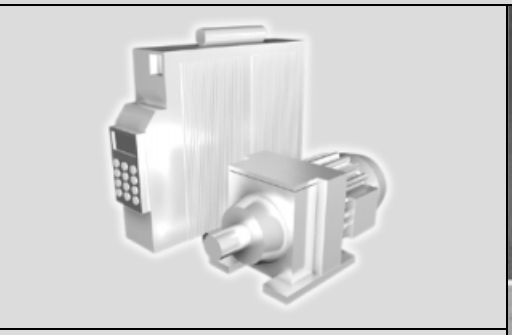
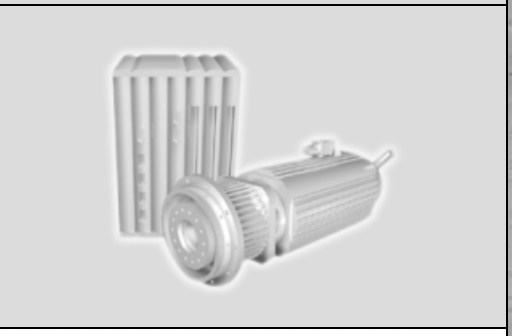
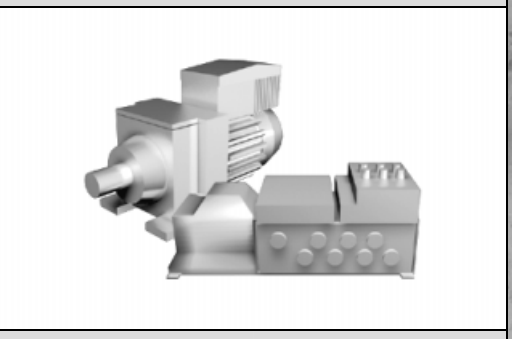
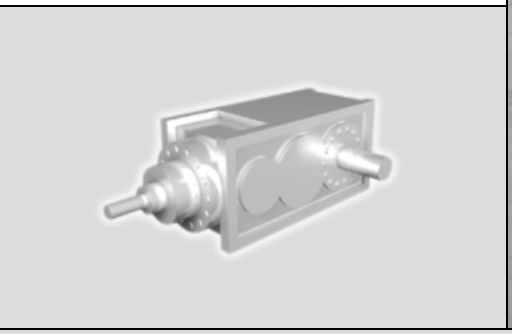
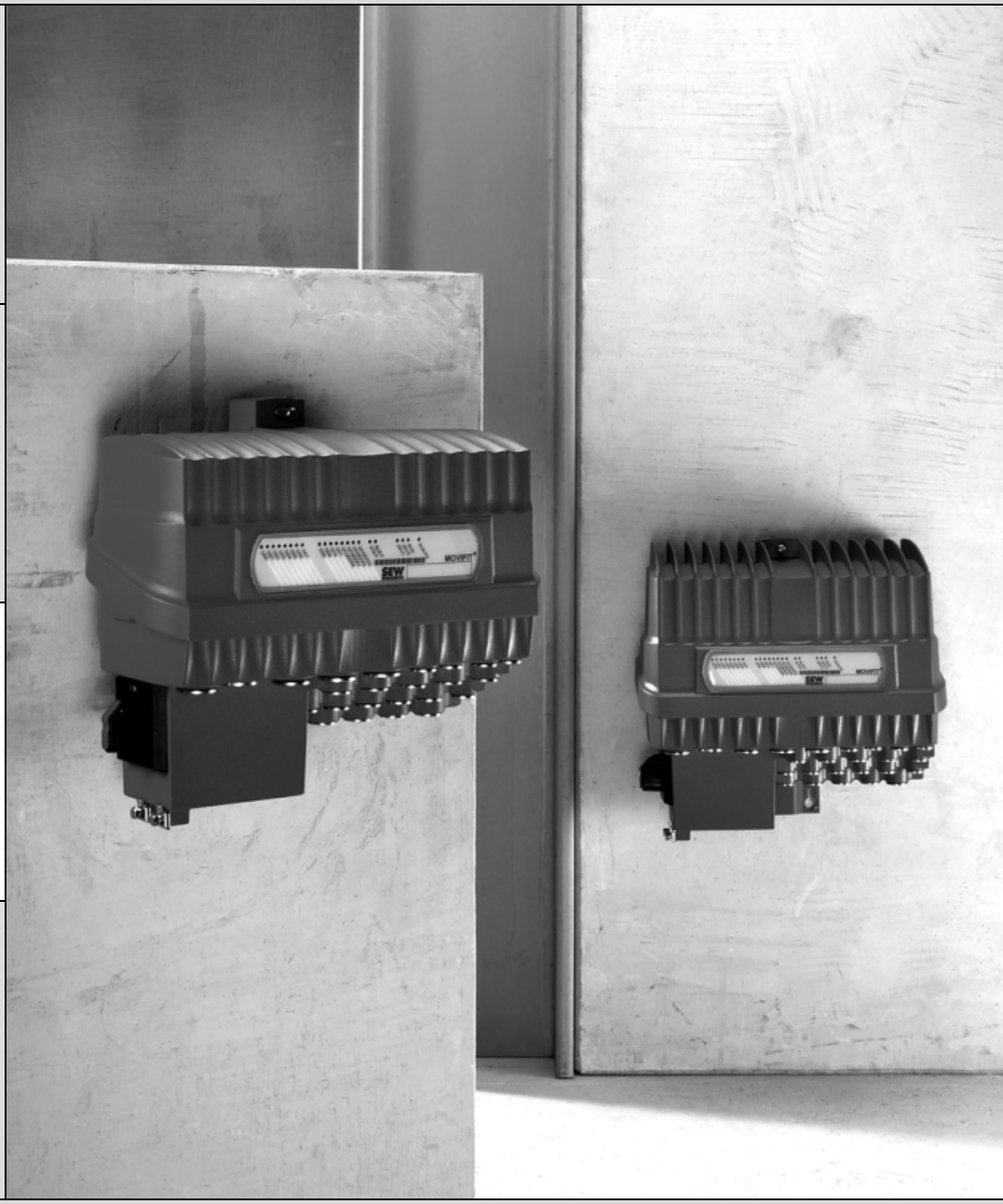
SEW EURODRIVE







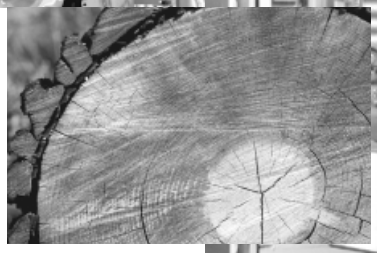




Safe Disconnection for MOVIFIT®

Edition 05/2007
11567015 / EN

Manual



SEW
EURODRIVE

1 General Information

1.1 Structure of the safety notes

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

Symbol	⚠ SIGNAL WORD
	Nature and source of hazard Possible consequence(s) if disregarded. • Measure(s) to avoid the hazard.

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

1.2 Right to claim under warranty

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

Make sure that the operating instructions are legible and available to persons responsible for the plant and its operation, as well as to persons who work independently on the unit.

1.3 Exclusion of liability

You must comply with the information contained in these operating instructions to ensure safe operation of MOVIFIT® and MOVIMOT® drives and in order to achieve the specified product properties and performance capacities. 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, any liability for defects is excluded.

1.4 Applicable documents

This document contains safety-oriented amendments and conditions for operation of MOVIFIT®-FC and MOVIFIT®-MC, with safe stopping of the drive according to stop category 0 or 1 according to EN 60204-1, fail-safe protection against restart according to EN 1037, fulfillment of safety category 3 according to EN 954-1, and use in performance level "d" applications according to EN ISO 13849-1.

It also contains a description of the safety-oriented PROFIsafe option S11 with the corresponding safety-relevant conditions for use in safety-oriented applications up to SIL3 according to EN 61508, safety category 4 according to EN 954-1 and performance level "e" according to EN ISO 13849-1.

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

2 Safety Concept

2.1 MOVIFIT®-MC safety concept

2.1.1 Description of the functions

The MC version of the MOVIFIT® acts as a power distributor and communication interface for controlling up to three MOVIMOT® drives. It features the option of enabling connection of an external emergency stop relay (or a higher-level safety control system). Whenever a connected emergency stop device (e.g. emergency stop button with latching function) is activated, this device disconnects the 24 V voltage supply that is required for generating the rotating field for the connected MOVIMOT® drives.

The 24V_P voltage supply (safety-oriented 24 V voltage supply) is connected to terminal X29 in the ABOX and fed to the EBOX via a plug strip. The EBOX houses electronic components, such as a short circuit protector, voltage monitor, RS485 transceiver and coupler. The safety-oriented 24V_P voltage supply is fed to the entrance to the EBOX via a polarity protection diode. Using the safety-oriented 24 V, a switch-mode power supply (SNT) generates 5 V voltage for the RS485 transceiver and the coupler. A short-circuit protector at the positive pole of the safety-oriented 24 V protects the tracks in the MOVIFIT® and the hybrid cables connected to the MOVIFIT®. Inside the ABOX, the safety-oriented 24V voltage is distributed to terminal strips X71, X81 and X91 or plug connectors X7, X8 and X9. These terminal strips or plug connectors are for connecting the respective MOVIMOT® drive, to which the corresponding RS+, RS- signals and L1, L2, L3 power cables are led.

Terminal strips X71, X81, X91 and plug connectors X7, X8 and X9 are connected to the MOVIMOT® drives via SEW hybrid cables. The connected MOVIMOT® drives are certified drive units featuring the "Safe Stop" safety function according to EN 954-1 category 3 which, in the event of the 24 V supply voltage being deactivated, switches off all active elements that generate pulse patterns at the inverter output.

Using a suitable external circuit via a safety control with

- approval to at least EN 954-1 category 3
- disconnection to at least to EN 954-1 category 3

makes MOVIFIT®-MC with safe disconnection to stop category 0 or 1 according to EN 60204-1 suitable for fail-safe protection against restart according to EN 1037 and fulfillment of safety category 3 to EN 954-1.

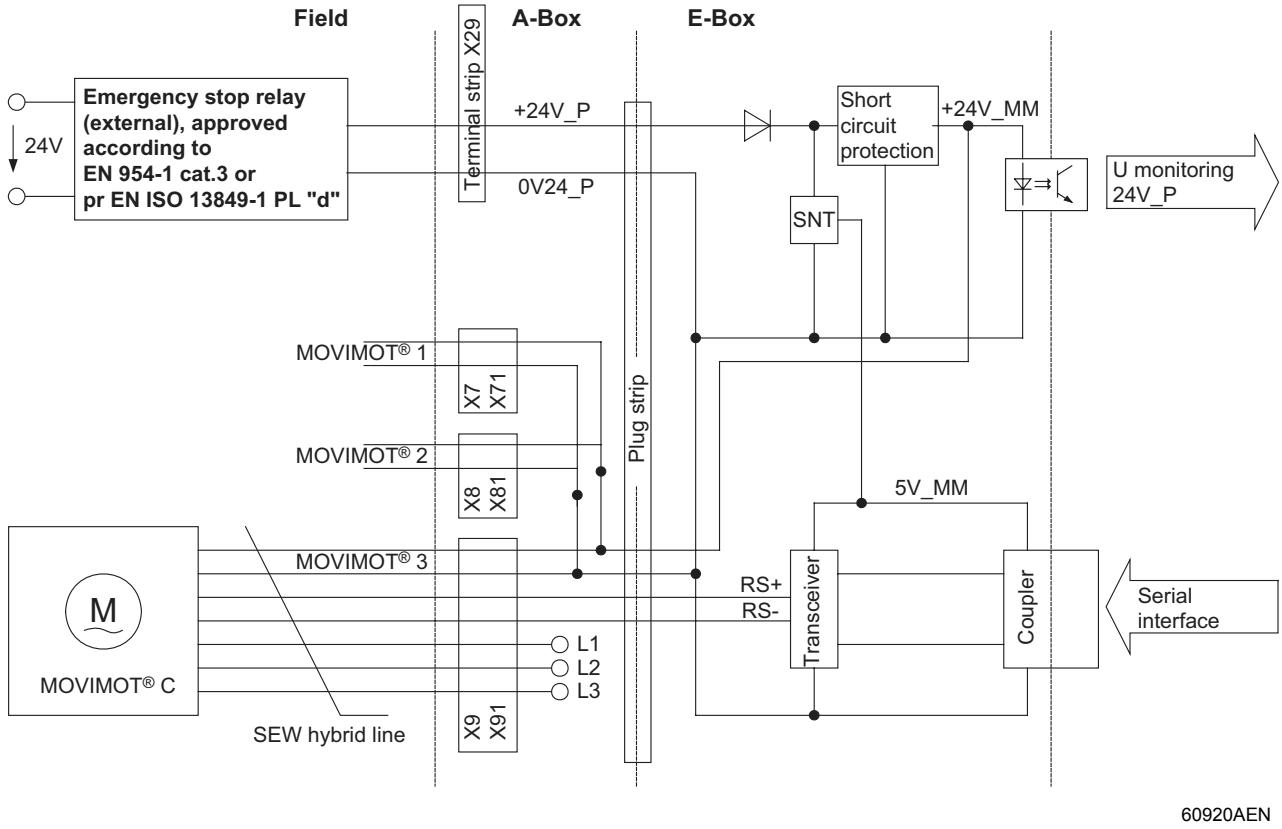
Using a suitable external circuit via a safety control with

- approval to at least EN ISO 13849-1 PL d
- disconnection to at least EN ISO 13849-1 PL d,

enables operation of MOVIFIT®-MC 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.

2.1.2 MOVIFIT®-MC block circuit diagram

The block circuit diagram below shows the MOVIFIT®-MC safety concept.



2.1.3 Restrictions

- Important: The safety concept is suitable for performing mechanical work on system/machine components only.
- Important: A system/machine-specific risk analysis must at all costs be carried out by the system/machine manufacturer and be observed when using the MOVIFIT®-MC.

⚠ DANGER

If the safety-oriented 24 V voltage is disconnected, MOVIFIT®-MC remains connected to the mains voltage.

Severe or fatal injuries from electric shock.

- If work is carried out on the electrical parts of the drive system, the drive system must be disconnected from the supply voltage using a suitable external disconnecting device.

2.2 Safety concept for MOVIFIT®-FC frequency inverters

2.2.1 Description of the functions

The FC version of MOVIFIT® acts as a power distributor and communication interface with an integrated frequency inverter with a range of 0.37 to 4 kW (0.50 to 5 hp). It is distinguished by the option of enabling connection of an external emergency stop relay (or a higher-level safety control system). Whenever a connected emergency stop device (e.g. emergency stop button with latching function) is connected and activated, this device disconnects the 24 V voltage supply that is required to generate the rotating field at the connected inverter output.

The 24V_P voltage supply (safety-oriented 24 V voltage supply) is connected to terminal X29 in the ABOX and is fed to the control electronics via a plug strip, and to the power section via the direct connector. The control electronics and the power section are housed in the EBOX. The safety-oriented 24V_P voltage supply is fed to the entrance to the EBOX via a polarity protection diode. A switch-mode power supply ("SNT Safety") generates 5 V voltage from the safety-oriented 24 V for the computer as well as the supply voltages for the output stage control.

The supply voltages and motor voltages are connected to a terminal strip in the ABOX and fed directly to the power section via a power connector.

The pulse patterns generated in the computer are formatted in the relevant control and relayed to the circuit breaker. If the supply voltages for the controls are switched off, no pulse patterns can be generated at the inverter output.

Disconnecting in the manner ensures that all active elements required to generate a pulse pattern at the inverter output are switched off.

Using a suitable external circuit via a safety control with

- approval to at least EN 954-1 category 3
- disconnection to at least EN 954-1 category 3

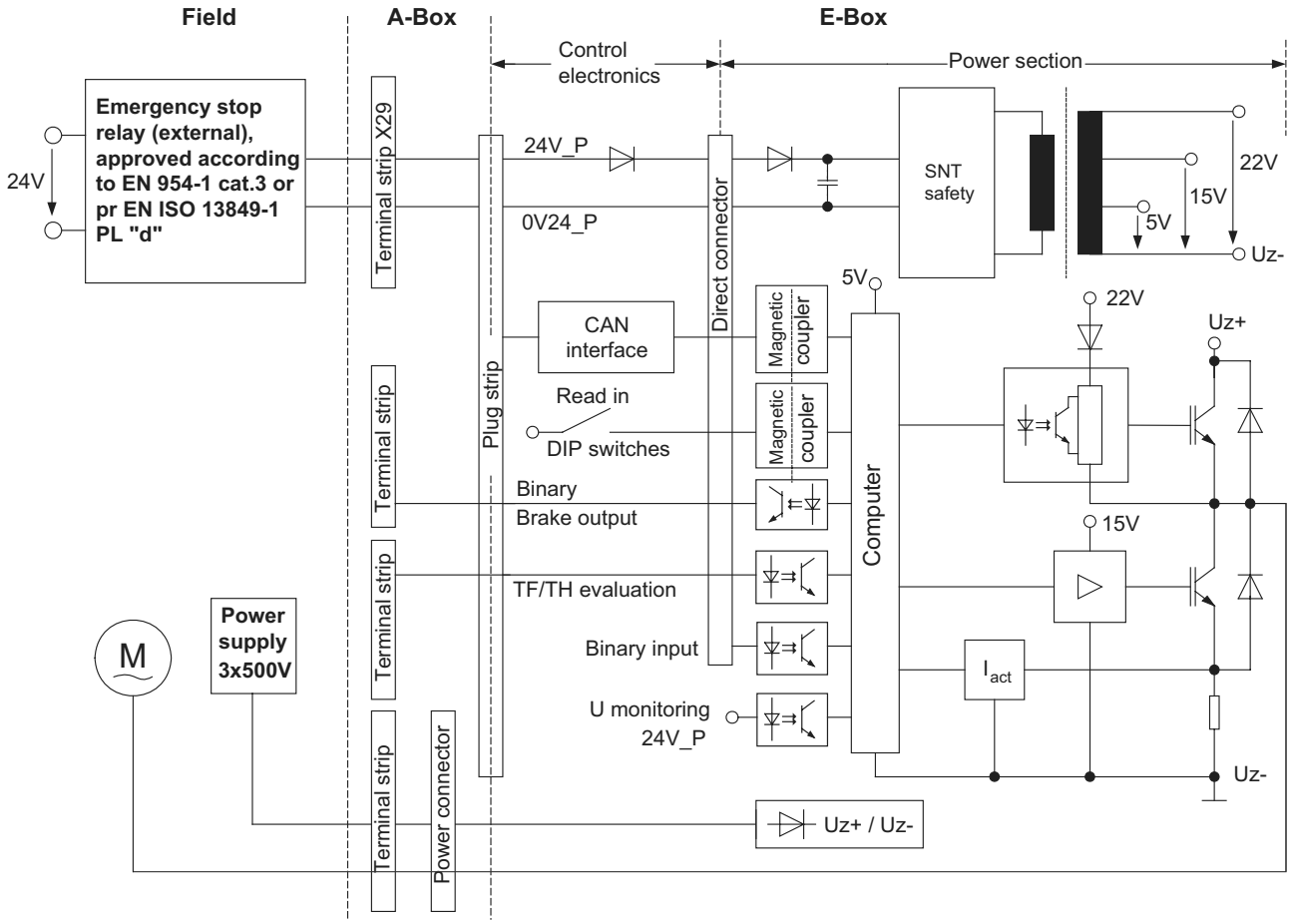
enables operation of MOVIFIT®-FC with safe disconnection to stop category 0 or 1 according to EN 60204-1, fail-safe protection against restart according to EN 1037 and fulfillment of safety category 3 to EN 954-1.

Using a suitable external circuit via a safety control with

- approval to at least EN ISO 13849-1 PL d,
- disconnection to at least EN ISO 13849-1 PL d,

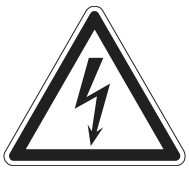
enables operation of MOVIFIT®-FC with safe disconnection according to stop category 0 or 1 to EN 60204-1, fail-safe protection against restart according to EN 1037 and fulfillment of performance level "d" to EN ISO 13849-1.

2.2.2 MOVIFIT®-FC block circuit diagram



2.2.3 Restrictions

- Important: The safety concept is only suitable for performing mechanical work on system/machine components.
- Important: A system/machine-specific risk analysis must at all costs be carried out by the system/machine manufacturer and be observed when using MOVIFIT®-FC.



⚠ DANGER

If the safety-oriented 24 V voltage is disconnected, MOVIFIT®-FC remains connected to the mains voltage.

Severe or fatal injuries from electric shock.

- If work is carried out on the electrical part of the drive system, the drive system must be disconnected from the supply voltage using a suitable external disconnecting device.

2.3 Safety concept for PROFIsafe option S11

- PROFIsafe option S11 is an integrated safety-oriented electronics component with failsafe inputs and outputs (F-DI, F-DO). The safety concept of this component is based on a safe status for all safety-oriented process variables. For PROFIsafe option S11 this value is "0", for all inputs F-DI and outputs F-DO.
- The 2-channel redundant system structure of the safety component ensures that, with suitable monitoring mechanisms, requirements SIL3 according to EN 61508, category 4 according to EN 954-1 and performance level "e" according to EN ISO 13849-1 are fulfilled. When the system detects a fault, the system reacts by reverting to a safe status. This makes the safety function available in the form of failsafe inputs and outputs connected to a higher-level safety control.
- The safe output F-DO_STO allows the 24 V supply to the inverter to be disconnected, which results in safe disconnection. Observe the above-described safety concept of MOVIFIT®-MC and MOVIFIT®-FC inverters and all requirements and installation instructions in this publication.

WARNING

As regards safe disconnection, the safety category of the basic MOVIFIT® unit applies to the entire system MOVIFIT®-MC/MOVIMOT® with PROFIsafe option S11 and MOVIFIT®-FC with PROFIsafe option S11.

Severe or fatal injuries.

- MOVIFIT®-MC/MOVIMOT® may only be used with applications up to category 3 according to EN 954-1.
- MOVIFIT®-FC may only be used in applications up to category 3 according to EN 954-1 and performance level "d" according to EN ISO 13849-1.

3 Safety Requirements

The following requirements are mandatory for installation and operation of MOVIFIT® in safety-oriented applications according to the safety categories mentioned above. The requirements are divided into the following sections:

- Approved devices
- Installation requirements
- Requirements for external safety control (binary control of safe disconnection)
- Requirements for external sensors and actuators (in combination with PROFIsafe option S11)
- Startup requirements
- Operation requirements

3.1 Notes on stop categories

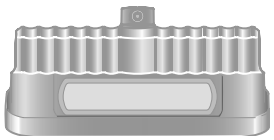
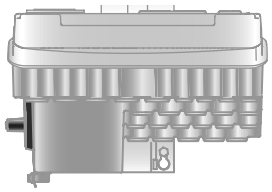
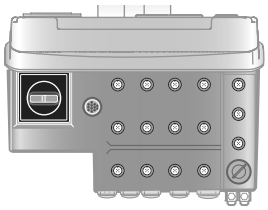
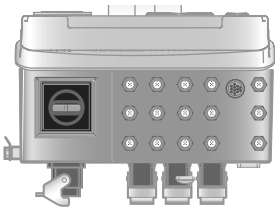
	NOTES
	• Stop category 0 permits disconnection of the safety 24 V voltage supply regardless of the setpoints. • Observe the following procedure for stop category 1: – Decelerate the drive using an appropriate brake ramp specified by the setpoint. – Disconnect the safety-oriented 24 V voltage supply.

	WARNING
	If, in the case of excessive temperature, temperature sensors and automatic disconnection are activated, note that the motor restarts automatically once it has cooled down. Severe or fatal injuries. • If this causes hazards or dangers, additional measures must be taken to prevent access to the hazardous areas associated with the drive.

3.2 Approved devices

3.2.1 MOVIFIT®-MC

The following devices are permitted for use in applications with safe disconnection of the drive according to stop category 0 or 1 to EN 60204-1, fail-safe protection against restart to EN 1037, and fulfillment of safety category 3 to EN 954-1 and performance level "d" to EN ISO 13849-1.

MOVIFIT®-MC			
EBOX	MTM1.A000-P1.A-00 MTM1.A000-E..A-00 MTM1.A000-D1.A-00 		
ABOX	MTA1.A-503-S011-M01-00 MTA1.A-503-S013-M01-00 MTA1.A-503-S012-M01-00 Connection box with terminals and cable glands	MTA11A-503-S111-M01-00 MTA11A-503-S213-M01-00 MTA11A-503-S112-M01-00 Hybrid connection box with terminals and M12 plug connector	MTA11A-503-H111-M01-00 MTA11A-503-H213-M01-00 MTA11A-503-H112-M01-00 HanModular® connection box with HanModular® plug connector and M12 plug connectors
			

NOTES

It is essential that the following are observed for the connection box with terminals and cable glands (MTA1.A-503-S01.-M01-00):

- Certification is only valid as of status 11 of the wiring board. If you use a wiring board with another status, consult SEW-EURODRIVE.
- The status of the wiring board is indicated in the first status field of the ABOX nameplate:

Status: 11 11 -- 10 -- 10 10 -- --

Status of the wiring board

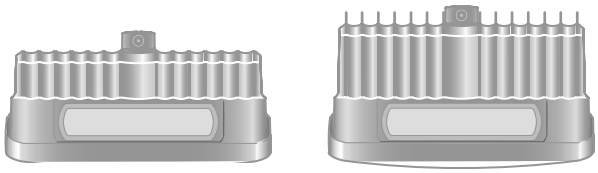
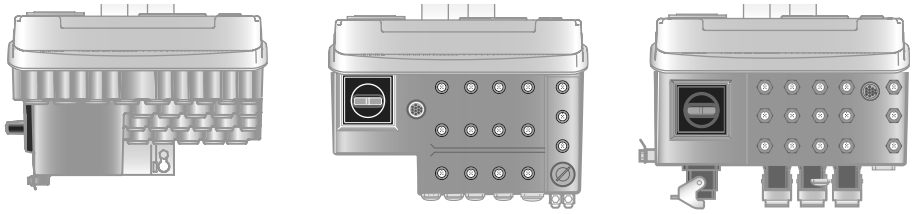
- An example of a nameplate is shown in the MOVIFIT®-MC operating instructions.

NOTE

Important: This certification only applies to the safe disconnection of MOVIFIT®-MC in combination with the safety- oriented MM..C-503-00 drive system and its requirements.

3.2.2 MOVIFIT®-FC

The following devices are permitted for use in applications with safe disconnection of the drive according to stop category 0 or 1 in accordance with EN 60204-1, fail-safe protection against restart according to EN 1037, and fulfillment of safety category 3 in accordance with EN 954-1 and performance level "d" according to EN ISO 13849-1.

<table>
<tr><th colspan="4">MOVIFIT®-FC</th></tr>
<tr><td>EBOX</td><td colspan="3">MTF1.A...-503-P1.A-00
MTF1.A...-503-E..A-00
MTF1.A...-503-D1.A-00
  </td></tr>
<tr><td rowspan="2">ABOX</td><td>MTA1.A-503-S021-...-00
MTA1.A-503-S023-...-00
MTA1.A-503-S022-...-00
Connection box with terminals and cable glands</td><td>MTA11A-503-S121-D01-00
MTA11A-503-S223-D01-00
MTA11A-503-S122-D01-00
Hybrid connection box with terminals and M12 plug connector</td><td>MTA11A-503-H121-D01-00
MTA11A-503-H223-D01-00
MTA11A-503-H122-D01-00
HanModular® connection box with HanModular® plug connector and M12 plug connectors</td></tr>
<tr><td colspan="3">  </td></tr>
</table>

NOTES

It is essential that the following points are observed for the connection box with terminals and cable glands (MTA1.A-503-S02.-...-00):

- Certification is only valid as of status 11 of the wiring board. If you use a wiring board with another status, consult SEW-EURODRIVE.
- The status of the wiring board is indicated in the first status field of the ABOX nameplate:

Status: 11 11 -- 10 -- 10 10 -- --

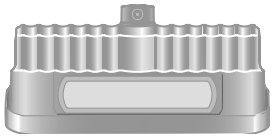
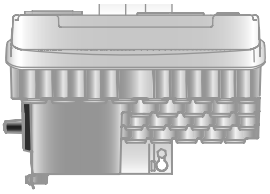
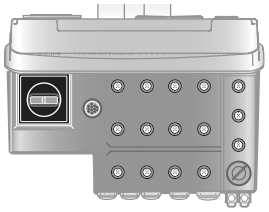
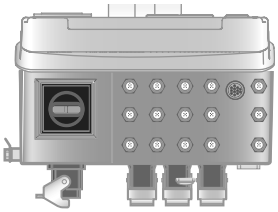
Status of the wiring board

- An example of a nameplate is shown in the MOVIFIT®-FC operating instructions.

3.2.3 MOVIFIT® with PROFIsafe option S11

PROFIsafe option S11 is permitted for use in safety-oriented applications up to SIL3 according to EN 61508, safety category 4 according to EN 954-1, and performance level "e" according to EN ISO 13849-1.

MOVIFIT®-MC with PROFIsafe option S11

MOVIFIT®-MC with PROFIsafe option S11			
EBOX	MTM1.A000-P1.A-00/S11 MTM1.A000-E2.A-00/S11		
			
ABOX	MTA1.A-503-S011-M01-00 MTA1.A-503-S013-M01-00 Connection box with terminals and cable glands	MTA11A-503-S111-M01-00 MTA11A-503-S213-M01-00 Hybrid connection box with terminals and M12 plug connector	MTA11A-503-H111-M01-00 MTA11A-503-H213-M01-00 HanModular® connection box with HanModular® plug connector and M12 plug connectors
			

NOTES

It is essential that the following points are observed for the connection box with terminals and cable glands (MTA1.A-503-S011-M01-00, MTA1.A-503-S013-M01-00):

- Certification is only valid as of status 11 of the wiring board. If you use a wiring board with another status, consult SEW-EURODRIVE.
- The status of the wiring board is indicated in the first status field of the ABOX nameplate:

Status: 11 11 -- 10 -- 10 10 -- --

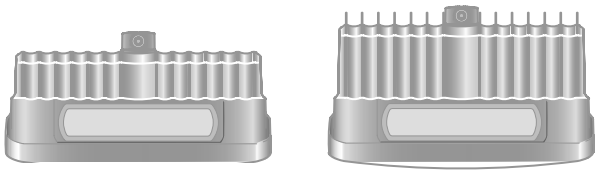
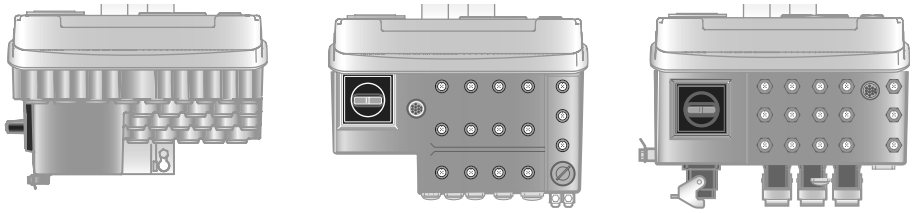
Status of the wiring board

- An example of a nameplate is shown in the MOVIFIT®-MC operating instructions.

NOTE

Important: The certification only applies to the safety-oriented PROFIsafe option S11. The safety level of the drive function depends on the MOVIFIT® basic unit used.

MOVIFIT®-FC with PROFIsafe option S11

MOVIFIT®-FC with PROFIsafe option S11			
EBOX	MTF1.A...-503-P1.A-00/S11 MTF1.A...-503-E2.A-00/S11		
			
ABOX	MTA1.A-503-S021-...-00 MTA1.A-503-S023-...-00 Connection box with terminals and cable glands	MTA11A-503-S121-D01-00 MTA11A-503-S223-D01-00 Hybrid connection box with terminals and M12 plug connector	MTA11A-503-H121-D01-00 MTA11A-503-H223-D01-00 HanModular® connection box with HanModular® plug connector and M12 plug connectors
			

NOTES

It is essential that the following points are observed for the connection box with terminals and cable glands (MTA1.A-503-S021-...-00, MTA1.A-503-S023-...-00):

- Certification is only valid as of status 11 of the wiring board. If you use a wiring board with another status, consult SEW-EURODRIVE.
- The status of the wiring board is indicated in the first status field of the ABOX nameplate:

Status: 11 11 -- 10 -- 10 10 -- --

Status of the wiring board

- An example of a nameplate is shown in the MOVIFIT®-FC operating instructions.

NOTE

Important: The certification only applies to the safety-oriented PROFIsafe option S11. The safety level of the drive function depends on the MOVIFIT® basic unit used.

3.3 Installation requirements

- The lines from the safety control system (or the safety-oriented tripping device) and MOVIFIT® terminal X29 are designated as safety-oriented control lines.
- Power lines and safety-oriented control lines have to be installed in separate cables.
- The length of the line from the safety control system to the MOVIFIT® device may not exceed 100 m (328 ft).
- Only original SEW hybrid cables may be used to connect MOVIFIT®-MC and MOVIMOT®, or MOVIFIT®-FC and the motor.
- The wiring technology used must comply with EN 60204-1.
- The safety-oriented control lines 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.
  - Inside an electrical installation space: individual conductors can be routed. Observe the respective regulations governing the application.
- It must be ensured that parasitic voltages cannot be generated in the safety-oriented control lines.
- When designing the safety circuits, always observe the values specified for safety components.
- Observe the notes on EMC compliant cabling in the MOVIFIT® and MOVIMOT® operating instructions.
- Only use voltage sources with safe disconnection (SELF/PELV) in accordance with VDE 0100. According to EN 60950-1, the voltage between the outputs or between any output and grounded parts may not exceed DC 60 V for longer than 0.2 s after only one fault. The maximum DC voltage may not exceed 120 V.
- Observe MOVIFIT® and MOVIMOT® technical specifications.

3.4 Requirements for external safety control

	NOTE
	The following requirements apply to binary control of safe disconnection.

- In order to meet EN 954-1 requirements, at least one approval for safety category 3 according to EN 954-1 must be supplied, and disconnection of the safety-oriented control voltage must be designed at least for safety category 3 according to EN 954-1.
- In order to meet EN ISO 13849-1 requirements, at least one approval must be supplied for performance level "d" according to EN ISO 13849-1, and disconnection of the safety-oriented control voltage must be designed at least for performance level "d" according to EN ISO 13849-1.
- When designing the circuit, always observe the values specified for the controller.
- The switching capacity of the controller must correspond at least to the maximum permitted limited output current of the DC 24 V voltage supply. Observe the controller manufacturer's instructions concerning the permitted contact rating 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.
- Control devices with force guided contacts and latching function (according to EN 60947-5-1) must be used for triggering safety-oriented disconnection.
- The controller must feature an option for signaling cross fault detection and trigger recognition if the wiring is designed with crossfault monitoring.
- The controller must be designed and connected in such a way that merely resetting the control device will not lead to a restart. A restart may only take place after additional acknowledgement has been given.

3.5 Requirements for external sensors and actuators

	NOTE
	The following requirements apply to using the PROFIsafe option S11.

- The project planner and the operator of the system or machine are responsible for the choice and use of external sensors and actuators to connect to the failsafe inputs and outputs of PROFIsafe option S11.
- Observe that generally the largest part of the maximum number of permissible dangerous faults for the targeted safety category is caused by sensors and actuators.
- In order to meet the safety category and/or SIL class requirements you must use suitable and qualified sensors and actuators and observe the permissible wiring diagram connections as well as the notes in the section entitled "Connecting safety-oriented inputs and outputs" on page 34.
- With PROFIsafe option S11, you may only use sensors with contacts at the safe F-DIx inputs. F-SSx internal sensor voltage must supply the power.
- In order for the failsafe inputs to register the sensor signals correctly, the duration of a signal may not be less than 15 ms.

3.6 Startup requirements

- Startup must be documented and the functionality of the safety functions proven.
- Always carry out and document startup checks of the disconnecting device and the correct wiring for MOVIFIT® applications with safe drive disconnection according to stop category 0 or 1 to EN 60204-1, fail-safe protection against restart according to EN 1037 and fulfillment of safety category 3 according to EN 954-1 or performance level "d" to EN ISO 13849-1.
- At startup, signal detection of the safety-oriented control voltage must be included in the functional test.

3.7 Operation requirements

- Operation is only permitted within the limits specified in the data sheets. This applies to the external safety control as well as to MOVIFIT® and MOVIMOT®.
- 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 Hazard Caused by Drive Coasting

WARNING

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

Severe or fatal injuries

- If coasting to a halt causes hazards, depending on the application, additional protective measures (e.g. movable covers with closure) must be taken to cover the hazardous area until persons are no longer in danger. Alternatively, the drive must be equipped with a safety brake.
- The additional protective covers must be designed and integrated so that they meet the requirements determined in the risk analysis for the machine.
- After activating the stop command, access to the machine must remain blocked until the drive has reached a standstill. Alternatively, the access time to ensure that the resulting safety distance is maintained adequately must be determined.

5 Electrical Installation

5.1 Installation instructions

Important: In order to guarantee electrical safety and fault-free operation, you must observe the basic installation instructions as well as the notes in the MOVIFIT® operating instructions.

Providing the requirements in the section entitled "Safety Requirements" and the wiring diagrams and notes given below are observed,

- MOVIFIT®-MC and -FC can be used in applications with safe disconnection of the drive according to stop category 0 or 1 to EN 60204-1, fail-safe protection against restart to EN 1037 and fulfillment of safety category 3 according to EN 954-1 as well as performance level "d" according to EN ISO 13849-1
- PROFIsafe option S11 is permitted for use in safety-oriented applications up to SIL3 according to EN 61508, safety category 4 according to EN 954-1, and performance level "e" according to EN ISO 13849-1.

WARNING

Only the types of connection described in this publication may be used.

Severe or fatal injuries.

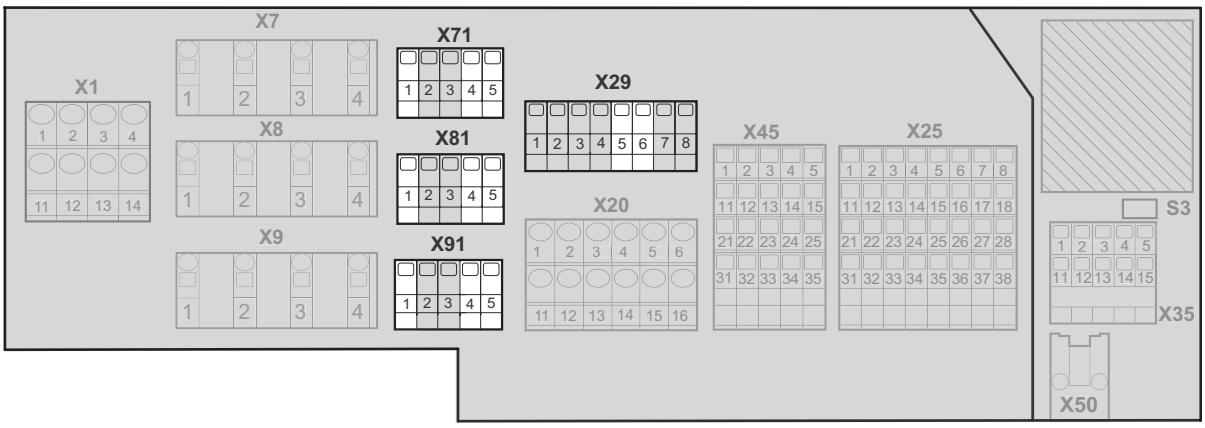
- Any different types of connection specified in other publications are not permissible.

5.2 Safe disconnection – MOVIFIT®-MC and -FC

5.2.1 MOVIFIT®-MC

Terminals relevant for safe disconnection

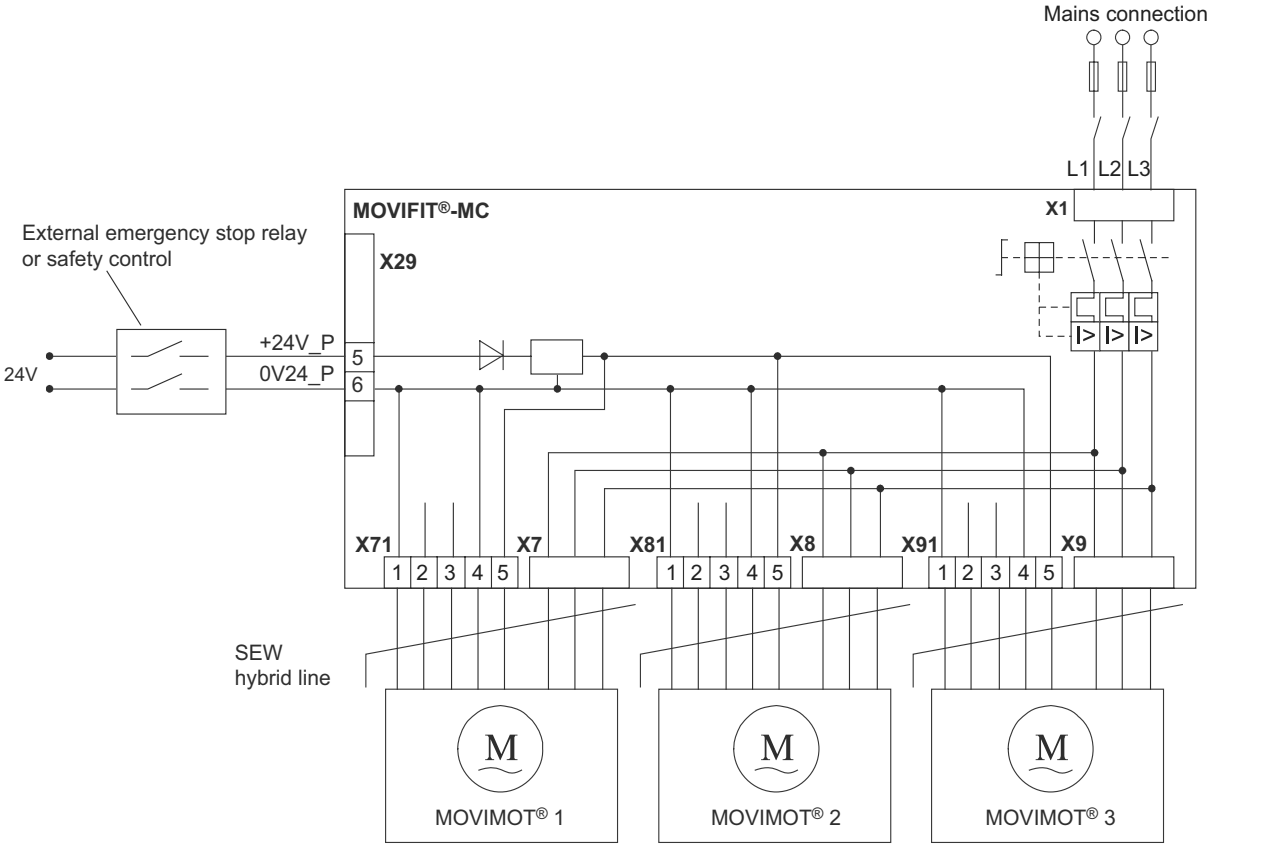
The following figure depicting the ABOX and "MTA...-S01.-...-00" terminals and cable glands shows the terminals relevant for safe disconnection of MOVIFIT®-MC:



60924AXX

Terminal strip	Name	Function
X29/5	**+24V_P**	Connection of safety-oriented 24 V supply voltage Connection of +24 V voltage for MOVIMOT®, supply
X29/6	**0V24V_P**	Connection of safety-oriented 24 V supply voltage Connection of 0V24 reference potential for MOVIMOT®, supply
X71/1, X71/4 **X81/1, X81/4** **X91/1, X91/4**	**0V24_MM**	Output for safety-oriented 24 V supply voltage Connection of 0V24 reference potential for MOVIMOT® 1...3
X71/5 **X81/5** **X91/5**	**+24V_MM**	Output of safety-oriented 24 V supply voltage Connection of +24 V supply voltage for MOVIMOT® 1...3

MOVIFIT®-MC wiring diagram for safe binary disconnection

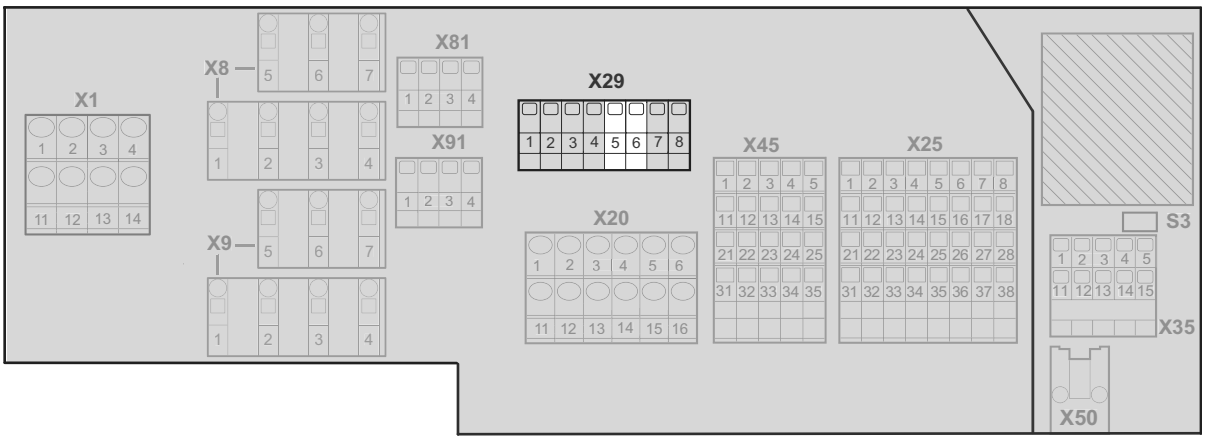


60927AEN

5.2.2 MOVIFIT®-FC

Terminals relevant for safe disconnection

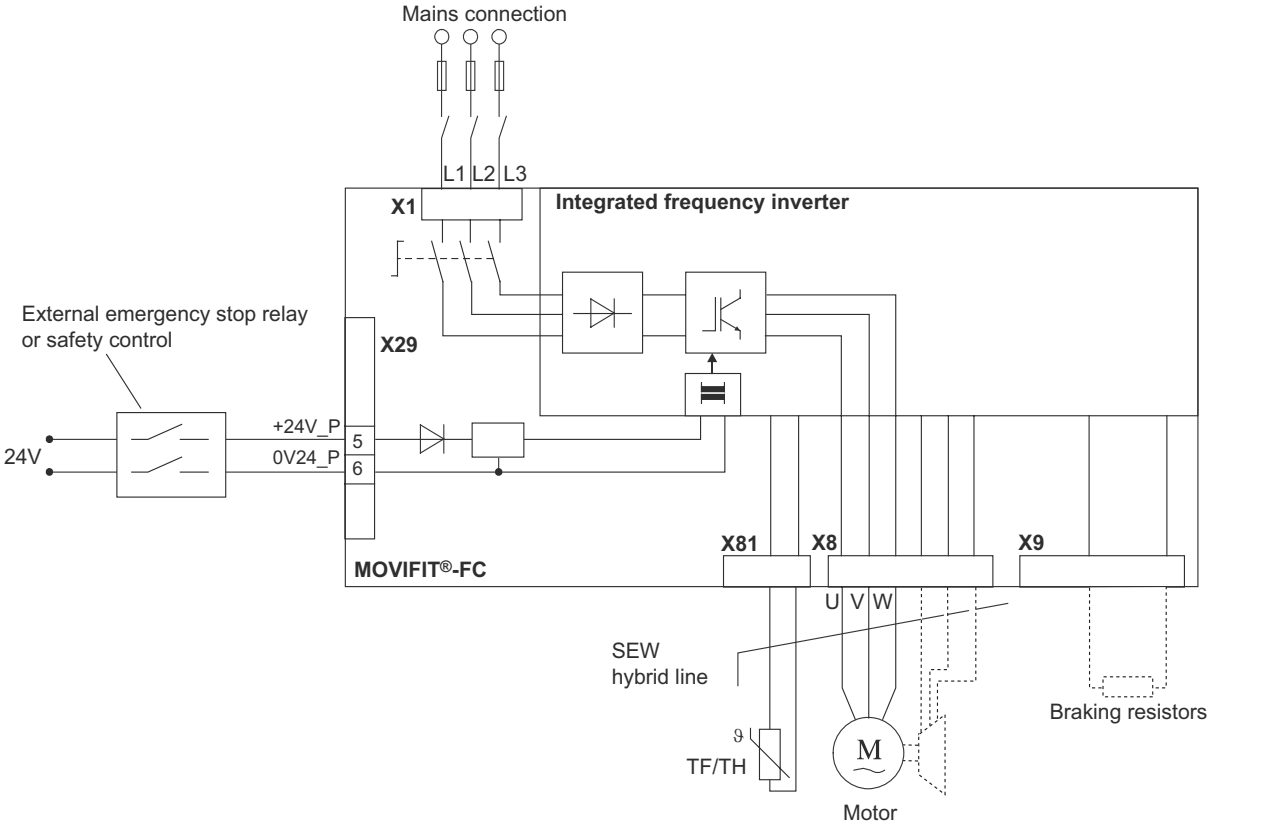
The following figure depicting the ABOX and "MTA...-S02.-...-00" terminals and cable glands shows the terminals relevant for safe disconnection of MOVIFIT®-FC:



60928axx

Terminal strip	Name	Function
X29/5	**+24V_P**	Connection of safety-oriented 24 V supply voltage +24 V supply for integrated frequency inverter, supply
X29/6	**0V24V_P**	Connection for safety-oriented 24 V supply voltage 0V24 reference potential for integrated frequency inverter, supply

MOVIFIT®-FC wiring diagram for safe binary disconnection



5.2.3 Group disconnection with MOVIFIT®-MC and -FC

Requirements

With group drives, a single emergency stop relay can provide a safety-oriented 24 V voltage supply for several MOVIFIT® units. The maximum possible number of units is determined by the maximum permitted contact rating of the emergency stop relay and the maximum permitted voltage drop of the DC 24 V supply for the MOVIFIT®.

Strictly observe other requirements and notes specified by the emergency stop relay manufacturer (such as protecting the output contacts from sticking or welding). Furthermore, when installing cables the basic requirements given in the section entitled "Safety Requirements" on page 11 apply.

For EMC reasons, the maximum length between the 24V_P connection (on MOVIFIT®, terminal X29) and the emergency stop relay is limited to a maximum of 100 m (328 ft).

Determining the maximum number of MOVIFIT® units for group disconnection

The number of MOVIFIT® units that can be connected with group disconnection is restricted by the following factors:

1) Switching capacity of the emergency stop relay

A fuse must be connected in front of the safety contacts according to the specifications of the emergency stop relay manufacturer to prevent the contacts from sticking or welding.

The project planner is responsible for observing and ensuring the correct switching capacity according to EN 60947-4-1 and EN 60947-5-1, and the correct contact fuse protection in accordance with the operating instructions of the emergency stop relay manufacturer.

2) Maximum permitted voltage drop in the 24 V voltage supply line

When configuring group drives, observe the respective cable lengths, cable cross-sections and the maximum currents which may occur for the safety-oriented 24 V supply voltage (24V_P). Use these factors to determine the voltage drops and compare them with the permissible input voltage range of the MOVIFIT® units.

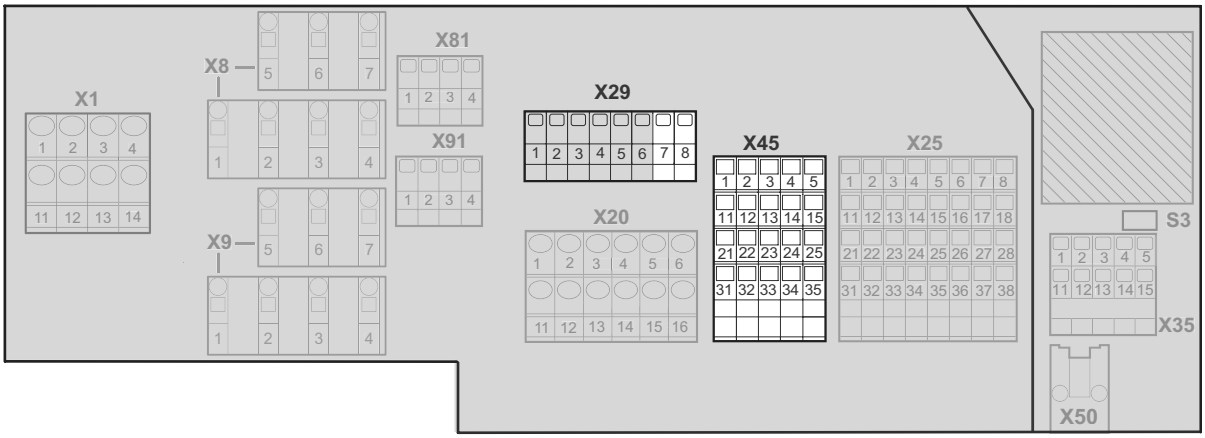
In the case of MOVIFIT®-MC units, you must also take the cable lengths connecting the MOVIMOT® units and their permissible input voltage range into account. The cross-section of the 24 V lines in the type B SEW hybrid cable is 0.75 mm^2.

A calculation based on the MOVIFIT® technical specifications must be performed separately for each group disconnection application.

5.3 PROFIsafe option S11

5.3.1 ABOX with terminals and cable glands

The following terminals relate to operating PROFIsafe option S11. The following figure depicts the MOVIFIT®-FC connector board:



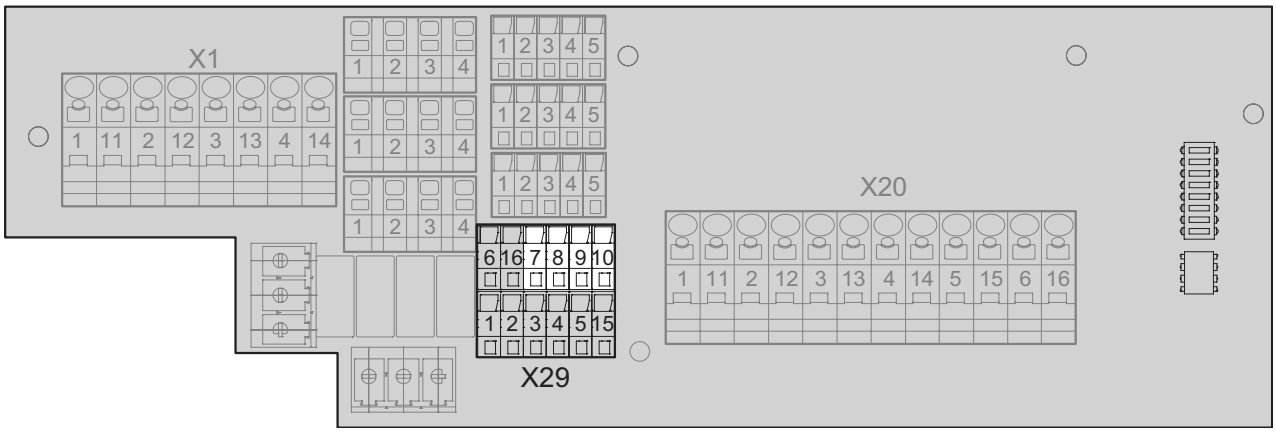
60933AXX

24 V distributor terminal (for distributing the supply voltage(s) to the MOVIMOT® units and the option card)			
No.		**Name**	**Function**
X29	**7**	+24V_O	+24 V supply for the option card, supply
	8	0V24_O	0V24 reference potential for the option card, supply

I/O terminal in combination with option card /S11			
No.		**Name**	**Function**
X45	**1**	F-DI00	Safety-oriented binary input F-DI00 (switching signal)
	2	F-DI02	Safety-oriented binary input F-DI02 (switching signal)
	3	F-DO00-P	Safety-oriented binary output F-DO00 (P switching signal)
	4	F-DO01_P	Safety-oriented binary output F-DO01 (P switching signal)
	5	F-DO_STO_P	Safety-oriented binary output F-DO_STO (P switching signal) for safe disconnection (STO)
	11	F-DI01	Safety-oriented binary input F-DI01 (switching signal)
	12	F-DI03	Safety-oriented binary input F-DI03 (switching signal)
	13	F-DO00 M	Safety-oriented binary output F-DO00 (M switching signal)
	14	F-DO01_M	Safety-oriented binary output F-DO01 (M switching signal)
	15	F-DO_STO_M	Safety-oriented binary output F-DO_STO (M switching signal) for safe disconnection (STO)
	21	F-SS0	+24V sensor supply for failsafe inputs F-DI00 and F-DI02
	22	F-SS0	+24V sensor supply for failsafe inputs F-DI00 and F-DI02
	23	F-SS1	+24V sensor supply for failsafe inputs F-DI01 and F-DI03
	24	F-SS1	+24V sensor supply for failsafe inputs F-DI01 and F-DI03
	25	F-SS1	+24V sensor supply for failsafe inputs F-DI01 and F-DI03
	31	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	32	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	33	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	34	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	35	0V24_O	OV24 reference potential for failsafe binary inputs/outputs

5.3.2 Hybrid connection box with terminals and M12 plug connector

Terminals The following terminals are relevant for operating PROFIsafe option S11. The following figure depicts the MOVIFIT®-MC connector board:

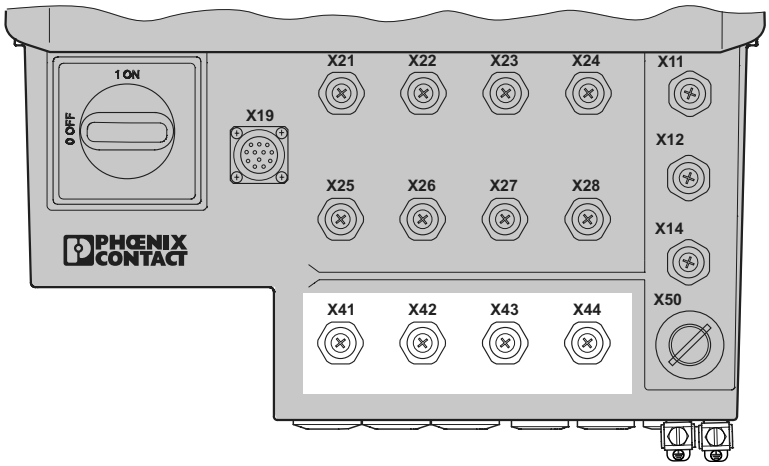


60934AXX

Distributor terminal 24 V (for distributing the supply voltage(s))			
No.		**Name**	**Function**
X29	**7**	+24V_O	+24 V supply for the option card, supply
	8	0V24_O	0V24 reference potential for the option card, supply
	9	F-DO_STO_P	Safety-oriented binary output F-DO_STO (P switching signal) for safe disconnection (STO)
	10	F-DO_STO_M	Safety-oriented binary output F-DO_STO (M switching signal) for safe disconnection (STO)

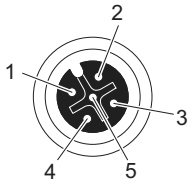
M12 connection sockets

The following M12 connection sockets are relevant for operating the PROFIsafe option S11:



60935AXX

The following figure depicts M12 plug connectors X41 to X44 (standard coding, female) for connecting optional I/Os when using PROFIsafe option S11:

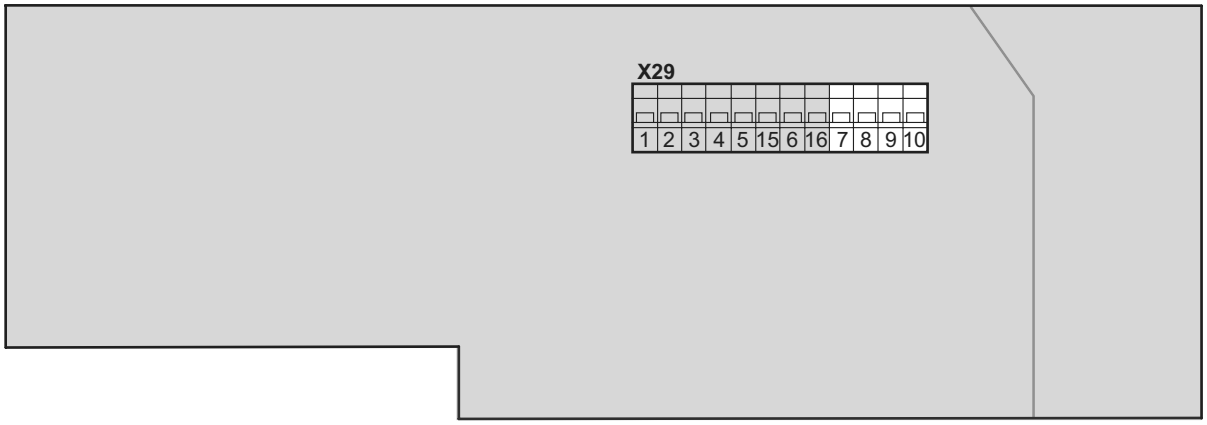


60569AXX

M12 plug connectors X41 to X44 for connecting optional I/Os when using PROFIsafe option S11			
Connector			
X41	**Pin 1**	F-SS0	+24 V sensor supply for failsafe inputs F-DI00 and F-DI02
	Pin 2	F-DI01	Safety-oriented binary input F-DI01 (switching signal)
	Pin 3	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	Pin 4	F-DI00	Safety-oriented binary input F-DI00 (switching signal)
	Pin 5	F-SS1	+24 V sensor supply for failsafe inputs F-DI01 and F-DI03
X42	**Pin 1**	F-SS0	+24 V sensor supply for failsafe inputs F-DI00 and F-DI02
	Pin 2	F-DI03	Safety-oriented binary input F-DI03 (switching signal)
	Pin 3	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	Pin 4	F-DI02	Safety-oriented binary input F-DI02 (switching signal)
	Pin 5	F-SS1	+24 V sensor supply for failsafe inputs F-DI01 and F-DI03
X43	**Pin 1**	Reserved	Reserved
	Pin 2	F-DO00_M	Safety-oriented binary output F-DO00 (M switching signal)
	Pin 3	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	Pin 4	F-DO00_P	Safety-oriented binary output F-DO00 (P switching signal)
	Pin 5	Reserved	Reserved
X44	**Pin 1**	Reserved	Reserved
	Pin 2	F-DO01_M	Safety-oriented binary output F-DO01 (M switching signal)
	Pin 3	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	Pin 4	F-DO01_P	Safety-oriented binary output F-DO01 (P switching signal)
	Pin 5	Reserved	Reserved

5.3.3 HanModular® connection box with HanModular® plug connector and M12 plug connector

Terminals The following terminals are relevant for operating the PROFIsafe option S11:

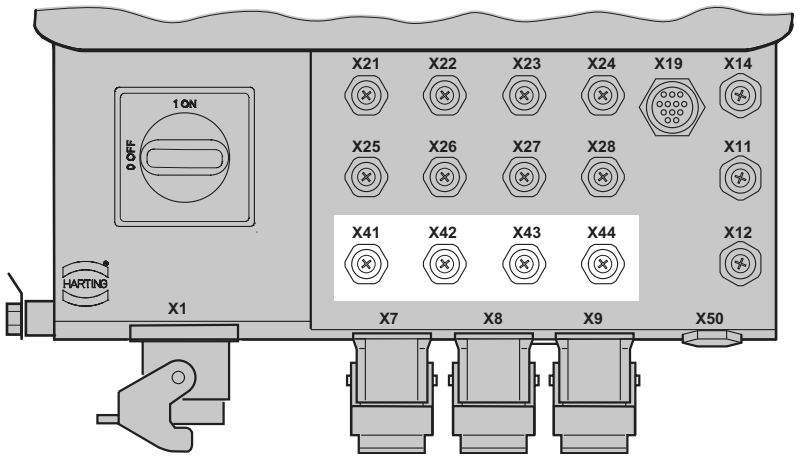


60936AXX

24 V distributor terminal (for distributing the supply voltage(s) to the MOVIMOT® units and the option card)			
No.		**Name**	**Function**
X29	**7**	+24V_O	+24 V supply for the option card, supply
	8	0V24_O	0V24 reference potential for the option card, supply
	9	F-DO_STO_P	Safety-oriented binary output F-DO_STO (P switching signal) for safe disconnection (STO)
	10	F-DO_STO_M	Safety-oriented binary output F-DO_STO (M switching signal) for safe disconnection (STO)

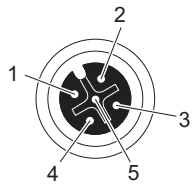
M12 connection sockets

The following M12 connection sockets are relevant for operating the PROFIsafe option S11:



60938AXX

The following figure depicts M12 plug connectors X41 to X44 (standard coding, female) for connecting optional I/Os when using PROFIsafe option S11:

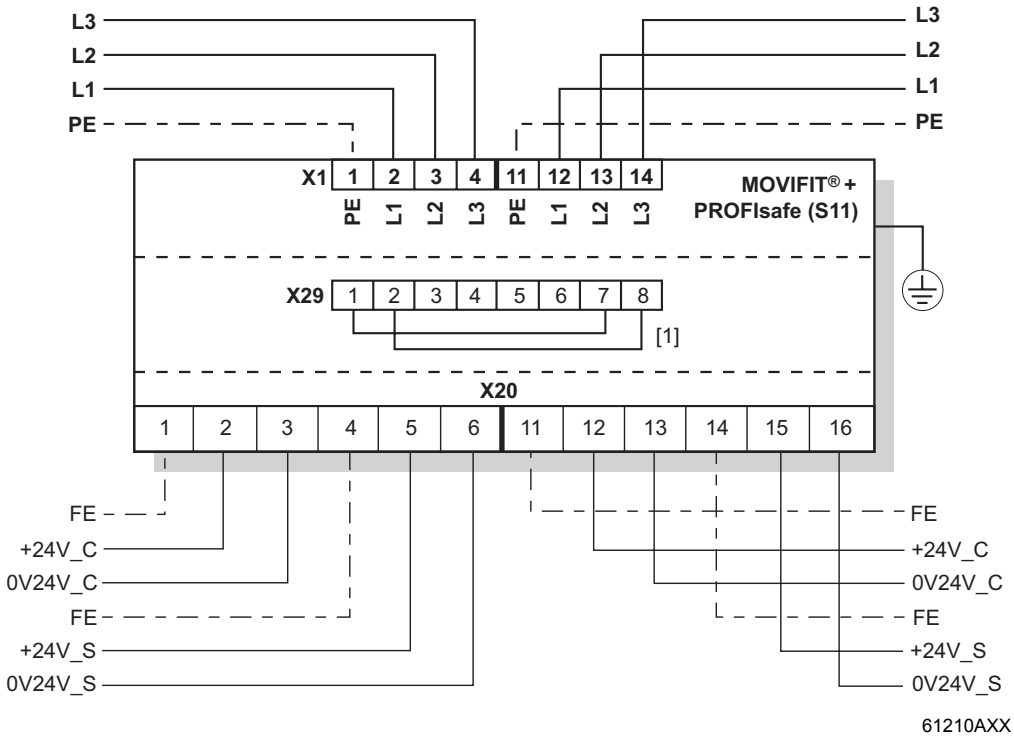


60569AXX

M12 plug connectors X41 to X44 for connecting optional I/Os when using PROFIsafe option S11			
Connector			
X41	**Pin 1**	F-SS0	+24 V sensor supply for failsafe inputs F-DI00 and F-DI02
	Pin 2	F-DI01	Safety-oriented binary input F-DI01 (switching signal)
	Pin 3	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	Pin 4	F-DI00	Safety-oriented binary input F-DI00 (switching signal)
	Pin 5	F-SS1	+24 V sensor supply for failsafe inputs F-DI01 and F-DI03
X42	**Pin 1**	F-SS0	+24 V sensor supply for failsafe inputs F-DI00 and F-DI02
	Pin 2	F-DI03	Safety-oriented binary input F-DI03 (switching signal)
	Pin 3	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	Pin 4	F-DI02	Safety-oriented binary input F-DI02 (switching signal)
	Pin 5	F-SS1	+24 V sensor supply for failsafe inputs F-DI01 and F-DI03
X43	**Pin 1**	Reserved	Reserved
	Pin 2	F-DO00_M	Safety-oriented binary output F-DO00 (M switching signal)
	Pin 3	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	Pin 4	F-DO00_P	Safety-oriented binary output F-DO00 (P switching signal)
	Pin 5	Reserved	Reserved
X44	**Pin 1**	Reserved	Reserved
	Pin 2	F-DO01_M	Safety-oriented binary output F-DO01 (M switching signal)
	Pin 3	0V24_O	OV24 reference potential for failsafe binary inputs/outputs
	Pin 4	F-DO01_P	Safety-oriented binary output F-DO01 (P switching signal)
	Pin 5	Reserved	Reserved

5.3.4 Connection example, power bus

The following figure shows an example of a power bus connection with two separate 24 V voltage circuits for the sensor/actuator supply. In this example, the 24V-C voltage supplies the S11 option as well as the failsafe inputs/outputs.



[1] Example depicting 24V-C voltage supply for PROFIsafe option S11

	NOTE
	Important: We recommend using the 24V_C electronics and sensor voltage to supply PROFIsafe option S11, as depicted in the figure above. Alternatively, always switch the 24V_O option voltage supply and the 24V_C voltage on and off together. Otherwise, communication with the safety control unit may produce malfunctions and fault messages, as the 24V_O voltage supplies the entire S11 option safety electronics. If 24V_O is switched off, the PROFIsafe station is missing in the network.

5.3.5 Connecting the safety-oriented inputs/outputs of PROFIsafe option S11

Terminal X45 or M12 plug connectors X41 to X44 are used to connect the safety-oriented inputs (F-DIx) and the safety-oriented outputs (F-DOx and F-DO_STO). The following sections depict and describe the various connections permitted.

With PROFIsafe option S11, processing of all failsafe inputs and outputs generally takes place using 2 channels. This means that the failsafe inputs and outputs are suitable for applications up to SIL3 according to EN 61508, safety category 4 according to EN 954-1, and performance level "e" according to EN ISO 13849-1. The external sensors and actuators to be connected and the related wiring must comply with the safety category applicable in each case.

Observe the wiring diagrams below and the list showing the faults detected in each case. Also observe the "Requirements for external sensors and actuators" on page 18.

Connection F-DIx / F-SSx

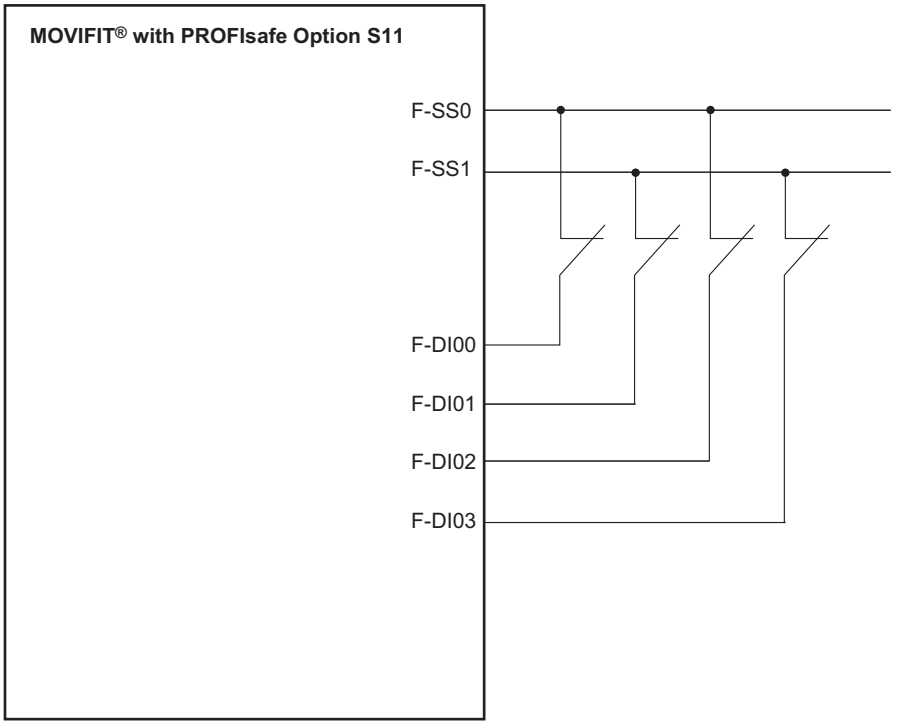
Observe the following notes for wiring the sensors.

- You may only connect sensors with contacts to the failsafe F-DIx inputs in accordance with the failsafe principle (e.g. emergency off buttons, door contact switches etc.)
- Both sensor supplies F-SS0 and F-SS1 are generally clocked.
- When connecting the sensors you must ensure that
  - F-SS0 is connected via the respective sensor with F-DI00 and F-DI02 (fixed assignment)
  - F-SS1 is connected via the respective sensor with F-DI01 and F-DI03 (fixed assignment)
- Unassigned inputs need not be switched. An open input is always read as a "0" signal.

Permissible wiring

Only the following wiring is permitted in safety-oriented applications:

a) Sensors, 1-pole connection (option of up to four 1-pole sensors)



61040AEN

Internal tests and monitoring processes detect the following faults:

- Short circuit in +24 V voltage supply
- Cross fault between two input signals fed by different F-SSx sensor supplies
- Open circuit or short circuit to reference potential is read as a "0" signal (no fault status)

⚠ DANGER

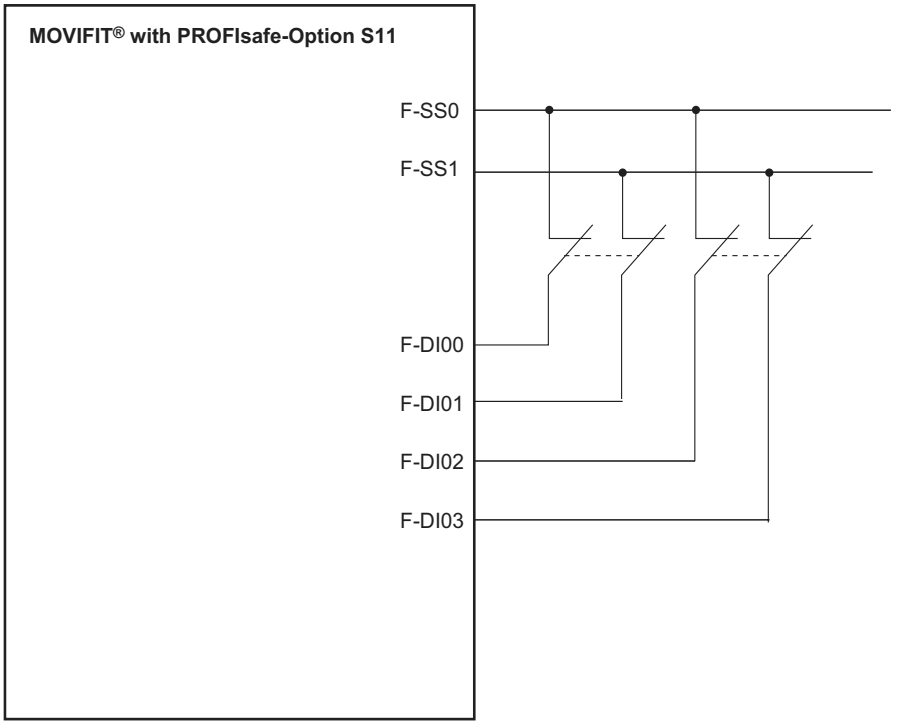
A short circuit between the F-SSx sensor supply and a corresponding F-DIx failsafe input (sensor jumpered) cannot be detected.

Severe or fatal injuries.

- Cabling must be routed in such a way as to avoid short circuits.

Whenever the system detects a fault it reverts to a safe status, i.e. all safety-oriented process values (F-DI, F-DO and STO) are set to "0". The safety pcb is also passivated (see section entitled "PROFIsafe option S11 fault table", page 62). The "F-STATE" LED displays the fault status (see section entitled "LED displays", page 56).

b) Sensors, 2-pole connection (up to two 2-pole sensors possible)



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NOTES

- Important: With this type of connection, there is no internal link and no evaluation of discrepancy time between the two input signals of a sensor.
- Signals F-DI00 and F-DI01 or F-DI02 and F-DI03 are generally transferred individually to the higher-level safety control. Logical operations and discrepancy time evaluations must be carried out here.

Internal tests and monitoring processes detect the following faults:

- Short circuit in +24 V voltage supply
- Cross fault between the two input signals of a sensor
- Open circuit or short circuit to reference potential is read as a "0" signal (no fault status)

⚠ DANGER

Important: A short circuit between the F-SSx sensor supply and a corresponding F-DIx failsafe input (sensor jumpered) cannot be detected.

Severe or fatal injuries.

- Cabling must be routed in such a way as to avoid short circuits like this.

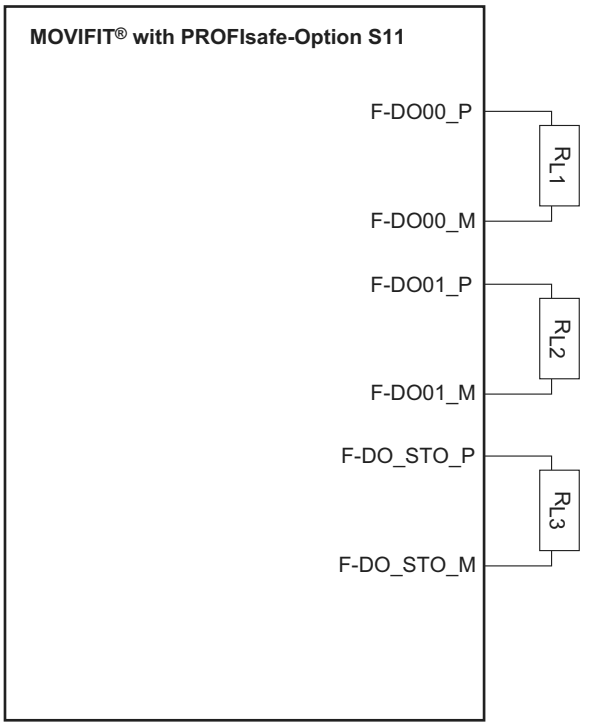
Whenever the system detects a fault, it reverts to a safe status, i.e. all safety-oriented process values (F-DI, F-DO and STO) are set to "0". The safety pcb is also passivated (see section "PROFIsafe option S11 fault table", page 62). The "F-STATE" LED displays the fault status (see section "LED displays", page 56).

Connecting F-DOx and F-DO_STO

- No shielded cables are required for the safety-oriented binary outputs.
- The safety-oriented binary outputs are 2-pole, designed as P-M switches, and controlled via PROFIsafe by a higher-level safety control.
- Actuators must generally be connected with the failsafe outputs F-DOx or F-DO_STO with a 2-pole connection between the P switch output to the M switch output.
- It is not permissible to make a 1-pole connection between F-DOx_P or F-DO_STO_P and the GND reference potential.
- Internal testing of the failsafe outputs is cyclical. However, when decoupling takes place, the test pulses at the connection terminals are not visible and need not be taken into account during operation.

Permissible wiring

Only the following wiring is permitted for safety-oriented applications:



61042AEN

	NOTE
	Important: When connecting actuators to X43 or X44 using a standard M12 connecting cable, the actuator is switched with only 1 pole (only via the P output). This is not permitted.

Internal tests and monitoring processes are able to detect various external faults.

When the output is switched on, the following faults can be detected.

- Short circuit between P output and reference potential
- Short circuit between M output and +24 V supply voltage
- Short circuit between P output and M output

When the output is switched off, the following faults can be detected.

- Short circuit between P output or M output and +24 V supply voltage
- Short circuit between P output or M output and reference potential

⚠ DANGER

Important: When the output is switched on, a short circuit between a P switch output (F-DOx_P or F-DO_STO_P) and the + 24 V supply voltage cannot be detected.

Severe or fatal injuries.

- Cabling must be routed in such a way as to avoid such short circuiting. Alternatively, the output must be switched off cyclically at regular intervals, in accordance with the risk analysis.

Whenever the system detects a fault, it reverts to a safe status, i.e. all safety-oriented process values (F-DI, F-DO and STO) are set to "0". The safety pcb is also passivated (see section "PROFIsafe option S11 fault table", page 62). The "F-STATE" LED displays the fault status (see section "Diagnostic LEDs", page 56).

5.3.6 Safety-oriented disconnection with PROFIsafe

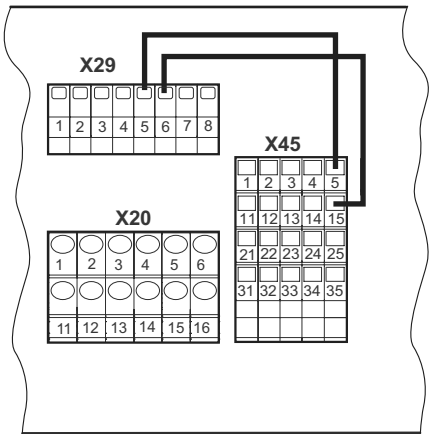
In order to safely disconnect the MOVIMOT® or MOVIFIT®-FC drive using PROFIsafe the failsafe output F-DO_STO must be connected with the 24 V voltage supply 24V_P (see figures below).

a) ABOX with terminals and cable glands

"MTA...-S01.-...-00, MTA...-S02.-...-00"

F-DO_STO_P (X45/5)with +24V_P (X29/5)and

F-DO_STO_M (X45/15) with 0V24_P (X29/6)



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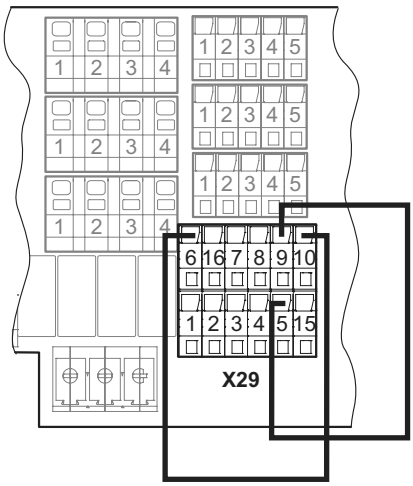
b) Hybrid connection box with terminals and M12 plug connector

"MTA...-S11.-...-00", "MTA...-S21.-...-00", MTA...-S12.-...-00", "MTA...-S22.-...-00"

F-DO_STO_P (X29/9) with +24V_P (X29/5) and

F-DO_STO_M (X29/10) with 0V24_P (X29/6)

Note: The figure depicts the MOVIFIT®-MC connection board.



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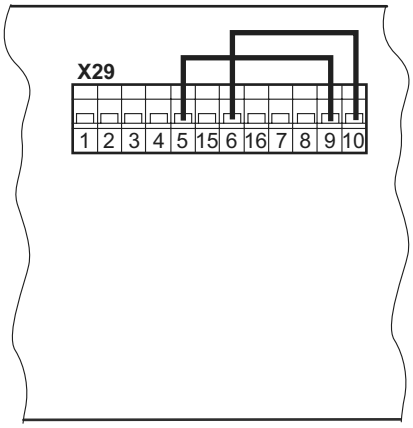
c) HanModular® connection box with HanModular® plug connector and M12 plug connector

"MTA...-H12.-...-00", "MTA...-H22.-...-00", "MTA...-H11.-...-00", "MTA...-H21.-...-00"

F-DO_STO_P (X29/9)with +24V_P (X29/5) and

F-DO_STO_M (X29/10) with 0V24_P (X29/6)



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⚠ DANGER

The safety function of MOVIFIT®-MC with MOVIMOT® may only be used in applications up to category 3 according to EN 954-1.

The safety function of the MOVIFIT®-FC frequency inverter may only be used in applications up to category 3 according to EN 954-1 and performance level "d" to EN ISO 13849-1.

Severe or fatal injuries.

- Observe the relevant "Safety Concept" on page 6 as well as the "Safety Requirements" on page 11.
- At startup, proof of proper safety functions must be provided and documented.

6 Startup with PROFIsafe Option S11

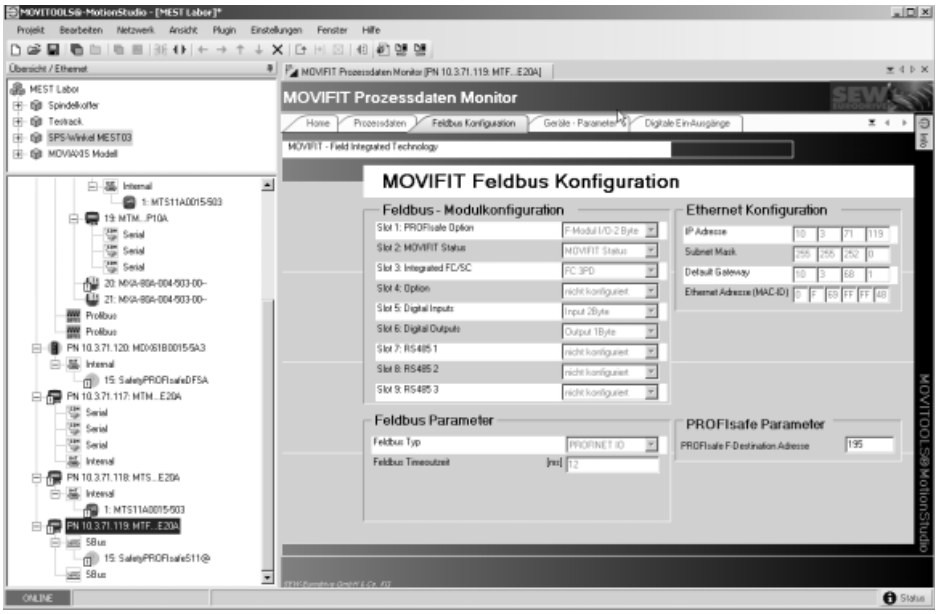
	NOTES
	• The basic startup procedure is described in the relevant MOVIFIT® operating instructions and in the corresponding software manual entitled "MOVIFIT® Function Level Classic" or "MOVIFIT® Function Level Technology". • Additional startup steps for PROFIsafe option S11 are described below:

6.1 Entering the PROFIsafe address

Once the MOVIFIT® and S11 option is supplied with 24 V voltage, you must enter the PROFIsafe device address (= F Destination Address) using MOVITOOLS® MotionStudio. You may enter an address ranging from 1 to 65534.

Ensure that the entry made on the device matches the PROFIsafe address set in the project planning software of the bus master (e.g. Siemens STEP7 HW Config).

Enter the PROFIsafe device address (= F Destination Address) in MOVITOOLS® MotionStudio using the MOVIFIT® process data monitor (see figure below):



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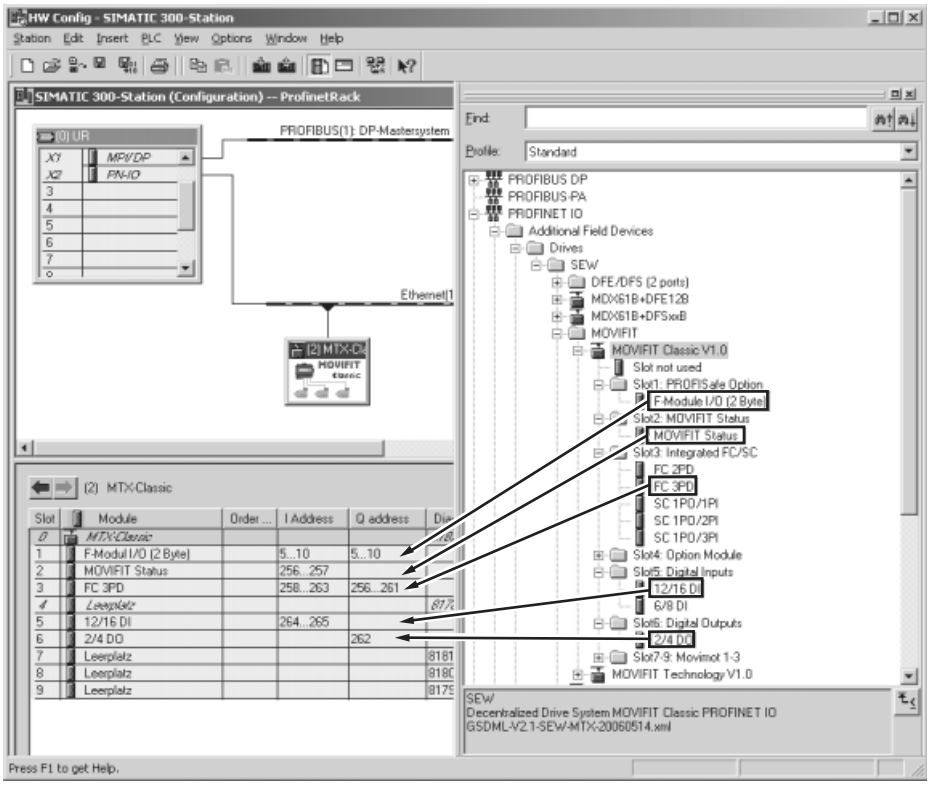
[1] Entering the PROFIsafe device address (= F Destination Address)

6.2 Configuring the PROFIsafe option in STEP7

To ensure fault-free MOVIFIT® operation using PROFIsafe, you must obtain the optional package entitled "Distributed Safety" as of version V5.4 for setting parameters under STEP7.

- Make sure that you have installed the current version of the appropriate GSD file.
- When configuring the buses for PROFIBUS DP and PROFINET IO, follow the steps described in the software manual "MOVIFIT® Function Level Classic" or "MOVIFIT® Function Level Technology".
- Configure the "F module I/O (2 bytes)" on slot 1 and enter the desired I/O or periphery addresses. The following figure shows a MOVIFIT®-FC configuration at the "Classic" function level in the PROFINET version.



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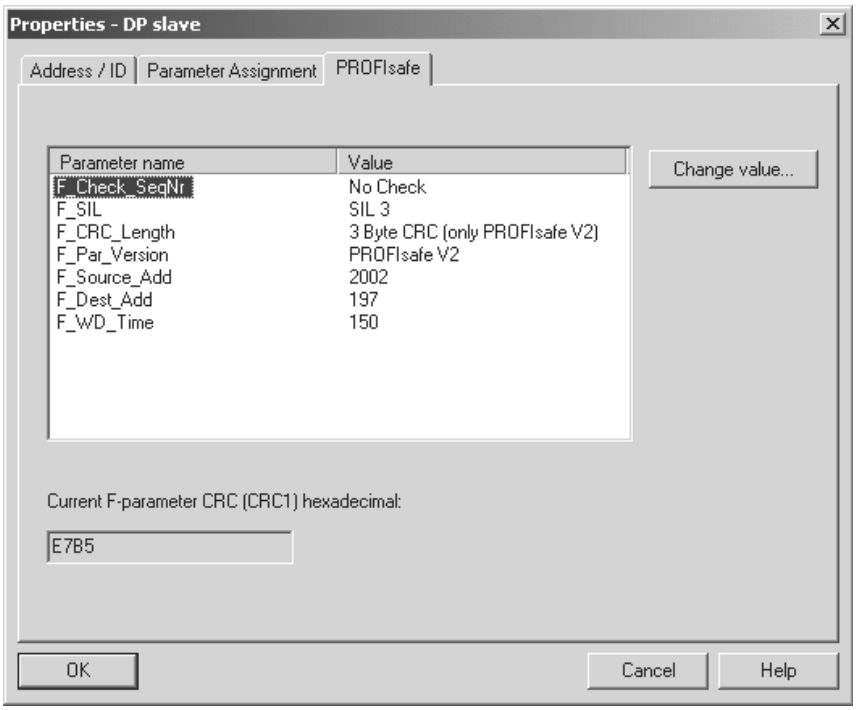
- Then set the parameters for the PROFIsafe option.

6.2.1 Setting parameters for PROFIsafe option S11

Select the F module at MOVIFIT® slot 1.

Right-click the context menu, select "Properties", followed by the "PROFIsafe" or "F parameters" tab. Below is an example for a PROFIBUS device.



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When the field bus or network systems starts up, the bus master sends the safety-relevant parameters in an F parameter block to the PROFIsafe option of the MOVIFIT®. A plausibility test then checks them in the option. The PROFIsafe option only exchanges data with bus master after positive confirmation for this F parameter block has been received. Below is a list of the safety-oriented parameters which are passed on to the PROFIsafe option.

Depending on the bus system being used, the following parameters are available:

PROFIsafe F parameters	Bus system	
	PROFIBUS DP	PROFINET IO
F_Check_SeqNr	Non-variable	Not available
F_SIL	Non-variable	Non-variable
F_CRC_Length	Variable	Non-variable
F_Par_Version	Variable	Non-variable
F_Source_Add	Non-variable	Non-variable
F_Dest_Add	Variable	Variable
F_WD_Time	Variable	Variable

Parameter "F_Check_SeqNr"

This parameter determines whether the Ready counter (consecutive number) is to be included in the consistency check (CRC calculation) of the F user data telegram.

The PROFIBUS version supports the following setting:

- F_Check_SeqNr = "No check"

Parameter "F_SIL"

This parameter enables F stations to check if the safety category matches that of the F-Host. Depending on the risk, different safety circuits with different safety classes SIL 1 to SIL 3 (SIL = Safety-Integrity-Level), apply in these safety-relevant cases.

The S11 option supports the following setting:

- F_SIL = SIL 3

Parameter "F_CRC_Length"

Depending on the length of the F user data (process values) and the PROFIsafe version, the length of the required CRC check value varies. This parameter communicates the anticipated length of the CRC2 key in the safety telegram to the F component.

The S11 option handles user data that is less than 12 bytes in length, so that with PROFIsafe V1, a 2 byte CRC is used and with PROFIsafe V2, a 3 byte CRC is used.

The S11 option supports the following settings:

- F_CRC_Length =

  2 byte CRC (only with PROFIsafe V1 combined with PROFIBUS)

  3 byte CRC (only with PROFIsafe V2)

Parameter "F_Par_Version"

This parameter identifies the PROFIsafe version supported by the S11 option. When using a MOVIFIT® with a PROFIBUS version, you can choose between PROFIsafe V1 and PROFIsafe V2, with a PROFINET version only PROFIsafe V2 is supported.

Parameter "F_Source_Add"

The PROFIsafe addresses are used for unique identification of the source (F_Source_Add) and destination (F_Dest_Add). The combination of source and destination address must be unique throughout the network and station. Depending on the master configuration, the source address F_Source_Add is automatically provided by STEP7.

Values ranging from 1 to 65534 can be entered in parameter "F_Source_Add".

You cannot directly edit this parameter in STEP7 HW Config.

Parameter "F_Dest_Add"

Enter the PROFIsafe address, previously set for the MOVIFIT® device with MOVITOOLS® MotionStudio, in this parameter.

Values ranging from 1 to 65534 can be entered in parameter "F_Dest_Add".

Parameter "F_WD_Time"

This parameter defines a monitoring time in the failsafe PROFIsafe option S11.

During this monitoring period, an up-to-date safety message must arrive from the F-CPU. Otherwise the S11 option reverts to safe status.

Select a monitoring time of a sufficient length so that communication can tolerate message delays, but also sufficiently short enough for your safety application to run without restriction.

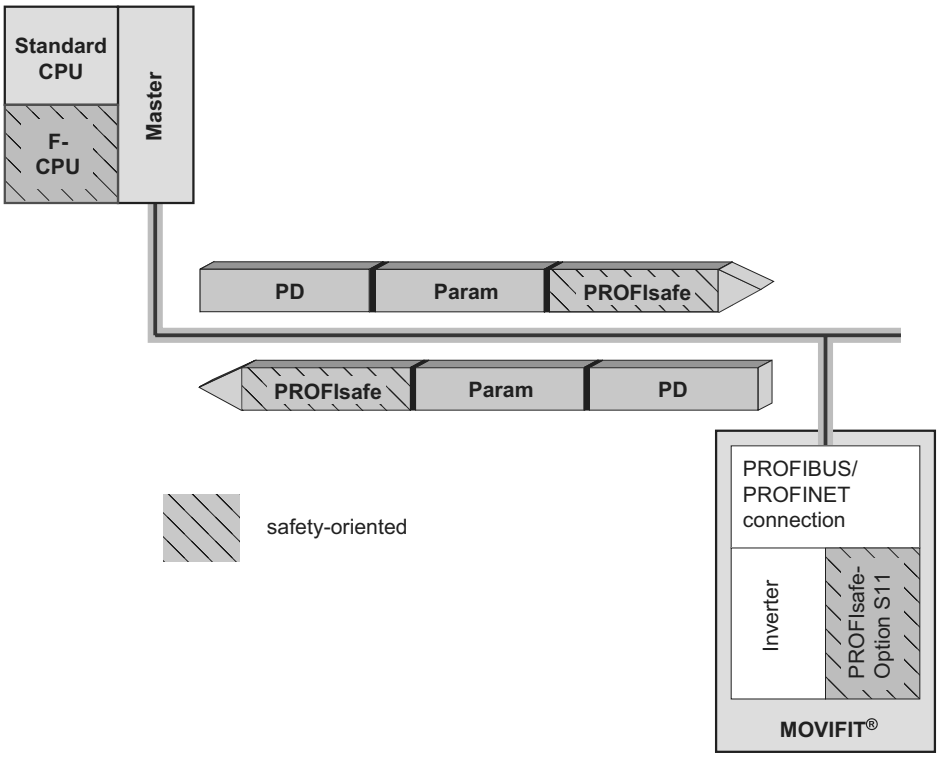
With the S11 option, you can enter the "F_WD_Time" parameter in steps of 1 ms, ranging from 1 ms to 10 s.

7 Data Exchange with PROFIsafe Option S11

7.1 Introduction

MOVIFIT® devices with an integrated PROFIsafe option support parallel operation of standard and safety-oriented communications via a bus system or network. You can run safety-oriented PROFIsafe communication using PROFIBUS DP and PROFINET IO.

Data exchanges between bus master and MOVIFIT® take place via the respective communication system that simultaneously acts as a "grey channel" for the safety-oriented application. The bus messages transferred then contain standard information for conventional MOVIFIT® operation and the PROFIsafe safety message. Depending on the configuration, the maximum available expansion level enables parallel exchanges of PROFIsafe safety data, the parameter channel and process data between the bus master and MOVIFIT®.



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7.2 Access to F periphery of PROFIsafe option S11 in STEP7

For safety-oriented communication, PROFIsafe option S11 requires a total of 6 bytes for the PROFIsafe message portion and 6 bytes for the process image. Of these, 2 bytes (= 16 bits) constitute the actual safety-oriented I/O data (F user data), and the remaining 4 bytes are required for storing the message in accordance with the PROFIsafe specifications (PROFIsafe header).

7.2.1 F periphery DB of PROFIsafe option S11

During translation in the HW Config tool, the system automatically generates an F periphery DB for every PROFIsafe option S11. The F periphery DB provides the user with an interface in which s/he can evaluate or control variables in the safety program.

The symbolic name consists of the invariable prefix "F", the start address of the F periphery, and the name entered in the object properties during configuration for the F periphery (e.g. F00008_198).

The following table shows the F periphery DB of PROFIsafe option S11:

	Address	Symbol	Data type	Function	Default
User-controllable variables	DBX0.0	"F00008_198.PASS_ON"	Bool	1 = activate passivation	0
	DBX0.1	"F00008_198.ACK_NEC"	Bool	1 = acknowledgment required for reintegration with S11	1
	DBX0.2	"F00008_198.ACK_REI"	Bool	1 = acknowledgment for reintegration	0
	DBX0.3	"F00008_198.IPAR_EN"	Bool	Variable for resetting parameters (not supported by PROFIsafe option S11)	0
Variables that can be evaluated	DBX2.0	"F00008_198.PASS_OUT"	Bool	Run passivation	1
	DBX2.1	"F00008_198.QBAD"	Bool	1 = substitute values are output	1
	DBX2.2	"F00008_198.ACK_REQ"	Bool	1 = acknowledgment required for reintegration	0
	DBX2.3	"F00008_198.IPAR_OK "	Bool	Variable for resetting parameters (not supported by PROFIsafe option S11)	0
	DBB3	"F00008_198.DIAG"	Byte	Service information	

PASS_ON This variable lets you activate passivation of the PROFIsafe option S11. Provided that PASS_ON = 1, the F periphery is passivated.

ACK_NEC After a fault has been corrected, the PROFIsafe option S11 is reintegrated, depending on ACK_NEC.

- ACK_NEC = 0: automatic reintegration occurs
- ACK_NEC = 1: automatic reintegration occurs following acknowledgement by the user

⚠ DANGER

It is only permissible to set the variable ACK_ NEC = 0 if automatic reintegration is safe for the process in question.

Severe or fatal injuries.

- Check if automatic reintegration is permissible for the process in question.

ACK_REI In order to reintegrate PROFIsafe option S11 after the fault has been corrected, user acknowledgement with positive edge of variable ACK_REI is required. Acknowledgement is only possible if variable ACK_REQ = 1.

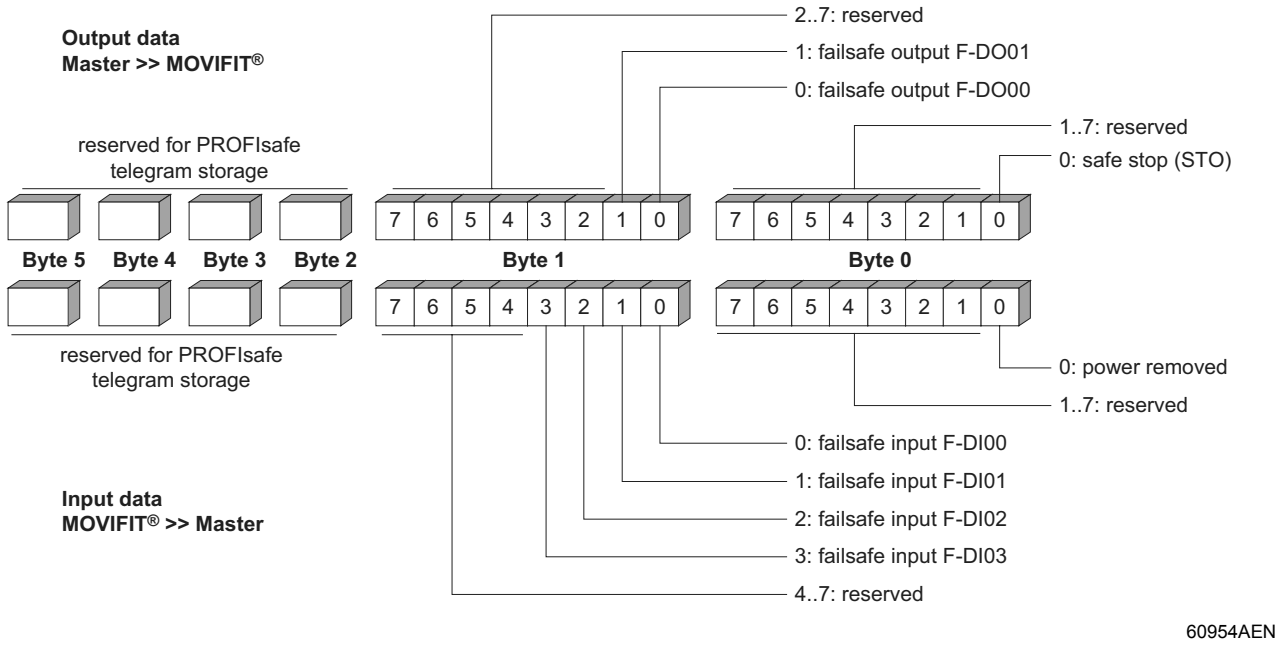
ACK_REQ The F control system sets ACK_REQ = 1 after all faults in the data exchange with PROFIsafe option S11 have been corrected. After successful acknowledgement, the F control system sets ACK_REQ = 0.

PASS_OUT Indicates whether PROFIsafe option S11 has been passivated. Substitute values are output.

QBAD Fault in data exchange with PROFIsafe option S11. Indicates that passivation is being run. Substitute values are output.

DIAG For service information purposes, the variable DIAG supplies non-failsafe information about faults that have occurred in the F control system. For further information refer to the relevant F control system manual.

7.2.2 F user data of PROFIsafe option S11



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Meaning of individual bits in PROFIsafe F user data

F user data coding is based on the "PROFIdrive on PROFIsafe" V1.0 specifications (PNO order no. 3.272). The "PROFIdrive Safety Block 1" specified in these specifications is mapped in byte 0. Byte 1 is manufacturer-specific. With the S11 option, it is used for the failsafe inputs and outputs.

Output data

Byte	Bit	Name	Default	Function	Comment
0	**0**	STO	0	Safe disconnection of the drive – "Safe Torque Off"	0-active
	1..7	–	0	Reserved	Do not use
1	**0**	F-DO00	0	Failsafe output 0	
	1	F-DO01	0	Failsafe output 1	
	2..7	–	0	Reserved	Do not use

Input data

Byte	Bit	Name	Default	Function	Comment
0	**0**	POWER_REMOVED	0	Response failsafe output F-DO_STO switched – "Power removed"	1-active
	1..7	–	0	Reserved	Do not use
1	**0**	F-DI00	0	Failsafe input 0	
	1	F-DI01	0	Failsafe input 1	
	2	F-DI02	0	Failsafe input 2	
	3	F-DI03	0	Failsafe input 3	
	4..7	–	0	Reserved	Do not use

7.2.3 Example of PROFIsafe option S11 control

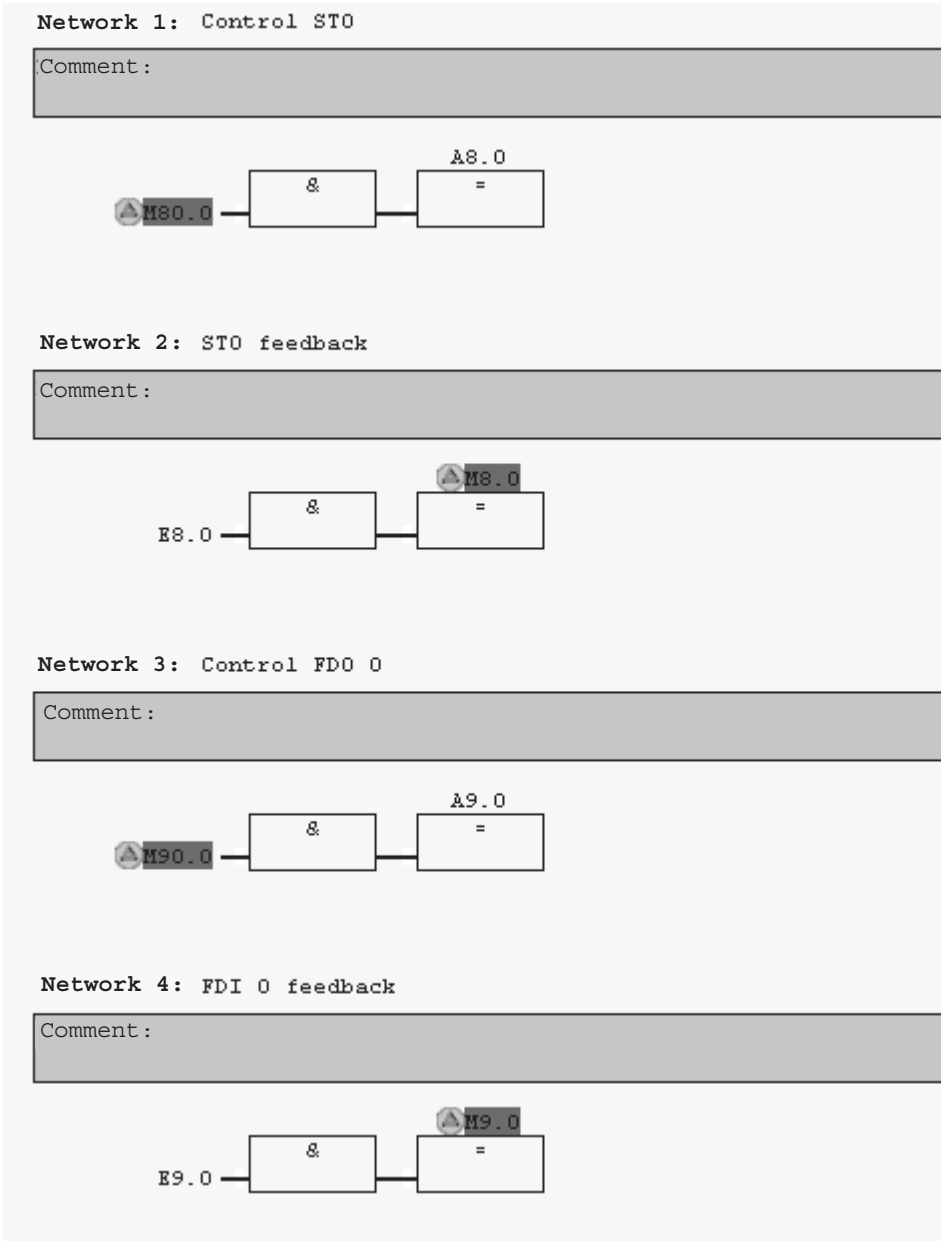
In the example for activating the failsafe functions of PROFIsafe option S11, it is prerequisite that a safety program and a process group have been created, and that an F control program module is available.

You can activate the failsafe functions and the F periphery as well as the evaluation of the responses by the F periphery by using flags. Note that in STEP7 flags are only permitted for coupling between the standard user program and safety program. Flags may not be used as buffers for F data.

	NOTE
	We accept no liability for the information provided in this example. This example does not represent a customer-specific solution, its aim is simply to assist the reader.

The following table shows allocation of input/output addresses to flags.

Address	Symbol	Flag	Meaning
E 8.0	S11_PowerRemoved	M 8.0	Response failsafe output switched.
E 9.0	S11_FDI00	M 9.0	Failsafe input 00
E 9.1	S11_FDI01	M 9.1	Failsafe input 01
E 9.2	S11_FDI02	M 9.2	Failsafe input 02
E 9.3	S11_FDI03	M 9.3	Failsafe input 03
A 8.0	S11_STO	M 80.0	Safe disconnection of the drive
A 9.0	S11_FDO00	M 90.0	Failsafe output 00
A 9.1	S11_FDO01	M 90.1	Failsafe output 01
DB811.DBX0.0	"F00008_198".PASS_ON	M 10.0	Activate passivation of S11
DB811.DBX0.1	"F00008_198".ACK_NEC	M 10.1	Set parameters for reintegration of S11
DB811.DBX0.2	"F00008_198".ACK_REI	M 10.2	Activate user acknowledgement of S11
DB811.DBX2.0	"F00008_198".PASS_OUT	M 10.3	Passivation of S11 has occurred
DB811.DBX2.1	"F00008_198".QBAD	M 10.4	Fault in S11
DB811.DBX2.2	"F00008_198".ACK_REQ	M 10.5	Indicates whether user acknowledgement is required for reintegration of S11.


Network 1: Control ST0
Comment:
A8.0
&
=
M80.0
Network 2: ST0 feedback
Comment:
M8.0
&
=
E8.0
Network 3: Control FD0 0
Comment:
A9.0
&
=
M90.0
Network 4: FDI 0 feedback
Comment:
M9.0
&
=
E9.0

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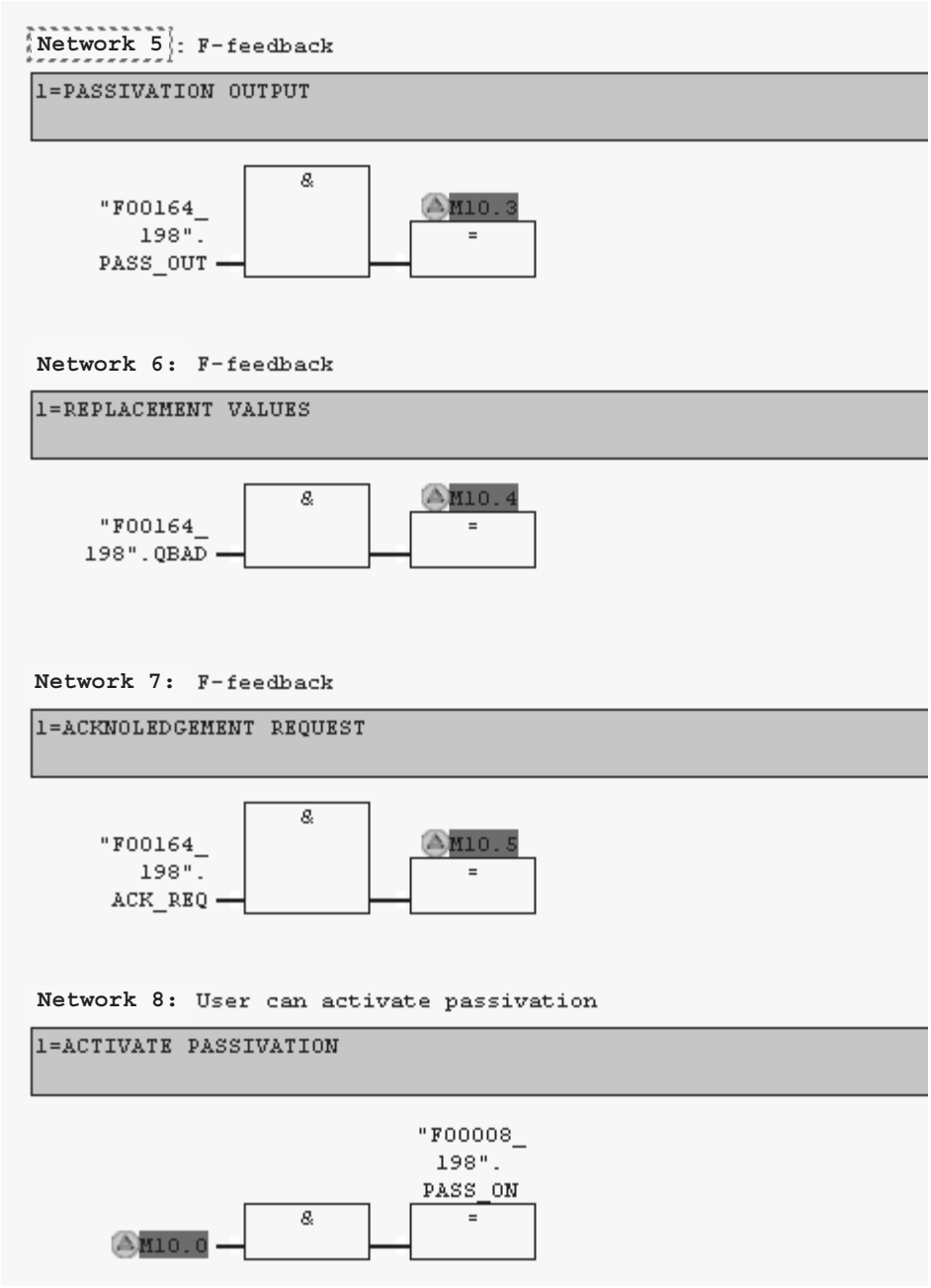
Network 5: F-feedback
1=PASSIVATION OUTPUT
"F00164_ 198". PASS_OUT
&
M10.3
=
Network 6: F-feedback
1=REPLACEMENT VALUES
"F00164_ 198".QBAD
&
M10.4
=
Network 7: F-feedback
1=ACKNOLEDGEMENT REQUEST
"F00164_ 198". ACK_REQ
&
M10.5
=
Network 8: User can activate passivation
1=ACTIVATE PASSIVATION
M10.0
&
"F00008_ 198". PASS_ON
=

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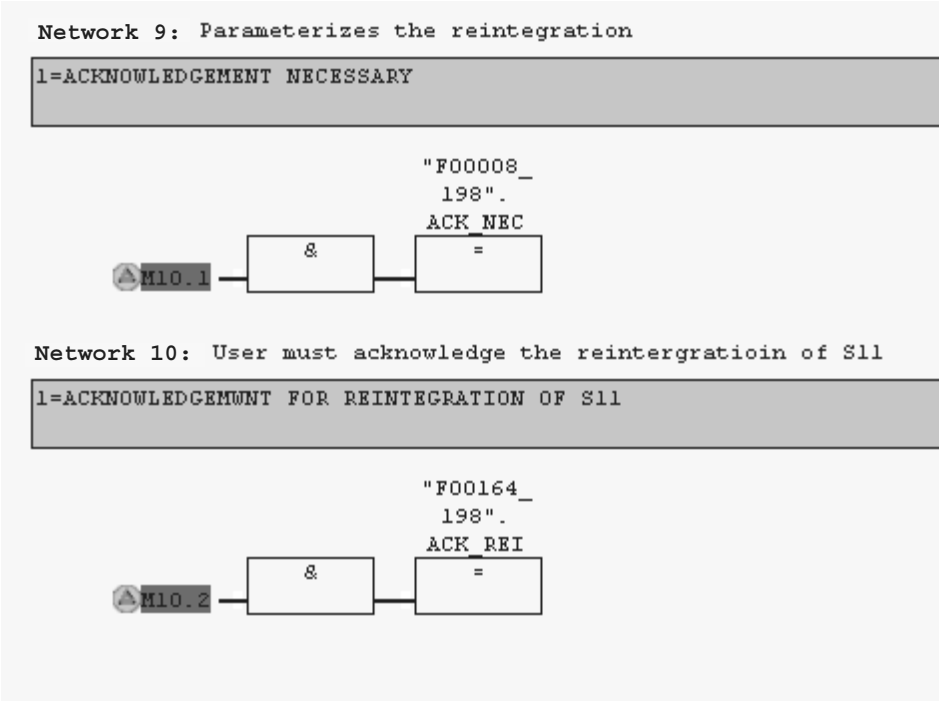
Network 9: Parameterizes the reintegration
1=ACKNOWLEDGEMENT NECESSARY
"F00008_
198".
ACK_NEC
&
=
M10.1
Network 10: User must acknowledge the reintergratioin of S11
1=ACKNOWLEDGEMWNT FOR REINTEGRATION OF S11
"F00164_
198".
ACK_REI
&
=
M10.2

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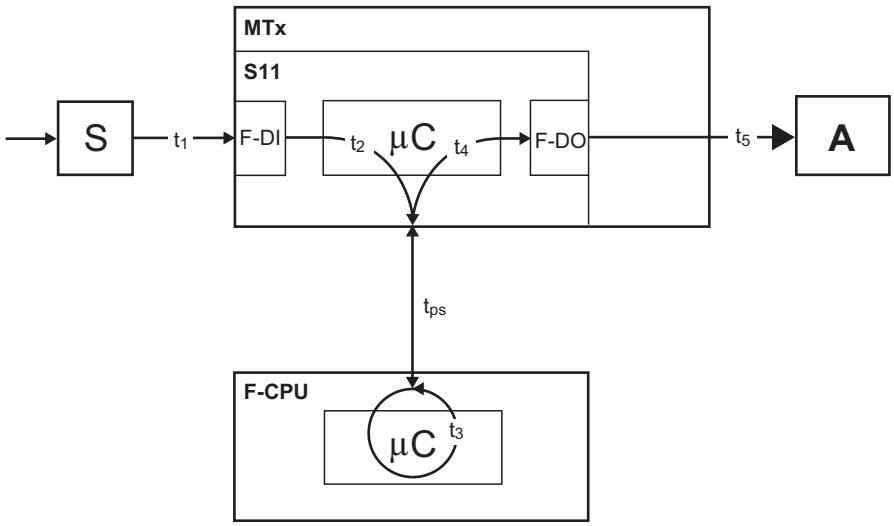
8 Response Times of PROFIsafe Option S11

Response times play a decisive part in the design and execution of safety functions of systems and machines. In order to match the response time to the requirements of a safety function, always take the entire system from sensor (or control device) to actuator into account. The following times are decisive:

- Response times of the connected sensors
- Internal response time of the failsafe inputs (filter time + processing time)
- PROFIsafe cycle time
- Processing time (cycle time) in the safety control
- PROFIsafe monitoring time "F_WD_Time"
- Internal reaction time of the failsafe outputs
- Response or switching time of the actuator

8.1 Response sequence in connection with PROFIsafe option S11

The following figure shows the response sequence in connection with PROFIsafe option S11:



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MTx MOVIFIT® basic unit
S11 PROFIsafe option S11
F-CPU Safety control
µC Micro-controller
S Safety sensor
F-DI Failsafe input
F-DO Failsafe output
A Actuator

Response time from safety sensor to receipt in safety control		
t1	Response time of the safety sensor	According to the manufacturer
t2	Internal response time (max.) of the failsafe input	25 ms
t_{ps}	PROFIsafe cycle time	According to safety control data
	Information available in PROFIsafe user data for processing in the safety control	Total

Response time from safety control to actuator		
t3	Processing time in safety control	To be generated from the safety control
t_{ps}	PROFIsafe cycle time	According to safety control data
t4	Internal reaction time of the failsafe output	25 ms
t5	Response or switching time of the actuator	According to the manufacturer
	Actuator switches after xx ms	Total

PROFIsafe monitoring time ("F_WD_Time") plays an important role in determining the maximum response time for a safety requirement (see section "PROFIsafe-Timeout", page 58). This time must be set in the safety control for option S11.

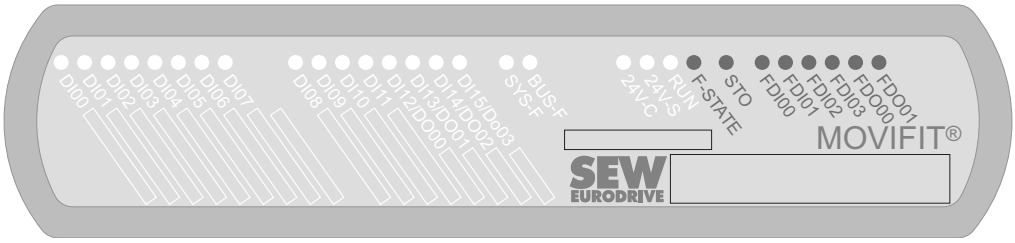
For the reaction sequence described above, with the PROFIsafe monitoring time defined as t_{WD}, the following formula is used to calculate the maximum total response time for an event at the safety sensor to switching the actuator:

$$\mathbf{t_{Response,max} = t1 + t2 + max\ \{t_{WD}\ ;\ t_{ps} + t3 + t_{ps} + t4\} + t5}$$

9 Diagnostics with PROFIsafe Option S11

9.1 Diagnostic LEDs

This section describes the option-specific LEDs for PROFIsafe option S11. These LEDs are shown as dark in the following figure. The following figure depicts the PROFIBUS version of a MOVIFIT®-MC:



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9.1.1 Statuses of LEDs "FDI.." and "FDO.."

LED	Status	Meaning
F-DI00	**Yellow**	HIGH level at input F-DI00
	Off	LOW level at input F-DI00 or open
F-DI01	**Yellow**	HIGH level at input F-DI01
	Off	LOW level at input F-DI01 or open
F-DI02	**Yellow**	HIGH level at input F-DI02
	Off	LOW level at input F-DI02 or open
F-DI03	**Yellow**	HIGH level at input F-DI03
	Off	LOW level at input F-DI03 or open
F-DO00	**Yellow**	Output F-DO00 active
	Off	Output F-DO00 inactive (switched off)
F-DO01	**Yellow**	Output F-DO01 active
	Off	Output F-DO01 inactive (switched off)

9.1.2 Statuses of LED "STO"

LED	Status	Meaning
STO	**Yellow**	• Drive has stopped safely ("STO active").
	Off	• Drive has not stopped safely ("STO inactive").

9.1.3 Statuses of LED "F-STATE"

LED	Status	Meaning	Troubleshooting
F-STATE	**Green**	• The S11 option is currently performing a cyclical data exchange with the F-Host. • Standard operating state.	–
	Red	• Fault status in the safety part. • 24V_O supply voltage missing	• Read diagnostic in F-Host. • Eliminate the cause of the fault and acknowledge in the F-Host.
	Off	• S11 option is currently in the initialization phase. • S11 option is not available or is not configured in the bus master (slot 1 is empty).	• Check voltage supply. • Check configuration of the bus master.
	Flashing red/green	A fault occurred in the safety part; cause of the fault already remedied – acknowledgement required.	Acknowledge fault in the F-Host (reintegration).

WARNING

Safety-oriented continued operation of LEDs "FDI..", "FDO..", "STO" and "F-STATE" by the user.

Severe or fatal injuries.

- The LEDs are not safety-oriented and may not be used as a safety device.

9.2 Fault statuses of PROFIsafe option S11

	NOTE
	Depending on the safety control used, other terms may be used for "passivation" and "reintegration" in the safety control documentation. For more information refer to the safety control documentation.

9.2.1 Fault in the safety part

PROFIsafe option S11 is able to detect various internal and external faults (at the failsafe inputs / outputs). For information on the types of faults, exact responses, and how to correct the faults, refer to the section entitled "PROFIsafe option S11 Fault Table". When faults occur in the safety part, the S11 option usually responds by passivation of the module and switching to substitute values instead of process values. All safety-oriented process values (F-DI and F-DO) are then set to "0" (→ safe status).

After the fault has been corrected, the S11 option is reintegrated with a user acknowledgement.

After reintegration, the process values ready at the failsafe inputs (F-DIx) are made available and the now available output values are transferred to the failsafe outputs (F-DOx).

9.2.2 PROFIsafe timeout

If safety-oriented PROFIsafe communication is interrupted or delayed, after the adjustable monitoring time "F_WD_Time" (see description of F parameters) has expired, the S11 option also responds with passivation and assuming safe status. After this time has expired, the relevant module is passivated in the safety control and the associated safety-oriented process values for the safety application are set to "0" (→ safe status).

Whenever passivation is to occur, user acknowledgement is required to reintegrate the module in question.

	⚠ DANGER
	It is also possible to set automatic reintegration in the safety control. Severe or fatal injuries. • This function may not be used in safety-oriented applications.

9.2.3 Safety diagnostics using PROFIBUS DP

The status of PROFIsafe communication and S11 option fault messages is transmitted to the DP master via a status PDU in accordance with the PROFIBUS DPV1 standard.

The following figure shows how diagnostic data is organized for PROFIsafe communication via slot 1. The F module for the S11 option is configured on slot 1.

Byte 11 is used for transferring diagnostic messages. These are defined in the PROFIsafe specifications.

Bytes 12 and 13 transfer the status and fault status of the S11 option to the higher-level DP master.

The figure below shows the structure of diagnostic data for PROFIBUS DPV1:

	Status block						
Bytes 1...6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13
6 bytes Standard diagnostics	**Header**	**Status Type**	**Slot Number**	**Status Specifier**	**Diag User Data 0**	**Diag User Data 1**	**Diag User Data 2**
...	0x07	0x81	0x00	0x00	PROFIsafe	F State 1	
	↑	↑	↑	↑	↑	↑	
	7 bytes module-specific diagnostics	0x81 = Status block with status message	0x00 = Slot 1 (PROFIsafe® option)	no DPV1 specifier	PROFIsafe diagnostic information in accordance with PROFIsafe profile V2.0	Cyclical F_State of the MOVIFIT®	

Diagnostic messages of the PROFIsafe layer

The table below shows the diagnostic messages of the PROFIsafe layer:

Byte 11	PROFIBUS diagnostic message (German)	PROFIBUS diagnostic message (English)
0_{hex} / 0_{dez}	Kein Fehler	–
40_{hex} / 64_{dez}	F_Dest_Add stimmt nicht überein	Mismatch of F_Dest_Add
41_{hex} / 65_{dez}	F_Dest_Add ist ungültig	F_Dest_Add not valid
42_{hex} / 66_{dez}	F_Source_Add ist ungültig	F_Source_Add not valid
43_{hex} / 67_{dez}	F_WD_Time ist 0 ms	F_WD_Time is 0 ms
44_{hex} / 68_{dez}	F_SIL Level größer max SIL Level	F_SIL exceeds SIL f. application
45_{hex} / 69_{dez}	Falsche F_CRC_Length	F_CRC_Length does not match
46_{hex} / 70_{dez}	Falsche F-Parameter Version	F parameter incorrectly set
47_{hex} / 71_{dez}	Fehler im CRC1-Wert	CRC1 fault

NOTE

For more information on the meaning of fault messages and troubleshooting procedures refer to the PROFIBUS-DP master manuals.

S11 option fault codes

The table below shows the fault codes of the S11 option:

Byte 12	Byte 13	Description (German)	Description (English)	Meaning / correction procedure
00_{hex} / 00_{dez}	00_{hex} / 00_{dez}	kein Fehler	–	see PROFIsafe option S11 fault table on page 62
	01_{hex} / 01_{dez}	Interner Ablauffehler	Internal sequence fault	
	02_{hex} / 02_{dez}	Interner Systemfehler	Internal system fault	
	03_{hex} / 03_{dez}	Fehler Kommunikation	Communication fault	
	04_{hex} / 04_{dez}	Fehler Elektronik-versorgung	Circuitry supply voltage fault	
	14_{hex} / 20_{dez}	Interner Fehler am sicheren Eingang (F-DIx)	Internal fault failsafe input	
	15_{hex} / 21_{dez}	Kurzschluss am sicheren Eingang (F-DIx)	Short circuit failsafe input	
	32_{hex} / 50_{dez}	Interner Fehler am sicheren Ausgang (F-DOx)	Internal fault failsafe output	
	33_{hex} / 51_{dez}	Kurzschluss am sicheren Ausgang (F-DOx)	Short circuit failsafe output	
	34_{hex} / 52_{dez}	Überlast am sicheren Ausgang (F-DOx)	Overload failsafe output	
	$6F_{hex}$ / 111_{dez}	Interner Kommunikations-fehler zur S11-Option	Internal communication timeout	
	$7F_{hex}$ / 127_{dez}	Fehler Initialisierung S11-Option	F init fault	

9.2.4 Safety diagnostics using PROFINET IO

The status of PROFIsafe communication and fault messages of the S11 option are reported to the PROFINET-IO controller where they can then be diagnosed. For more information on diagnostics refer to the MOVIFIT® manual on the MOVIFIT® function level "Classic" or "Technology".

Diagnostic messages of the PROFIsafe layer

The table below shows the diagnostic messages of the PROFIsafe layer:

	PROFINET diagnostic message (German)	PROFINET diagnostic message (English)
0_{hex} / 0_{dez}	Kein Fehler	–
40_{hex} / 64_{dez}	F_Dest_Add stimmt nicht überein	Mismatch of F_Dest_Add
41_{hex} / 65_{dez}	F_Dest_Add ist ungültig	F_Dest_Add not valid
42_{hex} / 66_{dez}	F_Source_Add ist ungültig	F_Source_Add not valid
43_{hex} / 67_{dez}	F_WD_Time ist 0 ms	F_WD_Time is 0 ms
44_{hex} / 68_{dez}	F_SIL Level größer max SIL Level	F_SIL exceeds SIL f. application
45_{hex} / 69_{dez}	Falsche F_CRC_Length	F_CRC_Length does not match
46_{hex} / 70_{dez}	Falsche F-Parameter Version	F parameter incorrectly set
47_{hex} / 71_{dez}	Fehler im CRC1-Wert	CRC1 fault

NOTE

For more information on the meaning of fault messages and correction procedures refer to the PROFIBUS IO controller manuals.

S11 option fault codes

The table below shows the fault codes of the S11 option:

	Description (German)	Description (English)	Meaning / correction procedure
$5F00_{hex}$ / 24320_{dez}	kein Fehler	–	see PROFIsafe option S11 fault table on page 62
$5F01_{hex}$ / 24321_{dez}	Interner Ablauffehler	Internal sequence fault	
$5F02_{hex}$ / 24322_{dez}	Interner Systemfehler	Internal system fault	
$5F03_{hex}$ / 24323_{dez}	Fehler Kommunikation	Communication fault	
$5F04_{hex}$ / 24324_{dez}	Fehler Elektronik-versorgung	Circuitry supply voltage fault	
$5F14_{hex}$ / 24340_{dez}	Interner Fehler am sicheren Eingang (F-DIx)	Internal fault failsafe input	
$5F15_{hex}$ / 24341_{dez}	Kurzschluss am sicheren Eingang (F-DIx)	Short circuit failsafe input	
$5F32_{hex}$ / 24370_{dez}	Interner Fehler am sicheren Ausgang (F-DOx)	Internal fault failsafe output	
$5F33_{hex}$ / 24371_{dez}	Kurzschluss am sicheren Ausgang (F-DOx)	Short circuit failsafe output	
$5F34_{hex}$ / 24372_{dez}	Überlast am sicheren Ausgang (F-DOx)	Overload failsafe output	
$5F7F_{hex}$ / 24447_{dez}	Fehler Initalisierung S11	F init fault	

9.2.5 Fault table PROFIsafe option S11

Fault code/description		Response	Cause	Procedure
00	**No fault**	–	–	–
01	**Internal sequence fault**	• F-DOx = 0 (switch off failsafe outputs) • F-DIx = 0 (→ safe status) • Passivation of S11 option	Safety electronics faulty, possibly due to EMC influence	• Check installation (EMC) • Switch 24 V voltage off and on again • Reintegrate S11 option • If this fault recurs, replace the EBOX or contact SEW service personnel.
02	**Internal system fault**			
03	**Communication fault**		PROFIsafe communication faulty	• Check configuration (e.g. PROFIsafe monitoring time) • Reintegrate S11 option
04	**Circuitry supply voltage fault**		Electronics supply outside specified parameters	• Check installation (EMC) • Switch 24 V voltage off and on again • Reintegrate S11 option • If this fault recurs, replace the EBOX or contact SEW service personnel.
20	**Internal fault at failsafe input (F-DIx)**	• F-DIx = 0 (→ safe status) • Passivation of S11 option	Safety electronics faulty, possibly due to EMC influence	• Check installation (EMC) • Switch 24 V voltage off and on again • Reintegrate S11 option • If this fault recurs, replace the EBOX or contact SEW service personnel.
21	**Short circuit at failsafe input (F-DIx)**		Short circuit in 24 V voltage supply or cross fault at failsafe inputs	• Check installation / wiring and eliminate short circuit • Reintegrate S11 option
50	**Internal fault at failsafe output (F-DOx)**	• F-DOx = 0 (switch off failsafe outputs) • Passivation of S11 option	Safety electronics faulty, possibly due to EMC influence	• Check installation (EMC) • Switch 24 V voltage off and on again • Reintegrate S11 option • If this fault recurs, replace the EBOX or contact SEW service personnel.
51	**Short circuit at failsafe output (F-DOx)**		• Short circuit in 24 V voltage supply or reference potential • Short circuit between F-DOx_P and F-DOx_M	• Check installation / wiring and eliminate short circuit • Reintegrate S11 option
52	**Overload at failsafe output (F-DOx)**		Overload at F-DOx (excessive current)	• Check installation / wiring and eliminate overload • Reintegrate S11 option
111	**Internal communication fault**	• F-DOx = 0 (switch off failsafe outputs) • F-DIx = 0 (→ safe status) • Passivation of S11 option	Safety electronics faulty, possibly due to EMC influence	• Check installation (EMC) • Switch 24 V voltage off and on again • Reintegrate S11 option • If this fault recurs, replace the EBOX or contact SEW service personnel.
127	**Initialization fault**	• F-DOx = 0 (switch off failsafe outputs) • F-DIx = 0 (→ safe status) • Passivation of S11 option	• Value of F_Dest_Add is zero • The S11 option is not compatible with the desired (configured) safety functions	• Using MOVITOOLS® MotionStudio, set F_Dest_Add to configured value • Replace EBOX or contact SEW service personnel

10 Technical Data

10.1 Technical data MOVIFIT®-MC (safety technology)

The table below provides the technical data for MOVIFIT®-MC (safety system). The technical data and approvals detailed in the MOVIFIT®-MC operating instructions must also be observed.

Technical data MOVIFIT®-MC (safety technology)	
Safety-oriented 24 V_P supply voltage **Short circuit protection for 24V_MM** **Input capacitance** **Input capacitance MOVIMOT® C (up to 3 connections)** **Current consumption MOVIMOT® C (up to 3 connections)**	V_{IN} = DC 24 V –15 % / +20 % according to EN 61131-2 Electronic, response value: 1.4 A ... 4.5 A 10 µF (behind polarity protection diode) 100 µF (behind polarity protection diode) ≤ 250 mA

10.2 Technical data MOVIFIT®-FC (safety technology)

The table below provides the technical data for MOVIFIT®-FC (safety technology). The technical data and approvals detailed in the MOVIFIT®-FC operating instructions must also be observed

Technical data MOVIFIT®-FC (safety technology)	
Safety-oriented 24 V_P supply voltage **Input capacitance** **Current consumption**	V_{IN} = DC 24 V –15 % / +20 % according to EN 61131-2 500 µF (behind polarity protection diode) ≤ 250 mA

10.3 Technical data PROFIsafe option S11

The technical data and approvals (CE, UL etc.) of the relevant basic MOVIFIT® device apply to the entire MOVIFIT® unit with S11 option. These can be found in the relevant operating instructions.

The table below specifies the technical data of PROFIsafe option S11:

Safety features	
Highest possible safety category	SIL3 according to EN 61508; category 4 according to EN 954-1 and performance level "e" according to EN ISO 13849-1
System structure	2 channels with diagnostics (1oo2D)
Type of operating mode	High demand rate according to EN 61508
Probability of a dangerous failure per hour (PFH value)	< 1.00E-9 (1 FIT)
Proof test interval (EN 61508)	10 years, after which the component must be replaced with a new one
Repair time	100 hours
Safe status	"0" value for all safety-oriented process values – F-DI and F-DO (outputs switched off)
24V_O voltage supply option	**V_{IN} = DC 24 V –15 % / +20 % according to EN 61131-2**
Own consumption	≤ 250 mA
Total current consumption	Own consumption + output current F-DO00 + F-DO1 + F-DO_STO + F sensor supply
Electrical isolation	Isolation between safety electronics (24V_O) and all other supply voltages
Failsafe inputs F-DI00, F-DI01, F-DI02, F-DI03	**Level according to EN 61131-2 DC24V, type 1, no electrical isolation**
Signal level	+15 V ... +30 V "1" = contact closed –3 V … +5 V "0" = contact open
Input resistance	Approx. 5 kΩ
Input filter time	4 ms
Minimum input signal time	15 ms
Response time (sensor switches → bit F-DIx updated in PROFIsafe user data)	≤ 25 ms (incl. filter time)
Sensor supply [cycle outputs] F-SS0, F-SS1	**DC 24 V output according to EN 61131-2, protected against short circuits and overloads, no electrical isolation**
Rated current	250 mA each
Leakage current	Max. 0.5 mA
Internal voltage drop	Max. 2 V
Short circuit protection	Electronic, response value: 0.7 A ... 2.1 A

Failsafe outputs P-M switch	DC 24 V outputs according to EN 61131-2, protected against short circuits and overloads
Permissible total current of outputs	≤ 2.5 A
Rated current **F-DO00, F-DO01** **F-DO_STO**	 2 A 1 A
Leakage current ("0" signal)	According to standard
Internal voltage drop (P and M output)	Max. 3 V
Short circuit protection **F-DO00, F-DO01** **F-DO_STO**	Electronic, response value: 10 A ... 24 A 2.8 A ... 9 A
Overload protection **F-DO00, F-DO01** **F-DO_STO**	Response value: 2.4 A ... 2.7 A 1.4 A ... 1.6 A
Load resistance range **F-DO00, F-DO01** **F-DO_STO**	 12 Ω ... 1 kΩ 24 Ω ... 1 kΩ
Switching off of inductive loads	Unlimited; integrated free-wheeling diode
Response time (command via PROFIsafe → Output switch)	≤ 25 ms
General technical data	
Cable lengths **failsafe inputs (F-DIx)** **failsafe voltage supply (F-SSx)** **failsafe outputs (F-DOx)**	 Max. 30 m Max. 30 m Max. 30 m
Ambient temperature for the entire unit	–25 °C to +40 °C (–13 °F to 104 °F)
Climate class	EN 60721-3-3, class 3K3
Storage temperature	–25 °C…+85 °C (–13 °F…+185 °F) (EN 60721-3-3, class 3K3)
Permissible oscillation and impact load	according to EN 50178
Overvoltage category	III according to IEC 60664-1 (VDE 0110-1)
Pollution class	2 according to IEC 60664-1 (VDE 0110-1) within the housing

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Address List

Germany			
Headquarters **Production** **Sales**	**Bruchsal**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal P.O. Box Postfach 3023 • D-76642 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 http://www.sew-eurodrive.de sew@sew-eurodrive.de
Service **Competence Center**	**Central** Gear units / Motors	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 1 D-76676 Graben-Neudorf	Tel. +49 7251 75-1710 Fax +49 7251 75-1711 sc-mitte-gm@sew-eurodrive.de
	Central Electronics	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal	Tel. +49 7251 75-1780 Fax +49 7251 75-1769 sc-mitte-e@sew-eurodrive.de
	North	SEW-EURODRIVE GmbH & Co KG Alte Ricklinger Straße 40-42 D-30823 Garbsen (near Hannover)	Tel. +49 5137 8798-30 Fax +49 5137 8798-55 sc-nord@sew-eurodrive.de
	East	SEW-EURODRIVE GmbH & Co KG Dänkritzer Weg 1 D-08393 Meerane (near Zwickau)	Tel. +49 3764 7606-0 Fax +49 3764 7606-30 sc-ost@sew-eurodrive.de
	South	SEW-EURODRIVE GmbH & Co KG Domagkstraße 5 D-85551 Kirchheim (near München)	Tel. +49 89 909552-10 Fax +49 89 909552-50 sc-sued@sew-eurodrive.de
	West	SEW-EURODRIVE GmbH & Co KG Siemensstraße 1 D-40764 Langenfeld (near Düsseldorf)	Tel. +49 2173 8507-30 Fax +49 2173 8507-55 sc-west@sew-eurodrive.de
	Drive Service Hotline / 24 Hour Service		+49 180 5 SEWHELP +49 180 5 7394357
	Additional addresses for service in Germany provided on request!		

France			
Production **Sales** **Service**	**Haguenau**	SEW-USOCOME 48-54, route de Soufflenheim B. P. 20185 F-67506 Haguenau Cedex	Tel. +33 3 88 73 67 00 Fax +33 3 88 73 66 00 http://www.usocome.com sew@usocome.com
Assembly **Sales** **Service**	**Bordeaux**	SEW-USOCOME Parc d'activités de Magellan 62, avenue de Magellan - B. P. 182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Lyon	SEW-USOCOME Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 00 Fax +33 4 72 15 37 15
	Paris	SEW-USOCOME Zone industrielle 2, rue Denis Papin F-77390 Verneuil l'Etang	Tel. +33 1 64 42 40 80 Fax +33 1 64 42 40 88
	Additional addresses for service in France provided on request!		

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

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

Australia			
Assembly **Sales** **Service**	**Melbourne**	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au
	Townsville	SEW-EURODRIVE PTY. LTD. 12 Leyland Street Garbutt, QLD 4814	Tel. +61 7 4779 4333 Fax +61 7 4779 5333 enquires@sew-eurodrive.com.au

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

Belgium			
Assembly **Sales** **Service**	**Brüssel**	SEW Caron-Vector S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.caron-vector.be info@caron-vector.be

Brazil			
Production **Sales** **Service**	**Sao Paulo**	SEW-EURODRIVE Brasil Ltda. Avenida Amâncio Gaiolli, 50 Caixa Postal: 201-07111-970 Guarulhos/SP - Cep.: 07251-250	Tel. +55 11 6489-9133 Fax +55 11 6480-3328 http://www.sew.com.br sew@sew.com.br
	Additional addresses for service in Brazil provided on request!		

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

Cameroon			
Sales	**Douala**	Electro-Services Rue Drouot Akwa B.P. 2024 Douala	Tel. +237 4322-99 Fax +237 4277-03

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

Chile			
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China			
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	Additional addresses for service in China provided on request!		

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

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

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India			
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Technical Offices	**Bangalore**	SEW-EURODRIVE India Private Limited 308, Prestige Centre Point 7, Edward Road Bangalore	Tel. +91 80 22266565 Fax +91 80 22266569 salesbang@seweurodriveinindia.com

Ireland			
Sales **Service**	**Dublin**	Alperton Engineering Ltd. 48 Moyle Road Dublin Industrial Estate Glasnevin, Dublin 11	Tel. +353 1 830-6277 Fax +353 1 830-6458

Israel			
Sales	**Tel-Aviv**	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 lirazhandasa@barak-online.net

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

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

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

Korea			
Assembly **Sales** **Service**	**Ansan-City**	SEW-EURODRIVE KOREA CO., LTD. B 601-4, Banweol Industrial Estate Unit 1048-4, Shingil-Dong Ansan 425-120	Tel. +82 31 492-8051 Fax +82 31 492-8056 http://www.sew-korea.co.kr master@sew-korea.co.kr

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

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

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

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

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

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

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

Norway			
Assembly **Sales** **Service**	**Moss**	SEW-EURODRIVE A/S Solgaard skog 71 N-1599 Moss	Tel. +47 69 241-020 Fax +47 69 241-040 http://www.sew-eurodrive.no sew@sew-eurodrive.no

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

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

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

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

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

Senegal			
Sales	**Dakar**	SENEMECA Mécanique Générale Km 8, Route de Rufisque B.P. 3251, Dakar	Tel. +221 849 47-70 Fax +221 849 47-71 senemeca@sentoo.sn

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

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

Slovakia			
Sales	**Bratislava**	SEW-Eurodrive SK s.r.o. Rybnicna 40 SK-83107 Bratislava	Tel. +421 2 49595201 Fax +421 2 49595200 http://www.sew.sk sew@sew-eurodrive.sk
	Zilina	SEW-Eurodrive SK s.r.o. ul. Vojtecha Spanyola 33 SK-010 01 Zilina	Tel. +421 41 700 2513 Fax +421 41 700 2514 sew@sew-eurodrive.sk
	Banská Bystrica	SEW-Eurodrive SK s.r.o. Rudlovská cesta 85 SK-97411 Banská Bystrica	Tel. +421 48 414 6564 Fax +421 48 414 6566 sew@sew-eurodrive.sk

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

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

Spain			
Assembly **Sales** **Service**	**Bilbao**	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Tel. +34 9 4431 84-70 Fax +34 9 4431 84-71 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es

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

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

Thailand			
Assembly **Sales** **Service**	**Chon Buri**	SEW-EURODRIVE (Thailand) Ltd. Bangpakong Industrial Park 2 700/456, Moo.7, Tambol Donhuaroh Muang District Chon Buri 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com

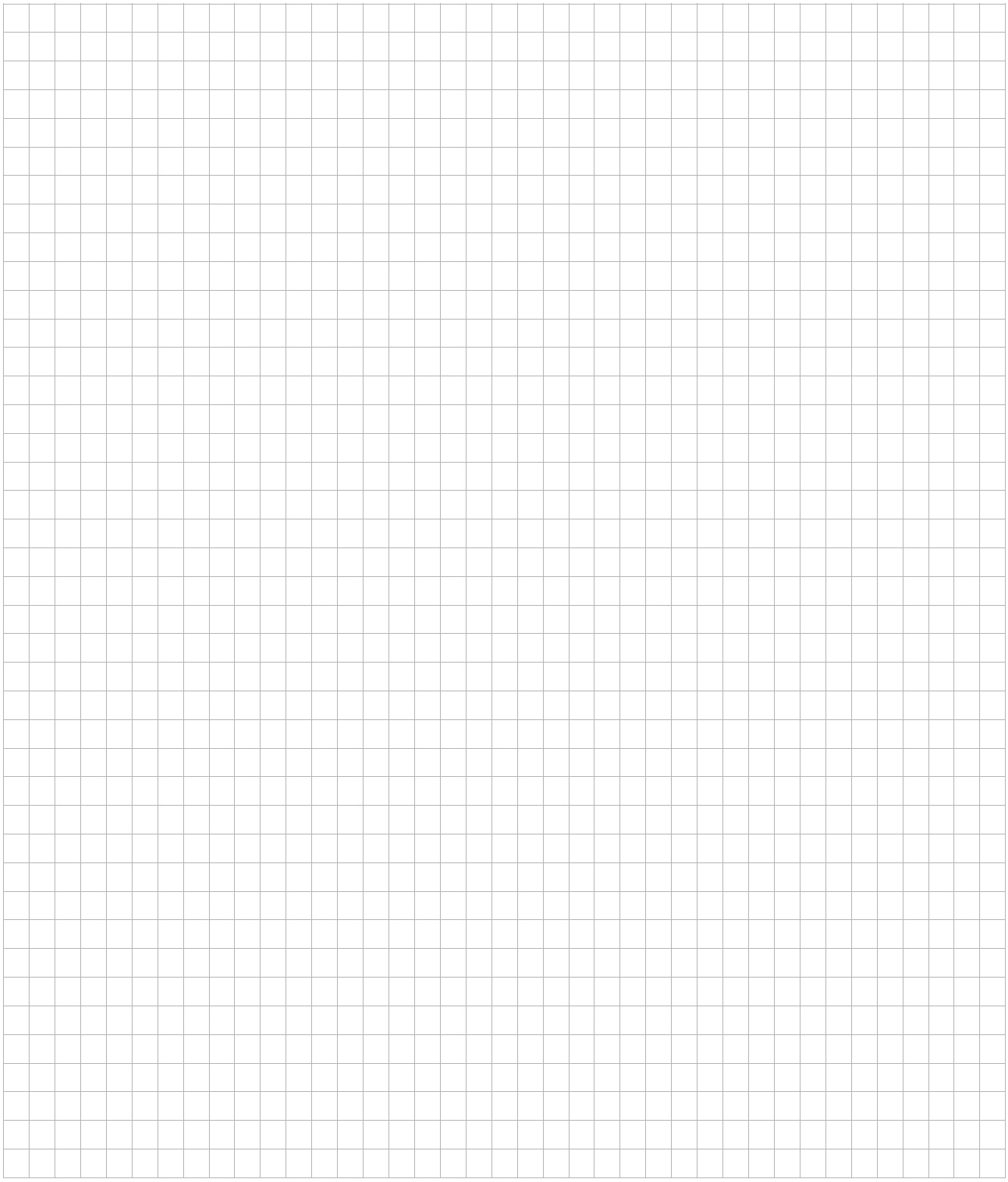
Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service 7, rue Ibn El Heithem Z.I. SMMT 2014 Mégrine Erriadh	Tel. +216 1 4340-64 + 1 4320-29 Fax +216 1 4329-76 tms@tms.com.tn

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419163 / 164 3838014/15 Fax +90 216 3055867 sew@sew-eurodrive.com.tr

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

USA			
Production **Assembly** **Sales** **Service**	**Greenville**	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Manuf. +1 864 439-9948 Fax Ass. +1 864 439-0566 Telex 805 550 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly **Sales** **Service**	**San Francisco**	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, California 94544-7101	Tel. +1 510 487-3560 Fax +1 510 487-6381 cshayward@seweurodrive.com
	Philadelphia/PA	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Dayton	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 440-3799 cstroy@seweurodrive.com
	Dallas	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

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



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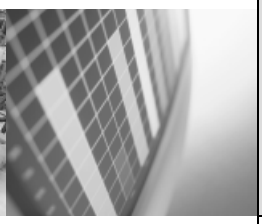



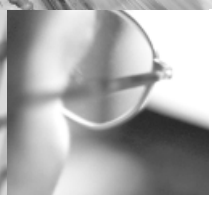

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