Imprint

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1 On this manual

1.1 Introduction

Before using the motor for the first time, you should familiarize yourself with this operating manual.
In particular, observe the safety notes described in chapter 2.
Only persons who meet the criteria for "Selection and Qualification of Staff" (see chapter 2.4) are allowed to work on the motors.
One copy of this manual has to be available for staff working on the motors with access at any time.
This manual is to help you use the motor safely and expertly and to use it as directed.
Observe this manual. This will help to avoid risks, reduce repair costs and down times and increase the lifetime and reliability of the products.
You also need to observe the valid rules for the prevention of accidents and for environmental protection in the country and place where the device is used.
1.2 Symbols, Signs and Forms of Depiction

The following symbols and signs are used in this document:

<table>
<thead>
<tr>
<th>Depiction</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>■</td>
<td>First level enumeration sign.</td>
</tr>
<tr>
<td>–</td>
<td>Second level enumeration sign.</td>
</tr>
<tr>
<td>▶</td>
<td><strong>Action symbol</strong>: The text following this symbol includes an instruction for action. Execute the instruction actions in the given order, from top to bottom.</td>
</tr>
<tr>
<td>✓</td>
<td><strong>Result symbol</strong>: The text following this symbol contains the result of an action.</td>
</tr>
<tr>
<td><em>Italics</em></td>
<td>If the describing text contains special terms (e.g. parameters) these are written in italics.</td>
</tr>
<tr>
<td>Serif font</td>
<td>If the manual contains program code, this is marked by Serif font.</td>
</tr>
<tr>
<td>![i]</td>
<td><strong>Information symbol</strong>: This symbol marks notes and useful tips for using the product.</td>
</tr>
<tr>
<td>![exclamation mark]</td>
<td><strong>Warning sign</strong>: Safety notes can be found in the relevant places. They are marked by this symbol.</td>
</tr>
</tbody>
</table>

*Table 1-1: Symbols, signs and forms of depiction*
2 General Safety Notes

This chapter contains general requirements for working safely. Every person using ELAU components or working on ELAU components has to read and observe these general safety notes. If activities involve a residual risk, you will find a clear note in the respective places. The note describes the risk that may occur and preventive measures to avoid that risk.

2.1 Basics

The motor is built according to the state of technology and generally accepted safety rules. Nevertheless, its use may cause a risk to life and limb or material damage if:

- you do not use the motor as directed
- work on the motor is not done by experts or instructed staff
- you inexpertly alter or modify the motor
- you fail to test the protective measures in place after installation, commissioning or servicing
- you do not observe the safety notes and regulations.

Only operate the motor in perfect technical condition, as directed, with regard to safety and risks and observe this manual.

The flawless and safe operation of the motor requires appropriate transport, storage, mounting and installation as well as careful maintenance.

In case of any circumstances that impair the safety and cause changes in the operating behavior, immediately bring the motor to a stop and inform the service staff in charge.

In addition to this manual, observe

- the prohibiting, warning and mandatory signs on the motor, the connected components and in the switching cabinet
- the relevant laws and regulations
- the operating manuals of the other components
- the universally valid local and national rules for safety and the prevention of accidents.
### 2.2 Depiction of Safety Notes

**Risk categories**

The safety notes in this manual are grouped into different risk categories. The table below shows which risk and possible consequences the symbol (pictograph) and the signal words indicate.

<table>
<thead>
<tr>
<th>Pictograph</th>
<th>Signal word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Pictograph]</td>
<td><strong>DANGER!</strong></td>
<td>Indicates an immediately dangerous situation that will result in death or very serious injuries if the safety rules are not observed.</td>
</tr>
<tr>
<td>![Pictograph]</td>
<td><strong>WARNING!</strong></td>
<td>Indicates a possibly dangerous situation that can result in serious injuries or major material damage if the safety rules are not observed.</td>
</tr>
<tr>
<td>![Pictograph]</td>
<td><strong>CAUTION!</strong></td>
<td>Indicates a possibly dangerous situation that might result in material damage if the safety rules are not observed.</td>
</tr>
</tbody>
</table>

*Table 2-1: Risk categories*
2.3 Use as Directed

The motor is designed as a drive component for installation in a machine or for combination with other components to form a machine/plant. The motor may only be used under the installation and operating conditions described in this documentation. You must use the accessories and ancillary parts (components, cables, etc.) mentioned in the documentation. You must not use any foreign objects or components that are not explicitly approved by ELAU. Use as directed also means that you

- observe the operating manuals and other documentations (see appendix)
- observe the inspection and service instructions.

**Misusage**

The operating conditions at the place where the device is used must be checked on the basis of the given technical data (performance information and ambient conditions) and observed. Commissioning is prohibited unless it is guaranteed that the applicable machine or plant in which the motor is installed is in its entirety compliant with the EC directive 98/37/EC (machine directive).

In addition, the following norms, directives and rules need to be observed:

- DIN EN 60204 Safety of machines: Electrical equipment of machines.
- DIN EN 292 part 1 and part 2 Safety of machines: Basics, general design rules.
- DIN EN 50178 Equipment of high-voltage plants with electronic operating means.
- EMC directive 89/336/EEC
2.4 Selection and Qualification of Staff

This manual is aimed exclusively at technically qualified staff with detailed knowledge in the field of automation technology.

Only qualified staff can recognize the significance of safety notes and implement them accordingly.

This manual is aimed in particular at design and application engineers in the fields of mechanical and electrical engineering, service and commissioning engineers.

Working on electrical equipment

Work on electrical equipment must only be done by qualified electricians or by instructed staff supervised by an electrician according to the electrotechnical rules.

An electrician is a person who, due to his vocational training, know-how and experience as well as knowledge of the valid regulations, is able to:

- evaluate the work he is supposed to do
- identify potential risks
- implement suitable safety measures.

2.5 Residual Risks

The motors reflects the current technical standard. Nevertheless, there is a residual risk, since the motors work with electrical current and voltage. We minimized the health risk for people by means of appropriate construction and safety technology.

2.5.1 Installation and Handling

WARNING!
Risk of injury while handling the unit!
Risk of injury due to squeezing, cutting or hitting!

- Observe the universally valid construction and safety rules for handling and installation.
- Use suitable installation and transport facilities and use them professionally. If necessary, use special tools.
- Take precautions against squeezing.
- If necessary, use suitable protective clothing (e.g. safety glasses, safety shoes, protective gloves).
- Do not stay under pending loads.
- Remove any leaking liquids from the floor immediately to avoid skidding.
2.5 Residual Risks

2.5.2 Protection against Touching Electrical Parts

Touching parts carrying a voltage of 50 Volts or higher can be dangerous. When electric appliances are operated, certain parts of these appliances inevitably carry a dangerous voltage.

---

**DANGER!**

High voltage!
Life hazard!

- Observe the universally valid construction and safety rules for working on high-voltage units.
- After installation, check the fixed connection of the earth conductor on all electric appliances according to the connection plan.
- Operation, even for short-term measuring and test purposes, is only permitted with an earth conductor firmly connected to all electric components. Otherwise high voltages may occur on the casing.
- Before accessing electric parts with voltages exceeding 50 Volts, disconnect the unit from mains or power supply and lock it out. After switching off, wait for at least 5 minutes before touching any components.
- Do not touch electrical connections of the components while the unit is on.
- Before switching on the unit, cover all voltage carrying parts to prevent accidental contact.
- Provide for protection against indirect touching (DIN EN 50178 / 1998 section 5.3.2).

---

**DANGER!**

High leak current!
Life hazard!

- The leak current is greater than 3.5 mA. Therefore the units must have a firm connection to the power grid (according to DIN EN 50178 - equipment of high-voltage systems).
2.5.3 Potentially Dangerous Movements

There can be different causes for potentially dangerous movements:

- mistakes in wiring or cable connection
- software errors
- faulty components
- errors in measuring value and signal encoders
- operating mistakes

The monitoring functions in the driving components to a large extent rule out malfunction. For your protection, you must not rely on these functions alone. Until the controls installed become effective, you should anticipate faulty movement of the drive, which can vary depending on the kind of malfunction and the operating state. Personal protection must be ensured by additional measures superior to the plant. These are planned by the plant engineer with regard to the specific circumstances of the plant and after a risk and error analysis. The safety provisions of the plant are taken into account.

DANGER!
Potentially dangerous movements!
Life hazard, serious injury or material damage!

- No persons are allowed within the motion range of the machine. This is to be ensured by means of devices like protective fences, grids, covers or photoelectric barriers.
- The fences and covers must be sufficiently strong to withstand the maximum possible motion energy.
- The emergency stop switch must be located very close to the operator. Check the operation of the emergency stop before starting up the plant.
- Secure against unintentional start by enabling the mains contactor of the drives via an emergency off circuit or by means of the function 'safe stop'.
- Before accessing the danger zone, bring the drives to a safe stop.
- To work on the plant, power must be turned off and locked out.
- Avoid operating high-frequency, remote-control and radio devices in the vicinity of the plant's electronics and connecting wires. If the use of those devices is inevitable, check system and plant for possible malfunctions before first operation. In some cases a special EMC check may be necessary.
3 Overview

3.1 In General

The highly dynamic synchronous AC servo motors of ELAU's SM series are permanent field synchronous machines designed especially for highly dynamic positioning tasks.

The low moment of inertia compared with other AC servo motors in combination with the high overload tolerance not only guarantees excellent acceleration values, but also reduces energy consumption and stray heat of the motor.

The torque is generated by the stator coil fed by a sinusoidal three-phase current system in combination with the magnetic field excited by the rotor magnets.

The generation of the rotary current system depends on the rotor position in the digital motor controller or the positioning motor controller.

For that purpose, the rotor position is monitored by a resolver. Thanks to that principle, the drives are extremely robust and work without wearing down.

3.2 Features of the servo motors

The SM motors are characterised by the following features:

- High equipment dependability
- Maintenance-free operation
- Overload protection (by motor temperature monitoring)
- High performance data
- High dynamics
- High overload capacity
- Large torque area
- Sinusoidal EMK
- High volt technique = low currents
- Low mass-moment of inertia
- Motor link and feedback system over connection box
- Simple and fast commissioning (by electronic vehicle identification plate in the SinCos encoder)
3.3 Versions

Motor feedback
- SinCos encoder singleturn or
- SinCos encoder multiturn or
- Resolver feedback

Holding brake
- without brake (standard) or
- with brake (option) to hold axis when in vertical position or when plant is powerless.

Shaft
- Smooth shaft (standard) or
- Shaft with feather groove (option)

Miscellaneous
- The SM motors also with ventilation and gear reducer options.
4 Transportation, Storage, Unpacking

4.1 Transportation

- Avoid shocks.
- Immediately check units for transport damage and inform your transport company, if necessary.

4.2 Storage

- Store units in a clean, dry place.

**Storage conditions:**
- Air temperature between -25 °C and +70 °C.
- Temperature fluctuations max. 30 K per hour.
4.3 Unpacking

- Check whether the delivery is complete.
- Check all units for transport damage.

**Type plate**

The type plate contains all necessary motor information:

![Type plate at the SM motor](image1)

**Fig. 4-1: type plate at the SM motor**

![Type plate of a SM motor](image2)

**Fig. 4-2: type plate of a SM motor**
4.3.1 Modified connections

Shield connection, connection technology and the installation of connection cables for SM Motors were improved and the terminal box adapted. Existing components, such as cables etc. can still be used. The new and previous versions of the motor are fully compatible.

In context with the improved connections, a hardware code was added on the type plate and the packaging of the motors.

**Example:** Type plate of an SM motor with modified connections.

![Type plate of an SM motor with modified connections](image)

**Fig. 4-3:** Type plate of an SM motor with modified connections

The following diagram shows how the cables are installed in the terminal box.

![SM motor terminal box - cable installation](image)

SM motor terminal box - cable installation
5 Maintenance

Recognizing and clearing an error quickly helps to keep the related production loss down to a minimum.

The diagnosis messages of the PacDrive™ system, which can be checked using EPAS, allows well directed and effective troubleshooting.

In case of an error, defective components can be exchanged with no problem. This ensures that the problem can be solved quickly and operation can be resumed soon. This work must be done by qualified maintenance staff only.

When returning a defective unit to the ELAU customer service, please complete the attached error report form.

5.1 Spare Parts, Components

Stock keeping of spare parts:
Keeping a stock of the essential components is a key prerequisite for the continuous functionality of the equipment.

ATTENTION!
Device compatibility!
Only units with identical hardware configuration and identical software version may be exchanged.

When ordering spare parts, please give the following data:
product name: e. g. SM 070-60-010-P0-44-M1-B0
article number: e. g. 19202602-509
You can find this information on the type plate of the motor (see Fig. 4-1) or in the configuration of your PacDrive™ M system.
5.2 Repair

By all means complete the attached error report form when returning defective components. You can also make a photocopy of the error report form and use it as a fax message.

ATTENTION!
Electro static discharge! Components may be damaged!
- Electronic parts may only be returned in the original or an equivalent packaging. In any case the components must be wrapped in an ESD packaging/foil. Otherwise warranty on equipment will be subject to termination.

5.3 Service Addresses

For ordering spare parts
ELAU AG
Postfach 1255
97821 Marktheidenfeld
Phone: +49 (0) 93 91 / 606 - 0
Fax: +49 (0) 93 91 / 606 - 300

For repair
Please send the components to be repaired or checked, along with the error report, to this address:
ELAU AG
Abt. Kundendienst
postal address: house address:
Postfach 1255 Dillberg 12
97821 Marktheidenfeld 97828 Marktheidenfeld

Service team
Should you need to talk to a member of our service team or require on-site service, please contact:
ELAU AG
Abt. Kundendienst / Applikation
Postfach 1255
97821 Marktheidenfeld
Phone: +49 (0) 93 91 / 606 - 142
Fax: +49 (0) 93 91 / 606 - 300
5.4 Exchanging Units

In addition to the notes below, please observe the information of the machine producer when exchanging the motor.

---

**DANGER!**

High Voltage!
Life Hazard!

- Before working on electrical units, disconnect from mains supply and secure against being switched on accidentally.
- The drives must be standing safely because life-threatening voltages can occur on the motor cables of servo motors in generator operation.
- Do not disconnect connector plugs while they are carrying voltage.

---

**CAUTION!**

Electro static discharge!
Components may be damaged!

- Only touch the boards by the edges. Do not touch any connections or components.
- Before touching the boards, discharge any possible static charge. For this purpose, touch an earthed metal surface, e.g. the casing.
- Do not place the boards on a metal surface.
- Avoid the creation of electro static charge by the use of appropriate clothing, carpets and furniture and by moving the boards as little as possible.
### Exchange motor

**NOTE**
If motors were stored longer than 2 years, the holding brake has to be resurfaced before you use it. See also "holding brake (option)" on page 52.

- Lift the main switch.
- Secure against accidental switch-on.

---

**DANGER!**
High voltage!
Life hazard!
- Connect or disconnect main power cable to motor only when no voltage is present on unit!

---

**CAUTION!**
Mechanical force!
Possible damage of the encoder system!
- When removing / applying a coupling off / to the motor shaft no impact may be executed on the motor shaft, to avoid damage of the encoder. Use suitable tools e. g. pullers.

---

**WARNING!**
Inadvertent movement of axes!
Danger of accident!
- With servo axes with indirect distance measurement system over the motor encoder the measure reference is lost with exchange of the engine!
  The measure reference to the machine coordinate system therefore is to be reconstituted after the exchange!

- Exchange motor as described by the machine manufacturer.

---

**CAUTION!**
Insufficient shield connection/earthing!
Motor damage!
- In general operate motor only with tightly screwed connector box.
5.4 Exchanging Units

**Exchange cable**
- Lift the main switch
- Secure against accidental switch-on

---

**DANGER!**
High voltage!
Life hazard!
- Separate or join performance plug connectors of the cables only in status without tension of the system!
- Join performance plug connectors only with dry and clean putting pages!
- If no finished cables produced by ELAU are used, check allocation of new cables for agreement with the connection diagram of the machine manufacturer!

---

- Exchange the cables considering the specification of the machine manufacturer.
5.5 Cleaning

If installed appropriately, the devices are to a large extent maintenance-free.

---

CAUTION!
Penetration of liquid due to inexpert cleaning!
Motor damage!
- If the motor is cleaned with a high-pressure cleaner, liquid may penetrate into the motor casing. Use cleaning methods compliant with the protection type of the motor.
5.6 EMC Rules

To control and regulate motors, the mains voltage is stored in the DC-circuit of the MC-4 MotorController by means of rectification. This stored energy is fed to the motor by deliberately switching on and off six semiconductor switches. The steep rise and fall of the voltage puts high demands on the insulation strength of the motor winding. Another essential aspect to be considered is the Electro Magnetic Compatibility (EMC) with other system components. The flank steepness of the clocked voltage generates harmonic oscillations of great intensity, up into the high-frequency range.

Therefore observe the following EMC rules:

- Choose the earthing option with the lowest possible ohm rate (e.g. unpainted mounting board of the switching cabinet) for installation.
- Contact the largest possible surface (skin effect). If necessary, remove existing paint to achieve large-surface contact.
- From the Central Earthing Point (CEP), lay earthing wires to the respective connections in a star structure. Earthing circuits are not admissible and can cause unnecessary distortions.
- Use shielded cables only.
- Only large-surface shield transitions are admissible.
- Shields must not be contacted via pin contacts of connector plugs.
- By all means observe the switching proposals.
- Cut motor cables to minimum length.
- Do not lay cable loops inside the switching cabinet.
CAUTION!
Electromagnetic fields!
Disturbances or failure of the system possible!

With the installation the following rules must be considered, in order to exclude consequences of excessive disturbance effects as far as possible.

- In connection with electronic controls, no inductive loads whatsoever must be switched without suitable interference elimination.
- For DC operation, suitable interference elimination can be achieved by arranging recovery diodes. For AC operation, commercially available erasing elements matching the connector type can be used.
- Only the interference elimination element mounted immediately at the point of inductivity serves this purpose. In any other case, the switching pulse may even emit increased interference via the interference elimination elements. It is much easier to avoid sources of interference in the first place, than to eliminate the effects of existing interference.
- In no case must the contacts switching unshielded inductive loads be arranged in the same room as the MC-4 MotorController; the same goes for cables carrying unshielded, switched inductivity and cables running parallel to them. The control must be separated from such „distorters“ by a Faraday cage (own section in the switching cabinet).

CAUTION!
Electromagnetic fields!
Disturbances or failure of the system possible!

- Dependent on the MotorController/motor combination and the cable length, system filters or motor filters should be used where possible.
  Please observe the project manuals of the MotorControllers (MC-4/PMC-2).
5.7 Commissioning

We urgently recommend using ELAU staff for initial commissioning. This should not only be done for warranty reasons; at the same time:
- the equipment is controlled,
- the optimum configuration is determined,
- the operating staff are instructed.

**How to proceed when commissioning:**

**Unpack and check**
- Remove packaging.
- Check devices for damage. Only undamaged devices may be put into operation.
- Check shipment for completeness.
- Check data using the type plates.

See also chapter Transportation, Storage, Unpacking.

**Installation**
- Observe requirements for the place of installation.
- Observe requirements for protection type and EMC rules.
- Install devices.

See also chapter Maintenance.

**Electrical connection**
- Connect devices, starting with the earth conductor.
- Check if the clamps are tight and the required cable cross sections are correct.
- Check the perfect execution of the shield, rule out short-circuits and interruptions.

See also chapter Technical Data und Maintenance.

**Check safety functions**
- Check thermo contact of the motor and/or PTC sensor.
- Check function of the brake (if any).
- Check EMERGENCY OFF chain and EMERGENCY OFF limit switch.

**Continue commissioning the plant**
- Continue commissioning the plant according to the operating manuals (packaging machine producer and MotorController).
5.8 PacDrive SM Motor with Barrier Pressure System

The optional barrier pressure system is used to operate the motor in ambient conditions with high demands on protection against intrusion of liquids.

In practice, different liquids with creeping rates different from water are used. Moreover, the pressure in the casing rises as the drive gets hot and falls as the drive cools off. Those pressure differences encourage the penetration of liquid barrier pressure system.

Permanent, reliable protection against the penetration of liquids and gases is achieved if the casing is kept under a slight overpressure by means of an air barrier. The pressurized air used for that purpose must be dry and free from dust and oil. As the system is closed, air consumption is so low that it can be neglected.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>0,1...0,3 bar</td>
<td>recommended</td>
</tr>
<tr>
<td>Pressure</td>
<td>0,4 bar</td>
<td>maximum</td>
</tr>
<tr>
<td>Operating condition</td>
<td>dust-free</td>
<td>by means of suitable microfilters</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>oil-free</td>
<td>by means of suitable oil separators</td>
</tr>
<tr>
<td>relative Luftfeuchtigkeit</td>
<td>20...30 %</td>
<td></td>
</tr>
</tbody>
</table>

Table 5-1: Operating conditions for the use of the barrier pressure system

Connection of the barrier pressure system

The motor is supplied with air via a commercially available compressed air pipe (polyamide plastic pipe 4 x 0,75 mm). A thread M3 for the barrier pressure system is placed in the terminal box.

Fig. 5-1: Connection of the barrier pressure system at the SM-motor
5.9 Configuration / Programming / Diagnosis

The motors are adjusted by ELAU. The customer does not need to execute alignment.

The adjustment of the MotorControllers to the motors is to be inferred from the documentation of the respective MotorController.

See also the documentation of the MotorController.

Error diagnosis and monitoring of the operating conditions is executed into the ELAU controllers.

See programing reference manual for appropriate descriptions.
5.10 Order Numbers

5.10.1 SM Motor

Type key

- **SM - 100 / 50 / 030 / P0 / 45 / S1 / B0 / XY**

**Flange size**
e.g.: 070 = 70 mm

**Speed nN**
e.g.: 50 = 5000 min⁻¹

**Torque Mₚ**
e.g.: 030 = 3.0 Nm

**Shaft version**
P0 = without feather groove (smooth shaft)
P1 = with feather groove (key) according to DIN 6885
P3 = stainless steel shaft without feather groove (smooth shaft)
P4 = stainless steel shaft with feather groove (key) DIN 6885

**Protection means shaft/casing**
1. digit = shaft
   - 4 = IP 64, 5 = IP 65
2. digit = casing
   - 0 = IP 20 (with surface ventilation)
   - 5 = IP 65
   - A = IP 67 (with option barrier pressure system)

**Encoder**
S1 = SinCos single-turn
M1 = SinCos multi-turn
R1 = Resolver

**Holding brake**
B0 = without brake
B1 = with brake

**Special option (bit coded)**
Bit 0 = 1 (01) with fan 230 V AC
Bit 2 = 1 (04) without lacquer

*Fig. 5-2: Type key legend for SM motor*
### 5.10.2 SM Motor

#### Basic Types

<table>
<thead>
<tr>
<th>Order number</th>
<th>Product name</th>
<th>Explanations</th>
</tr>
</thead>
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Tabelle 5-2: Order numbers for SM Motor

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**Shaft (stainless steel) / IP65**

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<tr>
<td>1920xxxx - 096</td>
<td>SM ... / ... / P4 / 50 / M1 / B1 / 01</td>
<td>Multiturn, shaft, brake, fan</td>
</tr>
</tbody>
</table>

**Option barrier pressure system / IP67**

<table>
<thead>
<tr>
<th>Order number</th>
<th>Product name</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920xxxx - 620</td>
<td>SM ... / ... / P3 / 5A / M1 / B1</td>
<td>Multiturn, brake</td>
</tr>
</tbody>
</table>
### Table 5-3: Order numbers for SM motor

<table>
<thead>
<tr>
<th>Order number</th>
<th>Product name</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920xxxx - 621</td>
<td>SM ... /.../... / P4 / 5A / M1 / B1</td>
<td>Multiturn, brake, shaft</td>
</tr>
<tr>
<td>1920xxxx - 622</td>
<td>SM ... / ... / P0 / 5A / M1 / B1</td>
<td>Multiturn, brake</td>
</tr>
<tr>
<td>1920xxxx - 623</td>
<td>SM ... / ... / P3 / 5A / M1 / B0</td>
<td>Multiturn</td>
</tr>
<tr>
<td>1920xxxx - 624</td>
<td>SM ... / ... / P4 / 5A / M1 / B0</td>
<td>Multiturn, shaft</td>
</tr>
</tbody>
</table>
## 5.10.3 Cables

### Motor Cables

<table>
<thead>
<tr>
<th>Order number</th>
<th>Product name</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 15 41 01</td>
<td>E-MO-067 UL cable 1.5 mm²</td>
<td>SM-070/100 on MC-4 X4</td>
</tr>
<tr>
<td>15 15 41 21</td>
<td>E-MO-092 UL cable 1.5 mm²</td>
<td>SM-140 on MC-4 X4</td>
</tr>
<tr>
<td>15 15 41 12</td>
<td>E-MO-082 UL cable 2.5 mm²</td>
<td>SM-140/30/210/... with fan on MC-4 / 22 A X4</td>
</tr>
<tr>
<td>15 15 41 17</td>
<td>E-MO-087 UL cable 2.5 mm²</td>
<td>SM-140/30/290; SM-140/30/370 on MC-4 / 22 A X4</td>
</tr>
<tr>
<td>15 15 41 20</td>
<td>E-MO-091 UL cable 4 mm²</td>
<td>SM-140/30/370/... with fan on MC-4 / 22 A X4 on MC-4 / 50 A X4</td>
</tr>
<tr>
<td>15 15 41 02</td>
<td>E-MO-068 CE cable 1.5 mm²</td>
<td>SM-070/100 on MC-4 X4</td>
</tr>
<tr>
<td>15 15 41 07</td>
<td>E-MO-073 CE cable 1.5 mm²</td>
<td>SM-140 on MC-4 X4</td>
</tr>
<tr>
<td>15 15 41 03</td>
<td>E-MO-069 CE cable 2.5 mm²</td>
<td>SM-140/30/210/... with fan on MC-4 / 22 A X4</td>
</tr>
<tr>
<td>15 15 41 13</td>
<td>E-MO-083 CE cable 2.5 mm²</td>
<td>SM-140/30/290; SM-140/30/370 on MC-4 / 22 A X4</td>
</tr>
<tr>
<td>15 15 41 14</td>
<td>E-MO-084 CE cable 4 mm²</td>
<td>SM-140/30/370/... with fan on MC-4 / 22 A X4 on MC-4 / 50 A X4</td>
</tr>
<tr>
<td>15 15 41 04</td>
<td>E-MO-070 UL cable 1.5 mm²</td>
<td>SM-070/100 on PMC-2</td>
</tr>
<tr>
<td>15 15 41 05</td>
<td>E-MO-071 CE cable 1.5 mm²</td>
<td>SM-070/100 on PMC-2</td>
</tr>
<tr>
<td>15 15 41 08</td>
<td>E-MO-074 CE cable 1.5 mm²</td>
<td>SM-140 on PMC-2</td>
</tr>
<tr>
<td>15 15 41 06</td>
<td>E-MO-072 CE cable 2.5 mm²</td>
<td>SM-140 on PMC-2</td>
</tr>
</tbody>
</table>

*Table 5-4: Order numbers for motor cables*
## 5.10.4 Connector Sets

### Encoder Cables

<table>
<thead>
<tr>
<th>Order number</th>
<th>Product name</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 15 42 01</td>
<td>E-FB-060 UL cable</td>
<td>SM-070; SM-100 X4 on MC-4 X8</td>
</tr>
<tr>
<td>15 15 42 02</td>
<td>E-FB-061 CE cable</td>
<td>SM-070; SM-100 X4 on MC-4 X8</td>
</tr>
<tr>
<td>15 15 42 13-XXX</td>
<td>E-FB-069 SM/SIN</td>
<td>Ext. motor side SM070/100</td>
</tr>
<tr>
<td>15 15 42 15</td>
<td>E-FB-071 UL cable</td>
<td>SM-140 X4 on MC-4 X8</td>
</tr>
<tr>
<td>15 15 42 17</td>
<td>E-FB-073 CE cable</td>
<td>SM-140 X4 on MC-4 X8</td>
</tr>
<tr>
<td>15 15 42 03</td>
<td>E-FB-062 CE cable</td>
<td>on PMC-2 X12 (SinCos)</td>
</tr>
<tr>
<td>15 15 42 04</td>
<td>E-FB-067 CE cable</td>
<td>on PMC-2 X6 (resolver)</td>
</tr>
</tbody>
</table>

*Table 5-5: Order numbers for encoder cables*

### Connector Sets

<table>
<thead>
<tr>
<th>Order number</th>
<th>Product name</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 15 44 01</td>
<td>Connector Set SM070/100</td>
<td>Connector motor cable compl.</td>
</tr>
<tr>
<td>15 15 44 02-001</td>
<td>Connector Set SM140 Type1</td>
<td>Connector motor cable compl. (up to SM140/30/210)</td>
</tr>
<tr>
<td>15 15 44 02-002</td>
<td>Connector Set SM140 Type2</td>
<td>Connector motor cable compl. (from SM140/30/290)</td>
</tr>
<tr>
<td>15 15 44 02-003</td>
<td>Connector Set SR-058</td>
<td>connector motor and feedback</td>
</tr>
</tbody>
</table>

*Table 5-6: Order numbers for connector sets*
6 Technical Data

6.1 General Technical Data

<table>
<thead>
<tr>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor type</td>
<td>Rotary synchr. servomotor, permanently excited</td>
</tr>
<tr>
<td>Magnetic material</td>
<td>Neodymium-Iron-Boron (NdFeB)</td>
</tr>
<tr>
<td>Insulation system (according to DIN VDE 0530)</td>
<td>Heat class F (155 °C)</td>
</tr>
<tr>
<td>Mounting orientation (according to DIN 42 950)</td>
<td>IM B5, IM V1, IM V3</td>
</tr>
<tr>
<td>Protection class (according to EN 60529)</td>
<td>IP65, in IM V3 shaft sealing required</td>
</tr>
<tr>
<td>Protection class (according to EN 60529)</td>
<td>IP67, with optional barrier pressure system</td>
</tr>
<tr>
<td>Cooling</td>
<td>Self-cooling, rated ambient temperature up to 40 °C</td>
</tr>
<tr>
<td>Coating Approvals</td>
<td>two component high solid expoxid resin coating</td>
</tr>
<tr>
<td></td>
<td>USDA - Incidental food contact</td>
</tr>
<tr>
<td></td>
<td>NFPA - Class A</td>
</tr>
<tr>
<td></td>
<td>NSF Standard 61 - Potable water</td>
</tr>
<tr>
<td></td>
<td>Color of coating, Ral 9005</td>
</tr>
<tr>
<td>Temperature monitoring</td>
<td>Three-code thermocontact (CPTC)in the stator coil,</td>
</tr>
<tr>
<td></td>
<td>switching temperature 130 °C</td>
</tr>
<tr>
<td>Shaft end</td>
<td>Cylindrical shaft end according to DIN 748 without key way</td>
</tr>
<tr>
<td>Concentric accuracy, coaxiality, axial run (according to DIN 42 955)</td>
<td>Tolerance N (normal)</td>
</tr>
<tr>
<td>Balancing class (according to DIN ISO 1940)</td>
<td>G 2.5</td>
</tr>
<tr>
<td>Built-in measuring system</td>
<td>Resolver 2 polepairs</td>
</tr>
<tr>
<td>Connection system</td>
<td>Cylindrical Connectors (IP67) turnable</td>
</tr>
</tbody>
</table>

*Table 6-1: General technical data*

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyed shaft</td>
<td>Keyed shaft according to DIN 6885 T1</td>
</tr>
<tr>
<td>Brake</td>
<td>Electromagnetic permanent-magnet holding brake</td>
</tr>
<tr>
<td>Shaft in stainless steel</td>
<td>Shaft in stainless steel with / without keyed shaft</td>
</tr>
<tr>
<td>Sealing Housing</td>
<td>Barrier pressure System (IP67)</td>
</tr>
<tr>
<td>Shaft Sealing</td>
<td>Viton radial shaft seal on the flange side</td>
</tr>
<tr>
<td>Cooling</td>
<td>air and water cooling (in preparation)</td>
</tr>
<tr>
<td>Measuring system</td>
<td>SKS36, SKM36more feedbacksystems available on request</td>
</tr>
</tbody>
</table>

*Table 6-2: General technical data (Options)*
### 6.1.1 Definitions and Physical Correlations

<table>
<thead>
<tr>
<th>Abbrev.</th>
<th>Unit</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I\textsubscript{0M}</td>
<td>[A]</td>
<td>standstill current of the motor effective value of the motor current at standstill torque $M_0$</td>
</tr>
<tr>
<td>I\textsubscript{NM}</td>
<td>[A]</td>
<td>rated motor current effective value of the motor current at rated torque $M_N$</td>
</tr>
<tr>
<td>I\textsubscript{SM}</td>
<td>[A]</td>
<td>peak motor current effective value of the motor current at peak torque $M_{SM}$</td>
</tr>
<tr>
<td>I\textsubscript{NC}</td>
<td>[A]</td>
<td>rated current of MotorController rated controller current (permanent operation S1)</td>
</tr>
<tr>
<td>I\textsubscript{SC}</td>
<td>[A]</td>
<td>peak current of the MotorController peak current of the controller for acceleration phases also effective value of the motor current at peak torque $M_{SA}$ supplied for a short time by the drive combination</td>
</tr>
<tr>
<td>J\textsubscript{M}</td>
<td>[kgcm$^2$]</td>
<td>rotor moment of inertia the rotor moment of inertia refers to a motor with resolver and without brake</td>
</tr>
<tr>
<td>J\textsubscript{ges}</td>
<td>[kgcm$^2$]</td>
<td>moment of inertia total moment of inertia (motor and load)</td>
</tr>
<tr>
<td>K\textsubscript{M}</td>
<td>[Nm/A]</td>
<td>torque constant of the motor ratio of standstill torque $M_0$ and standstill current $I_{0M}$ (e.g. $K_{M20}$ for 20°C).</td>
</tr>
<tr>
<td>m</td>
<td>[kg]</td>
<td>mass motor mass without brake and without fan</td>
</tr>
<tr>
<td>M\textsubscript{0}</td>
<td>[Nm]</td>
<td>standstill torque of the motor permanent torque (100% ED) at speed $n_0$. With an ambient temperature of 40 °C, an overtemperature of 60 °C occurs on the motor casing, depending on the thermal motor time constant</td>
</tr>
<tr>
<td>M\textsubscript{N}</td>
<td>[Nm]</td>
<td>rated motor torque permanent torque (100% ED) at rated speed $n_N$. Due to the speed-related losses, it is less than $M_0$. With an ambient temperature of 40 °C, an overtemperature of 60 °C occurs on the motor casing, depending on the thermal motor time constant</td>
</tr>
<tr>
<td>M\textsubscript{S3}</td>
<td>[Nm]</td>
<td>torque for intermittent operation S3 = 25% ED</td>
</tr>
<tr>
<td>M\textsubscript{SA}</td>
<td>[Nm]</td>
<td>peak motor torque of monitor in combination with Motor Controller</td>
</tr>
<tr>
<td>M\textsubscript{SM}</td>
<td>[Nm]</td>
<td>peak motor torque maximum torque which a servo motor can deliver on the working shaft for a short time</td>
</tr>
</tbody>
</table>
### Abbrev. | Unit | Definition
--- | --- | ---
\(n_{\text{NM}}\) | [1/min] | rated motor speed
|  |  | speed that can be used at rated torque. Idling speed \(n_L\) and mechanical limit speed \(n_{\text{limit}}\) of the servo motor are higher
\(P_{\text{NM}}\) | [kW] | rated mechanical power
|  |  | rated mechanical power of the servo motor according to rated speed \(n_N\) and rated torque \(M_N\).
\(P_{\text{NA}}\) | [kW] | rated motor power in combination with controller
\(P_{\text{ECKM}}\) | [kW] | fringe motor power (theoretical value)
|  |  | \(P_{\text{FRINGEM}} = M_{\text{DM}} \cdot n_N \cdot \pi / 30\)
\(R_W\) | [\(\Omega\)] | resistance of a motor winding
|  |  | resistance of a motor winding between phase and neutral point (e.g. \(R_{W20}\) for a winding temperature of 20 °C).
\(L_W\) | [mH] | winding inductivity
|  |  | winding inductivity for a winding temperature of 20 °C
\(t_{\text{bSM}}\) | [ms] | acceleration time
|  |  | acceleration time of the motor without external torque from 0 to rated speed \(n_N\) with peak motor current \(I_{\text{SM}}\).

*Table 6-3: Physical definitions with units*
physical correlations

Correlation between torque and current:

\[ M = K_M \times I_{\text{eff}} \]

- \( M \) in Nm
- \( K_M \) in Nm/A
- \( I_{\text{eff}} \) in A (effective value of the phase current)

Current:

\[ I_{\text{eff}} = \frac{I_{\text{summit}}}{1,41} \]

\( I_{\text{eff}} \) and \( I_{\text{summit}} \) in A

Rated motor power:

\[ P_{NM} = M_N \times n_N \times \frac{\pi}{30} \]

- \( P_{NM} \) in Watt
- \( M_N \) in Nm
- \( n_N \) in rpm

Admissible working time in AB operation (S3) with a play duration of 15 minutes:

\[ ED = \left( \frac{M_N}{M_{S3}} \right)^2 \times 100 \]

- \( ED \) in %
- \( M_N \) and \( M_{S3} \) in Nm

Effective torque with changing loads:

\[ M_{\text{eff}} < M_N \]

\[ M_{\text{eff}} = \frac{M_1^2 \times t_1 + M_2^2 \times t_2 + \ldots + M_n^2 \times t_n}{t_1 + t_2 + \ldots + t_n} \]
Velocity:

\[ \tau = \frac{n \times 2 \times \pi}{60} \]

- \( w \) in rad/sec
- \( n \) in rpm

Acceleration moment:

\[ M_b = I_{total} \times \left( \frac{w}{t_b} \right) \]

- \( M_b \) in Nm
- \( I_{ges} \) in kgm²
- \( w \) in rad/sec
- \( t_b \) in sec (acceleration time)

Acceleration:

\[ a = \frac{w}{t_b} \]

- \( a \) in rad/sec²
- \( w \) in rad/sec
- \( t_b \) in sec
Fig. 6-1: Physical correlations
6.1.2 Ambient conditions, approbations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>admissible ambient temperature from 0 to 1000 m over NN</td>
<td>0 - 40 °C with higher temperatures, power reduction by 1% per °C</td>
</tr>
<tr>
<td>air humidity</td>
<td>class F according to DIN 40040</td>
</tr>
<tr>
<td>insulation class</td>
<td>F</td>
</tr>
<tr>
<td>approbations</td>
<td>UL / cUL / CE</td>
</tr>
</tbody>
</table>

Table 6-4: Ambient conditions, approbations

**Reduced performance in case of higher ambient temperature and / or lower air pressure**

If you operate the motors outside the specified nominal data, the motors may be damaged. The effects of ambient temperature and installation height are described below.

The maximum ambient temperature allowed for the SM motor is 40°C. If the ambient temperature rises to a maximum of 55°C, the rated current drops by 1% for each °C.

![Graph showing reduced performance in case of higher ambient temperature](image)

*Fig. 6-2: Reduced performance in case of higher ambient temperature*

In the border range from 40°C to 55°C, multiply the performance data with the load factor you determined for the ambient temperature.
In environments less than 1000 meters above the sea level, no noteworthy performance reduction due to air pressure is to be expected for SM motors. For heights greater than 1000 meters above the sea level, note the performance data set forth in the diagram below.

**Fig. 6-3: Reduced performance when exceeding the installation height**

In the border range from 1000 m to 3000 m, multiply the performance data with the load factor you determined for the installation height.

In case of a performance reduction resulting from both causes, multiply the two load factors with the performance values.
6.1 General Technical Data

6.1.3 Protection class

The protection class of the SM motor depends on the position in which it is mounted.

All motor types have a fixing flange that makes it possible to install them according to method B5 (fixing flange with through holes).

According to DIN 42950 part 1 (edition 08.77), the motors can be mounted on the machine as follows:

<table>
<thead>
<tr>
<th>Structural shape</th>
<th>Admissible mounting positions according to DIN IEC 34-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>B05</td>
<td>![Diagram of mounting positions IM B5, IM V1, IM V3]</td>
</tr>
</tbody>
</table>

Fig. 6-4: Mounting positions of the motor

---

**CAUTION!**

Inadmissible mounting position!
Penetrating liquid causes motor damage!

- When installing the motor in position IM V3, make sure that there are no liquids at the drive shaft for a longer time. Even if a shaft seal is built in, one cannot rule out with absolute certainty that liquid penetrates into the motor casing along the drive shaft.

<table>
<thead>
<tr>
<th>Motor part</th>
<th>Protection class</th>
<th>Mounting position</th>
</tr>
</thead>
<tbody>
<tr>
<td>shaft</td>
<td>IP 64</td>
<td>IM B5, IM V1, IM V3</td>
</tr>
<tr>
<td></td>
<td>IP 60</td>
<td></td>
</tr>
<tr>
<td>shaft sealing</td>
<td>IP 65</td>
<td>IM B5, IM V1, IM V3</td>
</tr>
<tr>
<td>shaft with barrier pressure system</td>
<td>IP 67</td>
<td>IM B5, IM V1, IM V3</td>
</tr>
<tr>
<td>surface / connection box</td>
<td>IP 65</td>
<td>IM B5, IM V1, IM V3</td>
</tr>
<tr>
<td>surface / connection box with barrier pressure system</td>
<td>IP 67</td>
<td>IM B5, IM V1, IM V3</td>
</tr>
<tr>
<td>fan (optional)</td>
<td>IP 20</td>
<td>IM B5, IM V1, IM V3</td>
</tr>
</tbody>
</table>

Table 6-5: Protection means of SM Motors
6.1.4 Motor shaft and bearing

Execution of the shaft end
With a frictional connection, torque transmission must be achieved by pressure only. This ensures a safe load transmission without play.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Designation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>KTR Kupplungstechnik GmbH</td>
<td>CLAMPEX clamp set</td>
<td>SM 070: KTR 250 - 11x18</td>
</tr>
<tr>
<td>Rodder Damm 170 48432 Rheine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spieth Maschinenelemente</td>
<td>Spieth pressure sleeve series</td>
<td>SM 100: DSM 19.2</td>
</tr>
<tr>
<td>Alleenstraße 41 73790 Esslingen</td>
<td>DSM</td>
<td>SM 140: DSM 24.2</td>
</tr>
</tbody>
</table>

Table 6-6: Manufacturers of frictional connections

Shaft connections with round-ended feather key are form-fit. Under continuous duty with variable torque rates or high reversing activity, the position of the round-ended feather key may deflect. This reduces the quality of smooth running (a play develops!). Increasing deformation may cause the round-ended feather key to break and thus damage the shaft. For this reason, this kind of shaft-hub connection is suitable only for low strain. We recommend using smooth shaft ends.

Bearing
The bearing on the A side is a fixed bearing, on the B side is a loose bearing. Thus heat expansion of the slide has no effect on the A side.
Admissible shaft strain

![Diagram of shaft strain](image)

Fig. 6-5: Definition of shaft strain

<table>
<thead>
<tr>
<th>Motor</th>
<th>1000 1/min</th>
<th>2000 1/min</th>
<th>3000 1/min</th>
<th>4000 1/min</th>
<th>5000 1/min</th>
<th>6000 1/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM 070xx010</td>
<td>546</td>
<td>447</td>
<td>398</td>
<td>360</td>
<td>324</td>
<td>306</td>
</tr>
<tr>
<td>SM 070xx020</td>
<td>607</td>
<td>497</td>
<td>428</td>
<td>388</td>
<td>360</td>
<td>340</td>
</tr>
<tr>
<td>SM 100xx030</td>
<td>927</td>
<td>755</td>
<td>652</td>
<td>590</td>
<td>548</td>
<td></td>
</tr>
<tr>
<td>SM 100xx050</td>
<td>1000</td>
<td>820</td>
<td>710</td>
<td>643</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM 100xx080</td>
<td>1100</td>
<td>896</td>
<td>775</td>
<td>701</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM 140xx120</td>
<td>1335</td>
<td>1095</td>
<td>940</td>
<td>851</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM 140xx210</td>
<td>1445</td>
<td>1185</td>
<td>1020</td>
<td>923</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM 140xx290</td>
<td>1515</td>
<td>1240</td>
<td>1070</td>
<td>968</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM 140xx370</td>
<td>1560</td>
<td>1280</td>
<td>1100</td>
<td>996</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6-7: Admissible radial force \( F_{\text{radial}} \) [N]

Basis for calculation:
20,000 hours of operation as rated bearing life \( L_{10h} \) for a shaft without feather groove.

Admissible axial force \( F_{\text{axial}} \) [N]

\[
F_{\text{axial}} = 0.2 \times F_{\text{radial}}
\]
### 6.1.5 Encoders

#### SinCos

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of sinus-cosine phases per revolution</td>
<td>1024</td>
<td></td>
</tr>
<tr>
<td>dimensions</td>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>rotor moment of inertia</td>
<td>10</td>
<td>gcm²</td>
</tr>
<tr>
<td>code type for absolute value</td>
<td>binary</td>
<td></td>
</tr>
<tr>
<td>code development for clockwise shaft rotation, looking on &gt;A&lt; (see dimensional drawing)</td>
<td>rising</td>
<td></td>
</tr>
<tr>
<td>measuring step after arc tangent formation with 12 bit resolution</td>
<td>0.3</td>
<td>angular seconds</td>
</tr>
<tr>
<td>number of steps per revolution „SRS single-turn“</td>
<td>32.768</td>
<td></td>
</tr>
<tr>
<td>number of steps per revolution „SRM multi-turn“</td>
<td>134.217.728 = 32768 x 4096</td>
<td></td>
</tr>
<tr>
<td>error limits of the digital absolute value via RS 485</td>
<td>+/- 90</td>
<td>angular minutes</td>
</tr>
<tr>
<td>error limits for evaluation of the 1024-type signals, integral non-linearity</td>
<td>+/- 45</td>
<td>angular minutes</td>
</tr>
<tr>
<td>non-linearity within a sinus, cosine period, differential non-linearity</td>
<td>+/- 7</td>
<td>angular seconds</td>
</tr>
<tr>
<td>output frequency for sinus, cosine signals</td>
<td>0 ... 200 kHz</td>
<td></td>
</tr>
<tr>
<td>working speed up to which the absolute position can be formed reliably</td>
<td>6000</td>
<td>min⁻¹</td>
</tr>
<tr>
<td>max. angular acceleration</td>
<td>0.2 x 10⁶</td>
<td>rad/s²</td>
</tr>
<tr>
<td>operating torque</td>
<td>0.2</td>
<td>Ncm</td>
</tr>
<tr>
<td>starting torque</td>
<td>0.4</td>
<td>Ncm</td>
</tr>
<tr>
<td>admissible shaft movements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- radial movement, static</td>
<td>+/- 0.5</td>
<td>mm</td>
</tr>
<tr>
<td>- radial movement, dynamic</td>
<td>+/- 0.1</td>
<td>mm</td>
</tr>
<tr>
<td>- axial movement, static</td>
<td>+/- 0.75</td>
<td>mm</td>
</tr>
<tr>
<td>- axial movement, dynamic</td>
<td>+/- 0.2</td>
<td>mm</td>
</tr>
<tr>
<td>- angular movement at right angle to turning axis, static</td>
<td>+/- 0.005</td>
<td>mm/mm</td>
</tr>
<tr>
<td>- angular movement at right angle to turning axis, dynamic</td>
<td>+/- 0.0025</td>
<td>mm/mm</td>
</tr>
<tr>
<td>bearing life</td>
<td>3.6 x 10⁹</td>
<td>revolutions</td>
</tr>
<tr>
<td>working temperature range</td>
<td>-20 ... +115 °Celsius</td>
<td></td>
</tr>
<tr>
<td>operating temperature range</td>
<td>-20 ... +125 °Celsius</td>
<td></td>
</tr>
</tbody>
</table>
### 6.1 General Technical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>storage temperature range</td>
<td>-40 ... +125</td>
<td>°Celsius</td>
</tr>
<tr>
<td>admissible relative air humidity (dewing prohibited)</td>
<td>90</td>
<td>%</td>
</tr>
<tr>
<td>shock resistance when mounted according to DIN IEC 68 part 2-27</td>
<td>100/10</td>
<td>g/ms</td>
</tr>
<tr>
<td>vibration resistance when mounted according to DIN IEC 68 part 2-6</td>
<td>20/10 ... 2000</td>
<td>g/Hz</td>
</tr>
<tr>
<td>protection means according to DIN VDE 0470 part 1 when mounted</td>
<td>IP 40</td>
<td></td>
</tr>
<tr>
<td>EMT according to EN 50082-2 and EN 50081-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>operating voltage range</td>
<td>7 ... 12</td>
<td>V</td>
</tr>
<tr>
<td>recommended supply voltage</td>
<td>8</td>
<td>V</td>
</tr>
<tr>
<td>max. operating current without load</td>
<td>80</td>
<td>mA</td>
</tr>
<tr>
<td>available memory range in EEPROM</td>
<td>128</td>
<td>Byte</td>
</tr>
<tr>
<td>interface signals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIN, REFSIN, COS, REFCOS = process data channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS 485 = parameter channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>analog, differential, digital</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 6-8: Technical data of the SinCos encoder (SRS / SRM)*
Resolver
The SM motor can be supplied also with a brushless hollow shaft resolver.

Advantages of brushless hollow shaft resolvers
Brushless resolvers permit accurate positioning, velocity measurement and commutation of brushless electric motors without mechanical or temperature-related restrictions known from other sensors.

Brushless resolvers are excellently suited for industrial applications in rough ambient conditions, as they are largely independent of vibration, shock and increased temperature strain.

Main features
- compact design
- installation directly on the motor or drive shaft, no clutch
- no brushes or contacts
- no ball bearings
- compatibly with resolver/digital transducer
6.1.6 **Holding brake (optional)**

To hold the axis without play in standstill or while the plant is powerless, the servo motors can be supplied with a holding brake. The permanent magnet brake is a unifacial device that uses the power of a permanently magnetic field to generate brake power (electromagnetic normally closed system).

To lift the brake, the permanently magnetic field is superseded by an electromagnetic field. Safe lifting without residual moment, irrespective of the mounting position, is ensured by a steel spring. In addition to friction-free axial armature movement, the spring also provides for play-free transmission of the brake moment.

---

**DANGER!**

Descending axes!

Persons run the risk of squeezing or cutting off limbs.

- The holding brake alone does not guarantee personal protection. To protect people, provide for superior constructive measures, e.g. protective grid, or furnish the plant with a second brake.

---

**CAUTION!**

Holding brake may wear out prematurely!

Risk of personal injury!

- Only use holding brake during standstill
- Only use holding brake to stop a moving axis in EMERGENCY STOP situations.

The motors must not be operated against the closed brake. An emergency stop of the motor (i.e. the brake drops while the motor is running) is only allowed in exceptional cases, if the following conditions are met:

- The required brake power per emergency stop must not exceed the following values:
  - SM-070: 50 Ws
  - SM-100: 200 Ws
  - SM-140: 400 Ws
Between two emergency stops, the brakes must cool down for at least 3 minutes.

After 2000 emergency stops, the brake has reached its wearing limit.

**NOTE**
There are only a few diagnosis messages of the MotorController (MC-4 diagnosis messages with reaction A) which do not permit a controlled stop of the motor. In these few cases, the holding brake of the motor is required for the complete brake procedure (EMERGENCY STOP).

**Example:** To check whether the brake power is not exceeded in case of EMERGENCY STOP, observe the following:

Motor type: SM-070 60 020 with J_M = 0.79 kgcm²

Load: J_Load = 1.5 kgcm²

Speed: 2000 min⁻¹

\[
W_K = \frac{1}{2} \cdot J \cdot \omega^2
\]

\[
W_K = \frac{1}{2} \cdot J \cdot (2 \cdot \pi \cdot n)^2
\]

\[
W_K = \frac{1}{2} \cdot 0,000229 \text{kg} \cdot \text{m}^2 \cdot \left(2 \cdot \pi \cdot \frac{2000}{60} \cdot \frac{1}{s}\right)^2
\]

\[
W_K = \frac{1}{2} \cdot 0,000229 \cdot N \cdot s^2 \cdot \left(2 \cdot \pi \cdot \frac{2000}{60} \cdot \frac{1}{s}\right)^2
\]

\[
W_K = 5 \text{Ws}
\]

The times are valid for direct current, regular operating temperature and rated voltage. **Separation time** is the time from switching on the power to the point when the torque has faded to 10% of the rated torque. **Connection time** is the time from switching off the power until the rated torque is reached.
6.1 General Technical Data

**CAUTION!**
Power loss in case of long cables!
Brake may be worn out or damaged!
- The data for rated power and rated voltage apply at the connection box. Check the data at the connection box. A higher or separate power supply of the brake may be necessary.
- Too high voltage can damage the brake!

The holding brake is dimensioned differently for each motor series:

<table>
<thead>
<tr>
<th></th>
<th>SM 070</th>
<th>SM 100</th>
<th>SM 140</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>holding moment</td>
<td>2.5 (22.2)</td>
<td>11 (97.4)</td>
<td>22 (195)</td>
<td>[Nm] ([lb-in.])</td>
</tr>
<tr>
<td>connection time</td>
<td>5</td>
<td>20</td>
<td>25</td>
<td>[ms]</td>
</tr>
<tr>
<td>separation time</td>
<td>7</td>
<td>29</td>
<td>50</td>
<td>[ms]</td>
</tr>
<tr>
<td>mass</td>
<td>0.3</td>
<td>0.6</td>
<td>1.1</td>
<td>[kg]</td>
</tr>
<tr>
<td>moment of inertia</td>
<td>0.38 (0.00034)</td>
<td>1.06 (0.00094)</td>
<td>3.6 (0.0032)</td>
<td>[kgcm²] ([lb-in.-s²])</td>
</tr>
<tr>
<td>rated power</td>
<td>12</td>
<td>16</td>
<td>18</td>
<td>[W]</td>
</tr>
<tr>
<td>rated voltage</td>
<td>24 +/- 10%</td>
<td>24 +/- 10%</td>
<td>24 +/- 10%</td>
<td>[V] DC</td>
</tr>
</tbody>
</table>

Table 6-9: Technical data of the holding brake of the SM Motor

**Holding brake grind in**
If the motors are equipped with a holding brake and were already stored for more than 2 years before the assembly, the holding brake has to be ground in before you use it.

**CAUTION!**
High voltage!
Life hazard!
- Grind in the holding brake only in the developed status of the motor!

- In addition turn the motor by hand for approx. 50 revolutions in the closed state of the holding brake.
- The holding brake is now ready for use.
6.1.7 Surface Ventilation (optional)

To increase the permanent motor torque, the SM Motors can be supplied with surface ventilation.

The surface ventilation reduces the thermal transition resistance, so that the permanent torque characteristics of the motor are shifted upwards. The peak motor torque is not changed.

The increased permanent torque values are saved in the electronic type plate of the motor or the motor database.

![Fig. 6-6: Example for an SM motor with surface ventilation](MSM_MotorCberf_040009.png)

The fan is dimensioned differently for each motor series:

<table>
<thead>
<tr>
<th></th>
<th>SM 070</th>
<th>SM 100</th>
<th>SM 140</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>rated voltage</td>
<td>230</td>
<td>230</td>
<td>230</td>
<td>[V] AC</td>
</tr>
<tr>
<td>power intake</td>
<td>approx. 0.05</td>
<td>approx. 0.1</td>
<td>approx. 0.15</td>
<td>[A]</td>
</tr>
</tbody>
</table>

*Table 6-10: Technical data of the fans*
6.1 General Technical Data

6.1.8 Technical Data in Detail

Technical Data SM 070
Winding data for 6000 rpm with 3 AC 400 V

<table>
<thead>
<tr>
<th>Reference Data</th>
<th>mnemonic</th>
<th>60 010</th>
<th>60 020</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standstill torque (standard) - motor with surface ventilation</td>
<td>M0M</td>
<td>1.1</td>
<td>2.0 2.7</td>
<td>[Nm]</td>
</tr>
<tr>
<td>Rated speed</td>
<td>nN</td>
<td>6000</td>
<td>6000</td>
<td>[rpm]</td>
</tr>
<tr>
<td>Fringe motor power</td>
<td>PECKM</td>
<td>0.7</td>
<td>1.2</td>
<td>[kW]</td>
</tr>
<tr>
<td>Peak torque</td>
<td>MSM</td>
<td>4.7</td>
<td>7.7</td>
<td>[Nm]</td>
</tr>
</tbody>
</table>

Physical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. mechanical limit rpm</td>
<td>700</td>
<td>700</td>
<td>[rad/s]</td>
</tr>
<tr>
<td>Motor moment of inertia</td>
<td>0.48</td>
<td>0.79</td>
<td>[kgm²]</td>
</tr>
<tr>
<td>Acceleration at MSM</td>
<td>129</td>
<td>175</td>
<td>125 230 [rad/s²]</td>
</tr>
<tr>
<td>Max. shock (all directions)</td>
<td>200</td>
<td>200</td>
<td>[m/s²]</td>
</tr>
<tr>
<td>Max. vibration (radial)</td>
<td>200</td>
<td>200</td>
<td>[m/s²]</td>
</tr>
<tr>
<td>Max. vibration (axial)</td>
<td>40</td>
<td>40</td>
<td>[m/s²]</td>
</tr>
<tr>
<td>Mass</td>
<td>2.75</td>
<td>4.25</td>
<td>[kg]</td>
</tr>
<tr>
<td>Run-up time</td>
<td>5</td>
<td>5</td>
<td>[ms]</td>
</tr>
</tbody>
</table>

Thermal data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal time constant</td>
<td>46</td>
<td>43</td>
<td>[min]</td>
</tr>
<tr>
<td>Operating threshold thermo contact</td>
<td>130</td>
<td>130</td>
<td>[°C]</td>
</tr>
</tbody>
</table>

Electrical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of poles</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Circuit of the motor windings</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Torque constant (20°C)</td>
<td>0.86</td>
<td>0.85</td>
<td>[Nm/A]</td>
</tr>
<tr>
<td>Torque constant (120°C)</td>
<td>0.78</td>
<td>0.78</td>
<td>[Nm/A]</td>
</tr>
<tr>
<td>Winding resistance (120°C)</td>
<td>12.39</td>
<td>4.69</td>
<td>[Ohm]</td>
</tr>
<tr>
<td>Winding inducitivity (20°C)</td>
<td>21.9</td>
<td>10.8</td>
<td>[mH]</td>
</tr>
<tr>
<td>EMC at 1000 rpm</td>
<td>52</td>
<td>52</td>
<td>[V]</td>
</tr>
<tr>
<td>Standstill current - motor with surface ventilation</td>
<td>1.43</td>
<td>2.53</td>
<td>3.46 [A]</td>
</tr>
<tr>
<td>Peak current</td>
<td>6.0</td>
<td>9.9</td>
<td>[A]</td>
</tr>
</tbody>
</table>

Table 6-11: Technical data SM 070
### Technical Data SM 100

Winding data with 3 AC 400 V

<table>
<thead>
<tr>
<th>Reference Data</th>
<th>mnemonic</th>
<th>50 030</th>
<th>40 050</th>
<th>40 080</th>
<th>30 080</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standstill torque (standard) - motor with surface ventilation</td>
<td>( M_{0M} )</td>
<td>2.6</td>
<td>4.8</td>
<td>8.0</td>
<td>8.2</td>
<td>14</td>
</tr>
<tr>
<td>Rated speed</td>
<td>( n_N )</td>
<td>5000</td>
<td>4000</td>
<td>4000</td>
<td>3000</td>
<td>[rpm]</td>
</tr>
<tr>
<td>Fringe motor power</td>
<td>( P_{ECKM} )</td>
<td>1.4</td>
<td>2.0</td>
<td>3.4</td>
<td>2.6</td>
<td>[kW]</td>
</tr>
<tr>
<td>Peak torque</td>
<td>( M_{SM} )</td>
<td>10</td>
<td>16</td>
<td>30</td>
<td>27</td>
<td>[Nm]</td>
</tr>
</tbody>
</table>

#### Physical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. mechanical limit rpm</td>
<td>( n_{limit} )</td>
</tr>
<tr>
<td>Motor’s moment of inertia</td>
<td>( J_M )</td>
</tr>
<tr>
<td>Acceleration at ( M_{SM} )</td>
<td>( A_{SM} )</td>
</tr>
<tr>
<td>Max. shock (all directions)</td>
<td>( S )</td>
</tr>
<tr>
<td>Max. vibration (radial)</td>
<td>( V_R )</td>
</tr>
<tr>
<td>Max. vibration (axial)</td>
<td>( V_A )</td>
</tr>
<tr>
<td>Mass</td>
<td>( m )</td>
</tr>
<tr>
<td>Run-up time</td>
<td>( t_{bSM} )</td>
</tr>
</tbody>
</table>

#### Thermal data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal time constant</td>
<td>( t_A )</td>
</tr>
<tr>
<td>Operating threshold thermo contact</td>
<td>( T_{TK} )</td>
</tr>
</tbody>
</table>

#### Electrical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of poles</td>
<td>( P_Z )</td>
</tr>
<tr>
<td>Circuit of the motor windings</td>
<td></td>
</tr>
<tr>
<td>Torque constant (20°C)</td>
<td>( K_{M20} )</td>
</tr>
<tr>
<td>Torque constant (120°C)</td>
<td>( K_{M120} )</td>
</tr>
<tr>
<td>Winding resistance (120°C)</td>
<td>( R_{W120} )</td>
</tr>
<tr>
<td>Winding inductivity (20°C)</td>
<td>( L_W )</td>
</tr>
<tr>
<td>EMK at 1000 rpm</td>
<td>( E_{MK} )</td>
</tr>
<tr>
<td>Standstill current - motor with surface ventilation</td>
<td>( I_{0M} )</td>
</tr>
<tr>
<td>Peak current</td>
<td>( I_{SM} )</td>
</tr>
</tbody>
</table>

*Table 6-12: Technical Data SM 100*
### Technical Data SM 140

**Winding data for 3000 rpm with 3 AC 400 V**

<table>
<thead>
<tr>
<th>Reference Data</th>
<th>mnemonic</th>
<th>30 120</th>
<th>30 210</th>
<th>30 290</th>
<th>30 370</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standstill torque (standard) - motor with surface ventilation</td>
<td>$M_{0M}$</td>
<td>11</td>
<td>20</td>
<td>29</td>
<td>36</td>
<td>57*</td>
</tr>
<tr>
<td>Rated speed</td>
<td>$\eta_N$</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>[rpm]</td>
</tr>
<tr>
<td>Fringe motor power</td>
<td>$P_{ECKM}$</td>
<td>3.4</td>
<td>6.5</td>
<td>8.6</td>
<td>11</td>
<td>[kW]</td>
</tr>
<tr>
<td>Peak torque</td>
<td>$M_{SM}$</td>
<td>45</td>
<td>76</td>
<td>103</td>
<td>126</td>
<td>[Nm]</td>
</tr>
</tbody>
</table>

**Physical data**

| Max. mechanical limit rpm                            | $\eta_{limit}$ | 700    | 700    | 700    | 700    | [rad/s] |
| Motor’s moment of inertia                            | $J_M$          | 10.3   | 18.1   | 24.9   | 33.1   | [kgcm²] |
| Acceleration at $M_{SM}$                             | $A_{SM}$       | 46889  | 52473  | 53027  | 51485  | [rad/s²] |
| Max. shock (all directions)                          | $S$            | 200    | 200    | 200    | 200    | [m/s²]  |
| Max. vibration (radial)                              | $V_R$          | 200    | 200    | 200    | 200    | [m/s²]  |
| Max. vibration (axial)                               | $V_A$          | 40     | 40     | 40     | 40     | [m/s²]  |
| Mass                                                | $m$            | 10     | 14     | 18     | 22     | [kg]    |
| Run-up time                                         | $t_{bSM}$      | 7      | 6      | 6      | 6      | [ms]    |

**Electrical data**

| Number of poles                                      | PZ         | 8      | 8      | 8      | 8      |
| Torque constant (20°C)                               | $K_{M20}$  | 1.70   | 1.78   | 1.80   | 1.78   | [Nm/A] |
| Torque constant (120°C)                              | $K_{M120}$ | 1.55   | 1.62   | 1.64   | 1.62   | [Nm/A] |
| Winding resistance (120°C)                           | $R_{W120}$ | 1.65   | 0.57   | 0.36   | 0.24   | [Ohm]  |
| Winding inductivity (20°C)                            | $L_W$       | 9.64   | 3.4    | 1.89   | 1.23   | [mH]   |
| EMC at 1000 rpm                                      | EMC        | 103    | 108    | 109    | 108    | [V]    |
| Standstill current - motor with surface ventilation  | $I_{0M}$   | 7.04   | 12.7   | 16.8   | 21.8   | 35.6*  |
| Peak current                                         | $I_{SM}$   | 29     | 47     | 63     | 78     | [A]    |

*In this case, the maximum motor current must be limited to 29.5 A, which is the maximum permissible permanent current tolerance of the power cable.

Table 6-13: Technical data SM 140 30
### Technical Data SM 140

**Winding data for 2000 rpm with 3 AC 400 V**

<table>
<thead>
<tr>
<th>Reference Data</th>
<th>mnemonics</th>
<th>20 210</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standstill torque (standard) - motor with surface ventilation</td>
<td>M0M</td>
<td>21</td>
<td>[Nm]</td>
</tr>
<tr>
<td>Rated speed</td>
<td>nN</td>
<td>2000</td>
<td>[rpm]</td>
</tr>
<tr>
<td>Fringe motor power</td>
<td>PECKM</td>
<td>4.4</td>
<td>[kW]</td>
</tr>
<tr>
<td>Peak torque</td>
<td>MSM</td>
<td>78</td>
<td>[Nm]</td>
</tr>
</tbody>
</table>

**Physical data**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. mechanical limit rpm</td>
<td>n_limit</td>
<td>700</td>
</tr>
<tr>
<td>Motor’s moment of inertia</td>
<td>J_M</td>
<td>18.1</td>
</tr>
<tr>
<td>Acceleration at MSM</td>
<td>A_SM</td>
<td>53 303</td>
</tr>
<tr>
<td>Max. shock (all directions)</td>
<td>S</td>
<td>200</td>
</tr>
<tr>
<td>Max. vibration (radial)</td>
<td>V_R</td>
<td>200</td>
</tr>
<tr>
<td>Max. vibration (axial)</td>
<td>V_A</td>
<td>40</td>
</tr>
<tr>
<td>Mass</td>
<td>m</td>
<td>14</td>
</tr>
<tr>
<td>Run-up time</td>
<td>t_bSM</td>
<td>4</td>
</tr>
</tbody>
</table>

**Thermal data**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal time constant</td>
<td>t_A</td>
<td>91</td>
</tr>
<tr>
<td>Operating threshold thermo contact</td>
<td>T_TK</td>
<td>130</td>
</tr>
</tbody>
</table>

**Electrical data**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of poles</td>
<td>PZ</td>
<td>8</td>
</tr>
<tr>
<td>Circuit of the motor windings</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Torque constant (20°C)</td>
<td>K_M20</td>
<td>2.59 [Nm/A]</td>
</tr>
<tr>
<td>Torque constant (120°C)</td>
<td>K_M120</td>
<td>2.36 [Nm/A]</td>
</tr>
<tr>
<td>Winding resistance (120°C)</td>
<td>R_W120</td>
<td>1.14 [Ohm]</td>
</tr>
<tr>
<td>Winding inductivity (20°C)</td>
<td>L_W</td>
<td>7.19 [mH]</td>
</tr>
<tr>
<td>EMC at 1000 rpm</td>
<td>EMC</td>
<td>157 [V]</td>
</tr>
<tr>
<td>Standstill current</td>
<td>I_0M</td>
<td>8.97 [A]</td>
</tr>
<tr>
<td>Peak current</td>
<td>I_SM</td>
<td>33 [A]</td>
</tr>
</tbody>
</table>

*Table 6-14: Technical data SM 140 20 (data apply to flanged on motor at aluminium plate)*
6.1.9 Torque-speed characteristics

The torque-speed characteristics depict the following developments:

- admissible permanent torque (operating mode S1)
- peak torque at mains voltage = 230 V 3 AC
- peak torque at mains voltage = 380 V 3 AC
- peak torque at mains voltage = 400 V 3 AC
- peak torque at mains voltage = 480 V 3 AC

![Fig. 6-7: Example of torque-speed characteristics](image)

The characteristics refer to an ambient temperature of 40 °C and a casing overtemperature of 60 °C.

**NOTE**

With a single-phase mains connection (230 V) the characteristics of „M_{SM 230 V 3 AC}“ move approx. 20% to the left due to the lower DC-circuit voltage.
Fig. 6-8: Torque-speed characteristics SM 070 60 010

Fig. 6-9: Torque-speed characteristics SM 070 60 020
6.1 General Technical Data

**Fig. 6-10: Torque-speed characteristics SM 070 60 020 with surface ventilation**

**Fig. 6-11: Torque-speed characteristics SM 100 50 030**
Fig. 6-12: Torque-speed characteristics SM 100 40 050

Fig. 6-13: Torque-speed characteristics SM 100 40 080
6.1 General Technical Data

**Fig. 6-14: Torque-speed characteristics SM 100 40 080 with surface ventilation**

**Fig. 6-15: Torque-speed characteristics SM 100 30 080**
Fig. 6-16: Torque-speed characteristics SM 100 30 080 with surface ventilation

Fig. 6-17: Torque-speed characteristics SM 140 30 120
6.1 General Technical Data

Fig. 6-18: Torque-speed characteristics SM 140 30 120 with surface ventilation

Fig. 6-19: Torque-speed characteristics SM 140 30 210
Fig. 6-20: Torque-speed characteristics SM 140 30 210 with surface ventilation

Fig. 6-21: Torque-speed characteristics SM 140 30 290
Fig. 6-22: Torque-speed characteristics SM 140 30 290 with surface ventilation

Fig. 6-23: Torque-speed characteristics SM 140 30 370
Fig. 6-24: Torque-speed characteristics SM 140 30 370 with surface ventilation

Fig. 6-25: Torque-speed characteristics SM 140 20 210
6.2 Electrical Connections

Fig. 6-26: Overview of connections with SM Motor - 1

Fig. 6-27: Overview of connections with SM Motor - 2 (terminal box)

Connection of the motor cables to the terminal box, see also chapter 4.3.1 Modified connections.
6.2.1 X2 - motor

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation (lead no.)</th>
<th>Meaning</th>
<th>Range</th>
<th>Max. cross section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U (1)</td>
<td>3 AC 0 - 480 V</td>
<td>2.5 mm²</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>V (2)</td>
<td>3 AC 0 - 480 V</td>
<td>2.5 mm²</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>W (3)</td>
<td>3 AC 0 - 480 V</td>
<td>2.5 mm²</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PE</td>
<td>motor earth conductor</td>
<td>2.5 mm²</td>
<td></td>
</tr>
</tbody>
</table>

Table 6-15: Connection X2 - motor

NOTE
For SM 140 XX 120 and SM 140 XX 210, the X2 connector plug has a different shape and size.
For SM 140 XX 290 and SM 140 XX 370, X2 is a screw clamp, so that also a motor cable with 4 mm² can be connected.
6.2 Electrical Connections

6.2.2 X3 - brake / motor temperature

Table 6-16: Connection X3 - SM motor

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation (lead no.)</th>
<th>Meaning</th>
<th>Range</th>
<th>Max. cross section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>temp (5)</td>
<td>PTC motor temperature</td>
<td>1.5 mm²</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>temp (6)</td>
<td>PTC motortemperature</td>
<td>1.5 mm²</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>br- (7)</td>
<td>holding brake</td>
<td>DC 0 V</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>4</td>
<td>br+ (8)</td>
<td>holding brake</td>
<td>DC 24 V</td>
<td>1.5 mm²</td>
</tr>
</tbody>
</table>

NOTE
For SM motors SM 140 or higher, the X3 has a different size.

CAUTION!
Poles may be interchanged on the connector plug!
Motor may be damaged!
- Make sure the pin numbers are allocated correctly!
6.2.3 X4 - encoder (SinCos)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation</th>
<th>Meaning</th>
<th>Range</th>
<th>Max. cross section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Us</td>
<td>supply voltage</td>
<td>DC 7 - 12 V</td>
<td>0.25 mm²</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>supply voltage</td>
<td>DC 0 V</td>
<td>0.25 mm²</td>
</tr>
<tr>
<td>3</td>
<td>REFSIN</td>
<td>sinus reference signal</td>
<td></td>
<td>0.25 mm²</td>
</tr>
<tr>
<td>4</td>
<td>SIN</td>
<td>sinus trace</td>
<td></td>
<td>0.25 mm²</td>
</tr>
<tr>
<td>5</td>
<td>REFCOS</td>
<td>cosine reference signal</td>
<td></td>
<td>0.25 mm²</td>
</tr>
<tr>
<td>6</td>
<td>COS</td>
<td>cosine trace</td>
<td></td>
<td>0.25 mm²</td>
</tr>
<tr>
<td>7</td>
<td>RS485-</td>
<td>parameter channel -</td>
<td></td>
<td>0.25 mm²</td>
</tr>
<tr>
<td>8</td>
<td>RS485+</td>
<td>parameter channel +</td>
<td></td>
<td>0.25 mm²</td>
</tr>
</tbody>
</table>

Table 6-17: Connection X4 - SM motor (SinCos encoder)

CAUTION!

Poles may be interchanged on the connector plug!
Motor may be damaged!
- Make sure the pin numbers are allocated correctly!
6.2.4 X4 - encoder (Resolver)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation</th>
<th>Meaning</th>
<th>Range</th>
<th>Max. cross section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>reserves</td>
<td>0.25 mm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>reserves</td>
<td>0.25 mm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SIN -</td>
<td>Sinus -</td>
<td>0.25 mm²</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>SIN +</td>
<td>Sinus +</td>
<td>0.25 mm²</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>COS -</td>
<td>Cosinus -</td>
<td>0.25 mm²</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>COS +</td>
<td>Cosinus +</td>
<td>0.25 mm²</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>EXCT -</td>
<td>exciter signal -</td>
<td>0.25 mm²</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>EXCT +</td>
<td>exciter signal +</td>
<td>0.25 mm²</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6-18: Connection X4 - SM motor (Resolver)*

**CAUTION!**

Poles may be interchanged on the connector plug!
Motor may be damaged!
- Make sure the pin numbers are allocated correctly!
6.3 **Dimensions**

6.3.1 **SM-motor**

SM 070

![Dimensional drawing of SM 070](image)

**Fig. 6-28: Dimensional drawing of SM 070**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>xx 010</th>
<th>xx 020</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>201 (7.91)</td>
<td>261 (10.28)</td>
</tr>
<tr>
<td>X</td>
<td>152 (5.98)</td>
<td>212 (8.35)</td>
</tr>
</tbody>
</table>

**Table 6-19: Dimensions of SM 070 without brake**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>xx 010</th>
<th>xx 020</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>230 (9.06)</td>
<td>290 (11.42)</td>
</tr>
<tr>
<td>X</td>
<td>181 (7.13)</td>
<td>241 (9.49)</td>
</tr>
</tbody>
</table>

**Table 6-20: Dimensions of SM 070 with brake**

**Tolerances**

- Shaft diameter: j6
- Round-ended feather key, round end according to DIN 6885 T1, tolerance field N9
- Rotor balanced with half feather key.
SM 100

Fig. 6-29: Dimensional drawing of SM 100

Table 6-21: Dimensions of SM 100 without brake

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>xx 030</th>
<th>xx 050</th>
<th>xx 080</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>196 (7.72)</td>
<td>240 (9.45)</td>
<td>328 (12.91)</td>
</tr>
<tr>
<td>X</td>
<td>147 (5.79)</td>
<td>191 (7.52)</td>
<td>279 (10.98)</td>
</tr>
</tbody>
</table>

Table 6-22: Dimensions of SM 100 with brake

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>xx 030</th>
<th>xx 050</th>
<th>xx 080</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>231 (9.09)</td>
<td>275 (10.83)</td>
<td>363 (14.29)</td>
</tr>
<tr>
<td>X</td>
<td>182 (7.17)</td>
<td>226 (8.90)</td>
<td>314 (12.36)</td>
</tr>
</tbody>
</table>

**Tolerances**  
Shaft diameter: j6  
Round-ended feather key, round end according to DIN 6885 T1, tolerance field N9  
Rotor balanced with half feather key.
SM 140

Fig. 6-30: Dimensional drawing of SM 140

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>xx 120</th>
<th>xx 210</th>
<th>xx 290</th>
<th>xx 370</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>248 (9.76)</td>
<td>310 (12.20)</td>
<td>372 (14.65)</td>
<td>434 (17.09)</td>
</tr>
<tr>
<td>X</td>
<td>178 (7.01)</td>
<td>240 (9.45)</td>
<td>302 (11.89)</td>
<td>364 (14.33)</td>
</tr>
</tbody>
</table>

Table 6-23: Dimensions of SM 140 without brake

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>xx 120</th>
<th>xx 210</th>
<th>xx 290</th>
<th>xx 370</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>288 (11.34)</td>
<td>350 (13.78)</td>
<td>412 (16.22)</td>
<td>474 (18.66)</td>
</tr>
<tr>
<td>X</td>
<td>218 (8.58)</td>
<td>280 (11.02)</td>
<td>342 (13.46)</td>
<td>404 (15.91)</td>
</tr>
</tbody>
</table>

Table 6-24: Dimensions of SM 140 with brake

**Tolerances**
- Shaft diameter: j6
- Round-ended feather key, round end according to DIN 6885 T1, tolerance field N9
- Rotor balanced with half feather key.
SM Motor with surface ventilation

If an SM Motor has surface ventilation, the motor gets longer. Add the size A2 to the size A of the “standard motor”.

Table 6-25: Dimensions of SM Motor with surface ventilation

<table>
<thead>
<tr>
<th>SM motor</th>
<th>Size A2</th>
<th>Size N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM 070</td>
<td>approx. 59 mm (2.32)</td>
<td>approx. 110 mm (4.33)</td>
</tr>
<tr>
<td>SM 100</td>
<td>approx. 59 mm (2.32)</td>
<td>approx. 145 mm (5.71)</td>
</tr>
<tr>
<td>SM 140</td>
<td>approx. 70 mm (2.76)</td>
<td>approx. 170 mm (6.69)</td>
</tr>
</tbody>
</table>
6.3.2 SP-Gearbox

Fig. 6-32: Dimensional drawing of SP gearbox
# Sizes SP 060 and SP 075

<table>
<thead>
<tr>
<th>Size</th>
<th>SP 060</th>
<th>SP 075</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D1</td>
<td>g6</td>
<td>60</td>
</tr>
<tr>
<td>D2</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>D3</td>
<td>k6</td>
<td>16</td>
</tr>
<tr>
<td>D4</td>
<td>4x</td>
<td>5.5</td>
</tr>
<tr>
<td>D5</td>
<td></td>
<td>68</td>
</tr>
<tr>
<td>D6</td>
<td>F7</td>
<td>14</td>
</tr>
<tr>
<td>D7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D10</td>
<td></td>
<td>58.5</td>
</tr>
<tr>
<td>L1</td>
<td>+/- 2</td>
<td>129</td>
</tr>
<tr>
<td>L2</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>L3</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>L4</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>L5</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>L6</td>
<td>min. max.</td>
<td>15</td>
</tr>
<tr>
<td>L7</td>
<td>+0.5</td>
<td>4</td>
</tr>
<tr>
<td>L8</td>
<td>9.4</td>
<td>9.4</td>
</tr>
<tr>
<td>L9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>L10</td>
<td>44</td>
<td>64</td>
</tr>
<tr>
<td>L11</td>
<td>+/- 1</td>
<td>62</td>
</tr>
<tr>
<td>L12</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>L13</td>
<td>+/- 1</td>
<td>60</td>
</tr>
<tr>
<td>L14*</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>L15</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>L16</td>
<td>h9</td>
<td>5</td>
</tr>
<tr>
<td>L17</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>L18**</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>L19</td>
<td>48.3</td>
<td>68.3</td>
</tr>
<tr>
<td>L20</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>a</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>1xM6</td>
<td>1xM6</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>round-ended feather key according to DIN 6885 sheet 1, form A</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>M5</td>
<td>M5</td>
</tr>
<tr>
<td>t</td>
<td>12.5</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Table 6-26: Gearbox dimensions
* (on L14) In case of reversing operation and high gear strain, we recommend smooth drive shafts.
** (on L18) The dimensions may differ in case of very small motors.

## Sizes SP 100, SP 140 und SP 180

<table>
<thead>
<tr>
<th>Size</th>
<th>SP 100</th>
<th>SP 140</th>
<th>SP 180</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>D1</td>
<td>g6</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>D2</td>
<td>55</td>
<td>55</td>
<td>70</td>
</tr>
<tr>
<td>D3</td>
<td>k6</td>
<td>32</td>
<td>32</td>
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<td>102</td>
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<td>82,5</td>
<td>66,5</td>
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<td>L11</td>
<td>+/- 1</td>
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<td>L18**</td>
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<td>57</td>
<td>89,5</td>
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<td>L21</td>
<td>28</td>
<td>28</td>
<td>30,5</td>
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a      | 0,025  | 0,025  | 0,04   | 0,04   | 0,04   | 0,04   |
| B      | 18     | 18     | 20     | 20     | 20     | 20     |
### 6.3 Dimensions

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<th>SP 140</th>
<th>SP 180</th>
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<td>3xM12x1,5</td>
<td>3xM12x1,5</td>
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<td>D</td>
<td>1xM8x1</td>
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<td>1xM8x1</td>
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<td>E</td>
<td>round-ended feather key according to DIN 6885 sheet 1, form A</td>
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</tr>
<tr>
<td>M</td>
<td>M12</td>
<td>M12</td>
<td>M16</td>
</tr>
<tr>
<td>t</td>
<td>28</td>
<td>28</td>
<td>36</td>
</tr>
</tbody>
</table>

* (on L14) In case of reversing operation and high gear strain, we recommend smooth drive shafts.

** (on L18) The dimensions may differ in case of very small motors.

**Table 6.27: Gearbox dimensions**
7 Appendix

7.1 Contact Addresses

For repair
Please send the components to be repaired or checked, along with the error report, to this address:

ELAU AG
Abt. Kundendienst    house address:
Postfach 1255        Dillberg 12
97821 Marktheidenfeld   97828 Marktheidenfeld
Phone:  +49 (0) 93 91 / 606 - 142
Fax:    +49 (0) 93 91 / 606 - 340

Service team
Should you need to talk to a member of our service team or require on-site service, please contact:

ELAU AG
Dillberg 12
D-97828 Marktheidenfeld
Phone:  +49 (0) 93 91 / 606 - 0
Fax:    +49 (0) 93 91 / 606 - 300
e-mail: info@elau.de
Internet: www.elau.de

ELAU, Inc.
165 E. Commerce Drive
Schaumburg, IL 60173 - USA
Phone:  +1 847 490 4270
Fax:    +1 847 490 4206
e-mail: info@elau.com
Internet: www.elau.com

ELAU SYSTEMS ITALIA S.r.l.
Via Tosarelli 300
I-40050 Villanova di Castenaso (BO)
Phone:  +39 051 / 7818 70
Fax:    +39 051 / 7818 69
e-mail: info@elau.it
Internet: www.elau.it

NOTE
You find more contact addresses on the ELAU homepage (www.elau.de).
7.2 Further Literature

ELAU can provide you with these manuals and instructions on the PacDrive™ system:

**Project Manual**
Art. Nr. 17 13 00 58 -00x (DE, EN, FR)

**Programming Manual**
Art. Nr. 17 13 00 61 - 00x (DE, EN)

**Operating Manual PacDrive MC-4**
Art. Nr. 17 13 00 62 - 00x (DE, EN, IT, FR)

**Operating Manual CAN L2**
Art. Nr. 17 13 00 66 - 00x (DE, EN)

**Operating Manual PROFIBUS-DP**
Art. Nr. 17 13 00 67 - 00x (DE, EN)

**Operating Manual SM-Motor**
Art. Nr. 17 13 00 68 - 00x (DE, EN, IT, FR)

**Operating Manual EPAS-4**
Art. Nr. 17 13 00 70 - 00x (DE, EN)

**Operating Manual PacDrive Controller MAx-4**
Art. Nr. 17 13 00 71 - 00x (DE, EN, IT, FR)

**User Manual OPC-Server**
Art. Nr. 17 13 00 73 - 00x (DE, EN)

**Bedienungsanleitung Device Net**
Art. Nr. 17 13 00 76 - 00x (DE, EN)

**Bedienungsanleitung HMI Bibliotheken**
Art. Nr. 17 13 00 77 - 00x (DE, EN)

**Operating Manual INC-4 Incremental Encoder Module**
Art. Nr. 17 13 00 78 - 00x (DE, EN)

**Operating Manual CANopen**
Art. Nr. 17 13 00 79 - 00x (DE, EN)

**Operating Manual Motion Toolkit ECAM-4**
Art. Nr. 17 13 00 80 - 00x (DE, EN)

**Operating Manual PacNet Modul PN-4**
Art. Nr. 17 13 00 81 - 00x (DE, EN)
Art. Nr. -000 DEutsch -001 ENglish -002 ITalian -003 FRench
7.2 Further Literature

Operating Manual SR-Motor
Art. Nr. 17 13 00 82 - 00x (DE, EN)

Operating Manual Bus Terminal BT-4/DIO1
Art. Nr. 17 13 00 83 - 00x (DE, EN)

Operating Manual TTS Training- and Testsystems
Art. Nr. 17 13 00 88 - 00x (DE)

Operating Manual Automatic Controller Optimization
Art. Nr. 17 13 00 89 - 00x (DE, EN)

Operating Manual PacDrive SCL
Art. Nr. 17 13 00 93 - 00x (DE, EN)

Operating Manual PacDrive PS-4 and PacDrive PD-8
Art. Nr. 17 13 00 94 - 00x (DE, EN)

User Manual Evaluation Kit
Art. Nr. 17 13 00 95 - 00x (DE)

Operating Manual PacDrive Controller P600
Art. Nr. 17 13 00 96 - 00x (DE)

Operating Manual PacDrive Controller C200
Art. Nr. 17 13 00 97 - 00x (DE, EN, FR)

Operating Manual PacDrive Controller C400
Art. Nr. 17 13 00 98 - 00x (DE, EN, FR)

Operating Manual PacDrive Controller C600
Art. Nr. 17 13 00 99 - 00x (DE, EN, FR)

Operating Manual PacDrive PC Panel PCP
Art. Nr. 17 13 01 02 - 00x (DE)

Operating Manual SH Motor
Art. Nr. 17 13 01 05 - 00x (DE, EN)
7.3 **Product Training**

We offer practical workshops and seminars. Our experienced seminar leaders will enable you to make optimum use of the vast possibilities of the PacDrive™ system.

---

**NOTE**

Please contact us for further information or to order our seminar program. See also our homepage (www.elau.de).
7.4 Declaration by the manufacturer

Herstellererklärung / 
EC-Declaration by the manufacturer / 
CE-Déclaration du fabricant 
im Sinne der EG-Maschinenrichtlinie 98/37/EG, 
Anhang II Abschnitt B 
as defined by EC-machinery directive 98/37/EC, 
Annexe II Section B 
conformément à la directive "CE" relative aux 
machines 98/37/CE Annexe II Section B

Das von uns gelieferte Produkt 
The product delivered by our company 
The produit livré par notre société 
AC-Servomotor
AC-Servomotor
AC-Servomotor
SM 070
SM 070
SM 070
SM 100
SM 100
SM 100
SM 140
SM 140
SM 140

ist zum Einbau in eine Maschine be-
is intended to be incorporated into a 
est destiné à être installé dans une 
stimmt.
machine.
machine.

Die Inbetriebnahme ist solange unter-
The product must not be operated until 
La mise en service des composants est 
sagt, bis festgestellt wurde, dass die 
the machine into which this product is to 
fortement déconseillée avant que la 
Maschine, in die dieses Produkt einge-
be incorporated has been declared in 
machine n’ait été déclarée conforme aux 
baut werden soll, den Bestimmungen der 
conformity with the provisions of the 
dispositions de la directive.
EG-Richtlinie entspricht.
directive.

Hersteller:
Manufacturer:
Fabricant:
ELAU AG
ELAU AG
ELAU AG
Dillberg 12
Dillberg 12
Dillberg 12
D-97828 Marktheidenfeld
D-97828 Marktheidenfeld
D-97828 Marktheidenfeld

Stellung im Betrieb / Position :

Vorstand/Chairman

15.9.1998 Günter Locherer

...........................................................
(Datum, Date / Unterschrift, Signature)
7.5 Modifications

01 / 1999
- SM motors run-up times, delay in lifting and delay in clamping revised
- New motors: SM 140 30 290 and SM 140 30 370

03 / 2000
- Insulation class is not H but F
- \( M_0 \) updated (as type plate datas)
- \( M_N \) is now shown in the Torque-Motor Speed Characteristics
- Stop Torque of the brake from the SM 070 is not 5 but 2.5 Nm
- New motors: SM 100 40 080 and SM 140 20 210
- Order numbers updated
- Sales regions updated
- Structure of the document modified
- „technical data in detail“ modified
- Various errors cleared and improvements made

01 / 2001
- Structure of the document modified
- Motors with surface ventilation new
- Order numbers updated
- Description of the encoder systems new
- Description of the holding brake widen
- Various errors cleared and improvements made

09 / 2002
- Structure of the document modified
- Changing to IP65 (casing and connection box)
- Various errors cleared and improvements made

07 / 2004
- product terms adjusted to new layout

10 / 2005
- barrier pressure system option new

NOTE
The latest documentation and modification service on this product are available on the ELAU Homepage (http://www.elau.de).
7.6 Index

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7.7 Form for Error Report

This error report is absolutely necessary in order to enable efficient processing.
Send the error report to your ELAU representative or to:
ELAU AG, Abt. Kundendienst
Dillberg 12, D-97828 Marktheidenfeld
Fax: +49 (0) 93 91 / 606 - 340

Details on the defective product

Product name: ..................................................................................
Article number: .................................................................................
Serial number: .................................................................................
Software version: ..............................................................................
Hardware code: ................................................................................
Parameter enclosed: yes [ ] no [ ]
IEC program enclosed: yes [ ] no [ ]

Details of the machine on which the problem occurred:
Machine producer: ...........................................................................
Type: .............................................................................................
Hours of operation: .......................................................................... 
Machine number: ..............................................................................
Date of commissioning: ....................................................................
Producer/Type of machine control: ..................................................
Description of the problem:
..........................................................................................................
..........................................................................................................
..........................................................................................................

Additional information:

Problem state: Causes: Concomitant phenomena:
[ ] persistent [ ] unknown [ ] mechanical problems
[ ] when commissioning [ ] wiring error [ ] failure of mains supply (24V)
[ ] occurs sporadically [ ] mechanical damage [ ] failure of PMC-2
[ ] occurs after about…..hours [ ] moisture inside the unit [ ] motor failure
[ ] occurs in case of shocks [ ] encoder defective [ ] broken cable
[ ] depends on temperature [ ] [ ] insufficient ventilation
[ ] foreign object inside unit

Does the switching cabinet have an air conditioning system?Y/N [ ]

Have similar problems occurred before on the same axis? How often: .........................
Did the problems occur on certain days or times of day?
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