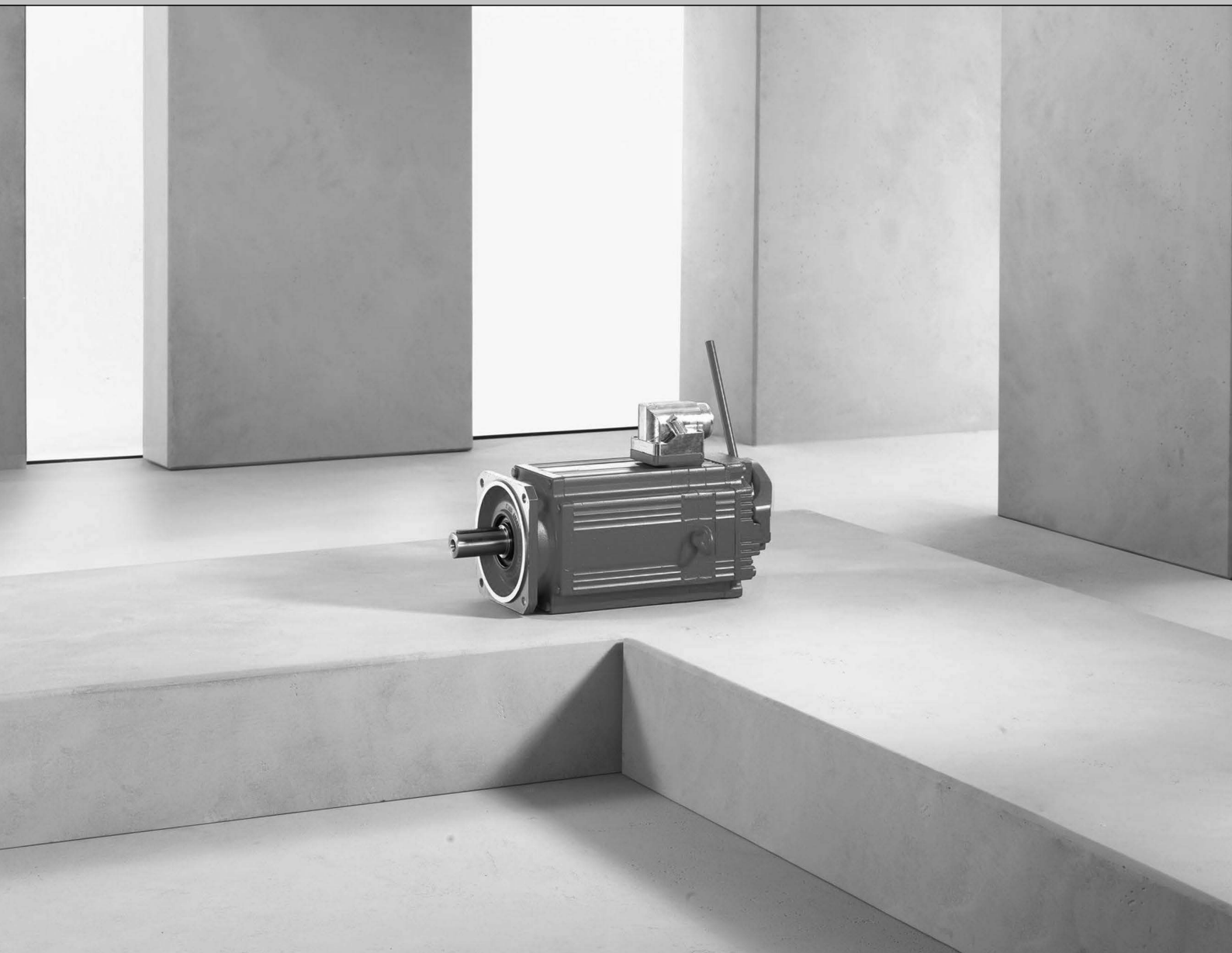




Addendum to the operating instructions



Safety encoders and safety brakes

CMP.., CMPZ.., CM3C.., ECM3C.., CM3P.., CM3G..

Functional safety



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1 General information

1.1 How to use this documentation

This addendum to the operating instructions contains special information on functionally safe motor options (safety encoder and safety brake) of the CMP..., CMPZ..., CM3C..., ECM3C..., CM3P..., CM3G.. motor series.

In addition to the addendum to the operating instructions at hand, the following operating instructions apply for motors with safety encoders and/or safety brakes:

- "CMP40 – CMP112, CMPZ71 – CMPZ100 synchronous servomotors" operating instructions
- "CM3C63 – 100 / CM3P63 – 100 synchronous servomotors" operating instructions
- "Explosion-protected ECM3C63 – 100 servomotors, ATEX and IECEx" operating instructions
- "PxG® integrated precision planetary gearmotors – PxG® CM3G.. series" operating instructions
- Addendum to the operating instructions "Encoders with HIPERFACE DSL®, EnDat 2.2, EnDat 3- and DRIVE-CLiQ interfaces" – CM3C..., CM3P..., CM3G..
- "Encoders with EnDat 2.2 and EnDat 3 interface – CMP40 – 112" addendum to the operating instructions

The documentation is an integral part of the product and contains important information on operation and service. The documentation is intended for all persons who perform assembly, installation, startup, and service work on the product.

Make sure this documentation is available in a legible state. Ensure that persons responsible for the systems and their operation as well as persons who work on the product independently have read the documentation carefully and understood it. If you have any questions or if you require further information, contact SEW-EURODRIVE.

Always use the latest edition of the documentation and software.

1.2 Content of the documentation

This documentation contains additional safety-related information and conditions for operation in safety-related applications.

1.3 Other applicable documentation

The following documentation and documents must also be observed:

- "Project Planning for BK..., BKB..., BP..., BR..., BY..., BZ.. Brakes" manual – (E)CM3C..., CMP(Z)..., CMSB..., CFM..., DRC.. synchronous servomotors – Standard brake/safety brake" manual
- "CMP40 – CMP112, CMPZ71 –CMPZ100 synchronous servomotors" catalog
- "CCM3C63 – CM3C100 / CM3P63 – 100 medium inertia / high dynamics synchronous servomotors" catalog
- "PxG® integrated precision planetary gearmotors – PxG® CM3G.. series" catalog

1.4 Other documentation

The following safety encoders and their integration into the safety system are not fully described in this documentation. In addition, observe the corresponding documentation of the respective manufacturers.

Type designation SEW-EURODRIVE	Details of the manufacturer		
	Manufacturer	Type designation	ID number
EH1E (Single-Turn EnDat 2.2)	<u>Heidenhain</u>	ECI1319	1304401-01
AH1E (Multi-Turn EnDat 2.2)	<u>Heidenhain</u>	EQI1331	1303257-01
EH4F (Single-turn EnDat 3)	<u>Heidenhain</u>	ECI1323	1386797-52
AH4F (Multi-turn EnDat 3)	<u>Heidenhain</u>	EQI1335	1386798-52
AH1Q (Multi-turn DRIVE-CLiQ)	<u>Heidenhain</u>	EQI1331S-FS	1222052-01
EK0J (Single-turn HIPERFACE DSL®)	<u>SICK</u>	EKS36S-2KF0B0S18	1116490
AK0J (Multi-turn HIPERFACE DSL®)	<u>SICK</u>	EKM36S-2KF0B0S18	1112044

2 Safety notes

2.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

2.2 Designated use

- The CMP.., CMPZ.., CM3C.., ECM3C.., CM3P.., CM3G. motors with functionally safe motor options are intended for industrial systems.
- When installed in machines, starting the designated operation is prohibited until you have determined that the machine complies with the local laws and directives. Machinery Directive 2006/42/EC in particular must be followed in the respective validity.
- In order to determine the achieved safety integrity level (SIL) or performance level (PL) of a system's safety functions, the system manufacturer must perform an overall evaluation. This document contains the product-related specifications necessary for the evaluation.
- Operation of CMP.., CMPZ.., CM3C.., ECM3C.., CM3P.., CM3G. motors with functionally safe motor options on third-party inverters is permitted.
- Before starting the designated use and during the entire operation, make sure that the system complies with the specifications of this documentation, and in particular the technical data.

2.2.1 Safety encoder

- The safety encoders described in this documentation are intended for use with CMP.., CMPZ.., CM3C.., ECM3C.., CM3P.., CM3G.. motors. It is not permitted to mount them on other motors.
- The frequency inverter must operate the motor with a safety encoder in a suitable control mode (operating mode).
- The motor with the safety encoder must be stopped electronically by the frequency inverter or an emergency stop brake. Stopping the motor by blocking the system can cause a positional deviation of the safety encoder or damage it.
- For EK0H, AK0H, AK1H, EK0Z, and AK0Z safety encoders, only the incremental interface is certified according to the PL d/SIL 2 approval. The absolute interface must not be used to implement safety functions without further measures in place.
- SEW-EURODRIVE recommends activating the "Lag error monitoring", "Speed monitoring", and "Encoder monitoring" monitoring functions when configuring the inverter.
- The safety encoders are rated for the following installation altitudes:
 - EK0H, AK0H: ≤ 5000 m above sea level
 - AK1H: ≤ 5000 m above sea level
 - EK0Z, AK0Z: ≤ 3800 m above sea level
 - EH1E, AH1E: ≤ 6000 m above sea level
 - EH4F, AH4F: ≤ 6000 m above sea level

- EK0J, AK0J: ≤ 5000 m above sea level
- AH1Q: ≤ 6000 m above sea level

Deviating installation altitudes and any derating of the drives or frequency inverters must be taken into account.

- The safety encoders described in this documentation are not capable of independently bringing about a safe state in the machine.
- In the event of a failure or malfunction of the safety encoder, injury and damage to the system or operating equipment must be prevented by means of suitable measures taken in the overall system.
- Protection against unintentional or automatic restarting of the machine must be ensured in the overall system, if necessary.
- The safety encoders described in this documentation are intended to be used in functional safety and are mounted on the motor. Fault exclusion in compliance with EN 61800-5-2 can be assumed on the mounting of the safety encoder.

Note that in case of emergency stop braking from speeds $> 20 \text{ min}^{-1}$, the encoders can output warnings or errors if the negative acceleration exceeds certain limit values. Before switching the device on again, warnings or errors must be checked and acknowledged if necessary.

2.2.2 Safety brake

- The safety brakes described in this documentation are intended for use with CMPZ.., CM3C.., ECM3C.., and CM3P.. motors. It is not permitted to mount them on other motors.
- The BY.. or BZ.. safety brake can be used exclusively as a holding brake. The designated use is to activate the brake at an idle state (brake application speed $< 20 \text{ min}^{-1}$). Emergency stop braking operations from higher motor speeds are permitted.

SEW-EURODRIVE recommends stopping the drive with stop category 1 in accordance with EN 60204-1.

- Motors with a safety brake are not suitable for operation in areas with increased vibration stress of level 1 (vibration level 1).
- Use of the safety brake is permitted in drive ambient temperatures of -20°C to $+40^\circ\text{C}$.
- The safety brakes described in this documentation are rated for installation altitudes of ≤ 1000 m above sea level.
- The number of emergency stop braking operations must be limited to avoid overloading the safety brake and gear unit. The maximum number of emergency stop braking operations is configured during project planning.
- To prevent the friction system from overheating, there must be a pause between 2 emergency stop braking operations. The required length of the pause is configured during project planning for the safety brake.
- The applicable project planning specifications and the resulting application limits of SEW-EURODRIVE must be complied with for the safety brake. If the application requirements or technical properties of the safety brake change, project planning and testing of the application limits must be carried out again.
- It is not permitted to retrofit a safety brake or replace an existing brake with a safety brake.
- The safety brake must not be exposed to the following substances/conditions:
 - Oils

- Acids
- Gases
- Vapors
- Radiation

2.3 Inspection/maintenance

Work on a drive with functionally safe motor options – indicated by the FS logo on the motor nameplate – can be performed by the operator.

Any work on the safety encoder and/or the safety brake is carried out at your own risk. The operator is responsible and liable for the proper fulfillment of the work described in the relevant documentation.

The operator has to ensure the traceability of the performed work regarding functional safety. In case of proven compliance with the work described in the documentation, the characteristics regarding functional safety described by the manufacturer are maintained. For an overview of the permitted work, refer to "Inspection/maintenance" (→  28).

For maintenance, use only genuine spare parts in accordance with the applicable spare parts list.

3 Functional safety (FS)

3.1 Functionally safe motor options

Motors from SEW-EURODRIVE are also available with the following functionally safe motor options:

- Safety brake
- Safety encoder
- Integrated STO (decentralized inverters)

Functionally safe motor options are designed for implementing safety functions.

SEW-EURODRIVE assumes responsibility for the delivered motor in terms of compliance of the functionally safe motor options (including their safety-relevant mechanical connections) with the functional safety regulations. Safety-relevant mechanical connections are designed with a manipulation indicator and marked as follows:

- Safety brake: locking compound
- Safety encoder: retaining ring or adhesive label

If these markings are damaged, there is a deviation from the delivery state.

3.2 Safety encoders

Safety encoders from SEW-EURODRIVE are characterized by their exceptional reliability as well as electronic and mechanical load capacity.

Safety encoders allow you to improve the safety of your machines by implementing safety functions in relation to their speed, direction of rotation, idle state, relative position, or absolute position. The safety encoder provides the safety-relevant signals in the intelligent interaction of sensor, control, and actuator.

The safety function requires a reliable mechanical connection between encoder and motor. At SEW-EURODRIVE, this connection is dimensioned in such a way that fault exclusion is achieved.

The safety encoders cannot trigger a safe state at the machine autonomously. Therefore, they have to be monitored in the overall system. In case the encoder or the evaluation electronics detects a fault, a fault response, such as safe state, is initiated in the overall system.

3.3 Safety brake

SEW-EURODRIVE safety brakes combine exceptional reliability with high electrical and mechanical durability.

Safety brakes allow you to increase the safety in your machines by implementing safety functions for deceleration and stopping. The safety brake represents the safety-relevant actuator in the intelligent interaction of sensor, control, and actuator.

The safety brakes cannot trigger a safe state at the machine autonomously. The brakes must be augmented in the overall system with suitable brake control and monitored by means of a brake test, if necessary. The overall system triggers a suitable fault response, e.g. the safe state, on request.

3.4 General information on functionally safe motor options

When implementing safety functions in machines, it is necessary to evaluate in particular whether the components to be used are suitable in terms of functional safety. When using functionally safe motor options from SEW-EURODRIVE, the following safety-related requirements, e.g. in accordance with EN ISO 13849 – parts 1 and 2, are already taken into account:

- Application of basic safety principles
- Application of proven safety principles
- Use of proven components
- Specifications on failure probability (B_{10D} , $MTTF_D$, or PFH_D)
- Common cause failure (CCF)
- Determination of the system structure (HFT) and/or the category (Cat.)
- Determination of the safety integrity level (SIL) and/or the performance level (PL)
- Determination of the service life
- Production monitoring with 100% final inspection
- Retraceability by the unique motor assignment
- Notice of influences and ambient conditions
- Compliance with normative requirements regarding documentation

As an advantage for the machine designer, SEW-EURODRIVE has already fulfilled these safety-relevant requirements for functionally safe motor options. In the overall analysis of safety technology, the machine designer can rely on the manufacturer's confirmation, e.g. based on the product documentation or the German Technical Inspection Association (TÜV) certificate. The internal effort required for evaluation and documentation is reduced considerably.

If other components (standard components) are used for implementing safety functions, the machine designer has to evaluate the safety-related requirements.

3.5 FS marking

SEW-EURODRIVE labels a functionally safe motor option on the drive with an FS logo and a 2-digit number on the motor nameplate. The number is a code that indicates which components in the drive are safety-related. This makes it possible to uniquely identify an available functional safety motor option via the motor nameplate.

Make sure you observe any present FS logo on the nameplate and its meaning according to the following table:

FS logo	Available functionally safe motor option		
	Decentralized inverters	Safety brake	Safety encoders
	✓	–	–
	–	✓	–
	–	–	✓
	✓	–	✓
	–	✓	✓

- ✓ The motor option is functionally safe.
- The motor option is not available.

If the FS logo is present on the motor nameplate, e.g. with the code "FS 11", the motor includes a combination of safety encoder and safety brake. Drives can also be equipped with 2 encoders, e.g. a built-in encoder and an add-on encoder. In such cases, the FS logo for the safety encoder always relates to the add-on encoder. If an FS logo is available, adhere to the information specified in the corresponding documentation.

If the FS logo with the code "FS 0X" is present on the motor nameplate, a special design related to functional safety is installed at the motor.

Observe the information concerning the special design in the documentation.

3.6 Traceability

Functionally safe motor options can be retraced by SEW-EURODRIVE with the motor serial number and thus have a unique assignment to the motor.

If a safety encoder or safety brake is replaced by SEW-EURODRIVE Service, traceability is ensured.

If you replace a functionally safe motor option on your own, you revoke this assignment. To continue the assignment, document the replacement yourself.

3.7 Underlying standards

The safety assessment is based on the following standards:

Safety integrity level 3 (SIL 3) or performance level e (PL e) can be achieved if a functionally safe motor option is suitably integrated into a safety system. The requirements, e.g. regarding the system architecture, any necessary diagnostics, and failure probabilities, are to be implemented in accordance with the normative specifications and this documentation.

If the safety system with safety brakes is to be evaluated in accordance with SIL, the necessary verification must be provided by the customer.

3.7.1 Safety encoder

	EN 62061 EN 61508	EN 61800-5-2	EN ISO 13849
EK0H AK0H	✓	–	✓
AK1H	✓	–	✓
EK0J AK0J	✓	–	✓
EH1E AH1E	✓	✓	✓
AH1Q	✓	✓	✓
EK0Z AK0Z	–	✓	✓
EH4F AH4F	✓	✓	✓

3.7.2 Safety brakes

	EN 62061 EN 61508	EN 61800-5-2	EN ISO 13849
BY..	–	–	✓
BZ..	–	–	✓

3.8 TÜV certification

The following certificate is available for the BZ.. safety brakes:

- Certificate of TÜV NORD Systems GmbH & Co. KG

A copy of the TÜV certificate can be obtained from SEW-EURODRIVE.

3.9 Safety sub-functions

3.9.1 Safety sub-functions of the safety encoders

In the case of EK0H, AK0H, AK1H, EK0Z, and AK0Z encoders, the absolute interface is not part of the SIL 2/PL d approval. The multi-turn absolute interface may only be used to implement safety functions with the simultaneous evaluation of a second encoder.

In the case of EH1E, AH1E, EK0J, AK0J, EH4F, AH4F and AH1Q encoders, the safe position is transferred digitally. This must be evaluated for safety and monitored by suitable evaluation electronics.

The safety subfunctions are dependent on the evaluation electronics.

Safety encoders can be used to implement the following safety sub-functions in compliance with EN 61800-5-2 with respect to speed, direction of rotation, idle state, and relative position.

En-coder	SS1	SS2	SOS	SLA	SLS	SDI	SLI	SSR	SSM
EK0H	✓	✓	✓	✓	✓	✓	✓	✓	✓
AK0H	✓	✓	✓	✓	✓	✓	✓	✓	✓
AK1H	✓	✓	✓	✓	✓	✓	✓	✓	✓
EK0Z	✓	✓	✓	✓	✓	✓	✓	✓	✓
AK0Z	✓	✓	✓	✓	✓	✓	✓	✓	✓
EH1E	✓	✓	✓	✓	✓	✓	✓	✓	✓
AH1E	✓	✓	✓	✓	✓	✓	✓	✓	✓
EH4F	✓	✓	✓	✓	✓	✓	✓	✓	✓
AH4F	✓	✓	✓	✓	✓	✓	✓	✓	✓
EK0J	✓	✓	✓	✓	✓	✓	✓	✓	✓
AK0J	✓	✓	✓	✓	✓	✓	✓	✓	✓
AH1Q	✓	✓	✓	✓	✓	✓	✓	✓	✓

Safety encoders can be used to implement the following safety sub-functions in compliance with EN 61800-5-2 with respect to the absolute position.

En-coders	SCA	SLP
EK0H	✓	✓
AK0H	✓	✓
AK1H	✓	✓
EH1E	✓	✓

En-coders	SCA	SLP
AH1E	✓	✓
EH4F	✓	✓
AH4F	✓	✓
EK0Z	✓	✓
AK0Z	✓	✓
EK0J	–	–
AK0J	–	–
AH1Q	✓	✓

3.9.2 Safety sub-functions of the safety brake

The implementation of a safety function with brakes requires that the brake be applied on request. The safety function is activated when the brake is applied. The brake coil has to be de-energized and the energy stored in the brake coil reduced.

By adding a safety brake to a safe overall system, the following safety sub-functions can be implemented:

- SBA (Safe Brake Actuation)
- SBH (Safe Brake Hold)

The SBA and SBH safety sub-functions are defined by SEW-EURODRIVE based on the standard EN 61800-5-2.

The implementation of the SBA and SBH safety sub-functions additionally require the safety sub-functions SBC and STO in the overall system, in accordance with EN 61800-5-2. For safety-related requests of the brake, SBC and STO ensure that the brake applies and that the drive does not generate a torque against the applied brake.

The SBC and STO safety sub-functions are not part of the brake and have to be additionally implemented in the overall safety system. The performance level (PL) of the SBC and STO safety sub-functions must at least meet the required performance level (PLr) of the application.

SEW-EURODRIVE recommends to stop the drive using stop category 1 according to EN 60204-1 prior to activating the SBC and STO safety sub-functions.

3.10 Initializing the safety encoder

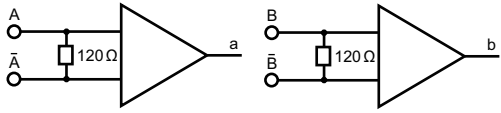
Switch the safety encoder off and on again at least once a year in accordance with EN 61800-5-2.

3.11 Requirements for the evaluation electronics

Where safety encoders are used for safety-related reasons, evaluation electronics are needed to monitor the signals of the rotary encoder and check their validity. When a malfunction is detected, a fault response (e.g. the safe state) must be triggered in the overall system.

The evaluation electronics in the overall system have to meet the following requirements.

3.11.1 Safety encoder: EK0H, AK0H, AK1H

Designation	Requirement
Safety requirements	≥ SIL 2
Diagnostic coverage (DC)	≥ 90% Diagnostics must be performed within the process response time.
Fault presumptions	According to EN 61800-5-2:2016, table D.8
Monitoring of the phasor length "r"	$r = \sqrt{a^2 + b^2}$ With $a = A - \bar{A}$ for cosine signals and $b = B - \bar{B}$ for sine signals
Safe state	Phasor length "r" outside of the range $350 \text{ mV} \leq r \leq 700 \text{ mV}$
Terminating resistor between A and $\bar{A}$ or B and $\bar{B}$	$120 \Omega \pm 10\%$ 
Terminating resistor between A, $\bar{A}$, B, $\bar{B}$ to the supply voltage and reference ground	> 1 kΩ
Sampling frequency	At least twice as high as the frequency maximally occurring in the application at the encoder signal outputs (Nyquist criterion)

The risk of an undetected fault at the safety encoder is increased if the sampling frequency is not adhered to. If you cannot adhere to the required sampling frequency when using the evaluation electronics, contact the manufacturer of the evaluation electronics to clarify any additional diagnostics.

If the safety encoders are operated with prefabricated encoder cables from SEW-EURODRIVE on evaluation electronics from SEW-EURODRIVE, these previously mentioned requirements have been met.

3.11.2 EK0Z, AK0Z safety encoders

The safety encoders are designed for operation with a MOVISAFE® CS..A safety option from SEW-EURODRIVE. The safety encoders are connected to the MOVI-C® inverter via the MOVILINK® DDI communication unit. The encoder data is available to the former and the safety option for further processing.

Requirement for using the safety encoders:

- MOVISAFE® CSS, CS..A or CSA31A safety option

Check the compatibility of the devices with the safety encoders with MOVILINK® DDI in the corresponding product manuals.

When operating the safety encoders on a compatible MOVISAFE® CSS, CS..A or CSA31A safety option, the requirements for the evaluation electronics are met. Operating the encoder with encoder evaluation units from other manufacturers is not permitted.

3.11.3 Safety encoders: EH1E, AH1E, AH1Q, EK0J, AK0J

Further requirements of the manufacturers have to be met for the safety encoders. You will find these in the manufacturer's documentation for the safety encoder.

Designation	Requirement
Safety requirements	≥ SIL 2
Diagnostic coverage (DC)	≥ 90% Diagnostics must be performed within the process response time.

3.11.4 Safety encoder: EH4F, AH4F

Further requirements of the manufacturers have to be met for the safety encoders. You will find these in the manufacturer's documentation for the safety encoder.

Designation	Requirement
Safety requirements	≥ SIL 2
Diagnostic coverage (DC)	≥ 90% Diagnostics must be performed within the process response time.

3.12 Brake test

In applications with brakes, the braking torque represents an important criterion for the functional and performance capability of the brake. If the braking torque is reduced or lost, the functionality of the application, the safety of the machine, and/or personal safety can be limited. To check the functional and performance capability of a brake, you can integrate a brake test into the overall system.

Especially for safety-related applications in which the brake performs a safety function, a brake test for the brake may be required by one or more standards, e.g. by EN ISO 13849-1. The brake test is not an independent safety subfunction but supplements a higher-level safety system for brake testing which is required by the standards. The overall system must meet the diagnostic coverage (DC) required by the standards.

A brake test provides you with information about the functional and performance capability of the brake. Potential faults or functional limitations can be detected at an early stage, allowing the necessary maintenance and repair work to be initiated. In a brake system with multiple brakes, each brake must be tested separately. This ensures that the safety function is maintained even if one brake fails.

The functional and performance capability of a brake can be adversely affected by a multitude of potential faults. To summarize, the potential faults can appear in one of the following fault patterns:

Fault pattern	Effect of fault
Brake remains applied	Safe state
Brake remains open	Dangerous state
Insufficient braking torque	Dangerous state
Brake does not release fully	Dangerous state



⚠ CAUTION

Undesired movements of the machine during a brake test due to damaged brake or brake control

Injury to persons and damage to property

- During the implementation and performance of a brake test, ensure that the safety of persons and the machine is guaranteed.

SEW-EURODRIVE offers various types of brake tests. These brake tests can be used to implement safety functions with brakes in horizontal and vertical applications up to performance level e.

3.13 Motor combinations

3.13.1 Safety encoders

Combination with CMP.. motors

Motor	Brake	Safety encoder								
		AK0H	AK1H	EK0Z	AK0Z	EK0H	EK0J ¹⁾ AK0J ¹⁾	EH1E AH1E	EH4F AH4F	AH1Q
CMP40	Without	✓	–	–	–	–	–	–	–	–
	BK..	✓	–	–	–	–	–	–	–	–
CMP50	Without	✓	✓	–	–	–	–	✓	✓	–
	BK..	✓	✓	–	–	–	–	✓	✓	–
CMP63	Without	✓	✓	–	–	–	–	✓	✓	–
	BK..	✓	✓	–	–	–	–	✓	✓	–
CMP71	Without	✓	✓	–	–	–	–	–	–	–
	BP..	✓	✓	–	–	–	–	–	–	–
CMP80	Without	✓	✓	–	–	–	–	–	–	–
	BP..	✓	✓	–	–	–	–	–	–	–
CMP100	Without	✓	✓	–	–	–	–	–	–	–
	BP..	✓	✓	–	–	–	–	–	–	–
CMP112S/M	Without	✓	✓	–	–	–	–	✓	✓	–
	BY..	–	✓	–	–	–	–	✓	✓	–
CMP112L/H/E	Without	–	✓	–	–	–	–	✓	✓	–
	BY..	–	✓	–	–	–	–	✓	✓	–

1) Available on request.

✓ Available
– Not available

Combination with CMPZ.. motors

Motor	Brake	Safety encoder			
		AK0H	AK1H	EK0Z	AK0Z
CMPZ71	Without	✓	✓	–	–
	BY..	–	✓	–	–
CMPZ80	Without	✓	✓	–	–
	BY..	–	✓	–	–
CMPZ100	Without	✓	✓	–	–
	BY..	–	✓	–	–

✓ Available
– Not available

3 Functional safety (FS)

Motor combinations

Combination with CM3C../CM3P.. motors

Motor	–Brake	Safety encoder						
		EK0H AK0H	AK1H ¹⁾	EK0Z ²⁾ AK0Z ²⁾	EK0J ³⁾ AK0J ³⁾	EH1E AH1E	EH4F AH4F	AH1Q
CM3C63 CM3P63	Without	✓	✓	✓	✓	✓	✓	✓
	BK..	✓	✓	✓	✓	✓	✓	✓
	BZ..	✓	✓	✓	–	✓	✓	–
	BZ.D	✓	✓	✓	✓	✓	✓	✓
	BZ.Z	–	–	–	–	–	–	–
CM3C71 CM3P71	Without	✓	✓	✓	✓	✓	✓	✓
	BK..	✓	✓	✓	✓	✓	✓	✓
	BZ..	✓	✓	✓	–	✓	✓	–
	BZ.D	✓	✓	✓	✓	✓	✓	✓
	BZ.Z	–	–	–	–	–	–	–
CM3C80 CM3P80	Without	✓	✓	✓	✓	✓	✓	✓
	BK..	✓	✓	✓	✓	✓	✓	✓
	BZ..	✓	✓	✓	–	✓	✓	–
	BZ.D	✓	✓	✓	✓	✓	✓	✓
	BZ.Z	–	–	–	–	–	–	–
CM3C100 CM3P100	Without	✓	✓	✓	✓	✓	✓	✓
	BK..	✓	✓	✓	✓	✓	✓	✓
	BZ..	✓	✓	✓	–	✓	✓	–
	BZ.D	✓	✓	✓	✓	✓	✓	✓
	BZ.Z	–	–	–	–	–	–	–

1) In preparation.

2) In preparation for CM3P63.

3) On request.

✓ Available
– Not available

Combination with CM3G.. motors

Motor	–Brake	Safety encoder					
		EK0H AK0H	EK0Z ¹⁾ AK0Z ¹⁾	EK0J ²⁾ AK0J ²⁾	EH1E AH1E	EH4F AH4F	AH1Q
CM3G63	Without	✓	✓	–	✓	✓	✓
	BKB..	✓	✓	–	✓	✓	✓
CM3G71	Without	✓	✓	✓	✓	✓	✓
	BKB..	✓	✓	✓	✓	✓	✓
CM3G80	Without	✓	✓	✓	✓	✓	✓
	BKB..	✓	✓	✓	✓	✓	✓
CM3G100	Without	✓	✓	✓	✓	✓	✓
	BKB..	✓	✓	✓	✓	✓	✓

1) In preparation for CM3G63.

2) On request.

✓ Available
– Not available

Combination with ECM3C.. motors

Motor	-Brake	Safety encoder			
		AK0H	AK1H ¹⁾	EK0Z ¹⁾	AK0Z ¹⁾
ECM3C63	Without	✓	✓	✓	✓
	BK..	✓	✓	✓	✓
	BZ..	✓	✓	✓	✓
	BZ.D	✓	✓	✓	✓
	BZ.Z	–	–	–	–
ECM3C71	Without	✓	✓	✓	✓
	BK..	✓	✓	✓	✓
	BZ..	✓	✓	✓	✓
	BZ.D	✓	✓	✓	✓
	BZ.Z	–	–	–	–
ECM3C80	Without	✓	✓	✓	✓
	BK..	✓	✓	✓	✓
	BZ..	✓	✓	✓	✓
	BZ.D	✓	✓	✓	✓
	BZ.Z	–	–	–	–
ECM3C100	Without	✓	✓	✓	✓
	BK..	✓	✓	✓	✓
	BZ..	✓	✓	✓	✓
	BZ.D	✓	✓	✓	✓
	BZ.Z	–	–	–	–

1) In preparation.

✓ Available
 – Not available

3.13.2 Safety brake

The safety brakes are available for the following motors in different sizes and with different braking torque levels.

Note that, with the /HR manual brake release brake option, reduced braking torque levels may be available to a limited extent. Contact SEW-EURODRIVE if required.

CM3C.., ECM3C.. and CM3P.. motors with BZ.. safety brake are also available in combination with MOVILINK® DDI. Note that in this combination, only brake controls in the control cabinet are permitted for the safety brake, see chapter "Combination of safety brake and brake control" (→ 41).

The braking torque designs of the BY.. brake are listed based on the value M_2 . This value is specified on the motor nameplate as the nominal braking torque M_{br} .

The braking torque designs of the BK.. brake are listed based on the value $M_{4,100^\circ\text{C}}$. This value is specified on the motor nameplate as the nominal braking torque M_{br} .

Motor size	Brake size	Braking torque levels in Nm		
		M_2	$M_{4,100^\circ\text{C}}$	M_1
CMPZ71	BY2	20	12	14
		14	8.4	9.8
		10	6	7
		7	4.2	4.9
CMPZ80	BY4	40	24	28
		28	16.8	19.6
		20	12	14
		14	8.4	9.8

Motor size	Brake size	Braking torque levels in Nm		
		M_2	$M_{4,100^{\circ}\text{C}}$	M_1
CMPZ100	BY8	80	48	56
		55	33	38.5
		40	24	28
		28	16.8	19.6

Motor size	Brake size	Braking torque levels in Nm	
		$M_{4,100^{\circ}\text{C}}$	M_1
CM3C63 CM3P63	BZ05	6	6
		4.5	4.5
		3.2	3.2
		2.5	2.5
	BZ05D	3.2	3.2
		2.5	2.5
CM3C71 CM3P71	BZ1	17	17
		12	12
		8.4	8.4
		6	6
	BZ1D	8.4	8.4
		6	6
CM3C80 CM3P80	BZ3	32	32
		23	23
		16	16
		11	11
		7.8	7.8
	BZ3D	16	16
CM3C100 CM3P100	BZ5	11	11
		63	63
		44	44
		32	32
	BZ5D	22	22
		32	32

Motor size	Brake size	Braking torque levels in Nm	
		$M_{4,100^{\circ}\text{C}}$	M_1
ECM3C63	BZ05	6	6
		4.5	4.5
		3.2	3.2
		2.5	2.5
	BZ05D	3.2	3.2
		2.5	2.5
ECM3C71	BZ1	17	17
		12	12
		8.4	8.4
		6	6
	BZ1D	8.4	8.4
		6	6

Motor size	Brake size	Braking torque levels in Nm	
		$M_{4,100^{\circ}\text{C}}$	M_1
ECM3C80	BZ3	32	32
		23	23
		16	16
		11	11
		7.8	7.8
	BZ3D	16	16
ECM3C100	BZ5	11	11
		63	63
		44	44
		32	32
		22	22
	BZ5D	32	32
		22	22

3.13.3 Safety technology

The safety encoders are available for the following safety technology from SEW-EURODRIVE: Observe the compatibility of the safety encoders with the respective safety technology, particularly the minimum hardware or firmware requirements. This information can be found in the documentation for the respective safety technology.

Encoders	MOVI-C® safety options				MOVIDRIVE® B	Safety modules
	CSL	CSS	CS..A	CSA31A	DCS..B	UCS..B
EK0H	–	✓	✓	✓	✓	✓
AK0H	–	✓	✓	✓	✓	✓
AK1H	–	✓	✓	✓	✓	✓
AK0Z	–	✓	✓	✓	–	–
EK0Z	–	✓	✓	✓	–	–
AK1Z	–	✓	✓	✓	–	–
EH1E	–	–	–	–	–	–
AH1E	–	–	–	–	–	–
EH4F	–	–	–	–	–	–
AH4F	–	–	–	–	–	–
AH1Q	–	–	–	–	–	–
EK0J	–	–	–	–	–	–
AK0J	–	–	–	–	–	–



Available



Not available

3.14 Acceptance

The system manufacturer has to perform an overall evaluation for determining the safety of a machine.

The effectiveness of each risk minimization must be checked. It must also be checked if the required safety integrity is reached for each implemented safety function.

To validate the safety integrity level, you can use the "SISTEMA" calculation tool from the Institut für Arbeitsschutz (Institute for Occupational Safety and Health of the German Social Accident Insurance).

4 Motor structure

4.1 Nameplates on the motor

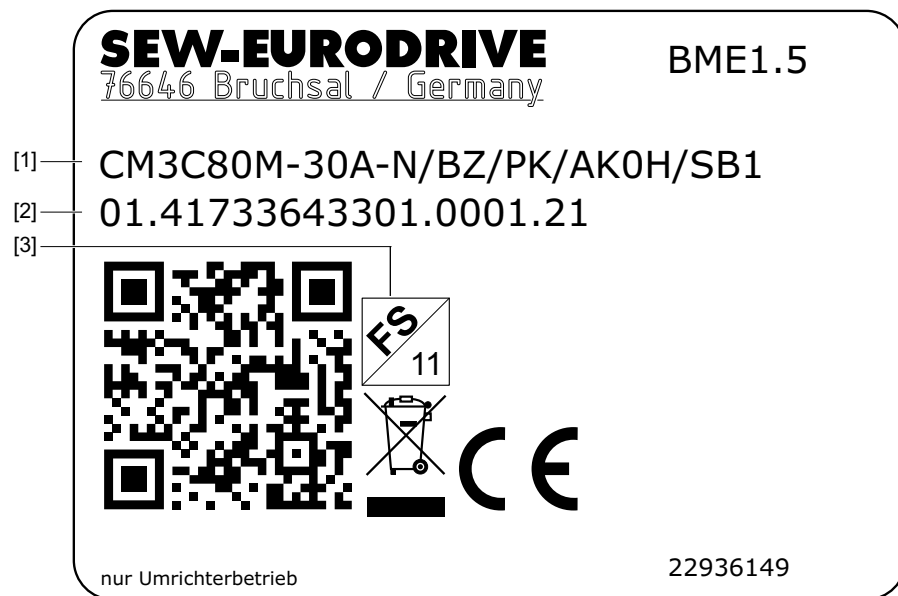
The following figure shows an example of the first nameplate of the CM3C.. motor:

	SEW-EURODRIVE 76646 Bruchsal / Germany	DI0E00 Jahr 2020	[1]	
[2]	CM3C71S-20A-P/BZ/DI/PK/AZ2Z/SD1		[2]	
[3]	01.7825733307.0001.20		[3]	
[4]	Mo 6,5 Nm	VTnC 0-2000 r/min	IM B5	[4]
[5]	Mpk 19,5 Nm	n max 7200 r/min	IP 65	[5]
[6]	Io 3,5 A	Up 257 V	kg 13,876	[6]
[7]	Imax 12,2 A	Ta -20..40 °C	Th.Kl. 155(F)	[7]
[8]	U _{sys} 400 V	Mbr 17 Nm	TENV ML 03	[8]
[9]	PS1 1,28 Kw	Ubr 218-243 AC V	nS1 2000r/min	[9]
3~IEC60034 22935908 Made in Germany				

Line	Specifications (from left to right)
[1]	Type code of the MOVILINK® DDI interface
[2]	Type designation
[3]	Serial number
[4]	- Standstill torque - Variable torque - Speed class - Mounting position
[5]	- Dynamic limit torque of the motor - Maximum permitted speed - Degree of protection according to IEC/EN 60034-5
[6]	- Standstill current - Voltage at the open terminals of the motor at rated speed - Mass
[7]	- Maximum permitted current - Permitted ambient temperature range - Thermal class
[8]	- System voltage, voltage of the supplying inverter - Nominal braking torque - TENV (Totally Enclosed Non-Ventilated) - Mounting location (plant code)

Line	Specifications (from left to right)
[9]	- Rated power continuous duty - Brake voltage - Rated speed continuous duty

The following figure shows the 2nd nameplate of a CM3C.. motor:



- [1] Type designation
- [2] Serial number
- [3] FS logo

5 Mechanical installation

5.1 General information

Note that greases and oils must not be allowed on the mechanical connections of the safety components during assembly or operation.

5.2 Manual brake release

If the /HR manual brake release was ordered, the safety brake with manual brake release is pre-installed and set at the factory.

Note that the /HR manual brake release must not be retrofitted to the safety brake. If required, contact SEW-EURODRIVE.

6 Electrical installation

6.1 General information

SEW-EURODRIVE recommends using prefabricated cables from SEW-EURODRIVE to connect the EK0H, AK0H, AK1H, EK0Z, and AK0Z safety encoders. For all other safety encoders, refer to the relevant manufacturer's documentation.

6.2 Thermal motor monitoring

The following potential fault patterns of a brake can lead to an impermissible increase in the motor temperature:

- Brake remains applied
- Brake does not release fully

If a safety brake is used, one of the following options for thermal monitoring of the motor must be employed:

- Motor protection /TF or /PI
- Temperature detection /PK, /PT, or /KY

6.3 Brake control

The brake is released electrically. The brake is applied when the voltage is switched off. The braking or stopping operation takes place mechanically.

The following ways of disconnecting the voltage supply from the brake exist:

- Functional control
Control of the brake is not evaluated for functional safety.
- Safe control
Control of the brake is evaluated for functional safety.

6.4 Permitted brake controls

The safety brake must be supplied by a brake control from SEW-EURODRIVE. There are several designs for this purpose which are either designated for installation in the motor wiring space or for installation in the control cabinet. The following supply types are **not permitted** for the safety brake:

- Operation with integrated brake control with MOVILINK® DDI (e.g. BG1Z, BS1Z)
- Supply via terminal board (direct wiring)

For further information on the permitted brake controls, refer to "Combination of safety brake and brake control" (→ 41). Connection may only be performed according to the valid wiring diagram enclosed.

7 Inspection/maintenance

7.1 Inspection and maintenance intervals



⚠ WARNING

Loss of the safety function due to improperly performed work on drives with functionally safe motor options.

Severe or fatal injuries.

- Improperly carried out work on drives with functionally safe motor options can result in loss of the safety functions. This can cause injuries and damage.
- Only qualified specialists are allowed to carry out work on drives with functionally safe motor options.

7.1.1 Safety encoder

Observe the information on service life in the technical data and comply with the prescribed instructions, see "Service life" (→ 30).

Any work on the safety encoder or the drive that requires opening marked connection elements must be carried out by SEW-EURODRIVE Service.

Type of work	Work permitted?	Note
Replacing the existing encoder with a safety encoder	No	If necessary, please contact SEW-EURODRIVE.
Work on the safety encoder (removal, mounting or replacement of the encoder)	No	The work must be carried out by SEW-EURODRIVE Service.
Changes to the safety encoder	No	The safety certification and any right to claim under limited warranty of SEW-EURODRIVE become void if the user modifies the safety encoder or its mounting.

7.1.2 Safety brake

Inspect and service the safety brake in accordance with the defined inspection and maintenance intervals, or – depending on the load conditions – every 0.5 to 2 years.

Wear times are subject to many factors and can therefore be quite short. The required inspection and maintenance intervals must be individually calculated by the system manufacturer in accordance with the project planning documents.

SEW-EURODRIVE recommends using SEW-EURODRIVE Service for maintenance work. This applies in particular to all work that requires the marked, safety-relevant connections to be opened.

If maintenance work is performed independently, the responsibility and liability for proper execution of the work described in the relevant documentation is passed to the user. For further information, refer to "Functional safety (FS)" (→ 10).

Type of work	Work permitted?	Comments
Replacing the safety brake.	No	Contact SEW-EURODRIVE.
Replacing the existing brake with a safety brake.	No	Contact SEW-EURODRIVE.
Changing the braking torque.	No	Replacement of safety brake necessary. (See "Replacing the safety brake")
Checking the air gap.	Yes	Observe minimum permitted brake lining carrier thickness. (This is done by measuring the working air gap indirectly – see the motor documentation)
Replacing individual parts of the safety brake.	No	–
Replacing the driver.	No	–
Retrofitting manual brake release /HR.	No	Contact SEW-EURODRIVE.
Replacing manual brake release /HR.	Yes	–

8 Technical data

8.1 Safety encoder

8.1.1 Service life

The safety encoders have a maximum service life of 20 years, after which it is essential to take them out of service.

In addition to the service life, the bearing service life, operating hours, and number of emergency stop braking operations also have to be taken into account. The parameter that is reached first depending on the application determines when the required shut-down takes place.

Encoder	Bearing service life	Operating Time	Number of emergency stop braking operations
EK0H AK0H	3.6 × 10 ⁹ revolutions	n/a	2000
AK1H			
EK0J AK0J			
EK0Z AK0Z		Calculated remaining service life	
EH1E AH1E AH1Q EH4F AH4F		40 000 hours	

Bearing service life for CM3G.. motors

For CM3G63 to CM3G80 motors with EH1E, AH1E, AH1Q, EH4F, or AH4F safety encoders, replace the B-side bearing after 20 000 h.

By contrast, for the following gearmotors, the B-side bearing must be replaced as follows:

- P7.GM42-0028.. CM3G80M after 16 000 h
- P7.GM42-038X.. CM3G80M after 17 000 h
- P7.GM42-0055.. CM3G80M after 15 000 h
- P7.GM42-0040.. CM3G80M after 18 500 h
- P..GM41-0010.. CM3G80M after 12 500 h

The following conditions apply to the bearing service life:

- 60% cdf
- Thermal rms speed of the motor $n_{e,eff} \leq 2000 \text{ min}^{-1}$
- Compliance with the permitted output torques according to the configuration

For $ED > 60\%$ and for $n_{e,eff} > 2000 \text{ min}^{-1}$, contact SEW-EURODRIVE.

Remaining service life via MOVILINK® DDI function parameters

The safety encoders with a MOVILINK® DDI interface, in conjunction with the safety options from the MOVI-C® modular automation system, electronically determine the remaining service life while taking into account thermal aging. The remaining service life until the motor with safety encoder must be shut down is counted from the production date.

The following relation can be used to check whether the remaining service life is sufficient for the safety encoder.

The safety encoder must be shut down if the following conditions apply:

- **Parameter "Prediction of remaining service life" - Times without voltage supply ≤ 0**

Examples:

- CM3C../BK../AK0Z: P10060.161 = 15 years; times without voltage supply = 5 years → 10 years remaining service life
- CM3G../BKB../AK0Z: P10060.161 = 5 years; times without voltage supply = 5 years → 0 years remaining service life
- DRN../BE../AK8Z: P10060.161 = 17 years; times without voltage supply = 3 years → 14 years remaining service life

The safety encoder may be used as long as none of the other factors (bearing service life, number of emergency stop braking operations) has been exceeded.

The following table lists the parameters that contain the forecast of the remaining service life and the histogram of the operating times in the respective temperature range. The parameters can be read using the MOVISUITE® engineering software and using a controller via parameter access:

Display text	Index	Subindex	Offset	Unit
Prediction of remaining service life	10060	161	–	Minutes
Runtime in temperature range < 90 °C	10060	162	0	Minutes
Runtime in temperature range 90 °C < 95 °C	10060	162	1	Minutes
Runtime in temperature range 95 °C < 100 °C	10060	162	2	Minutes
Runtime in temperature range 100 °C < 105 °C	10060	162	3	Minutes
Runtime in temperature range 105 °C < 110 °C	10060	162	4	Minutes
Runtime in temperature range 110 °C < 115 °C	10060	162	5	Minutes
Runtime in temperature range > 115 °C	10060	162	7	Minutes

8.1.2 Characteristic safety values

For the characteristic safety values of components from SEW-EURODRIVE, refer to the respective documentation or the SEW-EURODRIVE library for the "SISTEMA" software tool. The documentation and the library are available for download from www.sew-eurodrive.com.

8.1.3 Characteristic safety values of EK0H and AK0H

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	1.3 x 10 ⁻⁸ 1/h (≤ 5000 m) ²⁾	
MTTF _D value ¹⁾ with mounting on the motor	–	874 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.

3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

8.1.4 Characteristic safety values of AK1H

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	1.0 x 10 ⁻⁸ 1/h (≤ 5000 m) ²⁾	
MTTF _D value ¹⁾ with mounting on the motor	–	1073 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.

3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

8.1.5 Characteristic safety values EK0Z, AK0Z

	Characteristic safety values in accordance with	
	EN 61800-5-2	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ (with mounting on the motor; takes into account a derating due to motor reheating)	$2.3 \times 10^{-8} \text{ 1/h} = 23 \text{ FIT (T}_{\text{amb}} \leq 60 \text{ °C)}$	
Service life/proof test interval ²⁾	20 years maximum	
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Also take into account restrictions on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, the remaining service life of the encoder (see monitoring function of the CS..A safety option)

8.1.6 Characteristic safety values of EH1E and AH1E

The EH1E and AH1E safety encoders can be used up to SIL3/PL e.

It is essential that the customer takes into account and implements more stringent requirements of the encoder manufacturer with regard to implementation in the overall system. You will find the applicable characteristic safety values for SIL 3/PL e and the requirements with regard to implementation in the overall system in the associated manufacturer's documentation for the encoder.

Notice: Different characteristic safety values apply to the safety encoders, depending on the motor type and motor size. If values with reference to motor type and motor size are specified in addition to the generally valid values, they must be used.

Characteristic safety values of EH1E, AH1E – generally valid

The following characteristic safety values are generally valid, regardless of motor type and motor size:

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	$10.0 \times 10^{-9} \text{ 1/h (} \leq 1000 \text{ m)}$ $25.0 \times 10^{-9} \text{ 1/h (} \leq 6000 \text{ m)}^{2)}$	
MTTF _D value ¹⁾ with mounting on the motor	–	190 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.

3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

Characteristic safety values of EH1E, AH1E – CMP.. motors

The following characteristic safety values apply to the safety encoders on the following motor:

- CMP112

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	30.0 x 10 ⁻⁹ 1/h (≤ 1000 m) 45.0 x 10 ⁻⁹ 1/h (≤ 6000 m) ²⁾	
MTTF _D value ¹⁾ with mounting on the motor	–	183 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.

3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

Characteristic safety values of EH1E, AH1E – CM3G.. motors

The following characteristic safety values apply to the safety encoders on the following motors:

- CM3G63, CM3G71, CM3G80

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	20.0 x 10 ⁻⁹ 1/h (≤ 1000 m) 35.0 x 10 ⁻⁹ 1/h (≤ 6000 m) ²⁾	
MTTF _D value ¹⁾ with mounting on the motor	–	186 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.

3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

8.1.7 Characteristic safety values of EH4F, AH4F

The EH4F and AH4F safety encoders can be used up to SIL 3/PL e.

It is essential that the customer takes into account and implements more stringent requirements of the encoder manufacturer with regard to implementation in the overall system. You will find the applicable characteristic safety values for SIL 3/PL e and the requirements with regard to implementation in the overall system in the associated manufacturer's documentation for the encoder.

Notice: Different characteristic safety values apply to the safety encoders, depending on the motor type and motor size. If values with reference to motor type and motor size are specified in addition to the generally valid values, they must be used.

Characteristic safety values of EH4F, AH4F – generally valid

The following characteristic safety values are generally valid, regardless of motor type and motor size:

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	10.0 x 10 ⁻⁹ 1/h (≤ 1000 m) 30.0 x 10 ⁻⁹ 1/h (≤ 6000 m) ²⁾	
MTTF _D value ¹⁾ with mounting on the motor	–	190 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.

3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

Characteristic safety values of EH4F, AH4F – CMP.. motors

The following characteristic safety values apply to the safety encoders on the following motor:

- CMP112

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	30.0 x 10 ⁻⁹ 1/h (≤ 1000 m) 50.0 x 10 ⁻⁹ 1/h (≤ 6000 m) ²⁾	
MTTF _D value ¹⁾ with mounting on the motor	–	183 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

- 1) The specified values apply if the requirements for the evaluation electronics are adhered to.
- 2) Take into account any potential limitations or derating, for example due to the drive or the frequency in-verter.
- 3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

Characteristic safety values of EH4F, AH4F – CM3G.. motors

The following characteristic safety values apply to the safety encoders on the following motors:

- CM3G63, CM3G71, CM3G80

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	20.0 x 10 ⁻⁹ 1/h (≤ 1000 m) 40.0 x 10 ⁻⁹ 1/h (≤ 6000 m) ²⁾	
MTTF _D value ¹⁾ with mounting on the motor	–	186 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.

3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

8.1.8 Characteristic safety values of EK0J and AK0J

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	4.0 x 10 ⁻⁸ 1/h (≤ 5000 m) ²⁾	
MTTF _D value ¹⁾ with mounting on the motor	–	500 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

1) The specified values apply if the requirements for the evaluation electronics are adhered to.

2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.

3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

8.1.9 Characteristic safety values of AH1Q

Notice: Different characteristic safety values apply to the safety encoders, depending on the motor type and motor size. If values with reference to motor type and motor size are specified in addition to the generally valid values, they must be used.

Characteristic safety values of AH1Q – generally valid

The following characteristic safety values are generally valid, regardless of motor type and motor size:

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	$27.0 \times 10^{-9} \text{ 1/h } (\leq 1000 \text{ m})$ $97.0 \times 10^{-9} \text{ 1/h } (\leq 6000 \text{ m})^{2)}$	
MTTF _D value ¹⁾ with mounting on the motor	–	190 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

- 1) The specified values apply if the requirements for the evaluation electronics are adhered to.
- 2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.
- 3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

Characteristic safety values of AH1Q – CM3G.. motors

The following characteristic safety values apply to the safety encoders on the following motors:

- CM3G63, CM3G71, CM3G80

	Characteristic safety values in accordance with	
	EN 62061/EN 61508	EN ISO 13849-1
Classification	SIL 2	PL d
System structure	HFT = 1	2-channel (Cat. 3)
PFH _D value ¹⁾ with mounting on the motor (installation altitude)	$37.0 \times 10^{-9} \text{ 1/h } (\leq 1000 \text{ m})$ $107.0 \times 10^{-9} \text{ 1/h } (\leq 6000 \text{ m})^{2)}$	
MTTF _D value ¹⁾ with mounting on the motor	–	186 years
Service life/proof test interval	20 years ³⁾	
Safe failure fraction (SFF)	> 90%	–
Motor/encoder connection (only for drives with FS logo)	Fault exclusion in accordance with EN 61800-5-2	

- 1) The specified values apply if the requirements for the evaluation electronics are adhered to.
- 2) Take into account any potential limitations or derating, for example due to the drive or the frequency inverter.
- 3) Also take into account limitations on the service life, e.g. due to ball bearings, the number of emergency stop braking operations, and the operating hours.

8.2 Safety brake

8.2.1 Characteristic safety values

The characteristic safety values B_{10D} listed here apply to loads on the brake above the specified minimum values for the static and dynamic application factors f_{AS} and f_{Ad} . If the minimum values are undershot, the characteristic safety values B_{10D} no longer apply to the use case.

For the characteristic safety values of components from SEW-EURODRIVE, refer to the respective documentation or the SEW-EURODRIVE library for the "SISTEMA" software tool. The documentation and the library are available for download from www.sew-eurodrive.com.

8.2.2 Characteristic safety values for the BY.. safety brake

BY..		Characteristic safety values in accordance with EN ISO 13849-1	
Classification		Category 1 (Cat. 1)	
System structure		Single-channel	
Operating mode		High demand	
Safe state		The brake is applied	
Safety subfunctions		Safe braking (SBA – Safe Brake Actuation)	
		Safe holding (SBH – Safe Brake Hold)	
Service life		20 years or T_{10D} value (depending on which value occurs first)	
T_{10D} value		Calculation using $0.1 \times MTTF_D$	
$MTTF_D$ value		Calculation via B_{10D} value	
B_{10D} value	CMPZ71	BY2	15×10^6
	CMPZ80	BY4	12×10^6
	CMPZ100	BY8	9×10^6

8.2.3 Characteristic safety values for the BZ.. safety brake

BZ..		Characteristic safety values in accordance with EN ISO 13849-1	
Classification		Category 1 (Cat. 1)	
System structure		Single-channel	
Operating mode		High demand	
Safe state		The brake is applied	
Safety subfunctions		Safe braking (SBA – Safe Brake Actuation)	
		Safe holding (SBH – Safe Brake Hold)	
Service life		20 years or T_{10D} value (depending on which value occurs first)	
T_{10D} value		Calculation using $0.1 \times MTTF_D$	
$MTTF_D$ value		Calculation via B_{10D} value	
B_{10D} value	CM3C63, ECM3C63, CM3P63	BZ05, BZ05D	15×10^6
	CM3C71, ECM3C71, CM3P71	BZ1, BZ1D	15×10^6
	CM3C80, ECM3C80, CM3P80	BZ3, BZ3D	12×10^6
	CM3C100, ECM3C100, CM3P100	BZ5, BZ5D	9×10^6

8.3 Combination of safety brake and brake control

The following tables show the permitted and prohibited combinations of safety brake and brake control.

8.3.1 Installation in the control cabinet

Brake control	Voltage range V	Safety brake		
		BY2 BY4 BY8	BZ05 BZ1 BZ3 BZ5	BZ05D BZ1D BZ3D BZ5D
BST 0.6S	AC 460	✓	✓	–
BST 0.7S	AC 400	✓	✓	–
BST 1.2S	AC 230	✓	✓	–
SBM S-230-120	AC 230	✓	✓	–
SBM S-400-120	AC 400	✓	✓	–
SBM S-460-120	AC 460	✓	✓	–
SBM S-230-250	AC 230	✓	✓	–
SBM S-400-250	AC 400	✓	✓	–
SBM S-460-250	AC 460	✓	✓	–
BME 1.5	AC 150 – 500	✓	✓	–
BME 3	AC 42 – 150	✓	✓	–
BMP 1.5	AC 150 – 500	✓	✓	–
BMP 3	AC 42 – 150	✓	✓	–
BMK 1.5	AC 150 – 500	✓	✓	–
BMKB 1.5	AC 150 – 500	✓	✓	–
BMK 3	AC 42 – 150	✓	✓	–
BMH 1.5	AC 150 – 500	✓	✓	–
BMH 3	AC 42 – 150	✓	✓	–
BMV 5	DC 24	✓	✓	✓
BSG	DC 24	✓	✓	–

- ✓ Permitted
– Not permitted

8.3.2 Installation in the motor wiring space

Brake control	Voltage range V	Safety brake		
		BY2 BY4 BY8	BZ05 BZ1 BZ3 BZ5	BZ05D BZ1D BZ3D BZ5D
BG1Z	AC 200 – 500	–	–	–
BS1Z	DC 24	–	–	–

- ✓ Permitted
– Not permitted

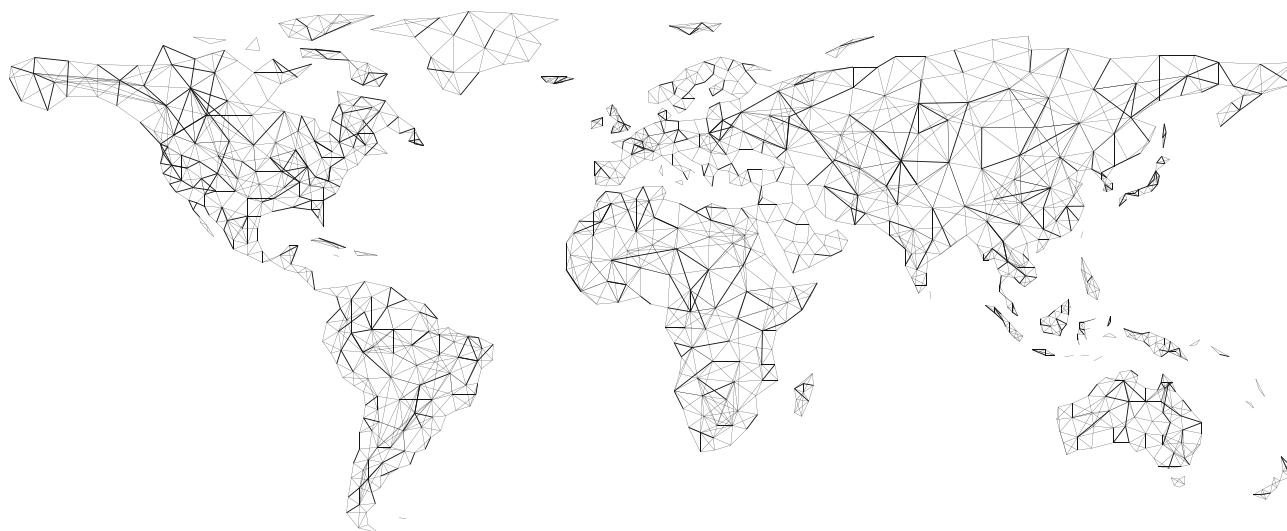
9 Contacting SEW-EURODRIVE

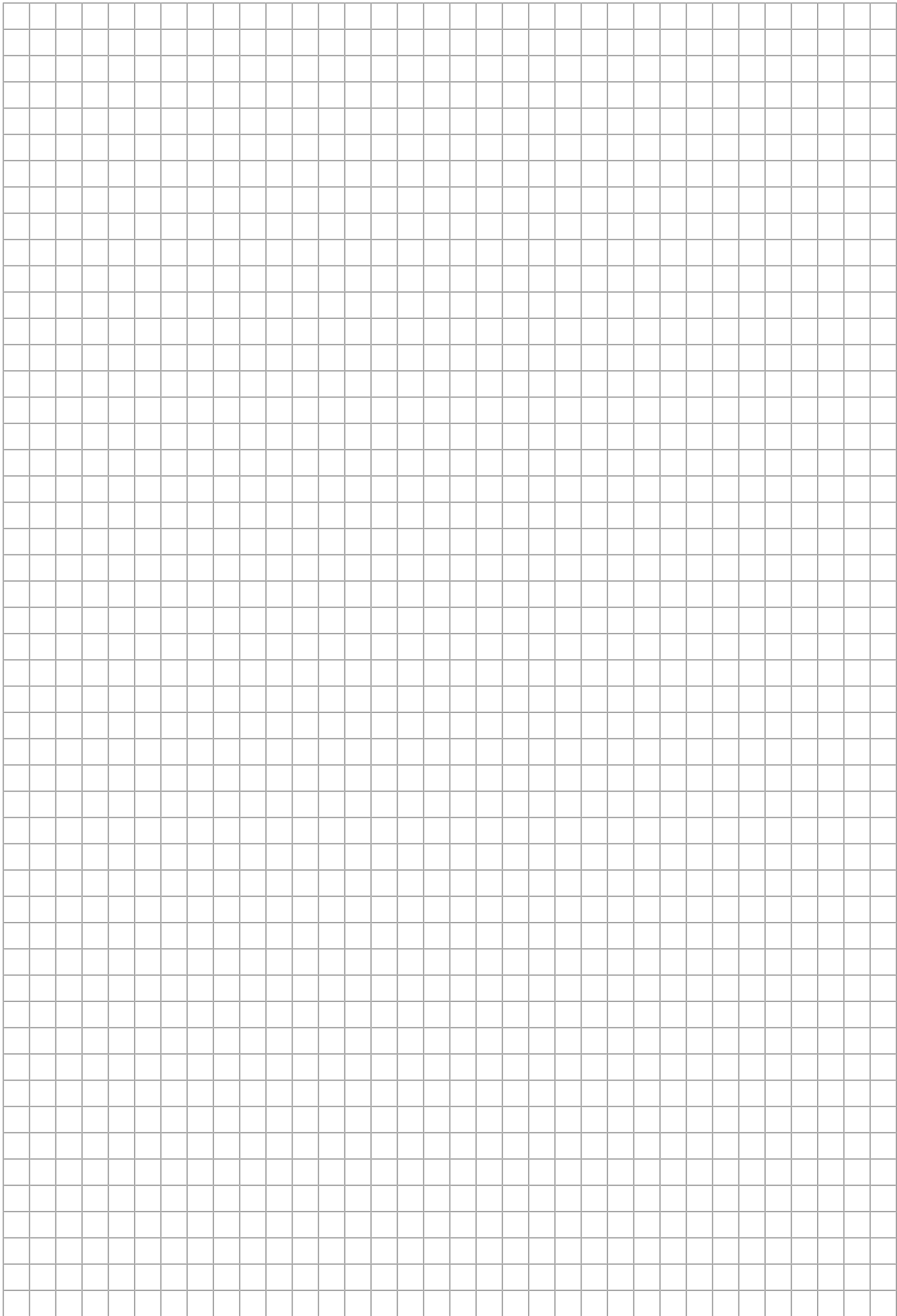
You can find the worldwide contact data and locations on the **SEW-EURODRIVE website** via the following link or the QR code shown below.

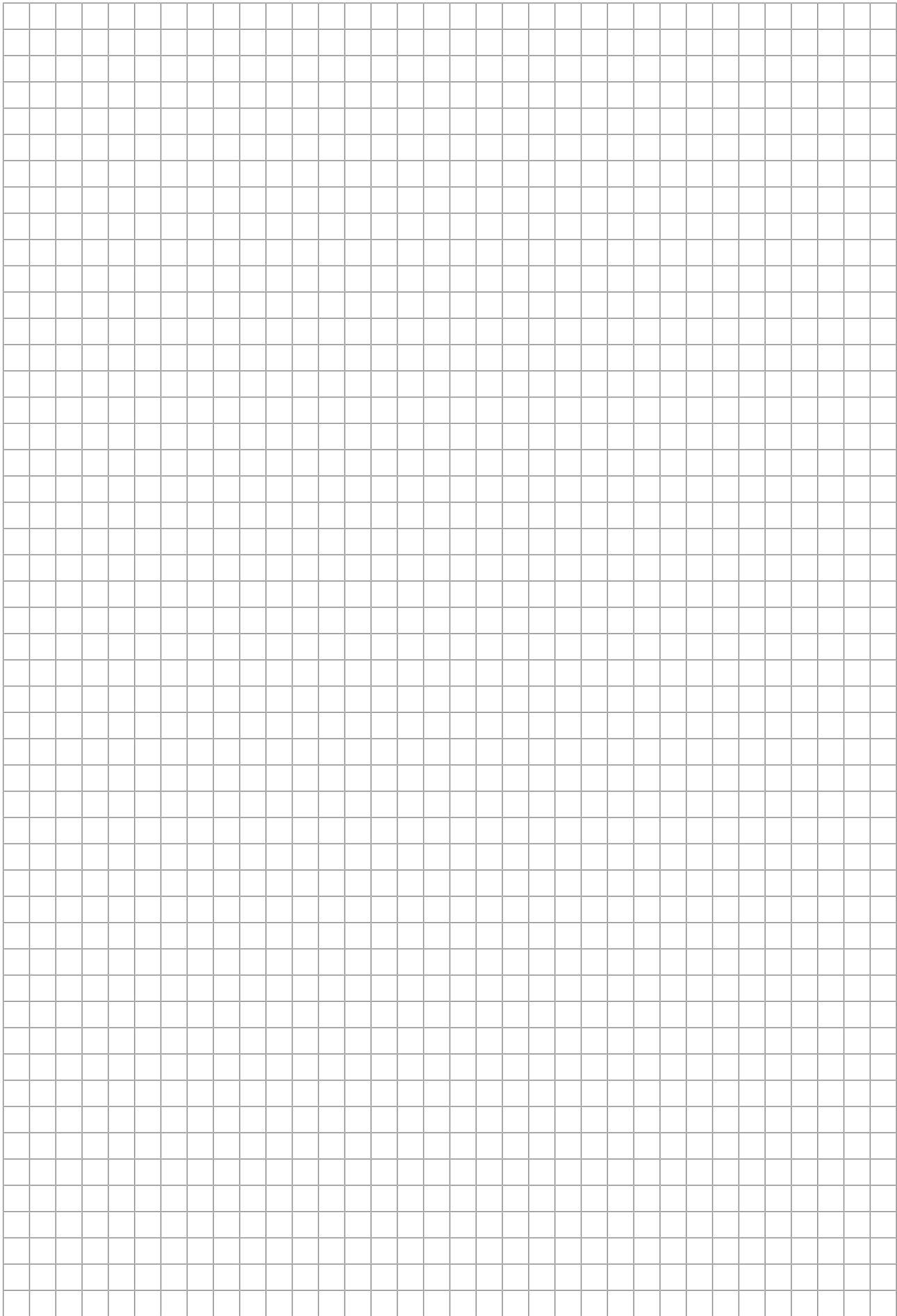
<https://www.sew-eurodrive.de/contacts-worldwide>

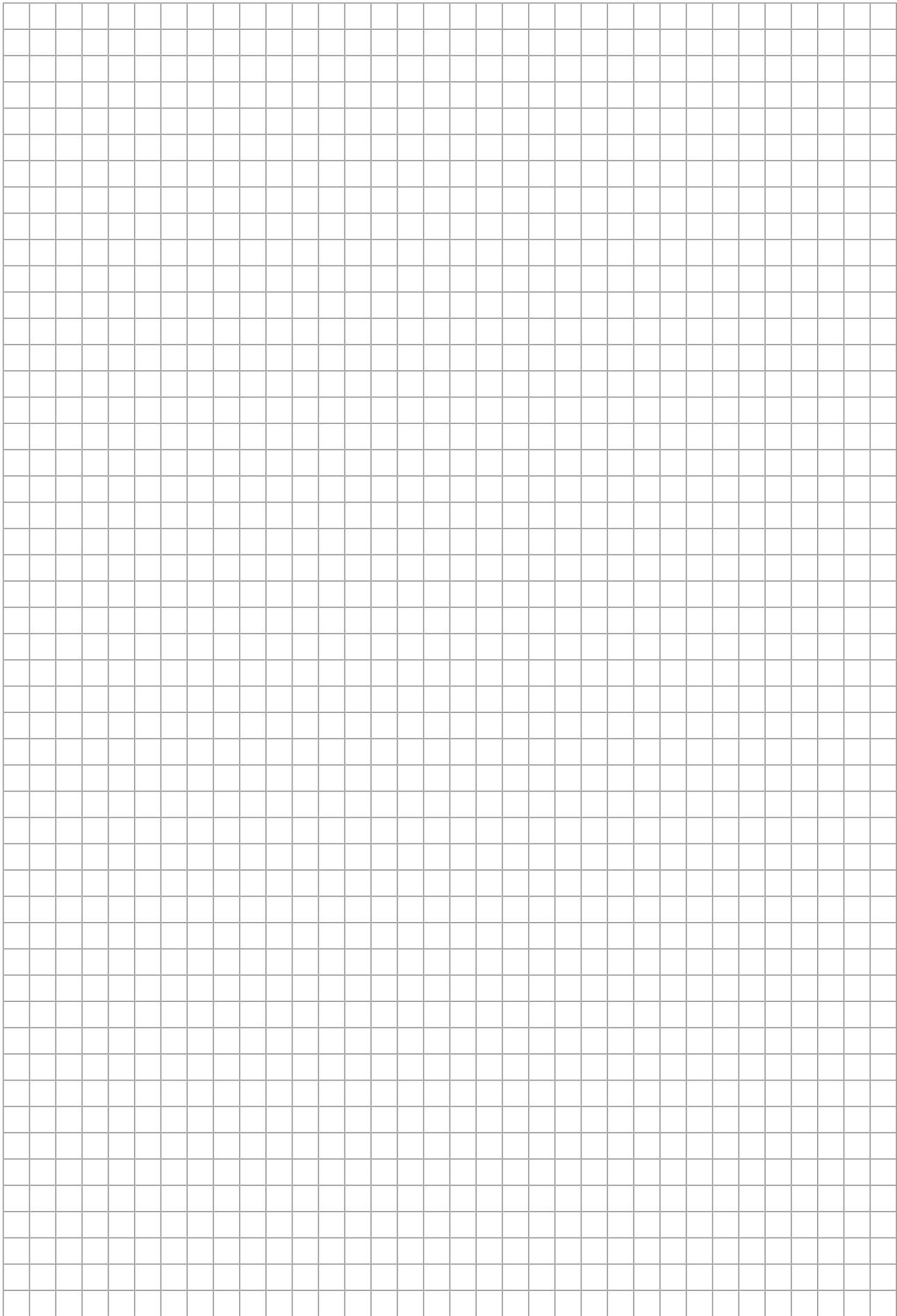


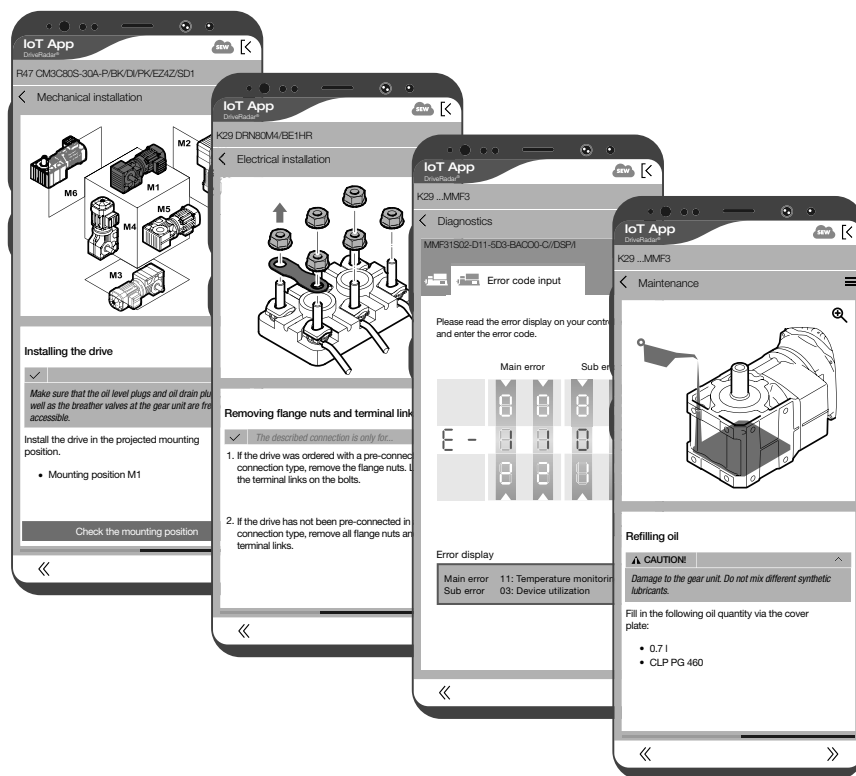
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