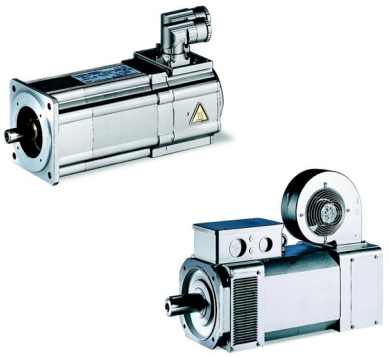


M...

MCA, MCS, MQA, MD□KS
0.5 Nm ... 1100 Nm

Asynchronous servo motors / synchronous servomotors

Operating Instructions EN

13573166

Lenze

Please read these instructions before you start working!
Follow the safety instructions enclosed.

i Contents

Contents

- The present documentation serves to safely work on and with the drives. It includes safety instructions which must be observed.
- All persons working on and with the drives must have the documentation available and must observe the information and notes relevant for their work.
- The documentation must always be in a complete and perfectly readable state.

If the information provided in this documentation is not sufficient in your case, please refer to the controller or gearbox documentation.

Tip!

Information and tools concerning the Lenze products can be found in the download area at

www.lenze.com

Validity

This documentation applies to servo motors:

Type	Name
MCS	Synchronous servo motors
MCM	
MCA	Asynchronous servo motors
MQA	
MD□KS	Synchronous servo motors

Target group

This documentation is directed at qualified skilled personnel according to IEC 60364.

Qualified skilled personnel are persons who have the required qualifications to carry out all activities involved in installing, mounting, commissioning, and operating the product.

1.1 Document history

Material number	Version			Description
13302706	1.0	07/2009	TD09	First edition of the operating instructions, separate from three-phase AC motors
13340243	2.0	06/2010	TD09	Complete revision
13573166	6.0	04/2019	TD09	Revision of several chapters Implementation of new layout
---	4.0	---	TD09	Cancelled
13573166	6.0	04/2019	TD09	Complete revision with supplement of the MCM motor
13491314	5.1	07/2015	TD09	Changes of the nameplates MCA, MCM, MCS and MQA
13573166	6.0	04/2019	TD09	Kapitel: Wartungsintervall für den Safety-Geber geändert.

1.2 Conventions used

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

Type of information	Writing	Example/notes
Numeric notation		
Decimal	Standard notation	Example: 1234
Decimal separator	Point	The decimal point is always used. For example: 1234.56
Icons		
Page reference	🕮	Reference to another page with additional information For instance: 🕮 16 = see page 16
Documentation reference	🌍	Reference to another documentation with additional information Example: 🌍 EDKxxx = see EDKxxx documentation
Wildcard	□	Wildcard for options, selection data

1.3 Terminology used

Term	Describes the following
Motor	Servo motor in the designs according to motor code, 🕮 12 to 🕮 LEERER MERKER
Inverter	Any servo inverter Any frequency inverter
Drive system	Drive systems with servo motors and other Lenze drive components

1.4 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions

Layout of the safety instructions:

Danger!

(characterises the type and severity of danger)

Note

(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
 **Danger!**	**Danger of personal injury through dangerous electrical voltage** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 **Danger!**	**Danger of personal injury through a general source of danger** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 **Stop!**	**Danger of property damage** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
 **Note!**	Important note to ensure trouble-free operation
 **Tip!**	Useful tip for easy handling
	Reference to another document

2.1 General safety instructions for drive components

Danger!

Disregarding the following basic safety measures may lead to severe personal injury and damage to material assets!

Note!

Safety-related parameters of safety encoders used can be obtained from the SISTEMA database, the Lenze AKB (Application Knowledge Base) or the data sheet of the encoder manufacturer.

- Transport and storage in a dry, low-vibration environment without aggressive atmosphere; preferably in the packaging provided by the manufacturer.
  - Protect against dust and impacts.
  - Observe climatic conditions according to the technical data.
- Use load carrying equipment for transport! (📖 21)
- Lenze drive and automation components ...
  ... must only be used as intended.
  ... must never be commissioned despite noticeable damage.
  ... must never be technically changed.
  ... must never be commissioned in an incompletely mounted state.
  ... must never be operated without the required covers.
  ... may have live, moving or rotary parts during and after operation - corresponding to their type of protection. Surfaces may be hot.
  ... must not be operated with large vibrations.
  ... must not be operated in the frequency range of a plant or the drive system.
- All specifications of the corresponding enclosed documentation must be observed.
  This is vital for safe and trouble-free operation and for achieving the specified product features.
- Only qualified skilled personnel are permitted to work with or on Lenze drive and automation components.
  According to IEC 60364 or CENELEC HD 384, these are persons ...
  ... who are familiar with the installation, assembly, commissioning and operation of the product,
  ... possess the appropriate qualifications for their work,
  ... and are acquainted with and can apply all the accident prevent regulations, directives and laws applicable at the place of use.

2.2 Application as directed

Low-voltage machines are not household appliances, but are intended as components that are only applied for re-use for industrial or professional purposes in terms of IEC/EN 61000-3-2.

They meet the requirements of the 2014/35/EU Low-Voltage Directive and the harmonised standards of the IEC/EN 60034 series.

Low-voltage machines with IP23 protection or less are only intended for outdoor use when applying special protective features.

The integrated brakes must not be used as safety brakes. It cannot be ruled out that interference factors which cannot be influenced cause a brake torque reduction.

- Drives
  - ... must only be operated under the operating conditions and power limits specified in this documentation.
  - ... comply with the protection requirements of the EU Low-Voltage Directive.

Any other use shall be deemed inappropriate!

2.3 Foreseeable misuse

- Do not operate the motors
  - ... in explosion-protected areas
  - ... in aggressive environments (acid, gas, vapour, dust, oil)
  - ... in water
  - ... in radiation environments

Note!
Increased surface and corrosion protection can be achieved by using adapted coating systems.

2.4 Residual hazards

Protection of persons

- The motor surfaces can become very hot. Danger of burns when touching!
  - Provide protection against accidental contact, if necessary.
- Highfrequency voltages can be capacitively transferred to the motor housing through the inverter supply.
  - Earth motor housing carefully.
- Danger of unintentional starting or electrical shocks
  - Connections must only be made when the equipment is deenergised and the motor is at standstill.
  - Installed brakes are no fail-safe brakes.

Motor protection

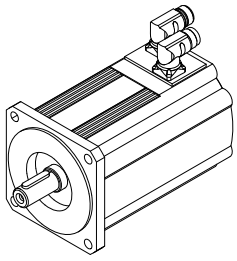
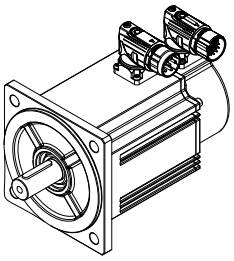
- Installed thermal detectors are **no full protection** for the machine.
  - If required, limit the maximum current, parameterise the controller such that it will be switched off after some seconds of operation with $I > I_N$, especially if there is the danger of blocking.
  - Installed overload protection does not prevent an overload under any conditions.
- Installed brakes are **no fail-safe brakes**.
  - The torque may be reduced by disruptive factors that cannot be influenced such as ingressing oil.
- Fuses are no motor protection.
  - Use current-dependent motor protection switches at average operating frequency.
  - Use installed thermal detectors at high operating frequency.
- 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 shafts of motor and driving machine exactly to each other.
- If deviations from normal operation occur, e.g. increased temperature, noise, vibration, determine the cause and, if necessary, contact the manufacturer. If in doubt, switch off the motor.

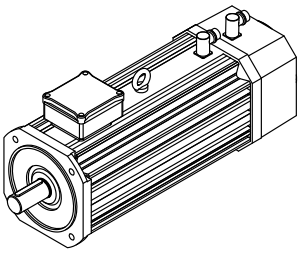
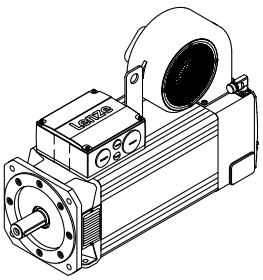
Fire protection

- Fire hazard
  - Prevent contact with flammable substances.

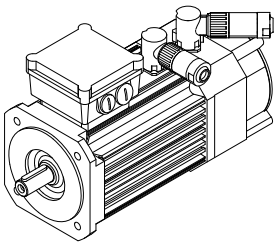
3.1 Identification

MC, MQA type

Synchronous servo motors	
MCS	**MCM**
 MT-MCS-001.iso	 MT-MCM-002.iso

Asynchronous servo motors	
MCA	**MQA**
 MT-MCA-001.iso	 MT-MQA-001.iso

MD... type

Synchronous servo motors
MD□KS
 MT-MDFKS-001.iso

3.1.1 Motor code

MCA; MCS; MQA

servo motors

Example		M	C	A	21X25	-	RS0	B0	-	A38R	-	ST5 S00N	-	R0SU
Meaning	**Type**	**Motor code**												
Product line		M												
Type	Compact servo motors (if required, with axial ventilation)		C											
	Radially ventilated motor		Q											
Design	Asynchronous			A										
	Synchronous			S										
Motor frame size, motor length, speed	Square dimension 62 mm				06									
	Square dimension 89 mm				09									
	Square dimension 102 mm				10									
	Square dimension 116 mm				12									
	Square dimension 130 mm				13									
	Square dimension 142 mm				14									
	Square dimension 165 mm				17									
	Square dimension 192 mm				19									
	Square dimension 200 mm				20									
	Square dimension 214 mm				21									
	Square dimension 220 mm				22									
	Square dimension 260 mm				26									
	Overall length				C...X									
	Speed in 100 rpm				XX									
Speed, angle encoder	Resolver p=1						RS0							
	Multiturn absolute value encoder with sin/cos signals, Hiperface						SKM							
	Singleturn absolute value encoder with sin/cos signals, Hiperface						SRS							
	Multiturn absolute value encoder with sin/cos signals, Hiperface						SRM							
	Singleturn absolute value encoder with sin/cos signals, EnDat						ECN							
	Multiturn absolute value encoder with sin/cos signals, EnDat						EQN							
	Multiturn absolute value encoder with sin/cos signals, EnDat					-	EQI							
	TTL incremental encoder with commutation signals UVW (IK4096-5V-T, Renco R35i)						C40							
	Incremental encoder TTL						TXX							
	Incremental HTL encoder						HXX							
	Resolver p=1 for safety function						RV0							
	Singleturn absolute value encoder with sin/cos signals, Hiperface for safety function						SVS							
	Multiturn absolute value encoder with sin/cos signals, Hiperface for safety function						SVM							
	Incremental encoder for safety function						S1S							
	Sin-Cos IG2048-5V-S incremental encoder						S20							
	No encoder						NN0							
Brake	Without brake							B0						
	Spring-applied brake 24V DC							F1						
	Spring-applied brake 24V DC, reinforced							F2						
	Spring-applied brake 205V DC							F5						
	Spring-applied brake 205V DC, reinforced							F6						
	Spring-applied brake 230V AC							FG						
	Spring-applied brake 230V AC, reinforced							FH						
	PM brake 24V DC							P1						
	PM brake 24V DC, reinforced							P2						
	PM brake 205V DC							P5						
	PM brake 205V-DC, reinforced							P6						

Example		M	C	A	21X25	-	RS0	B0	-	A38R	-	ST5 S00N	-	R0SU
Meaning	**Type**	**Motor code**												
Design	Standard flange form A/FF with through hole, cyl. shaft without keyway									A				
	Standard flange form A/FF with through hole, cyl. shaft with keyway									B				
	Standard flange form C/FT with threaded holes, cyl. shaft without keyway									C				
	Standard flange form C/FT with threaded holes, cyl. shaft with keyway (standard attachment)									N				
	Same as version A except that flange is large									F				
	Same as version B except that flange is large									G				
	Same as version C except that flange is large									U				
	Same as version N except that flange is large									V				
	Foot mounting B3 without keyway									O				
	Foot mounting B3 with keyway									P				
Shaft	Shaft 11x23 (MCS06)								-	11				
	Shaft 14x30 (MCS09; MCA 10)									14				
	Shaft 19x40 (MCS12; MCA13)									19				
	Shaft 24x50 (MCS14; MCA14, 17)									24				
	Shaft 28x60 (MCS19; MCA19)									28				
	Shaft 38x80 (M□A22, 22)									38				
	Shaft 55x110 (M□A26)									55				
Concentricity/vibrational severity/direct gearbox attachment	Concentricity/vibrational severity									N, R or V				
	Direct gearbox attachment: Motor without pinion for mounting on open gearbox with pinion; flange for direct gearbox attachment without intermediate cover, with tapered hollow shaft									Z0X				
	Direct gearbox attachment: Motor without pinion for mounting on open gearbox with pinion; flange for direct gearbox attachment with intermediate cover, with tapered hollow shaft									Y0X				
Electrical connection	Separate circular connectors for power/brake, encoder/thermal detector, fan											ST		
	Shared rectangular connector for power, encoder...											SQ		
	Separate terminal boxes for power/brake, encoder/thermal detector/fan											KK		
	Separate terminal boxes for power/brake, blower circular connectors for encoder, thermal detector											KG		
	Terminal box for power+brake; circular connector for encoder and thermal detector; circular connector for blower											KS		
	Circular connector for power+brake; circular connector for encoder+thermal detector; terminal box for fan											SK		
Enclosure	IP23											2		
	IP54 without shaft sealing ring (except for direct gearbox attachment)											5		
	IP65 with shaft sealing ring											6		
	IP64 (A-flange, without shaft sealing ring) / IP65											A		
	IP54 with shaft sealing ring (A-end bearing, oil-tight)											B		
	IP54 with shaft sealing ring, double lip (A-end bearing dust-tight)											C		
Cooling	Natural ventilation / without fan											D		
	Natural ventilation / without fan											S00		
	Blower 230V; AC; 1N; filter										-	F1F		
	Blower 400V; AC; 3N; filter											F3F		
	Blower 480V; AC; 3N											FWO		
	Blower 230V; AC; 1N											F10		
	Blower 400V; AC; 3N											F30		
	Blower 115V; AC; 1N											F50		
	Blower 480V; AC; 3N; filter											FWF		
Load flywheel	Without additional load flywheel											N		
	With additional mass inertia											J		
Motor protection, temperature protection	NC thermal contact													B
	PT1000 + PTC (MCS09...19)													D
	PT1000; electronic nameplate													E
	PT1000													R
	PT1000 - TCO NC contact (standard MQA)													T
Electronic nameplate	Standard nameplate													0
	Standard nameplate + electronic nameplate												-	1
	Second nameplate supplied loose													2
	Second nameplate supplied loose + electronic nameplate													3
Colour/specification	Colour: black													S
	Specification - UL design and CSA design, approval													U
	Specification - UL design, approval													R

MCM

servo motors

Example		M	C	M	06 B 30	-	RS0	B0	A11	ST S00	RU
Meaning	**Type**	**Motor code**									
Product line		M									
Type	Compact servo motors (if required, with axial ventilation)		C								
Design	Synchronous			M							
Motor frame size	Square dimension 62 mm				06						
	Square dimension 89 mm				09						
	Square dimension 116 mm				12						
Motor length	20				B						
	30				C						
	40				D						
	50				E						
	60				F						
	70				G						
	80				H						
	90				I						
	100				J						
Speed 100 rpm	3000				30						
Mains voltage	400 V					-					
Speed sensor, angle sensor	Resolver p=2						RS0				
	Multiturn absolute value encoder with sin/cos signals, Hiperface						SKM				
Brake	Without brake							B0			
	Spring-applied brake 24V DC							F1			
Design	Standard flange form A/FF with through hole, cyl. shaft without keyway								A		
	Standard flange form A/FF with through hole, cyl. shaft with keyway								B		
Shaft	Shaft 11x23 (MCM06)								11		
	Shaft 14x30 (MCM09)								14		
	Shaft 19x40 (MCM12)								19		
Electrical connection	Separate circular connectors for power/brake, encoder/PT1000									ST	
Cooling	Natural ventilation / without fan									S00	
Motor protection, temperature	PT1000 sensor										R
Specification	Specification - UL design and CSA design, approval										U

MD□KS

servo motors

Example		M	D	S	K	S	AG	056	-	1	3
Meaning	**Type**	**Motor code**									
Product line		M									
Type	Three-phase AC current		D								
Cooling	Forced ventilated			F							
	Natural ventilation			S							
Design, housing	Compact servo motor with square housing and cooling ribs				K						
Machine type	Synchronous machine					S					
Built-on accessories	Absolute value encoder						AG				
	Brake and sin-cos absolute value encoder or SSI absolute value encoder						BA				
	Brake and resolver						BS				
	Resolver						RS				
	Resolver for safety function						RV				
Size								056			
								071			
Overall length										0	
										1	
									-	2	
										3	
Number of pole pairs											3

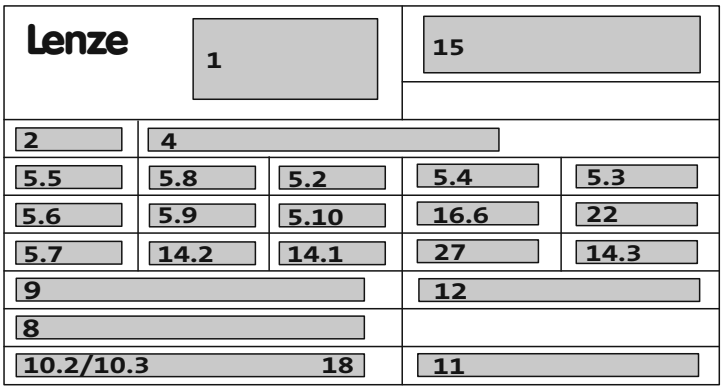
Example		SFC	1024	-	8V	-	K	2
Meaning	**Type**	**Encoder code**						
Product line	Resolver	RS						
	Resolver for safety function	RV						
	Incremental encoder	IG						
	Incremental encoder with commutation signal	IK						
	Singleturn absolute value encoder	SFC						
	Multitum absolute value encoder	AM						
Number	2-pole resolver for servo motors		0					
	2-pole resolver for three-phase AC motors		1					
	Number of pole pairs for resolvers		2, 3, 4,...					
	Number of steps / increments per revolution		32, 128, 512, 1024, 2048, ...					
Voltage	Medium supply voltage			-	5V, 8V, 15V, 24V, ...			
Interface or signal level	Standard							
	TTL						T	
	HTL (for incremental encoders)						H	
	Hiperface (for absolute value encoders)						H	
	EnDat						E	
	sin/cos 1 V_{ss}						S	
	For safety function					-		
	TTL						U	
	HTL (for incremental encoders)						K	
	Hiperface (for absolute value encoders)						K	
	EnDat						F	
	sin/cos 1 V_{ss}						V	
	Safety integration level (SIL)							1
								2
								3
								4

Note!

If feedback systems for safety functions are used, the manufacturer's documentation must be observed!

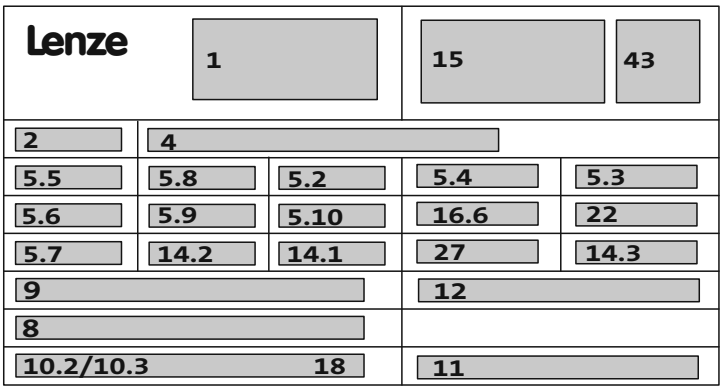
3.1.2 Nameplate

Asynchronous and synchronous servo motors



MT-SYN-001.des

MCM synchronous servo motors



MT-MCM-00X.des

3 Product description

Nameplate

Pos.		Contents		
1		Manufacturer / production location		
2		Type of motor / standard		
3		Gearbox type		
4		Motor type		
5		Technical data		
5	5.1	Ratio		
5	5.2	Rated torque		
5	5.3	Rated speed		
5	5.4	Rated frequency		
5	5.5	Rated voltage		
5	5.6	Rated current		
5	5.7	Maximum current		
5	5.8	Rated power [kW]		
5	5.9	Rated power [HP]		
5	5.10	Continuous standstill torque		
6		Mounting position / position of the system blocks		
7		Lubricant details		
7	7.1	Lubricant amount		
7	7.2	Lubricant type		
8		Brake data		
8	8.1	Type		
8	8.2	AC/DC brake voltage		
8	8.3	Braking torque, electrical power input		
9		For feedback / pulse encoder or resolver data, 🕮 LEERER MERKER		
10		Production data		
10	10.1	Order number		
10	10.2	Material number		
10	10.3	Serial number		
11		Bar code		
12		Motor number		
13		Information with regard to the operating mode		
14		Additional motor specifications		
14	14.1	Temperature class		
14	14.2	Enclosure		
14	14.3	Motor protection		
15		Applicable conformities, approvals and certificates		
16		Rated data for various frequencies		
16	16.1	Hz	=	frequency
16	16.2	kW	=	motor power
16	16.3	rpm	=	motor speed
16	16.4	V	=	motor voltage
16	16.5	A	=	motor current
16	16.6	cos φ	=	motor power factor for M□A
16		U_{in} [V]	=	induced voltage for MC□
16	16.7	η	=	motor efficiency: at a rated power of 100%
17		Application factor (specified if <1.0) / load capacity		
18		Year of manufacture / week of manufacture		
19		UL file number		
20		Additional customer data		
21		UL category (e.g. inverter duty motor)		
22		C86 = motor code for inverter parameterisation (code 0086)		
23		Efficiency class		
24		Partial load efficiencies for 50Hz operation at a rated power of 50% and 75%		
25		Range A Voltage tolerance range according to range A as specified by IEC/EN 60034-1		
27		Permissible ambient temperature (e.g. Ta ≤ 40°C)		
29		Standstill current (ampere locked rotor ALR)		
30		Weight		
31		Plug design (number of poles)		
43		Internal key: QR code		

4.1 General data and operating conditions

General data

Conformity			
CE	2006/95/EC	Low-Voltage Directive	
Approvals			
UL	ANSI/UL 1004-1 ANSI/UL 1004-6	Rotating Electrical Machines Servo and Stepper Motors	
CSA	CSA-C22.2 No. 100	Motors and Generators	
EAC	TP TC 020/2011 (TR CU 020/2011)	Electromagnetic compatibility of technical means	Eurasian Conformity TR CU: Technical Regulation of Customs Union
EAC	TP TC 004/2011 (TR CU 004/2011)	On safety of low voltage equipment	Eurasian Conformity TR CU: Technical Regulation of Customs Union

Protection of persons and devices			
Enclosure	IEC/EN 60034-5	See nameplate	
		Degrees of protection only apply to horizontal installation	
		All unused connectors must be closed with protection covers or blanking plugs.	
Temperature class	F (155 °C) IEC/EN 60034-1	Exceedance of the temperature limit weakens or destroys the insulation	
Permissible voltage		As specified by limiting curve A of the pulse voltage from IEC / TS 60034-25:2007 (corresponds to IVIC C/B/B@500V)	
EMC			
Noise emission	IEC/EN 61800-3	Depending on the controller, see documentation for the controller.	
Noise immunity			

Operating conditions

Ambient conditions			
Climatic			
Transport	IEC/EN 60721-3-2	2K3 (-20 °C ... +70 °C)	
Storage	IEC/EN 60721-3-1	1K3 (-20 °C ... +60 °C)	< 3 months
		1K3 (-20 °C ... +40 °C)	> 3 months
Operation	IEC/EN 60721-3-3	3K3 (-20 °C ... +40 °C) MC A, MCS, MD□KS	Without brake
		3K3 (-15 °C ... +40 °C) MC M, MQA	
		3K3 (-10 °C ... +40 °C)	With brake
		3K3 (-15 °C ... +40 °C)	With blower
		> +40 °C	With power reduction, see catalogue
Site altitude		< 1000 m amsl - without power reduction > 1000 m amsl < 4000m amsl with power reduction, see catalogue	
Humidity		Relative humidity ≤ 85 %, without condensation	
Electrical			
The motor connection type depends on the controller			
Length of the motor cable		inverter instructions	
Length of cable for speed feedback			
Mechanical			
	IEC/EN60721-3-3	3M6	

4.1.1 Setting the switching frequency to the rated motor data

The rated data are valid for operation on an inverter with a switching frequency of at least 8 kHz. If operated at a switching frequency of f_{ch}=4 kHz, the following consequences must be observed.

Motor type	Consequences
MQA 20, 22, 26 MCA 20, 22, 26	At f_{ch} = 4 kHz, the motor continuously reaches only approx. 95 % of its rated torque. Increased noise emission
MCM, MCS MCA 10, 13, 14, 17, 19, 21 MD□KS	All published rated data remain valid if f_{ch} = 4 kHz.

5.1 Important notes

Danger!

Some of the motors mounted to the gearboxes are equipped with transport aids. They are **only** intended for the mounting/dismounting of the motor to the gearbox and must **not** be used for the entire geared motor!

- Only move the drive with means of transport or hoists that have sufficient load-bearing capacity.
- Ensure safe fixing.
- Avoid shocks!

5.2 Preparation

Remove the corrosion protection from the shaft ends and flanges. If necessary, remove dirt using standard cleaning solvents.

Stop!

Bearings or seals must not come into contact with the solvent - material damages.

After a long storage period (> 1 year) you have to check whether moisture has entered the motor. For this purpose, measure the insulation resistance (measuring voltage 500 V_{DC}). In case of values ≤1kΩper volt of rated voltage, dry the winding.

5.3 Assembly of built-on accessories

Follow these instructions carefully. Please note that the warranty and product liability will become void in the event of impermissible alterations or modifications to the motors.

- Mount the transmission elements:
  - Shocks and impacts must be avoided! They could destroy the motor.
  - For mounting always use the centre bore in the motor shaft as specified by DIN 332-DR-M...
  - Tolerances of the shaft ends:
    ≤ ∅ 50 mm: ISO k6, > ∅ 50 mm: ISO m6.
- Only use an extractor for the disassembly.
- When using belts for torque/power transmission:
  - Tension the belts in a controlled manner.
  - Provide protection against accidental contact! During operation, surface temperatures of up to 140°C are possible.

5.3.1 Installation

Important notes

- The mounting surface must be dimensioned for the design, weight and torque of the motor.
- The foot and flange faces must rest flat on the mounting surface.
  - Incorrect motor alignment reduces the service life of the roller bearings and transmission elements.

Impacts on shafts can cause bearing damage.

- Do not exceed the permissible range of ambient operating temperature (📖 19).
- Fasten the motor securely.
- Ensure that the ventilation is not impeded. The exhaust air, also the exhaust air of other machines next to the drive system, must not be taken in immediately.
- During operation, surfaces are hot, up to 140 °C! Ensure that guard preventing accidental contact is in place!

Note!

From the air inlet to other component parts, a minimum distance of 10% of the outer diameter of the fan cover must be complied with!

Ensure an even surface, solid foot or flange mounting and exact alignment if a direct clutch is connected. Avoid resonances with the rotational frequency and double mains frequency which may be caused during assembly. With an additional support on the N-end side in the case of flange-mounted motors (in particular for MQA and great MCA), vibrations that may occur can be reduced. Bracing of the motor by the additional support must be reliably avoided.

Only mount or remove transmission elements using appropriate means. In order to facilitate handling, heat them beforehand. Cover belt pulleys and clutches with a touch guard.

Stop!

Ensure a correct belt tension!

The machines are halfkey balanced. The clutch must be halfkey balanced, too. The visible jutting out part of the key must be removed.

Designs with shaft end at the bottom must be protected with a cover at the N-end, preventing the ingress of foreign particles into the fan.

5.4 Holding brake (option)

Important notes

As an option, the motors can be fitted with a brake. The installation of brakes (in or on the motor) increases the length of the motor.

Note!
The brakes used are not fail-safe because interference factors which cannot be influenced (e.g. oil ingress) may lead to a reduction in torque.

The brakes are used as holding brakes and serve to hold the axes at standstill or in the deenergised state.

Emergency stops at higher speeds are possible but high switching energy increases wear on the friction surfaces and the hub, (📖 26).

The spring-applied brakes work on the basis of the closed-circuit principle, i.e. the brake is closed in the deenergised state. The brakes for DC supply can be fed with a bridge-rectified DC voltage (bridge rectifier) or with a smoothed DC voltage. The permissible voltage tolerance is ±10 %.

In case of long motor cables the voltage drop must be checked due to increasing conductor resistance and compensated for by higher input voltage if necessary.

The following applies to Lenze system cables:

$$U^* = U_B + \left[\frac{0.08\ \Omega}{m} \cdot L \cdot I_B\right]$$

U^* [V]	Resulting supply voltage
U_B [V]	Rated voltage of the brake
I [m]	Cable length
I_B [A]	Rated current of the brake

Stop!
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.

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, not integrated into the motor).

Please refer to the catalogue for servo motors for detailed information about holding brakes.

Note!
The brake cannot be readjusted. When the wear limit is reached, the brake has to be replaced.

5.4.1 Permanent magnet holding brakes

These brakes are used as holding brakes and serve to hold the axes without backlash at standstill or in the deenergised state.

Stop!

- Inherent to the design, the rated torque for permanent magnet holding brakes is solely classified as holding torque at standstill. When braking from full motor speed,
  e.g. in the case of emergency stops, the braking torque is substantially reduced.
- This holding brake is only designed for a limited number of emergency stops. Utilisation as a working brake, e.g. to decelerate a load, is not permissible.

When activating the brake, it must be ensured that the brake is released or engaged at zero speed to avoid unnecessary and rapid wear of the brake.

When used solely as holding brakes, the brakes are virtually wear free on their friction surfaces. If the max. permissible switching energy per emergency stop (see catalogue) is not exceeded, at least 2000 emergency stop functions from a speed of 3000 rpm are possible.

$W = ½ \cdot J_{tot} \cdot \omega^2$	W [J]	Energy
	J_{tot} [kgm^2]	Total moment of inertia
	ω [$^1/_s$]	Angular velocity $\omega=2\pi\ ^n/_{60}$, n= speed [rpm]

The holding torques specified in the catalogue only apply when the motor is at standstill. In the case of a slipping brake, the dynamic braking torque always applies which depends on the speed.

Note!

The permanent magnet holding brakes are maintenance-free and cannot be adjusted. In the event of wear, e.g. by emergency stops, the brakes must be replaced.

These brakes work on the basis of the closed-circuit principle, i.e. the brake is closed in the deenergised state.

Brakes with a rated voltage of DC 24 V are designed for smoothed DC voltages with a ripple of <1 %. It must be ensured that the connector on the motor side is supplied with the minimum voltage of DC 24 V -10 %. If necessary, the voltage drop in the cable should also be considered. If the maximum voltage DC 24 V + 5 % is exceeded, the brake can close again. Supplying the brake with bridge-rectified DC voltage (bridge rectifier without additional smoothing) or a DC voltage with a ripple of >1 % can lead to a malfunctioning of the brake or an increase in the engagement and disengagement times.

Brakes with a rated voltage of DC 205 V are designed for bridge-rectified DC voltage, i.e. for supply via a bridge rectifier from the 230 V mains (half-wave rectifiers are not permissible). Supplying the brake with smoothed DC voltage can lead to malfunctioning or an increase in the engagement and disengagement times. With regard to the minimum and maximum voltages, the same conditions apply as for brakes with 24 V, i.e. the permissible voltage tolerance is 205 V DC +5 %, -10 %.

Wear of permanent magnet brakes

If applied as directed (application as holding brakes), the permanent magnet brakes of the servo motors are wear free and intended for long operating times. The wear on the friction lining is due to e.g. emergency stops.

The table below describes the different reasons for wear and their impact on the components of the permanent magnet brakes.

Component	Effects	Influencing factors	Cause
Friction lining / friction surface at the armature plate and external pole	Wear on the friction lining	Applied friction energy	Braking during operation (impermissible, holding brakes!)
			Emergency stops
			Overlapping wear when the drive starts and stops
			Active braking by the drive motor with the help of the brake (quick stop)
Springs	Fatigue failure of the springs	Number of switching operations of the brake	Axial duty cycle of the springs
Permanent magnet	Useless brake	Temperature, overvoltage	Excessive overvoltages / temperatures

Stop!

In case of wear above the maximum air gap (↻ brake operating instructions), application of the brake cannot be ensured. In this case, no braking process is carried out.

5.4.2 Spring-applied holding brakes

These brakes are used as holding brakes and serve to hold the axes without backlash at standstill or in the deenergised state.

For permissible operating speeds and characteristics, please see the motor catalogue applicable in each case. Emergency stops at higher speeds are possible, but high switching energy increases wear on the friction surfaces and the hub.

Stop!

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.

The formula below provides a simplified way to calculate friction energy per switching cycle which must not exceed the limit value for emergency stops that depends on the operating frequency (📖 motor catalogue; Lenze drive solutions: formulas, dimensioning, and tables).

$$Q = ½ \cdot J_{tot} \cdot \Delta\omega^2 \cdot \frac{M_K}{M_K - M_L}$$

Q [J]	Friction energy
J_{tot} [kgm²]	Total mass inertia (motor + load)
$\Delta\omega$ [$^1/_s$]	Angular velocity $\omega=2\pi\ ^n/_{60}$, n= speed [rpm]
M_K [Nm]	Characteristic torque
M_L [Nm]	Load torque

Depending on the operating conditions and possible heat dissipation, surface temperatures can be up to 130 °C.

More detailed information on the used brakes is provided in the corresponding catalogues.

Wear on spring-applied brakes

Spring-applied brakes are wear-resistant and designed for long maintenance intervals, (📖 23).

However, the friction lining, the teeth between the brake rotor and the hub, and also the braking mechanism are naturally subject to function-related wear which depends on the application case (see table). In order to ensure safe and problem-free operation, the brake must therefore be checked and maintained regularly and, if necessary, replaced (see brake maintenance and inspection).

The following table describes the different causes of wear and their effect on the components of the spring-applied brake. In order to calculate the useful life of the rotor and brake and determine the maintenance intervals to be prescribed, the relevant influencing factors must be quantified. The most important factors are the applied friction energy, the starting speed of braking and the switching frequency. If several of the indicated causes of wear on the friction lining occur in an application, their effects are to be added together.

Component	Effect	Influencing factors	Cause
Friction lining	Wear on the friction lining	Applied friction energy	Braking during operation (impermissible, holding brakes!)
			Emergency stops
			Overlapping wear when the drive starts and stops
			Active braking by the drive motor with the help of the brake (quick stop)
		Number of start-stop cycles	Starting wear if motor is mounted in a position with the shaft vertical, even if the brake is open
Armature plate and flange	Running-in of armature plate and flange	Applied friction energy	Friction between the brake lining and the armature plate or flange e.g. during emergency braking or service brake operation
Teeth of the brake rotor	Teeth wear (primarily at the rotor end)	Number of start-stop cycles, Level of the braking torque, Dynamics of the application, Speed fins in operation	Relative movement and impacts between brake rotor and brake hub
Armature plate bracket	Armature plate, cap screws and bolts are deflected	Number of start-stop cycles, Level of braking torque	Load changes and impacts due to reversal error during interaction between armature plate, cap screws and guide bolts
Springs	Fatigue failure of the springs	Number of switching operations of the brake	Axial load cycle and shearing stress on the springs due to radial reversing error of the armature plate

6.1 Important notes

Danger!

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

Before working on the power connections, always disconnect the drive component from the mains and wait until the motor is at standstill. Verify safe isolation from supply!

Stop!

Electrical connections must be carried out in accordance with the national and regional regulations!

Observe tolerances according to IEC/EN 60034-1:

- Voltage ±5 %
- Frequency ±2 %
- Wave form, symmetry (increases heating and affects electromagnetic compatibility)

Observe notes on wiring, information on the nameplate, and the connection scheme in the terminal box.

- The connection must ensure a continuous and safe electrical supply, i.e.
  - no loose wire ends,
  - use assigned cable end fittings,
  - ensure good electrical conductivity of the contact (remove residual lacquer) if an (additional) PE connection on the motor housing is used),
  - establish a safe PE conductor connection,
  - tighten the plugin connector to the limit stop.
  - After the connection is completed, make sure that all connections on the terminal board are firmly tightened.
- The smallest air gaps between uncoated, live parts and against earth must not fall below the following values.

Minimum requirements for basic insulation according to IEC/EN 60664-1 (CE)	Higher requirements for UL design	Motor diameter
3.87 mm	6.4 mm	< 178 mm
	9.5 mm	> 178 mm

- The terminal box has to be free of foreign bodies, dirt, and humidity.
- All unused cable entries and the box itself must be sealed against dust and water.

6.2 EMC-compliant wiring

The EMC-compliant wiring of the motors is described in detail in the Operating Instructions for the Lenze controllers.

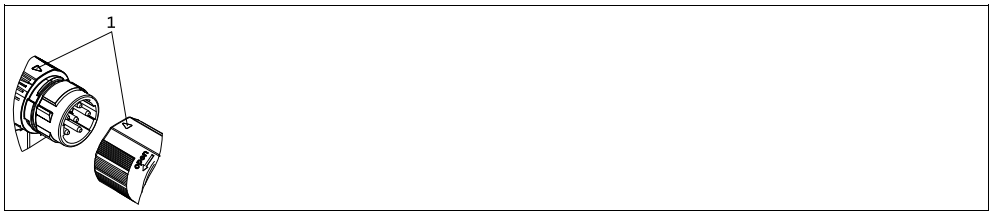
- Use of metal EMC cable glands with shield connection.
- Connect the shielding to the motor and to the device.

6.3 Plug connectors

The connectors comply with vibration and shock class 3M6 as specified in IEC/EN60721-3-3. This applies to all power, encoder and fan connector boxes.

Stop!

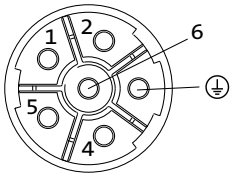
- **Cable connectors with screwed connection:**
  – Always use with the O-rings supplied.
- **Cable connectors with a SpeedTec bayonet lock:**
  – Remove O-ring and dispose of it.

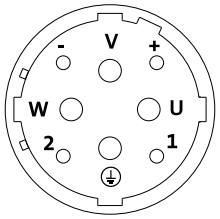


When connecting the cable connector to the motor connector, make sure that the aids to orientation (pos. 1) are facing each other. Only then trouble-free operation is ensured.

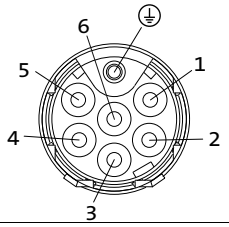
- Tighten the box nut of the cable connectors!
- Never disconnect cable connectors whilst voltage is being applied! Otherwise the connector may be destroyed! Inhibit the inverter before disconnecting the plugs!

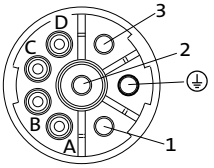
6.3.1 Power connections / holding brake

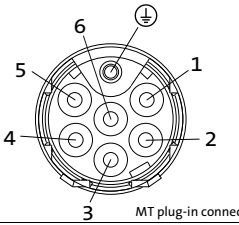
6-pole (external view of poles)			
Contact	**Name**	**Meaning**	**M23**
1 2	BD1 BD2	Holding brake + Holding brake -	
⏚	PE	PE conductor	
4 5 6	U V W	Power phase U Power phase V Power phase W	

MCA 19...21, MCS 14...19, MQA 20 (external view of poles)			
Contact	**Name**	**Meaning**	**M40**
1 2	Not assigned		
+ -	BD1 BD2	Holding brake + Holding brake -	
⏚	PE	PE conductor	
U V W	U V W	Power phase U Power phase V Power phase W	

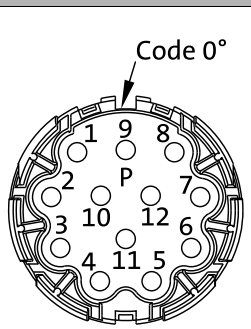
6.3.2 Fan

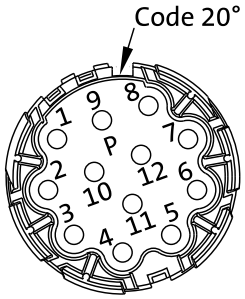
Single-phase (external view of poles)			
Contact	**Name**	**Meaning**	**M17**
⏚	PE	PE conductor	
1 2	U1 U2	AC fan	
3	Not assigned		
4 5	U+ U-	DC fan	
6	Not assigned		

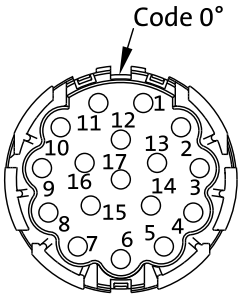
8-pole (external view of poles)			
Contact	**Name**	**Meaning**	**M23**
⏚	PE	PE conductor	
1 2 3	Not assigned		
A B	U1 U2	AC fan	
C D	U+ U-	DC fan	

Three-phase (external view of poles)			
Pin	**Standard description**	**Name**	**M17**
⏚	PE	PE conductor	 MT plug-in connector-001.iso/dms
1	U	Fan	
2	Not assigned		
3	V	Fan	
4	Not assigned		
5			
6	W	Fan	

6.3.3 Feedback system

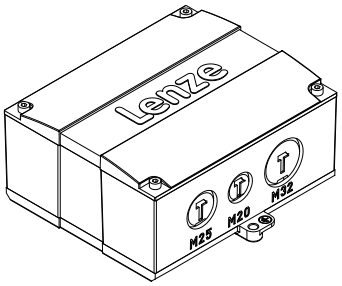
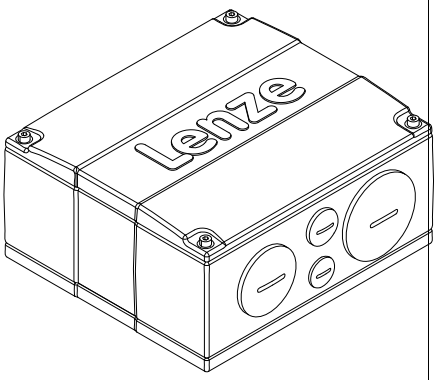
Resolver (external view of poles)			
Contact	**Name**	**Meaning**	**M23**
1 2	+ Ref - Ref	Transformer windings (reference windings)	
3	+VCC ENP	Supply: electronic nameplate [1]	
4 5	+COS -COS	Stator windings cosine	
6 7	+SIN -SIN	Stator windings Sine	
8 9	Not assigned		
10	Shield	Encoder housing shield	
11 12	+ PT1000 - PT1000	Thermal detector PT1000	

Incremental encoder / sin/cos absolute value encoder Hiperface (external view of poles)			
Contact	**Name**	**Meaning**	**M23**
1	B	Track B / + SIN	
2 3	$\overline{A}$ A	Track A inverse / - COS Track A / + COS	
4 5	+ U_B GND	Supply + Mass	
6 7	$\overline{Z}$ Z	Zero track inverse / - RS485 Zero track / + RS485	
8	Not assigned		
9	$\overline{B}$	Track B inverse / - SIN	
10	Shield	Encoder housing shield	
11 12	+ PT1000 - PT1000	Thermal detector PT1000	

Sin/cos absolute value encoder with EnDat interface (external view of poles)			
Contact	**Name**	**Meaning**	**M23**
1	U_P sensor	Supply U_P sensor	
2 3	Not assigned		
4	0 V sensor	0 V sensor supply	
5 6	+ PT1000 - PT1000	Thermal detector PT1000	
7	+ U_B	Supply + / +VCC ENP [1]	
8 9	Cycle $\overline{Cycle}$	Clock pulse EnDat interface Clock pulse inverse EnDat interface	
10	GND	Mass	
11	Shield	Encoder housing shield	
12 13	B $\overline{B}$	Track B Track B inverse	
14	Data	Data EnDat interface	
15 16	A $\overline{A}$	Track A Track A inverse	
17	$\overline{Data}$	Data inverse EnDat interface	

1) Only for versions with electronic nameplate ENP.

6.4 Terminal box

Terminal box with knock out	Terminal box with screwed connections
 MT-terminal box-001.iso	 MT-terminal-box-002.iso
The openings in the terminal box are cast closed and can be opened by the customer as required.	

Note!

Open the holes on the underside of the knock out terminal box when the cover is closed.

Cable glands and terminal studs for the power terminal box

Motor type / motor size		Cable glands	Power connection				
			Terminal			Terminal board	
			Cable cross-section [mm²]	Stripping length [mm]	Tightening torque [Nm]	Threaded bolt	Tightening torque [Nm]
MCA	10, 13, 14, 17	1 x M20 x 1.5 + 1 x M16 x 1.5	0.08 ... 2.5	10 ... 11	2)	-----	-----
	19, 21	1 x M32 x 1.5 + 1 x M25 x 1.5	0.2 ... 10	10 ... 11	2)	-----	-----
	20	2 x M20 + 2 x M 25 + 2 x M32	2.5 ... 16	18 ... 20	2)	-----	-----
	22	1 x M40x1.5 + 1 x M50x1.5 + 1 x M20x1.5 + 1 x M16x1.5	10 ... 35	18	3.2	-----	-----
	26	1 x M50 x 1.5 + 1 x M63 x 1.5 + 1 x M20 x 1.5 + 1 x M16 x 1.5	-----			M12	15.5
MQA	20	2 x M20 + 2 x M 25 + 2 x M32	2.5 ... 16	18 ... 20	2)	-----	-----
	22	1 x M40x1.5 + 1 x M50x1.5 + 1 x M20x1.5 + 1 x M16x1.5	10 ... 35	18	3.2	-----	-----
	26	1 x M50 x 1.5 + 1 x M63 x 1.5 + 1 x M20 x 1.5 + 1 x M16 x 1.5	-----			M12	15.5
MCS	09, 12, 14D, 14H, 14L15, 14P14, 19F15, 19J15	2 x M20 + 2 x M25 + 2 x M32	0.08 ... 2.5 1)	10 ... 11	2)	-----	-----
	14L32, 14P32, 19F13, 19J30, 19P		0.2 ... 10	10 ... 11	2)	-----	-----
MD□KS	056, 071	1 x M20 x 1.5 + 1 x M16 x 1.5	0.08 ... 2.5	10 ... 11	2)	-----	-----

Tab. 1 Cable glands and connecting terminals

1) 4 mm² without wire end ferrule
2) Spring terminal

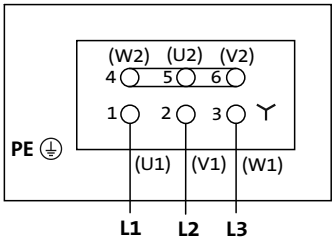
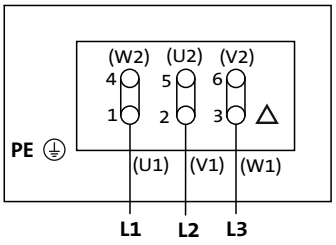
Cable glands for the fan terminal box

Motor type/size		Screwed connection
MCA/MQA	20	1 x M 16 x 1.5
	22	
	26	

6.4.1 Power connections

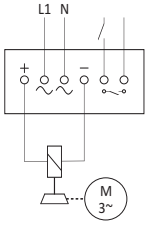
MCA; MCS, MQA 20...22, MD□KS		
Contact	**Name**	**Meaning**
⏚	PE	PE conductor
U V W	U V W	Motor winding phase U Motor winding phase V Motor winding phase W
TP1 TP2	TP1 TP2	PTC thermistor
TB1 TB2	TB1 TB2	Thermostat Thermal NC contact

MCA 26, MQA 26		
Contact	**Name**	**Meaning**
⏚	PE	PE conductor
1	U1	Start of winding phase U
2	V1	Start of winding phase V
3	W1	Start of winding phase W
4	W2	End of winding phase W
5	U2	End of winding phase U
6	V2	End of winding phase V

Star connection	Delta connection
	

6.4.2 Holding brake DC 205 V - connected via rectifier (optionl)

Contact	Name	Meaning	
~	BA1	Connection to L1 - mains	AC-excited brake (rectifier)
~	BA2	Connection to N - mains	
+	BD1 (factory-set wiring)	Connection of holding brake +	
-	BD2 (factory-set wiring)	Connection of holding brake -	
⊶	Switching contact, DC switching		



6.4.3 Holding brake DC 24 V (optional)

Contact	Name	Meaning
BD1	BD1	Holding brake +
BD2	BD2	Holding brake -

6.4.4 Fan

1-phase		
Contact	**Name**	**Meaning**
⏚	PE	PE conductor
U1	U1	Connection to L1 - mains
U2	U2	Connection to N - mains

3-phase		
Contact	**Name**	**Meaning**
⏚	PE	PE conductor
L1	U	Connection to L1 mains
L2	V	Connection to L2 mains
L3	W	Connection to L3 mains

6.4.5 Feedback system

Resolver		
Contact	**Name**	**Meaning**
B1 B2	+ Ref - Ref	Transformer windings (reference windings)
B3	+ VCC ENP	Supply: electronic nameplate [1]
B4 B5	+COS -COS	Stator winding cosine
B6 B7	+SIN -SIN	Stator winding sine
B8	Not assigned	
R1 R2	+ PT1000 - PT1000	Thermal detector PT1000

1) Only for versions with electronic nameplate ENP.

Incremental encoder / sin/cos absolute value encoder with Hiperface		
Contact	**Name**	**Meaning**
B1 B2	+ U_B GND	Supply + Mass
B3 B4	$\overline{A}$ $\overline{A}$	Track A / + COS Track A inverse / - COS
B5 B6	$\overline{B}$ $\overline{B}$	Track B / + SIN Track B inverse / - SIN
B7 B8	$\overline{Z}$ $\overline{Z}$	Zero track / + RS485 Zero track inverse / - RS485
B10	Shield	Encoder housing shield
R1 R2	+ PT1000 - PT1000	Thermal detector PT1000

Sin/cos absolute value encoder with EnDat interface		
Contact	**Name**	**Meaning**
B1	+ U_B	Supply + / + VCC ENP [1]
B2	GND	Mass
B3 B4	$\overline{A}$ $\overline{A}$	Track A Track A inverse
B5 B6	$\overline{B}$ $\overline{B}$	Track B Track B inverse
B7 B8	$\overline{Data}$ $\overline{Data}$	Data EnDat interface Data inverse EnDat interface
B20 B21	$\overline{Cycle}$ $\overline{Cycle}$	Clock pulse EnDat interface Clock pulse inverse EnDat interface
B22	U_P sensor	U_P sensor
B23	0 V sensor	0 V sensor
B24	Shield	Encoder housing shield
B25	Not assigned	
R1 R2	+ PT1000 - PT1000	Thermal detector PT1000

1) Only for versions with electronic nameplate ENP.

Motor-encoder combinations

Drive systems with Servo Drives 9400 and safety module SM301 provide speed-dependent safety functions for safe speed monitoring and/or safe relative-position monitoring. Observe permissible motor-encoder combinations during configuration.

- Possible speed-dependent safety functions with safety module SM301:
  - Safe stop 1 (SS1)
  - Safe operational stop (SOS)
  - Safely limited speed (SLS)
  - Safe maximum speed (SMS)
  - Safe direction (SDI)
  - Safe speed monitor (SSM)
  - Safely limited increment (SLI)
- Permissible motor-encoder combinations for these functions:

Synchronous servo motors	Encoder		Safe speed monitoring with SM301	
	Type	Product key		
MCS 06 ... 19 MDXKS 56 / 71	Sin/cos absolute value, single-turn	AS1024-8V-K2	Single-encoder concept	PL d / SIL 2
	Sin/cos absolute value, multi-turn	AM1024-8V-K2		
	Resolver	RV03		PL e / SIL 3
			Two-encoder concept	Up to PL e / SIL 3

Asynchronous servo motors	Encoder		Safe speed monitoring with SM301	
	Type	Product key		
MCA 10 ... 26 MQA 20 ... 26	Sin/cos incremental	IG1024-5V-V3	Single-encoder concept	PL e / SIL 3
	Resolver	RV03		
			Two-encoder concept	Up to PL e / SIL 3

A ”two-encoder concept” includes e.g. a resolver as motor encoder and, at the same time, an absolute value encoder (sin/cos), an incremental encoder (TTL), or digital encoder (SSI/bus) as position encoder on the machine.

In the case of the ”2-encoder concept”, the achievable risk mitigation (PL/SIL) depends on the suitability of the encoders used.

Note!

If feedback systems for safety functions are used, the manufacturer’s documentation must be observed!

8.1 Important notes

For trial run without output elements, lock the featherkey. Do not deactivate the protective devices, not even in a trial run.

Check the correct operation of the brake before commissioning motors with brakes.

8.2 Before switching on

Note!

Before switch-on, you must ensure that the motor starts with the intended direction of rotation.

Lenze motors rotate CW (looking at the driven shaft) if a clockwise three-phase field L1 → U1, L2 →V1, L3 → W1 is applied.

Before initial commissioning, before commissioning after an extended standstill period, or before commissioning after an overhaul of the motor, the following must be checked:

- Measure the insulation resistance, in case of values ≤1 kΩ per volt of rated voltage, dry the winding.
- Have all screwed connections of the mechanical and electrical parts been firmly tightened?
- Is the unrestricted supply and removal of cooling air ensured?
- Has the PE conductor been connected correctly?
- Have the protective devices against overheating (temperature sensor evaluation) been activated?
- Is the inverter correctly parameterised for the motor? (Inverter operating instructions)
- Are the electrical connections o.k.?
- Does the motor connection have the correct phase sequence?
- Are rotating parts and surfaces which can become very hot protected against accidental contact?
- Is the contact of good electrical conductivity if a PE connection on the motor housing is used?

8.3 Functional test

- Check all functions of the drive after commissioning:
- Direction of rotation of the motor
  - Direction of rotation in the disengaged state (see chapter ”Electrical connection”).
- Torque behaviour and current consumption
- Function of the feedback system

8.4 During operation

Stop!

- Fire hazard! Do not clean or spray motors with flammable detergents or solvents.
- Avoid overheating! Deposits on the drives impede the heat dissipation required and have to be removed regularly.

Danger!

During operation, motor surfaces must not be touched. According to the operating status, the surface temperature for motors can be up to 140°C. For the protection against burn injuries, provide protection against contact, if necessary. Observe cooling-off times!

During operation, carry out inspections on a regular basis. Pay special attention to:

- Unusual noises
- Oil spots on drive end or leakages
- Irregular running
- Increased vibration
- Loose fixing elements
- Condition of electrical cables
- Speed variations
- Impeded heat dissipation
  - Deposits on the drive system and in the cooling channels
  - Pollution of the air filter

In case of irregularities or faults: (📖 46.

9.1 Important notes

Danger!

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

Before working on the power connections, always disconnect the drive component from the mains and wait until the motor is at standstill. Verify safe isolation from supply!

The guarantor of the engine is a component for use with security features.

Danger!
If not properly performed work on the guarantor of the motor lead to the loss of safety functions.

Possible consequence: Property damage and / or personal injury.
Protection measure: Repair or replacement of the collateral provider is allowed only by Lenze Service or its empower people.

Shaft sealing rings and roller bearings have a limited service life.

Regrease bearings with relubricating devices while the low-voltage machine is running. Only use the grease recommended by the manufacturer.

If the grease drain holes are sealed with a plug, (IP54 drive end; IP23 drive and nondrive end), remove plug before commissioning. Seal bore holes with grease.

9.2 Maintenance intervals

Inspections

- If the machine is exposed to dirt, clean the air channels regularly.

9.2.1 Motor

- Only the bearings and shaft sealing rings become worn.
  – Check bearings for noise (after approx. 15,000 h at the latest).
- In order to prevent overheating, remove dirt deposits on the drives regularly.
- We recommend carrying out an inspection after the first 50 operating hours. In this way, you can detect and correct any irregularities or faults at an early stage.

9.2.2 Safety encoder

Die Geber AS1024-8V-K2 und AM1024-8V-K2 müssen nach einer Gebrauchsdauer von 10 Jahren getauscht werden.

Der Sicherheitsgeber des Motors ist ein Bauteil zur Verwendung mit Sicherheitsfunktionen.

Danger!

Nicht fachgerecht ausgeführte Arbeiten am Sicherheitsgeber des Motors führen zum Verlust der Sicherheitsfunktionen.

Mögliche Folgen:

- Sachschäden und/oder Personenschäden

Schutzmaßnahmen:

- Reparatur oder der Austausch des Sicherheitsgebers ist nur durch den Lenze-Service oder seine bevollmächtigen Personen zulässig.

9.2.3 Holding brake

The brakes need to be checked on a regular basis to ensure safe and trouble-free operation.

The necessary maintenance intervals primarily depend on the stress to which the brake is subjected in an application. When a maintenance interval is being calculated, all causes of wear must be taken into account (see notes "Wear on spring-applied brakes"). In the case of brakes which are subjected to low levels of stress, e.g. holding brakes with emergency stop function, regular inspections at a fixed time interval are recommended. In order to reduce the amount of work involved in maintenance, perform the inspection at the same time as other maintenance work carried out cyclically on the machine if possible.

If the brakes are not properly serviced, operating faults, production outages or damage to machinery can occur. A maintenance concept adapted to the operating conditions and the stresses to which the brakes are subjected must therefore be drawn up for every application. For brakes, the maintenance intervals and servicing work listed in the following table are necessary.

Maintenance interval for holding brake with emergency stop	Maintenance work
At least every 2 years	Inspection of the brake integrated in the motor: • Check ventilation function and activation/deactivation
After 1 million cycles at the latest	
Shorter intervals in the case of frequent emergency stops!	

The brakes of the MCA, MCM, MCS, MQA, and MD□KS motors cannot be accessed from the outside! (Maintenance work on the brakes must be carried out by Lenze Service staff only!)

9.3 Maintenance operations

Stop!

- Make sure that no foreign bodies can enter the inside of the motor!
- Do not remove plugs when voltage is being applied!

Danger!

- Only work on the drive system when it is in a deenergised state!
- Hot motor surfaces of up to 150 °C. Observe cooling times!
- Remove loads acting on motors or secure loads acting on the drive!

9.3.1 Blower

If the motor is equipped with a blower, this blower must be cleaned or even replaced at regular intervals depending on the amount of dust (if necessary, daily).

9.3.2 Fan with dust protection filter

For the motors, dry filters are used.

Note!

The dust protection filter is mounted to the fan unit. Depending on the amount of dust, the filter must be cleaned completely or replaced at regular intervals!

Polluted filters substantially reduce the amount of cooling air. This brings about higher winding temperatures, reduces the filters' service life and may cause damage to the filters.

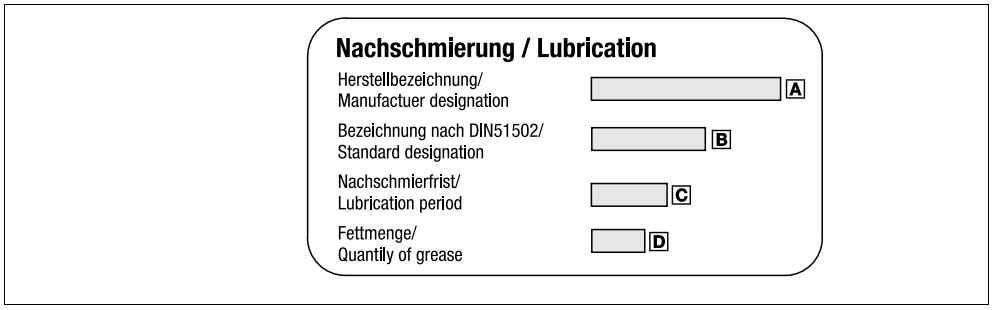
When replacing the filters it **must** be ensured that all covers as well as the filter are fit tightly, therefore preventing the occurrence of leakages for a damaging ingress of dust!

In the case of **moist** dust, new filter mats must be mounted. At the latest when the filter is replaced for the first time it should be checked that the interior of the motor is clean.

9.3.3 Motors with bearing relubricating devices

Under normal operating conditions, the bearings used have a service life of approx. 20.000 operating hours. Ex works the bearings are filled with a high-quality, heat-resistant roller bearing grease. (The permissible operating temperature range of the grease used is between -25°C and +120°C).

Relubrication period, type of grease and amount of grease are stated on an additional indicating label on the motor.



A Manufacturer designation
B Designation of grease type according to DIN51502
C Relubrication period
D Amount of grease

9.3.4 Motor plug connection assignment

This motor-plug assignment is a rough selection of possible mechanical combinations.

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

Further information is provided in the "System cables" system manual at:
www.Lenze.com → Download → Technical documentation → Finding technical documentation
Filter: Type of contents
System manual
Filter: Product
System cable

Connector	Connectable cross-section of the motor cable
EWS0001 / EWS1001	1.0 mm^2, 1.5 mm^2, 2.5 mm^2
EWS0012 / EWS1012	2.5 mm^2, 4.0 mm^2
EWS0013 / EWS1013	6.0 mm^2, 10.0 mm^2, 16.0 mm^2

9.3.5 Power connection cable connectors

Asynchronous servo motors

Motor type		Plug size *	Screw plug		SpeedTec	
			Spare part designation	Coding in the system cable type code	Spare part designation	Coding in the system cable type code
MCA	10I40- ... S00	M23	EWS0001	M01	EWS1001	M04
	13I34- ... Fx0					
	13I41- ... S00					
	14L16- ... Fx0					
	14L20- ... S00					
	14L35- ... Fx0					
	14L41- ... S00					
	17N17- ... Fx0					
	17N23- ... S00					
	17N35- ... Fx0					
	17N41- ... S00					
	19S17- ... Fx0	M40	EWS0012	M02	EWS1012	M05
	19S23- ... S00					
	19S35- ... Fx0	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
	19S42- ... S00	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
	20X14- ... Fx0					
	20X29- ... Fxx	M40	EWS0013	M03	EWS1013	M06
	21X17- ... Fx0	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
	21X25- ... S00	M40	EWS0012	M02	EWS1012	M05
	21X35- ... Fx0		EWS0013	M03	EWS1013	M06
	21X42- ... S00	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
MQA	20					

Synchronous servo motors

Motor type		Plug size *	Screw plug		SpeedTec	
			Spare part designation	Coding in the system cable type code	Spare part designation	Coding in the system cable type code
MDSKS 056 - 071		M23	EWS0001	M01	EWS1001	M04
MCM, MCS	06					
	09					
	12					
	14D					
	14H12- ... Fx0					
	14H15- ... S00					
	14H28- ... Fx0	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
	14H32- ... S00	M23	EWS0001	M01	EWS1001	M04
	14L14- ... Fx0					
	14L15- ... S00					
	14L30- ... Fx0	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
	14L32- ... S00					
	14P11- ... Fx0	M23	EWS0001	M01	EWS1001	M04
	S43.14					
	14P26- ... Fx0	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
	14P32- ... S00					
	19F12- ... Fx0	M23	EWS0001	M01	EWS1001	M04
	19F14- ... S00					
	19F29- ... Fx0	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
	19F30- ... S00					
	19J12- ... Fx0					
	19J14- ... S00	M23	EWS0001	M01	EWS1001	M04
	19J29- ... Fx0	M40	EWS0013	M03	EWS1013	M06
	19J30- ... S00	M40	EWS0012 EWS0013	M02 M03	EWS1012 EWS1013	M05 M06
	19P12- ... Fx0					
	19P14- ... S00	M23	EWS0001	M01	EWS1001	M04
	19P29- ... Fx0	M40	EWS0013	M03	EWS1013	M06
	19P30- ... S00					

* At times, older documents also stated plug sizes of 1.0 (M23) and 1.5 (M40).

9.3.6 Cable connectors

Feedback

Type of encoder	Plug size *	Screw plug		SpeedTec	
		Spare part designation	Coding in the system cable type code	Spare part designation	Coding in the system cable type code
Resolver	M23	EWS0006	F01	EWS1006	F05
Incremental encoder		EWS0010	F02	EWS1010	F06
Sin/cos encoder, Hiperface		EWS0010	F02	EWS1010	F06
Sin/cos encoder, EnDat		EWS0017	F03	EWS1017	F07
Incremental encoder, Renco R35		EWS0023	F04	EWS1023	F08

Blower

Blower	Plug size *	Screw plug		SpeedTec	
		Spare part designation	Coding in the system cable type code	Spare part designation	Coding in the system cable type code
MDFKS	M23	EWS0003	L01	EWS1003	L03
MCS, MCA, MQA	M17	EWS0021	L02	EWS1021	L04

9.4 Repair

- We recommend having all repairs carried out by the Lenze Service department.
- In case of version with safety encoder, observe chapter 9.2.2!

If faults occur during operation of the drive system:

- First check the possible causes of malfunction according to the following table.

Note!

Also observe the corresponding chapters in the operating instructions for the other components of the drive system.

If the fault cannot be remedied using one of the listed measures, please contact the Lenze Service.

Danger!

- Only work on the drive system when it is in a deenergised state!
- Hot motor surfaces of up to 150 °C. Observe cooling times!
- Remove loads acting on motors or secure loads acting on the drive!

Fault	Cause	Remedy
Motor too hot Can only be evaluated by measuring the surface temperature: • Non-ventilated motors > 140 °C • Externally ventilated or self-ventilated motors > 110 °C	Insufficient cooling air, blocked air ducts.	Ensure unimpeded circulation of cooling air
	Preheated cooling air	Ensure a sufficient supply of fresh cooling air
	Overload, with normal mains voltage the current is too high and the speed too low	Use larger drive (determined by power measurement)
	Rated operating mode exceeded (S1 to S8 IEC/EN 60034-1)	Adjust rated operating mode to the specified operating conditions. Determination of correct drive by expert or Lenze customer service
	Loose contact in supply cable (temporary two-phase operation!)	Tighten loose contact
	Fuse has blown (two-phasing!)	Replace fuse
	Overload of the drive	Check load and, if necessary, reduce by means of longer ramp-up times
		Check winding temperature
	Heat dissipation impeded by deposits	Clean surface and cooling fins of the drives
Motor suddenly stops and does not restart	Overload monitoring of the inverter is activated	Check inverter settings
		Reduce load caused by longer acceleration times
Incorrect direction of rotation of the motor, correct display on the controller	Motor cable polarity is reversed	Check the polarity and correct
	Polarity of encoder cable reversed	
Motor rotates normally but does not reach the expected torque	Motor cable interchanged cyclically Not all motor phases connected	Connect the phases at the motor cable connection correctly
Motor turns in one direction at maximum speed in an uncontrolled manner	Motor cable interchanged cyclically	Check motor connector and correct it if necessary
	Polarity of encoder cable reversed	Check encoder connection and correct it if necessary
Motor rotates slowly in one direction and cannot be influenced by the inverter	Polarity of motor cable and encoder cable reversed	Check and correct polarity
Irregular running	Insufficient shielding of motor or resolver cable	Checking shielding and earth connection
	Drive inverter gain too large	Adjust the gains of the inverters (see operating instructions for drive inverter)
Vibrations	Insufficiently balanced coupling elements or machine	Rebalance
	Inadequate alignment of drive train	Realign machine unit, check foundation if necessary
	Loose fixing screws	Check and tighten screw connections
Running noises	Foreign particles inside the motor	Repair by manufacturer if necessary
	Bearing damage	
Surface temperature > 140°C	Overload of the drive	Check load and, if necessary, reduce by means of longer ramp-up times
		Check winding temperature
	Heat dissipation impeded by deposits	Clean surface and cooling fins of the drives

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