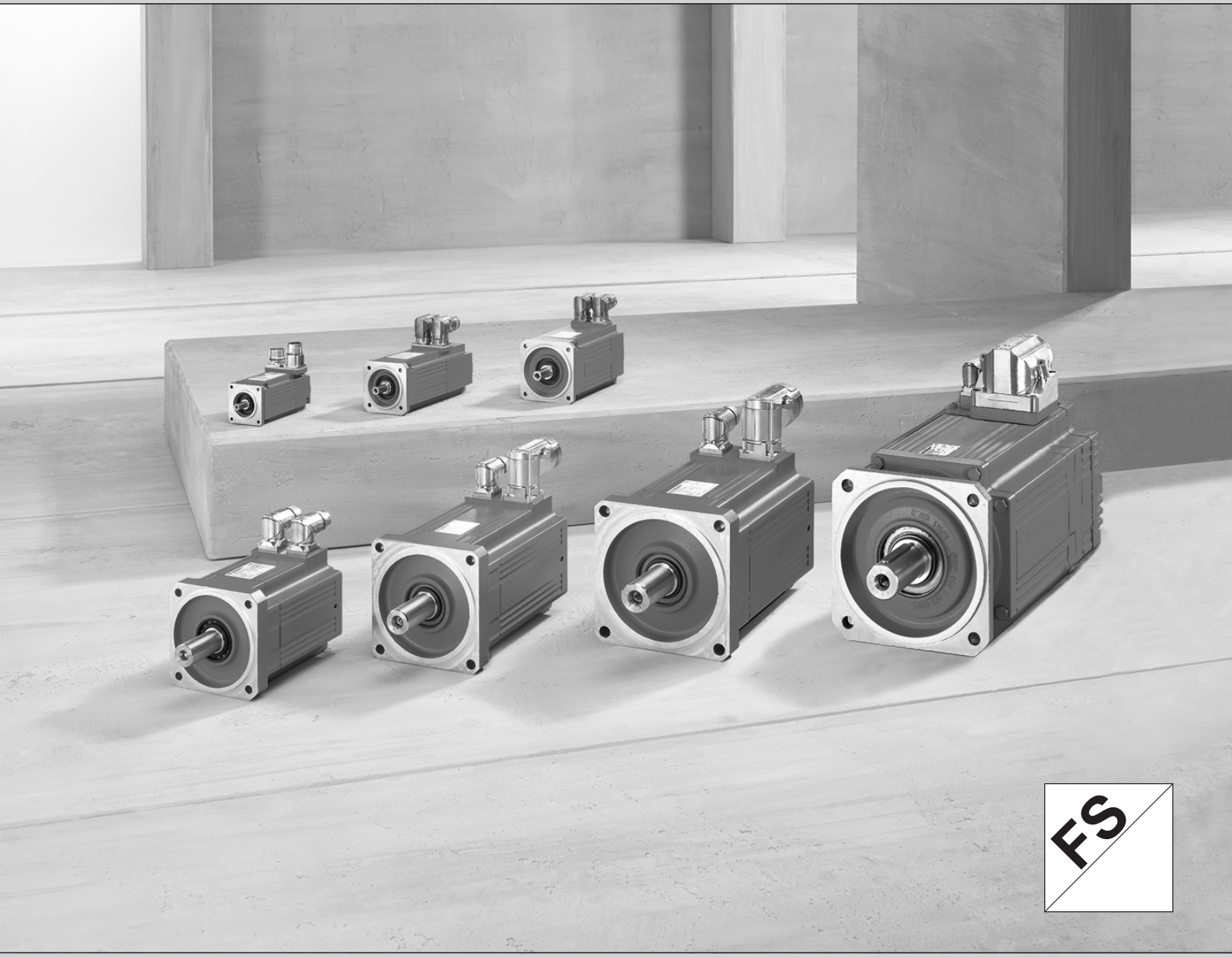
SEW EURODRIVE

Addendum to the Operating Instructions



FS

AK0H(FS), AK1H(FS) Safety-Rated Encoders

Synchronous Servomotors CMP40 – 112, CMPZ71 – 100

Functional Safety

Edition 03/2016

22491465/EN

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1 General information

1.1 About this documentation

This addendum to the operating instructions "Safety-Rated Encoders AK0H/AK1H – CMP40 – 112, CMPZ71 – 100 Synchronous Servomotors – Functional Safety" contains special information regarding the safety-rated encoders AK0H(FS)/AK1H(FS) for CMP.. motors.

The operating instructions "CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" contain information about CMP.. motors without safety-rated mount-on components.

The documentation for a motor with safety-rated mount-on components comprises of the following documents:

- "CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions
- Addendum to the operating instructions "Safety-Rated Encoders AK0H/AK1H – CMP40 – 112, CMPZ71 – 100 Synchronous Servomotors – Functional Safety"

The operating instructions and the addendum to the operating instructions are an integral part of the product and contain important information for operation and service. The operating instructions and the addendum to the operating instructions are intended for staff responsible for the assembly, installation, startup and maintenance of the product.

The operating instructions and the addendum to the operating instructions must be legible and accessible at all times. Make sure that staff responsible for the plant and its operation, as well as persons who work independently on the unit, have read the operating instructions and the addendum to the operating instructions carefully and understood them.

Make sure you always use the latest documentation and software version.

Our documentation is available in various languages for download from the homepage (www.sew-eurodrive.com). If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE directly.

You can also order the printed documentation from SEW-EURODRIVE.

1.2 Structure of the safety notes

1.2.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
⚠ **DANGER**	Imminent hazard	Severe or fatal injuries.
⚠ **WARNING**	Possible dangerous situation	Severe or fatal injuries.
⚠ **CAUTION**	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the drive system or its environment.
INFORMATION	Useful information or tip: Simplifies handling of the drive system.	

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1.2.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of dangerous electrical voltage
	Warning of hot surfaces
	Warning of risk of crushing
	Warning of suspended load
	Warning of automatic restart

1.2.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

⚠ **SIGNAL WORD** Type and source of hazard. Possible consequence(s) if disregarded. Measure(s) to prevent the hazard.

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1.3 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the unit!

1.4 Exclusion of liability

Read the information in this documentation, otherwise safe operation is impossible. You must comply with the information contained in this documentation 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 these operating instructions. In such cases, SEW-EURODRIVE assumes no liability for defects.

1.5 Other applicable documentation

This document supplements the operating instructions and limits the application notes according to the following information. Use this document only together with the operating instructions.

1.6 Motor type notation

These operating instructions cover the motor types CMP and CMPZ.

If information refers to both CMP and CMPZ motors, the notation CMP. motors is used.

If information refers to either CMP or CMPZ motors, the motor type is stated explicitly.

1.7 Product names and trademarks

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.8 Copyright notice

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2 Safety notes

2.1 Preliminary information

The following basic safety notes must be read carefully to prevent injury to persons and damage to property. The user must ensure that the basic safety notes are read and observed. Ensure that persons responsible for the machinery and its operation as well as persons who work on the unit independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

The following safety notes are primarily concerned with the use of the unit described in these operating instructions. If you use other components from SEW-EURODRIVE, also refer to the safety notes for these particular components in the corresponding documentation.

Also observe the additional safety notes provided in the individual chapters of this documentation.

2.2 Target group

The document is for everyone who plans, configures and starts up safety-rated encoders in motors.

Any work with the software may only be performed by adequately qualified personnel. Qualified personnel in this context are persons who have the following qualifications:

- Appropriate instruction.
- Knowledge of this documentation and other applicable documentation.
- SEW-EURODRIVE recommends additional product training for products that are operated using the respective software.

Any mechanical work on the components may only be performed by adequately qualified personnel. Qualified personnel in the context of this documentation are persons familiar with the design, mechanical installation, troubleshooting and maintenance of the product, who possess the following qualifications:

- Training in mechanical engineering, e.g. as a mechanic or mechatronics technician (final examinations must have been passed).
- Knowledge of this documentation and other applicable documentation.

All electrical work on connected units is to be performed exclusively by adequately qualified electricians. Qualified electricians in the context of this documentation are persons familiar with electrical installation, startup, troubleshooting and maintenance of the product, who possess the following qualifications:

- Training in electrical engineering, e.g. as an electrician or mechatronics technician (final examinations must have been passed).
- Knowledge of this documentation and other applicable documentation.
- Knowledge of the relevant safety regulations and laws.
- Knowledge of all other standards, directives and laws named in this documentation.

The above mentioned persons must have the authorization expressly issued by the company to install, operate, program, configure, label and ground units, systems and circuits in accordance with the standards of safety technology.

All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately.

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In addition to the qualifications listed above, persons that perform work on the safety-rated encoders must have the following knowledge:

- Functional safety.
- The relevant safety regulations and laws, especially with the requirements of EN ISO 13849 and all other standards, directives and laws specified in this documentation.
- The content of the operating instructions at hand.
- The content of the detailed operating instructions.

Also observe the addendum to the operating instructions "Safety-Rated Brakes – Synchronous Servomotors CMPZ71 – CMPZ100 – Functional Safety" when working on safety-rated brakes.

2.3 Designated use

The designated use refers to the procedure specified in the operating instructions and the addendum to the operating instructions.

CMP and CMPZ synchronous servomotors are drive motors designed for use in industrial and commercial systems. Motor loads other than those specified and areas of application other than industrial and commercial systems should only be used after consultation with SEW-EURODRIVE.

Using these products in potentially explosive atmospheres is prohibited, unless specifically designated otherwise.

During transported or when installed, the encoder must not be exposed to oils, acids, gases, vapors or radiation.

The CMP and CMPZ synchronous servomotors meet the requirements of the currently valid low voltage directive. When installed in machines, startup (i.e. start of designated operation) is prohibited until it is determined that the machine complies with the local laws and directives. In the EU/EC area of applicability, the Machinery Directive 2006/42/EC must be observed.

Technical data and information on the connection requirements are provided on the nameplate and in the documentation; these must be observed under all circumstances.

When using a CMP brakemotor, note that the designated use is applying the brake at standstill (< 50 1/min). Operating the motor outside the area of designated use can cause permanent damage to the encoder. Emergency braking operations, e.g. in case of a power failure or emergency switching off, are possible without adversely affecting the encoder.

The BY.. brake cannot be used in conjunction with AK0H encoders.

The motor temperature must mandatorily be monitored via the connected frequency inverter.

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2.4 Transport/storage

Follow the instructions on transportation, storage and proper handling.

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If you notice any transport damage, do not startup the motor and consult the SEW-EURODRIVE Service.

Remove transport protection prior to startup.

Tighten installed transportation eyebolts. They are only designed for the weight of the motor/gearmotor; do not attach any additional loads.

The installed eyebolts are in accordance with DIN 580. Observe the loads and specifications given there. If the gearmotor has 2 lifting eyes or lifting eyebolts, then you should also use both lifting eyes for attaching transport ropes. In this case, the tension force vector of the slings must not exceed a 45° angle in accordance with DIN 580.

INFORMATION

- Screw in the lifting eyes all the way.
- Make sure that the lifting eyes carry only a reduced load, as the angle of the load exceeds 45°.
- Due to the angle of the load, the lifting eyes are oversized. Note that the lifting eyes are not designed to hold the entire load of the gear unit.

Store the servomotor in a dry, dust-free environment if it is not to be installed straight away. The servomotor can be stored for one year without requiring any special measures before startup.

2.5 Installation/assembly

Observe the instructions in chapter "Mechanical Installation" and chapter "Electrical Installation" of the detailed operating instructions.

The units must be installed and cooled according to the regulations and specifications in the corresponding documentation.

Protect the synchronous servomotors from excessive strain. Ensure that components are not deformed, particularly during transportation and handling.

2.6 Electrical connection

Perform electrical installation according to the pertinent regulations (e.g. cable cross sections, fusing, protective conductor connection). For any additional information, refer to the applicable documentation.

Observe the wiring information and differing data on the nameplate.

Observe the instructions in chapter "Electrical Installation" of the detailed operating instructions.

2.7 Startup/operation

Whenever changes to normal operation occur, such as increased temperatures, noise, vibrations, determine the cause and consult the manufacturer.

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Note the instructions in chapter "Startup" of the operating instructions "CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors".

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3 Functional safety (FS)

3.1 Safety-rated encoder

The following encoders are available as safety-rated motor option for synchronous servomotors.

- AK0H, part number: 13356615
- AK1H, part number: 13410547

In the safety-rated design, encoders and the procedure of installation in the synchronous servomotor comply with the requirements for functional safety. In this case, the encoders are only permitted to be used in the described unit combinations. It is not permitted to adapt them to other motors.

The safety-related use of encoders is intended to realize safety functions in regard of speed, direction of rotation and stop. For this purpose, the encoder is coupled to the motor shaft. The encoder system cannot trigger responses on its own initiative as a result to encoder-internal diagnostics. This requires a higher-level safe evaluation device that detects interferences, which could lead to a hazardous situation.

Increased demands are placed on the electrical and mechanical coupling, e.g. the shielded connection lead stranded in pairs with correct wiring in line with EMC directives.

INFORMATION

For the safety-rated encoders AK0H and AK1H, only the Sin/Cos interface is safety-rated. The RS485 interface (Hiperface®) is not safety-rated. The absolute position values, as well as other data (e.g. nameplate, diagnostics) can be referred to for general diagnostic purposes.

3.2 Underlying standards

The safety assessment of the encoder is based on the following standards and safety classes:

Underlying standards for safety-rated encoders	
Safety class/ underlying standard	• Safety Integrity Level (SIL) according to EN 62061:2005/IEC 61508:2011 • Performance level (PL) according to EN ISO 13849-1:2008

3.3 Encoder mounting

The connection between the encoder and the motor is a safety-rated frictional connection.

The mechanics and the corresponding connections can be included in the safety consideration as fault exclusion according to EN ISO 13849-1. Observe the mechanical limits in chapter "Technical data" (→ 🗎 24).

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3.4 FS mark

The motor nameplate is sufficient to identify the safety-rated encoder. Disassembly of the drive is not necessary for identification. An exemplary nameplate is shown in chapter "Nameplate" (→ 🗎 18).

3.4.1 FS logo on the nameplate

Drives from SEW-EURODRIVE can be equipped with optional motor options for functional safety.

Encoders, brakes, or other accessories, can be integrated in the synchronous servomotor as safety-related components either individually or in combination.

SEW-EURODRIVE indicates the integration of functional safety by the following FS logo and a two-digit number on the nameplate of the motor.

The number is a code that indicates which components in the drive are safety-related. Observe the following excerpt from the valid code table for all products.

Functional safety	Brake	Encoder/Encoder mounting
02	x	
04		x
11	x	x

If the FS logo on the nameplate contains the code "FS 11", for example, the motor is equipped with a combination of safety-rated brake and safety-rated encoder.

If the drive bears the FS logo on the nameplate, you must adhere to the information in the following documents:

- Addendum to the operating instructions "Safety-Rated Encoders AK0H/AK1H – CMP40 – 112, CMPZ71 – 100 Synchronous Servomotors – Functional Safety"
- Addendum to the operating instructions "Safety-Rated Brakes – CMPZ71 – CMPZ100 Synchronous Servomotors – Functional Safety"

3.5 Traceability

All safety-rated encoders have the serial number of the motor for unique motor assignment. This allows SEW-EURODRIVE to inform the respective customers/operators in the event of product defects.

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3.6 Unit combination

Observe the following points for device combination:

- If a safety-rated encoder is used in combination with a brakemotor with BY.. brake, the permitted working air gap of the brake must not be exceeded. Check the working air gap according to the specifications in chapter "Inspection/Maintenance" in the operating instructions "CMP40 – 112, CMPZ71 – 100 Synchronous Servomotors".

  Insufficient maintenance of the BY.. brake may damage the encoder.
- BP.. and BK.. brakes are maintenance-free. The working air gap cannot be checked as the brake is integrated in the motor.

3.6.1 Combination with CMP motors

CMP motor	Brake	FS encoder	
		AK0H	AK1H
CMP40	None	X	–
	BP..	X	–
	BK..	X	–
CMP50	None	X	X
	BP..	X	–
	BK..	X	X
CMP63	None	X	X
	BP..	X	–
	BK..	X	X
CMP71	None	X	X
	BP..	X	X
CMP80	None	X	X
	BP..	X	X
CMP100	None	X	X
	BP..	X	X
CMP112S/M	None	X	X
	BY..	–	X
CMP112L/H/E	None	–	X
	BY..	–	X

X Available
– Not available

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3.6.2 Combination with CMPZ motors

CMP motor	Brake	FS encoder	
		AK0H	AK1H
CMPZ71	None	X	X
	BY..	–	X
	BY..(FS)	–	X
CMPZ80	None	X	X
	BY..	–	X
	BY..(FS)	–	X
CMPZ100	None	X	X
	BY..	–	X
	BY..(FS)	–	X

X Available
– Not available

3.7 Safety functions

Safety-rated encoders AK0H and AK1H serve to realize the following safety function according to EN 61800-5-2:

Safety functions according to EN 61800-5-2		
Abbrevi-ation	Designation (German)	Designation (English)
SS1	Safe Stop 1	Safe stop 1
SS2	Safe Stop 2	Safe stop 2
SOS	Safe operational stop	Safe operational stop
SLA	Safely-limited acceleration	Safely-limited acceleration
SLS	Safely-limited speed	Safely-limited speed
SDI	Safe direction	Safe direction
SLI	Safely-limited increment	Safely-limited increment
SAR	Safe acceleration range	Safe acceleration range
SSR	Safe speed range	Safe speed range

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3.8 Achievable safety integrity

A safety-rated encoder complements a safety system consisting of several system components.

The safety-rated encoders AK0H and AK1H are certified for the safety functions mentioned above according to the following standards:

- SIL 2 according to EN 62061/IEC 61508
- PL d according to EN ISO 13849-1

The achieve safety integrity in the entire safety system, performance level (PL) or safety integrity level (SIL) is determined by the following:

- The selected safety structure, category (Cat.)
- Reliability of the used system components (PL, B_{10d}, $MTTF_d$, ...)

  The $MTTF_d$ value is calculated specifically for the application based on the B_{10d} value for the component and the switching frequency of the application.
- Diagnostic coverage (DC_{avg})

  The diagnostic coverage is realized via an external encoder evaluation unit. The external encoder evaluation unit must meet the requirements in chapter "Encoder evaluation unit" (→ 🗎 26).
- Failure due to a common cause (CCF) with categories 2, 3, and 4.

The achieved safety integrity for the selected safety system must be determined in the overall evaluation of the system. The required characteristic safety values and safety characteristics for the safety-rated encoders in chapter "Technical data" (→ 🗎 24) must be observed.

In addition to the product documentations, the characteristic safety values of components by SEW-EURODRIVE are also available on the SEW-EURODRIVE homepage on the Internet and in the SEW-EURODRIVE library for the Sistema software of the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA, formerly BGIA).

3.9 Encoder evaluation

Adhere to the permitted encoder temperature, see chapter "Encoder" (→ 🗎 24). If operation within the specified limits cannot be guarantee, cyclical monitoring of the encoder status is mandatory, for example via the parameter channel of the encoder interface. Respective measures must be taken if necessary.

If a safety-rated encoder AK0H, AK1H is used in safety technology, a encoder evaluation unit is additionally required to diagnose the encoder (monitoring). The encoder evaluation unit must meet the specifications in chapter "Encoder evaluation unit" (→ 🗎 26).

When safety-rated encoders AK0H and AK1H are operated in combination with safety modules from SEW-EURODRIVE, for example MOVISAFE® UCS..B or DCS..B, the requirements to the encoder monitoring are met.

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3.10 Validation

To determine the safety of a machine, the plant manufacturer must carry out an overall evaluation.

Check the effectiveness of the risk minimization at the end. This includes checking if the required safety integrity is achieved for each implemented control-related safety function.

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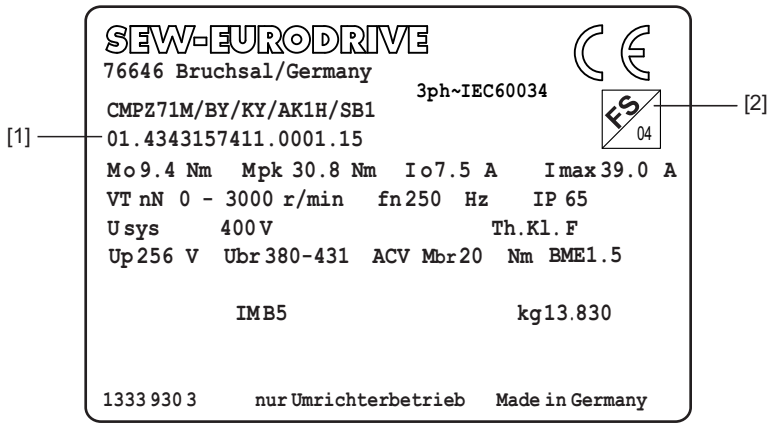
4 Motor structure

4.1 Nameplate

4.1.1 Motor

The following figure shows an example nameplate of a servomotor with FS logo.



18014401399594379

[1] Serial number
[2] FS logo for functional safety, see also the chapter "FS logo on the nameplate" (→ 🗎 13).

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5 Mechanical installation

This chapter contains no special information about safety-rated components. The information in the relevant operating instructions is binding.

5.1 Retrofitting safety-rated encoders

Only SEW-EURODRIVE may retrofit a safety-rated encoder.

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6 Electrical installation

⚠ DANGER

Risk of injury due to electric shock.

Severe or fatal injuries.

- It is essential to comply with the safety notes in chapter 2 during installation!
- Switch contacts in utilization category AC-3 according to EN 60947-4-1 must be used for switching the motor and the brake.
- Use switch contacts in utilization category DC-3 according to EN 60947-4-1 for switching the brake with DC 24 V.
- When motors are powered by inverters, you must adhere to the wiring instructions issued by the inverter manufacturer.
- Observe the operating instructions of the servo inverter.

INFORMATION

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

Observe these notes.

- Safety notes
- Wiring diagram

Note the information and explanations about correct wiring in the corresponding operating instructions.

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7 Startup

7.1 Prerequisites for startup

⚠ DANGER

Risk of injury due to electric shock.

Severe or fatal injuries.

- Observe the safety notes in chapter 2 during installation.
- Switch contacts in utilization category AC-3 according to EN 60947-4-1 must be used for switching the motor and the brake.
- When motors are powered by inverters, you must adhere to the wiring instructions issued by the inverter manufacturer.
- Observe the operating instructions of the servo inverter.

⚠ DANGER

Disabling functional safety devices.

Severe or fatal injuries.

- Only qualified personnel is allowed to carry out work on functional safety components.
- Any work on functional safety components must be carried out by strictly observing the specifications in the operating instructions at hand and the respective addendum to the operating instructions. Else, the right to claim under warranty will become invalid.

INFORMATION

The rated speed of the motor in a gearmotor can be higher than the permitted, input speed of the gear unit.

Limit the maximum speed at the servo inverter. For information on the procedure, refer to the documentation of the servo inverter.

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8 Inspection/maintenance

⚠ DANGER

Disabling functional safety devices.

Severe or fatal injuries.

- Only qualified personnel is allowed to carry out work on functional safety components.
- Any work on functional safety components must be carried out by strictly observing the specifications in the operating instructions at hand and the respective addendum to the operating instructions. Otherwise, the warranty will become void.

⚠ DANGER

The servomotor has live parts during and after operation.

Severe or fatal injuries from electric shock.

- De-energize all power, brake and signal cables before unplugging the power or signal plug connector.
- Secure the motors against unintended power-up.
- The motor can generate a voltage when the shaft is rotated. Do not touch the connector pins.

⚠ CAUTION

The servomotor can have a surface temperature of more than 100 °C during operation.

Risk of burns and fire.

- Never touch the CMP synchronous servomotor during operation or in the cool down phase once it has been switched off.

NOTICE

Only use original spare parts, otherwise the motor can be damaged.

Possible damage to property.

- Use only genuine spare parts in accordance with the valid spare parts list.

NOTICE

Working air gap at brake too large.

Possible damage to property.

- When a BY.. brake is used, the working air gap must be measured at regular intervals, which are specified in the "CMP40 – 112, CMPZ71 – 100 Synchronous Servomotors" operating instructions in chapter "Inspection/Maintenance". A working air gap that exceeds the permitted maximum value can cause encoder errors or destroy the encoder.

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8.1 Functional Safety

Certain demands on the mechanical coupling of the encoder system to the motor must be met so that the encoder can be used for safety-relevant tasks.

SEW-EURODRIVE assumes responsibility for the delivered motor/gearmotor with safety-rated encoder in terms of compliance with the functional safety regulations for encoders. Safety-rated connection elements are sealed to highlight the delivery state.

There are 2 options for performing work on the encoder or motor during which these sealed screw connections must be opened:

- Ask the SEW-EURODRIVE Service to perform this work.
- If you perform any work on safety-rated encoders yourself, note that disassembly and assembly work on the safety-rated encoder may only be performed by qualified personnel. All work on the safety-rated encoder and its mechanical coupling are performed at your own risk, and the responsibility for the safety-rated encoder and the liability for functional safety shifts to the operator.

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9 Technical data

9.1 Encoder

Designation		Value	
		AK0H	AK1H
Ambient temperature of motor		-20 °C to +60 °C	
Operating temperature of encoder		-20 °C to +110 °C	-20 °C to +115 °C
Storage temperature of encoder		-40 °C to +125 °C	
Maximum speed		9000 min^{-1}	12000 min^{-1}
Vibration resistance according to EN 60068-2-6		≤ 500 m/s^2 ≈ 50 g (10 Hz to 2 kHz)	≤ 200 m/s^2 ≈ 20 g (10 Hz to 2 kHz)
Shock resistance according to EN 60068-2-27		≤ 1000 m/s^2 ≈ 100 g (6 ms)	
Maximum angular acceleration		5 ×10^5 rad/s^2	2 ×10^5 rad/s^2
Degree of protection according to EN 60529		IP50	IP40
Operating voltage		DC +7 to +12 V	
Current consumption without load		60 mA	80 mA
Incremental section	Interface	sin/cos	
	Periods/revolution	128	1024
	Accuracy	±0.0222° (±80 angular seconds)	±0.0125° (±45 angular seconds)
Absolute part	Interface	RS485 (Hiperface®)	
	Steps/revolution (single-turn)	12 bit = 4096	15 bit = 32768
	Revolution (multi-turn)	12 bit = 4096	12 bit = 4096
	Accuracy	±0.0888° (±320 angular seconds)	±0.025° (±90 angular seconds)

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9.2 Characteristic safety values

9.2.1 Characteristic safety values for AK0H encoders

The following table shows the characteristic safety values of the safety-rated encoders AK0H, in regard of the Sin/Cos signals.

	Characteristic values according to	
	EN 62061/IEC 61508	**EN ISO 13849-1**
Safety class/underlying standards	SIL2	PL d
Structure	HFT = 1	2-channel (corresponds to category 3)
Probability of a dangerous failure per hour (PFH_d value)[1)]	1.3×10^{-8} 1/h	
Mean time to dangerous failure ($MTTF_d$ value)	–	100 years
Mission time/service life	20 years	
Proof test interval	Not required	–
Safe fault coverage (SSF)	> 90%	–
Motor/encoder connection	In a drive with FS logo on the nameplate: Fault exclusion according to EN ISO 13849-1.	

1) The specified value refers to a diagnostic coverage of 90%, that must be achieved by an encoder evaluation unit. Diagnostics must be performed within the process response time. For corresponding error presumptions, refer to the EN 61800-5-2 standard. The encoder evaluation unit must at least meet the requirements for SIL 2.

9.2.2 Characteristic safety values for AK1H encoders

The following table shows the characteristic safety values of the safety-rated encoders AK1H, in regard of the Sin/Cos signals.

	Characteristic values according to	
	EN 62061/IEC 61508	**EN ISO 13849-1**
Safety class/underlying standards	SIL2	PL d
Structure	HFT = 1	2-channel (corresponds to category 3)
Probability of a dangerous failure per hour (PFH_d value)[1)]	1.0×10^{-8} 1/h	
Mean time to dangerous failure ($MTTF_d$ value)	–	1073 years
Mission time/service life	20 years	
Proof test interval	Not required	-
Safe fault coverage (SSF)	> 90%	-
Motor/encoder connection	In a drive with FS logo on the nameplate: Fault exclusion according to EN ISO 13849-1.	

1) The specified value refers to a diagnostic coverage of 90%, that must be achieved by an encoder evaluation unit. Diagnostics must be performed within the process response time. For corresponding error presumptions, refer to the EN 61800-5-2 standard. The encoder evaluation unit must at least meet the requirements for SIL 2.

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9.3 Encoder evaluation unit

Designation	Value
Safety requirements	≥ SIL 2 according to EN 62061/IEC 61508
Error detection rate[1)]	DC ≥ 90%
Error presumptions	according to EN 61800-5-2:2007, table D.16
Signal amplitude monitoring[2)]	DC 0.5 V_{SS} to 1.5 V_{SS} (peak-peak)
Safety functions that can be implemented	SS1, SS2, SOS, SLA, SLS, SDI, SLI, SAR, SSR

1) Diagnostics must be performed within the process response time.
2) In the encoder evaluation unit, signals A, /A, B and /B must be high-resistance (> 1 kΩ) to the supply voltage and 0 V.

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10 Malfunctions

For any work performed on the motor during which the sealed connections of the safety-rated encoder are loosened, you must observe the notes in chapter "Functional Safety" (→ 🗎 23).

10.1 Encoder malfunctions

When a BY.. brake is used, the working air gap of the brake must be measured at regular intervals, which are specified in the "CMP40 – 112, CMPZ71 – 100 Synchronous Servomotors" operating instructions in chapter "Inspection/Maintenance".

A working air gap that exceeds the permitted maximum value can cause encoder errors or destroy the encoder.

Encoder malfunctions are displayed at the inverter with a corresponding error message, or at the higher-level encoder evaluation unit.

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11 Declaration of Conformity

Declaration of Conformity

SEW EURODRIVE

Translation of the original text **900820610/EN**

SEW-EURODRIVE GmbH & Co. KG
Ernst-Blickle-Straße 42, D-76646 Bruchsal
declares under sole responsibility that the following products

motors of the series	**CMP40-112, CMPZ71-100**	
in connection with encoders of the type	**AK0H (functional safety)** **AK1H (functional safety)**	
possibly in connection with		
Gear units of the series	**R..; RES** **F..** **K..; KES** **W..** **S..** **H..** **BS.F..** **PS.F..** **PS.C..**	
are in conformity with		
Machinery Directive	**2006/42/EC** **(L 157, 09.06.2006, 24-86)**	**1)**

This includes the fulfillment of the protection targets for "electrical power supply" in accordance with annex I No. 1.5.1 according to the Low Voltage Directive 73/23/EEC -- Note: 2006/95/EC (until 19 Apr 2016) and 2014/35/EU (as of 20 Apr 2016) are currently valid.

Applied harmonized standards:	**EN ISO 13849-1:2008 / AC:2009**	**5)**
	EN 61800-5-2: 2007	**5)**
	EN 60034-1:2010	
	EN 60034-5:2001 / A1:2007	
	EN 60664-1:2007	
	EN ISO 12100:2010	
	EN 60204-1:2006 / A1:2009	
Other applied standards:	**EN 61508-2:2010**	

1) The products are intended for installation in machines. Startup is prohibited until it has been established that the machinery into which these products are to be incorporated complies with the provisions of the aforementioned Machinery Directive.

5) All safety-relevant requirements of the product-specific documentation (operating instructions, manual, etc.) must be met over the entire product life cycle.

Bruchsal	**29.02.2016**	Johann Soder	
Place	Date	Managing Director Technology	a) b)

a) Authorized representative for issuing this declaration on behalf of the manufacturer
b) Authorized representative for compiling the technical documents

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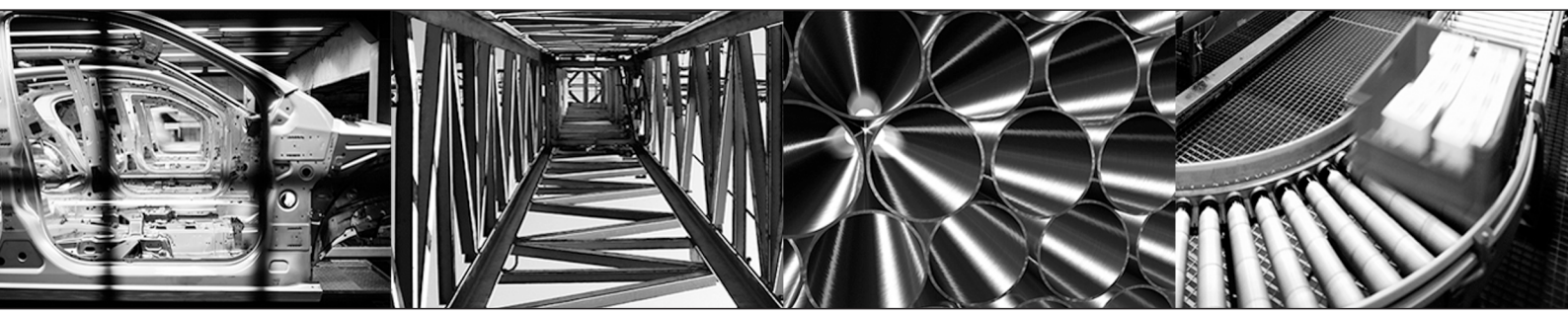

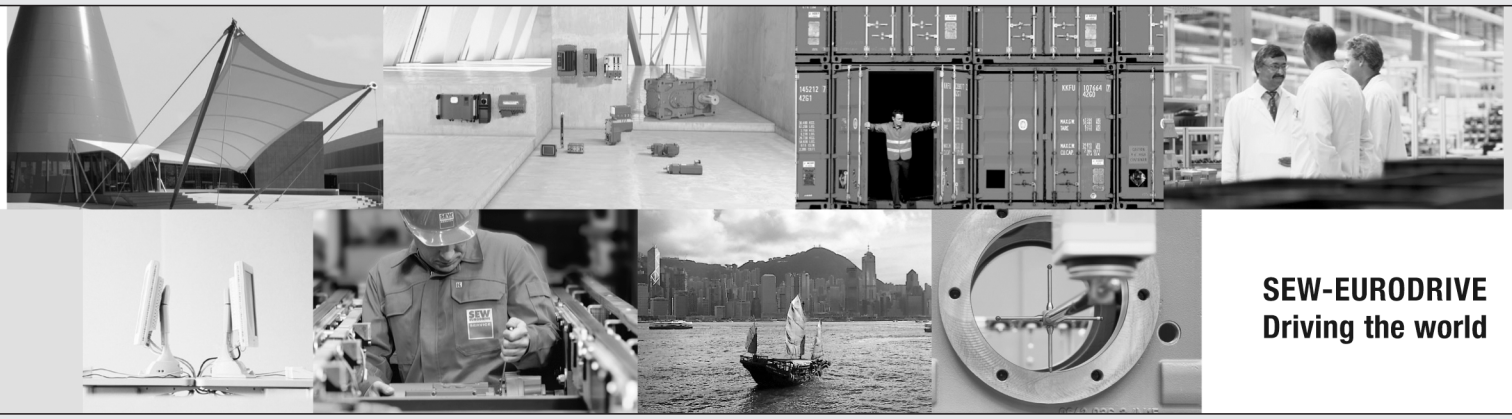

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