Project planning EN

Servo motors

Synchronous servo motor m850

Contents

Contents

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

Further documents

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

Notations and conventions

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

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

Layout of the safety instructions

⚠DANGER!

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

⚠WARNING!

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

⚠CAUTION!

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

NOTICE

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

Product information

Product description

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, i950, Servo Drives 9400, and Inverter Drives 8400 TopLine, 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 thanks to connectors with bayonet catch and rotatable connector boxes
- Reduced cabling thanks to one-cable technology in connection with digital absolute value encoders

m850-S140/S3240 synchronous servo motor

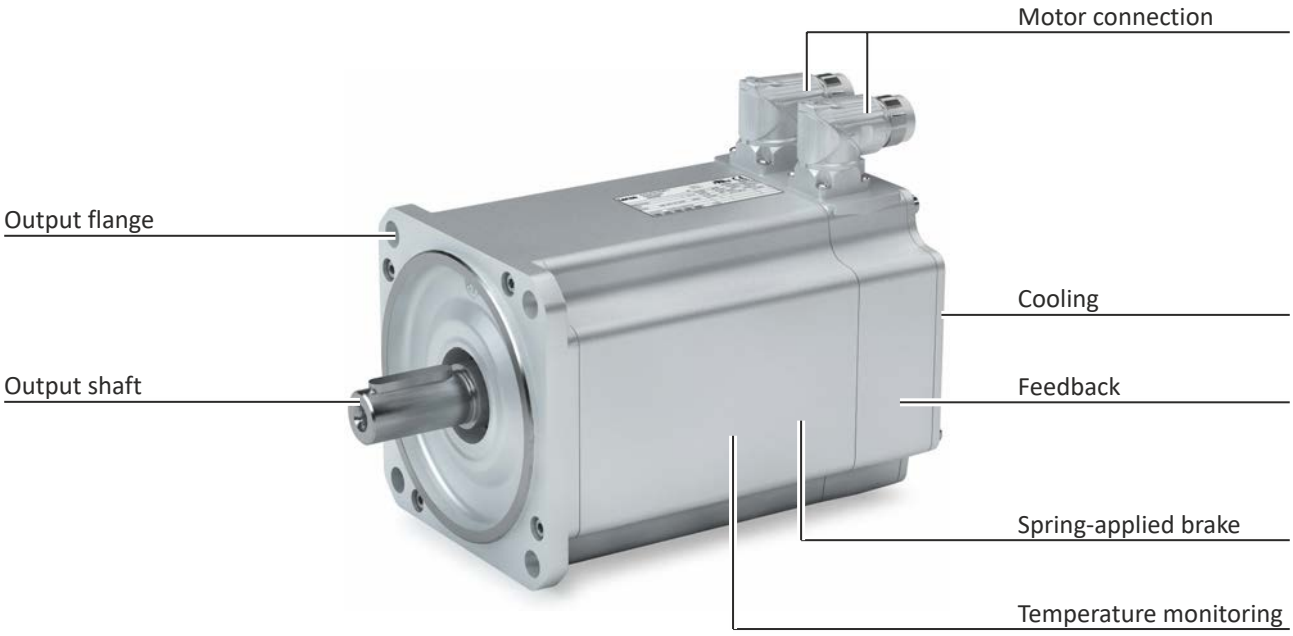
Synchronous servo motor m850-S120/L3960 with one-cable technology in connection with digital absolute value encoder

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

Features


Motor connection
Output flange
Cooling
Output shaft
Feedback
Spring-applied brake
Temperature monitoring

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		**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		
Output flange	mm	FF130		
Cooling		**Self-ventilated IP54** Self-ventilated IP65		
Motor connection		ICN connector Hybrid connector ICN for one-cable technology		
Spring-applied brake		**Without** With		
Characteristic torque	Nm	18		
DC brake voltage	V	24		
Feedback		**Resolver** Absolute value encoder Digital absolute value encoder for one-cable technology		
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		**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		
Output flange	mm	FF165		
Cooling		**Self-ventilated IP54** Self-ventilated IP65		
Motor connection		ICN connector Hybrid connector ICN for one-cable technology		
Spring-applied brake		**Without** With		
Characteristic torque	Nm	32		
DC brake voltage	V	24		
Feedback		**Resolver** Absolute value encoder Digital absolute value encoder for one-cable technology		
Temperature monitoring		PT1000 thermal detector + 2 PTC thermistors		

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		**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		
Output flange	mm	FF215		
Cooling		**Self-ventilated IP54** Self-ventilated IP65		
Motor connection		ICN connector Hybrid connector ICN for one-cable technology		
Spring-applied brake		**Without** With		
Characteristic torque	Nm	100		
DC brake voltage	V	24		
Feedback		**Resolver** Absolute value encoder Digital absolute value encoder for one-cable technology		
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.

Safety instructions

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

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

Please observe the specific safety information in the other sections!

Basic safety instructions

Personnel

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

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

Process engineering

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

Application as directed

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

Foreseeable misuse

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

Residual hazards

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

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

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

Protection of persons

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

Motor protection

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

Drive dimensioning

The dimensioning is suitable for:

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

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

Drive function

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

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

Mechanical strength

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

Thermal dimensioning

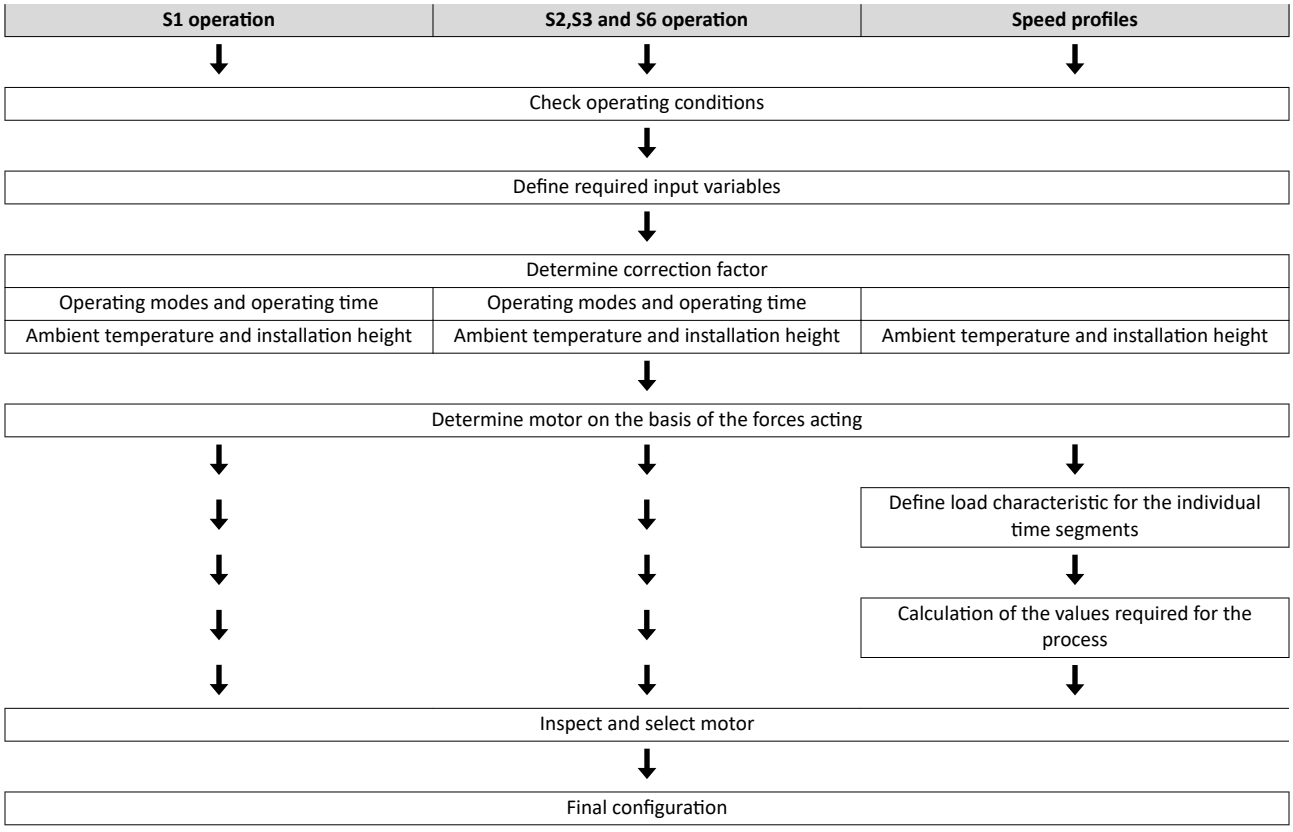
For the inverter, the thermal dimensioning process is carried out on the basis of the continuous inverter current or on the basis of the continuous torque from the motor-inverter combination, which can be reached.

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 🕮 57

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 < 17 teeth = 1.15	≥ 20 teeth = 1.0 < 20 teeth = 1.25 < 13 teeth = 1.4	With belt tightener= 2.0 - 2.5 Without belt tightener= 2.5 - 3.0	1.5 - 2.0
			Calculation		**Check**	
Radial force	F_{rad}	N	$F_{rad} = 2000 \times \frac{M_{L,max} \times f_z}{dw}$		$F_{rad} \leq F_{rad,max}$	
Axial force	F_{ax}	N			$F_{ax} \leq F_{rad,max}$	

dw Effective diameter of transmission element

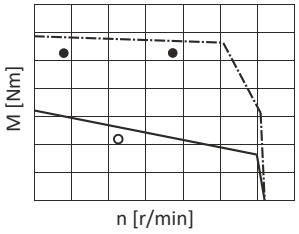
▸ Radial forces and axial forces 23

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 (●)			
Below the maximum torque characteristic of the servo motor-inverter combination, taking $M_{L,max}$ into consideration		n_L M_L	
Thermally effective operating point (○)			
Below the S1 torque characteristic of the servo motor		n_L $M_L / (k_L \times k_H)$	

▸ Rated data 25

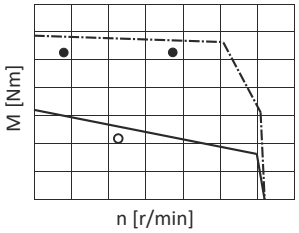
▸ Torque characteristics 34

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	**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	$M_{eff} = \sqrt{\frac{1}{T}\sum_z M_z^2 \times \Delta t_z}, T \leq 1min$	M_{eff}	Nm
Mean speed	$n_m = \lvert\overline{n_{L,z}}\rvert = \frac{1}{T}\sum_z \lvert n_{L,z} \rvert \times \Delta t_z$	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 ... 10 Optimum k_J = 1	$k_J = J_L / (J_M + J_B)$	
Checking the motor torques			
Acceleration torque	$M_{S,z} = M_z + (J_M + J_B) \times \frac{2\pi \times \Delta n_{L,z}}{60 \times \Delta t_z}$	$M_{S,z}$	Nm
Effective torque	$M_{S,eff} = \sqrt{\frac{1}{T}\sum_z M_{S,z}^2 \times \Delta t_z}$	$M_{S,eff}$	
All operating points (●)			
Below the maximum torque characteristic of the servo motor-inverter combination, taking $M_{L,max}$ into consideration		$n_{L,z}$ $M_{S,z}$	
Thermally effective operating point (○)		n_m $M_{S,eff} / k_H$	
Below the S1 torque characteristic of the servo motor			

▸ Rated data 📖 25

▸ Torque characteristics 📖 34

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)	• Indoor installation, no special corrosion protection necessary • Painting by customer	Standard
OKS-G (primed)	• Dependent on subsequent top coat applied	Optional
OKS-S (small)	• Standard applications • Internal installation in heated buildings • Air humidity up to 90 %	
OKS-M (medium)	• Internal installation in non-heated buildings • Covered, protected external installation • Air humidity up to 95 %	
OKS-L (large)	• External installation • Air humidity above 95 % • Chemical industrial plants • Food industry	

Surface and corrosion protection (called OKS)	Corrosivity category	Surface coating	Colour	Coating thickness
	DIN EN ISO 12944-2	Design		
without OKS (unpainted)				
OKS-G (primed)		• 2K PUR priming coat		60 ... 90 µm
OKS-S (small)	Comparable to C1	• 2K-PUR top coat	• Standard: RAL 7012 • Optional: RAL Classic	80 ... 120 µm
OKS-M (medium)	Comparable to C2	• 2K PUR priming coat • 2K-PUR top coat		110 ... 160 µm
OKS-L (large)	Comparable to C3			140 ... 200 µm

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.

Information on electrical installation

Important notes

⚠ DANGER!

Hazardous voltage!

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

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

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

Preparation

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

EMC-compliant wiring

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

Technical data

Notes regarding the given data

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

- Ambient temperature T_U = 40 °C for motors (in accordance with EN 60034)
- Site altitude ≤ 1000 m above sea level

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

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

NOTICE

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

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

Standards and operating conditions

Conformities/approvals

Conformity		
CE	2014/35/EU	Low-Voltage Directive
	2014/30/EU	EMC Directive (reference: CE-typical drive system)
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

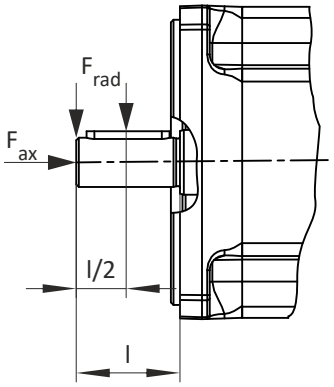
Climate		
1K3 (-20 °C ... +60 °C)	EN 60721-3-1	Storage, < 3 months
1K3 (-20 °C ... +40 °C)	EN 60721-3-1	Storage, > 3 months
2K3 (-20 °C ... +70 °C)	EN 60721-3-2	Transport
3K3 (-20 °C ... +40 °C)	EN 60721-3-3	Operation, without brake
3K3 (-10 °C ... +40 °C)	EN 60721-3-3	Operation, with brake
Relative 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	

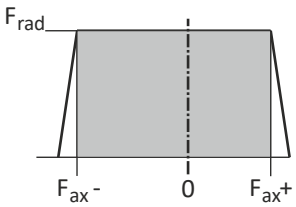
Radial forces and axial forces

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

Application of force at l

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

Rated data

Inverter mains connection 400 V, Self-ventilated

Product name			m850-S120/S3960	m850-S120/M3960	m850-S120/L3960
Standstill torque	M_0	Nm	6.50	11.0	15.0
Rated torque	M_N	Nm	4.80	7.40	9.00
Max. torque	$M_{Max.}$	Nm	14.5	29.0	44.0
Rated speed	n_N	rpm	3960	3960	3960
Max. speed	$n_{Max.}$	rpm	6000	6000	6000
Rated power	P_N	kW	2.00	3.10	3.70
Standstill current	I_0	A	5.50	8.80	12.1
Rated current	I_N	A	4.30	6.40	7.80
Max. current	$I_{Max.}$	A	15.0	28.0	42.0
Rated voltage	$U_{N, AC}$	V	330	330	320
Rated frequency	f_N	Hz	330	330	330
Moment of inertia	J	kgcm²	6.50	12.4	18.2
Efficiency	$\eta_{100\ \%}$		0.902	0.914	0.914
Torque constant	$Kt_{0\ 150°C}$	Nm/A	1.18	1.25	1.24
Voltage constant	$KE_{LL\ 150\ °C}$	V/1000 rpm	69.0	73.1	72.9
Stator terminal resistance	$R_{UV\ 20°C}$	Ω	2.24	1.02	0.63
Stator terminal resistance	$R_{UV\ 150°C}$	Ω	3.38	1.54	0.95
Stator inductance	L	mH	11.5	6.73	4.58
Mass	m	kg	6.50	9.25	12.0

Product name			m850-S140/S3240	m850-S140/M3240	m850-S140/L3240
Standstill torque	M_0	Nm	11.0	21.0	28.0
Rated torque	M_N	Nm	8.50	14.0	17.4
Max. torque	$M_{Max.}$	Nm	26.0	53.5	80.0
Rated speed	n_N	rpm	3240	3240	3240
Max. speed	$n_{Max.}$	rpm	6000	6000	6000
Rated power	P_N	kW	2.90	4.80	5.90
Standstill current	I_0	A	7.40	14.0	18.0
Rated current	I_N	A	6.30	10.0	12.2
Max. current	$I_{Max.}$	A	23.0	45.5	66.0
Rated voltage	$U_{N, AC}$	V	340	330	330
Rated frequency	f_N	Hz	270	270	270
Moment of inertia	J	kgcm²	15.7	30.1	44.6
Efficiency	$\eta_{100\ \%}$		0.879	0.915	0.926
Torque constant	$Kt_{0\ 150°C}$	Nm/A	1.49	1.50	1.56
Voltage constant	$KE_{LL\ 150\ °C}$	V/1000 rpm	86.8	88.4	90.7
Stator terminal resistance	$R_{UV\ 20°C}$	Ω	1.44	0.56	0.37
Stator terminal resistance	$R_{UV\ 150°C}$	Ω	2.16	0.85	0.55
Stator inductance	L	mH	9.90	5.22	3.76
Mass	m	kg	9.50	14.5	19.5

Technical data

Rated data

Inverter mains connection 400 V, Self-ventilated

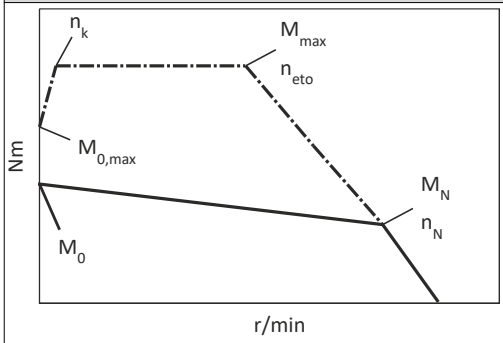
Product name			m850-S190/S3000	m850-S190/M3000	m850-S190/L2520
Standstill torque	M_0	Nm	27.0	46.0	67.0
Rated torque	M_N	Nm	16.0	24.0	35.0
Max. torque	$M_{Max.}$	Nm	71.0	120	200
Rated speed	n_N	rpm	3000	3000	2520
Max. speed	$n_{Max.}$	rpm	4500	4500	4500
Rated power	P_N	kW	5.00	7.50	9.20
Standstill current	I_0	A	16.0	26.8	30.8
Rated current	I_N	A	10.3	15.4	17.7
Max. current	$I_{Max.}$	A	64.0	87.0	112
Rated voltage	$U_{N, AC}$	V	340	330	345
Rated frequency	f_N	Hz	250	250	210
Moment of inertia	J	kgcm²	60.8	117	193
Efficiency	$\eta_{100\ \%}$		0.905	0.919	0.929
Torque constant	$Kt_{0\ 150°C}$	Nm/A	1.69	1.72	2.18
Voltage constant	$KE_{LL\ 150\ °C}$	V/1000 rpm	99.2	101	125
Stator terminal resistance	$R_{UV\ 20°C}$	Ω	0.45	0.20	0.16
Stator terminal resistance	$R_{UV\ 150°C}$	Ω	0.68	0.30	0.24
Stator inductance	L	mH	5.46	2.90	2.76
Mass	m	kg	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, please refer to the servo inverter documentation.

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

Derating speed

Motor	Derating speed
	n_k
	rpm
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	

Inverter Drives 8400 TopLine

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

Motor			Inverter												
			E84AVTC□												
			1524	2224	3024	4024	5524	7524	1134	1534	1834	2234	3034	3734	4534
m850-S120/S3960															
Rated torque	M_{rated}	Nm	4.4	4.8	4.8	4.8	4.8								
Standstill torque	M_0	Nm	4.6	6.5	6.5	6.5	6.5								
Max. standstill torque	$M_{0,max}$	Nm	6.9	9.4	11.6	14.1	14.5								
Max. torque	M_{max}	Nm	8.8	11.8	14.2	14.5	14.5								
Transition speed	n_{eto}	rpm	3450	2953	2627	2599	2599								
m850-S120/M3960															
Rated torque	M_{rated}	Nm		6.5	7.4	7.4	7.4	7.4	7.4						
Standstill torque	M_0	Nm		7.0	9.1	11.0	11.0	11.0	11.0						
Max. standstill torque	$M_{0,max}$	Nm		10.5	13.5	17.0	22.0	26.6	29.0						
Max. torque	M_{max}	Nm		13.7	17.3	21.6	27.5	29.0	29.0						
Transition speed	n_{eto}	rpm		3609	3270	2928	2551	2477	2477						
m850-S120/L3960															
Rated torque	M_{rated}	Nm			8.4	9.0	9.0	9.0	9.0	9.0					
Standstill torque	M_0	Nm			9.0	11.8	15.0	15.0	15.0	15.0					
Max. standstill torque	$M_{0,max}$	Nm			13.6	17.5	23.2	28.7	38.5	44.0					
Max. torque	M_{max}	Nm			17.9	22.7	29.9	36.5	44.0	44.0					
Transition speed	n_{eto}	rpm			3789	3464	3058	2752	2483	2483					
m850-S140/S3240															
Rated torque	M_{rated}	Nm		7.6	8.5	8.5	8.5	8.5							
Standstill torque	M_0	Nm		8.3	10.9	11.0	11.0	11.0							
Max. standstill torque	$M_{0,max}$	Nm		12.3	15.4	19.0	23.6	26.0							
Max. torque	M_{max}	Nm		15.7	19.3	23.2	26.0	26.0							
Transition speed	n_{eto}	rpm		2767	2481	2213	2050	2050							
m850-S140/M3240															
Rated torque	M_{rated}	Nm				13.3	14.0	14.0	14.0	14.0					
Standstill torque	M_0	Nm				14.3	19.5	21.0	21.0	21.0					
Max. standstill torque	$M_{0,max}$	Nm				21.4	28.1	34.4	45.2	53.5					
Max. torque	M_{max}	Nm				27.5	35.8	43.0	53.5	53.5					
Transition speed	n_{eto}	rpm				2908	2576	2333	2051	2051					
m850-S140/L3240															
Rated torque	M_{rated}	Nm					17.4	17.4	17.4	17.4	17.4	17.4			
Standstill torque	M_0	Nm					20.2	25.7	28.0	28.0	28.0	28.0			
Max. standstill torque	$M_{0,max}$	Nm					30.1	37.4	50.5	64.4	74.0	80.0			
Max. torque	M_{max}	Nm					39.0	47.8	63.4	78.5	80.0	80.0			
Transition speed	n_{eto}	rpm					2889	2647	2288	2018	1994	1994			

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	35.0
Standstill torque	M_0	Nm						35.9	51.1	67.0	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	200.0
Max. torque	M_{max}	Nm						71.4	98.6	129.0	152.0	169.2	200.0	200.0	200.0
Transition speed	n_{eto}	rpm						2380	2146	1915	1766	1669	1523	1523	1523

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

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

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		
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		

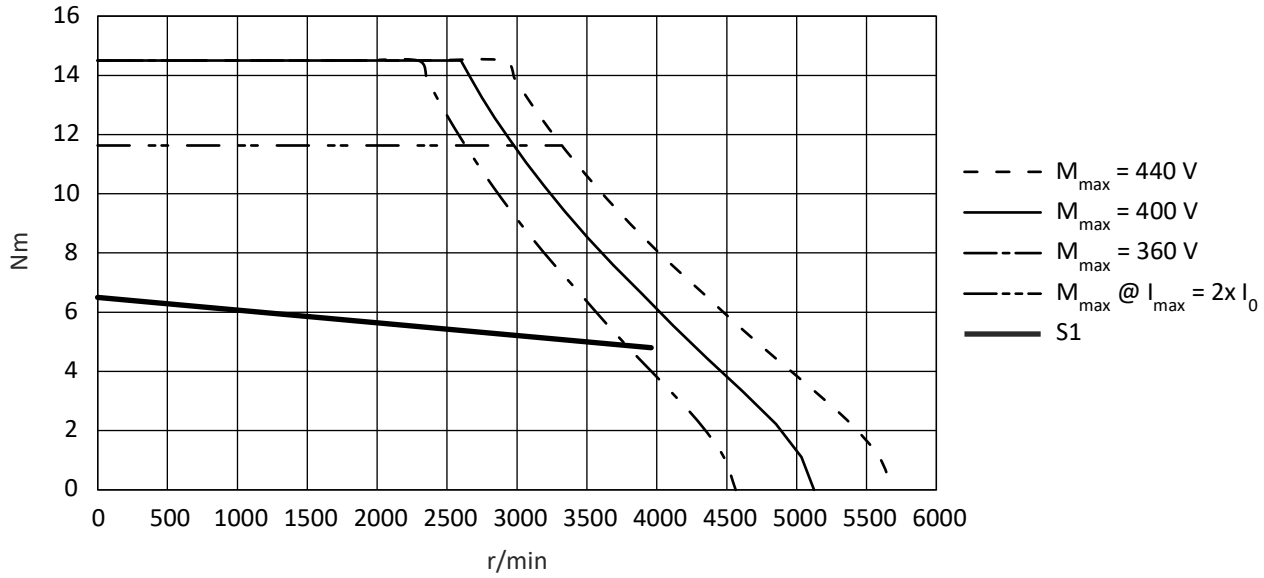
Motor			Inverter								
			E94A□□								
			E0044	E0074	E0094	E0134	E0174	E0244	E0324	E0474	E0594
m850-S190/S3000											
Rated torque	M_{rated}	Nm		13.7	16.0	16.0	16.0	16.0	16.0		
Standstill torque	M_0	Nm		14.9	19.7	27.0	27.0	27.0	27.0		
Max. standstill torque	$M_{0,max}$	Nm		34.2	43.2	55.0	63.6	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

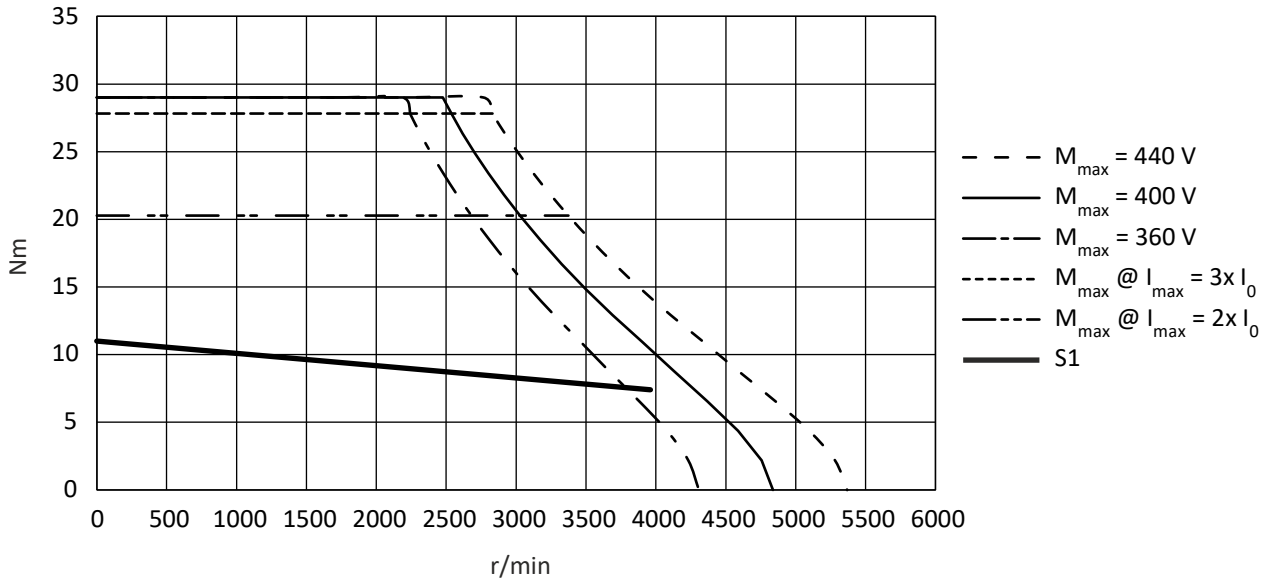
m-n characteristics for your motor-inverter combination can be found on the Internet: http://www.lenze.com → Product Finder → M-n characteristics

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

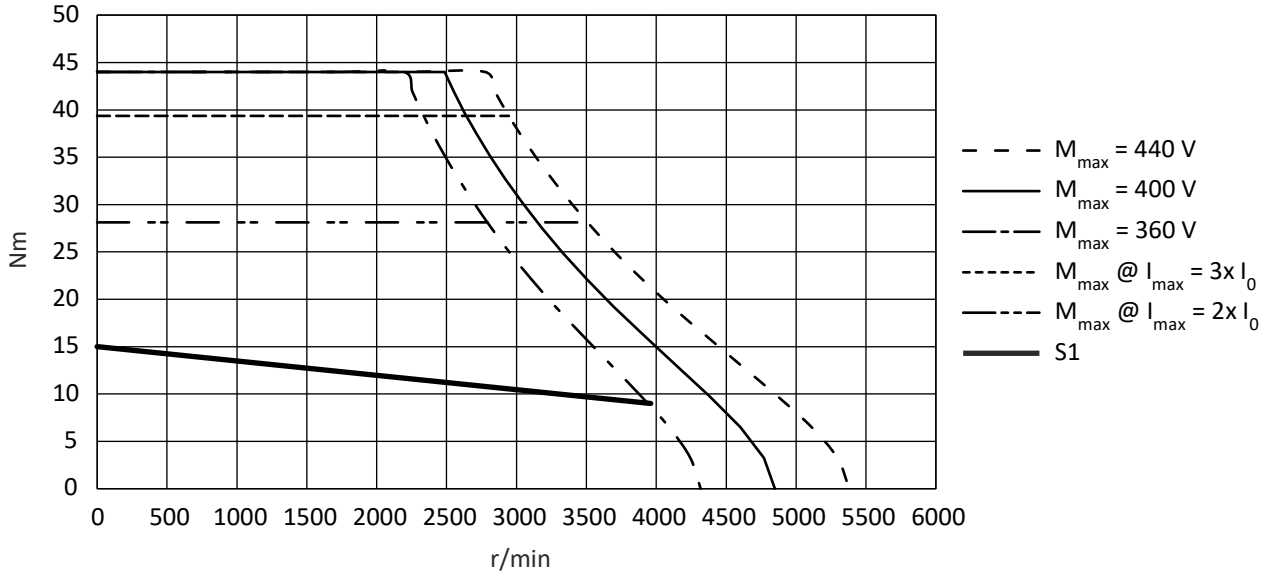
m850-S120/S3960



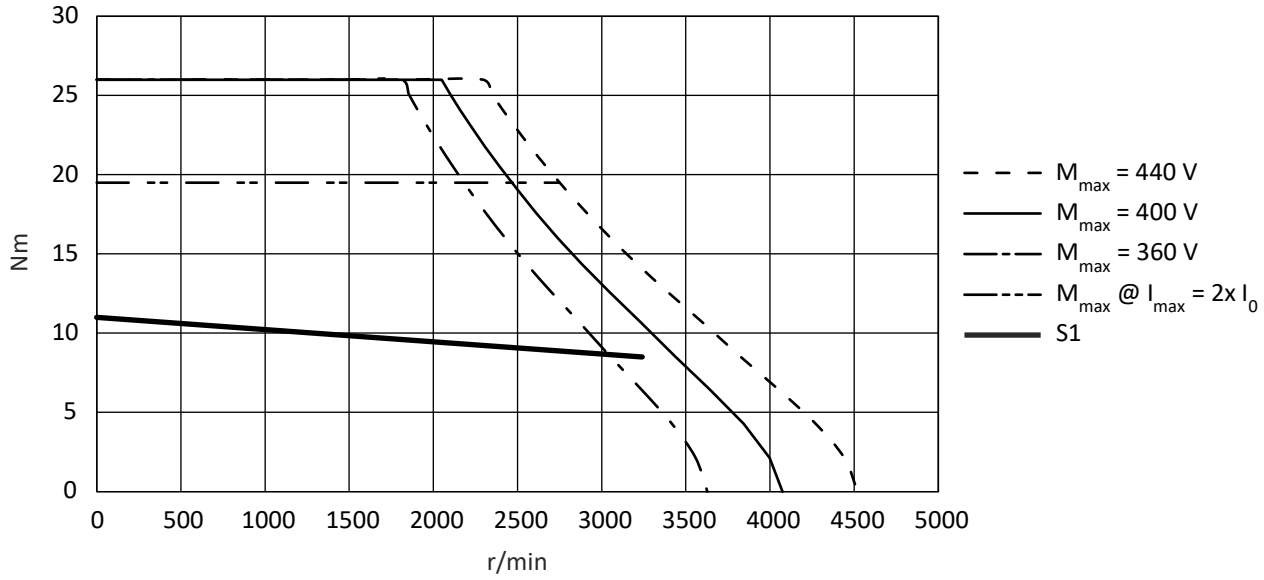
m850-S120/M3960



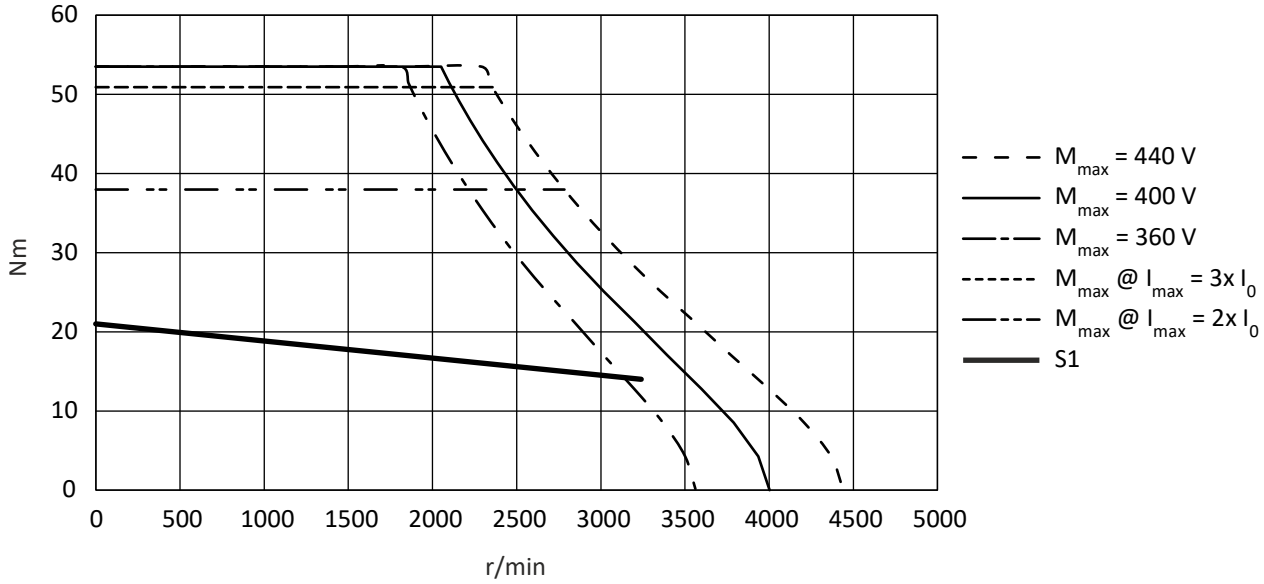
m850-S120/L3960



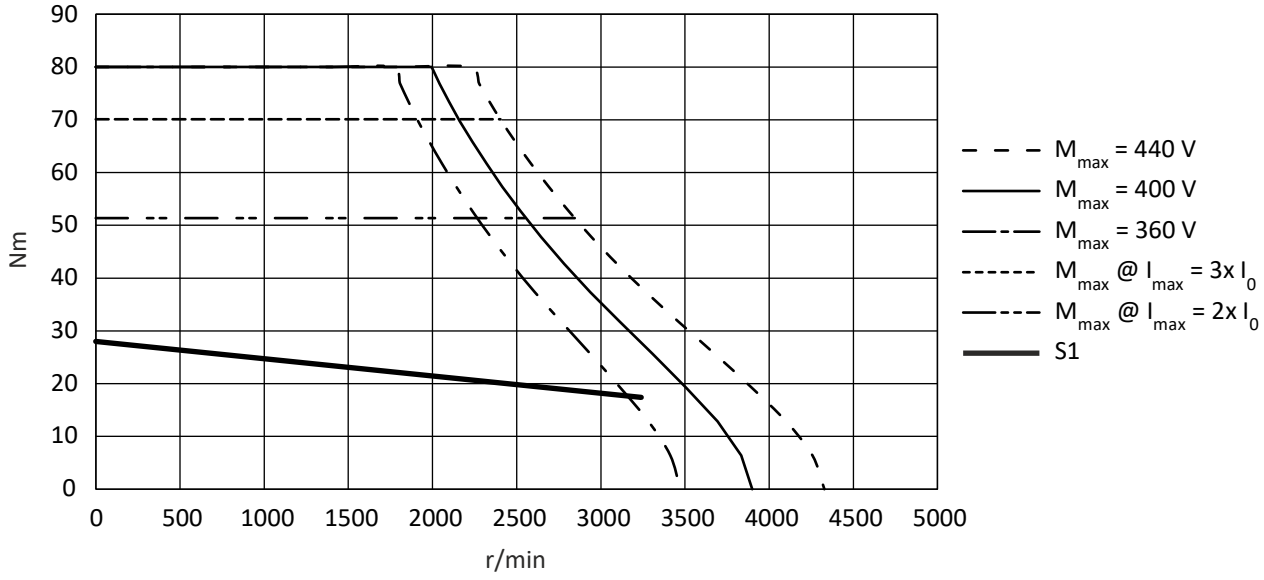
m850-S140/S3240



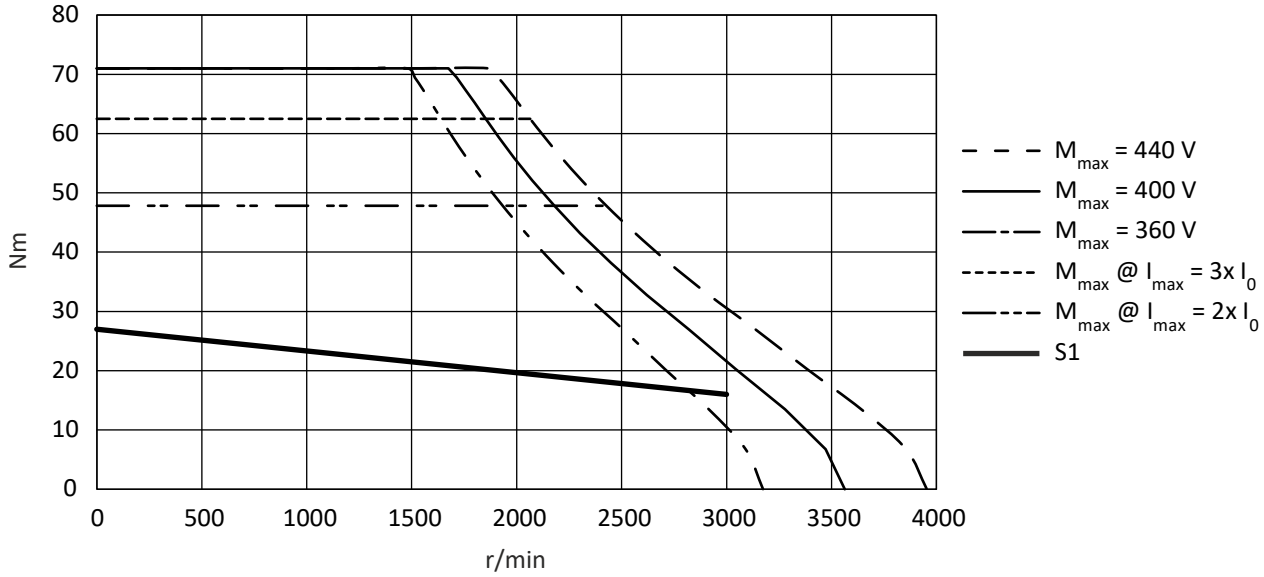
m850-S140/M3240



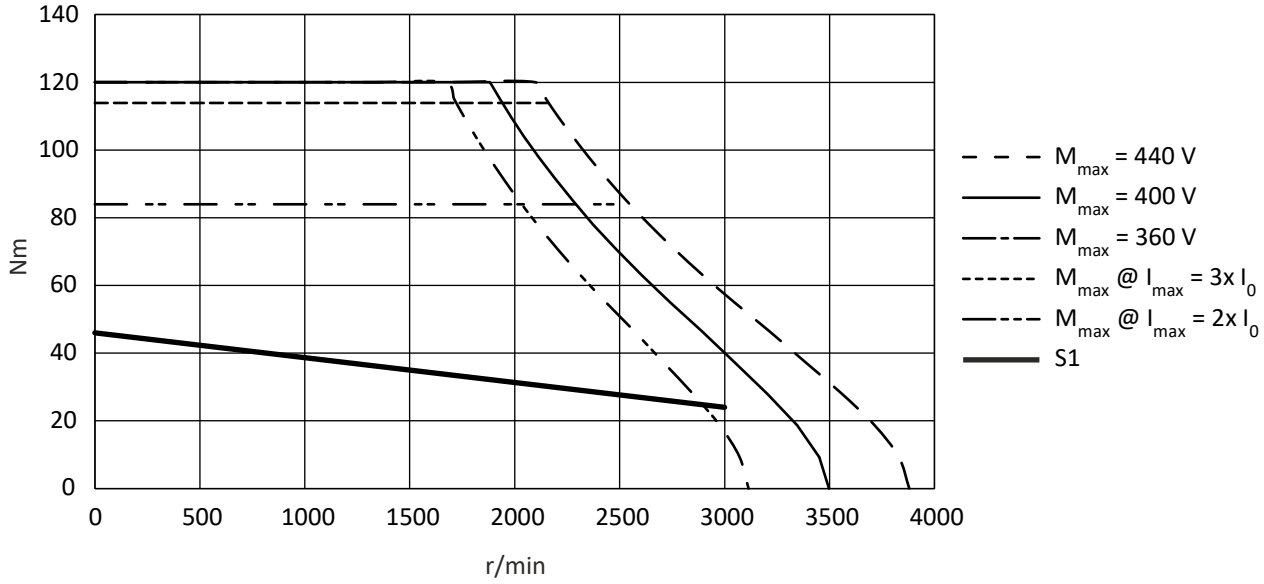
m850-S140/L3240



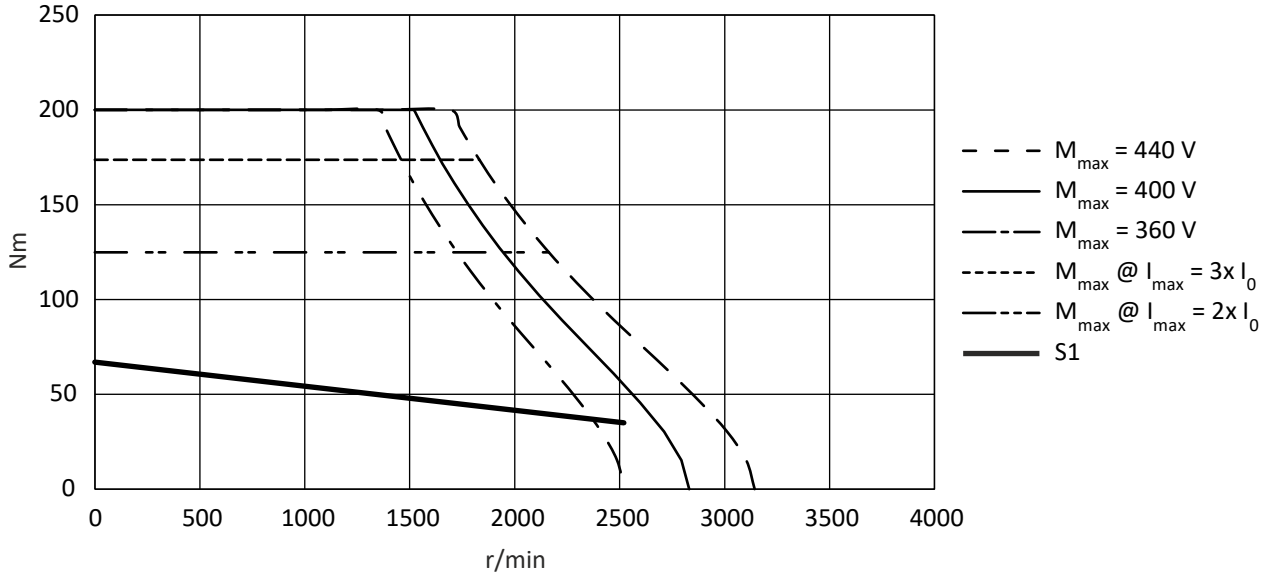
m850-S190/S3000



m850-S190/M3000



m850-S190/L2520

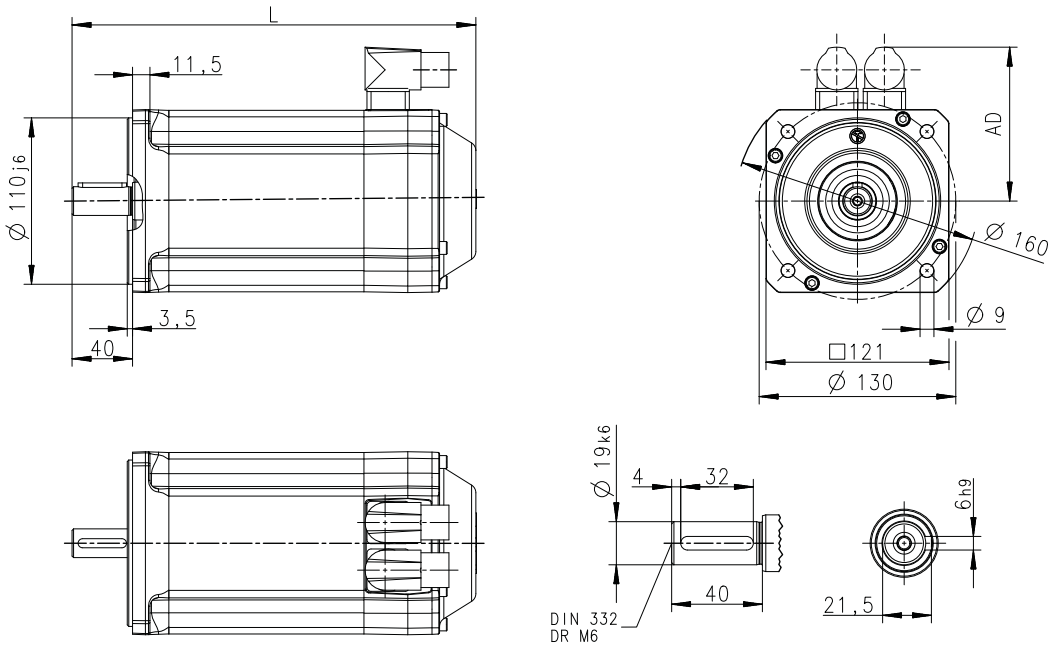


Dimensions

Basic dimensions

The dimensions also apply for motors with one-cable technology

Self-ventilated motors m850-S120
Output flange FF130

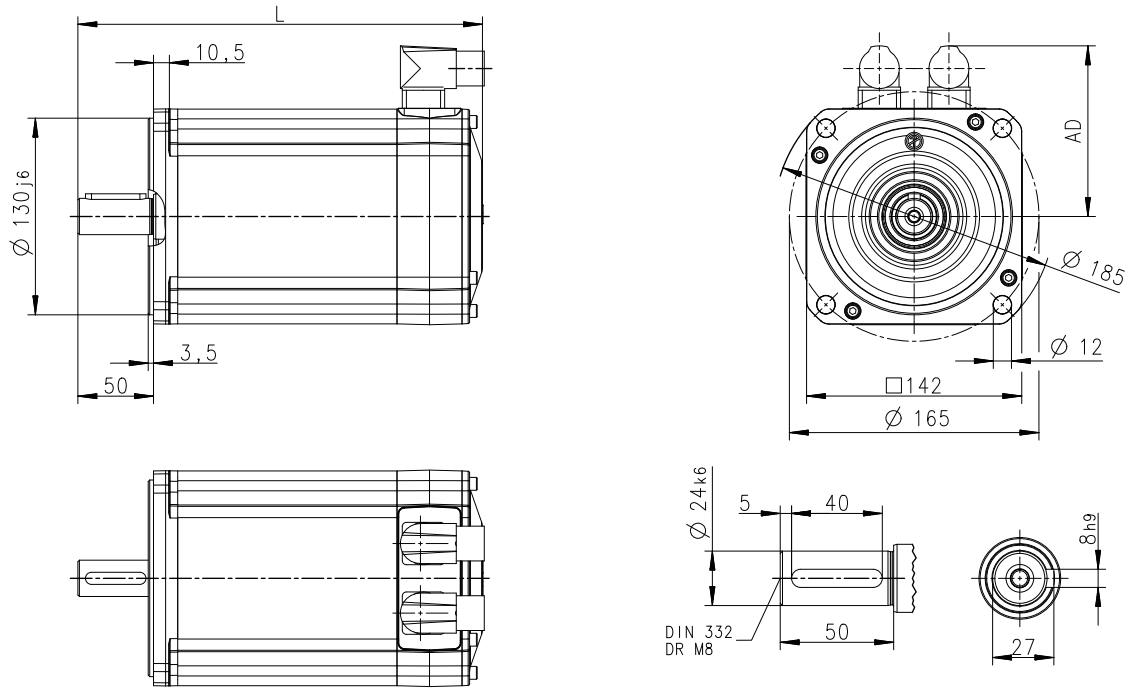


8800564-00

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

m850-S140

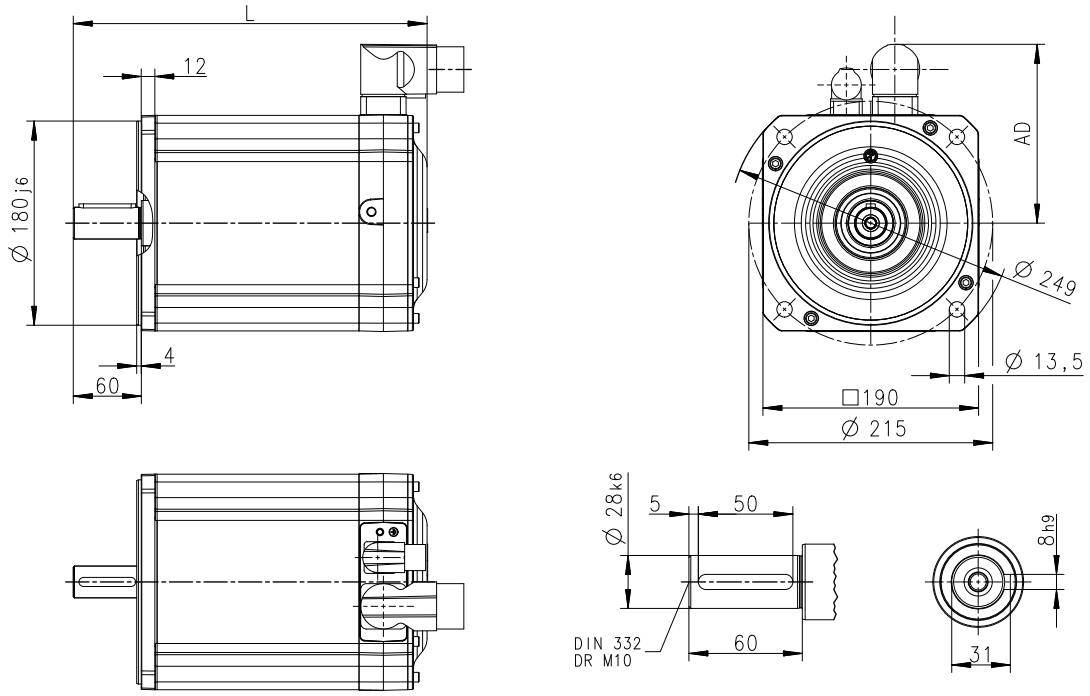
Output flange FF165



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

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 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.

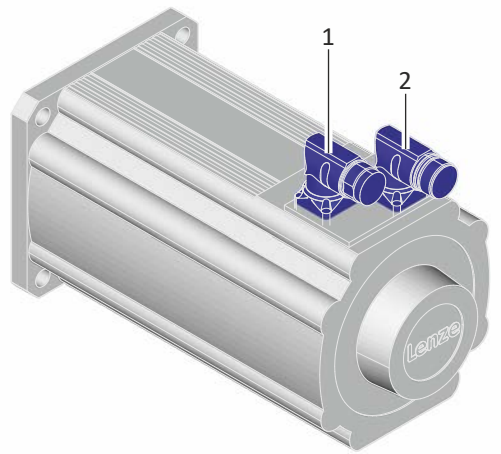
Motors with a digital absolute value encoder are connected via a hybrid connector for the one-cable technology. The connection takes place via a Lenze hybrid system cable.

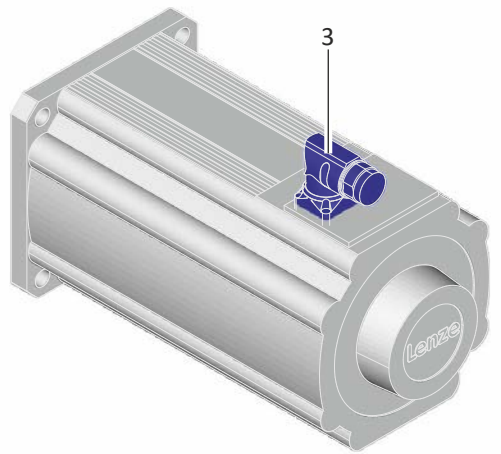
The advantage: all the required wiring takes place in just one plug.

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

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

Position of the connections



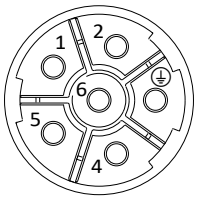


Position	Meaning	Position	Meaning
1	Connector, ICN-M23 6-pole Connector, ICN-M40 8-pole • Power connection • Brake connection • PE connection	3	Connector, ICN-M23 hybrid • Power connection • Brake connection • PE connection • Terminal for digital absolute value encoder • Connection of temperature monitoring
2	Connector ICN-M23 • Feedback connection • Connection of temperature monitoring		

Power and brake connection

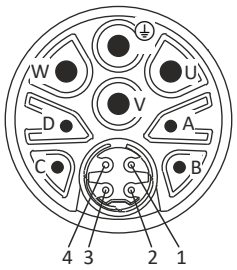
Connector ICN-M23 for motor:

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

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

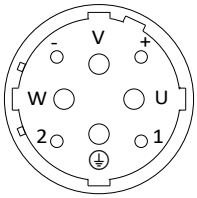
NOTICE

Only for versions with digital absolute value encoders.

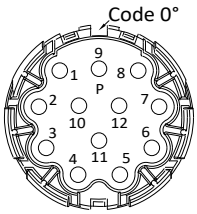
ICN-M23 connector assignment Hybrid			
Contact	**Name**	**Meaning**	
U	U	Power phase U	
V	V	Power phase V	
W	W	Power phase W	
PE	PE	PE	
A	BD1	Holding brake +	
B	BD2	Holding brake -	
C		not assigned	
D		not assigned	
1		not assigned	
2	+	VCC/data	
3	-	GND/data	
4		not assigned	

Connector ICN-M40 for motor:

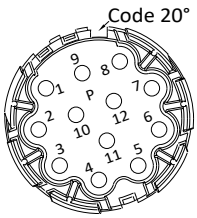
m850-S140/L3240 m850-S190/M3000
m850-S190/L2520

ICN-M40 connector assignment 8-pole			
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 ETS	Power supply: electronic nameplate	
4	+COS	Stator windings cosine	
5	-COS		
6	+SIN	Stator windings Sine	
7	-SIN		
8		Not assigned	
9			
10	Shield	Encoder housing shield	
11	+	Temperature monitoring: KTY/PT1000	
12	-		

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

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

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	S120/M3960	S120/L3960	S140/S3240	S140/M3240
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 catch						
Order code		EWS1001				
Coding in the system cable type code		M04				

Motor code		m850-				
		S140/L3240		S190/S3000	S190/M3000	S190/L2520
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 catch						
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 catch		
Order code	EWS1006	EWS1010
Coding in the system cable type code	F05	F06

Hybrid cables for one-cable technology

Motor code	m850-		
	S120/S3960 S120/M3960 S120/L3960	S140/S3240 S140/M3240	S190/M3000
Connector with bayonet catch	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		
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		

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:

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

NOTICE

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

NOTICE

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

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

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

$$Q = \frac{1}{2} \times J_{ges} \times \left(2\pi \times \frac{\Delta n}{60} \right)^2 \times \frac{M_N}{M_N - M_L}$$

Q	J	Friction energy
J_{total}	kgm^2	Total mass inertia (motor + load)
Δn	rpm	Differential speed
M_N	Nm	Rated torque of the brake
M_L	nM	Load torque

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

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

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

It is not possible to readjust the brake.

Spring-applied brakes

Rated data

NOTICE

Engagement and disengagement times apply to rated voltage (± 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 ≤ 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	$U_{N,DC}$	V	24		
Rated torque					
At 20 °C	M_N	Nm	20		
At 120 °C	M_N	Nm	18		
Output current	I_N	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	$kgcm^2$	0.75		
Brake motor	J_{MB}	$kgcm^2$	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	$U_{N,DC}$	V	24		
Rated torque					
At 20 °C	M_N	Nm	34		
At 120 °C	M_N	Nm	32		
Output current	I_N	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	$kgcm^2$	2.01		
Brake motor	J_{MB}	$kgcm^2$	18.1	32.5	46.9
Load/brake motor ratio	J_L/J_{MB}		34	19	13

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	$kgcm^2$	10.42		
Brake motor	J_{MB}	$kgcm^2$	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
AM20-8V-D	i950				-

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	$U_{in,max}$	V	10.0	
Max. input frequency	$f_{in,max}$	kHz	4.00	
Ratio				
Stator / rotor			0.30 ± 5 %	
Rotor impedance	Z_{ro}	Ω	51 + j90	
Stator impedance	Z_{so}	Ω	102 + j150	
Impedance	Z_{rs}	Ω	44 + j76	
Min. insulation resistance				
With DC 500 V	R_{min}	MΩ	10.0	
Number of pole pairs			1	
Max. angle error		'	-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

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.

The digital absolute value encoder AM20-8V-D for one-cable technology is possible with the following motors:

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

Feedback type		**Digital absolute value**	**SinCos absolute value**	
Feedback		**AM20-8V-D**	**AM128-8V-H**	**AM128-8V-K2**
Speed-dependent safety functions		No	No	Yes
Encoder type		Multi-turn	Multi-turn	Multi-turn
Resolution		20 bits	-	-
Pulses		-	128	128
Output signals		-	1 Vss	1 Vss
Interfaces		Digital	Hiperface	Hiperface
Absolute revolution		4096	4096	4096
Resolution (angle)	'	0.02	0.40	0.40
Accuracy	'	-	-1.3 ... 1.3	-1.3 ... 1.3
Position value error limit				
Integral nonlinearity	'	1	-	-
System accuracy	'	1.7	-	-
Min. DC input voltage	V	-	7.0	7.0
Max. DC input voltage	V	-	12.0	12.0
Max. speed	rpm	9000	9000	9000
Max. current consumption	A	0.15	0.060	0.060
Limit frequency	kHz	-	200	200

Speed-dependent safety functions

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

Temperature monitoring

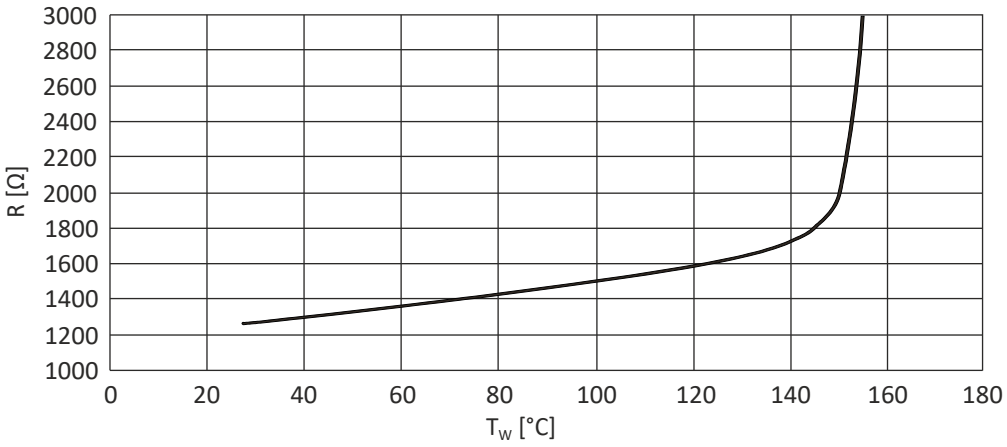
Thermal detectors PT1000

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_W	Winding temperature

Product codes

Motor product code

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	Briefly	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
Product approval	CE	C
	CE; cULus	L
Manufacturer	Lenze	C
Internal key		0

Appendix

Good to know

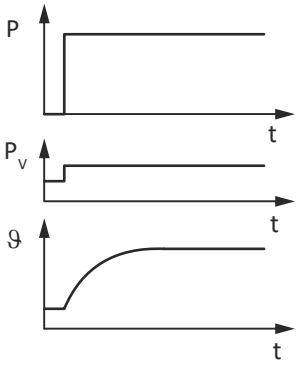
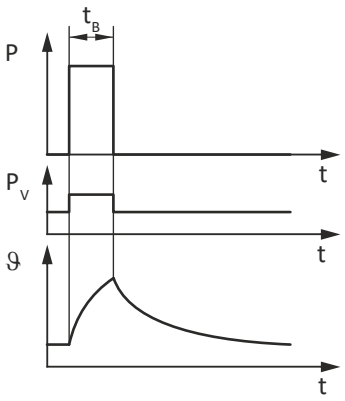
Approvals/directives

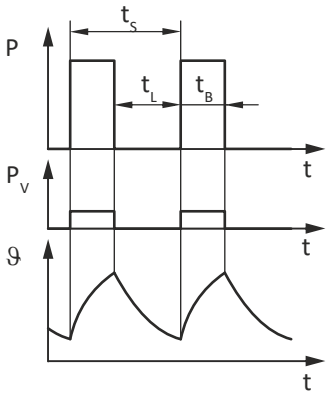
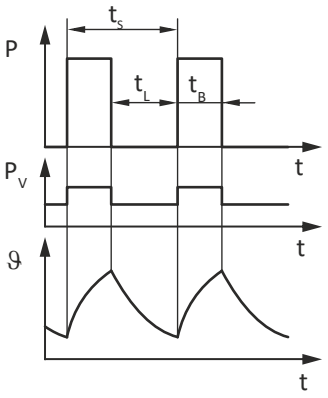
CCC	China Compulsory Certification documents the compliance with the legal product safety requirements of the PR of China - in accordance with Guobiao standards.
$_{C}CSA_{US}$	CSA certificate, tested according to US and Canada standards
UE	Union Européenne documents the declaration of the manufacturer 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
	
Operation with a constant load until the motor reaches the thermal steady state. The motor may be actuated continuously with its rated power.	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.

Intermittent operation S3	Non-intermittent periodic operation S6
	
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.	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	Power	P_V	Power loss
t	Time	t_B	Load period
t_L	Idle time	t_S	Cycle duration
ϑ	Temperature		

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).

Lenze Automation GmbH
Postfach 10 13 52, D-31763 Hameln
Hans-Lenze-Str. 1, D-31855 Aerzen
Germany
HR Hannover B 205381
+49 5154 82-0
+49 5154 82-2800
sales.de@lenze.com
www.lenze.com