SEW EURODRIVE

Manual

MOVIDRIVE® Modular, MOVIDRIVE® System

MOVISAFE® CS..A Safety Card

Edition 12/2017

23535652/EN

Table of contents

23535652/EN – 12/2017

23535652/EN – 12/2017

23535652/EN – 12/2017

23535652/EN – 12/2017

23535652/EN – 12/2017

1 General information

1.1 About this documentation

The current version of the documentation is the original.

This documentation is an integral part of the product. The documentation is written for all employees who assemble, install, start up, and service this product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the machinery and its operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation or 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 grading and meaning of the signal words for safety notes.

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

1.2.2 Structure of section-related safety notes

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

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

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

Meaning of the hazard symbols

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

Hazard symbol	Meaning
	General hazard

23535652/EN – 12/2017

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

1.2.3 Structure of embedded safety notes

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

This is the formal structure of an embedded safety note:

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

1.3 Rights to claim under limited warranty

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

1.4 Content of the documentation

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

1.5 Exclusion of liability

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

23535652/EN – 12/2017

1.6 Other applicable documentation

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

- "MOVIDRIVE® Modular" and "MOVIDRIVE® System" operating instructions
- "MOVIDRIVE® Modular, MOVIDRIVE® System Manual – Multi-Encoder Card CES11A"
- Addendum to the operating instructions "Safety Encoders and Safety Brakes, AC Motors DR.., DRN.., EDR.., EDRN"
- Addendum "Safety-Rated Encoders – Functional Safety for Synchronous Motors"

1.7 Product names and trademarks

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

1.8 Copyright notice

23535652/EN – 12/2017

2 Safety notes

2.1 Preliminary information

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

2.2 User duties

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it.

As the user, you must ensure that all of the work listed in the following is carried out only by qualified specialists:

- Setup and installation
- Installation and connection
- Startup
- Maintenance and repairs
- Shutdown
- Disassembly

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- National and regional safety and accident prevention regulations
- Warning and safety signs on the product
- All other relevant project planning documents, installation and startup instructions, and wiring diagrams
- Do not assemble, install or operate damaged products
- All system-specific specifications and conditions

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.

2.3 Target group

Specialist for mechanical work

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

- Qualification in the mechanical area in accordance with the national regulations
- Familiarity with this documentation

23535652/EN – 12/2017

Specialist for electrotechnical work

Any electrotechnical work may only be performed by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons familiar with electrical installation, startup, troubleshooting, and maintenance of the product who possess the following qualifications:

- Qualification in the electrotechnical area in accordance with the national regulations
- Familiarity with this documentation

Additional qualification

In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation. The persons must have the express authorization of the company to operate, program, parameterize, label, and ground units, systems, and circuits in accordance with the standards of safety technology.

Instructed persons

All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately. The purpose of the instruction is that the persons are capable of performing the required tasks and work steps in a safe and correct manner.

2.4 Designated use

The product is intended for installation in inverters.

The product is a programmable safety control for manufacturing safety cutoffs and functions. The product is intended for use:

- In emergency off devices
- As a safety-related component pursuant to Machinery Directive 2006/42/EC
- As a PES for risk reduction pursuant to EN 61508
- In safety circuits according to EN 60204-1
- As a PES for functional safety pursuant to EN 62061
- As a SRP/CS pursuant to EN ISO 13849
- As a device for implementing the safety functions pursuant to EN 61800-5-2

In the case of installation in electrical systems or machines, it is prohibited to start the proper operation of the product until it is determined that the machine meets the requirements stipulated in the local laws and directives.

The standards given in the declaration of conformity apply to the product.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

Technical data and information on the connection conditions are provided on the nameplate and in chapter "Technical data" in the documentation. Always comply with the data and conditions.

2.5 Transport

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If the product is damaged, it must not be assembled, installed or started up.

Observe the following notes when transporting the device:

- Ensure that the product is not subject to mechanical impact during transportation.

23535652/EN – 12/2017

If necessary, use suitable, sufficiently dimensioned handling equipment.

Observe the information on climatic conditions in chapter "Technical data" of the documentation.

2.6 Installation/assembly

Ensure that the product is installed and cooled according to the regulations in the documentation.

Protect the product from strong mechanical strain. The product and its mounting parts must never protrude into the path of persons or vehicles. Ensure that components are not deformed and insulation spaces are not changed, particularly during transportation and handling. Electric components must not be mechanically damaged or destroyed.

Observe the notes in chapter "Mechanical installation" (→ 🗎 38) in the documentation.

2.6.1 Restrictions of use

The following applications are prohibited unless the device is explicitly designed for such use:

- Use in potentially explosive atmospheres
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, and radiation
- Operation in applications with impermissibly high mechanical vibration and shock loads in excess of the regulations stipulated in EN 61800-5-1
- Use at an elevation of more than 4000 m above sea level

2.7 Electrical installation

Ensure that all of the required covers are correctly attached after carrying out the electrical installation.

Make sure that preventive measures and protection devices comply with the applicable regulations (e.g. EN 60204-1 or EN 61800-5-1).

23535652/EN – 12/2017

2.8 Definitions

- The designation "F-DI." stands for a safe input.
- The designation "F-DO." stands for a safe output.
- The designation "CS..A" is used as a generic term for all derivatives of the MOVISAFE®CS 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 CS.." parameter tool is the parameterization interface in MOVISUITE® for the MOVISAFE® CS..A safety card.

2.9 Startup/operation

Observe the safety notes in the chapters "Startup" (→ 🗎 62) and Operation in the documentation.

Depending on the degree of protection, products may have live, uninsulated, and sometimes moving or rotating parts, as well as hot surfaces during operation.

Mechanical blocking or internal drive safety functions of the product can cause a motor standstill. Eliminating the cause of the problem or performing a reset may result in the drive restarting automatically. If, for safety reasons, this is not permitted for the drive-controlled machine, first disconnect the product from the supply system and then start troubleshooting.

The fact that the operation LED and other display elements are no longer illuminated does not indicate that the product has been disconnected from the supply system and no longer carries any voltage.

In the event of deviations from normal operation, switch the product off. Possible deviations are increased temperatures, noise, or vibration, for example. Determine the cause. Contact SEW-EURODRIVE if necessary.

Do not deactivate monitoring and protection devices of the machine or system even for a test run.

Additional preventive measures may be required for applications with increased hazard potential. Be sure to check the effectiveness of the protection devices after every modification.

23535652/EN – 12/2017

3 Safety concept

3.1 General information

The MOVISAFE® CS..A safety card is a safe assembly with safe digital inputs and outputs and, depending on the parameterization, safe communication.

MOVISAFE® CS..A is fully integrated in the MOVIDRIVE® modular inverter or the MOVIDRIVE® system inverter. This means that MOVISAFE® CS..A internally activates the STO drive safety function of the inverter. The output stage of the inverter is safely switched off by the STO function.

The safety concept is based on a safe state existing for all safe process values. A safe state of the MOVISAFE® CS..A safety card is defined as follows:

- The internal output F-DO_STO is activated as N.C. As a result, the drive safety function STO is switched and the output stage of the inverter is switched off.
- All other existing safe digital outputs are activated as N.C.
- With parameterized safe communication, either substitute values are sent for the data (i.e. all data is "0"), or the communication is interrupted.

3.2 Notes on stop categories

- With stop category 0, the output stage of the inverter is switched off, irrespective of the setpoints set.
- With stop category 1, the MOVISAFE® CS..A safety card monitors the stopping of the drive and subsequently interrupts the supply of power to the motor:
  - With SS1(c), the output stage of the inverter is switched off after the parameterized delay time.
  - With SS1(b), the stopping of the drive is monitored. At a standstill, the output stage of the inverter is switched off.
- With stop category 2, the MOVISAFE® CS..A safety card monitors the stopping of the drive and subsequently monitors the safe operating stop:
  - With SS2(c), the safe operating stop is monitored after the parameterized delay time.
  - With SS2(b), the stopping of the drive and the subsequent safe operating stop are monitored.

3.3 Pluggable safety key

The pluggable CRC memory must be inserted upon activation of the MOVISAFE® CS..A safety card and may not be removed when the safety card is activated.

The parameterization data of the MOVISAFE®CS..A safety card is divided into application-related data and a key data set. The key data set ensures the data integrity.

The application-related data is stored in the device. The application-related data is released with the aid of the key data set on the pluggable CRC memory. The safety card becomes operational only if the key data set on the pluggable CRC memory matches the parameterization.

23535652/EN – 12/2017

The pluggable CRC memory is also used to establish a location reference in the system. Since the application-related data set is released only with the matching key data set on the pluggable CRC memory, the location reference can be established in this way. It is the user's responsibility to secure the location reference of the pluggable CRC memory in the system. The data for safe communication is also stored on the pluggable CRC memory, because this data has the same location reference. This ensures that, in the event of a device replacement, the application-related data and the communication data are available again immediately.

3.4 Identification and authentication

The unique identification of the device and an authentication of the user are necessary for the steps "Parameterize", "Create report" and "Confirm validation". To identify the device, the ID of the pluggable CRC memory is entered in the login dialog of the device. The ID is printed on the pluggable CRC memory. This mechanism ensures that the parameterization tool Assist CS.. is connected to the correct device. The user is authenticated via the entry of a password.

3.5 Report and safety check

The acceptance report can be created once the parameters are downloaded. The acceptance of the safety card within the system can be carried out (see chapter "Requirements for commissioning") with this acceptance report. Following acceptance, this must be confirmed in the safety card. The confirmation is not a replacement for the test that must be carried out. The "Checksum of the report" of the safety card is announced as confirmation of the acceptance.

3.6 MOVISAFE® CS..A safety concept

- The MOVISAFE® CS..A safety card is an integrated, safe assembly that can be operated with or without PROFIsafe connection. MOVISAFE® CS..A is equipped with safe inputs and outputs (F-DI, F-DO) and is available in the following designs.

  MOVISAFE® CSB21A safety card:

  – 4 safe inputs

  MOVISAFE® CSS21A safety card:

  – 4 safe inputs
  – 2 safe dual-channel outputs

  MOVISAFE® CSB31A safety card:

  – 4 safe inputs
  – 2 safe dual-channel outputs
  – 2nd encoder slot (not used for functional safety)

  MOVISAFE® CSS31A safety card:

  – 4 safe inputs
  – 2 safe dual-channel outputs
  – 2nd encoder slot (not used for functional safety)

23535652/EN – 12/2017

- The MOVISAFE® CS..A safety card can release or safely deactivate the output stage of the inverter. The switching state of the internal output F-DO_STO, and thus the STO drive safety function, must be stable once within 60 seconds for at least 2 seconds (2.5 seconds with extended diagnostics).
- The safety concept of the MOVISAFE® CS..A safety card is based on a safe state existing for all safe process values. For the MOVISAFE® CS..A, this value is "0" for all F-DI inputs and F-DO outputs.
- The system was designed pursuant to IEC 61508 for SIL3 and EN ISO 13849-1 for Performance Level e.
- The MOVISAFE® CSS21A and CSS31A safety cards can reliably monitor motion functions in conjunction with the following safety-rated encoders:
  - ES7S/EG7S (FS)
  - AS7W/AG7W (FS)
  - AK0H/AK1H (FS)
  - EI7C FS

  The MOVISAFE® CS..A safety card switches off the output stage of the inverter when a limit value of an active drive safety function is exceeded.

3.7 Drive safety functions

This chapter describes the drive safety functions pursuant to EN 61800-5-2. The following table shows the availability of the drive safety functions described below, depending on the respective MOVISAFE® CS..A safety card used.

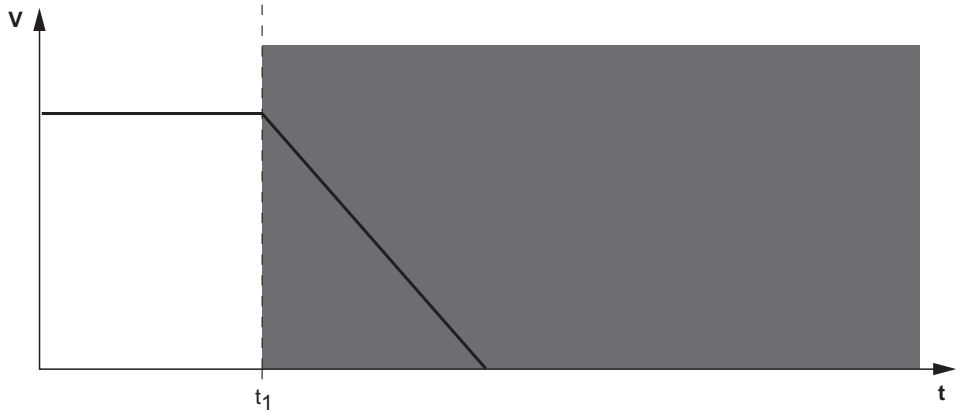
MOVISAFE® safety card	Drive safety functions												
	Idle state				Motion								
	STO	SBC	SS1(c)	SS1(b)	SS2(c)	SS2(b)	SOS	SLS	SSM	SSR	SDI	SLI	SLA
				Only with FS encoder									
CSB21A	x		x										
CSS21A	x	x	x	x	x	x	x	x	x	x	x	x	x
CSB31A[1)]	x	x	x										
CSS31A[1)]	x	x	x	x	x	x	x	x	x	x	x	x	x

1) has a second encoder connection (not used for functional safety)

23535652/EN – 12/2017

3.7.1 STO – Safe Torque Off

If the STO function is activated, the drive inverter no longer supplies power to the motor. As a result, the drive cannot generate torque. This drive safety function corresponds to a non-controlled stop according to EN 60204-1, stop category 0.



9007201225613323

■ = Drive safety function trips
v = Speed
t = Time
t_1 = Point of time when STO is triggered.

INFORMATION

The motor coasts to a halt or is stopped mechanically.

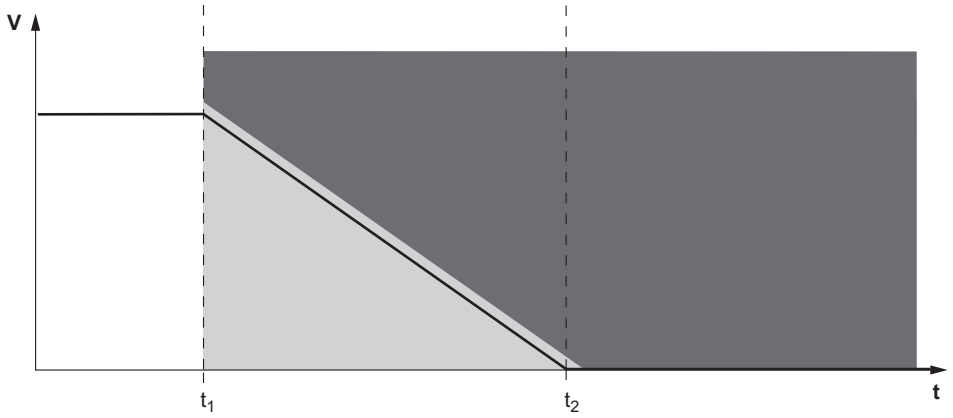
Controlled standstill is preferred, if possible.

23535652/EN – 12/2017

3.7.2 SS1(b) – Safe Stop 1

When the SS1(b) function is active, the drive inverter brings the motor to a standstill electrically. The deceleration is monitored. The STO drive safety function is triggered when the monitored deceleration 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.



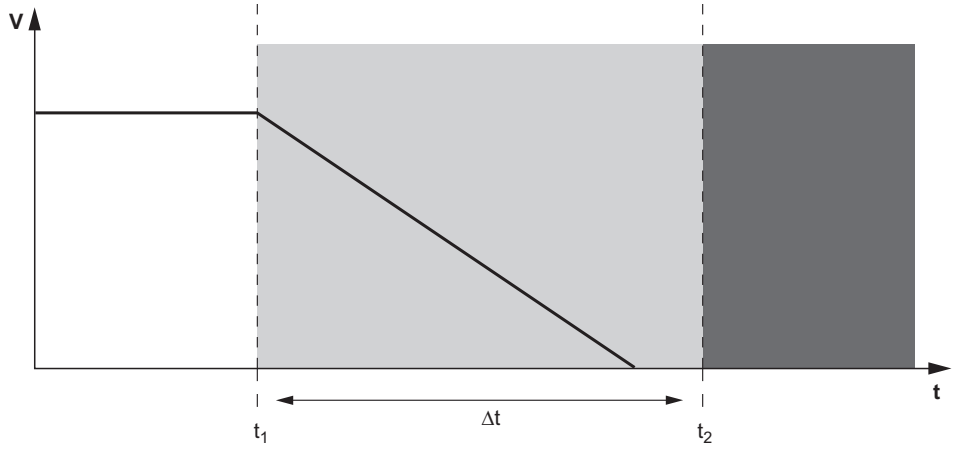
9007201225616011

= Drive safety function monitored
= Drive safety function trips
v = Speed
t = Time
t_1 = Point in time when SS1(b) is activated and motor deceleration is triggered.
t_2 = Point of time when STO is triggered.

3.7.3 SS1(c) – Safe Stop 1

When the SS1(c) function is active, the drive inverter brings the motor to a standstill electrically. The drive safety function STO is 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.



9007201225618443

= Drive safety function monitored
= Drive safety function trips
v = Speed
t = Time
t_1 = Point of time when SS1(c) is activated and motor deceleration is triggered.
t_2 = Point of time when STO is triggered.
Δt = Safety-relevant period of time

INFORMATION

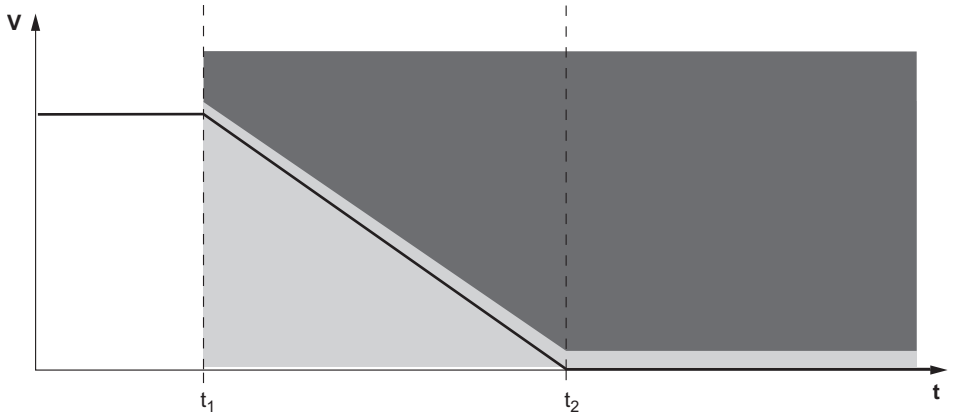
- The SS1(c) function does not monitor the stopping of the drive.
- The safety-relevant period of time Δt allows the drive to come to a stop. In the event of a fault, the drive does not come to a stop and becomes de-energized at the time t_2 (STO).

23535652/EN – 12/2017

3.7.4 SS2(b) – Safe Stop 2

When the SS2(b) function is active, the drive inverter brings the motor to a standstill electrically. The deceleration is monitored. The position must be safely monitored after standstill (SOS function according to EN 61800-5-2). The STO drive safety function will be triggered if the deceleration value is exceeded while stopping or if movement occurs during standstill. STO means that standstill has to be ensured by a mechanical brake.

This drive safety function corresponds to a controlled stop of the drive according to EN 60204-1, stop category 2.



9007201225698059

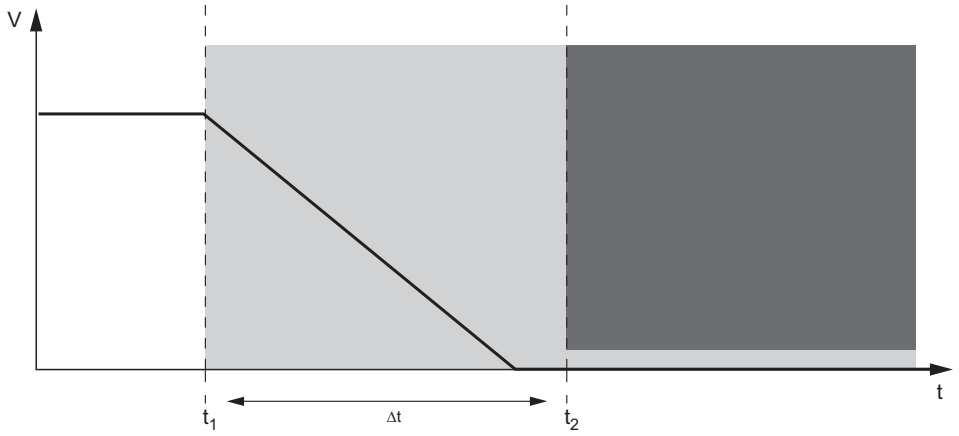
= Drive safety function monitored
= Drive safety function trips
v = Speed
t = Time
t_1 = Point in time when SS2(b) is activated and motor deceleration is triggered.
t_2 = Point in time when SOS is triggered.

23535652/EN – 12/2017

3.7.5 SS2(c) – Safe Stop 2

When the SS2(c) function is active, the drive inverter brings the motor to a standstill electrically. At standstill, the drive inverter delivers the power to keep the motor in position. The position must be safely monitored after a specified, safety-relevant time has elapsed (SOS function according to EN 61800-5-2). Any movement at standstill triggers the STO drive safety function. STO means that standstill has to be ensured by a mechanical brake.

This drive safety function corresponds to a controlled stop of the drive according to EN 60204-1, stop category 2.



9007201429937291

= Drive safety function monitored
= Drive safety function trips
v = Speed
t = Time
t_1 = Point of time when SS2(c) is activated and motor deceleration is triggered.
t_2 = Point in time when SOS is triggered.
Δt = Safety-relevant period of time

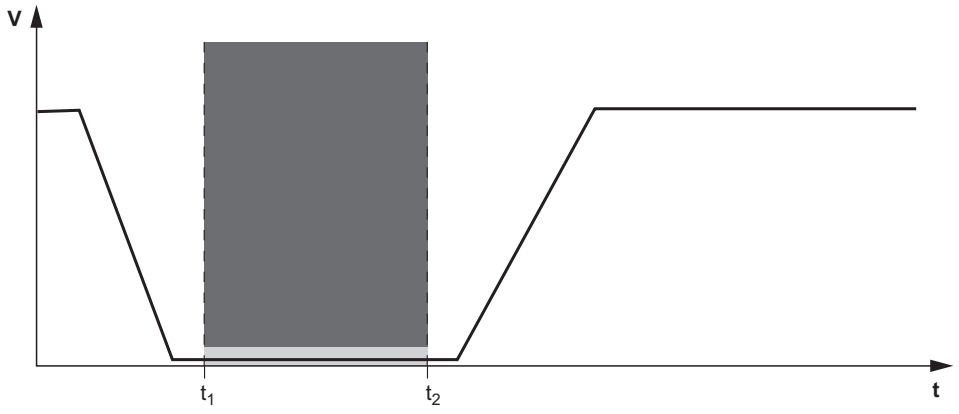
INFORMATION

- The SS2(c) function does not monitor the stopping of the drive.
- The safety-relevant 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. It will not be de-energized until the time t_2 (STO).

23535652/EN – 12/2017

3.7.6 SOS – Safe Operating Stop

The SOS function prevents the motor from deviating from the stop position by more than a specified value. The drive inverter delivers the power to keep the motor in position. If the specified value is exceeded, the drive safety function will be triggered and an error response will be initiated at the same time.

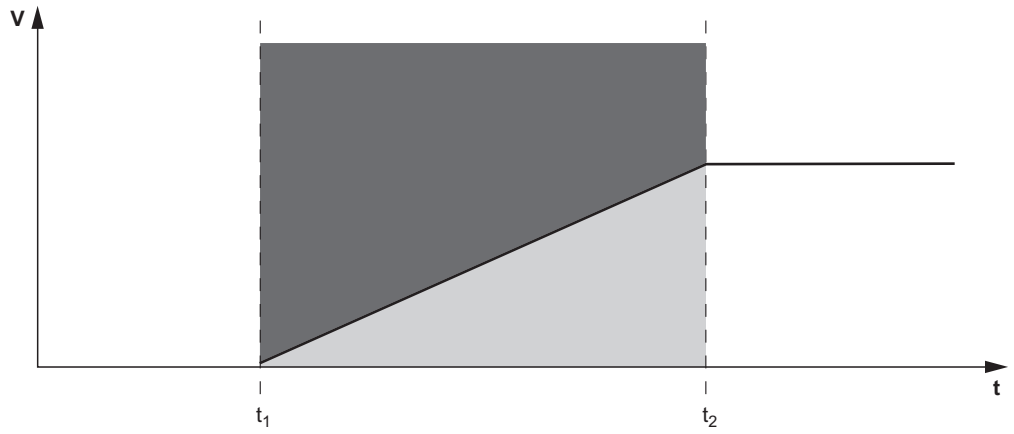


9007201225700491

= Drive safety function monitoring
= Drive safety function trips
v = Speed
t = Time
t_1 = Point in time at which SOS is triggered.
t_2 = Point in time at which SOS is deactivated.

3.7.7 SLA – Safely Limited Acceleration

The SLA function prevents a movement from exceeding a specified acceleration value. If the permitted acceleration limit is exceeded, the drive safety function will be triggered and an error response will be initiated at the same time.



9007201225705355

= Drive safety function monitoring
= Drive safety function trips
v = Speed
t = Time
t_1 = Point in time at which SLA is activated.
t_2 = Point in time at which SLA is deactivated.

23535652/EN – 12/2017

3.7.8 SLS – Safely Limited Speed

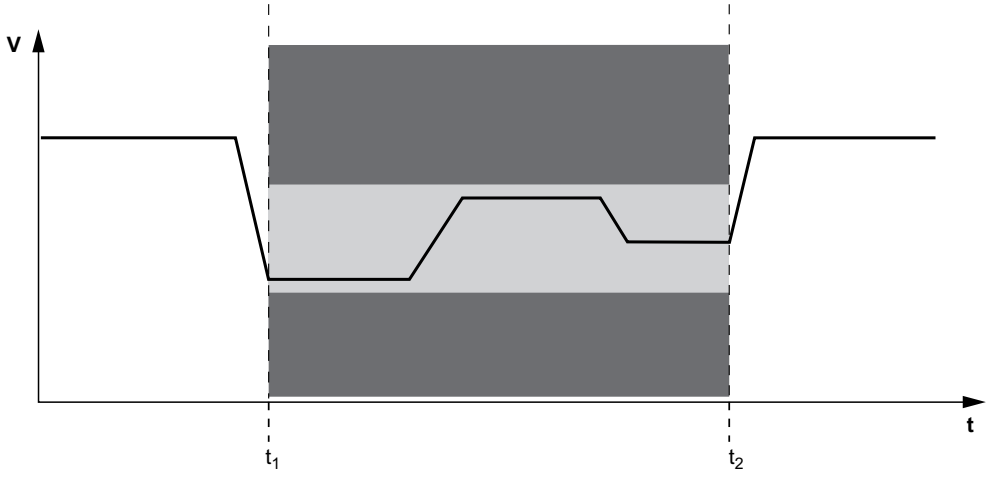
The SLS function prevents the drive from exceeding a specified speed. If the permitted speed is exceeded, the drive safety function will be triggered and an error response will be initiated simultaneously.

9007201225702923

= Drive safety function monitoring
= Drive safety function trips
v = Speed
t = Time
t_1 = Time at which SLS is activated.
t_2 = Time at which SLS is deactivated.

3.7.9 SSR – Safe Speed Range

The SSR function prevents the speed of the drive from exceeding a specified range. Exceeding or failing to achieve the allowed speed range causes triggering of the drive safety function, and an error response is initiated at the same time.



9007201659986827

= Drive safety function monitoring
= Drive safety function trips
v = Speed
t = Time
t_1 = Point in time at which SSR is activated.
t_2 = Point in time at which SSR is deactivated.

23535652/EN – 12/2017

3.7.10 SSM – Safe Speed Monitoring

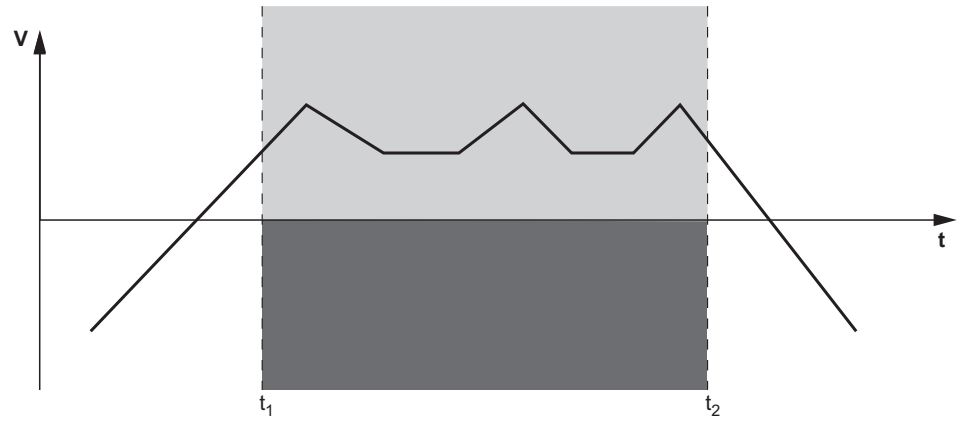
The SSM function monitors whether the drive exceeds a specified speed. An exceeding of the allowed speed is signaled.

9007201225702923

= Drive safety function monitoring
= Drive safety function trips
v = Speed
t = Time
t_1 = Point in time at which SSM is activated.
t_2 = Point in time at which SSM is deactivated.

3.7.11 SDI – Safe Direction

The SDI function prevents movement in an unintended direction. If this condition is violated, the drive safety function will be triggered and an error response will be initiated at the same time (usually STO or SS1).



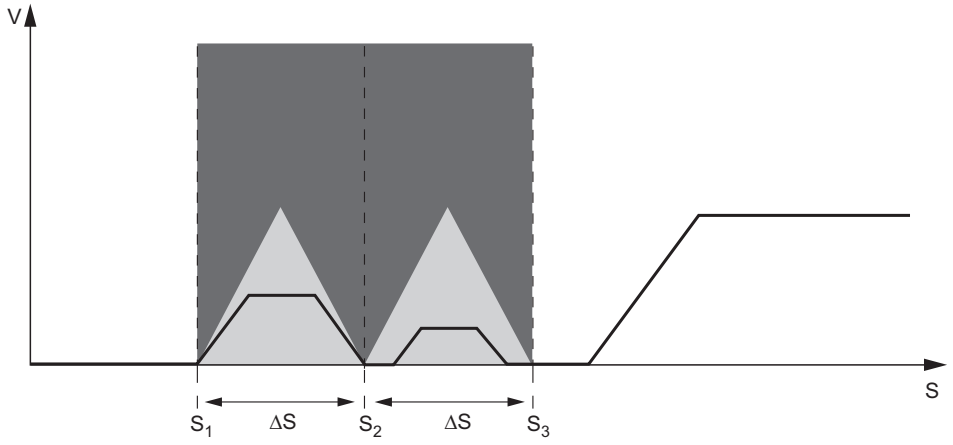
9007201225717643

= Drive safety function monitored
= Drive safety function trips
v = Speed
t = Time
t_1 = Point in time when SDI is activated.
t_2 = Point in time when SDI is deactivated.

23535652/EN – 12/2017

3.7.12 SLI – Safely Limited Increment

The SLI function prevents a movement from exceeding a specified increment. If the limit value of the increment is violated, the drive safety function will be triggered and an error response will be initiated at the same time.

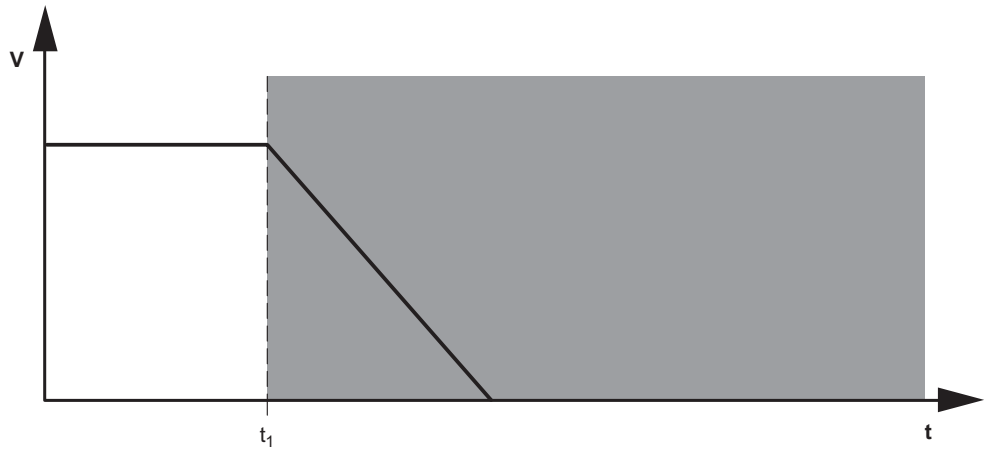


9007201225720459

= Drive safety function monitoring
= Drive safety function trips
v = Speed
s = Distance
s_1, s_2 = Point at which SLI is activated.
s_2, s_3 = Point at which SLI is deactivated.
Δs = Safe increment

3.7.13 SBC – Safe Brake Control

The SBC function provides a safe output signal for controlling an external brake. This means no power is supplied to release the brake electrically.



18014400788450571

= Drive safety function interrupts the power supply to the brake.
v = Speed
t = Time
t_1 = Point in time when the drive is stopped.

23535652/EN – 12/2017

3.8 Safety concept of Assist CS..

3.8.1 Safety parameters

For all drive safety functions, MOVISAFE® CS.. A is equipped with setting options through safety parameters.

The safety parameters determine the behavior of the corresponding drive safety functions and are therefore safety-relevant. All safety parameters are combined in the parameter set.

3.8.2 Test concept and test procedure

The parameters of the MOVISAFE® CS..A safety card are set using an engineering PC with the "Assist CS.." parameterization tool. As the PC and the "Assist CS.." parameterization tool are not safety-related and therefore possibly not error-free, the safety concept prescribes the following measures:

- Identification of the MOVISAFE® CS..A.
- The ID of the pluggable CRC memory must be entered via a dialog when establishing a connection with the MOVISAFE® CS..A safety card.
- Guided parameter setting procedure with the parameterization tool "Assist CS.." with integrated safety features such as plausibility check of entries. The user must compare the entered parameters with the device parameters and confirm (verify) them.
- Completion of the parameterization by verification of parameters, assisted by the parameterization tool "Assist CS.." with subsequent creation of an acceptance protocol for validation of the safety functions.

23535652/EN – 12/2017

4 Safety requirements

4.1 Installation requirements

- Power cables and the safe control cables must be routed separately.
- The wiring technology used must comply with EN 60204-1.
- The safe control cables of the MOVISAFE® CS..A safety card must be installed pursuant to EMC requirements. Observe the following information:
  - Observe the regulations applicable to the application and the information in the operating instructions for the inverter.
  - If the safe outputs and/or inputs are wired in a dual-channel configuration, the corresponding cables must be routed closely together. The cables must be of the same length; a length difference between the cables of ≤ 3% is permissible.
- Make sure that no parasitic voltages can be generated in safe control cables.
- Outside of a closed installation room, safety-related control cables must be protected against external damage.
- Only voltage sources with protective separation (SELV/PELV) pursuant to EN 60204-1 and EN 61131-2 are permitted for any DC 24 V supply voltages to the MOVIDRIVE® modular/system. In case of a single fault, the voltage between the outputs or between any output and grounded parts may not exceed 60 V DC. This also applies to sensors that are supplied by a separate voltage supply and connected to the MOVISAFE® CS..A safety card.
- The encoder cable must not carry a TF signal when connecting an EI7C FS built-in encoder to the MOVIDRIVE® modular/system.
- The safety card must be protected against conductive dirt, e.g. by installing it in a control cabinet with degree of protection IP54 pursuant to IEC 60529.

  Assuming that the presence of conductive dirt can be excluded at the installation site, a control cabinet with a correspondingly lower degree of protection is also permitted if in accordance with the applicable standards (e.g. EN 60204-1). The same applies to temporary condensation, e.g. due to rapid changes in ambient temperature.

4.2 Encoder cable requirements

4.2.1 Sine/cosine encoder cable

- Use a shielded encoder cable. Connect the shield at both ends.
- Max. length of the encoder cable: 100 m
- Use the prefabricated encoder cables from SEW-EURODRIVE. Observe the following requirements if you use other encoder cables:
  - Encoder cable length ≤ 50 m

    The cross section of each core of the encoder cable must be ≥ 0.25 mm^2. The resistance load per unit length of the cores must not exceed 78 Ω/km (at 20 °C).
  - Encoder cable length > 50 m:

    The cross section of the cores for the encoder voltage supply and GND must be ≥ 0.5 mm^2. The resistance load per unit length of these cores must not exceed 39 Ω/km. The resistance load per unit length of the signal cores must not exceed 78 Ω/km (at 20 °C).

23535652/EN – 12/2017

– Differential signal pairs (e.g. the track signals A and $\overline{A}$, B and $\overline{B}$, C and $\overline{C}$, Data + and Data-) must be routed via twisted cores.
– The encoder cable may exhibit the following maximum capacitances per unit length:

  Capacitance per unit length core / core: CA' = 70 pF/m

  Capacitance per unit length core / shield: CS' = 120 pF/m
– In the signal path from the encoder to the inverter, the encoder signals must not branch off to other devices.

4.2.2 HTL encoder cable

- Use a shielded encoder cable. Connect the shield at both ends.
- Max. length of the encoder cable: 100 m
- Use the prefabricated encoder cables from SEW-EURODRIVE. Observe the following requirements if you use other encoder cables:
  – The cross section of each core of the encoder cable must be ≥ 0.25 mm^2. The resistance load per unit length of the cores must not exceed 78 Ω/km (at 20 °C).
  – The encoder cable may not conduct any signals other than the encoder signals, i.e., the encoder signals must not be conducted with other signals in the same cable. The encoder signals must be conducted in twisted pairs as follows:

    U_B and GND

    A+ and A-

    B+ and B-
  – The encoder cable may exhibit the following maximum capacitances per unit length:

    Capacitance per unit length core / core: CA' = 70 pF/m

    Capacitance per unit length core / shield: CS' = 120 pF/m
  – In the signal path from the encoder to the inverter, the encoder signals must not branch off to other devices.

4.3 Requirements for external sensors and actuators

- The project planner and the user of the system or machine are responsible for the number and utilization of external sensors and actuators for connection with the safe inputs and outputs of the MOVISAFE® CS..A safety card.

  Note that, as a rule, the greater part of the maximum permissible probability of hazardous errors for the respectively preferred safety classes originates with the sensors and actuators.
- Use the calculation tool "SISTEMA" from the "BGIA" (Institute for Occupational Health and Safety of the German Employer's Liability Insurance Associations) for selecting suitable sensor technology and actuators.
- To meet the required performance level (PL/SIL), you must use suitable and correspondingly qualified sensors and actuators, and observe the relevant wiring diagrams and information in the chapters "Safe inputs" and "Safe outputs". The permissible encoders are described in the chapter "Encoder requirements".

23535652/EN – 12/2017

4.4 Startup requirements

Following parameterization and startup, the system startup engineer must check and document whether all of the drive safety functions are being executed correctly.

For MOVIDRIVE® applications with safe disconnection of the drive

- as per stop category 1 or 2 in accordance with EN 60204-1,
- with restart inhibit in accordance with EN 1037,

you must, as a general rule, carry out and document startup checks of the disconnecting device and the correct wiring.

This is supported by the "Assist CS.." parameterization tool with an acceptance protocol.

INFORMATION

- In order to avoid a hazard in the intended application when a fault occurs, the user must check whether the fault response time of each drive safety function is then shorter than the maximum permitted fault response time of the application. The maximum permitted fault response time may not be exceeded!
- The user must ensure implementation of the requirements of the required performance level pursuant to EN ISO 13849-1.

4.5 Requirements for stopping in an emergency pursuant to EN 60204-1 (emergency stop)

The MOVISAFE® CS..A safety cards, in combination with an emergency stop command device and the external control, are suitable for implementing an emergency stop in accordance with EN 60204-1. In order to ensure protection against unanticipated restarting of the drive pursuant to EN 1037, the start command must be canceled via the external controller.

⚠ WARNING

In the case of a pending travel command, the drive restarts after acknowledgment of the safety card.

Severe or fatal injuries.

- Cancel the travel command before acknowledgment of the safety card.

4.6 Encoder requirements

4.6.1 Safety encoders at the DR.., DRN.. AC motor.

The safety encoders described below are designated for use with DR.., DRN.. motors. It is not permitted to mount them to other motors.

Motor sizes	Encoder	Part number	
		with connection cover	without connection cover
DR..71 – DR..132	ES7S	13642898	13642715
DRN80 – DRN132S	AS7W	13643916	13643878

23535652/EN – 12/2017

Motor sizes	Encoder	Part number	
		with	without
		connection cover	
DR..160 – DR..280	EG7S	13642952	13642782
DRN132M – DRN280	AG7W	13643932	13643894

Motor sizes	Encoder	Part number
DR..71 – DR..132 DRN80 – DRN132S	EI7C FS	Ordering with part number not possible

4.6.2 Safety encoders on the EDR.., EDRN.. explosion-proof AC motor.

The safety encoders described below are designated for use with EDR.., EDRN.. motors. It is not permitted to mount them to other motors.

Motor sizes	Encoder	Part number	
		with	without
		connection cover	
EDR..71 – EDR..132 EDRN80 – EDRN132S	ES7S	13642898	13642715
	AS7W	13643916	13643878
EDR..160 – EDR..280 EDRN132M – EDRN280	EG7S	13642952	13642782
	AG7W	13643932	13643894

4.6.3 Safety encoders on the CMP/CMPZ synchronous servomotor

The safety encoders described below are designated for use with the CMP.. and CMPZ.. synchronous servo motors. It is not permitted to mount them to other motors.

- AK0H (part number 13356615)

  Permitted for: CMP40 – CMP112S/M, CMPZ71 – CMPZ100
- AK1H (part number 13410547)

  Permitted for: CMP50 – CMP112L/H/E, CMPZ71 – CMPZ100

In order to implement a drive safety function with the AK0H or AK1H encoder, the motor must be started with the control mode CFC.

In addition, the following inverter settings are also recommended:

- Activation of lag error monitoring
- Activation of speed monitoring
- Activation of encoder monitoring

23535652/EN – 12/2017

4.6.4 Quantization error

Position

The actual position value is formed directly from the encoder increments. On the basis of one encoder revolution, this results in the following quantization error for the actual position value, which is included in all position functions:

- EI7C FS: 3,75 °
- AK0H: 0,8 °
- AK1H: 0,09 °
- E..7S: 0,09 °
- A..7W: 0,05 °

Speed

The speed calculation determines the average speed in the time range set via the *Filter time speed SinCos (8708.3)* parameter:

Quantization error_v in 1/min =

(15 s x 1/min) / (PPR_count x parameterized_filter time)

In addition to the process-related quantization error, there is an additional actual speed error of 0.3%:

Error_v_SinCos = Actual speed x 0.3% + Quantization error_v

The speed calculation for the encoder EI7C FS determines the average speed over the last 4 recorded encoder increments. The response time of the encoder evaluation is thus dependent on the actual speed. The error in the calculated speed value equals a maximum of 1% of the actual speed:

Error_v_EI7C FS = Actual speed x 1%

Setting the *Filter time speed HTL (8708.4)* parameter makes it possible to filter the calculated speed via a sliding average value filter with the parameterized length.

Acceleration

The acceleration calculation determines the average acceleration in the time range set via the parameter *Filter time acceleration (8708.2)*. The quantization error that thereby occurs decreases as the filter time increases. In return, the response time increases in accordance with the filter time.

Quantization error_a in 1/min s =

(120 s x 1/min) / (PPR_count x (parameterized_filter time)^2)

In addition to the process-related quantization error, there is an additional actual acceleration error of 0.5%:

Error_a_SinCos = Actual acceleration x 0.5% + Quantization error_a

23535652/EN – 12/2017

5 Hazard caused by coasting of the drive

⚠ WARNING

Hazard caused by coasting of the drive. Without mechanical brake or if the brake is faulty, a danger exists of the drive coasting to a halt.

Severe or fatal injuries.

- If the coasting of the drive causes any application-specific dangers, you must provide for additional preventive measures (e.g. guard with guard locking device). The additional preventive measures must cover the danger zone until no further danger to personnel exists. As an alternative, you must equip the drive with a safety brake.
- 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 standstill depending on the hazard involved. As an alternative, you must determine the access or intervention time and then calculate and observe the resulting safety clearance.

23535652/EN – 12/2017

6 Device structure

6.1 Type designation

The type designation MOVISAFE® CSxxA contains the following data:

CSxx1A	MOVISAFE® CS..A safety card	
CS	Series:	
	C	MOVI-C® option card
	S	Safety
x	Function:	
	B	Basic: Stop functions without encoder
	S	Standard: Speed functions with a safe encoder
x	Hardware design:	
	1	MOVITRAC®
	2	MOVIDRIVE® without 2nd Encoder
	3	MOVIDRIVE® with 2nd Encoder
1	Design characteristic	
A	Technology version	

6.2 Scope of delivery

- MOVISAFE® CS..A:
  - Option card with plug-in spring-loaded terminals on X60.
  - Safety key

23535652/EN – 12/2017

6.3 Compatibility

The MOVISAFE® CS..A safety card can be used with MOVIDRIVE® modular/system inverters with the following or later device statuses. The device status can be found on the inverter's system nameplate.

- **Device status MOVIDRIVE® modular single axis**

Size	Device status location								
	1	2	3	4	5	6	7	8	9
1	xx	xx	xx	13 00	xx	xx	xx	11 00	-
2	xx	xx	xx	13 00	xx	xx	xx	11 00	-
3	xx	xx	xx	13 00	xx	xx	xx	11 00	-
4	xx	xx	xx	13 00	xx	xx	xx	11 00	-
5	xx	xx	xx	13 00	xx	xx	xx	11 00	-
6	xx	xx	xx	13 00	xx	xx	xx	11 00	-

The "xx" entries have no effect on compatibility.

- **Device status MOVIDRIVE® modular dual axis**

Size	Device status location								
	1	2	3	4	5	6	7	8	9
2	xx	xx	xx	13 00	xx	xx	11 00	11 00	-

The "xx" entries have no effect on compatibility.

- **Device status MOVIDRIVE® system control unit**

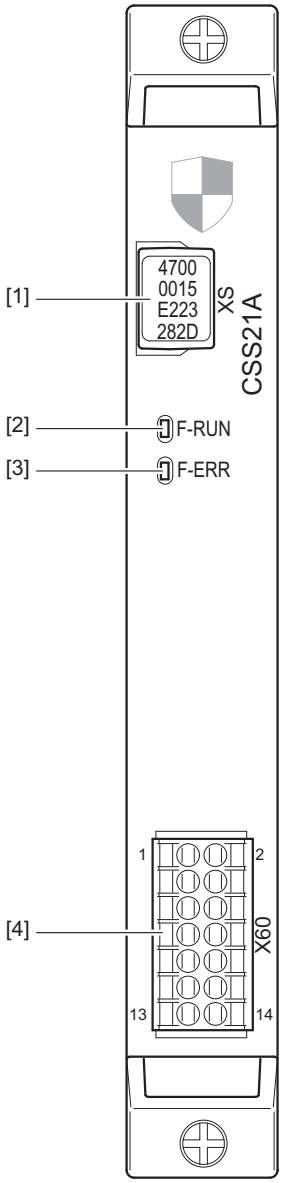
	Device status location								
	1	2	3	4	5	6	7	8	9
-	xx	xx	12 00	11 00	xx	-	-	-	-

The "xx" entries have no effect on compatibility.

- The CS..A safety card requires MOVIDRIVE® firmware V2.10.

23535652/EN – 12/2017

6.4 MOVISAFE® CSS21A/CSB21A

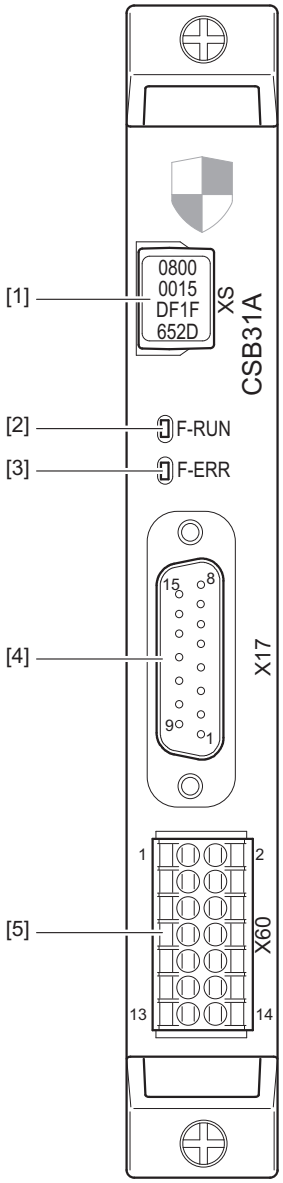


20367319307

[1] XS: Slot for the pluggable CRC memory
[2] "F-RUN" LED
[3] "F-ERR" LED
[4] X60: F-DIx and F-DOx connection

23535652/EN – 12/2017

6.5 MOVISAFE® CSB31A/CSS31A



20370612875

[1] XS: Slot for the pluggable CRC memory
[2] "F-RUN" LED
[3] "F-ERR" LED
[4] X17: Connection of 2nd encoder (not used for functional safety)
[5] X60: F-DIx and F-DOx connection

23535652/EN – 12/2017

7 Mechanical installation

7.1 Before you start

Observe the following information before beginning with the installation or removal of the MOVISAFE® CS..A safety card:

- Disconnect the inverter from the power. Switch off the DC 24 V and the line voltage.
- Take appropriate measures to protect the option card from electrostatic charge (use a discharge strap, wear conductive shoes, etc.) before touching it.
- **Before installing** the option card, remove the keypad and the front cover.
- **After installing** the option card, replace the front cover and the keypad.
- Keep the option card in its original packaging. Do not remove the option card from the original packaging until immediately before installation.
- Hold the option card by its edges only. Do not touch any of the components.

7.2 Installation of the MOVISAFE® CS..A safety card

The MOVISAFE® CS..A safety card can be installed only in the following inverters:

Inverter	MOVISAFE® CS.21A	MOVISAFE® CS.31A
MOVIDRIVE® modular MDA – single-axis module	Yes	Yes
MOVIDRIVE® modular MDD – double-axis module	Yes	No
MOVIDRIVE® system	Yes	Yes

7.3 Installation of the MOVISAFE® CS..A – MOVIDRIVE® modular safety card

Observe the notes in chapter "Electrical Installation" in the inverter operating instructions.

INFORMATION

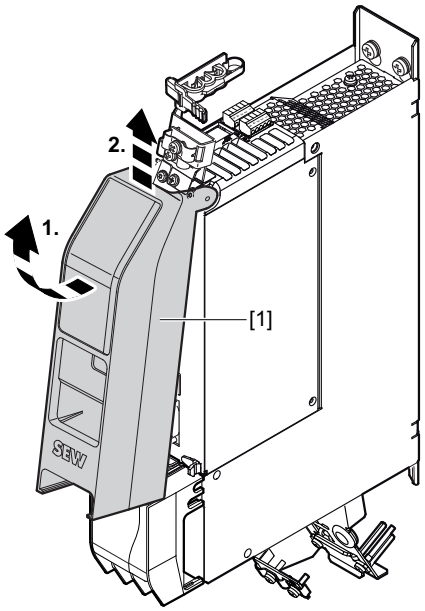
Requirements for installation.

The MOVISAFE® CS..A safety card can be installed only in option-capable axis modules.

1. Disconnect the application inverter from the power supply. Disconnect the DC 24 V supply and the line voltage.
2. Ensure electrostatic discharge with suitable measures before starting work. Suitable measures for equipotential bonding include, for example, the use of a discharge strap or wearing conductive shoes.

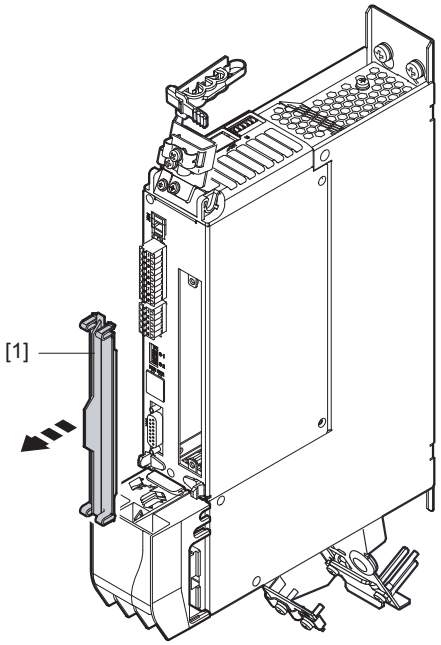
23535652/EN – 12/2017

3. Remove the safety cover [1] from the front of the application inverter.



27021611749935499

4. Remove the plastic cover [1] at the card slot.



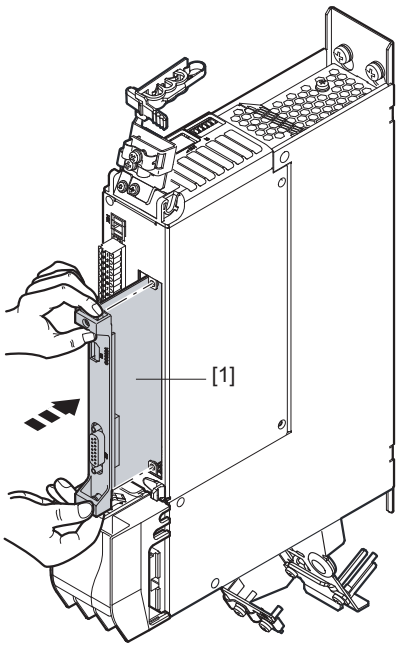
18014412495192075

INFORMATION

Handling the card.

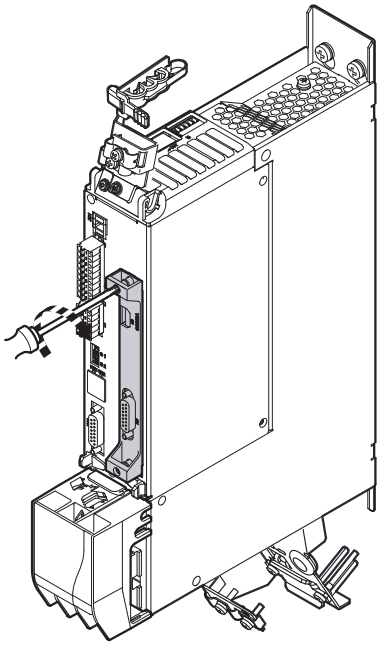
Hold the MOVISAFE® CS..A safety card only by the edges.

5. Take the MOVISAFE® CS..A safety card [1] and insert it in the slot with slight pressure.



18014412495196939

6. Screw the safety card tight with the specified tightening torque (0.6 – 0.8 Nm).



18014412495199371

7. Install the safety cover at the front side of the application inverter.

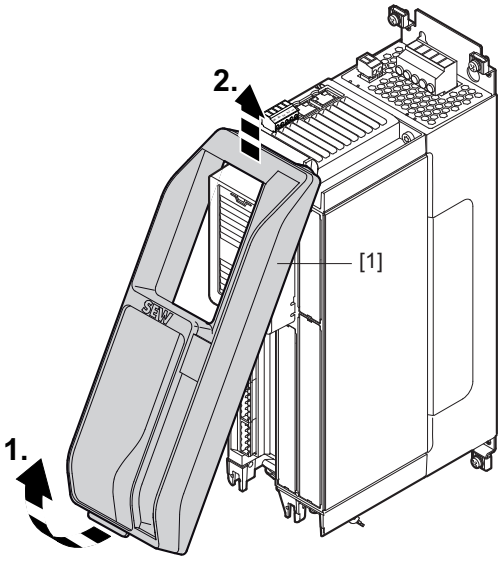
7.4 Installation of the MOVISAFE® CS..A safety card MOVIDRIVE® system

Observe the notes in chapter "Electrical Installation" in the inverter operating instructions.

1. Disconnect the application inverter from the power supply. Disconnect the DC 24 V supply and the line voltage.

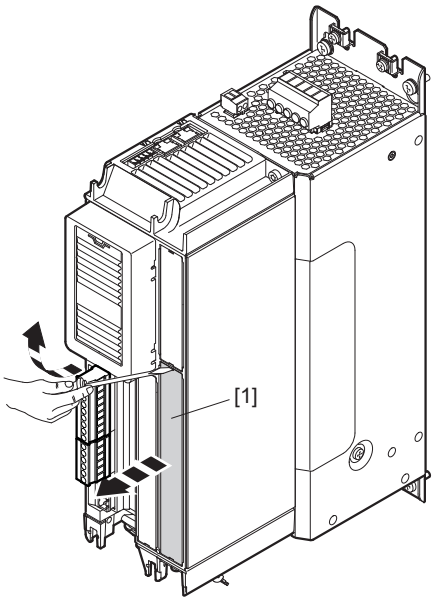
23535652/EN – 12/2017

2. Ensure electrostatic discharge with suitable measures before starting work. Suitable measures for equipotential bonding include, for example, the use of a discharge strap or wearing conductive shoes.
3. Remove the safety cover [1] from the front of the application inverter.



14299394571

4. Remove the plastic cover [1] of the card slot using a screwdriver.



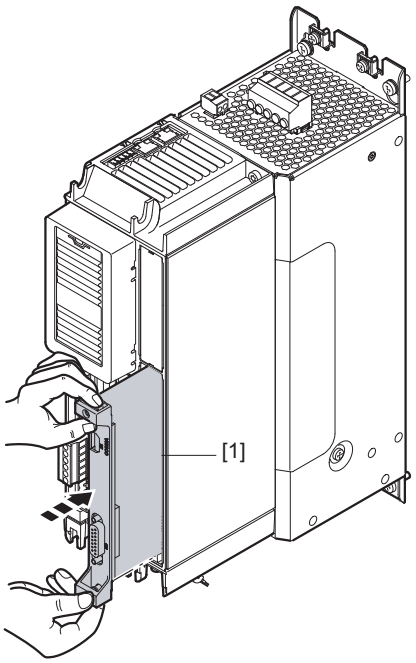
15160620811

INFORMATION

Handling the card.

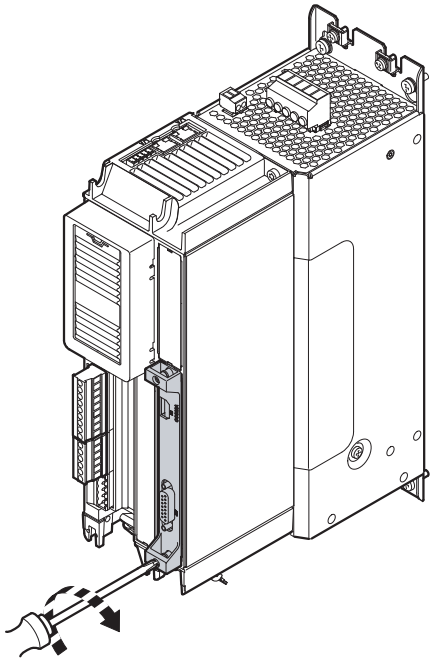
Hold the MOVISAFE® CS..A safety card only by the edges.

5. Take the MOVISAFE® CS..A safety card [1] and insert it in the slot with slight pressure.



15160623243

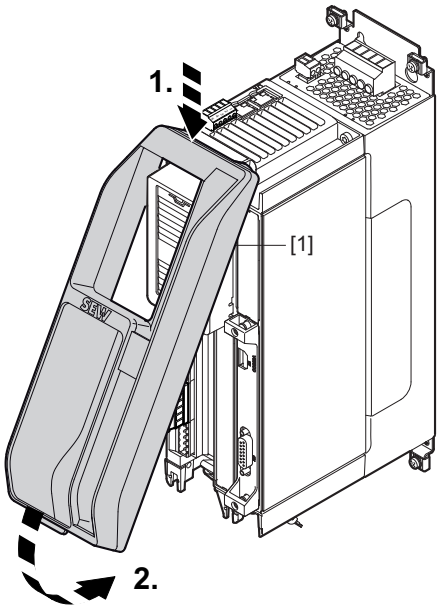
6. Screw the safety card tight with the specified tightening torque (0.6 – 0.8 Nm).



15160625675

23535652/EN – 12/2017

7. Install the safety cover [1] at the front of the application inverter.



14578455307

23535652/EN – 12/2017

8 Electrical installation

8.1 Installation instructions

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

⚠ WARNING

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

Severe or fatal injuries.

- Non-compliant connection designs specified in other documentation are not permissible.

8.2 Connection and terminal assignment

8.2.1 Part numbers

MOVISAFE® CSB21A: 28233360

MOVISAFE® CSS21A: 28233379

MOVISAFE® CSB31A: 28233387

MOVISAFE® CSS31A: 28233395

23535652/EN – 12/2017

8.2.2 Terminal assignment

Description	LED/ Terminal	Function
F-RUN LED F-ERR LED	F-RUN LED F-ERR LED	The LEDs indicate the respective status of the CS..A option (see chapter "Diagnostics").
XS: Slot for pluggable CRC memory	XS	Slot for pluggable CRC memory.
X17 (D-sub DA-15): Connecting **non-safe encoders** (with CSS31A and CSB31A only)	X17:1 – 15	Assignment according to the **non-safe encoder** connected (see manual "MOVIDRIVE® modular, MOVIDRIVE® system – multi-encoder card CES11A").
X60: Connection of digital inputs (plug-in spring-loaded terminals)	X60:1 F-DI00	Safe digital input F-DI00.
	X60:2 F-DI01	Safe digital input F-DI01.
	X60:3 GND	Reference potential for safe inputs/outputs.
	X60:4 GND	Reference potential for safe inputs/outputs.
	X60:5 F-DI02	Safe digital input F-DI02.
	X60:6 F-DI03	Safe digital input F-DI03.
	X60:7 GND	Reference potential for safe inputs/outputs.
	X60:8 GND	Reference potential for safe inputs/outputs.
	X60:9 F-SS0	DC 24 V sensor voltage supply for safe digital inputs F-DI00 and F-DI02.
	X60:10 F-SS1	DC 24 V sensor voltage supply for safe digital inputs F-DI01 and F-DI03.
	X60:11 F-DO00_M	Safe digital output F-DO00_M (not with CSB21A).
	X60:12 F-DO00_P	Safe digital output F-DO00_P (not with CSB21A).
	X60:13 F-DO01_M	Safe digital output F-DO01_M (not with CSB21A).
	X60:14 F-DO01_P	Safe digital output F-DO01_P (not with CSB21A).

8.3 Safe disconnection

The jumper must be removed if MOVISAFE® CS..A is plugged in. No other voltage may be connected as well.

8.4 Safe digital inputs (F-DI.)

The safe digital inputs (F-DI.) are connected at terminal X60. The following sections explain and describe the permitted connection options.

23535652/EN – 12/2017

The processing of the safe digital inputs takes place in dual-channel mode inside the MOVISAFE® CS..A safety card. The safe digital inputs are therefore suitable for applications up to SIL 3 pursuant to IEC 61508 and Performance Level e pursuant to EN ISO 13849-1. The external sensors to be connected and their wiring must be in compliance with the required safety class.

- Sensors that either switch the sensor supply F-SSx with active pulsed voltage supply through to a safe digital input (F-DIx) or block it. The time behavior of the pulsed voltage supply must not be influenced by the sensor.
- Electronic sensors or evaluation devices that automatically generate test pulses (switch-on or switch-off pulses) on the input signals, the duration of which is < 1 ms.
- Any signal sources that generate a DC input signal within the scope of the specification of F-DIx.

Note the wiring diagrams below. The range of connection designs might be limited depending on the sensor type. Note in addition the chapter "Requirements for external sensors and actuators" as well as the general installation regulations.

Possible contact bounce and interference can be filtered out by a parameterizable input filter. Contact bounces and interferences that are shorter than the set filter time are removed from the signal.

Unassigned inputs need not be wired. An open input is always read as a "0" signal. The safe state of the safe digital inputs is the output of "logical 0" on the associated process values.

The MOVISAFE® CS..A safety card evaluates the digital inputs as follows.

Connection type: Single-channel:

Logic level input terminal F-DI.	Process value F-DI.
0	0
1	1

Connection type: Dual-channel equivalent:

Logic level input terminal F-DI.	Logic level input terminal F-DI. + 1	Process value F-DI.
0	0	0
0	1	0
1	0	0
1	1	1

Connection type: Dual-channel non-equivalent:

Logic level input terminal F-DI.	Logic level input terminal F-DI. + 1	Process value F-DI.
0	0	0
0	1	0
1	0	1
1	1	0

With paired evaluation, 2 safe digital inputs F-DI. are combined into one input pair, which has an effect on a common process value.

23535652/EN – 12/2017

The assignment is made pursuant to the following table: D.

Input terminal	Input pair	Assigned process value
F-DI0	F-DI0/1	F-DI0
F-DI1		
F-DI2	F-DI2/3	F-DI2
F-DI3		

8.4.1 Discrepancy monitoring

The safety card carries out discrepancy time monitoring for input pairs in the dual-channel equivalent and dual-channel non-equivalent connection types. The discrepancy time monitoring verifies whether the two input signals are delivering error-free levels that match the switching state of the sensor. A deviation is tolerated for the parameterized discrepancy time. An input error occurs if the deviation from the expected signal state exceeds the discrepancy time. The discrepancy time can be adjusted for each input pair via a parameter.

The safety card carries out a switch test function for input pairs in the dual-channel equivalent and dual-channel non-equivalent connection types in order to verify the connected switch for correct switching behavior following a detected discrepancy error. The switch test function can be activated and deactivated for each input pair via a parameter. The switch test function assumes that the switch contacts are moved into the opened/activated state after the occurrence of the discrepancy error, so that the two input signals assume the required state for the switch test:

- Connection type; Dual-channel equivalent
  - F-DI. = logical "0"
  - F-DI. + 1 = logical "0"
- Connection type; Dual-channel non-equivalent
  - F-DI. = logical "0"
  - F-DI. + 1 = logical "1"

Only in this case can the discrepancy error be acknowledged; acknowledgment is otherwise impossible and the input remains in the discrepancy error.

8.4.2 Interlocking

An interlocking function is available for the secure digital inputs. This can be activated via a parameter with the parameter tool "Assist CS..". The interlocking prevents a drive safety function activated via the safe digital inputs from being deactivated without user intervention via the change in input signals from the "0" state to the "1" state. The interlocking sets the process value of the safe digital input to logical "0" until an acknowledgment has occurred.

The acknowledgment can occur as follows:

- Via a safe digital input that is parameterized as "Acknowledgment of interlocking safe digital input".
- Via a safe digital input that is parameterized as "Acknowledgment of interlocking safe digital input and error".
- Via the "Acknowledge F-DI" bit in the safe process output data.

The inputs with active parameterization remain at logical "0" after each activation of the safety card until an acknowledgment has been carried out.

23535652/EN – 12/2017

8.4.3 Signal monitoring

The signal monitoring detects when the input signal is in an undefined state (unstable state) for too long. The maximum duration for which an unstable state is permitted is calculated from the set filter time multiplied by the parameter value of the parameter *Signal monitoring* (Index 8704, Subindex 8). The function can also be deactivated with the value "0" via the *Signal monitoring* parameter. The safety card responds with an input error if the signal monitoring is active and the maximum duration has been exceeded.

8.4.4 Pulsed voltage supply and crossfault monitoring

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

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

- F-DI00, F-DI02 via the respective sensor to F-SS0.
- F-DI01, F-DI03 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 either from F-SS0 / F-SS1 or from another +24 V supply that has the same ground reference.

⚠ WARNING

Danger due to incorrect setting of the parameter *F-DI. Connection type* when connecting dual-channel sensors. There is no redundancy or discrepancy check with the "Single-channel", setting.

Severe or fatal injuries.

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

Only the connection designs shown below are permitted for safe applications! Also note the assignment of the connection designs of the safe digital inputs to the category structures pursuant to EN ISO 13849-1.

8.4.5 Sensors with contact (single-channel)

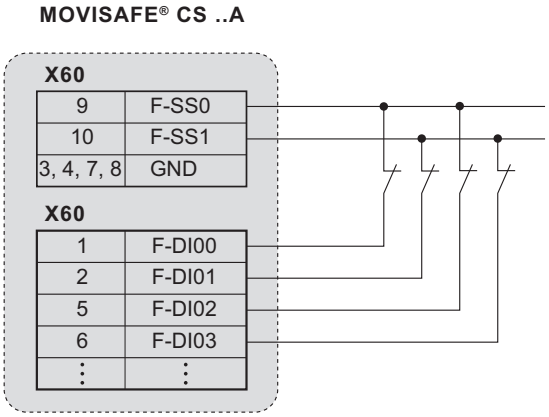
A single-channel sensor is connected via the sensor supply F-SS0 or F-SS1. The sensor cycle available there makes it possible for crossfaults in the wiring to be detected. Note the detailed assignment of F-DI. to the sensor supply F-SS0 or F-SS1 in the chapter "Terminal assignment".

Settings in the parameterization tool "Assist CS..":

- Choose the single-channel connection type.
- Depending on the requirement with respect to safety technology, activate or deactivate the "crossfault monitoring" and pulsed voltage supply of the sensor supply.

23535652/EN – 12/2017

The following figure shows the MOVISAFE® CS..A safety card with single-channel contact-equipped sensors.



9007207666482571

Operation with activated crossfault monitoring

The following errors are detected:

- Crossfault between every digital input line F-DI. and a 24 V supply voltage.
- Crossfault between a digital input line F-DIx and another digital input line F-DIy, which is assigned to another sensor supply, if at least the associated switch contact of the other digital input F-DIy is closed.
- Crossfault between a digital input line FDI and a sensor supply line not assigned to the input F-DI.
- Crossfault between a sensor supply line F-SS and a 24 V supply voltage if the digital input F-DI is assigned to the sensor supply and the switch contact belonging to F-DI is closed.
- Crossfault between the sensor supply lines F-SS themselves if the switch contact belonging to the digital input F-DI is closed.

⚠ WARNING

The MOVISAFE® CS..A safety card **cannot** detect a short circuit between an F-SS. sensor supply and an associated safe input F-DI.

Severe or fatal injuries.

- Make sure that no short circuit between the sensor supply F-SS. and an associated safe input F-DI. is possible.

⚠ WARNING

If crossfault monitoring is deactivated, the MOVISAFE® CS..A safety card **cannot** detect crossfaults in the cabling. This configuration is **not** permitted for safe applications without further measures.

Severe or fatal injuries.

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

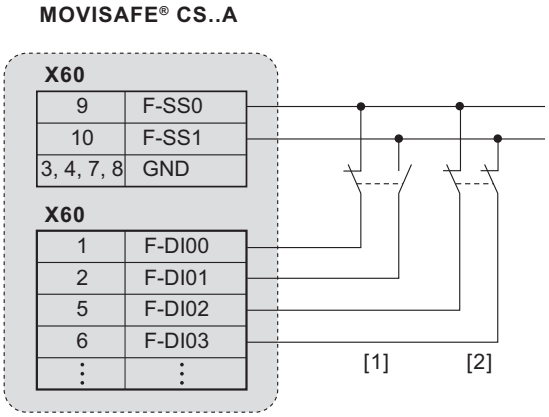
8.4.6 Sensors with contact (dual-channel)

A dual-channel contact-equipped sensor is connected via the sensor supply F-SS0 and F-SS1. Note the detailed assignment of the safe digital inputs (F-DI.) to the sensor supply F-SS0 and F-SS1 in chapter "Terminal assignment".

Settings in the parameterization tool "Assist CS..":

- Choose the dual-channel connection type.
- Activate or deactivate crossfault monitoring and pulsed sensor supply, depending on the safety requirements.

The following figure shows the MOVISAFE® CS..A safety card with contact-equipped dual-channel sensors in the non-equivalent and equivalent connection designs.



9007207666486027

[1] Dual-channel contact-equipped sensor in "non-equivalent" connection design
[2] Dual-channel contact-equipped sensor in "equivalent" connection design

Operation with activated crossfault monitoring

The following errors are detected:

- Crossfault between every digital input line F-DI. and a 24 V supply voltage.
- Crossfault between a digital input line F-DIx and another digital input line F-DIy, which is assigned to another sensor supply, if at least the associated switch contact of the other digital input F-DIy is closed.
- Crossfault between a digital input line F-DI and a sensor supply line not assigned to the input F-DI.
- Crossfault between a sensor supply line F-SS and a 24 V supply voltage if the digital input F-DI is assigned to the sensor supply and the switch contact belonging to F-DI is closed.
- Crossfault between the sensor supply lines F-SS themselves if the switch contact belonging to the digital input F-DI is closed.

Operation without crossfault monitoring

When using a dual-channel, non-equivalent-switching sensor, the MOVISAFE® CS..A safety card can detect a crossfault between the two digital inputs of an input pair.

23535652/EN – 12/2017

⚠ WARNING

The MOVISAFE® CS..A safety card cannot detect a short circuit between an F-SS. sensor supply and an associated safe digital input F-DI. (bridging of the sensor).

Severe or fatal injuries.

- Make sure that a short circuit between the sensor supply F-SS. and an associated safe digital input F-DI. is not possible.

⚠ WARNING

If crossfault monitoring is deactivated and a dual-channel, equivalent-switching sensor is used, the MOVISAFE® CS..A safety card **cannot** detect crossfaults in the cabling.

Severe or fatal injuries.

- Make sure that crossfaults are not possible at the safe digital inputs F-DI.

INFORMATION

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

8.4.7 Active sensors (dual-channel)

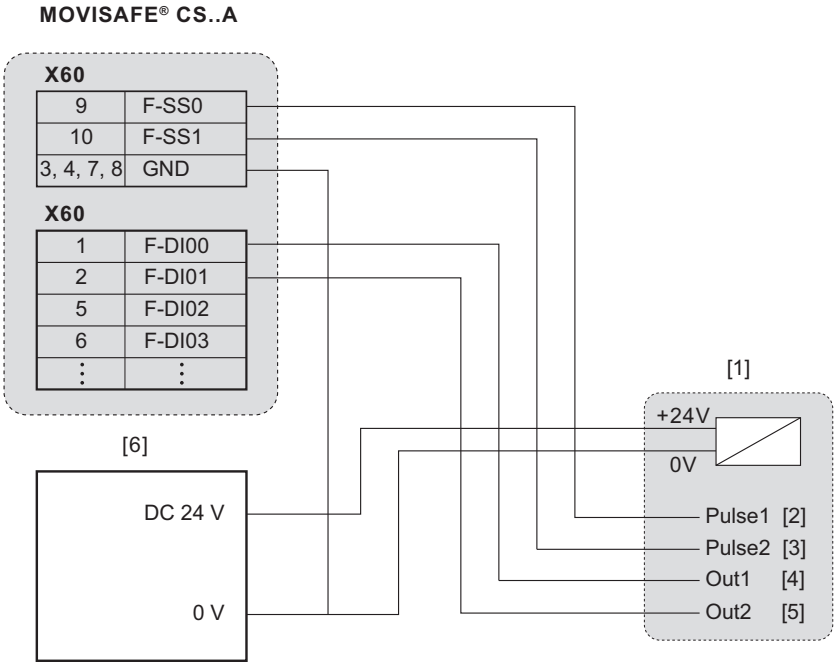
When connecting a dual-channel sensor with additional voltage supply, the voltage is supplied via an external DC 24 V power supply. The voltage supplies for the sensor outputs are connected to the sensor supply F-SS0 and F-SS1. The safe outputs of the sensor are connected with 2 channels to the respective safe digital inputs (F-DI.) at terminal X60. Note the detailed assignment of the safe digital inputs (F-DI.) to the sensor supply F-SS0 and F-SS1 in chapter "Terminal assignment".

Settings in the parameterization tool "Assist CS..":

- Choose the dual-channel connection type (equivalent/non-equivalent).
- Activate or deactivate the pulsed sensor supply, depending on the safety requirements.
- Parameterize the permitted discrepancy time between the two input signals of the sensor you are using.

23535652/EN – 12/2017

The following figure shows the MOVISAFE® CS..A safety card with an active sensor (dual-channel).



9007207666490251

[1] Active dual-channel sensor
[2] Supply of output 1 (Out1)
[3] Supply of output 2 (Out2)
[4] Safe digital output 1
[5] Safe digital output 2
[6] External DC 24 V voltage supply

Operation with activated crossfault monitoring

The following errors are detected:

- Crossfault between every digital input line F-DI. and a 24 V supply voltage.
- Crossfault between a digital input line F-DIx and another digital input line F-DIy, which is assigned to another sensor supply, if at least the associated switch contact of the other digital input F-DIy is closed.
- Crossfault between a digital input line FDI and a sensor supply line not assigned to the input F-DI.
- Crossfault between a sensor supply line F-SS and a 24 V supply voltage if the digital input F-DI is assigned to the sensor supply and the switch contact belonging to F-DI is closed.
- Crossfault between the sensor supply lines F-SS themselves if the switch contact belonging to the digital input F-DI is closed.

⚠ WARNING

The MOVISAFE® CS..A safety card cannot detect a short circuit between an F-SS. sensor supply and an associated safe digital input F-DI. (bridging of the sensor).

Severe or fatal injuries.

- Make sure that a short circuit between the sensor supply F-SS. and an associated safe digital input F-DI. is not possible.

23535652/EN – 12/2017

⚠ WARNING

If crossfault monitoring is deactivated, the MOVISAFE® CS..A safety card **cannot** detect crossfaults in the cabling.

Severe or fatal injuries.

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

23535652/EN – 12/2017

8.4.8 Sensors with semiconductor outputs (OSSD, dual-channel)

When connecting an OSSD-capable sensor, make sure that a pulsed voltage supply is activated for the voltage supply.

INFORMATION

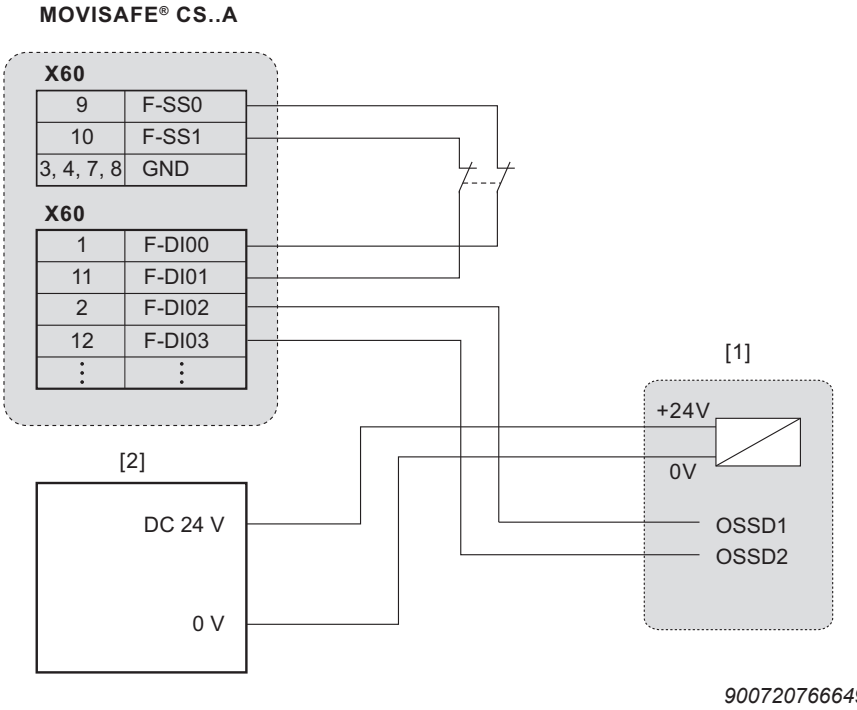
Deactivate the crossfault monitoring at the respective safe inputs if the OSSD-capable sensor technology.

OSSD-capable sensor technology tests and diagnoses the OSSD outputs on its own. The faults detected in the cabling depend on the diagnostic function of the used sensor.

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

Design 1

If contact-equipped sensors are used in addition to sensors with OSSD-capable outputs and if the contact-equipped sensors require crossfault monitoring, the OSSD-capable sensor can be supplied via an external voltage supply.

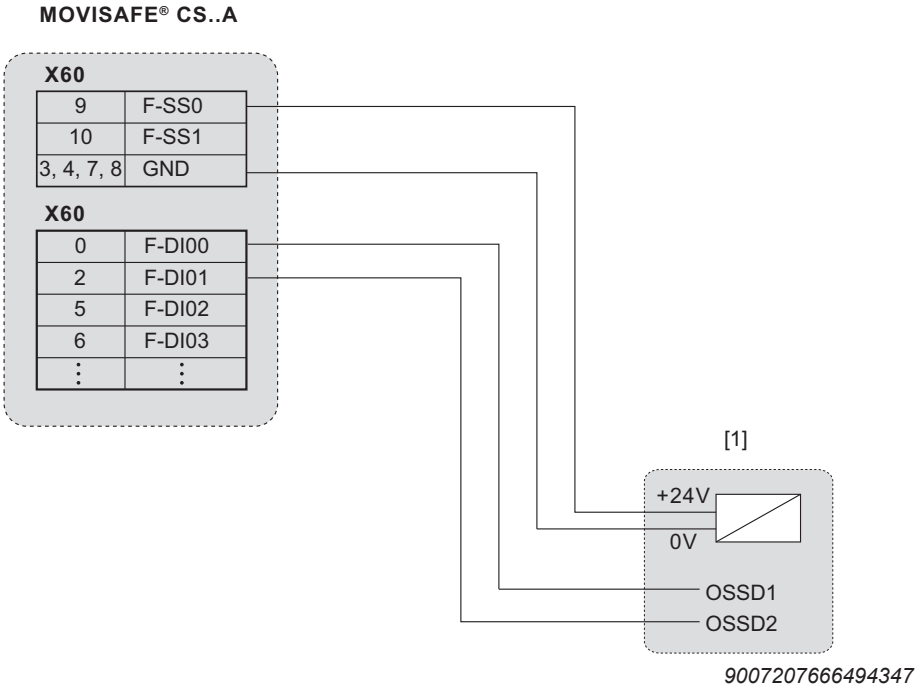


[1] OSSD sensor (e.g. scanner or light grid)
[2] External DC 24 V voltage supply

23535652/EN – 12/2017

Design 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 voltage supply (F-SS0 and F-SS1) in the "Assist CS.." parameterization tool.



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

INFORMATION

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

Use the external voltage supply for sensors that have a higher current consumption than the F-SS. sensor supply lines can provide.

8.5 Safe digital outputs (F-DO.)

8.5.1 General information

The processing of the safe digital outputs takes place inside the MOVISAFE® CS..A safety card in dual-channel format. The safe digital outputs can therefore achieve SIL 3 pursuant to IEC 61508 and Performance Level e pursuant to EN ISO 13849-1. The external actuators to be connected and their wiring must comply with the respective required safety class.

The actuators can be connected to the safe digital outputs F-DO00 and F-DO01 (not with MOVISAFE® CSB21A) via 2 poles, sourcing/sinking output, or single-pole, sourcing output.

Set the respective configuration during startup using the parameterization tool "Assist CS..".

Single-pole, sinking digital outputs are not permitted.

It is not necessary to use shielded cables for all safe digital outputs.

Note the dependency of the achieved Performance Level (PL) and SIL on the selected connection design of the safe digital outputs. The switching state of both outputs F-DO00 and F-DO01 must be stable at least once within 60 seconds for a minimum of 2 seconds. The error response "Output error" is triggered if this stable state cannot be effected, thus resulting in a failure to execute the diagnostics in their entirety. The consequence of this is that the respective digital output is switched to the safe state "open".

Diagnostics can be activated optionally for the 24 V switch outputs F-DO00 and F-DO01. The diagnostics recognizes an interrupted output current circuit if the value of the output current falls below that of the "Minimum current for wire break monitoring" with through-connected output.

If a wire break is detected, the "Output error" error response occurs, which blocks all outputs.

8.5.2 Capacitive loads

- A capacitive load of no more than 10 nF may be connected to the output without any additional measures. Capacitive loads often occur in electronic assemblies as buffer capacitors.

  If the capacitive load has a diode in series to its input, the maximum load capacity permitted is 12 µF. This diode is often installed as polarity protection diode in electronic assemblies.
- If the capacitive load is not known or is higher than 10 nF, the inrush current must be limited to the permitted values of the output pursuant to DIN EN 61131-2.

INFORMATION

Due to the thermal load of the output components, the maximum switching frequency of the digital outputs in the presence of capacitive loads must be limited to the value specified in chapter "Technical data" > "Safe digital outputs".

8.5.3 Inductive loads

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

- Inductive loads always must 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".

NOTICE

Operation of inductive loads without freewheeling diode may damage the MOVISAFE® CS..A safety card.

Damage to the MOVISAFE® CS..A safety card

- Inductive loads must always be connected via a freewheeling diode. The safe digital outputs of the MOVISAFE® CS..A safety card are not equipped with a freewheeling diode.
- Varistors and other overvoltage protection elements are not permitted.

23535652/EN – 12/2017

8.5.4 Ohmic loads

Lamps are examples of ohmic loads.

- Lamps can be connected for display purposes. Note that an increased cold current flows when incandescent lamps or halogen lamps are switched on. The cold current must not exceed the permitted output current pursuant to DIN EN 61131-2.

8.5.5 Information about line diagnostics and test pulses

Short voltage pulses are added to the output signals to monitor the cabling. 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 the protective separation of MOVISAFE® CS..A with a maximum of 10 MOVIDRIVE® modular and MOVIDRIVE® system units, a test pulse duration of 1 ms is to be used.

Total capacitance must not exceed 1 µF with the maximum test pulse duration (5000 ms). If the set test pulse duration is longer than the required value, the test pulse duration during operation is reduced automatically.

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

Operating the devices without line diagnostics is therefore not recommended.

⚠ WARNING

When line diagnostics is deactivated, the MOVISAFE® CS..A safety card cannot detect a short circuit between a sourcing output (F-DO._P) and the +24 V supply voltage or between an M switching output (F-DO._M) and the reference potential.

Severe or fatal injuries.

Install the wiring in such a way that no short circuit is possible:

- Between a sourcing output (F-DO._P) and the +24 V supply voltage.
- or between an sinking output (F-DO._M) and the reference potential.

The outputs F-DO00 and F-DO01 are equipped with an optional open-circuit monitoring function. The wire break monitoring checks whether the connected actuator is consuming a minimum current. If the actuator current is below the minimum value, the MOVISAFE® CS..A safety card detects this as an open circuit.

Activate open-circuit monitoring only if you are sure that the current consumption of the actuator is always above the minimum current (see chapter "Technical data" > "Safe digital outputs").

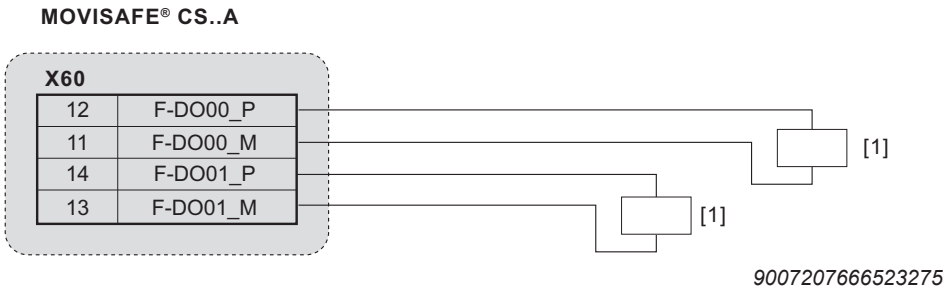
8.5.6 Output F_DO-STO

The switching state of the internal output F-DO_STO and thus the STO safety function must be stable at least once within 60 seconds for a minimum of 2 seconds.

If the extended diagnostics is activated via the "Assist CS.." tool, the signal must be stable for 2.5 sec. The error response "Output error" (which blocks all outputs) is triggered if this stable state cannot be effected, resulting in a failure to execute the diagnostics in their entirety.

23535652/EN – 12/2017

8.5.7 Actuator (dual-channel, sourcing output)



[1] Actuator

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, because the MOVISAFE® CS..A safety option disconnects the sourcing and the sinking output terminals.

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

The sourcing / sinking connection design is suitable for applications up to SIL 3 pursuant to IEC 61508 and Performance Level e pursuant to EN ISO 13849-1.

Fault detection using line diagnostics

The MOVISAFE® CS..A safety card detects the following faults in the external cabling when the output is switched on or off:

- Short circuit between sourcing output and a supply voltage that lies within the range of 15 - 30 V and has the same ground potential as the MOVISAFE® CS..A safety card.
- Short circuit between the sinking output and the reference potential or a voltage < 6 V.

The MOVISAFE® CS..A safety card also detects 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 sourcing output and GND
- Overload at every output
- Open circuit (with F-DO., if activated)

INFORMATION

In case of a short circuit, a high short-circuit current can occur for a short time. Depending on the DC 24 V supply voltage used, this can cause a voltage dip that limits the operation of MOVIDRIVE® modular or MOVIDRIVE® system and/or individual assemblies.

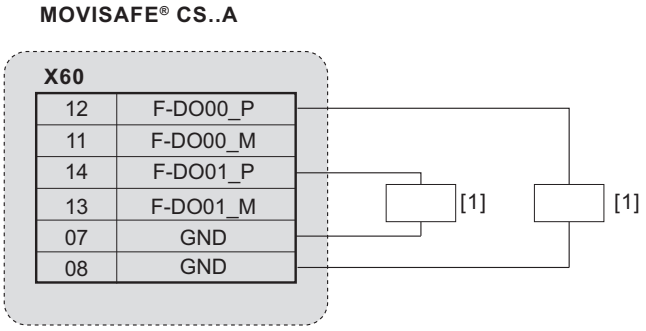
If the voltage supply is not stable enough, it may result in a reset and a restart of the MOVISAFE® CS..A safety card.

- Make sure the voltage supply does not collapse in case of output short circuits.

23535652/EN – 12/2017

8.5.8 Actuator (dual-channel, sourcing output)

In dual-channel sourcing operation, the actuators are wired as follows.



9007207666505227

[1] Actuator

Connect the actuator on two channels between F-DO00_P and F-DO01_P and GND. The actuator input need not be isolated. The dual-channel sourcing output connection design is suitable for applications up to SIL 3 pursuant to IEC 61508 and Performance Level e pursuant to EN ISO 13849-1.

This connection type cannot be adjusted directly via a parameter, but is instead achieved by the following parameterization and control of the two outputs involved:

- Both outputs are parameterized as single-channel sourcing outputs.
- Both outputs are switched simultaneously. This can be achieved via a drive safety function (STO, SBC) assigned to both outputs or via the secure process output data F-PA (F-DO00 and F-DO01).

The MOVISAFE® CS..A safety card detects the following faults in the external cabling when the output is switched on or off:

- Short circuit between sourcing output and a supply voltage that lies within the range 15 - 30 V and has the same ground potential as the other assembly.

The MOVISAFE® CS..A safety card detects the following faults when the output is switched on:

- Short circuit between different sourcing outputs
- Short circuit between the P output and the reference potential
- Overload at every output
- Wire break (if activated)

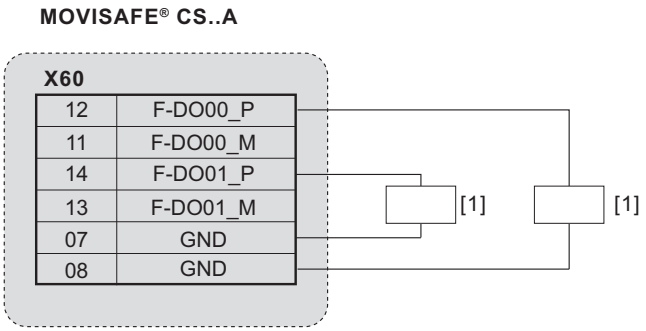
⚠ WARNING

In case of a short circuit between the sourcing output and a 24 V supply voltage, the MOVISAFE® CS..A safety card can no longer switch off the actuator, meaning that it can no longer switch to a safe state.

Severe or fatal injuries.

- Route the cables in such a way that no short circuit between the sourcing output and a +24 V supply voltage is possible.

8.5.9 Actuator (single-channel, sourcing output)



9007207666505227

[1] Actuator

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

The actuator input need not be isolated.

The sourcing output connection design is suitable for applications up to SIL 3 pursuant to IEC 61508 and Performance Level d pursuant to EN ISO 13849-1.

The MOVISAFE® CS..A safety card detects the following faults in the external cabling when the output is switched on or off:

- Short circuit between sourcing output and a supply voltage that lies within the range 15 - 30 V and has the same ground potential as the assembly.

The MOVISAFE® CS..A safety card also detects the following faults when the output is activated:

- Short circuit between different sourcing outputs
- Short circuit between the P output and the reference potential 0 V
- Overload at every output
- Wire break F-DO., if activated)

⚠ WARNING

In case of a short circuit between the sourcing output and a 24 V supply voltage, the MOVISAFE® CS..A safety card can no longer switch off the actuator nor otherwise switch over to a safe state.

The line diagnostics function can detect the fault. However, the MOVISAFE® CS..A safety card cannot switch over to the safe state as there is no redundant switch-off channel in this connection design.

Severe or fatal injuries.

- Route the cables in such a way that no short circuit between the sourcing output and a +24 V supply voltage is possible.
- Make sure that an additional redundant switch-off channel exists for the actuator (e.g., by using a second sourcing output).

INFORMATION

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

For safe outputs, refer also to details contained in the chapter "Technical data".

23535652/EN – 12/2017

INFORMATION

In case of a short circuit, a high short-circuit current can occur for a short time. Depending on the DC 24 V supply voltage used, this can cause a voltage dip that limits the operation of MOVIDRIVE® modular or MOVIDRIVE® system and/or individual assemblies.

If the voltage supply is not stable enough, it may result in a reset and a restart of the MOVISAFE® CS..A safety card.

- Make sure the DC 24 V voltage supply does not collapse in the event of output short circuits.

8.6 EI7C FS built-in encoder

8.6.1 Properties

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

The MOVISAFE® CS..A can detect a minimum speed of 60 min^{-1} in connection with the EI7C FS built-in encoder.

The MOVISAFE® CS..A evaluates the signal of the EI7C FS built-in encoder.

The MOVISAFE® CS..A and the EI7C FS built-in encoder monitor the encoder signal. The MOVISAFE® CS..A safety card detects interruptions and crossfaults in the encoder line. If a fault occurs, the MOVISAFE® CS..A activates the drive safety function STO in the MOVIDRIVE® modular or MOVIDRIVE® system, and the torque is switched off safely.

Use only the EI7C FS built-in encoder in connection with MOVISAFE® CS..A.

8.6.2 Installation

Use a shielded cable to connect the EI7C FS built-in encoder to the matching encoder inputs of a MOVIDRIVE® modular or MOVIDRIVE® system.

⚠ WARNING

Incorrect wiring can disable the encoder function and monitoring features for the encoder.

Severe or fatal injuries.

- The encoder may be connected only to the MOVISAFE® CS..A safety card.
- The encoder signals may be connected only to the terminals of a MOVIDRIVE® modular or MOVIDRIVE® system intended for this purpose. It is not permitted to connect other devices or assemblies.

INFORMATION

- The encoder cable must not carry any TF signals when an EI7C FS built-in encoder is connected to the MOVIDRIVE® modular or MOVIDRIVE® system.
- The MOVISAFE® CS..A safety card can detect a minimum speed of 60 min^{-1} in connection with an EI7C FS built-in encoder.

23535652/EN – 12/2017

9 Startup

9.1 General startup instructions

INFORMATION

- The startup procedure of the standard functions of the MOVIDRIVE® modular/system is described in the respective operating instructions "MOVIDRIVE® modular" or "MOVIDRIVE® system".
- Firmware version V2.10 or higher must be used in the MOVIDRIVE® modular/system inverter for startup of the MOVISAFE® CS..A safety card.
- If a brake is connected to the MOVIDRIVE® modular/system, the *FCB 01 Output stage inhibit* function block must be selected in the MOVISUITE® parameter tree under [Functions] > [Drive functions]. In *FCB 01 Output stage inhibit*, the *Close brake with STO* parameter must be set to "On".
- The following chapters describe the additional startup procedure for the MOVISAFE® CS..A safety card and its drive safety functions.
- Note the prerequisites for installation and operation of MOVISUITE®.
- The MOVISAFE® CS..A safety card is supported by MOVISUITE® version 1.2 or higher.
- When starting up several similar devices with identical parameterization, the devices can be parameterized via the "Import/Export" function. Note that you must validate every single device to accomplish this.

9.2 Startup designs 1 – 2

No drive safety function is approved in the delivery state of the safety card. The safety card permanently activates STO.

9.2.1 Design 1: Independent operation (no connection to PROFIsafe)

The MOVISAFE® CS..A safety card can be parameterized and operated without PROFIsafe connection (independent operation).

Take into account the following constraints for this operating mode:

- The parameters of the MOVISAFE® CS..A safety card are set using the "Assist CS.." parameterization tool.
- The validation of the system is supported by a acceptance protocol generated in the "Assist CS.." parameterization tool.

For startup, perform the following steps:

1. Parameterization of drive safety functions in the "Assist CS.." parameterization tool.
2. Startup of the standard functions.

   For more detailed information, refer to chapter "Startup" in the "MOVIDRIVE® modular" and MOVIDRIVE® system" operating instructions.
3. Acceptance and validation supported by the "Assist CS.." parameterization tool.

23535652/EN – 12/2017

9.2.2 Design 2: With PROFIsafe connection

The MOVISAFE® CS..A safety card can be parameterized and operated with PROFIsafe connection. (Fieldbus connection).

Take into account the following constraints for this operating mode:

- The parameters of the MOVISAFE® CS..A safety card are set using the "Assist CS.." parameterization tool.
- The validation of the system is supported by a acceptance protocol generated in the "Assist CS.." parameterization tool.

For startup, perform the following steps:

1. Parameterization of drive safety functions in the "Assist CS.." parameterization tool.
2. Startup of the fieldbus and the higher-level F-PLC.
3. Startup of the standard functions.

   For detailed information, refer to chapter "Startup" in the "MOVIDRIVE® modular" and MOVIDRIVE® system" operating instructions.
4. Acceptance and validation supported by the "Assist CS.." parameterization tool.

9.3 Adjusting the maximum test duration for load with unknown capacitance

In order to determine the "Maximum test duration" parameter (Index 8705.2) for a load with unknown capacitance at a safe digital output (F-DO.), proceed as follows:

1. Select one of the two safe digital outputs, F-DO00 or F-DO01. Connect the load according to the selected connection type and set the "Connection type".
2. Set the "Maximum test duration" parameter (Index 8705.2) to the maximum value of 5000 µs.
3. Interconnect the selected output for at least 10 seconds.
4. Form the maximum value from the following values for the selected output:
   - Value of the "Maximum duration test pulse A" display parameter (Index 8703.37)
   - Value of display parameter "Maximum duration test pulse B" (Index 8703.8)
5. Block the selected output for at least 10 seconds.
6. Form the maximum value from the following values for the selected output:
   - Formed maximum value from step 4
   - Value of the "Maximum duration test pulse A" display parameter (Index 8703.37)
   - Value of display parameter "Maximum duration test pulse B" (Index 8702.8)
7. In order to specify the "Maximum test duration" value (Index 8705.2), add a reserve of 500 µs to the maximum value determined in step 6.

23535652/EN – 12/2017

9.4 Parameterization of the drive safety functions

9.4.1 Prerequisites

For a successful startup, you need the "Assist CS.." parameterization tool. You can call up the "Assist CS.." parameterization tool directly in MOVISUITE® (version 1.2 or higher; download from www.sew-eurodrive.de).

9.4.2 Parameterization procedure

This chapter describes the parameterization of the drive safety functions step-by-step.

1. Start **MOVISUITE®.**
2. **Scan the network.**

   Scan the network that contains your engineering interface to the MOVIDRIVE® device (RS485, Ethernet, etc.).
3. **Start the "Assist CS.." parameterization tool.**

   Start the "Assist CS.." parameterization tool from the MOVISUITE® interface.

   A window opens with a prompt to enter the ID of the pluggable CRC memory and the password.
4. **Enter the serial number of the device and establish a connection.**

   Enter the pluggable CRC memory ID of the safety card to be parameterized and the corresponding password and confirm the entry with [OK].

   The serial number can be found on the pluggable CRC memory (XXXX XXXX XXXX XXXX).

   The querying of the pluggable CRC memory ID ensures that the "Assist CS.." parameterization tool connects to the right device.
5. **Upload the current parameterization of the device.**

   After entering the pluggable CRC memory ID, the current parameterization of the drive safety function is compared with the parameterization that is stored in the database. If the data sets are identical, the "Assist CS.." parameterization tool starts. In case of deviation, a dialog opens in which the user can choose whether the offline or online data set should be used further. This is to read out the current configuration; it can also be done during operation.
6. **Parameter setting**

   Set the parameterization according to your safety-related requirements of your application.

   For parameterization of the MOVISAFE® CS..A safety card, call the individual sections in the parameter tree and enter the required values. The higher-level parameters, such as IO error effects, fieldbus connection, encoder activation, and limit speeds of the motor are set in the "General parameters" area. The parameterization of the sensors and actuators are set in the "F-DI" and "F-DO" areas. After that, in the "Function assignment" area, the parameters of the drive safety functions are set and assigned to the parameterized inputs/outputs.

   The "Assist CS.." parameterization tool creates a parameter set from all of the parameters.

23535652/EN – 12/2017

7. **Transferring the parameter set to the device**

   Click the [Download] button to transfer the parameter set to the MOVISAFE® CS..A safety card.

   After the download, the transferred parameter set is checked for consistency and plausibility. Possibly existing inconsistencies or plausibility errors are displayed and can then be corrected.

For a detailed description of steps 4 – 7, refer to chapter "Assist CS..".

Once the parameter set has been transferred to the MOVISAFE® CS..A safety card without any errors, you can start up the standard functions and, if required, make the connection to the higher-level safety controller (F-PLC).

9.4.3 Encoder error muting

⚠ WARNING

The active function "Encoder error muting" deactivates the encoder-dependent drive safety functions (except STO). This can cause immediate start-up of the system.

Severe or fatal injuries.

- Before activation of the "Encoder error muting" function, the user must undertake organizational measures for the protection of personnel and machinery.

The active function "Encoder error muting" is signaled on the LED F-ERR by rapid yellow flashing. The "Encoder error muting" function has the following effects:

- The opening of the internal output F-DO_STO is suppressed due to the encoder error response.
- The error responses of all drive safety functions are suppressed.
- The safe process data bit *F-PE_Muting_Enc-Err* is set.
- The safe process data bit *F-PE-ErrorState* remains set.
- The error code continues to be displayed.
- Activation of the drive safety function STO continues to be possible without restriction. All other drive safety functions become deactivated.

The "Encoder error muting" function is automatically exited in the following cases:

- Another error is detected.
- An error is acknowledged.
- 5 minutes after activation.

If the "Encoder error muting" function has been automatically deactivated, all sources must first cancel the activation before another activation.

9.4.4 Test mode

The limit value violation of the drive safety function SS1, SS2 and SOS can be tested when test mode is active.

The test mode suppresses the base device control (FCB selection).

The test mode is activated by a rising edge (0 → 1) at a safe digital input or via the safe process output data (F-PA).

The status of the test mode is signaled by the safe process data (process data bit: Test mode active) and in the "Assist CS.." parameterization tool and via the LED display.

23535652/EN – 12/2017

The test mode is automatically exited in the following cases:

- During parameterization of the safety card
- By opening the internal output F-DO_STO (e.g. error response, limit value violation, activation of drive safety function STO)
- 5 minutes after activation

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

Note that this startup design supports only the safe fieldbus profile "PROFIsafe".

9.5.1 Prerequisites

- The higher-level F-PLC must support the iPar CRC mechanism.
- For a successful startup, you need the "Assist CS.." parameterization tool. You can call up the "Assist CS.." parameterization tool directly in MOVISUITE® (version 1.2 or higher; download from www.sew-eurodrive.de).
- Additional requirements for using the MOVISAFE® CS..A with PROFIsafe fieldbus connection via PROFIBUS or PROFINET:
  - STEP7, optional "Distributed Safety" package version 5.4 and higher (for controllers from the Siemens company)
  - GSDML file (PROFINET, version 2.6 or higher). Download from www.sew-eurodrive.de.

9.5.2 Setting the PROFIsafe address

The PROFIsafe address is set with the "Assist CS.." parameterization tool.

9.6 Operating states

The MOVISAFE® CS..A safety card distinguishes between the following operating states:

- Operation
- Parameter setting
- Safe state after critical error

9.6.1 Operating state “Operation”

In the "Operation" operating state, the selected drive safety functions are executed in accordance with the parameterization (see chapter "Drive safety functions"). The drive safety functions are selected either via the safe digital inputs or the F-process data. The external, safe digital outputs can be controlled directly via the F-process data if no function has been assigned to the safe digital outputs in the function assignment.

9.6.2 Operating state “Parameterization”

In the "Parameterization" operating state, the MOVISAFE® CS..A safety card is in the safe state. The MOVISAFE® CS..A can be parameterized in this state. If an error occurs during the parameterization, e.g., a violation of a plausibility rule, MOVISAFE® CS..A remains in the "Parameterization" state.

23535652/EN – 12/2017

9.6.3 Operating state “Safe state” after critical fault

No F-process data communication occurs in the "Safe state" operating state. All safe digital inputs and outputs are disconnected from power. The "Safe state" operating state can be resolved only by deactivation and reactivation.

9.7 Safety-relevant acceptance

⚠ DANGER

The proper functioning of the drive safety functions is not guaranteed without a safety-relevant acceptance.

Severe or fatal injuries.

- Verify every single drive safety function.

To ensure the correctly parameterized drive safety functions, you must perform verification and documentation of the parameters once startup and parameterization have been completed. This is supported by the Assist CS.. tool, integrated in MOVISUITE®, in the form of an acceptance protocol.

The safety concept relies on the following basic assumptions. Parameters stored in the flash memory of the safety card cannot change automatically. Online tests and corresponding signatures ensure this by implementing basic measures on the module. However, the configuration cannot be evaluated by the subassembly. This affects the parameterization of the safe inputs and outputs and the limit values of the drive safety functions. The verification occurs with the acceptance report.

For unused drive safety functions, it is sufficient to verify whether the release is parameterized to "No".

9.7.1 Sequence

After a successful startup, you must confirm that the data of the acceptance report matches the parameters on the safety card. You must identify and protocol the values parameterized for the user units, sensors and monitoring functions individually by performing a function test. All limit values of the safety card must be verified by exceeding each limit value and then triggering the defined state (safe state = STO + brake de-energized). You may must take this into account in the machine and system controls.

9.7.2 Creating an acceptance report

With the Assist CS.. tool integrated in MOVISUITE®, you can generate an individual acceptance report and save it as a PDF. Before creating the report, enter the system-specific data in the Assist CS.. form. The system-specific data is transferred to the PDF file.

9.7.3 Structure of the acceptance report

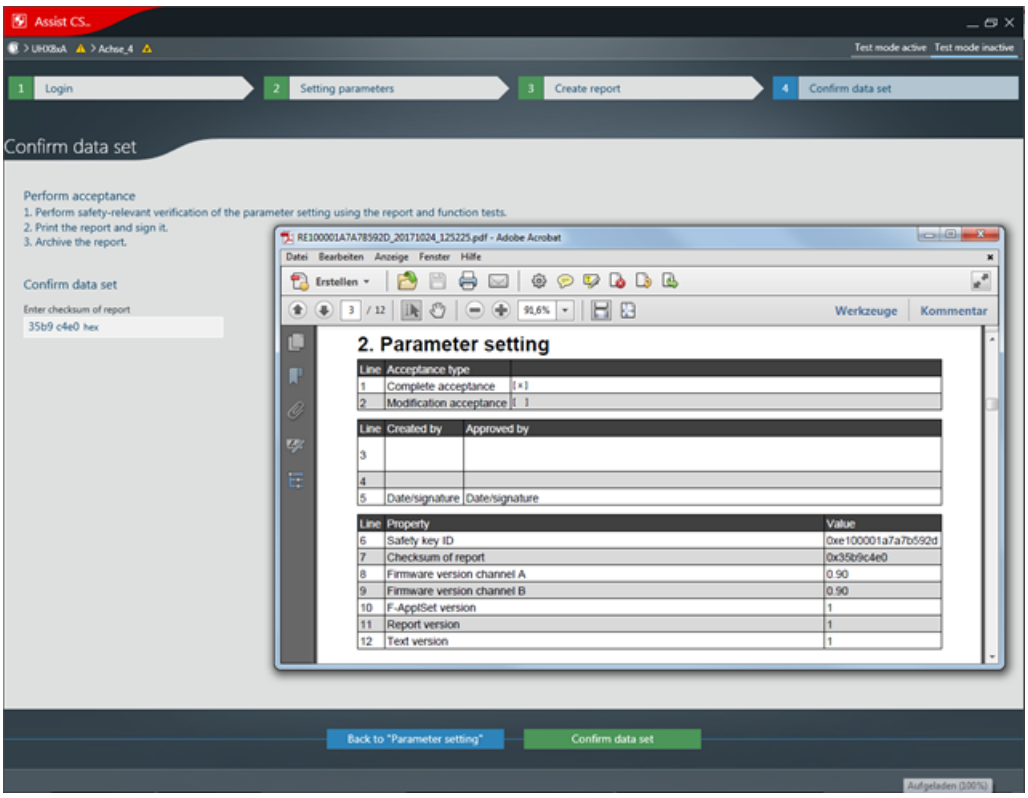
The acceptance report that is generated as a PDF file contains the following information:

- System information
- Parameters of the safety card
- Overview of checksums
- Communication data

23535652/EN – 12/2017

9.7.4 Confirming acceptance

The status of the safety card must be confirmed after completion of the safety technology verification. To confirm the data set, enter the checksum of the report in Assist CS..



21877787147

10 Data exchange with higher-level controller

10.1 Introduction

MOVIDRIVE® devices with integrated safety card support parallel operation of standard and safe communication via a bus system or network. The safe PROFIsafe communication can be carried out via PROFINET IO. To do so, the MOVI-C® CONTROLLER to which the MOVIDRIVE® modular/system with integrated safety card are connected must be connected to a failsafe controller (F-host) via PROFINET IO.

To control failsafe functions and for evaluation of the responses from the safety card via PROFIsafe, the assignment of the individual bits within the F-process input/output data must be taken into account.

10.1.1 Number of safety cards on the MOVI-C® CONTROLLER

Depending on the device design of the MOVI-C® CONTROLLER, the safe PROFIsafe communication can be routed to many different devices of the MOVIDRIVE® modular/system series with the integrated safety card.

The MOVI-C® CONTROLLERS UHX25A-N/UHX45A-N support 8 safety cards.

The MOVI-C® CONTROLLERs UHX84A-R/UHX85A-R support up to 24 safety cards, depending on the device firmware. You can read out the device firmware of the MOVI-C® CONTROLLER UHX84A-R/UHX85A-R in MOVISUITE® in the "Device data" > "Main components" > "System package" section.

- Firmware V2.0 Release 201703xxxx (March 2017) and older supports up to 8 safety cards. The non-safe process data can be configured starting at slot 9.

  For the MOVI-C® CONTROLLER UHX84-R/UHX85-R, the object "UHX84-R/UHX85-R V2.0" in the hardware catalog of the TIA portal must be used.
- Firmware V2.x or V3.0 Release 201707xxxx (July 2017) and later support 24 safety cards. The non-safe process data can be configured starting at slot 25.

  For this version, the object "UHX84-R/UHX85-R V3.0" in the hardware catalog of the TIA portal must be used.

10.2 F-periphery access of the safety card in the TIA portal

For safe communication, the CSB..A safety cards need a total of 8 bytes for input data and 7 bytes for output data for the PROFIsafe telegram part and occupies them in the process image. Of these, 4 bytes of input data and 3 bytes of output data are the actual safe I/O data (F-reference data).

For safe communication, the CSS..A safety cards need a total of 10 bytes for input data and 9 bytes for output data for the PROFIsafe telegram part and occupies them in the process image. Of these, 6 bytes of input data and 5 bytes of output data are the actual safe I/O data (F-reference data).

The remaining 4 bytes are required for the telegram backup according to the PROFIsafe specification.

23535652/EN – 12/2017

10.2.1 F-periphery-data component of the safety card

During translation in the configuration tool (HW Config), the system automatically generates an F periphery data component (DB) for each safety card. The F periphery DB offers the user an interface in which he or she 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 safety card:

	Address	Symbolic name (Variable)	Data type	Function	Presetting
Variables that the user can control.	DBX0.0	"F00008_198" (PASS_ON)	BOOL	1: Activate passivation	0
	DBX0.1	"F00008_198" (ACK_NEC)	BOOL	1: Acknowledgment required for reintegration with safety card	1
	DBX0.2	"F00008_198" (ACK_REI)	BOOL	1: Acknowledgment for reintegration	0
	DBX0.3	"F00008_198" (IPAR_EN)	BOOL	Variable for reparameterization (not supported by the safety card).	0
Variables that the user can evaluate.	DBX2.0	"F00008_198" (PASS-OUT)	BOOL	Run passivation	1
	DBX2.1	"F00008_198" (QBAD)	BOOL	1: Substitute values are output	1
	DBX2.2	"F00008_198" (ACK_REQ)	BOOL	1: Acknowledgment required for reintegration	0
	DBX2.3	"F00008_198" (IPAR_OK)	BOOL	Variable for reparameterization (not supported by the safety card).	0
	DBB3	"F00008_198" (DIAG)	BYTE	Service information	-

PASS_ON

With the PASS_ON variable, you can activate a passivation of the safety card. Passivation of the F periphery takes place, Provided that PASS_ON = "1".

23535652/EN – 12/2017

ACK_NEC

After resolving an error, the safety card is reintegrated depending on the setting of the variable ACK_NEC.

- ACK_NEC = 0: Automatic reintegration occurs.
- ACK_NEC = 1: Automatic reintegration occurs following acknowledgment by the user.

⚠ WARNING

Disallowed parameterization of the variable *ACK_NEC = 0*.

Severe or fatal injuries

- The parameterization of the variable *ACK_NEC = 0* is permitted only if automatic reintegration is safe for the process in question.
- Check if automatic reintegration is permitted for the process in question.

ACK_REI

In order to reintegrate the safety card after the fault has been corrected, user acknowledgment with positive edge at the variable *ACK_REI* is required. Acknowledgment is possible only if variable *ACK_REQ = 1.*

ACK_REQ

The F control system sets *ACK_REQ = 1* after all faults in the data exchange with the safety card have been corrected. After successful acknowledgment, the F control system sets *ACK_REQ = 0.*

PASS_OUT

The variable *PASS_OUT* indicates whether there is a passivation of the safety card. Substitute values are output.

QBAD

Error in the data exchange with the safety card. 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.

23535652/EN – 12/2017

10.3 F process output data

10.3.1 CSB21A profile variant “Technology Bus STO”

Byte	Bit	Name	Value	Description
0	0	STO1	0	The STO drive safety function is selected.
			1	The STO drive safety function is not selected.
	1	Reserve		
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Acknow-ledge F-DI	0	No acknowledgment. Edge 0 → 1: Acknowledgment of the locked digital inputs.
			1	Acknowledgment has been requested (re-acknow-ledgment by edge 0 → 1).
	7	Acknow-ledgment error	0	No acknowledgment. Edge 0 → 1: Acknowledgment of the pending errors.
			1	Acknowledgment has been requested (re-acknow-ledgment by edge 0 → 1).
1	0	F-DO00	0	Output F-DO00 is not selected. The safety-related output is open.
			1	Output F-DO00 is selected. The safety-related output is closed.
	1	F-DO01	0	Output F-DO01 is not selected. The safety-related output is open.
			1	Output F-DO01 is selected. The safety-related output is closed.
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
2	0	Reserve		
	1	Reserve		
	2	SSX1	0	The SSx1 drive safety function is selected.
			1	The SSx1 drive safety function is not selected.
	3	SSX2	0	The SSx2 drive safety function is selected.
			1	The SSx2 drive safety function is not selected.
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

10.3.2 CSB31A profile variant “Technology Bus F-DO”

Byte	Bit	Name	Value	Description
0	0	STO1	0	The STO drive safety function is selected.
			1	The STO drive safety function is not selected.
	1	Reserve		
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Acknowledge F-DI	0	No acknowledgment. Edge 0 → 1: Acknowledgment of the locked digital inputs.
			1	Acknowledgment has been requested (re-acknowledgment by edge 0 → 1).
	7	Acknowledgment error	0	No acknowledgment. Edge 0 → 1: Acknowledgment of the pending errors.
			1	Acknowledgment has been requested (re-acknowledgment by edge 0 → 1).

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
1	0	F-DO00	0	Output F-DO00 is not selected. The safety-related output is open.
			1	Output F-DO00 is selected. The safety-related output is closed.
	1	F-DO01	0	Output F-DO01 is not selected. The safety-related output is open.
			1	Output F-DO01 is selected. The safety-related output is closed.
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		
2	0	Reserve		
	1	Reserve		
	2	SSX1	0	The SSx1 drive safety function is selected.
			1	The SSx1 drive safety function is not selected.
	3	SSX2	0	The SSx2 drive safety function is selected.
			1	The SSx2 drive safety function is not selected.
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

23535652/EN – 12/2017

10.3.3 CSS21A/CSS31A profile variant “Technology Standard”

Byte	Bit	Name	Value	Description
0	0	STO1	0	The STO drive safety function is selected.
			1	The STO drive safety function is not selected.
	1	SLI enable	0	Blockage of step motion.
			1	Release of a step. In the case of edge 0 → 1, the current position value is saved as a reference.
	2	SBT Clearance	0	Brake test selection blocked.
			1	Brake test selection possible.
	3	Reserve		
	4	Muting Enc-Err	0	Encoder muting not selected.
			1	Encoder muting selected.
	5	Inverter control muting	0	Test mode for drive safety functions is not selected.
			1	Test mode for drive safety functions is selected.
	6	Acknowledge F-DI	0	No acknowledgment. Edge 0 → 1: Acknowledgment of the locked digital inputs.
			1	Acknowledgment has been requested (re-acknowledgment by edge 0 → 1).
	7	Acknowledgment error	0	No acknowledgment. Edge 0 → 1: Acknowledgment of the pending errors.
			1	Acknowledgment has been requested (re-acknowledgment by edge 0 → 1).
1	0	F-DO00	0	Output F-DO00 is not selected. The safety-related output is open.
			1	Output F-DO00 is selected. The safety-related output is closed.
	1	F-DO01	0	Output F-DO01 is not selected. The safety-related output is open.
			1	Output F-DO01 is selected. The safety-related output is closed.
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
2	0	SOS1	0	The SOS drive safety function is selected.
			1	The SOS drive safety function is not selected.
	1	Reserve		
	2	SSX1	0	The SSx1 drive safety function is selected.
			1	The SSx1 drive safety function is not selected.
	3	SSX2	0	The SSx2 drive safety function is selected.
			1	The SSx2 drive safety function is not selected.
	4	SDI1	0	The SDI1 drive safety function is selected.
			1	The SDI1 drive safety function is not selected.
	5	SDI2	0	The SDI2 drive safety function is selected.
			1	The SDI2 drive safety function is not selected.
	6	SLI1	0	The SLI1 drive safety function is selected.
			1	The SLI1 drive safety function is not selected.
	7	SLI2	0	The SLI2 drive safety function is selected.
			1	The SLI2 drive safety function is not selected.
3	0	SLS1	0	The SLS1 drive safety function is selected.
			1	The SLS1 drive safety function is not selected.
	1	SLS2	0	The SLS2 drive safety function is selected.
			1	The SLS2 drive safety function is not selected.
	2	SLS3	0	The SLS3 drive safety function is selected.
			1	The SLS3 drive safety function is not selected.
	3	SLS4	0	The SLS4 drive safety function is selected.
			1	The SLS4 drive safety function is not selected.
	4	SSR1	0	The SSR1 drive safety function is selected.
			1	The SSR1 drive safety function is not selected.
	5	SSR2	0	The SSR2 drive safety function is selected.
			1	The SSR2 safety function is not selected.
	6	Reserve		
	7	Reserve		

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
4	0	SLA1	0	The SLA1 drive safety function is selected.
			1	The SLA1 drive safety function is not selected.
	1	SLA2	0	The SLA2 drive safety function is selected.
			1	The SLA2 drive safety function is not selected.
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

10.3.4 Substitute values

In the F-controller, all bits described as "Reserve" must be set to 0.

For drive safety functions that are unused, the bit must be set for the selection via the safe process output data (F-PA); otherwise, an error in the encoder system leads immediately to an encoder error.

10.4 F process input data

10.4.1 CSB21A profile variant “Technology Bus STO”

Byte	Bit	Name	Value	Description
0	0	STO1	0	The STO drive safety function is not active. The 24 V supply voltage is switched on, and safe disconnection for the connected drive is not effective or an error has occurred at the output.
			1	The STO drive safety function reports the status "STO active", and all outputs parameterized to STO are without voltage.
	1	Reserve		
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Warning	0	The drive safety option is in error-free operation.
			1	At least one warning is active in the safety card.
	7	Error state	0	The safety card is in error-free operation.
			1	At least one warning is active in the safety card.

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
1	0	F-DI00	0	Process value of digital safe digital input F-DI00, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI00, voltage is present.
	1	F-DI01	0	Process value of digital safe digital input F-DI01, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI01, voltage is present.
	2	F-DI02	0	Process value of digital safe digital input F-DI02, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI02, voltage is present.
	3	F-DI03	0	Process value of digital safe digital input F-DI03, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI03, voltage is present.
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		
2	0	Reserve		
	1	Reserve		
	2	SSx1	0	The SSx1 drive safety function is not active, or an error has occurred.
			1	The SSx1 drive safety function is active.
	3	SSx2	0	The SSx2 drive safety function is not active, or an error has occurred.
			1	The SSx2 drive safety function is active.
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		
3	0	Reserve		
	1	Reserve		
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

23535652/EN – 12/2017

10.4.2 CSB31A profile design "Technology Bus F-DO"

Byte	Bit	Name	Value	Description
0	0	STO1	0	The STO drive safety function is not active. The 24 V supply voltage is switched on, and safe disconnection for the connected drive is not effective or an error has occurred at the output.
			1	The STO drive safety function reports the status "STO active", and all outputs parameterized to STO are without voltage.
	1	Reserve		
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Warning	0	The safety card is in error-free operation.
			1	At least one warning is active in the safety card.
	7	Error state	0	The safety card is in error-free operation.
			1	At least one warning is active in the safety card.
1	0	F-DI00	0	Process value of digital safe digital input F-DI00, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI00, voltage is present.
	1	F-DI01	0	Process value of digital safe digital input F-DI01, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI01, voltage is present.
	2	F-DI02	0	Process value of digital safe digital input F-DI02, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI02, voltage is present.
	3	F-DI03	0	Process value of digital safe digital input F-DI03, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI03, voltage is present.
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
2	0	Reserve		
	1	Reserve		
	2	SSx1	0	The SSx1 drive safety function is not active, or an error has occurred.
			1	The SSx1 drive safety function is active.
	3	SSx2	0	The SSx2 drive safety function is not active, or an error has occurred.
			1	The SSx2 drive safety function is active.
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		
3	0	Reserve		
	1	Reserve		
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

23535652/EN – 12/2017

10.4.3 CSS21A/CSS31A profile variant “Technology Standard”

Byte	Bit	Name	Value	Description
0	0	STO1	0	The STO drive safety function is not active. The 24 V supply voltage is switched on, and safe disconnection for the connected drive is not effective or an error has occurred at the output.
			1	The STO drive safety function reports the status "STO active", and all outputs parameterized to STO are without voltage.
	1	Drive safety function diagnostics	0	No drive safety function has determined the exceeding of a limit value.
			1	At least one selected drive safety function has determined the exceeding of a limit value or cannot execute limit value monitoring as a consequential error.
	2	SBT Active	0	Brake test is not active.
			1	Brake test is active.
	3	Reserve		
	4	Muting Enc-Err	0	The encoder muting function is not active, or an error has occurred.
			1	The encoder muting function is active.
	5	Inverter control muting	0	Test mode for drive safety functions is not active
			1	Test mode for drive safety functions is active.
	6	Warning	0	The safety card is in error-free operation.
			1	At least one warning in the safety card is active.
	7	Error state	0	The safety card is in error-free operation.
			1	At least one error in the safety card is active.

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
1	0	F-DI00	0	Process value of digital, safe digital input F-DI00, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI00, voltage is present.
	1	F-DI01	0	Process value of digital, safe digital input F-DI01, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI01, voltage is present.
	2	F-DI02	0	Process value of digital, safe digital input F-DI02, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI02, voltage is present.
	3	F-DI03	0	Process value of digital, safe digital input F-DI03, no voltage or error is present.
			1	Process value of digital, safe digital input F-DI03, voltage is present.
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		
2	0	SOS1	0	The SOS1 drive safety function is not active, or an error has occurred.
			1	The SOS1 drive safety function is active.
	1	Reserve		
	2	SSx1	0	The SSx1 drive safety function is not active, or an error has occurred.
			1	The SSx1 drive safety function is active.
	3	SSx2	0	The SSx2 drive safety function is not active, or an error has occurred.
			1	The SSx2 drive safety function is active.
	4	SDI1	0	The SDI1 drive safety function is not active, or an error has occurred.
			1	The SDI1 drive safety function is active.
	5	SDI2	0	The SDI2 drive safety function is not active, or an error has occurred.
			1	The SDI2 drive safety function is active.
	6	SLI1	0	The SLI1 drive safety function is not active, or an error has occurred.
			1	The SLI1 drive safety function is active.
	7	SLI2	0	The SLI2 drive safety function is not active, or an error has occurred.
			1	The SLI2 drive safety function is active.

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
3	0	SLS1	0	The SLS1 drive safety function is not active, or an error has occurred.
			1	The SLS1 drive safety function is active.
	1	SLS2	0	The SLS2 drive safety function is not active, or an error has occurred.
			1	The SLS2 drive safety function is active.
	2	SLS3	0	The SLS3 drive safety function is not active, or an error has occurred.
			1	The SLS3 drive safety function is active.
	3	SLS4	0	The SLS4 drive safety function is not active, or an error has occurred.
			1	The SLS4 drive safety function is active.
	4	SSR1	0	The SSR1 drive safety function is not active, or an error has occurred.
			1	The SSR1 drive safety function is active.
	5	SSR2	0	The SSR2 drive safety function is not active, or an error has occurred.
			1	The SSR2 drive safety function is active.
	6	Reserve		
	7	Reserve		
4	0	SLA1	0	The SLA1 drive safety function is not active, or an error has occurred.
			1	The SLA1 drive safety function is active.
	1	SLA2	0	The SLA2 drive safety function is not active, or an error has occurred.
			1	The SLA2 drive safety function is active.
	2	SSM1	0	The SSM1 drive safety function is not active, or an error has occurred.
			1	The SSM1 drive safety function is active.
	3	SSM2	0	The SSM2 drive safety function is not active, or an error has occurred.
			1	The SSM2 drive safety function is active.
	4	SSM3	0	The SSM3 drive safety function is not active, or an error has occurred.
			1	The SSM3 drive safety function is active.
	5	SSM4	0	The SSM4 drive safety function is not active, or an error has occurred.
			1	The SSM4 drive safety function is active.
	6	Reserve		
	7	Reserve		

23535652/EN – 12/2017

Byte	Bit	Name	Value	Description
5	0	Reserve		
	1	Reserve		
	2	Reserve		
	3	Reserve		
	4	Reserve		
	5	Reserve		
	6	Reserve		
	7	Reserve		

10.4.4 Substitute values

For all outgoing process data (F-PE), the value "0" is written as the substitute value. The *Error State* is excluded from this. For the *Error State*, the value "1" is written as the substitute value in the case of an error-free protocol. In the case of a faulty FS-protocol, the value "0" is written for *Error State*.

10.5 Acknowledgment of safety card

10.5.1 Acknowledgment of PROFIsafe data exchange

The PROFIsafe communication must be error-free for safe data exchange of the safety card via PROFIsafe. As soon as there is an acknowledgment request of the safety card via the *ACK_OK* bit in the F-periphery data component, the user must trigger an acknowledgment by a rising edge via the *ACK_REI* bit.

10.5.2 Acknowledgment of safety card

As soon as the safe data exchange of the safety card via PROFIsafe is error-free, errors in the safety card can be acknowledged by a rising edge via the *Error acknowledgment* bit in the F-process output data.

23535652/EN – 12/2017

11 Response times

The response time plays a decisive role in the design and execution of drive safety functions in systems and machines. In order to match the response time to the requirements of a drive safety function, always take the entire system into account, from the sensor (or command device) to the actuator. The following times are of particular importance in connection with the MOVISAFE® CS..A safety card:

- Response time 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 the MOVISAFE® CS..A safety card
- Response time of the actuators (e.g. frequency inverters)

Establish the response sequence for each drive safety function in your application and determine the maximum response time for each case, taking into account the relevant manufacturer data. Observe in particular the information contained in the safety documentation of the safety controller used.

Details of the maximum response time of the MOVISAFE® CS..A safety card can be found in the chapter "Technical data". For detailed information regarding response time consideration for safe PROFIsafe communication, refer to the respective standard: IEC 61784-3-3.

11.1 Calculation of response times

The following response times are fixed:

- $T_{\_Sys}$ = 4 ms (cycle time of the system)
- $T_{\_Task}$ = 0.5 ms (cycle time of a process)
- Maximum fault response time $T_{\_FRZ}$ = 9 ms applies for the deactivation of the internal output F-DO_STO and the external safe digital outputs F-DO, as well as for setting the error status of the safe process input data (F-PE).
- The response times of the safety cards in relation to the safe digital outputs (F-DO) apply for ohmic loads ≤30 kΩ.

23535652/EN – 12/2017

11.1.1 Encoder

All response times must be multiplied by the factor 1.002.

Calculation factor (formula symbol)	Calculation specification response time
sine/cosine encoder: • Processing time encoder positioning ($T_{\_ENC\_POS}$)	$T_{\_Sys} + T_{\_Task}$
• Processing time encoder speed ($T_{\_ENC\_VEL}$)	Filter time speed (8708.3) + $T_{\_Task} + T_{\_Sys}$
• Processing time encoder acceleration ($T_{\_ENC\_ACC}$)	Filter time acceleration (8708.2) + 2 × $T_{\_Task} + T_{\_Sys}$
EI7C built-in encoder: • Processing time encoder speed ($T_{\_ENC\_VEL}$)	Filter time speed (8708.4) + $1/n_{\_Actual} + T_{\_Task} + T_{\_Sys}$
Response time encoder error: • Deactivation F-DO_STO/ F-DOx • Setting error status F-PE	 8 ms 12 ms

11.1.2 Safe digital input F-DI

All response times must be multiplied by the factor 1.002.

Calculation factor (formula symbol)	Calculation specification response time
Input processing time with selection F-DI ($T_{\_InputProcessing\_F\text{-}DI}$)	Input filter time (8704.2) + 2 ms + $T_{\_Sys}$ + 350 µs
Input processing with deselection F-DI: ($T_{\_InputProcessing\_F\text{-}DI\_Deselection}$) • Single-channel • Dual-channel	 Input filter time (8704.2) + 51 ms + $T_{\_Sys}$ + 350 µs Input filter time (8704.2) + 2 ms + $T_{\_Sys}$ + 350 µs
Response time of line diagnostics	30 ms (the response times of the drive safety functions are not taken into account)

23535652/EN – 12/2017

11.1.3 Safe communication

The response times for the safe communication always relate to the safe protocol and not to the external interface of the safety card. All response times must be multiplied by the factor 1.002.

Calculation factor (formula symbol)	Calculation specification response time
Input processing time via safe process output data ($T_{\_InputProcessing\_F\text{-}PA}$)	$2 \times T_{\_Task} + T_{\_Sys}$
Response time selection (F-DIx after F-PE)	$T_{\_InputProcessing\_F\text{-}DIx} + T_{Sys}$
Response time (F-PA after F-DOx)	$T_{\_InputProcessing\_F\text{-}PA} + T_{Sys}$

11.1.4 Selection of a drive safety function via a safe digital input in independent operation

All response times must be multiplied by the factor 1.002.

Calculation factor	Calculation specification response time
STO	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + brake application time[1] (8706.15)
SOS	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$
SS1(b)	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SS2(b)	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + Actual_speed/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SS1(c)	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + SSx(c) delay t1 (8706.8) + brake application time[1] (8706.15)
SS2(c)	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + SSx(c) delay t1 (8706.8)
SSx(b) with SLI	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + Actual_speed/ SSx(b)delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SSx(c) with SLI	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + SSx(c) delay t1 (8706.8)
SLS	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + monitoring delay t_2 (8706.23) + (Maximum speed - limit speed (8706.24))/delay a (8706.27) + SSx(x) jerk time[2] t_3 (8706.28)
SSR	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + monitoring delay t2 (8706.53)
SDI	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$
SLI	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$
SLA	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$

1) If SBC release (8706.14) = no, then the brake application time = 0

2) With ramp monitoring = linear, the jerk time = 0

11.1.5 Selection of a drive safety function via safe communication

The response times for the safe communication always relate to the safe protocol and not to the external interface of the safety card. All response times must be multiplied by the factor 1.002.

Calculation factor	Calculation specification response time
STO: • Via F-PA	$T_{\_InputProcessing\_F\text{-}PA} + 2 \times T_{\_Sys}$ + brake application time[1] (8706.15)

Calculation factor	Calculation specification response time
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + 2 × $T_{\_Sys}$ + brake application time[1] (8706.15)
SOS:	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA}$ + $T_{\_Sys}$
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + $T_{\_Sys}$
SS1(b):	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA}$+ 2 × $T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + 2 × $T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SS2(b):	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA}$ + $T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + $T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SS1(c):	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA}$ + 2 × $T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time[1] (8706.15)
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + 2 × $T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time[1] (8706.15)
SS2(c):	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA}$ + $T_{\_Sys}$ + SSx(c) delay t_1 (8706.8)
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + $T_{\_Sys}$ + SSx(c) delay t_1 (8706.8)
SSx(b):	
• With end state SLI via F-PA	$T_{\_InputProcessing\_F\text{-}PA}$+ 2 × $T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• With end state SLI via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + 2 × $T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SSx(c):	
• With end state SLI via F-PA	$T_{\_InputProcessing\_F\text{-}PA}$ + 2 × $T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time[1] (8706.15)
• With end state SLI via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + 2 × $T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time[1] (8706.15)
SLS:	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA}$ + $T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.23) + (maximum speed - speed limit (8706.24))/SSx(b) delay a (8706.27) + SSx(x) jerk time[2] t_3 (8706.28)
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI}$ + $T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.23) + (maximum speed - speed limit (8706.24))/SSx(b) delay a (8706.27) + SSx(x) jerk time[2] t_3 (8706.28)

23535652/EN – 12/2017

Calculation factor	Calculation specification response time
SSM	$T_{\_InputProcessing\_F\text{-}PA} + T_{\_Sys}$
SSR:	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA} + T_{\_Sys}$ + monitoring delay t_2 (8706.53)
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$ + monitoring delay t_2 (8706.53)
SDI:	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA} + T_{\_Sys}$
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$
SLI:	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA} + T_{\_Sys}$
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$
SLA:	
• Via F-PA	$T_{\_InputProcessing\_F\text{-}PA} + T_{\_Sys}$
• Via F-DI	$T_{\_InputProcessing\_F\text{-}DI} + T_{\_Sys}$

1) If SBC-release (8706.4) = no, then the brake application time = 0

23535652/EN – 12/2017

11.1.6 Response time in case of limit value violation in independent operation

All response times must be multiplied by the factor 1.002.

Calculation factor	Calculation specification response time
SOS	$T_{\_ENC\_POS} + T_{\_Sys}$
SSx(b)	$T_{\_ENC\_VEL} + T_{\_Sys}$
SLS with parameterized error response:	
• STO	$T_{\_ENC\_VEL} + T_{\_Sys}$
• SS1(c)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time [1] (8706.15)
• SS2(c)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8)
• SS1(b)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) +Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• SS2(b)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SSM	$T_{\_ENC\_VEL} + T_{\_Sys}$
SSR with parameterized error response:	
• STO	$T_{\_ENC\_VEL} + T_{\_Sys}$
• SS1(c)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time[1] (8706.15)
• SS2(c)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8)
• SS1(b)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) +Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• SS2(b)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SDI	$T_{\_ENC\_POS} + T_{\_Sys}$
SLI	$T_{\_ENC\_VEL} + T_{\_Sys}$
SLA with parameterized error response:	
• STO	$T_{\_ENC\_ACC} + T_{\_Sys}$
• SS1(c)	$T_{\_ENC\_ACC} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time[1] (8706.15)
• SS2(c)	$T_{\_ENC\_ACC} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8)
• SS1(b)	$T_{\_ENC\_ACC} + T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• SS2(b)	$T_{\_ENC\_ACC} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)

1) If SBC-release (8706.14) = no, then the brake application time = 0

2) With ramp monitoring = linear, the jerk time = 0

23535652/EN – 12/2017

11.1.7 Response time in case of limit value violation with safe communication

The response times for the safe communication always relate to the safe protocol and not to the external interface of the safety card. All response times must be multiplied by the factor 1.002.

Calculation factor	Calculation specification response time
SOS	$T_{\_ENC\_POS} + 2 \times T_{\_Sys}$
SSx(b)	$T_{\_ENC\_VEL} + 2 \times T_{\_Sys}$
SLS with parameterized error response:	
• STO	$T_{\_ENC\_VEL} + 2 \times T_{\_Sys}$
• SS1(c)	$T_{\_ENC\_VEL} + 2 \times T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time [1] (8706.15)
• SS2(c)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8)
• SS1(b)	$T_{\_ENC\_VEL} + 2 \times T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) +Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] (8706.11)
• SS2(b)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
SSM	$T_{\_ENC\_VEL} + T_{\_Sys}$
SSR with parameterized error response:	
• STO	$T_{\_ENC\_VEL} + 2 \times T_{\_Sys}$
• SS1(c)	$T_{\_ENC\_VEL} + 2 \times T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time[1] (8706.15)
• SS2(c)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8)
• SS1(b)	$T_{\_ENC\_VEL} + 2 \times T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) +Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• SS2(b)	$T_{\_ENC\_VEL} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• F-PE	$T_{\_ENC\_VEL} + T_{\_Sys}$
SDI	$T_{\_ENC\_POS} + 2 \times T_{\_Sys}$
SLI	$T_{\_ENC\_VEL} + 2 \times T_{\_Sys}$
SLA with parameterized error response:	
• STO	$T_{\_ENC\_ACC} + 2 \times T_{\_Sys}$
• SS1(c)	$T_{\_ENC\_ACC} + 2 \times T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + brake application time[1] (8706.15)
• SS2(c)	$T_{\_ENC\_ACC} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8)
• SS1(b)	$T_{\_ENC\_ACC} + 2 \times T_{\_Sys}$ + SSx(b) monitoring delay t_2 (8706.9) + brake application time[1] (8706.15) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)
• SS2(b)	$T_{\_ENC\_ACC} + T_{\_Sys}$ + SSx(c) delay t_1 (8706.8) + Actual_speed (8700.79)/SSx(b) delay a (8706.10) + SSx(x) jerk time[2] t_3 (8706.11)

Calculation factor	Calculation specification response time
• F-PE	$T_{\_ENC\_ACC} + T_{\_Sys}$

1) If SBC-release (8706.14) = no, then the brake application time = 0
2) With ramp monitoring = linear, the jerk time = 0

11.1.8 Deselection of a drive safety function via a safe digital input

All response times must be multiplied by the factor 1.002.

Calculation factor (formula symbol)	Calculation specification response time
Response time ($T_{\_InputProcessing\_F\text{-}DI\_Deselection}$)	$T_{\_InputProcessing\_F\text{-}DI\_Deselection}$ + 16 ms

11.1.9 Deselection of a drive safety function via safe communication

The response times for the safe communication always relate to the safe protocol and not to the external interface of the safety card. All response times must be multiplied by the factor 1.002.

Calculation factor (formula symbol)	Calculation specification response time
Response time ($T_{\_InputProcessing\_F\text{-}DI\_Deselection}$)	$T_{\_InputProcessing\_F\text{-}PA}$ + 16 ms

23535652/EN – 12/2017

12 Service

12.1 Modification/changes to the device

- Hardware changes

  Any changes to the CS..A safety card can be performed only by SEW-EURODRIVE.
- Firmware modifications

  Only SEW-EURODRIVE is authorized to make changes to the firmware.
- Repair

  Only SEW-EURODRIVE is authorized to repair the CS..A safety card.
- Warranty

INFORMATION

The safety certification and any right to claim under limited warranty of SEW-EURODRIVEbecome void if the user modifies the device internally (e.g. exchange of components, welding parts).

12.2 Waste disposal

Observe the applicable national regulations. Dispose of materials separately in accordance with the nature of the materials and the regulations in force, for example:

- Electronics scrap (circuit boards)
- Plastics
- Sheet metal
- Copper
- Aluminum

12.3 Status LEDs

⚠ WARNING

Danger due to incorrect interpretation of the LEDs "F-RUN" and "F-ERR"

Severe or fatal injuries

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

INFORMATION

- "Slow" blinking frequency means that the LED is blinking at 1 Hz.
- "Fast" blinking frequency means that the LED is blinking at 2Hz.

23535652/EN – 12/2017

12.3.1 "F-RUN" LED

The following table shows the states of the "F-RUN" LED.

LED status	Meaning
Red, slowly flashing	Device identification for parameterization.
Red, rapidly flashing	Firmware update, do not switch the device off.
Green, rapidly flashing	• Device booting up/initializing • Device in parameterization state
Red	• STO drive safety function is active • Critical error (cannot be acknowledged)
Green, rapidly flashing	• Device in the operating state with one or more of the following constraints: – The assembly controls inverters – Test mode
Green, slowly flashing	Acceptance of the assembly has not yet taken place.
Off	Device off.

12.3.2 "F-ERR" LED

The following table shows the states of the "F-ERR" LED.

LED status	Priority	Meaning
Red	1	Critical error, cannot be acknowledged
Yellow, rapidly flashing	2	Encoder fault muting
Red, slowly flashing	3	• Error can be acknowledged • Error outside of the device, cabling system error • Reaction to limit value overshoot active
Yellow	4	Warning: • Error connection basic device • Firmware update, do not switch the device off.
Green, slowly flashing	5	Error in the operating state "Parameterization": • Error in the parameterization • No parameterization exists • Current parameter set not consistent with the plug-gable CRC memory • Inconsistent parameterization
Green	6	Error-free operation.

23535652/EN – 12/2017

12.4 Error states of the MOVISAFE® CS..A safety card

⚠ DANGER

The MOVISAFE® CS..A safety card has an error and automatically restarts in the following cases:

- The DC-24-V supply voltage was switched off and back on.
- The safety card was in the standby state.
- Several inverter errors were acknowledged.

Result: Severe or fatal injuries

- To prevent the automatic restart in the aforementioned cases, the parameter *Error status after start-up* (8703.240) must be parameterized to "System error". The system error must be acknowledged.

12.4.1 Error classes

The occurring safety card errors are divided into 5 different error classes. Depending on the error class, the response described in the following table is carried out.

Error class	Response
Message.	Entry in fault memory, no further response.
Warning.	Entry in fault memory, no further response.
Output error, input error, encoder error.	Entry in fault memory and safe state of digital inputs and outputs as applicable.
System error.	Entry in fault memory and safe state of digital inputs and outputs.
Critical error.	Entry in fault memory and safe state of digital inputs and outputs. No safe communication.

Message

No error response is carried out in the case of a message. An entry is made in the fault memory. In addition, the corresponding error code is transferred.

Warning

No error response is carried out in the case of a warning. An entry is made in the fault memory. In addition, the corresponding error code is transferred.

A warning is information, e.g. about an error in the encoder system, which has no effect with regard to safety technology at the time of occurrence, but which can represent an error at a later time.

Output error, input error, encoder error

Output error

If the safety card detects an error at a safe digital output, all safe digital outputs are switched to the safe state. In addition, the drive safety function STO is activated and the safety card is set to the safe state. In the FS protocol, the bits of the outputs F-DO0 and F-DO1 are set to "0" and the bits for the drive safety function STO and the error are set to "1".

In addition, the corresponding error code is transferred for the output error that occurred.

Input error

If the safety card detects an error at a safe digital input, the affected safe digital inputs is switched to the safe state. If the affected safe digital input is parameterized as dual-channel, both inputs are switched to the safe state. In the FS-protocol, the bits of the affected safe digital inputs are set to "0" and the error bit is set to "1".

In addition, the corresponding error code is transferred for the input error that occurred.

INFORMATION

If a safe digital input is assigned to a drive safety function via the function assignment, then this drive safety function is selected in the event of an input error.

At a safe digital input with detected error, the error must first be resolved and the safe state established before an acknowledgment of the input error. In this way, a drive safety function is not erroneously selected after acknowledgment of an input error.

Encoder error

If the safety card detects an error in the encoder system, this leads to a warning in the absence of an activated drive safety function. The safety card continues to remain operationally ready. If at least one drive safety function is active, this leads to an encoder error. In addition, all active instances of the drive safety functions assume an error state. If the drive safety function SSM is parameterized, this always leads to an encoder error. In addition, the corresponding error code is transferred for the encoder error that occurred.

The acknowledgment of the encoder error with activated drive safety function leads to a restart of the drive safety function with the following changes:

- SOS: The limit positions are recalculated.
- SDI: The limit position is recalculated.
- SLI: System error.
- SLS: The monitoring delay and the transition ramp are recalculated.
- SSx: The monitoring delay and the delay are recalculated.
- SSR: The monitoring delay restarts.

INFORMATION

The acknowledgment of a limit value violation leads to a different behavior of the activated drive safety function than the acknowledgment of an encoder error.

The response to an encoder error can be suppressed with the "Encoder error muting" function. The "Encoder error muting" function can be activated at a safe digital input or via the safe process data. Refer to the "Encoder error muting" chapter for more information.

System error

In the case of a system error, all safe digital inputs and all safe digital outputs are switched to the safe state. In addition, the drive safety function STO is executed without delay and the outputs F-DO0 and F-DO1 are deactivated. The safety card is set to the safe state.

In the FS protocol, the bits of the safe digital outputs F-DO0 and F-DO1 and inputs F-DI00, F-DI01, F-DI02 and F-DI03 are set to "0" and the bits for the drive safety function STO and the error are set to "1".

In addition, the corresponding error code is transferred for the system error that occurred.

23535652/EN – 12/2017

INFORMATION

If the safe digital output is assigned to a drive safety function via the function assignment, this drive safety function is selected in the case of a system error.

Critical error

In the case of a critical error, the safety card is set to the safe state. All safe digital inputs and all safe digital outputs are switched to the safe state. In addition, the drive safety function STO is executed without delay. The sensor supply for the safe digital inputs is also switched to the deenergized state. Active safe communication is suspended.

In addition, the corresponding error code is transferred for the critical error that occurred.

Error messages

If there is an error in the safety card, the inverter indicates that the safety card is reporting an error.

Measures for error resolution and more information on causes can be found via the error status of the safety card.

12.5 Error diagnostics

The error status "Current first error" indicates the first error of the safety card that occurred, along with the associated error code, sub-error code and the error description. For internal purposes, additional error codes are displayed.

The current first error is the error that occurs after a restart or since the last acknowledgment as the first error with the highest priority.

23535652/EN – 12/2017

12.5.1 Error messages

If there is an error in the safety card, this error is indicated by the inverter as follows.

Subfault: 46.50 **Description: Warning**		
	Response: Warning with self-reset	
	Cause	Measure
	- Safety card reports a subcomponent error of the "Warning" type.	See error status "Subcomponent safety card"

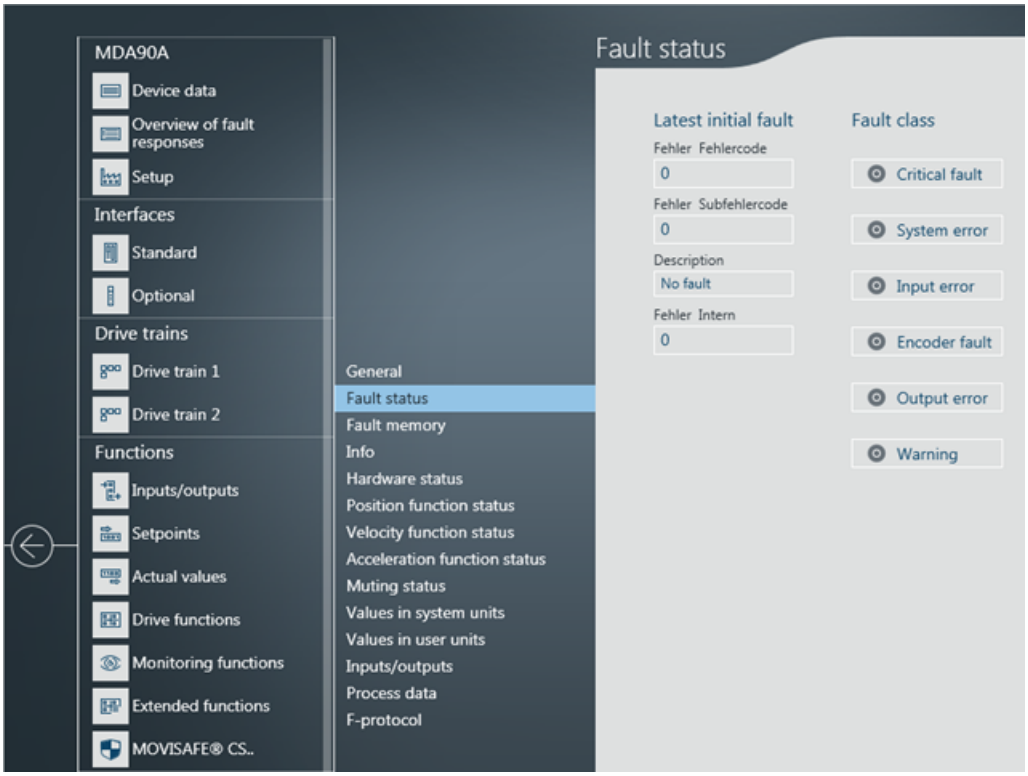
Subfault: 46.51 **Description: Error**		
	Response: Emergency stop and output stage inhibit with self-reset	
	Cause	Measure
	The safety option signals a subcomponent error of the "Standard error" type.	See error status "Subcomponent safety card"

Subfault: 46.52 **Description: Critical error**		
	Response: Output stage inhibit with self-reset	
	Cause	Measure
	- Safety card reports a subcomponent error of the type "Critical error" type.	See error status "Subcomponent safety card"

23535652/EN – 12/2017

12.5.2 Diagnostics with MOVISUITE® Assist CS..

The current error of the safety card is displayed with the corresponding error description in the "Diagnostics" segment in the menu command [MOVISAFE® CS..] > [Error status].



21877778571

12.5.3 Diagnostics with PROFIsafe connection

The CS..A safety card with PROFIsafe connection triggers a diagnostic alarm at the F-host in the data exchange between the F-host (fieldbus master) and the safety card (fieldbus slave) in the case of an error. Simultaneously, the associated error code is transferred via the communication connection.

The F-host responds to the dispatched diagnostic alarm if the *Diagnostic alarm assembly parameter* is enabled for the safety card in the F-host per configuration. Depending on the fieldbus used (PROFIBUS DP or PROFINET IO), the error code of the safety card can be evaluated in the F-host. A diagnostic alarm does not trigger an error response in the F-host (default setting of the safety card in the F-host).

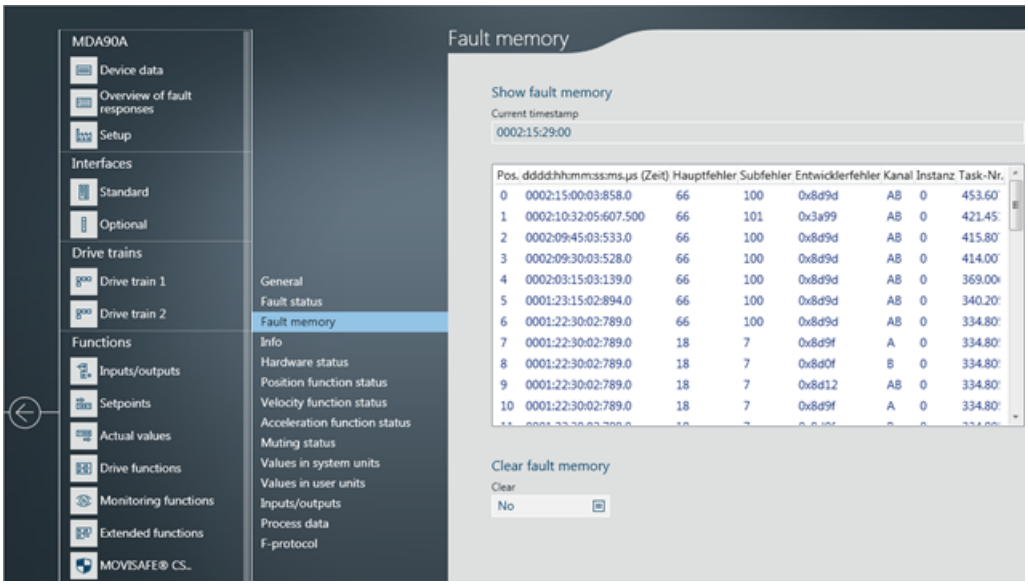
The safety card has PROFIsafe and assembly-specific error codes. All error codes of the CS..A safety card are listed in an error table.

INFORMATION

You can find the structure and the evaluation of a diagnostic data set in the F-host in the respective manual of the fieldbus master. In addition, ensure that the current device description file of the SEW_EURODRIVE drive system is always installed in the engineering tool of the F-host during configuration.

12.5.4 Fault memory

The current first error and all other subsequent errors are residually saved in the fault memory with associated timestamp. Direct subsequent errors that still occur before error acknowledgment or a DC-24-V reset will then generate an additional entry only if they have not yet been entered in the fault memory by the time of occurrence. The errors that arise are compared in their primary and sub-errors as a differentiating criterion.



21877805963

Additional messages for the errors are entered in the fault memory in the columns "Primary error" and "Sub-error". These are messages that do not directly trigger an error response of the CS..A safety card. Essentially, these are the message "Power On" (primary error 66 and sub-error 100) and the message "Acknowledgment message" (primary error 66 and sub-error 101).

The actual value of the operating hours counter of the safety card is displayed in the "Time" column. The "Developer error," "Channel," "Instance" and "Task No." columns are used for internal purposes. The fault memory is organized as a ring memory. The most recently occurring error is shown in line 0 of the list. If there are more than 50 entries, the oldest error is overwritten.

12.6 Device replacement

⚠ WARNING

An incorrect parameterization of the safety card is enabled due to incorrectly inserted pluggable CRC memory.

Severe or fatal injuries.

- Ensure that the pluggable CRC memory matching the application is inserted at the right system position.

23535652/EN – 12/2017

12.6.1 Device replacement with MOVI-C® CONTROLLER

The following steps must be performed for the actual device replacement:

The system offers the option to save the application-related data set for the inverter and the data set for the safety card on the controller. This step must be carried out in advance by the user.

1. Switch off the device to be replaced.
2. Pull the pluggable CRC memory from the safety card.
3. Replace the device (including MOVISAFE® CS..A safety card) or only the MOVISAFE® CS..A safety card.
4. Re-insert the pluggable CRC memory pulled out in step 2.
5. Carry out a functional test. The checking of all parameters is omitted.

The controller detects the device replacement automatically and loads the application-related data set to the MOVISAFE® CS..A safety card. The localized key data set on the pluggable CRC memory ensures that the right application-related data set has been loaded. The MOVISAFE® CS..A safety card is subsequently in the same state that it was in before the device replacement. This means that the MOVISAFE® CS..A safety card will be in the "Accepted" state again afterwards if it was in the "Accepted" state before the device replacement. In order to ensure correct connection of the sensors and actuators, a function test of the safety card is still required in the case of automatic device replacement function.

12.6.2 Device replacement with MOVISUITE®

For device replacement with MOVISUITE®, proceed as follows:

1. Back up the device data set of the device to be replaced with the menu item [Unit] > [PC]
2. Switch off the device to be replaced.
3. Pull the pluggable CRC memory from the safety card.
4. Replace the device (including MOVISAFE® CS..A safety card) or only the MOVISAFE® CS..A safety card.
5. Re-insert the pluggable CRC memory pulled out in step 3.
6. Load the device data set saved in step 1 back onto the new device with the menu item [PC] > [Unit].
7. Perform a functional test of the system.

23535652/EN – 12/2017

13 Technical data

13.1 General technical data

	Value
Ambient temperature for storage of the safety card	≥ 25 °C – ≤ 85 °C
Ambient temperature of MOVIDRIVE® system, all sizes (Derating, see "MOVIDRIVE® system" operating instructions)	• 0 °C – 40 °C without derating • 40 °C – 55 °C with derating
Ambient temperature of MOVIDRIVE® modular, all sizes	0 °C – 45 °C without derating
Installation altitude	Maximum 3800 m

13.2 General electrical data

The safety card is supplied with voltage by the basic device.

13.2.1 Power consumption of the option cards

Option card	Power consumption
CIO21A	1.2 W
CID21A	0.4 W
CES11A	0.8 W
CSB21A	5.1 W
CSS21A	12.3 W
CSB31A	24.3 W
CSS31A	24.3 W

23535652/EN – 12/2017

13.3 Safe digital inputs

F-DI00 – F-DI03	Value/description
Properties	DC 24 V input pursuant to EN 61131-2, type 3
Signal level	• Logic "0" = LOW input: ≤ 5 V or ≤ 1.5 mA • Logic "1" = HIGH input: ≥ 11 V and ≥ 2 mA
Reference ground	GND
Power demand (typical)	0.21 W at DC 24 V
Input current	≤ 15 mA
Input resistance	≤ 4 kΩ at DC 24 V
Input filter time, parameterizable	4 ms – 250 ms
Permitted cable length	30 m
Error response time with single-pole connection	No greater than the response time without error.
Edge steepness of input signal	> 120 V/s
Input capacitance	< 500 pF

23535652/EN – 12/2017

13.4 Sensor supply

F-SS0, F-SS1	Value/description
Properties	• DC 24 V output pursuant to EN 61131-2 • Short circuit and overload protection • No galvanic isolation
Rated current	150 mA
Inrush current (≤ 10 ms)	300 mA
Short-circuit protection	1.2 A
Internal voltage drop	< DC 1.3 V
Pulsed voltage supply (if activated)	• 2 ms open (LOW) • Period duration, pulsed voltage supply: 8 ms
Permitted cable length	30 m (per sensor)
Leakage current (F-SSx blocked)	< 0.1 mA

13.5 Safe digital outputs

F-DO00_P/M, F-DO01_P/M	Value/description
Properties	• DC 24 V output pursuant to EN 61131-2 • Short circuit and overload protection
Rated current	150 mA
Inrush current (≤ 10 ms)	300 mA
Leakage current (F-DOx blocked)	< 0.1 mA
Maximum switching frequency	10 Hz
Overload protection	210 mA
Minimum current for wire break monitoring	15 mA
Permitted cable length	30 m
Load capacitance (max. test pulse duration)	≤ 300 nF
Load capacitance (1 ms test pulse duration)	50 nF
Capacitance to GND/PE (sourcing output only)	≤ 10 nF
Load capacitance with diode de-coupling	≤ 12 µF
Load inductance	≤ 100 µH
Load inductance with freewheeling diode	≤ 40 H
Minimum load resistance	> 130 Ω

23535652/EN – 12/2017

13.6 Characteristic safety values

13.6.1 Drive safety functions without encoder evaluation

	Characteristic values pursuant to	
	EN 62061/IEC 61800-5-2	**EN ISO 13849-1**
Tested safety class/underlying standards	SIL 3	PL e
Probability of dangerous failure per hour (PFH_d value)	3×10^{-9} 1/h	
Mission Time/service life	20 years, after which the component must be replaced with a new one.	
Proof-Test interval	20 years	-
Safe state	Value "0" for all safe F-DO process values (output disabled)	
Drive safety function	• STO, SS1c, SBC • Safe digital inputs/outputs • Safe communication	

INFORMATION

In the case of 1-pole wiring of the safe digital inputs/outputs, the feasible performance level pursuant to EN ISO 13849-1 is reduced to PL d. Continue to observe the installation requirements.

13.6.2 Drive safety functions with encoder evaluation

	Characteristic values pursuant to	
	EN 62061/IEC 61800-5-2	**EN ISO 13849-1**
Tested safety class/underlying standards	SIL 2	PL d
Probability of dangerous failure per hour (PFH_d value)	3×10^{-9} 1/h	
Mission Time/service life	20 years, after which the component must be replaced with a new one.	
Proof-Test interval	20 years	-
Safe state	Value "0" for all safe F-DO process values (output disabled)	
Drive safety function	SS1b, SS2, SOS, SLS, SSM, SSR, SDI, SLI, SLA	

23535652/EN – 12/2017

Index

23535652/EN – 12/17

F

H

I

M

N

O

P

Q

R

23535652/EN – 12/17

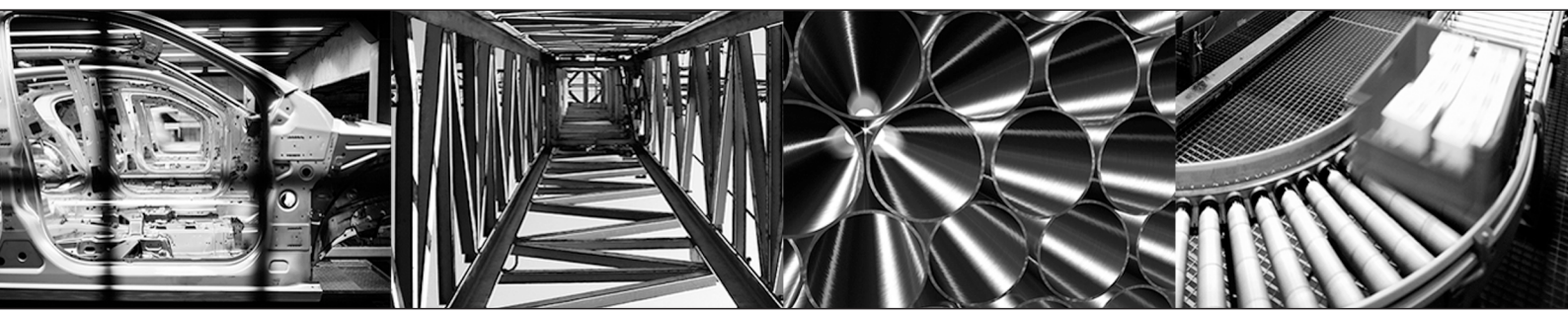
S

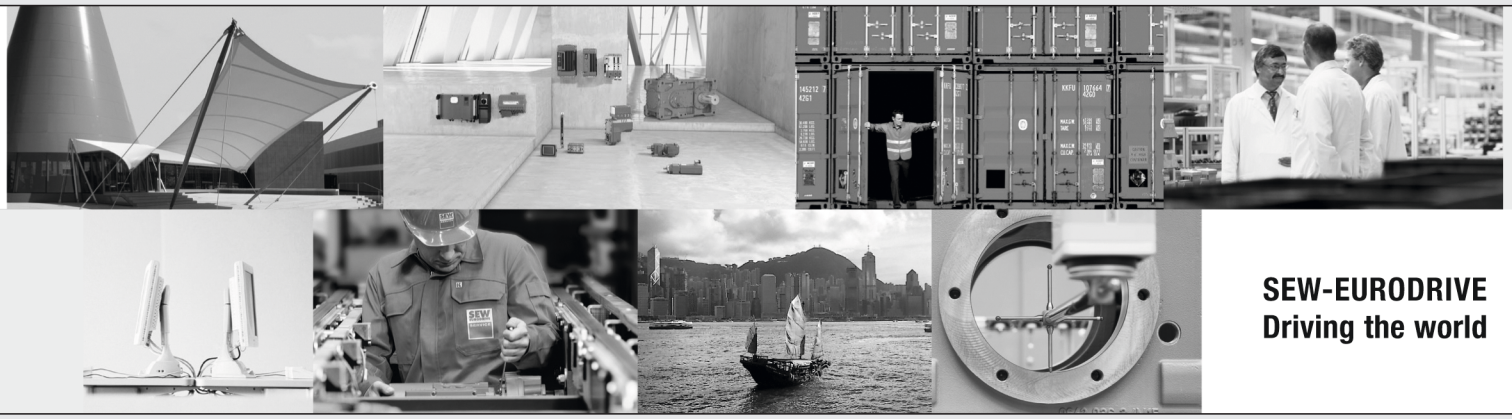
23535652/EN – 12/17

T

W

23535652/EN – 12/17





SEW-EURODRIVE
Driving the world

SEW-EURODRIVE GmbH & Co KG
Ernst-Blickle-Str. 42
76646 BRUCHSAL
GERMANY
Tel. +49 7251 75-0
Fax +49 7251 75-1970
sew@sew-eurodrive.com
➞ **www.sew-eurodrive.com**