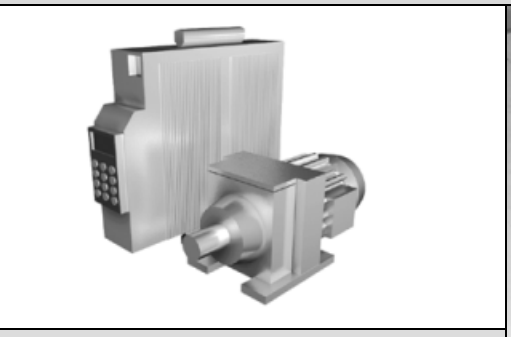
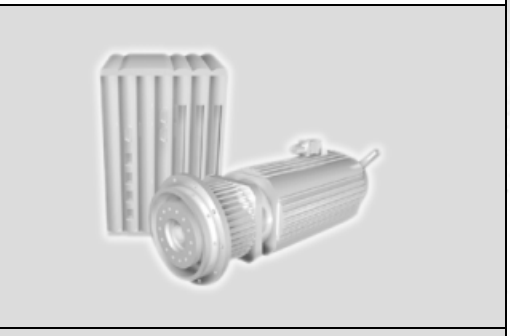
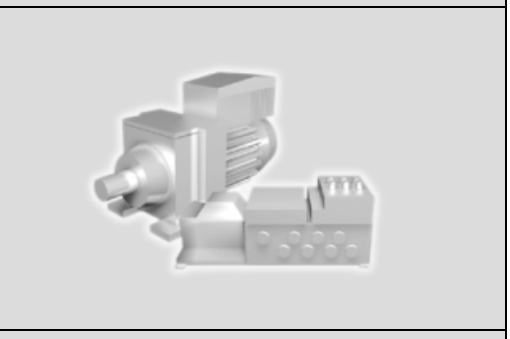
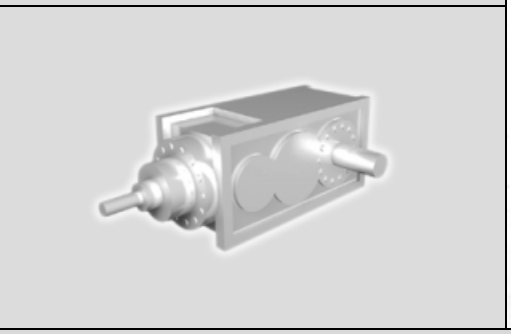
SEW EURODRIVE









MOVITRAC® B
Safe Disconnection – Conditions

Edition 06/2007
11469013 / EN

Manual

SEW EURODRIVE

1 Important Notes

1.1 Safety and warning notes

Always observe the safety and warning notes in this documentation.

Electrical hazard
Possible consequences: Severe or fatal injuries.

Hazard
Possible consequences: Severe or fatal injuries.

Hazardous situation
Possible consequences: Slight or minor injuries.

Harmful situation
Possible consequences: Damage to the unit and the environment.

Tips and useful information.

1.2 Contents of this manual

This document contains **safety-related addendums and conditions** for the operation of **MOVITRAC® B with safe disconnection of the drive according to stop category 0 or 1 according to EN 60204-1 and fail-safe protection against restart according to EN 1037 and conformance with safety category 3 according to EN 954-1**.

It also describes the operation of **MOVITRAC® B with safe disconnection of the drive according to stop category 0 or 1 to EN 60204-1, fail-safe protection against restart according to EN 1037 and fulfillment of performance level "d" according to EN ISO 13849-1.**

This document supplements the MOVITRAC® B operating instructions and limits the application notes according to the following information. **It may only be used in conjunction with the MOVITRAC® B operating instructions.**

2 Safety Concept

- In case of danger, any potential risk to a machine must be eliminated as quickly as possible. Dangerous movements can generally be bringing the unit to standstill and applying restart prevention.
- MOVITRAC® B is characterized by the optional connection of X17 to an external fail-safe, prototype tested emergency stop relay. The emergency stop relay disconnects all active elements (disconnection of the safety oriented 24 V power supply of the output stage control) that generate the pulse trains to the power output stage (IGBT) when a connected control device (E-STOP button with latching function) is activated.
- Disconnecting the 24 V voltage supply at connector X17 ensures that the supply voltages required for operating the frequency inverter and consequently for generating a rotating field of pulse patterns (which allow the generation of a rotating field) are safely interrupted, preventing automatic restart.
- Instead of separating the drive galvanically from the power supply using contactors or switches, the disconnection procedure described here prevents the power semiconductors in the frequency inverter from being activated, thus ensuring safe disconnection. This process disconnects the rotating field generation for the respective motor. The individual motor cannot develop any torque in this state even though the mains voltage is still present.
- The requirements for the safety control are clearly defined in the following sections and must be observed.

Using a suitable external circuit via a safety control with

– **approval to at least EN 954-1 category 3**

enables operation of the MOVITRAC® B frequency inverter with safe disconnection to stop category 0 or 1 according to EN 60204-1, fail-safe protection against restart according to EN 1037 and fulfillment of safety category 3 to EN 954-1.

Using a suitable external circuit via a safety control with

– **approval for EN ISO 13849-1, performance level "d"**

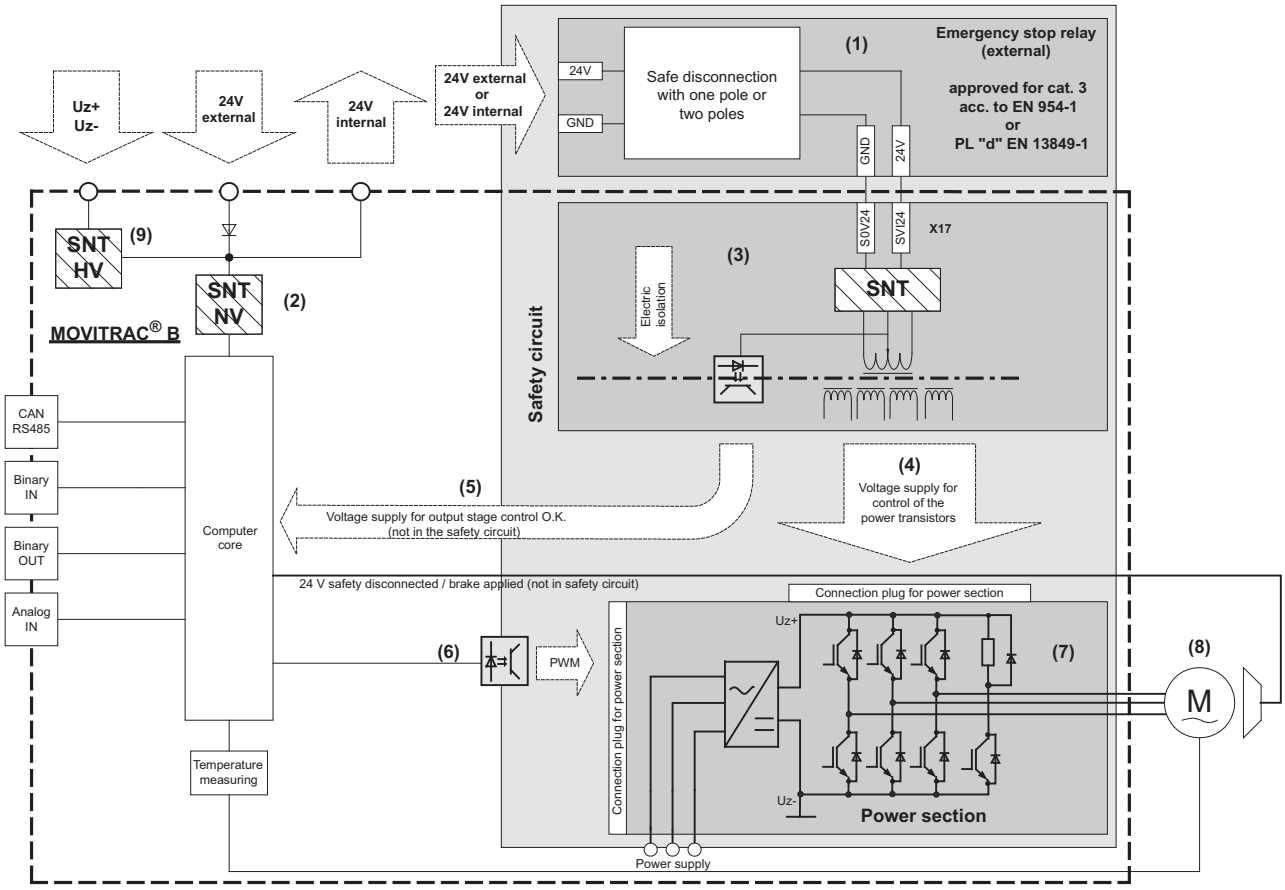
enables operation of the MOVITRAC® B frequency inverter with safe disconnection according to stop category 0 or 1 to EN 60204-1, fail-safe protection against restart according to EN 1037 and fulfillment of performance level "d" to EN ISO 13849-1.

2.1 Restrictions

- **Important: The safety concept is only suitable for performing mechanical work on the system / machine components.**
- **Caution: A system / machine-specific risk analysis must be provided by the system / machine manufacturer and taken into account for the use of the MOVITRAC® B frequency inverter.**

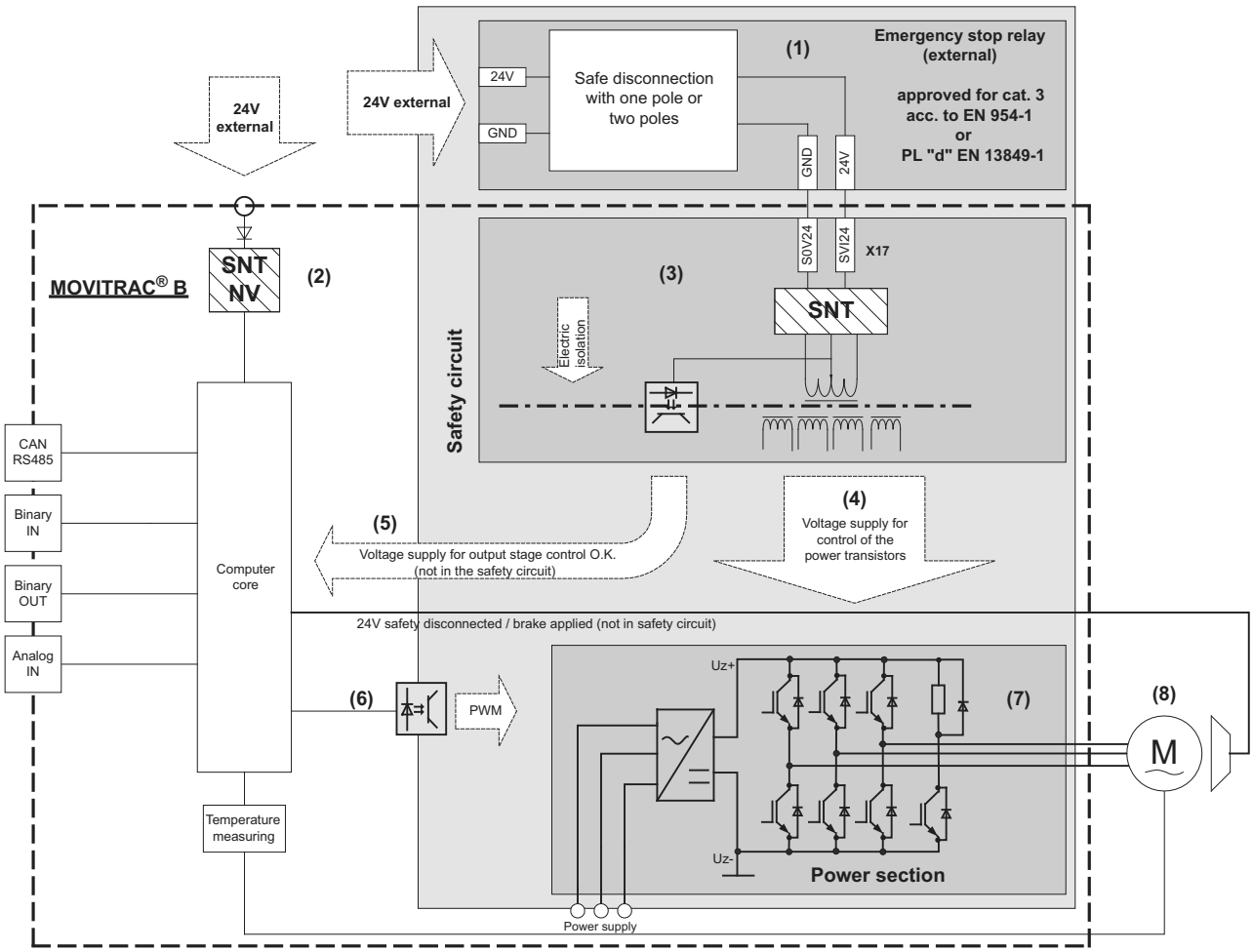
- **Danger of fatal injury: When the safety-oriented 24 V voltage supply is disconnected, the mains supply voltage is still present at the frequency inverter DC link.**
- **Caution: If work is carried out on the electrical section of the drive system, the DC link voltage must be disconnected.**

2.2 Representation of the "safety concept for MOVITRAC® B / control unit"



[1] Emergency stop relay (external)
[2] Low voltage switched-mode power supply
[3] Safety switched-mode power supply (SNT)
[4] Voltage supply for control of power transistors
[5] Feedback to the computer core: Voltage supply for output stage control O.K. (not in the safety circuit)
[6] Pulse width modulated signals for the output stage
[7] Power section
[8] Motor
[9] High voltage switched-mode power supply

2.3 Representation of the "safety concept for MOVITRAC® B / size 0"



[1] Emergency stop relay (external)
[2] Low voltage switched-mode power supply
[3] Safety switched-mode power supply (SNT)
[4] Voltage supply for control of power transistors
[5] Feedback to the computer core: Voltage supply for output stage control O.K. (not in the safety circuit)
[6] Pulse width modulated signals for the output stage
[7] Power section
[8] Motor

For units of size 0 in design MC07B...-S0, an external 24 V supply must always be connected as the control electronics can only be powered in this way.

3 Safety Requirements

The following conditions are mandatory for the installation and operation of MOVITRAC® B in applications with safe disconnection of the drive in accordance with category 0 or 1 of EN 60204-1 and fail-safe protection against restart according to EN 1037, and conformance with safety category 3 of EN 954-1 or performance level "d" of EN ISO 13849-1. The requirements are divided into the following sections:

- Approved devices
- Installation requirements
- Requirements for external safety switching devices
- Startup requirements
- Operation requirements

3.1 Notes on stop categories

- Stop category 0 means that the safety 24 V voltage supply can be disconnected independent of the setpoints.
- Observe the following procedure for stop category 1:
  - Decelerate the drive using an appropriate brake ramp specified by the setpoint.
  - Disconnect the safety-oriented 24 V voltage supply.

3.2 Approved devices

The following frequency inverters are permitted for applications with safe disconnection according to stop category 0 or 1 of EN 60204-1, fail-safe protection against restart according to EN 1037 and compliance with safety category 3 according to EN 954-1 or performance level "d" according to EN ISO 13489-1.

3.2.1 MOVITRAC® B for AC 3 × 380 ... 500 V supply voltage

Power [kW]	Size	Type
0.55	0S	MC07B0005-5A3-4-S0
0.75	0S	MC07B0008-5A3-4-S0
1.1	0S	MC07B0011-5A3-4-S0
1.5	0S	MC07B0015-5A3-4-S0
2.2	0L	MC07B0022-5A3-4-S0
3.0	0L	MC07B0030-5A3-4-S0
4.0	0L	MC07B0040-5A3-4-S0
5.5	2S	MC07B0055-5A3-4-00
7.5	2S	MC07B0075-5A3-4-00
11	2	MC07B0110-5A3-4-00
15	3	MC07B0150-503-4-00
22	3	MC07B0220-503-4-00
30	3	MC07B0300-503-4-00
37	4	MC07B0370-503-4-00
45	4	MC07B0450-503-4-00
55	5	MC07B0550-503-4-00
75	5	MC07B0750-503-4-00

3.2.2 Hazard caused by drive coasting

Note that if the drive does not have a mechanical brake, or if the brake is defective, the drive may coast to a halt.

Note: If coasting to a halt results in application-dependent hazards, take additional protective measures (for example, movable covers with closure), which cover the hazardous area until persons are no longer in danger.

The additional protective covers must be designed and integrated in such a way that they meet the safety category required for the machine.

After activating the stop command, access to the machine must remain blocked until the drive has reached standstill, or the access time has to be determined to ensure that an adequate safety distance is maintained.

3.3 Installation requirements

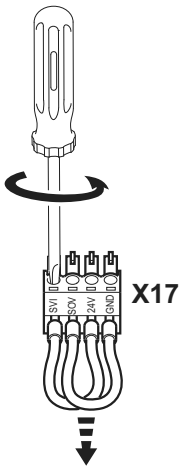
Note the following instructions for applications of MOVITRAC® B with safe disconnection of the drive according to stop category 0 or 1 according to EN 60204-1 and fail-safe protection against restart according to EN 954-1 safety category 3 or performance level "d" according to EN ISO 13849-1.

- The line between the safety control system (or the safety-oriented tripping device) and MOVITRAC® B terminal X17 is designated as the safety-oriented 24 V voltage supply.
- Power lines and the safety-oriented 24 V supply voltage must be installed in separate cable ducts.
- The safety-oriented 24 V supply voltage must be routed according to EMC guidelines and as follows:
  - Outside an electrical installation space: Shielded cables must be routed permanently (fixed) and protected against external damage, or other equivalent measures.
  - Individual conductors can be routed inside an electrical installation space.

  Observe the respective regulations governing the application.
- It must be ensured that parasitic voltages cannot be generated in the safety-oriented 24 V supply voltage.
- The total cable length between the safety control system (e.g. safety switching device) and MOVITRAC® B is limited to a maximum length of 100 m for EMC reasons.
- The switching capacity of the emergency stop relay and the maximum permissible voltage drop on the 24 V supply cable must be observed during disconnection of group drives.
- Only use terminal connections (terminal blocks) that meet EN 60204-1 and prevent short-circuits.
- Observe the notes in the "MOVITRAC® B" operating instructions on EMC compliant cabling. It is essential that you apply the shielding at both ends on the housing.
- Only use power supplies with safe isolation (SELV/PELV) according to VDE010. According to EN 60950-1, the voltage between the outputs or between any output and a ground part must not exceed DC 60 V voltage for longer than 0.2 s after only one fault. The maximum DC voltage must be 120 V.

- You must remove the jumpers at X17:1 to X17:4 (→ following figure) for use in applications with safe disconnection of the drive according to stop category 0 or 1 in accordance with EN 60204-1 and fail-safe protection against restart according to EN 954-1 safety category 3 or performance level "d" according to EN ISO 13849-1.
- The shielded lines of the safety-oriented 24 V voltage supply (terminal X17) must be clamped under the signaling electronics shield clamp.
- You must observe the technical data of MOVITRAC® B (→ MOVITRAC® B operating instructions).

Removing jumpers



3.4 Requirements for external safety switching devices

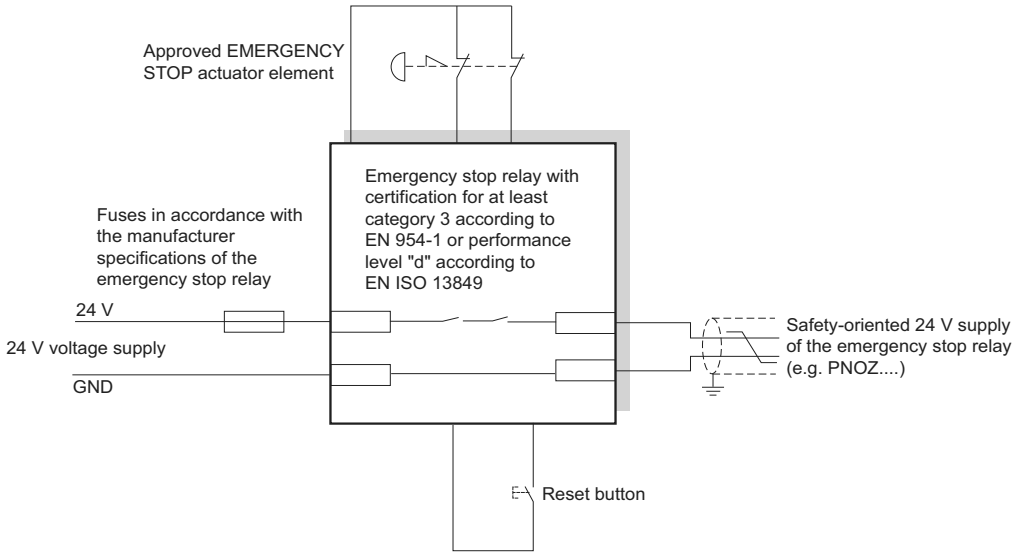
- If the requirements of the standard EN 954-1 are to be met, at least one approval for safety category 3 according to EN 954-1 must be available.
- If the requirements of the standard EN ISO 13849-1 are to be met, at least one approval for performance level "d" according to EN ISO 13849-1 must be available.
- If the DC 24 V link voltage is safely disconnected at the positive pole only, no test pulses must be applied to this pole in disconnected condition.
- Bipolar disconnection of the DC 24 V supply is permitted.
- The values specified for the safety switching devices must be adhered to when designing the circuit.
- The switching capacity of the emergency stop relay must correspond at least to the maximum permitted limited output current of the DC 24 V voltage supply. **Observe the manufacturer's instructions of the emergency stop relay concerning the permitted contact load and required fusing for emergency stop relays. If the manufacturer provides no specific information on this issue, the contacts must be protected with 0.6 times the nominal value of the maximum contact rating specified by the manufacturer.**
- The controller must be designed and connected in such a way that resetting the control unit itself will not lead to a restart. A restart may only be carried out after an additional reset of the controller.

3.4.1 "Emergency stop relay" sample circuit

The following figure shows the basic interface of an external emergency stop relay (according to the before mentioned requirements) to MOVITRAC® B.

The information in the respective manufacturer's data sheets must be observed for connection.

1-pole disconnection of the 24 V supply voltage:



3.5 Startup requirements

- Startup must be documented and the functionality of the safety functions proven.
- Startup checks of the disconnecting device and the correct wiring must be performed and documented for MOVITRAC® B with safe disconnection of the drive according to stop category 0 or 1 of EN 60204-1, fail-safe protection against restart according to EN 1037 and compliance with safety category 3 according to EN 954-1 or performance level "d" according to EN ISO 13849-1.
- At startup, the safety-related 24 V control voltage must be included in the functional test.

3.6 Operation requirements

- Operation is only allowed within the limits specified in the data sheets. This applies both to the external emergency stop relay as well as MOVITRAC® B.
- The safety functions must be checked at regular intervals to ensure perfect working order. The period of time between the tests should be specified in accordance with the risk analysis.

4 Technical Data

X17 safety input, terminal 4

Voltage / Cross-Section / Time		Min.	Type.	Max.	Unit
Safety oriented 24 V supply voltage		19.2	24	30	DC V
Power consumption (size / capacity)	Size 0 / 27 µF Size 1 / 270 µF Size 2/2S / 270 µF Size 3 / 270 µF Size 4 / 270 µF Size 5 / 270 µF			3 5 6 7.5 8 10	
Cable cross-section of safety-oriented 24 V supply voltage		0.75		1.5	mm^2
Time between disconnection of the safety-oriented 24 V supply voltage at MOVITRAC® B until the disconnection of the pulse pattern at output stage $t_{switch-off}$	Size 0 Size 1 ... Size 5			20 100	ms

5 Connection Variants

Refer to the publication "Safe Disconnection for MOVITRAC® B – Applications" for examples of approved connection variants of units listed in the section "Approved Units" for safe disconnection of the drive according to stop category 0 or 1 of EN 60204-1 and fail-safe protection against restart according to EN 1037 and fulfillment of the safety category according to EN 954-1 or performance level "d" of EN ISO 13849-1. The publication "Safe Disconnection for MOVITRAC® B – Applications" is constantly being supplemented by possible applications. The publication includes checklists, which offer additional assistance in project planning and installation as well as operating MOVITRAC® B drives in safety-oriented applications. It is essential that you comply with the publications listed in the section "Safety and warning instructions" for all the connection variants listed in the publication "Safe Disconnection for MOVITRAC® B – Applications".

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How we're driving the world

With people who think fast and develop the future with you.

With a worldwide service network that is always close at hand.

With drives and controls that automatically improve your productivity.

With comprehensive knowledge in virtually every branch of industry today.

With uncompromising quality that reduces the cost and complexity of daily operations.

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With a global presence that offers responsive and reliable solutions. Anywhere.

With innovative technology that solves tomorrow's problems today.

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SEW-EURODRIVE GmbH & Co KG
P.O. Box 3023 · D-76642 Bruchsal / Germany
Phone +49 7251 75-0 · Fax +49 7251 75-1970
sew@sew-eurodrive.com

→ **www.sew-eurodrive.com**