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# Servo motors

m850 synchronous servo motor



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## Inhalt

<b>About this document</b> .....	<b>5</b>
Document description .....	5
Further documents.....	5
Notations and conventions.....	6
<b>Product information</b> .....	<b>7</b>
Product description .....	7
Identification of the products.....	7
Features.....	8
The modular system .....	9
<b>Information on project planning</b> .....	<b>11</b>
Safety instructions .....	12
Basic safety instructions .....	12
Application as directed.....	12
Foreseeable misuse.....	12
Residual hazards.....	13
Drive dimensioning.....	14
Final configuration.....	18
Environmental conditions.....	18
<b>Information on mechanical installation</b> .....	<b>19</b>
Important notes.....	19
Transport.....	19
Installation.....	19
<b>Information on electrical installation</b> .....	<b>20</b>
Important notes.....	20
Preparation.....	20
<b>Technical data</b> .....	<b>21</b>
Notes regarding the given data .....	21
Standards and operating conditions.....	22
Conformities/approvals.....	22
Protection of persons and device protection .....	22
EMC data.....	22
Environmental conditions.....	22
Radial forces and axial forces .....	23
Rated data .....	25
Inverter mains connection 400 V, Self-ventilated.....	25
Selection tables.....	27
Torque characteristics.....	34
Dimensions.....	39
Basic dimensions.....	39

# Inhalt

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<b>Product extensions</b> .....	<b>42</b>
Motor connection.....	42
Connection via ICN connector .....	42
Brakes.....	46
Spring-applied brakes.....	48
Feedback .....	50
Resolver .....	51
Absolute value encoder.....	52
Temperature monitoring.....	53
Thermal detectors PT1000.....	53
<b>Product codes</b> .....	<b>54</b>
<b>Appendix</b> .....	<b>55</b>
Good to know.....	55
Approvals/directives .....	55
Operating modes of the motor.....	56
Enclosures.....	57



## 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](#)  12
  - ▶ [Information on mechanical installation](#)  19
  - ▶ [Information on electrical installation](#)  20
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### Further documents



Information and tools with regard to the Lenze products can be found on the Internet:

<http://www.lenze.com> → Download

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# 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			
	Programs	» «	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!**

This note refers to an imminent danger which, if not avoided, may result in death or serious injury.

#### **WARNING!**

This note refers to a danger which, if not avoided, may result in death or serious injury.

#### **CAUTION!**

This note refers to a danger which, if not avoided, may result in minor or moderate injury.

#### **NOTICE**

This note refers to a danger which, if not avoided, may result in damage to material assets.



## Product information

### Product description

#### m850 - 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 Top-Line, high-performance drive solutions in the torque range from 4.8 to 200 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



Fig. 1: m850-S140/S3240 synchronous servo motor

## Identification of the products

### Product name of the motor

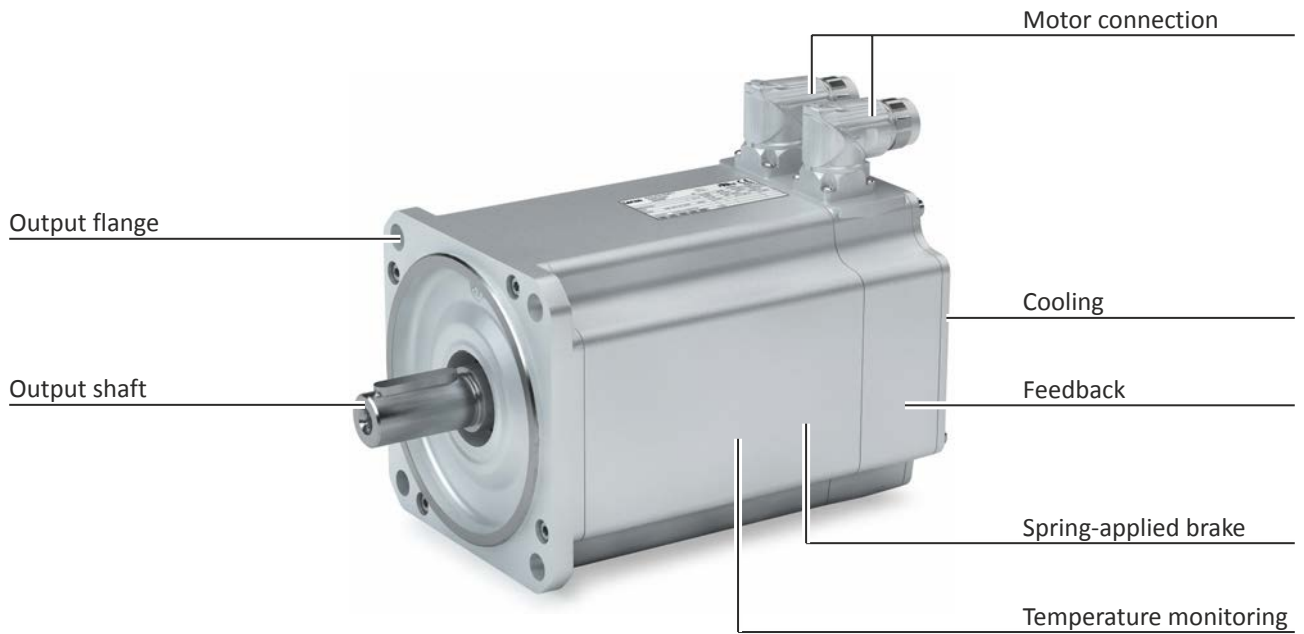
Product series		Type	Flange height		Overall length	Rated speed	Motor
			mm			rpm	
m850	-	S (synchronous)	120	/	S (short)	3960	m850-S120/S3960
					M (medium)	3960	m850-S120/M3960
					L (long)	3960	m850-S120/L3960
			140		S (short)	3240	m850-S140/S3240
					M (medium)	3240	m850-S140/M3240
					L (long)	3240	m850-S140/L3240
			190		S (short)	3000	m850-S190/S3000
					M (medium)	3000	m850-S190/M3000
					L (long)	2520	m850-S190/L2520

# Product information

Features



## 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		m850-S120/S3960	m850-S120/M3960	m850-S120/L3960
Technical data				
Rated power	kW	2.0	3.1	3.7
Rated torque	Nm	4.8	7.4	9.0
Max. torque	Nm	14.5	29.0	44.0
Rated speed	rpm	3960	3960	3960
Colour		Unpainted		
Surface and corrosion protection (called OKS)		<b>Without</b> Different types of OKS		
Output shaft				
<b>Solid shaft without keyway</b>	mm	19 x 40		
Solid shaft with featherkey	mm	19 x 40		
Shaft material		Steel		
Shaft sealing ring material		FKM		
Output flange	mm	FF130		
Cooling		<b>Self-ventilated IP54</b> Self-ventilated IP65		
Motor connection		ICN connector		
Spring-applied brake				
		<b>Without</b> With		
Characteristic torque	Nm	18		
DC brake voltage	V	24		
Feedback				
		<b>Resolver</b> Absolute value encoder		
Temperature monitoring		PT1000 thermal detector + 2 PTC thermistors		

Motor		m850-S140/S3240	m850-S140/M3240	m850-S140/L3240
Technical data				
Rated power	kW	2.9	4.8	5.9
Rated torque	Nm	8.5	14.0	17.4
Max. torque	Nm	26.0	53.5	80.0
Rated speed	rpm	3240	3240	3240
Colour		Unpainted		
Surface and corrosion protection (called OKS)		<b>Without</b> Different types of OKS		
Output shaft				
<b>Solid shaft without keyway</b>	mm	24 x 50		
Solid shaft with featherkey	mm	24 x 50		
Shaft material		Steel		
Shaft sealing ring material		FKM		
Output flange	mm	FF165		
Cooling		<b>Self-ventilated IP54</b> Self-ventilated IP65		
Motor connection		ICN connector		
Spring-applied brake				
		<b>Without</b> With		
Characteristic torque	Nm	32		
DC brake voltage	V	24		
Feedback				
		<b>Resolver</b> Absolute value encoder		
Temperature monitoring		PT1000 thermal detector + 2 PTC thermistors		

# Product information

The modular system



Motor		m850-S190/S3000	m850-S190/M3000	m850-S190/L2520
Technical data				
Rated power	kW	5.0	7.5	9.2
Rated torque	Nm	16	24	35
Max. torque	Nm	71.0	120	200
Rated speed	rpm	3000	3000	2520
Colour		Unpainted		
Surface and corrosion protection (called OKS)		<b>Without</b> Different types of OKS		
Output shaft				
<b>Solid shaft without keyway</b>	mm	28 x 60		
Solid shaft with featherkey	mm	28 x 60		
Shaft material		Steel		
Shaft sealing ring material		FKM		
Output flange	mm	FF215		
Cooling		<b>Self-ventilated IP54</b> Self-ventilated IP65		
Motor connection		ICN connector		
Spring-applied brake				
		<b>Without</b> With		
Characteristic torque	Nm	100		
DC brake voltage	V	24		
Feedback				
		<b>Resolver</b> Absolute value encoder		
Temperature monitoring		PT1000 thermal detector + 2 PTC thermistors		



### **Information on project planning**

In order to carry out an accurate drive dimensioning process, you can use our configuring software, the Drive Solution Designer.

With the Drive Solution Designer you can carry out the drive dimensioning process quickly and with top quality. The software contains profound and proven expertise with regard to drive applications and mechatronic drive components.

Please refer to your competent Lenze sales company.

# Information on project planning

Safety instructions  
Foreseeable misuse



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## 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.

The procedural notes and circuit details described in this document 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/EC: 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/EC: 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



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## 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  $I > I_{\text{rated}}$ , 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.

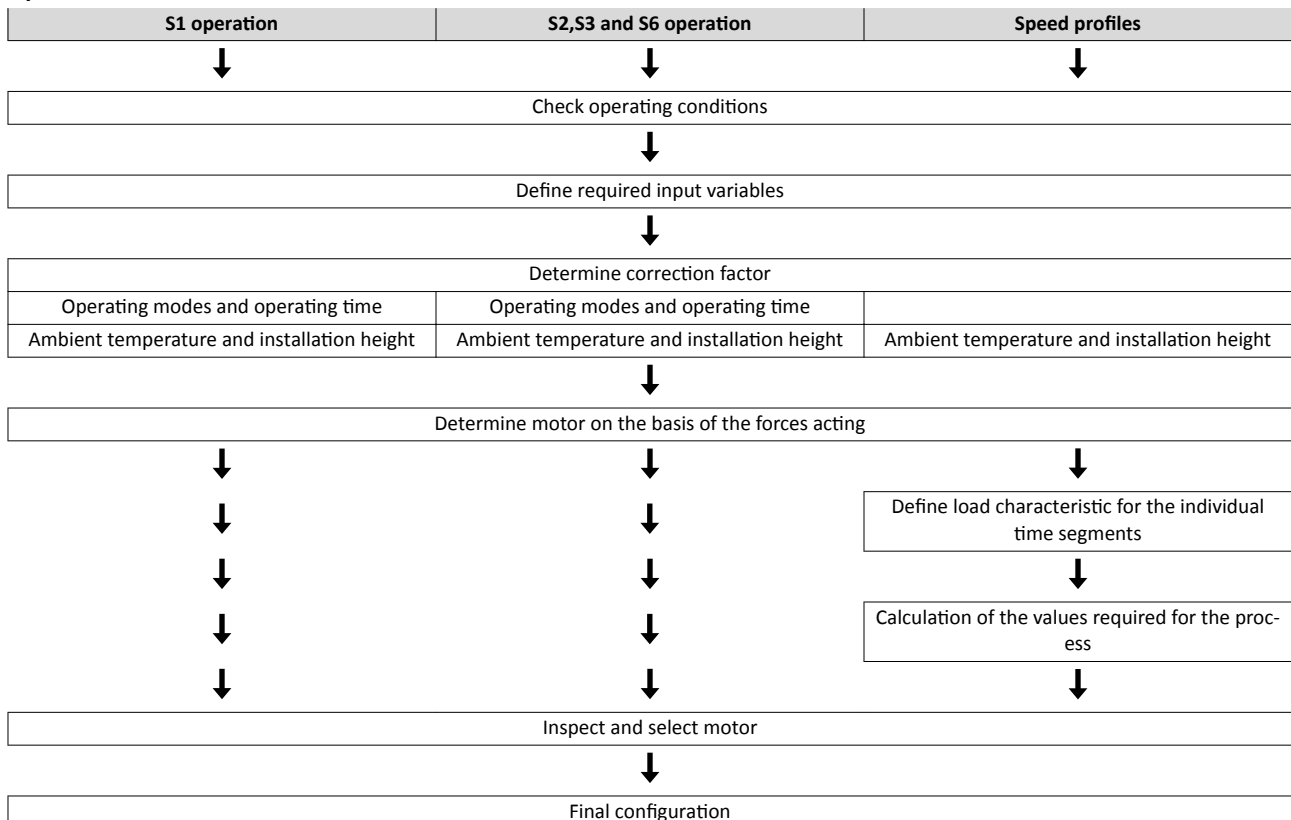
The motor is thermally dimensioned on the basis of the mean speed and the effective torque.

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





### Check operating conditions

Check
Approvals
Conformity declarations
Supply voltage
Enclosure
Ambient temperature
Surface protection

▶ Conformities/approvals [22](#)

▶ Environmental conditions [18](#)

### 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

▶ Operating modes of the motor [56](#)

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 pre-loading)	Narrow V-belt ( depending on the preloading)
Additional radial force factor	$f_z$		$\geq 17$ teeth = 1.0	$\geq 20$ 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	
			<b>Calculation</b>		<b>Check</b>	
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](#) 23

### 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](#) 25

### 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 (○)		$n_L$	
Below the S1 torque characteristic of the servo motor		$M_L / (k_L \times k_H)$	

► [Rated data](#) 25

► [Torque characteristics](#) 34





### 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	$\Delta t_z$	$n_{L,z}$	$\Delta n_{L,z}$	$M_{L,z}$	$M_z$	$M_{S,z}$	$J_L$
s	s	rpm	rpm	Nm	Nm	Nm	kgcm <sup>2</sup>

	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	$M_{eff} = \sqrt{\frac{1}{T} \sum M_z^2 \times \Delta t_z}, T \leq 1 \text{min}$	$M_{eff} =$	Nm
Mean speed	$n_m = \overline{n_{L,z}} = \frac{1}{T} \sum  n_{L,z}  \times \Delta t_z$	$n_m =$	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	$M_{S,eff} = \sqrt{\frac{1}{T} \sum M_{S,z}^2 \times \Delta t_z}$	$M_{S,eff} =$	
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 [25](#)

▶ Torque characteristics [34](#)

# Information on project planning

Final configuration  
Environmental conditions



## Final configuration

	Check
Connection dimensions	Output shaft Output flange
Product extensions	Brake Feedback

More information about the final configuration:

▶ [The modular system](#) 9

▶ [Product extensions](#) 42

## Environmental conditions

### Surface and corrosion protection (called OKS)

Depending on the ambient conditions, the surface and corrosion protection system (called OKS) offers tailor-made solutions for optimum protection.

Various surface coatings ensure that the motors operate reliably even at high air humidity, in outdoor installation or in the presence of atmospheric impurities. Any colour from the "RAL Classic" collection can be chosen for the top coat.

For the indoor installation and if no special corrosion protection is required, the products are also available unpainted (without OKS).

Surface and corrosion protection (called OKS)	Applications	Type
without OKS (unpainted)	<ul style="list-style-type: none"> <li>Indoor installation, no special corrosion protection necessary</li> <li>Painting by customer</li> </ul>	Standard
OKS-G (primed)	<ul style="list-style-type: none"> <li>Dependent on subsequent top coat applied</li> </ul>	Optional
OKS-S (small)	<ul style="list-style-type: none"> <li>Standard applications</li> <li>Internal installation in heated buildings</li> <li>Air humidity up to 90 %</li> </ul>	
OKS-M (medium)	<ul style="list-style-type: none"> <li>Internal installation in non-heated buildings</li> <li>Covered, protected external installation</li> <li>Air humidity up to 95 %</li> </ul>	
OKS-L (large)	<ul style="list-style-type: none"> <li>External installation</li> <li>Air humidity above 95 %</li> <li>Chemical industrial plants</li> <li>Food industry</li> </ul>	

Surface and corrosion protection (called OKS)	Corrosivity category	Surface coating	Colour	Coating thickness
	<b>DIN EN ISO 12944-2</b>	<b>Design</b>		
without OKS (unpainted)				
OKS-G (primed)		<ul style="list-style-type: none"> <li>2K PUR priming coat</li> </ul>		60 ... 90 µm
OKS-S (small)	Comparable to C1	<ul style="list-style-type: none"> <li>2K-PUR top coat</li> </ul>	<ul style="list-style-type: none"> <li>Standard: RAL 7012</li> <li>Optional: RAL Classic</li> </ul>	80 ... 120 µm
OKS-M (medium)	Comparable to C2	<ul style="list-style-type: none"> <li>2K PUR priming coat</li> </ul>		110 ... 160 µm
OKS-L (large)	Comparable to C3	<ul style="list-style-type: none"> <li>2K-PUR top coat</li> </ul>		140 ... 200 µm



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## 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](#) 22
- 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](#) 18
- 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.



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## 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



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The notes for the electrical connection can be found in the terminal box (if motors with a terminal box are used).  
the connection plan (if motors with connectors are used).

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### EMC-compliant wiring



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

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## 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.



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In the case of other operating conditions, the achievable values can differ from those name. In the case of extreme operating conditions, please ask the Lenze sales company that is responsible for you..

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# Technical data

Standards and operating conditions  
Environmental conditions



## Standards and operating conditions

### Conformities/approvals

Conformity		
CE	2014/35/EU	Low-Voltage Directive
	2014/30/EU	EMC Directive (reference: CE-typical drive system)
EAC	TR TC 004/2011	Eurasian conformity: safety of low voltage equipment
	TP TC 020/2011	Eurasian conformity: electromagnetic compatibility of technical means
Approval		
cULus	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

Enclosure		
IP54	EN 60034-5	Self-ventilated
IP65	EN 60034-5	Self-ventilated
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 (-20 °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 a.m.s.l.		Without power reduction
1000 ... 2000 m amsl		Reduce rated output current of the inverter by 5 %/1000 m
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	



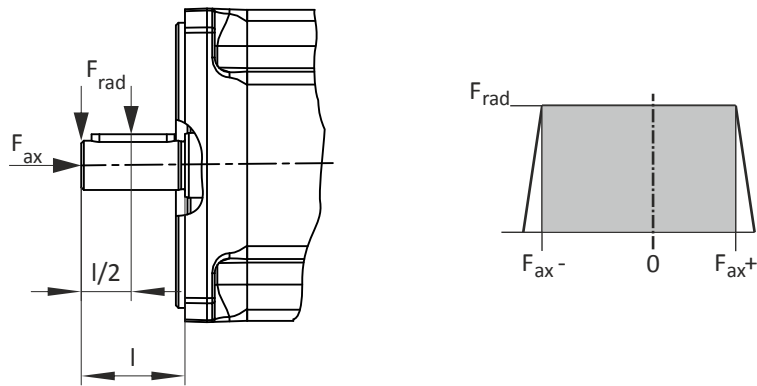
## Radial forces and axial forces



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 [25](#)

### Application of forces



### Application of force at $l/2$

Bearing service life $L_{10h}$			Motor		
			m850-S120/S3960 m850-S120/M3960 m850-S120/L3960	m850-S140/S3240 m850-S140/M3240 m850-S140/L3240	m850-S190/S3000 m850-S190/M3000 m850-S190/L2520
5000 h					
Radial force	$F_{rad}$	N	940	1210	2600
Axial tensile force	$F_{ax,-}$	N	-870	-1100	-1440
Axial compression force	$F_{ax,+}$	N	530	700	960
10000 h					
Radial force	$F_{rad}$	N	740	960	2050
Axial tensile force	$F_{ax,-}$	N	-670	-860	-1120
Axial compression force	$F_{ax,+}$	N	330	450	640
20000 h					
Radial force	$F_{rad}$	N	600	790	1620
Axial tensile force	$F_{ax,-}$	N	-540	-690	-920
Axial compression force	$F_{ax,+}$	N	200	290	440
30000 h					
Radial force	$F_{rad}$	N	480	660	1440
Axial tensile force	$F_{ax,-}$	N	-490	-660	-800
Axial compression force	$F_{ax,+}$	N	150	260	320

# Technical data

## Radial forces and axial forces



### Application of force at I

Bearing service life $L_{10h}$			Motor		
			m850-S120/S3960	m850-S140/S3240	m850-S190/S3000
			m850-S120/M3960	m850-S140/M3240	m850-S190/M3000
			m850-S120/L3960	m850-S140/L3240	m850-S190/L2520
5000 h					
Radial force	$F_{rad}$	N	820	1030	2170
Axial tensile force	$F_{ax, -}$	N	-800	-1080	-1290
Axial compression force	$F_{ax, +}$	N	460	680	810
10000 h					
Radial force	$F_{rad}$	N	650	820	1710
Axial tensile force	$F_{ax, -}$	N	-640	-830	-1030
Axial compression force	$F_{ax, +}$	N	300	420	550
20000 h					
Radial force	$F_{rad}$	N	530	670	1350
Axial tensile force	$F_{ax, -}$	N	-520	-670	-820
Axial compression force	$F_{ax, +}$	N	180	270	340
30000 h					
Radial force	$F_{rad}$	N	420	550	1210
Axial tensile force	$F_{ax, -}$	N	-470	-630	-720
Axial compression force	$F_{ax, +}$	N	130	230	240





# Technical data

Rated data  
Inverter mains connection 400 V, Self-ventilated

## Rated data

### Inverter mains connection 400 V, Self-ventilated

Product name			m850-S120/S3960	m850-S120/M3960	m850-S120/L3960
Standstill torque	Nm	$M_0$	6.50	11.0	15.0
Rated torque	Nm	$M_N$	4.80	7.40	9.00
Max. torque	Nm	$M_{max}$	14.5	29.0	44.0
Rated speed	rpm	$n_N$	3960	3960	3960
Max. speed	rpm	$n_{max}$	6000	6000	6000
Rated power	kW	$P_N$	2.00	3.10	3.70
Standstill current	A	$I_0$	5.50	8.80	12.1
Output current	A	$I_N$	4.30	6.40	7.80
Max. current	A	$I_{max}$	15.0	28.0	42.0
Rated voltage	V	$V_{r, AC}$	330	330	320
Rated frequency	Hz	$f_N$	330	330	330
Moment of inertia	kgcm <sup>2</sup>	J	6.50	12.4	18.2
Efficiency		$\eta_{100\%}$	0.902	0.914	0.914
Torque constant	Nm/A	$Kt_{0, 150^\circ C}$	1.18	1.25	1.24
Voltage constant	V/ 1000rpm	$KE_{LL, 150^\circ C}$	69.0	73.1	72.9
Stator terminal resistance	$\Omega$	$R_{UV, 20^\circ C}$	2.24	1.02	0.63
Stator terminal resistance	$\Omega$	$R_{UV, 150^\circ C}$	3.38	1.54	0.95
Stator inductance	mH	L	11.5	6.73	4.58
Mass	kg	m	6.50	9.25	12.0

Product name			m850-S140/S3240	m850-S140/M3240	m850-S140/L3240
Standstill torque	Nm	$M_0$	11.0	21.0	28.0
Rated torque	Nm	$M_N$	8.50	14.0	17.4
Max. torque	Nm	$M_{max}$	26.0	53.5	80.0
Rated speed	rpm	$n_N$	3240	3240	3240
Max. speed	rpm	$n_{max}$	6000	6000	6000
Rated power	kW	$P_N$	2.90	4.80	5.90
Standstill current	A	$I_0$	7.40	14.0	18.0
Output current	A	$I_N$	6.30	10.0	12.2
Max. current	A	$I_{max}$	23.0	45.5	66.0
Rated voltage	V	$V_{r, AC}$	340	330	330
Rated frequency	Hz	$f_N$	270	270	270
Moment of inertia	kgcm <sup>2</sup>	J	15.7	30.1	44.6
Efficiency		$\eta_{100\%}$	0.879	0.915	0.926
Torque constant	Nm/A	$Kt_{0, 150^\circ C}$	1.49	1.50	1.56
Voltage constant	V/ 1000rpm	$KE_{LL, 150^\circ C}$	86.8	88.4	90.7
Stator terminal resistance	$\Omega$	$R_{UV, 20^\circ C}$	1.44	0.56	0.37
Stator terminal resistance	$\Omega$	$R_{UV, 150^\circ C}$	2.16	0.85	0.55
Stator inductance	mH	L	9.90	5.22	3.76
Mass	kg	m	9.50	14.5	19.5

# Technical data

Rated data

Inverter mains connection 400 V, Self-ventilated



Product name			m850-S190/S3000	m850-S190/M3000	m850-S190/L2520
Standstill torque	Nm	$M_0$	27.0	46.0	67.0
Rated torque	Nm	$M_N$	16.0	24.0	35.0
Max. torque	Nm	$M_{max}$	71.0	120	200
Rated speed	rpm	$n_N$	3000	3000	2520
Max. speed	rpm	$n_{max}$	4500	4500	4500
Rated power	kW	$P_N$	5.00	7.50	9.20
Standstill current	A	$I_0$	16.0	26.8	30.8
Output current	A	$I_N$	10.3	15.4	17.7
Max. current	A	$I_{max}$	64.0	87.0	112
Rated voltage	V	$V_{r, AC}$	340	330	345
Rated frequency	Hz	$f_N$	250	250	210
Moment of inertia	kgcm <sup>2</sup>	J	60.8	117	193
Efficiency		$\eta_{100\%}$	0.905	0.919	0.929
Torque constant	Nm/A	$Kt_{0 150\text{ °C}}$	1.69	1.72	2.18
Voltage constant	V/ 1000rpm	$KE_{LL 150\text{ °C}}$	99.2	101	125
Stator terminal resistance	$\Omega$	$R_{UV 20\text{ °C}}$	0.45	0.20	0.16
Stator terminal resistance	$\Omega$	$R_{UV 150\text{ °C}}$	0.68	0.30	0.24
Stator inductance	mH	L	5.46	2.90	2.76
Mass	kg	m	19.8	28.5	41.0



## 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, see the servo inverter catalogue.

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).
	$M_{rated}$	Rated torque	
	$n_{rated}$	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
m850-S120/S3960	60
m850-S120/M3960	
m850-S120/L3960	
m850-S140/S3240	
m850-S140/M3240	
m850-S140/L3240	
m850-S190/S3000	
m850-S190/M3000	
m850-S190/L2520	





# Technical data

Selection tables

Motor	Inverter													
	E84AVTC□													
	1524	2224	3024	4024	5524	7524	1134	1534	1834	2234	3034	3734	4534	
m850-S190/S3000														
Rated torque	$M_{rated}$	Nm				14.8	16.0	16.0	16.0	16.0	16.0	16.0		
Standstill torque	$M_0$	Nm				16.0	21.9	27.0	27.0	27.0	27.0	27.0		
Max. standstill torque	$M_{0,max}$	Nm				24.1	32.1	39.2	51.4	62.5	68.8	71.0		
Max. torque	$M_{max}$	Nm				31.4	40.7	48.9	61.8	71.0	71.0	71.0		
Transition speed	$n_{eto}$	rpm				2668	2373	2153	1868	1674	1674	1674		
m850-S190/M3000														
Rated torque	$M_{rated}$	Nm					20.3	24.0	24.0	24.0	24.0	24.0	24.0	
Standstill torque	$M_0$	Nm					22.3	28.3	40.3	46.0	46.0	46.0	46.0	
Max. standstill torque	$M_{0,max}$	Nm					33.5	42.6	58.9	76.7	90.0	103.8	120.0	
Max. torque	$M_{max}$	Nm					44.6	55.5	75.4	96.5	111.5	120.0	120.0	
Transition speed	$n_{eto}$	rpm					2924	2732	2412	2130	1967	1884	1884	
m850-S190/L2520														
Rated torque	$M_{rated}$	Nm						32.6	35.0	35.0	35.0	35.0	35.0	35.0
Standstill torque	$M_0$	Nm						35.9	51.1	67.0	67.0	67.0	67.0	67.0
Max. standstill torque	$M_{0,max}$	Nm						53.9	76.0	100.5	119.5	139.9	168.0	194.9
Max. torque	$M_{max}$	Nm						71.4	98.6	129.0	152.0	169.2	200.0	200.0
Transition speed	$n_{eto}$	rpm						2380	2146	1915	1766	1669	1523	1523

# Technical data

## Selection tables



### 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□				
			0104	0204	0324	0484	0644
m850-S120/S3960							
Rated torque	$M_{rated}$	Nm	4.8	4.8			
Standstill torque	$M_0$	Nm	5.9	6.5			
Max. standstill torque	$M_{0,max}$	Nm	10.8	14.5			
Max. torque	$M_{max}$	Nm	10.8	14.5			
Transition speed	$n_{eto}$	rpm	3106	2599			
m850-S120/M3960							
Rated torque	$M_{rated}$	Nm		7.4	7.4		
Standstill torque	$M_0$	Nm		11.0	11.0		
Max. standstill torque	$M_{0,max}$	Nm		22.5	29.0		
Max. torque	$M_{max}$	Nm		22.5	29.0		
Transition speed	$n_{eto}$	rpm		2863	2477		
m850-S120/L3960							
Rated torque	$M_{rated}$	Nm		9.0	9.0	9.0	
Standstill torque	$M_0$	Nm		12.4	15.0	15.0	
Max. standstill torque	$M_{0,max}$	Nm		23.8	35.6	44.0	
Max. torque	$M_{max}$	Nm		23.8	35.6	44.0	
Transition speed	$n_{eto}$	rpm		3398	2789	2483	
m850-S140/S3240							
Rated torque	$M_{rated}$	Nm		8.5	8.5		
Standstill torque	$M_0$	Nm		11.0	11.0		
Max. standstill torque	$M_{0,max}$	Nm		24.0	26.0		
Max. torque	$M_{max}$	Nm		24.0	26.0		
Transition speed	$n_{eto}$	rpm		2167	2050		
m850-S140/M3240							
Rated torque	$M_{rated}$	Nm		14.0	14.0	14.0	
Standstill torque	$M_0$	Nm		15.0	21.0	21.0	
Max. standstill torque	$M_{0,max}$	Nm		28.8	42.1	53.5	
Max. torque	$M_{max}$	Nm		28.8	42.1	53.5	
Transition speed	$n_{eto}$	rpm		2855	2362	2051	
m850-S140/L3240							
Rated torque	$M_{rated}$	Nm		14.3	17.4	17.4	17.4
Standstill torque	$M_0$	Nm		15.6	24.9	28.0	28.0
Max. standstill torque	$M_{0,max}$	Nm		30.8	46.6	64.4	78.5
Max. torque	$M_{max}$	Nm		30.8	46.6	64.4	78.5
Transition speed	$n_{eto}$	rpm		3142	2677	2266	2018



# Technical data

Selection tables

Motor			Inverter				
			E70ACMS□				
			0104	0204	0324	0484	0644
m850-S190/S3000							
Rated torque	$M_{rated}$	Nm		15.5	16.0	16.0	16.0
Standstill torque	$M_0$	Nm		16.9	27.0	27.0	27.0
Max. standstill torque	$M_{0,max}$	Nm		32.8	47.8	62.5	71.0
Max. torque	$M_{max}$	Nm		32.8	47.8	62.5	71.0
Transition speed	$n_{eto}$	rpm		2620	2180	1853	1674
m850-S190/M3000							
Rated torque	$M_{rated}$	Nm			24.0	24.0	24.0
Standstill torque	$M_0$	Nm			27.5	41.2	46.0
Max. standstill torque	$M_{0,max}$	Nm			54.0	76.7	96.5
Max. torque	$M_{max}$	Nm			54.0	76.7	96.5
Transition speed	$n_{eto}$	rpm			2760	2396	2130
m850-S190/L2520							
Rated torque	$M_{rated}$	Nm			31.6	35.0	35.0
Standstill torque	$M_0$	Nm			34.8	52.2	67.0
Max. standstill torque	$M_{0,max}$	Nm			69.4	100.5	129.0
Max. torque	$M_{max}$	Nm			69.4	100.5	129.0
Transition speed	$n_{eto}$	rpm			2398	2131	1915

# Technical data

## Selection tables



### Servo Drives 9400 HighLine



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

Motor			Inverter																
			E94A□□																
			E0044	E0074	E0094	E0134	E0174	E0244	E0324	E0474	E0594								
m850-S120/S3960																			
Rated torque	$M_{rated}$	Nm	4.8	4,8															
Standstill torque	$M_0$	Nm	5.9	6.5															
Max. standstill torque	$M_{0,max}$	Nm	14.5	14.5															
Max. torque	$M_{max}$	Nm	14.5	14.5															
Transition speed	$n_{eto}$	rpm	2599	2599															
m850-S120/M3960																			
Rated torque	$M_{rated}$	Nm		7.4	7.4														
Standstill torque	$M_0$	Nm		11.0	11.0														
Max. standstill torque	$M_{0,max}$	Nm		23.4	29.0														
Max. torque	$M_{max}$	Nm		23.4	29.0														
Transition speed	$n_{eto}$	rpm		2800	2477														
m850-S120/L3960																			
Rated torque	$M_{rated}$	Nm		9.0	9.0	9.0	9.0												
Standstill torque	$M_0$	Nm		10.9	14.5	15.0	15.0												
Max. standstill torque	$M_{0,max}$	Nm		24.8	31.9	41.6	44.0												
Max. torque	$M_{max}$	Nm		24.8	31.9	41.6	44.0												
Transition speed	$n_{eto}$	rpm		3335	2961	2559	2483												
m850-S140/S3240																			
Rated torque	$M_{rated}$	Nm		8.5	8.5														
Standstill torque	$M_0$	Nm		11.0	11.0														
Max. standstill torque	$M_{0,max}$	Nm		24.7	26.0														
Max. torque	$M_{max}$	Nm		24.7	26.0														
Transition speed	$n_{eto}$	rpm		2123	2050														
m850-S140/M3240																			
Rated torque	$M_{rated}$	Nm		12.3	14.0	14.0	14.0												
Standstill torque	$M_0$	Nm		13.2	17.6	21.0	21.0												
Max. standstill torque	$M_{0,max}$	Nm		30.0	38.0	48.5	53.5												
Max. torque	$M_{max}$	Nm		30.0	38.0	48.5	53.5												
Transition speed	$n_{eto}$	rpm		2802	2498	2175	2051												
m850-S140/L3240																			
Rated torque	$M_{rated}$	Nm			16.7	17.4	17.4	17.4	17.4	17.4									
Standstill torque	$M_0$	Nm			18.2	25.4	28.0	28.0	28.0	28.0									
Max. standstill torque	$M_{0,max}$	Nm			41.6	54.8	65.8	74.3	80.0										
Max. torque	$M_{max}$	Nm			41.6	54.8	65.8	74.3	80.0										
Transition speed	$n_{eto}$	rpm			2815	2473	2236	2083	1994										





# Technical data

Selection tables

Motor			Inverter								
			E94A□□								
			E0044	E0074	E0094	E0134	E0174	E0244	E0324	E0474	E0594
m850-S190/S3000											
Rated torque	$M_{rated}$	Nm		13.7	16.0	16.0	16.0	16.0	16.0		
Standstill torque	$M_0$	Nm		14.9	19.7	27.0	27.0	27.0	27.0		
Max. standstill torque	$M_{0,max}$	Nm		34.2	43.2	55.0	63.6	68.9	71.0		
Max. torque	$M_{max}$	Nm		34.2	43.2	55.0	63.6	68.9	71.0		
Transition speed	$n_{eto}$	rpm		2576	2304	2007	1833	1724	1674		
m850-S190/M3000											
Rated torque	$M_{rated}$	Nm				24.0	24.0	24.0	24.0	24.0	
Standstill torque	$M_0$	Nm				28.0	35.4	46.0	46.0	46.0	
Max. standstill torque	$M_{0,max}$	Nm				64.3	78.7	90.4	110.3	120.0	
Max. torque	$M_{max}$	Nm				64.3	78.7	90.4	110.3	120.0	
Transition speed	$n_{eto}$	rpm				2585	2367	2208	1975	1884	
m850-S190/L2520											
Rated torque	$M_{rated}$	Nm				32.2	35.0	35.0	35.0	35.0	35.0
Standstill torque	$M_0$	Nm				35.5	44.8	64.0	67.0	67.0	67.0
Max. standstill torque	$M_{0,max}$	Nm				83.3	103.2	120.0	150.1	176.0	200.0
Max. torque	$M_{max}$	Nm				83.3	103.2	120.0	150.1	176.0	200.0
Transition speed	$n_{eto}$	rpm				2277	2110	1980	1778	1634	1523

# Technical data

## Torque characteristics

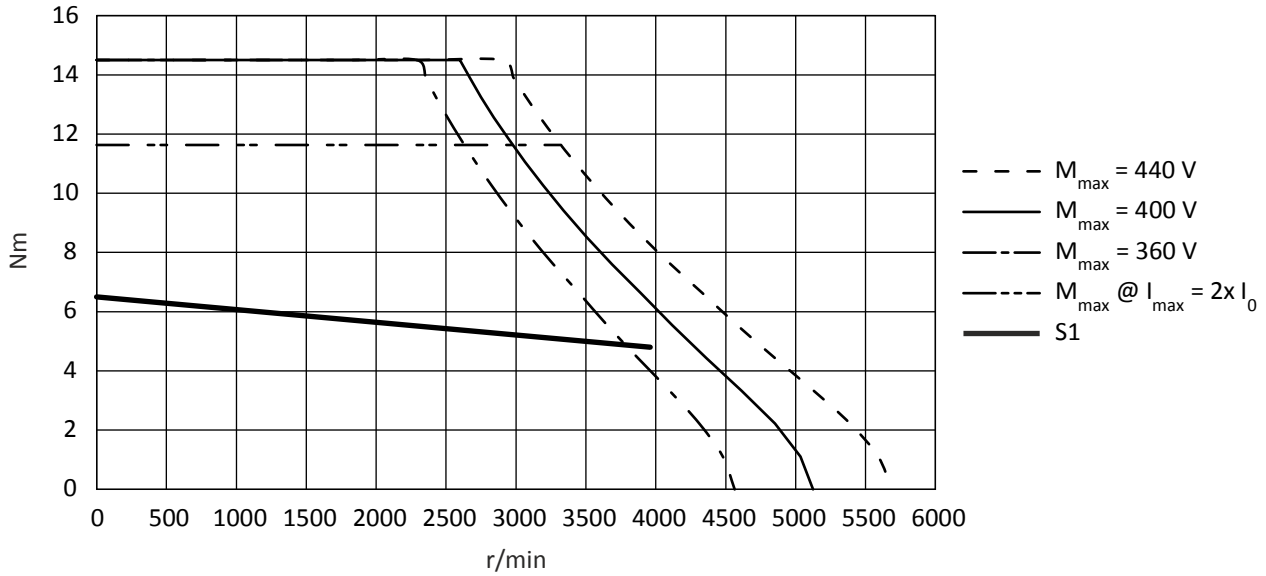


### Torque characteristics

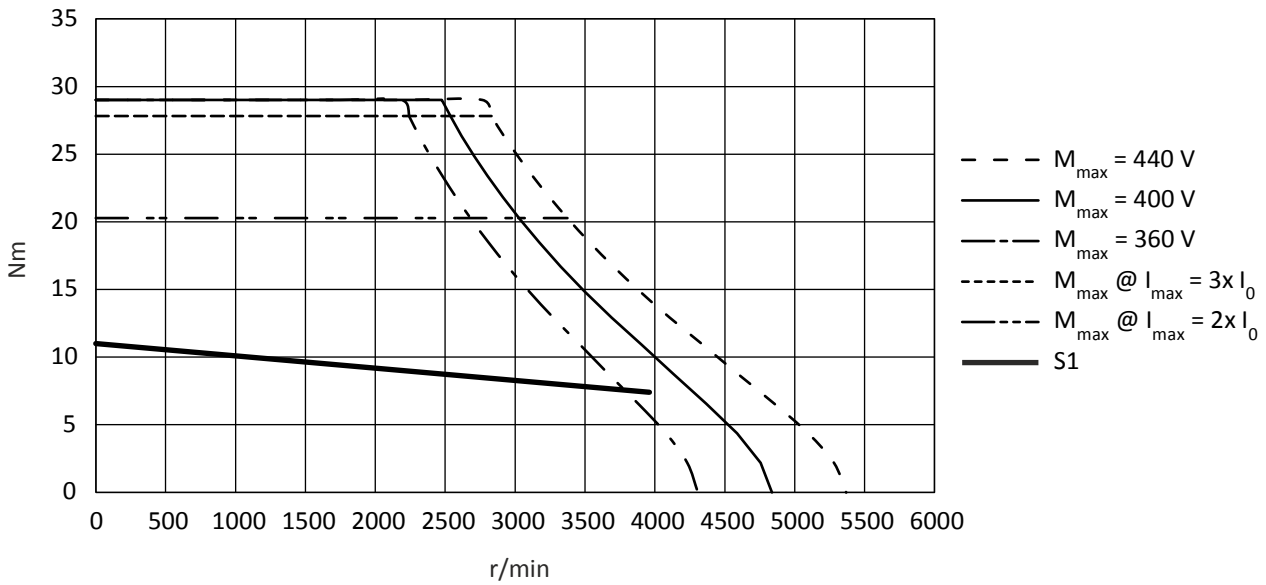


The data apply to an inverter mains voltage of 3 x 400 V.

#### m850-S120/S3960



#### m850-S120/M3960

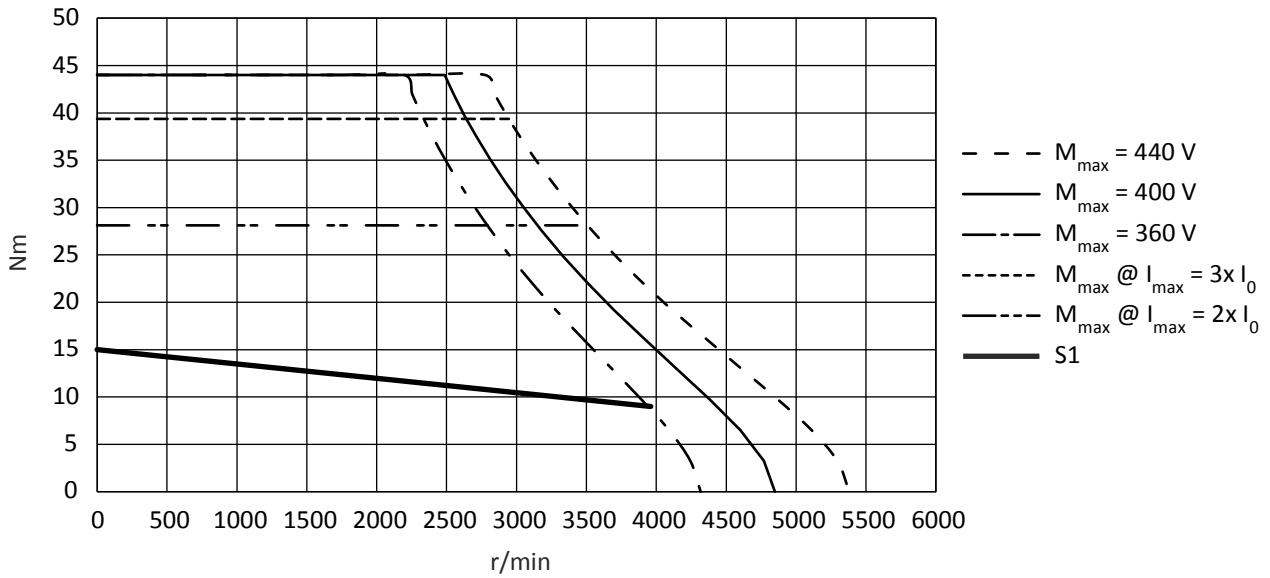




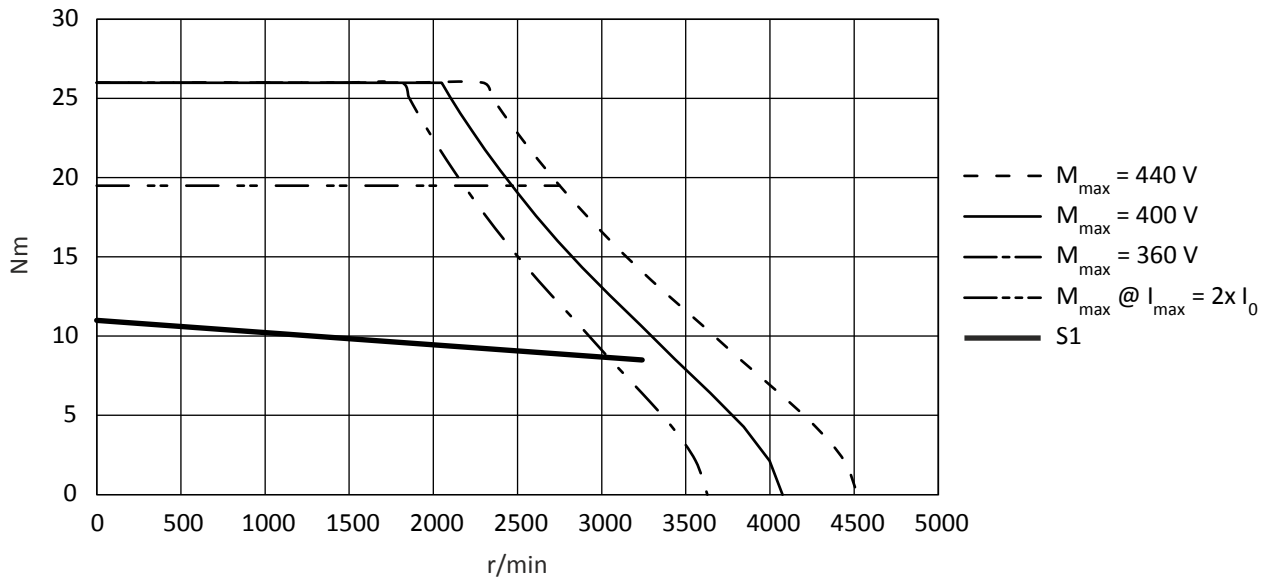
# Technical data

## Torque characteristics

### m850-S120/L3960



### m850-S140/S3240

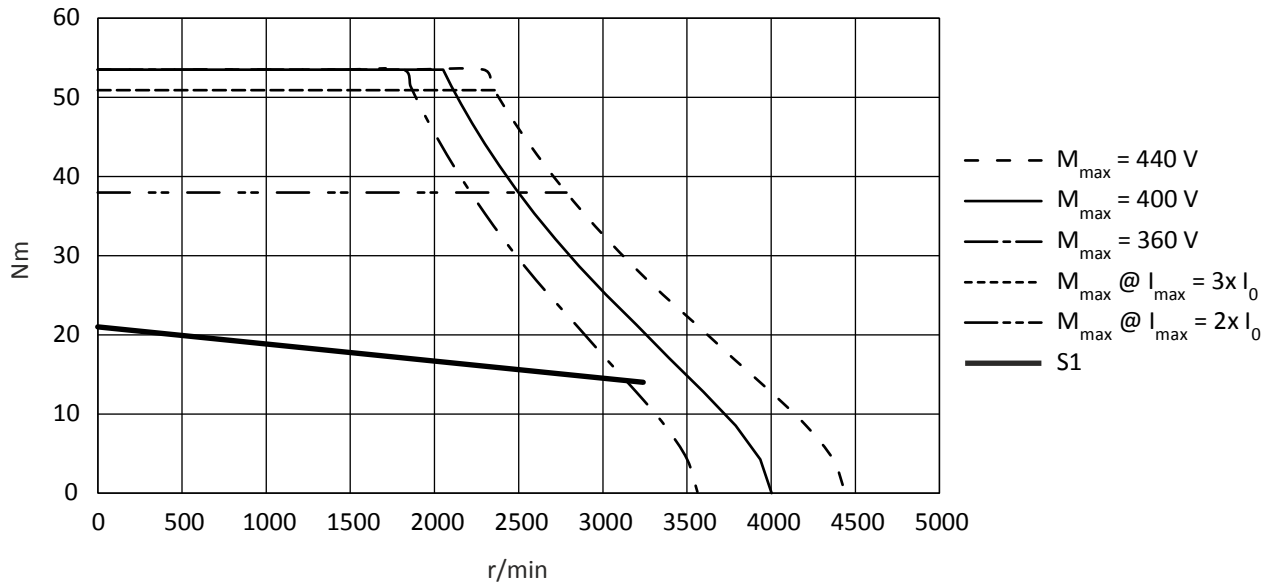


# Technical data

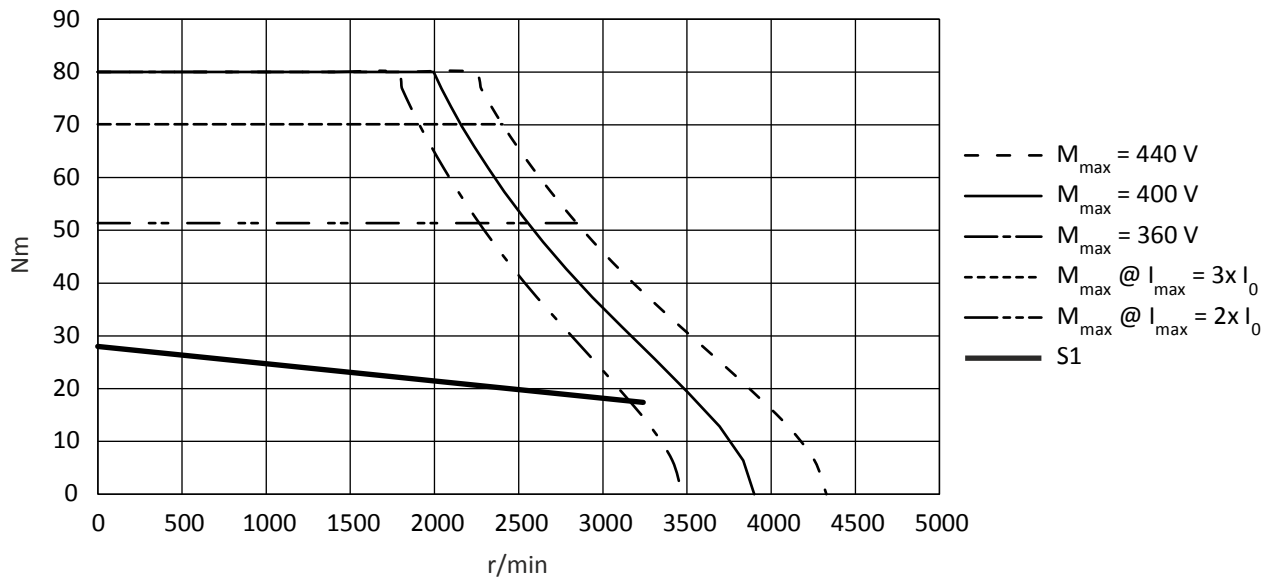
## Torque characteristics



### m850-S140/M3240



### m850-S140/L3240

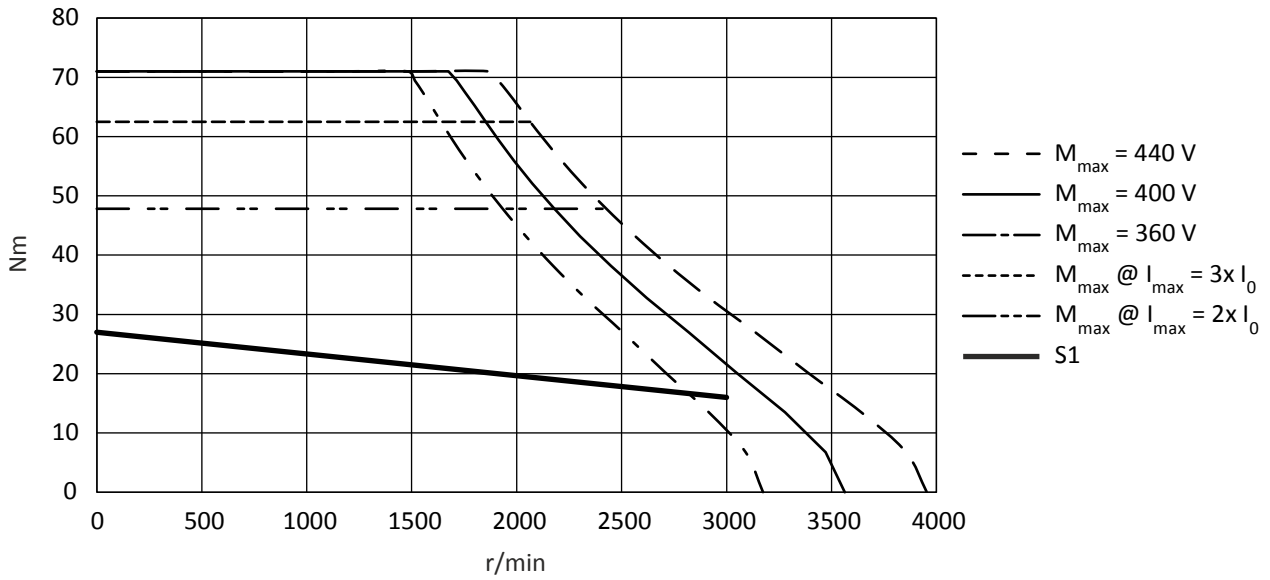




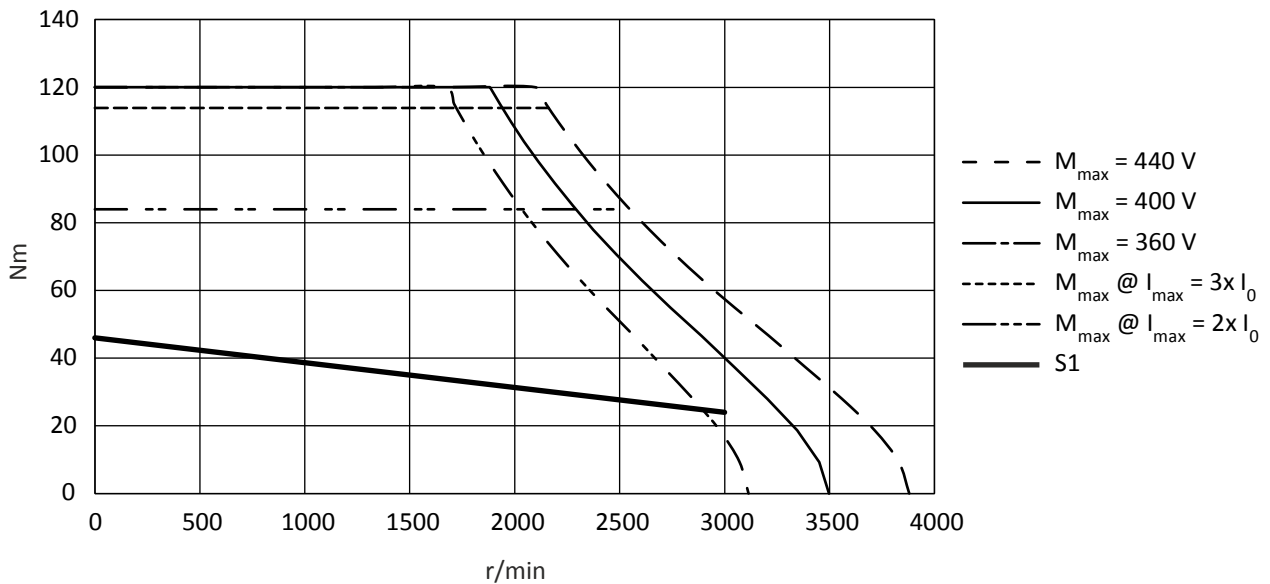
# Technical data

## Torque characteristics

**m850-S190/S3000**



**m850-S190/M3000**

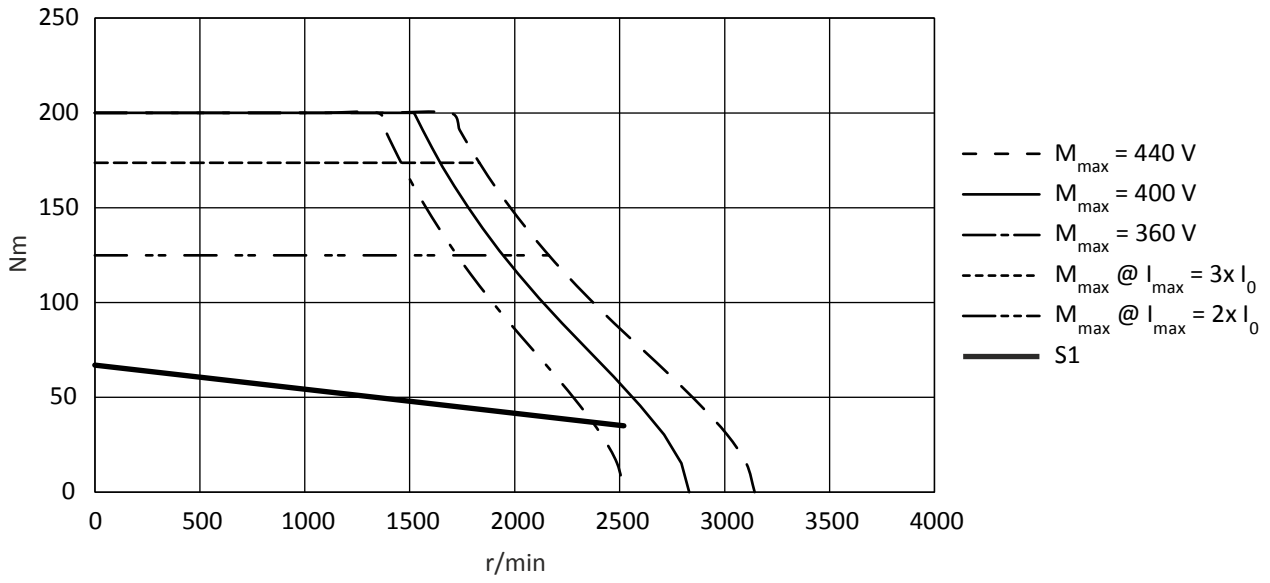


# Technical data

Torque characteristics



## m850-S190/L2520





# Technical data

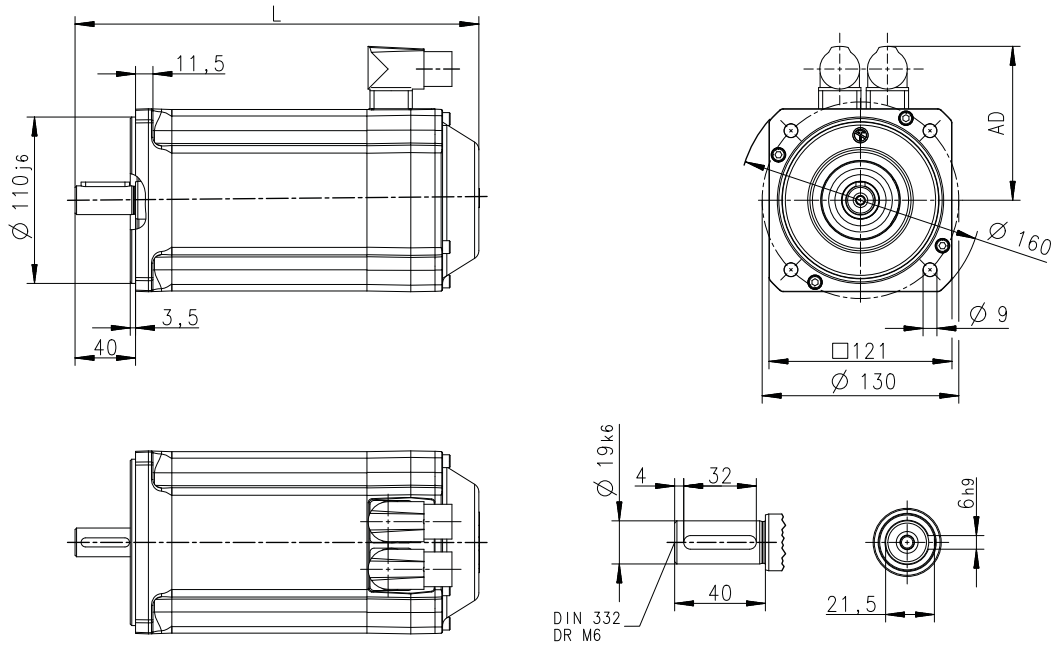
Dimensions  
Basic dimensions

## Dimensions

### Basic dimensions

Self-ventilated motors  
m850-S120

Output flange FF130



8800564-00

Motor			m850-S120/S3960	m850-S120/M3960	m850-S120/L3960
Total length without brake	L	mm	229	267	305
Total length with brake	L	mm	275	313	351
Motor/connection distance	AD	mm	102	102	102

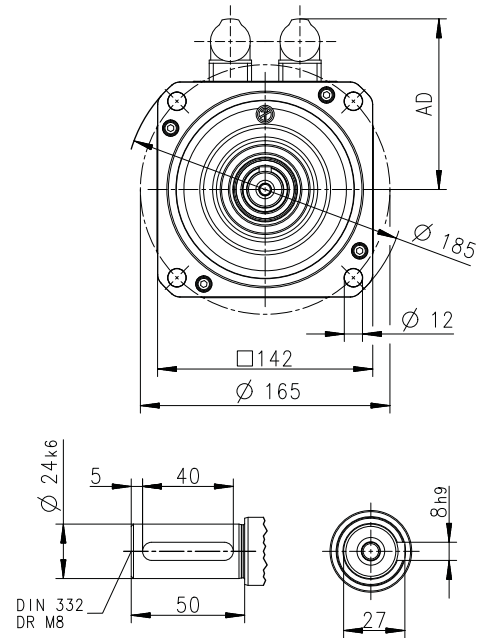
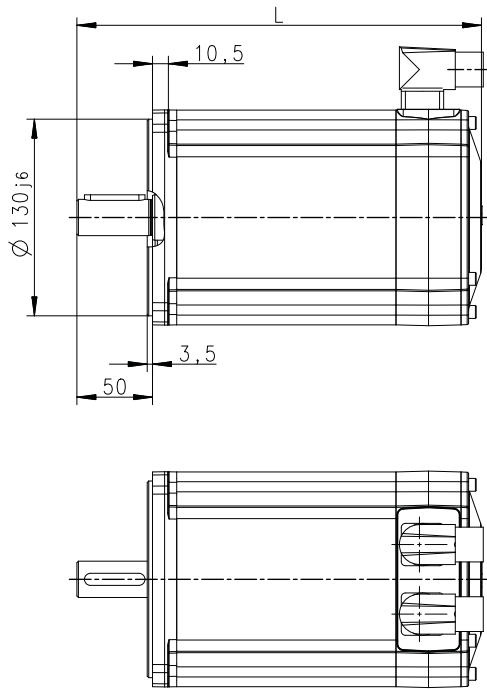
# Technical data

Dimensions  
Basic dimensions



## m850-S140

Output flange FF165



8800565-00

Motor			m850-S140/S3240	m850-S140/M3240	m850-S140/L3240
Total length without brake	L	mm	232	272	312
Total length with brake	L	mm	285	325	365
Motor/connection distance	AD	mm	114	114	135



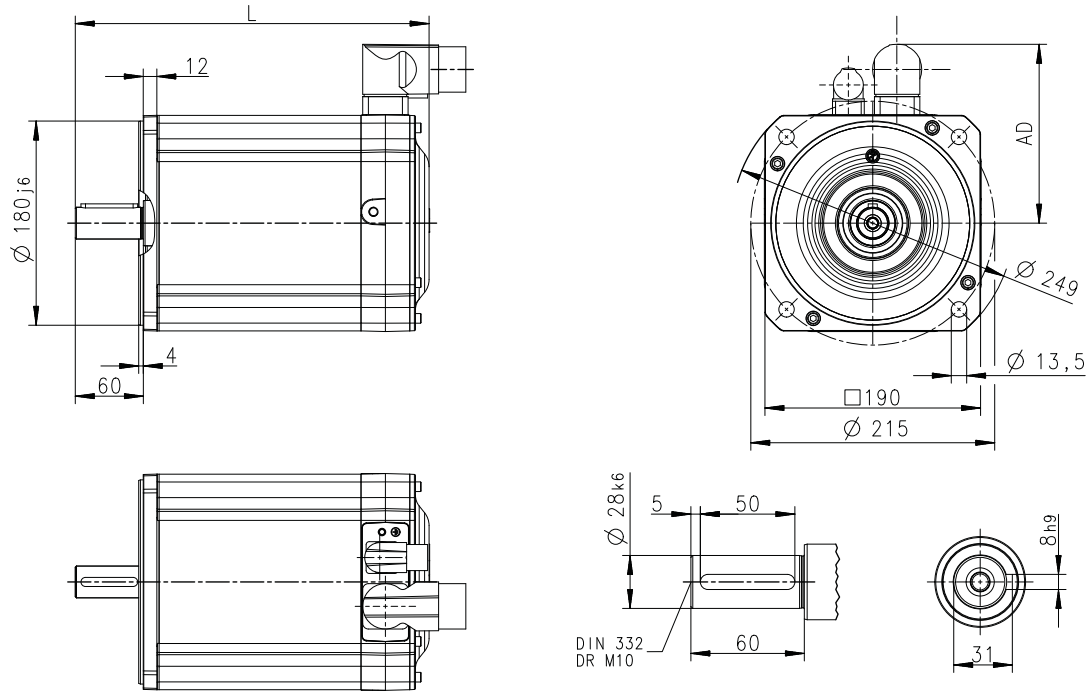


# Technical data

Dimensions  
Basic dimensions

## m850-S190

Output flange FF215



8800566-00

Motor			m850-S190/S3000	m850-S190/M3000	m850-S190/L2520
Total length without brake	L	mm	264	312	376
Total length with brake	L	mm	332	380	444
Motor/connection distance	AD	mm	137	158	158



## Product extensions

### Motor connection

#### Connection via ICN connector

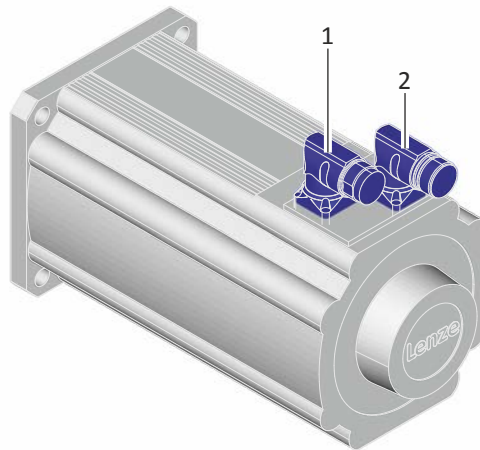
The electrical connection to the servo motors as a standard is established via ICN connectors. The connector can be rotated by 270 ° and are provided with a bayonet catch for SpeedTec connectors. Since the catch of the connector is compatible with conventional box nuts, existing counter plugs with a 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 connectors



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



## Product extensions

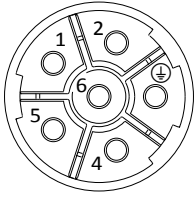
Motor connection  
Connection via ICN connector

### Power and brake connection

For motor:

m850-S120/S3960      m850-S140/S3240      m850-S190/S3000  
 m850-S120/M3960      m850-S140/M3240  
 m850-S120/L3960

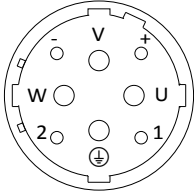
ICN-M23 connector assignment		
Contact	Name	Meaning
1	BD1	Holding brake +
2	BD2	Holding brake -
PE	PE	PE conductor
4	V	Power phase U
5	V	Power phase V
6	W	Power phase W



For motor:

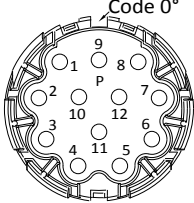
m850-S140/L3240      m850-S190/M3000  
 m850-S190/L2520

ICN-M40 connector assignment		
Contact	Name	Meaning
1		Not assigned
2		Not assigned
+	BD1	Holding brake +
-	BD2	Holding brake -
PE	PE	PE conductor
V	V	Power phase U
V	V	Power phase V
W	W	Power phase W



### Feedback and temperature monitoring connection

ICN-M23 connector assignment: resolver		
Contact	Name	Meaning
1	+ Ref	Transformer windings
2	- Ref	
3	+VCC ENP	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
12	-	



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

# Product extensions

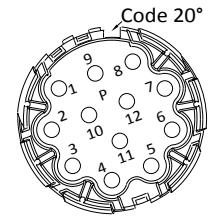
Motor connection

Connection via ICN connector



**ICN-M23 connector assignment: incremental and SinCos absolute value encoder Hiperface**

Contact	Name	Meaning
1	B	Track B / + SIN
2	A <sup>-</sup>	Track A inverse / - COS
3	A	Track A / + COS
4	+ UB	Supply +
5	GND	Mass
6	Z <sup>-</sup>	Zero track inverse / - RS485
7	Z	Zero track / + RS485
8		Not assigned
9	B <sup>-</sup>	Track B inverse / - SIN
10	Shield	Encoder housing shield
11	+	Temperature monitoring
12	-	





## Product extensions

Motor connection  
Connection via ICN connector

### Motor plug connection assignment

#### NOTICE

When making your selection, the motor data and permissible currents of the cables according to the system cable system manual must be observed.

#### Power terminal connectors

Motor code		m850-S120/S3960	m850-S120/M3960	m850-S120/L3960
Plug		ICN-M23		
Motor cable	mm <sup>2</sup>	1.0/1.5/2.5		
Screw plug				
Order code		EWS0001		
Coding in the system cable type code		M01		
SpeedTec				
Order code		EWS1001		
Coding in the system cable type code		M04		

Motor code		m850-S140/S3240	m850-S140/M3240	m850-S140/L3240	
Plug		ICN-M23		ICN-M40	
Motor cable	mm <sup>2</sup>	1.0/1.5/2.5		2.5/4.0	6.0/10/16
Screw plug					
Order code		EWS0001		EWS0012	EWS0013
Coding in the system cable type code		M01		M02	M03
SpeedTec					
Order code		EWS1001		EWS1012	EWS1013
Coding in the system cable type code		M04		M05	M06

Motor code		m850-S190/S3000	m850-S190/M3000	m850-S190/L2520
Plug		ICN-M23	ICN-M40	
Motor cable	mm <sup>2</sup>	1.0/1.5/2.5	6.0/10/16	
Screw plug				
Order code		EWS0001	EWS0013	
Coding in the system cable type code		M01	M03	
SpeedTec				
Order code		EWS1001	EWS1013	
Coding in the system cable type code		M04	M06	

#### Feedback connectors

Feedback	Resolver	SinCos absolute value Hiperface
Plug	ICN-M23	ICN-M23
Screw plug		
Order code	EWS0006	EWS0010
Coding in the system cable type code	F01	F02
SpeedTec		
Order code	EWS1006	EWS1010
Coding in the system cable type code	F05	F06

# 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

In case of these brakes, the rated torque applies solely as holding torque at standstill.

- ▶ Emergency stops at higher speeds are possible but high switching energy increases wear on the friction surfaces and the hub.
- ▶ During braking from full motor speed, e.g. in the event of emergency stops, the braking torque is significantly reduced.
- ▶ 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 <sup>2</sup>	Total mass inertia (motor + load)
	$\Delta n$	rpm	Differential speed
	$M_{rated}$	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 for each emergency stop with  $n = 3000$  rpm for a maximum of 3-6 emergency stops per hour.

Motor			m850-S120/S3960	m850-S120/M3960	m850-S120/L3960
Supply voltage range	$U_{in,DC}$	V	21.6 ... 25.2		
Rated voltage	$U_{rated,DC}$	V	24		
Rated torque					
At 20 °C	$M_{rated}$	Nm	20		
At 120 °C	$M_{rated}$	Nm	18		
Output current	$I_{rated}$	A	1.2		
Engagement time	$t_1$	ms	30		
Disengagement time	$t_2$	ms	110		
Maximum switching energy	$Q_E$	J	3100		
Mass	m	kg	2.00		
Moment of inertia					
Brake	J	kgcm <sup>2</sup>	0.75		
Brake motor	$J_{MB}$	kgcm <sup>2</sup>	7.5	13.3	19.2
Load/brake motor ratio	$J_L/J_{MB}$		74	47	32

Motor			m850-S140/S3240	m850-S140/M3240	m850-S140/L3240
Supply voltage range	$U_{in,DC}$	V	21.6 ... 25.2		
Rated voltage	$U_{rated,DC}$	V	24		
Rated torque					
At 20 °C	$M_{rated}$	Nm	34		
At 120 °C	$M_{rated}$	Nm	32		
Output current	$I_{rated}$	A	1.4		
Engagement time	$t_1$	ms	50		
Disengagement time	$t_2$	ms	150		
Maximum switching energy	$Q_E$	J	3100		
Mass	m	kg	3.00		
Moment of inertia					
Brake	J	kgcm <sup>2</sup>	2.01		
Brake motor	$J_{MB}$	kgcm <sup>2</sup>	18.1	32.5	46.9
Load/brake motor ratio	$J_L/J_{MB}$		34	19	13





## Product extensions

Brakes  
Spring-applied brakes

Motor			m850-S190/S3000	m850-S190/M3000	m850-S190/L2520
Supply voltage range	$U_{in,DC}$	V	21.6 ... 25.2		
Rated voltage	$U_{rated,DC}$	V	24		
Rated torque					
At 20 °C	$M_{rated}$	Nm	102		
At 120 °C	$M_{rated}$	Nm	100		
Output current	$I_{rated}$	A	2.1		
Engagement time	$t_1$	ms	40		
Disengagement time	$t_2$	ms	230		
Maximum switching energy	$Q_E$	J	5700		
Mass	m	kg	6.70		
Moment of inertia					
Brake	J	kgcm <sup>2</sup>	10.42		
Brake motor	$J_{MB}$	kgcm <sup>2</sup>	72,6	128.9	204.3
Load/brake motor ratio	$J_L/J_{MB}$		15	8	5



## 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				
RS0	i700	E84AVTC	E94A	-
RV03	i700	E84AVTC	E94A	E94A
Absolute value encoder				
AM128-8V-H	i700	E84AVTC	E94A	-
AM128-8V-K2	i700	E84AVTC	E94A	E94A

### Safety engineering

Servo motors can perform speed-dependent safety functions for safe speed and / or safe relative position monitoring in a drive system by Lenze inverters or Controllers. In case of inverters, these functions are implemented by integrable safety modules and in case of Controllers by the additionally required Safety Controller.

When planning systems/installations of this kind, always observe the following:

- When using just one single feedback system in the environment of these safety applications, the applicable safety engineering standard IEC 61800-5-2 (adjustable speed electrical power drive systems - Part: 5-2: Safety requirements - Functional) stipulates special requirements for the connection between feedback system and motor shaft.
- This is due to the fact that two-channel safety systems at this point in the mechanical system are actually designed as single-channel systems. If this mechanical connection is designed with considerable overdimensioning, the standard permits exclusion of the fault "encoder-shaft breakage" or "encoder-shaft slip". As such, acceleration limit values must not be exceeded for the individual drive solutions.

You can find the limit values in the corresponding feedback data of the individual motor ranges.

### Speed-dependent safety functions

Examples of speed-dependent safety functions:

- Safe stop 1 (SS1)
- Safe operational stop (SOS)
- Safely limited speed (SLS)
- Safe maximum speed (SMS)
- Safe direction (SDI) of motion
- Operation mode selector (OMS) with confirmation (ES)
- Safe speed monitor (SSM)
- Safely limited increment (SLI)



## 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			RS0	RV03
Speed-dependent safety functions			No	Yes
Resolution				
Angle		'	0.80	
Accuracy		'	-10 ... 10	
Absolute positioning			1 revolution	
Max. speed	$n_{\max}$	rpm	8000	
Max. input voltage				
DC	$U_{\text{in,max}}$	V	10.0	
Max. input frequency	$f_{\text{in,max}}$	kHz	4.00	
Ratio				
Stator / rotor			0.30 ± 5 %	
Rotor impedance	$Z_{\text{ro}}$	$\Omega$	51 + j90	
Stator impedance	$Z_{\text{so}}$	$\Omega$	102 + j150	
Impedance	$Z_{\text{rs}}$	$\Omega$	44 + j76	
Min. insulation resistance				
With DC 500 V	$R_{\text{min}}$	M $\Omega$	10.0	
Number of pole pairs			1	
Max. angle error		'	-10 ... 10	

## Speed-dependent safety functions

Feedback			RV03
Max. permissible angular acceleration	$\alpha$	rad/s <sup>2</sup>	19000
Functional safety			
IEC 61508			SIL3
EN 13849-1			Up to Performance Level e

# Product extensions

Feedback  
Absolute value encoder



## 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	AM128-8V-K2
Speed-dependent safety functions			No	Yes
Encoder type			Multi-turn	Multi-turn
Pulses			128	128
Output signals			1 Vss	1 Vss
Interfaces			Hiperface	Hiperface
Absolute revolution			4096	4096
Resolution (angle)		'	0.40	0.40
Accuracy		'	-1.3 ... 1.3	-1.3 ... 1.3
Min. DC input voltage	$U_{in,min}$	V	7.00	7.00
Max. DC input voltage	$U_{in,max}$	V	12.0	12.0
Max. speed	$n_{max}$	rpm	9000	9000
Max. current consumption	$I_{max}$	A	0.060	0.060
Limit frequency	$f_{max}$	kHz	200	200

## Speed-dependent safety functions

Feedback			AM128-8V-K2
Max. permissible angular acceleration	$\alpha$	rad/s <sup>2</sup>	240000
Functional safety			
IEC 61508			SIL2
EN 13849-1			Up to Performance Level d



### Temperature monitoring

#### Thermal detectors PT1000

The thermal sensors used continuously monitor the motor temperature. The temperature information is transferred to the inverter using the system cable of the feedback system. **This is not a full motor protection!**

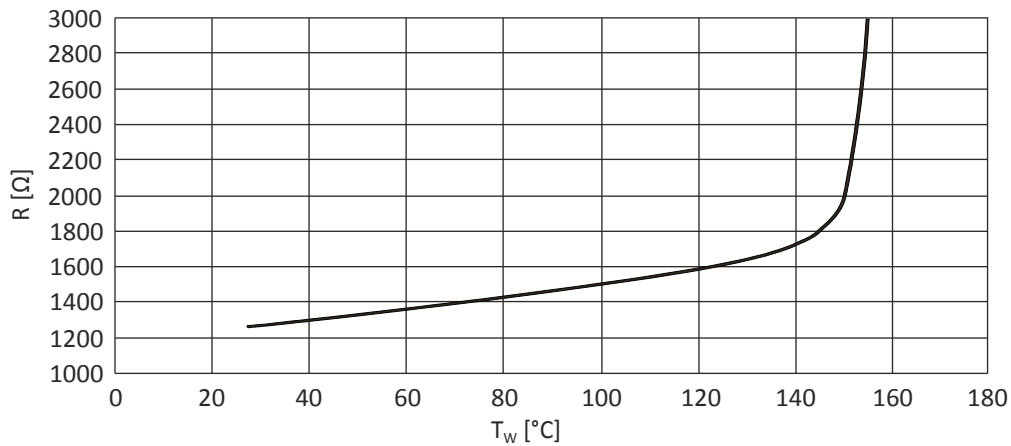
The motors are monitored via three thermal sensors connected in series (1x PT1000 + 2x PTC 150 °C). This makes it possible to determine the motor temperature in the permissible operating range and at the same time execute the overtemperature response configured in the inverter in one of the winding strands.



The three thermal sensors connected in series are identified on the nameplate by the short designation "PT1k+2PTC".



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<sub>w</sub> Winding temperature

# Product codes



## Product codes

### Motor product code

Example		M	8	5	A	S	120	S	25	5	S	0	R	C	C	0
Meaning	Variant	Motor code														
Portfolio segment		M														
Product family	8		8													
Product level	5			5												
Product generation	1				A											
Product type	Synchronous servo motor					S										
Flange height	120						120									
	140						140									
	190						190									
Motor length	Shortly							S								
	Medium							M								
	Long							L								
Speed	25 x 100 rpm								25							
	30 x 100 rpm								30							
	32 x 100 rpm								32							
	40 x 100 rpm								40							
Enclosure	IP5x									5						
	IP6x									6						
Cooling	No cooling										S					
Brake attachment	No brake												0			
	Spring-applied brake												F			
	Permanent magnet brake												P			
Encoder mounting	Resolver												R			
	Absolute value encoder												A			
Product approval	CE													C		
	CE; cULus													L		
Manufacturer	Lenze														C	
Internal key																0



## Appendix

### Good to know

#### Approvals/directives

CCC	China Compulsory Certification documents the compliance with the legal product safety requirements of the PR of China - GB standards.
c <sub>CSA</sub> <sub>US</sub>	CSA certificate, tested according to US and Canada standards
CE	Communauté Européenne documents the declaration of the manufacturer that EC Directives are complied with.
CEL	China Energy Label documents the compliance with the legal energy efficiency requirements for motors, tested according to PR of China standards
CSA	Canadian Standards Association CSA certificate, tested according to Canada standards
UL <sup>Energy</sup> <sub>US CA</sub>	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 <sub>UL</sub> <sub>US</sub>	UL certificate for products, tested according to US and Canada standards
c <sub>UR</sub> <sub>US</sub>	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) are complied with.
UL	Underwriters Laboratory Listed Product
UR	UL certificate for components, tested according to US standards



### Operating modes of the motor

Operating modes S1 ... S10 as specified by EN 60034-1 describe the basic stress of an electrical machine.

In continuous operation a motor reaches its permissible temperature limit if it outputs the rated power dimensioned for continuous operation. However, if the motor is only subjected to load for a short time, the power output by the motor may be greater without the motor reaching its permissible temperature limit. This behaviour is referred to as overload capacity.

Depending on the duration of the load and the resulting temperature rise, the required motor can be selected reduced by the overload capacity.

### The most important operating modes

Continuous operation S1	Short-time operation S2
<p>Operation with a constant load until the motor reaches the thermal steady state. The motor may be actuated continuously with its rated power.</p>	<p>Operation with constant load; however, the motor does not reach the thermal steady state. During the following standstill, the motor winding cools down to the ambient temperature again. The increase in power depends on the load duration.</p>
Intermittent operation S3	Non-intermittent periodic operation S6
<p>Sequence of identical duty cycles comprising operation with a constant load and subsequent standstill. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/downtime ratio.</p>	<p>Sequence of identical duty cycles comprising operation with a constant load and subsequent no-load operation. The motor cools down during the no-load phase. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/idle time ratio.</p>

P Power  
 t Time  
 $t_L$  Idle time  
 $\vartheta$  Temperature

$P_V$  Power loss  
 $t_B$  Load period  
 $t_S$  Cycle duration





## 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 similar.	2	Protection against diagonally falling water (dripping water), $15^\circ$ compared to normal service position.
3	Protection against small foreign particles $d > 2.5$ mm. Keeping away tools, wires or similar.	3	Protection against spraying water, up to $60^\circ$ to the vertical
4	Protection against granular foreign particles, $d > 1$ mm, keeping away tools, wire or similar.	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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