



Servo motors

m850 synchronous servo motor

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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](#)  12
 - ▶ [Information on mechanical installation](#)  23
 - ▶ [Information on electrical installation](#)  24
-

Further documents



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

www.Lenze.com → Downloads

About this document

Notations and conventions



Notations and conventions

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

Numbers			
	Decimal separator	Point	In general, the decimal point is 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!

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

The m850 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 i700 and i950 servo inverters, 9400 servo drives, and 8400 TopLine inverter drives, 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
- Optimal smooth running characteristics for exact 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 connectors with bayonet lock and swivel connector boxes
- Reduced cabling by One Cable Technology (OCT) in connection with digital absolute value encoders



m850-S140/S3240 synchronous servo motor



Synchronous servo motor m850-S120/L3960 with One Cable Technology (OCT) in connection with digital absolute value encoder

Identification of the products

Product name: m850 synchronous servo motor

Product range	Version	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	su ppl y	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	

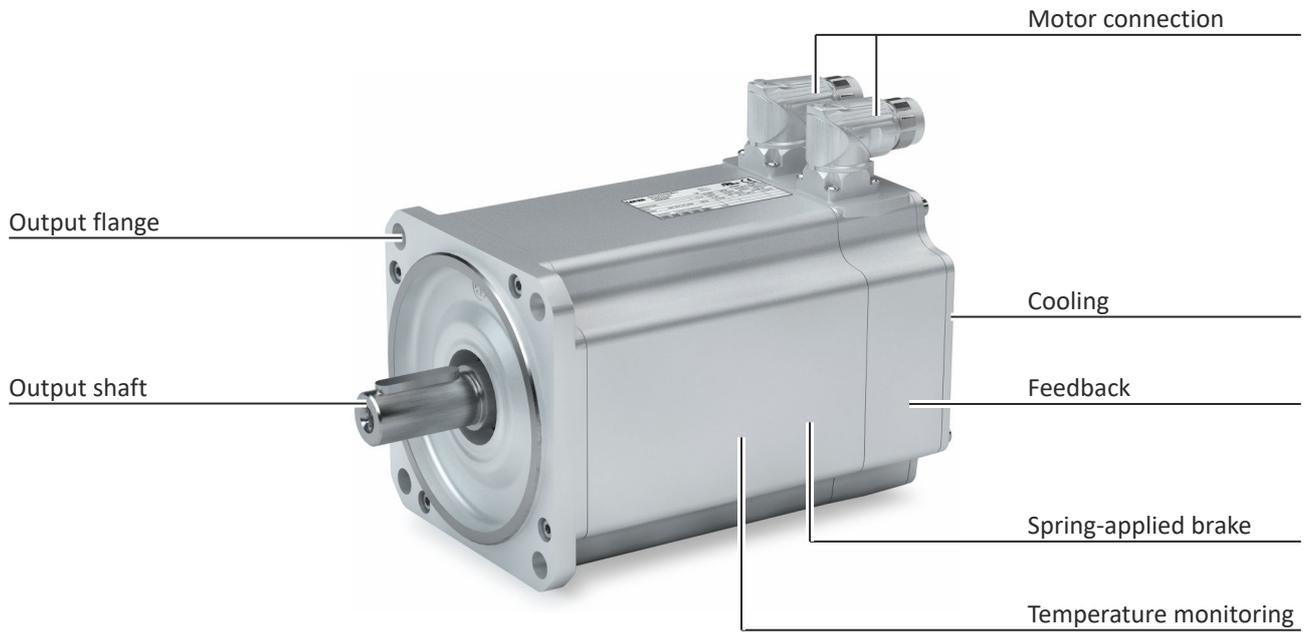
Product information

Features



Features

The following figure provides an overview of the elements and connections on the product. Their position, size and appearance may vary.





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
Color		Unpainted		
Surface and corrosion protection		Without Different types of OKS		
Output shaft				
Solid shaft without keyway	mm	19 x 40		
Solid shaft with featherkey	mm	19 x 40		
Shaft material		Steel		
Shaft sealing ring material		FKM		
Shaft seal		Standard Dustproof		
Output flange	mm	FF130		
Cooling		Self-ventilated IP54 Self-ventilated IP65		
Motor connection		ICN connector ICN hybrid connector for One Cable Technology (OCT)		
Spring-applied brake		Without With		
Characteristic torque	Nm	18		
DC brake voltage	V	24		
Feedback				
Without functional safety		Resolver Absolute value encoder Digital absolute value encoder for One Cable Technology (OCT)		
With functional safety		Resolver Absolute value encoder Digital absolute value encoder for One Cable Technology (OCT)		
Temperature monitoring		Temperature sensor PT1000 + 2 PTC thermistor		

Product information

The modular system



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
Color		Unpainted		
Surface and corrosion protection		Without Different types of OKS		
Output shaft				
Solid shaft without keyway	mm	24 x 50		
Solid shaft with featherkey	mm	24 x 50		
Shaft material		Steel		
Shaft sealing ring material		FKM		
Shaft seal		Standard Dustproof		
Output flange	mm	FF165		
Cooling		Self-ventilated IP54 Self-ventilated IP65		
Motor connection		ICN connector ICN hybrid connector for One Cable Technology (OCT)		
Spring-applied brake		Without With		
Characteristic torque	Nm	32		
DC brake voltage	V	24		
Feedback				
Without functional safety		Resolver Absolute value encoder Digital absolute value encoder for One Cable Technology (OCT)		
With functional safety		Resolver Absolute value encoder Digital absolute value encoder for One Cable Technology (OCT)		
Temperature monitoring		Temperature sensor PT1000 + 2 PTC thermistor		



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
Color		Unpainted		
Surface and corrosion protection		Without Different types of OKS		
Output shaft				
Solid shaft without keyway	mm	28 x 60		
Solid shaft with featherkey	mm	28 x 60		
Shaft material		Steel		
Shaft sealing ring material		FKM		
Shaft seal		Standard Dustproof		
Output flange	mm	FF215		
Cooling		Self-ventilated IP54 Self-ventilated IP65		
Motor connection		ICN connector ICN hybrid connector for One Cable Technology (OCT)		
Spring-applied brake		Without With		
Characteristic torque	Nm	100		
DC brake voltage	V	24		
Feedback				
Without functional safety		Resolver Absolute value encoder Digital absolute value encoder for One Cable Technology (OCT)		
With functional safety		Resolver Absolute value encoder Digital absolute value encoder for One Cable Technology (OCT)		
Temperature monitoring		Temperature sensor PT1000 + 2 PTC thermistor		

Information on project planning

Safety instructions



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

DANGER!

Dangerous electrical voltage

Possible consequences: Death or severe injuries from electric shock

- ▶ Any work on the device must only be carried out in a deenergized state.
- ▶ After switching off the mains voltage, observe the signs on the product.

Product

- The product must only be used as directed.
- Never commission the product in the event of visible damage.
- The product must never be technically modified.
- Never commission the product before assembly has been completed.
- The product must never be operated without required covers.
- Connect/disconnect all pluggable terminals only in de-energized condition.
- Only remove the product from the installation in the de-energized state.

Personnel

Only qualified and skilled personnel are allowed to work with the product. IEC 60364 and/or CENELEC HD 384 define the qualifications of these persons as follows:

- They are familiar with the installation, mounting, commissioning, and operation of the product.
- They possess the appropriate qualifications for their tasks.
- They are familiar with all regulations for the prevention of accidents, directives, and laws applicable at the location and are able to apply them.

Electrical connection

When working on energized products, comply with the applicable national accident prevention regulations.

The electrical installation work must be carried out according to the appropriate regulations (e.g. cable cross-sections, fusing, PE conductor connection). Additional information can be obtained from this documentation.

This documentation contains notes about installation according to EMC regulations. Also observe these notes for CE-marked products. The manufacturer of the system or machine is responsible for adherence to the limits required in connection with EMC legislation.

Operation

Where appropriate, you must equip the system with additional monitoring and protective devices. Comply with the safety regulations and other regulations applicable at the place of operation.

After disconnecting the product from the supply voltage, do not touch live device parts and power terminals immediately because capacitors may be charged. Observe the corresponding information labels on the product.

Dirt or dust deposits impede the heat dissipation and cooling. Remove any such deposits where appropriate at regular intervals.

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.

Disposal

The products and accessories must be properly disposed of in accordance with the applicable regulations. The products contain raw materials that can be recycled such as metals, plastics and electronic components.

Information on project planning

Safety instructions
Application as directed



Application as directed

NOTICE

Please observe the notes in the following chapters!

- ▶ [Safety instructions](#) 12
- ▶ [Information on mechanical installation](#) 23
- ▶ [Information on electrical installation](#) 24

-
- 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 classed as a machine under 2006/42/EC: Machinery Directive.
 - No machine is to be commissioned or put into operation as intended in conjunction with the product until it has been determined that the machine meets the regulations of EC Directive 2006/42/EC: Machinery Directive; observe EN 60204-1.
 - Commissioning or putting into operation as intended is only permitted in compliance with the EMC Directive 2014/30/EU.
 - The product is not a household appliance. Instead, it is a component that is intended exclusively for further use in the context of commercial or professional use as defined by EN 61000-3-2.
 - The product can be used according to the technical data if the drive systems have to comply with categories in accordance with EN 61800-3.
 - 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 is only to be operated together with an inverter.

Foreseeable misuse

- Operate directly on the mains voltage
- Use in potentially explosive atmospheres
- Operate in aggressive environments (acids, gases, vapors, dusts, oils)
- Operate under water
- Operate under radiation
- Operate in generator mode



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!

Product

Observe the warning labels on the product!



Dangerous electrical voltage:

Before working on the product, make sure there is no voltage applied to the power terminals!

After mains disconnection, the power terminals will still carry the hazardous electrical voltage for the time given next to the symbol!



Electrostatic sensitive devices:

Before working on the product, the staff must ensure to be free of electrostatic charge!



High leakage current:

Carry out fixed installation and PE connection in compliance with:
EN 61800-5-1 / EN 60204-1



Hot surface:

Use personal protective equipment or wait until the device has cooled down!

Protection of persons

- The product does not provide any safety-related functions.
 - A higher-level safety system must be implemented.
 - Provide additional monitoring and protective equipment complying with the safety regulations applicable in each case.
- 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 deenergized.
- Voltages may occur on the drive components (e.g. capacitive, caused by inverter supply).
 - Careful earthing must be carried out at the marked positions of the components.
- There is a risk of burns from hot surfaces!
 - Provide protection against accidental contact.
 - Use personal protective equipment or wait until the device has cooled down!
 - Prevent contact with flammable substances.
- Risk of injury from rotating parts.
 - Before working on the drive system, ensure that the motor is at a standstill.
- There is a danger of unintentional start-up or electric shocks!
- Installed brakes are no fail-safe brakes.
 - torque may be reduced by disruptive factors that cannot be influenced such as ingressing oil.

Information on project planning

Safety instructions
Residual hazards



Motor protection

- Version with plug:
 - Never disconnect the plug when energized. The plug could be destroyed.
 - Switch off the voltage supply or disable the inverter prior to disconnecting the plug.
- Installed thermal detectors are no full protection for the machine.
 - Limit the maximum current if necessary. Parameterize the inverter so that it will be switched off after several seconds of operation with $I > I_{rated}$ especially if there is a danger of blocking.
 - The integrated overload protection does not prevent overloading under all conditions.
- The fuses are no motor protection.
 - Use a current-dependent motor protection switch.
 - Use the built-in thermal detectors.
- Excessively high torques cause a fracture of the motor shaft.
 - Do not exceed the maximum torques according to the technical data on the nameplate.
- Lateral forces on the motor shaft are possible.
 - Align the shafts of motor and driven machine exactly to each other.



Drive dimensioning

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 design the drive both quickly and to a high quality. The software contains profound and proven expertise with regard to drive applications and mechatronic drive components.

Please get in touch with your Lenze representative.

The dimensioning is suitable for:

- kinematic profiles
- operating modes S1, S2, S3, S6 [67](#)
- 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 and an inverter with a sufficient maximum current are selected. Further limits (maximum speed, installation height...) are specified in tables.

Mechanical strength

On the basis of the occurring forces and torques, a drive is selected that has a sufficient mechanical 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.



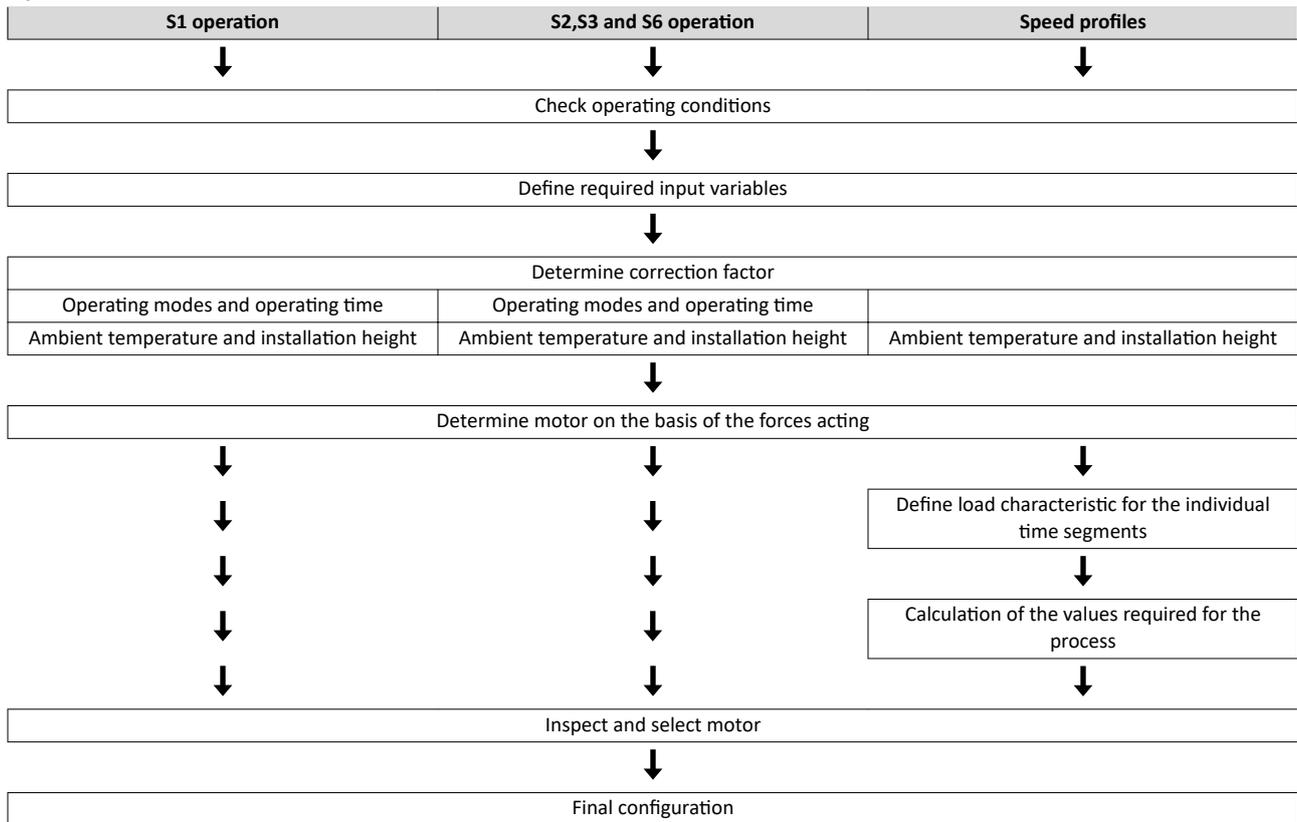
If dimensioning processes are complex or reach limit loads, please refer to your Lenze representative.

Information on project planning

Drive dimensioning



Operation chart



Check operating conditions

Check
Approvals
Conformities
Supply voltage
Degree of protection
Ambient temperature
Surface protection

▶ [Standards and operating conditions](#) 26

▶ [Surface and corrosion protection](#) 22

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 [67](#)

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 Without belt tightener= 2.5 - 3.0	1.5 - 2.0
			< 17 teeth = 1.15	< 20 teeth = 1.25 < 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			$F_{ax} \leq F_{ax,max}$	

dw Effective diameter of transmission element

► Radial forces and axial forces [28](#)

Operating mode S1

Check and select servo motor/inverter combination			
	Check	Selection	Unit
Output torque	$M_{rated} \geq M_L / (k_L \times k_H)$	M_{rated}	Nm
Output speed	$n_{rated} \geq n_L$	n_{rated}	rpm

► Rated data [30](#)



Operating modes S2, S3, and S6

Check and select servo motor/inverter combination			
	Check	Selection	Unit
Output torque	$M_{rated} \geq M_L / (k_L \times k_H)$	M_{rated}	Nm
Output speed (recommendation)	$n_{rated} \geq n_L$	n_{rated}	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 here, $M_{L,max}$ must be considered		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](#) 30

▶ [Torque characteristics](#) 39

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	$M_{\text{rated}} > M_{\text{eff}} / k_H$	M_{rated}	Nm
Output speed	$n_{\text{rated}} \geq n_m$	n_{rated}	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	$M_{S,\text{eff}} = \sqrt{\frac{1}{T} \sum_z M_{S,z}^2 \times \Delta t_z}$	$M_{S,\text{eff}}$	
All operating points (●)		$n_{L,z}$	
below the maximum torque characteristic of the servo motor/ inverter combination here, $M_{L,\text{max}}$ must be considered		$M_{S,z}$	
Thermally effective operating point (○)		n_m	
below the S1 torque characteristic of the servo motor		$M_{S,\text{eff}} / k_H$	

▶ [Rated data](#) 30

▶ [Torque characteristics](#) 39

Information on project planning

Final configuration
Surface and corrosion protection



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](#) 49

Surface and corrosion protection

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

Various surface coatings ensure reliable functioning even at high air humidity, in outdoor installations, or in the presence of atmospheric contamination. Any color from the "RAL Classic" collection can be chosen for the top coat.

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

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

Surface and corrosion protection	Corrosivity category	Surface coating	Color	Coating thickness
	DIN EN ISO 12944-2	Design		
Without OKS(uncoated)				
OKS-G (primed)		<ul style="list-style-type: none"> • 2K PUR priming coat 		30 ... 40 µm
OKS-S (small)	Comparable to C1	<ul style="list-style-type: none"> • 2K-PUR top coat 	<ul style="list-style-type: none"> • Standard: RAL 7012 • Optional: According to RAL Classic possible 	50 ... 70 µm
OKS-M (medium)	Comparable to C2	<ul style="list-style-type: none"> • 2K PUR priming coat 		80 ... 110 µm
OKS-L (large)	Comparable to C3	<ul style="list-style-type: none"> • 2K-PUR top coat 		110 ... 150 µm



Information on mechanical installation

Important notes

- Install the product according to the information in the chapter "Standards and operating conditions".
 - ▶ [Standards and operating conditions](#) 26
- The technical data and the data regarding the supply conditions can be found on the nameplate and in this documentation.
- Ambient media – especially chemically aggressive ones – may damage shaft sealing rings, lacquers and plastics.
- Lenze offers special surface and corrosion protection in this case.

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 securely 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 transport.
- Avoid electrostatic discharges on electronic components and contacts.
- Avoid impacts.
- Check the carrying capacity of the hoists and load handling devices. The weights can be found in the shipping documents.
- Secure the load against tipping and falling down.
- Standing beneath suspended loads is prohibited.

Installation

- 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!

Risk of injury and risk of burns from dangerous voltage

Power terminals may also carry voltage in the switched-off state or when the motor is stopped and may cause life-threatening cardiac arrhythmia and serious burns.

- ▶ Disconnect the product from the mains.
- ▶ Check that the power terminals are deenergized before starting work.

-
- When working on energized products, comply with the applicable national accident prevention regulations.
 - The electrical installation must be carried out according to the appropriate 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.

Operation on an external inverter

A max. pulse voltage amplitude of $U_{pk} = 1560 \text{ V}$ at the motor terminals must not be exceeded. Here, the minimum pulse rise time must be $t_R = 0.1 \mu\text{s}$.

If it cannot be ruled out that the permissible voltage peaks will be exceeded or that the minimum pulse rise time will not be reached, the following measures must be initiated:

- Reduction of the DC-bus voltage (threshold for brake chopper voltage)
- Use of filters, chokes
- Use of special motor cables

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

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 compliance with EN 60034)
- Site altitude $\leq 1000\text{ m}$ above mean sea level

The selection tables specify the inverter/ motor combination with the achievable torques.

The rated data applies to the S1 operating mode S1 (in accordance with EN 60034) and the operation on a servo 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 get in touch with your Lenze representative.

Cooling effect of mounting flange

Mounting on a thermally conducting / insulating plate or machine chassis has an influence on heating up the motor, particularly when using naturally ventilated motors.

The motor rating data specified in the catalogue applies when mounting on a steel plate with free convection with the following dimensions:

Motor	Width	Height
	mm	mm
m850-S120 ... S190	450	450

Technical data

Standards and operating conditions
Conformities and approvals



Standards and operating conditions

Conformities and approvals

Conformities		
CE	2011/65/EU	RoHS Directive
	2014/30/EU	EMC Directive (reference: CE-typical drive system)
	2014/35/EU	Low-Voltage Directive
EAC	TP TC 020/2011	Eurasian conformity: Electromagnetic compatibility of technical means
	TP TR 004/2011	Eurasian conformity: Safety of low voltage equipment

Approvals		
CEL	CEL 038-2020	Energy efficiency for China. Affected motors receive a separate label.
cULus	-	UL 1004-1
		UL 1004-6
		for USA and Canada (requirements of the CSA 22.2 No. 274)

Protection of persons and device protection

Degree of protection			
EN	EN 60529, EN 60034-5	IP54	Information applies to the mounted and ready-for-use state
		IP65	

Temperature class			
Insulation system	EN 60034-1	F (155 °C)	Insulation system

Permissible voltage			
Limit curve A of the pulse voltage	IEC/TS 60034-25:2007	IEC/TS 60034-25:2007	
IVIC C	IEC 60034-18-41	at 500 V	

EMC data

Noise emission		
Fulfills requirements according to	EN 60034-1	A final overall assessment of the drive system is indispensable

Noise immunity		
Fulfills requirements according to	EN 60034-1	A final overall assessment of the drive system is indispensable



Environmental conditions

Climate			
Storage	EN IEC 60721-3-1:1997	1K3 (-20 ... +40 °C)	>3 months
		1K3 (-20 ... +60 °C)	<3 months
Transport	EN IEC 60721-3-2:1997	2K3 (-20 ... +70 °C)	
Operation	EN IEC 60721-3-3:1995 + A2:1997	3K3 (-10 ... +40 °C)	Operation, without brake
		3K3 (-20 ... +40 °C)	
Site altitude			
0 ... 1000 m amsl	-	without current derating	
1000 ... 2000 m. amsl	-	Reduce rated output current by 5 %/1000 m	
Air humidity			
Without condensation	-	Average relative humidity 85 %	
Vibration resistance			
Operation	EN IEC 60721-3-3:1995 + A2:1997	3M5	Only in operation with feedback AM20-8V-D or AM20-8V-D2
		3M6	
Vibration severity			
A	EN 60034-14	-	-
Vibration velocity			
Free suspension	-	1.6 mm/s	
Smooth running, axial runout, concentricity			
Normal class	EN 50347 / IEC 60072-1	-	-



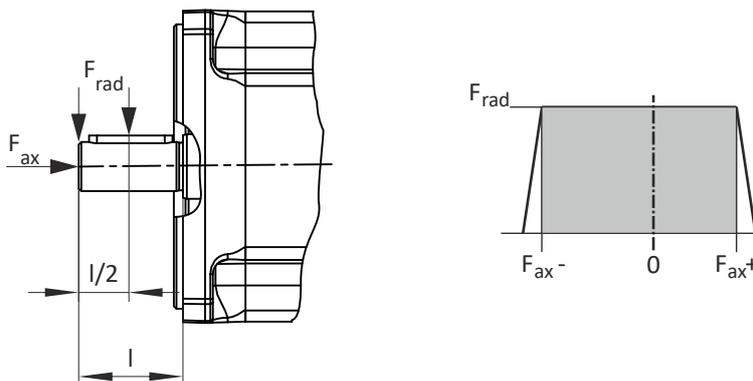
Radial forces and axial forces



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](#) 30

Application of forces



Application of force at $l/2$

Motor			m850-S120	m850-S140	m850-S190
Bearing service life 5000					
Radial force	F_{rad}	rated	940	1210	2600
Min. axial force	$F_{ax,-}$	rated	-870	-1100	-1440
Max. axial force	$F_{Fax,+}$	rated	530	700	960
Bearing service life 10000					
Radial force	F_{rad}	rated	740	960	2050
Min. axial force	$F_{ax,-}$	rated	-670	-860	-1120
Max. axial force	$F_{Fax,+}$	rated	330	450	640
Bearing service life 20000					
Radial force	F_{rad}	rated	600	790	1620
Min. axial force	$F_{ax,-}$	rated	-540	-690	-920
Max. axial force	$F_{Fax,+}$	rated	200	290	440
Bearing service life 30000					
Radial force	F_{rad}	rated	480	660	1440
Min. axial force	$F_{ax,-}$	rated	-490	-660	-800
Max. axial force	$F_{Fax,+}$	rated	150	260	320



Application of force at I

Motor			m850-S120	m850-S140	m850-S190
Bearing service life 5000					
Radial force	F_{rad}	rated	820	1030	2170
Min. axial force	$F_{ax,-}$	rated	-800	-1080	-1290
Max. axial force	$F_{Fax,+}$	rated	460	680	810
Bearing service life 10000					
Radial force	F_{rad}	rated	650	820	1710
Min. axial force	$F_{ax,-}$	rated	-640	-830	-1030
Max. axial force	$F_{Fax,+}$	rated	300	420	550
Bearing service life 20000					
Radial force	F_{rad}	rated	530	670	1350
Min. axial force	$F_{ax,-}$	rated	-520	-670	-820
Max. axial force	$F_{Fax,+}$	rated	180	270	340
Bearing service life 30000					
Radial force	F_{rad}	rated	420	550	1210
Min. axial force	$F_{ax,-}$	rated	-470	-630	-720
Max. axial force	$F_{Fax,+}$	rated	130	230	240

Technical data

Rated data

Inverter mains connection 400 V, Self-ventilated motors



Rated data

Inverter mains connection 400 V, Self-ventilated motors

Motor			m850-S120/ S3960	m850-S120/ M3960	m850-S120/ L3960	m850-S140/ S3240	m850-S140/ M3240	m850-S140/ L3240
Standstill torque	M_0	Nm	6.50	11.0	15.0	11.0	21.0	28.0
Rated torque	M_{rated}	Nm	4.80	7.40	9.00	8.50	14.0	17.4
Max. torque	M_{max}	Nm	14.5	29.0	44.0	26.0	53.5	80.0
Rated speed	n_{rated}	rpm	3960	3960	3960	3240	3240	3240
Max. speed	n_{max}	rpm	6000	6000	6000	6000	6000	6000
Rated power	P_{rated}	kW	2	3.1	3.7	2.9	4.8	5.9
Standstill current	I_0	A	5.50	8.80	12.1	7.40	14.0	18.0
Rated current	I_{rated}	A	4.30	6.40	7.80	6.30	10.0	12.2
Max. current	I_{max}	A	15.0	28.0	42.0	23.0	45.5	66.0
Rated voltage	V_{rated}	V	330	330	320	340	330	330
Rated frequency	f_{rated}	Hz	330	330	330	270	270	270
Moment of inertia	J	kgcm ²	6.50	12.4	18.2	15.7	30.1	44.6
Efficiency	η		0.902	0.914	0.914	0.879	0.915	0.926
Torque constant	$K_{t0 150}$ °C	Nm/A	1.18	1.25	1.24	1.49	1.50	1.56
Voltage constant	$K_{E_{LL 150}}$ °C	V/ (1000/ min)	68.99	73.1	72.93	86.81	88.36	90.67
Stator terminal resistance	$R_{UV 20}$ °C	Ω	2.24	1.02	0.63	1.436	0.562	0.366
Stator terminal resistance	$R_{UV 150}$ °C	Ω	3.376	1.537	0.949	2.164	0.847	0.552
Stator inductance	L	mH	11.5	6.73	4.58	9.90	5.22	3.76
Weight	m	kg	6.5	9.25	12.0	9.50	14.5	19.5



Technical data

Rated data

Inverter mains connection 400 V, Self-ventilated motors

Motor			m850-S190/S3000	m850-S190/M3000	m850-S190/L2520
Standstill torque	M_0	Nm	27.0	46.0	67.0
Rated torque	M_{rated}	Nm	16.0	24.0	35.0
Max. torque	M_{max}	Nm	71.0	120	200
Rated speed	n_{rated}	rpm	3000	3000	2520
Max. speed	n_{max}	rpm	4500	4500	4500
Rated power	P_{rated}	kW	5	7.5	9.2
Standstill current	I_0	A	16.0	26.8	30.8
Rated current	I_{rated}	A	10.3	15.4	17.7
Max. current	I_{max}	A	64.0	87.0	112
Rated voltage	V_{rated}	V	340	330	345
Rated frequency	f_{rated}	Hz	250	250	210
Moment of inertia	J	kgcm ²	60.8	117	193
Efficiency	η		0.905	0.919	0.929
Torque constant	$K_{t_{0.150}}$ °C	Nm/A	1.69	1.72	2.18
Voltage constant	$K_{E_{LL150}}$ °C	V/ (1000/ min)	99.24	101.13	124.86
Stator terminal resistance	R_{UV20} °C	Ω	0.452	0.196	0.16
Stator terminal resistance	R_{UV150} °C	Ω	0.681	0.295	0.241
Stator inductance	L	mH	5.46	2.90	2.76
Weight	m	kg	19.8	28.5	41.0

Technical data

Selection tables



Selection tables

Notes on the selection tables

The selection tables represent the combinations of servo motors and servo inverters. They 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 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 that require a longer holding of the standstill torque, it is recommended to hold the drive via the holding brake and, for instance, reducing the current by inverter disable.	
	$M_{0,max}$	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 achievable 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



i700 servo inverter



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

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



9400 HighLine servo drives



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

Motor			Inverter							
			E94A□□							
			E0044	E0074	E0094	E0134	E0174	E0244	E0324	E0474
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	
Standstill torque	M_0	Nm			18.2	25.4	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



Torque characteristics



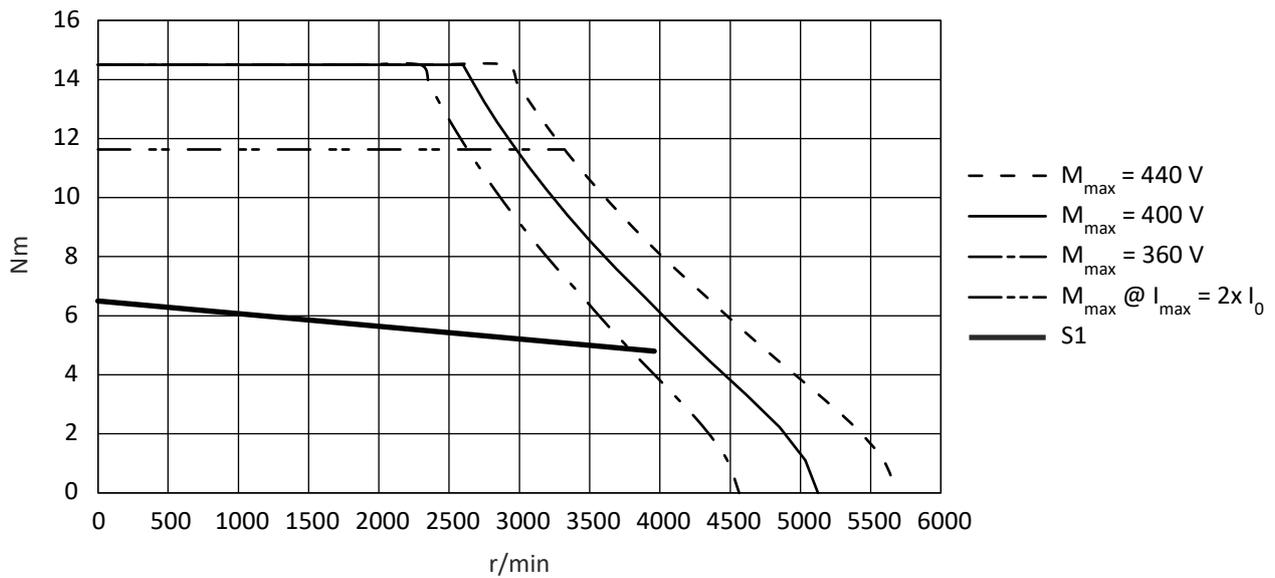
The torque/speed characteristic for your motor/inverter combination can be found on the Internet:

<http://www.lenze.com> → Product Finder → M-n characteristics

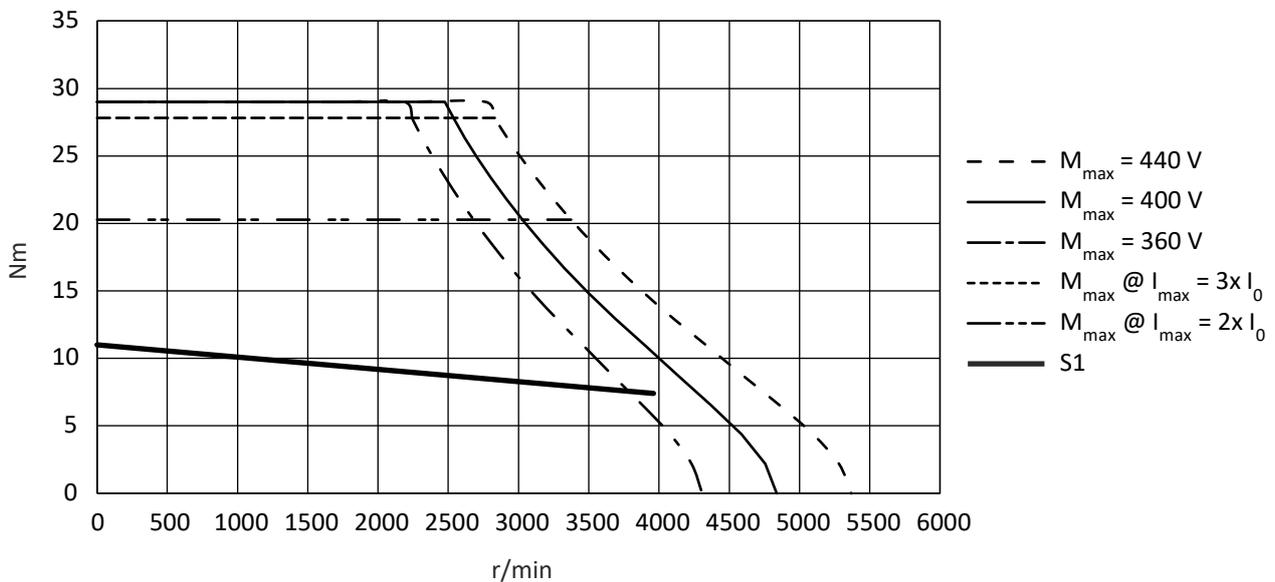


The following data apply to a mains voltage 3 x 400 V of the inverter.

m850-S120/S3960



m850-S120/M3960

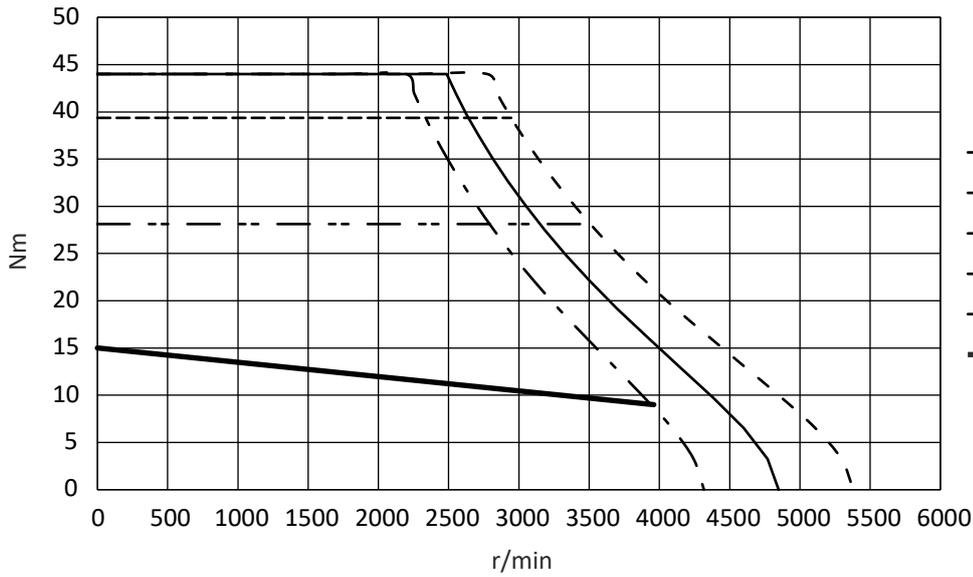


Technical data

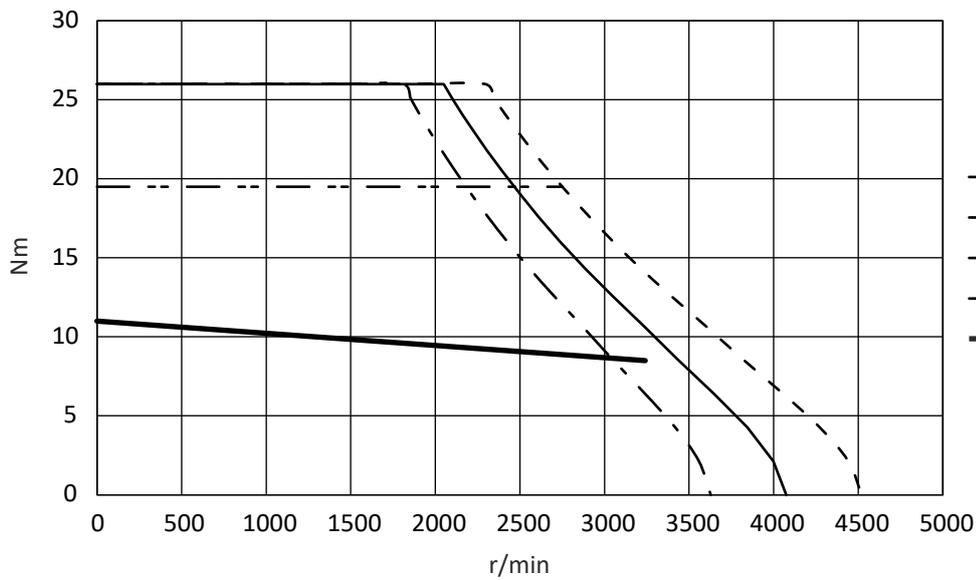
Torque characteristics



m850-S120/L3960



m850-S140/S3240

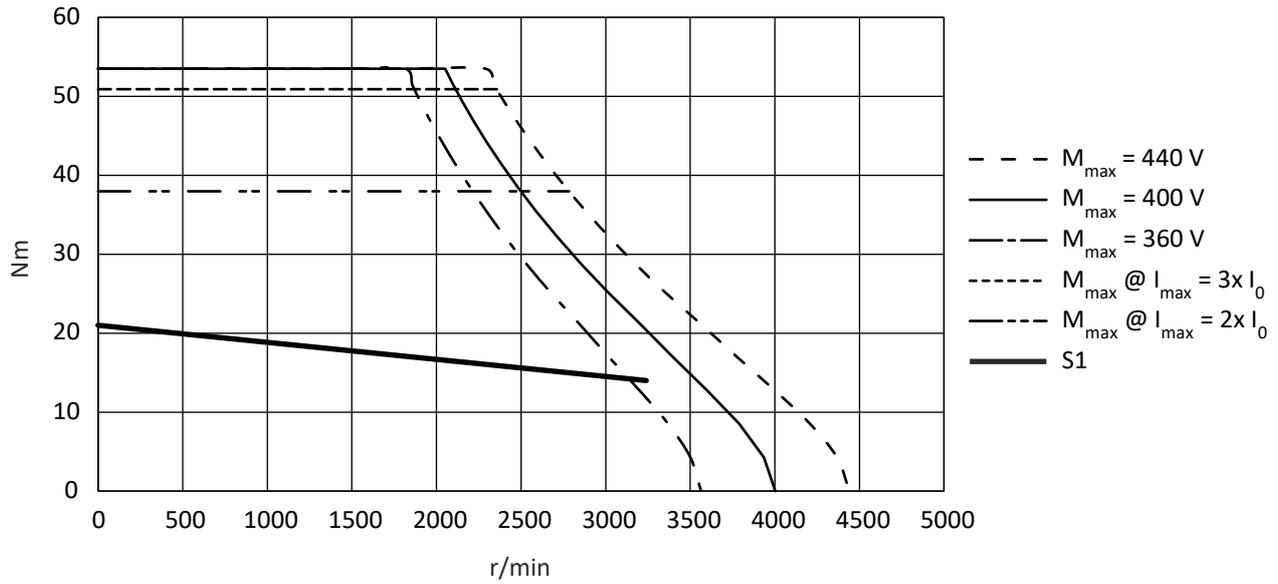




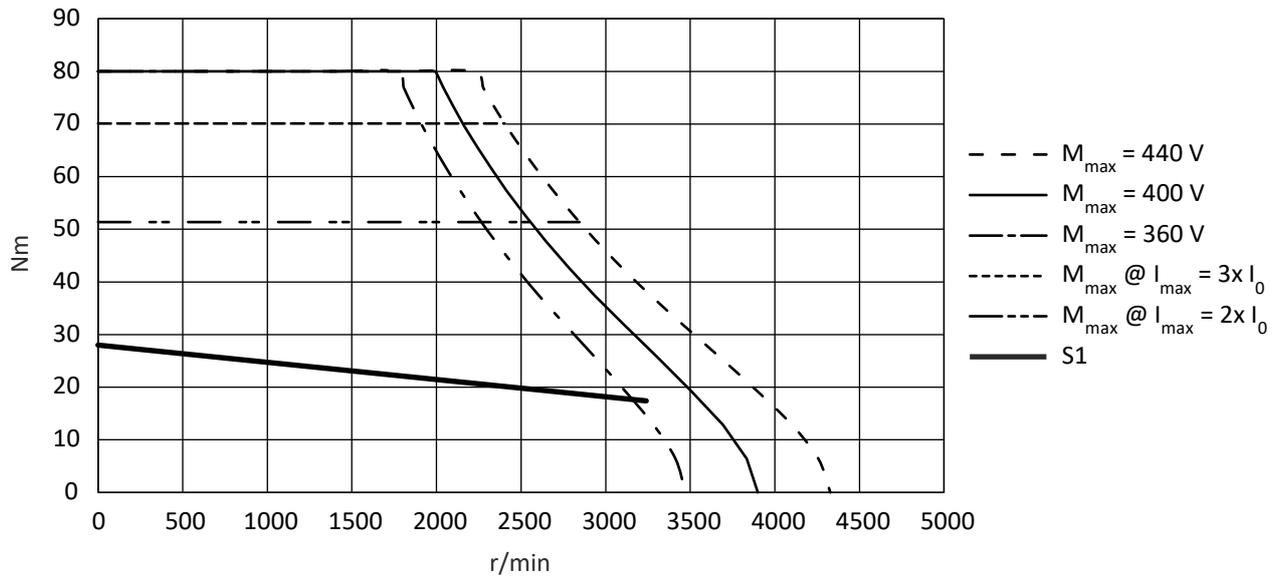
Technical data

Torque characteristics

m850-S140/M3240



m850-S140/L3240

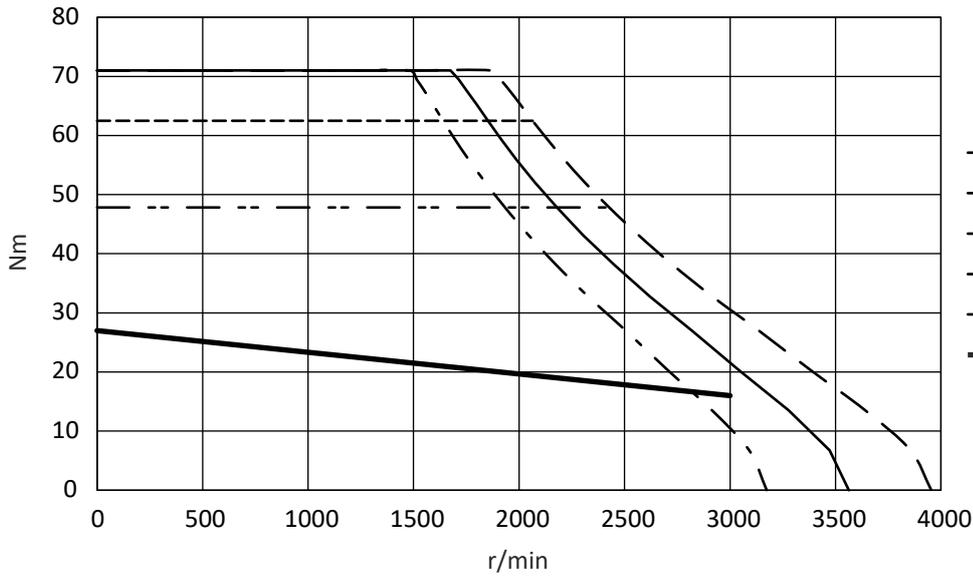


Technical data

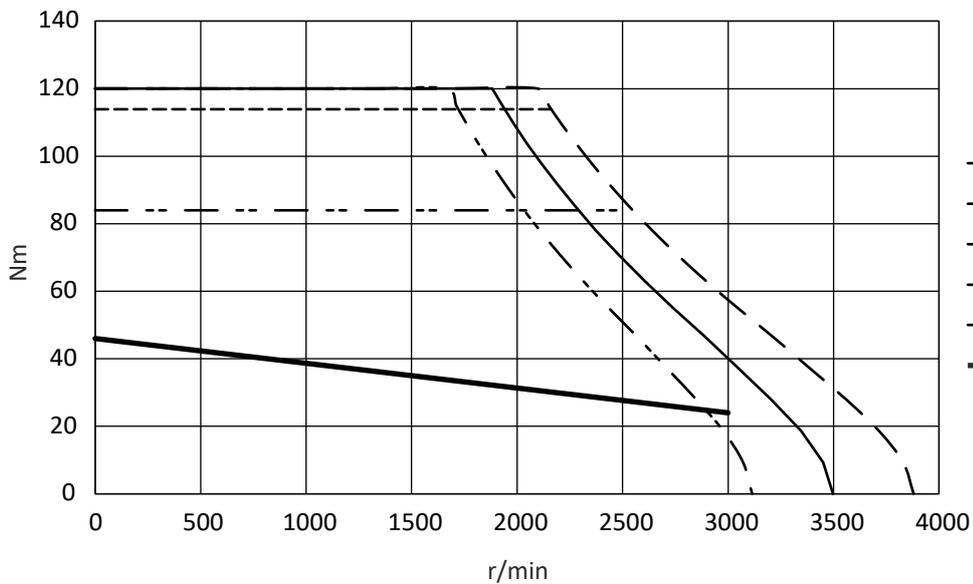
Torque characteristics



m850-S190/S3000



m850-S190/M3000

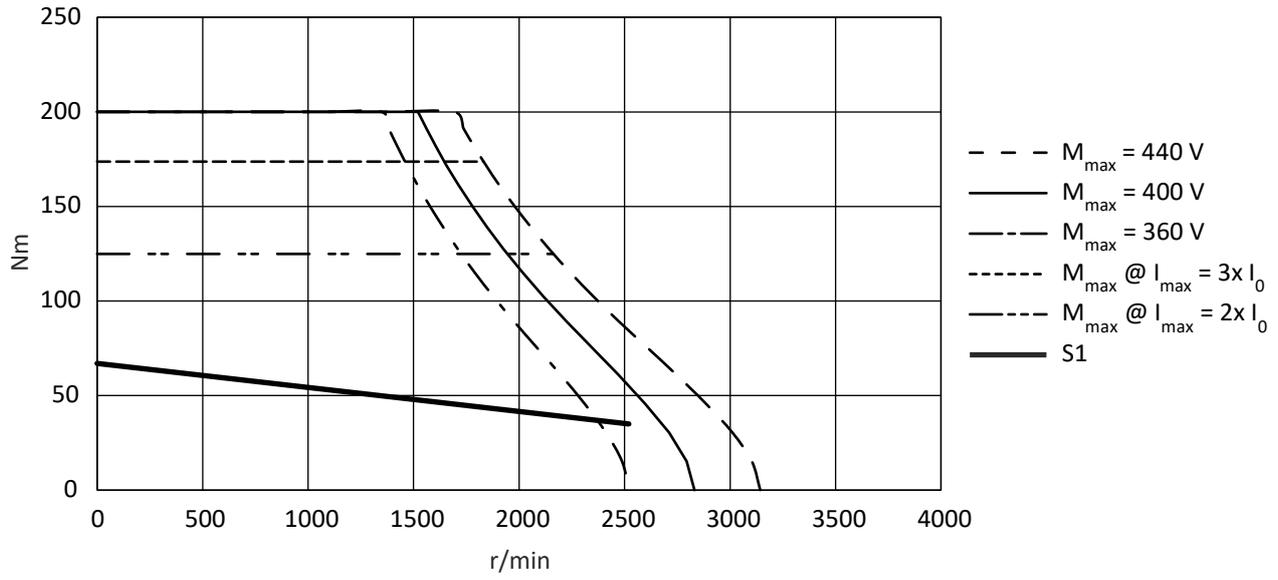




Technical data

Torque characteristics
Basic dimensions

m850-S190/L2520



Technical data

Dimensions



Dimensions

Notes on the basic dimensions



The dimensions also apply for motors with One Cable Technology (OCT).

Table content

Explanation

Table content		Explanation
Total length without brake	L	Total length of the drive with resolver
Total length with brake	L	Total length of the drive with resolver
Motor/connection distance	AD	Distance from center of motor to end of connector/terminal box



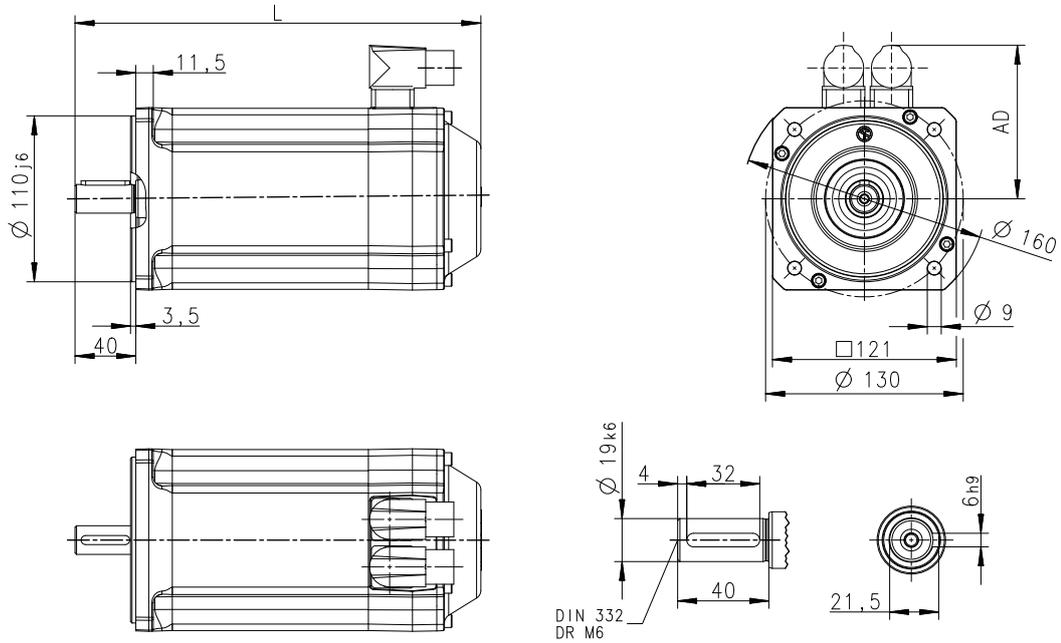
Technical data

Dimensions
Basic dimensions

Basic dimensions

m850-S120, self-ventilated

Output flange FF130



8800564-00

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

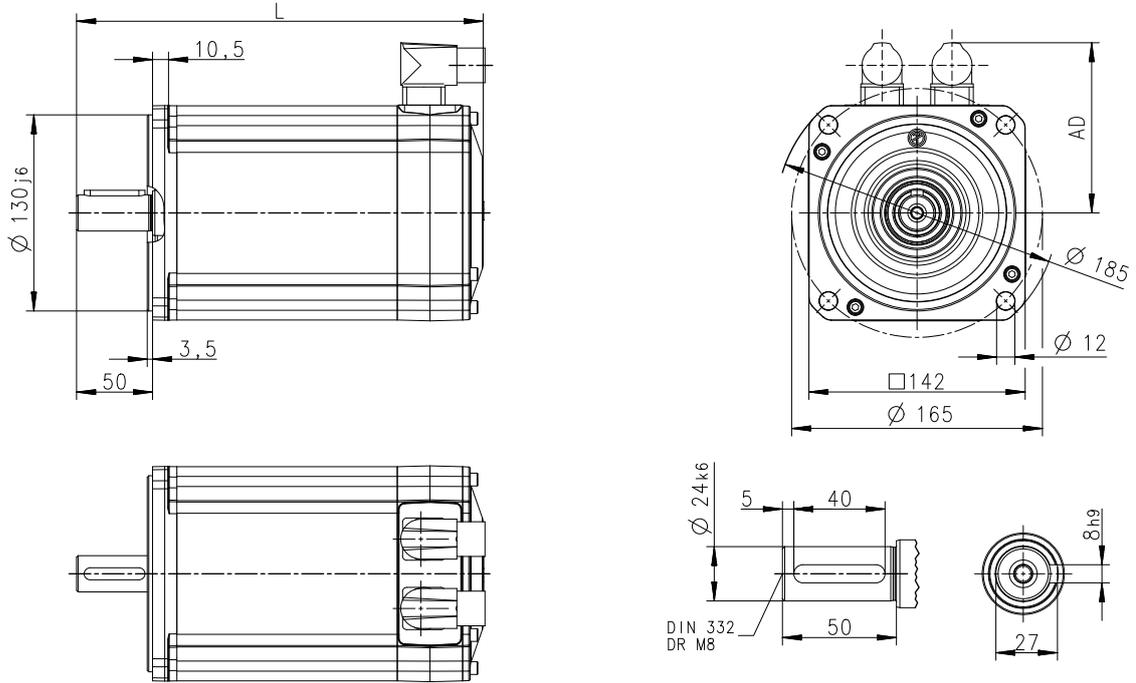
Technical data

Dimensions
Basic dimensions



m850-S140, self-ventilated

Output flange FF165



8800565-00

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

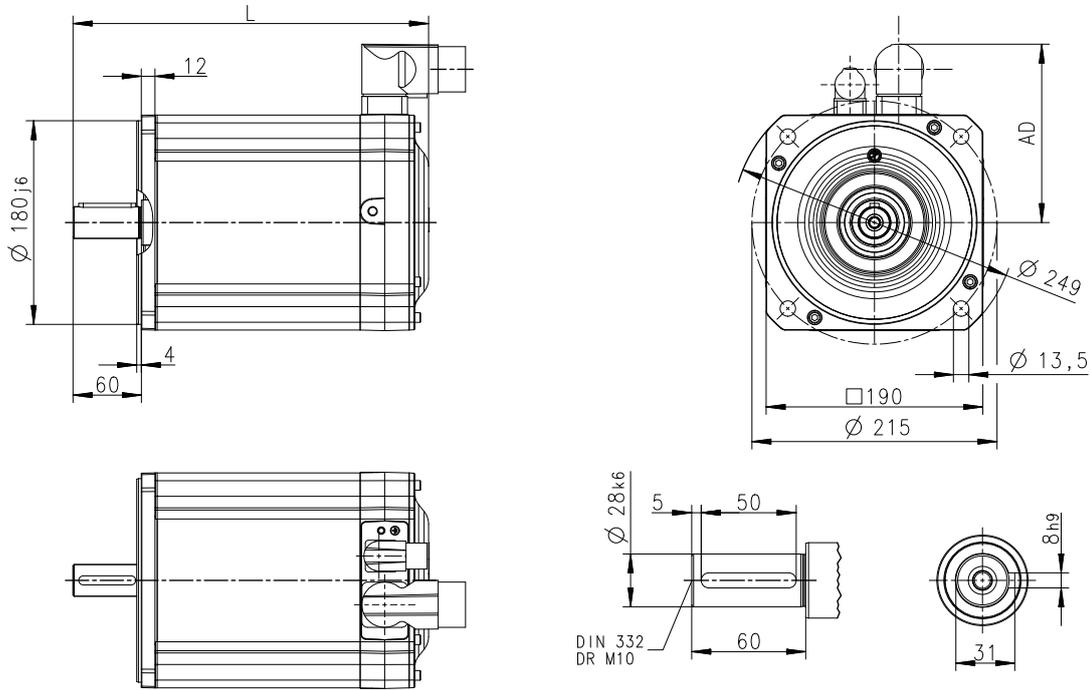


Technical data

Dimensions
Basic dimensions

m850-S190, self-ventilated

Output flange FF215



8800566-00

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

Technical data

Weights
Basic weights



Weights

Basic weights



The basic weights are listed in the rated data.

▶ [Rated data](#)  30

Observe ▶ [Additional weights](#)  48!

Additional weights

Motors

Motor			m850-		
			S120/S3960 S120/M3960 S120/L3960	S140/S3240 S140/M3240 S140/L3240	S190/S3000 S190/M3000 S190/L2520
Spring-applied holding brake	m	kg	2.0	3.0	6.7



Product extensions

Motor connection

Connection via ICN connector

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

The connection is made via two plug connectors, one for power and brake and one for feedback and temperature monitoring. Alternatively, Lenze offers One Cable Technology (OCT).

The connectors can be rotated by 270 ° and are provided with a bayonet catch. Since the catch of the connector is also compatible with conventional box nuts, existing mating connectors with a screw plug can continue to be used without any problems.



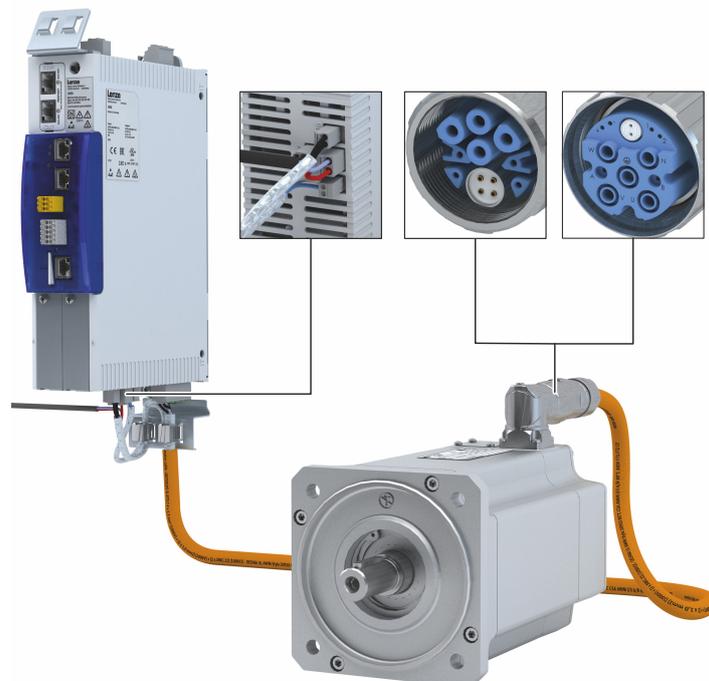
In order to provide for a quick and error-free connection of Lenze motors to Lenze inverters, we recommend using prefabricated Lenze system cables.

One Cable Technology (OCT)

With the aid of the open motor feedback protocol HIPERFACE DSL® and the digital absolute value encoder AM20-8V-D, the motor supports the future-oriented One Cable Technology (OCT).

Advantages

- All necessary wiring is done in only one connector.
- The use of hybrid cables allows for combined servo and feedback cables.
- This intelligently minimizes connecting cables, cable variants, and connection costs.
- The motor temperature is transmitted digitally together with the encoder signal. An additional connection for a motor temperature sensor is not required.



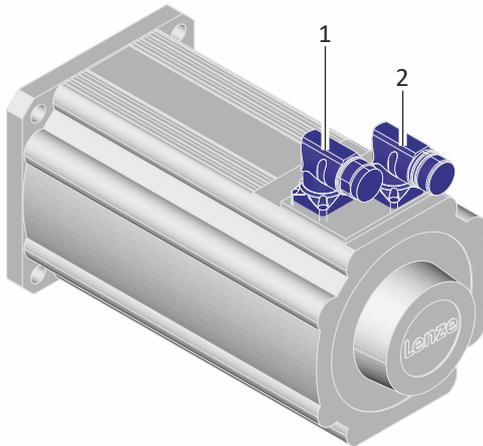
Product extensions

Motor connection
Connection via ICN connector

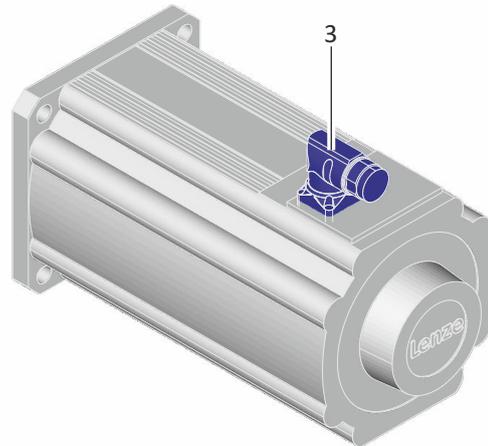


Position of the connections

Standard connection



One Cable Technology (OCT)



Position	Meaning	Position	Meaning
1	ICN-M23 connector, 6-pole ICN-M40 connector, 8-pole • Power connection • Brake connection • PE connection	3	For One Cable Technology (OCT) ICN-M23 connector, hybrid ICN-M40 connector, hybrid • Power connection • Brake connection • PE connection • Connection of digital absolute value encoder • Connection of temperature monitoring
2	ICN-M23 connector • Feedback connection • Connection of temperature monitoring		

Motor/ICN connector assignment

Standard connection: Power and brake

One Cable Technology (OCT): Power connection, brake, feedback and temperature monitoring

Motor	Connector	Motor	Connector	Motor	Connector
m850-S120/S3960	ICN-M23	m850-S140/S3240	ICN-M23	m850-S190/S3000	ICN-M23
m850-S120/M3960	ICN-M23	m850-S140/M3240	ICN-M23	m850-S190/M3000	ICN-M40
m850-S120/L3960	ICN-M23	m850-S140/L3240	ICN-M40	m850-S190/L2520	ICN-M40



Product extensions

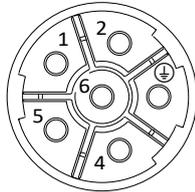
Motor connection
Connection via ICN connector

Standard connection

Connection of power and brake

ICN-M23 connector assignment

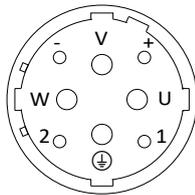
6-pole



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

ICN-M40 connector assignment

8-pole



ICN M40 8-pole		
Contact	Name	Meaning
+	BD1	Holding brake +
-	BD2	Holding brake -
PE	PE	PE conductor
U	U	Power phase U
V	V	Power phase V
W	W	Power phase W
1		Not assigned
2		Not assigned

Product extensions

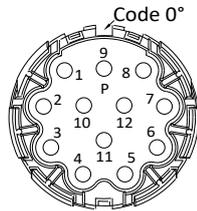
Motor connection
Connection via ICN connector



Feedback and temperature monitoring connection

ICN-M23 connector assignment

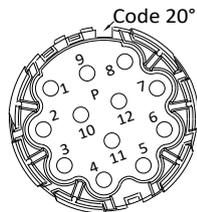
Resolver



ICN M23 for resolvers		
Contact	Name	Meaning
1	+Ref	Transformer windings
2	-Ref	Transformer windings
3	+VCC ETS	Supply: Electronic nameplate (Only for motors and inverters that support this function)
4	+COS	Stator windings cosine
5	-COS	Stator windings cosine
6	+SIN	Stator windings sine
7	-SIN	Stator windings sine
8		Not assigned
9		Not assigned
10	Schirm	Encoder housing shield
11	+	Temperature monitoring: PT1000
12	-	Temperature monitoring: PT1000

ICN-M23 connector assignment

Incremental and SinCos absolute value encoder Hiperface©



ICN M23 for 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	Schirm	Encoder housing shield
11	+	Temperature monitoring: PT1000
12	-	Temperature monitoring: PT1000



Motor/connector 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	S120/M3960	S120/L3960	S140/S3240
Plug		ICN-M23 6-pole			
Motor cable	mm ²	1.0/1.5/2.5			
Screw plug					
Order code		EWS0001			
Coding in the system cable type code		M01			
Bayonet lock					
Order code		EWS1001			
Coding in the system cable type code		M04			

Motor code		m850-			
		S140/L3240		S190/S3000	S190/M3000
Plug		ICN-M40 8-pole		ICN-M23 6-pole	ICN-M40 8-pole
Motor cable	mm ²	2.5/4.0	6.0/10/16	1.0/1.5/2.5	6.0/10/16
Screw plug					
Order code		EWS0012	EWS0013	EWS0001	EWS0013
Coding in the system cable type code		M02	M03	M01	M03
Bayonet lock					
Order code		EWS1012	EWS1013	EWS1001	EWS1013
Coding in the system cable type code		M05	M06	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
Bayonet lock		
Order code	EWS1006	EWS1010
Coding in the system cable type code	F05	F06

Product extensions

Motor connection
 Connection via ICN connector

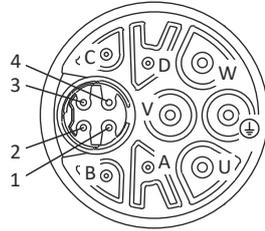


One Cable Technology (OCT)

Connection of power, brake, feedback and temperature monitoring

ICN-M23 connector assignment, hybrid

For One Cable Technology (OCT) with digital absolute value encoder



ICN M23 Hybrid for One Cable Technology (OCT) with digital absolute value encoder		
Contact	Name	Meaning
U	U	Power phase U
V	V	Power phase V
W	W	Power phase W
PE	PE	PE
A	BD1	Holding brake +
B	BD2	Holding brake -
C	+	Optional temperature monitoring: PTC +
D	-	Optional temperature monitoring: PTC -
1		Not assigned
2	+	VCC/data +
3	-	GND/data -
4		Not assigned

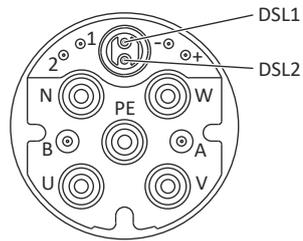


Product extensions

Motor connection
Connection via ICN connector

ICN-M40 connector assignment, hybrid

For One Cable Technology (OCT) with digital absolute value encoder



ICN M40 Hybrid for One Cable Technology (OCT) with digital absolute value encoder		
Contact	Name	Meaning
U	U	Power phase U
V	V	Power phase V
W	W	Power phase W
A	BD1	Holding brake +
B	BD2	Holding brake -
PE	PE	PE
N		Not assigned
DSL1	+	VCC/data +
DSL2	-	GND/data -
+		Not assigned
-		Not assigned
1	+	Optional temperature monitoring: PTC +
2	-	Optional temperature monitoring: PTC -

Product extensions

Motor connection
Connection via ICN connector



Hybrid cables for One Cable Technology (OCT)

Connector with bayonet lock	ICN-M23 Hybrid
Order code for hybrid cable 1.5 mm ²	
Cable length 2.0 m	EYP0080A0020M11A00
Cable length 3.5 m	EYP0080A0035M11A00
Cable length 5.0 m	EYP0080A0050M11A00
Cable length 7.5 m	EYP0080A0075M11A00
Cable length 10 m	EYP0080A0100M11A00
Cable length 15 m	EYP0080A0150M11A00
Cable length 20 m	EYP0080A0200M11A00
Cable length 50 m	EYP0080A0500M11A00
Cable length 100 m	EYP0080A1000M11A00
Order code for hybrid cable 2.5 mm ²	
Cable length 2.0 m	EYP0081A0020M11A00
Cable length 3.5 m	EYP0081A0035M11A00
Cable length 5.0 m	EYP0081A0050M11A00
Cable length 7.5 m	EYP0081A0075M11A00
Cable length 10 m	EYP0081A0100M11A00
Cable length 15 m	EYP0081A0150M11A00
Cable length 20 m	EYP0081A0200M11A00
Connector with bayonet lock	ICN-M40 Hybrid
Order code for hybrid cable 4.0 mm ²	
Cable length 2.0 m	EYP0085A0020M12A00
Cable length 3.5 m	EYP0085A0035M12A00
Cable length 5.0 m	EYP0085A0050M12A00
Cable length 7.5 m	EYP0085A0075M12A00
Cable length 10 m	EYP0085A0100M12A00
Cable length 15 m	EYP0085A0150M12A00
Cable length 20 m	EYP0085A0200M12A00
Cable length 50 m	EYP0085A0500M12A00
Cable length 100 m	EYP0085A1000M12A00
Order code for hybrid cable 6.0 mm ²	
Cable length 2.0 m	EYP0086A0020M12A00
Cable length 3.5 m	EYP0086A0035M12A00
Cable length 5.0 m	EYP0086A0050M12A00
Cable length 7.5 m	EYP0086A0075M12A00
Cable length 10 m	EYP0086A0100M12A00
Cable length 15 m	EYP0086A0150M12A00
Cable length 20 m	EYP0086A0200M12A00
Cable length 50 m	EYP0086A0500M12A00
Cable length 100 m	EYP0086A1000M12A00



Brakes

⚠ 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.

Motor supply cables

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:

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

Product extensions

Brakes



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.



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	m850- S140/ S3240	m850- S140/ M3240	m850- S140/ L3240	m850- S190/ S3000	m850- S190/ M3000	m850- S190/ L2520
Supply voltage range	V_{in}	V	21.6 ... 26.4								
Supply voltage	V_{rated}	V	24								
Bemessungsdrehmoment											
At 20 °C	M_{rated}	Nm	20			34			102		
At 120 °C	M_{rated}	Nm	18			32			100		
Rated current	I_{rated}	A	1.2			1.4			2.1		
Engagement time t1	t_1	ms	30			50			40		
Disengagement time t2	t_2	ms	110			150			230		
Friction energy	Q_E	kJ	3.1						5.7		
Weight	m	kg	2.0			3.0			6.70		
Massenträgheitsmoment											
Brake	J	kgcm ²	0.75			2.01			10.42		
Brake motor	J_{MB}	kgcm ²	7.5	13.3	19.2	18.1	32.5	46.9	72.6	128.9	204.3
Load/brake motor ratio	J_L/J_{MB}		74	47	32	34	19	13	15	8	5



Feedback

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

Inverter	Feedback without functional safety		
	Resolver	Absolute value encoder	Digital absolute value encoder for OCT
i950 servo inverter	RS0	AM128-8V-H	AM20-8V-D
i700 servo inverter	RS0	AM128-8V-H	-
8400 TopLine inverter drives	RS0	AM128-8V-H	-
9400 HighLine servo drives	RS0	AM128-8V-H	-

Inverter	Feedback with functional safety		
	Resolver	Absolute value encoder	Digital absolute value encoder for OCT
i950 servo inverter	RV03	AM128-8V-K2	AM20-8V-D2
9400 HighLine servo drives	RV03	AM128-8V-K2	-

Feedbacks in the environment of functional safety

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, the permissible angular 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)
- 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
Design			Mounting	
Resolution - angle		'	0.8	0.8
Min. accuracy		'	-10	-10
Max. accuracy		'	10	10
Absolute positioning			1 revolution	1 revolution
Max. speed	n_{\max}	rpm	8000	8000
Max. DC input voltage	$V_{\text{in,max}}$	V	10	10
Max. input frequency	$f_{\text{in,max}}$	kHz	4	4
Ratio stator/rotor			0.3	0.3
Min ratio tolerance		%	-5	-5
Max ratio tolerance		%	5	5
Rotor impedance	Z_{ro}	Ω	51+j90	51+j90
Stator impedance	Z_{so}	Ω	102+j150	102+j150
Impedance	Z_{rs}	Ω	44+j76	44+j76
Min. insulation resistance at DC 500 V	R_{min}	M Ω	10	10
Number of pole pairs			1	1
Max. angle error Min		'	-10	-10
Max. angle error Max		'	10	10

Speed-dependent safety functions

Feedback			RV03
Max. permissible angular acceleration	α	rad/s ²	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.



With the aid of the open feedback protocol HIPERFACE DSL® and in connection with the digital absolute value encoder AM20-8V-D, the motor supports the future-oriented One Cable Technology (OCT).

Feedback type			Digital absolute value encoder		SinCos absolute value encoder	
Feedback			AM20-8V-D	AM20-8V-D2	AM128-8V-H	AM128-8V-K2
Speed-dependent safety functions			No	Yes	No	Yes
Design			Mounting	Mounting	Mounting	Mounting
Encoder type			Multi-turn	Multi-turn	Multi-turn	Multi-turn
Resolution		bit	20	20	-	-
Pulses			-	-	128	128
Output signals			Digital	Digital	SinCos 1 Vss	SinCos 1 Vss
Interfaces			Hiperface	Hiperface	Hiperface	Hiperface
Absolute revolution			4096	4096	4096	4096
Resolution - angle			0.02	0.02	0.4	0.4
Min. accuracy		'	-	-	-1.3	-1.3
Max. accuracy		'	-	-	1.3	1.3
Fehlergrenze Positionswert						
System accuracy			1.7	1.7	-	-
Integral nonlinearity			1	1	-	-
Min. DC input voltage	$V_{in,min}$	V	-	-	7	7
Max. DC input voltage	$V_{in,max}$	V	-	-	12	12
Max. current consumption	I_{max}	A	0.15	0.15	0.06	0.06
Limit frequency	f_{max}	kHz	-	-	200	200

Speed-dependent safety functions

Feedback			AM20-8V-D2	AM128-8V-K2
Max. permissible angular acceleration	α	rad/s ²	240000	240000
Functional safety				
IEC 61508			SIL2	
EN 13849-1			Up to Performance Level d	



Temperature monitoring

Thermal detectors PT1000

The thermal detector used continuously monitors 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!**

This makes it possible to determine the motor temperature in the permissible operating range with great accuracy.

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!**

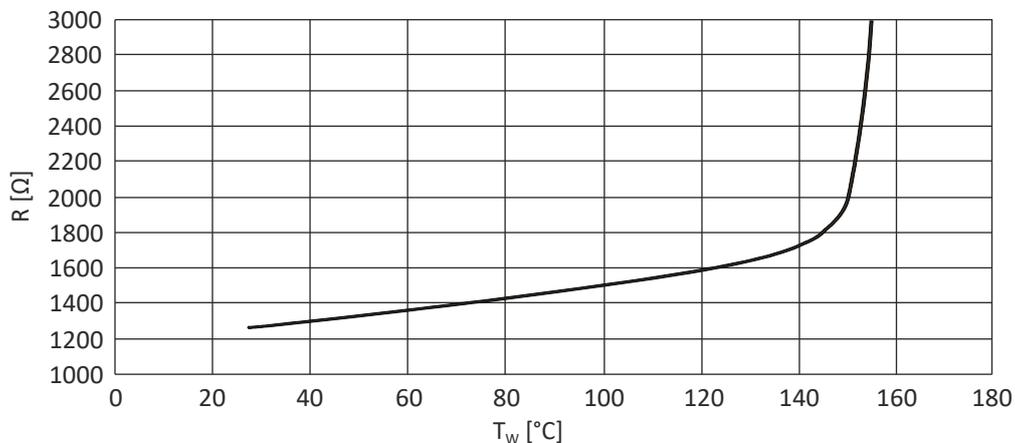
The motors are monitored via three thermal sensors connected in series (1x PT1000 + 2x PTC 150 °C). This makes it possible to determine the motor temperature in the permissible operating range and at the same time execute the overtemperature response configured in the inverter in one of the winding strands.



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_w Winding temperature

Product codes



Product codes

Product code of m850 synchronous servo motor

Example	M	8	5	A	S	120	S	25	5	S	0	R	C	C	0		
Meaning	Variant		Product 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	Short								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				
Degree of protection	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	
	Digital absolute value encoder																D
	Hiperface DSL®																
Product approval	CE															C	
	CE; cULus															L	
Manufacturer	Lenze															C	
Internal key																0	



Environmental notes and recycling

Lenze has been certified to the worldwide DIN EN ISO 14001 environmental management standard for many years. As part of our environmental policy and the associated climate responsibility, please note the following information on hazardous ingredients and the recycling of Lenze products and their packaging:



Lenze products are partly subject to the EU Directive 2011/65/EU on the restriction of certain hazardous substances in electrical and electronic equipment (RoHS). This is documented accordingly in the EU declaration of conformity and with the CE mark.



Lenze products are not subject to EU Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), but some contain batteries/rechargeable batteries in accordance with EU Directive 2006/66/EC (Battery Directive). The disposal route, which is separate from household waste, is indicated by corresponding labels with the "crossed-out trash can". Any batteries/rechargeable batteries included are designed to last the life of the product and do not need to be replaced or otherwise removed by the end user.



Lenze products are usually sold with cardboard or plastic packaging. This packaging complies with EU Directive 94/62/EC on packaging and packaging waste (Packaging Directive). The required disposal route is indicated by material-specific labels with the "recycling triangle".

Example: "21 - other cardboard"

REACH

Lenze products are subject to the European Regulation EC No. 1907/2006 (REACH Chemicals Regulation). When used as intended, exposure of substances to humans, animals and the environment is excluded.

Lenze products are industrial electrical and electronic products and are disposed of professionally. Both the mechanical and electrical components such as electric motors, gearboxes or inverters contain valuable raw materials that can be recycled and reused. Proper recycling and thus maintaining the highest possible level of recyclability is therefore important and sensible from an economic and ecological point of view.

- Coordinate professional disposal with your waste disposal company.
- Separate mechanical and electrical components, packaging, hazardous waste (e.g. gear oils) and batteries/rechargeable batteries wherever possible.
- Dispose of the separated waste in an environmentally sound and proper manner (no household waste or municipal bulky waste).

What?	Material	Disposal instructions
Pallets	Wood	Return to manufacturers, freight forwarders or reusable materials collection system
Packaging material	Paper, cardboard, pasteboard, plastics	Collect and dispose of separately
Products		
Electronic devices	Metal, plastics, circuit boards, heatsinks	As electronic waste give to professional disposer for recycling
Gearbox	Oil	Drain oil and dispose of separately
	Casting, steel, aluminium	Dispose as metal scrap
Motors	Casting, copper, rotors, magnets, potting compound	As engine scrap give to professional disposer for recycling
Dry-cell batteries/rechargeable batteries		As used batteries give to professional disposer for recycling



Further information on Lenze's environmental and climate responsibility and on the topic of energy efficiency can be found on the Internet:

www.Lenze.com → search word: "Sustainability"



Appendix

Good to know

Approvals and 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.



Operating modes of the motor

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

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
 ϑ Temperature

P_v Power loss
 t_B Load period
 t_S Cycle duration

Appendix

Good to know
Enclosures



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).

