SEW EURODRIVE

SL2 Synchronous Linear Motors

Edition 11/2008

16630815 / EN

Operating Instructions

SEW
EURODRIVE

Contents

1 General Information

1.1 How to use the operating instructions

The operating instructions are an integral part of the product and contain important information for operation and service. The operating instructions are written for all employees who assemble, install, startup, and service this product.

The operating instructions must be kept available in a legible condition. Ensure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the operating instructions completely and understood them. If you are unclear about any of the information in this documentation, or if you require further information, please contact SEW-EURODRIVE.

1.2 Structure of the safety notes

The safety notes in these operating instructions are designed as follows:

Pictogram	SIGNAL WORD!
	Type and source of danger. Possible consequence(s) if the safety notes are disregarded. • Measure(s) to prevent the hazard.

Pictogram	Signal word	Meaning	Consequences if disregarded
Example:  General hazard  Specific hazard, e.g. electric shock	DANGER	Imminent danger	Severe or fatal injuries
	WARNING	Possible dangerous situation	Severe or fatal injuries
	CAUTION	Possible dangerous situation	Minor injuries
	STOP	Possible damage to property	Damage to the drive system or its environment
	NOTE	Useful information or tip Simplifies handling of the drive system.	

1.3 Rights to claim under warranty

Adhering to the operating instructions is a prerequisite for fault-free operation and the fulfillment of any right to claim under warranty. Therefore, read the operating instructions before you start working with the unit!

Make sure that the operating instructions are available to persons responsible for the plant and its operation, as well as to person who work independently on the unit. You must also ensure that the documentation is legible.

1.4 Exclusion of liability

You must comply with the information contained in these operating instructions to ensure safe operation of the SL2 linear motor and to achieve the specified product characteristics and performance features. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of the operating instructions. In such cases, any liability for defects is excluded.

1.5 Copyright notice

2 Safety Notes

2.1 Preliminary information

	**NOTE** Due to the strong permanent magnets installed in the secondaries of the SL2 linear motors, the following safety regulations must be observed. **Also observe the supplementary safety notes in the individual sections of this manual.**

	**DANGER** **The strong magnetic fields and the associated high ferromagnetic attraction forces can be directly harmful to your health, for example for persons with cardiac pacemakers, or indirectly as a result of fast motor movements and high thrust forces.** Severe or fatal injuries. • Work must not be carried out by persons with cardiac pacemakers.

	**DANGER** **Danger caused by magnetic field** Even at a distance of 100 mm, the magnetic flux density of the secondaries present is < 5 mT (at 150 mm < 0.5 mT). Since the magnetic flux density in SL2 linear motors is generated exclusively by the magnetic fields of the secondaries, this value is independent from the operating status of the SL2 linear motor. Severe or fatal injuries. • Special caution needs to be the rule in close proximity (distances < 50 mm) to the secondaries due to the high attraction forces. Magnetic forces are often underestimated since they are not visible. • Magnetic attraction forces often arise abruptly in the immediate proximity range and can grow in excess of several 100 kg for medium-sized objects.

2.2 General information

DANGER

During operation, the linear motor can have movable parts.

Severe or fatal injuries.

- All work related to transportation, putting into storage, setup/mounting, connection, startup, maintenance and repair may only be carried out by qualified personnel observing
  - The relevant detailed operating instructions
  - The warning and safety signs on the motor
  - All other project planning documents, operating instructions and wiring diagrams related to the drive
  - The specific regulations and requirements for the system
  - The national/regional regulations governing safety and the prevention of accidents
- Never install damaged products
- Removing covers without authorization, improper use as well as incorrect installation or operation may result in severe injuries to persons or damage to property.
- Do not lead any metallic objects that are heavy (> 1 kg) or have a wide surface (> 1 dm²) to the secondary with unprotected hands to the secondary.
- Place at least two pointed wedges made of firm, non-magnetic material, such as brass or stainless steel (edge angle approx. 10° - 15°) and a hammer ready to free parts of the body that have been trapped. If necessary, e.g. if mounting space is limited, customized installation appliances should be used to facilitate and safeguard work.
- Do not bring watches and magnetizable data carriers (such as credit cards, disks, etc.) into close proximity <100 mm of SL2 linear motors.

Refer to the documentation for additional information.

WARNING

Touching the linear motors when they have not cooled down could result in burns. Linear motors can have a surface temperature of over 100 °C.

Danger of burns

- Never touch the linear motor during operation or in the cool down phase once it has been switched off.

2.3 Target group

SL2 linear motors represent a potential hazard for persons and property. Consequently, assembly, installation, startup and service work may only be performed by trained personnel who are aware of the potential hazards.

Staff must be appropriately qualified for the task in hand and be familiar with the assembly, installation, startup and operation of the product. They must read the operating instructions, in particular the safety notes section, carefully and ensure that they understand and comply with them.

2.4 Designated use

SL2 synchronous linear motors are motors for industrial and commercial systems. If motors are subject to loads other than those permitted, or if they are used areas of application other than industrial and commercial systems, you must first consult with SEW-EURODRIVE.

Do not operate the unit until you have ensured that the machine complies with the Low Voltage Directive 73/23/EEC and that the conformity of the end product has been determined to comply with the Machinery Directive 98/37/EC.

Technical data and information about permissible conditions can be found on the nameplate and in the documentation.

Operating environment

The following uses are prohibited unless the units are expressly designed for the purpose:

- Use in potentially explosive areas.
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, radiation. Please contact SEW-EURODRIVE if you have any questions on the environmental conditions.
- Use in non-stationary applications that are subject to mechanical vibration and impact loads in excess of the requirement of EN 50178.

Safety functions

SL2 linear motors are not allowed to perform any safety functions unless they are subordinate to other safety systems.

Use higher-level safety systems to ensure protection of equipment and personnel.

2.5 Integral part of the product

The operating instructions are an integral part of the SL2 linear motors and contain important information for operation and service. The operating instructions are written for all assembly, installation, startup and service staff who are involved in the installation and maintenance of SL2 synchronous linear motors.

2.6 Behavior and immediate measures in case of accidents

- If the machine is connected to the power supply system, press the EMERGENCY OFF button immediately.
- Request first aid immediately.
- You need the tools mentioned previously to free body parts jammed in between two secondaries or a secondary and a ferromagnetic component (e.g. steel plate, steel carrier, machine bed, tool). Separate the components at the separation gap using the pointed wedge.

⚠ WARNING

Danger caused by magnetic field

Severe or fatal injuries.

- The magnetic forces are always present regardless of the operating status of the system.

2.7 Waste disposal

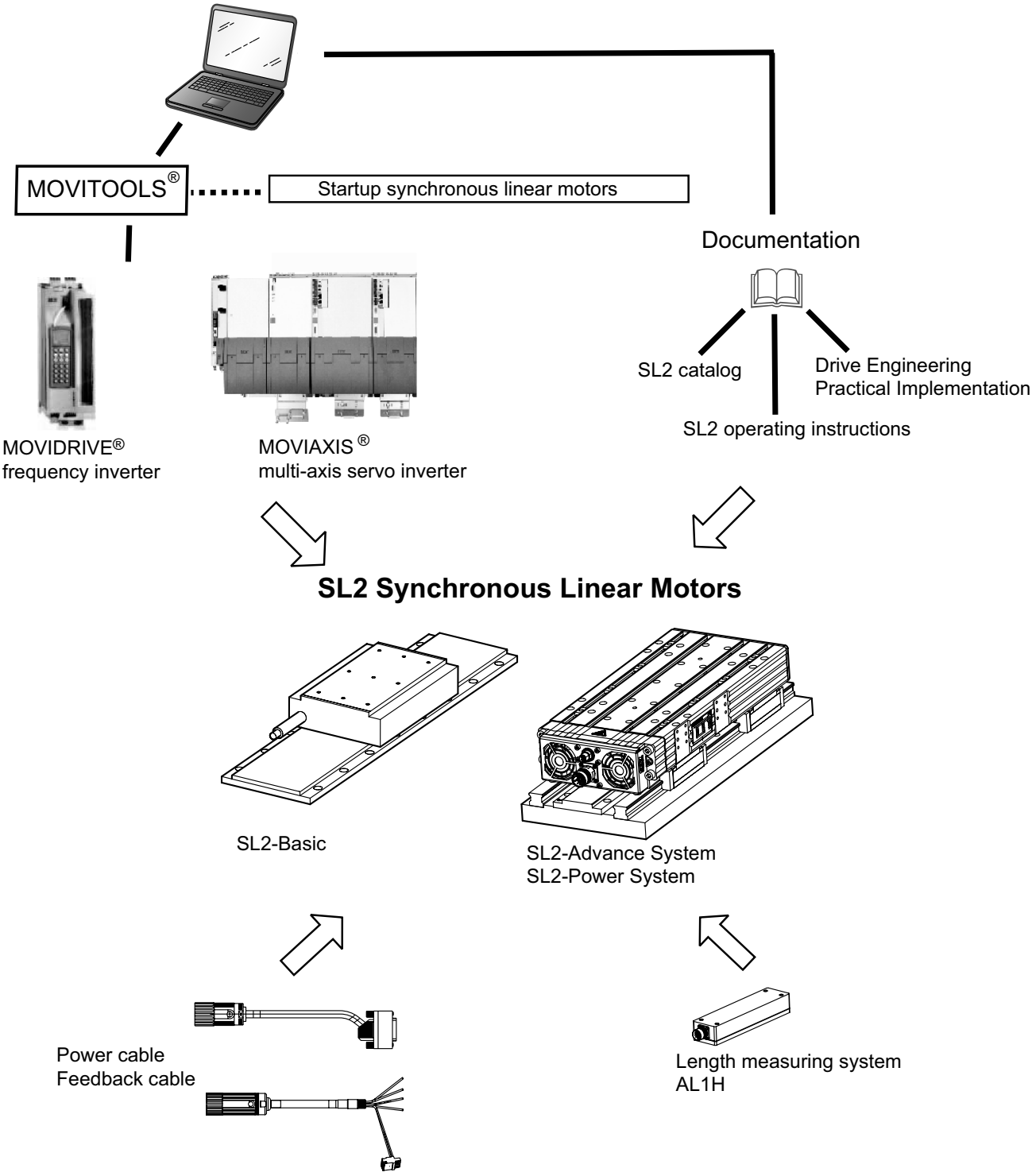
This product consists of:

- Iron
- Aluminum
- Copper
- Plastics
- Electronic components

Dispose of all components in accordance with applicable regulations.

3 Product Description and Overview of Types

3.1 System environment



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3.2 Documentation

Internet

You will find the current documentation on SL2 synchronous linear motors in many languages on the SEW-EURODRIVE homepage (http://www.sew-eurodrive.com). Here, you can download the files directly or order a printed copy from SEW-EURODRIVE.

Manuals

- MOVIDRIVE® B
- MOVIAXIS® project planning manual

CAD data

CAD data is available from SEW-EURODRIVE for all sizes on request.

- 2D-DXF, DWG and TIF
- 3D-IGES, STEP

Documentation

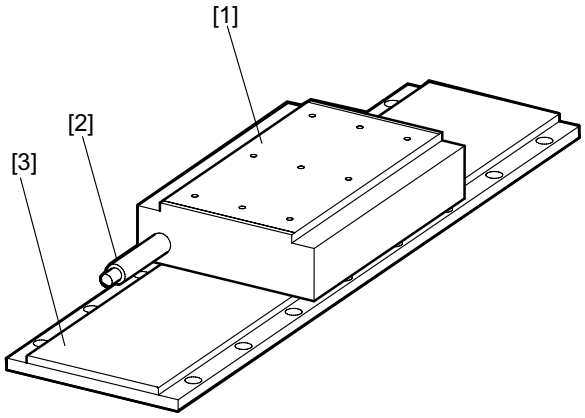
- "SL2 Synchronous Linear Motors" catalog

3.3 SL2 product designs

SEW-EURODRIVE offers **three** product designs for SL2 linear motors:

SL2-Basic	Motor package and secondaries
SL2-Advance System	Motor package integrated in cooling unit and secondaries. Prepared for installation of linear guides and the linear encoder.
SL2-Power System	Motor package integrated in motor cooling unit with forced cooling fan and secondaries. Prepared for installation of linear guides and the linear encoder.

3.3.1 SL2-Basic



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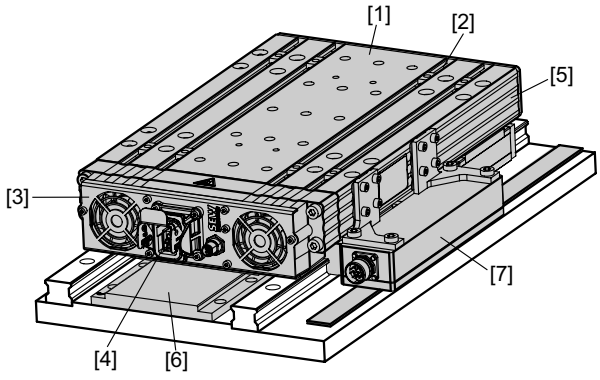
[1] Primary
[2] Electrical connection in form of a cable extension
[3] Secondaries with permanent magnets

3.3.2 SL2-Advance System / SL2-Power System



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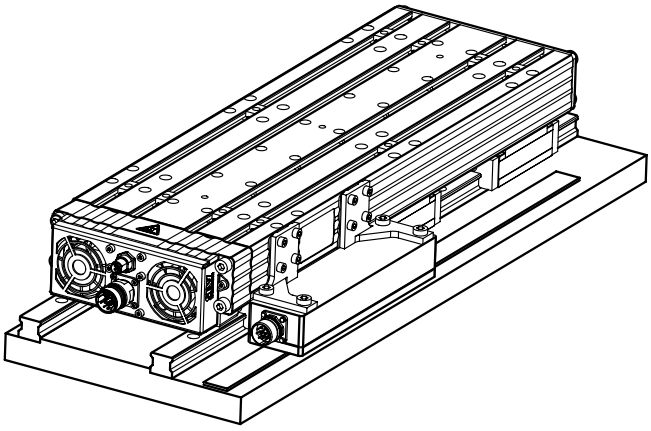
[1] Optional motor cooling unit
[2] Prepared grooves as retaining system for customer setup
[3] Forced cooling fan of optional motor cooling unit
[4] Electrical plug connector
[5] Primary (not visible) installed in motor cooling unit
[6] Secondary
[7] Linear measuring system

3.4 System components for SL2-Advance System and SL2-Power System

3.4.1 System description

The linear motor is installed into a motor cooling unit at the factory for product groups SL2-Advance System and SL2-Power System.



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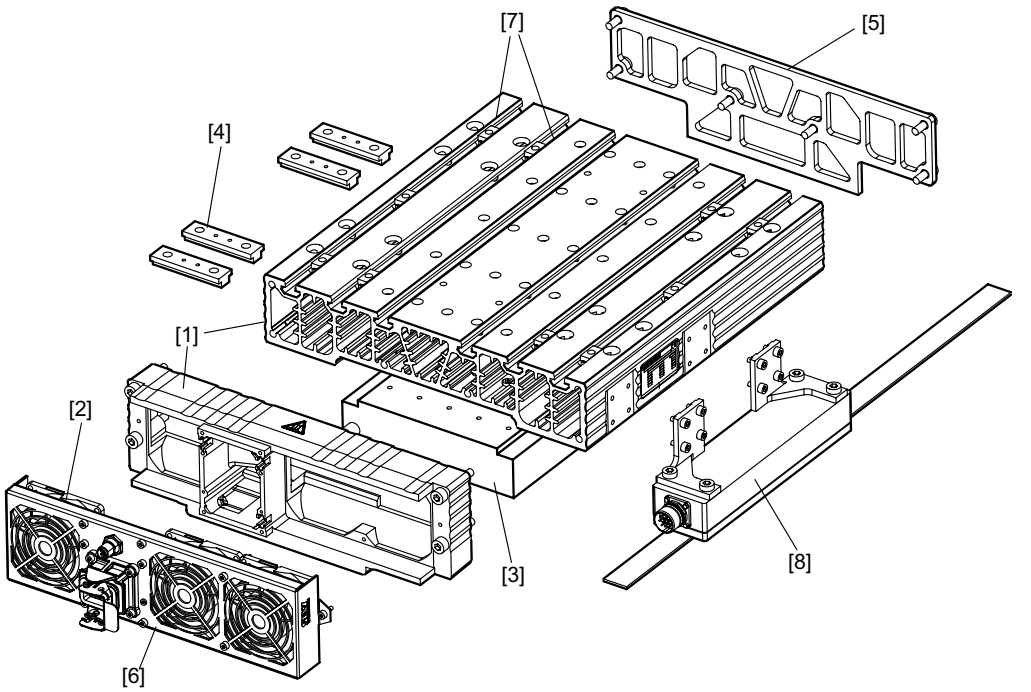
For motor sizes

- SL2-P050,
- SL2-P100,
- SL2-P150,

the motor cooling unit is available for all lengths (except for SL2-P150VS) as system components.

3.4.2 Part drawing of the SL2-Advance System and SL2-Power System



[1] Motor cooling unit
[2] Forced cooling fan (in SL2-Power System only)
[3] Primary
[4] Integrated floating bearing for temperature compensation
[5] End plate
[6] Front panel with power plug and fan guard
[7] Slots for installation of components by customer (T-slot nuts supplied)
[8] Linear measuring system

3.4.3 Design of the subsystems

The motor is installed into the motor cooling unit by SEW-EURODRIVE and connected to a standardized power plug. The 24 V power supply for the fans is provided by a separate plug when using forced cooling fans.

3.4.4 Fields of application for the SL2-Advance System

The SL2-Advance System can basically be used in all fields of application for the SL2 linear motor. There are no limitations.

⚠ WARNING

When using in hoists

The motor system is not equipped with its own holding brake. With incremental encoder, commutation search is required after each reset.

Severe or fatal injuries.

- SEW-EURODRIVE strongly recommends that you use an absolute measuring system when using the system as hoist drive. You find information in section 5 of the "SL2 Synchronous Linear Motors" catalog.

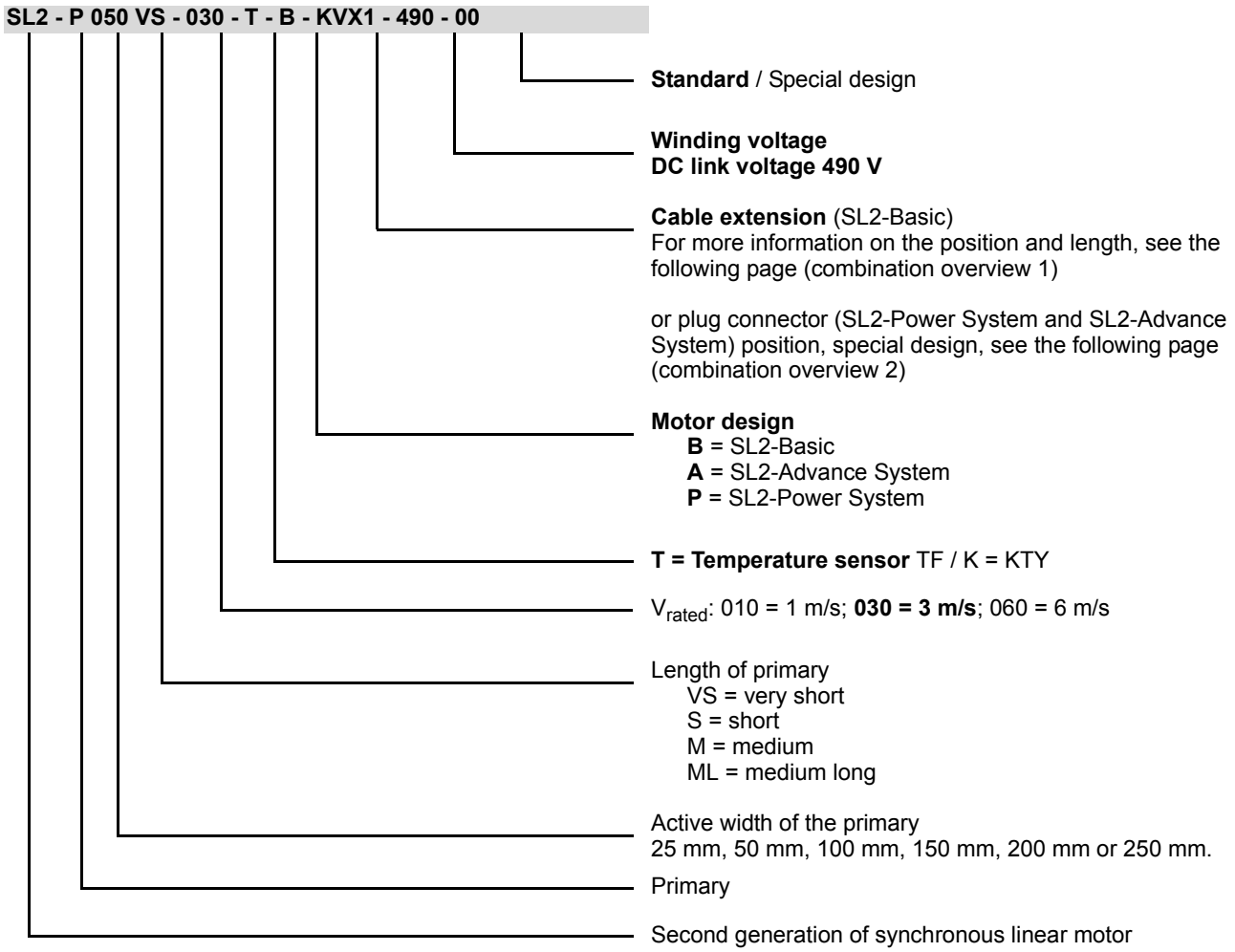
3.4.5 Fields of application for the SL2-Power System

The use of the motor cooling unit with forced cooling fans is limited to enclosure IP54.

3.5 Type code

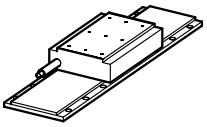
The following diagram shows the type code structure.

3.5.1 Primary



	NOTE
	The standard design appears in bold.

3.5.2 1. Combination overview for SL2-Basic/cable extension



SL2-P...-...-K V X 1-...

Length of cable extension in [m]
1 m = standard
4 m = optional
0 = 0.5 m cable length only for connection version[1)]

Position of cable outlet
X = standard

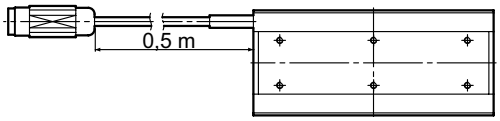
Electrical connection
V = connected

K = Cable extension
A = Connector

1) Connector version AVX= refers to a 0.5 m cable extension with prefabricated connector

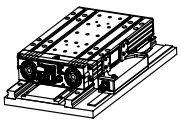
NOTE

- The SL2-Basic version with $I_{rated} \leq 26$ A is available with Intercontec round connector → → type AVX0 .



- SL2 primaries with a cable length of 2 m are no longer available.

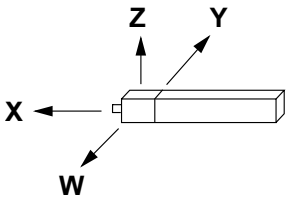
3.5.3 2. Combination overview for SL2-Advance and SL2-Power System / connector position



SL2-P...-...-S S X S-...

Special design
S = Standard

Connector position
X = Standard (Y, Z, W)



The following combinations of motor + connector position are not available:
- SL2-050 Power System with connector position Z[1)]
- SL2-100 Power System with connector position W[1)]
- SL2-150 Power System with connector position Z[1)]

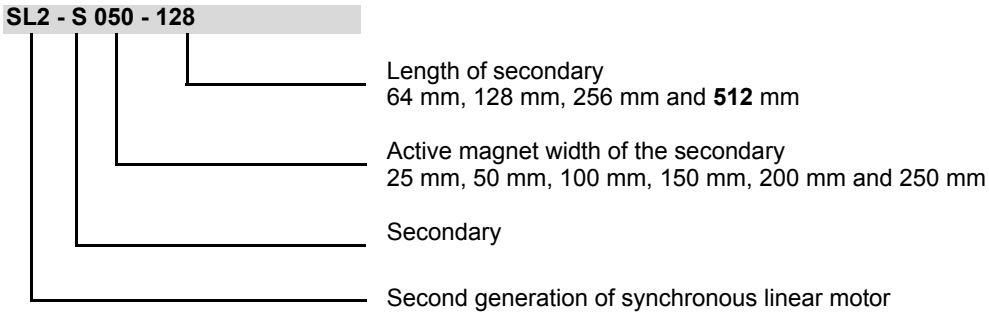
Mechanical design
S = Standard

Connector

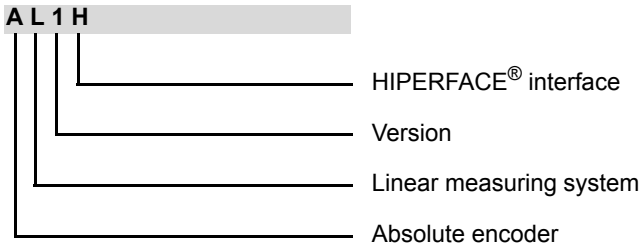
1) Collision with M12 24 V connector

	NOTE
	The standard design appears in bold.

3.5.4 Secondary



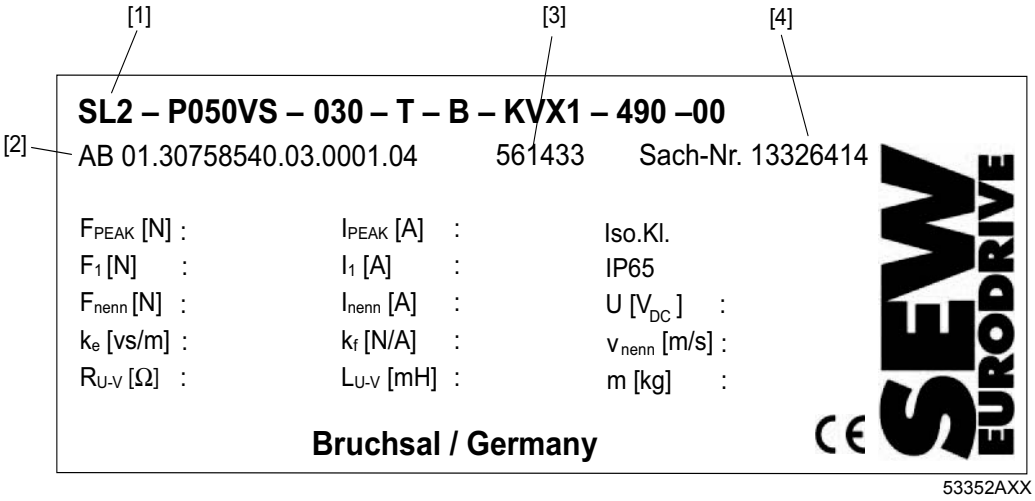
3.5.5 Linear measuring system



3.6 Nameplate

Labels are attached to the primaries and secondaries that show the technical data as follows:

3.6.1 Nameplate SL2-Basic



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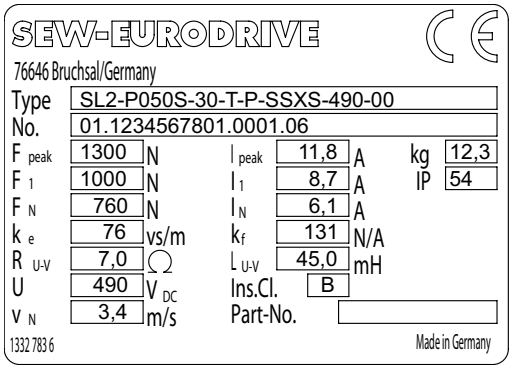
[1]	=	Type code
[2]	=	Customer order number
[3]	=	Production number
[4]	=	Part number
F_{PeaK}	=	Peak force
F_1	=	Maximum force available up to v_1
F_{nenn}	=	Permanent force
k_e	=	Voltage constant
R_{U-V}	=	Winding resistance[1)]
I_{PEAK}	=	Maximum current
I_1	=	Current at F_1
I_{nenn}	=	Rated current
k_f	=	Force factor
L_{U-V}	=	Inductance[1)]
Iso.KL.	=	Insulating material class
IP	=	Degree of protection
U	=	Voltage
v_{nenn}	=	Velocity up to which the rated force is available
m	=	Mass

1) Half the conductor value (UV value) is used for startup.

3.6.2 Nameplate SL2-Advance System SL2-Power System



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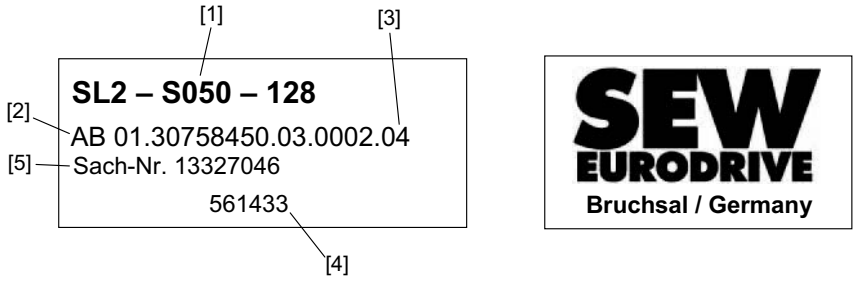
Type	=	Type code
No.	=	Customer order number
F_{PeaK}	=	Peak force
F_1	=	Maximum force available up to v_1
F_N	=	Permanent force
k_e	=	Voltage constant
R_{U-V}	=	Winding resistance[1)]
U	=	Voltage
v_N	=	Velocity up to which the rated force is available
I_{PEAK}	=	Maximum current
I_1	=	Current at F_1
I_N	=	Rated current
k_f	=	Force factor
L_{U-V}	=	Inductance[1)]
Ins.Cl.	=	Insulating material class
Part no.	=	Part number
kg	=	Weight
IP	=	Degree of protection

1) Half the conductor value (UV value) is used for startup.

3.6.3 Nameplate for secondaries



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[1] = Type code
[2] = Customer order number
[3] = Date of production
[4] = Production number
[5] = Part number

3.7 Scope of delivery for system components

The scope of delivery for SL2 linear motors comprises:

- Primaries
- Secondaries with permanent magnets
- SL2-Advance System
  - Primary installed in motor cooling unit
  - Electrical plug connector
  - T-slot nuts for mounting of customer loads are included
- SL2-Power System
  - Primary installed in motor cooling unit
  - Electrical plug connector
  - Forced cooling fan completely assembled and electrically wired to M12 plug connector
  - T-slot nuts for mounting of customer loads are included
- Prefabricated power and feedback cables
- Control and regulation systems such as MOVIDRIVE®
- Linear measuring system
- Encoder mount-on components

Not included in the scope of delivery:

- Linear guide systems
- Linear measurement systems (except for AL1H)
- Cable carriers
- Brake systems
- Buffers / shock absorbers

4 Transportation and Storage

4.1 Notes

	**STOP**
	Improper transport may result in damages to the linear motor. Potential damage to property! • Strictly observe the notes in this chapter.

- Use suitable, sufficiently rated handling equipment if necessary.
- Inspect the shipment immediately upon receipt for any damage that may have occurred during transportation. Inform the shipping company immediately in the event of damage. It may be necessary to preclude startup.

  Use suitable means of transport with adequate space if necessary. Remove securing devices used for transportation prior to startup.
- Mark the storage locations of secondaries ("Danger! Strong magnetic fields", pictograms).
- Never store secondaries unpacked; use non-magnetic packaging material with a thickness of at least 2 cm on the magnetic side.
- Observe the warning instructions on the packaging.
- Keep storage area dry.
- Protect storage sites from heat.
- For transportation of machines or components with primaries or secondaries already installed on travel axis/axes: Lock the axis/axes to prevent accidental movement (due to missing self-locking mechanism).

4.2 Transport

4.2.1 SL2-Basic primaries

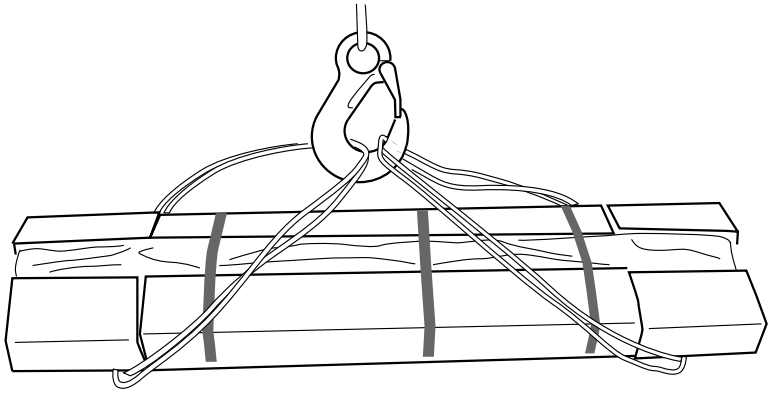
Primaries of the SL2-Basic

- SL2-P100M/ML
- SL2-P150S/M/ML
- SL2-P200S/M/ML
- SL2-P250VS/S/M/ML

with a net weight of more than 18 kg are equipped with the following transportation aids:

1. Packaged primary

STOP	**STOP**
	Improper transport may result in damages to the packaged primary Potential damage to property! • Transport the packaged primary with the attached crane slings only. • The weight of the primary is indicated on the nameplate or dimension sheet.



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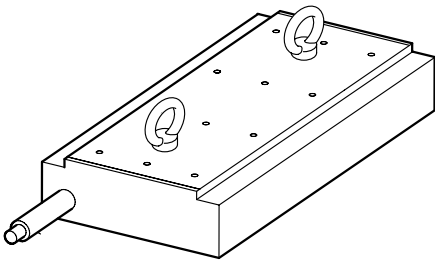
2. Unpacked primary

STOP	**STOP**
	Improper transport may result in damages to the unpackaged primary. Potential damage to property! • The primary is equipped with two M6 threads for transportation with lifting eyebolts (parts not included in scope of delivery) for further transportation or handling.



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4.2.2 SL2-Advance System / SL2 -Power System primaries

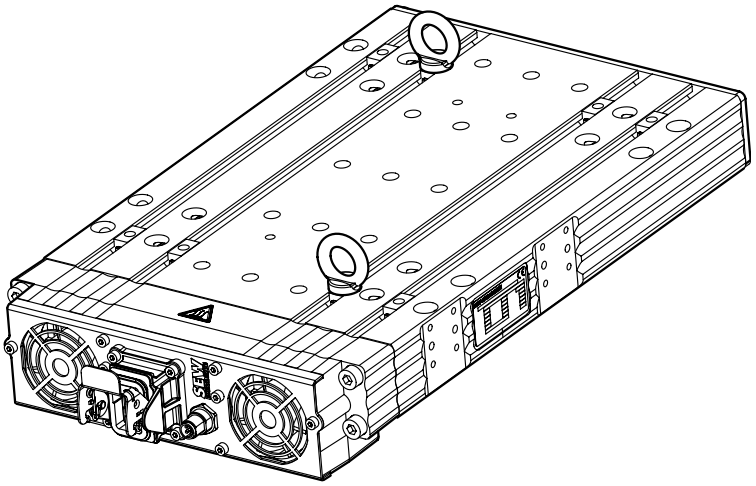
The primaries of the SL2-Advance Systems / SL2-Power Systems

- SL2-P050M/ML
- SL2-P100S/M/ML
- SL2-P150S/M/ML

with a net weight of more than 18 kg can be removed from the box using a hoist.

1. Unpacked primary

STOP	**STOP**
	Improper transport may result in damages to the primary. Potential damage to property! • The T-slot nuts on the motor cooling unit are equipped with two M8 lifting eyebolts (parts not included in scope of delivery) for further transportation or handling.



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4.3 Packaging

STOP	**STOP** Protective cover must not be damaged since it ensures corrosion protection of metal parts.

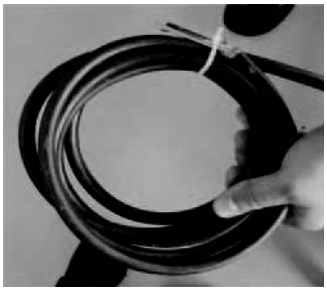
Primaries

Primaries of size:

- SL2-P025
- SL2-P050
- SL2-P100
- SL2-P150

are packaged as follows:

1. Cable extension



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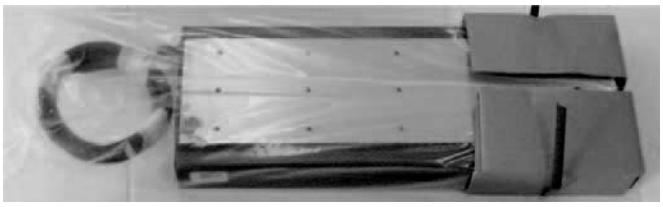
2. Plastic bag/corrosion protection



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	NOTE A bag containing the following information is attached to the motor: • Safety notes • Wiring diagram **Comply with this information.**

3. Completely packaged in carton with nameplate

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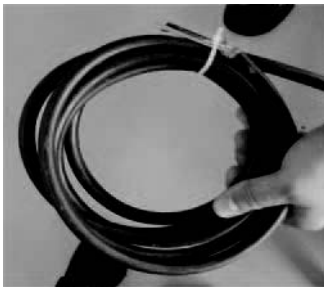
Primaries of size:

- SL2-P150
- SL2-P200
- SL2-P250

are packaged as follows:

1. Cable extension



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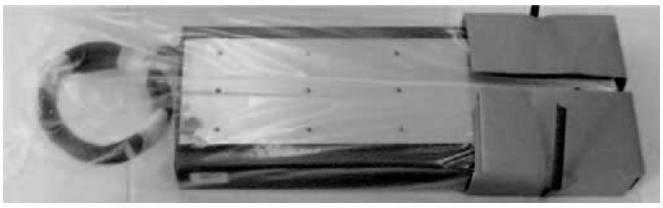
2. Plastic bag/corrosion protection



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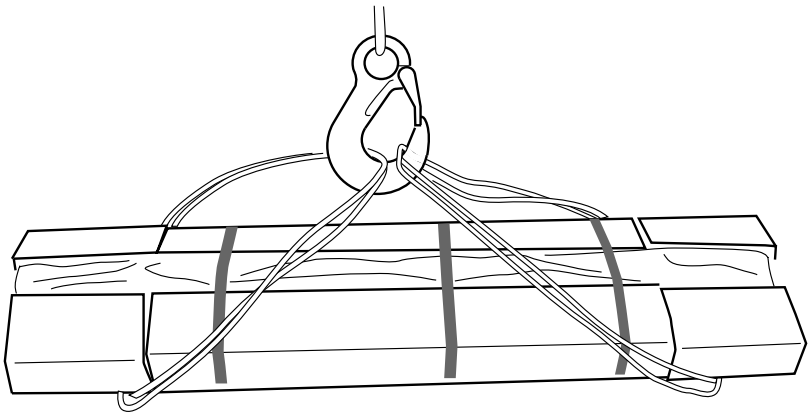
3. Completely packaged in carton with plywood support or transport slings



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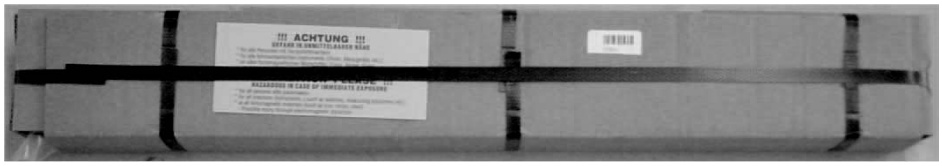
Secondary for all motor types

STOP	**STOP**
	Protective cover must not be damaged since it ensures corrosion protection of metal parts.

1. Box with packaging straps



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2. Contents secondary box:
   - Secondary packed in protective cover
   - Safety notes and warning labels enclosed loose inside box
   - Touch guard magnetic surface (wooden board)

4.4 Corrosion protection and storage conditions

The motor parts are protected against corrosion for five years in closed original packaging.

Observe the following storage conditions for SL2 linear motors:

- Store the SL2 linear motors inside.
- Keep storage area clean and dry.
- Maintain a storage temperature between –5 °C and +70 °C
- Relative humidity not to exceed 95 %
- Original packaging must be free from damages

Stored SL2 linear motors must be equipped with the following warning labels:

Warning	Magnetic
	

4.5 Coating

SL2-Basic

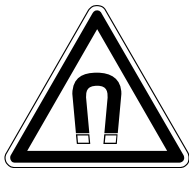
The motor parts are coated black matte (EPOXY two-component single coat paint) as standard.

SL2-Advance System / SL2 -Power System

With the exception of the front area, all motor parts are anodized with a black coating. The front side of the motor is coated with black matte.

4.6 Return delivery to SEW-EURODRIVE

Return primary and secondary components in original packaging only.



⚠ WARNING

Danger caused by magnetic field

Severe or fatal injuries.

- Cover the magnetic side of the secondaries with a wooden board (thickness 2 cm) over the entire surface and connect. Special caution needs to be the rule in close proximity (distances < 50 mm) to the secondaries due to the high attraction forces. Magnetic forces are often underestimated since they are not visible.
- Magnetic attraction forces often arise abruptly in the immediate proximity range.

5 Mechanical Installation

5.1 Notes

DANGER

Danger caused by magnetic field

Severe or fatal injuries.

- Never place secondaries on metal.
- Never place a primary directly on a secondary.
- Hold the tools firmly (with both hands). Slowly guide the tools to the secondary.
- Wear work gloves during installation.
- Do not remove the packaging of the secondary until directly before it is installed.
- Carry out installation work in pairs only.
- Cover already installed secondaries with at least 2 cm of non-magnetic material (e.g. wood) during installation.
- Use customized installation appliances to facilitate and safeguard work, if necessary (e.g. if mounting space is limited).
- Make sure that the primary is grounded according to regulations with the PE grounding bar in the control cabinet as a reference potential.
- Attach the enclosed warning sign in a prominent position or in the vicinity of the secondaries installed.

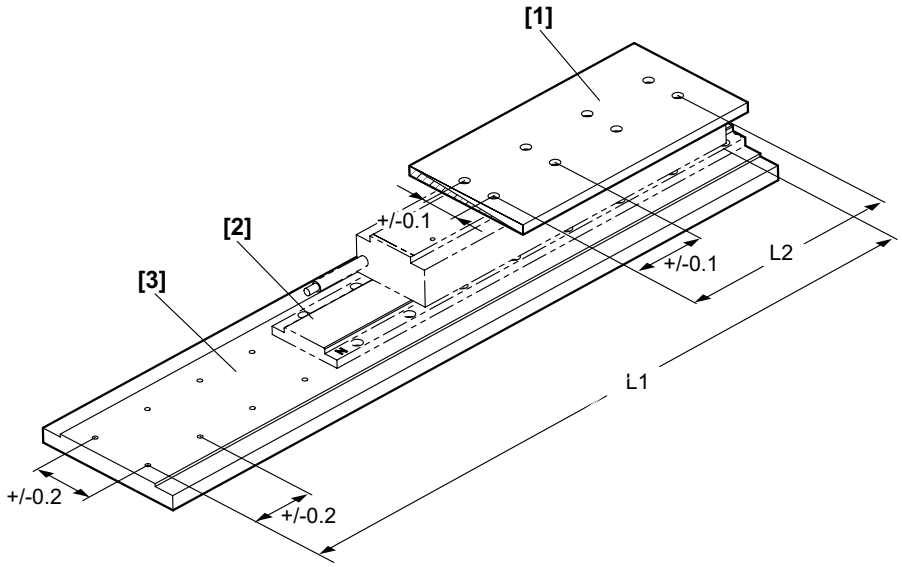
DANGER

Risk of injury due to electric shock.

Severe or fatal injuries.

- Make sure that the primary is grounded according to regulations with the PE grounding bar in the control cabinet as a reference potential.

5.2 Installation tolerances



[1] Installation of primary

with reference to the largest primary, max. deflection length / width 0.1 mm

[2] Secondary

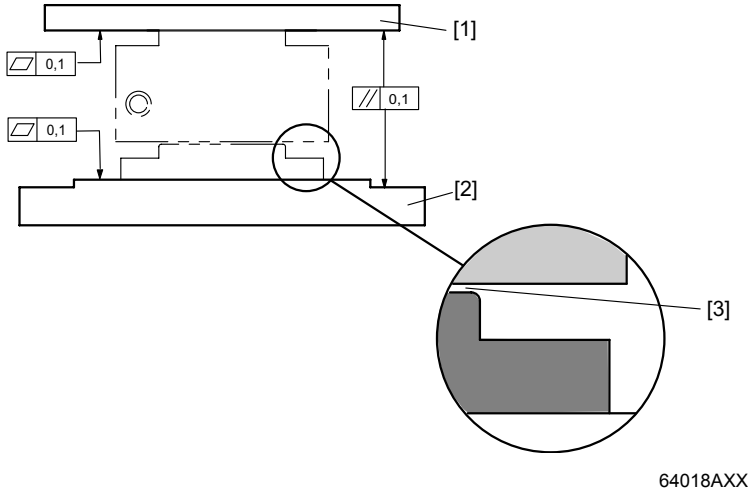
with reference to 512 mm length, max. deflection 0.1 mm

[3] Installation of secondary

[L1] ± 0.3 mm with reference to total length

[L2] ± 0.2 mm with reference to total length

	NOTE
	For information on the air gap, refer to the "Derating" section (see chapter 10.4). **The tolerance of the air gap is ± 0.05 mm.**



[1] Installation of primary (mounting plate)
[2] Installation of secondary (basic body, e. g machine base)
[3] Air gap

Shape and position tolerances in reference to 1000 mm length

The shape and position tolerances must be observed for the function of the SL2 linear motor. Depending on the used measuring system, it may be necessary to have a greater accuracy of the mounted parts for safe operation. These accuracies are sufficient for the functionality of the AL1H encoder system.

These shape and position tolerances will have to be observed in operating mode at steady-state temperature of the SL2 linear motor. Also take into consideration the influence of the loads applied by the customer.

5.3 Required tools

- Standard tools
- Operation with conductor end sleeves: Crimping tool and conductor end sleeves (without insulation shroud, DIN 46228, Part 1, Material E-Cu)
- Crimping tool for plug connectors

5.4 Installing SL2-Basic

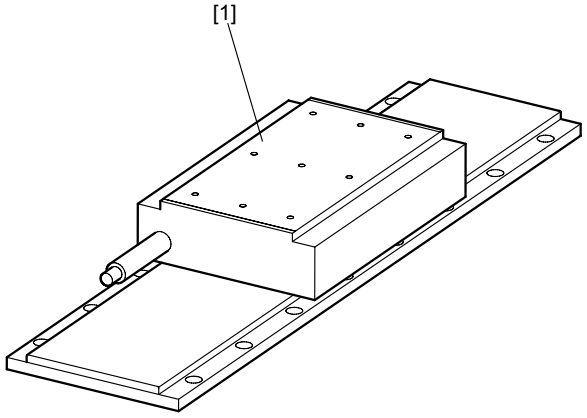
5.4.1 Before you start

Check that

- The entries on the nameplate of the drive and/or the output voltage of the inverter match the voltage supply system,
- The drive is undamaged (no damage caused by transportation or storage)
- Ensure that the following requirements have been met:
  - Ambient temperature between +5 °C and +40 °C[1)]
  - No harmful oils, acids, gases, vapors, radiation etc. in the vicinity
  - Installation altitude max. 1000 m above sea level[1)]

	NOTE
	Start with the installation of the primary. Install the secondaries once all other installation work has been completed, immediately prior to startup of the drive. Observe the safety notes about handling the secondaries (see chapter 2).

5.4.2 Preparing the SL2-Basic primary for installation



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Mounting surfaces [1]:

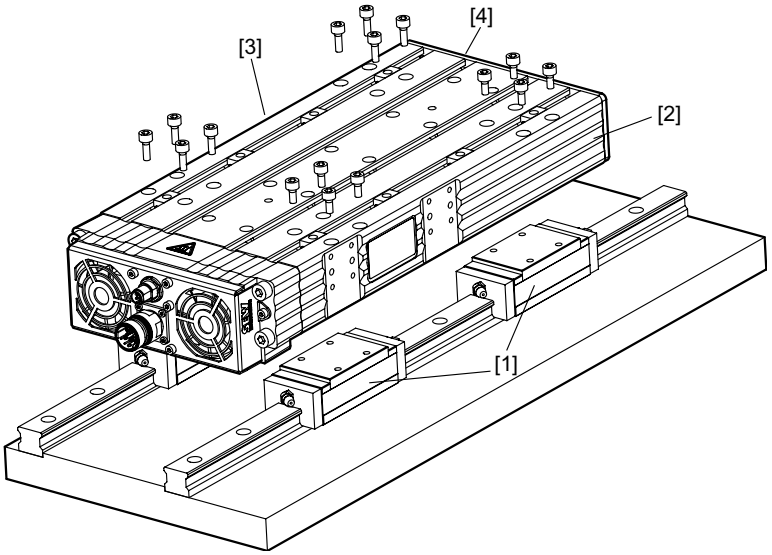
The mouting surfaces of the primary were treated with an anti-corrosion agent at the factory. Do not remove this protection layer. Before installing the surface, wipe the surface with a lint free cloth to remove any dust, dirt, etc. clinging to the surface.

Retaining screws:

Use **all** M5 tapped holes in the mouting surface for retaining purposes. Use screws of size M5, strength class 8.8 or higher. The minimum depth of engagement is 8 mm. The tightening torque is always 6 Nm and may not be exceeded, even with screws of a higher strength class.

1) Observe the derating data in chapter 10.4 of the catalog.

5.5 Installing the SL2-Advance System and SL2-Power System



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[1] Guide carriage
[2] Fixed bearing end
[3] Floating bearing end
[4] End plate

The SL2-Advance System and SL2-Power System are screwed onto the guide carriage [1]. Bores for cylinder screws to DIN EN ISO 4762 (previously DIN 912) are provided for this purpose on the primary housing (screws are not included in the scope of delivery).

NOTE

Guide systems available for SL2-Advance System and SL2-Power System are listed in chapter 10.10.

This screw connection essentially determines the mechanical load capacity of the primary. Use screws of strength class 8.8.

Deviating loads of the screw connection must be determined in accordance with the standard calculation procedures used in mechanical engineering (VDI 2230). The customer loads and design of the guide system are included in the calculation.

The calculation basis must not exceed a maximum interface pressure under the screw head of 230 N/mm². The friction value μ_{head} under the screw head is 0.15.

Type		Size of screw	Tightening torque [Nm]	Number of screws			
				VS	S	M	ML
SL2-050	Fixed bearing end [2]	M6x12	10	8	8	12	12
	Floating bearing end [3]	M6x16	10	8	8	12	12
SL2-100	Fixed bearing end [2]	M8x16	20	8	8	12	12
	Floating bearing end [3]	M8x20	20	8	8	12	12
SL2-150	Fixed bearing end [2]	M8x16	20		8	8	12
	Floating bearing end [3]	M8x20	20		8	8	12

5.5.1 Prerequisite for assembly

First assemble the guide system including the guide carriage according to the manufacturer's specifications. Note in particular the requirements regarding the accuracy of the mounting surfaces (→ chapter. 5.2 "Installation tolerances")

5.5.2 Starting the installation

⚠ WARNING

Improper installation may result in hazardous situations.

Severe or fatal injuries!

- Install the secondaries once all other installation work has been completed, immediately prior to startup of the drive. Observe the safety notes about handling the secondaries in the individual chapters.

5.5.3 Installing the primary

1. Wipe the surface of the primary lightly with a lint free cloth to remove any dust, dirt, etc.
2. Align the guide carriages [1] on the guide rails (see figure on the previous page) so that the primary can be installed.
3. Place the primary onto the guide carriage [1]. Use suitable hoists for heavy parts (see chapter 2.1 Transportation).
4. Attach all the screws to connect the primary with the guide carriages [1]. Do not grease or oil the screws.

NOTE

Use a magnetic hexagon socket tool to attach the screws. They prevent screws from falling out in unfavorable mounting positions. If screws fall inside the primary housing, it is essential that you remove them. The end plate [4] can be removed for easier access (see illustration on the previous page).

5. First tighten the screws at the fixed bearing end [2] in accordance with the tightening torque (see table on the previous page).
6. Then tighten the screws at the floating bearing end [3].

5.6 Installing the SL2 secondaries

5.6.1 Perparing the secondaries for installation

⚠ WARNING

Danger caused by magnetic field

Severe or fatal injuries!

- Do not unpack parts until you are ready for installation.

Preparing installation of secondaries size 050-200

First prepare the M6 retaining threads in the machine base to install the secondaries.

Preparing installation of secondaries size 250

Parallel pins are additionally needed to install size SL2-S 250. Pin holes with a bore diameter of 5 H7 mm must be provided in the machine base. Observe a distance tolerance of ± 0.02 mm for the bores.

Use cylinder pins according to ISO 2338-5m6 for securing by pins.

For blind holes we recommend to use parallel pins with internal thread according to DIN 7979-5m6 to facilitate removing the pins in case of disassembly.

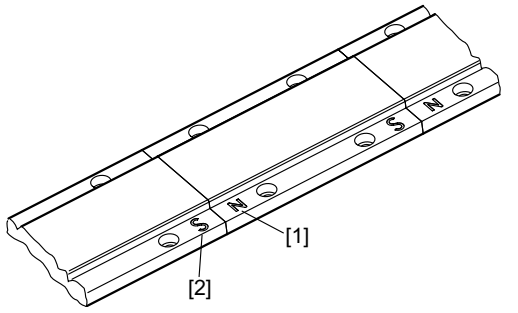
STOP

The pins have to be fitted securely in the bore to prevent them from coming loose during linear motor operation. Please check for proper pin connection.

The mouting surfaces of the secondary were treated with an anti-corrosion agent at the factory. Do not remove this protection layer. Before installing the surface, wipe the surface with a lint free cloth to remove any dust, dirt, etc. clinging to the surface.

5.6.2 Installing the secondaries

Install the first part at one end of the travel section and work your way down in one direction. The orientation of the first part can be random. The adjoining part will have the same orientation. The north [1] (N) and south [2] (S) poles are identified on the secondaries (see following illustration). You can combine secondaries of different lengths.



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[1] North pole
[2] South pole

Use **all** bores of the secondary for retaining purposes. Use screws of size M6, strength class 8.8 or higher. The engagement depth and tightening torque (generally 10 Nm) depend on the customer support structure.

Move primary over secondaries by hand prior to startup of drive to check for unhindered operation.

Use non-magnetic testing devices, such as feeler gauges made of stainless steel, aluminum, brass or copper sheets if you are planning to check the visible air gap.

DANGER

Risk of injury due to electric shock.

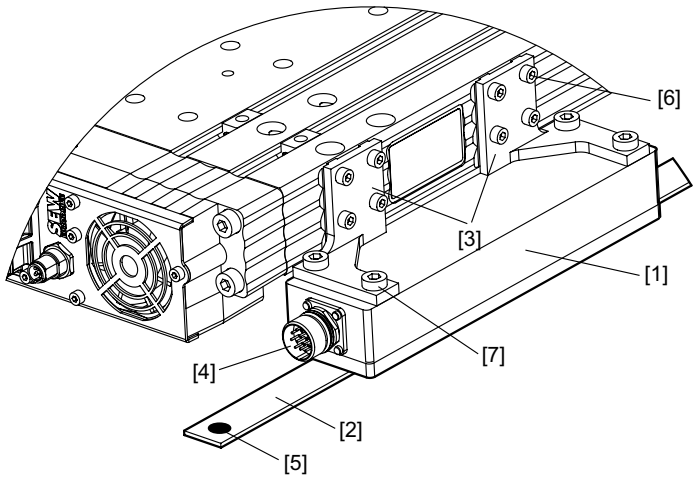
Induced voltages of up to 500 V can be generated by movement of the primary (generator principle) even if the motor is not connected.

Severe or fatal injuries!

- Only remove the protection cap on the power plug of the primary immediately before connecting the power plug to the power supply.

5.7 Installing the AL1H measuring system

STOP	**STOP**
	• It is essential that you read the manufacturer's operating instructions provided with the encoder system. • Note for installation of the measuring tape [2] that the end identified by a dot [5] is stuck-on in the direction of the connecting plug.



[1] Linear sensor
[2] Measuring tape
[3] Encoder mount-on components
[4] Connection of the linear sensor
[5] Identification of the installation direction of the measuring tape
[6] Screw for primary housing/mount-on components
[7] Screw for linear sensor/mount-on components

Use the M8x20 non-magnetic stainless steel screws provided to connect the linear sensor/mount-on components [7] (tightening torque 16 Nm).

Tighten the M5x12 screws lightly to secure the primary housing/mount-on components [6] (maximum tightening torque 5 Nm).

5.8 Mechanical load capacity SL2-Advance and SL2-Power

STOP	**STOP**
	Check the following points in each application.

The permitted mechanical load capacity of the entire linear drive system depends on the size, position and type of the forces caused by the loads mounted by customers and the permitted loads from:

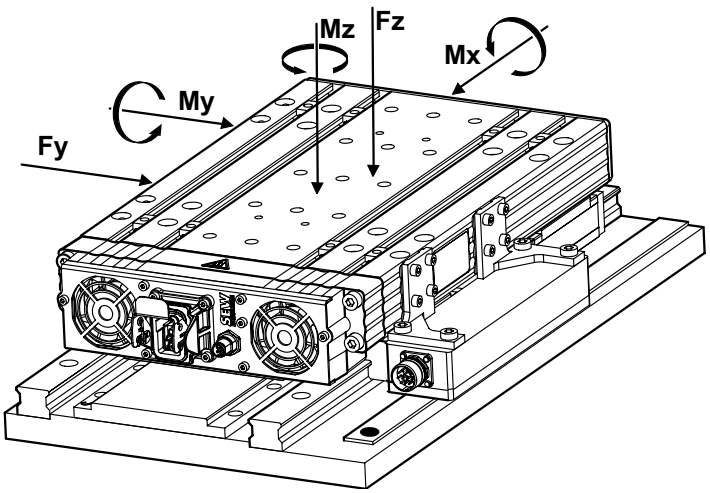
- Guide system
- Retaining screws for guide carriages on the cooling unit
- Cooling unit housing
- Loads mounted via slots/T-slot nuts

However, to help with the selection, the permitted loads have been reduced to simple applications and clear calculation models. Depending on the individual application, greater loads may occur. Contact SEW-EURODRIVE for more information.

5.8.1 Guide systems

The detailed project planning process for the linear guide system must be performed together with the manufacturer of the guide system and is not the responsibility of SEW-EURODRIVE.

5.8.2 Housing of the motor cooling unit



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[Mx] = Permitted load torque on the X axis
[My] = Permitted load torque on the Y axis
[Mz] = Permitted load torque on the Z axis
[Fy] = Permitted force in Y direction
[Fz] = Permitted force in Z direction

The table (see below) shows the permitted static loads on the entire primary. The magnetic attraction forces between the primary and secondary are already taken into account.

The values in the following table apply to both directions for the forces and torque ratings.

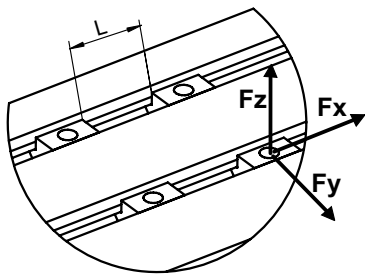
STOP

The housing is only allowed to be subjected to one load value. If several forces/torques act on the housing at the same time, SEW-EURODRIVE can calculate the exact load bearing capacity of the motor cooling unit.

Motor type	Mx [Nm]	Fy [N]	My [Nm]	Fz [N]	Mz [Nm]
SL2-050VS	1500	1600	2500	12000	150
SL2-050S	1700	1800	4500	14000	220
SL2-050M	2500	2800	10000	20000	550
SL2-050ML	2800	3000	16000	20000	800
SL2-100VS	3400	3100	3200	12000	200
SL2-100S	3800	3400	8000	14000	400
SL2-100M	5500	5300	20000	20000	1000
SL2-100ML	5800	5700	32000	20000	1500
SL2-150S	5300	4000	10000	19000	400
SL2-150M	6000	4600	20000	26000	700
SL2-150ML	8500	6500	45000	32000	1800

5.9 Installing customer components on primary

T-slot nuts are inserted in the primary housing at the factory for the installation of customer components. If required, the distribution of the T-slot nuts within the primary housing can be adapted. To do so, unscrew the end plate [4] (see figure in chapter 5.5), insert the T-slot nuts in the required slot using a spring and screw the end panel plate on.



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The design of the slot system is based on the modular profile system from Bosch/Rexroth so that components from this modular system or similar modular systems can be used.

Permitted static load for the slot:

In direction	Fz	12000 N	(plastic deformation starts)
In direction	Fx	1000 N	
In direction	Fy	1000 N	

NOTE

Rule of thumb: 1000 N (≈ 100 kg) per T-slot nut in every direction

As long as the minimum distance [L] between the T-slot nuts is observed, the T-slot nuts can be distributed as required within the customer mounting surface.

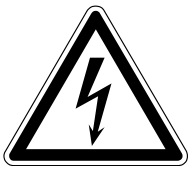
Motor type	Number of T-slot nuts enclosed	Min. distance (L) between the T-slot nuts [mm]
SL2-050VS	6	70
SL2-050S	8	80
SL2-050M	10	90
SL2-050ML	10	90
SL2-100VS	8	70
SL2-100S	8	80
SL2-100M	10	90
SL2-100ML	10	90
SL2-150S	10	80
SL2-150M	12	90
SL2-150ML	14	90

To make it easier for customers to install/remove loads, each cooling unit comes equipped with pin holes for positioning. Additionally, the T-slot nuts are secured to ensure that they do not shift.

Any other loads acting on the screw connection of the T-slot nuts must be determined in accordance with the standard calculation procedures used in mechanical engineering (VDI 2230). The customer loads and design of the mount-on components are included in the calculation.

Generally, the permitted load of the primary is limited by the screw itself.

6 Electrical Installation



DANGER

Risk of injury due to electric shock.

Severe or fatal injuries.

- Strictly observe the safety notes in the individual chapters.
- When motors are powered from inverters, you must adhere to the wiring instructions issued by the inverter manufacturer. Adhere to the operating instructions for the inverter.

NOTE

A bag containing the following information is attached to the motor:

- Safety notes
- Wiring diagram

Comply with this information.

6.1 Electrical connection

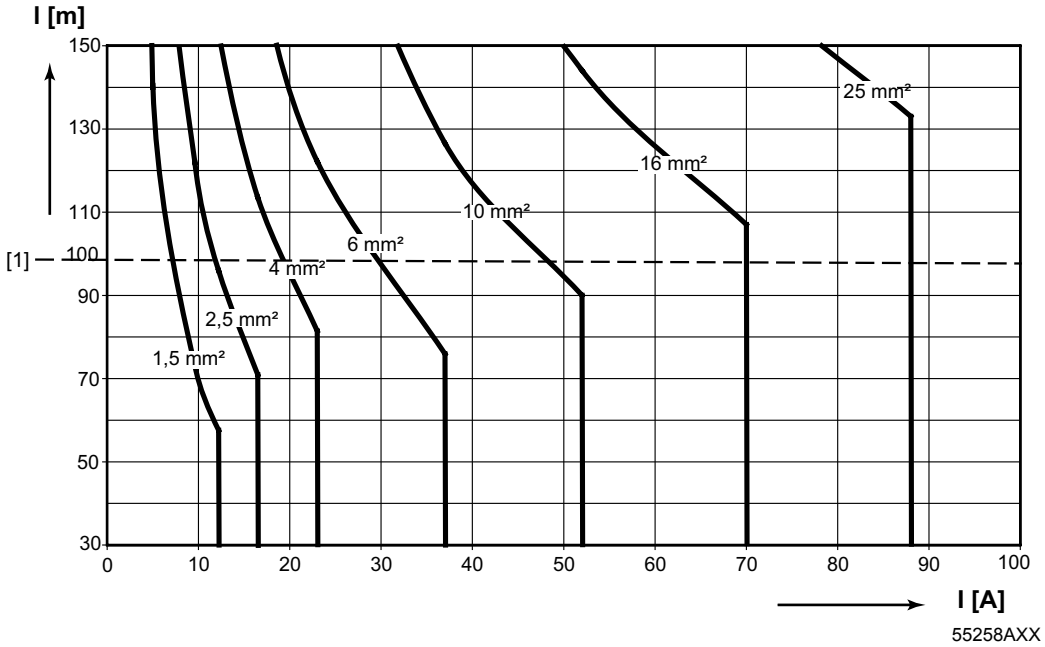
6.1.1 SL2-Basic electrical connection

STOP	**STOP** The current carrying capacity only applies to the SL2-Basic design with standard cable length 1m.

Cable extension type	1	2	3	4	5
Outer diameter [mm]	9.6	10.8	13	17.5	20.5
Cores	4 x 1.5 + 1 x (2 x 0.5)	4 x 2.5 + 1 x (2 x 0.5)	4 x 4 + 1 x (2 x 0.5)	4 x 6 + 1 x (3 x 1.5)	4 x 10 + 1 x (3 x 1.5)
Load A at ambient temperature 30 °C [A]	18	26	34	44	61
Load A at ambient temperature 40 °C [A]	16	23	30	40	55
Load A at ambient temperature 60 °C [A]	12	17	24	31	43
Color of power cores	Black	Black	Black	Black	Black
Identification phase U	1	1	1	U/L1	U/L1
Identification phase V	2	2	2	V/L2	V/L2
Identification phase W	3	3	3	W/L3	W/L3
Color protective earth	Yellow / green	Yellow / green	Yellow / green	Yellow / green	Yellow / green
Color of thermistor core (TF1)	White	White	White	Black	Black
Color of thermistor core (TF2)	Brown	Brown	Brown	Black	Black
Thermistor identification (TF1) PTC140	-	-	-	1	1
Thermistor identification (TF2) PTC140	-	-	-	2	2
Thermistor identification KTY-84 Anode	White	White	White	1	1
Thermistor identification KTY-84 Kathode	Brown	Brown	Brown	2	2
Minimum bending radius fixed routing [mm]	20	22	26	53	62
Minimum bending radius at constant motion [mm]	96	110	130	175	205

6.1.2 Project planning for cable cross section of the power cable

Cable dimensioning according to EN 60402



[1] Max. permitted cable length to SEW specification = 100 m

The diagram (see figure above) is the basis for chapters 4.2 and 4.3.

Hybrid cables with cross sections of 1.5 mm^2 to 10 mm^2 can be ordered from SEW-EURODRIVE.

Cable load through current I in [A] according to EN 60204-1 table 5, ambient temperature 40 °C

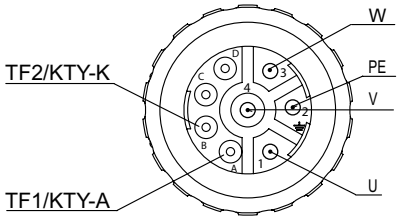
Cable cross section [mm^2]	Three-core sheathed line in pipe or cable [A]	Three-core sheathed line on top of one another on wall [A]	Three-core sheathed cable next to one another [A]
1.5	12.2	15.2	16,1
2.5	16.5	21	22
4	23	28	30
6	29	36	37
10	40	50	52
16	53	66	70
25	67	84	88
35	83	104	114

These data are merely recommended values and are **no substitute for detailed project planning** of the supply cables depending on the actual application, taking the applicable regulations into account!

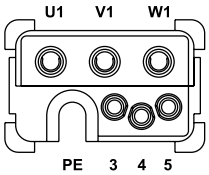
6.1.3 Pin assignment of the power connection for the SL2-Advance System and SL2 -Power System

The following pin assignments are described as viewed onto the motor.

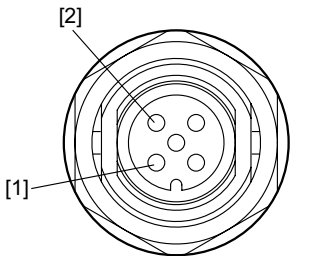
Size SL2-P050 and design AVX0

Pin	Assigned	Plug connector
1	U	**BEGA 089** 
4	V	
3	W	
2	PE	
A	TF1/KTY-A	
B	TF2/KTY-K	
C	n.c.	
D	n.c.	

Size SL2-P100, SL2-P150

Pin	Assigned	Plug connector
U1	U1	**C148U connector with socket contacts**
V1	V1	
W1	W1	
PE	Green / yellow	
3	n.c	
4	(TF1)/KTY-A	
5	(TF2)/KTY-K	

6.1.4 Pin assignment for the power supply to the fan in the SL2-Power System



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[1] +24 V
[2] Grounding

6.1.5 Safety notes

EMC measures

SEW-EURODRIVE SL2 synchronous linear motors are designed for use as components for installation in machinery and systems. The designer of the machine or system is responsible for complying with the EMC Directive 89/336/EEC. For more detailed information on this subject, refer to the SEW publications:

"Drive Engineering Practical Implementation Volume 7, Project Planning for Drives" and "Drive Engineering Practical Implementation Volume 9, EMC in Drive Engineering".

Encoder connection

Observe the following instructions when connecting an encoder:

- Use a shielded cable with twisted pair conductors only.
- Connect the shield to the PE potential on both ends over a large surface area.
- Route signal cables separately from power cables or brake cables (min. distance 200 mm).

Thermal motor protection

STOP	**STOP**
	Risk of unwanted axis movements due to interference from parasitic signals (EMC) via the motor cable. When an older MOVIDRIVE® *compact* MCH inverter is used, SEW-EURODRIVE strongly recommends that you use an external TF evaluation unit (e.g. EMT6-K from Möller or 3RN1011 from Siemens). Under extreme EMC conditions, the TF line can be wound, for example with 5 windings around a ferrite ring choke or an HD002 output choke.

STOP	**STOP**
	If you use a KTY temperature sensor (KTY84...140), it is essential that you contact SEW-EURODRIVE.

STOP	**STOP**
	If you use inverters from another manufacturer, contact SEW-EURODRIVE. This is to ensure that thermal motor monitoring is ensured for the customer's installation.

6.2 Prefabricated cables for SL2-Advance System / SL2 -Power System

	NOTE
	Cables with line cross sections of 1.5 and 2.5 mm^2 have low capacitive properties for operation on inverters. Older cables without low capacitive properties have another outer diameter.

6.2.1 Prefabricated power cables

For the motor designs

- SL2-Advance System
- SL2-Power System

SEW-EURODRIVE offers prefabricated power and feedback cables from 1 m to 100 m for straightforward and reliable connection.

The opposite cable end is fitted with cable lugs (for power cables) or conductor end sleeves. The shielding is connected to the mating connector.

Prefabricated power cables are used to connect the:

- Motor power
- Motor protection (**TF** or KTY)

6.2.2 Prefabricated feedback cable

SEW-EURODRIVE offers a feedback cable for the AL1H linear measuring system. The cable is fitted with plug connectors for connection to the encoder and the inverter.

The cables are only available as cable carrier cables. Cables from the company Nexan are used.

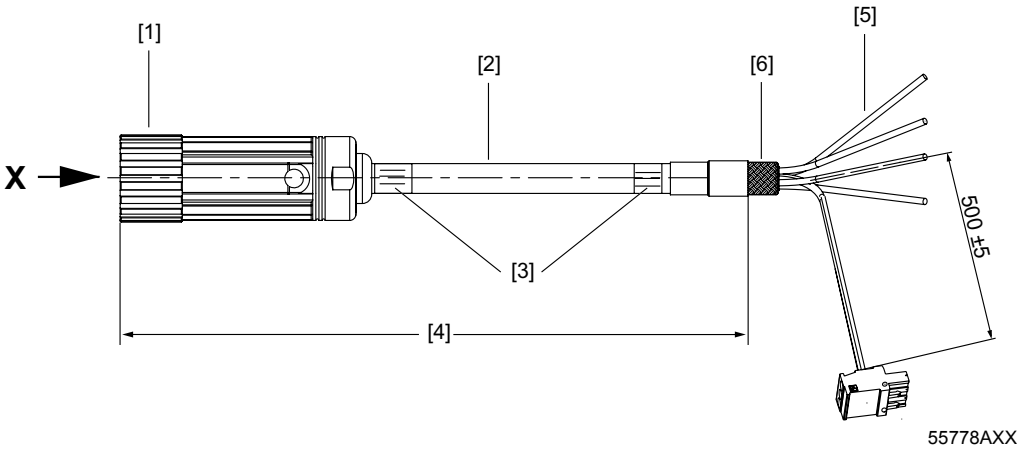
6.2.3 SL2 unit designation

Power cables of the SL2-P050... motors correspond to the brakemotor cables of the CM71 motor series with an SB71-74 round plug connector.

The power cables for the motor sizes SL2-P100 and SL2-P150 correspond to the brake motor cables of the CM motor series with SB51-59 plug connectors.

	NOTE
	Observe the data given in the specification in chapters 6.1 and 6.2.

6.2.4 Structure of power cables for SL2-050 motors and AVX0 design



[1] Connector: Intercontec BSTA 078
[2] SEW-EURODRIVE logo printed on cable
[3] Nameplate
[4] Line length ≤ 10 m: Tolerance +200 mm
Line length ≥ 10 m: Tolerance +2 %
Permitted cable length according to the technical documents
[5] Prefabricated cable end for inverter
Required loose parts are supplied with the cable
[6] Shielding 20 mm, pulled back approximately + 5 mm

Prefabricated cables for motor side

The power cables on the motor side consist of an 8-pin plug connector and socket contacts.

The shield is connected in the connector housing according to EMC requirements. All plug connectors seal the plug on the cable end with a lamellar seal and ensure cable relief according to EN 61884.

Prefabricated cables for inverter end

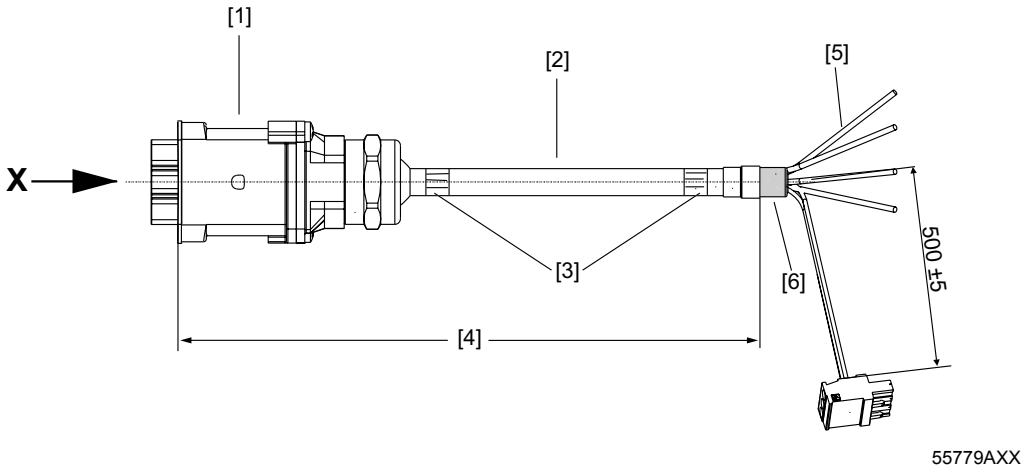
The individual cable cores of the power cables are exposed and the shield is prepared for connection in the control cabinet. The cable for the inverter end has yet to be assembled. The loose parts required are supplied with the cable in a separate bag.

Loose parts

The following loose parts are supplied in accordance with the core cross sections for connection to the power terminals on the inverter:

Bag no.	Contents
1	4 x conductor end sleeves 1.5 mm^2 , insulated 4 x M6 U-shaped cable lugs 1.5 mm^2
2	4 x conductor end sleeves 2.5 mm^2 , insulated 4 x M6 U-shaped cable lugs 2.5 mm^2
3	4 x conductor end sleeves 4 mm^2 , insulated 4 x M6 U-shaped cable lugs 4 mm^2 4 x M10 U-shaped cable lugs 4 mm^2

6.2.5 Structure of power cables for SL2-100 and SL2-150 motors



[1] Connector: Amphenol
[2] SEW-EURODRIVE logo printed on cable
[3] Nameplate
[4] Line length ≤ 10 m: Tolerance +200 mm
Line length ≥ 10 m: Tolerance +2 %
Permitted cable length according to the technical documents
[5] Prefabricated cable end for inverter
Required loose parts are supplied with the cable
[6] Shielding 20 mm, pulled back approximately + 5 mm

Prefabricated cables for motor side

The power cables on the motor end have a 6-pin EMC Amphenol plug connector and socket contacts.

The shield is connected in the connector housing according to EMC requirements. All plug connectors seal the plug on the cable end with a lamellar seal and ensure cable relief according to EN 61884.

Prefabricated cables for inverter end

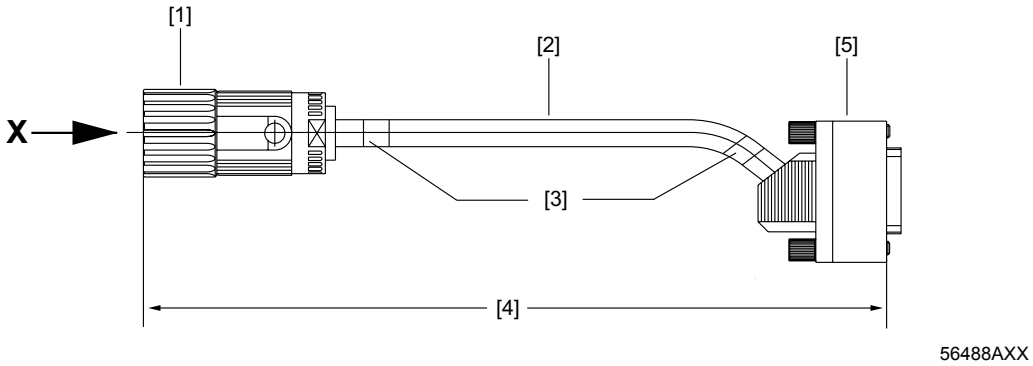
The individual cable cores of the power cables are exposed and the shield is prepared for connection in the control cabinet. The cable for the inverter end has yet to be assembled. The loose parts required are supplied with the cable in a separate bag.

Loose parts

The following loose parts are supplied in accordance with the core cross sections for connection to the power terminals on the inverter:

Bag no.	Contents
1	4 x conductor end sleeves 1.5 mm^2 , insulated 4 x M6 U-shaped cable lugs 1.5 mm^2
2	4 x conductor end sleeves 2.5 mm^2 , insulated 4 x M6 U-shaped cable lugs 2.5 mm^2
3	4 x conductor end sleeves 4 mm^2 , insulated 4 x M6 U-shaped cable lugs 4 mm^2 4 x M10 U-shaped cable lugs 4 mm^2
4	4 x M6 U-shaped cable lugs 6 mm^2 4 x M10 U-shaped cable lugs 6 mm^2
5	4 x M6 U-shaped cable lugs 10 mm^2 4 x M10 ring-type cable lugs 10 mm^2

6.2.6 Structure of the AL1H feedback cable for MOVIDRIVE® B



[1] Connector: Intercontec ASTA
[2] Printed on connector: SEW-EURODRIVE
[3] Nameplate
[4] Line length ≤ 10 m: Tolerance +200 mm
Line length ≥ 10 m: Tolerance +2 %
Permitted cable length according to the technical documents
[5] Sub-D connector

A 12-pin EMC signal plug connector with socket contacts from Intercontec is used to connect the encoder system. The shield is connected in the connector housing according to EMC requirements. All plug connectors seal the plug on the cable end with a lamellar seal.

Prefabricated cables for inverter end

A commercial sub-D EMC connector with pin contacts is used on the inverter end. A 9-pin or 15-pin connector matching the inverter is used.

Hybrid cable

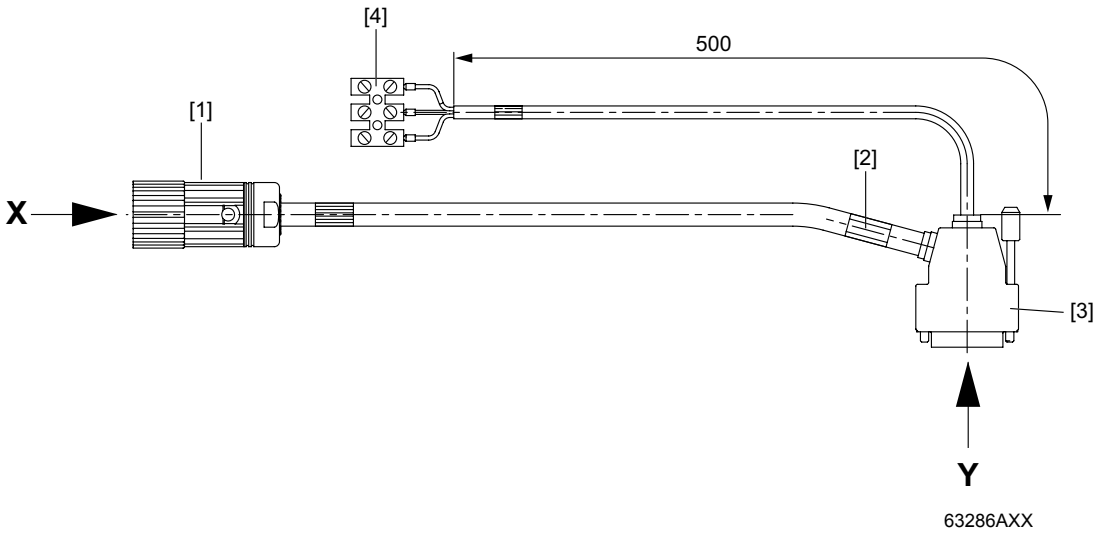
The outer cable sheath on the motor and inverter end bears a nameplate with part number and logo of the prefabricated cable manufacturer. The ordered length and permitted tolerance are interrelated as follows:

- Line length ≤ 10 m: Tolerance 200 mm
- Line length ≥ 10 m: Tolerance +2 %

	NOTE
	Refer to the system manual of the inverter for determining the maximum cable length.

Make sure that an EMC-compliant environment is maintained during project planning.

6.2.7 Structure of the AL1H feedback cable for MOVIAXIS®



[1] Connector: Intercontec ASTA
[2] Nameplate
[3] Sub-D connector
[4] Screw terminal

A 12-pin EMC signal plug connector with socket contacts from Intercontec is used to connect the encoder system. The shield is connected in the connector housing according to EMC requirements. All plug connectors seal the plug on the cable end with a lamellar seal.

Prefabricated cables for inverter end

A sub-D EMC connector with pin contacts is used on the inverter end. A 9-pin or 15-pin connector matching the inverter is used.

With MOVIAXIS®, the temperature sensor of the linear motor can be connected using screw terminals. The sensor can be evaluated via encoder input.

Hybrid cable

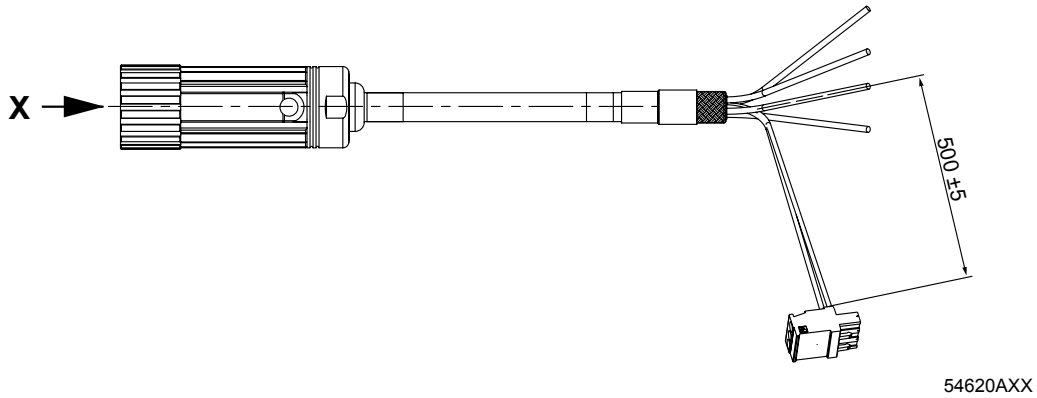
The outer cable sheath on the motor and inverter end bears a nameplate with part number and logo of the prefabricated cable manufacturer. The ordered length and permitted tolerance are interrelated as follows:

- Line length ≤ 10 m: Tolerance 200 mm
- Line length ≥ 10 m: Tolerance +2 %

	NOTE
	Refer to the system manual of the inverter for determining the maximum cable length.

Make sure that an EMC-compliant environment is maintained during project planning.

6.2.8 Pin assignment of power cable SL2-050 and AVX0 design



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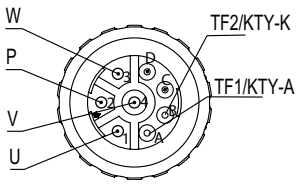
The customer assembles the cable with a Phoenix plug connector. The connector can be cut off because it is not required for the TF connection.

Plug connector	Pin	Core identification	Assigned	Contact type	Extra
BSTA 078  **View X**	1	Black with white lettering U, V, W	U		Bag of loose parts
	4		V		
	3		W		
	2	Green/yellow	PE		
	A	Black 1	TF1/KTY-A	Cut off Phoenix connector	
	B	Black 2	TF2/KTY-K		
	C	Black 3	n.c.	Ground in control cabinet	
	D	–	n.c.		

Plug connector type	Number of cores and line cross section	Part no.	Installation type	LC[1)]
SB71 / SB81	**4 x 1.5 mm² (AWG 16)** **3 x 1 mm² (AWG 17)**	0590 631 8	Cable carrier installation	X
SB72 / SB82	**4 x 2.5 mm² (AWG 14)** **3 x 1 mm² (AWG 12)**	0590 632 6	Cable carrier installation	X
SB74 / SB84	**4 x 4 mm² (AWG 12)** **3 x 1 mm² (AWG 17)**	0590 484 6	Cable carrier installation	

1) Cable with low capacitance characteristics (LC = low capacity).

Alternative plug connector at customer end

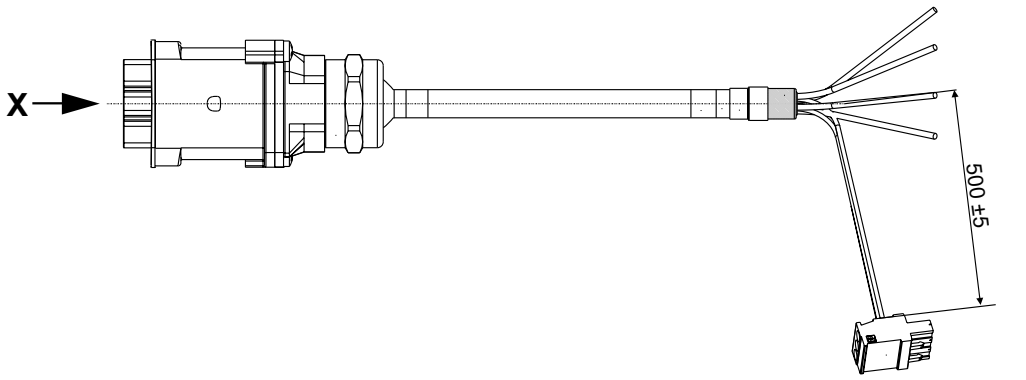
Plug connectors for power supply with socket contacts (complete).

Type	Number of cores and line cross section	Part no.
SB71 / SB81	**4 x 1.5 mm² (AWG 16)** **3 x 1 mm² (AWG 17)**	0198 919 7
SB72 / SB82	**4 x 2.5 mm² (AWG 14)** **3 x 1 mm² (AWG 12)**	0198 919 7
SB74 / SB84	**4 x 4 mm² (AWG 12)** **3 x 1 mm² (AWG 17)**	0199 163 9

NOTE

The pin assignment deviates from SEW servomotor cables for DS and CMP motors.

6.2.9 Pin assignment for SL-100 and SL2-150 power cables



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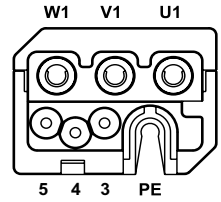
The cable is fitted with a Phoenix plug connector at the control cabinet end. The connector can be cut off because it is not required for the TF connection.

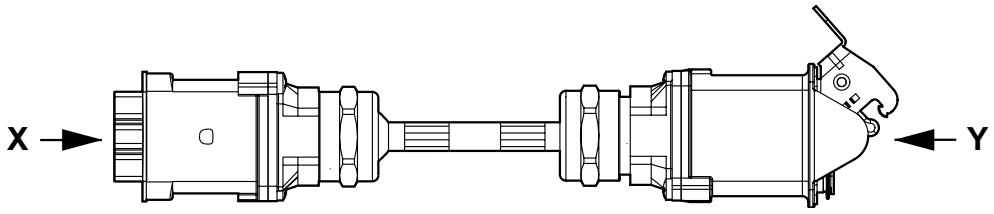
Plug connector	Pin	Core identification	Assigned	Contact type	Extra
C148U connector with socket contacts	U1	Black with white lettering U, V, W	U	Cut-off, length ca. 250 mm	Bag of loose parts
	V1		V		
	W1		W		
 **View X**	PE	Green/yellow	(protective earth)		
	3	Black 1	n.c	Ground in control cabinet	
	4	Black 2	TF1/KTY-A	Cut off Phoenix connector	
	5	Black 3	TF2/KTY-K		

Power cable type

Plug connector type, complete	Number of cores and line cross section	Part number	Installation type	LC[1)]
SB51 / SB61	**4 x 1.5 mm² (AWG 16) + 3 x 1.0 mm² (AWG 17)**	1333 116 7	Cable carrier installation	X
SB52 / SB62	**4 x 2.5 mm² (AWG 12) + 3 x 1.0 mm² (AWG 17)**	1333 117 5		X
SB54 / SB64	**4 x 4 mm² (AWG 10) + 3 x 1.0 mm² (AWG 17)**	199 194 9		
SB56 / SB66	**4 x 6 mm² (AWG 10) + 3 x 1.5 mm² (AWG 16)**	199 196 5		
SB59 / SB69	**4 x 10 mm² (AWG 10) + 3 x 1.5 mm² (AWG 17)**	199 198 1		

1) Cable with low capacitance characteristics (LC = low capacity).

6.2.10 Pin assignment for SL-100 and SL2-150 power extension cables



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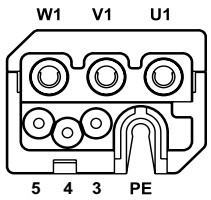
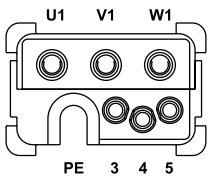
Pin assignment for extension cables

Plug connector	Pin	Core identification	Pin	Plug connector
C148U adapter with pin contacts	U1	Black with white lettering U, V, W	U1	**C148U connector with socket contacts**
	V1		V1	
	W1		W1	
	PE	Green/yellow	PE	
	n.c	Black 1	n.c	
	4 TF1/KTY-A	Black 2	4 TF1/KTY-A	
	5 TF1/KTY-K	Black 3	5 TF1/KTY-K	



View Y



View X

The extension cable has the same pin assignment as all other contacts.

Power extension cable types

Plug connector type, complete	Number of cores and line cross section	Part number	Installation type	LC[1)]
SK51 / SK61	**4 x 1.5 mm² (AWG 16) + 3 x 1.0 mm² (AWG 17)**	1333 120 5	Cable carrier installation	X
SK52 / SK62	**4 x 2.5 mm² (AWG 12) + 3 x 1.0 mm²(AWG 17)**	1333 121 3		X
SK54 / SK64	**4 x 4 mm² (AWG 10) + 3 x 1.0 mm² (AWG 17)**	0199 204 X		
SK56 / SK66	**4 x 6 mm² (AWG 10) + 3 x 1.5 mm² (AWG 16)**	0199 206 6		
SK59 / SK69	**4 x 10 mm² (AWG 10) + 3 x 1.5 mm² (AWG 17)**	0199 208 2		

1) Cable with low capacitance characteristics (LC = low capacity).

Alternative plug connector at customer end

Plug connectors for power supply with socket contacts (complete).

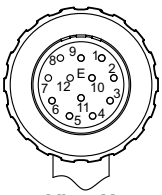
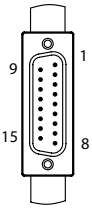
Type	Cross sections	Part no.
SB51 / SB61	**4 x 1.5 mm² (AWG 16) + 3 x 1.0 mm² (AWG 17)**	199 142 6
SB52 / SB62	**4 x 2.5 mm² (AWG 12) + 3 x 1.0 mm² (AWG 17)**	199 143 4
SB54 / SB64	**4 x 4 mm² (AWG 10) + 3 x 1.0 mm² (AWG 17)**	199 144 2
SB56 / SB66	**4 x 6 mm² (AWG 10) + 3 x 1.5 mm² (AWG 16)**	199 145 0
SB59 / SB69	**4 x 10 mm² (AWG 10) + 3 x 1.5 mm² (AWG 17)**	199 146 9

6.2.11 Cable for AL1H encoder MOVIDRIVE®

.

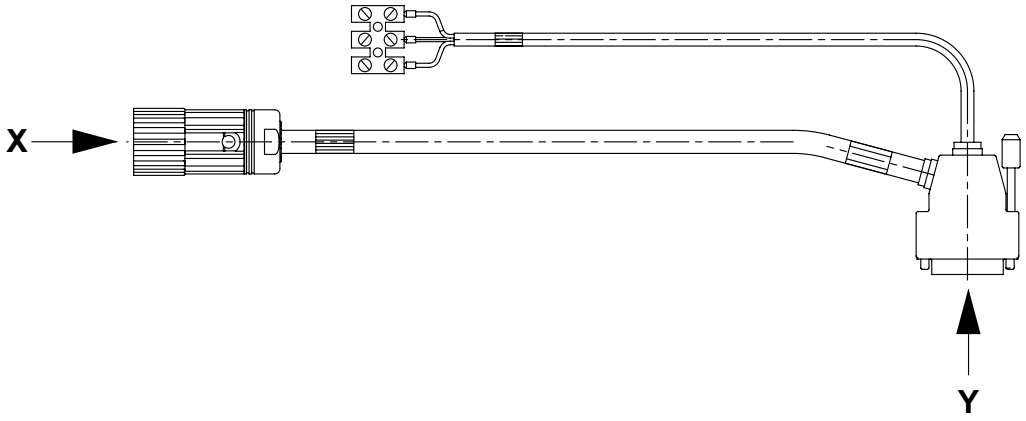
Type	Installation	Part number
SL2	Cable carrier installation (MOVIDRIVE® B)	0595 151 8

Cable pin assignment for feedback cables

Encoder end					Connecting MOVIDRIVE® MDX..B	
Plug connector	Contact no.	Description	Cable core color	Description	Contact no.	Plug connector
ASTA021FR 198 921 9 12-pin with socket contacts  View X	1	S3 (cosine -)	Blue (BU)	S3 (cosine -)	9	Sub-D 15-pin  MOVIDRIVE® B View Y
	2	Data (+)	Black (BK)	Data (+)	4	
	3	n. c.		n. c.	3	
	4	n. c.		n. c.	5	
	5	S2 (sine +)	Yellow (YE)	S2 (sine +)	2	
	6	S4 (sine -)	Green (GN)	S4 (sine -)	10	
	7	Data (-)	Violet (VT)	Data (-)	12	
	8	S1 (cosine +)	Red (RD)	S1 (cosine +)	1	
	9	n. c.		n. c.	6	
	10	GND	Grey/pink (GY-PK) / pink (PK)	GND	8	
	11	n. c.		n. c.	7	
	12	U_S	red/blue (RD-BU) / gray (GY)	U_S	15	
		n. c.	n. c.	n. c.	11	
		n. c.	n. c.	n. c.	13	
		n. c.	n. c.	n. c.	14	

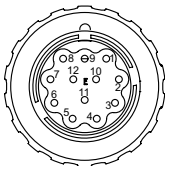
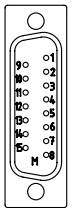
6.2.12 Cable for AL1H encoder MOVIAXIS®

Using the following cable, also the temperature switch of the linear motor can be connected to the encoder input. If this is not necessary, you can use the previously described MOVIDRIVE® cable

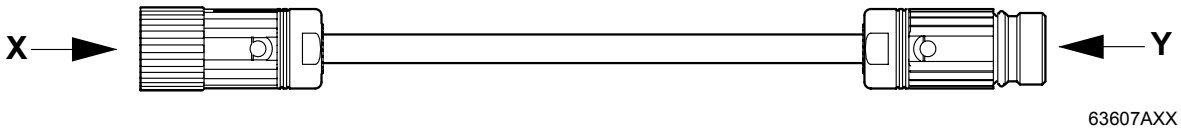


Type	Installation	Part number
SL2	Cable carrier installation	1333 224 4

Cable pin assignment for feedback cables

Encoder end					Connecting MOVIDRIVE® MDX..B	
Plug connector	Contact no.	Description	Cable core color	Description	Contact no.	Plug connector
ASTA021FR 198 921 9 12-pin with socket contacts  View X	1	S3 (cosine -)	Blue (BU)	S3 (cosine -)	9	Sub-D 15-pin  View Y
	2	Data (+)	Black (BK)	Data (+)	4	
	3	n. c.		n. c.	3	
	4	n. c.		n. c.	5	
	5	S2 (sine +)	Yellow (YE)	S2 (sine +)	2	
	6	S4 (sine -)	Green (GN)	S4 (sine -)	10	
	7	Data (-)	Violet (VT)	Data (-)	12	
	8	S1 (cosine +)	Red (RD)	S1 (cosine +)	1	
	9	n. c.		n. c.	6	
	10	GND	Grey/pink (GY-PK) / pink (PK)	GND	8	
	11	n. c.		n. c.	7	
	12	U_s	red/blue (RD-BU) / gray (GY)	U_s	15	
		n. c.	n. c.	n. c.	11	
		n. c.	n. c.	n. c.	13	
		n. c.				
	1	TF/TH/KTY+	BN	TF/TH/KTY+	14	
	2	TF/TH/KTY-	WH	TF/TH/KTY-	6	
	3	Shielding		PE		

6.2.13 Extension cable for AL1H encoders



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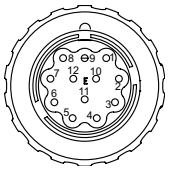
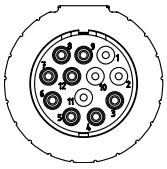
Type	Installation	Part number
SL2	Cable carrier installation	1333 387 9

Cable pin assignment for feedback cables

Encoder end					Connecting MOVIDRIVE® MDX..B	
Plug connector	**Contact no.**	**Description**	**Cable core color**	**Description**	**Contact no.**	**Plug connector**
ASTA021FR **198 921 9** **12-pin with socket contacts**	1	S3 (cosine -)	Blue (BU)	S3 (cosine -)	1	**AKUA020 MR** **12-pole**
	2	Data (+)	Black (BK)	Data (+)	2	
	3	n. c.		n. c.	3	
	4	n. c.		n. c.	4	
	5	S2 (sine +)	Yellow (YE)	S2 (sine +)	5	
	6	S4 (sine -)	Green (GN)	S4 (sine -)	6	
	7	Data (-)	Violet (VT)	Data (-)	7	
	8	S1 (cosine +)	Red (RD)	S1 (cosine +)	8	
	9	n. c.		n. c.	9	
	10	GND	Grey/pink (GY-PK) / pink (PK)	GND	10	
	11	n. c.		n. c.	11	
	12	U_S	Red/blue (RD-BU) / gray (GY)	U_S	12	
		n. c.	n. c.	n. c.		
		n. c.	n. c.	n. c.		
		n. c.				



View X



View Y

Alternative plug connector at customer end

Type	Cross sections	Part no.
ALH1	**6 x 2 x 0.25 mm²**	01986732

6.2.14 Cable carrier installation of power cables

Technical specifications of the cable

Installation type		**Cable carrier**				
Cable cross sections		**4 x 1.5 mm² + 3 x 1 mm²**	**4 x 2.5 mm² + 3 x 1 mm²**	**4 x 4 mm² + 3 x 1 mm²**	**4 x 6 mm + 3 x 1.5 mm²**	**4 x 10 mm² + 3 x 1.5 mm²**
Manufacturer		**Nexans**				
Manufacturer designation		PSL(LC)C11Y-J 4x...+3A.../C		PSL11YC11Y-J 4x... +3A.../C		
Operating voltage Uo/	[VAC]	600 / 1000				
Temperature range	[°C]	–20 to + 60				
Max. temperature	[°C]	+ 90 (conductor)				
Min. bending radius	[mm]	150	170	155	175	200
Diameter D	[mm]	15.0 ±1.4	16.2 ±0.7	15.3 ±0.5	17.4 ±0,5	20.5 ±0.5
Maximum acceleration	[m/s²]	20				
Max. velocity	[m/min]	200 at max. travel distance of 5 m				
Core identification		BK with lettering WH + GN/YE				
Sheath color		Orange similar to RAL 2003				
Approval(s)		DESINA / VDE / UL / cULus				
Capacitance core / shielding	[nF/km]	105	105	170	170	170
Capacitance core / core	[nF/km]	65	65	95	95	95
Halogen-free		Yes				
Silicone-free		Yes				
CFC-free		Yes				
Inner insulation (cable)		Polyolefin		TPM		
Outer insulation (sheath)		TPU (PURE)				
Flame-retardant/self-extinguishing		Yes				
Conductor material		E-Cu blank				
Shielding		Braided tinned Cu shield (optically covered > 85 %)				
Weight (cable)	[kg/km]	280	380	410	540	750

6.2.15 Cable carrier installation of feedback cable:

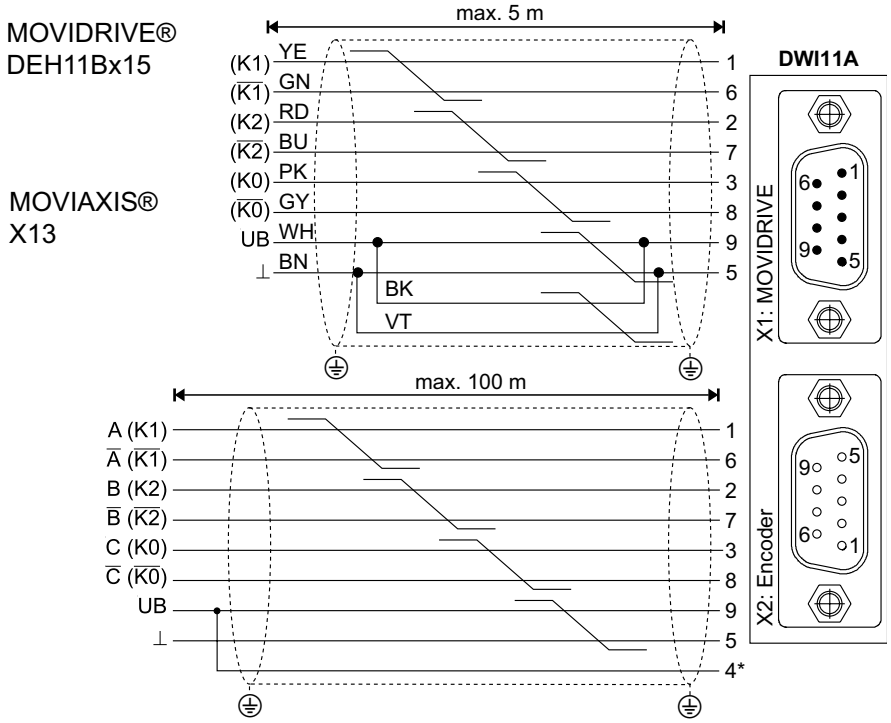
Technical specifications of the cable

Installation type		**Cable carrier**
Accessory designation		**AL1H / ES1H**
Cable cross sections **Manufacturer**		**6 x 2 x 0.25 mm²** **Nexans**
Manufacturer designation		SSL11YC11Y6x 2 x 0.25
Operating voltage Uo/	[VAC]	300
Temperature range	[°C]	–20 to + 60
Max. temperature	[°C]	+90 (on conductor)
Min. bending radius	[mm]	100
Diameter D	[mm]	9.8 ± 0.2
Maximum acceleration	[m/s²]	20
Max. velocity	[m/min]	200
Core identification		WH/BN, GN/YE, GY/PK, BU/RD, BK/VT, GY-PK/RD-BU
Sheath color		Green similar to RAL 6018
Approval(s)		DESINA / UL / VDE / c UL us
Capacitance core/shielding	[nF/km]	100
Capacitance core / core	[nF/km]	55
Halogen-free		Yes
Silicone-free		Yes
CFC-free		Yes
Inner insulation (core)		PP
Outer insulation (sheath)		TPE-U
Flame-retardant/self-extinguishing		Yes
Conductor material		E-Cu blank
Shielding		Braided tinned Cu
Weight	[kg/km]	130

6.2.16 Connecting non-SEW encoders with 5 V supply voltage

Many incremental encoders are not suited for direct connection to the 12 V supply of the encoder evaluation.

Encoders with 5 V supply voltage can be supplied by the SEW inverters MOVIDRIVE® or MOVIAXIS® if a DWI11A isused between inverter and encoder to convert the voltage.



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MOVIDRIVE® HIPERFACE® encoder card type DEH X15 option: DWI11A X1: MOVIDRIVE®

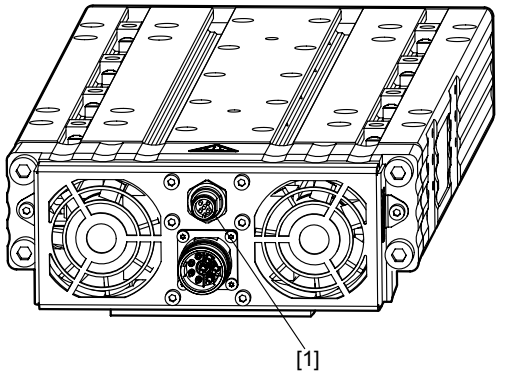
For fixed installation: 8179573

MOVIAXIS® Encoder connection X13: DWI11A X1

For fixed installation 13331531

The cable of MOVIDRIVE® can be used if not temperature sensor is additionally evaluated on the encoder input.

6.2.17 Power supply for the fan



[1] M12 fan connection, 5-pole

The fans in power design are supplied via a commercially available 5-pole, M12 plug connection with DC 24 V.

The power demand of the fan is as follows for

- Sizes 50 to 100: 7.2 W
- Size 150: 18 W

Customer connection cables are not available from SEW-EURODRIVE.

Suitable connection cables can be ordered from manufacturers, such as:

- Phoenix CONTACT
- Hirschmann
- Harting

The following table is an extract from trailing cables available from Phoenix CONTACT:

Sensor/actuator cables, straight M12 socket, 3-pin (suitable for 5-pin connector)

Cable length	Article designation	Article number
3 m	SAC-3P-3,0-PUR/M12FS	16 94 49 9
5 m	SAC-3P-5.0-PUR/M12FS	16 83 51 0
10 m	SAC-3P-10,0-PUR/M12FS	16 93 03 4

6.2.18 UWU51A switched-mode power supply

For the SL2-Power System design, the UWU51A switched-mode power supply is available for powering the fan.

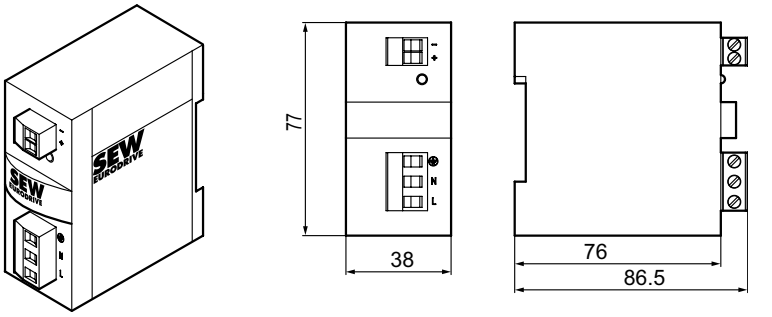
Input: 100 ... AC 240 V –6 % / +10 %, 50/60 Hz

Output: DC 24 V, 1 % / +2 %, 1.25 A

Connection: Terminal screws 0.2 ... 2.5 mm^2, separable.

Degree of protection: IP20; attachment to EN 5022 support rail in the control cabinet

Part number: 0 187 441 1



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7 Startup

DANGER

Risk of injury due to electric shock.

Severe or fatal injuries!

- When motors are powered from inverters, you must adhere to the wiring instructions issued by the inverter manufacturer. Observe the operating instructions for the inverter.

STOP

Improper startup may result in damages to the linear motor.

Potential damage to property!

- Do closely observe the notes in this chapter.

- Never work in the travel range when the machine is switched on.
- Ensure free axis travel.
- Check the final positions.
- Check the linear measuring system prior to turning on the machine.
- Limit the maximum power in the inverter.
- Set the velocity limits in the inverter to small values.
- SL2-Basic, SL2-Advance System and SL2-Power System are started up in the same way.
- Observe the safety notes in the individual chapters.

7.1 Prerequisites for startup

Before startup, make sure that

- The primary moves along the entire travel distance easily, without collisions and free from mechanical contact between the primary and secondary
- All connections have been made properly
- All protection devices have been installed correctly
- All motor protection devices are active
- The brake works correctly in hoists
- You have a MOVIDRIVE® unit with firmware that supports SL2 linear motors, such as MOVIDRIVE® B MDX...-0T (firmware 824 854 0.18 avaiable since week 14/2007), or older inverter (special design -08;)

  or

  You have a MOVIAXIS® with firmware that supports SL2 linear motors (such as MOVIAXIS® with firmware 21 or higher (available since February 2007)
- There are no other sources of danger present
- The MOVITOOLS® MotionStudio startup software is installed on your PC.

7.2 Commutation travel process

Unlike rotating systems, there is no mechanical connection between encoder system, primary and secondary in SL2 linear motors.

This connection must be made during startup. The synchronous linear motor can then be controlled directly by the inverter.

This process is referred to as commutation search or commutation travel.

This takes place

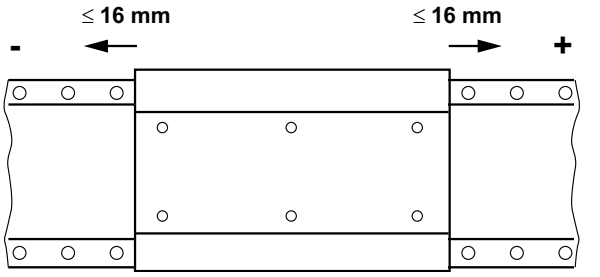
- Once after "encoder adjustment" for absolute distance measuring systems
- Every time the unit is turned on or reset in case of incremental distance measuring systems.

Below a description of the standard communication travel type. How the communication travel type is actived in the relevant inverter is described in the startup procedures for the relevant MOVIDRIVE® and MOVIAXIS® inverters.

	NOTE
	Depending on the drive axis, more types are available on request if the standard commutation travel type is not useful for your specific application.

7.2.1 Commutation travel process

1. The linear motor moves to a random position. This can be a distance of between 0 mm to max. 16 mm in either direction from the start position. The linear motor stops here for about one second.



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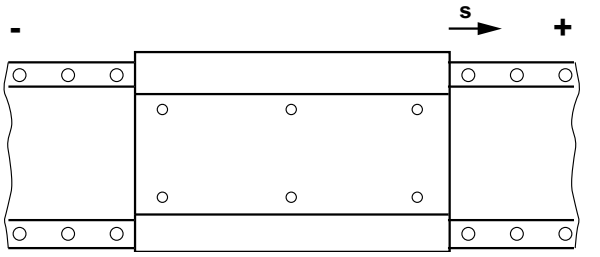
2. The SL2 linear motor is moved in positive direction S = 32 mm with MOVIDRIVE® (64 mm with MOVIAXIS®). It stops here for about one second.



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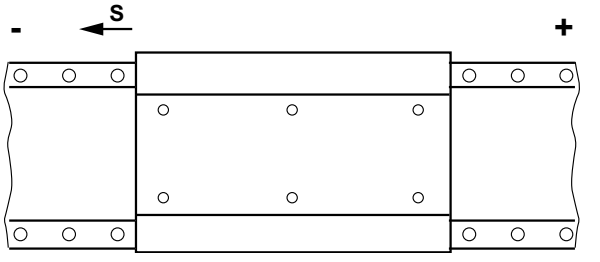
3. The linear motor is moved in negative direction S = 32 mm with MOVIDRIVE® (64 mm with MOVIAXIS®). It stops here for about one second.



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With MOVIDRIVE®, the linear motor repeats the commutation travel if it hits a hardware limit switch during the travel. As a result, the linear motor moves to a new start position, 32 mm away from the limit switch and repeats commutation travel. For MOVIAXIS®, this function was in preparation when this publication was printed.

You will then hear a quiet cracking noise and the linear motor switches from controlled to automatic mode.

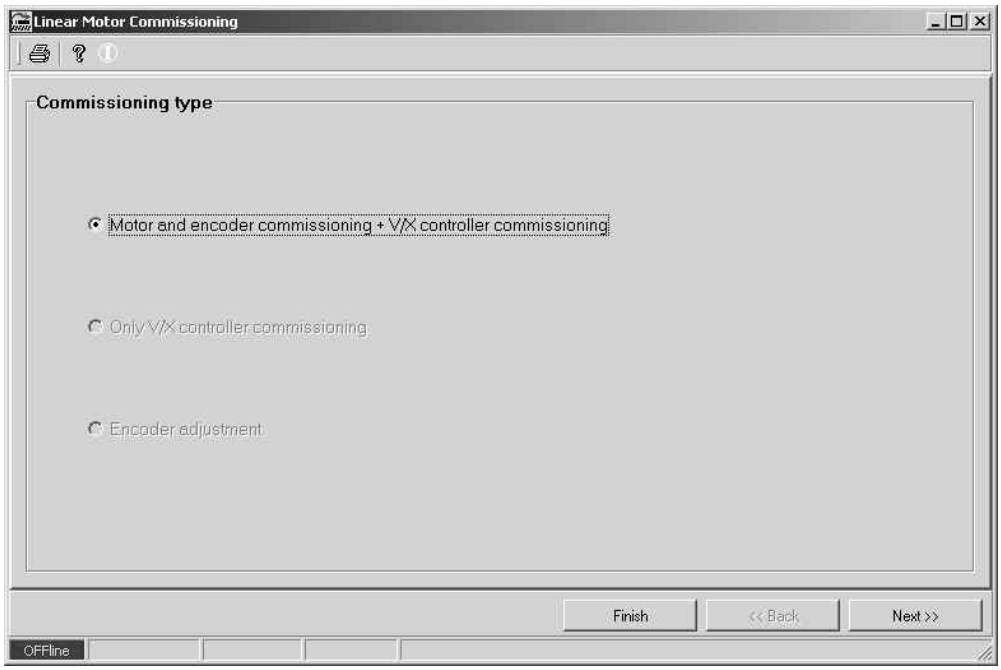
7.3 MOVIDRIVE® startup procedure

Proceed as follows:

7.3.1 Parameterization

1. Make sure that the inverter is in controller inhibit or 24 V mode.
2. Execute startup for linear motors in MOVITOOLS® Shell starting with the factory setting.

   Refer to the online help for linear motor startup. Parameter setting is complete once you have pressed the "Download" button twice and the below window is displayed again. Exit the startup window at this point.



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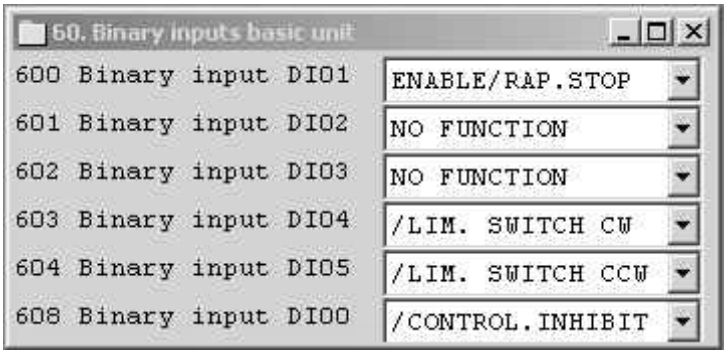
7.3.2 Checking encoder evaluation

3. Manually move the primary in one direction and observe parameter P003 (actual position) in MOVITOOLS® Shell. Determine the positive direction of movement. Then slide the linear motor once over the entire travel distance to check if the encoder works correctly in all areas.

7.3.3 Checking hardware limit switches

4. Set the parameters for the hardware limit switches, for example like in the figure, and check their function by manually sliding the primary to the limit switches.



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7.3.4 Activate drive limits for initial startup

5. For initial startup limit the maximum speed via parameter P302 (max. speed 1) and the maximum force with parameter P304 (torque limit) so that the motor cannot develop its full force and speed in case of an uncontrolled axis movement.

	NOTE
	Do not limit the maximum force with parameter P303 (current limit 1) and do not limit the maximum speed in the first dialog of the linear motor startup (this is the dialog that appears after the illustration) because these parameters also affect internal system values.

7.3.5 Commutation travel

6. Deactivate controller inhibit DI00=1. The linear motor now starts the above described commutation process. See chapter 8 for troubleshooting of errors that may occur during commutation travel.

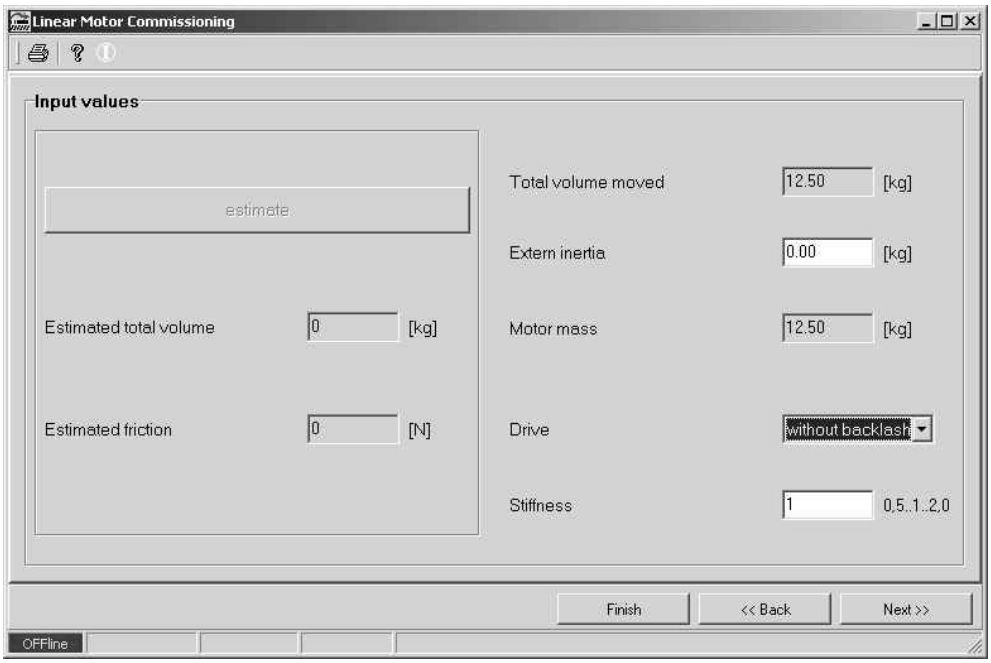
	⚠ WARNING
	Under no circumstances may enable be present during commutation travel. Risk of injury due to non-controlled axis movements. • Risk of injury due to non-controlled axis movements. This hazard does not exist any longer since firmware 824 854 0.18 (available since week 14/2007) because this situation is compensated by fault message "81 – start condition".

Once commutation travel is complete, the inverter sets variable H458 to 1. This value will be evaluated later in the IPOS$^{plus®}$ program or in the PLC to permit the inverter enable.

7.3.6 Optimizing the axis

7. Write a short program to have the linear motor move cyclically between two positions.

   Start the program and in the linear motor startup, carry out the point "V/X controller startup only." If the linear motor moves correctly, set the current and force limits to their original values (see point 5) and optimize the drive control loop via *"Stiffness*" and the "*Estimate*" button as you would with rotary servomotors.



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7.3.7 Further settings

8. With an absolute encoder, you will now execute the menu item "Encoder adjustment". The linear motor is then ready for operation immediately once the system is turned on. If you do not execute the menu item "Encoder adjustment", an absolute encoder will behave like an incremental encoder and the linear motor will carry out a commutation travel once the controller inhibit has been removed and the unit switched on.

9. If you need a different positive encoder counting direction for your linear axis, activate the reversal option for the motor rotation via parameter P350.

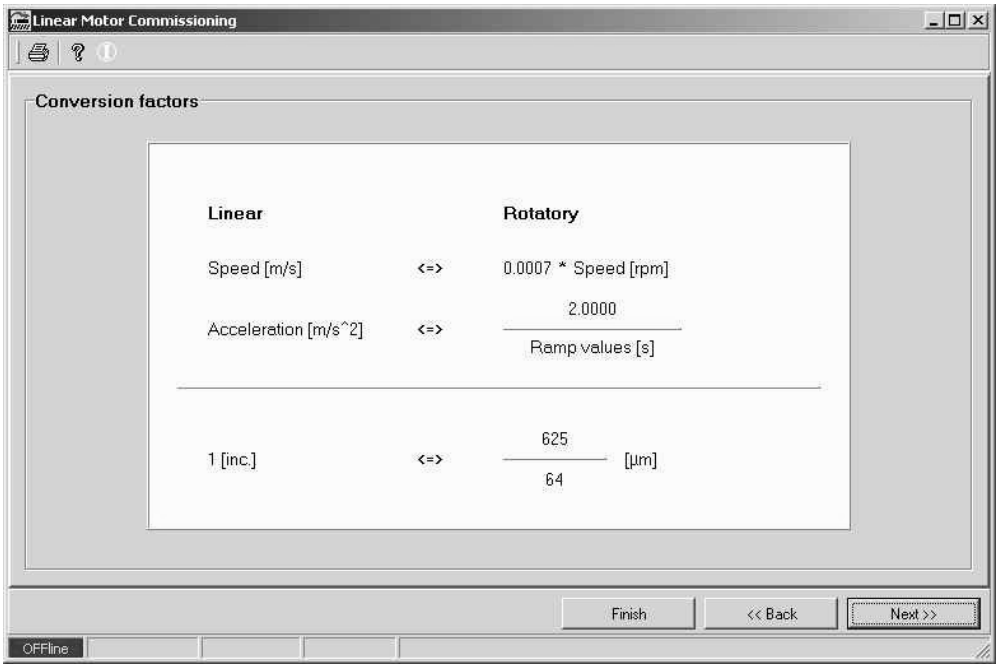
10. Remove the TF line from the inverter with enabled motor check whether TF monitoring is responding (fault 31; TF trigger).

11. If the drive has an external brake, we recommend that you control it directly. The brake is controlled using parameters P730 - P732.

12. For easier handling of sensor head replacement of the AL1H for servicing purposes, set P948 "Automatic encoder detection" to OFF. If P948 is set to ON, the inverter will automatically reset bit H473, bit 25 "LSM commutates" and forces another commutation travel. P948 = OFF is recommended by SEW because the absolute information is in the measuring tape and the actual position and commutation information is maintained after sensor replacement.

7.4 MOVIDRIVE®: Calculating travel parameters

The inverter and the integrated IPOS$^{plus®}$ sequence control work internally with rotatory values. During startup, the program determines conversion factors for linear values to rotatory values.



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Example:

A 100M-030 synchronous linear motor with HIPERFACE® encoder is to be operated with the following travel information:

v = 1 m/s

s = 1000 mm

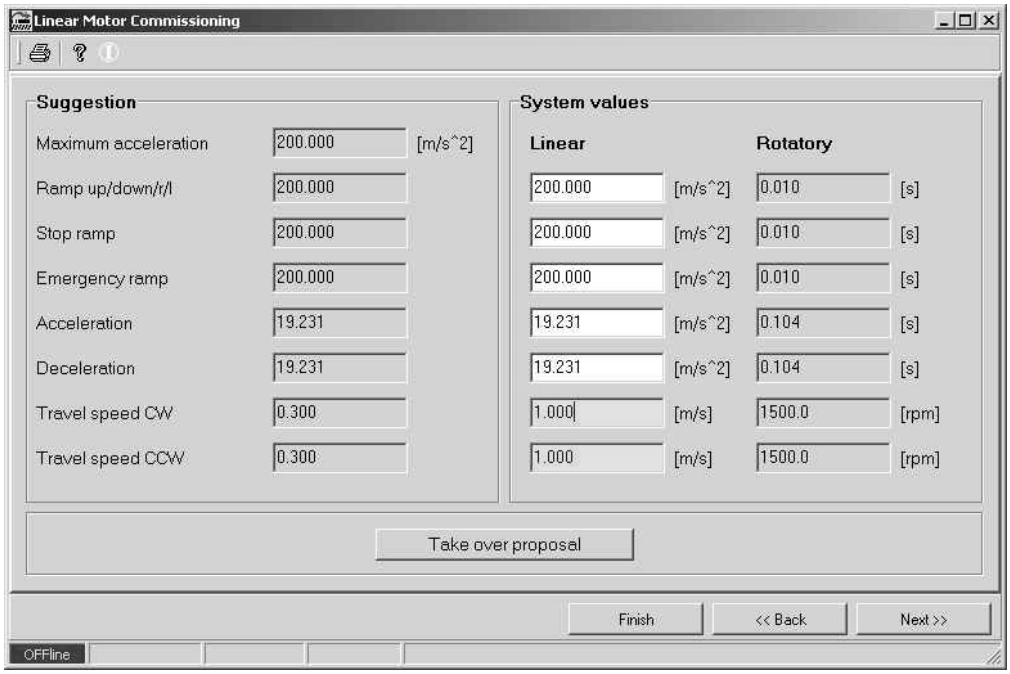
a = 5 m/s^2

Based on the conversion factors shown above, the following rotary information will be displayed in IPOS$^{plus®}$ or via fieldbus:

Speed = 0.0007 / velocity = 1428 rpm

Distance = 64 / 625 x 1000 = 102400 increments

Ramp = 2.000 / 5 = 0.4 s



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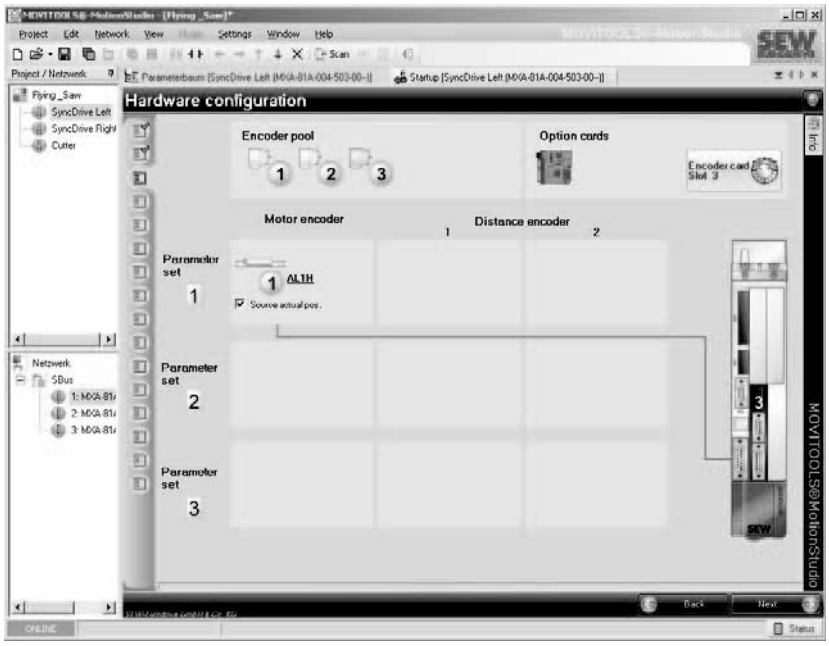
The values are rounded off. You can calculate the exact rotary values for IPOS$^{plus®}$ from the linear values in the last screen of the V/X controller startup. In the figure, a set speed of 1500 rpm was calculated for IPOS$^{plus®}$ after the positioning velocity 1 m/s was entered.

7.5 MOVIAXIS®: Startup procedure

Proceed as follows:

7.5.1 Parameterization

1. Make sure that the inverter is in controller inhibit or 24 V mode.
2. Execute startup for linear motors in MOVITOOLS® MotionStudio starting with the factory setting. The following dialogs show the typical settings for this process.



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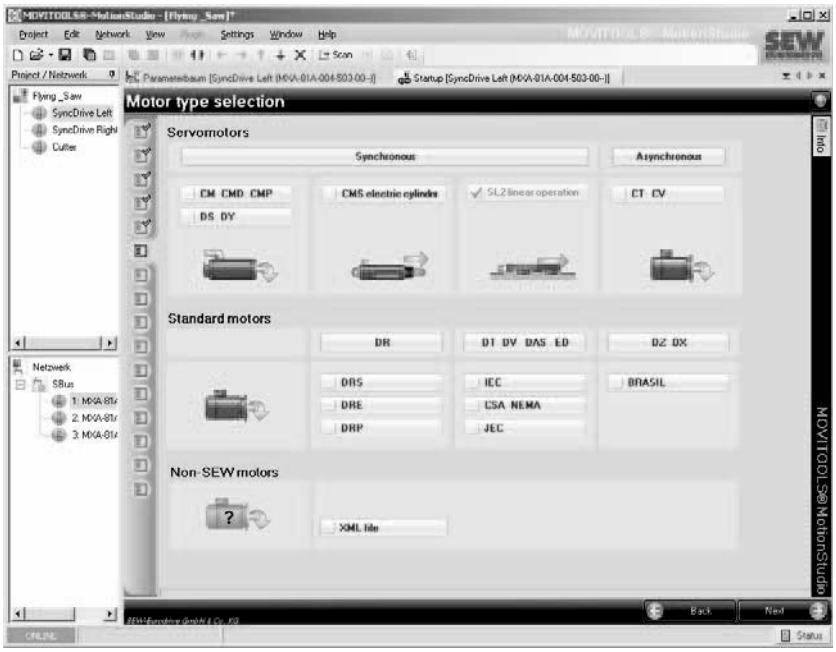
+



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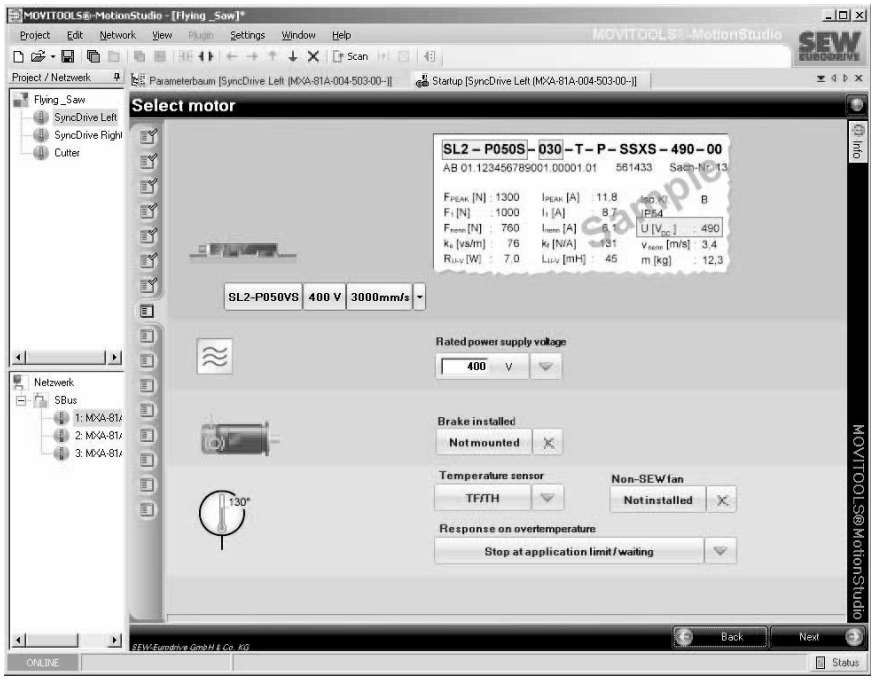
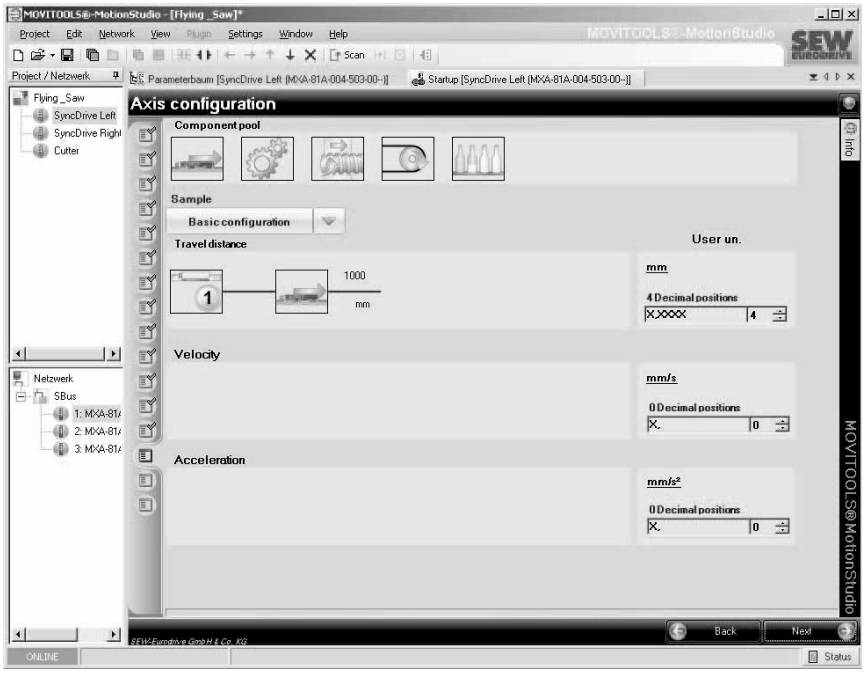


64393AEN



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7.5.2 Checking encoder evaluation

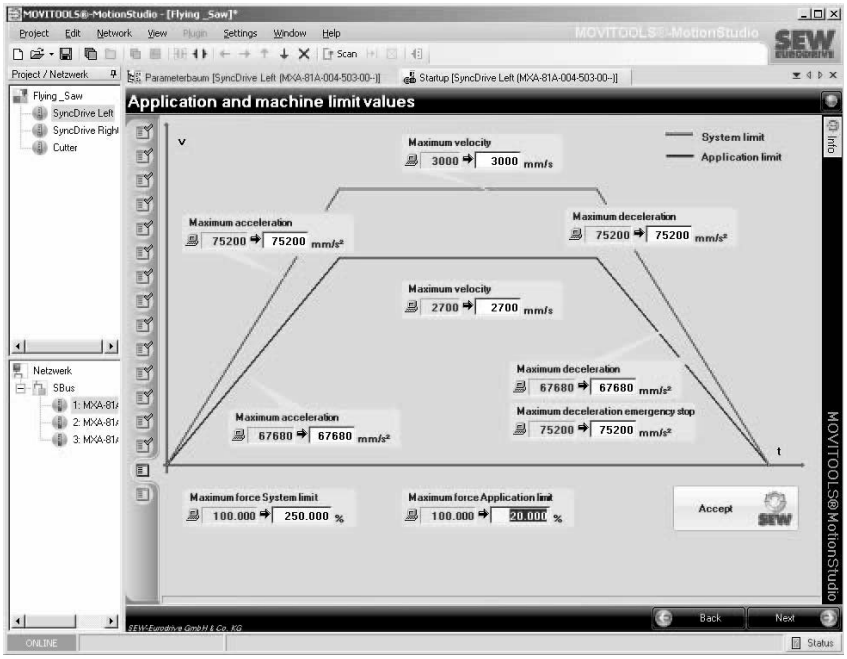
3. Manually move the primary in one direction and observe index 9704, subindex 2 (actual position) in Shell of MOVITOOLS® MotionStudio. Determine the positive direction of movement. Then slide the linear motor once over the entire travel distance to check if the encoder works correctly in all areas.

7.5.3 Checking hardware limit switches

4. Set the hardware limit switch parameters and check their function by manually sliding the primary to the limit switches.

7.5.4 Activate drive limits for initial startup

5. For initial startup, limit the maximum speed and the maximum force via the application limit values so that the motor cannot develop its full force and speed in case of a non-controlled axis movement.



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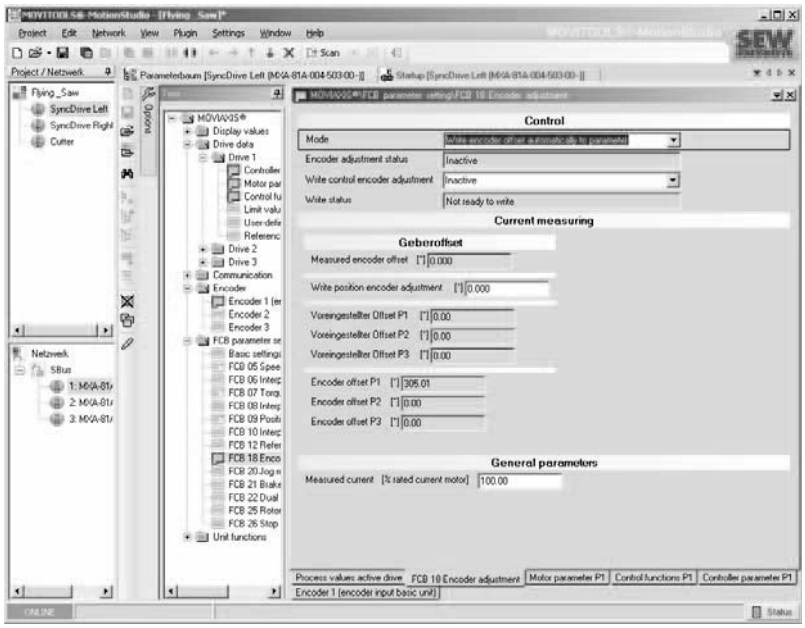
7.5.5 Commutation travel



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6. The FCB18 encoder adjustment serves for the process of the standard commutation travel type described in chapter 7.2.1 In "Write encoder offset automatically in parameter" mode, an offset is stored in the inverter after successful commutation travel when using an incremental encoder or AL1H. After having selected the FCB, set controller inhibit DI00 = 1. If an error occurs during commutation travel, rectify the error by means of the information in chapter 8. If you want to use other FCB18 modes, observe the note below. If you want to use FCB25 rotor position identification in exceptional cases, consult SEW-EURODRIVE.

⚠ WARNING

Never use „Write encoder offset to Hipferface encoder“ when using AL1H and FCB18. Else, the factory set identical offset of every AL1H in the encoder memory will be overwritten.

Risk of injury due to non-controlled axis movements when replacing the encoder for service purposes.

- If the AL1H sensor is replaced in case of service, the motor will not be commutated correctly unless FCB18 is executed again.

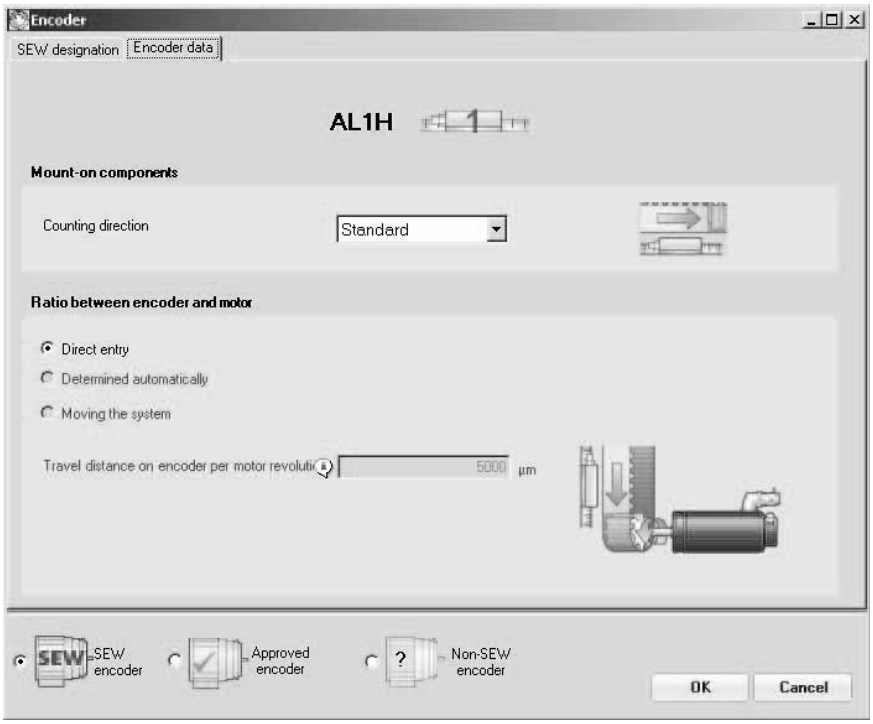
After successful commutation travel, the inverter automatically sets the bit "Motor commutated" in the status word. This value is later to be evaluated in the PLC to permit inverter enable. With absolute encoders such as AL1H, the bit "Motor commutated" is not generated and will therefore not be set after calibration.

7.5.6 Optimizing the axis

7. In the controller setting dialog at startup, you can determine the external axis mass and the external mass moment of inertia of the load of a rotative axis by clicking the "Measure" button. Reset the application limit values of current and force to the original values (see point 5) and optimize the control loop of the drive as usual for rotative servomotors.

7.5.7 Further settings

8. With MOVIAXIS® you can adjust the counting direction of the encoder to the counting direction of the motor phase without having to swap two motor phases. Use index 9719 subindex for this purpose. It can be set, for example with the subsequent subdialog at the startup for encoder configuration.



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9. If you need another positive encoder counting direction for your linear axis, activate the reversal option for the motor rotation via index "Direction of rotation reversal" 8537 subindex 0.

10. Remove the TF line from the encoder plug of MOVIAXIS® when the motor is at standstill and enabled to check whether TF monitoring is responding.

11. If the drive has an external brake, we recommend that you control it from the inverter. Use the indexes of the brake in the motor parameters to control the brake and set the time for brake release and brake application.

8 Malfunctions

The inverter indicates malfunctions depending on the type via diagnostic LEDs or a 7-segment display and an error code. To rectify the error, consult the system manual or operating instructions of the relevant MOVIDRIVE® and MOVIAXIS® unit. The following notes offer additional information for troubleshooting in particular for linear motors.

	**NOTE**
	Faults may be hard to localize if the EMC wiring is not carried out correctly. These are often coupled into the inverter by the TF lines running in the same duct as the motor cable. To exclude this fault, we recommend that you disconnect the TF for test purposes (set the "Fault response to motor overtemperature" to no response) during commutation travel.

	**STOP**
	Motor monitoring is disabled. Make sure that there is no thermal overload at the linear motor. Potential damage to property. • Make sure to connect TF monitoring after successful troubleshooting and set the "Fault response to motor overtemperature" parameter to EMERGENCY STOP /FAULT.

8.1 MOVIDRIVE®: Faults during commutation search

Fault	Possible cause	Remedy
Encoder error (14) when linear motor is moved manually	Encoder not installed correctly	Check installation using the encoder manufacturer information: 1. Air gap encoder - measuring tape 2. Alignment encoder - measuring tape 3. With HIPERFACE® encoder: Check mounting direction so that cable output shows in the direction of the smaller absolute values (direction "dot" on the measuring tape if available)
	Encoder not connected correctly	Check pin assignment, operate HIPERFACE® encoder as sin/cos encoder for test purposes.
Linear motor does not start after removal of CONTROLLER INHIBIT	Motor cable interrupted	Check linear motor connection
	Brake function P730 = ON	P730 must be set to OFF for commutation search
	(only for HIPERFACE® encoder) inverter reports that encoder has already been adjusted (H458=1)	If you want to perform commutation travel, select "Encoder adjustment" in the startup screen. In this case, the inverter will reset the bit automatically.
n-monitoring/lag error during commutation travel	Inverter not in status "NO ENABLE" because enable is set in addition to CONTROLLER INHIBIT or a terminal has been programmed to "ENABLE".	Assign binary input directly on unit via IPOSplus® control word or via fieldbus with ENABLE, e.g. P603 = ENABLE/STOP
	EMC problems	See system manual and volume 9 "Practical Drive Engineering". Check for correct shielding, equipotential bonding and observe the note at the beginning of this chapter
Encoder fault after commutation travel. Compensation movement (1st movement) without noticeable 2nd movement.	Motor cable interrupted; an alternating field can be established but no rotating field	Check linear motor connection
Encoder fault after commutation travel in positive direction (2nd movement)	Counting direction of the encoder does not correspond to U,V,W phase sequence of motor	Check to see if encoder counts positive in the direction that the primary was moving. If not, swap connections of U and W motor cables.
	Resolution of encoder system incorrect / encoder defective	Slide the linear motor for a defined distance and check whether the displayed increments correspond to the calculated value using the calculation displayed by MOVITOOLS® MotionStudio. Adjust the encoder resolution in the linear motor startup, if necessary, and check the distance between scanner and measuring tape.
	Current limit reduced too far	Reset P303 to the value set by linear motor startup. Use parameter P304 for force reduction
Encoder error after commutation travel in negative direction (3rd movement)	Travel distances are not identical because axis is mechanically sluggish	Make sure that the drive travels with easy movement for the entire distance and no other forces are at play (process forces, weight forces)
	Travel distances are not identical because encoder is defective	Slide the linear motor for a defined distance and check whether the displayed increments correspond to the calculated value using the calculation displayed by MOVITOOLS® MotionStudio. Adjust the encoder resolution in the linear motor startup, if necessary, and check the distance between scanner and measuring tape.
	Current limit reduced too far	Reset P303 to the value set by linear motor startup. Use parameter P304 to reduce the force.
Linear motor rotates too far	EMC problems	See system manual and volume 9 "Practical Drive Engineering". Check for correct shielding, equipotential bonding and observe the note at the beginning of this chapter
	Defective spot in linear scale	Slide the linear motor for a defined distance and check whether the displayed increments correspond to the calculated value using the calculation displayed by MOVITOOLS® MotionStudio. Perform checks at several spots and check the distance between scanner and measuring tape.

8.2 MOVIDRIVE®: Problems during operation

Fault	Possible cause	Remedy
Linear motor with AL1H performs commutation travel automatically after encoder replacement or reports fault 81 start condition	Bit 25 in H473 was cleared after installing a replacement encoder because P948 Automatic encoder detection was set to ON.	• Before you retrofit the new sensor, install old AL1H sensor, load data backup, set P948 to OFF. This procedure is preferred for hoists. Check actual position of axis to old value and carefully check for proper functioning of axis in manual mode. - OR • Recalibrate new AL1H sensor in startup screen for encoder adjustment (see startup chapter).
Fault 81 Start condition when using incremental encoder	Controller changes to "Enable" without bit 25 in H473 LSM commuted = 1	See problems during commutation search
Linear motor does not start	Motor cable interrupted	Check motor connection
	Brake does not release	Check brake control; check air supply for pneumatic brakes
Linear motor makes humming noise or does not run smoothly	Fault on encoder cable	See system manual and volume 9 "Practical Drive Engineering". Check for correct shielding, equipotential bonding and observe the note at the beginning of this chapter
	Controller parameters set incorrectly	Perform startup of control loop once again
	Encoder connection with primary not rigid enough	Check to see if mechanical connection between encoder and primary is rigid enough.
	Permitted operating temperature of encoder exceeded	• Select the travel cycle so that the effective value of the output current is less than the rated current of the motor • Arrange for better heat dissipation of primary • Decouple encoder thermally (mounting with plastic distance plate) • Use encoder system with higher permitted operating temperature
Linear motor heats up excessively	Overload	Select the travel cycle so that the effective value of the output current is less than the rated current of the motor
	Insufficient cooling	Improve cooling or install fan
	Air gap too large, resulting in power loss at same current (see derating table in catalog)	Adjust air gap
	Ambient temperature is too high	Select travel cycle so that effective value of output current is less than rated current of SL2 linear motor
HIPERFACE® encoder fault	Problems on encoder cable	If the problems do not occur during manual sliding, they are often caused by problems in the encoder or TF line. Consult the system manual or volume 9 of Practical Drive Engineering for troubleshooting. Check for correct shielding, equipotential bonding and observe the note at the beginning of this chapter
	Encoder not installed correctly	Check installation using the encoder manufacturer information: 1. Air gap encoder - measuring tape 2. Alignment encoder - measuring tape 3. With HIPERFACE® encoder: Check mounting direction so that cable output shows in direction smaller absolute values (direction "dot" on the measuring tape if present) Check rigidity of encoder mounting. Observe the manufacturer tolerances even with fast accelerations.

8.3 MOVIAXIS®: Problems during commutation search

Fault	Possible cause	Remedy
Encoder error (14) when linear motor is moved manually	Encoder not installed correctly	Check installation using the encoder manufacturer information: 1. Air gap encoder - measuring tape 2. Alignment encoder - measuring tape 3. With HIPERFACE® encoder: Check mounting direction so that cable output shows in the direction of the smaller absolute values (direction "dot" on the measuring tape if available).
	Encoder not connected correctly	Check pin assignment, operate HIPERFACE® encoder as sin/cos encoder for test purposes.
Linear motor does not start after removal of CONTROLLER INHIBIT	Motor cable interrupted	Check linear motor connection.
Error E16 subcode 1042 with arbitrary FCB selection except for FCB18 or FCB25	Motor not commutated	Commutate motor first with FCB18 or FCB25.
n-monitoring/lag error during commutation travel or encoder error at the first moment when the motor receives current.	EMC problems	See system manual and volume 9 "Practical Drive Engineering". Check for correct shielding, equipotential bonding and observe the note at the beginning of this chapter.
Encoder error after commutation travel. Compensation movement (1st movement) without noticeable 2nd movement.	Motor cable interrupted; an alternating field can be established but no rotating field	Check linear motor connection.
Encoder error after commutation travel in positive direction (2nd movement)	Counting direction of the encoder does not correspond to U,V,W phase sequence of motor	Check to see if encoder counts positive in the direction that the primary was moving. If not, swap connections of U and W motor cables, or invert sense of rotation of encoder to that of the motor (see Startup chapter, point 8).
	Resolution of encoder system incorrect / encoder defective	Slide the linear motor for a defined distance and compare the measured distance with the distance in the actual position. Adjust the encoder resolution in the encoder configuration of motor startup and check the distance between scanner and measuring tape.
	Torque limit reduced too far	Adjust application limit and system limit maximum torque.
Encoder error after commutation travel in negative direction (3rd movement)	Travel distances are not identical because axle is mechanically sluggish	Make sure that the drive travels with easy movement for the entire distance and no other forces are at play (process forces, weight forces).
	Travel distances are not identical because encoder is defective	Slide the linear motor for a defined distance and compare the measured distance with the distance in the actual position. If necessary, adjust the encoder resolution in the encoder configuration of motor startup and check the distance between scanner and measuring tape.
	Torque limit reduced too far	Adjust application limit and system limit maximum torque.
Linear motor rotates too far	EMC problems	See system manual and volume 9 "Practical Drive Engineering". Check for correct shielding, equipotential bonding and observe the note at the beginning of this chapter.
	Defective spot in linear scale	Slide the linear motor for a defined distance and compare the measured distance with the distance in the actual position. If necessary, adjust the encoder resolution in encoder configuration of motor startup and check the distance between scanner and measuring tape.

8.4 MOVIAXIS®: Problems during operation

Fault	Possible cause	Remedy
Error start condition (81) with arbitrary FCB selection except for FCB18 or FCB25	Motor not commutated	Commutate motor first with FCB18 or FCB25
Linear motor does not start	Motor cable interrupted	Check motor connection
	Brake does not release	Check brake control; check air supply for pneumatic brakes
Linear motor makes humming noise or does not run smoothly	Fault on encoder cable	See system manual and volume 9 "Practical Drive Engineering". Check for correct shielding, equipotential bonding and observe the note at the beginning of this chapter
	Controller parameters set incorrectly	Perform startup of control loop once again
	Encoder connection with primary not rigid enough	Check to see if mechanical connection between encoder and primary is rigid enough.
	Permitted operating temperature of encoder exceeded	• Select the travel cycle so that the effective value of the output current is less than the rated current of the motor • Arrange for better heat dissipation of primary • Decouple encoder thermally (mounting with plastic distance plate) • Use encoder system with higher permitted operating temperature
Linear motor heats up excessively	Overload	Select the travel cycle so that the effective value of the output current is less than the rated current of the motor
	Insufficient cooling	Improve cooling or install fan
	Air gap too large, resulting in power loss at same current (see derating table in catalog)	Adjust air gap
	Ambient temperature is too high	Select travel cycle so that effective value of output current is less than rated current of the SL2 linear motor
HIPERFACE® encoder fault	Problems on encoder cable	If the problems do not occur during manual sliding, they are often caused by problems in the encoder or TF line. Consult the system manual or volume 9 of "Practical Drive Engineering" for troubleshooting. Check for correct shielding, equipotential bonding and observe the note at the beginning of this chapter
	Encoder not installed correctly	Check installation using the encoder manufacturer information: 1. Air gap encoder - measuring tape 2. Alignment encoder - measuring tape 3. With HIPERFACE® encoder: Check mounting direction so that cable output shows in direction smaller absolute values (direction "dot" on the measuring tape if present) Check rigidity of encoder mounting. Observe the manufacturer tolerances even with fast accelerations.

9 Inspection / Maintenance

9.1 Notes

DANGER

Risk of injury due to electric shock.

Induced voltages of up to 500 V can be generated by movement of the primary (generator principle) even if the motor is not connected. Do not remove the protection cap on the power plug of the primary until immediately before connecting the power plug to the power supply.

Severe or fatal injuries.

- After separating the inverter from the supply voltage, wait for at least five minutes before you touch any live parts (e.g. contacts, thread bolts) or loosen connections. Measure the voltage on the DC link and wait until the voltage has dropped below 40 V.

WARNING

Touching the linear motors when they have not cooled down could result in burns. Linear motors can have a surface temperature of over 100 °C.

Danger of burns

- Never touch the linear motor during operation or in the cool down phase once it has been switched off.

STOP

Improper inspection and maintenance may result in damages to the linear motor.

Potential damage to property.

- Do closely observe the notes in this chapter.

- Keep motor area free from chips.
- Listen for and note any noise.
- Power connections can conduct voltages even if the motor is not turning. Never disconnect electrical connections of motors while they are energized.
- Wear work gloves when carrying out maintenance and repair work.
- Ensure safe disconnection from the voltage supply before working on the machine.
- Never work in the travel range when the machine is switched on.
- Remove any chips from the motor area on a regular basis.
- Use only genuine spare parts in accordance with the valid parts list.
- Motors can become very hot during operation – danger of burns.
- Disconnect the linear motor from the power supply before starting work and protect it against unintentional re-start.

9.2 General maintenance work

The primaries and secondaries are maintenance-free and cannot be repaired. Replace defective parts.

Remove any traces of dirt, chips, dust, etc. from the secondaries with a soft cloth.

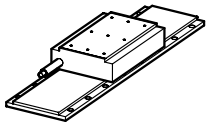
Note that mobile cables are subject to wear. They have to be checked for external changes on a regular basis.

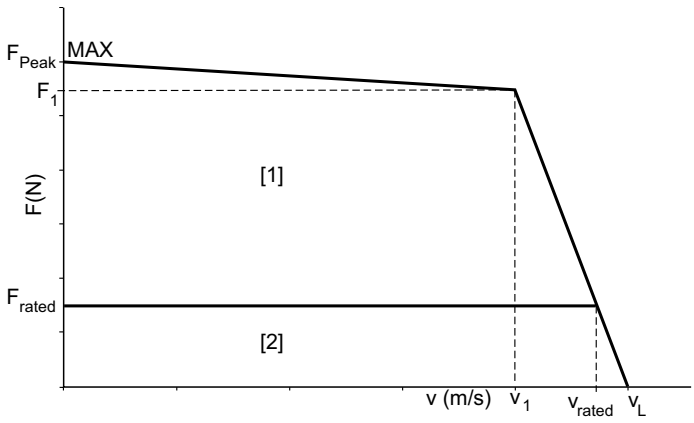
9.3 Additional maintenance for Power version

Keep air entry screen on fans free from congestion.

10 Technical Data

10.1 SL2-Basic motor data





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[1] = Dynamic limit forces
[2] = Thermal limit forces
F_{rated} = Permanent force
when mounting to a horizontal aluminum cooling surface with
- four times primary flange surface
- 10 mm thick
- up to an ambient temperature of up to 40 °C
- an installation altitude of up to 1000 m

F_1 = Maximum force available up to v_1
F_{Peak} = Maximum force
v_L = Theoretical maximum traveling velocity
v_1 = Velocity up to which force F_1 is available
v_{rated} = Velocity up to which the rated force is available
I_{rated} = Rated current
I_1 = Current at F_1
I_{Peak} = Maximum current
F_D = Force through magnetic attraction

Motor type	Force				Velocity		Current			Winding resistance	Inductance	Cable cross section[1)]
	F_{Peak} [N]	F_1 [N]	F_{rated} [N]	F_D [N]	v_1 [m/s]	v_{rated} [m/s]	I_{Peak} [A]	I_1 [A]	I_{rated} [A]	R_1 [Ω]	L_1 [mH]	[mm]
SL2-025VS	330	240	125	750	3	3.2	3.0	2.0	0.95	22,5	100	3 x 1,5
SL2-025VS	330	225	125	750	6	6.8	6.0	4.0	2.0	4.75	25.5	3 x 1.5
SL2-025S	650	470	240	1450	1.5	1.6	3.0	1.95	0.9	45.1	201	3 x 1.5
SL2-025S	650	460	240	1450	3	3.2	6.0	3.9	1.8	11.2	100.5	3 x 1.5
SL2-050VS	650	500	280	1480	3 6	3.4 8.0	6.0 13.9	4.4 10.3	2.2 5.3	7.0 1.2	43 8	3 x 1.5 3 x 1.5
SL2-050S	1300	1000	560	2880	1 3 6	1.3 3.4 6.9	4.8 11.8 24.5	3.5 8.7 17.8	1.8 4.5 9.0	24.4 3.6 0.8	130 27.5 6.0	3 x 1.5 3 x 1.5 3 x 1.5
SL2-050M	1950	1500	840	4300	1 3 6	1.1 3.3 6.4	5.9 18.0 33.0	4.4 12.8 24.6	2.2 6.5 12.6	21.0 2.4 0.6	130 16.5 4.5	3 x 1.5 3 x 1.5 3 x 1.5
SL2-050ML	2600	2000	1120	5700	1 3 6	1.1 3.4 6.9	7.8 24.0 48.0	5.8 17.8 35.5	2.9 9.1 18.2	15.2 1.6 0.4	100 11.5 3.0	3 x 1.5 3 x 1.5 3 x 2.5

Motor type	Force				Velocity		Current			Winding resistance	Inductance	Cable cross section[1]
	F_{Peak} [N]	F_1 [N]	F_{rated} [N]	F_D [N]	v_1 [m/s]	v_{rated} [m/s]	I_{Peak} [A]	I_1 [A]	I_{rated} [A]	R_1 [Ω]	L_1 [mH]	[mm]
SL2-100VS	1325	1000	600	2950	1 3 6	1.1 3.8 6.9	4.8 14.2 24.6	3.4 10.3 17.8	1.9 5.6 9.7	19.2 1.9 0.65	142.5 15.5 6.0	3 x 1.5 3 x 1.5 3 x 1.5
SL2-100S	2650	2000	1200	5760	1 3 6	1.1 3.4 6.9	8.0 25.0 49.0	5.8 17.8 35.5	3.1 9.7 20	12.5 1.3 0.3	100 11.5 3.0	3 x 1.5 3 x 1.5 3 x 2.5
SL2-100M	3970	3000	1800	8570	1 3 6	1.3 3.2 6.9	14.2 35.0 75.0	10.3 24.6 53.3	5.6 13.5 29.2	5.9 1.0 0.2	46.0 9.0 2.0	3 x 1.5 3 x 1.5 3 x 4.0
SL2-100ML	5300	4000	2400	11380	1 3 6	1.1 3.4 7.0	16.0 49.0 100.0	11.5 35.5 74.4	6.3 19.5 40.7	6.3 0.6 0.1	50.0 6.5 1.5	3 x 1.5 3 x 2.5 3 x 6.0
SL2-150VS	2000	1500	900	4420	1 3 6	1.1 3.3 6.4	6.1 18.0 35.0	4.4 12.8 24.6	1.9 7.0 13.5	16.1 1.75 0.5	127.5 16.0 4.5	3 x 1.5 3 x 1.5 3 x 1.5
SL2-150S	3900	3000	1800	8640	1 3 6	1.1 3.2 6.4	12.0 33.5 67.0	8.7 24.5 49.0	4.8 13.5 27.0	8.0 0.9 0.2	65.0 9.0 2.5	3 x 1.5 3 x 1.5 3 x 4.0
SL2-150M	5800	4500	2700	12860	1 3 6	1.1 3.4 6.4	18.0 53.0 100.0	13.1 39.0 74.5	7.2 21.5 40.7	5.4 1.1 0.1	42.5 6.0 1.5	3 x 1.5 3 x 2.5 3 x 6.0
SL2-150ML	7700	6000	3600	17000	1 3 6	1.1 3.7 6.4	24.0 76.0 132.0	17.4 56.7 98.0	9.4 31.0 53.8	4.0 0.3 0.1	32.5 3.5 1.3	3 x 1.5 3 x 4.0 3 x 6.0
SL2-200VS	2700	2000	1260	5900	1 3 6	1.1 3.4 7.6	8.1 25.0 55.0	5.7 17.8 39.2	3.3 10.2 22.5	11.2 1.2 0.2	100 11.5 2.5	3 x 1.5 3 x 1.5 3 x 2.5
SL2-200S	5200	4000	2520	11520	1 3 6	1.1 3.4 7.2	15.6 48.2 101	11.5 35.5 74.4	6.6 20.4 42.7	5.6 0.6 0.1	50.0 6.0 1.5	3 x 1.5 3 x 2.5 3 x 6.0
SL2-200M	7800	6000	3780	17150	1 3	1.1 3.4	23.4 72.0	17.2 53.3	9.9 30.1	3.7 0.4	32 3.3	3 x 1.5 3 x 4.0
SL2-200ML	10350	8000	5040	22780	1 3	1.1 3.6	30.6 100.0	22.7 74.4	13.0 42.8	2.9 0.2	25 3	3 x 1.5 3 x 6.0
SL2-250VS	3170	2400	1500	7370	1 3 6	1.2 3.5 6.6	10.0 30.0 57.0	7.3 21.8 41.2	4.1 12.4 23.5	8.4 0.9 0.2	77.5 8.0 2.3	3 x 1.5 3 x 1.5 3 x 2.5
SL2-250S	6300	4800	3000	14400	1 3 6	1.1 3.3 6.6	18.7 57.0 113.0	13.6 41.2 82.4	7.8 23.5 47.0	4.5 0.4 0.1	40 4.5 1.2	3 x 1.5 3 x 4.0 3 x 6.0
SL2-250M	9450	7200	4500	21430	1 3	1.1 3.5	30.0 90.0	21.8 65.0	12.4 37.2	2.6 0.3	13.5 2.6	3 x 1.5 3 x 6.0
SL2-250ML	12600	9600	6000	28450	1 3	1.1 3.3	37.0 113.0	27.2 82.5	15.5 47.0	2.2 0.2	20 2.2	3 x 1.5 3 x 6.0

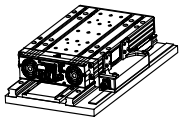
1) Cable cross section on SL2-Basic primary (for configuration of cable cross sections for the inverter, see section 4.11)

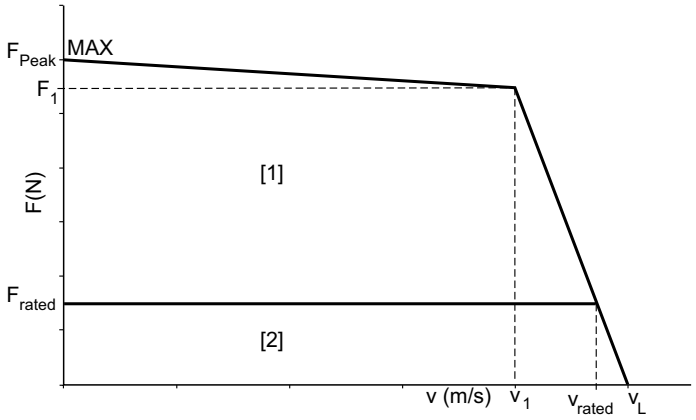
Electrical values refer to sine-shaped commutation and are indicated as effective values or refer to them.

NOTE

For inverter assignment, see chapters 10.5 and 10.6.

10.2 SL2-Advance System motor data





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[1] = Dynamic limit forces
[2] = Thermal limit forces
F_{rated} = Permanent force

Rated characteristics refer to operation at

- an ambient temperature of 40 °C
- an installation altitude of up to 1000 m

F_1 = Maximum force available up to v_1
F_{Peak} = Maximum force
v_L = Theoretical maximum traveling velocity
v_1 = Velocity up to which force F_1 is available
v_{rated} = Velocity up to which the rated force is available
I_{rated} = Rated current
I_1 = Current at F_1
I_{Peak} = Maximum current
F_D = Force through magnetic attraction

Motor type	Force				v_1	Current			Cable cross section	To cable lengths	Part no. cable	Cable cross section	To cable lengths	Part no. cable
	F_{Peak}	F_1	F_{rated}	F_D		I_{Peak}	I_1	I_{rated}						
	[N]				[m/s]	[A]			[mm²]	[m]		[mm²]	[m]	
SL2-050VS	650	500	280	1480	- 3 6	- 6.0 13.9	- 4.4 10.3	- 2.2 5.3	1.5 1.5	100 100	0590 631 8 0590 631 8			
SL2-050S	1300	1000	560	2880	1 3 6	4.8 11.8 24.5	3.5 8.7 17.8	1.8 4.5 9.0	1.5 1.5 1.5	100 100 57	0590 631 8 0590 631 8 0590 631 8	2.5	100	0590 632 6
SL2-050M	1950	1500	840	4300	1 3 6	5.9 18.0 33.0	4.4 12.8 24.6	2.2 6.5 12.6	1.5 1.5 2.5	100 100 71	0590 631 8 0590 631 8 0590 632 6	4.0	100	0590 484 6
SL2-050ML	2600	2000	1120	5700	1 3 6	7.8 24.0 48.0	5.8 17.8 35.5	2.9 9.1 18.2	1.5 1.5 4.0	100 57 100	0590 631 8 0590 631 8 0590 484 6	2.5	100	0590 632 6
SL2-100VS	1325	1000	600	2950	1 3 6	4.8 14.2 24.6	3.4 10.3 17.8	1.9 5.6 9.7	1.5 1.5 1.5	100 100 57	1333 116 7 1333 116 7 1333 116 7	2.5	100	1333 117 5
SL2-100S	2650	2000	1200	5760	1 3 6	8.0 25.0 49.0	5.8 17.8 35.5	3.1 9.7 20	1.5 1.5 4.0	100 57 100	1333 116 7 1333 116 7 0199 194 9	2.5	100	1333 117 5
SL2-100M	3970	3000	1800	8570	1 3 6	14.2 35.0 75.0	10.3 24.6 53.3	5.6 13.5 29.2	1.5 2.5 6.0	100 71 100	1333 116 7 1333 117 5 0199 196 5	4.0	100	0199 194 9
SL2-100ML[1)]	5300	4000	2400	11380	1 3	16.0 49.0	11.5 35.5	6.3 19.5	1.5 4.0	100 100	1333 116 7 0199 194 9			
SL2-150S	3900	3000	1800	8640	1 3 6	12.0 33.5 67.0	8.7 24.5 49.0	4.8 13.5 27.0	1.5 2.5 6.0	100 71 100	1333 116 7 1333 117 5 0199 196 5	4.0	100	0199 194 9
SL2-150M[1)]	5800	4500	2700	12860	1 3	18.0 53.0	13.1 39.0	7.2 21.5	1.5 4.0	100 82	1333 116 7 0199 194 9			
SL2-150ML[1)]	7700	6000	3600	17000	1 3	24.0 76.0	17.4 56.7	9.4 31.0	1.5 6.0	57 77	1333 116 7 0199 196 5	2.5 10.0	100 100	1333 117 5 0199 198 1

1) Not available in speed class 6 m/s.

Electrical values refer to sine-shaped commutation and are indicated as effective values or refer to them.

NOTE

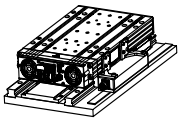
R_1, and L_1 see chapter 10.1 "SL2-Basic motor data"

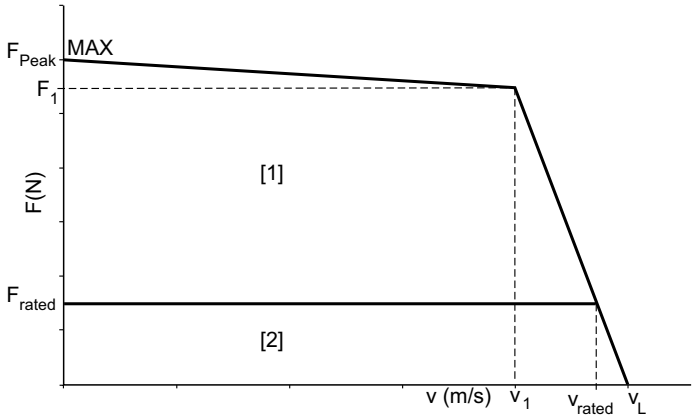
F_{peak} = identical to F_{peak} of SL2-Basic

NOTE

For inverter assignment, see chapters 10.5 and 10.6.

10.3 SL2-Power System motor data





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[1] = Dynamic limit forces
[2] = Thermal limit forces
F_{rated} = Permanent force
Rated characteristics refer to operation at
- an ambient temperature of 40 °C
- an installation altitude of up to 1000 m

F_1 = Maximum force available up to V_1
F_{Peak} = Maximum force
v_L = Theoretical maximum traveling velocity
v_1 = Velocity up to which force F_1 is available
v_{rated} = Velocity up to which the rated force is available
I_{rated} = Rated current
I_1 = Current at F_1
I_{Peak} = Maximum current
F_D = Force through magnetic attraction

Motor type	Force				v_1	Current			Cable cross section	To cable lengths	Part no. cable	Cable cross section	To cable lengths	Part no. cable
	F_{Peak}	F_1	F_{rated}	F_D		I_{Peak}	I_1	I_{rated}						
	[N]				[m/s]	[A]			[mm²]	[m]		[mm²]	[m]	
SL2-050VS	650	500	400	1480	- 3 6	- 6.0 13.9	- 4.4 10.3	- 3.1 7.6	1.5 1.5	100 100	0590 631 8 0590 631 8			
SL2-050S	1300	1000	760	2880	1 3 6	4.8 11.8 24.5	3.5 8.7 17.8	2.4 6.1 12.2	1.5 1.5 1.5	100 100 57	0590 631 8 0590 631 8 0590 631 8	2.5	100	0590 632 6
SL2-050M	1950	1500	980	4300	1 3 6	5.9 18.0 33.0	4.4 12.8 24.6	2.6 7.6 14.7	1.5 1.5 2.5	100 100 71	0590 631 8 0590 631 8 0590 632 6	4.0	100	0590 484 6
SL2-050ML	2600	2000	1280	5700	1 3 6	7.8 24.0 48.0	5.8 17.8 35.5	3.3 10.4 20.8	1.5 1.5 4.0	100 57 82	0590 631 8 0590 631 8 0590 484 6	2.5	100	0590 632 6
SL2-100VS	1325	1000	780	2950	1 3 6	4.8 14.2 24.6	3.4 10.3 17.8	2.5 7.3 12.6	1.5 1.5 1.5	100 100 57	1333 116 7 1333 116 7 1333 116 7	2.5	100	1333 117 5
SL2-100S	2650	2000	1570	5760	1 3 6	8.0 25.0 49.0	5.8 17.8 35.5	4.1 12.7 25.5	1.5 1.5 6.0	100 57 100	1333 116 7 1333 116 7 0199 196 5	2.5	100	1333 117 5
SL2-100M	3970	3000	2540	8570	1 3 6	14.2 35.0 75.0	10.3 24.6 53.3	7.9 19.1 41.2	1.5 4.0 10.0	57 100 100	1333 116 7 0199 194 9 0199 198 1	2.5	100	1333 117 5
SL2-100ML[1)]	5300	4000	2700	11380	1 3	16.0 49.0	11.5 35.5	7.1 21.9	1.5 4.0	100 82	1333 116 7 0199 194 9	6.0	100	0199 196 5
SL2-150S	3900	3000	2700	8640	1 3 6	12.0 33.5 67.0	8.7 24.5 49.0	7.2 20.3 40.5	1.5 4.0 10.0	100 100 100	1333 116 7 0199 194 9 0199 198 1			
SL2-150M[1)]	5800	4500	3800	12860	1 3	18.0 53.0	13.1 39.0	10.1 30.1	1.5 6.0	57 100	1333 116 7 0199 196 5	2.5	100	1333 117 5
SL2-150ML[1)]	7700	6000	5500	17000	1 3	24.0 76.0	17.4 56.7	14.4 47.4	2.5 10.0	71 100	1333 117 5 0199 198 1	2.5	100	1333 117 5

1) Not available in speed class 6 m/s.

Electrical values refer to sine-shaped commutation and are indicated as effective values or refer to them.

NOTE

R_1, and L_1 see chapter 10.1 "SL2-Basic motor data"

F_{peak} = identical to F_{peak} of SL2-Basic

NOTE

For inverter assignment, see chapters 10.5 and 10.6.

10.4 Derating

10.4.1 Influence of the ambient temperature on linear motors

	Ambient temperature [°C]				
	0...40	45	50	55	60
Rated thrust	1.0 x F_N	0.96 x F_N	0.92 x F_N	0.87 x F_N	0.82 x F_N

10.4.2 Influence of the installation altitude on linear motors

	Installation altitude [m]						
	up to 1000	1500	2000	2500	3000	3500	4500
Rated thrust	1.0 x F_N	0.97 x F_N	0.94 x F_N	0.9 x F_N	0.86 x F_N	0.82 x F_N	0.77 x F_N

10.4.3 Influence of increasing the mechanical air gap S in linear motors

NOTE

- SEW-EURODRIVE recommends that customers set an air gap of 1 mm for the SL2-Basic, SL2-Advance System und SL2-Power System motors (smaller air gaps are only possible if the customer's surrounding structure is very stable).
- The following feasible thrust forces require that air gap tolerances of ± 0.05 mm are observed.

	Mechanical air gap [d_{mech} [1)]] [mm]				
Σ	0.5	0.6	0.7	0.8	0.9
Maximum force F_1	1.0 x F_1	0.995 x F_1	0.99 x F_1	0.983 x F_1	0.975 x F_1
Magnetic attraction force F_D	1.0 x F_D	0.99 x F_D	0.98 x F_D	0.967 x F_D	0.95 x F_D

1) visible air gap between primary and secondary in installed state of motor, referred to as SIGMA Σ.

	Mechanical air gap [d_{mech} [1)]] [mm]					
Σ	SEW-EURODRIVE recommendation 1.0	1.1	1.2	1.3	1.4	1.5
Maximum force F_1	**0.965 x F_1**	0.955 x F_1	0.94 x F_1	0.93 x F_1	0.915 x F_1	0.90 x F_1
Magnetic attraction force F_D	**0.93 x F_D**	0.90 x F_D	0.865 x F_D	0.83 x F_D	0.78 x F_D	0.73 x F_D

1) visible air gap between primary and secondary in installed state of motor, referred to as SIGMA Σ.

10.5 Maximum force with MOVIDRIVE®MDX61B

10.5.1 Speed class 1 m/s

The table shows the maximum force that can be reached with the connected MOVIDRIVE® MDX61B inverter.

NOTE

The maximum forces (F_{max}) that can be reached do not depend on SL2-Basic, SL2-Advance System, SL2-Power System.

Motor V_{rated} = 1 m/s		MOVIDRIVE® MDX61B_A...-5_3 (400/500 V unit) in SERVO operating modes (P700)											
	P [kW]	0005	0008	0011	0014	0015	0022	0030	0040	0055	0075	0110	0150
	I_{rated} [A]	2	2,4	3,1	4	4	5,5	7	9,5	12,5	16	24	32
	I_{max} [A]	4	4,8	6,2	8	6	8,25	10,5	14,25	18,75	24	36	48
	Systems	F_{max} [N]											
SL2-P025S	Basic	650											
SL2-050S	Basic Advance Power	1115	1300			1300							
SL2-050M	Basic Advance Power	1380	1620	1950	1950	1950							
SL2-050ML	Basic Advance Power	1453	1696	2120	2600	2070	2600						
SL2-100VS	Basic Advance Power	1140	1325	1325	1325	1325							
SL2-100S	Basic Advance Power	1467	1703	2118	2650	2060	2650						
SL2-100M	Basic Advance Power			1953	2412	1902	2475	3050	3970				
SL2-100ML	Basic Advance Power						3000	3710	4800	5300			
SL2-150VS	Basic	1380	1615	2000	2000	1970							
SL2-150S	Basic Advance Power		1800	2230	2785	2170	2880	3490	3900				
SL2-150M	Basic Advance Power						3100	3750	4830	5800			
SL2-150ML	Basic Advance Power							4330	5240	6330	7700		
SL2-200VS	Basic			2145	2670	2090	2700						
SL2-200S	Basic						3050	3710	4810	5200			
SL2-200M	Basic								5150	6450	7800		
SL2-200ML	Basic									6840	8390	10350	
SL2-250VS	Basic			2090	2600	2040	2670	3170					
SL2-250S	Basic							3890	5000	6300			
SL2-250M	Basic								5140	6370	7810	9450	
SL2-250ML	Basic									7020	8620	12300	12600

10.5.2 Speed class 3 m/s

The table shows the maximum force that can be reached with the connected MOVIDRIVE® MDX61B inverter.

Motor V_{rated} = 3 m/s		MOVIDRIVE® MDX61B_A...-5_3 (400/500 V unit) in SERVO operating modes (P700)															
	P [kW]	0005	0008	0011	0014	0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450
	I_{rated} [A]	2	2,4	3,1	4	4	5,5	7	9,5	12,5	16	24	32	46	60	73	89
	I_{max} [A]	4	4,8	6,2	8	6	8,25	10,5	14,25	18,75	24	36	48	69	90	109,5	133,5
	Systems	F_{max} [N]															
SL2-P025VS	Basic	330															
SL2-P025S	Basic	650															
SL2-050VS	Basic Advance Power	460	537	650	650	650											
SL2-050S	Basic Advance Power			738	926	717	955	1175	1300								
SL2-050M	Basic Advance Power							1280	1640	1950							
SL2-050ML	Basic Advance Power							1290	1650	2090	2600						
SL2-100VS	Basic Advance Power						830	1020	1325								
SL2-100S	Basic Advance Power								1680	2090	2560	2650					
SL2-100M	Basic Advance Power									2455	2950	3970					
SL2-100ML	Basic Advance Power										2950	4050	5200	5300			
SL2-150VS	Basic						1065	1280	1650	2000							
SL2-150S	Basic Advance Power									2425	2950	3900					
SL2-150M	Basic Advance Power										3070	4200	5330	5800			
SL2-150ML	Basic Advance Power											4250	5400	7080	7700		
SL2-200VS	Basic								1650	2100	2610	2700					
SL2-200S	Basic										2920	4050	5200				
SL2-200M	Basic											4340	5490	7480	7800		
SL2-200ML	Basic												5680	7510	9430	10350	
SL2-250VS	Basic								2120	2610	3170						
SL2-250S	Basic											4310	5410	6300			
SL2-250M	Basic												5670	7560	9450		
SL2-250ML	Basic													8270	10340	12260	12600

10.5.3 Speed class 6 m/s

The table shows the maximum force that can be reached with the connected MOVIDRIVE® MDX61B inverter.

Motor V_{rated} = 6 m/s		MOVIDRIVE® MDX61B_A...-5_3 (400/500 V unit) in SERVO operating modes (P700)															
	P [kW]	0005	0008	0011	0014	0015	0022	0030	0040	0055	0075	0110	0150	0220	0300	0370	0450
	I_{rated} [A]	2	2,4	3,1	4	4	5,5	7	9,5	12,5	16	24	32	46	60	73	89
	I_{max} [A]	4	4,8	6,2	8	6	8,25	10,5	14,25	18,75	24	36	48	69	90	109,5	133,5
	Systems	F_{max} [N]															
SL2-P025VS	Basic			330													
SL2-050VS	Basic Advance Power				400	320	415	510	650								
SL2-050S	Basic Advance Power							675	840	1040	1280	1300					
SL2-050M	Basic Advance Power									1200	1470	1950					
SL2-050ML	Basic Advance Power										1450	2025	2600				
SL2-100VS	Basic Advance Power								850	1045	1300	1325					
SL2-100S	Basic Advance Power											2025	2600	2650			
SL2-100M	Basic Advance Power											2025	2765	3700	3970		
SL2-100ML	Basic												2800	3750	4780	5300	
SL2-150VS	Basic									1220	1470	2000					
SL2-150S	Basic Advance Power											2350	2950	3900			
SL2-150M	Basic Advance Power												3150	4220	5290	5800	
SL2-150ML	Basic Advance Power														5600	6570	7700
SL2-200VS	Basic											1860	2390	2700			
SL2-200S	Basic													3760	4710	5200	
SL2-250VS	Basic											2150	2730	3170			
SL2-250S	Basic													4150	5180	6130	6300

10.6 Maximum forces with MOVIAXIS®

10.6.1 Speed class 1 m/s

The table shows the maximum force that can be reached with the connected MOVIAXIS® MX..6300 multi-axis servo inverter.

NOTE

The maximum forces (F_{max}) that can be reached do not depend on SL2-Basic, SL2-Advance System, SL2-Power System.

Motor V_{rated} = 1 m/s		MOVIAXIS® MX									
		BG1			BG2		BG3		BG4	BG5	BG6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
	Systems	F_{max} [N]									
SL2-P025S	Basic	285	650								
SL2-050S	Basic Advance Power	1300									
SL2-050M	Basic Advance Power	1705	1950								
SL2-050ML	Basic Advance Power	1798	2600								
SL2-100VS	Basic Advance Power	1367	1082	1325							
SL2-100S	Basic Advance Power	1817	2650								
SL2-100M	Basic Advance Power		2979	3970							
SL2-100ML	Basic Advance Power		3583	5300							
SL2-150VS	Basic	1694	2000								
SL2-150S	Basic Advance Power		3399	3900							
SL2-150M	Basic Advance Power		3579	5800							
SL2-150ML	Basic Advance Power			6919	7700						
SL2-200VS	Basic	1805	2700								
SL2-200S	Basic		3610	5200							
SL2-200M	Basic			6955	7800						
SL2-200ML	Basic			7319	10350						
SL2-250VS	Basic	1768	3170								
SL2-250S	Basic		3701	6300							
SL2-250M	Basic			6813	9450						
SL2-250ML	Basic				10645	12600					

10.6.2 Speed class 3 m/s

The table shows the maximum force that can be reached with the connected MOVIAXIS® MX multi-axis servo inverter.

Motor V_{rated} = 3 m/s		MOVIAXIS® MX									
		BG1			BG2		BG3		BG4	BG5	BG6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
	Systems	F_{max} [N]									
SL2-P025VS	Basic	225.4	330								
SL2-P025S	Basic	650									
SL2-050VS	Basic Advance Power	568	650								
SL2-050S	Basic Advance Power		1116	1300							
SL2-050M	Basic Advance Power		1220	1950							
SL2-050ML	Basic Advance Power			2211	2600						
SL2-100VS	Basic Advance Power		993	1325							
SL2-100S	Basic Advance Power			2246	2650						
SL2-100M	Basic Advance Power			2528	3587	3970					
SL2-100ML	Basic Advance Power				3485	4473	5300				
SL2-150VS	Basic		1223	2000							
SL2-150S	Basic Advance Power			2528	3587	3900					
SL2-150M	Basic Advance Power				3594	4630	5800				
SL2-150ML	Basic Advance Power					4467	6387	7700			
SL2-200VS	Basic			2260	2700						
SL2-200S	Basic				3516	4521	5200				
SL2-200M	Basic					4816	6877	7800			
SL2-200ML	Basic						6737	8678	10350		
SL2-250VS	Basic			2271	3170						
SL2-250S	Basic				3686	4762	6300				
SL2-250M	Basic						6813	8727	9450		
SL2-250ML	Basic						7373	9524	12600		

10.6.3 Speed class 6 m/s

The table shows the maximum force that can be reached with the connected MOVIAXIS® MX multi-axis servo inverter.

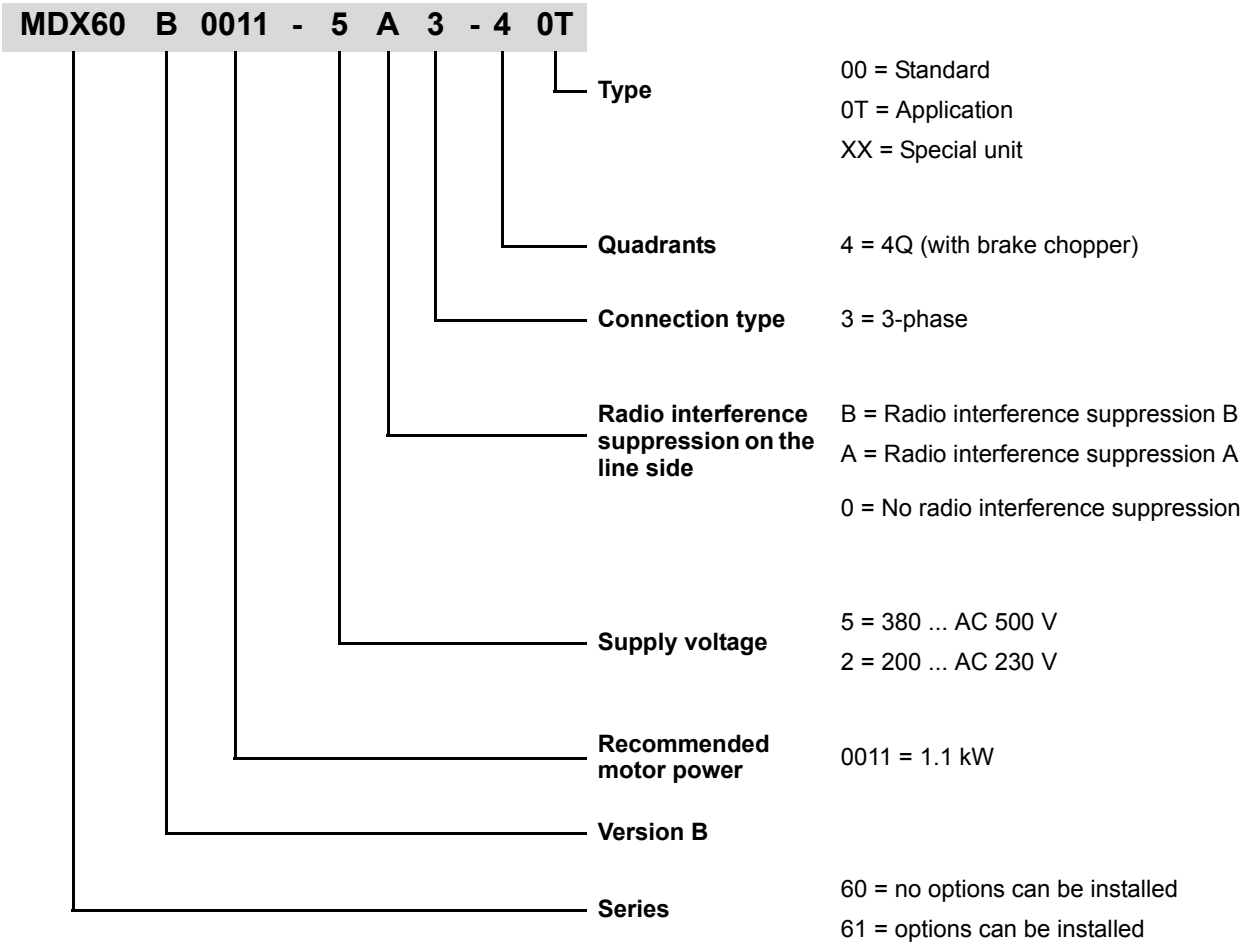
Motor V_{rated} = 6 m/s		MOVIAXIS® MX									
		BG1			BG2		BG3		BG4	BG5	BG6
	I_{rated} [A]	2	4	8	12	16	24	32	48	64	100
	I_{max} [A]	5	10	20	30	40	60	80	120	160	250
	Systems	F_{max} [N]									
SL2-P025VS	Basic	274	330								
SL2-050VS	Basic Advance Power		486	650							
SL2-050S	Basic Advance Power			1116	1300						
SL2-050M	Basic Advance Power			1254	1771	1950					
SL2-050ML	Basic Advance Power				1728	2211	2600				
SL2-100VS	Basic Advance Power			1123	1325						
SL2-100S	Basic Advance Power				1742	2237	2650				
SL2-100M	Basic Advance Power					2357	3360	3970			
SL2-100ML	Basic						3355	4314	5300		
SL2-150VS	Basic			1264	1793	2000					
SL2-150S	Basic Advance Power					2528	3587	3900			
SL2-150M	Basic Advance Power						3775	4854	5800		
SL2-150ML	Basic Advance Power							5072	7195	7700	
SL2-200VS	Basic				1610	2077	2700				
SL2-200S	Basic						3376	4348	5200		
SL2-250VS	Basic				1843	2381	3170				
SL2-250S	Basic						3686	4762	6300		

10.7 Unit designation for MOVIDRIVE® MDX61B

SL2 linear motors can be operated together with the technology version of MOVIDRIVE® MDX61B inverters from SEW-EURODRIVE.

	NOTE
	Make sure that the guide carriage is unobstructed and can move freely in relation to the secondary.

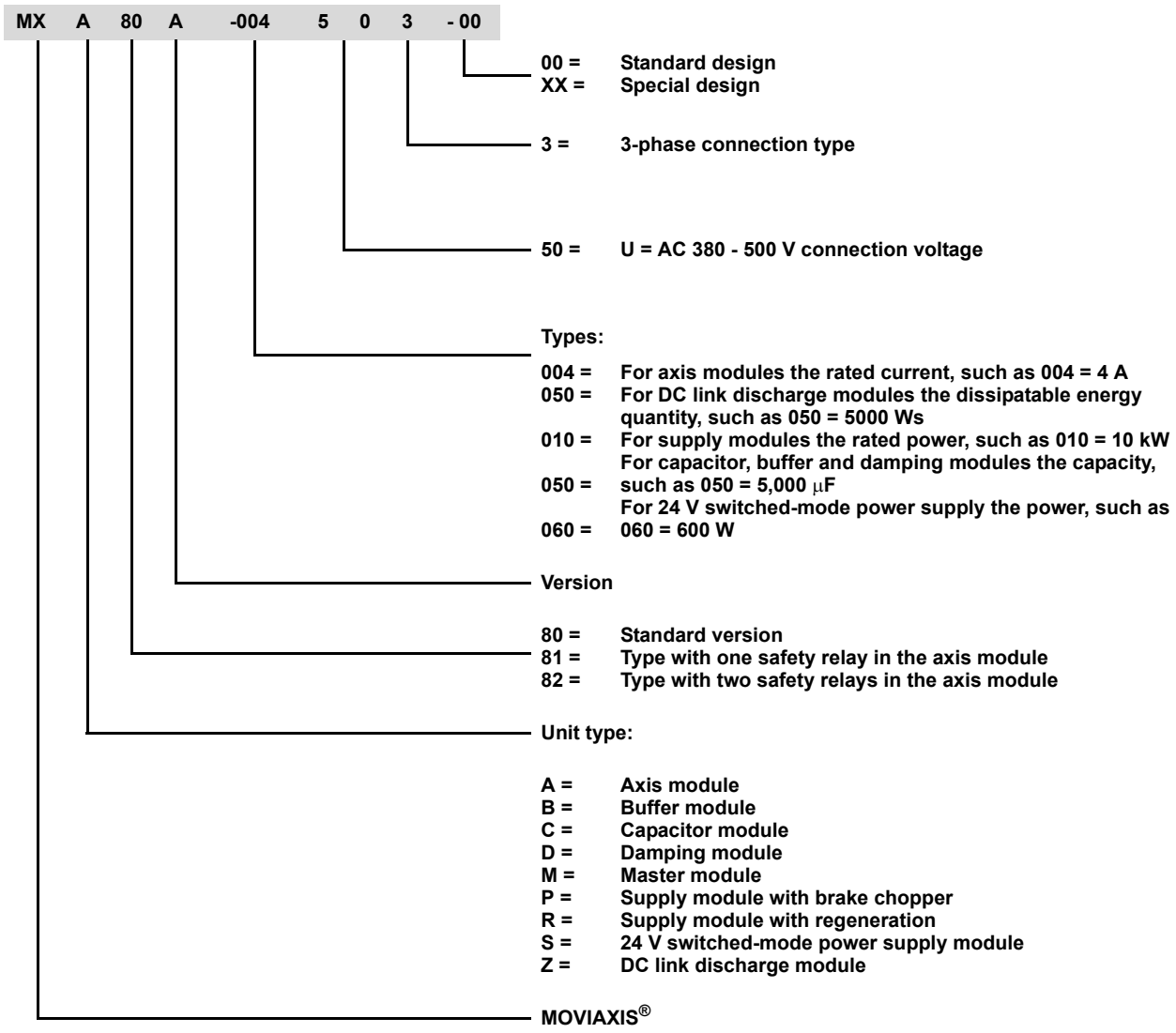
Example



	NOTE
	• Always use the option HIPERFACE® encoder card type DEH to connect the AL1H motor encoder. • For more information, refer to the MOVIDRIVE® B system manual. • The linear motors were integrated into the standard firmware beginning with firmware 18 (you have to choose the application version of MOVIDRIVE®). This means special unit 08 is no longer required.

10.8 Unit designation for MOVIAXIS® basic units

Example:



Unit designation for the axis module:

MXA80A-004-503-00	=	Axis module with 4 A rated current

Unit designation for the buffer module component

MXB80A-050-503-00	=	Buffer module

Unit designation for the capacitor module component

MXC80A-050-503-00	=	Capacitor module

Unit designation for the master module component:

MXM80A-000-000-00	=	Master module

Unit designation for the supply module:

MXP80A-010-503-00	=	10 kW supply module
MXR80A-025-503-00	=	25 kW supply module with regeneration (in preparation)

Unit designation for the 24 V switched-mode power supply module component

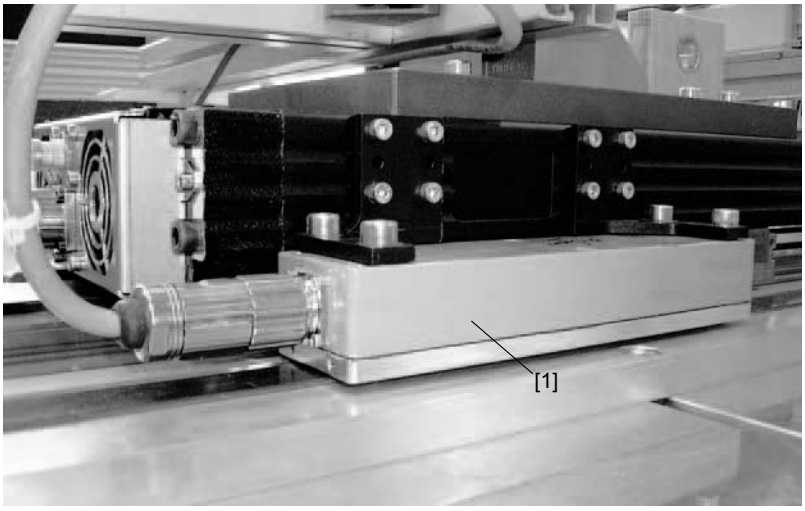
MXS80A-060-503-00	=	24 V switched-mode power supply module

Unit designation DC link discharge module component:

MXZ80A-050-503-00	=	DC link discharge module with a dissipatable energy quantity of 5000 Ws

10.9 Technical data of the absolute linear measuring system AL1H

The absolute linear measuring system corresponds to the linear measuring system from SICK / Stegmann.



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10.9.1 Technical data and characteristic features to DIN 32878

General data	
Measuring length	max. 40 m
Magnetic tape length of the measuring length	+130 mm[1)]
Reproducibility	±10 µm
Measurement accuracy	type ± 0.3 mm/m at 20 °C
Max. traveling velocity	6 m/s
Temperature expansion coefficient T_k steel band	16 µm/°C/m
Position tolerances and dimensions	See scale drawing
Mass • Sensor part • Magnetic tape	 0.693 kg 0.433 kg/m
Materials • Sensor parts • Magnetic tape • Stainless steel band	 AlmgSiPbF28 Tromaflex 928 No. 1.4435
Ambient temperature, operation	0 °C ... +60 °C
Degree of protection	IP65

1) Constant due to technical limitations

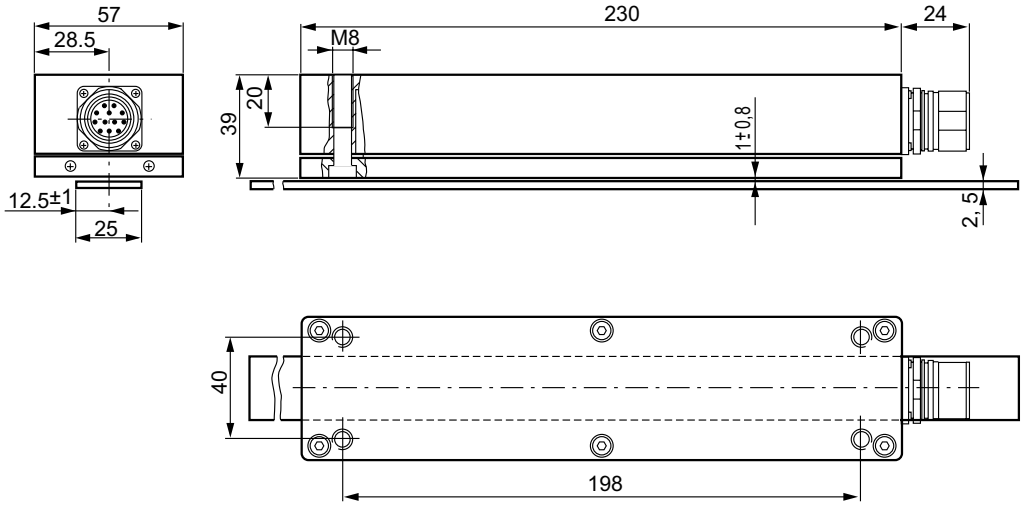
10.9.2 HIPERFACE® interface data

General data	
Cycle length	5 mm ± 3 %
Position resolution (cycle length/32 = 5 mm/32)	156.25 µm
Initialization time	2500 ms
Supply voltage	7 V to 12 V
Power consumption	4.3 W
Interface signals	
Process data channel • SIN, COS • REFSIN, REFCOS	 0.9 Vpp ... 1.1 Vpp 2.2 V to 2.8 V
Non-linearity within a sine, cosine period, differential non-linearity	± 50 µm
Parameter channel	to EIA 485

STOP	**STOP**
	External magnetic fields should not exceed the surface of the material measure 64 mT (640 Oe; 52 kA/m) as this could cause irreparable damage to the coding on the material measure. Magnetic fields > 1 mT on the measuring system influence measuring accuracy.

10.9.3 Scale drawings and position tolerances

General tolerances to DIN ISO 2768-mk



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10.9.4 Additional information

Data for the AL1H linear measuring system in this documentation were based on the data available from SICK / Stegmann at the time of printing. The design and units are subject to change. The data from SICK / Stegmann apply.

Current information can be found in

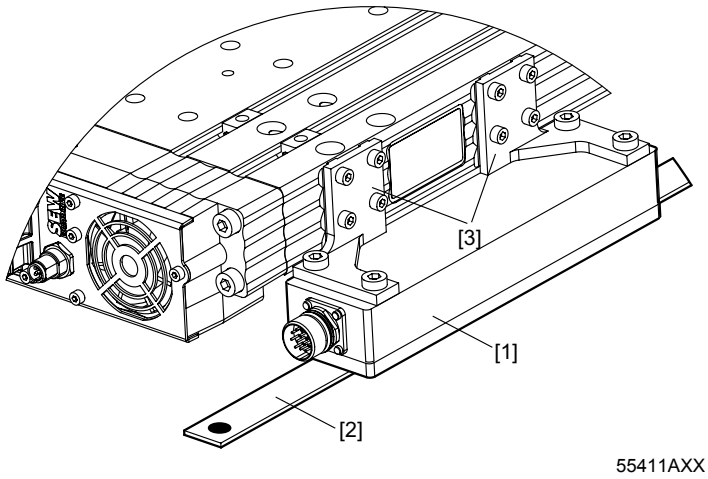
- the operating instructions from SICK / Stegmann, which are enclosed with the linear motor

or

- at www.stegmann.de

10.9.5 Encoder mount-on components

For the SL2-Advance System and SL2-Power System, mount-on components are available for these encoders under the part number 13328301.



[1] Linear sensor
[2] Measuring tape
[3] Encoder mount-on components

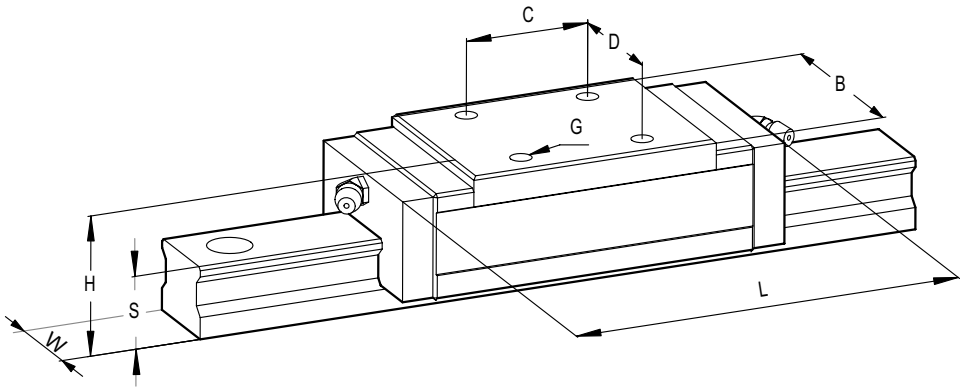
Function	SEW part number	Description
Linear sensor	1332 8263	AL1H, HIPERFACE®, 12-pin unit connector M23
Measuring tape	1332 8271	Magnet tape with adhesive tape
Mount-on components	1332 8301	LinCoder® L230 mount-on components for SL2-Advance System / SL2-Power System cooling unit
Feedback cable MOVIDRIVE®	0595 1518	Encoder cable for MOVIDRIVE®, approved for use with cable carriers. The maximum permitted length of the encoder cable is 85 m
Feedback cable MOVIAXIS®	1333 2244	Encoder cable for MOVIAXIS®, approved for use with cable carriers. Note: The maximum permitted cable length with MOVIAXIS® is 34 m when connected to X13 basic unit, and 75 m when connected to XGH multi-encoder card.
Feedback extension cable MOVIAXIS® MOVIDRIVE®	1333 3879	Encoder cable extension for MOVIDRIVE® and MOVIAXIS®, approved for use with cable carriers

10.10 Technical data for linear guide systems

The following guide systems can be installed on the SL2-Advance System and the SL2-Power System primaries.

STOP	**STOP** It is essential that you check that the primary/guide carriage can move freely in relation to the secondaries.

10.10.1 SL2 - P050VS/S/M/ML Advance/Power



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Guide systems (standard mounting) to DIN 645-1 version 3M

$L_{max.}$ [1]	B	C	D	H	W	$S_{max.}$	G
			[mm]				
SL2-P050VS = 94 SL2-P050S = 133 SL2-P050M = 144 SL2-P050ML = 190	48	35	35	40	23	24	M6x8

1) The max. length is dependent on the size

Manufacturer	Size
THK	HSR 25 R (standard) SHS 25 R (with ball chain)
INA	KUVE 25 B H KUVE 25 B KT H (with Quadspacer)
NSK	LAH 25 ANZ
Schneeberger	BMC 25
HIWIN	HGH25CA

10.10.2 SL2 - P100VS/S/M Advance/Power

Guide systems (standard mounting) to DIN 645-1 version 3M

$L_{max.}$ [1)]	B	C	D	H	W	$S_{max.}$	G
[mm]							
SL2-P100VS = 94 SL2-P100S = 140 SL2-P100M = 140	60	40	40	45	28	25	M8x10

1) The max. length is dependent on the size

Manufacturer	Size
THK	HSR30R SHS 30R (with ball chain)
INA	KUVE 30 B H KUVE 30 B KT H (with Quadspacer)

10.10.3 SL2 - P100ML Advance/Power

Guide systems (standard mounting, long guide carriages) to DIN 645-1 version 3L

$L_{max.}$	B	C	D	H	W	$S_{max.}$	G
[mm]							
170	60	60	40	45	28	25	M8x10

Manufacturer	Size
THK	HSR30LR SHS 30LR (with ball chain)
INA	KUVE 30 B HL KUVE 30 B KT HL (with Quadspacer)

10.10.4 SL2 - P150S/ML Advance/Power

Guide systems (standard mounting) to DIN 645-1 version 3M

$L_{max.}$	B	C	D	H	W	$S_{max.}$	G
[mm]							
170	70	50	50	55	34	29,8	M8x10

Manufacturer	Size
THK	HSR 35R SHS 35R (with ball chain)
INA	KUVE 35 B H KUVE 35 B KT H (with Quadspacer)
NSK	LAH 35 ANZ
Schneeberger	BMC 35
HIWIN	HGH35CA

10.10.5 SL2 - P150M Advance/Power

Guide systems (standard mounting) to DIN 645-1 version 3L

$L_{max.}$	B	C	D	H	W	$S_{max.}$	G
[mm]							
250	70	72	50	55	34	29,8	M8x10

Manufacturer	Size
THK	HSR 35LR SHS 35LR (with ball chain)
INA	KUVE 35 B HL KUVE 35 B KT HL (with Quadspacer)
NSK	LAH 35 BNZ
Schneeberger	BMD 35
HIWIN	HGH35HA

11 Declaration of Conformity

11.1 SL2 synchronous linear motors

SEW-EURODRIVE GmbH & Co KG
Ernst-Blickle-Str. 42
D-76646 Bruchsal

Konformitätserklärung

für Linearmotoren
nach ISO/IEC Guide 22, nach DIN EN 45014 Seite 1/1

Declaration of conformity

for linear motors
in accordance with ISO/IEC Guide 22, in accordance with DIN EN 45014 Page 1/1

SEW-EURODRIVE erklärt die Konformität des Produktes
declares that the following product

Typ / Model Synchrone-Linearmotor Reihe SL2-...

Ab.-Nr./ AB.-No.

mit der
are conform with the

Niederspannungsrichtlinie 73/23EG
Low Voltage Directive 73/23EC
und der / and the
EMV-Richtlinie 89/336EG
EMC Directive 89/336EC

auch in Verbindung mit
also when combined with

Optionen und Zubehör
options and asseccories

Angewandte harmonisierte Normen: EN 60204-1
applied harmonized standards: EN 50081-1
EN 50082-2

Die Einhaltung der EMV-Richtlinie setzt einen EMV-gerechten Einbau der Produkte, die Beachtung der spezifischen Installationshinweise und der Produktdokumentation voraus. Dies wurde an bestimmten Anlagekonfigurationen nachgewiesen.

Adherence to the EMC-Directive requires EMC-compliant installation of the products and compliance with the specific installation instructions and product documentation.
Conformity with these Directives was established based on certain plant configurations.

SEW-EURODRIVE GmbH & Co KG

Bruchsal , 25.02.2004 ppa.

E. Dörr
Funktion: Vertriebsleitung / Deutschland
Function: Head of Sales / Germany

Ort und Datum der Ausstellung
Place and date of issue

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	Additional addresses for service in Germany provided on request!		

France			
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Assembly **Sales** **Service**	**Bordeaux**	SEW-USOCOME Parc d'activités de Magellan 62, avenue de Magellan - B. P. 182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Lyon	SEW-USOCOME Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 00 Fax +33 4 72 15 37 15
	Paris	SEW-USOCOME Zone industrielle 2, rue Denis Papin F-77390 Verneuil l'Etang	Tel. +33 1 64 42 40 80 Fax +33 1 64 42 40 88
	Additional addresses for service in France provided on request!		

Algeria			
Sales	**Alger**	Réducom 16, rue des Frères Zaghnoun Bellevue El-Harrach 16200 Alger	Tel. +213 21 8222-84 Fax +213 21 8222-84 reducom_sew@yahoo.fr

Argentina			
Assembly **Sales** **Service**	**Buenos Aires**	SEW EURODRIVE ARGENTINA S.A. Centro Industrial Garin, Lote 35 Ruta Panamericana Km 37,5 1619 Garin	Tel. +54 3327 4572-84 Fax +54 3327 4572-21 sewar@sew-eurodrive.com.ar http://www.sew-eurodrive.com.ar

Australia			
Assembly **Sales** **Service**	**Melbourne**	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au

Austria			
Assembly **Sales** **Service**	**Wien**	SEW-EURODRIVE Ges.m.b.H. Richard-Strauss-Strasse 24 A-1230 Wien	Tel. +43 1 617 55 00-0 Fax +43 1 617 55 00-30 http://sew-eurodrive.at sew@sew-eurodrive.at

Belarus			
Sales	**Minsk**	SEW-EURODRIVE BY RybalkoStr. 26 BY-220033 Minsk	Tel.+375 (17) 298 38 50 Fax +375 (17) 29838 50 sales@sew.by

Belgium			
Assembly **Sales** **Service**	**Brüssel**	**SEW Caron-Vector** Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.be info@caron-vector.be
Service Competence Center	**Industrial Gears**	**SEW Caron-Vector** Rue de Parc Industriel, 31 BE-6900 Marche-en-Famenne	Tel. +32 84 219-878 Fax +32 84 219-879 http://www.sew-eurodrive.be service-wallonie@sew-eurodrive.be
	Antwerp	**SEW Caron-Vector** Glasstraat, 19 BE-2170 Merksem	Tel. +32 3 64 19 333 Fax +32 3 64 19 336 http://www.sew-eurodrive.be service-antwerpen@sew-eurodrive.be

Brazil			
Production **Sales** **Service**	**Sao Paulo**	SEW-EURODRIVE Brasil Ltda. Avenida Amâncio Gaiolli, 152 - Rodovia Presidente Dutra Km 208 Guarulhos - 07251-250 - SP SAT - SEW ATENDE - 0800 7700496	Tel. +55 11 2489-9133 Fax +55 11 2480-3328 http://www.sew-eurodrive.com.br sew@sew.com.br
	Additional addresses for service in Brazil provided on request!		

Bulgaria			
Sales	**Sofia**	BEVER-DRIVE GmbH Bogdanovetz Str.1 BG-1606 Sofia	Tel. +359 2 9151160 Fax +359 2 9151166 bever@fastbg.net

Cameroon			
Sales	**Douala**	Electro-Services Rue Drouot Akwa B.P. 2024 Douala	Tel. +237 33 431137 Fax +237 33 431137

Canada			
Assembly **Sales** **Service**	**Toronto**	SEW-EURODRIVE CO. OF CANADA LTD. 210 Walker Drive Bramalea, Ontario L6T3W1	Tel. +1 905 791-1553 Fax +1 905 791-2999 http://www.sew-eurodrive.ca marketing@sew-eurodrive.ca
	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. 7188 Honeyman Street Delta. B.C. V4G 1 E2	Tel. +1 604 946-5535 Fax +1 604 946-2513 marketing@sew-eurodrive.ca
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger LaSalle, Quebec H8N 2V9	Tel. +1 514 367-1124 Fax +1 514 367-3677 marketing@sew-eurodrive.ca
	Additional addresses for service in Canada provided on request!		

Chile			
Assembly **Sales** **Service**	**Santiago de Chile**	SEW-EURODRIVE CHILE LTDA. Las Encinas 1295 Parque Industrial Valle Grande LAMPA RCH-Santiago de Chile P.O. Box Casilla 23 Correo Quilicura - Santiago - Chile	Tel. +56 2 75770-00 Fax +56 2 75770-01 http://www.sew-eurodrive.cl ventas@sew-eurodrive.cl

China			
Production **Assembly** **Sales** **Service**	**Tianjin**	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 46, 7th Avenue, TEDA Tianjin 300457	Tel. +86 22 25322612 Fax +86 22 25322611 info@sew-eurodrive.cn http://www.sew-eurodrive.cn
Assembly **Sales** **Service**	**Suzhou**	SEW-EURODRIVE (Suzhou) Co., Ltd. 333, Suhong Middle Road Suzhou Industrial Park Jiangsu Province, 215021	Tel. +86 512 62581781 Fax +86 512 62581783 suzhou@sew-eurodrive.cn
	Guangzhou	SEW-EURODRIVE (Guangzhou) Co., Ltd. No. 9, JunDa Road East Section of GETDD Guangzhou 510530	Tel. +86 20 82267890 Fax +86 20 82267891 guangzhou@sew-eurodrive.cn
	Shenyang	SEW-EURODRIVE (Shenyang) Co., Ltd. 10A-2, 6th Road Shenyang Economic Technological Development Area Shenyang, 110141	Tel. +86 24 25382538 Fax +86 24 25382580 shenyang@sew-eurodrive.cn
	Wuhan	SEW-EURODRIVE (Wuhan) Co., Ltd. 10A-2, 6th Road No. 59, the 4th Quanli Road, WEDA 430056 Wuhan	Tel. +86 27 84478398 Fax +86 27 84478388
	Additional addresses for service in China provided on request!		

Colombia			
Assembly **Sales** **Service**	**Bogotá**	SEW-EURODRIVE COLOMBIA LTDA. Calle 22 No. 132-60 Bodega 6, Manzana B Santafé de Bogotá	Tel. +57 1 54750-50 Fax +57 1 54750-44 http://www.sew-eurodrive.com.co carlos.gomez@sew.eurodrive.com.co

Croatia			
Sales **Service**	**Zagreb**	KOMPEKS d. o. o. PIT Erdödy 4 II HR 10 000 Zagreb	Tel. +385 1 4613-158 Fax +385 1 4613-158 kompeks@inet.hr

Czech Republic			
Sales	**Praha**	SEW-EURODRIVE CZ S.R.O. Business Centrum Praha Lužná 591 CZ-16000 Praha 6 - Vokovice	Tel. +420 255 709 601 Fax +420 220 121 237 http://www.sew-eurodrive.cz sew@sew-eurodrive.cz

Denmark			
Assembly **Sales** **Service**	**Kopenhagen**	SEW-EURODRIVEA/S Geminivej 28-30 DK-2670 Greve	Tel. +45 43 9585-00 Fax +45 43 9585-09 http://www.sew-eurodrive.dk sew@sew-eurodrive.dk

Egypt			
Sales **Service**	**Cairo**	Copam Egypt for Engineering & Agencies 33 El Hegaz ST, Heliopolis, Cairo	Tel. +20 2 22566-299 + 1 23143088 Fax +20 2 22594-757 http://www.copam-egypt.com/ copam@datum.com.eg

Estonia			
Sales	**Tallin**	ALAS-KUUL AS Reti tee 4 EE-75301 Peetri küla, Rae vald, Harjumaa	Tel. +372 6593230 Fax +372 6593231 veiko.soots@alas-kuul.ee

Finland			
Assembly **Sales** **Service**	**Lahti**	SEW-EURODRIVE OY Vesimäentie 4 FIN-15860 Hollola 2	Tel. +358 201 589-300 Fax +358 3 780-6211 sew@sew.fi http://www.sew-eurodrive.fi
Production **Assembly** **Service**	**Karkkila**	SEW Industrial Gears Oy Valurinkatu 6 FIN-03600 Karkkila	Tel. +358 201 589-300 Fax +358 201 589-310 sew@sew.fi http://www.sew-eurodrive.fi

Gabon			
Sales	**Libreville**	Electro-Services B.P. 1889 Libreville	Tel. +241 7340-11 Fax +241 7340-12

Great Britain			
Assembly **Sales** **Service**	**Normanton**	SEW-EURODRIVE Ltd. Beckbridge Industrial Estate P.O. Box No.1 GB-Normanton, West- Yorkshire WF6 1QR	Tel. +44 1924 893-855 Fax +44 1924 893-702 http://www.sew-eurodrive.co.uk info@sew-eurodrive.co.uk

Greece			
Sales **Service**	**Athen**	Christ. Boznos & Son S.A. 12, Mavromichali Street P.O. Box 80136, GR-18545 Piraeus	Tel. +30 2 1042 251-34 Fax +30 2 1042 251-59 http://www.boznos.gr info@boznos.gr

Hong Kong			
Assembly **Sales** **Service**	**Hong Kong**	SEW-EURODRIVE LTD. Unit No. 801-806, 8th Floor Hong Leong Industrial Complex No. 4, Wang Kwong Road Kowloon, Hong Kong	Tel. +852 36902200 Fax +852 36902211 contact@sew-eurodrive.hk

Hungary			
Sales **Service**	**Budapest**	SEW-EURODRIVE Kft. H-1037 Budapest Kunigunda u. 18	Tel. +36 1 437 06-58 Fax +36 1 437 06-50 office@sew-eurodrive.hu

India			
Assembly **Sales** **Service**	**Vadodara**	SEW-EURODRIVE India Private Limited Plot No. 4, GIDC POR Ramangamdi • Vadodara - 391 243 Gujarat	Tel. +91 265 2831086 Fax +91 265 2831087 http://www.seweurodriveindia.com sales@seweurodriveindia.com subodh.ladwa@seweurodriveindia.com

Ireland			
Sales **Service**	**Dublin**	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Tel. +353 1 830-6277 Fax +353 1 830-6458 info@alperton.ie http://www.alperton.ie

Israel			
Sales	**Tel-Aviv**	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 http://www.liraz-handasa.co.il office@liraz-handasa.co.il

Italy			
Assembly **Sales** **Service**	**Milano**	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 I-20020 Solaro (Milano)	Tel. +39 02 96 9801 Fax +39 02 96 799781 http://www.sew-eurodrive.it sewit@sew-eurodrive.it

Ivory Coast			
Sales	**Abidjan**	SICA Ste industrielle et commerciale pour l'Afrique 165, Bld de Marseille B.P. 2323, Abidjan 08	Tel. +225 2579-44 Fax +225 2584-36

Japan			
Assembly **Sales** **Service**	**Iwata**	SEW-EURODRIVE JAPAN CO., LTD 250-1, Shimoman-no, Iwata Shizuoka 438-0818	Tel. +81 538 373811 Fax +81 538 373814 http://www.sew-eurodrive.co.jp sewjapan@sew-eurodrive.co.jp

Korea			
Assembly **Sales** **Service**	**Ansan-City**	SEW-EURODRIVE KOREA CO., LTD. B 601-4, Banweol Industrial Estate 1048-4, Shingil-Dong Ansan 425-120	Tel. +82 31 492-8051 Fax +82 31 492-8056 http://www.sew-korea.co.kr master@sew-korea.co.kr
	Busan	SEW-EURODRIVE KOREA Co., Ltd. No. 1720 - 11, Songjeong - dong Gangseo-ku Busan 618-270	Tel. +82 51 832-0204 Fax +82 51 832-0230 master@sew-korea.co.kr

Latvia			
Sales	**Riga**	SIA Alas-Kuul Katlakalna 11C LV-1073 Riga	Tel. +371 7139253 Fax +371 7139386 http://www.alas-kuul.com info@alas-kuul.com

Lebanon			
Sales	**Beirut**	Gabriel Acar & Fils sarl B. P. 80484 Bourj Hammoud, Beirut	Tel. +961 1 4947-86 +961 1 4982-72 +961 3 2745-39 Fax +961 1 4949-71 ssacar@inco.com.lb

Lithuania			
Sales	**Alytus**	UAB Irseva Naujoji 19 LT-62175 Alytus	Tel. +370 315 79204 Fax +370 315 56175 info@irseva.lt http://www.sew-eurodrive.lt

Luxembourg			
Assembly **Sales** **Service**	**Brüssel**	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.sew-eurodrive.lu info@caron-vector.be

Malaysia			
Assembly **Sales** **Service**	**Johore**	SEW-EURODRIVE SDN BHD No. 95, Jalan Seroja 39, Taman Johor Jaya 81000 Johor Bahru, Johor West Malaysia	Tel. +60 7 3549409 Fax +60 7 3541404 sales@sew-eurodrive.com.my

Mexico			
Assembly **Sales** **Service**	**Quéretaro**	SEW-EURODRIVE MEXICO SA DE CV SEM-981118-M93 Tequisquiapan No. 102 Parque Industrial Quéretaro C.P. 76220 Quéretaro, México	Tel. +52 442 1030-300 Fax +52 442 1030-301 http://www.sew-eurodrive.com.mx scmexico@seweurodrive.com.mx

Morocco			
Sales	**Casablanca**	Afit 5, rue Emir Abdelkader MA 20300 Casablanca	Tel. +212 22618372 Fax +212 22618351 ali.alami@premium.net.ma

Netherlands			
Assembly **Sales** **Service**	**Rotterdam**	VECTOR Aandrijftechniek B.V. Industrieweg 175 NL-3044 AS Rotterdam Postbus 10085 NL-3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 http://www.vector.nu info@vector.nu

New Zealand			
Assembly **Sales** **Service**	**Auckland**	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Tel. +64 9 2745627 Fax +64 9 2740165 http://www.sew-eurodrive.co.nz sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz

Norway			
Assembly **Sales** **Service**	**Moss**	SEW-EURODRIVE A/S Solgaard skog 71 N-1599 Moss	Tel. +47 69 24 10 20 Fax +47 69 24 10 40 http://www.sew-eurodrive.no sew@sew-eurodrive.no

Peru			
Assembly **Sales** **Service**	**Lima**	SEW DEL PERU MOTORES REDUCTORES S.A.C. Los Calderos, 120-124 Urbanizacion Industrial Vulcano, ATE, Lima	Tel. +51 1 3495280 Fax +51 1 3493002 http://www.sew-eurodrive.com.pe sewperu@sew-eurodrive.com.pe

Poland			
Assembly **Sales** **Service**	**Lodz**	SEW-EURODRIVE Polska Sp.z.o.o. ul. Techniczna 5 PL-92-518 Łódź	Tel. +48 42 67710-90 Fax +48 42 67710-99 http://www.sew-eurodrive.pl sew@sew-eurodrive.pl
		24 Hour Service	Tel. +48 602 739 739 (+48 602 SEW SEW) sewis@sew-eurodrive.pl

Portugal			
Assembly **Sales** **Service**	**Coimbra**	SEW-EURODRIVE, LDA. Apartado 15 P-3050-901 Mealhada	Tel. +351 231 20 9670 Fax +351 231 20 3685 http://www.sew-eurodrive.pt infosew@sew-eurodrive.pt

Romania			
Sales **Service**	**Bucureşti**	Sialco Trading SRL str. Madrid nr.4 011785 Bucuresti	Tel. +40 21 230-1328 Fax +40 21 230-7170 sialco@sialco.ro

Russia			
Assembly **Sales** **Service**	**St. Petersburg**	ZAO SEW-EURODRIVE P.O. Box 36 195220 St. Petersburg Russia	Tel. +7 812 3332522 +7 812 5357142 Fax +7 812 3332523 http://www.sew-eurodrive.ru sew@sew-eurodrive.ru

Senegal			
Sales	**Dakar**	SENEMECA Mécanique Générale Km 8, Route de Rufisque B.P. 3251, Dakar	Tel. +221 338 494 770 Fax +221 338 494 771 senemeca@sentoo.sn

Serbia			
Sales	**Beograd**	DIPAR d.o.o. Ustanicka 128a PC Košum, IV floor SCG-11000 Beograd	Tel. +381 11 347 3244 / +381 11 288 0393 Fax +381 11 347 1337 office@dipar.co.yu

Singapore			
Assembly **Sales** **Service**	**Singapore**	SEW-EURODRIVE PTE. LTD. No 9, Tuas Drive 2 Jurong Industrial Estate Singapore 638644	Tel. +65 68621701 Fax +65 68612827 http://www.sew-eurodrive.com.sg sewsingapore@sew-eurodrive.com

Slovakia			
Sales	**Bratislava**	SEW-Eurodrive SK s.r.o. Rybničná 40 SK-831 06 Bratislava	Tel. +421 2 33595 202 Fax +421 2 33595 200 sew@sew-eurodrive.sk http://www.sew-eurodrive.sk
	Žilina	SEW-Eurodrive SK s.r.o. Industry Park - PChZ ulica M.R.Štefánika 71 SK-010 01 Žilina	Tel. +421 41 700 2513 Fax +421 41 700 2514 sew@sew-eurodrive.sk
	Banská Bystrica	SEW-Eurodrive SK s.r.o. Rudlovská cesta 85 SK-974 11 Banská Bystrica	Tel. +421 48 414 6564 Fax +421 48 414 6566 sew@sew-eurodrive.sk
	Košice	SEW-Eurodrive SK s.r.o. Slovenská ulica 26 SK-040 01 Košice	Tel. +421 55 671 2245 Fax +421 55 671 2254 sew@sew-eurodrive.sk

Slovenia			
Sales **Service**	**Celje**	Pakman - Pogonska Tehnika d.o.o. UI. XIV. divizije 14 SLO - 3000 Celje	Tel. +386 3 490 83-20 Fax +386 3 490 83-21 pakman@siol.net

South Africa			
Assembly **Sales** **Service**	**Johannesburg**	SEW-EURODRIVE (PROPRIETARY) LIMITED Eurodrive House Cnr. Adcock Ingram and Aerodrome Roads Aeroton Ext. 2 Johannesburg 2013 P.O.Box 90004 Bertsham 2013	Tel. +27 11 248-7000 Fax +27 11 494-3104 http://www.sew.co.za info@sew.co.za
	Cape Town	SEW-EURODRIVE (PROPRIETARY) LIMITED Rainbow Park Cnr. Racecourse & Omuramba Road Montague Gardens Cape Town P.O.Box 36556 Chempet 7442 Cape Town	Tel. +27 21 552-9820 Fax +27 21 552-9830 Telex 576 062 cfoster@sew.co.za
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 2 Monaceo Place Pinetown Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 700-3451 Fax +27 31 700-3847 hengela@sew.co.za

Spain			
Assembly **Sales** **Service**	**Bilbao**	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Tel. +34 94 43184-70 Fax +34 94 43184-71 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es

Sweden			
Assembly **Sales** **Service**	**Jönköping**	SEW-EURODRIVE AB Gnejsvägen 6-8 S-55303 Jönköping Box 3100 S-55003 Jönköping	Tel. +46 36 3442 00 Fax +46 36 3442 80 http://www.sew-eurodrive.se info@sew-eurodrive.se

Switzerland			
Assembly **Sales** **Service**	**Basel**	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein bei Basel	Tel. +41 61 417 1717 Fax +41 61 417 1700 http://www.imhof-sew.ch info@imhof-sew.ch

Thailand			
Assembly **Sales** **Service**	**Chonburi**	SEW-EURODRIVE (Thailand) Ltd. 700/456, Moo.7, Donhuaroh Muang Chonburi 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com

Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service Zone Industrielle Mghira 2 Lot No. 39 2082 Fouchana	Tel. +216 71 4340-64 + 71 4320-29 Fax +216 71 4329-76 tms@tms.com.tn

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419164, 3838014, 3738015 Fax +90 216 3055867 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr

Ukraine			
Sales **Service**	**Dnepropetrovsk**	SEW-EURODRIVE Str. Rabochaja 23-B, Office 409 49008 Dnepropetrovsk	Tel. +380 56 370 3211 Fax +380 56 372 2078 http://www.sew-eurodrive.ua sew@sew-eurodrive.ua

USA			
Production **Assembly** **Sales** **Service** **Cooporate Offices**	**Southeast Region**	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Manufacturing +1 864 439-9948 Fax Assembly +1 864 439-0566 Fax Confidential/HR +1 864 949-5557 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly **Sales** **Service**	**Northeast Region**	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Midwest Region	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 440-3799 cstroy@seweurodrive.com
	Southwest Region	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Western Region	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. +1 510 487-3560 Fax +1 510 487-6433 cshayward@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

Venezuela			
Assembly **Sales** **Service**	**Valencia**	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia, Estado Carabobo	Tel. +58 241 832-9804 Fax +58 241 838-6275 http://www.sew-eurodrive.com.ve ventas@sew-eurodrive.com.ve sewfinanzas@cantv.net

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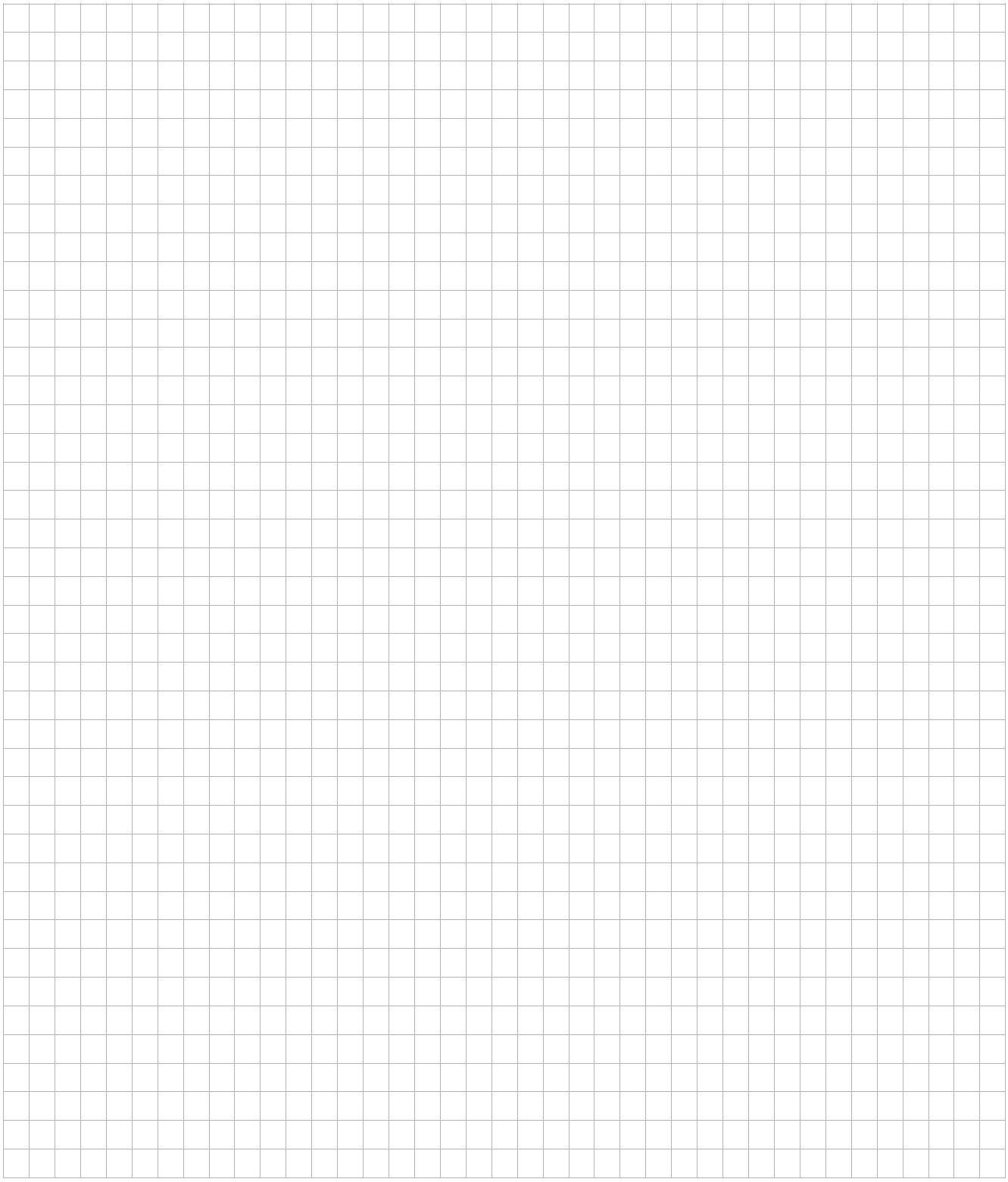

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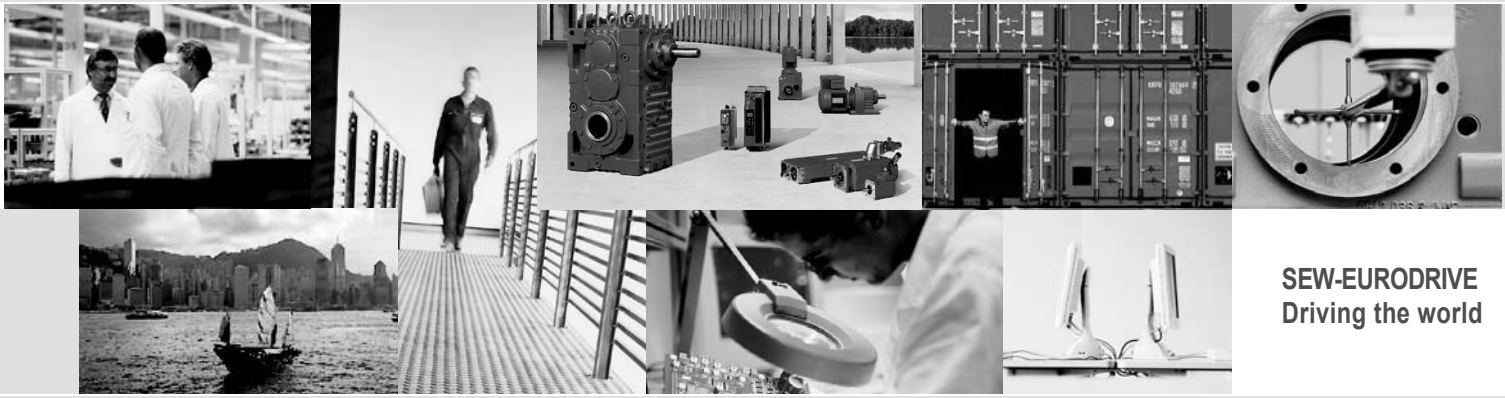

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