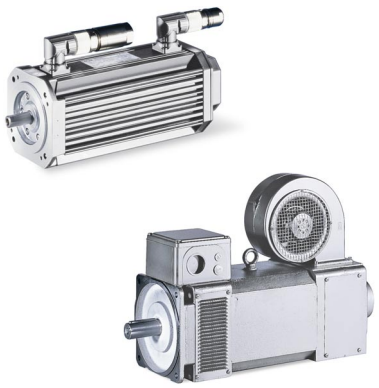


M...

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

Asynchronous servo motors / synchronous servo motors

Operating Instructions EN

13459473

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

EN

i Contents

EN

Contents

- The present operating instructions are intended for safe working on and with the motors. They contain safety instructions that must be observed.
- All personnel working on and with the motors must have the operating instructions available during work and observe the information and notes relevant for them.
- The operating instructions must always be complete and in a perfectly readable state.

If the information and notes provided in this documentation do not meet your requirements, please refer to the controller and/or gearbox documentation.

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

Validity

This documentation is valid for servo motors:

Type	Designation
MCS	Synchronous servo motors
MCA	Asynchronous servo motors
MQA	
MDFQA	
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
13459473	3.0	01/2014	TD09	

1.2 Conventions used

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

Type of information	Identification	Examples/notes
Spelling of numbers		
Decimal separator	Point	In general, the decimal point is used. For instance: 1234.56
Icons		
Page reference	🕮	Reference to another page with additional information For instance: 🕮 16 = see page 16
Wildcard	☐	Wildcard for options, selection data

EN

1.3 Terminology used

Term	In the following text used for
Motor	Servo motors in the versions according to product key, see page 15 to page 17 .
Controllers	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

Structure of 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 troublefree operation
 **Tip!**	Useful tip for simple handling
	Reference to another documentation

EN

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.

- Lenze drive and automation components ...
  ... must only be used for the intended purpose.
  ... must never be operated if damaged.
  ... must never be subjected to technical modifications.
  ... must never be operated unless completely assembled.
  ... must never be operated without the covers/guards.
  ... can - depending on their degree of protection - have live, movable or rotating parts during or after operation. Surfaces can be hot.

- 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.

- 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 a 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 Low-Voltage Directive 2006/95/EC and the harmonised standards of the IEC/EN 60034 series.

It is permissible to use low-voltage machines with IP23 protection or less outdoors only if special protective measures are taken.

Do not use the integrated brakes as fail-safe brakes. It cannot be ruled out that the braking torque will be reduced due to disruptive factors that cannot be influenced.

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

Note!

Generally, all products this documentation is valid for meet the requirements of the Low-Voltage Directive 2006/95/EC. Products that do not meet the minimum efficiencies of the EU Directive 640/2009 (and hence the ErP Directive 2009/125/EC), will not be CE-compliant as of 16th June 2011 and thus do not receive a CE designation.

In that case, the product may only be used outside the EEA.

Any other use shall be deemed inappropriate!

EN

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

EN

- 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

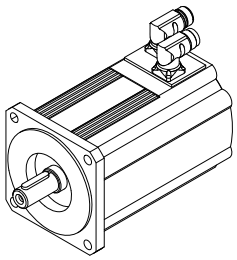
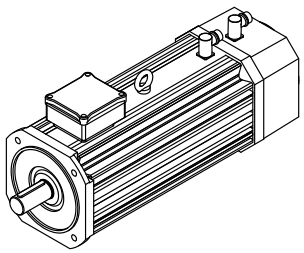
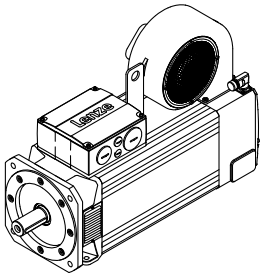
- Installed thermal detectors are **no full protection** for the machine.
  - If required, limit the maximum current, parameterise the controller such that it will be switched off after some seconds of operation with $I > I_N$, especially if there is the danger of blocking.
  - Installed overload protection does not prevent an overload under any conditions.
- Installed brakes are **no fail-safe brakes**.
  - The torque can be reduced due to disruptive factors that cannot be influenced, e.g. by ingressing oil due to a defect shaft sealing ring on the A side.
- 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

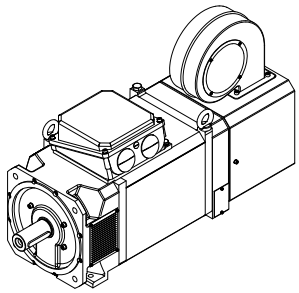
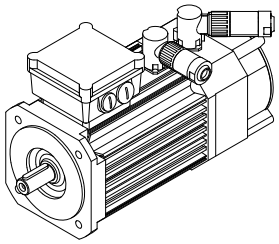
- Fire hazard
  - Prevent contact with flammable substances.

3.1 Identification

Types MC., MQA

Synchronous servo motors MCS	Asynchronous servo motors MCA	 MQA
 MT-MCS-001.iso	 MT-MCA-001.iso	 MT-MQA-001.iso

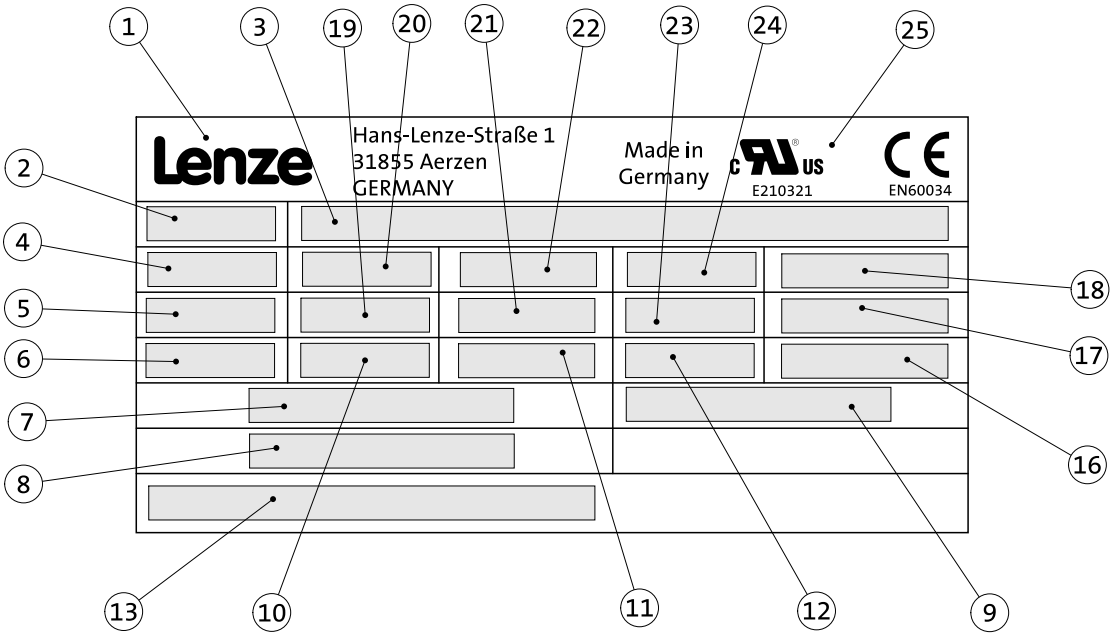
Type MD...

Asynchronous servo motors MDFQA	Synchronous servo motors MD□KS
 MT-MDFQA-002.iso	 MT-MDFKS-001.iso

EN

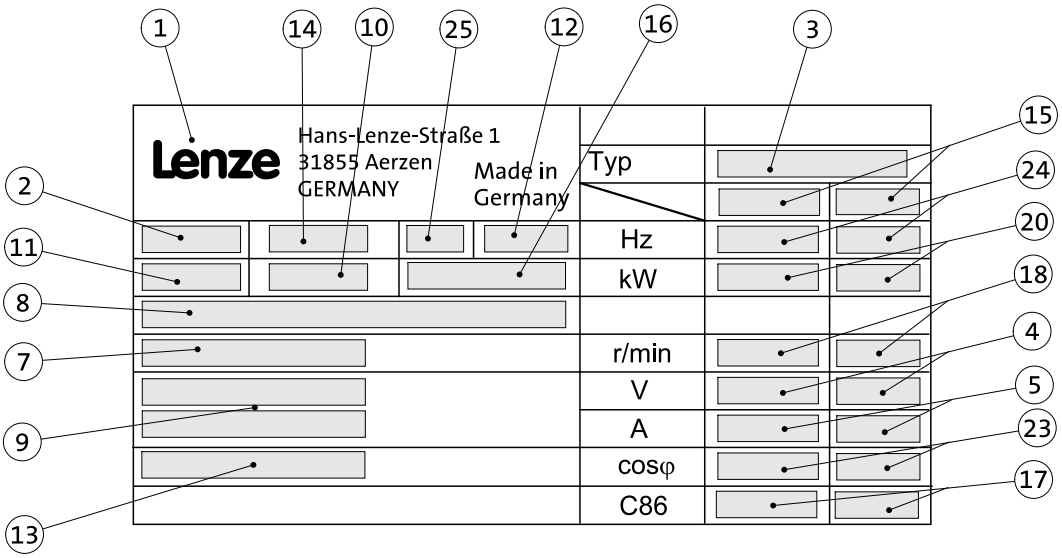
3.1.1 Nameplate

Asynchronous and synchronous servo motors



Nameplate SYN-001.iso

IP23 MDFQA asynchronous servo motors



Nameplate-SYN-002.iso

EN

No.	Explanation
1	Manufacturer
2	Motor type
3	Lenze motor type
4	Rated voltage U_r [V]
5	Rated current I_r [A]
6	Maximum current I_{max} [A]
7	Labelling of encoder (example: IG2048 - 5V - T; explanation 📖 18) / resolver correction value C 416
8	Feedback/encoder or resolver data; brake data (if available): AC/DC brake voltage Current Braking torque
9	Motor no.
10	Enclosure
11	Temperature class
12	Permissible ambient temperature range
13	8-digit identification number + 16-digit serial number
14	General motor standard
15	Circuit of the winding
16	Motor protection/thermal sensor
17	Selection number for operation on servo inverters (enter the provided selection number in C0086 to automatically optimise the control mode)
18	Rated speed n_r [rpm]
19	Rated power P_r [HP]
20	Rated power P_r [kW]
21	Continuous standstill torque M_0 [Nm]
22	Rated torque M_r [Nm]
23	Rated power factor cos φ
24	Rated frequency f_r [Hz]
25	Valid conformities, approvals and certificates: CE identification/standard UL mark with UL file number

Example: MCA

Lenze Hans-Lenze-Straße 1, 31855 Aerzen, GERMANY — Made in Germany — E210321 — EN60034

3~MOT	Typ **MCA** 21X25-RS0P1-A38R-ST5S00N-R0SU			
390 V~	6.4 kW	24.6 Nm	85 Hz	2490 r/min
13.5 A	8.58 HP	Mo 39 Nm	cosφ 0.83	C86: 1378
	IP 54	I. CL. F	Ta 40°C	KTY
Geber Feedback	RS12345678 C416:		Id.Nr. 15061467	
Bremse Brake	24 V- 1.46 A 80.0 Nm			

SN 15061467100000170712345

MT-MCA-002.iso/dms

Example: MCS

Lenze Hans-Lenze-Straße 1, 31855 Aerzen, GERMANY — Made in Germany — E210321 — EN60034

3~MOT	Typ **MCS** 14H32-SRMP1-B24N-ST6S00N-R0SU			
295 V~	4.7 kW	14.0 Nm	215 Hz	3225 r/min
11.9 A	HP	Mo 21.0 Nm	U_{in} 246 V	C86: 1331
max. 45.5 A	IP 65	I. CL. F	Ta 40°C	KTY + 2PTC
Geber Feedback	AM1024-8V-H C416:		Id.Nr. 15227910	
Bremse Brake	24V- 0.87 A 18.0 Nm			

SN 152279100000170712345

MT-MCS-002.iso/dms

Example: MDFQA

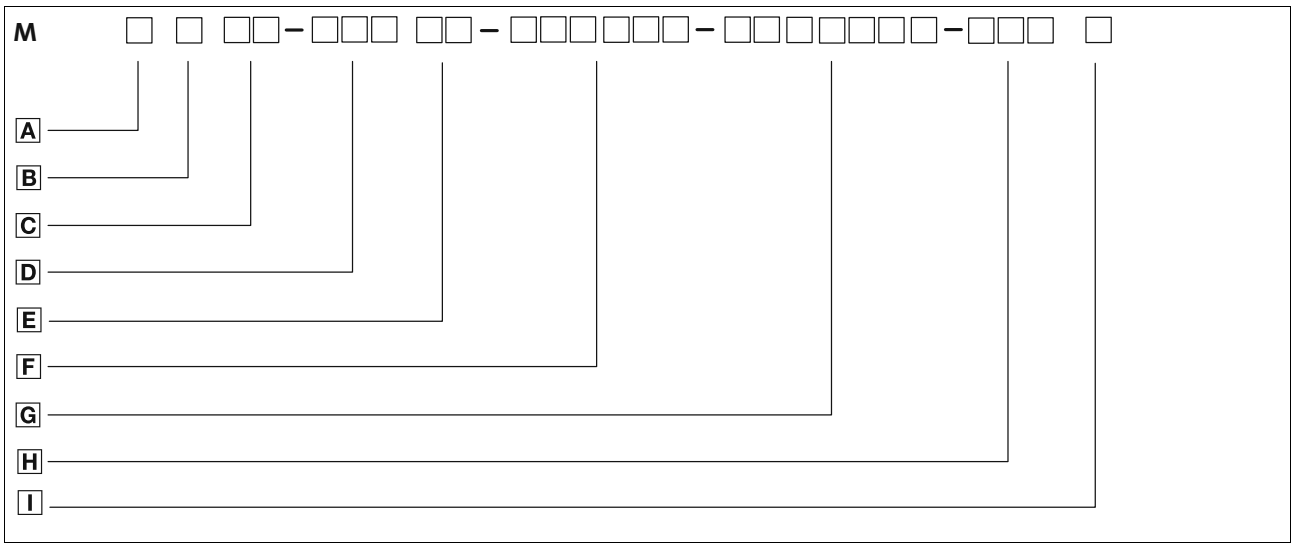
Lenze Hans-Lenze-Straße 1, 31855 Aerzen, GERMANY — Made in Germany

3~MOT	EN60034	CE	Ta 40°C	Typ	MDFQABI160-32
I. CL. F	IP 23s		KTY/TKO		Δ / Y
Br. 480 V 0.18 A 150 Nm				Hz	31 / 18
Geber IG2048-5V-T				kW	40.5 / 22.6
MAT-NR. 13148476				r/min	890 / 498
AUF-NR. 00000123				V	355 / 360
MOT-NR: 1314847610000017071234 5				A	87.0 / 51.5
				cos φ	0.86 / 0.87
				C86	1302 / 1301

MT-MDFQA-003.iso/dms

3.1.2 Product key

Servo motors MCA, MCS, MQA



Legend for product key

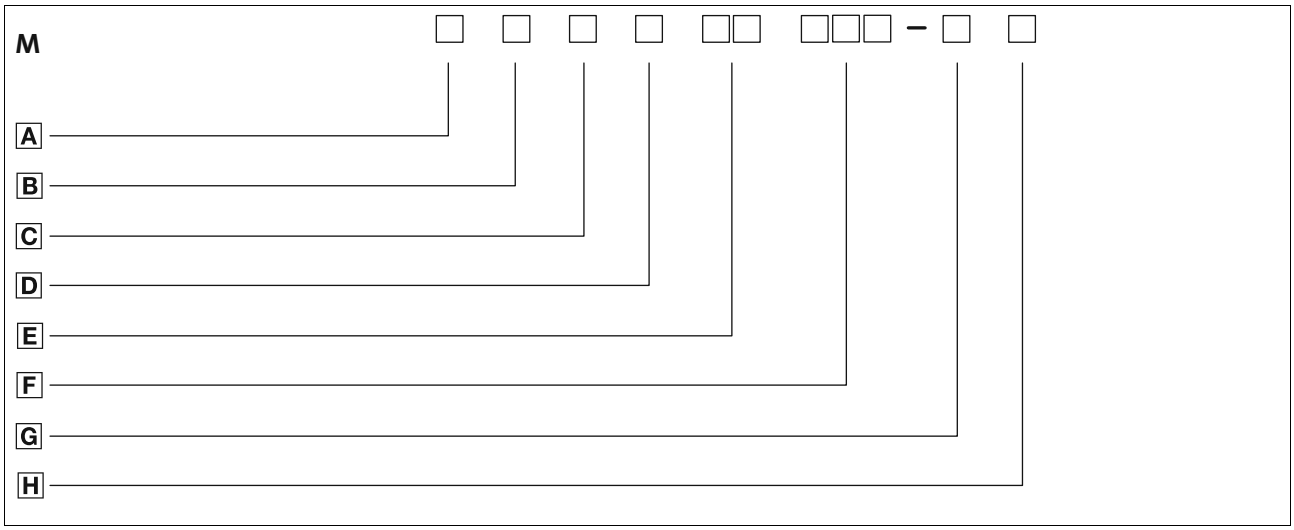
A Type			
C	Compact servo motors (if required, with axial ventilation)	Q	Radially ventilated motor
B Design			
A	Asynchronous	S	Synchronous
C Motor frame size, motor length, speed			
06	Square dimension 62 mm	19	Square dimension 192 mm
09	Square dimension 89 mm	20	Square dimension 200 mm
10	Square dimension 102 mm	21	Square dimension 214 mm
12	Square dimension 116 mm	22	Square dimension 220 mm
13	Square dimension 130 mm	26	Square dimension 260 mm
14	Square dimension 142 mm	C...X	Overall length
17	Square dimension 165 mm	XX	Speed in 100 min^{-1}
D Speed sensor, angle sensor			
RS0	Resolver p=1	RVO	Resolver p=1 "safety"
SKM	Multiturn absolute value encoder with sin/cos signals, Hiperface	SVS	Singleturn absolute value encoder with sin/cos signals, Hiperface "safety"
SRS	Singleturn absolute value encoder with sin/cos signals, Hiperface	SVM	Multiturn absolute value encoder with sin/cos signals, Hiperface "safety"
SRM	Multiturn absolute value encoder with sin/cos signals, Hiperface		
ECN	Singleturn absolute value encoder with sin/cos signals, EnDat		
EQN	Multiturn absolute value encoder with sin/cos signals, EnDat		
EQI	Multiturn absolute value encoder with sin/cos signals, EnDat		
CXX	Incremental encoder TTL with commutation signals UVW	S1S	Incremental encoder with safety function
TXX	Incremental encoder TTL	SXX	Incremental encoder sin/cos (IS2048)
HXX	Incremental HTL encoder	NNO	No encoder
E Brake			
B0	Without brake	FH	Spring-applied brake 230V AC, reinforced
F1	Spring-applied brake 24V DC	P1	PM brake 24V DC
F2	Spring-applied brake 24V DC, reinforced	P2	PM brake 24V DC, reinforced
F5	Spring-applied brake 205V DC	P5	PM brake 205V DC
F6	Spring-applied brake 205V DC, reinforced	P6	PM brake 205V-DC, reinforced
FG	Spring-applied brake 230V AC		

EN

F Design, shaft, concentricity/vibrational severity/direct gearbox attachment				
Design				
A	Standard flange form A/FF with through hole, cyl. shaft without keyway			
B	Standard flange form A/FF with through hole, cyl. shaft with keyway			
C	Standard flange form C/FT with threaded holes, cyl. shaft without keyway			
N	Standard flange form C/FT with threaded holes, cyl. shaft with keyway (standard attachment)			
F	Same as version A except that flange is large		V	Same as version N except that flange is large
G	Same as version B except that flange is large		O	Without flange and without keyway
U	Same as version C except that flange is large		P	Without flange and with keyway
Shaft				
11	Shaft 11x23 (MCS06)		24	Shaft 24x50 (MCS14; MCA14, 17)
14	Shaft 14x30 (MCS09; MCA 10)		28	Shaft 28x60 (MCS19; MCA19)
19	Shaft 19x40 (MCS12; MCA13)		38	Shaft 38x80 (MCA21)
Concentricity/vibrational severity/direct gearbox attachment				
N or R	Concentricity/vibrational severity			
Z0X	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			
Y0X	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			
G Electrical connection, enclosure, cooling, load flywheel				
Electrical connection				
ST	Separate circular connectors for power/brake, encoder/thermal detector, fan			
SQ	Shared rectangular connector for power, encoder...			
KK	Separate terminal boxes for power/brake, encoder/thermal detector/fan			
KG	Separate terminal boxes for power/brake, blower circular connectors for encoder, thermal detector			
KS	Terminal box for power+brake; circular connector for encoder and thermal detector; circular connector for blower			
SK	Circular connector for power+brake; circular connector for encoder+thermal detector; terminal box for fan			
Enclosure				
2	IP23		6	IP65 with shaft sealing ring
5	IP54 without shaft sealing ring (except for direct mounting on gearbox)			
A	IP64 (A-flange, without shaft sealing ring) / IP65			
B	IP54 with shaft sealing ring (A-bearing, oil-tight)			
C	IP54 with shaft sealing ring, double lip (A bearing dust-tight)			
D	IP65 with double-lip shaft sealing ring			
Cooling				
S00	Self cooling/without fan		F10	Blower 230V; AC; 1N
F1F	Blower 230V; AC; 1N; filter		F30	Blower 400V; AC; 3N
F3F	Blower 400V; AC; 3N; filter		F50	Blower 115V; AC; 1N
FWO	Blower 480V; AC; 3N		FWF	Blower 480V; AC; 3N; filter
Load flywheel				
N	Without additional load flywheel		J	With additional mass inertia
H Motor protection, electron. nameplate, color/specification, approval				
Temperature protection				
B	NC thermal contact		R	KTY sensor
E	KTY sensor; electronic nameplate			
Electronic nameplate				
0	Standard nameplate		2	Second nameplate supplied loose
1	Standard nameplate + electronic nameplate		3	Second nameplate supplied loose + electronic nameplate
Colour/specification				
S	Colour: black		U	Specification - UL design and CSA design, approval c UL us
			R	Specification - UL design, approval UL
I Miscellaneous				

EN

Servo motors MD□□□

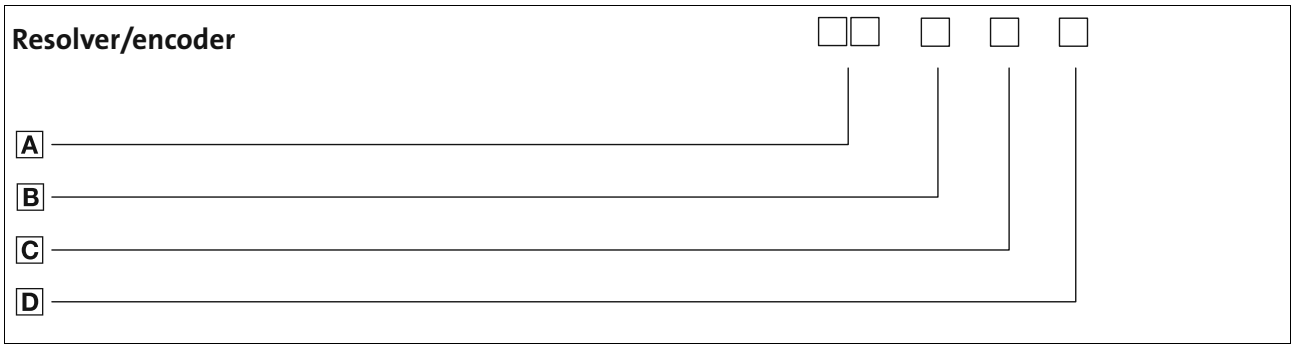


Legend for product key

A Type	
D	Three-phase AC current
B Cooling method, ventilation	
F	Forced ventilated
S	Natural ventilation (cooling by convection and radiation)
C Design, housing	
K	Compact servo motor with square housing and cooling ribs
Q	IP23 servo motor with square housing
D Machine type	
A	Asynchronous machine
S	Synchronous machine
E Built-on accessories	
AG	Absolute value encoder
BA	Brake and sin-cos absolute value encoder or SSI absolute value encoder
BI	Brake, incremental encoder
BS	Brake and resolver
BR	Brake, resolver
IG	Incremental encoder
RS	Resolver
RV	Resolver ”safety”
F Frame size	
036; 056; 071; 100, 112, 132, 160	
G Overall length	
0; 1; 2; 3; 4	
H Number of pole pairs	
1, 2; 3	

EN

Feedback system



Legend for the product key

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

Example of a complete encoder name:
AS1024-8V-K2 = Singleturn absolute value encoder with safety function;
1024 periods per revolution; 8V supply voltage;
Hiperface interface; safety integration level SIL2

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

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

Protection of persons and devices		
Enclosure		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 60034	Exceedance of the temperature limit weakens or destroys the insulation
Permissible voltage		According to limiting curve A of the pulse voltage from IEC / TS 60034-25 (image 14)
EMC		
Noise emission	IEC/EN 61800-3	Depending on the controller, see documentation for the controller.
Noise immunity		

EN

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)	Without brake
		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		See 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
MDFQA 160	• At f_{ch} = 4 kHz, the motor continuously reaches only approx. 95 % of its rated torque. • Strongly increased noise emission
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
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 the instructions below carefully. Please note that, in the event of impermissible alteration or modification of the motor, you will lose all entitlements to make claims under warranty and to benefit from product liability obligations.

- Mount the transmission elements:
  - Shocks and impacts must be avoided! They could destroy the motor.
  - Always use the centre bore in the motor shaft (in accordance with DIN 332, design D) for mounting.
  - 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!

Ensure an even surface, solid foot/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 by the assembly.

Use appropriate means to mount or remove transmission elements (heating) and cover belt pulleys and clutches with a touch guard. Avoid impermissible belt tensions.

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 which prevents 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), can 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 (see wear of brakes, page 25 and 26).

The brakes operate according to 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. Information on the permissible voltage tolerance is provided in the respective motor catalogue.

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:

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

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 a 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 also increases the service life of the relay contacts (external, not integrated in 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.

EN

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.

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.

$W = ½ \cdot J_{ges} \cdot \omega^2$	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.

Stop!

The 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.

Note!

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

These brakes operate according to 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.

EN

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 respective valid motor catalogue. 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).

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

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

EN

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

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

For more information on spring-applied brakes, please refer to the corresponding catalogues and operating instructions of the brakes.

Wear on spring-applied brakes

Spring-applied brakes of the INTORQ BFK458, BFK460 series and the spring-applied brake of the MQA motors are wear resistant and designed for long maintenance intervals.

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	Effects	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

EN

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)

EN

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 Wiring according to EMC

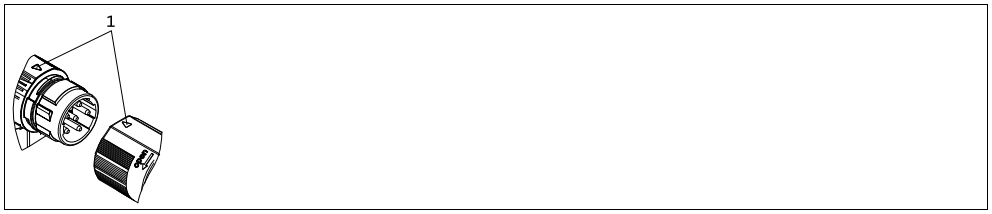
The EMC-compliant wiring of the motors is described in detail in the Operating Instructions for the Lenze controllers.

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

6.3 Plug connectors

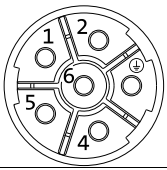
Stop!

- Tighten the coupling ring of the connector.
- If plugs **without** SpeedTec bayonet nut connectors are used, the connector boxes for the power / encoder / fan connections must be secured by O-rings if loadings by vibration occur:
  – M17 connector box with O-ring 15 x 1.3 mm
  – M23 connector box with O-ring 18 x 1.5 mm
  – M40 connector box with O-ring 27 x 4.0 mm
- Never disconnect plugs when voltage is being applied! Otherwise, the plugs could be destroyed! Inhibit the controller before disconnecting the plugs!

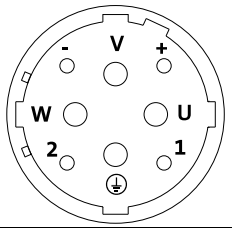


When connecting the cable socket to the motor connector, make sure that the aids to orientation (pos. 1) are facing each other. Only then, trouble-free operation is ensured.

6.3.1 Power connections / holding brake

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

EN

MCA 19...21, MCS 14...19, MQA 20 (external view of poles)			
Pin	**Standard description**	**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	

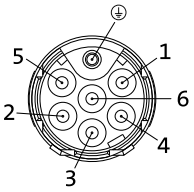
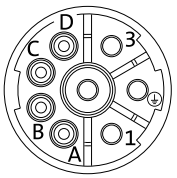
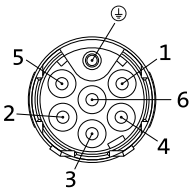
* At times, older documents also stated plug sizes of 1.0 (M23) and 1.5 (M40).

6.3.2 Holding brake

MDFQA		
Pin	**Standard description**	**Meaning**
1	BD1	Holding brake +
2	BD2	Holding brake -

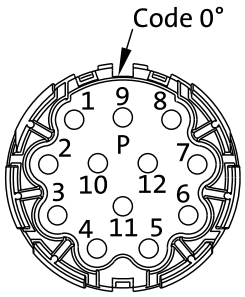
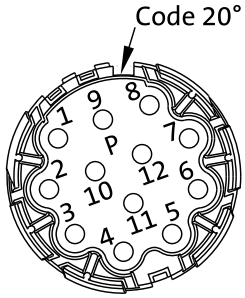
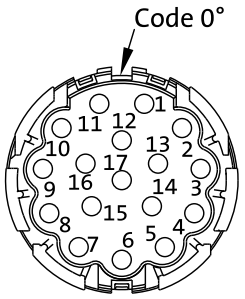
6.3.3 Fan

EN

Single-phase (external view of poles)			
Pin	**Standard description**	**Name**	**M17**
⏚	PE	PE conductor	 MT plug-in connector-001.iso/dms
1 2	U1 U2	AC fan	
3 4 5 6	U+ U-	DC fan	
8-pole (external view of poles)			
Pin	**Standard description**	**Name**	**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	 M connector-001
1	U	Fan	
2	Not assigned		
3	V	Fan	
4 5	Not assigned		
6	W	Fan	

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

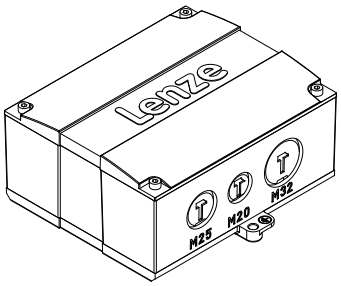
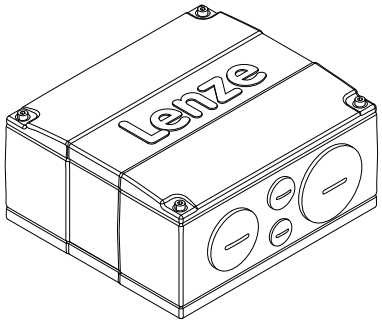
6.3.4 Feedback system

Resolver (external view of poles)			
Pin	**Designation**	**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 10	Not assigned		
11 12	+KTY -KTY	Thermal sensor KTY	
Incremental encoder / sin/cos absolute value encoder Hiperface (external view of poles)			
Pin	**Designation**	**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		Not assigned	
11 12	+KTY -KTY	Thermal sensor KTY	
			MT plug-in connector-001.iso/dms
Sin/cos absolute value encoder with EnDat interface (external view of poles)			
Pin	**Designation**	**Meaning**	**M23**
1	UP sensor	Supply UP sensor	
2 3	Not assigned		
4	0 V sensor	0 V sensor supply	
5 6	+KTY -KTY	Thermal sensor KTY	
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	Shield for housing of encoder	
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.
* At times, older documents also stated plug sizes of 1.0 (M23) and 1.5 (M40).

EN

6.4 Terminal box

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

Note!

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

EN

Cable glands and terminal studs for the power terminal box

Motor type / motor size		Power connection					
		Screwed connections	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)	-----	-----
MDFQA	160	2 x M63 x 1.5 + 1 x M16 x 1.5				M12	15.5
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

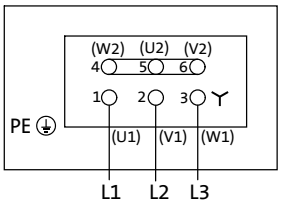
Motor type/size		Screwed connection
MCA/MQA	20	1 x M 16 x 1.5
	22	
	26	

6.4.1 Power connections

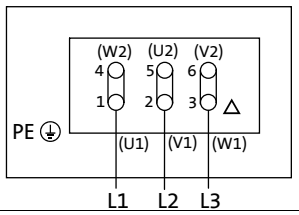
MCA; MCS, MQA 20...22, MD□KS, SDSGA, SDSGS		
Terminal	**Standard description**	**Meaning**
⏚	PE	PE conductor
U	U	Motor winding phase U
V	V	Motor winding phase V
W	W	Motor winding phase W
TP1	TP1	PTC thermistor
TP2	TP2	
TB1	TB1	Thermostat
TB2	TB2	Thermal NC contact

MCA 26, MQA 26, MDFQA 160		
Terminal	**Standard description**	**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

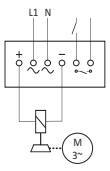


Delta connection



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

Terminal	Standard description	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)

Terminal	Standard description	Meaning
BD1	BD1	Holding brake +
BD2	BD2	Holding brake -

EN

6.4.4 Fan

1-phase		
Terminal	**Standard description**	**Meaning**
⏚	PE	PE conductor
U1	U1	Connection to L1 - mains
U2	U2	Connection to N - mains

3-phase		
Terminal	**Standard description**	**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		
Terminal	**Designation**	**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	+KTY -KTY	Thermal sensor KTY

1) Only for versions with electronic nameplate ENP.

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

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

1) Only for versions with electronic nameplate ENP.

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7 Safety engineering

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 kΩper 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 controller correctly parameterised for the motor? (Controller 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?

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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 may not be touched. According to the operating status, the surface temperature for motors can be up to 150°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: (📖 45).

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!

Stop!

Repair work or replacement of defective safety encoders must only be carried out by Lenze service personnel!

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 non-drive end), remove plug before commissioning. Seal bore holes with grease.

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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

After a service life of 10 years, an inspection of the metal elastomer torque plate is required for the encoders AS1024-8V-K and AM1024-8V-K. If no replacement is required, an inspection interval of max. 5 years has to be observed.

Stop!

Repair work or replacement of defective safety encoders must only be carried out by Lenze service personnel!

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 MCS, MCA, 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 dust protection filter, this filter must be cleaned or even replaced at regular intervals depending on the amount of dust (if necessary, daily).

For motors equipped with a dry filter, the dust must be shaken out completely. If the dust is wet, the filter mat must be replaced.

9.3.2 Fan with dust protection filter

Dry-type filters are used for the motors. Dry dust should be removed completely by tapping.

Note!

The dust filter is mounted on the ventilation aggregate. Depending on the amount of dust, the filter must be cleaned and replaced in regular intervals!

Soiled filters reduce the amount of cooling air significantly. This leads to a higher winding temperature, reduces its service life and may lead to damages.

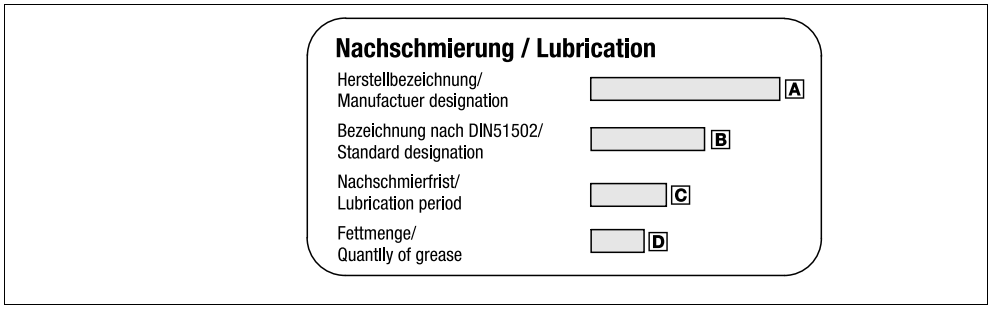
When replacing the filter you **must** take care that all covers and filters are tightly fixed so that there are no leaks for harmful dust!

In case of **wet** dust you must install new filter mats. The internal cleanness of the motor should be checked at the latest when you replace the filter for the first time.

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

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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 cable system manual must be observed.

Further information is provided in the system cables system manual at:
www.Lenze.de → Download →Technical documentation → Accessories (product range) → System manual (filter: Content type)

Connector	Connectable cross-section of the motor cable
EWS0001 / EWS1001	1.0 mm², 1.5 mm², 2.5 mm²
EWS0012 / EWS1012	2.5 mm², 4.0 mm²
EWS0013 / EWS1013	6.0 mm², 10.0 mm², 16.0 mm²

9.3.5 Power connection for plug-in connector at the cable end

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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					

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

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 036 - 071	M23	EWS0001	M01	EWS1001	M04
MDFKS 071					
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 Plug-in connector at the cable end

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

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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

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

9.4 Repair

- It is recommended to have all repairs performed by Lenze Service.
- Delivery of spare parts is available upon request.
- In case of version with safety encoder, observe chapter 9.2.2!

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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 single-phase operation!)	Tighten loose contact
	Fuse has blown (single-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 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 single-phase operation!)	Tighten loose contact
	Fuse has blown (single-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 controller 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	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, if necessary, correct
	Polarity of encoder cable reversed	Check encoder connection and, if necessary, correct
Motor rotates slowly in one direction and cannot be influenced by the controller	Polarity of motor cable and encoder cable reversed	Check the polarity and correct
Irregular running	Insufficient shielding of motor or resolver cable	Checking shielding and earth connection
	Drive controller gain too large	Adjust the gains of the controllers (see Drive controller operating instructions)
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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