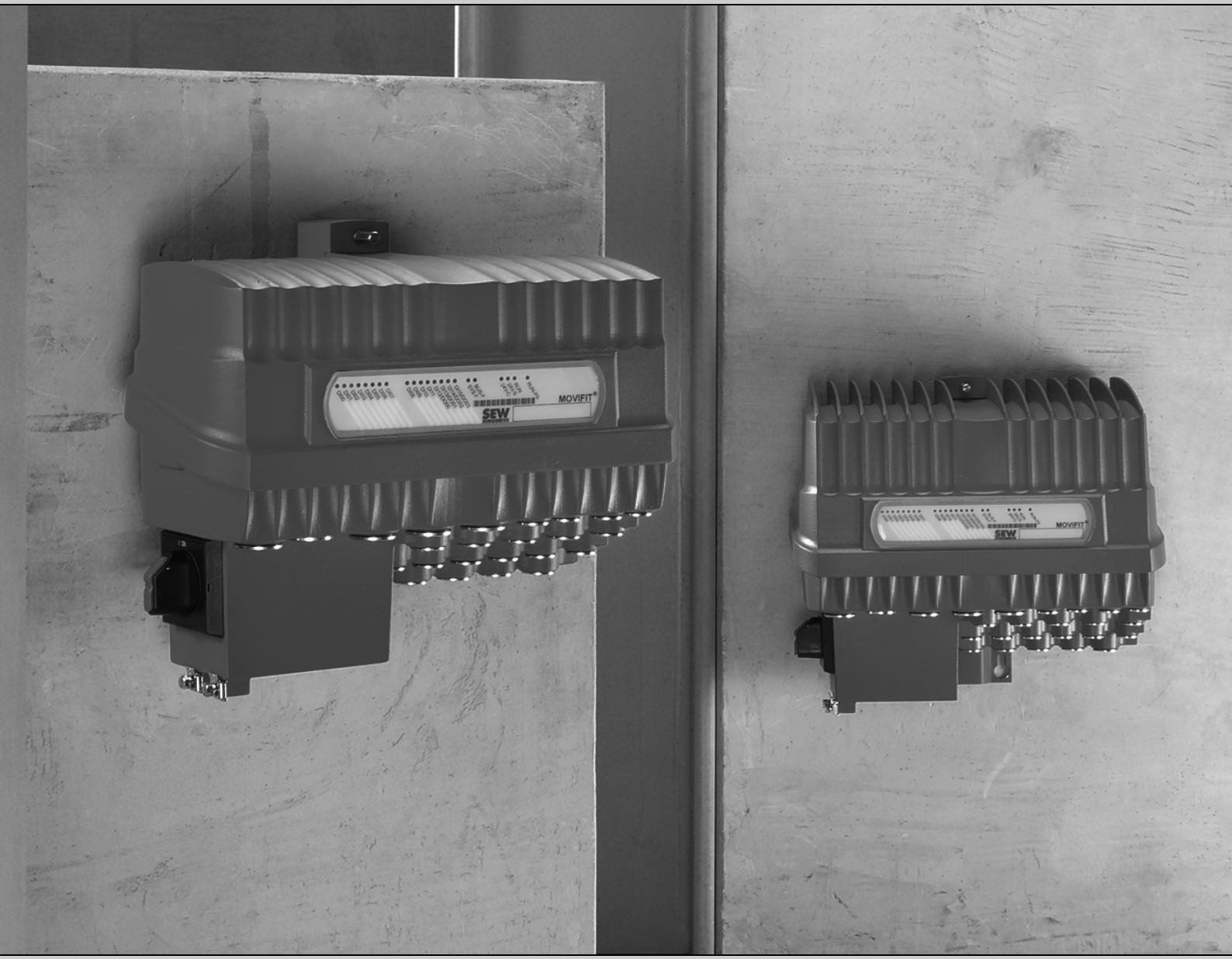
SEW EURODRIVE

Manual

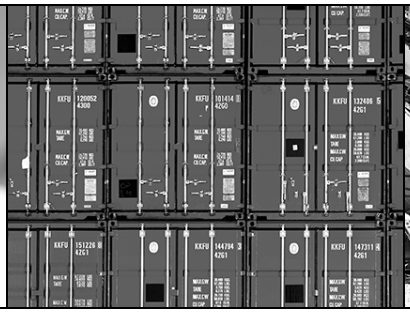


MOVIFIT® FC
Functional Safety with S12 Safety Option

Edition 07/2013

20087756 / EN






Contents

1 General information

1.1 How to use this documentation

The documentation is an integral part of the product and contains important information on operation and service. The documentation is written for all employees who assemble, install, start up, and service this product.

The documentation must be accessible and legible. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

1.2 Structure of the safety notes

1.2.1 Meaning of signal words

The following table shows the graduation and meaning of the signal words for safety notes, warnings regarding potential risks of damage to property, and other notes.

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

1.2.2 Design of the section-related safety notes

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

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

⚠ SIGNAL WORD!

Type and source of danger.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the danger.

1.2.3 Design of the embedded safety notes

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

This is the formal structure of an embedded safety note:

- ⚠ **SIGNAL WORD!** Type and source of hazard.

  Possible consequence(s) if disregarded.

  – Measure(s) to prevent the hazard.

1.3 Rights to claim under warranty

A requirement of fault-free operation and fulfillment of any rights to claim under limited warranty is that you adhere to the information in the documentation. Therefore read the documentation before you start working with the unit.

1.4 Content of the documentation

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

1.5 Exclusion of liability

You must comply with the information contained in this documentation to ensure safe operation and to achieve the specified product characteristics and performance features. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability for defects is excluded.

1.6 Other applicable documentation

This manual supplements the existing documentation and limits the application notes according to the information below. Use this manual only together with the following documents:

- "DR.71-225, 315 AC Motors" operating instructions
- "MOVIFIT® FC" operating instructions
- Manuals for the corresponding function level and fieldbus:
  - "MOVIFIT® Function Level "Classic"" ...
  - "MOVIFIT® Function Level "Technology""...
- "Safety-Rated Encoders – Functional Safety for AC Motors" addendum

1.7 Product names and trademarks

All product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.8 Copyright

2 Safety notes

2.1 General information

Never install or start up damaged products. Submit a complaint to the shipping company immediately in the event of damage.

During operation, drive inverters can have live, bare and movable or rotating parts as well as hot surfaces, depending on their degree of protection.

Removing covers without authorization, improper use as well as incorrect installation or operation may result in severe injuries to persons or damage to property.

Refer to the documentation for additional information.

2.2 Target group

Only qualified personnel are authorized to install, startup or service the units or correct unit faults (observe IEC 60364 or CENELEC HD 384 or DIN VDE 0100 and IEC 60664 or DIN VDE 0110 as well as national accident prevention guidelines).

Qualified personnel in the context of these basic safety notes are all persons familiar with installation, assembly, startup, programming, parameterization and operation of the product who possess the necessary qualifications. In addition to that, they must be familiar with the relevant safety regulations and laws, especially with the requirements of EN ISO 13849-1 and all other standards, directives and laws specified in this documentation. The above mentioned persons must have the authorization expressly issued by the company to operate, program, configure, label and ground units, systems and circuits in accordance with the standards of safety technology.

All persons involved in any other work, such as transportation, storage, operation and disposal, must be trained appropriately.

2.3 Designated use

The S12 safety option is designed for installation in the MOVIFIT® drive controller.

When installed in machines, startup of the S12 safety option (i.e. start of designated operation) is prohibited until it is determined that the machine complies with the local laws and directives. In the individual area of application, you must especially observe the Machinery Directive 2006/42/EC as well as the EMC Directive 2004/108/EC. The EMC test specifications EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-6, EN 61000-6-2 and EN 55011 form the basis for this. EN 60204-1 must also be observed.

The S12 safety option is a parameterizable safety controller that can be used to realize safety shutdowns and drive safety functions. The module can be used as follows:

- In emergency switching off devices
- As safety component according to Machinery Directive 2006/42/EC
- As PES for risk reduction according to IEC 61508
- In safety circuits according to EN 60204-1 and EN 60204-32
- As PES for functional safety according to IEC 62061
- As SRP/CS according to EN ISO 13849
- As device for implementing the safety functions according to EN 61800-5-2
- As logics unit for signal conversion and processing in two-hand control according to EN 574

Observe the technical data and information on the connection requirements as provided on the nameplate and in the documentation.

2.4 Transportation and storage

Observe the notes on transportation, storage and proper handling. Comply with the requirements for climatic conditions stated in chapter "Technical data of S12 safety option".

2.5 Installation

The units must be installed and cooled as stipulated in the corresponding documentation, see chapter "Other applicable documentation".

Protect the S12 safety option from improper strain. Ensure that components are not deformed and/or insulation spaces are maintained, particularly during transportation. Avoid contact with electronic elements and contacts.

The S12 safety option contains components that can easily be damaged by electrostatic energy and improper handling. Prevent mechanical damage or destruction of electric components (may pose health risk).

The following applications are prohibited unless explicitly permitted:

- Use in potentially explosive atmospheres.
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, radiation, etc.
- Use in non-stationary applications.

2.6 Definitions

- The designation F-DI. stands for safety-related input.

  The designation F-DO. stands for safety-related output.

  The dot "." is a placeholder.
- The designation S12 is used as a generic term for all derivatives of the S12 product series. If a particular derivative is referred to in the manual, then the complete designation is used.
- The term "safe" used in this manual refers to the classification as a safe function according to EN ISO 13849-1.
- PROFIsafe is a technology standard for a safe fieldbus system.
- The "Assist S12" parameterization tool is a user interface for setting the parameters of the S12 safety option.

3 Safety concept

The drive safety functions shown in this chapter are based on the standard EN 61800-5-2.

3.1 Safety concept for MOVIFIT® FC frequency inverters

3.1.1 Description of the function

The FC version of MOVIFIT® acts as a power distributor and communication interface with an integrated frequency inverter with a power range of 0.37 to 4 kW. It can be connected with an external safety relay, an external safety controller, or the integrated S12 safety option. For a safe torque off, these units disconnect the 24 V supply voltage that is necessary to generate a rotating field at the inverter output.

The 24V_P supply voltage (safety-related 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 plug connector. The control electronics and the power section are housed in the EBOX. The safety-related 24V_P voltage supply is routed through a polarity protection diode at the input of the EBOX. A switched-mode power supply ("SNT Safety") generates a 5 V voltage from the safety-related 24 V supply for the computer as well as the supply voltages for the output stage control.

The line 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 conditioned in the respective 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.

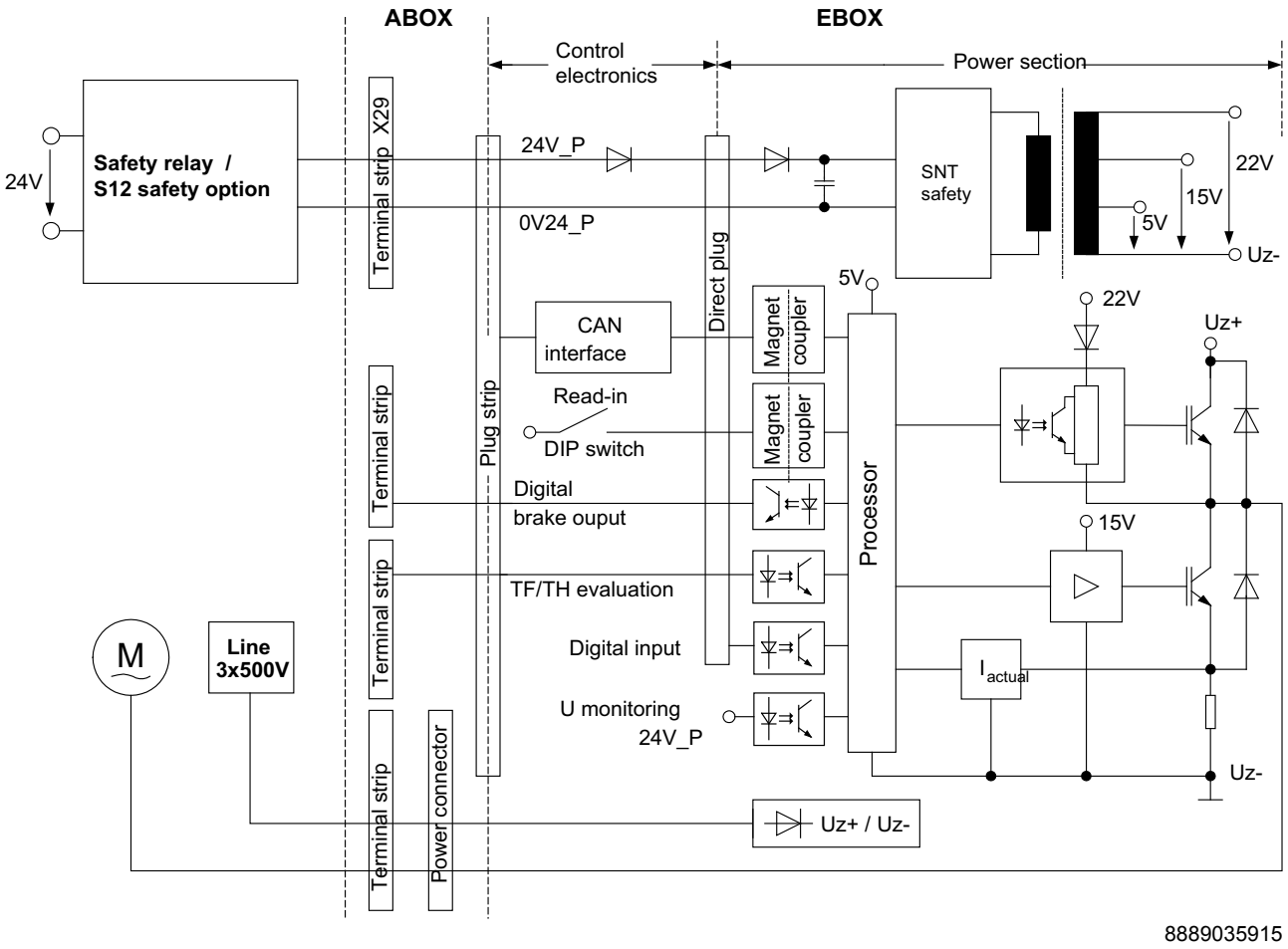
This kind of disconnection ensures that all active elements required to generate a pulse pattern at the inverter output are switched off.

External connection via a safety controller that

- Is approved for at least PL d according to EN ISO 13849-1
- Disconnects with at least PL d according to EN ISO 13849-1

allows the MOVIFIT® FC units to be used for "safe torque off and safe stop 1" according to EN 61800-5-2 and "fail-safe protection against unintended restart" according to EN 1037, and to meet Performance Level d according to EN ISO 13849-1. The MOVIFIT® unit supports stop categories 0 and 1 according to EN 60204-1.

3.1.2 MOVIFIT® FC block diagram



3.1.3 Restrictions

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

⚠ WARNING

Electric shock due to dangerous voltages in the ABOX. If the safety-related 24 V voltage is disconnected, MOVIFIT®-FC remains connected to the mains voltage.

Severe or fatal injuries.

- Switch off the power to the MOVIFIT® unit using a suitable external disconnecting device, and wait at least 1 minute before opening the wiring space.

3.2 Safety concept of S12 safety option

- The S12 safety option is an integrated, safety-related electronic assembly that can be operated with or without PROFIsafe connection. It is equipped with safety-related inputs and outputs (F-DI, F-DO). It is available in the following 2 versions:
  - **S12A safety option:**
    - 4 safety-related inputs
    - 1 safety-related 2-channel output for STO
    - 2 safety-related 2-channel outputs
  - **S12B safety option:**
    - 8 safety-related inputs
    - 1 safety-related 2-channel output for STO
    - No other safety-related outputs
- With both safety option versions, the STO function of the internal power section of MOVIFIT® FC can be activated with the integrated, safety-related F-DO-STO output.
- The safety concept of this assembly is based on a safe status for all safety-related process variables. For the S12 safety option, this value is "0" for all inputs F-DI and outputs F-DO.
- The system was designed according to IEC 61508 SIL3 and EN ISO 13849-1 Performance-Level e.
- The safety-related output F-DO_STO is used to disconnect the 24 V supply to the inverter, which achieves safety-related stopping of the drive. In this context, observe the safety concept of the MOVIFIT® FC inverter, all conditions, and all installation specifications in this publication.

⚠ WARNING

For the overall MOVIFIT® FC system with S12 safety option, the safety class of the MOVIFIT® unit is decisive with respect to safe stop and safe torque off.

Severe or fatal injuries.

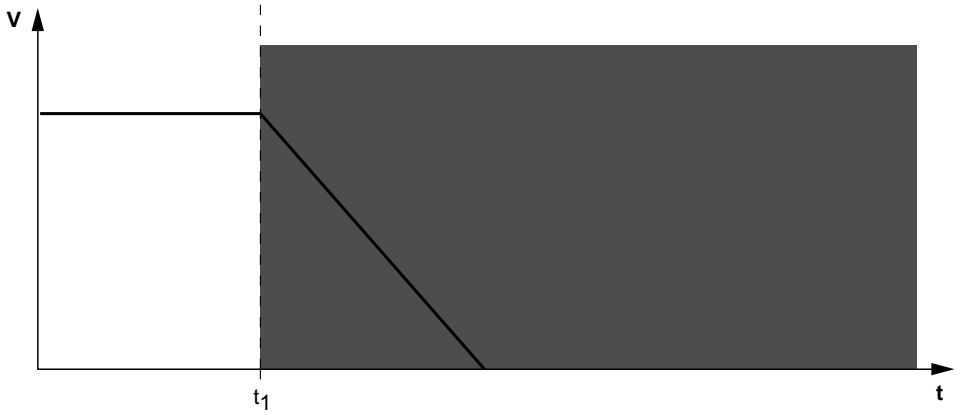
- MOVIFIT® FC may only be used up to Performance Level d according to EN ISO 13849-1.
- Group drive is not allowed for MOVIFIT® FC.
- Also note the constraints in the "MOVIFIT® FC" operating instructions.

3.3 Drive safety functions

This chapter describes the drive safety functions according to EN 61800-5-2. Some of the drive safety functions of the S12 safety option exceed the definitions in the standard.

3.3.1 STO – Safe Torque Off

When the STO function is active, the drive inverter does not supply any power to the motor. The drive cannot generate torque. This drive safety function corresponds to a non-controlled stop according to EN 60204-1, stop category 0.



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Drive safety function trips

v = Velocity
t = Time
t_1 = Point of time when STO is triggered

INFORMATION

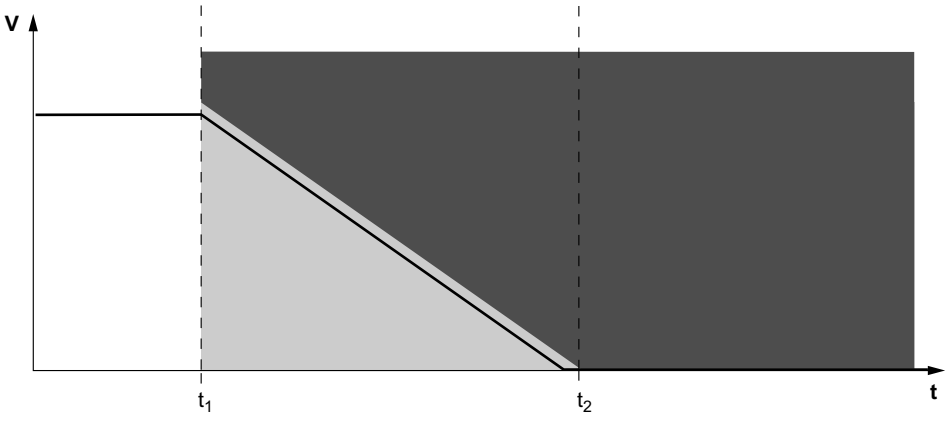
The motor coasts to a halt or is stopped mechanically.

Controlled standstill is preferred, if possible (see SS1).

3.3.2 SS1(a) – Safe Stop 1

When the SS1(a) function is active, the inverter brings the motor to a standstill electrically. The braking operation is controlled and monitored. The drive safety function STO is triggered when the monitored brake curve is exceeded or when standstill is reached.

This drive safety function corresponds to a controlled stop of the drive according to EN 60204-1, stop category 1.



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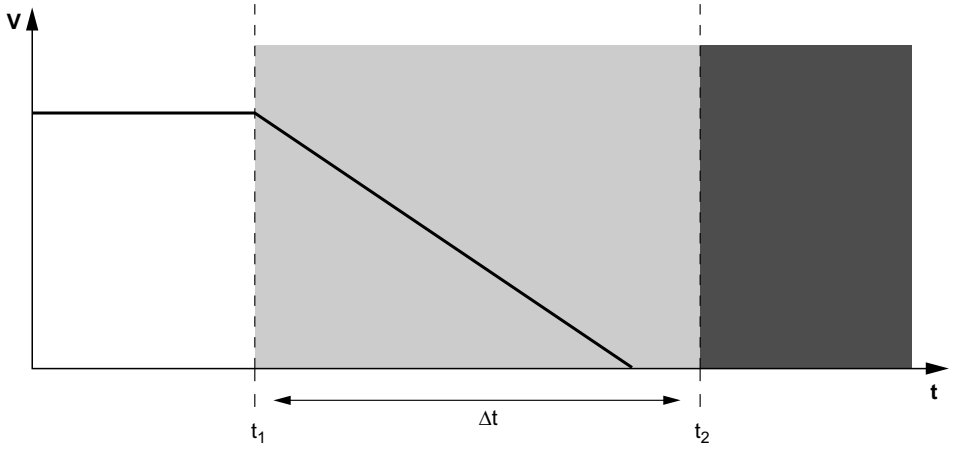
Drive safety function monitoring
Drive safety function trips

v = Velocity
t = Time
t_1 = Point of time when SS1(a) is activated and the braking action is triggered
t_2 = Point of time when STO is triggered

3.3.3 SS1(c) – Safe Stop 1

When the SS1(c) function is active, the inverter brings the motor to a standstill electrically. The drive safety function STO will be triggered after a specified, safety-related time.

This drive safety function corresponds to a controlled stop of the drive according to EN 60204-1, stop category 1.



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Drive safety function monitoring
Drive safety function trips

v = Velocity
t = Time
t_1 = Point of time when SS1(c) is activated and the braking action is triggered
t_2 = Point of time when STO is triggered
Δt = Safety-related period of time

INFORMATION

- The SS1(c) function does not monitor the stopping of the drive.
- The safety-related period of time Δt allows the drive to come to a stop. In the event of a fault, the drive does not come to a stop and becomes de-energized at the time t_2 (STO).

3.3.4 SLS – Safely Limited Speed

The SLS function prevents the drive from exceeding a specified velocity. When the permitted speed is exceeded, the drive safety function stops the drive (STO or SS1). At the same time, an error response (normally STO or SS1) is triggered.

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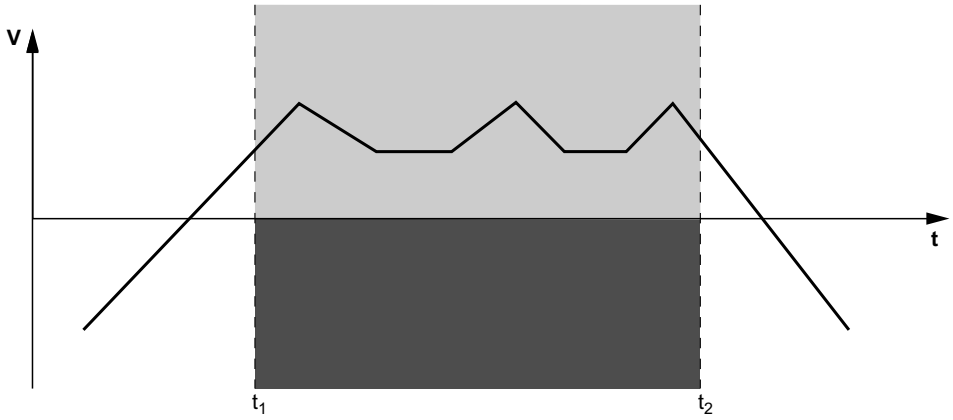
Drive safety function monitoring
Drive safety function trips

v = Velocity
t = Time
t_1 = Point of time when SLS is activated
t_2 = Point of time when SLS is deactivated

3.3.5 SDI – Safe Direction

The SDI function prevents movement in an unintended direction. If this condition is violated, the drive safety function stops the drive. At the same time, an error response (STO) is triggered.



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Drive safety function monitoring
Drive safety function trips

v = Velocity
t = Time
t_1 = Point of time when SDI is activated
t_2 = Point of time when SDI is deactivated

3.4 Safety concept of Assist S12

3.4.1 Safety parameters

All drive safety functions of the S12 safety option can be set via safety parameters (*F-iPar*).

The safety parameters (*F-iPar*) determine the behavior of the corresponding drive safety function and are therefore safety-relevant. All safety parameters (*F-iPar*) are combined in the *F-iPar* parameter set.

3.4.2 Test concept and test procedure

The parameters of the S12 safety option are set using an engineering PC with the "Assist S12" parameterization tool. As the PC and the "Assist S12" parameterization tool are not safety-related and therefore not error-free, the safety concept requires the following measures:

- Tests that the S12 safety option and the user have to carry out,
- Guided parameter setting process in the "Assist S12" parameterization tool with integrated safety characteristics.

The following test procedure ensures that only the parameter values that you have set (and not any unwanted or distorted values) are transferred to the S12 safety option.

1. **Connecting MOVIFIT® to the PC and locating it**
   - Connect the engineering PC (PC with "MOVITOOLS® MotionStudio" and "Assist S12") to the MOVIFIT® unit via the diagnostic interface.
   - Start "MOVITOOLS® MotionStudio".
   - Scan the network in MOVITOOLS® MotionStudio".
   - Start the "Assist S12" parameterization tool and locate the MOVIFIT® unit.

     To avoid confusion with other equipment, enter the serial number of the MOVIFIT® that you want to parameterize. The serial number is on the namplate of the MOVIFIT® EBOX (SO#XX.XXXXXXXXX.XXXX.XX)

     The actual parameter set is automatically transferred from the MOVIFIT® unit to the "Assist S12" parameterization tool.
2. **Setting and downloading parameters**
   - Set the parameters in the "Assist S12" parameterization tool according to your safety-related requirements. For this purpose, you can use functional folders with all safety-related setting options.
   - The "Assist S12" parameterization tool creates a new *iPar* parameter set from all parameters.

     Transfer the *iPar* parameter set to the S12 safety option.

     This process is not safety-related.
3. **Remedying plausibility errors**
   - During the download, the actual parameter set is checked for consistency and plausibility and then saved locally.

     The "Assist S12" parameterization tool shows the new actual parameter set in a separate column.

- The "Assist S12" parameterization tool highlights any occurred plausibility errors in blue.

  Remedy all plausibility errors.

4. **Verification and validation**
   - Check whether the set actual parameters correspond with the desired parameters. Check whether the parameters are correct for your plant. Confirm the checks in the "Assist S12" parameterization tool.
   - Finally, the "Assist S12" parameterization tool generates a validation protocol.
   - Validate the parameterizable drive safety functions of the plant during startup using the validation protocol.

4 Safety conditions

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

- Nameplate of complete unit
- Installation requirements
- Requirements for external sensors and actuators (in combination with S12 safety option)
- Startup requirements
- Operational requirements

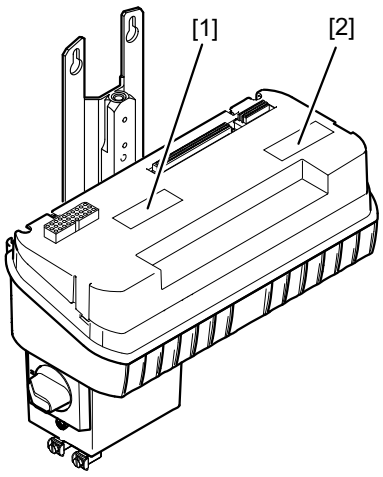
4.1 Notes on stop categories

- **Stop category 0** permits disconnection of the safety-related 24 V voltage supply regardless of the setpoints.
- In **stop category 1**, the S12 safety option controls the stopping of the drive:
  - With SS1(c), the safety-rated 24 V supply voltage is disconnected after the parameterized braking period.
  - With SS1(a), the stopping of the drive is monitored. At standstill, the safety-related 24 V supply voltage is disconnected.

4.2 Nameplates

4.2.1 Nameplate position

The following figure shows the positions of the nameplates on the ABOX:



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[1] Nameplate of the complete unit (EBOX and ABOX)
[2] ABOX nameplate

4.2.2 Nameplate of complete unit

The following figure provides an example of a nameplate of the complete MOVIFIT® FC unit (EBOX and ABOX):

8510442251

This nameplate is only present when both EBOX and ABOX were ordered as a unit.

INFORMATION

Only components marked with the FS logo for functional safety may be installed in safety applications. For combinations of units without FS logo (consisting of individual EBOX and ABOX), the safety function must be described in the documentation.

4.2.3 Description of FS logo

The FS logo can be displayed on the complete unit nameplate of MOVIFIT® in the following versions:

MOVIFIT® with STO (with or without S11 PROFIsafe option)

For more information about MOVIFIT® with **FS01** logo, refer to the "MOVIFIT® MC / FC – Functional Safety manual".

MOVIFIT® with S12 safety option

For more information about MOVIFIT® with **FS80** logo, refer to this manual.

4.3 Installation requirements

- Power cables and safety-related control cables have to be routed separately.
- Only original SEW hybrid cables may be used to connect MOVIFIT® FC and the motor.
- The wiring technology used must comply with EN60204-1.
- The safety-related control cables of the S12 safety option must be installed according to EMC requirements.

  Adhere to the relevant regulations in force for the application.
- Make sure that parasitic voltages cannot be generated in the safety-related control cables.
- Observe the values specified for safety components when designing the safety circuits.
- Observe the notes in the "MOVIFIT® ..." operating instructions on EMC-compliant cabling.
- Only use voltage sources with safe disconnection (SELF/PELV) in accordance with VDE 0100. According to EN 61131-2, the voltage between the outputs or between any output and grounded parts may not exceed DC 60 V in case of a single fault in the voltage supply.
- Observe the technical data of MOVIFIT®.

Note the additional requirements in connection with the encoder EI7C FS:

- When connecting an EI7C FS encoder to the MOVIFIT® unit, the encoder cable must not carry a TF signal.
- When using an EI7C FS encoder together with application modules, the digital inputs DI04 – DI07 at the X25 terminal of the application module may not be used at all, or as encoder inputs only.
- The S12 safety option can detect a minimum speed of 60 rpm in connection with an EI7C FS encoder.

4.4 Sensor and actuator requirements

- The project planner and the operator of the system or machine are responsible for the selection and use of external sensors and actuators to connect to the safety-related inputs and outputs of the S12 safety option.
- Note that the majority of dangerous failures for any given safety class is usually caused by the sensors and actuators.
- To meet the required Performance Level (PL) / SIL, you have to use suitable and qualified sensors and actuators and observe the relevant wiring diagrams and notes in chapter "Safety-related inputs" (page 37) and "Safety-related outputs" (page 45).

4.5 Startup requirements

After parameterization and startup, the startup engineer has to check and document the correct performance of the safety functions.

For MOVIFIT® applications with safety-related disconnection of the drive

- in stop category 0 or 1 in accordance with EN 60204-1,
- fail-safe protection against restart in accordance with EN 1037,
- and compliance with Performance Level d according to EN ISO 13849-1,

startup checks of the disconnecting device and the correct wiring must always be carried out and documented.

This is supported by the "Assist S12" parameterization tool with a validation protocol.

INFORMATION

The insert labels of the MOVIFIT® EBOXes are assigned to the respective EBOX. If you take out the labels to mark them, make sure that they are re-inserted in the right EBOX.

To avoid danger in the application, the user has to check whether the error response time of each safety function (when a failure occurs) is shorter than the maximally permitted error response time of the application. The maximally permitted error response time may not be exceeded!

4.6 Operational requirements

⚠ WARNING

When using a TF temperature sensor and automatic disconnection in case of overtemperature, there is a risk that the drive restarts automatically when the motor cools down.

Severe or fatal injuries.

- If danger could result from automatic restarts, you must prevent access to the hazardous areas that are connected to the drive.

- Operation is only permitted within the limits specified in the technical data. This applies to the S12 safety option and the MOVIFIT® unit.

5 Hazard caused by a coasting drive

⚠ WARNING

Without mechanical brake or if the brake is faulty, the drive might coast to a halt.

Severe or fatal injuries.

- If coasting to a halt causes hazards, depending on the application, additional protective measures (e.g. guard 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 safe braking system.
- The additional protective covers must be designed and integrated so that they meet the requirements determined in the risk assessment 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 must be determined to ensure that the resulting safety distance is maintained adequately.

6 Electrical installation

6.1 Installation instructions

To guarantee electrical safety and fault-free operation, you must observe the general installation instructions and the notes in the MOVIFIT® operating instructions.

⚠ 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.

6.1.1 UL-compliant installation

For UL-compliant installation in conjunction with the S12 safety option, observe the following note:

INFORMATION

For UL-compliant installation, limit the input current for the S12 safety option to 4 A.

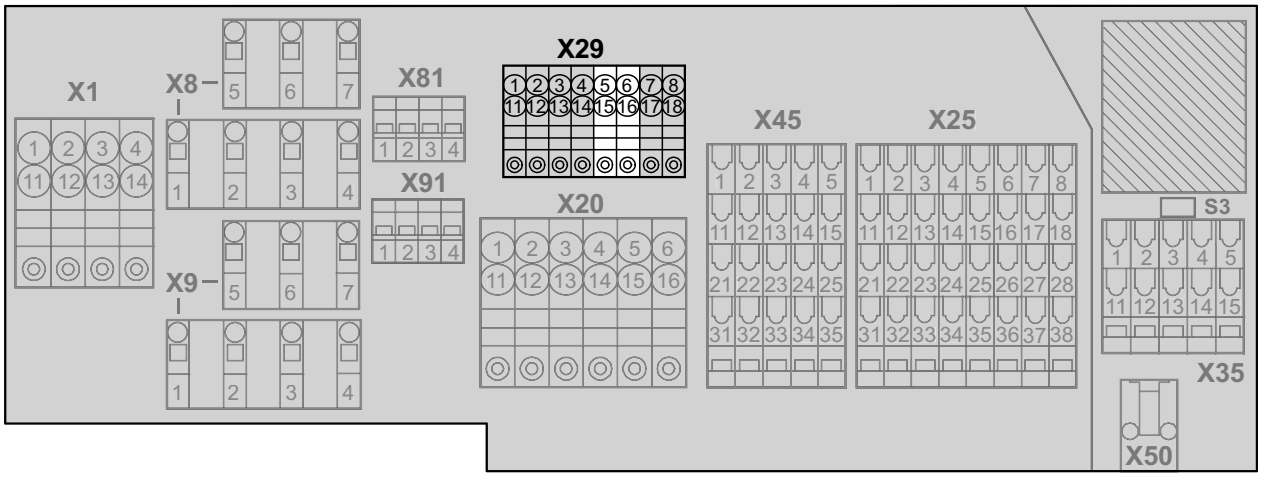
See chapter "Connection example for power bus" (page 32).

6.2 Safe disconnection of MOVIFIT®

6.2.1 MOVIFIT® FC

Relevant terminals for safe disconnection

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



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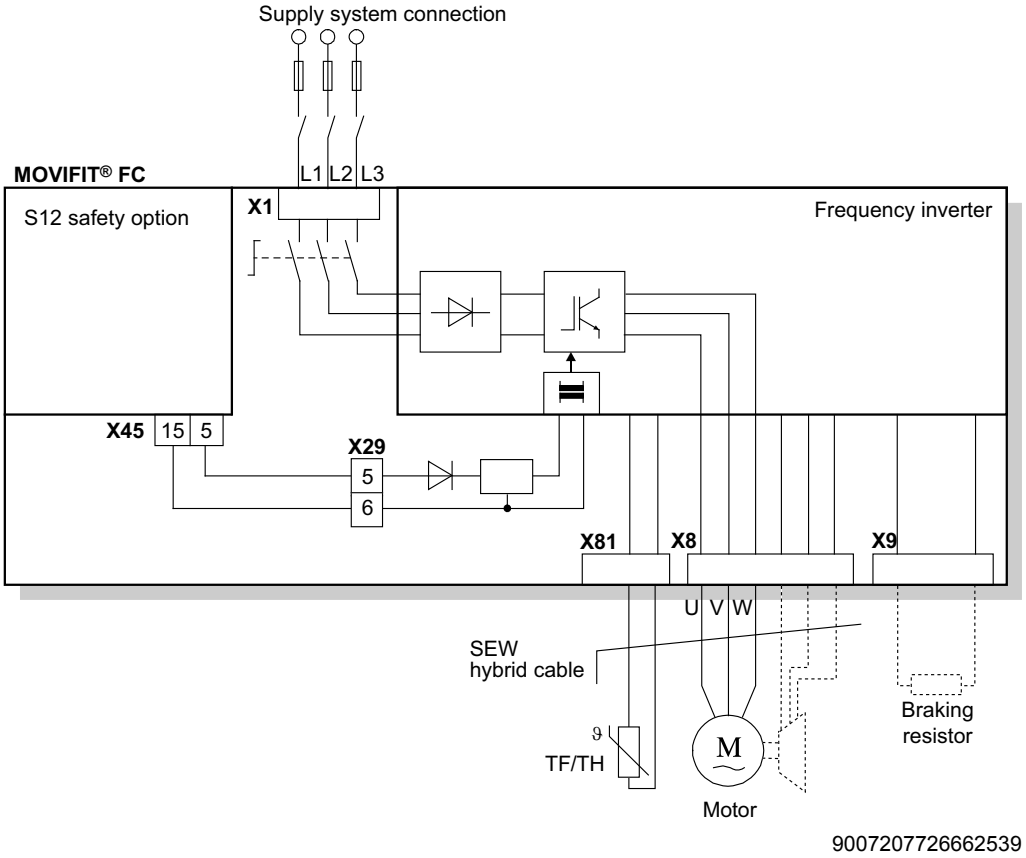
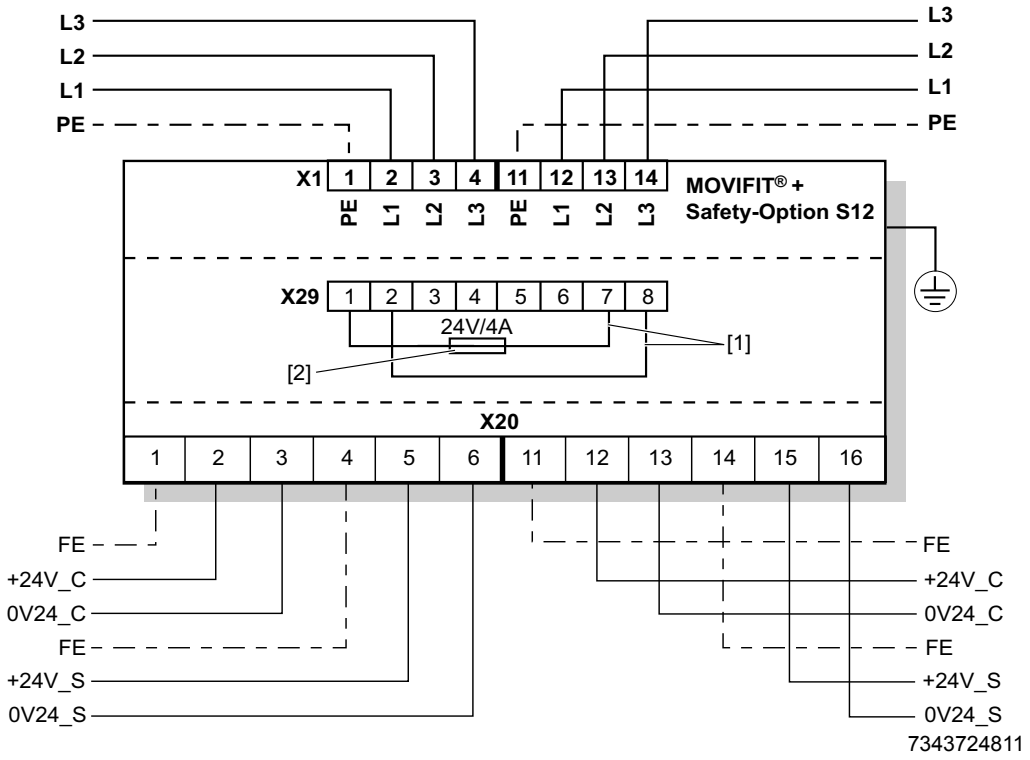
Terminal strip	Name	Function
X29/5	**+24V_P**	Connection of safety-related 24 V supply voltage +24V supply for integrated frequency inverter
X29/6	**0V24_P**	Connection of safety-related 24 V supply voltage 0V24 reference potential for integrated frequency inverter
X29/15	**+24V_P**	Connection of safety-related 24 V supply voltage +24V supply for integrated frequency inverter
X29/16	**0V24_P**	Connection of safety-related 24 V supply voltage 0V24 reference potential for integrated frequency inverter

Wiring diagram for MOVIFIT® FC with S12 safety option for safe disconnection



6.2.2 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. The S12 safety option and the safety-related inputs/outputs are supplied by the 24V_C voltage in the example.



[1] Example showing 24V_C supply for S12 safety option
[2] Example (fuse 24 V / 4 A) for UL-compliant installation (depending on the installation)

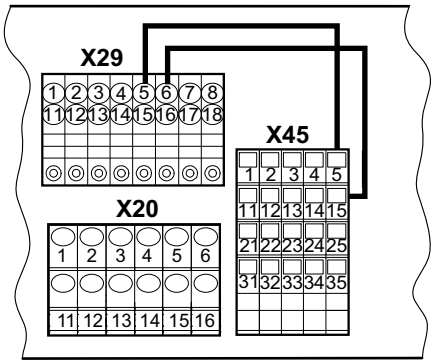
INFORMATION

SEW-EURODRIVE recommends using the 24V_C electronics and sensor voltage to supply the S12 safety option, 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, this might cause faults and error messages in the communication with the safety controller, as the 24V_O voltage supplies the entire safety electronics of the S12 safety option. If 24V_O is switched off, the PROFIsafe station is missing in the network.

6.2.3 Safety-related stopping with S12 safety option

To safely disconnect the MOVIFIT® FC drive using the S12 safety option, the safe output F-DO_STO must be connected to the 24 V voltage supply 24V_P (see the following figure).



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⚠ WARNING

The drive safety function of MOVIFIT® FC inverter is only permitted for applications up to Performance Level d according to EN ISO 13849-1.

Severe or fatal injuries.

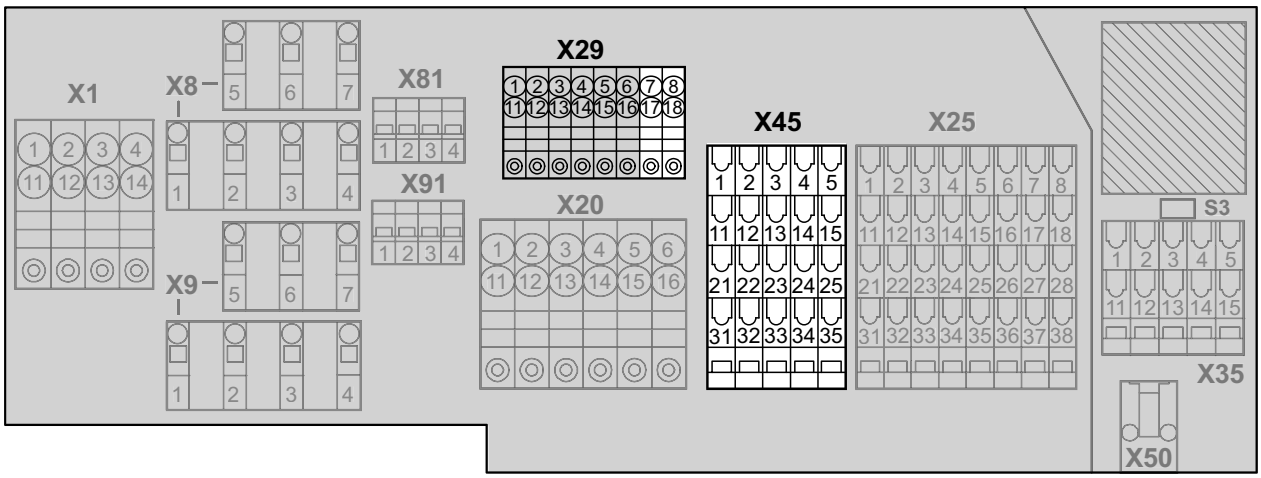
- Observe the relevant "Safety concept" (page 14) as well as the "Safety requirements" (page 24).
- The drive safety functions must be verified and documented during startup.

6.3 S12 safety option – electrical installation

6.3.1 Terminal assignment

The following connection terminals are relevant for operating the S12 safety option. The following figures show an example of the connection board for MOVIFIT® FC:

X29: 24 V distributor terminals



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Distributor terminal 24 V (for distributing the supply voltage to the option card)			
No.		**Name**	**Function**
X29	7	+24V_O	+24 V supply for option card
	8	0V24_O	0V24 reference potential for option card
	17	+24V_O	+24 V supply for option card
	18	0V24_O	0V24 reference potential for option card

X45: I/O terminals for safety-related inputs/outputs with S12A safety option

I/O terminals for safety-related inputs/outputs (only in connection with S12A safety option)			
No.		**Name**	**Function**
X45	1	F-DI00	Safety-related digital input F-DI00 (switching signal)
	2	F-DI02	Safety-related digital input F-DI02 (switching signal)
	3	F-DO00_P	Safety-related digital output F-DO00 (sourcing signal)
	4	F-DO01_P	Safety-related digital output F-DO01 (sourcing signal)
	5	F-DO_STO_P	Safety-related digital output F-DO_STO (sourcing signal) for safe torque off in the drive (STO)
	11	F-DI01	Safety-related digital input F-DI01 (switching signal)
	12	F-DI03	Safety-related digital input F-DI03 (switching signal)
	13	F-DO00_M	Safety-related digital output F-DO00 (sinking signal)
	14	F-DO01_M	Safety-related digital output F-DO01 (sinking signal)
	15	F-DO_STO_M	Safety-related digital output F-DO_STO (sinking signal) for safe torque off in the drive (STO)
	21	F-SS0	+24 V sensor supply for safety-related inputs F-DI00 and F-DI02
	22	F-SS0	+24 V sensor supply for safety-related inputs F-DI00 and F-DI02
	23	F-SS1	+24 V sensor supply for safety-related inputs F-DI01 and F-DI03
	24	F-SS1	+24 V sensor supply for safety-related inputs F-DI01 and F-DI03
	25	F-SS1	+24 V sensor supply for safety-related inputs F-DI01 and F-DI03
	31	0V24_O	OV24 reference potential for safety-related inputs/outputs
	32	0V24_O	OV24 reference potential for safety-related inputs/outputs
	33	0V24_O	OV24 reference potential for safety-related inputs/outputs
	34	0V24_O	OV24 reference potential for safety-related inputs/outputs
	35	0V24_O	OV24 reference potential for safety-related inputs/outputs

X45: I/O terminals for safety-related inputs/outputs with S12B safety option

I/O terminals for safety-related inputs/outputs (only in connection with S12B safety option)			
No.		**Name**	**Function**
X45	1	F-DI00	Safety-related digital input F-DI00 (switching signal)
	2	F-DI02	Safety-related digital input F-DI02 (switching signal)
	3	F-DI04	Safety-related digital input F-DI04 (switching signal)
	4	F-DI06	Safety-related digital input F-DI06 (switching signal)
	5	F-DO_STO_P	Safety-related digital output F-DO_STO (sourcing signal) for safe torque off in the drive (STO)
	11	F-DI01	Safety-related digital input F-DI01 (switching signal)
	12	F-DI03	Safety-related digital input F-DI03 (switching signal)
	13	F-DI05	Safety-related digital input F-DI05 (switching signal)
	14	F-DI07	Safety-related digital input F-DI07 (switching input)
	15	F-DO_STO_M	Safety-related digital output F-DO_STO (sinking signal) for safe torque off in the drive (STO)
	21	F-SS0	+24 V sensor supply for safety-related inputs F-DI00, F-DI02, F-DI04 and F-DI06
	22	F-SS0	
	23	F-SS1	+24 V sensor supply for safety-related inputs F-DI01, F-DI03, F-DI05 and F-DI07
	24	F-SS1	
	25	F-SS1	
	31	0V24_O	OV24 reference potential for safety-related inputs/outputs
	32	0V24_O	OV24 reference potential for safety-related inputs/outputs
	33	0V24_O	OV24 reference potential for safety-related inputs/outputs
	34	0V24_O	OV24 reference potential for safety-related inputs/outputs
	35	0V24_O	OV24 reference potential for safety-related inputs/outputs

6.3.2 Safety-related inputs (F-DI.)

The safety-related inputs (F-DI.) are connected at terminal X45. The following sections explain and describe the permitted connection options.

The safety-related inputs are processed in 2-channel mode in the S12 safety option. The safety-related inputs are therefore suitable for applications up to SIL3 according to IEC 61508 and Performance Level e according to EN ISO 13849-1. The external sensors and their wiring must comply with the required safety class

Please note the wiring diagrams below. In addition, observe the "Sensor and actuator requirements" (page 27).

Unassigned inputs need not be wired. An open input is always read as a "0" signal.

Pulsed voltage supply and cross-fault monitoring

For information about parameter setting and operating principles, refer to chapter "Startup":

If crossfault monitoring is active for a safety-related input F-DI, the following assignment between the sensor supply F-SS and the safety-related input F-DI must be adhered to:

- F-DI00, F-DI02, F-DI04 (S12B only), F-DI06 (S12B only) via the respective sensor to F-SS0
- F-DI01, F-DI03, F-DI05 (S12B only), F-DI07 (S12B only) via the respective sensor to F-SS1

Crossfault monitoring can be selected separately for each input.

If crossfault monitoring is not active (e.g. for sensors with OSSD output), the sensors can be supplied by F-SS or by another +24 V supply that has the same ground reference as 24V_O. If 24V_O and 24V_C are jumpered (X29), you can use the sensor supply of terminal X25.

The safety-related inputs do not require shielded cables.

⚠ WARNING

Danger due to incorrect setting of parameter *F-DI. connection type* when connecting 2-channel sensors. With the setting "1-channel", there is no redundancy or discrepancy check.

Severe or fatal injuries.

- When connecting 2-channel sensors, you must set the parameter *F-DI. connection type* to "2-channel (non-equivalent/equivalent)".

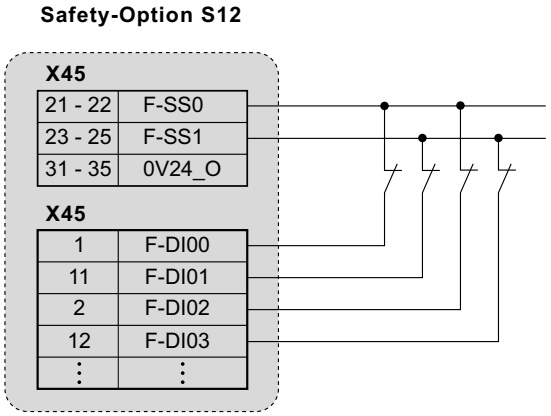
Only the connection variants shown below are permitted in safety-related applications. Also note the assignment of connection options of the safety-related inputs to the category structure according to EN ISO 13849-1.

a) Sensors with contact (1-channel)

A 1-channel sensor is connected via the sensor supply F-SS0 or F-SS1, so that crossfaults in the wiring can be detected. Note the detailed assignment of F-DI. to the sensor supply F-SS0 or F-SS1 in chapter "Terminal assignment".

- Select "1-channel connection type" in the "Assist S12" parameterization tool.
- Activate or deactivate crossfault monitoring and pulsed voltage supply (page 37), depending on the safety requirements.

The following figure shows the S12 safety option with 1-channel sensors with contacts:



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Operation with activated crossfault monitoring

The following errors are detected:

- Crossfaults between the digital input and a 24 V supply voltage
- Crossfaults between the digital input and the sensor supply that is not assigned to the input, and all input lines connected to this sensor supply.

⚠ WARNING

The S12 safety option cannot detect a short circuit between a F-SS. sensor supply and a corresponding safety-related input F-DI. (bridging the sensor).

Severe or fatal injuries.

- Make sure that a short circuit between the sensor supply F-SS. and a corresponding safety-related input F-DI. is not possible.

⚠ WARNING

If crossfault monitoring is deactivated, the S12 safety option cannot detect crossfaults in the wiring. This configuration is not permitted for safe applications without further measures.

Severe or fatal injuries.

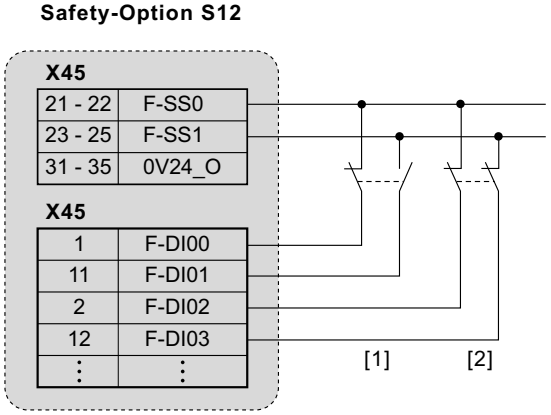
- A 1-channel sensor with crossfault monitoring can achieve a category 2 structure according to EN ISO 13849-1.

a) Sensors with contact (2-channel)

A 2-channel sensor with contacts is connected via the sensor supply F-SS0 and F-SS1. Note the detailed assignment of F-DI. to the sensor supply F-SS0 and F-SS1 in chapter "Terminal assignment".

- Select "2-channel connection type" in the "Assist S12" parameterization tool.
- Activate or deactivate crossfault monitoring and pulsed voltage supply, depending on the safety requirements.
- Set the permitted discrepancy time between the two input signals of the sensor you are using.

The following figure shows the S12 safety option with 2-channel sensors with contacts in the connection variants "non-equivalent" and "equivalent":



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[1] Non-equivalent
[2] Equivalent

Operation with activated crossfault monitoring

The following errors are detected:

- Crossfault between a digital input and a 24 V supply voltage
- Crossfault between the two digital inputs of an input pair.

Operation without crossfault monitoring

When using a 2-channel, non-equivalent sensor, the S12 safety option can detect a crossfault between the two digital inputs of an input pair.

⚠ WARNING

The S12 safety option cannot detect a short circuit between a F-SS. sensor supply and a corresponding safety-related input F-DI. (bridging the sensor).

Severe or fatal injuries.

- Make sure that a short circuit between the sensor supply F-SS. and a corresponding safety-related input F-DI. is not possible.

⚠ WARNING

If crossfault monitoring is deactivated and a 2-channel, equivalent-switching sensor is used, the S12 safety option cannot detect crossfaults in the wiring.

Severe or fatal injuries.

- Make sure that crossfaults are not possible at the safety-related inputs F-DI.

INFORMATION

- Both connection variants, implemented as 2-channel sensor (equivalent or non-equivalent), can achieve a **category 3 structure** according to EN ISO 13849-1 **without crossfault monitoring**.
- Both connection variants, implemented as 2-channel sensor (equivalent or non-equivalent), can achieve a **category 4 structure** according to EN ISO 13849-1 **with crossfault monitoring**.

INFORMATION

- Note that in the non-equivalent connection variant, the NC contact is connected to the sensor supply F-SS0.

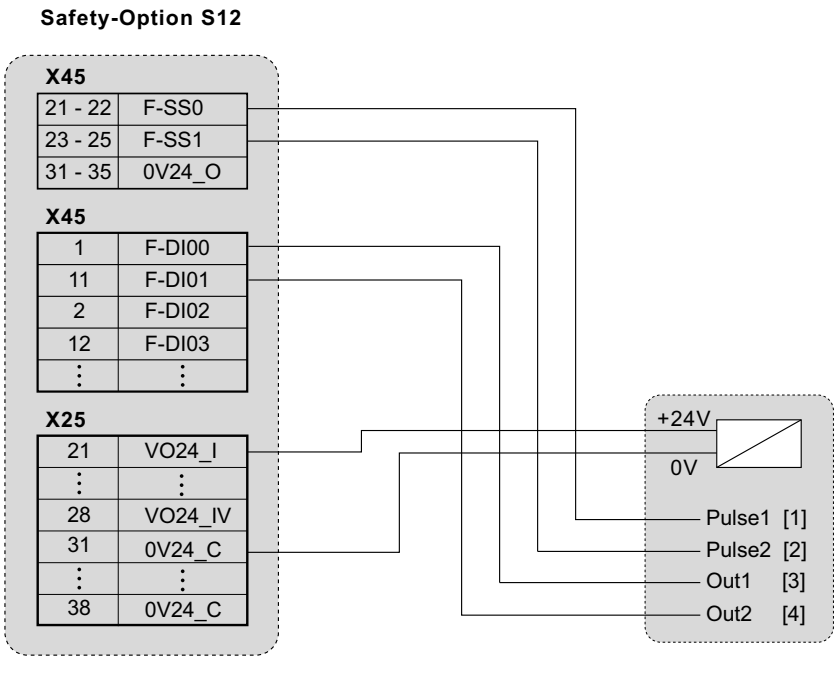
c) Active sensors (2-channel)

When connecting a 2-channel sensor with additional voltage supply, the voltage is supplied via the respective pins of terminal X25. The voltage supplies for the sensor outputs are connected to the sensor supply F-SS0 and F-SS1. The safety-related outputs of the sensor are connected with two channels to the respective inputs F-DI. at terminal X45.

Note the detailed assignment of F-DI. to the sensor supply F-SS0 and F-SS1 in chapter "Terminal assignment".

- Select "2-channel connection type" (equivalent/non-equivalent) in the "Assist S12" parameterization tool.
- Activate or deactivate pulsed voltage supply, depending on the safety requirements, in the "Assist S12" parameterization tool.
- Parameterize the discrepancy time between the two input signals of the sensor you are using.

The following figure shows the S12 safety option with active sensor (2-channel):



[1] Supply of output 1 (Out1)
[2] Supply of output 2 (Out2)
[3] Safety-related digital output 1
[4] Safety-related digital output 2

Operation with activated crossfault monitoring

The following errors are detected:

- Crossfault between a digital input and a 24 V supply voltage
- Crossfault between the two digital inputs of an input pair.

⚠ WARNING

The S12 safety option cannot detect a short circuit between a F-SS. sensor supply and a corresponding safety-related input F-DI. (bridging the sensor).

Severe or fatal injuries.

- Make sure that a short circuit between the sensor supply F-SS. and a corresponding safety-related input F-DI. is not possible.

⚠ WARNING

If crossfault monitoring is deactivated, the S12 safety option cannot detect crossfaults in the wiring.

Severe or fatal injuries.

- Make sure that crossfaults are not possible at the safety-related inputs F-DI., or that they can be detected by the sensor.

INFORMATION

- Both connection variants, implemented as 2-channel sensor (equivalent or non-equivalent), can achieve a **category 3 structure** according to EN ISO 13849-1 **without crossfault monitoring**.
- Both connection variants, implemented as 2-channel sensor (equivalent or non-equivalent), can achieve a **category 4 structure** according to EN ISO 13849-1 **with crossfault monitoring**.

The S12 safety option must be supplied by the electronics and sensor voltage 24V_C, see chapter "Connection example for power bus":

d) Sensors with semiconductor outputs (OSSD, 2-channel)

When connecting an OSSD sensor, make sure that pulsed voltage supply is deactivated.

INFORMATION

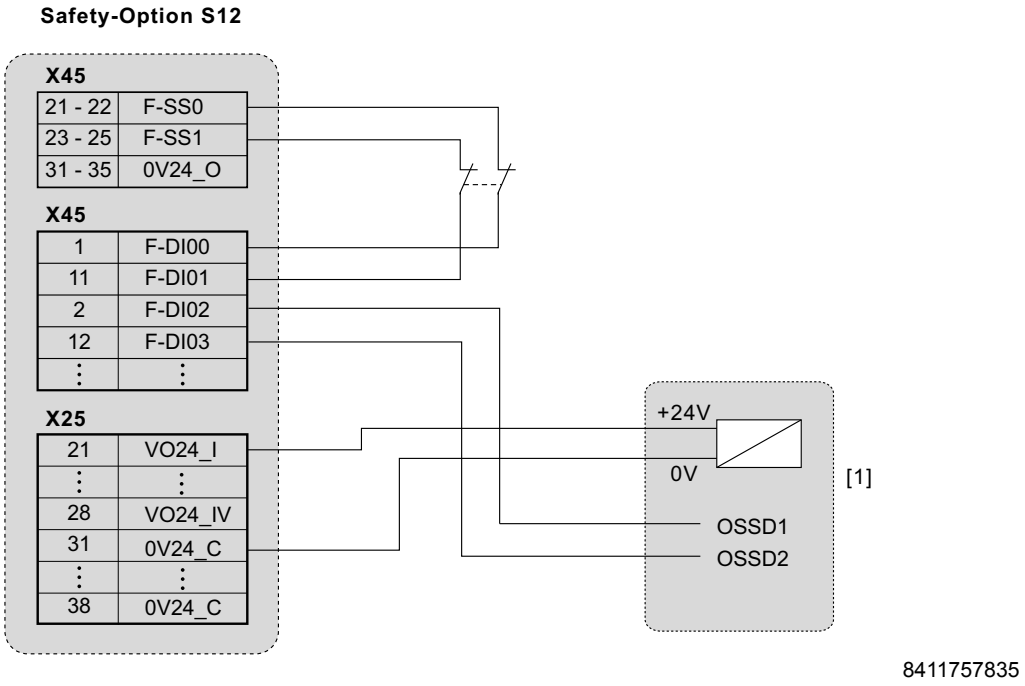
Deactivate crossfault monitoring for the safety-related inputs.

The sensor must check the wiring for crossfaults. The faults detected in the wiring depend on the diagnostic function of the sensor.

For OSSD sensors, the following two connection variants are possible (examples):

Connection variants 1

If pulsed voltage supply is required (e.g. for connecting other, non-OSSD sensors), the OSSD sensor can be supplied by the corresponding pins of the X25 terminal.



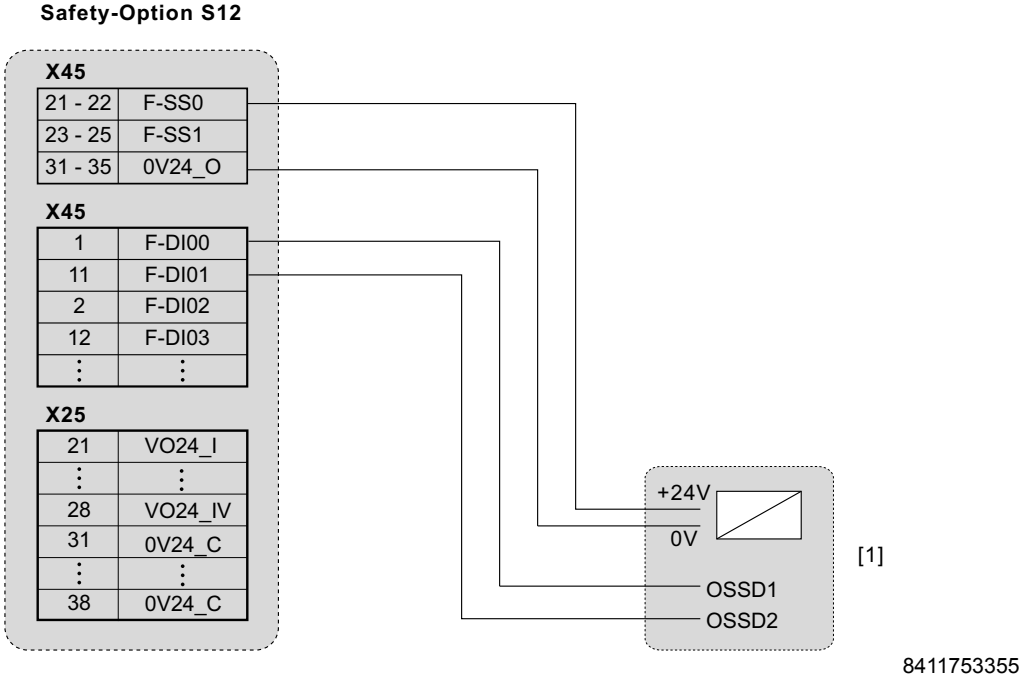
[1] OSSD sensor (e.g. scanner or light grid)

The S12 safety option must be supplied by the electronics and sensor voltage 24V_C, see chapter "Connection example for power bus".

Connection variants 2

If only OSSD sensors are used, the voltage can also be supplied via terminals F-SS0 and F-SS1.

- In this case, deactivate the pulsed sensor supply (F-SS0 and F-SS1) in the "Assist S12" parameterization tool.



[1] OSSD sensor (e.g. scanner or light grid)

INFORMATION

The achievable Performance Level is mainly determined by the OSSD sensors used.

For sensors that have a current consumption that is too high for the F-SS. sensor supply, use the voltage supply of terminal X25.

6.3.3 Safety-related outputs (F-DO. and F-DO_STO)

General information

The safety-related outputs are processed in 2-channel mode within the S12 safety option. The safety-related outputs are therefore suitable for applications up to SIL3 according to IEC 61508 and Performance Level e according to EN ISO 13849-1. The external actuators and their wiring must comply with the required safety class.

The safety-related outputs (F-DO. and F-DO_STO) are connected to terminal X45.

The actuators are connected to the safety-related output F-DO_STO via 2 poles, sourcing/sinking output. Other connection variants are not permitted.

The actuators can be connected to the safety-related outputs F-DO00 and F-DO01 via 2 poles, sourcing/sinking output, or via 1 pole, sourcing output. This is configured in the "Assist S12" parameterization tool. 1-pole, sinking digital outputs are not permitted.

The safety-related digital outputs do not require shielded cables.

Note that the achievable Performance Level (PL) and SIL depend on the selected connection variant for the safety-related outputs.

Information about permitted loads

The connectable loads are subject to the following restrictions:

Control of safe torque off of the inverter (STO)

- MOVIFIT® FC: Disconnection of safety-related 24 V supply voltage for the STO function of the inverter:

  Each output may only control the safe torque off of max. one MOVIFIT® inverter.

In addition to the control of the safe torque off of the inverter, ohmic and inductive loads can be connected. However, you may not connect capacitive loads. The current consumption of the additional load must not exceed 100 mA.

Capacitive loads

- Without any additional measures, a capacitive load of no more than 130 µF may be connected to the output. Capacitive loads often occur in electronic assemblies as buffer capacitors.

  The capacitive load must be equipped with a diode in series with the output. This is often installed as polarity protection diode in electronic assemblies.
- If the capacitive load is not known, or higher than 130 µF, the inrush current must be limited to the permitted values of the output according to EN 61131-2.

Inductive loads

Inductive loads are, for example, relays, contactors, valves, actuator coils.

- Inductive loads always have to be connected between sourcing and sinking outputs.
- The energy stored in the load inductance, which depends on the inductance value and the current, may not exceed the values specified in chapter "Technical data".

⚠ CAUTION

Operation of inductive loads without flyback diode can damage the S12 safety option.

Damage to the S12 safety option

- Inductive loads must always be connected via a flyback diode. The safety-related output of the S12 safety option is now equipped with a flyback diode.
- Varistors and other overvoltage protection elements are not permitted.

Lamps

- Lamps can be connected to display statuses. Note that when using incandescent lamps or halogen lamps, an increased cold current flows when they are switched on. The cold current must not exceed the permitted output current according to EN 61131-2.

Information about line diagnostics and test pulses

Short voltage pulses are added to the output signals to monitor the wiring. This means the output voltage is interrupted briefly (pulsed). The maximum duration of the interruption can be set in the F-DO parameter *Test duration*. The required duration of test pulses is determined by the capacitances in the connected load, which affect the line diagnostics. For a safe disconnection of MOVIFIT® FC, a test duration of 1 ms is sufficient. When setting the maximum test duration, the capacitance must not exceed 1 µF. If the set test duration is longer than the required value, the test pulse duration during operation is reduced automatically.

Line diagnostics can be deactivated via parameters. Only short circuit and overload protection is active in that case. Crossfaults will not be detected.

It is therefore not recommended to operate the units without line diagnostics.

⚠ WARNING

When line diagnostics is deactivated, the S12 safety option cannot detect a short circuit between a sourcing output (F-DO._P) and the +24 V supply voltage or between a sinking output (F-DO._M) and the reference potential.

Severe or fatal injuries.

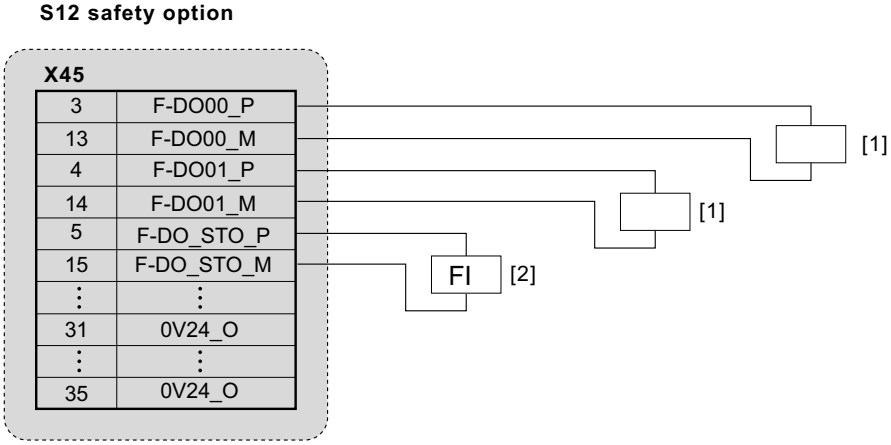
- Install the wiring in such a way that a short circuit
  - between a sourcing output (F-DO._P) and the +24 V supply voltage
  - or between a sinking output (F-DO._M) and the reference potential

  is not possible.

The outputs are equipped with an optional open-circuit monitoring function. This function checks whether the connected actuator is consuming a minimum current. If the actuator current is below the minimum value, the S12 safety option detects this as an open circuit.

Only activate open-circuit monitoring when you are sure that the current consumption of the actuator is always above the minimum current (see chapter "Technical data of S12 safety option" / "Safety-related outputs").

Actuator (2-channel, sourcing/sinking output)



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[1] Actuators
[2] STO = Safe torque off of the inverter

Connect the actuator between F-DO._P and F-DO._M. The actuator can still be switched off in case of a crossfault in one of the connection lines, as the S12 safety option disconnects the sourcing and the sinking output terminal.

The input of the actuator must be floating and without any connection to a reference potential. Inside the S12 safety option, there is a switching element between F-DO._M and the reference potential. With a non-floating actuator, this switching element would be bridged. The redundancy of the sourcing and sinking output would no longer be given.

The sourcing/sinking output connection variant is suitable for applications up to SIL3 according to IEC 61508 and Performance Level e according to EN ISO 13849-1.

Fault detection using line diagnostics

The S12 safety option detects the following faults in the external wiring when the output is switched on or off.

- Short circuit between the sourcing output and the +24 V supply voltage
- Short circuit between the sinking output and the 0V24_O reference potential
- Short circuit between the sinking output and the +24 V supply voltage

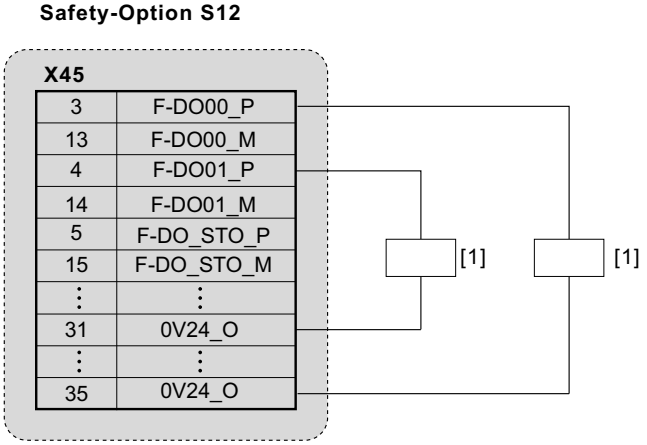
The S12 safety option can also detect the following faults when the output is activated:

- Short circuit between different sourcing outputs
- Short circuit between different sinking outputs
- Short circuit between sourcing output and sinking output
- Short circuit between the sourcing output and the 0V24_O reference potential
- Overload at any output
- Open circuit (if activated)

INFORMATION

In case of a short circuit, a high short-circuit current can occur for a short time. Depending on the 24 V supply voltage used, this can cause a voltage drop that affects the operation of MOVIFIT® and/or individual assemblies.

Actuator (1-channel, sourcing output)



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[1] Actuators

Connect the actuator between F-DO._P and the 0V24_O reference potential.

The actuator input does not have to be floating.

The sourcing output connection variant is suitable for applications up to SIL3 according to IEC 61508 and Performance Level d according to EN ISO 13849-1.

The S12 safety option detects the following faults in the external wiring when the output is switched on or off.

- Short circuit between the sourcing output and the +24 V supply voltage

The S12 safety option can also detect the following faults when the output is activated:

- Short circuit between different sourcing outputs
- Short circuit between the sourcing output and the 0V24_O reference potential
- Overload at any output
- Open circuit (if activated)

⚠ WARNING

In case of a short circuit between the sourcing output and a 24 V supply voltage, the S12 safety option can no longer switch off the actuator and go to a safe state.

The line diagnostics function can detect the fault, however, the S12 safety option cannot go to a safe state as there is no redundant switch-off channel in this connection variant.

Severe or fatal injuries.

- Route the cables in such a way that a short circuit between the sourcing output and a +24 V supply voltage is not possible.
- Or make sure that an additional, redundant switch-off channel is available for the actuator (e.g. by using a second sourcing output).

INFORMATION

SEW-EURODRIVE recommends to use the sourcing/sinking output or 2 parallel, sourcing outputs, if possible.

For safety-related outputs, refer also to chapter "Technical data".

INFORMATION

In case of a short circuit, a high short-circuit current can occur for a short time. Depending on the 24 V supply voltage used, this can cause a voltage drop that affects the operation of MOVIFIT® and/or individual assemblies.

6.4 Incremental encoder EI7C FS

6.4.1 Properties

The EI7C FS built-in encoder is a safety-related incremental encoder with 24 signal periods per revolution.

The EI7C FS encoder is used to monitor the speed or direction of rotation of the motor for the drive safety functions SS1a, SLS, and SDI.

The S12 safety option evaluates the signal of the EI7C FS encoder.

The S12 safety option and the EI7C FS encoder monitor the encoder signal. The S12 safety option detects interruptions and crossfaults in the encoder line. If an error occurs, the S12 safety option activates the STO drive safety function in MOVIFIT®, and the torque is safely switched off.

Only use the EI7C FS encoder in connection with the S12 safety option.

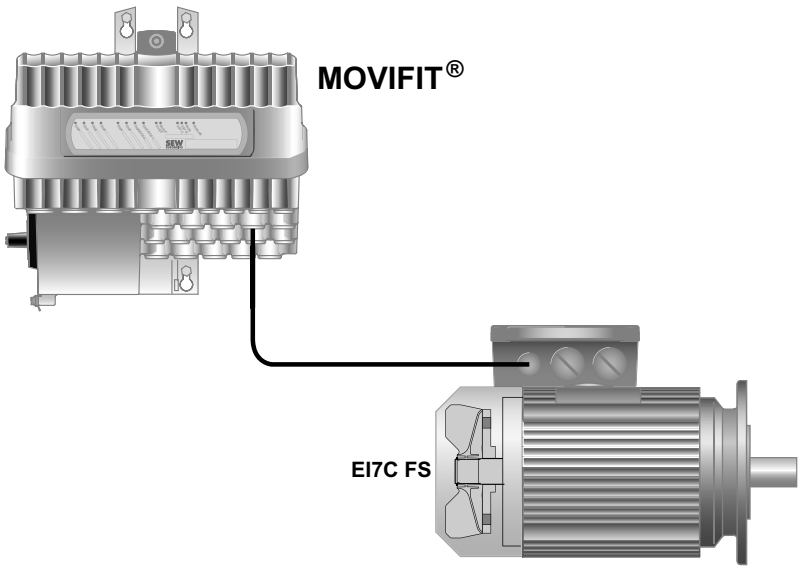
6.4.2 Installation

Use a shielded cable to connect the EI7C FS incremental encoder to the matching encoder inputs of MOVIFIT®.

The EI7C FS built-in encoder is connected to the terminal box of the motor with an 8-pole M12 plug connector. Pins 7 and 8 of the plug connector must not be connected.

The encoder cable must meet the following requirements:

- Max. length of the encoder cable: 30 m
- Minimum core cross section: 0.25 mm^2 (AWG23)
- The encoder cable must be shielded. The shield must be connected over a large surface area at both ends.
- The cores of the encoder cable must be twisted in pairs.



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⚠ WARNING

Incorrect wiring can disable the encoder functions and encoder monitoring.

Severe or fatal injuries.

- Only connect the encoder with the S12 safety option as illustrated above.
- The encoder signals may only be connected to the designated terminals of a MOVIFIT® unit. It is not permitted to connect other units or assemblies.
- Only use the designated cables and plug connectors to connect the encoder (M12, 8-pole and M12, 4-pole). Other plug connectors or terminals are not permitted.

INFORMATION

- When connecting an EI7C FS encoder to the MOVIFIT® unit, the encoder cable must not carry a TF signal.
- When using an EI7C FS encoder together with application modules, the digital inputs DI04 – DI07 at the X25 terminal of the application module may not be used at all, or as encoder inputs only.
- The S12 safety option can detect a minimum speed of 60 rpm in connection with an EI7C FS encoder.

Standard ABOX encoder connection

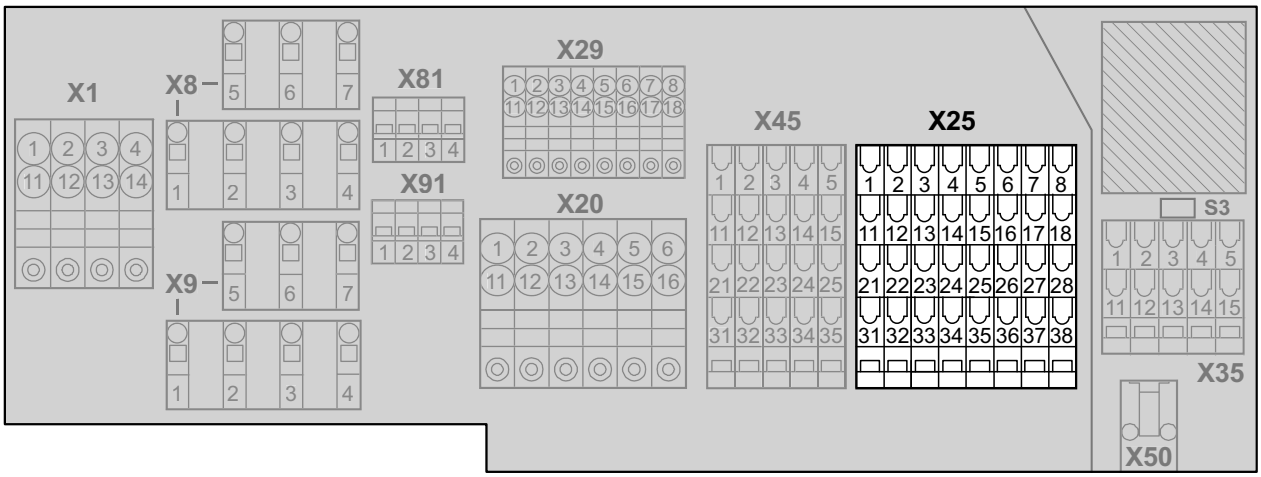
X25: I/O terminals

⚠ WARNING

Danger due to incorrect connection of EI7C FS encoder. If the track signals of the encoder are swapped by mistake during wiring, the encoder can report an incorrect direction of rotation. This might lead to the motor turning in the wrong direction.

Severe or fatal injuries.

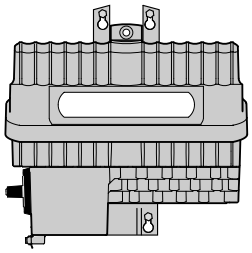
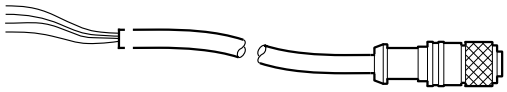
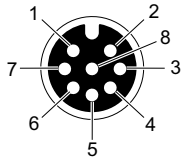
- Make sure that the EI7C FS encoder is wired correctly according to the following terminal assignment:

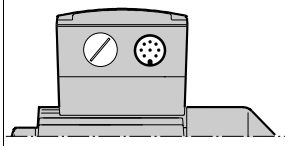


812537739

I/O terminal for digital inputs/outputs (connection of sensors + actuators)					
No.		"Technology" function level with • PROFIBUS • PROFINET			
		Function level "Classic" with PROFINET		Function level "Classic" with PROFIBUS	
		Name	Function	Name	Function
X25	3	DI04	FS encoder track A connection	DI02	FS encoder track A connection
	4	DI06	FS encoder track /A connection	DI03	FS encoder track /A connection
	13	DI05	FS encoder track B connection	B	FS encoder track B connection
	14	DI07	FS encoder track /B connection	B/	FS encoder track /B connection
	23	VO24-II	+24 V sensor supply group II (DI04 – DI07) from +24V_C	+24 V sensor supply group II (DI02 – DI03) from +24V_C	
	24	VO24-II	+24 V sensor supply group II (DI04 – DI07) from +24V_C	+24 V sensor supply group II (DI02 – DI03) from +24V_C	
	33	0V24_C	0V24 reference potential for sensors		
	34	0V24_C	0V24 reference potential for sensors		

Connection cable The following table provides an overview of the cables available for this connection:

<table>
<tr><th>MOVIFIT®</th><th>Connection cable</th><th>Length/ Installation type</th><th>Drive</th></tr>
<tr>
<td>Standard ABOX:
 
Terminal
X25/3
X25/4
X25/13
X25/14
X25/23
X25/33</td>
<td>Encoder cable
Part number: 1 362 327 3
 
Socket
M12, 8-pole
Female, A-coded
 

Color coding | Function | Pin
Brown | FS encoder track A | 3
White | FS encoder track /A | 4
Yellow | FS encoder track B | 5
Green | FS encoder track /B | 6
Gray | 24 V supply | 1
Pink | 0V24 reference potential | 2</td>
<td>Variable
  </td>
<td>Motor with cable glands and AVRE plug connector
  </td>
</tr>
</table>

Hybrid ABOX encoder connection

X23, X24: Digital inputs/outputs

I/O of variants

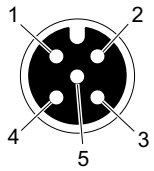
The number and assignment of digital inputs/outputs depends on

- the function level
- and the fieldbus interface of the MOVIFIT® unit.

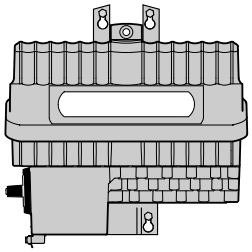
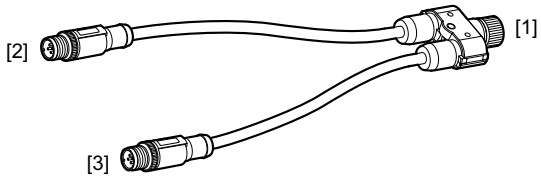
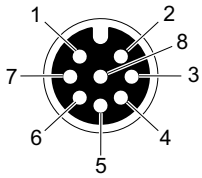
I/O variant	MOVIFIT® variant	
	Function level	Fieldbus
12 DI + 4 DI/O	Technology	• PROFIBUS • PROFINET
	Classic	• PROFINET
6 DI + 2 DI/O	Classic	• PROFIBUS

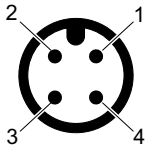
X23, X24 assignment

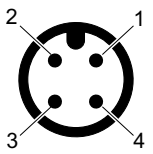
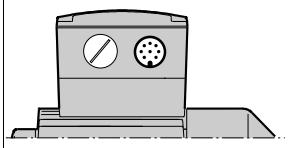
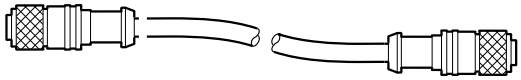
The following table shows information about these connections:

Function				
Digital inputs/outputs of the hybrid ABOX				
Connection type				
M12, 5-pole, female, A-coded				
Wiring diagram				
 2264816267				
I/O variant	**Assignment**			
12 DI + 4 DI/O	**No.**	**X23** (FS encoder connection)	**X24** (FS encoder connection)	
	1	VO24-II	VO24-II	
	2	DI05 FS encoder track B	DI07 FS encoder track /B	
	3	0V24_C	0V24_C	
	4	DI04 FS encoder track A	DI06 FS encoder track /A	
	5	n.c.	n.c.	
6 DI + 2 DI/O	**No.**	**X23**	**X24**	
	1	VO24-II	VO24-II	
	2	B FS encoder track B	B/ FS encoder track /B	
	3	0V24_C	0V24_C	
	4	DI02 Encoder track A	DI03 Encoder track /A	
	5	n.c.	n.c.	

Connection cable The following table provides an overview of the cables available for this connection:

<table>
<tr><th>MOVIFIT®</th><th>Connection cable</th><th>Length/ Installation type</th><th>Drive</th></tr>
<tr><td rowspan="2">Hybrid ABOX:
  </td><td>Y adapter M12-Y AVRE-MOVIFIT V01
Part number: 1 909 363 2
 
[1] M12, 8-pole, female, A-coded
Socket
 
1: +24 V supply voltage
2: 0V24 reference potential
3: Encoder input MOVIFIT® track A
4: Encoder input MOVIFIT® track /A
5: Encoder input MOVIFIT® track B
6: Encoder input MOVIFIT® track /B
7+8: Not connected

[2] M12, 4-pole, male, standard-coded
Connector X23
 
1: +24 V supply voltage
2: Encoder input track B
3: 0V24 reference potential
4: Encoder input track A

[3] M12, 4-pole, male, standard-coded
Connector X24
 
1: n.c.
2: Encoder input track /B
3: n.c.
4: Encoder input track /A</td><td>0.3 m
  </td><td rowspan="2">Motor with cable glands and AVRE plug connector
  </td></tr>
<tr><td>Extension cable, 8-pole
Part number: 1 814 867 0
  </td><td>Variable
  </td></tr>
</table>

7 Safety functions of the S12 safety option

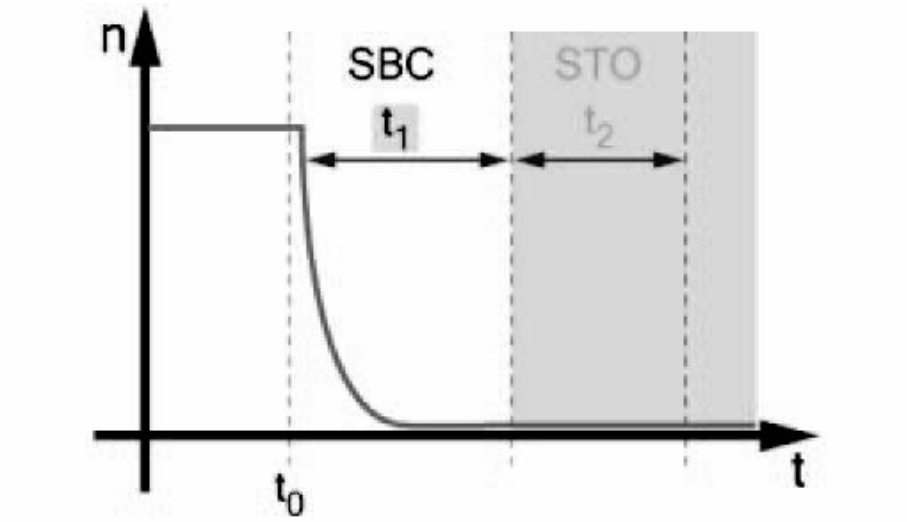
This chapter describes the safety functions of the S12 safety option. Information about standards and directives for the drive safety functions is given in chapter "Drive safety functions" (page 17).

The parameterization of the drive safety functions is based on the parameterization with the "Assist S12" parameterization tool (parameter abbreviations, e.g. t1).

7.1 STO – Safe Torque Off

7.1.1 Description of the function

The following figure shows the sequence of events:



8746069643

The STO function in connection with the assigned safety-related output and the power section is used to safely deactivate the torque of the drive (see chapter "Safe disconnection of MOVIFIT®" (page 30)).

With the S12 A safety option, you can also assign the safety-related outputs F-DO00 and F-DO01 to the STO function.

SBC (only with S12A version of the safety option)

When the STO function is activated, all safety-related outputs assigned to the SBC function are switched off immediately. With the *STO delay (t1)* parameter, the switching off of the safety-related output F-DO_STO is delayed. This allows the application of the brake before the motor torque is switched off.

If STO is activated due to a fault, e.g. limit speed exceeded (SLS), the STO delay is not used.

INFORMATION

The safe brake control function (SBC) can only be implemented with additional, external measures.

The MOVIFIT® FC version offers a diagnostic function that monitors the communication connection to the power section.

When the S12 safety option detects a communication with the power section even though the F-DO_STO output is switched off, an error message is issued.

This function allows the system to detect a "bridged / faulty" STO connection with the power section.

INFORMATION

This function is not safety-related. If the power section is wired incorrectly or in case of crossfaults in the output, a fault response to establish a safe state (STO) cannot be ensured. In addition, communication evaluation is faulty and therefore only an indication, not proof for an error state.

7.1.2 Activation

The drive safety function "Safe Torque Off" (STO) can be activated by the following sources:

- F-DI
- Process data (PROFIsafe)

7.1.3 Status

The status of the STO drive safety function is transmitted via the status information in the "STO Active" process data.

7.1.4 Parameter

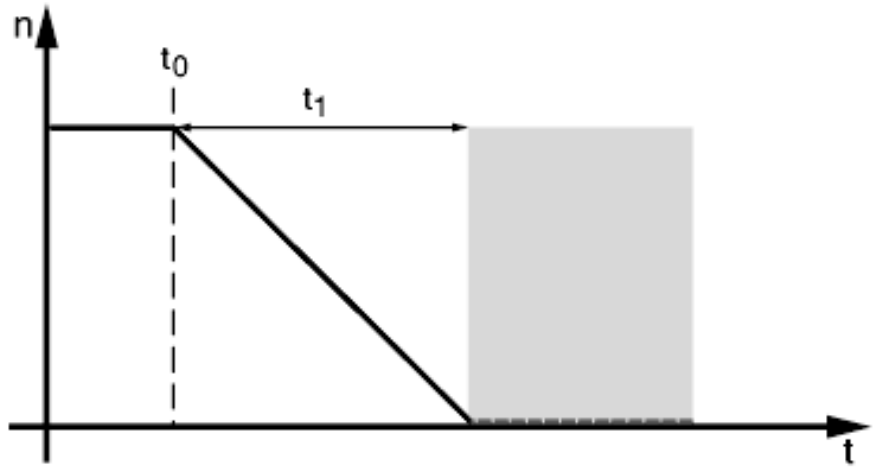
The following table lists the parameters of the drive safety function:

Parameter	Description
STO delay (t1)	The *STO (t1) delay* is the time delay between tripping the drive safety function and switching off F-DO_STO, and other F-DO outputs parameterized to STO, if applicable.
STO status delay (t2)	The *STO status display delay (t2)* is the time by which the STO active signal in the PROFIsafe process data is delayed after the F-DO_STO output is switched off.
Permitted coasting duration (t3)	The coasting duration is the time between tripping the STO drive safety function and the drive going below the minimum speed (see chapter "Coasting duration measurement" (page 74)).

7.2 SS1(c) – Safe Stop 1

7.2.1 Description of the function

The following figure shows the sequence of events:



8746073611

When the SS1(c) drive safety function is tripped, the parameterized *SS1(c) delay time (t1)* is started, and a stop command is transmitted to the inverter at the same time. After the delay time has elapsed, the STO function is tripped, see chapter "STO – Safe Torque Off" (page 57).

When SS1(c) is deactivated, the STO function is deactivated as well (as long as it is not activated by other sources).

If the SS1 function is deactivated during the SS1(c) delay time, the stop command to the inverter is revoked.

7.2.2 Activation

The SS1(c) drive safety function can be activated by the following sources:

- F-DI
- Process data (PROFIsafe)

7.2.3 Status

The status of the SS1(c) drive safety function is transmitted via the status information in the "SS1 Active" process data.

7.2.4 Parameter

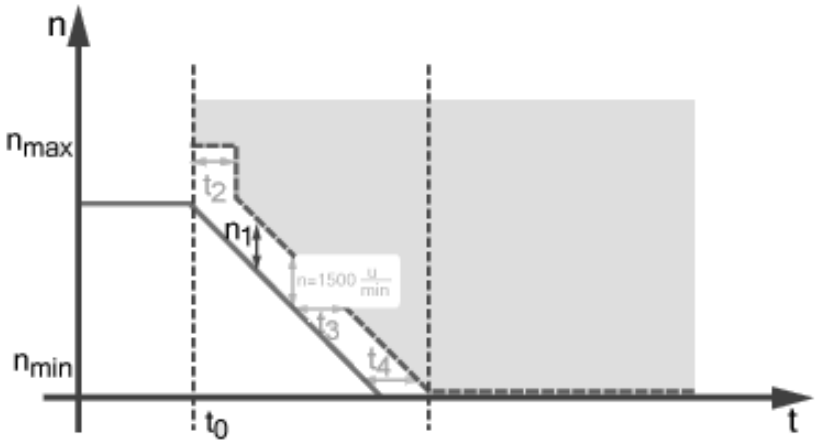
The following table lists the parameters of the drive safety function:

Parameter	Description
Function	Function enable
SS1c delay (t1)	The SS1c delay time (t1) is the time between the tripping of the drive safety function and the activation of the STO function.

7.3 SS1(a) – Safe Stop 1

7.3.1 Description of the function

The following figure shows the sequence of events:



8746077579

The SS1(a) variant of the SS1 function is used to monitor the deceleration of the drive to a standstill. The inverter receives a stop command and the parameterized limit of the speed deceleration ramp *SS1a ramp time (t3)* and initiates the speed deceleration ramp.

For the duration of the *SS1a ramp monitoring delay (t2)*, the speed is only monitored with respect to the *maximum motor speed* n_{max}.

After that, the function starts monitoring whether the ramp-shaped speed limit curve is exceeded.

The STO function is activated when the speed limit curve reaches "0", or when the currently monitored speed limit values are exceeded.

If the SS1 function is deactivated before the STO function is activated, the stop command to the inverter is revoked.

When SS1(a) is deactivated, the STO function is deactivated as well (as long as it is not activated by other sources).

The speed is monitored symmetrically in both directions of rotation.

7.3.2 Activation

The SS1(a) drive safety function can be activated by the following sources:

- F-DI
- Process data (PROFIsafe)

7.3.3 Status

The status of the SS1(a) drive safety function is transmitted via the status information in the "SS1 Active" process data.

7.3.4 Parameter

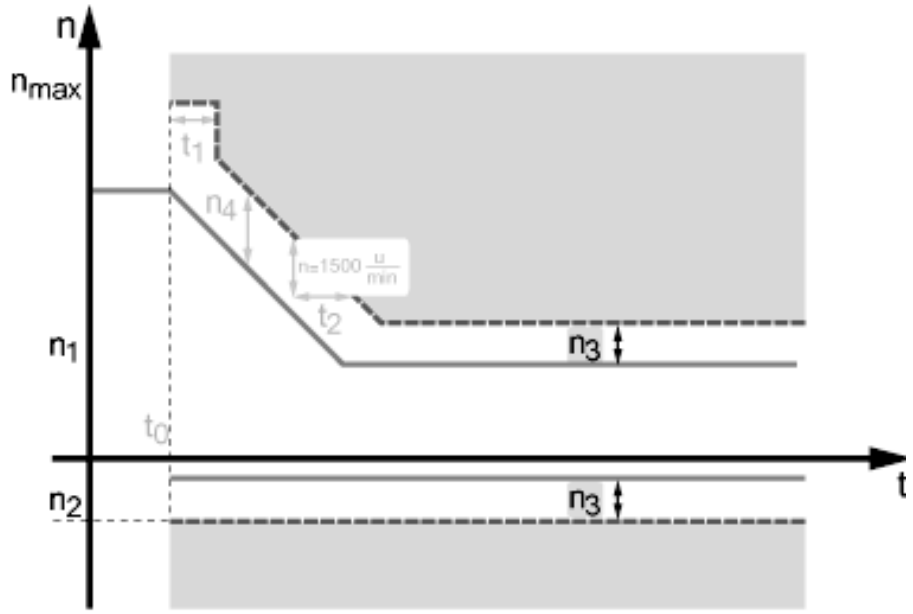
The following table lists the parameters of the drive safety function:

Parameter	Description
Function	Function enable
SS1a ramp monitoring delay (t2)	Time delay until the speed deceleration ramp is monitored
SS1a ramp time (t3)	Ramp time of the speed limit curve and limit of the speed deceleration ramp for the inverter
SS1a STO function selection delay (t4)	Delay time from when the drive goes below the minimum speed until the STO function is tripped
SS1a distance to ramp (n1)	Speed tolerance for calculating the speed limit curve
Maximum motor speed (n_{max})	Monitored maximum speed from the activation of the drive safety function until the start of monitoring of the speed deceleration ramp (speed limit curve). Applicable for SS1a function and all SLS function blocks together.
Minimum motor speed (n_{min})	Lower limit for speed monitoring

7.4 SLS – Safely Limited Speed

7.4.1 Description of the function

The following figure shows the sequence of events:



8746081547

The SLS function monitors the motor speed for violation of a limit value. This is implemented with different speed limit values for the positive and negative direction of rotation.

Before the drive safety function becomes active when tripped, the speed can be reduced along a monitored deceleration ramp if the speed is higher than the set speed setpoint limit for the inverter at the time when the function is tripped.

When the function is tripped, the setpoint limits for both directions of rotation and the parameterized limit of the speed deceleration ramp *SLS ramp time* are transferred to the inverter, so that the inverter can begin with the speed deceleration ramp.

The setpoint limits for the inverter result from the SLS speed limit values *Limit speed, positive (n1)* and *Limit speed, negative (n2)* minus the SLS speed tolerance *Difference to limit speed (n3)*.

After that, the function starts monitoring whether the ramp-shaped speed limit curve is exceeded.

For the duration of the *SLS ramp monitoring delay (t1)*, the speed is only monitored with respect to the parameterized *maximum motor speed* n_{max}.

In the opposite direction, the parameterized SLS speed limit is monitored during the entire time. The monitored speed reduction phase ends when the ramp-shaped speed limit curve reaches the parameterized speed limit value. Then, the SLS drive safety function becomes active.

For operation of systems with speed overshoots, a speed filter is integrated in the SLS function. If the activated SLS function detects an overshoot over the speed limit values, this will be tolerated within the parameterized rotation angle range *SLS speed filter* without initiating an error response.

The parameterized error response is only triggered when the integral of the overspeed exceeds the parameterized *SLS speed filter* limit value.

This means speed overshoots can be tolerated without the motor speed exceeding the parameterized speed limit values for a longer time.

If an error causes the exceedance of the current speed limit value during the ramp phase or of the parameterized integral limit value, the parameterized error response (SS1 or STO) is triggered.

There are 4 equal-priority function blocks available for the SLS function. They control and monitor the parameterized speeds independently of each other.

De-select the SLS function to cancel speed limitation.

7.4.2 Activation

The individual function blocks of the SLS drive safety function can be activated by the following sources:

- F-DI
- Process data (PROFIsafe)

7.4.3 Status

The status of each function block of the drive safety function is transmitted via a separate status information block in the "SLS Active" process data.

7.4.4 Error response

The error response to overspeed can be parameterized:

- STO (the time *STO delay (t1)* is not effective)
- SS1(a) or SS1(c), depending on the parameter settings for the SS1 function

7.4.5 Parameter

The following table lists the parameters of the drive safety function:

Parameters that are not specific to SLS:

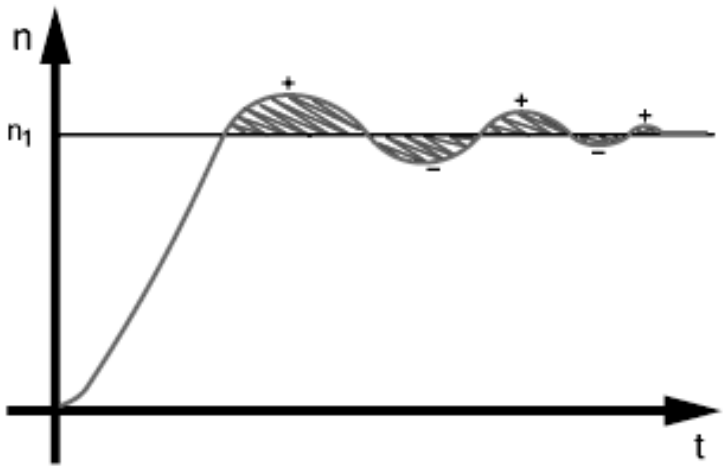
Parameter	Description
SLS ramp monitoring delay (t1)	Time delay until the speed deceleration ramp is monitored
SLS ramp time (t2)	Ramp time for the monitored speed limit curve in the S12 safety option and for the limit of the speed deceleration ramp in the inverter
SLS difference to ramp (n4)	Speed tolerance to calculate the speed limit curve during the speed deceleration ramp
SLS speed filter	Limit value for the integral of the tolerated exceedance of the speed limit values (=tolerated angle of rotation). This means speed overshoots can be tolerated without the motor speed exceeding the parameterized speed limit values for a longer time.
SLS error response to overspeed	Error response of SLS function to overspeed
Maximum motor speed	Monitored maximum speed from the activation of the drive safety function until the start of monitoring of the speed deceleration ramp (speed limit curve). Also applies to SS1a function.
Minimum motor speed	Lower limit for speed monitoring. Also applies to SS1a function

Parameters that are specific to SLS function blocks:

Parameter	Description
SLS function	Function enable
SLS positive limit speed (n1)	Speed limit value in the positive direction of rotation, which is monitored by the S12 safety option when the respective SLS function block is activated.
SLS negative limit speed (n2)	Speed limit value in the negative direction of rotation, which is monitored by the S12 safety option when the respective SLS function block is activated. This value is not signed.
SLS difference to limit speed (n3)	Speed tolerance (corresponds with the difference between monitored speed limit value and the setpoint limit for the inverter). This parameter applies to both directions of rotation.

7.4.6 Speed filter determination

The following figure shows the speed filter:



8746648587

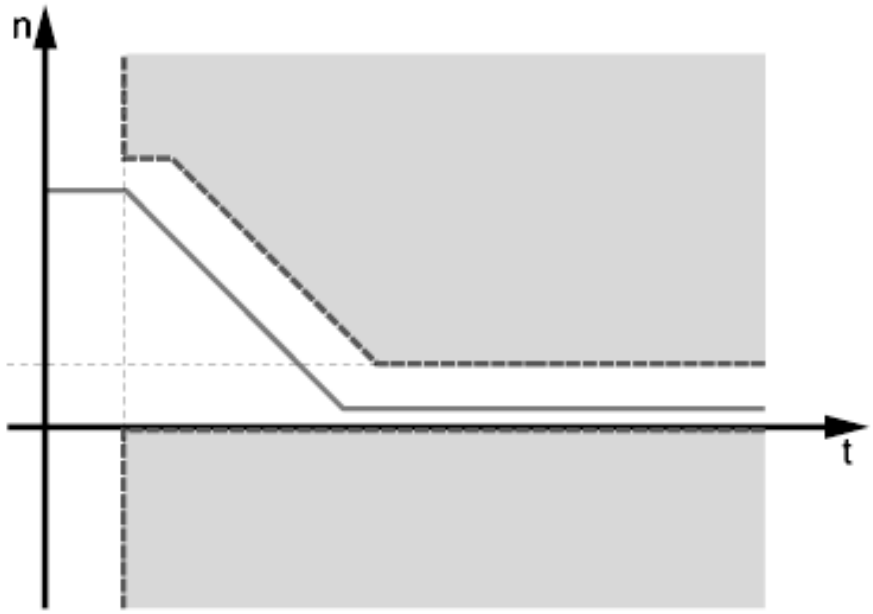
Proceed as follows to use this speed filter:

1. In the "SLS general" screen of the "Assist S12" parameterization tool, enter the maximum value of the *SLS speed filter* and accept the parameter settings (1000°).
2. Determine any overshoots in productive operation.
3. Read out the determined maximum value from the diagnostics screen "Safety function -> maximum overshoot" of the "Assist S12" parameterization tool. Add a suitable tolerance to the value and compare this value with the value from the risk assessment. Transfer the determined parameter *SLS speed filter* and accept the parameter settings.

7.5 SDI – Safe Direction

7.5.1 Description of the function

The following figure shows the sequence of events:



8746085515

The SDI function monitors the direction of rotation. It is part of each SLS function block and can only be selected via this function block.

The SDI function is parameterized in the respective parameter blocks of the SLS function. The SDI function is activated by selecting the corresponding SLS function.

Within a SLS function block, you can block either the positive or negative direction of rotation by enabling the SDI function. When the drive moves into the blocked direction, the STO function is activated after an adjustable tolerance value *SDI tolerance* and a system-related error detection time. A system-related tolerance value of 7° must be added to the adjustable tolerance value *SDI tolerance* .

INFORMATION

The SDI function is for monitoring purposes only. The blocked direction of rotation must be restricted in addition by the SLS function. To do so, parameterize the SLS limit speed of the blocked direction of rotation to the tolerance value (SLS parameter *Difference to limit speed (n3)*.

7.5.2 Activation

The SDI drive safety function can be activated by the following sources:

- F-DI
- Process data (PROFIsafe)

In each case, it can only be activated by selecting the corresponding SLS function.

7.5.3 Status

The status of the SDI drive safety function is transmitted via the status information in the process data. When the SDI drive safety function detects an incorrect rotation into the prohibited direction, the "ASF error" bit is set to "0".

7.5.4 Error response

Error response for movement into the blocked direction of rotation:

- STO (the time *STO delay (t1)* is not effective)

7.5.5 Parameter

The following table lists the parameters of the drive safety function:

Parameter	Description
SDI function	Function enable (blocking a direction of rotation)
SDI tolerance	Tolerated movement into the blocked direction of rotation. Applies to all SLS/SDI function blocks.

7.6 Safety-related inputs

7.6.1 Description of the function

The S12A variant has 4 inputs. The S12B variant has 8 inputs. The inputs can be connected and parameterized in 1-channel, 2-channel equivalent, or 2-channel non-equivalent mode.

You can connect the following sensors to the safety-related F-DI inputs:

- Electromechanical sensors (switches, buttons, emergency off, etc.)
- Sensors with contact-based outputs
- Sensors with electronic output (initiators, etc.)
- Sensors with OSSD output

The possible connection variants depend on the type of sensor. The range of connection variants might be limited depending on the sensor type.

The following chapters describe the evaluation of terminal signals for the permitted connection types. For detailed information about electrical connections, refer to chapter "S12 safety option – Electrical installation" (page 34).

7.6.2 Connection type

Connection type: 1-channel

Each input terminal is assigned one-to-one to a process value.

Input terminal DIx	Process value DIx	Discrepance monitoring
0	0	-
1	1	-

(x = 0, 1, 2, ..., 7)

Connection type: 2-channel equivalent

The two input terminals DIx and DIx+1 of the input pair are connected to equivalent-switching sensors/switches. They are assigned to the shared process value DIx. The DIx+1 process value is set to "0" in 2-channel connection mode.

Input terminal DIx	Input terminal DIx+1	Process value DIx	Process value DIx+1	Discrepancy monitoring
0	0	0	(0)	OK
0	1	0	(0)	Discrepancy detected
1	0	0	(0)	Discrepancy detected
1	1	1	(0)	OK

(x = 0, 2, 4, 6)

Connection type: 2-channel non-equivalent

The two input terminals DIx and DIx+1 of the input pair are connected to non-equivalent switching sensors/switches. They are assigned to the shared process value DIx. The DIx+1 process value is set to "0" in 2-channel connection mode.

Input terminal DIx (normal processing)	Input terminal DIx+1 (inverted processing)	Process value DIx	Process value DIx+1	Discrepancy monitoring
0	0	0	(0)	Discrepancy detected
0	1	0	(0)	OK
1	0	1	(0)	OK
1	1	0	(0)	Discrepancy detected

(x = 0, 2, 4, 6)

The F-DI process value determined in this way is both sent via fieldbus (F-DIx bit) and used for function assignment. If an error occurs in input processing (e.g. crossfault, no stable signal within the filtering time, etc.), the process image of the corresponding F-DI (pair) goes to a safe state. This case is not shown in the tables above.

Discrepancy time

Discrepancy monitoring is active for the 2-channel connection types. It checks for invalid switching states within one F-DI input pair (equivalent switching type: different levels, non-equivalent switching type: same levels), which can be caused by a defect. If a prohibited switching state exists longer than the set discrepancy time, an error is detected.

Depending on the type of the connected switch(es), there can be a significant time delay between the switching times of the two inputs when the switch is actuated. The discrepancy time should be set longer than the maximally expected time delay.

Input filter

The input signal goes through a parameterizable filter to eliminate contact bouncing and interference. Bounces that are shorter than the set filter time are removed from the signal.

The filter has an additional time monitoring function. If a fault lasts longer than the set filter time, an error can be detected.

Crossfault monitoring

To detect faults in the external wiring, the "Crossfault monitoring" diagnostic function can be use. It can be activated for each input via the parameter *Crossfault monitoring*.

Crossfaults are detected by the S12 safety option switching off the sensor supplies F-SS0 and F-SS1 briefly with a time delay (pulsed voltage supply). A logical "0" level is now expected at the corresponding F-DI terminals. The prerequisite for this is that the connected switches are supplied by the corresponding sensor supplies, and that pulsed voltage supply is activated.

Pulsed voltage supply of F-SS0 and F-SS1 can be activated or deactivated together via the parameter *F-DI pulsed sensor supply*. With pulsed voltage supply deactivated, +24 V is permanently present at the F-SS0 and F-SS1 terminals.

Switch test

The switch test function is used to check a connected switch when a discrepancy error occurs. Before the error can be acknowledged, the switch must be actuated, so that both signals of the F-DI pair are in the required state for the switch test:

Switch test state	Input terminal DIx	Input terminal DIx +1
Equivalent connection type	0	0
Non-equivalent connection type	0	1

With this, the system can detect faulty switches, which would lead to a discrepancy only in the actuated state (e.g. in case of emergency off switches).

7.6.3 Parameter

The following table lists the parameters of the safety function:

Parameter	Description
Connection type	Setting the desired F-DI connection type (1-channel, 2-channel equivalent or 2-channel non-equivalent)
Input filter time (t1)	Filter time for the input signal
Discrepancy time (t2)	Maximum permitted time difference between the signal changes of the input signals of a 2-channel connection
F-DI pulsing sensor supply	Pulsed sensor supply active: F-SS0 and F-SS1 are connected to a pulsed voltage supply. Pulsed sensor supply not active: F-SS0 and F-SS1 are connected to a continuous 24 V supply.
F-DI crossfault monitoring	Activation of crossfault monitoring for the corresponding F-DI.
F-DI switch test	Switch test active: Errors can only be acknowledged after a signal change to the disabled state.

7.7 Safety-related outputs

7.7.1 Description of the function

The safety-related output F-DO_STO is fixedly assigned to the STO drive function of the S12 safety option. It is used to activate the safe torque off function of the integrated inverter (MTF).

The S12A variant has 2 additional, safety-related, freely usable 24 V switching outputs (F-DO00 and F-DO01), which can be controlled via fieldbus and the STO and SBC drive safety functions of the S12 safety option. The two outputs can be used as 2-pole sourcing/sinking outputs or 1-pole sourcing outputs.

Each output has a sourcing output terminal F-DO._P and a sinking output terminal F-DO._M.

For a sourcing/sinking output connection, the load is connected between F-DO._P and F-DO._M, so that each output terminal can interrupt the current flow through the load.

For a sourcing output connection, the load is connected between F-DO._P and ground.

All outputs offer the following testing and monitoring functions:

- Short circuit and overload protection is always active. The output current of each output is monitored. In case of overload, the output is switched off. The sum of the output currents is also monitored.
- Line diagnostics can detect short circuits and crossfaults in external wiring. When the output is active, test pulses are used to test the functioning and wiring of the output. You can deactivate this with the *Line diagnostics* parameter, if necessary.
- Wire-break detection can detect an interrupted output circuit if the output current falls below the minimum load. You can activate this monitoring function with parameter *Wire-break monitoring*.

7.7.2 Parameter

The following table lists the parameters of the safety function:

Parameter	Description
Connection type	Setting the chosen connection type (2-pole sourcing/sinking or 1-pole sourcing)
Line diagnostics	Activation of line diagnostics for the output
Test duration:	Maximum switch-off time for line diagnostics of the safety-related output F-DO
Wire breakage detection	Activation of the wire-break monitoring

7.8 Function assignment

Control of the drive safety functions

All drive safety functions can be controlled via the digital inputs of the S12 safety option. For this purpose, the process values of the digital inputs are assigned to the safety functions. It is also possible to assign several inputs to one drive safety function.

In fieldbus operation, simultaneous control via F-DI and bus process data is possible. The safety function becomes active when at least one of the activation sources requests its activation.

Different safety functions can be activated in parallel and at the same time.

Output control

In addition to control via process data, the freely usable outputs F-DO00 and F-DO01 can be controlled by the STO and SBC drive functions. Each control signal can switch off the output.

When the outputs are assigned to the STO function, the input for safe torque off of other frequency inverters can be connected there.

Interlocking logic

For applications in which a deactivation of safety functions without user intervention must be prevented (e.g. automatic restart), the interlocking logic can be used. The F-DI process value for the activation of the safety function remains in a safe state until it is acknowledged.

Interlocking can be acknowledged:

- Via a separate F-DI that was parameterized to the function "Acknowledge interlocking F-DI and error"
- Or via fieldbus (safe process output data).

Interlocking is always acknowledged with a rising edge (0/1).

The interlocking logic can be activated by setting the relevant parameters.

When the S12 safety option is switched on, the process values of F-DI parameterized to "interlocking" are initially interlocked in a safe state (irrespective of the input signal).

7.8.1 Parameter

The following table shows the parameters:

Parameter	Description
F-DI interlock	Activation of the F-DI interlock function
F-DI function	Assignment of F-DI to safety functions or to acknowledging/interlocking function
F-DO function	Only with S12A safety option: Assignment of STO/SBC drive safety functions to outputs F-DO00 and F-DO01

7.9 Test mode

7.9.1 Description of the function

To validate the drive safety functions, it is necessary to test the associated monitoring functions and their limits. This is accomplished with the test mode for the drive safety functions, which can be used to deactivate the speed control functions of the S12 safety option to the inverter.

The safety functions themselves including speed monitoring remain active in test mode. When test mode is activated, the inverter can be controlled via its standard control sources (e.g. fieldbus, manual operation, application module) so that it violates the speed limits of the selected safety functions, which will allow you to assess the corresponding error response behavior.

7.9.2 Activation

- "Assist S12" parameterization tool
- Process data (PROFIsafe) via "SF test" bit

To activate the test mode, a 0/1 level change in at least one of the two control signals is required (Assist S12 / process data).

The test mode has a time limit. It is cancelled automatically after 5 minutes.

If you still require the test mode after 5 minutes, you must re-activate it. Test mode is also cancelled automatically if the STO function is activated intentionally or as an error response, e.g. with the SS1(a) or SLS / SDI function.

7.9.3 Status

The activation state of the test mode is shown by the "SF test active" status message in the process input data (PROFIsafe) and by the green/yellow-flashing F-State LED.

The test mode offers no status message indicating the correct operation of the tested safety function. To assess the correct operation of the drive, you can use the error messages of the SLS and SS1 function.

7.10 Coasting time measurement

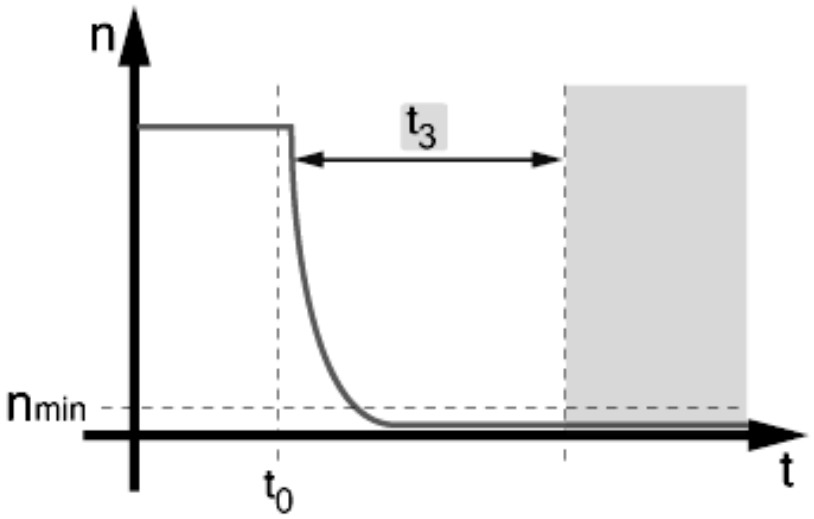
7.10.1 Definition

The coasting time is the period from activating the STO function to when the drive falls below the minimum speed.

It depends on several factors, especially load torque, moment of inertia of the load, and the braking torque of a brake. The coasting time must be taken into account when validating a plant; it also must be checked at regular intervals.

7.10.2 Description of the function

The following figure shows the sequence of events:



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The coating time measurement function measures the time between the activation of the STO function and the undercut of the minimum speed, using the safety-related EI7C FS encoder and speed measurement.

It compares the measured time with a parameterized limit value (*Permitted coating time (t3)*) and issues an error message if the limit value is exceeded. Note that the maximum coasting time to be tested can only be measured under defined conditions, e.g. maximum load inertia, maximum speed in this application.

7.10.3 Activation

The coasting time measurement starts when the STO function is activated if a *Permitted coasting time* limit value ≠ "0" is parameterized. When the parameterized limit value is exceeded, an error message is only issued if the test mode for the safety function was activated before the STO function. (The test mode is automatically deactivated again when STO is activated).

INFORMATION

The result of the coasting time measurement is valid only if the STO function decelerates the drive to a standstill.

7.10.4 Parameter

The following table lists the parameters of the diagnostic function:

Parameter	Description
Permitted coasting time (t3)	Limit value for the STO coasting time. An error message is issued when this limit is exceeded

INFORMATION

To assess the correct operation of the drive, you can use the error messages of the S12 safety option. The measured coasting time and the corresponding current speed when the STO function is activated are shown in the "Assist S12" parameterization tool.

The coasting time measurement function is for diagnostic purposes only.

8 Startup

8.1 General startup instructions

INFORMATION

- The basic startup procedure is described in the relevant "MOVIFIT® ..." operating instructions and in the corresponding fieldbus manual "MOVIFIT® Function Level Classic ..." or "MOVIFIT® Function Level Technology ...".
- The following chapters describe additional startup steps for the S12 safety option.
- Note the prerequisites for installation and operation of MOVITOOLS® MotionStudio.

8.2 Startup variants

8.2.1 Startup with default parameter setting (without "Assist S12" parameterization tool

INFORMATION

When starting up several similar units with identical S12 parameterization, they can be parameterized via the "Import/Export" function.

Note that you have to validate every single unit.

The S12 safety option is delivered with a default parameter set that allows you to use the S12 safety option without changing any parameters. In this operating mode, the following conditions must be taken into account:

- This operating mode is only possible with PROFIsafe fieldbus.
- The iPar CRC is stored as default value in the GSDML file for the S12A safety option. This value is suggested to the user during the configuration process. The S12B safety option is also delivered with a default parameter set.

  Here, the iPar CRC must be entered in the PROFIsafe master.
- The statuses of F-DI. and F-DO. can be processed and controlled via the F-PLC without any further parameter setting steps.
- Only the STO function is supported in this startup variant.

The following steps are required for startup:

1. Startup of the fieldbus and the higher-level F-PLC (page 80)
2. Startup of the standard functions

   (For detailed information, refer to chapter "Startup" in the "MOVIFIT® ..." operating instructions.)
3. Validation (see chapter Verification and validation (page 86))

8.2.2 Startup for independent operation

The S12 safety option can be parameterized and operated without PROFIsafe connection (independent operation).

In this operating mode, the following conditions must be taken into account:

- The parameters of the S12 safety option are set with the "Assist S12" parameterization tool.
- The validation of the plant is supported by a validation protocol generated in the "Assist S12" parameterization tool.

The following steps are required for startup:

1. Parameterization of safety functions (page 78) in the "Assist S12" parameterization tool
2. Startup of the standard functions

   (For detailed information, refer to chapter "Startup" in the "MOVIFIT® ..." operating instructions.)
3. Verification and validation (page 86) supported by the "Assist S12" parameterization tool

8.2.3 Startup with PROFIsafe connection

The S12 safety option can be parameterized and operated with a PROFIsafe connection (fieldbus connection).

In this operating mode, the following conditions must be taken into account:

- The parameters of the S12 safety option are set with the "Assist S12" parameterization tool.
- The validation of the plant is supported by a validation protocol generated in the "Assist S12" parameterization tool.

The following steps are required for startup:

1. Parameterization of safety functions (page 78) in the "Assist S12" parameterization tool
2. Startup of the fieldbus and the higher-level F-PLC (page 80)
3. Startup of the standard functions

   (For detailed information, refer to chapter "Startup" in the "MOVIFIT® FC" operating instructions.)
4. Verification and validation (page 86) supported by the "Assist S12" parameterization tool

8.3 Setting the safety function parameters

8.3.1 Requirements

- You need the following components for successful parameterization:
  - "Assist S12" parameterization tool, can be called in MOVITOOLS® MotionStudio, version 5.90 and higher

    Download from www.sew-eurodrive.com

8.3.2 Procedure

The following sequence shows the steps for parameterizing the safety functions:

1. **Start MOVITOOLS® MotionStudio**
2. **Scan network**

   Scan the network that contains your engineering interface (RS485, Ethernet, etc.)
3. **Start "Assist S12" parameterization tool**

   Start the "Assist S12" parameterization tool from the user interface of MOVITOOLS® MotionStudio.

   A window appears in that prompts you to enter the serial number of the unit.
4. **Enter the serial number of the unit and establish a connection**

   The serial number ensures that the "Assist S12" parameterization tool connects to the right unit.
5. **Upload the current parameter settings of the unit**

   After entering the serial number, the current parameter settings of the S12 safety option are uploaded to the "Assist S12" parameterization tool. The uploaded values are shown in the "S12 actual value" column. This is to read out the current configuration; it can also be done during operation.
6. **Parameterization**

   To set the parameters, call the individual areas in the parameter tree and enter the required values. In the "General parameters" area, the higher-level parameters, such as fieldbus connection, encoder activation, and limit speed of the motor are set. In the areas "F-DI" and "F-DO", the parameters of the sensors and actuators are set. After that, the parameters of the safety functions are set and assigned to the parameterized inputs/outputs in the "function assignment" area.
7. **Download the parameter set to the unit**

   Click on the [Download] button to download the parameter set to the S12 safety option. The download is password-protected.

   Standard password (default): **sew_s12**
8. **Scan network again**

   The power section is detected during this new network scan.
9. **Configure the complete MOVIFIT® unit (including the power section)**

   This saves the standard values for the unit locally.
10. **Start the "Assist S12" parameterization tool again**

The F parameter set is saved with the restart.

INFORMATION

When you configure the complete unit in MOVITOOLS® MotionStudio, the safety-related parameters are not saved.

The MOVIFIT® unit can only be configured when the S12 safety option has enabled the power section.

The safety-related parameters must be saved and loaded in the "Assist S12" parameterization tool.

For a detailed description of steps 4 – 7, refer to chapter "Assist S12" (page 89).

When the parameter set has been transferred to the S12 safety option without any problems, you can start up the standard functions and, if required, connect it to the higher-level safety controller (F-PLC).

8.4 Startup of the fieldbus and the higher-level F-PLC

Note that this startup variant only supports the safety-related fieldbus profile "PROFIsafe".

8.4.1 Requirements

- The higher-level F-PLC must support iPar CRC.
- You need the following components for successful startup:
  - "Assist S12" parameterization tool, can be called in MOVITOOLS® MotionStudio, version 5.90 and higher
- Additional requirements for using theS12 safety option with PROFIsafe fieldbus connection via PROFIBUS or PROFINET:
  - STEP 7, optional "Distributed Safety" package version 5.4 and higher (for controllers from the company Siemens)
  - GSD file (PROFIBUS) or GSDML file (PROFINET, version 2.6 and higher):

    Download from www.sew-eurodrive.com

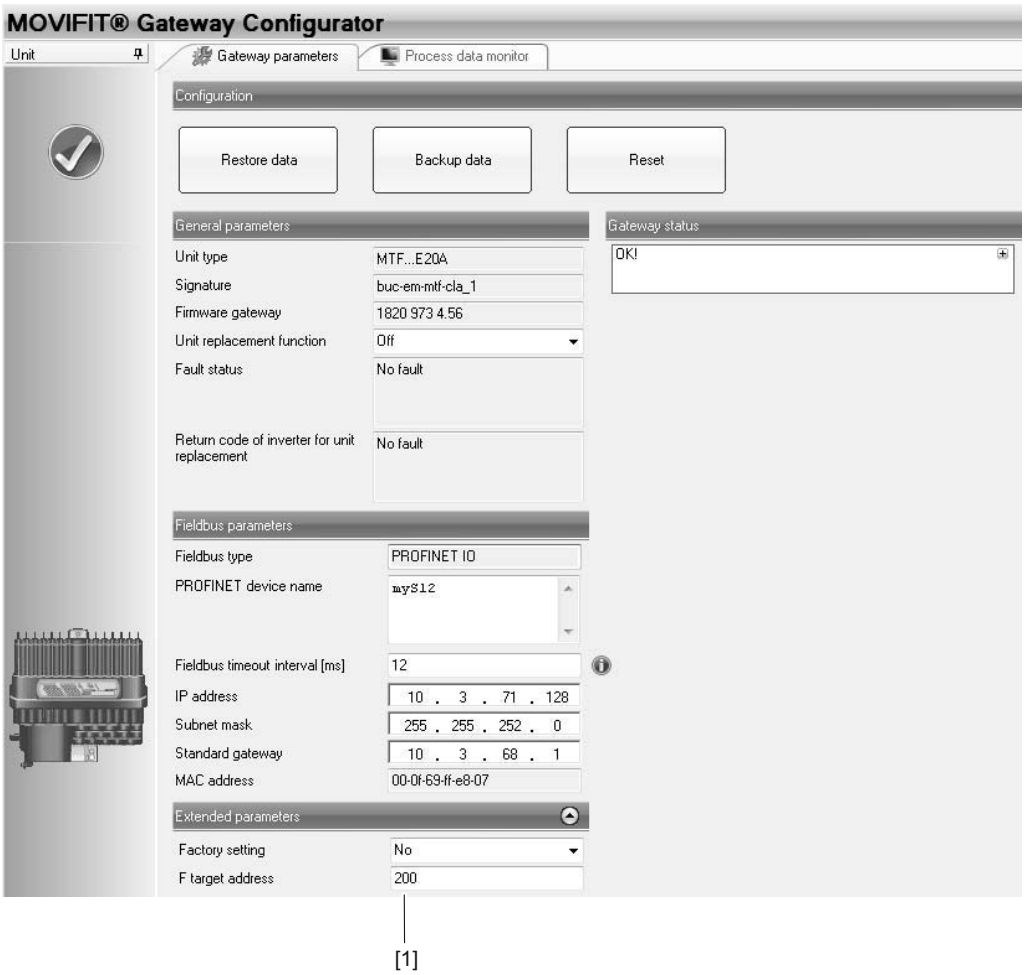
8.4.2 Setting the PROFIsafe address

Once the MOVIFIT® unit including S12 safety option is supplied with 24 V voltage, you must enter the PROFIsafe unit address (= F Destination Address) using the MOVITOOLS® MotionStudio engineering software. You may enter an address ranging from 1 to 65534.

Make sure that the unit settings match the parameterized PROFIsafe address set in the configuration software of the bus master (e.g. Siemens STEP7 HW Config).

- Start the MOVIFIT® gateway configurator in the MOVITOOLS® MotionStudio engineering software.
- Set the PROFIsafe unit address (= F destination address) in the MOVIFIT® gateway configurator, or via the parameter tree for units with function level "Technology".

Refer to the following illustration:



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[1] Setting the PROFIsafe unit address (= F destination address)

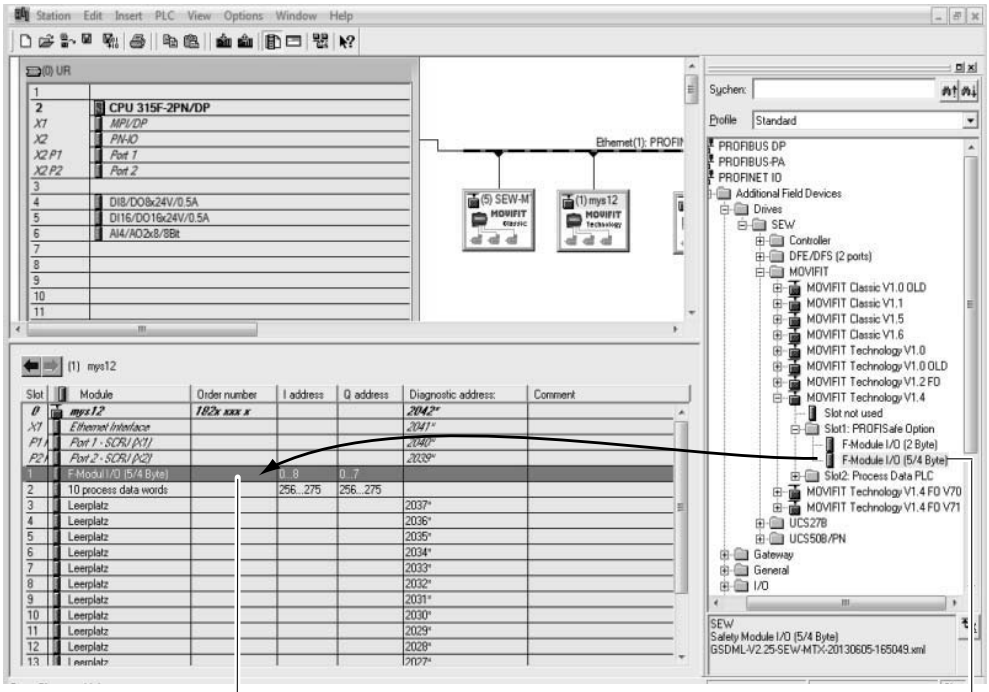
8.4.3 Configuring the S12 safety option in STEP 7

To ensure fault-free operation of MOVIFIT® with PROFIsafe, you need the optional package entitled "Distributed Safety" as of version V5.4 for configuration and parameterization under STEP7.

- Make sure that you have installed the current version of the corresponding GSD/GSDML 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 (5/4 byte)" [1] in slot 1.

  To do so, drag-and-drop the module [1] to slot 1 [2] and enter the desired I/O or periphery addresses.

  The following figure shows the configuration of a MOVIFIT® FC with "Classic" function level as PROFINET version.



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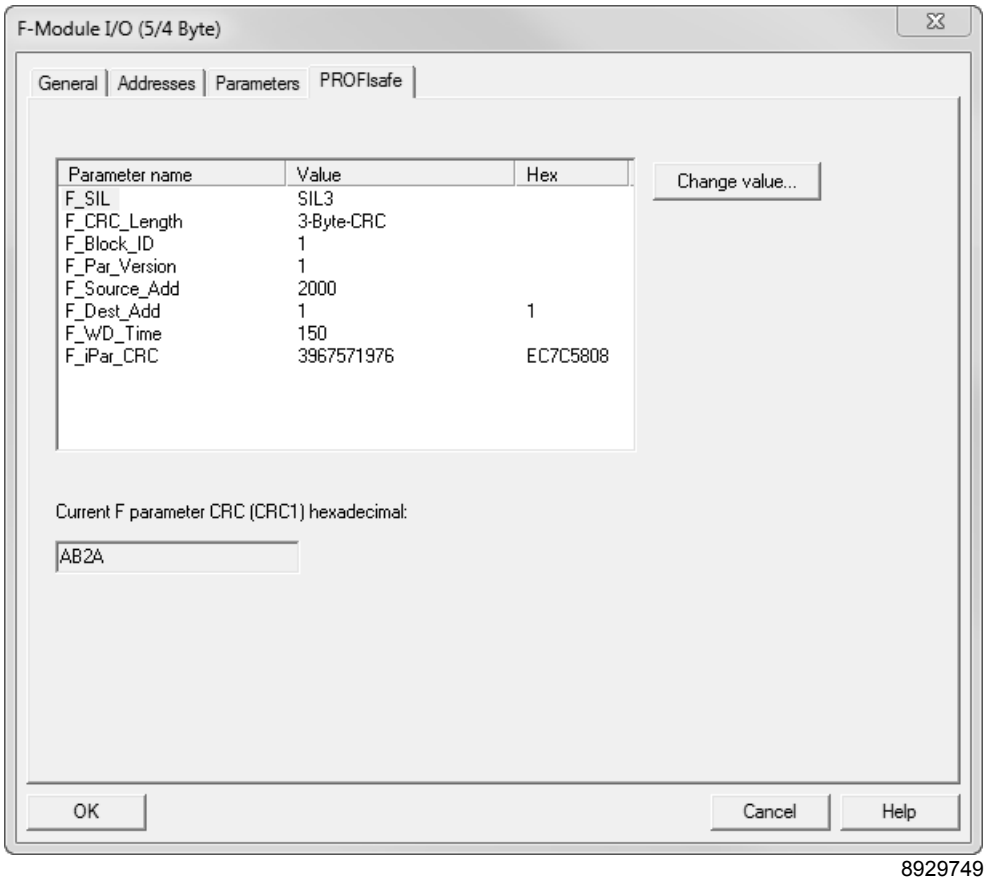
- Then, parameterize the S12 safety option.

Configuration of S12 safety option

Select the F module in MOVIFIT® slot 1.

Make a right-click to open the context menu, select "Properties", then the "PROFIsafe" or "F parameters" tab. Below is an example of a PROFINET I/O device.



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When the fieldbus or network systems starts up, the bus master sends the safety-relevant parameters in an F parameter block to the S12 safety option of the MOVIFIT®.

A plausibility test then checks them in the option. The S12 safety option only exchanges data with the bus master after a positive confirmation of this F parameter block.

Below is a list of the safety-related parameters which are transferred to the S12 safety 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	Fixed	Not installed
F_SIL	Fixed	Fixed
F_CRC_Length	Fixed	Fixed
F_Block_ID	Fixed	Fixed
F_Par_Version	Fixed	Fixed
F_Source_Add	Fixed	Fixed
F_Dest_Add	Variable	Variable
F_WD_Time	Variable	Variable
F_iPar_CRC	Variable	Variable

F_SIL parameter

This parameter enables F stations to check whether 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-related cases.

The S12 safety option supports the following setting:

- F_SIL = SIL 3

INFORMATION

The safety class SIL 3 only applies to the S12 safety option. The possible safety class for the drive safety functions depends on the type of the respective MOVIFIT® basic unit.

F_CRC_Length parameter

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 S12 safety 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 S12 safety option supports the following settings:

- F_CRC_Length =

  2 byte CRC (only with PROFIsafe V1 in combination with PROFIBUS)

  3 byte CRC (only with PROFIsafe V2)

F_Block_ID parameter

The parameter has the value "1" if it exists, and "0" if it doesn't.

The value "1" shows that the data set for F_iPar_CRC is expanded by 4 bytes.

IMPORTANT: The *F_Block_ID* parameter must not be changed.

F_Par_Version parameter

This parameter identifies the PROFIsafe version supported by the S12 safety option. When using a MOVIFIT® unit with PROFIBUS, you can choose between PROFIsafe V1 and PROFIsafe V2; with PROFINET, only PROFIsafe V2 is supported.

F_Source_Add parameter

The PROFIsafe addresses are used for a clear identification of source (*F_Source_Add*) and destination (*F_Dest_Add*). The combination of source and destination address must be unique across the network and all nodes. The source address F_Source_Add is assigned automatically via STEP 7 depending on the configuration of the master.

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

You cannot directly edit this parameter in STEP7-HW Config.

F_Dest_Add parameter

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

The *F_Dest_Add* parameter can have values between 1 and 65534.

F_WD_Time parameter

This parameter defines a monitoring time in the failsafe S12 safety option.

A valid safety telegram must arrive from the F-CPU within this monitoring time. Otherwise, the S12 safety option reverts to safe status.

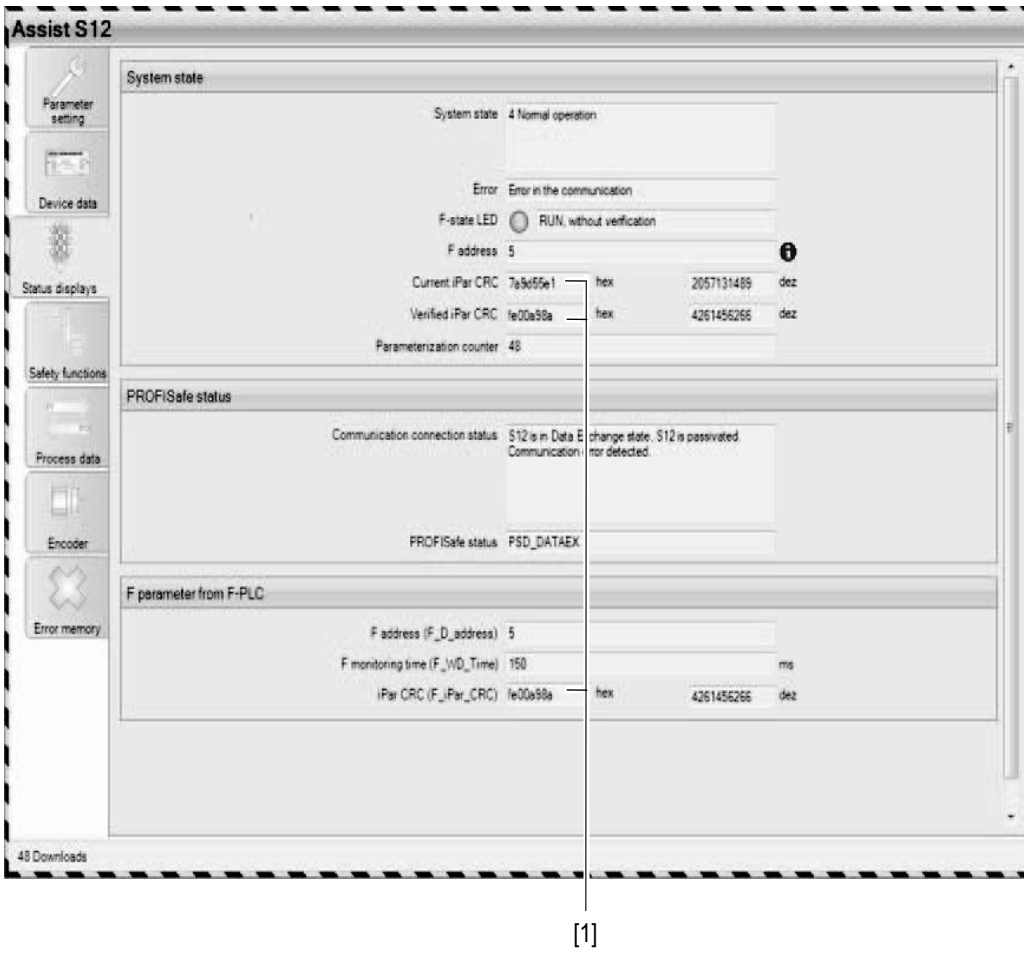
Select a monitoring time of sufficient length so that communication can tolerate telegram delays, but also short enough for your safety application to run without restrictions.

You can enter the *F_WD_Time* parameter in steps of 1 ms, ranging from 1 ms to 10 s for the S12 safety option.

F_iPar_CRC parameter

This parameter represents the CRC value that is calculated from the safety-related unit parameters.

The following figure shows the parameter in the "Assist S12" parameterization tool in the window of the "Status display" tool bar.



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[1] iPar-CRC / F-iPar-CRC

The following table shows the version ID and the iPar CRC of the S12 variants:

S12 variant:	Version ID	Default iPar CRC
S12A	e.g. 3565205509	e.g. 3967571976
S12B	e.g. 2609672025	e.g. 4219245997

8.5 Verification and validation

8.5.1 Overview

To ensure that the parameterized safety functions work, you have to check the parameters after startup and record this.

- First, check and confirm all parameters in the "Assist S12" parameterization tool.
- Then validate the parameterized safety functions within the framework of a functional test.

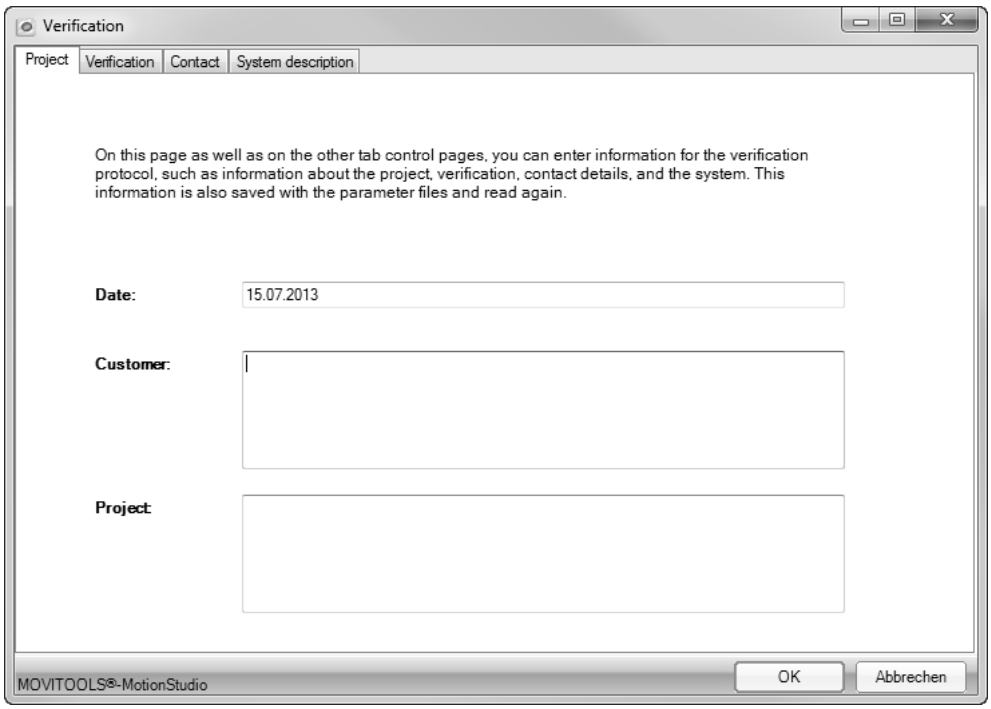
  To support the validation, the "Assist S12" parameterization tool offers a validation protocol function.

8.5.2 Verification

1. First, check all parameters in the "Assist S12" parameterization tool. To do so, compare the entered values with the displayed actual values.
2. Confirm the check by ticking the "Verified" check box and repeat this process for every page on the "Parameterization" tab.

   The verification status is shown in the parameter tree. There you can see which parameter block has already been verified and which still needs to be checked and confirmed. After ticking all "Verified" check boxes, the [Finish] button becomes active in the header.
3. Click the [Finish] button to continue.

   The "Finish" dialog opens:



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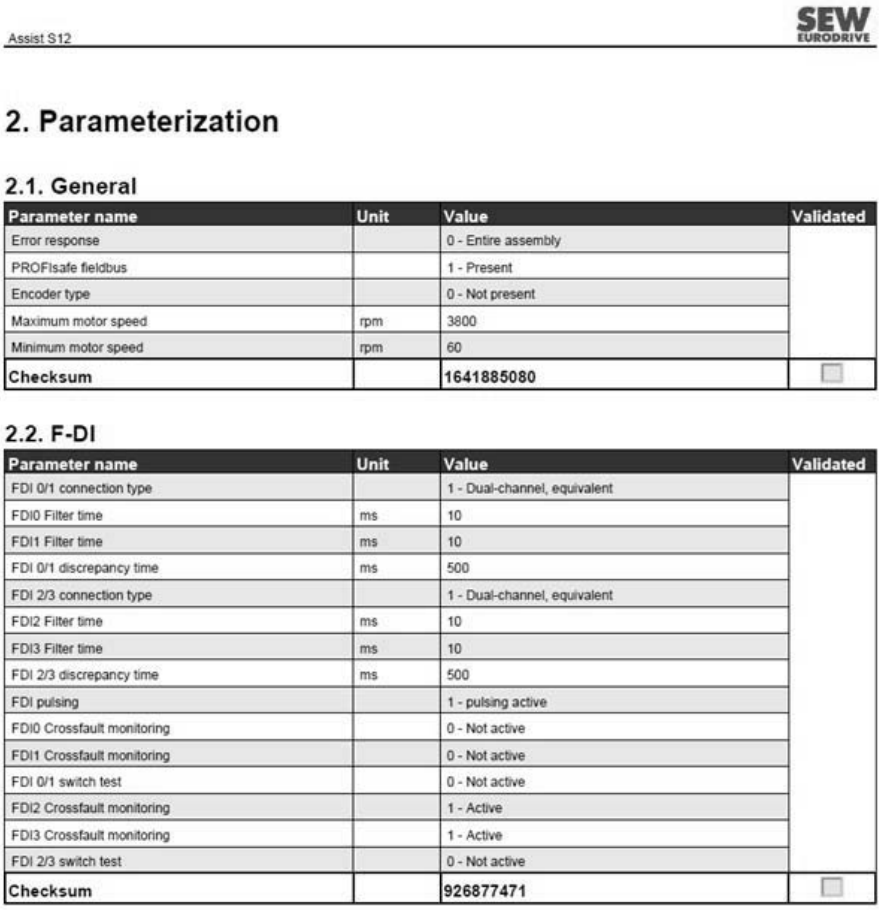
4. Enter all relevant data. To do so, use the following tabs:
   - Project
   - Verification
   - Contact

- System description

5. Click [OK] to transfer the verification status to the unit.
   The validation protocol opens and shows the data you have entered before.



Assist S12

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2. Parameterization

2.1. General

Parameter name	Unit	Value	Validated
Error response		0 - Entire assembly	
PROFIsafe fieldbus		1 - Present	
Encoder type		0 - Not present	
Maximum motor speed	rpm	3800	
Minimum motor speed	rpm	60	
Checksum		**1641885080**	☐

2.2. F-DI

Parameter name	Unit	Value	Validated
FDI 0/1 connection type		1 - Dual-channel, equivalent	
FDI0 Filter time	ms	10	
FDI1 Filter time	ms	10	
FDI 0/1 discrepancy time	ms	500	
FDI 2/3 connection type		1 - Dual-channel, equivalent	
FDI2 Filter time	ms	10	
FDI3 Filter time	ms	10	
FDI 2/3 discrepancy time	ms	500	
FDI pulsing		1 - pulsing active	
FDI0 Crossfault monitoring		0 - Not active	
FDI1 Crossfault monitoring		0 - Not active	
FDI 0/1 switch test		0 - Not active	
FDI2 Crossfault monitoring		1 - Active	
FDI3 Crossfault monitoring		1 - Active	
FDI 2/3 switch test		0 - Not active	
Checksum		**926877471**	☐

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8.5.3 Validation

Procedure

Each parameterized safety function must be validated and documented within the framework of a functional test. There is a special test mode (page 73) for the functional tests of the speed-related safety functions.

Structure of the validation protocol

The first chapter of the validation protocol lists all relevant system information from the "Verification" windows. The second chapter lists all parameter settings and the corresponding checksum (block CRC).

INFORMATION

- All listed parameters must be validated in the system and confirmed in the validation protocol.
- The user must validate all the configured data in the printed validation protocol. To do so, the user must check all the set limit values of the activated monitoring functions by performing a functional test.
- The user must check the following in the validation protocol:
  - If verification is repeated, the previous protocol can be used for comparison. In this case, the user only has to check the blocks in which parameters have been changed.
    Note that the CRC may only deviate in blocks with changed values. In blocks with unchanged parameter value, the CRCs must be the same as in the previous protocol. In the block with changed values, all values have to be checked.
  - The user may not make any subsequent changes in the validation protocol.

The user must check the version ID of the parameter set that is printed in the validation protocol.

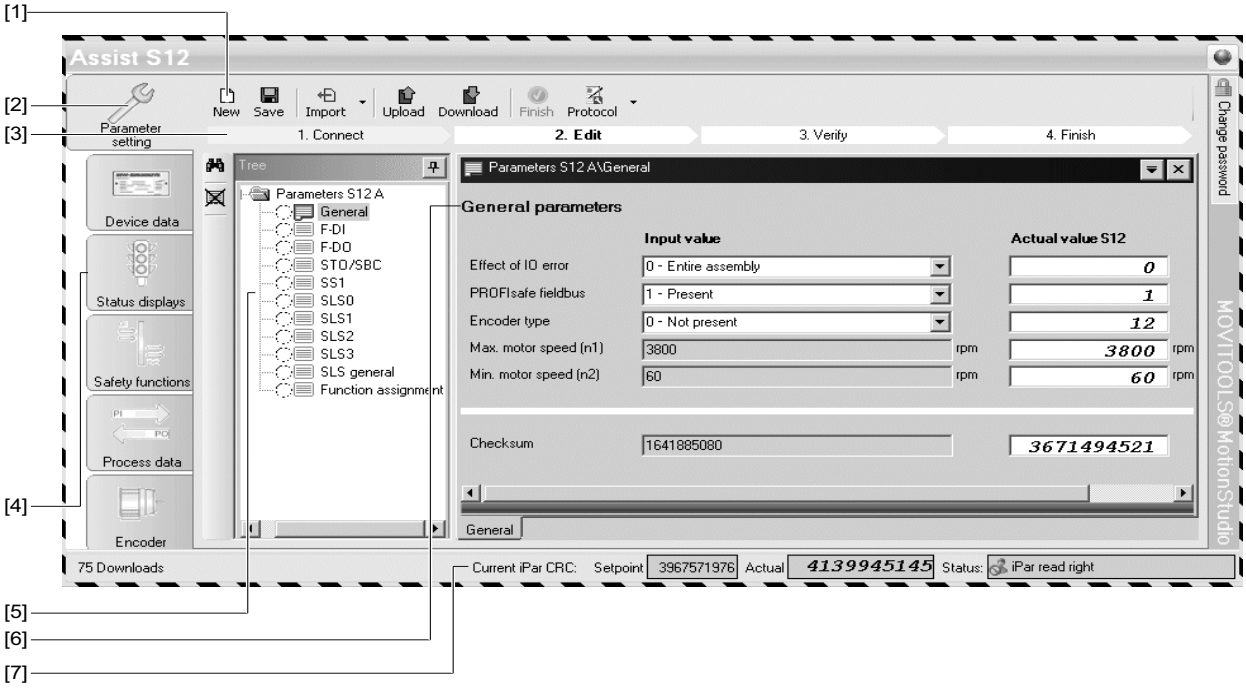
The following table shows the version ID and the iPar CRC of the S12 variants:

S12 variant:	Version ID	Default iPar CRC
S12A	e.g. 3565205509	e.g. 3967571976
S12B	e.g. 2609672025	e.g. 4219245997

9 Assist S12

9.1 Structure of the user interface

The following figure shows the user interface of the "Assist S12" parameterization tool:



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[1]	**Menu bar**	The menu bar offers different selection options (depending on the current step in the parameterization procedure). For detailed information, refer to chapter "Menu bar" (page 90).
[2]	**"Parameter setting" function**	The "Assist S12" parameterization tool starts the parameter setting function.
[3]	**Parameterization steps**	The parameterization process is shown in 4 steps from left to right: 1. Connect 2. Edit 3. Verify 4. Decrease The active step is highlighted and corresponds with the respective selection options in the menu bar.
[4]	**Tool bar**	Vertically arranged buttons for all tasks. For detailed information, refer to chapter "Tool bar" (page 91).
[5]	**Folder for parameter groups**	Double-click a folder to show all the parameters of a group
[6]	**Window of the active parameter group**	This window shows drop-down menus and edit boxes to adjust the parameters of a certain group.
[7]	**Status bar**	The following information is displayed: • iPar CRC (setpoint and actual value) • Status (e.g. iPar read access)

The following pages describe the control elements in detail.

9.1.1 Menu bar

The menu bar contains the following buttons:

- **[New]**

  Loads the default parameter set to the setpoint column (corresponding to the connected variant).

- **[Save] button**

  Saves the current setpoint parameters (left column) to the PC.

- **[Import/Export]**

  Saves the current setpoint parameters (left column) to a selectable file or reads the setpoints from a user-specified file.

- **[Upload]**

  Loads the parameters from the S12 safety option to the actual value column (right column).

- **[Download]**

  Sends the current setpoint parameters of the left column to the S12 safety option. The "Upload" is then carried out automatically.

- **[Finish]**

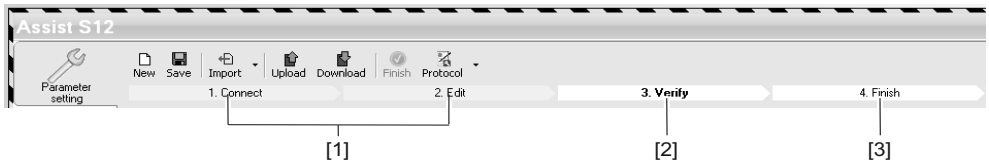
  After a download, the user has to compare and verify the setpoint and actual value columns again. The result of this verification (= the ticked check boxes) is sent to the S12 safety option by clicking the [Finish] button.

- **[Protocol]**

  Shows the validation protocol that was generated last. The user can also select another validation protocol from the drop-down list connected to the protocol button.

9.1.2 Parameterization steps

The parameterization steps are shown below the menu bar. The steps are represented by 4 arrows that show the active step in the parameterization process.



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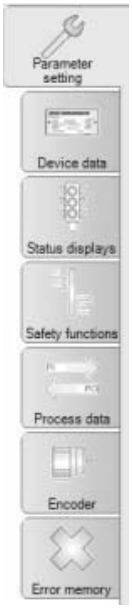
Arrow colors

- Green arrows [1] show the steps that have already been completed (here: "1. Connect" and "2. Edit").
- The white arrow with a bold font ("3. Verify") [2] shows the active step.
- The other white arrows [3] show the steps that are yet to be completed.

9.1.3 Tool bar

The tool bar contains buttons for the following tasks:



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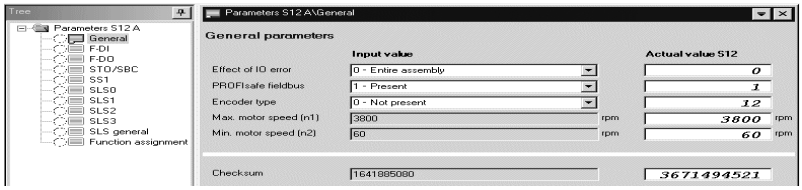
- Click on a button to open the window with the display and entry options for the corresponding task.

  The following chapter describes the individual tasks in detail.

9.1.4 Parameterization window

The window in the "Parameterization" area is divided into two parts:



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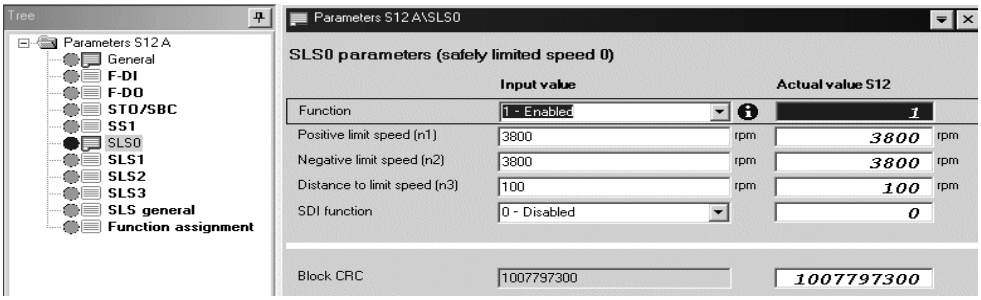
The left shows the parameter tree, which can be used to navigate between the parameter groups. Double-click on the individual parameter blocks/groups to expand them. The parameters are then shown on the right.

9.1.5 Plausibility error indication

The following figures gives an example of how plausibility errors are shown in the two parameter groups (on the left) "General" and "SLS0":



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Plausibility errors are marked with the following colors:

- **Blue:** Both the faulty "S12 actual values" (on the right) and the corresponding parameter groups (on the left) are marked in blue.

  When you move the mouse pointer over the field marked in blue, a tooltip for the indicated error is shown.

- **White:** Parameter groups are marked in white if it is not possible to indicate their status.

  This can have the following reasons:

  – The "Assist S12" parameterization tool was started; no data has been uploaded yet.

  – Data has been uploaded, but not downloaded yet. The blocks cannot be marked in green without a download.

- **Green:** No plausibility error

9.1.6 Status bar

The status bar indicates the status of the parameterization:

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After uploading the data, the current parameterization status of the S12 safety option is shown on the left. On the left in the figure above, a faulty, invalid parameter setting is shown (highlighted in red in the program). Next to this, the iPar CRC for all setpoint/actual values are shown. On the very right, the access mode of the S12 safety option is shown with the following possible values:

- Connection request received (only when connecting the S12 safety option)
- Read access to iPar parameters
- Write access to iPar (additional write access with parameterization password. The F parameters in the S12 safety option can only be changed in this mode).
- Not connected (there is no valid connection)

9.1.7 Change password

The password offers protection from unintentional access. It does not safeguard the configuration.

The following two passwords are set at the factory:

- Default password: **sew_s12**
- Master password: **sew_s12m**

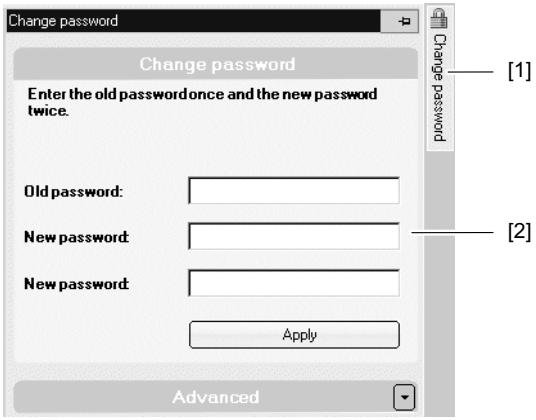
INFORMATION

Change the default password with your first access.

To change the password, proceed as follows:

1. Move the mouse pointer (no clicking) over the "Change password" area [1]:

   The input window [2] opens.



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2. To change the password, enter the old password and then twice the new password in the input window [2].
3. Click on [Apply] to confirm your entries.

You can undo password changes by entering the master password "sew_s12m" in the password prompt. The default password "sew_s12" is now restored. The master password is only accepted in the "Give write access" window.

9.2 Data management

General note on data management: The person starting up or operating the S12 safety option must ensure the availability of the current parameter set. The "Assist S12" parameterization tool offers suitable mechanisms for this (save, import/export).

9.2.1 Project-relevant files

The following 4 files are important for the parameterization process with the "Assist S12" parameterization tool. They are stored in the project directory of MOVITOOLS® MotionStudio.

- **Configuration file xxx.vd0**

  The name xxx is automatically derived from the MOVIFIT® signature during the configuration.

  This file belongs to the standard configuration mechanism (export, import, upload, download, etc.) of MOVITOOLS® MotionStudio. It also contains diagnostic parameters that are not safety-relevant for the S12 safety option, such as the serial number or the content of the error memory. It does not contain the safety-related F parameters.

  In contrast with configuration files of non-safety-related units, this file cannot be used for direct parameterization of the S12 safety option.

- **System information file "SystemInfo_xxx.xml"**

  xxx stands for the serial number of the S12 safety option.

  This file does not belong to the standard configuration mechanism of MOVITOOLS® MotionStudio. The "Assist S12" parameterization tool automatically uses the right file as soon as the serial number is read (online when establishing a definitive connection with the S12 safety option, or offline from the vd0 file). The content of the system information file is for documentation purposes. It is listed in the validation protocol.

- **Validation protocol "S12Protocol-xxx-yyy.pdf"**

  xxx stands for the serial number of the S12 safety option, yyy for the creation time of the file.

  This file does not belong to the standard offline mechanism of MOVITOOLS® MotionStudio. The "Assist S12" parameterization tool automatically uses the right file as soon as the parameterization tool has read out the serial number (online when establishing a definitive connection with the S12 safety option, or offline from the *.vd0 file).

  This file can only be created online during the verification process (verification of the set parameters).

  This file contains the system information and the F parameter values.

- **Last opened file "lastOpened_xxx.s12par"**

  xxx stands for the serial number of the S12 safety option.

  This file does not belong to the standard configuration mechanism of MOVITOOLS® MotionStudio. The "Assist S12" parameterization tool automatically uses the right file as soon as the serial number is read (online when establishing a definitive connection with the S12 safety option, or offline from the vd0 file).

  This file contains the setpoints of the F parameters set last in the "Assist S12" parameterization tool. It cannot be downloaded directly to the S12 safety option. The user has to go through the parameterization process of the "Assist S12" parameterization tool.

The directory in which the mentioned files are stored depend on whether the MOVIFIT® unit was configured with the S12 safety option or not. Note that the S12 safety option is always configured together with the MOVIFIT® unit. The directories are based on the "MotionStudio project folder" that is defined in "New project" dialog in MotionStudio.

The target directory and name form the name of the basic folder of this MotionStudio project.

9.2.2 Data management with non-configured S12 safety option

In the non-configured state (i.e. there is a MotionStudio project, but the MOVIFIT® unit with safety option has not been connected yet to the project view), you can only work online.

In this case, there is no configuration file that can be used as a basis for offline mode.

The data of the "Assist S12" parameterization tool is stored in the user directory of MOVITOOLS® MotionStudio.

Example:

The MotionStudio project folder is `C:\Users\USERNAME\Documents\SEW\MotionStudio\MMSProjektS12`

At first, this directory only contains the project file `MMSProjektS12.sewproj`. The subfolder `\UserData` is still empty.

After a complete parameterization process (online, offline is not possible), the following 2 files and a subdirectory are added to `\UserData`:

- `lastOpened_01.1241714603.0001.08.s12par`
- `SystemInfo_01.1241714603.0001.08.xml`
- Subdirectory `\S12Protocol-01.1241714603.0001.08` with the PDF protocol file created during the parameterization process.

In this example, "01.1241714603.0001.08" is to be the serial number of the S12 safety option.

For each S12 safety option connected to other MOVIFIT® units, these files and the subdirectory are created with the respective serial number.

Each verification of the same unit (= same serial number) generates another PDF file in the folder with a new creation time in the file name.

9.2.3 Data management with configured S12 safety option

In the configured state (i.e. there is a project for the MOVIFIT® unit with the S12 safety option), you can work online or offline. In this case, there is a configuration file that is used as a basis for offline mode.

You can only configure a MOVIFIT® unit together with an S12 safety option. The S12 safety option cannot be configured separately.

The data of the "Assist S12" parameterization tool is stored in the MOVITOOLS® MotionStudio project in the device directory of the S12 safety option.

Example:

The MotionStudio project folder is `C:\Users\USERNAME\Documents\SEW\MotionStudio\MMSProjektS12`

At first, this directory only contains the project file `MMSProjektS12.sewproj`. The subdirectory `\Devices` has been added.

`\Devices` now contains a subdirectory (the name of which has been derived from the MOVIFIT® signature "MovifitS12" during the configuration process) for the S12 safety option: `\MovifitS12 - O_1`.

The directory `\MovifitS12 - O_1` contains the following files and subdirectories:

- `lastOpened_01.1241714603.0001.08.s12par`
- `SystemInfo_01.1241714603.0001.08.xml`
- Subdirectory `\S12Protocol-01.1241714603.0001.08` with the PDF protocol file created during the parameterization process.

In this example, "01.1241714603.0001.08" is to be the serial number of the S12 safety option.

For each S12 safety option connected to other MOVIFIT® units, these files and the subdirectory are created with the respective serial number.

Each verification of the same unit (= same serial number) generates another PDF file in the folder with a new creation time in the file name.

Startup before configuration

If the S12 safety option has been started up before the configuration process in MOVITOOLS® MotionStudio, any data has been saved in the `\UserData` directory of MOVITOOLS® MotionStudio.

When the "Assist S12" parameterization tool is started after the configuration process, the following data is copied once:

- `lastOpened_...s12par`
- `SystemInfo_....xml`

Source directory of the copying process:

`C:\Users\USERNAME\Documents\SEW\MotionStudio\MMSProjektS12\UserData`

Target directory of the copying process:

`C:\Users\USERNAME\Documents\SEW\MotionStudio\MMSProjektS12\Devices\Devicename`

The folder with validation protocol files is copied as well, if it exists.

9.3 Parameterization

9.3.1 Parameter setting procedure

For successful parameterization of the S12 safety option, you have to adhere to a specific parameterization process, which is given by the "Assist S12" parameterization tool.

Prerequisite:

Consider the following for parameterization:

- You cannot parameterize the S12 safety option without the "Assist S12" parameterization tool.
- Parameterization is only possible with an active connection to the S12 safety option.

Parameter setting procedure

The parameterization process basically looks as follows:

- Enter setpoints in the "Assist S12" parameterization tool in the left column.
- The "Download" function sends the values to the S12 safety option.
- The S12 safety option check the transmitted setpoints for consistency and plausibility.
- After a successful transmission, you can check the parameterization with a first functional test.
- Compare all setpoints and actual values and verify their consistency.
- The verification process is completed by clicking on the [Finish] button.

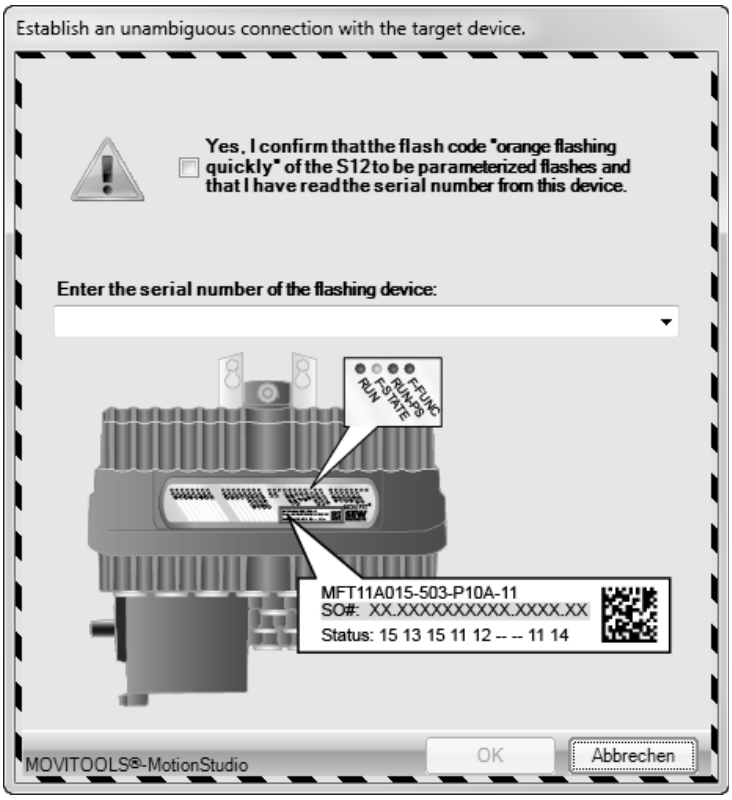
9.3.2 Paremeterization procedure

Follow the steps below to set the parameters (once):

1. **Start "Assist S12" parameterization tool**

   Start the "Assist S12" parameterization tool from the user interface of MOVITOOLS® MotionStudio.

   A window appears that prompts you to enter the serial number of the unit:



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2. **Enter the serial number and establish a connection**

   When the "Assist S12" parameterization tool is opened, an LED of the connected S12 safety option starts flashing in a certain way. Read off the serial number from the S12 safety option with the flashing "F State LED" and enter it.

   The serial number is sent back to the connected S12 safety option and checked there. This process ensures that the S12 safety option selected at the PC is the desired S12 safety option.

   Note: You only have to enter the serial number for a certain unit when you establish a connection for the first time. If you want to re-establish a connection with the unit at a later time, simply select the serial number from the drop-down menu.

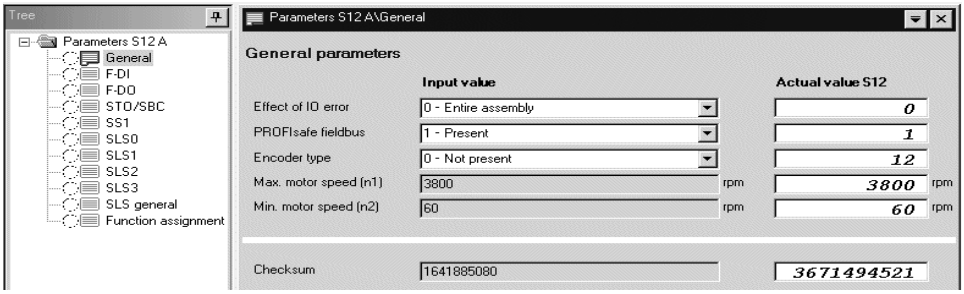
   When connecting the "Assist S12" parameterization tool with a certain S12 safety option (which can be identified via the serial number) for the first time, the default setpoints are used. You can always restore these default values by clicking on the [New] button.

3. **Upload the current parameter settings of the unit**

   Click on the [Upload] button to upload the current parameter settings of the S12 safety option to the "Assist S12" parameterization tool. The uploaded values are shown in the "S12 actual value" column. This is to read out the current configuration; it can also be done during operation.

4. **Parameterization**

   Double-click the parameter directories and enter the setpoints in the respective fields in the "input value" column.



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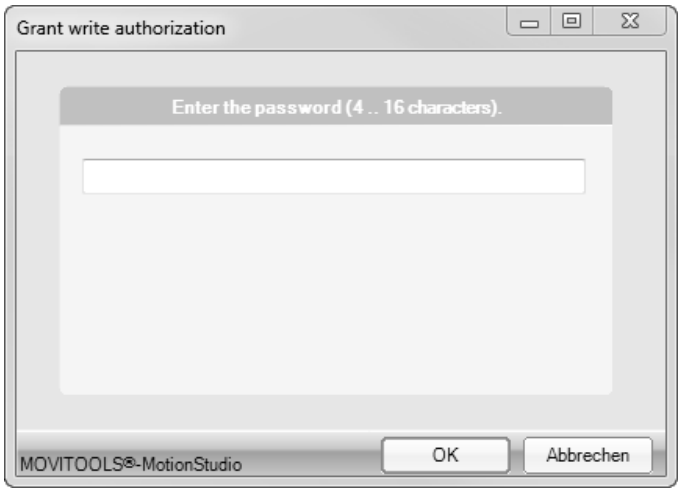
5. **Download the parameter set to the unit**

   Click on the [Download] button to download the parameter set to the S12 safety option. The download is password-protected.

6. **Enter password**

   Standard password (default): **sew_s12**



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   You can also change the password, if necessary. For detailed information, refer to chapter "Changing the password".

   After downloading the parameters, an "Upload" is carried out automatically, so that the feedback from the S12 safety option is visible.

7. **Identify plausibility errors**

   Identify any plausibility errors based on their color marking. For detailed information, refer to chapter "Plausibility error indication" (page 92).

8. **Correct all plausibility errors and verify the configuration**

   If the S12 safety option does not detect any error, the individual parameters are now displayed with a check box, which you have to tick for verification. Go through all parameter groups, check that your setpoints correspond with the read-back actual values in the S12 safety option, and tick all blocks that are correct. If you adjust any parameters here, you have to download the parameter settings again. Once you have ticked (verified) all parameter groups, the [Finish] button becomes active.

9. **Finish**

   Click the [Finish] button to tell the S12 option that you have verified all parameters.

10. **Create validation protocol**

    The "Assist S12" parameterization tool creates a PDF file for validation and documentation, the so-called validation protocol. It contains the parameter settings, a checksum, a parameterization counter, and a system description. You can determine the content of this system description in a dialog window.

    This dialog window appears automatically when you click the [Finish] button.

    The validation protocol can be printed out and used in the validation of the system. Here, too, you can tick off the individual parameter blocks that have already been validated.

    When at least one protocol file has been created, the [Protocol] button becomes active.

    You can open the last generated protocol, or select and open a protocol from the drop-down list of generated protocols.

9.3.3 Changing the parameter settings

The process for changing parameter settings is basically the same as for first-time parameterization (page 97).

The original process is shortened because verified data is already available:

- **Automatic recovery of the last setpoints:**

  When you exit the "Assist S12" parameterization tool, the setpoints for each parameterized S12 safety option are saved locally on the PC.

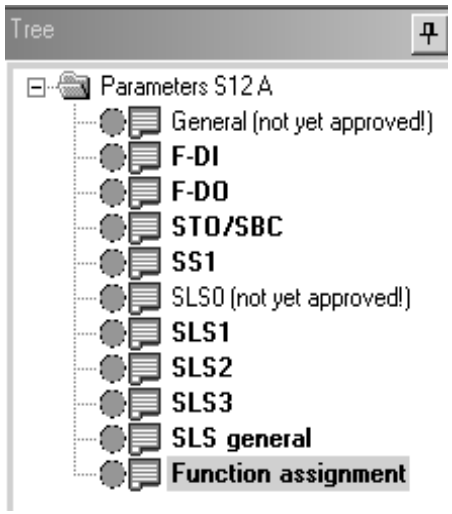
  When you open the "Assist S12" parameterization tool again, these setpoints are automatically shown in the "Input values" column.

- **Verification of changed parameter blocks only**

  If you change individual parts of the parameter set, you only have to verify the changed blocks.

  Unchanged parameter blocks are shown as verified ("ticked off") and can no longer be changed; otherwise, they have to be verified again.

  The following figure shows the difference between verified parameter blocks and non-verified parameter blocks:



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The names of unchanged (verified) parameter blocks are shown in "bold".

The names of parameter blocks that still need to be verified are shown "normally".

In addition, "not yet approved" is shown next to the parameter block designation.

9.3.4 Parameter display

To show the current parameter settings, proceed as follows:

- Click [Upload].

  The current parameter settings are uploaded and shown in the actual value columns.

The actual values of the S12 safety option are shown via an independent channel in the "Assist S12" parameterization tool. The "Assist S12" parameterization tool cannot interpret this data.

A comparison of iPar CRCs and the setpoint and actual values shows whether the setpoint and actual values are identical.

9.4 Device data

The "Device data" block shows the serial nunber, device signature, device type, firmware part number, and release number of the connected S12 safety option.

9.5 Status displays

The "Status displays" block shows the system status with error messages, F state LED, F address, parameterization counter, and CRCs for the F parameters. Next to this, the PROFIsafe status and F-PLC parameters are displayed.

For detailed information, refer to chapter "Diagnostics with Assist S12" (page 125).

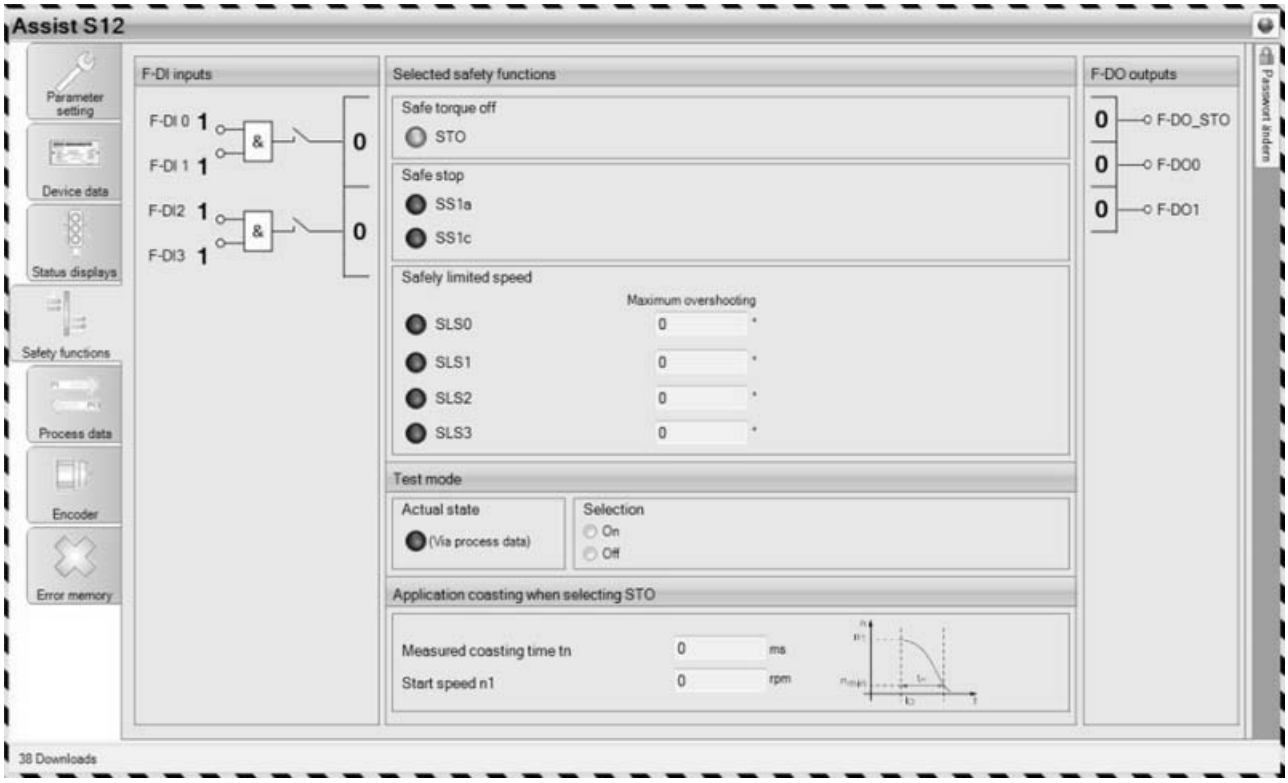
9.6 Safety functions

The "Safety functions" block shows information about the inputs and outputs (F-DI and F-DO) and about the safety functions of the S12 safety option.

The F-DIs are shown in the left part of the window.

9.6.1 Overview

The following figure shows the display elements for the "Safety functions" block:



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The following pages describe the display elements in detail.

9.6.2 Safety function status

The status of the safety functions is displayed with the following LED colors:

LED color	Meaning
Yellow	Function selected
Light gray	Connection interrupted
Black	Function not active

INFORMATION

The status displays in the "Assist S12" parameterization tool are NOT safety-related and can be faulty.

They are only for diagnostic purposes.

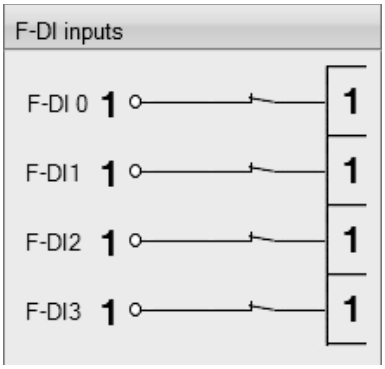
9.6.3 F-DI inputs

F-DIs are displayed in the left part of the window with 4 or 8 inputs, depending on the variant (A or B). The inputs can be parameterized as 1-channel or 2-channel inputs. With 2-channel parameterization, a difference is made between equivalent and non-equivalent connection (see figure for example 2).

On the left margin of the F-DI block, the detected input levels of the safety-related F-DI inputs are shown; on the right margin, the corresponding F-DI process values are shown. They are also used to control the safety functions and are output via the safe process input data.

When the *IO error impact* parameter is set to "entire assembly", not only the process value of the F-DI affected by the error goes to safe state, but the process values of all other F-DIs as well. This status is shown by open switches between the F-DI input signal and the F-DI process values.

Example 1: 4 F-DI 1-channel, not interlocking



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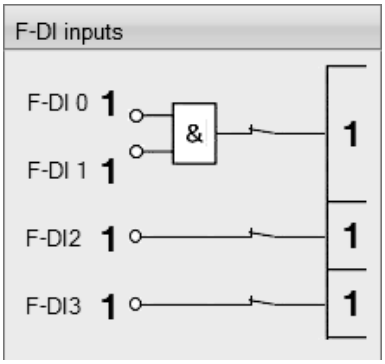
Example 2: 2 F-DI 2-channel combined to one input (equivalent-switching)



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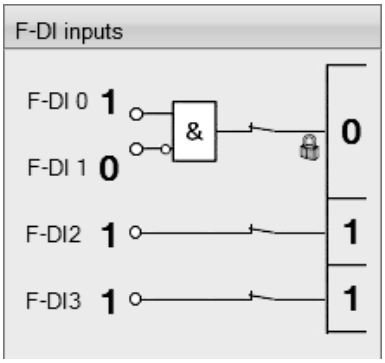
Example 3: 2 F-DI programmed to interlocking

The F-DIs can be programmed to "interlocking" (page 72). A lock indicates that the process values of an F-DI are in a locked state. In an error state (switch open) or when the input signal is 0, the lock symbol is not displayed.



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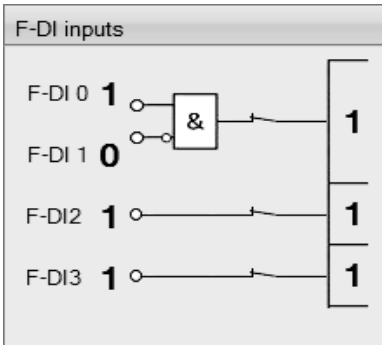
The following figure shows the unlocked F-DI after acknowledgement:



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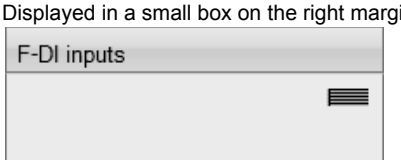
Representation conventions

The following 6 elements are used for representing F-DIs:

Element	Meaning/example
Designation of input	Text that designates the input (e.g. F-DI0)
Value of the input signal (signal level)	1: Voltage connected 0: No voltage connected
Input link	Solid line for 1-channel inputs Logic gate of two F-DI with 2-channel programming
Switch	A closed switch indicates that no error was detected in the input evaluation and that the process value of the F-DI / the F-DI pair is used to control the safety functions and to form the process input data. In case of an error, the switch is displayed as open.
Interlocking state	Represented by a lock in front of the process value of the F-DI / F-DI pair if the input signal is "1" but the input is locked and therefore the process value is "0").
Process value of the F-DI or F-DI pair	If it is not possible to give information on terminal programming and assignment because the connection to the S12 safety option is interrupted, the F-DIs are displayed as a small rectangle. Displayed in a small box on the right margin of the F-DI block:  8772067467

9.6.4 F-DO outputs

The F-DOs are shown in the right part of the window. They cannot be programmed.

9.6.5 Test mode

You can switch the test mode on and off in the "Safety functions" block.

The test mode is the only area in which values of the S12 safety option are not only displayed, but can also be controlled by the user via the PC.

As the test mode can also be switched on and off with a process data bit via fieldbus, note the following:

The activation signal for test mode via the "Assist S12" parameterization tool is linked with the activation signal via process data with an OR operation. The test mode is activated with a rising edge in one of both activation signals. To deactivate the test mode, both activation signals must be set to "off".

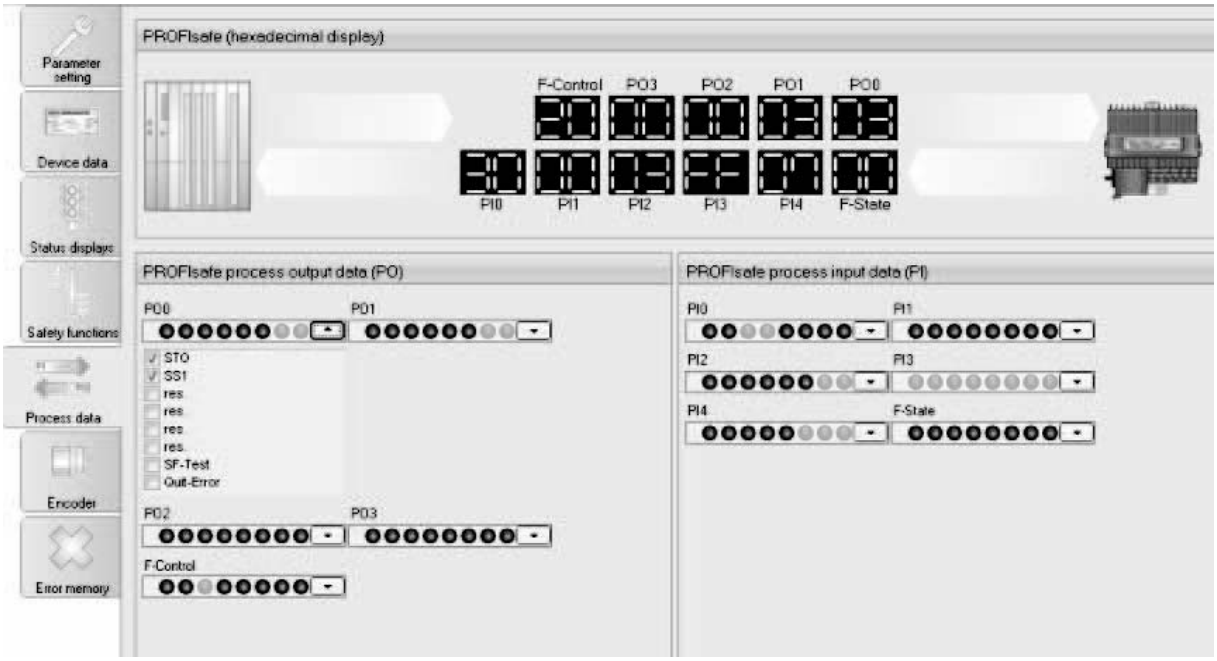
If the test mode has been activated via process data, control via the "Assist S12" parameterization tool is limited.

The test mode is deactivated automatically after 5 minutes. (This time frame starts with the first activation of the test mode and cannot be extended by further activation edges.)

9.7 Process data

In the "Process data" block, you can see the process data that are exchanged between the higher-level controller and the MOVIFIT® unit.

In the upper part of the window, the process data are displayed in hexadecimal format. In the lower part of the window, you can display individual bits by clicking on the drop-down menu of the corresponding process data word (PI., PO.).



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9.8 Encoder

The "Encoder" block shows the speed measured by the encoder. It also indicates whether the minimum speed of the motor is exceeded.

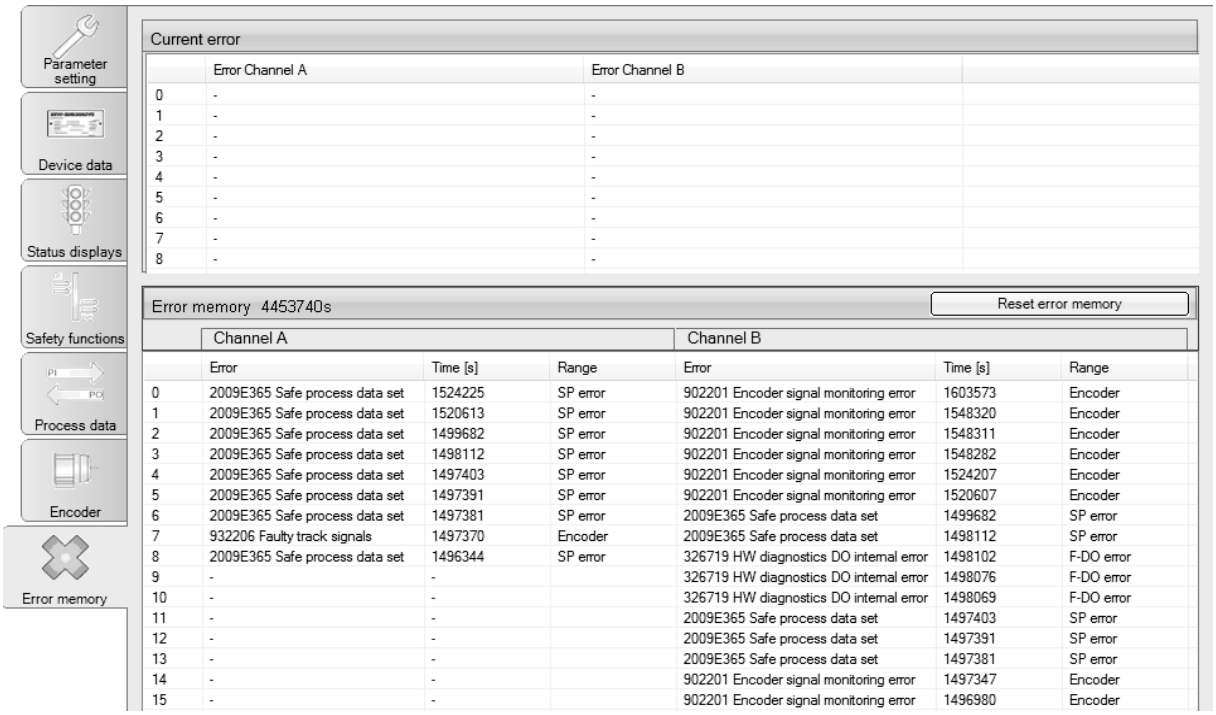
9.9 Error memory

The "Error memory" block shows the two error memories of the S12 safety option.

In the upper part of the window, the "current errors" are shown. This information is lost when the S12 safety option is switched off. Acknowledgeable errors are deleted after they are acknowledged.

The content of the lower error memory is preserved after a reconnection or acknowledgement. This memory can be deleted with the [Reset error memory] button. The memory is a circular buffer. The new entries overwrite the oldest entries as soon as the memory capacity limit is reached.

The specified time is the duty time of the S12 safety option. It is given in seconds. For comparison reasons, the current duty time is shown to the left of the [Reset error memory] button (in the example below, the current duty time is 4453740 s).



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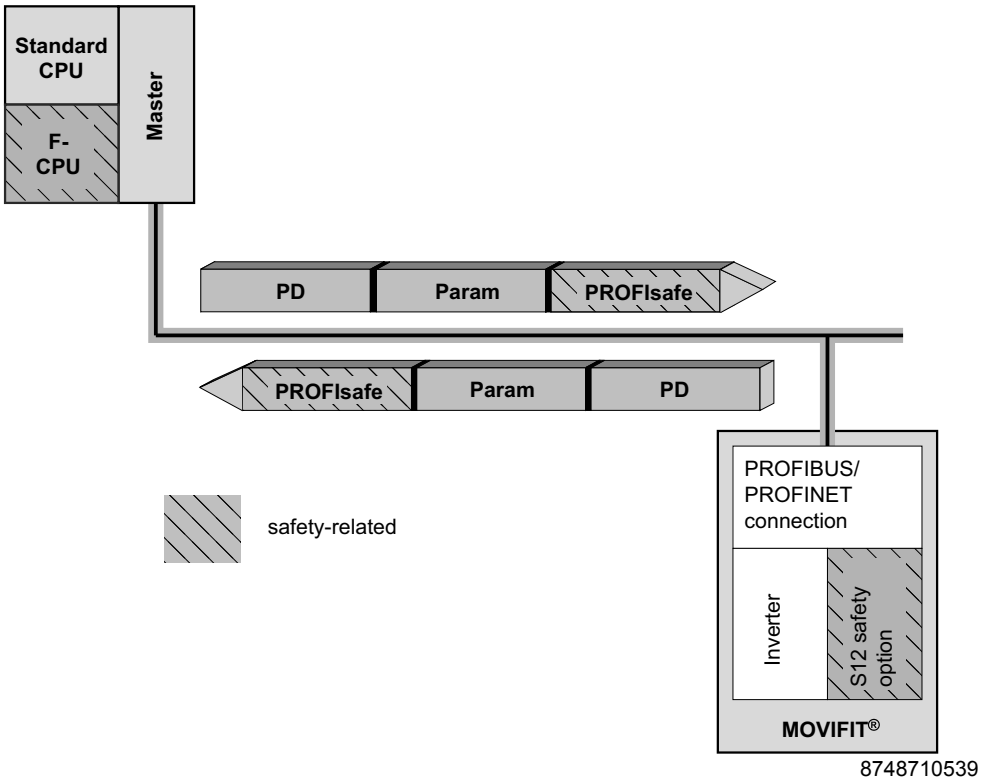
For detailed information, refer to chapter "Diagnostics with Assist S12" / "Error memory" (page 128).

10 Data exchange

10.1 Introduction

MOVIFIT® units with integrated S12 safety option support parallel operation of standard and safety-related communication via a bus system or network. You can run safety-related PROFIsafe communication via PROFIBUS DP and PROFINET IO.

The transmitted bus telegrams contain standard information for conventional MOVIFIT® operation and the PROFIsafe safety telegram. 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 the MOVIFIT® unit.



10.2 F periphery access of the S12 safety option in STEP 7

For safety-related communication, the S12 safety option needs a total of 9 bytes for input data and 8 bytes for output data for the PROFIsafe telegram part and occupies them in the process image. Of these, 5 input bytes and 4 output bytes constitute the actual safety-related I/O data (F user data), and the remaining 4 bytes are required for telegram protection in accordance with the PROFIsafe specifications.

10.2.1 F periphery DB of S12 safety option

During compilation in the configuration tool (HW Config), the system automatically generates an F periphery DB for every S12 safety option. The F periphery DB offers a user interface in which you 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 the S12 safety option:

	Address	Symbol	Data type	Function	Default
User-controllable variables	DBX0.0	“F00008_198.PASS_ON“	Boolean	1 = activate passivation	0
	DBX0.1	“F00008_198.ACK_NEC“	Boolean	1 = acknowledgment required for reintegration with S12 safety option	1
	DBX0.2	“F00008_198.ACK_REI“	Boolean	1 = acknowledgment for reintegration	0
	DBX0.3	“F00008_198.IPAR_EN“	Boolean	Variable for resetting parameters (not supported by S12 safety option)	0
Variables that can be evaluated	DBX2.0	“F00008_198.PASS_OUT“	Boolean	Run passivation	1
	DBX2.1	“F00008_198.QBAD“	Boolean	1 = substitute values are output	1
	DBX2.2	“F00008_198.ACK_REQ“	Boolean	1 = acknowledgment required for reintegration	0
	DBX2.3	“F00008_198.IPAR_OK “	Boolean	Variable for resetting parameters (not supported by S12 safety option)	0
	DBB3	“F00008_198.DIAG“	Byte	Service information	

PASS_ON

This variable lets you activate passivation of the S12 safety option. Provided that PASS_ON = 1, the F periphery is passivated.

ACK_NEC

After a fault has been corrected, the S12 safety option is reintegrated, depending on ACK_NEC.

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

⚠ WARNING

The variable ACK_ NEC = 0 may only be parameterized if automatic reintegration is safe for the process in question.

Severe or fatal injuries.

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

ACK_REI — In order to reintegrate the S12 safety option 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.

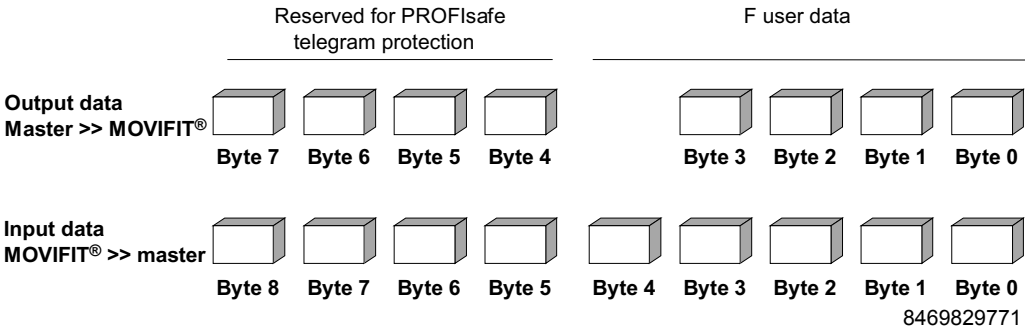
ACK_REQ — The F control system sets ACK_REQ = 1 after all faults in the data exchange with the S12 safety option have been corrected. After successful acknowledgement, the F control system sets ACK_REQ = 0.

PASS_OUT — Indicates whether the S12 safety option has been passivated. Substitute values are output

QBAD — Error in the data exchange with the S12 safety option. Indicates passivation. 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.

10.2.2 F user data of S12 safety option



F process output data

Byte	Bit	Name	Value	Description
0	**0**	STO	0	STO is selected.
			1	STO is not selected.
	1	SS1	0	SS1 function is selected. (execution of parameterized SS1(a) **or** SS1(c) function)
			1	SS1 function is not selected.
	2 – 5	Reserved	-	-
	6	SF test	0	Test mode for drive safety functions is not selected.
			1	Test mode for drive safety functions is selected (edge 0/1).
	7	Acknowl-edge error	0	For 0/1 edge: Acknowledgement of pending errors and unlocking of interlocking F-DI inputs. Note: After the acknowledgement, the bit should be reset to "0" to avoid unintentional acknowledgements during startup and reintegration of the controller.
			1	
1	**0**	SLS0	0	The SLS0 drive safety function is selected.
			1	The SLS0 drive safety function is not selected.
	1	SLS1	0	The SLS1 drive safety function is selected.
			1	The SLS1 drive safety function is not selected.
	2	SLS2	0	The SLS2 drive safety function is selected.
			1	The SLS2 drive safety function is not selected.
	3	SLS3	0	The SLS3 drive safety function is selected.
			1	The SLS3 drive safety function is not selected.
	4 – 7	Reserved	-	-
2	**0**	F-DO00	0	F-DO00 output is not selected; the safety-rated output is open.
			1	F-DO00 output is selected; the safety-rated output is closed.
	1	F-DO01	0	F-DO01 output is not selected; the safety-rated output is open.
			1	F-DO01 output is selected; the safety-rated output is closed.
	2 – 7	Reserved	-	-
3	**0 – 7**	Reserved	-	-

F process input data

Byte	Bit	Name	Value	Description
0	**0**	STO active	0	The STO function is not active; 24 V supply voltage is switched on, safe disconnection for the connected drive is not effective or an error has occurred at the output.
			1	The STO function reports the status "STO active", and all outputs parameterized to STO are without voltage.
	1	SS1 active	0	The SS1 function is not active. The function is not selected, or an error has occurred. The STO status is not part of the SS1 status and must be consulted via bit 0.
			1	The SS1 function is active. The drive is brought to a safe stop with a safely monitored ramp with SS1 (a) or after the delay time with SS1(c). There is always a transition to STO.
	2 – 3	Reserved	-	-
	4	Standstill	0	Standstill is not active, shaft is rotating
			1	Standstill is active, standstill ($n < n_{min}$) detected
	5	ASF error	0	Speed error in active drive safety function SS1a or SLS/SDI
			1	No speed error in any active drive safety function
	6	SF test active	0	Test mode for drive safety functions is not active.
			1	Test mode for drive safety functions is active.
	7	Error	0	The S12 safety option is running without any errors.
			1	At least one error is active in the S12 safety option.
1	**0**	SLS0 active	0	The SLS0 drive safety function is not active, or an error has occurred.
			1	The SLS0 drive safety function is active.
	1	SLS1 active	0	The SLS1 drive safety function is not active, or an error has occurred.
			1	The SLS1 drive safety function is active.
	2	SLS2 active	0	The SLS2 drive safety function is not active, or an error has occurred.
			1	The SLS2 drive safety function is active.
	3	SLS3 active	0	The SLS3 drive safety function is not active, or an error has occurred.
			1	The SLS3 drive safety function is active.
	4 – 7	Reserved	-	-

Byte	Bit	Name	Value	Description
2	**0**	F-DI00	0	Process value of digital, safety-related input F-DI00, no voltage present.
			1	Process value of digital, safety-related input F-DI00, voltage present.
	1	F-DI01	0	Process value of digital, safety-related input F-DI01, no voltage present.
			1	Process value of digital, safety-related input F-DI01, voltage present.
	2	F-DI02	0	Process value of digital, safety-related input F-DI02, no voltage present.
			1	Process value of digital, safety-related input F-DI02, voltage present.
	3	F-DI03	0	Process value of digital, safety-related input F-DI03, no voltage present.
			1	Process value of digital, safety-related input F-DI03, voltage present.
	4	F-DI04	0	Process value of digital, safety-related input F-DI04, no voltage present.
			1	Process value of digital, safety-related input F-DI04, voltage present.
	5	F-DI05	0	Process value of digital, safety-related input F-DI05, no voltage present.
			1	Process value of digital, safety-related input F-DI05, voltage present.
	6	F-DI06	0	Process value of digital, safety-related input F-DI06, no voltage present.
			1	Process value of digital, safety-related input F-DI06, voltage present.
	7	F-DI07	0	Process value of digital, safety-related input F-DI07, no voltage present.
			1	Process value of digital, safety-related input F-DI07, voltage present.

Byte	Bit	Name	Value	Description
3	**0**	QFDI0	0	Qualifier F-DI00; "bad": The corresponding F-DI is transmitted with the substitute value.
			1	Qualifier F-DI00; "good": The corresponding F-DI is transmitted with the current process value.
	1	QFDI1	0	Qualifier F-DI01; "bad": The corresponding F-DI is transmitted with the substitute value.
			1	Qualifier F-DI01; "good": The corresponding F-DI is transmitted with the current process value.
	2	QFDI2	0	Qualifier F-DI02; "bad": The corresponding F-DI is transmitted with the substitute value.
			1	Qualifier F-DI02; "good": The corresponding F-DI is transmitted with the current process value.
	3	QFDI3	0	Qualifier F-DI03; "bad": The corresponding F-DI is transmitted with the substitute value.
			1	Qualifier F-DI03; "good": The corresponding F-DI is transmitted with the current process value.
	4	QFDI4	0	Qualifier F-DI04; "bad": The corresponding F-DI is transmitted with the substitute value.
			1	Qualifier F-DI04; "good": The corresponding F-DI is transmitted with the current process value.
	5	QFDI5	0	Qualifier F-DI05; "bad": The corresponding F-DI is transmitted with the substitute value.
			1	Qualifier F-DI05; "good": The corresponding F-DI is transmitted with the current process value.
	6	QFDI6	0	Qualifier F-DI06; "bad": The corresponding F-DI is transmitted with the substitute value.
			1	Qualifier F-DI06; "good": The corresponding F-DI is transmitted with the current process value.
	7	QFDI7	0	Qualifier F-DI07; "bad": The corresponding F-DI is transmitted with the substitute value.
			1	Qualifier F-DI07; "good": The corresponding F-DI is transmitted with the current process value.
4	**0**	QFDO-STO	0	Qualifier QFDO-STO; "bad": The corresponding F-DO is switched off due to an error.
			1	Qualifier QFDO-STO; "good": The corresponding F-DO is switched via the current process value.
	1	QFDO0	0	Qualifier QFDO0; "bad": The corresponding F-DO is transmitted with the substitute value.
			1	Qualifier QFDO0; "good": The corresponding F-DO is transmitted with the current process value.
	2	QFDO1	0	Qualifier QFDO1; "bad": The corresponding F-DO is transmitted with the substitute value.
			1	Qualifier QFDO1; "good": The corresponding F-DO is transmitted with the current process value.
	3 – 7	Reserved	-	-

10.2.3 Activation examples for the S12 safety option

In the example for activating the failsafe functions of the S12 safety option, it is prerequisite that a safety program and a process group have been created, and that an F control program module is available.

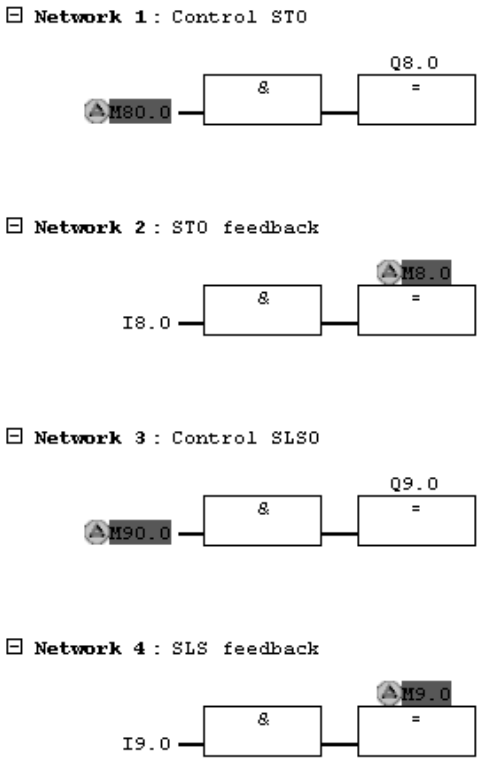
You can activate the failsafe functions and the F periphery as well as the evaluation of the responses by the F periphery by using flags. Note that in STEP 7, flags are only permitted for coupling between the standard user program and the safety program. Flags may not be used as buffers for F data.

INFORMATION

SEW-EURODRIVE accepts 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	Comment
E 8.0	S12 PowerRemoved	M 8.0	Feedback: safety-related output switched.	1-active
E 9.0	S12 SLS0 active	M 9.0	Feedback: SLS0 active.	
E 10.0	S12 F-DI00	M 9.1	Status of the safety-related input F-DI00	
A 8.0	S12 STO	M 80.0	STO is selected.	0-active
A 9.0	S12 SLS0	M 90.0	SLS0 is selected.	
A 10.0	S12 F-DO01	M 90.1	Safety-related output DO01 is selected.	1-active
DB811.DBX0.0	"F00008_198".PASS_ON	M 10.0	Activating the passivation of the S12 safety option.	-
DB811.DBX0.1	"F00008_198".ACK_NEC	M 10.1	Parameterizing the reintegration of S12 safety option.	
DB811.DBX0.2	"F00008_198".ACK_REI	M 10.2	Activating the user acknowledgement for the S12 safety option.	
DB811.DBX2.0	"F00008_198".PASS_OUT	M 10.3	S12 safety option passivated.	
DB811.DBX2.1	"F00008_198".QBAD	M 10.4	Error in the S12 safety option.	
DB811.DBX2.2	"F00008_198".ACK_REQ	M 10.5	Indicates whether user acknowledgement is required for reintegration of the S12 safety option.	


Network 1 : Control STO
M80.0
&
Q8.0
=
Network 2 : STO feedback
I8.0
&
M8.0
=
Network 3 : Control SLSO
M90.0
&
Q9.0
=
Network 4 : SLS feedback
I9.0
&
M9.0
=

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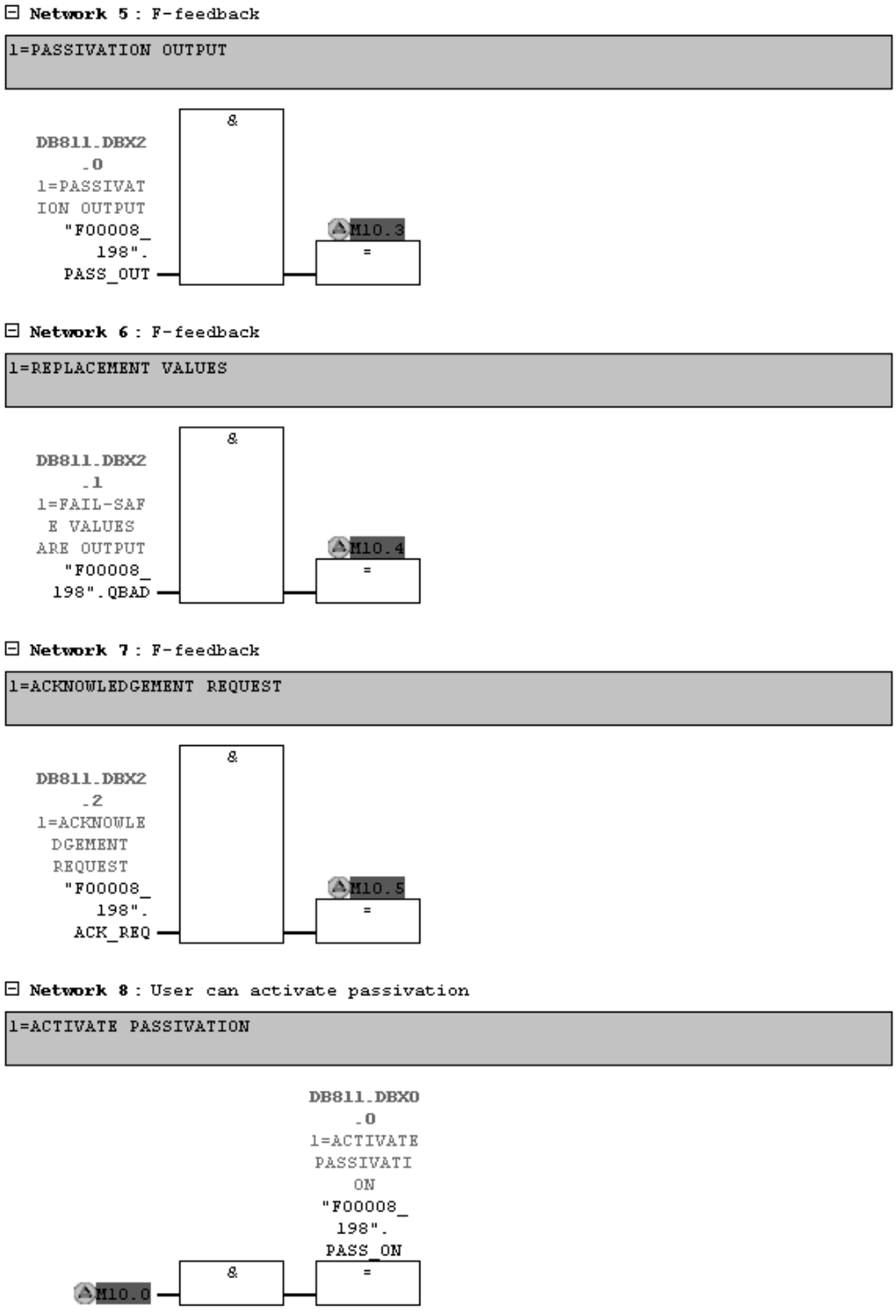
Network 5 : F-feedback
1=PASSIVATION OUTPUT
DB811.DBX2
.0
1=PASSIVAT
ION OUTPUT
"F00008_
198".
PASS_OUT
&
M10.3
=
Network 6 : F-feedback
1=REPLACEMENT VALUES
DB811.DBX2
.1
1=FAIL-SAF
E VALUES
ARE OUTPUT
"F00008_
198".QBAD
&
M10.4
=
Network 7 : F-feedback
1=ACKNOWLEDGEMENT REQUEST
DB811.DBX2
.2
1=ACKNOWLE
DGEMENT
REQUEST
"F00008_
198".
ACK_REQ
&
M10.5
=
Network 8 : User can activate passivation
1=ACTIVATE PASSIVATION
DB811.DBX0
.0
1=ACTIVATE
PASSIVATI
ON
"F00008_
198".
PASS_ON
M10.0
&
=

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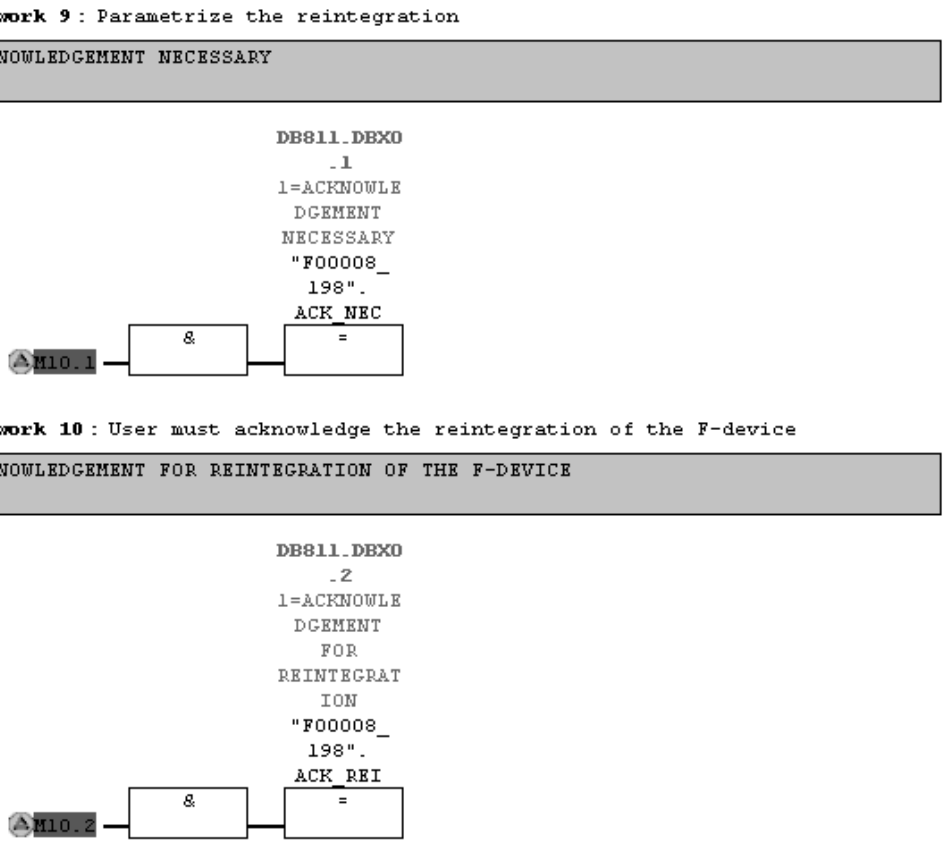
- ACK_NEC = 0: Automatic reintegration
- ACK_NEC = 1: Automatic reintegration following acknowledgement by the user

⚠ WARNING

The variable ACK_ NEC = 0 may only be parameterized if automatic reintegration is safe for the process in question.

Severe or fatal injuries.

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



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11 Response times

Response times play a decisive role 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 of particular importance in connection with the S12 safety option:

- Response times of the connected sensors
- PROFIsafe cycle time
- Processing time (cycle time) in the safety controller
- PROFIsafe monitoring time *F_WD_Time*
- Internal response times of S12 safety option
- Response time of actuators (e.g. frequency inverters)

Establish the response sequence for each safety function in your application and determine the maximum response time for each case considering the relevant manufacturer data. Observe the information in the safety documentation of the used safety controller.

For detailed information about the maximum response time of the S12 safety option, refer to chapter "Technical data of the S12 safety option" (page 151). For detailed information about response time consideration for safety-related PROFIsafe communication, refer to the respective standard: IEC 61784-3-3.

12 Service

12.1 Diagnostic LEDs

⚠ WARNING

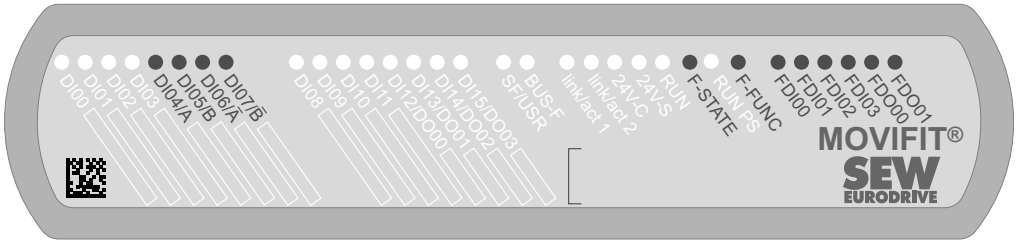
Danger due to incorrect interpretation of the "FDI.", "FDO.", "F-FUNC" and "F-STATE" LEDs.

Severe or fatal injuries.

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

This chapter describes the option-specific LEDs for the S12 safety option. In the following figure, these LEDs are shown as dark.

The following figure shows an example of the S12A safety option:



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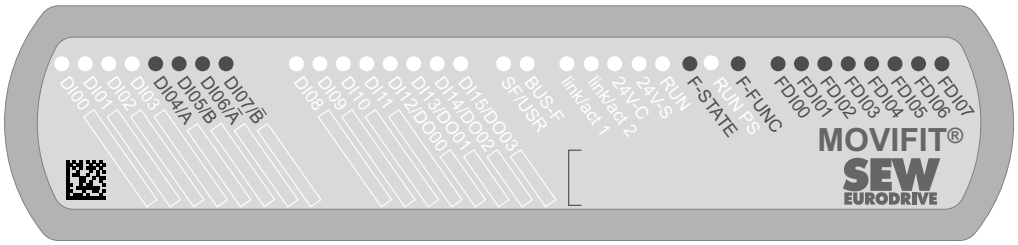
The following figure shows an example of the S12B safety option:



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12.1.1 "FDI.." and "FDO.." LEDs

The following table shows the statuses of the "FDI.." and "FDO.." LEDs:

LED	State	Meaning
FDI..	**Off**	LOW level at input F-DI.. or open
		Parameterization active
	Yellow	HIGH level at input F-DI..
		Display test, 2 s after reset
	Red	Error at input F-DI.. (except discrepancy errors)
FDO..	**Off**	Output F-DO.. inactive (switched off)
	Yellow	Output F-DO.. active
		Display test, 2 s after reset
	Red	Error at output F-DO..

INFORMATION

The "FDO.." LEDs are only relevant for the S12A safety option.

12.1.2 "F-FUNC" LED

The following table shows the statuses of the "F-FUNC" LED:

LED	State	Meaning
F-FUNC	**Off**	STO function not active or error at output FDO_STO
	Yellow	Drive in safe torque off mode, F-DO_STO without voltage
	Flashing yellow 250 ms cycle	Brake ramp active (SLS, SS1a)
	Flashing yellow 1 s cycle	Speed monitoring active (SLS)

12.1.3 "F-STATE" LED

The following table shows the statuses of the "F-STATE" LED:

LED	State	Meaning	Troubleshooting
F-STATE	**Off**	• The S12 safety option is currently in the initialization phase. • No 24 V_0 emergency stop voltage supply • S12 safety 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.
	Yellow	• S12 safety option is in RUN mode, but safety parameters not verified yet.	• Verify the safety parameters.
	Flashing yellow	• Flash code for identification of the device during authentication (entering the serial number in "Assist S12")	
	Green	• S12 safety option is in RUN mode, verification of safety parameters completed.	-
	Flashing yellow/green	• Test mode for drive safety functions active.	-
	Flashing red	• Error occurred (error can be acknowledged)	• Error diagnostics • Correct the error and acknowledge via F host or programmed F-DI input.
	Red	• Error occurred (error cannot be acknowledged)	• Error diagnostics

12.2 Error states of the S12 safety option

INFORMATION

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

12.2.1 Error in the safety module

The S12 safety option is able to detect various internal and external faults (at the safety-related inputs/outputs). For information on the types of error, exact responses, and how to correct the errors, refer to chapter "Error table of S12 safety option".

The error response of the S12 safety option can be parameterized. For detailed information, refer to chapter "Parameter description" / "General information".

INFORMATION

In fieldbus mode, the S12 safety option is not passivated with every error.

12.2.2 PROFIsafe timeout

If the safety-related PROFIsafe communication is interrupted or delayed, the S12 safety option responds with passivation and assuming a safe status after the adjustable monitoring time "*F_WD_Time*" (see description of F parameters) has expired. After this time has expired, the relevant assembly is passivated in the safety controller, and the associated safety-related process values for the safety application are set to "0" (→ safe status).

⚠ WARNING

Automation reintegration can also be set in the safety controller.

Severe or fatal injuries.

- This function must not be used in safety-related applications.

12.2.3 Safety diagnostics using PROFIBUS DP

The status of PROFIsafe communication and S12 safety option error messages is transmitted to the DP master via a status PDU in accordance with the PROFIBUS DPV1 standard.

The following figure shows the structure of the diagnostic data for PROFIsafe communication via slot 1. In slot 1, the F module for the S12 safety option is configured.

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

Bytes 12 and 13 transmit the status and error status of the S12 safety option to the higher-level DP master.

The figure below shows the structure of diagnostics 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 (S12 safety option)	No DPV1 specifier	PROFIsafe diagnostic information in accordance with PROFIsafe profile V2.0	Cyclical F_State of MOVIFIT®	

PROFIsafe layer diagnostic messages

INFORMATION

For more information on the meaning and remedy of error messages, refer to the manuals on the PROFIBUS-DP master and to chapter "Error table of S12 safety option" (page 132).

12.2.4 Safety diagnostics via PROFINET IO

The status of PROFIsafe communication and error messages of the S12 safety option are reported to the PROFINET IO controller, where they can then be diagnosed. For detailed information about diagnostics, refer to the manual of MOVIFIT® function level "Classic ..." or "Technology ...".

PROFIsafe layer diagnostic messages

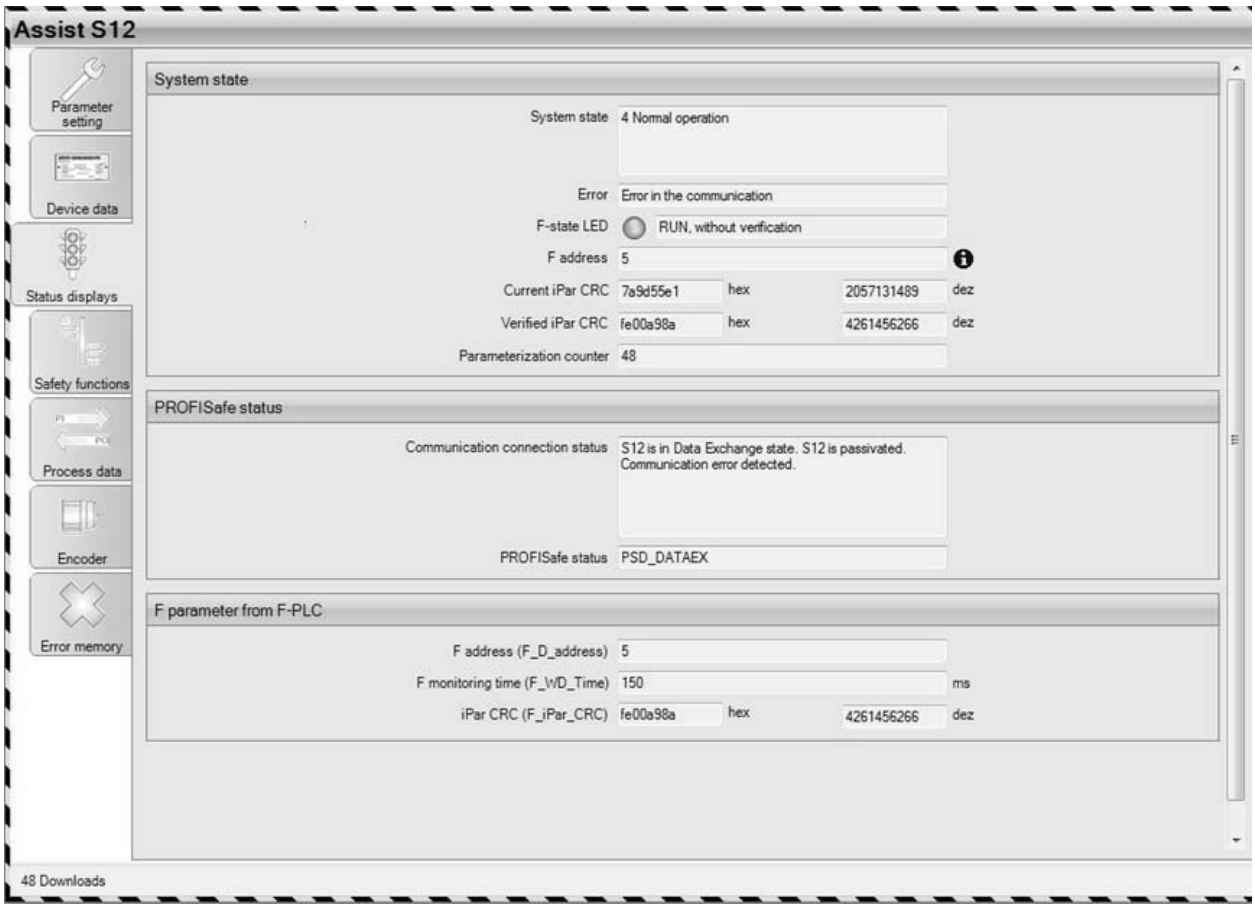
INFORMATION

For detailed information on the meaning and remedy of error messages, refer to the manuals on the PROFINET IO controller and to chapter "Error table of S12 safety option" (page 132).

12.3 Diagnostics with Assist S12

12.3.1 Status displays

The following figure shows the "status displays" block:



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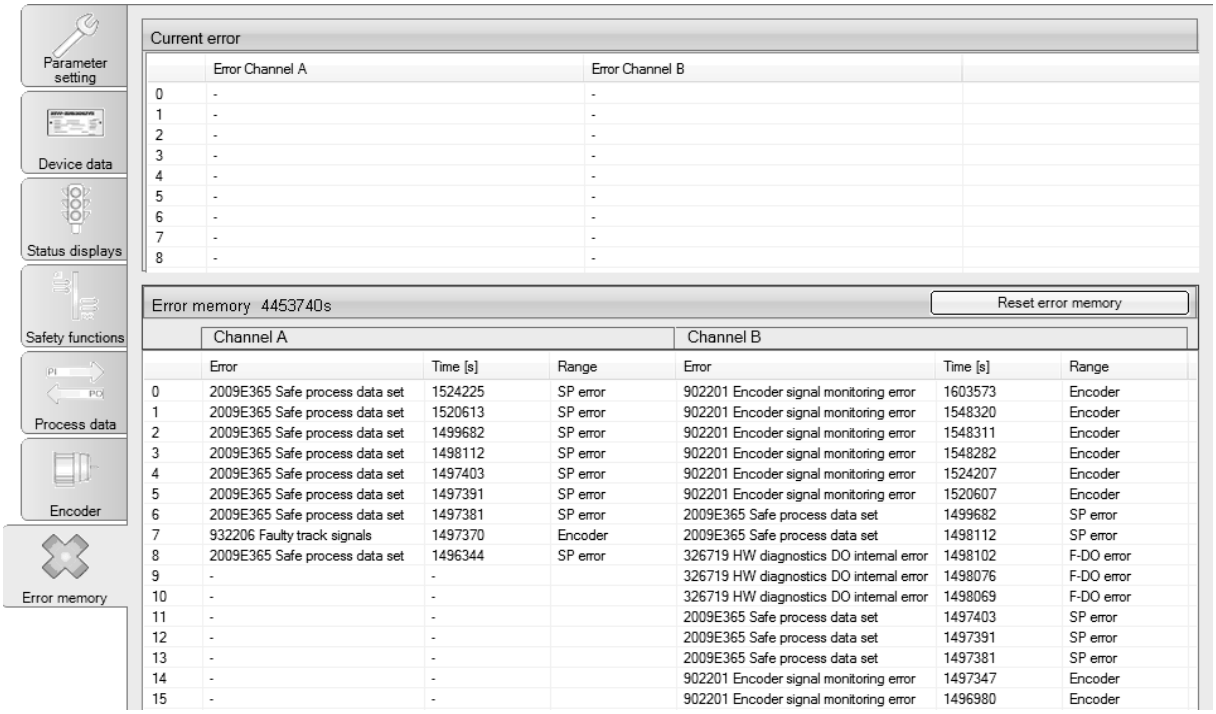
The following table lists the values of the status display:

Display group	Display parameters	Display value/status	Meaning
System state	System state	0 - initialization	Safe condition
		1 - parameterization	Processing and transferring parameters
		2 - verification completed	The parameter settings were verified. System waiting for restart or bus restart (safe state).
		4 - run	Normal operation
		5 - stopping	Exiting "run" status during verification or re-parameterization The inverter goes to safe status (STO).
	Error	Displays the current error code	For detailed information about the error, refer to the error code table.
	F-state LED	Off	Option not available; 24V_O missing; initialization phase active
		Yellow	iPar parameters not verified yet
		Flashing yellow	Device identification
		Green	System status RUN; verification completed
		Flashing yellow/green	Test mode active
		Flashing red	Error status can be acknowledged
		Red	Error status cannot be acknowledged
	F address	Display of set F address (For detailed information about F address settings, refer to chapter "Setting the PROFIsafe address" (page 80)	
	Current iPar CRC	Current and verified iPar CRC	
	Verified iPar CRC		
	Parameterization counter	Displays the number of parameterization processes	
PROFISafe status	Communication connection status	Descriptive text for communication status	
	PROFIsafe status	Communication status ID	
F parameters from F PLC	F address F monitoring time iPar CRC	Displays the F parameters set in the F PLC	

Display group	Display parameters	Display value/status	Meaning
System state	System state	0 - initialization	Safe condition
		1 - parameterization	Determining the parameter set/unit replacement scenarios during startup, or processing of a parameter download, or a verification (safe state)
		2 - verification completed	The parameter settings were verified. System waiting for restart or bus restart (safe state).
		4 - run	Normal operation
		5 - stopping	Exiting "run" status during verification or re-parameterization The inverter goes to safe status (STO).
	Error	Displays the current error code	For detailed information about the error, refer to the error code table.
	F-state LED	Off	Option not available; 24V_O missing; initialization phase active
		Red	Error status cannot be acknowledged
		Flashing red	Error status can be acknowledged
		Yellow	iPar parameters not verified yet
		Flashing yellow	Device identification
		Green	System status RUN; verification completed
		Flashing yellow/green	Test mode active
	F address	Display of set F address (For detailed information about F address settings, refer to chapter "Setting the PROFIsafe address" (page 80)	
	Current iPar CRC	Current and verified iPar CRC	
	Verified iPar CRC		
	Parameterization counter	Displays the number of parameterization processes	
PROFIsafe status	Communication connection status	Descriptive text for communication status	
	PROFIsafe status	Communication status ID	
F parameters from F PLC	F address F monitoring time iPar CRC	Displays the F parameters set in the F PLC	

12.3.2 Error memory

The following figure shows the "error memory" block:



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- **Current errors (error list)**

  The "current errors" list is a chronological error history. The first error is displayed in line 0. Subsequent errors are entered in the lines below that without regard for priorities. Identical error codes are not entered more than once. When there are more than 10 errors with different error codes, only the error code in line 9 is overwritten (no circular buffer).

  If no acknowledgeable errors are pending, the current error list is deleted completely with an error acknowledgement. With a 24 V reset, the list is deleted irrespective of the acknowledgeability of the listed errors. The error list helps you to analyze details when several error messages are interconnected.

- **Error memory**

  All initial errors (i.e. error that occur after switching on the S12 safety option or that occur again after acknowledging an error) are stored remanently with the corresponding time stamp. Directly inherited errors that occur before an error acknowledgement or 24 V reset are stored in the error memory only if they have a higher display priority.

  To the left of the [Reset error memory] button, the current value of the operating hours counter of the S12 safety option is shown in seconds.

  The error memory can only be deleted by clicking the [Reset error memory] button. The entries remain in the memory after an error acknowledgement, a 24 V reset or a parameter download.

  In line 0 of the list, the most recent initial or inherited error is shown. The list is a circular buffer. If there are more than 32 entries, the oldest error is overwritten.

- **Structure of the error codes**

  The error list entries consist of the error code ID (hex value) and the collective error designation.

12.4 Unit replacement

INFORMATION

A faulty S12 safety option must be put out of operation within the next 100 hours.

For unit replacement, a MOVIFIT® in the plant/application is replaced by an identical unit. The replacement unit must not necessarily be a new unit. The safety parameter set is stored locally in the ABOX. This is why the ABOX should only be replaced if absolutely necessary. When replacing the ABOX, the overall unit must be validated again. When replacing the EBOX, the data are transferred automatically from the ABOX memory (only in fieldbus mode). In this case, you do not have to validate the safety functions. In independent operation, the safety functions must be re-parameterized and re-validated.

After a unit replacement, the functionality of the application should be restored without user interaction. The possible unit replacement scenarios and corresponding measures are described in the chapters below.

When replacing a MOVIFIT® unit, a difference is made between the following variants.

12.4.1 Replacing the EBOX

As a rule, the replacement behavior of the unit components differs depending on the operating mode:

- Fieldbus mode / PROFIsafe

  In fieldbus mode, the EBOX can be replaced without any further user intervention.

- Independent operation

  In independent operation, parameter verification and overall validation become necessary after a unit replacement.

The user must not disassemble the MOVIFIT® EBOX.

The following replacement scenarios are supported for the EBOX:

Initial situation	Response of the S12 safety option	Necessary measure
Fieldbus mode is activated in the safety parameter set	Unit starts as usual	None
Safety parameter set or hardware is incompatible with the new S12 safety option	Unit error	Re-parameterization and verification A password set earlier for this item (ABOX) is reset to the default setting.
Fieldbus mode is deactivated in the safety parameter set (independent operation)	Unit error	
The ABOX is new or has never been operated together with the S12 safety option. The new EBOX contains the default safety parameter set (e.g. brand-new)	The unit starts with the verified default safety parameter settings	If operation with default parameter settings is desired: Enter the default iPar CRC in the F controller (overall validation necessary). Otherwise re-parameterization, verification, and overall validation

An overall validation of the safety functions after replacing the EBOX is not necessary if the iPar CRC of the safety parameter set remains unchanged after re-parameterization. This can be proven by comparing the iPar CRC with the existing validation protocol.

After replacing the EBOX, make sure to enter the new serial number of the EBOX in the existing validation protocol of the complete unit.

12.4.2 Replacing the ABOX with/without EBOX

The following replacement scenarios are supported for the ABOX or the complete unit:

Initial situation	Response of the S12 safety option	Necessary measure
Complete unit is prepared (parameterized and verified)	Unit starts	Validating the wiring
Complete unit (brand-new)	Unit starts, if iPar CRC has been registered in the controller	Re-parameterization, verification, and overall validation
Replacing the ABOX	Possible unit error	Re-parameterization, verification, overall validation

INFORMATION

If the iPar CRC of the safety parameter settings remains the same after re-parameterization (comparison of validation protocol with previous protocol), you only have to validate the wiring after replacing the ABOX or the complete unit.

Replacing individual circuit boards in the ABOX is not permitted.

The password is linked to the ABOX. After replacing the ABOX, the password might change.

12.5 Error table of the S12 safety option

Error no. Hex.	Error no. Dec.	Unit status short text	Response	Cause	Measure
0002	2	Internal system error	• Display • Switching off the F-DO outputs • Safe status of option (depending on the parameter settings)	Internal system error	• Acknowledge error, switch unit off and on again, if necessary • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0004	4	DSO supply voltage error	Safe status of option	Overvoltage protection error detected in S12 safety option. (supply voltage outside the permitted range, hardware fault detected in protection circuit)	• Check 24 V voltage supply at terminal 24V_O (permitted voltage range, voltage peaks, voltage dips). • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0008	8	Ext memory DSO error	Warning or safe status of option	EEPROM data error	• Acknowledge error, check parameter settings (re-parameterize, if necessary). • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0014	20	HW diagnostics: DI internal error	Parameterizable F-DI error response	Error detected in internal evaluation of safety-related F-DI inputs	• Acknowledge error • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0016	22	Discrepancy error F-DI00 – F-DI01	Parameterizable F-DI error response	• Parameterizable discrepancy time in 2-channel evaluation of safety-related F-DI inputs exceeded / error in sub-channel • Switch test conditions not fulfilled	• Check the connected 2-channel switch/sensor at the safety-related input pair F-DI 0/1 (2/3, 4/5, 6/7) or increase the parameter *F-DI 0/1 (2/3, 4/5, 6/7) discrepancy time*. • When the function *F-DI 0/1 (2/3, 4/5, 6/7) switch test* is activated, the switch test condition must be fulfilled before the error can be acknowledged.
0018	24	Discrepancy error F-DI02 – F-DI03			
001A	26	Discrepancy error F-DI04 – F-DI05			
001C	28	Discrepancy error F-DI06 – F-DI07			
0020	32	Crossfault F-DI00	Parameterizable F-DI error response	Crossfault detected at safety-related F-DI input	Check external wiring/connection of safety-related F-DI input for crossfaults.
0021	33	Crossfault F-DI01			
0022	34	Crossfault F-DI02			
0023	35	Crossfault F-DI03			
0024	36	Crossfault F-DI04			
0025	37	Crossfault F-DI05			
0026	38	Crossfault F-DI06			
0027	39	Crossfault F-DI07			
0028	40	Wiring fault F-DI00	Parameterizable F-DI error response	No stable input signal within the parameterized input filter time at safety-related F-DI input	Check the switch/sensor connected to the safety-related F-DI input. Increase the *F-DI input filter time* parameter.
0029	41	Wiring fault F-DI01			
002A	42	Wiring fault F-DI02			
002B	43	Wiring fault F-DI03			
002C	44	Wiring fault F-DI04			
002D	45	Wiring fault F-DI05			
002E	46	Wiring fault F-DI06			
002F	47	Wiring fault F-DI07			
0032	50	HW diagnostics: DO internal error	Safe state of option or parameterizable F-DO error response	Error detected in internal hardware of safety-related F-DO outputs	• Acknowledge error. • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0034	52	F-DO overcurrent error	Safe status of option	The safety-related F-DO outputs are overloaded in total	Reduce the sum of the current load at the safety-related F-DO outputs.

Error no.		Unit status short text	Response	Cause	Measure
Hex.	Dec.				
0035	53	DO_STO error: Cross circuit	Parameterizable F-DO error response	Error in internal hardware of the safety-related F-DO_STO output (internal crossfault)	• Acknowledge error. • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0036	54	DO_STO error: Overcurrent		Current load at safety-related F-DO_STO output is too high	Reduce the current load at safety-related F-DO_STO output.
0037	55	DO_STO error: Overvoltage		Crossfault detected at safety-related F-DO_STO output	Check external connection of safety-related F-DO_STO output for crossfaults.
0038	56	DO_STO error: Internal measuring error	Safe state of option or parameterizable F-DO error response	Error in internal hardware of the safety-related F-DO_STO output (internal measuring error)	• Acknowledge error. • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0039	57	DO00 error: crossfault	Parameterizable F-DO error response	Error in internal hardware of the safety-related F-DO00 output (internal crossfault)	
003A	58	DO00 error: overvoltage		Current load at safety-related F-DO00 output is too high	Reduce the current load at safety-related F-DO00 output.
003B	59	DO00 error: overvoltage		Crossfault detected at safety-related F-DO00 output	Check external connection of safety-related F-DO00 output for crossfaults.
003C	60	DO00 error: Internal measuring error	Safe state of option or parameterizable F-DO error response	Error in internal hardware of the safety-related F-DO00 output (internal measuring error)	• Acknowledge error. • If error occurs repeatedly, contact SEW Service or replace the EBOX.
003D	61	DO01 error: crossfault	Parameterizable F-DO error response	Error in internal hardware of the safety-related F-DO01 output (internal crossfault)	• Acknowledge error. • If error occurs repeatedly, contact SEW Service or replace the EBOX.
003E	62	DO01 error: overvoltage		Current load at safety-related F-DO01 output is too high	Reduce the current load at safety-related F-DO01 output.
003F	63	DO01 error: overvoltage		Crossfault detected at safety-related F-DO01 output	Check external connection of safety-related F-DO01 output for crossfaults.
0040	64	DO01 error: Internal measuring error	Safe state of option or parameterizable F-DO error response	Error in internal hardware of the safety-related F-DO01 output (internal measuring error)	• Acknowledge error. • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0041	65	DO_STO error: Wire break	Parameterizable F-DO error response	Minimum current not reached with active F-DO_STO output	Check external connection of safety-related F-DO_STO output for wire break/interruption.
0042	66	DO00 error: wire break		Minimum current not reached with active F-DO00 output	Check external connection of safety-related F-DO00 output for wire break/interruption.
0043	67	DO01 error: wire break		Minimum current not reached with active F-DO01 output	Check external connection of safety-related F-DO01 output for wire break/interruption.

Error no.		Unit status short text	Response	Cause	Measure
Hex.	Dec.				
0050	80	SLS0/1/2/3: n_{max} exceeded	STO / SS1 (depending on parameter setting)	The parameterized limit value *Max. motor speed* with selected SLS0/1/2/3 function or within the parameterized monitoring delay of SLS0 is exceeded.	• Check the application Increase the *Max. motor speed* parameter.
0051	81				
0052	82				
0053	83				
0054	84	SLS0/1/2/3/4: n_{sls} exceeded		Parameterized SLS speed ramp exceeded while decelerating the drive to the SLS0/1/2/3/4 limit speed.	• Check application/startup. • Extend the SLS parameter *ramp time*. • Increase the SLS parameter *ramp monitoring delay*. • Increase the SLS parameter *difference to ramp*.
0055	85				
0056	86				
0057	87				
0058	88	SLS0/1/2/3: n_{sls_r} exceeded		Parameterized SLS0/1/2/3 limit speed *positive limit speed* exceeded	• Check application/startup. • Increase the SLS0/1/2/3 parameter *difference to limit speed*. • Increase the SLS parameter *speed filter*.
0059	89				
005A	90				
005B	91				
005C	92	SLS0/1/2/3: n_{sls_l} exceeded	STO / SS1 (depending on parameter setting)	Parameterized SLS0/1/2/3 limit speed *negative limit speed* exceeded	
005D	93				
005E	94				
005F	95				
0060	96	n_{sls0} in opposite direction exceeded		Parameterized SLS0/1/2/3 limit speed in opposite direction exceeded while drive is decelerating.	• Check application/startup. • Extend the SLS parameter *ramp time*.
0061	97	n_{sls1} in opposite direction exceeded			
0062	98	n_{sls2} in opposite direction exceeded			
0063	99	n_{sls3} in opposite direction exceeded			
0064	100	SS1A: n_{max} exceeded	STO	The parameterized limit value *Max. motor speed* with selected SS1(a) function or within the parameterized monitoring delay of SS1(a) is exceeded.	• Check the application • Increase the *Max. motor speed* parameter.
0065	101	SS1A: n_{max} in ramp exceeded		Parameterized SS1(a) speed ramp exceeded while decelerating the drive to speed 0.	• Check application/startup. • Extend the parameter *SS1a ramp time*. • Increase the parameter *SS1a ramp monitoring delay*. • Increase the parameter *SS1a distance to ramp*.
0066	102	SS1A: n_{min} at standstill exceeded		After reaching standstill (i.e. speed below parameterized minimum speed *minimum motor speed*), the minimum speed was exceeded again.	• Check the application • Increase the *Min. motor speed* parameter. • Use a brake motor / check brake wear.
0067	103	STO: Disconnection bypassed	(STO)	MOVIFIT® FC variant: After disconnecting the F-DO_STO output, communication with the inverter is still detected (monitoring is not safety-related)	Check connection/wiring of power section to safety-related F-DO_STO output (safe disconnection of power section).
0068	104	STO: Coasting time exceeded	STO	Parameterized STO limit value *permitted coasting time* (time from activation of STO until detection of standstill) exceeded.	• Check application / brake wear. • Increase the STO parameter *permitted coasting time*.
0070	112	SDI0/1/2/3 error: Clockwise direction of rotation	STO	Movement detected in the positive direction that is blocked by SLS0/1/2/3, SDI0/1/2/3	• Check the application. • Increase the SLS parameter *SDI tolerance*.
0071	113				
0072	114				
0073	115				
0074	116	SDI0/1/2/3 error: Counterclockwise direction of rotation		Movement detected in the negative direction that is blocked by SLS0/1/2/3.	
0075	117				
0076	118				
0077	119				

Error no.		Unit status short text	Response	Cause	Measure
Hex.	Dec.				
0080	128	Parameter setting not plausible	Safe status of S12	The current parameter setting contains parameter values outside the permitted value range and/or not permissible combinations of parameter values.	Correct the parameter settings according to the notes in the "Assist S12" parameterization tool and download the parameter settings again.
0081	129	Parameter setting corrupt		The safety parameter set is corrupt and cannot be used.	Re-parameterize the unit.
0082	130	Parameter setting not compatible		The safety parameter set is not compatible with the current unit firmware.	
0083	131	Unit replacement error		A unit was replaced, and PROFIsafe mode is deactivated in the local parameter set (ABOX). In this case, the local parameter set cannot be transferred.	
0084	132	S12 parameter set missing in ABOX		There is no safety parameter set stored in the local memory (ABOX).	
0085	133	Error when storing data in the ABOX	STO	An error occurred when storing the safety parameter set in the local memory (ABOX).	• Switch unit off and on again. • Check the parameter settings, re-parameterize, if necessary. • If error occurs repeatedly, contact SEW Service or replace the EBOX/ABOX.
0086	134	Internal parameter set corrupt	Warning	The safety parameter set in the internal memory (EBOX) is corrupt and cannot be used.	• Re-parameterize the unit • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0087	135	Control card communication error	Safe state of S12	Internal communication error.	• Switch unit off and on again. • If error occurs repeatedly, contact SEW Service or replace the EBOX.
0088	136	Error saving verification	No transition to RUN/STO	An error occurred when storing the safety parameter set in the local memory.	• Switch unit off and on again • Check the parameter settings, re-parameterize, if necessary. • If error occurs repeatedly, contact SEW Service or replace the EBOX/ABOX.
0090	144	Encoder signal monitoring error	STO	Non-equivalence error in the encoder track signals or encoder in error state	• Check the encoder track signal lines • Replace encoder, if necessary.
0091	145	Encoder level monitoring error		Error in the level monitoring function for the encoder track signals	• Check the encoder track signal lines • Replace encoder, if necessary.
0092	146	Maximum speed error		The encoder detected a speed that exceeds the maximally evaluable value of 3800 rpm.	Check inverter parameterization / application.
0093	147	Faulty track signals		Interference in the encoder track signals.	• Check encoder cable and connection. • Check ground connection and shielding.
1040	4160	Ambient temperature too high	Safe status of option	The temperature sensor for the EBOX electronics reports that the max. permitted temperature is exceeded.	Improve the cooling of the EBOX. Reduce the load on the safety-related F-DO outputs. MOVIFIT® FC variant: Reduce the motor load / PWM frequency of the inverter.
1041	4161	Ambient temperature too low		The temperature sensor for the EBOX electronics reports that the min. permitted temperature is undercut.	Increase the ambient temperature.
1042	4162	Supply voltage too high	All F-DOS switched off	Voltage supply (24V_O) too high	Check 24 V voltage supply at terminal 24V_O.
1043	4163	Supply voltage too low		Voltage supply (24V_O) too low	

Error no.		Unit status short text	Response	Cause	Measure
Hex.	Dec.				
2000	8192	DSO status error when receiving FPAR	Warning	Safety protocol error: SetPrm process - DSO not in a valid state	Disconnect/connect communication
2001	8193	Error applying FPAR to DSO	Safe status of option	Safety protocol error: SetPrm process – transfer of FPar failed	
2002	8194	Faulty process data length	Warning or safe status of option	Safety protocol error: Check configuration process – faulty process data length of PO/PI data	
2003	8195	CRC2 configuration error	Safe status of option	Safety protocol error: Check configuration process – configuration in SPD failed, invalid CRC length	
2004	8196	Error in configuration process		Safety protocol error: Check configuration process – invalid return when configuring SPD	
2005	8197	DSO status when receiving CheckCfg	Warning	Safety protocol error: SetPrm check configuration process	
2006	8198	Error in SPD	Warning or safe status of option	Safety protocol error: Check configuration process – faulty process data length of PO/PI data	Power off / power on S12
2007	8199	Communication error	Warning	Safety protocol error: Cyclic data exchange error	Reintegrate the S12 safety option and acknowledge the message
2008	8200	Safety protocol timeout	Warning	Safety protocol error: Cyclic data exchange error, timeout detected	
2009	8201	Safe process data set		Safety protocol error: Cyclic data exchange error, process data in safe state	
200A	8202	SP zero message received		Safety protocol error: Cyclic data exchange error, zero telegram was received	
8040	32832	Mismatch of F_Dest_Add	Safe status of option	F parameterization error: Mismatch of safety destination address	Check F parameters in the configuration tool of the safe fieldbus master
8041	32833	F_Dest_Add not valid		F parameterization error: Safety destination address not valid	
8042	32834	F_Source_Add not valid		F parameterization error: Safety source address not valid	
8043	32835	F_WD_Time is 0 ms		F parameterization error: Safety watchdog time value is 0 ms	
8044	32836	F_SIL exceeds SIL f. application		F parameterization error: F_SIL parameter exceeded	
8045	32837	F_CRC_Length does not match		F parameterization error: Parameter F_CRC_Length not valid	
8046	32838	F parameter set incorrectly		F parameterization error: Version of F parameter set incorrect	
8047	32839	Inconsistent FPar CRC1 error		F parameterization error: Data inconsistent in received F parameter block	
8048	32840	Device information, see manual		F parameterization error: Device-specific diagnostics	
8049	32841	Save iParameter WDT exceeded		F parameterization error: Save iParameter watchdog time exceeded	
804A	32842	Restore iParameter WDT exceeded		F parameterization error: Restore iParameter watchdog time exceeded	
804B	32843	Inconsistent iParameter iParCRC		F parameterization error: Inconsistent IParameters (iParError)	
804C	32844	F_Block_ID not supported		F parameterization error: F_BlockID not supported	
804D	32845	Transmission error: CRC2 error		F parameterization error: Transmission error: data inconsistent	
804E	32846	Transmission error: WDT elapsed		F parameterization error: Transmission error: timeout	
804F	32847	Reserved for further use		F parameterization error: Reserved, do not use numbers, do not evaluate numbers	-

13 Parameter description

13.1 General information

13.1.1 10122.7 IO error effects

The drop-down menu contains the following options:

– Entire assembly:

  The entire safety option goes to a safe state.

– Channel-wise, (F-DI), block-wise, (F-DO):

  F-DI: When an error is pending at an F-DI, only the F-DI that is affected by the error goes to a safe state.

  F-DO: When an error is pending at an F-DO, all the other F-DOs go to a safe state as well.

– Channel-wise, (F-DI, F-DO)

  F-DI: When an error is pending at an F-DI, only the F-DI that is affected by the error goes to a safe state.

  F-DO: When an error is pending at an F-DO, only the F-DO that is affected by the error goes to a safe state.

13.1.2 10122.10 PROFIsafe fieldbus

The drop-down menu contains the following options:

– Available:

  The S12 safety option supports the PROFIsafe protocol.

– Not available:

  The S12 safety option is used independently.

13.1.3 10122.2 Encoder type

The drop-down menu contains the following options:

– Not available:

  No encoder evaluation and monitoring. Speed-related safety functions cannot be parameterized.

– EI7C FS:

  A connected EI7C encoder is evaluated. The speed-related safety functions can be executed on the basis of the detected speed.

13.1.4 10122.8 Maximum motor speed (n1)

Unit: rpm

Value range:

• 60 – **3800**

The maximum motor speed (n1) is the maximum speed that is tolerated when the speed-related safety functions are selected. If the motor speed is above the parameterized maximum motor speed when these safety-functions are selected, an error is tripped.

If the drive exceeds a speed of 3800 rpm, an error is tripped irrespective of the selected function when operation with speed sensor is parameterized.

13.1.5 10122.9 Minimum motor speed (n2)

Unit: rpm

Value range:

- **60** – 200

The minimum motor speed (n2) is the speed below which speed monitoring is no longer active.

An exceedance of the parameterized speed limit can only be detected above the minimum speed. A speed below the minimum speed is interpreted by the S12 safety option as standstill.

13.2 F-DI

13.2.1 Safety-related digital inputs

10123.2 – 10123.5 Connection type

The drop-down menu contains the following options:

– 1-channel:

  The corresponding F-DIs are evaluated independently of each other.

– 2-channel equivalent:

  The input levels are processed in pairs. If the input levels are not equal, the process value of the F-DI pair goes to a safe state. After the parameterized discrepancy time has elapsed, an error message is generated and the process value is kept in a safe state until the error is acknowledged.

  With equivalent input levels, the process image follows the input level of the input channel with an even channel number.

– 2-channel non-equivalent:

  The input levels are processed in pairs. If the input levels are equal, the process value of the F-DI pair goes to a safe state. After the parameterized discrepancy time has elapsed, an error message is generated and the process image is kept in a safe state until the error is acknowledged.

  With non-equivalent input levels, the process image follows the input level of the input channel with an even channel number.

10123.10 – 10123.17 Input filter time (t1)

Unit: ms

Value range: 4 – **10** – 250

Description: Specifies the filter time for the F-DIs.

10123.6 – 10123.9 Discrepance time (t2)

Unit: ms

Value range: 25 – **500** – 5000

The discrepancy time (t2) is the tolerated time in which the F-DIs of an F-DI pair that is parameterized for 2-channel mode may have a discrepancy in the input level (equivalent: both different, non-equivalent: both identical) before an error is tripped.

13.2.2 Diagnostics

10123.18 F-DI pulsed sensor supply

The drop-down menu contains the following options:

– Active:

Pulsed voltage supply for F-SS0 and F-SS1 is active. Activated pulsed voltage supply is a prerequisite for the activation of crossfault monitoring.

– Not active:

  Pulsed voltage supply for F-SS0 and F-SS1 is not active.

  A constant 24 V supply is output at F-SS0 and F-SS1.

10123.19 – 10123.26 Crossfault monitoring

The drop-down menu contains the following options:

– Active:

  Crossfault monitoring is active. Faults in the sensor wiring can be detected.

– Not active:

  Crossfault monitoring is not active.

10123.28 – 10123.30 F-DI. switch test

The drop-down menu contains the following options:

– Active:

  The switch test function for 2-channel evaluation is active. When the switch test function is active, a discrepancy error is only acknowledged if the input levels meet the switch test conditions (equivalent: both F-DI input levels are LOW, non-equivalent: even-numbered F-DI input level is LOW and uneven-numbered F-DI input level is HIGH).

– Not active:

  The switch test function for 2-channel evaluation is not active.

13.3 F-DO

13.3.1 10124.6 F-DO-STO line diagnostics

The drop-down menu contains the following options:

– Not active:

  The line diagnostics function is not active.

– Active:

  The line diagnostics function is active.

13.3.2 10124.9 F-DO-STO test duration (t1)

Unit: µs

Value range: 250 – **1000** – 5000

Description: Maximum test pulse duration for the F-DO STO switch tests

13.3.3 10124.12 F-DO-STO wire break monitoring

The drop-down menu contains the following options:

– Not active:

  The wire break monitoring function is not active.

– Active:

  The wire break monitoring function is active.

13.3.4 10124.2, 10124.3 F-DO0/1 connection type

The drop-down menu contains the following options:

– 2-pole sourcing/sinking:

  The load is connected between F-DO0/1_P and F-DO0/1_M.

– 1-pole sourcing:

  The load is connected between F-DO0/1_P and 0V24_O.

13.3.5 10124.4, 10124.5 F-DO0/1 line diagnostics

The drop-down menu contains the following options:

– Not active:

  The line diagnostics function is not active.

– Active:

  The line diagnostics function is active.

13.3.6 10124.7, 10124.8 F-DO0/1 test duration (t2, t3)

Unit: µs

Value range: 250 – **1000** – 5000

Description: Maximum test pulse duration for the F-DO0/1 switch tests

13.3.7 10124.10, 10124.11 F-DO0/1 wire break monitoring

The drop-down menu contains the following options:

– Not active:

  The wire break monitoring function is not active.

– Active:

  The wire break monitoring function is active.

13.4 STO / SBC

13.4.1 10125.3 STO delay (t1)

Unit: ms

Value range: **0** – 1000

The STO delay (t1) is the time delay between tripping the STO safety function and switching off F-DO_STO, and other F-DO outputs parameterized to STO, if applicable.

Only for S12A safety option.

13.4.2 10125.2 STO status display delay (t2)

Unit: ms

Value range: 0 – **40** – 500

The STO status display delay (t2) is the delay time after which the status of the STO function is shown as active at the earliest after switching off the F-DO_STO output. This applies to the STO status both in the safe process input data and in internal processing.

This parameter should be set to the time that the actuator (e.g. inverter) needs to go to a safe state (e.g. STO) after switching off the safety-related F-DO_STO output. (Response time of actuator with respect to STO).

13.4.3 10125.4 Permitted coasting time (t3)

Unit: ms

Value range: **0** – 65535

The coasting time is defined as the time between selecting the STO safety function and the standstill of the drive. The coasting time can be measured and monitored with respect to exceeding the parameterized limit value. If the test mode is active, exceeding the limit value *Permitted coasting time* trips an error and maintains the STO status until the error is acknowledged. An encoder must be parameterized to use this function. Coasting measurement is only active when a value ≠ "0" is parameterized.

13.5 SS1

13.5.1 10126.2 Function

The drop-down menu contains the following options:

– Inhibited:

  No SS1 safety function can be selected.

– SS1a enabled:

  Variant a of the SS1 safety function is active.

– SS1c enabled:

  Variant c of the SS1 safety function is active.

13.5.2 10126.3 SS1c delay (t1)

Unit: ms

Value range: 10 – **1000** – 10000

The SS1c delay time (t1) is the time between the selection of the safety function and the activation of the STO function.

13.5.3 10126.6 SS1a ramp monitoring delay (t2)

Unit: ms

Value range: 10 – **500** – 1000

The SS1a ramp monitoring delay (t2) is the time between the selection of the SS1a function and the start of monitoring of the speed deceleration ramp. (The stop command is sent to the inverter immediately when the function is selected). During the delay time, adherence to the maximum motor speed (n1) is monitored. This time is necessary to compensate for the transmission delay to the inverter.

13.5.4 10126.5 SS1a ramp time (t3)

Unit: ms

Value range: 10 – **1000** – 10000

The ramp time (t3) is the ramp time for the monitored speed limit curve in the safety option and the limit of the speed deceleration ramp in the inverter.

13.5.5 10126.7 SS1a distance to ramp (n1)

Unit: rpm

Value range: 0 – **100** – 1000

SS1 distance to ramp (n1) is the tolerance speed that is added to the current value of the motor speed when the function is selected. This determines the start value of the monitored speed limit curve.

13.5.6 10126.4 SS1a STO function selection delay (t4)

Unit: ms

Value range: 10 – **250** – 1000

If the motor speed decreases faster than specified by the SS1a ramp time, STO is also activated earlier, when the motor speed falls below the minimum motor speed (n2) for at least the time specified in SS1a function selection delay. The parameterized time prevents the early activation of STO when the speed only briefly falls below the minimum speed.

13.6 SLS 0, 1, 2, 3

13.6.1 10128.2 – 10131.2 Function

The drop-down menu contains the following options:

– Enabled:

  The SLS function is enabled.

– Inhibited:

  The SLS function is not enabled.

13.6.2 10128.3 – 10131.3 Limit speed, positive (n1)

Unit: rpm

Value range: 60 – **3800**

The positive limit speed (n1) is the speed limit value in the positive direction of rotation when the corresponding SLS function has been activated by the safety option.

13.6.3 10128.4 – 10131.4 Limit speed, negative (n1)

Unit: rpm

Value range: 60 – **3800**

The negative limit speed (n2) is the speed limit value in the negative direction of rotation when the corresponding SLS function has been activated by the safety option.

13.6.4 10128.5 – 10131.5 Distance to limit speed (n3)

Unit: rpm

Value range: 0 – **100** – 1000

The distance to the limit speed (n3) is the tolerance between the SLS speed limit value n1/n2 monitored by the safety option via an encoder and the speed setpoint limit values that are active in the inverter.

13.6.5 10128.6 – 10131.6 SDI function

The drop-down menu contains the following options:

– Deactivated:

  The direction of rotation is not monitored.

– Positive/negative direction permitted:

  The positive/negative direction of rotation is monitored. Movement that exceeds the permitted tolerance (see 10127.7) into the blocked (not permitted) direction trips an error with STO error response.

13.7 SLS (general)

13.7.1 10127.4 Ramp monitoring delay (t1)

Unit: ms

Value range: 10 – **500** – 1000

The ramp monitoring delay (t1) is the time between the selection of the SLS function and the start of monitoring of the speed deceleration ramp. (The speed limit is sent to the inverter immediately when the function is selected). During the delay time, adherence to the maximum motor speed (n1) is monitored.

This time is necessary to compensate for the transmission delay to the inverter.

13.7.2 10127.2 Ramp time (t2)

Unit: ms

Value range: 10 – **1000** – 10000

The ramp time (t2) is the ramp time for the monitored speed limit curve in the S12 safety option and the limit of the speed deceleration ramp in the inverter.

13.7.3 10127.3 Distance to ramp (n4)

Unit: rpm

Value range: 0 – **100** – 1000

The distance to the ramp (n4) is the tolerance speed that is added to the current value of the motor speed when the function is selected. This determines the start value of the monitored speed limit curve for monitoring the deceleration to the SLS speed limit values.

13.7.4 10127.5 Error response to overspeed

The error response to exceeding the monitored speed limit curve can be parameterized with the SLS function. The error response applies to all SLS function blocks. (The STO error response always applies to the SDI sub-function).

The drop-down menu contains the following options:

– STO:

  The STO function is activated when the speed monitoring function trips.

  (When STO is activated as an error response to SLS; the safety-related outputs are deactivated immediately. There is no deactivation delay by the parameterized *STO delay (t1)* time.)

– SS1:

  The SS1 function is activated when the speed monitoring function trips. This is the SS1 variant that was parameterized for the SS1 function.

13.7.5 10127.6 Speed filter

Unit: Degree

Value range: **0** – 1000

The speed filter is the tolerated limit value for a brief exceedance of the parameterized SLS speed limit values. Physically, the filter limit value corresponds to a tolerated angle of rotation. Filtering is not active yet while the drive is decelerating to the parameterized SLS speed limit values.

13.7.6 10127.7 SDI tolerance

Unit: Degree

Value range: **0** – 3600

The parameter specifies the maximally permitted tolerance of the SDI functions for movement into the blocked direction. Due to mechanical conditions, the actually tolerated movement into the blocked direction can be up to 7° greater than this parameter value.

13.8 Function assignment

13.8.1 Safety-related inputs

10132.3 – 0132.10 F-DI0 – FDI7 interlocking

The drop-down menu contains the following options:

– Not active:

  Interlocking function is not active.

– Active:

  The process value of the F-DI that controls the safety functions and that is sent via the safe process input data remains locked in a safe state until the error is acknowledged.

  After starting the S12 safety option, all process images of F-DIs parameterized for interlocking are in a locked/safe state, irrespective of the current input information.

10132.11, 10132.14, 10132.17, 10132.20, 10132.23, 10132.26, 10132.29, 10132.32 Function of F-DI0 – FDI7

The drop-down menu contains the following options:

– No assignment:

  The F-DI does not select any safety function. Its process image is still output via the safe process input data.

– STO:

  The F-DI selects the STO function.

– SS1:

  The F-DI selects the SS1c or SS1a function.

– SLS0, 1, 2, 3:

  The F-DI selects one of the SLS function blocks.

– Acknowledgement of interlocking F-DI and error:

  A 0-1 edge at the F-DI triggers an error acknowledgement, which cancels the locked state of F-DIs parameterized for interlocking.

With 2-channel evaluation, only the resulting process image (even-numbered channel number) can be assigned a function. A safety function can be assigned to more than one F-DI. In this case, the F-DIs are ANDed.

13.8.2 Safety-related outputs

10132.35, 10132.36 Function of F-DO0/1

The drop-down menu contains the following options:

– No assignment:

  The safety-related output is controlled by the safe process output data. In independent operation, the output is always deactivated.

– STO:

  The safety-related output can be deactivated by the safe process output data or by the STO function. If the output is controlled by the STO function, is switches simultaneously with the F-DO_STO output.

– SBC:

  The safety-related output can be deactivated by the safe process output data or by the STO function. If the output is controlled by the STO function, is switches simultaneously with the STO function selection.

The output is active as long as none of the other active control sources (process data, error responses, system state, STO/SBC function) demands deactivation.

14 Application examples

This chapter contains examples for starting up typical applications.

The examples show all startup steps in a table with the following sequence:

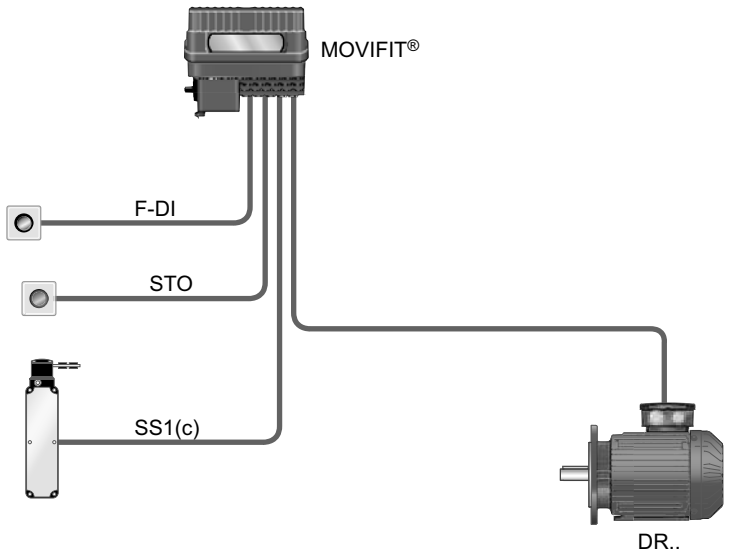
Startup step	
A	Electrical installation
B	Parameterization
C	Startup of standard part / periphery (fieldbus)
D	Verification and validation

14.1 Example 1: Independent operation

The following chapter shows examples of how the safety functions STO and SS1(c) are realized. A speed sensor is not required to implement the safety functions. The safety functions are controlled via F-DI... The MOVIFIT® unit in use is operated independently (i.e. no PROFIsafe connection).

- Use the B variant of the safety option for independent operation.

The following figure shows the application example:



8702546059

The following table shows the startup sequence:

A	Electrical installation	
1.	Connection of 24 V supply voltage:	+24V -> X20:2 0V24 -> X20:3
2.	Connection of supply voltage for S12 safety option:	X29:1 -> X29:7 X29:2 -> X29:8
3.	Emergency stop: (2-channel, non-equivalent)	X45:1 -> X45:21 X45:11 -> X45:23
4.	Door switch: (2-channel, equivalent)	X45:2 -> X45:22 X45:12 -> X45:24
5.	Acknowledgement button: (1-channel)	X45: 3 -> X45: 25

B	Parameterization	
1.	Switch on the unit.	LED status after powering up the unit LED F-STATE = RED (flashing) LED RUN PS = OFF LED F-FUNC = YELLOW
2.	Start MOVITOOLS® MotionStudio and scan the network via the RS485 interface.	The safety option is detected in the network.
3.	Start the "Assist S12" parameterization tool.	A window for entering the serial number opens.
4.	Enter the serial number of the unit.	The "Assist S12" parameterization tool starts.
5.	Call the default parameter set by clicking the [New] button.	The default parameter set is shown in the "input value" column.
6.	Adapt the following parameters in the parameter tree: General • PROFIsafe fieldbus: 0 – not present F-DI • F-DI 0/1 connection type: 2 – 2-channel non-equivalent • F-DI 2/3 connection type: 1 – 2-channel, equivalent • F-DI 4 connection type: 0 – 1-channel SS1 • Function: 1 – SS1c enabled Function assignment parameters • Function of F-DI0: 1 – STO • Function of F-DI2: 2 – SS1 • Function of F-DI4: 9 – Acknowledge latching F-DI and error	
7.	Click the [Download] button in the menu bar.	The parameter set is downloaded to the unit. LED status after the download: LED F-STATE = YELLOW (RUN, without verification) LED RUN PS = YELLOW LED F-FUNC = OFF LED FDI00 - FDI03 = YELLOW

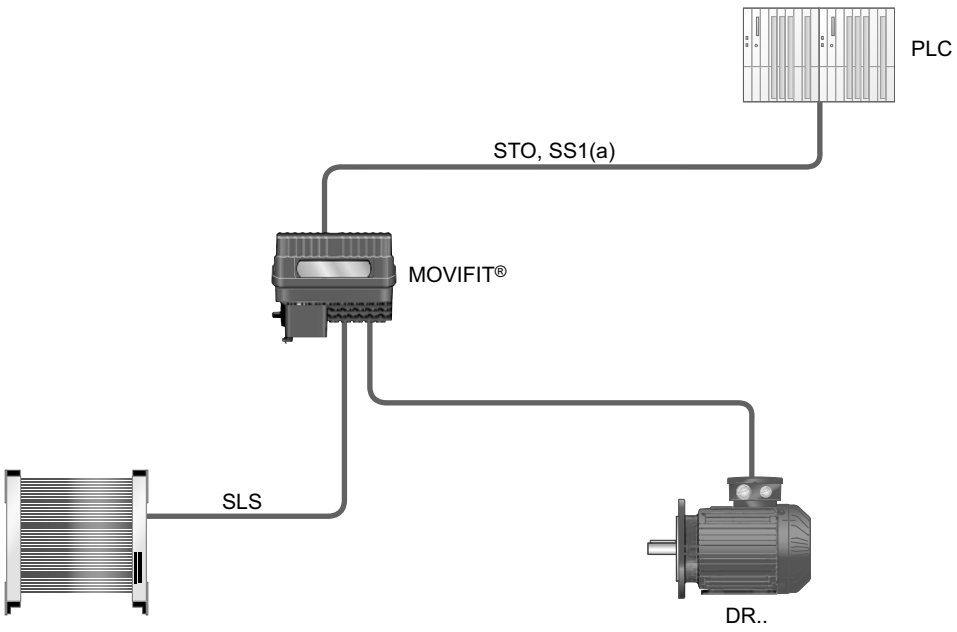
C	Standard part startup	
1.	Startup the standard part as described in the MOVIFIT® FC operating instructions.	

D	Verification and validation	
1.	Go to the "Assist S12" parameterization tool and verify individual blocks in the parameter tree. (Tick the "Verified" checkbox.)	After all blocks have been verified, the [Finish] button in the menu bar becomes active.
2.	Click the [Finish] button. Enter the system information in the dialog and click [OK] to confirm.	The verification is downloaded to the unit. Now, the validation protocol of the system opens. LED F-STATE = OFF (S12 not ready) LED RUN PS = OFF LED F-FUNC = YELLOW LED FDI00 - FDI03 = OFF
3.	Print out the validation protocol and switch the unit off/on (this is necessary to complete the verification in independent operation).	The startup is now completed.

14.2 Example 2: PROFIsafe connection

The following example shows the implementation of the safety functions STO, SS1(a), and SLS. The STO and SS1(a) safety functions are controlled via process data. The SLS safety function is controlled via F-DI. In this example, an OSSD-capable light grid is installed.

The following figure shows the application example:

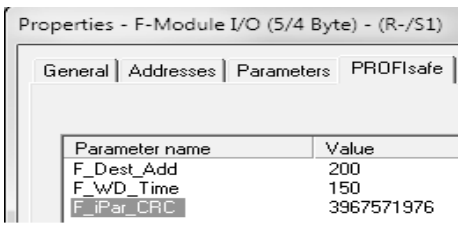


The following table shows the startup sequence:

A	Electrical installation	
1.	Connection of 24 V supply voltage:	+24V -> X20:2 0V24 -> X20:3
2.	Connection of supply voltage for S12 safety option:	X29:1 -> X29:7 X29:2 -> X29:8
3.	Light grid (OSSD-capable)	+24V -> X45:21 0V24 -> X45:31 OSSD1 -> X45:1 OSSD2 -> X45:11
4.	Connection of EI7C FS	Encoder track A -> X25:3 Encoder track /A -> X25:4 Encoder track B -> X25:13 Encoder track /B -> X25:14 +24V -> X25: 23 0V24 -> X25: 33

B	Parameterization	
1.	Switch on the unit.	LED status after powering up the unit LED F-STATE = RED (flashing) LED RUN PS = OFF LED F-FUNC = YELLOW
2.	Start MOVITOOLS® MotionStudio and scan the network via the RS485 interface.	The safety option is detected in the network.
3.	Start the "Assist S12" parameterization tool.	A window for entering the serial number opens.
4.	Enter the serial number of the unit.	The "Assist S12" parameterization tool starts.
5.	Call the default parameter set by clicking the [New] button.	The default parameter set is shown in the "input value" column.

B	Parameterization	
6.	Adapt the following parameters in the parameter tree: General • Encoder type: 12 - EI7C FS F-DI • F-DI 0/1 connection type: 1 – 2-channel, equivalent SS1 • Function: 2 – SS1a enabled SLS0 • Function: 1 – enabled • Positive limit speed (n1): 2 – SS1a enabled • Negative limit speed (n2): 2 – SS1a enabled Function assignment parameters • Function of F-DI0: 3 – SLS0	
7.	Click the [Download] button in the menu bar.	The parameter set is downloaded to the unit. LED status after the download: LED F-STATE = YELLOW (RUN, without verification) LED RUN PS = YELLOW LED F-FUNC = OFF LED FDI00 - FDI03 = YELLOW

C	Startup of periphery (F-PLC / fieldbus)	
1.	PROFIBUS DP / PROFINET IO startup	See MOVIFIT® Function Level "Classic" / "Technology" manual
2.	Enter the current F_parameter in the PROFIsafe controller. **Important:** Read out the current F-iPar_CRC in the "Status" of the "Assist S12" parameterization tool and enter it in the engineering tool of the higher-level PROFIsafe controller in the F_parameters of the MOVIFIT® unit.	 8773160459
3.	Activation of the STO and SS1 safety functions: Activate PO0, bit 0 and 1 = "true". Acknowledge any errors, PO0, bit 7.	STO and SS1 become active (PI0, bit 0 and 1 = "false") Safety part without errors F-State LED = GREEN RUN-PS = YELLOW
4.	Startup of MOVIFIT® inverter	See MOVIFIT® operating instructions.

D	Verification and validation	
1.	Go to the "Assist S12" parameterization tool and verify individual blocks in the parameter tree. (Tick the "Verified" checkbox.)	After all blocks have been verified, the [Finish] button in the menu bar becomes active.
2.	Click the [Finish] button. Enter the system information in the dialog and click [OK] to confirm.	The verification is downloaded to the unit. Now, the validation protocol of the system opens. LED F-STATE = OFF (S12 not ready) LED RUN PS = OFF LED F-FUNC = YELLOW LED FDI00 - FDI03 = OFF
3.	Validate the system and document this.	The startup is now completed.

15 Technical data

15.1 Safety characteristics

15.1.1 Overall assembly: S12 safety option

The tables below show the safety characteristics of the overall assembly:

Designation	Characteristic safety values according to	
	IEC 62061 / IEC 61508	EN ISO 13849-1
Classification	SIL 2[1)]	PL d
System structure	HFT = 0	Category 2
Operating mode selection	High demand	–
Probability of dangerous failure per hour (PFHd value)	< 15 x 10^{-9} 1/h	< 15 x 10^{-9} 1/h
Mission time / service life	20 years	
Proof test interval	Not required	–
Safe condition	• PROFIsafe: Logic value "0" for all safety-related process values • Safety-related F-DO outputs: Outputs deactivated (logic "0")[2)]	
Safety functions	• STO, SS1, SLS, SDI (according to EN 61800-5-2) • Safety-related digital inputs and outputs • PROFIsafe communication	

1) The S12 safety option is a subsystem of type B according to IEC 61508.

2) When a safety-related output is used to control the STO function of the inverter, the function is activated in a safe state.

15.1.2 Extended safety class for safety-related digital inputs and outputs

The following tables show the safety characteristics for safety-related digital inputs and outputs:

Safety functions: • **Safety-related inputs** • **Safety-related outputs (sourcing/sinking)** • **PROFIsafe**	**Characteristic safety values according to**	
	IEC 62061 / IEC 61508	**EN ISO 13849-1**
Classification	SIL 3	PL e
System structure	HFT = 1	2 channel (corresponds to category 3)
Probability of dangerous failure per hour (PFHd value)	$< 1 \times 10^{-9}$ 1/h	$< 1 \times 10^{-9}$ 1/h

Safety functions: • **Safety-related outputs (sourcing/sinking)**	**Characteristic safety values according to**	
	IEC 62061 / IEC 61508	**EN ISO 13849-1**
Classification	SIL 3	PL e
System structure	HFT = 1	2 channel (corresponds to category 3)
Probability of dangerous failure per hour (PFHd value)	$< 4 \times 10^{-9}$ 1/h	$< 4 \times 10^{-9}$ 1/h

15.1.3 MOVIFIT® FC

The following table shows the MOVIFIT® FC characteristic safety values:

Designation	**Characteristic safety values according to**
	EN ISO 13849-1
Classification	PL d
Probability of dangerous failure per hour (PFHd value)	0 (fault exclusion)
Mission time / service life	20 years
Safe state	Safe torque off
Safety functions	STO, SS1[1] according to EN 61800-5-2

1) With suitable external control

15.2 Technical data: S12 safety option

15.2.1 Voltage supply

Designation	Value
Option voltage supply 24V_O	DC 24 V -15% / +20% according to EN 61131-2
Max. internal consumption	• Only S12 safety option: ≤ 100 mA • With all F-DI supplied via F-SS0/1: – S12A: ≤ 160 mA (when using mechanical switches) – S12B: ≤ 200 mA (when using mechanical switches)
Total current consumption	Internal consumption of S12 + output current F-DO00 + F-DO01 + F-DO_STO + F sensor supply
Electrical isolation	Separation of safety electronics (24V_O) and all other supply voltages

15.2.2 Safety-related inputs

Designation • **F-DI00 – F-DI03 (S12 type A)** • **F-DI00 – F-DI07 (S12 type B)**	**Value**
Properties	according to EN 61131-2 DC 24 V, type 3
Signal level	–3 V – +5 V Logic "0" = input LOW +11 V – +30 V Logic "1" = input HIGH
	0V24_O
Input resistance	ca. 3 kΩ
Type. Power demand	0.21 W at 24 V
Input filter time, parameterizable	4 ms – 250 ms
Permitted cable length	30 m
Minimum input signal duration[1)]	Filter time + 50 ms
Response time (input switches -> bit F-DI. in the PROFIsafe user data updated)	1-0 transition ≤ 2 x input filter time + 20 ms 0-1 transition ≤ 2 x input filter time + 50 ms
Error response time with single-pole connection	No greater than the response time without error
Rise rate of input signal	> 120 V/s

1) Minimum duration of an activation or deactivation pulse that is guaranteed to be processed by the system and sent with the PROFIsafe user data for at least one bus cycle.

15.2.3 Sensor supply of pulse outputs

Designation • **F-SS0, F-SS1**	**Value**
Properties	DC 24 V output according to EN 61131-2, protected against short circuits and overloads, no electrical isolation
Rated current	250 mA
Internal voltage drop	2 V
Short circuit protection	Electronic, response value: 0.7 A – 2.1 A
Pulsed voltage supply (if activated)	F-SS 6 ms energized (HIGH), 2 ms deenergized (LOW)
Permitted cable length	30 m (per sensor)

15.2.4 Safety-related outputs

Designation • F-DO_STO, F-DO00, F-DO01 (S12 type A) • F-DO_STO (S12 type B)	Value
Properties	DC 24 V outputs according to EN 61131-2 Short circuit and overload protection
Permissible total current of outputs	≤ 1.9 A
Rated current F-DO00, F-DO01 F-DO_STO	 2 A 1 A
Leakage current ("0" signal)	≤ 1 mA
Internal voltage drop	Sourcing/sinking connection: 3 V Sourcing connection: 2 V
Permitted loads (each output)	• STO deactivation: 1 MOVIFIT® FC • Capacitive load: ≤ 130 µF • Inductive load: – 0.5 H at maximum current – 2 H at < 1 A – 10 H at < 0.3 A
Short circuit protection	10 A – 24 A
Overload protection F-DO00, F-DO01 F-DO_STO	Response value: 2.4 A – 2.7 A 1.2 A – 1.4 A
Test pulses	Min. 250 µs Max. 250 µs – 5 ms (adjustable)
Permitted cable lengths	Max. 30 m
Bus response time (bit F-DO. in the PROFIsafe user data updated) -> output switches)	≤ 8 ms
Terminal response time (assigned F-DI. terminal switches -> output switches)	1-0 transition: ≤ 2 x input filter time + 10 ms 0-1 transition: ≤ 2 x input filter time + 40 ms

15.2.5 Encoder interface

Designation	Value
Properties	Encoder interface for HTL encoder signals A, /A, B, /B
Permitted encoders	EI7C FS
Signal level	0 V – +3 V: Encoder track LOW (logic "0") +10.7 V – +30 V: Encoder track HIGH (logic "1")
Maximum operating speed	3600 rpm
Max. permitted input frequency	1520 Hz
Response time of speed measurement	Calculated according to the formula: Response time of speed measurement (in ms) = 13 + 7500 / n n: Speed in rpm
Error response time of speed measurement[1)]	No greater than the response time without error

1) The error response time is the total time from when an internal error occurs or an external error in the encoder circuit is detected until the S12 safety option goes to a safe state.

15.2.6 Ambient conditions

Designation	Value
Ambient temperature for the entire unit	–25 °C to +40 °C
Climate class	EN 60721-3-3, class 3K3
Storage temperature	-25 °C to +85 °C (EN 60721-3-3, class 3K3)
Permissible oscillation and impact load	According to EN 61800-5-1
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

15.3 Technical data of MOVIFIT® FC (safety technology)

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

Designation	Value
Safety-related 24V_P supply voltage	V_{IN} = DC 24 V -15% / +20% according to EN 61131-2
Input capacitance	100 µF (behind polarity protection diode)
Current consumption	150 mA
STO response time	40 ms

16 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
Production / Industrial Gears	**Bruchsal**	SEW-EURODRIVE GmbH & Co KG Christian-Pähr-Str.10 D-76646 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-2970
Service Competence Center	**Mechanics / Mechatronics**	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@sew-eurodrive.de
	Electronics	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal	Tel. +49 7251 75-1780 Fax +49 7251 75-1769 sc-elektronik@sew-eurodrive.de
Drive Technology Center	**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		+49 800 SEWHELP +49 800 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
Production	**Forbach**	SEW-USOCOME Zone industrielle Technopôle Forbach Sud B. P. 30269 F-57604 Forbach Cedex	Tel. +33 3 87 29 38 00
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
	Nantes	SEW-USOCOME Parc d'activités de la forêt 4 rue des Fontenelles F-44140 Le Bignon	Tel. +33 2 40 78 42 00 Fax +33 2 40 78 42 20

France			
	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	**Algiers**	REDUCOM Sarl 16, rue des Frères Zaghnoune Bellevue 16200 El Harrach Alger	Tel. +213 21 8214-91 Fax +213 21 8222-84 info@reducom-dz.com http://www.reducom-dz.com

Argentina			
Assembly **Sales**	**Buenos Aires**	SEW EURODRIVE ARGENTINA S.A. Ruta Panamericana Km 37.5, Lote 35 (B1619IEA) Centro Industrial Garín Prov. de Buenos Aires	Tel. +54 3327 4572-84 Fax +54 3327 4572-21 sewar@sew-eurodrive.com.ar http://www.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

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://www.sew-eurodrive.at sew@sew-eurodrive.at

Belarus			
Sales	**Minsk**	SEW-EURODRIVE BY RybalkoStr. 26 BY-220033 Minsk	Tel.+375 17 298 47 56 / 298 47 58 Fax +375 17 298 47 54 http://www.sew.by sales@sew.by

Belgium			
Assembly **Sales** **Service**	**Brussels**	**SEW-EURODRIVE n.v./s.a.** Researchpark Haasrode 1060 Evenementenlaan 7 BE-3001 Leuven	Tel. +32 16 386-311 Fax +32 16 386-336 http://www.sew-eurodrive.be info@sew-eurodrive.be
Service Competence Center	**Industrial Gears**	**SEW-EURODRIVE n.v./s.a.** Rue de Parc Industriel, 31 BE-6900 Marche-en-Famenne	Tel. +32 84 219-878 Fax +32 84 219-879 http://www.sew-eurodrive.be service-wallonie@sew-eurodrive.be

Brazil			
Production **Sales** **Service**	**São Paulo**	SEW-EURODRIVE Brasil Ltda. Avenida Amâncio Gaiolli, 152 - Rodovia Presidente Dutra Km 208 Guarulhos - 07251-250 - SP SAT - SEW ATENDE - 0800 7700496	Tel. +55 11 2489-9133 Fax +55 11 2480-3328 http://www.sew-eurodrive.com.br sew@sew.com.br

Brazil			
Assembly **Sales** **Service**	**Rio Claro**	SEW-EURODRIVE Brasil Ltda. Rodovia Washington Luiz, Km 172 Condomínio Industrial Conpark Caixa Postal: 327 13501-600 – Rio Claro / SP	Tel. +55 19 3522-3100 Fax +55 19 3524-6653 montadora.rc@sew.com.br
	Joinville	SEW-EURODRIVE Brasil Ltda. Rua Dona Francisca, 12.346 – Pirabeiraba 89239-270 – Joinville / SC	Tel. +55 47 3027-6886 Fax +55 47 3027-6888 filial.sc@sew.com.br
	Indaiatuba	SEW-EURODRIVE Brasil Ltda. Estrada Municipal Jose Rubim, 205 Rodovia Santos Dumont Km 49 13347-510 - Indaiatuba / SP	Tel. +55 19 3835-8000 sew@sew.com.br

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

Cameroon			
Sales	**Douala**	Electro-Services Rue Drouot Akwa B.P. 2024 Douala	Tel. +237 33 431137 Fax +237 33 431137 electrojemba@yahoo.fr

Canada			
Assembly **Sales** **Service**	**Toronto**	SEW-EURODRIVE CO. OF CANADA LTD. 210 Walker Drive Bramalea, ON L6T 3W1	Tel. +1 905 791-1553 Fax +1 905 791-2999 http://www.sew-eurodrive.ca l.watson@sew-eurodrive.ca
	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. Tilbury Industrial Park 7188 Honeyman Street Delta, BC V4G 1G1	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 Lasalle, PQ 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			
Assembly **Sales** **Service**	**Santiago**	SEW-EURODRIVE CHILE LTDA. Las Encinas 1295 Parque Industrial Valle Grande LAMPA RCH-Santiago de Chile P.O. Box Casilla 23 Correo Quilicura - Santiago - Chile	Tel. +56 2 75770-00 Fax +56 2 75770-01 http://www.sew-eurodrive.cl ventas@sew-eurodrive.cl

China			
Production **Assembly** **Sales** **Service**	**Tianjin**	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 46, 7th Avenue, TEDA Tianjin 300457	Tel. +86 22 25322612 Fax +86 22 25323273 info@sew-eurodrive.cn http://www.sew-eurodrive.cn
Assembly **Sales** **Service**	**Suzhou**	SEW-EURODRIVE (Suzhou) Co., Ltd. 333, Suhong Middle Road Suzhou Industrial Park Jiangsu Province, 215021	Tel. +86 512 62581781 Fax +86 512 62581783 suzhou@sew-eurodrive.cn

China			
	Guangzhou	SEW-EURODRIVE (Guangzhou) Co., Ltd. No. 9, JunDa Road East Section of GETDD Guangzhou 510530	Tel. +86 20 82267890 Fax +86 20 82267922 guangzhou@sew-eurodrive.cn
	Shenyang	SEW-EURODRIVE (Shenyang) Co., Ltd. 10A-2, 6th Road Shenyang Economic Technological Development Area Shenyang, 110141	Tel. +86 24 25382538 Fax +86 24 25382580 shenyang@sew-eurodrive.cn
	Wuhan	SEW-EURODRIVE (Wuhan) Co., Ltd. 10A-2, 6th Road No. 59, the 4th Quanli Road, WEDA 430056 Wuhan	Tel. +86 27 84478388 Fax +86 27 84478389 wuhan@sew-eurodrive.cn
	Xi'An	SEW-EURODRIVE (Xi'An) Co., Ltd. No. 12 Jinye 2nd Road Xi'An High-Technology Industrial Development Zone Xi'An 710065	Tel. +86 29 68686262 Fax +86 29 68686311 xian@sew-eurodrive.cn
	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 sew@sew-eurodrive.com.co

Croatia			
Sales **Service**	**Zagreb**	KOMPEKS d. o. o. Zeleni dol 10 HR 10 000 Zagreb	Tel. +385 1 4613-158 Fax +385 1 4613-158 kompeks@inet.hr

Czech Republic			
Sales **Assembly** **Service**	**Hostivice**	SEW-EURODRIVE CZ s.r.o. Floriánova 2459 253 01 Hostivice	Tel. +420 255 709 601 Fax +420 235 350 613 http://www.sew-eurodrive.cz sew@sew-eurodrive.cz
	Drive Service Hotline / 24 Hour Service	HOT-LINE +420 800 739 739 (800 SEW SEW)	**Servis:** Tel. +420 255 709 632 Fax +420 235 358 218 servis@sew-eurodrive.cz

Denmark			
Assembly **Sales** **Service**	**Copenhagen**	SEW-EURODRIVEA/S Geminivej 28-30 DK-2670 Greve	Tel. +45 43 9585-00 Fax +45 43 9585-09 http://www.sew-eurodrive.dk sew@sew-eurodrive.dk

Egypt			
Sales **Service**	**Cairo**	Copam Egypt for Engineering & Agencies 33 EI Hegaz ST, Heliopolis, Cairo	Tel. +20 2 22566-299 +1 23143088 Fax +20 2 22594-757 http://www.copam-egypt.com/ copam@datum.com.eg

Estonia			
Sales	**Tallin**	ALAS-KUUL AS Reti tee 4 EE-75301 Peetri küla, Rae vald, Harjumaa	Tel. +372 6593230 Fax +372 6593231 veiko.soots@alas-kuul.ee

Finland			
Assembly **Sales** **Service**	**Hollola**	SEW-EURODRIVE OY Vesimäentie 4 FIN-15860 Hollola 2	Tel. +358 201 589-300 Fax +358 3 780-6211 http://www.sew-eurodrive.fi sew@sew.fi
Service	**Hollola**	SEW-EURODRIVE OY Keskikankaantie 21 FIN-15860 Hollola	Tel. +358 201 589-300 Fax +358 3 780-6211 http://www.sew-eurodrive.fi sew@sew.fi
Production **Assembly**	**Karkkila**	SEW Industrial Gears Oy Valurinkatu 6, PL 8 FI-03600 Karkkila, 03601 Karkkila	Tel. +358 201 589-300 Fax +358 201 589-310 sew@sew.fi http://www.sew-eurodrive.fi

Gabon			
Sales	**Libreville**	ESG Electro Services Gabun Feu Rouge Lalala 1889 Libreville Gabun	Tel. +241 741059 Fax +241 741059 esg_services@yahoo.fr

Great Britain			
Assembly **Sales** **Service**	**Normanton**	SEW-EURODRIVE Ltd. DeVilliers Way Trident Park Normanton West Yorkshire WF6 1GX	Tel. +44 1924 893-855 Fax +44 1924 893-702 http://www.sew-eurodrive.co.uk info@sew-eurodrive.co.uk
	Drive Service Hotline / 24 Hour Service		Tel. 01924 896911

Greece			
Sales	**Athens**	Christ. Boznos & Son S.A. 12, K. 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

Hong Kong			
Assembly **Sales** **Service**	**Hong Kong**	SEW-EURODRIVE LTD. Unit No. 801-806, 8th Floor Hong Leong Industrial Complex No. 4, Wang Kwong Road Kowloon, Hong Kong	Tel. +852 36902200 Fax +852 36902211 contact@sew-eurodrive.hk

Hungary			
Sales **Service**	**Budapest**	SEW-EURODRIVE Kft. H-1037 Budapest Kunigunda u. 18	Tel. +36 1 437 06-58 Fax +36 1 437 06-50 http://www.sew-eurodrive.hu office@sew-eurodrive.hu

India			
Registered Office **Assembly** **Sales** **Service**	**Vadodara**	SEW-EURODRIVE India Private Limited Plot No. 4, GIDC POR Ramangamdi • Vadodara - 391 243 Gujarat	Tel. +91 265 3045200, +91 265 2831086 Fax +91 265 3045300, +91 265 2831087 http://www.seweurodriveindia.com salesvadodara@seweurodrivein-dia.com

India			
Assembly **Sales** **Service**	**Chennai**	SEW-EURODRIVE India Private Limited Plot No. K3/1, Sipcot Industrial Park Phase II Mambakkam Village Sriperumbudur - 602105 Kancheepuram Dist, Tamil Nadu	Tel. +91 44 37188888 Fax +91 44 37188811 saleschennai@seweurodriveindia.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 info@alperton.ie http://www.alperton.ie

Israel			
Sales	**Tel-Aviv**	Liraz Handasa Ltd. Ahofer Str 34B / 228 58858 Holon	Tel. +972 3 5599511 Fax +972 3 5599512 http://www.liraz-handasa.co.il office@liraz-handasa.co.il

Italy			
Assembly **Sales** **Service**	**Solaro**	SEW-EURODRIVE di R. Blickle & Co.s.a.s. Via Bernini,14 I-20020 Solaro (Milano)	Tel. +39 02 96 9801 Fax +39 02 96 980 999 http://www.sew-eurodrive.it sewit@sew-eurodrive.it

Ivory Coast			
Sales	**Abidjan**	SICA Société Industrielle & Commerciale pour l'Afrique 165, Boulevard de Marseille 26 BP 1173 Abidjan 26	Tel. +225 21 25 79 44 Fax +225 21 25 88 28 sicamot@aviso.ci

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 373855 http://www.sew-eurodrive.co.jp sewjapan@sew-eurodrive.co.jp

Kazakhstan			
Sales	**Almaty**	ТОО "СЕВ-ЕВРОДРАЙВ" пр.Райымбека, 348 050061 г. Алматы Республика Казахстан	Тел. +7 (727) 334 1880 Факс +7 (727) 334 1881 http://www.sew-eurodrive.kz sew@sew-eurodrive.kz

Kenya			
Sales	**Nairobi**	Barico Maintenances Ltd Kamutaga Place Commercial Street Industrial Area P.O.BOX 52217 - 00200 Nairobi	Tel. +254 20 6537094/5 Fax +254 20 6537096 info@barico.co.ke

Latvia			
Sales	**Riga**	SIA Alas-Kuul Katlakalna 11C LV-1073 Riga	Tel. +371 6 7139253 Fax +371 6 7139386 http://www.alas-kuul.com info@alas-kuul.com

Lebanon			
Sales Lebanon	**Beirut**	Gabriel Acar & Fils sarl B. P. 80484 Bourj Hammoud, Beirut	Tel. +961 1 510 532 Fax +961 1 494 971 ssacar@inco.com.lb
		After Sales Service	service@medrives.com
Sales Jordan / Kuwait / Saudi Arabia / Syria	**Beirut**	Middle East Drives S.A.L. (offshore) Sin El Fil. B. P. 55-378 Beirut	Tel. +961 1 494 786 Fax +961 1 494 971 info@medrives.com http://www.medrives.com
		After Sales Service	service@medrives.com

Lithuania			
Sales	**Alytus**	UAB Irseva Statybininku 106C LT-63431 Alytus	Tel. +370 315 79204 Fax +370 315 56175 irmantas@irseva.lt http://www.sew-eurodrive.lt

Luxembourg			
Assembly **Sales** **Service**	**Brussels**	**SEW-EURODRIVE n.v./s.a.** Researchpark Haasrode 1060 Evenementenlaan 7 BE-3001 Leuven	Tel. +32 16 386-311 Fax +32 16 386-336 http://www.sew-eurodrive.lu info@sew-eurodrive.be

Madagascar			
Sales	**Antananarivo**	Ocean Trade BP21bis. Andraharo Antananarivo. 101 Madagascar	Tel. +261 20 2330303 Fax +261 20 2330330 oceantrabp@moov.mg

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

Morocco			
Sales **Service**	**Mohammedia**	SEW-EURODRIVE SARL 2 bis, Rue Al Jahid 28810 Mohammedia	Tel. +212 523 32 27 80/81 Fax +212 523 32 27 89 sew@sew-eurodrive.ma http://www.sew-eurodrive.ma

Namibia			
Sales	**Swakopmund**	DB Mining & Industrial Services Einstein Street Strauss Industrial Park Unit1 Swakopmund	Tel. +264 64 462 738 Fax +264 64 462 734 sales@dbmining.in.na

Netherlands			
Assembly **Sales** **Service**	**Rotterdam**	SEW-EURODRIVE B.V. Industrieweg 175 NL-3044 AS Rotterdam Postbus 10085 NL-3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 Service: 0800-SEWHELP http://www.sew-eurodrive.nl info@sew-eurodrive.nl

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

Nigeria			
Sales	**Lagos**	EISNL Engineering Solutions and Drives Ltd Plot 9, Block A, Ikeja Industrial Estate (Ogba Scheme) Adeniyi Jones St. End Off ACME Road, Ogba, Ikeja, Lagos Nigeria	Tel. +234 (0)1 217 4332 team.sew@eisnl.com http://www.eisnl.com

Norway			
Assembly **Sales** **Service**	**Moss**	SEW-EURODRIVE A/S Solgaard skog 71 N-1599 Moss	Tel. +47 69 24 10 20 Fax +47 69 24 10 40 http://www.sew-eurodrive.no sew@sew-eurodrive.no

Pakistan			
Sales	**Karachi**	Industrial Power Drives Al-Fatah Chamber A/3, 1st Floor Central Commercial Area, Sultan Ahmed Shah Road, Block 7/8, Karachi	Tel. +92 21 452 9369 Fax +92-21-454 7365 seweurodrive@cyber.net.pk

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 Łódź	Tel. +48 42 676 53 00 Fax +48 42 676 53 49 http://www.sew-eurodrive.pl sew@sew-eurodrive.pl
	Service	Tel. +48 42 6765332 / 42 6765343 Fax +48 42 6765346	Linia serwisowa Hotline 24H Tel. +48 602 739 739 (+48 602 SEW SEW) serwis@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**	**Bucharest**	Sialco Trading SRL str. Brazilia nr. 36 011783 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 RUS-195220 St. Petersburg	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. +221 338 494 770 Fax +221 338 494 771 senemeca@sentoo.sn http://www.senemeca.com

Serbia			
Sales	**Beograd**	DIPAR d.o.o. Ustanicka 128a PC Košum, IV sprat SRB-11000 Beograd	Tel. +381 11 347 3244 / +381 11 288 0393 Fax +381 11 347 1337 office@dipar.rs

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. Rybničná 40 SK-831 06 Bratislava	Tel. +421 2 33595 202 Fax +421 2 33595 200 sew@sew-eurodrive.sk http://www.sew-eurodrive.sk
	Žilina	SEW-Eurodrive SK s.r.o. Industry Park - PChZ ulica M.R.Štefánika 71 SK-010 01 Žilina	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-974 11 Banská Bystrica	Tel. +421 48 414 6564 Fax +421 48 414 6566 sew@sew-eurodrive.sk
	Košice	SEW-Eurodrive SK s.r.o. Slovenská ulica 26 SK-040 01 Košice	Tel. +421 55 671 2245 Fax +421 55 671 2254 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 info@sew.co.za

South Africa			
	Cape Town	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 bgriffiths@sew.co.za
	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 48 Prospecton Road Isipingo Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 902 3815 Fax +27 31 902 3826 cdejager@sew.co.za
	Nelspruit	SEW-EURODRIVE (PTY) LTD. 7 Christie Crescent Vintonia P.O.Box 1942 Nelspruit 1200	Tel. +27 13 752-8007 Fax +27 13 752-8008 robermeyer@sew.co.za

South Korea			
Assembly **Sales** **Service**	**Ansan**	SEW-EURODRIVE KOREA CO., LTD. B 601-4, Banweol Industrial Estate #1048-4, Shingil-Dong, Danwon-Gu, Ansan-City, Kyunggi-Do Zip 425-839	Tel. +82 31 492-8051 Fax +82 31 492-8056 http://www.sew-korea.co.kr master.korea@sew-eurodrive.com
	Busan	SEW-EURODRIVE KOREA Co., Ltd. No. 1720 - 11, Songjeong - dong Gangseo-ku Busan 618-270	Tel. +82 51 832-0204 Fax +82 51 832-0230 master@sew-korea.co.kr

Spain			
Assembly **Sales** **Service**	**Bilbao**	SEW-EURODRIVE ESPAÑA, S.L. Parque Tecnológico, Edificio, 302 E-48170 Zamudio (Vizcaya)	Tel. +34 94 43184-70 Fax +34 94 43184-71 http://www.sew-eurodrive.es sew.spain@sew-eurodrive.es

Swaziland			
Sales	**Manzini**	C G Trading Co. (Pty) Ltd PO Box 2960 Manzini M200	Tel. +268 2 518 6343 Fax +268 2 518 5033 engineering@cgtrading.co.sz

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 jonkoping@sew.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**	**Chonburi**	SEW-EURODRIVE (Thailand) Ltd. 700/456, Moo.7, Donhuaroh Muang Chonburi 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.com

Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service Zone Industrielle Mghira 2 Lot No. 39 2082 Fouchana	Tel. +216 79 40 88 77 Fax +216 79 40 88 66 http://www.tms.com.tn tms@tms.com.tn

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRİVE Tekstilkent Ticaret Merkezi B-13 Blok No:70 Esenler / İstanbul	Tel. +90-262-9991000-04 Fax +90-262-9991009 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr

Ukraine			
Assembly **Sales** **Service**	**Dnipropetrovsk**	ООО «СЕВ-Евродрайв» ул.Рабочая, 23-В, офис 409 49008 Днепропетровск	Тел. +380 56 370 3211 Факс. +380 56 372 2078 http://www.sew-eurodrive.ua sew@sew-eurodrive.ua

United Arab Emirates			
Sales **Service**	**Sharjah**	Copam Middle East (FZC) Sharjah Airport International Free Zone P.O. Box 120709 Sharjah	Tel. +971 6 5578-488 Fax +971 6 5578-499 copam_me@eim.ae

USA			
Production **Assembly** **Sales** **Service**	**Southeast Region**	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 Manufacturing +1 864 439-9948 Fax Assembly +1 864 439-0566 Fax Confidential/HR +1 864 949-5557 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly **Sales** **Service**	**Northeast Region**	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
	Midwest Region	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 332-0038 cstroy@seweurodrive.com
	Southwest Region	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Western Region	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, CA 94544	Tel. +1 510 487-3560 Fax +1 510 487-6433 cshayward@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 ventas@sew-eurodrive.com.ve sewfinanzas@cantv.net

Vietnam			
Sales	**Ho Chi Minh City**	**All sectors except harbor and offshore:** Nam Trung Co., Ltd 250 Binh Duong Avenue, Thu Dau Mot Town, Binh Duong Province HCM office: 91 Tran Minh Quyen Street District 10, Ho Chi Minh City	Tel. +84 8 8301026 Fax +84 8 8392223 namtrungco@hcm.vnn.vn truongtantam@namtrung.com.vn khanh-nguyen@namtrung.com.vn
		Harbor and offshore: DUC VIET INT LTD Industrial Trading and Engineering Services A75/6B/12 Bach Dang Street, Ward 02, Tan Binh District, 70000 Ho Chi Minh City	Tel. +84 8 62969 609 Fax +84 8 62938 842 totien@ducvietint.com
	Hanoi	Nam Trung Co., Ltd R.205B Tung Duc Building 22 Lang ha Street Dong Da District, Hanoi City	Tel. +84 4 37730342 Fax +84 4 37762445 namtrunghn@hn.vnn.vn

Zambia			
Sales	**Kitwe**	EC Mining Limited Plots No. 5293 & 5294,Tangaanyika Road, Off Mutentemuko Road, Heavy Industrial Park, P.O.BOX 2337 Kitwe	Tel. +260 212 210 642 Fax +260 212 210 645 sales@ecmining.com http://www.ecmining.com

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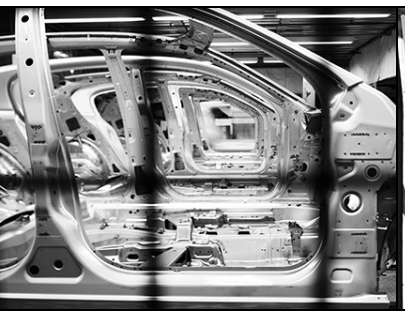

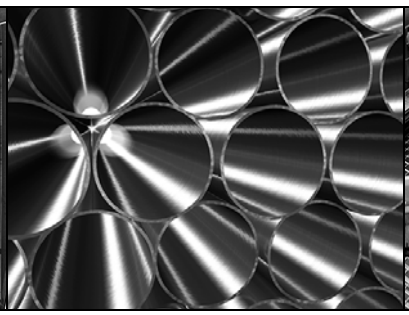


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