enclosures

The degree of protection indicates the suitability of a motor for specific ambient conditions with regard to humidity as well as the protection against contact and the ingress of foreign particles. The degrees of protection are classified by EN 60529.

The first code number after the code letters IP indicates the protection against the ingress of foreign particles and dust. The second code number refers to the protection against the ingress of humidity.

Code number 1	Degree of protection	Code number 2	Degree of protection
0	No protection	0	No protection
1	Protection against the ingress of foreign particles $d > 50$ mm. No protection in case of deliberate access.	1	Protection against vertically dripping water (dripping water).
2	Protection against medium-sized foreign particles, $d > 12$ mm, keeping away fingers or the like.	2	Protection against diagonally falling water (dripping water), 15° compared to normal service position.
3	Protection against small foreign particles $d > 2.5$ mm. Keeping away tools, wires or the like.	3	Protection against spraying water, up to 60° from vertical.
4	Protection against granular foreign particles, $d > 1$ mm, keeping away tools, wire or the like.	4	Protection against spraying water from all directions.
5	Protection against dust deposits (dust-protected), complete protection against contact.	5	Protection against water jets from all directions.
6	Protection against the ingress of dust (dust-proof), complete protection against contact.	6	Protection against choppy seas or heavy water jets (flood protection).

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