AMKmotion
Safety manual
Functional safety
Extract for
Controller cards KW-R07 / -R17 / -R27

Version: 2022/20
Part no.: 203446

Translation of the "Original Dokumentation"

AMKmotion

MEMBER OF THE ARBURG FAMILY

Imprint

Name: PDK_203446_Sicherheitshandbuch_KW-R07

Version:

Version: 2022/20		
Chapter	**Change**	**Initials**
Product version	Firmware of the safety board updated	STL
Compatible versions up from	Version of the software package and the firmware of the safety board updated	LeS
5	Electrical connections	
XS20	Links to 'Information on propagation delay times' added	STL
6	Safety functions	
6.2	Monitoring of the switch-off path added	STL
SLS, SLI, SDIn/p, SMS, SOS, SSR, SS1, SS2	new Topic "Acknowledge an error with "Delete error""	LeS
7	Application	
7.1.3	Dynamization, note on parameter setting the dynamization pulse duration, at least 100 µs greater than dynamization pulse SDYNx	LeS
8	Startup	
8.2	Footnote added for KW-R27. With firmware V2.12 2018/40, the participant address must be in the range 1 to 63 via ID34023 'BUS address participant'	STL
8.2 8.2.1	Extension address range: • up to 250 for KW-R27 • up to 63 still for KW-R07 and KW-R17	LeS
9	Operation	
9.1.1.1	Chapter 'Filtering of the safe inputs, contact bounce' added	STL
11	Safety parameters	
Prm2	Example added	LeS
Prm27 Prm29 Prm57 Prm62	Note to prevent wrong parameter setting	LeS
Prm71 Prm73 Prm77 Prm79 Prm83 Prm85	Links to 'Information on propagation delay times' added	STL
13	Diagnosis	
3609	Info 1: 73 and Info 1: 74 Information for error rectification added.	STL
3606	Info 1: 27	
	Glossary	
D	Dynamic sampling	STL
D	Dormant errors	STL

Previous version: 2017/48

Product version:

Product (Part no.)	Firmware version (Part no.)	Hardware version
KW-R07 (O807)	• Controller card from AER5-6_SW_111_1320_204533.zip • Safety device AESF1_SW_108_1950_206990.zip	V1.17
KW-R17 (O873)		V1.12
KW-R27 (O957)	• Controller card from AER26_SW_212_1840_207284.zip • Safety device AESF1_SW_108_1950_206990.zip	V1.04
PC	• AIPEX PRO from AipexPro_303_1541_205890.zip • AIPEX PRO service pack AipexPro_303_SP02_1625_206533 • from adb1350.xml (in folder C:\Program Files\Common Files\AMK) • from AMK_ECsoe_111_204834.xml (in folder C:\Program Files\Common Files\AMK\EtherCAT) • SafePMT V1.21 206343 • AMK-PrmTable_default_206081_V1.20.prm CRC: 0x0C88FC97 • AMK-PrmTable_default_204318_V1.15.prm CRC: 0x375122FA	-
Certification TÜV	• Report no.: 968/M 307.01/13 • Report no.: 968/M 307.02/14 • Report no.: 968/M 307.04/17 • Report no.: 968/FSP 1091.02/17	-

Reservation: We reserve the right to modify the content of the documentation as well as the delivery options for the product.

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For fast and reliable troubleshooting, you can help us by informing our Customer Service about the following:

- Type plate data for each unit
- Software version
- Device configuration and application
- Type of fault/problem and suspected cause
- Diagnostic messages (error messages)

E-mail service@amk-motion.com

Internet address: www.amk-motion.com

Compatible versions up from...

Software package SW_Paket_Safety_vvv_yyww_nnnnnn.zip (contains the following software products)		version date AMK part no.	1.08 2019/50 206990
Firmware of the safety board AESF1_SW_vvv_yyww_nnnnnn.zip		version date AMK part no.	1.08 2019/50 206990
Firmware of the controller card KW-R07 / KW-R17 AER5-6_SW_vvv_yyww_nnnnnn.zip		version date AMK part no.	1.11 1320 204533
Firmware of the controller card KW-R27 AER26_SW_vvv_yyww_nnnnnn.zip		version date AMK part no.	2.12 1840 207284
AMK data base adbyyww.xml		date	2013/50
Device description file AMK_ECsoe_vvv_nnnnnn.xml		version AMK part no.	1.11 204834
AIPEX PRO AipexPro_vvv_yyww_nnnnnn.zip		version date AMK part no.	3.03 2015/41 205890
AIPEX PRO service pack AipexPro_vvv_SPxx_yyww_nnnnnn.zip		version SP date AMK part no.	- SP02 2016/25 206533
Safe parameter editor SafePMT Vv.v.v nnnnnn		version AMK part no.	1.21 206343
Safe parameter set (template) AMK-PrmTable_default_nnnnnn_Vv.v.prm	Software package 1.07	version CRC AMK part no.	1.20 0x0C88FC97 206081
	Software package 1.05 1.04	Version CRC AMK part no.	1.15 0x375122FA 204318
Safety manual PDK_203446_Sicherheitshandbuch_KW-R07_de.pdf PDK_203446_Sicherheitshandbuch_KW-R07_en.pdf		date AMK part no.	2022/20 203446

vvv	version no.
yyww	date of creation yy: year ww: calendar week
nnnnnn	AMK part no.

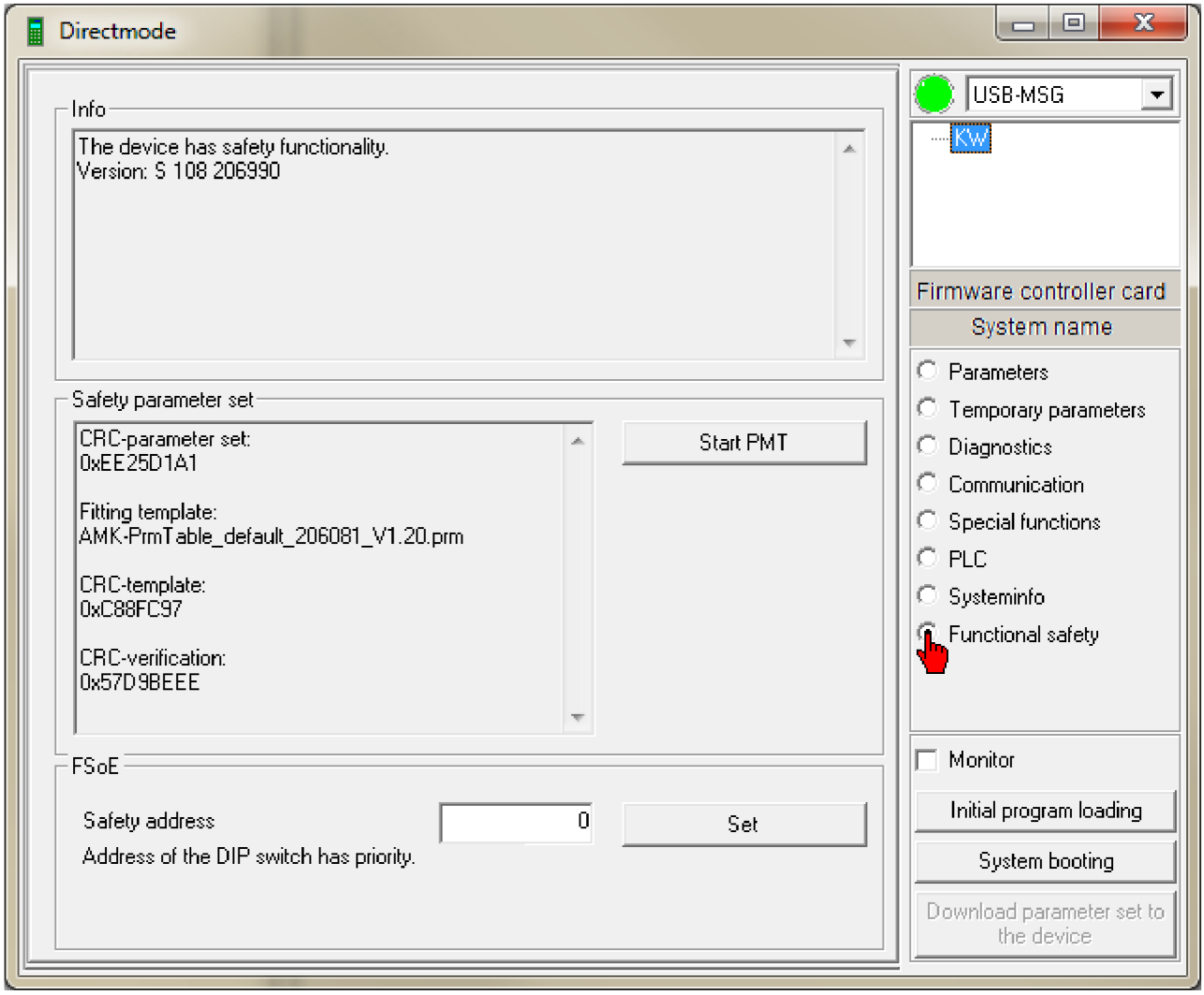
The above mentioned versions show the state of certification of the functional safety firmware V1.07.

Higher versions of the controller card firmware, the PC software AIPEX PRO, the AMK data base, and the device description file can be installed later.

The safe parameter editor SafePMT and the safe parameter sets (templates) are part of AIPEX PRO.

The safety manual is embodied in the 'AMK Online Documentation'. Follow chapter 'Safety technology'.

The firmware version of the safety board and the corresponding template is displayed with the AIPEX PRO 'Directmode' or AIPEX LITE.



Window content 'Info'

The field displays the status of the connection, and also the information if the linked device has a safety board or not.
Version: Firmware safety board
Matching template device version (firmware safety board)

Window content 'Safety parameter set'

Displays the safe parameter set check sum (CRC) and the used template.

CRC-parameter set: Check sum (CRC) customer specific safe parameter set
Fitting template: Matching template device version (firmware safety board)
CRC-template: Check sum (CRC) template
CRC-verification: Check sum (CRC) customer specific safe parameter set + serial number device

Content

1 About this documentation

The following descriptions about the functional safety are valid for drive controllers either designed as controller card KW-R07, KW-R17 or KW-R27. For simplicity, the controller cards in this document are named as KW-Rx7. The designation KW-Rx7 stands for KW-R07, KW-R17 and KW-R27.

If necessary, the text will distinguish the controller type. Otherwise, the expressions 'drive controller' or just 'controller' mean any types.

1.1 Structure of this document

Topic	Chapter	Chapter number
Validity, use and the purpose of the document	Imprint	-
	About this document	1
Safety	For your safety	2
Information for planning and projecting personnel	Product overview	3
	Projecting	4
	Safety functions	6
	Application	7
	Operation	9
	Certificates	14
Practice information for startup personnel	Electrical connections	5
	Startup	8
	Safety parameters	11
	Unsafe parameters	12
Practice information for operating or maintenance personnel	Diagnosis	13
	Service	10
Abbreviations and terms will be explained	Glossary	-

1.2 Keeping this document

This document must permanently be available and readable at the place where the product is in use. If the product is used at another place or changed the owner, the document must be passed on.

1.3 Target group

Any person that is qualified and intends to work with this product must read, understand and follow this document:

- Projecting
- Connection
- Parameterization
- Startup
- Testing and maintenance
- Service and repair

1.4 Purpose

The documentation at hand describes the functional safety of the KW-R07 / -R17 controller cards.
It is intended to qualify the user to parameterise and command safety functions.

This document is addressed to any person who handles the product. It gives information about the following topics:

- Safety messages which are absolutely necessary to take care of during handling the product
- Projecting, planning and dimensioning of the application
- Electrical connections
- Startup and operation
- Replacement
- Diagnosis
- Conformity with standards

1.5 Display conventions

Display	Meaning
	This symbol points to parts of the text to which particular attention should be paid!
	The red hand symbol indicates the button or menu item to click on. The red hand symbol indicates the option to be selected.
0x	0x followed by a hexadecimal number, e. g. 0x500A
'Names'	Names are represented with apostrophes e. g. parameters, variables, etc.
'Text'	Menu items and buttons in a software or on a controller, e. g.: Click the **'OK'** button in the **'Options'** menu to call up the 'Delete PLC program' function
>xxx<	Placeholder, variables, e. g. IP address of the controller: >192.168.0.1<
→	Task procedure / operating sequence, e. g. **'Start'** → **'All programs'** → **'Additional'** → **'Editor'** e. g. 0 → 1 edge
See 'chapter name' on page x	Executable cross-reference in electronic output media

1.6 Appendant documents

Standards and directives

Name	Title
DIN EN 61800-5-2	Adjustable speed electrical power drive systems Part 5-2: Safety requirements - Functional safety
EN 60204-1	Safety of machinery - Electrical equipment of machines Part 1: General requirements

Device descriptions

AMK part no.	Title
27859	Motor encoders
28932	Servo drives KE/KW
202744	Controller cards KW-R06 / -R16 / -R07 / -R17
204918	Controller cards KW-R24(-R) / -R25 / -R26 / -R27

Functional descriptions

AMK part no.	Title
25786	Diagnostic messages
204979	Software description AIPEX PRO V3 (PC software for startup and parameterization)
203704	Parameter description KW-R06 / -R16 / -R07 / -R17 / / KW-R24(-R) / -R25 / -R26 / -R27 (properties of controller parameters)
204364	Functional safety, application examples
204412	TwinCAT controller with FSoE (not yet in English)
204539	Initial startup KE/KW (not yet in English)

The above mentioned device and functional descriptions are embodied in the 'AMK Online Documentation'.

2 For your safety

2.1 Basic notes for your safety

- At electrical drive systems, hazards are present in principle that can result in death or fatal injuries:
  - Electrical hazard (e. g. electric shock due to touch on electrical connections)
  - Mechanical hazard (e. g. crush, retract due to the rotation of the motor shaft)
  - Thermal hazard (e. g. burns due to touch on hot surfaces)
- These hazards are present while starting up and operating the unit, and also during servicing or maintenance work.
- Safety instructions in the documentation and on the product warn about the hazards.
- Personnel must have read and understood the safety instructions before installing and operating the product. In the documentation about the product the usage warnings pertain to direct hazards and must therefore be followed directly when operating or handling the product by the operator.
- AMKmotion products must be kept in their original order, that means it is not allowed to do a significant constructional change on hardware side and software is not allowed to be decompiled and change the source code.
- Damaged or faulty products are not allowed to be integrated or put into operation.
- Do not start the system in which the AMKmotion products are installed (begin of intended use) until you can determine that all relevant standards, laws, and directives have been complied with, e. g. low voltage directive, EMC directive, and the machinery directive, and possible further product standards. The plant manufacturer is responsible for the compliance with the laws, directives, and standards.
- The devices must be installed, electrically connected and operated as shown in the device description documentation. The technical data and the required environmental conditions must be observed at all times.

2.2 Safety rules for handling electrical systems

In particular on drive systems, the instructions pertaining to safety and the following five safety rules have to be kept in the specified sequence:

1. Switch off electrical circuits (also electronic and auxiliary circuits).
2. Secure against being switched on again.
3. Determine that there is no voltage.
4. Ground and short circuit.
5. Cover or close off neighboring parts that are under voltage.

Reverse the measures taken in reverse order after completing the work.

2.3 Presenting safety messages

Any safety information is configured as follows:

⚠ SIGNAL WORD	
	**Type and source of risk** Consequence(s) of non-observance **Steps to prevent:** • ...

2.4 Class of hazard

Safety and warning messages are graduated into classes of hazard (according to ANSI Z535). The class of hazard defines the potential risk of harm and is described by a single word, if the safety information is ignored. The signal word is followed by a safety alert symbol (ISO 3864, DIN EN ISO 7010). In accordance with ANSI Z535, the following signal words are used to define the class of hazard.

Safety alert symbol and signal word	Class of hazard and its meaning
⚠ DANGER	DANGER indicates a hazardous situation which, if not avoided, **will** result in death or serious injury
⚠ WARNING	WARNING indicates a hazardous situation which, if not avoided, **could** result in death or serious injury
⚠ CAUTION	CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, **could** result in minor or moderate injury
NOTICE	NOTICE is used to address preventions to avoid material damage, but not related to personal injury.

2.5 Safety alert symbols used

Safety symbol	Meaning
	Generic warning!
	Warning against dangerous electrical voltage!

2.6 Intended use

The functions of the functional safety monitor drive movements and states safely and bring the drive into a safe state in case of an error. The safety functions protect people who are in the range of movement of running machines.

2.7 Requirements for the personnel and their qualification

Only authorized and qualified personnel may work on and with the AMKmotion drive systems.

Specialised personnel must:

- Perform mechanical and electrical work that is described in this documentation, such as mounting and connecting
- Observe all information in the documentation accompanying the product in order to work with the product safely and in an error-free manner
- Understand and know hazards that occur when handling the product
- Know connections and functions of the system
- Be familiar with the control concept in order to operate the drive system
- Be authorized to switch circuits and devices on and off, ground and label them
- Observe local specific safety requirements

2.8 Warranty

- All information in the documents accompanying the product must be complied with for a safe and trouble-free operation.
- The assertion of warranty claims is excluded if the information in the documents is not observed completely.
- Hardware and firmware may not be modified except by personnel authorized by AMKmotion and after consultation with AMKmotion.
- The company AMKmotion GmbH + Co KG is not liable for damages from unintended use, incorrect installation or operation, exceeding rated values and non-observance with the environmental conditions.

3 Product overview

3.1 Product description

The goal of any safety technology is to protect human health. According to the machine guideline, each manufacturer is obligated to perform a risk assessment in order to determine all hazards originating from the manufacturer's machine. In the first step, the hazards from the risk assessment must be prevented by the design or eliminated. Other protective measures may be taken only if the danger cannot be eliminated by other constructive measures.

Many tasks need to be carried out while the machine is running and protective measures are inactive, e.g. when configuring a tool machine or an industrial robot in a production cell. In general, the machine guideline allows standing in the danger area of a running machine under certain conditions.

For works on running machines, protective measures must be installed that safely monitor the machine movements and that bring the drive into a safe state in case of error. The functional safety offers safety functions with which the health hazards resulting from the running machine are maximally reduced.

- **Safe encoder monitoring** (SEM)
- **Safe torque off** (STO)
- **Safe stop 1** (SS1)
- **Safe operating stop** (SOS)
- **Safe stop 2** (SS2)
- **Safe maximum speed** (SMS)
- **Safe speed range** (SSR)
- **Safely-limited speed** (SLS)
- **Safe direction** (SDI)
- **Safely-limited increment** (SLI)

The safety functions can be divided into the categories normal operation, safe operating mode and stop function.

Normal operation: SEM, SMS

Functions in normal operation are always active and cannot be switched off. In addition to the functions in normal operation, functions in the safe operating mode can be implemented.

Safe operating modes: SOS, SSR, SLS, SDI, SLI

Safe operating modes monitor whether the actual values of the drive comply with the safely parameterised limit values for speed and position, for example. In case of error, the safe operating mode activates a stop function.

Stop function: STO, SS1, SS2

Stop functions monitor the deceleration of the drive, the subsequent regular standstill within the parameterisable standstill window or they switch the drive without torque in case of error. Stop functions are triggered by an edge and cannot be aborted.

In the safety function SS1, the drive is automatically slowed down by the safety function itself. In all other stop functions, the drive movement is only monitored, but not initiated by the safety function.

The stop functions are prioritised on the other safety functions. STO has the highest priority:

1. STO (highest priority)
2. SS1
3. SS2 (lowest priority)

The safety functions can either be commanded by local safe inputs and outputs or via fieldbus and the FSoE protocol.

The safety functions do not control the drive movement but monitor actual values and states of the drive for limit values that have been parameterised application-specific as safe parameters in the safety functions. The drive movements are commanded as before from the user's control unit. If an active safety function detects a deviation from the limit values, the safety function immediately switches the drive into the safe state that has been parameterised application-specific for this case.

For instance, safe states in case of error are:

- **Safe torque off** (STO)
- **Safe stop 1** (SS1)
- **Safe stop 2** (SS2)

The parameterisation of the safety functions is carried out with the safe parameter editor in the AMK PC Software AIPEX PRO.

The states of the safe inputs and outputs are transmitted via an unsafe communication bus to the users control unit.

3.2 Product name and order data

Product name	Order number
Controller cards	
KW-R07	O807
KW-R17	O873
KW-R27	O957
Firmwares	
AE-R05/R06 V1.11 2013/20 [1)]	204533
AE-R26 V2.11_2016/46[1)]	206645
AE-SF1 SW V1.07 2016/11[1)]	206082
PC software	
AIPEX PRO V3.03 2015/41[1)]	205890
Service pack V3.03 SP2 2016/25	206533

1) The mentioned versions are minimum required versions, higher versions are possible

The controller card KW-Rx7 contains two components:

- Controller card AE-Rx6
- Safety board AE-SF1

This 'package' is not allowed to be changed by the customer!

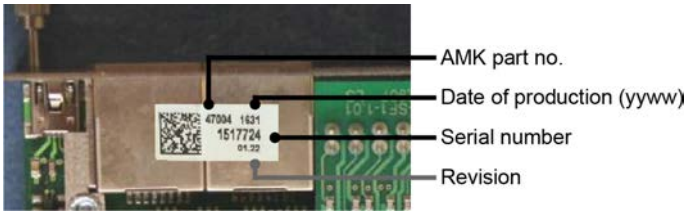
Only this way, the safety-related parameter set can be associated explicitly to the device.

3.3 Controller card

The controller cards are packages containing the basic controller board e.g. AE-R06 and the safety board AE-SF1.
This combination is not allowed to be changed.

(Example: KW-R07)

On the connectors X85 / X86 of the controller card, you will find a label showing the AMK part-no., date of production, serial number and hardware revision.



3.4 Delivery

Please check whether the delivered parts correspond with the delivery note. If the delivery is incomplete, please contact your nearest AMKmotion representative.

Check the components for signs of transport damage after their arrival. Do not install and operate any damaged components.

If there is any transport damage, immediately inform the delivering freight carrier and inform your AMKmotion representative.

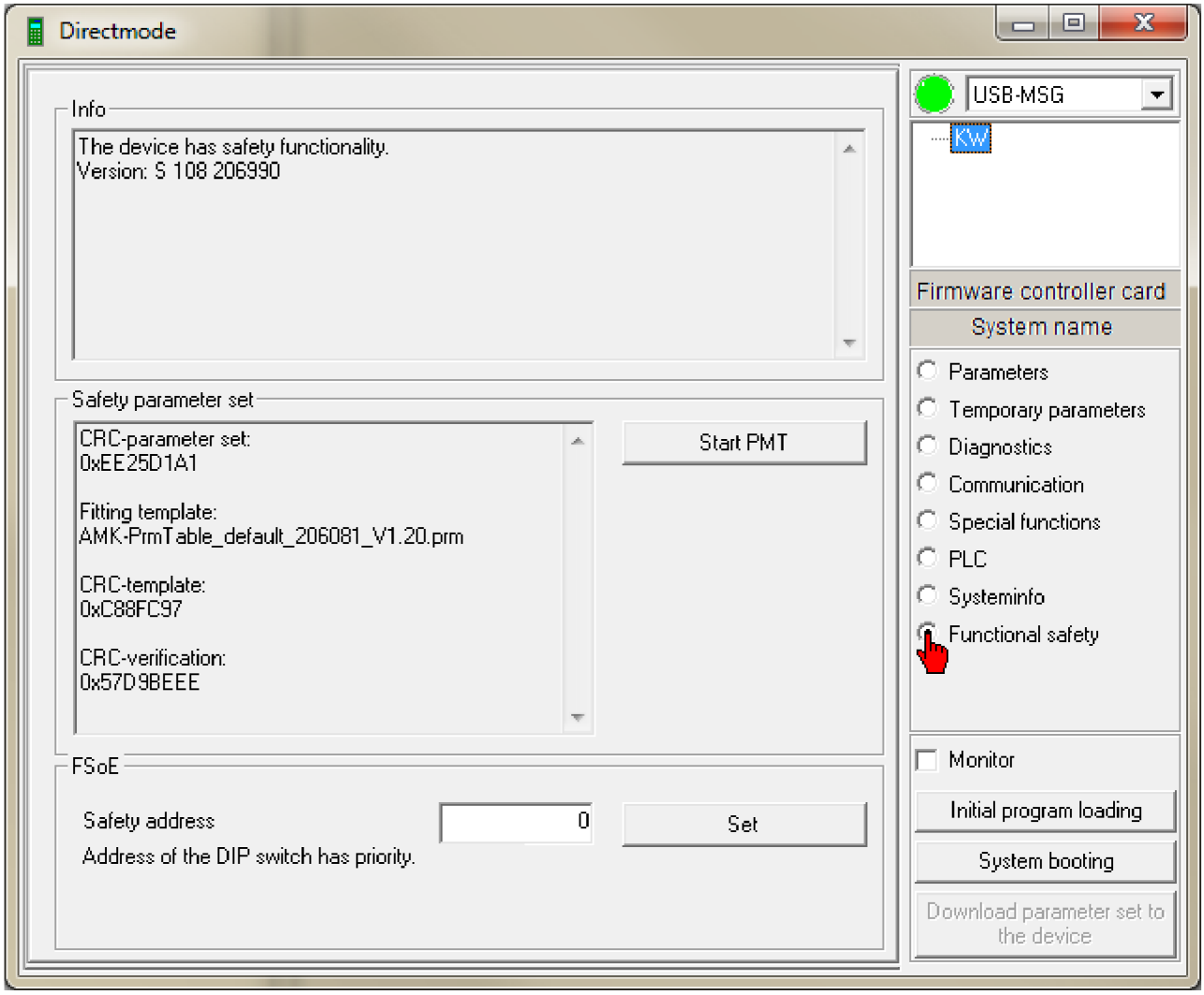
In state of delivery, the ordered versions of the controller and safety firmware are installed on the controller.
You have to install the software AIPEX PRO onto your PC (Siehe 'Requirements' auf Seite 84.).

4 Projecting

4.1 Reading out firmware versions

The firmware version can be read from ID30 'Software version' instance 0 (firmware controller card) and instance 2 (Safety-Board).

The firmware version of the safety board and the corresponding template is displayed with the AIPEX PRO 'Directmode' or AIPEX LITE.



Window content 'Info'

The field displays the status of the connection, and also the information if the linked device has a safety board or not.

Version: Firmware safety board

Matching template device version (firmware safety board)

Window content 'Safety parameter set'

Displays the safe parameter set check sum (CRC) and the used template.

CRC-parameter set: Check sum (CRC) customer specific safe parameter set

Fitting template: Matching template device version (firmware safety board)

CRC-template: Check sum (CRC) template

CRC-verification: Check sum (CRC) customer specific safe parameter set + serial number device

4.2 Standardisation of position values

The resolution of the position is 65536 increments/revolution and cannot be changed. The encoder resolution does not influence the resolution of the position.

4.3 Ripple of actual values

The safety functions monitor actual values and compare these to specified limit values. All limit values are absolute values not to be exceeded. Otherwise, the monitoring safety function reacts. In principle, actual values have a ripple that can lead to an exceeding of the limit values of the safety functions. The ripple of the actual values need to be taken into account when specifying the limit values for the monitoring safety functions in order to avoid an unintended activation of a safety function.

4.4 Achievable safety classification

The machine guideline 2006/42/EG demands from each manufacturer of a machine that a risk assessment is carried out in order to determine the safety and health requirements applicable for the machine. According to EN ISO 12100-1, the risk assessment is the complete procedure which encompasses a risk analysis and risk assessment. The machine must then be designed and built while taking into consideration the results of the risk assessment.

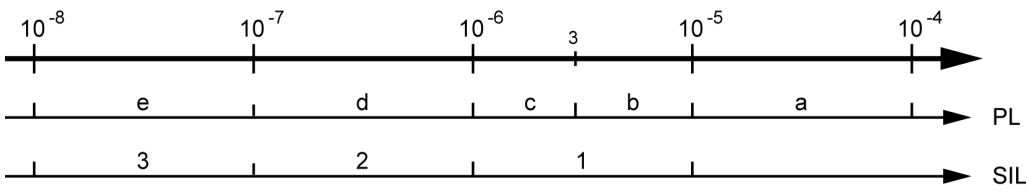
EN ISO 13849-1 describes the procedure for the risk assessment after completed mechanical design and serves to determine the requirements for the safety-related parts of the control system of a machine (**Performance Level PL**).

EN 62061 describes the procedure for risk assessment after concluded mechanical design and serves to determine the requirements for the safety-related parts of the control system of a machine (**Safety Integrity Levels SIL**).
The procedure for risk assessment described in the norm EN 62061 should essentially be regarded as an alternative to EN ISO 13849-1.

⚠ WARNING	
	**Danger due to uncontrolled movements of the drive system** External encoders (sensor systems) are not part of the safety assessment of the drive controller. **Steps to prevent:** • According to EN 61800-5-2, the user has to classify and evaluate the whole safety function line (converter, motor, motor shaft, external encoder sensors, ...)

Performance Level (PL)	Safety Integrity Levels (SIL)	Probability of a dangerous breakdown per hour [1/h]
a	-	10^{-5} to $<10^{-4}$
b	1	3 x 10^{-6} to $<10^{-5}$ (1 breakdown in 100000 h)
c		10^{-6} to < 3 x 10^{-6}
d	2	10^{-7} to $<10^{-6}$ (1 breakdown in 1000000 h)
e	3	10^{-8} to $<10^{-7}$ (1 breakdown in 10000000 h)

Excerpt of EN ISO 13849-1



4.4.1 Classification of safety functions depending on the encoder type

Depending on the deployed encoder, the safety functions can reach different safety classifications.

Relevant for KW-R07:

Safety functions	STO [1]	SS1	SS2	SOS	SLS	SSR	SDI	SLI	SMS	
Encoder type	**Safety Integrity Levels(SIL)[3]/ Performance Level (PL)[2]**									**Note**
R (Resolver)	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	The resolver reaches a higher safety category through forced dynamic sampling.
R combined with another sine encoder	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	SIL3/ PLe	Prm4, Prm5

Relevant for KW-Rx7:

Safety functions	STO [1]	SS1	SS2	SOS	SLS	SSR	SDI	SLI	SMS	
Encoder type	**Safety Integrity Levels(SIL)[3]/ Performance Level (PL)[2]**									**Note**
I (incremental sine encoder with zero pulse)	SIL3/ PLe	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL3/ PLe	-
E, F (EnDat 2.1 with sine/cosine traces)	SIL3/ PLe	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL3/ PLe	Only the sine/cosine traces are evaluated.
S, T, U, V Hiperface	SIL3/ PLe	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	Only the sine/cosine traces are evaluated.
P, Q (EnDat 2.2 light) digital and sine/cosine traces	SIL3/ PLe	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL2/ PLd	SIL3/ PLe	Sine/cosine traces in the encoder required
P, Q (EnDat 2.2 light) digital	-	-	-	-	-	-	-	-	-	no sine/cosine traces present

1) The encoder type is not relevant for STO
2) according to EN ISO 13849-1
3) according to EN/IEC 62061

NOTICE	
	SIL3 and **PLe** can only be achieved if • the safe inputs are dynamised (only if Prm7 = 1 (SE1-SE3) is set). • in the safe sine encoder monitoring (SEM) Prm9 + Prm10 ≤ 24 h

4.4.2 Specific values of safety component

- EN 61508 Parts 1 - 7
  Functional safety of electrical/electronic/programmable electronic safety-related systems

- EN 62061
  Safety of machinery-Functional safety of safety-related electrical, electronic and programmable electronic control systems
- EN ISO 13849-1
  Safety of Machinery - Safety-related parts of control systems - Part 1: General principles for design

The values are valid for the following safety components

- from AE-SF1 rev 1.07

Standard	Symbol	Value
PFH_PFDavg (EN 61508)	PFD_{avg} (T1 = 20 a)	$1.7 * 10^{-4}$
	PFH_G	$2 * 10^{-9}$ 1/h
EN ISO 13849-1	Kategorie	4 / PLe
	$MTTF_d$	187 Years
	DC_{avg}	high

5 Electrical connections

5.1 AMKASYN KE/KW

5.1.1 Compact inverter KW: [X08, X09] supply voltage 24 VDC

NOTICE	
Material Damage!	**Overload of the terminal and the internal circuit board!** The connected rating of the terminals X08, X09 is restricted. The terminals X08 or X09 are designed for a current of at most 8 A. **Steps to prevent:** • A looping of the 24 VDC supply voltage is permitted for a total of 5 modules at the most. • If more than 5 devices are installed, each group of five needs to be supplied separately with 24 VDC.

NOTICE	
Material Damage!	**Material damage caused by incorrect handling!** Mechanical damage to terminals! Disconnected signal lines. **Steps to prevent:** • The plug connectors are partially encoded. Do not push in with force. • Never pull on the cable, but rather on the connector casing.

Description

For supplying the internal switched mode power supply and the fan.

X08: Connection 24 VDC supply voltage

X09: Looping of the voltage

Technical data

- 24 VDC ± 15% PELV power supply acc. to IEC/EN 60950
- Ripple max. 5%, with integrated switch-on current limitation
- The 0 V potential of the power supply unit should be earthed at the central PE.

Version

Type	Pins	Class
Connector with spring connection	2	1-row pin strip

Assignment

[X08] / [X09]	Connection	Signal	Description
front view, device side X09 PIN 2 X09 PIN 1 X08 PIN 2 X08 PIN 1 	1	0 VDC	Connection 0 VDC logic supply
	2	24 VDC	Connection 24 VDC logic supply

Connection

Recommended cable type	2-wire, unshielded
Cable assembly	Flexible line or wire end ferrule without plastic sheath
Shield connection	-

	Complete KE/KW series
Cross-section min./max.	0.25 mm²/ 1.5 mm² AWG 24 / AWG 16
Recommended wire cross-sections	0.75 mm² AWG 18
Cable stripping length	9 mm
Terminal	FK-MCP 1,5/2-ST-3,80

Note	A loss of the 24V supply > 10 ms creates a fault: Internally the "SBM (System Ready)" message is reset and the main contactor is released. The supply must be carried out mandatorily as a PELV power supply acc. to IEC/EN 60950

5.1.2 Controller card KW-Rx7: [XS20] safety I/O

Description

- 3 safe input pairs
- 2 secure short-circuit proof output pairs
- Parameterizable dynamic sampling
- Electrically isolated
- Two-channel
- Dynamic sampling signal via SDYN1 and SDYN2 outputs available

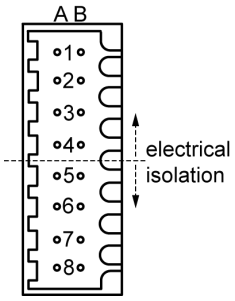
Technical data

- Norm IEC 61131-2 type 3 digital inputs:
  Rated input voltage 0-30 VDC, maximal input current at 30 VDC = 15 mA
  Level 0-5 VDC: low, 11-30 VDC: high
  Electrically delay of T_{on} = 3-8 µs, T_{off} = 48-57 µs
- Norm IEC 61131-2 digital outputs:
  Rated output voltage 24 VDC, rated output current maximal 0.5 A, short-circuit safe, electrically isolated, electrically delay of T_{on} 8-20 µs, T_{off} = 50-55 µs at 200 mA load
- Reference potential: PE bus bar
- Maximal cable length: 30 m

Design

Type	Poles	Class
Connector with spring connection	16	2-row pin strip

Assignment

[XS20]	Connection	Signal	Description
front view, device side 	A1	SA1.1	Binary output SA1.1/SA1.2 500 mA, High Side min. 20 mA on differential load. (siehe 'Prm104 'SA1.2 output type" auf Seite 140)
	A2	SA2.1	Binary output SA2.1/SA2.2 100 mA, High Side
	A3	SDYN1	Dynamic sampling output 1 100 mA, High Side
	A4	SGND1	Reference potential 0 V for SVCC1
	B1	SE1.1	Binary input SE1.1/SE1.2 24 V, I_{max} = 15 mA
	B2	SE2.1	Binary input SE2.1/SE2.2 24 V, I_{max} = 15 mA
	B3	SE3.1	Binary input SE3.1/SE3.2 24 V, I_{max} = 15 mA
	B4	SVCC1	Supply SVCC1, 24 V ± 20 %
	---------- Potential separation ----------		
	A5	SA1.2	Binary output SA1.1/SA1.2 500 mA, High Side and Low Side
	A6	SA2.2	Binary output SA2.1/SA2.2 100 mA, High Side
	A7	SDYN2	Dynamic sampling output 2 100mA, High Side
	A8	SGND2	Reference potential 0 V for SVCC2
	B5	SE1.2	Binary input SE1.1/SE1.2 24 V, I_{max} = 15 mA
	B6	SE2.2	Binary input SE2.1/SE2.2 24 V, I_{max} = 15 mA
	B7	SE3.2	Binary input SE3.1/SE3.2 24 V, I_{max} = 15 mA
	B8	SVCC2	Binary supply SVCC2, 24 V ± 20 %

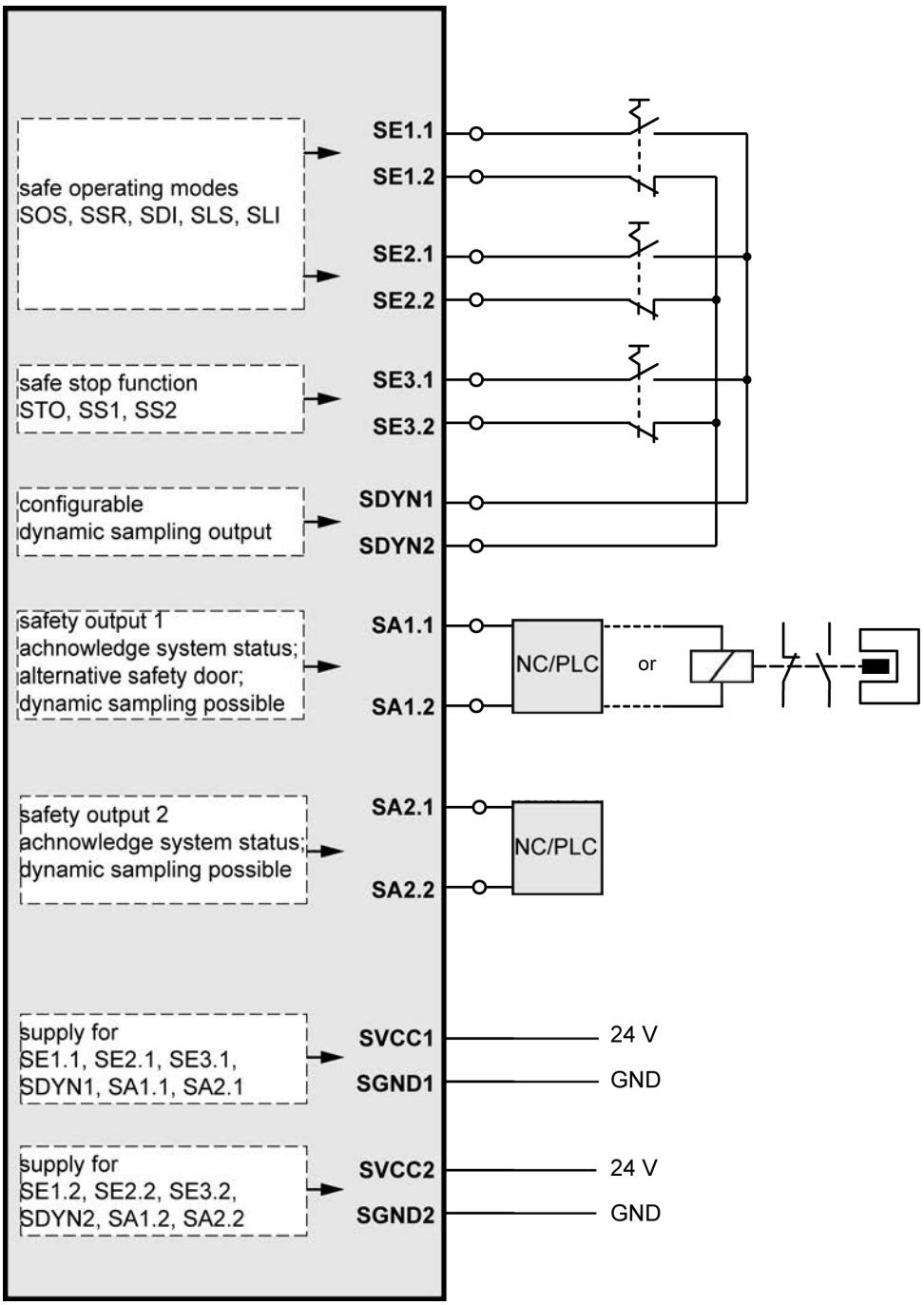
Connection

Mating connector	Weidmüller socket connector, 16-poles AMK part no. 202020
Cable	16-wire, shielded
Cross-section min.-max.	0,2 mm^2 - 1 mm^2 AWG 28 - AWG 18
Shield connection	Shield on one side on the module housing
Note	The supply must be carried out mandatorily as a PELV power supply acc. to IEC/EN 60950 which provides at least 3 A.

SIL3 can only be reached if the following features of the connection are matched:

- Shielded cable
- Maximal cable length 30 m
- PELV power supply acc. to IEC/EN 60950

Circuit principle



(Example for dynamic sampling of the safe inputs)

Application examples how to use the safe inputs can be found in the document Functional safety, application examples (AMK part no. 204364)

Information on propagation delay times:

Siehe 'Propagation delay of safe inputs' auf Seite 113.
Siehe 'Filtering of the safe inputs, contact bounce' auf Seite 113.
Siehe 'Propagation delay of safe outputs' auf Seite 115.

5.1.3 Controller card KW-Rx7: other interfaces

The other interfaces of the controller card are described in the device description 'Controller cards KW-R06 / -R16 / -R07 / -R17', AMK part no. 202744 or Controller cards KW-R24(-R) / -R25 / -R26 / -R27, AMK part no. 204918.

6 Safety functions

6.1 Safe sine encoder monitoring (SEM)

The normal operation function 'Safe encoder monitoring (SEM)' is always active and can not get deactivated.

The signal traces of the encoders are generally monitored in normal operations. In principle, encoders cannot be monitored for errors in standstill. A hardware malfunction in standstill can result in the encoder monitoring not detecting whether the drive is rotating or not.

A position change will only be recognised if the encoder moves at least an angle of one sine period.

Description

- With the encoder standing still, the 'Transition time in case of standstill' (Prm9) starts counting.
  If the drive moves before this T(warn) time is exceeded, the counter will be reset.
- If the drive does not move until the end of the 'Transition time in case of standstill', the diagnostic messages 3610, Info1 = 38 / 39, Info2 = 3 are generated (Warning: Prm9 'Transition time in case of standstill' was exceeded)
  These messages can be cleared but the counter will not be reset until the drive moves.
- When generating the warning messages, the counter of the 'Reaction time in case of standstill' (T(err), Prm10) starts. If the drive moves before this time is exceeded, both counters will be reset.
- After the 'Reaction time in case of standstill' is passed, the drive switches to 'Safe stop 1 (SS1)' and thus will finish with 'Safe torque off (STO)'.
- The diagnostic messages 3606, Info1 = 38 / 39, Info2 = 4 are sent (Prm10 'Reaction time in case of standstill' was exceeded).
  At the same time, the 30 minutes internal monitoring interval starts.
- When the internal monitoring interval is passed, the diagnostic messages 3606 are sent again and the monitoring interval starts again. Thus, the message will be sent every 30 minutes until the drive moves again.
- The counters of Prm9 T(warn) and Prm10 T(err) and the internal monitoring interval will not be reset until the encoder sends a position change.

Resolvers give dynamic sampled input signals in principle. So the encoder monitoring is only valid for sine encoders.
(See document Device description Motor encoders, Part no. 27859)

SIL 3 / PLe will only be achieved if
Σ (Prm9, Prm10) ≤ 24 h

⚠ DANGER	
	**Danger to life due to unexpected movements!** The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down). **Steps to prevent:** • Install an external, mechanical brake that prevents a movement. • Install a counterweight in order to maintain the axis in balance.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm4	'Channel 1 encoder type'	Enc_Ch1	-	0	1
Prm5	'Channel 2 encoder type'	Enc_Ch2	-	0	1
Prm9	'Transition time in case of standstill'	T(warn)	min	1	60000
Prm10	'Reaction time in case of standstill'	T(err)	min	1	60000

6.2 Monitoring of the switch-off path

In normal operation, the switch-off paths are monitored in both channels. Dynamic principles are used to detect dormant errors.

The check can only be carried out with active power output stage enable (EF) and inactive STO.

If for more than 1 hour, no dynamic check of the line drivers can be carried out, the warning message 3610 'Safety - Warning during operation' Info1 = 75, Info2 = 6 or Info1 = 76, Info2 = 6 is generated.

Dynamic sampling

Dynamic sampling means that a clocked signal is installed or sent instead of a static signal. "Static signal errors" can be detected through dynamically sampled input and output signals by cyclically monitoring the signals for the dynamic sampling pattern.

Dormant error

A dormant error is an error in inactive monitoring channels. The error does not occur because the switch-off path is currently inactive. Dormant errors are problematic because the higher-level system can not distinguish between a dormant error and an operation where monitoring limits are not violated.

6.3 Safe torque off (STO)

Properties

- Safety function according to DIN EN 61800-5-2:2008-04
- Uncontrolled stop according to EN 60204-1, stop category 0
- The drive is immediately (≤ 10 ms) switched torque-free (Siehe 'Propagation delay times' auf Seite 113.)
- Protection against unexpected start of the motor

Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

The STO safety function is started by an 1-0 edge and cannot be interrupted.

In case of active safety function STO, the pulse width modulation (PWM) is blocked on two channels. The PWM controls the transistors of the power output stage of the inverter. In case of two channel blocked PWM, the unexpected start of the motor is prevented safely.

If STO is active, the drive motions are no longer controlled as no further error reaction is possible. 'Safe encoder monitoring (SEM)' and monitoring of the switch-off path furthermore are active.

If the safety function 'Safe torque off (STO)' is already set during system run-up, the firmware of the controller card will generate the diagnostic message 2320 'EF inactive' due to system characteristics.

⚠ DANGER	
	**Danger to life due to unexpected movements!** The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down). **Steps to prevent:** • Install an external, mechanical brake that prevents a movement. • Install a counterweight in order to maintain the axis in balance.

⚠ DANGER	
	**Danger of life due to electric shock!** Lethal voltages can exist at the motor connection output terminals of the inverter in spite of blocked PWM. **Steps to prevent:** • Do not touch the contacts of the terminals.

6.3.1 Synchronous motors in field weakening

If the PWM is blocked in the STO state in synchronous motors that are operated in field weakening, the still rotating motor induces a voltage that is higher than the one of the feeding DC bus. Due to the induced voltage, a current flows into the DC bus via the free-wheel diodes in the inverter, resulting in the motor being actively decelerated by the inverter. During the deceleration process, the energy from the motor is fed back into the supply grid and/or discharged via a brake resistor. The inverter decelerates the motor until the voltage induced by the motor is smaller than the one in the DC bus. Only then the motor becomes free of torque and runs down.

⚠ DANGER	
	**Danger to life due to electric shock when touching the motor connections!** The permanent magnets of the rotor of a synchronous machine induce dangerous direct current at the motor connections when the axis rotates. **Steps to prevent:** • Make sure that the motor shaft does not rotate. • Only touch the connections when the motor shaft does not rotate any longer and when you have determined that no voltage applies any longer.

⚠ DANGER	
	**Danger to life due to electric shock when touching the DC bus connections!** LED indicators on the front side of the KE/KW modules do not signal the voltage-free state of the device terminals in OFF state. The DC bus terminals lead life-threatening direct current as long as the power supply is connected to the supply grid or as long as the DC bus is fed generatively from the motor. **Steps to prevent:** 1. Ensure that the motor shaft stands still. 2. Separate the power supply from the supply grid and allow for the discharge time of the DC bus capacitators (min. 5 minutes). 3. Make sure that the DC bus terminal is voltage-free before touching the connections.

NOTICE	
Material Damage!	**Material damage in case of excessive DC bus voltage!** If the PWM is blocked in the STO state in synchronous motors that are operated in field weakening, the still rotating motor induces a voltage that is higher than the one of the feeding DC bus. Due to the induced voltage, a current flows into the DC bus via the free-wheel diodes in the inverter. This results in a potential increase of the voltage in the DC bus over the permitted value. This way, the power supply can be destroyed. **Steps to prevent:** • Ensure that the regenerative feedback of the power supply is activated. • Use a sufficiently dimensioned brake resistor at the power supply.

6.4 Safe stop 1 (SS1)

Properties

- Safety function according to DIN EN 61800-5-2:2008-04
- Controlled stop according to EN 60204-1, stop category 1
- Automatic or user-controlled deceleration procedure
- Safe monitoring of the deceleration procedure (2-channel actual speed value monitoring)
- Protection against restart

Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

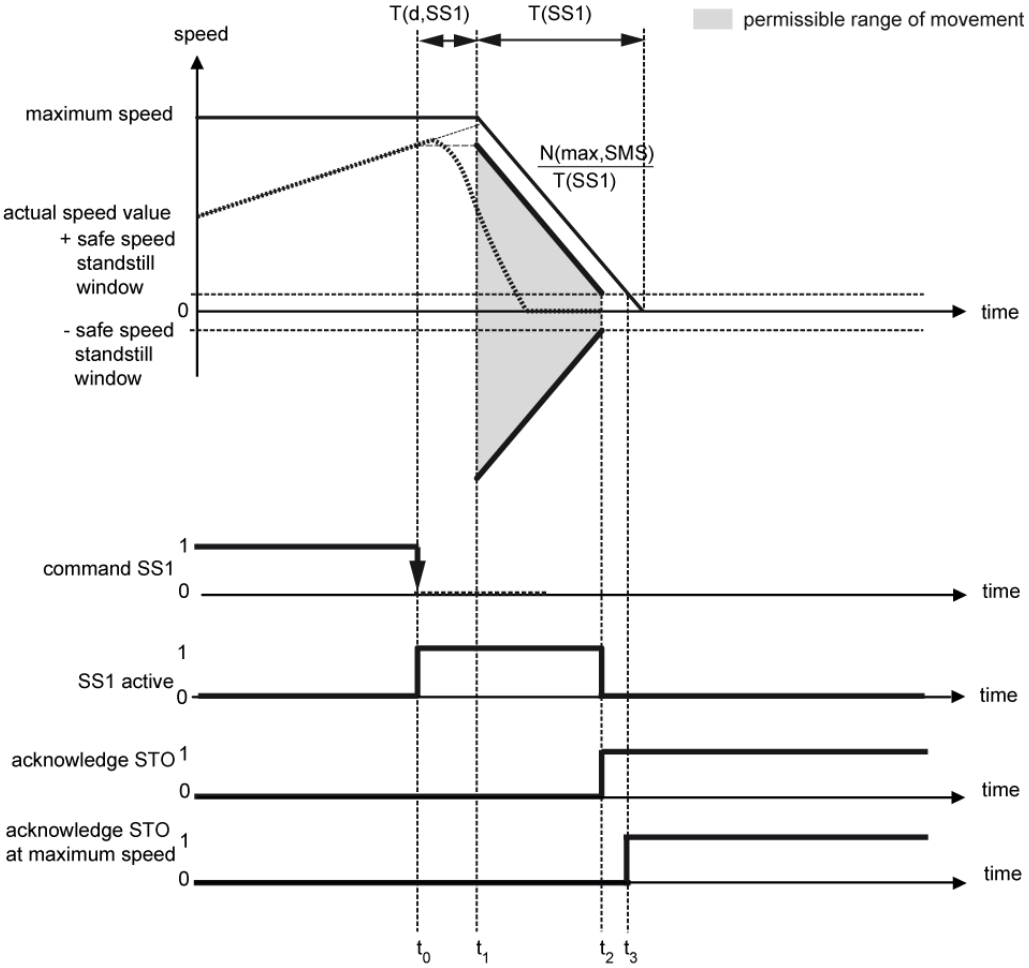
The initialised SS1 safety function monitors the deceleration procedure of the drive and subsequently transfers the drive into 'Safe torque off (STO)'.

⚠ DANGER	
	**Danger to life due to unexpected movements!** The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down). **Steps to prevent:** • Install an external, mechanical brake that prevents a movement. • Install a counterweight in order to maintain the axis in balance.

The deceleration procedure is automatically initiated by the safety function or by the user controller.

- Safety function initiates deceleration procedure
  - SS1 withdraws 'controller enable' RF:
    Drive controlled braking with ID32782 'Deceleration ramp RF inactive'
  - ...
- User control unit initiates deceleration procedure
  - Speed setpoint = 0:
    Deceleration ramp with ID32781 'Deceleration ramp'
  - Withdrawal of 'controller enable' RF:
    Drive controlled braking with ID32782 'Deceleration ramp RF inactive'
  - Control unit interpolates a movement profile and sends cyclical setpoints to the drive
  - ...

Example 1: Drive movement meets the permissible range of movement



Time t	Explanation
$t = t_0$	The safety function is started by a 1-0 edge and cannot be interrupted.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t \geq t_2$	The safety function switches the drive into the STO state and sets the STO acknowledgement bit. In the STO state, drive movements are no longer monitored since no further error reaction is possible.
$t = t_3$	STO acknowledgement at maximum speed

Reaction in case of an error

As soon as the safety function detects a deviation from the limits of the monitored values, the drive is set to the safe state 'Safe torque off (STO)' (example 2).

⚠ DANGER

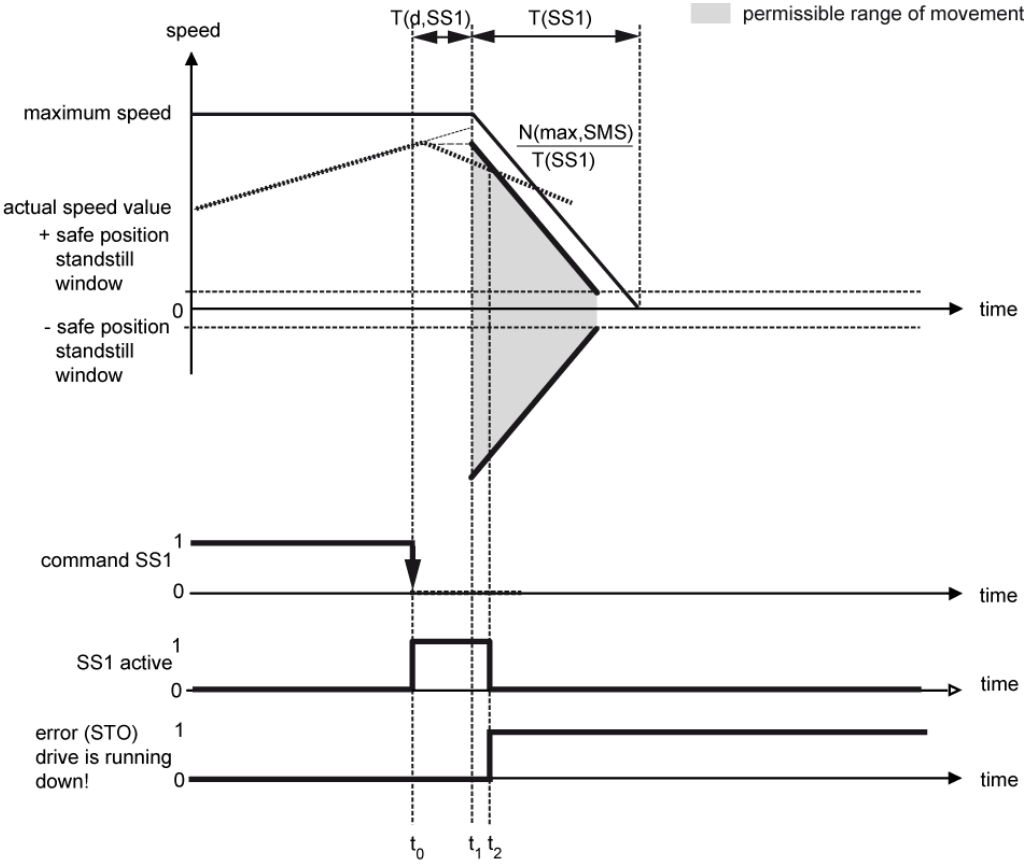
Danger to life due to unexpected movements!

The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down).

Steps to prevent:

- Install an external, mechanical brake that prevents a movement.
- Install a counterweight in order to maintain the axis in balance.

Example 2: Drive movement deviates from the parameterised ramp



Time t	Explanation
$t = t_0$	The safety function is started by a 1-0 edge and cannot be interrupted.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t = t_2$	The safety function detects an error, switches the drive into the STO state and sets the error bit.
$t \geq t_2$	In the STO state, drive movements are no longer monitored since no further error reaction is possible.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm18	'SS1 transition period'	T(d,SS1)	ms	0	65535
Prm20	'SS1 brake ramp time'	T(SS1)	ms	0	65535
Prm21	'SS1 safe speed standstill window'	N(zero,SS1)	U/min	0	60000
Prm67	'SMS safe maximum speed'	N(max,SMS)	rpm	0	60000

Relevant unsafe parameters

Parameter	Name	Code	Unit	Min	Max
ID113	'Maximum speed'	Nmax	rpm	1	100000
ID32781	'Deceleration ramp'	TL	ms	1	1200000
ID32782	'Deceleration ramp RF inactive'	-	ms	1	1200000
ID33203	'Safety bits'	-	-	0	65535

6.5 Safe operating stop (SOS)

Properties

- Safety function according to DIN EN 61800-5-2:2008-04
- Safe standstill monitoring with drift recognition
  (2-channel monitoring of the speed and position feedback value)

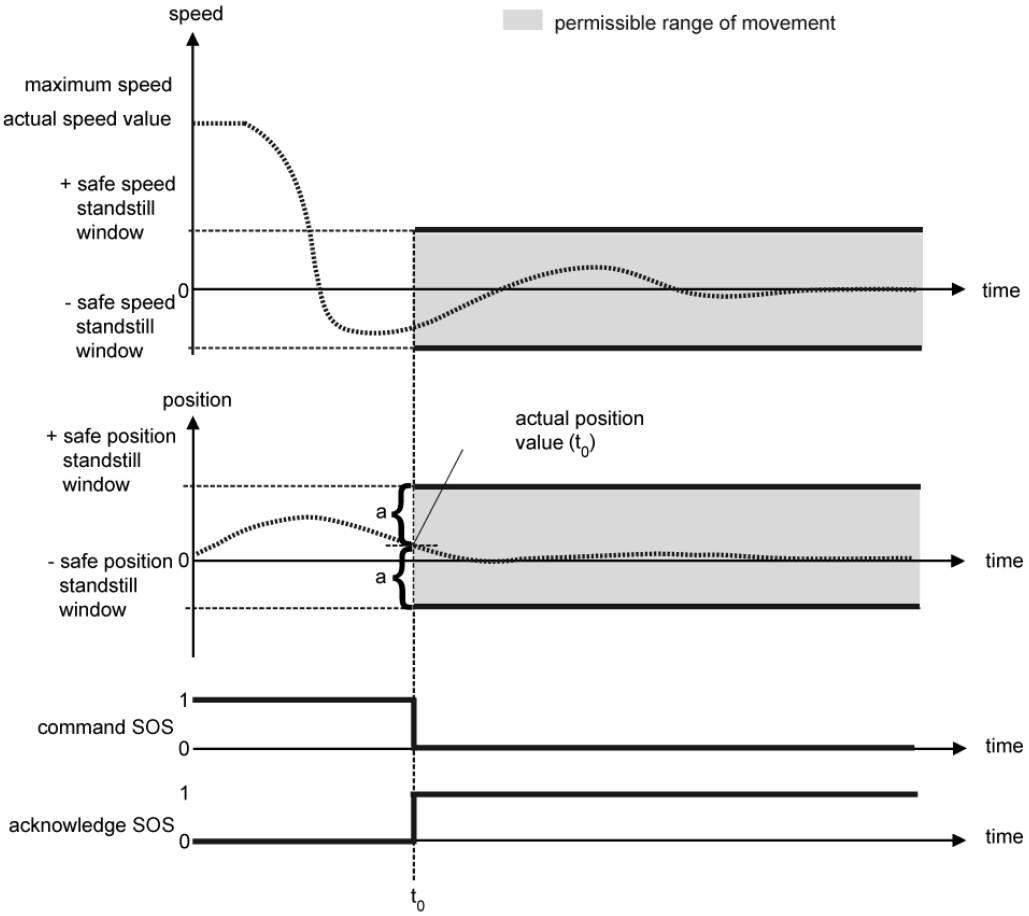
Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

The started SOS safety function monitors the actual speed value and monitors the compliance with the safe speed standstill window and the safe position standstill window.

⚠ GEFAHR	
	**Danger to life due to unexpected movements!** The normal operating function 'Safe encoder monitoring (SEM)' is active at any time. It will switch the drive from 'Safe operating stop (SOS)' to 'Safe stop 1 (SS1)' and subsequently to 'Safe torque off (STO)' if the monitored encoder stays in standstill for a longer time than parameterised in 'Safe encoder monitoring (SEM)'. In the status 'Safe torque off (STO)', in case of mains failure or defective drive controller, the drive will be torque-free. External force applied to the drive axis can cause life-threatening movements, e.g. hanging axes can fall down. **Steps to prevent:** • Install an external, mechanical brake that prevents a movement. • Install a counterweight in order to maintain the axis in balance. • Adapt the parameters of 'Safe encoder monitoring (SEM)' to your application.

Example 1: Drive movement meets the permissible range of movement



Time t	Explanation
$t = t_0$	The safety function is started. The safe position standstill window is symmetrically placed around the position feedback value of the drive at the time of the commanding.

Reaction in case of an error

As soon as the safety function detects a deviation from the limits of the monitored values, the drive is set to the safe state 'Safe torque off (STO)' **(example 2)** and **(example 3)**.

⚠ DANGER

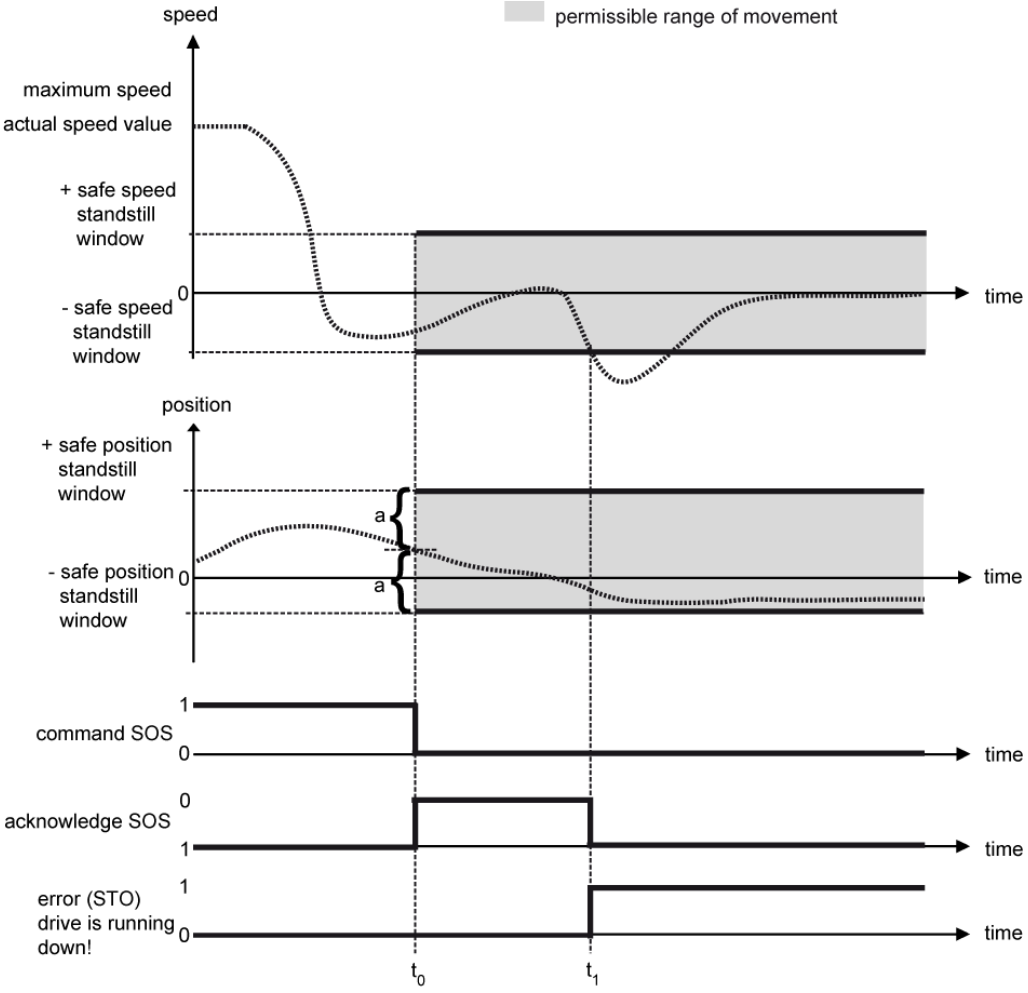
Danger to life due to unexpected movements!

The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down).

Steps to prevent:

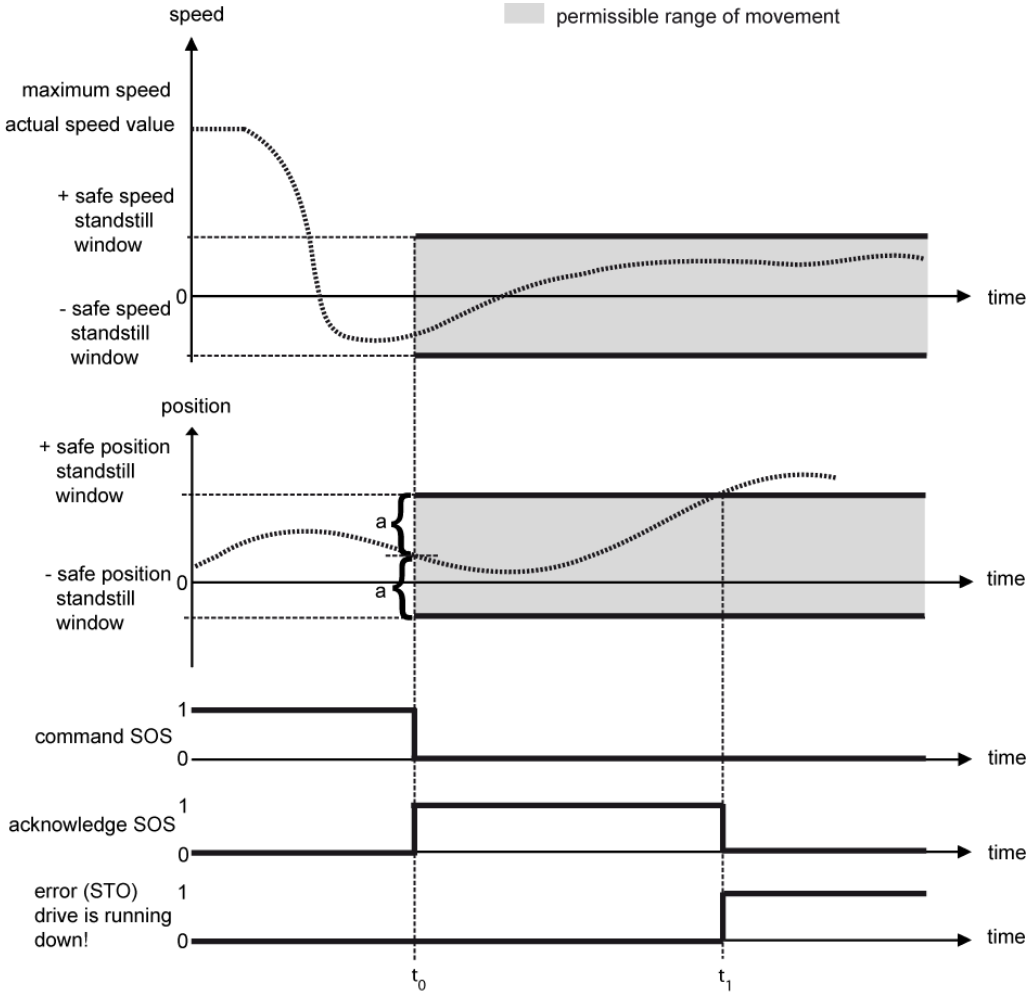
- Install an external, mechanical brake that prevents a movement.
- Install a counterweight in order to maintain the axis in balance.

Example 2: Drive movement deviates from the safe speed standstill window



Time t	Explanation
$t = t_0$	The safety function is started. The safe position standstill window is symmetrically placed around the position feedback value of the drive at the time of the commanding.
$t_0 < t < t_1$	The safety function monitors the compliance with the safe speed standstill window and the safe position standstill window and checks whether the actual speed value meets the permissible range of movement.
$t = t_1$	The safety function detects that the safe speed standstill window has been left, switches the drive into the STO state and sets the error bit. The SOS acknowledgement bit is reset.
$t \geq t_1$	In the STO state, drive movements are no longer monitored since no further error reaction is possible.

Example 3: Drive movement deviates from the safe position standstill window



Time t	Explanation
$t = t_0$	The safety function is started. The safe position standstill window is symmetrically placed around the position feedback value of the drive at the time of the commanding.
$t_0 < t < t_1$	The safety function monitors the compliance with the safe speed standstill window and the safe position standstill window and checks whether the actual speed value meets the permissible range of movement.
$t = t_1$	The safety function detects that the positions standstill window has been left, switches the drive into the STO state and sets the error bit. The SOS acknowledgement bit is reset.
$t \geq t_1$	In the STO state, drive movements are no longer monitored since no further error reaction is possible.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm28	'SOS safe speed standstill window'	N(zero,SOS)	U/min	0	60000
Prm29	'SOS safe position standstill window'	S(zero,SOS)	Incr.	-2147483647	2147483647

6.6 Safe stop 2 (SS2)

Properties

- Safety function according to DIN EN 61800-5-2:2008-04
- Controlled stop according to EN 60204-1, stop category 2
- Safe standstill control with drift recognition
  (2-channel monitoring of the actual speed and position values)

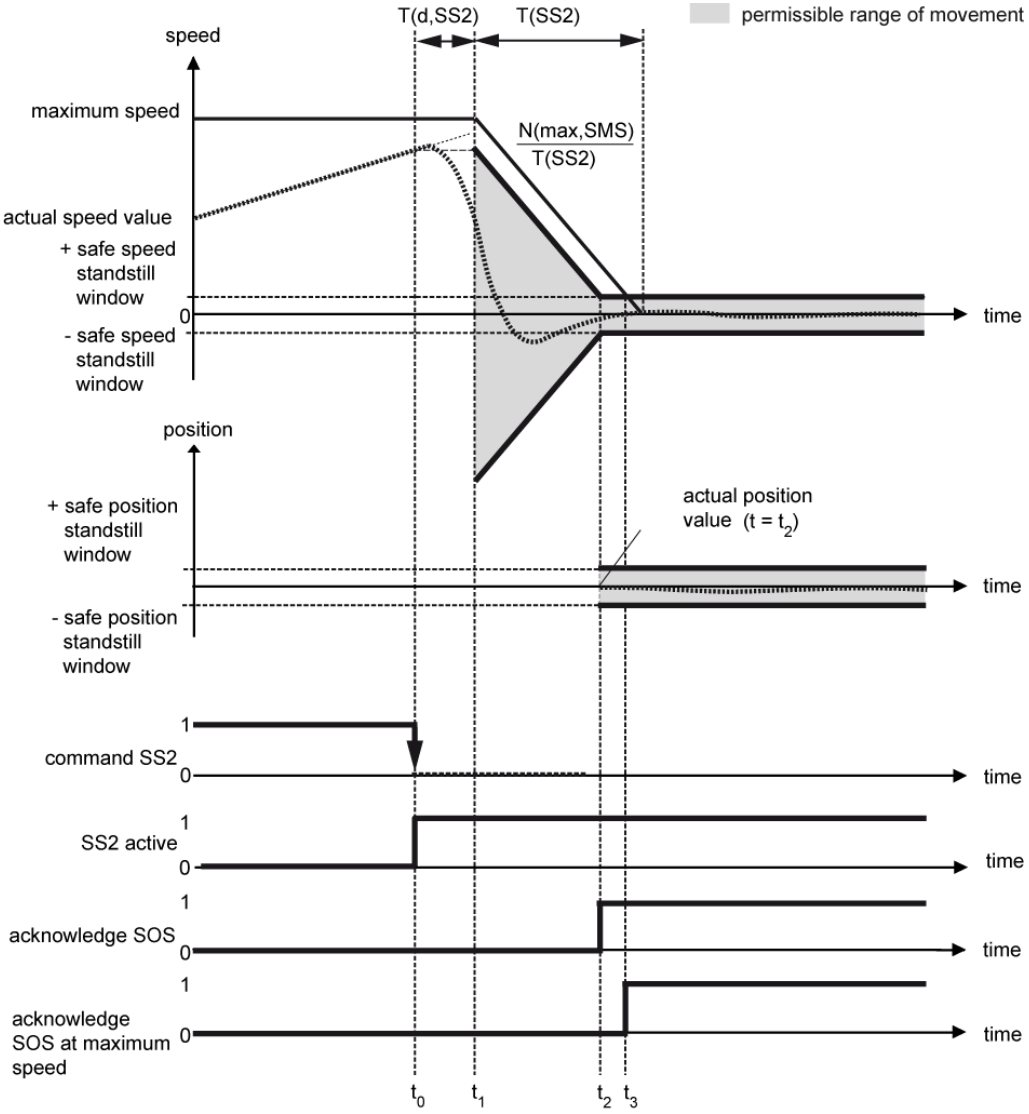
Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

The initialised SS2 safety function monitors the deceleration process of the drive and subsequently the safe standstill in regular operations. The deceleration procedure must be initiated by the user controller.

⚠ GEFAHR	
	**Danger to life due to unexpected movements!** The normal operating function 'Safe encoder monitoring (SEM)' is active at any time. It will switch the drive from 'Safe operating stop (SOS)' to 'Safe stop 1 (SS1)' and subsequently to 'Safe torque off (STO)' if the monitored encoder stays in standstill for a longer time than parameterised in 'Safe encoder monitoring (SEM)'. In the status 'Safe torque off (STO)', in case of mains failure or defective drive controller, the drive will be torque-free. External force applied to the drive axis can cause life-threatening movements, e.g. hanging axes can fall down. **Steps to prevent:** • Install an external, mechanical brake that prevents a movement. • Install a counterweight in order to maintain the axis in balance. • Adapt the parameters of 'Safe encoder monitoring (SEM)' to your application.

Example 1: Drive movement in the permissible range of movement



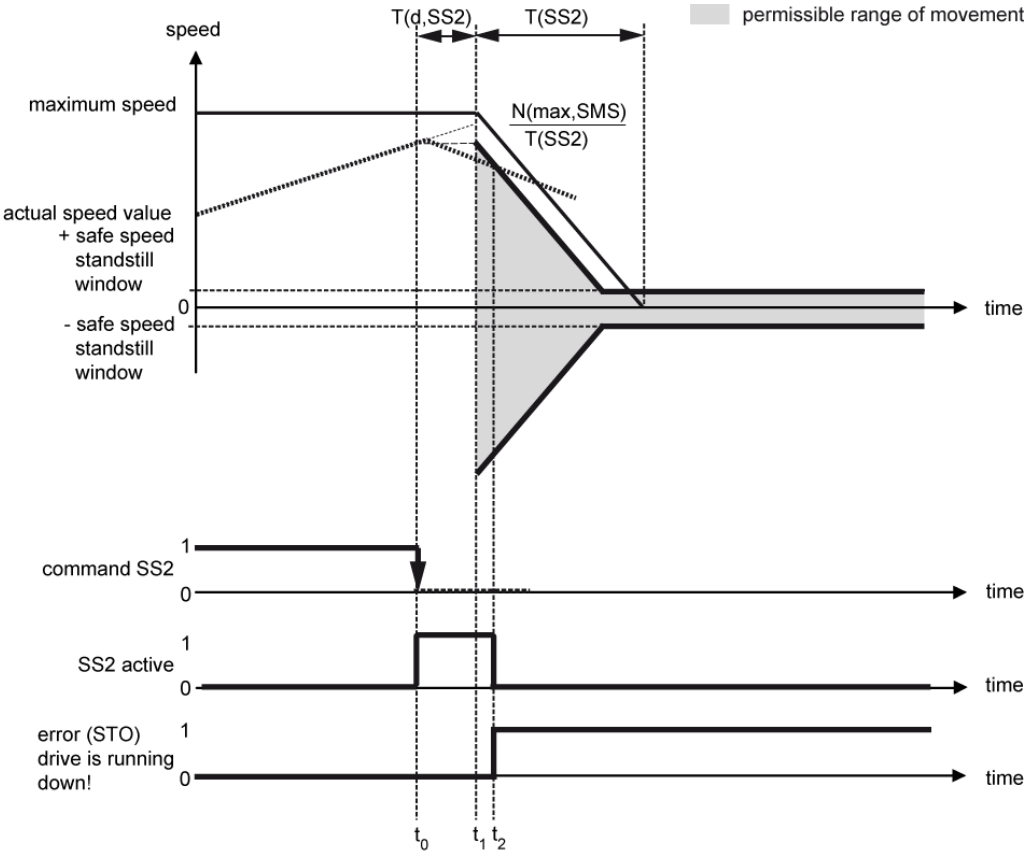
Time t	Explanation
$t = t_0$	The safety function is started by a 1-0 edge and cannot be interrupted.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t \geq t_2$	The safety function switches the drive into the SOS state and sets the SOS acknowledgement bit. In the SOS state, the safety function monitors whether the actual speed value meets the safe speed standstill window and the actual position value meets the safe position standstill window.
$t = t_3$	SOS acknowledgement at maximum speed

Reaction in case of an error

As soon as the safety function detects a deviation from the limits of the monitored values, the drive is set to the safe state 'Safe torque off (STO)' **(example 2)** and **(example 3)**.

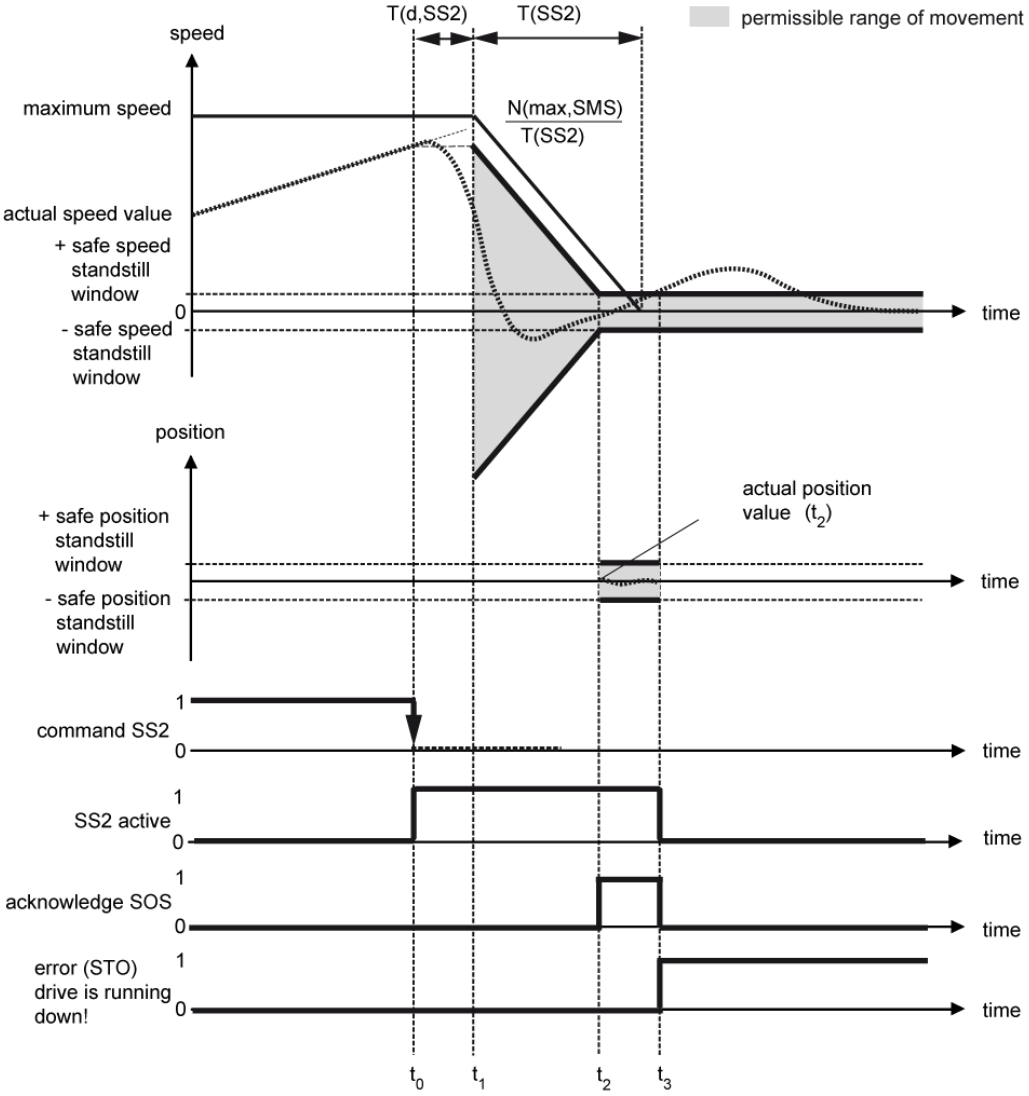
⚠ DANGER	
⚠	**Danger to life due to unexpected movements!** The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down). **Steps to prevent:** • Install an external, mechanical brake that prevents a movement. • Install a counterweight in order to maintain the axis in balance.

Example 2: Drive movement deviates from the parameterised deceleration ramp



Time t	Explanation
$t = t_0$	The safety function is started by a 1-0 edge and cannot be interrupted.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t = t_2$	The safety function detects an error, switches the drive into the STO state and sets the error bit.
$t \geq t_2$	In the STO state, drive movements are no longer monitored since no further error reaction is possible.

Example 3: Drive movement deviates from the safe speed standstill window in the SOS state



Time t	Explanation
$t = t_0$	The safety function is started by a 1-0 edge and cannot be interrupted.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t = t_2$	The safety function switches the drive into the SOS state and sets the SOS acknowledgement bit.
$t_2 \leq t < t_3$	In the SOS state, the safety function monitors whether the actual speed value is in the safe speed standstill window and the actual position value complies with the safe position standstill window.
$t = t_3$	The safety function detects an error, switches the drive into the STO state and sets the error bit. The SOS acknowledgement bit is reset.
$t \geq t_3$	In the STO state, drive movements are no longer monitored since no further error reaction is possible.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm23	'SS2 transition period'	T(d,SS2)	ms	0	65535
Prm25	'SS2 brake ramp time'	T(SS2)	ms	0	65535
Prm26	'SS2 safe speed standstill window'	N(zero,SS2)	U/min	0	60000
Prm27	'SS2 safe position standstill window'	S(zero,SS2)	Incr.	-2147483647	2147483647
Prm67	'SMS safe maximum speed'	N(max,SMS)	rpm	0	60000

Relevant unsafe parameters

Parameter	Name	Code	Unit	Min	Max
ID113	'Maximum speed'	Nmax	rpm	1	100000
ID32781	'Deceleration ramp'	TL	ms	1	1200000
ID32782	'Deceleration ramp RF inactive'	-	ms	1	1200000

6.7 Safe maximum speed (SMS)

Properties

- Special case of the SSR safety function according to DIN EN 61800-5-2:2008-04
- Safe monitoring of the actual speed value (2-channel)
- Parameterisable stop function in case of error

Description

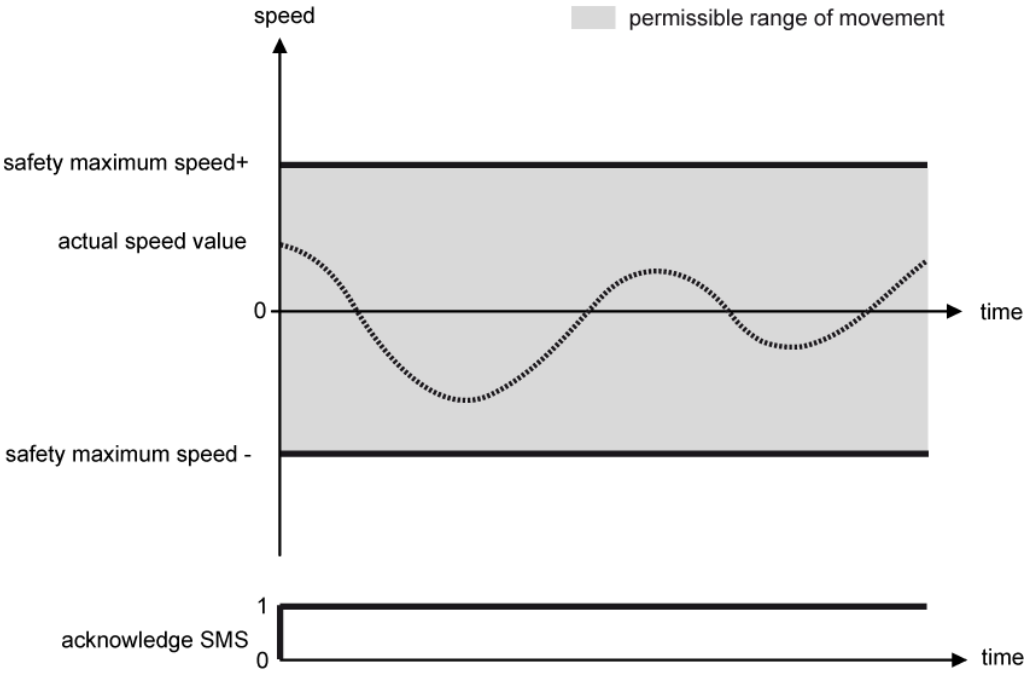
The SMS safety function belongs to the normal operation category. The SMS safety function is automatically started after the system booting. It monitors whether the actual speed value meets the parameterised permissible speed range.

The normal operation function 'Safe maximum speed (SMS)' is always active and can not get deactivated.

The monitoring of the safe maximum speed can be "switched off" in principle by setting the Prm67 'SMS safe maximum speed', N(max,SMS), to its maximum value.

In this case, you must consider that the safe maximum speed directly governs the steepness of the braking ramps of the stop fuctions SS1 and SS2 as well as the safe operation modes SSR and SLS.

Example 1: Drive movement in the permissible range of movement



Reaction in case of an error

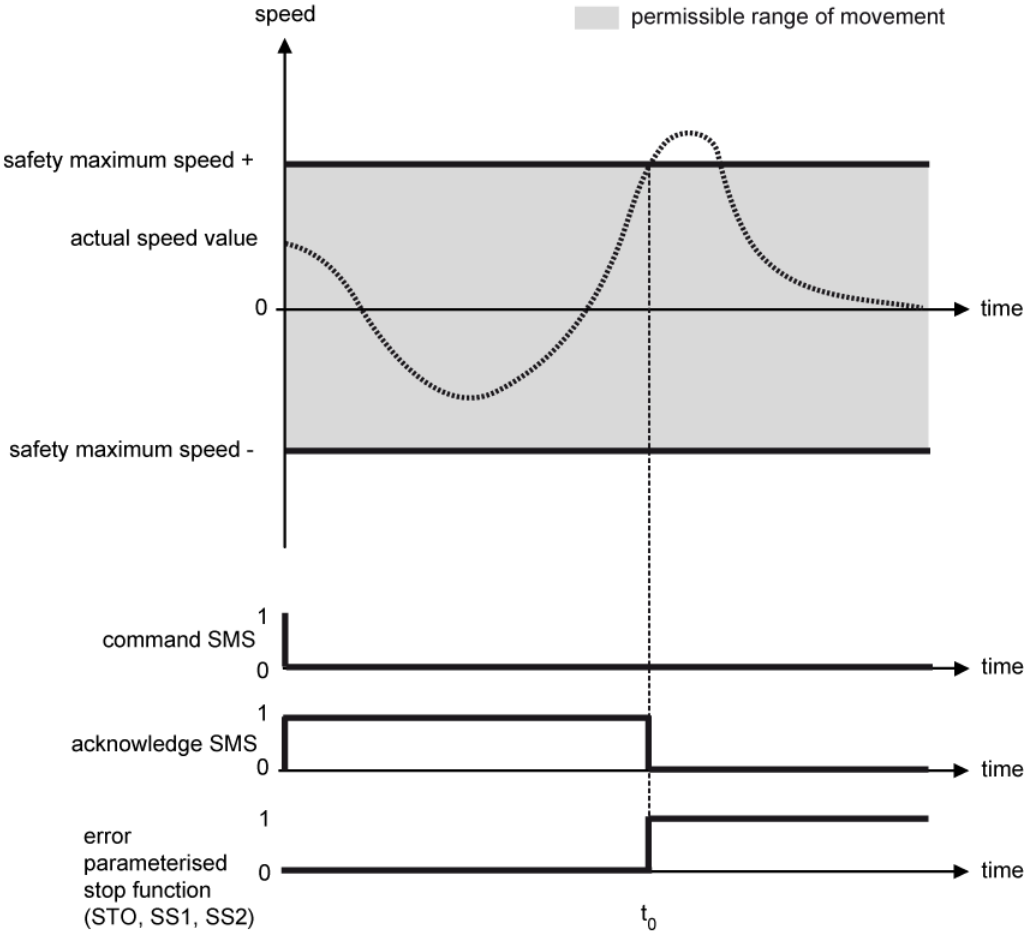
As soon as the safety function detects a deviation from the limits of the controlled values, the drive executes a safe stop function that has previously been set by parameter ('Safe torque off (STO)', 'Safe stop 1 (SS1)' or 'Safe stop 2 (SS2)').

⚠ DANGER	
⚠	**Danger to life due to unexpected movements!** The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down). **Steps to prevent:** • Install an external, mechanical brake that prevents a movement. • Install a counterweight in order to maintain the axis in balance.

⚠ WARNING	
	**Danger due to unexpected stop function!** If there are different error reactions projected for the safety functions, an unexpected final state can occur in case of error. Example: Two safety functions are active at the same time with error reactions SS1 respectively SS2. STO will result definitely. **Steps to prevent:** • We recommend to project the same stop function for all safety functions! • If it is not possible to project the same stop function, the different reactions must be considered!

The reaction time of the drive in case of error is prolonged by the reaction time of the parameterised stop function!

Example 2: Drive movement deviates from the permissible speed range



Time t	Explanation
$t < t_0$	The SMS safety function is automatically started after the system booting. It monitors whether the actual speed value meets the parameterised permissible speed range.
$t = t_0$	The safety function detects that the maximum velocity has been exceeded, switches the drive into the parameterised stop function and sets the error bit. The SMS acknowledgement bit is reset.
$t \geq t_0$	The behaviour is dependant on the parameterised stop function.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm67	'SMS safe maximum speed'	N(max,SMS)	rpm	0	60000
Prm68	'SMS error reaction'	SMS_ERR	-	0	2

6.8 Safe speed range (SSR)

Properties

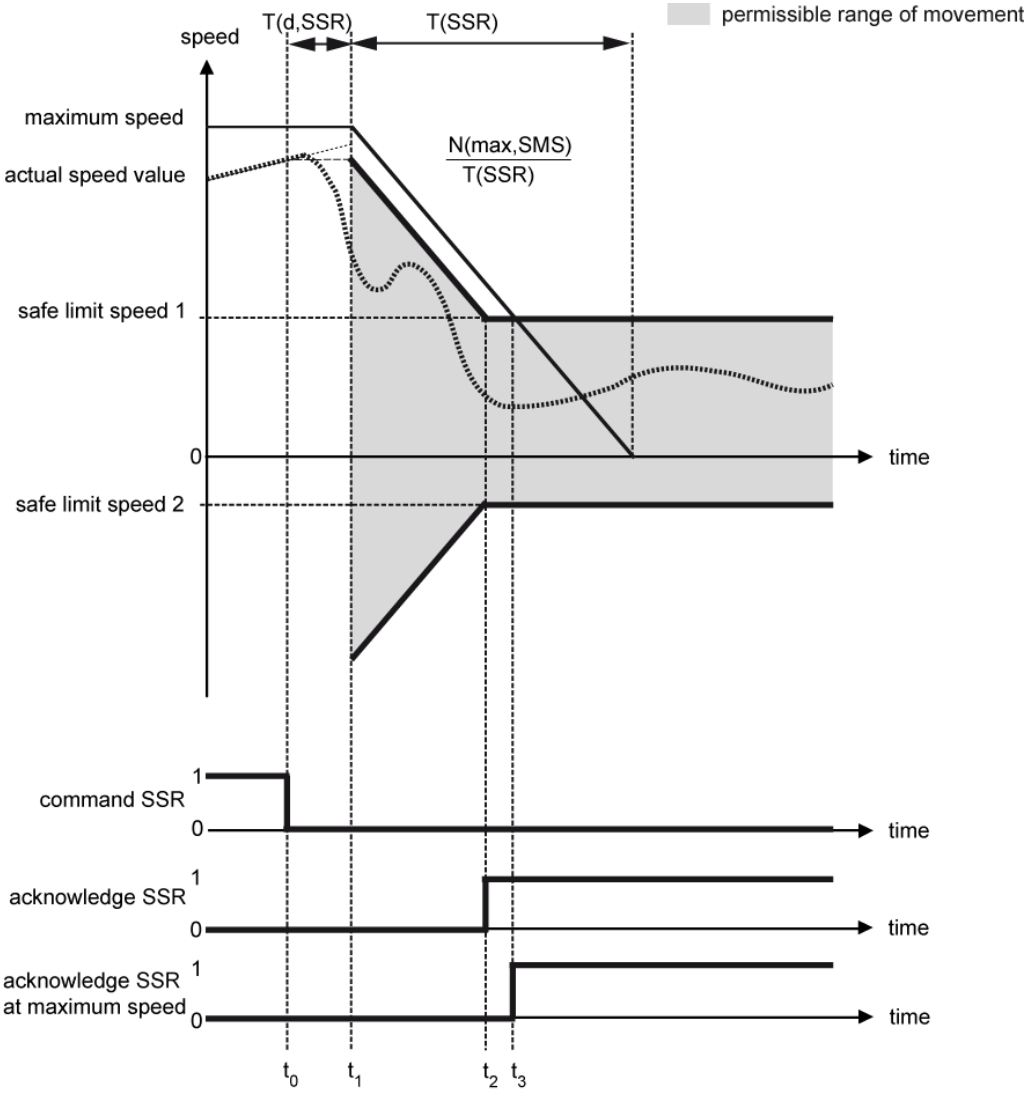
- Safety function according to DIN EN 61800-5-2:2008-04
- Freely parameterisable safe speed range (2-channel actual speed value monitoring)
- 4 individually configurable safety functions SSR1, SSR2, SSR3, SSR4
- Parametrisable stop function in case of error

Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

The started SSR safety function monitors the speed change of the drive, and subsequently the operation within a parameterised safe speed range. The speed change must be initiated by the user controller.

Example 1: Drive movement in the permissible range of movement



Time t	Explanation
$t = t_0$	The safety function is started.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permitted range of movement.

Time t	Explanation
$t \geq t_2$	The safety function switches the drive into the SSR state and sets the SSR acknowledgement bit. In the SSR state, the safety function monitors whether the actual speed value meets the parameterised safe speed range.
$t = t_3$	Acknowledgement SSR at maximum speed

Reaction in case of an error

As soon as the safety function detects a deviation from the limits of the controlled values, the drive executes a safe stop function that has previously been set by parameter ('Safe torque off (STO)', 'Safe stop 1 (SS1)' or 'Safe stop 2 (SS2)') **(example 2)** and **(example 2a)**.

The 4 SSR safety functions monitor the drive independently from each other. As soon as the drive leaves the speed range parameterised in one of the SSR1 - SSR4 safety functions, the stop function that has been parameterised for this SSR becomes active **(example 3)**.

⚠ DANGER

Danger to life due to unexpected movements!

The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down).

Steps to prevent:

- Install an external, mechanical brake that prevents a movement.
- Install a counterweight in order to maintain the axis in balance.

⚠ WARNING

Danger due to unexpected stop function!

If there are different error reactions projected for the safety functions, an unexpected final state can occur in case of error.

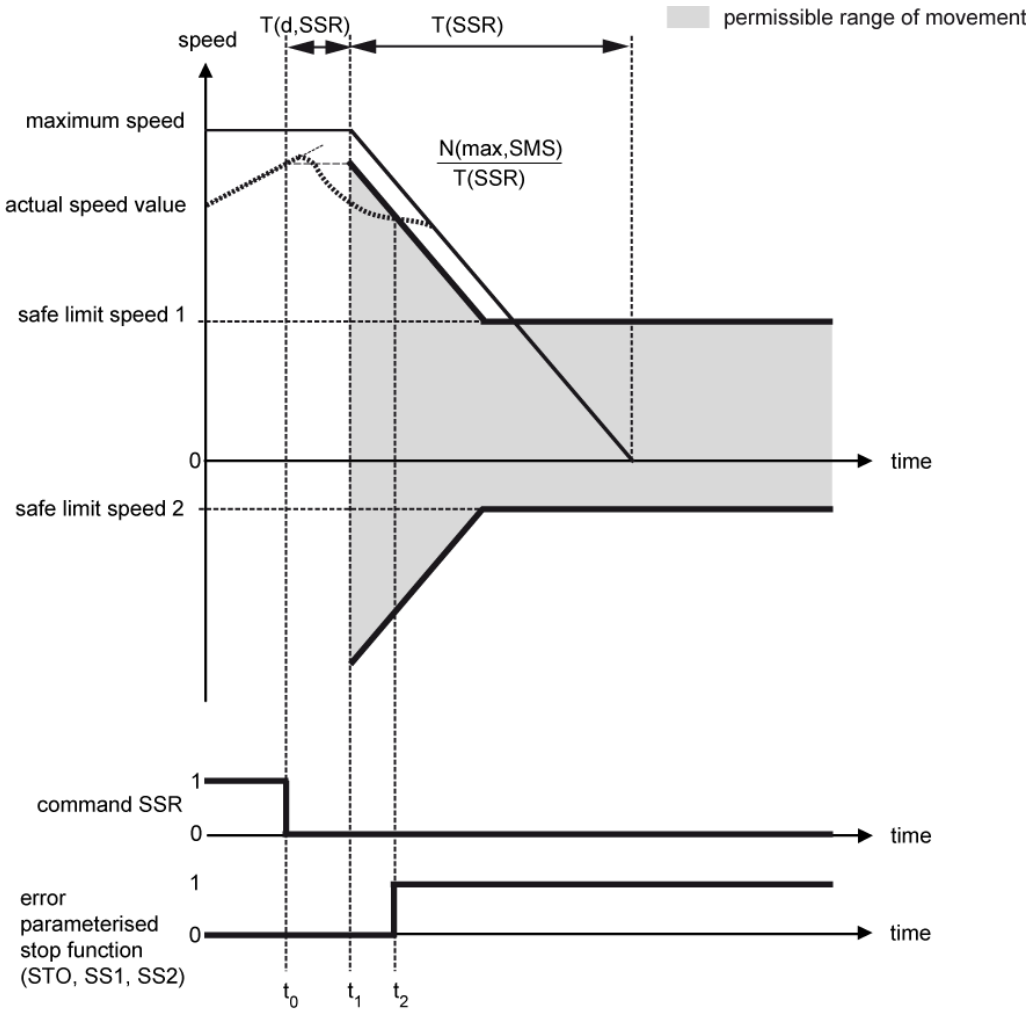
Example:
Two safety functions are active at the same time with error reactions SS1 respectively SS2. STO will result definitely.

Steps to prevent:

- We recommend to project the same stop function for all safety functions!
- If it is not possible to project the same stop function, the different reactions must be considered!

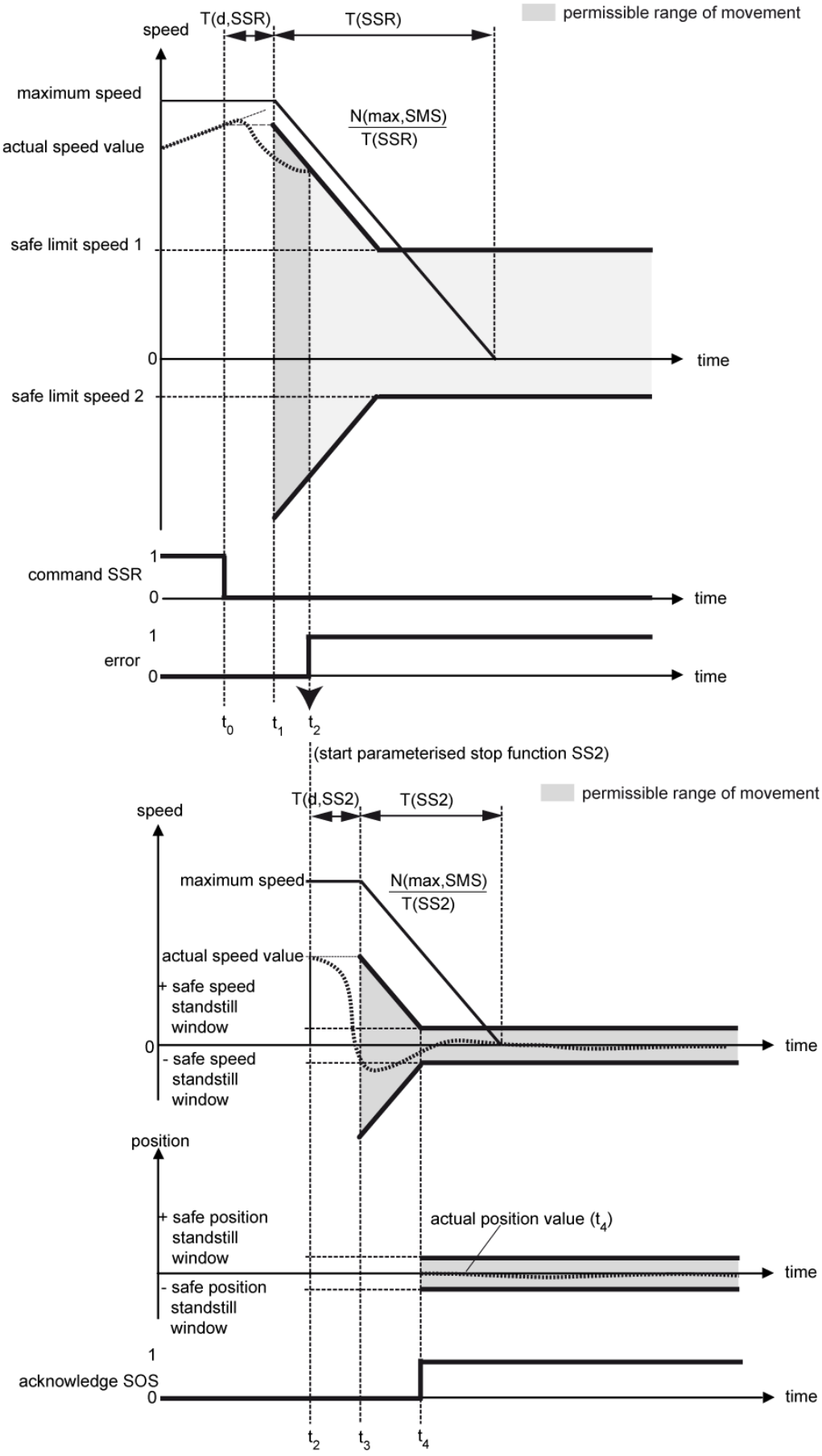
The reaction time of the drive in case of error is prolonged by the reaction time of the parameterised stop function!

Example 2: Drive movement deviates from the permissible range of movement



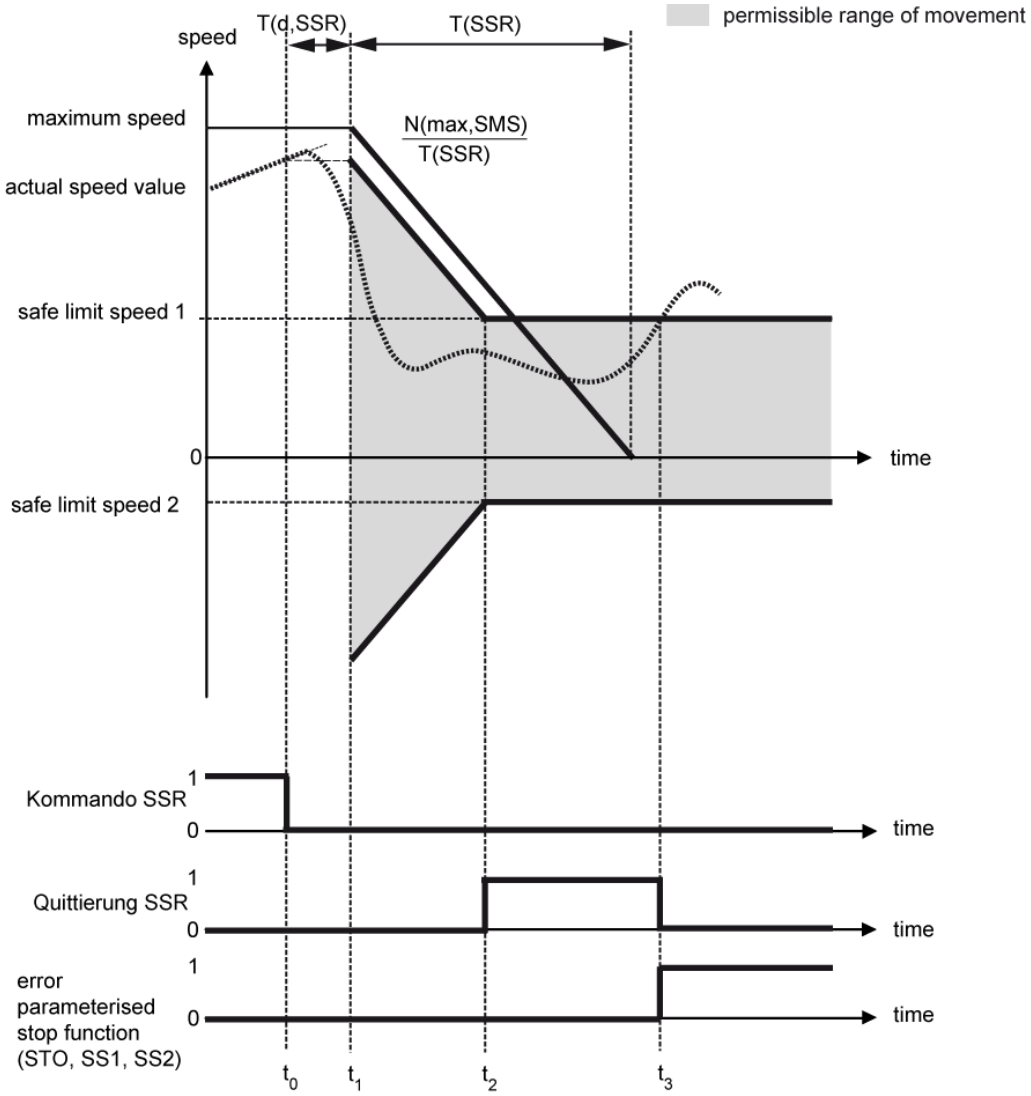
Time t	Explanation
$t = t_0$	The safety function is started.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t = t_2$	The safety function detects an error, starts the parameterised stop function and sets the error bit.

Example 2a: Drive movement deviates from the permissible range of movement (SS2 as parameterised stop function)



Time t	Explanation
$t = t_0$	The safety function is started.
$t_0 < t < t_1$	In the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value lies within the permissible range of movement.
$t = t_2$	The safety function detects an error, starts the parameterised stop function SS2 and sets the error bit.
$t_2 < t < t_3$	In the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_3 \leq t < t_4$	The safety function monitors the parameterised ramp and checks whether the actual speed value lies within the permissible range of movement.
$t \geq t_4$	The safety function switches the drive into the SOS state and sets the SOS acknowledgement bit. In the SOS state, the safety function monitors whether the actual speed value is in the safe speed standstill window and the position feedback value is in the safe position standstill window.

Example 3: Drive movement deviates from the safe speed range in the SSR state



Time t	Explanation
$t = t_0$	The safety function is started.

Time t	Explanation
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value lies within the permissible range of movement.
$t = t_2$	The safety function switches the drive into the SSR state and sets the SSR acknowledgement bit.
$t_2 \leq t < t_3$	In the SSR state, the safety function monitors whether the actual speed value meets the safe speed range.
$t = t_3$	The safety function detects an error, switches the drive into the parameterised stop function and sets the error bit. The SSR acknowledgement bit is reset.
$t \geq t_3$	The drive behaviour depends on the parametrised stop function.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm30	'SSR1 transition period'	T(d,SSR1)	ms	0	65535
Prm32	'SSR1 brake ramp time'	T(SSR1)	ms	0	65535
Prm33	'SSR1 safe limit speed 1'	N(ul,SSR1)	rpm	-60000	60000
Prm34	'SSR1 safe limit speed 2'	N(ll,SSR1)	rpm	-60000	60000
Prm35	'SSR1 error reaction'	SSR1_ERR	-	0	2
Prm36	'SSR2 transition period'	T(d,SSR2)	ms	0	65535
Prm38	'SSR2 brake ramp time'	T(SSR2)	ms	0	65535
Prm39	'SSR2 safe limit speed 1'	N(ul,SSR2)	rpm	-60000	60000
Prm40	'SSR2 safe limit speed 2'	N(ll,SSR2)	rpm	-60000	60000
Prm41	'SSR2 error reaction'	SSR2_ERR	-	0	2
Prm42	'SSR3 transition period'	T(d,SSR3)	ms	0	65535
Prm44	'SSR3 brake ramp time'	T(SSR3)	ms	0	65535
Prm45	'SSR3 safe limit speed 1'	N(ul,SSR3)	rpm	-60000	60000
Prm46	'SSR3 safe limit speed 2'	N(ll,SSR3)	rpm	-60000	60000
Prm47	'SSR3 error reaction'	SSR3_ERR	-	0	2
Prm48	'SSR4 transition period'	T(d,SSR4)	ms	0	65535
Prm50	'SSR4 brake ramp time'	T(SSR4)	ms	0	65535
Prm51	'SSR4 safe limit speed 1'	N(ul,SSR4)	rpm	-60000	60000
Prm52	'SSR4 safe limit speed 2'	N(ll,SSR4)	rpm	-60000	60000
Prm53	'SSR4 error reaction'	SSR4_ERR	-	0	2
Prm67	'SMS safe maximum speed'	N(max,SMS)	rpm	0	60000

Relevant unsafe parameters

Parameter	Name	Code	Unit	Min	Max
ID113	'Maximum speed'	Nmax	rpm	1	100000
ID32780	'Acceleration ramp'	TH	ms	1	1200000
ID32781	'Deceleration ramp'	TL	ms	1	1200000
ID32782	'Deceleration ramp RF inactive'	-	ms	1	1200000

6.9 Safely-limited speed (SLS)

Properties

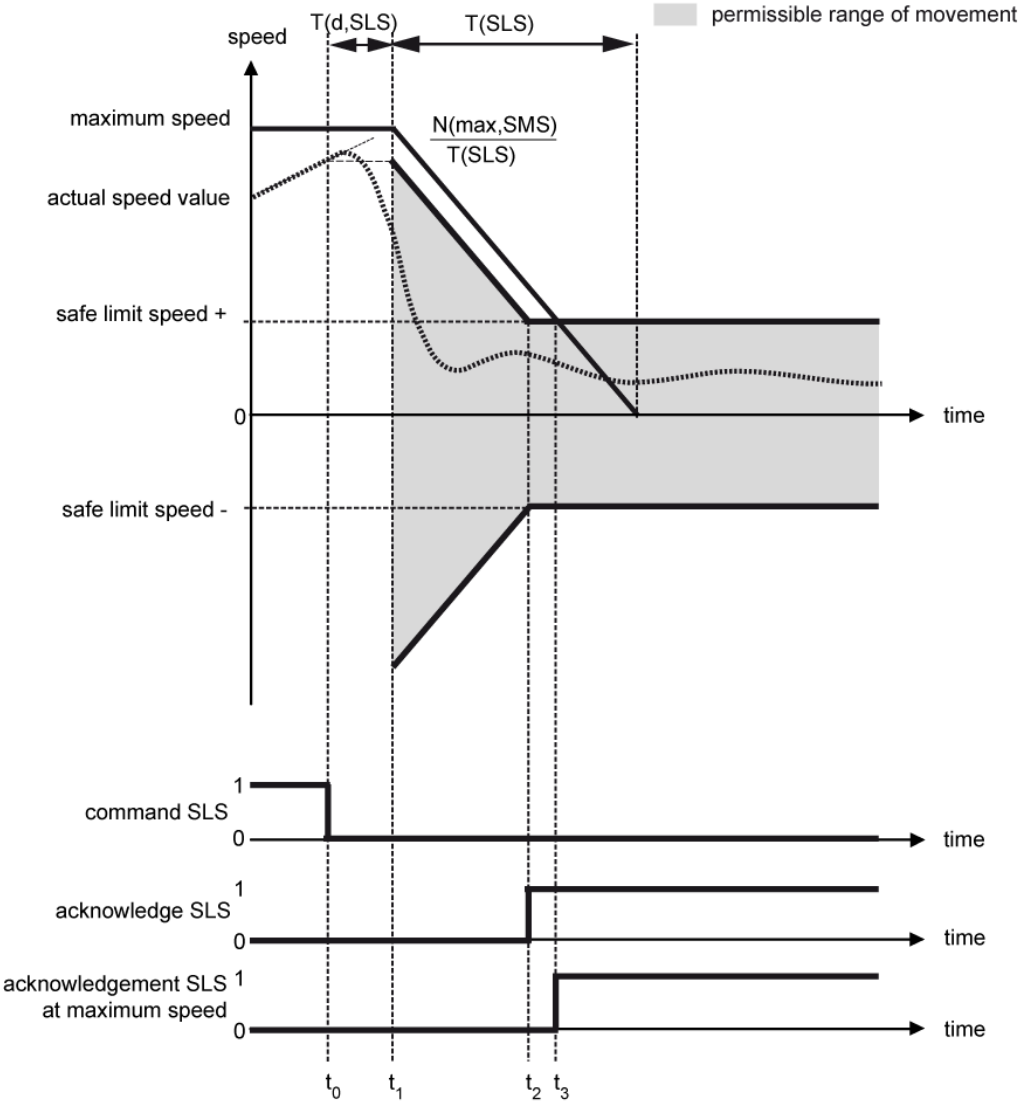
- Safety function according to DIN EN 61800-5-2:2008-04
- Parameterisable safe speed range (2-channel actual speed value monitoring)
- Parameterised speed limit automatically is positive and negative speed limit value
- 2 individually configurable functions SLS1 and SLS2
- Parameterisable stop function in case of error

Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

The started SLS safety function monitors the deceleration procedure of the drive, and subsequently the operation within a parameterised safe speed range. The speed change must be initiated by the user controller.

Example 1: Drive movement in the permissible range of movement



Time t	Explanation
$t = t_0$	The safety function is started.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.

Time t	Explanation
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t \geq t_2$	The safety function switches the drive into the SLS state and sets the SLS acknowledgement bit. In the SLS state, the safety function monitors whether the actual speed value meets the parameterised safe speed range.
$t = t_3$	Acknowledgement SLS at maximum speed

Reaction in case of an error

As soon as the safety function detects a deviation from the limits of the controlled values, the drive executes a safe stop function that has previously been set by parameter ('Safe torque off (STO)', 'Safe stop 1 (SS1)' or 'Safe stop 2 (SS2)') **(example 2)**.

The 2 SLS safety functions monitor the drive independently from each other. As soon as the drive leaves the parameterised speed range in a safety function, the stop function becomes active that has been parameterised for this SLS **(example 3)**.

⚠ DANGER

Danger to life due to unexpected movements!

The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down).

Steps to prevent:

- Install an external, mechanical brake that prevents a movement.
- Install a counterweight in order to maintain the axis in balance.

⚠ WARNING

Danger due to unexpected stop function!

If there are different error reactions projected for the safety functions, an unexpected final state can occur in case of error.

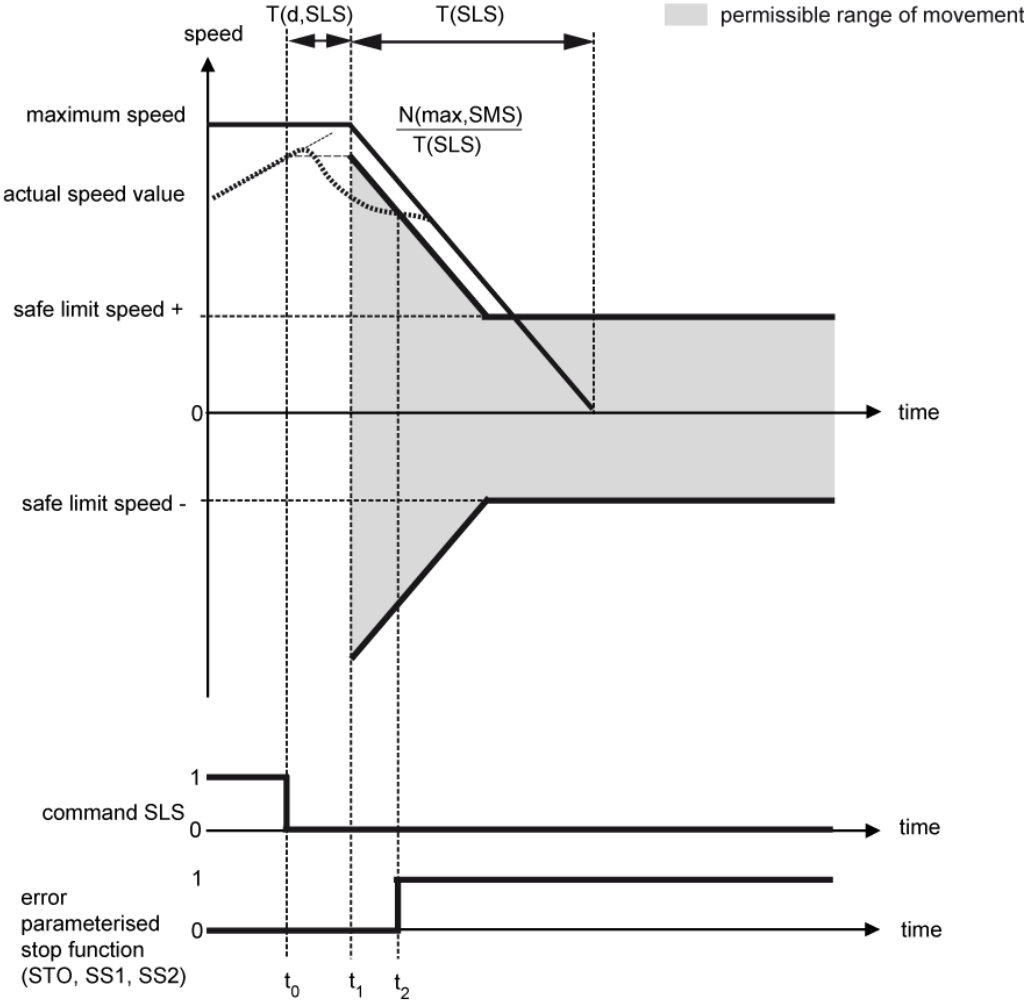
Example:
Two safety functions are active at the same time with error reactions SS1 respectively SS2. STO will result definitely.

Steps to prevent:

- We recommend to project the same stop function for all safety functions!
- If it is not possible to project the same stop function, the different reactions must be considered!

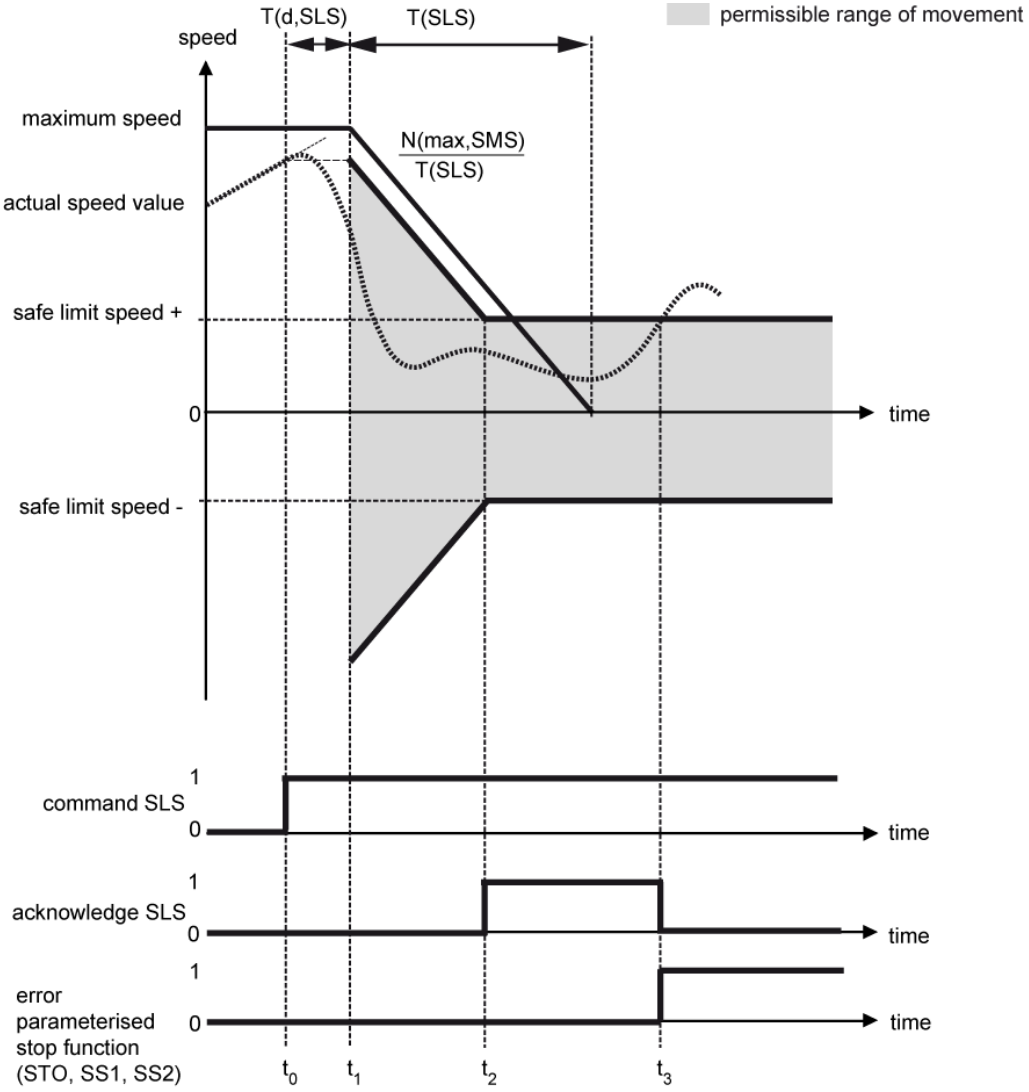
The reaction time of the drive in case of error is prolonged by the reaction time of the parameterised stop function!

Example 2: Drive movement deviates from the permissible range of movement



Time t	Explanation
$t = t_0$	The safety function is started.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t = t_2$	The safety function detects an error, starts the parameterised stop function and sets the error bit.

Example 3: Deviation from the speed range in the SLS state



Time t	Explanation
$t = t_0$	The safety function is started.
$t_0 < t < t_1$	During the transition period, the actual speed value of the drive must be adjusted to the parameterised limits of the started safety function. The parameterised limits are not monitored yet.
$t_1 \leq t < t_2$	The safety function monitors the parameterised ramp and checks whether the actual speed value meets the permissible range of movement.
$t = t_2$	The safety function switches the drive into the SLS state and sets the SLS acknowledgement bit.
$t_2 \leq t < t_3$	In the SLS state, the safety function monitors whether the actual speed value meets the parameterised safe speed range.
$t = t_3$	The safety function detects an error, starts the parameterised stop function and sets the error bit. The SLS acknowledgement is reset.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm54	'SLS1 transition period'	T(d,SLS1)	ms	0	65535
Pmr56	'SLS1 brake ramp time'	T(SLS1)	ms	0	65535
Prm57	'SLS1 safe limit speed'	N(limit,SLS1)	rpm	-60000	60000
Prm58	'SLS1 error reaction'	SLS1_ERR	-	0	2
Prm59	'SLS2 transition period'	T(d,SLS2)	ms	0	65535
Prm61	'SLS2 brake ramp time'	T(SLS2)	ms	0	65535
Prm62	'SLS2 safe limit speed'	N(limit,SLS2)	rpm	-60000	60000
Prm63	'SLS2 error reaction'	SLS2_ERR	-	0	2
Prm67	'SMS safe maximum speed'	N(max,SMS)	rpm	0	60000

Relevant unsafe parameters

Parameter	Name	Code	Unit	Min	Max
ID113	'Maximum speed'	Nmax	rpm	1	100000
ID32780	'Acceleration ramp'	TH	ms	1	1200000
ID32781	'Deceleration ramp'	TL	ms	1	1200000
ID32782	'Deceleration ramp RF inactive'	-	ms	1	1200000

6.10 Safe direction positive (SDIp)

Properties

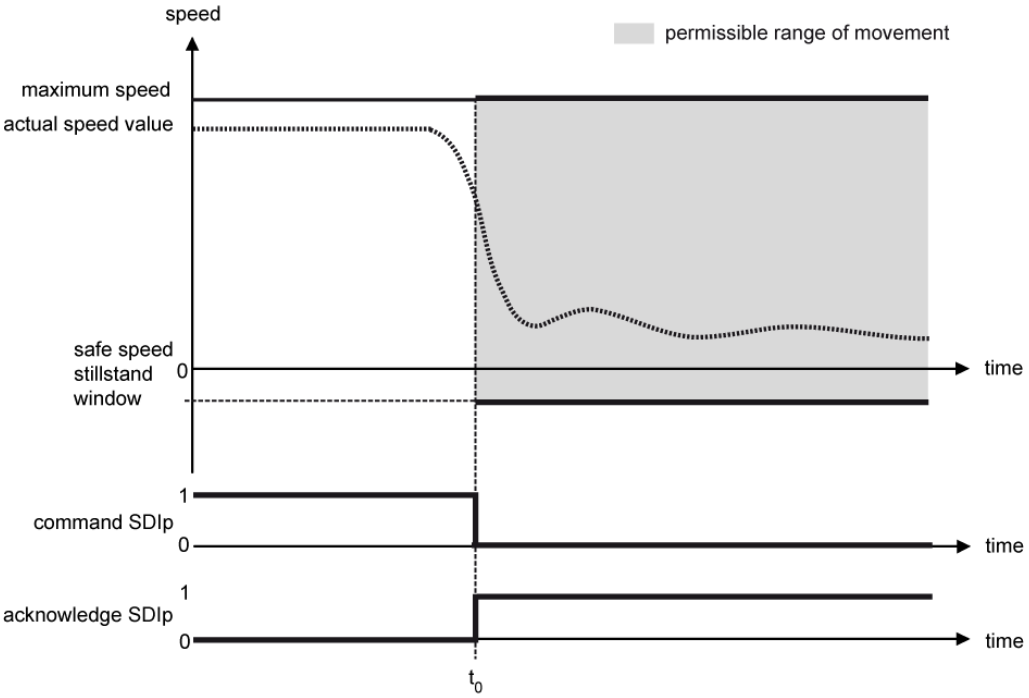
- Safety function according to DIN EN 61800-5-2:2008-04
- Monitoring the motor shaft direction of rotation
- Safe monitoring of the actual speed value (2-channel)
- Positive direction of rotation permitted

Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

The started SDIp safety function monitors that the motor shaft does not rotate in the negative direction by monitoring the actual speed value for the correct sign. The safe speed standstill window defines a speed range between zero speed and the negative direction not permitted. Control fluctuations around zero speed within the safe speed standstill window do not result in the generation of an error by the safety monitoring.

Example 1: Drive movement in the permissible range of movement (positive direction permissible)



Time t	Explanation
$t = t_0$	The safety function is started and the SDIp acknowledgement is set.

Reaction in case of an error

As soon as the safety function detects a deviation from the limits of the monitored values, the drive is set to the safe state 'Safe torque off (STO)'. **(example 2)**.

⚠ DANGER

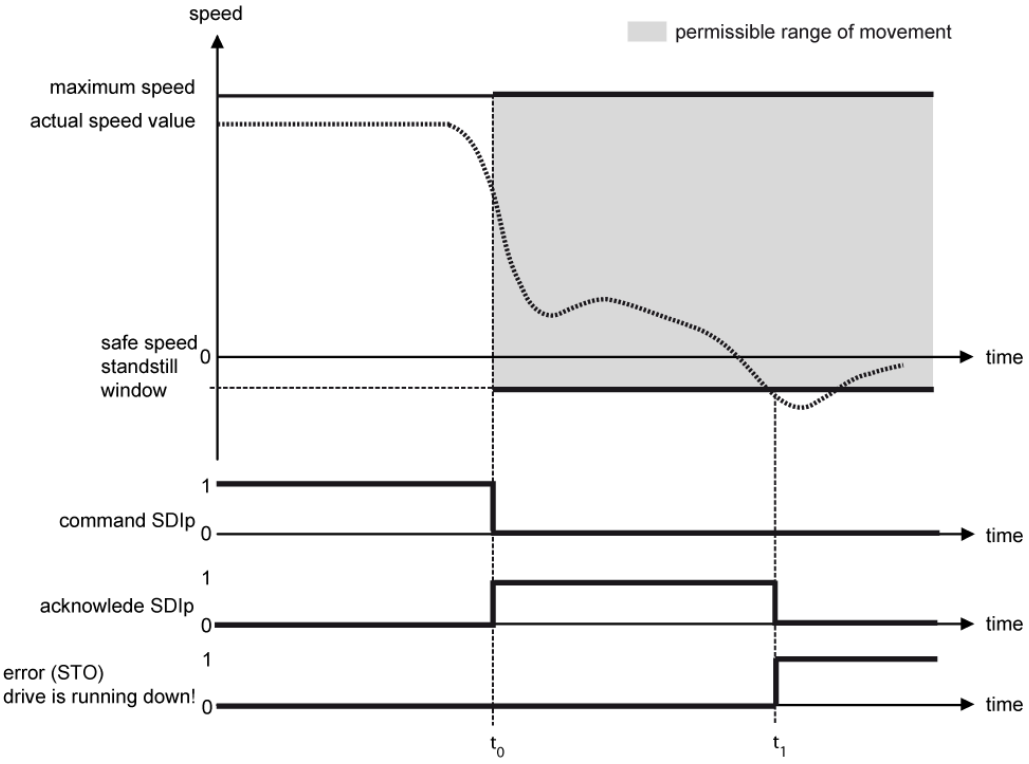
Danger to life due to unexpected movements!

The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down).

Steps to prevent:

- Install an external, mechanical brake that prevents a movement.
- Install a counterweight in order to maintain the axis in balance.

Example 2: Drive movement deviates from the direction in the SDIp state (positive direction permissible)



Time t	Explanation
$t = t_0$	The safety function is started and the SDIp acknowledgement is set.
$t_0 < t < t_1$	The safety function monitors whether the actual speed value meets the permissible range of movement.
$t = t_1$	The safety function detects an error, switches the drive into the STO state and sets the error bit. The SDIp acknowledgement bit is reset.
$t \geq t_1$	In the STO state, drive movements are no longer monitored since no further error reaction is possible.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm64	'SDI safe speed standstill window'	N(zero,SDI)	rpm	0	60000

The parameter Prm64 is used by the SDIn and SDIp function.

6.11 Safe direction negative (SDIn)

Properties

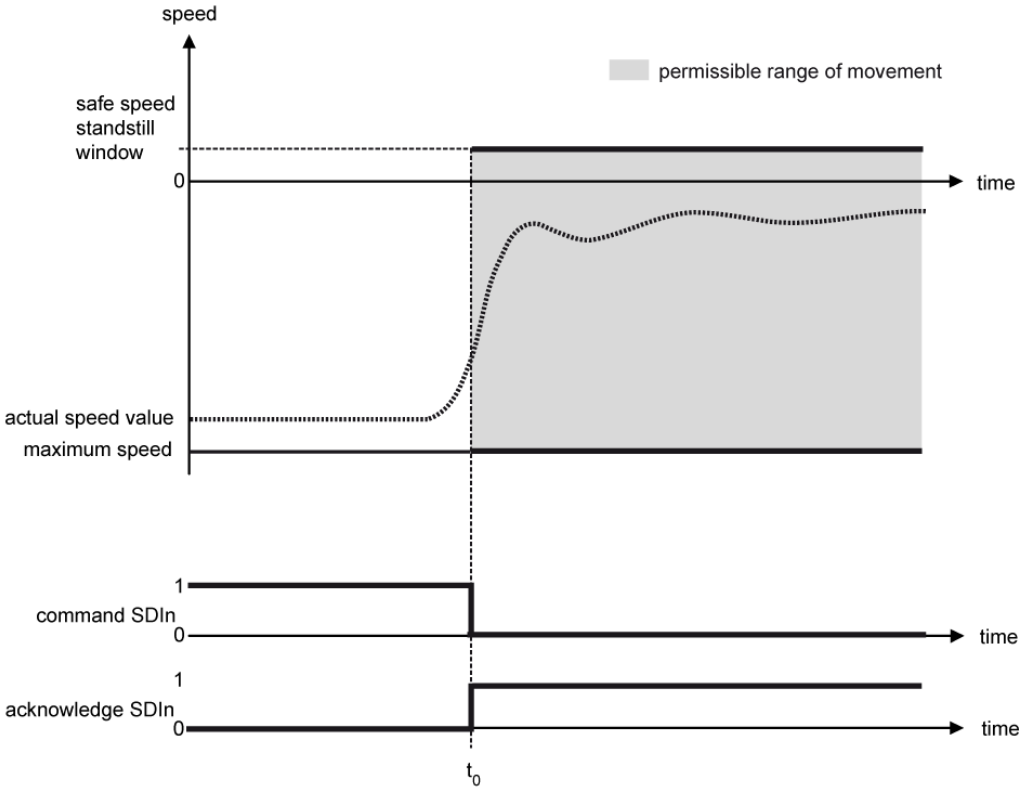
- Safety function according to DIN EN 61800-5-2:2008-04
- Monitoring the motor shaft direction of rotation
- Safe monitoring of the actual speed value (2-channel)
- Negative direction of rotation permitted

Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

The started SDIn safety function monitors that the motor shaft does not rotate in the positive direction by monitoring the actual speed value for the correct sign. The safe speed standstill window defines a speed range between zero speed and the positive direction not permitted. Control fluctuations around zero speed within the safe speed standstill window do not result in the generation of an error by the safety monitoring.

Example 1: Drive movement in the permissible range of movement (negative direction permissible)



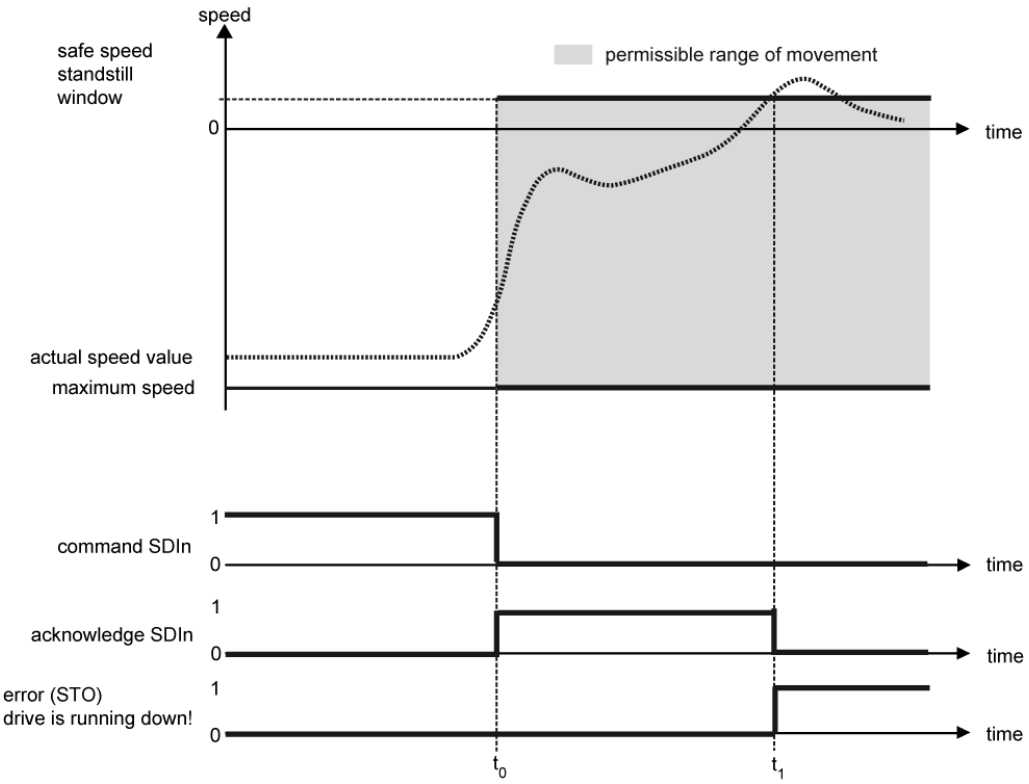
Time t	Explanation
$t = t_0$	The safety function is started and the SDIn acknowledgement is set.

Reaction in case of an error

As soon as the safety function detects a deviation from the limits of the monitored values, the drive is set to the safe state 'Safe torque off (STO)'. **(example 2)**.

DANGER	
	Danger to life due to unexpected movements! The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down). **Steps to prevent:** • Install an external, mechanical brake that prevents a movement. • Install a counterweight in order to maintain the axis in balance.

Example 2: Drive movement deviates from the direction in the SDIn state (negative direction permissible)



Time t	Explanation
$t = t_0$	The safety function is started and the SDIn acknowledgement is set.
$t_0 < t < t_1$	The safety function monitors whether the actual speed value meets the permissible range of movement.
$t = t_1$	The safety function detects an error, switches the drive into the STO state and sets the error bit. The SDIn acknowledgement bit is reset.
$t \geq t_1$	In the STO state, drive movements are no longer monitored since no further error reaction is possible.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm64	'SDI safe speed standstill window'	N(zero,SDI)	rpm	0	60000

The parameter Prm64 is used by the SDIn and SDIp function.

6.12 Safely-limited increment (SLI)

Properties

- Safety function according to DIN EN 61800-5-2:2008-04
- Safe monitoring of the parameterisable position range (2-channel)
- Parameterisable stop function in case of error

Description

The safety function can be started by a safe input or by the corresponding bit in the control data.
The acknowledgement can be fed back by safe output or by status data.

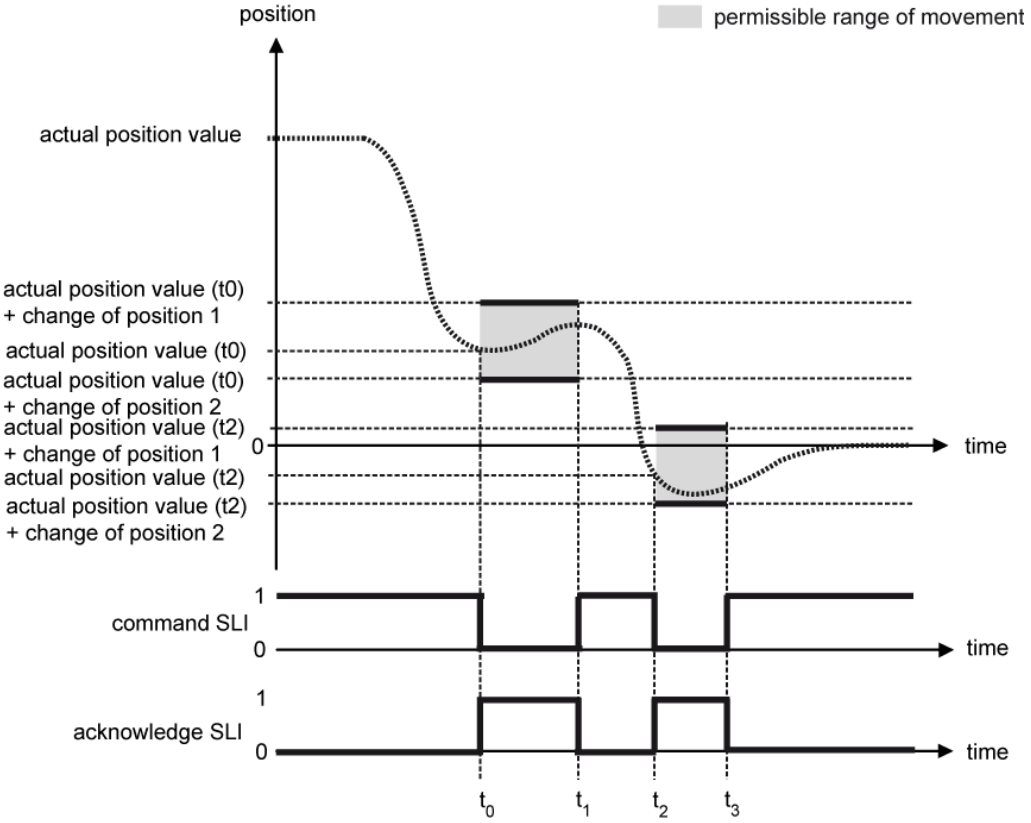
The started SLI safety function monitors whether the actual position value of the drive complies with the parametrised range.

The permitted position range results from the actual position at the time when the SLI safety function is selected. The upper position limit is the start position plus the higher value of Prm65 and Prm66. The lower position limit is the start position plus the lower of the two values.

SLI should be combined with SLS or SSR so that the speed is monitored additionally in case of movements within the permitted range of movement.
If this permitted range of movement will be left with a particular speed, the motor is braked via a ramp (see 'Reaction in case of an error') if SS1 or SS2 are parameterised as error reaction. Because of this delay, the drive runs further into the not permitted range. This transition range up to standstill has to be taken into account when fixing the permitted range of movement. The transition range is not monitored by the SLI safety function

The resolution of the position is standardised to 65536 increments/revolution.

Example 1: Drive movement in the permissible range of movement



Time t	Explanation
$t = t_0$	The safety function is started and the SLI acknowledgement bit is set.
$t_0 < t < t_1$	The safety function monitors whether the actual position value meets the position limits.

Time t	Explanation
$t = t_1$	The safety function is deactivated and the SLI acknowledgement bit is reset.
$t_1 < t < t_2$	No monitoring by the SLI safety function is active.
$t = t_2$	The safety function is started and the SLI acknowledgement bit is set.
$t_2 < t < t_3$	The safety function monitors whether the actual position value meets the position limits.
$t = t_3$	The safety function is deactivated and the SLI acknowledgement bit is reset.
$t > t_3$	No monitoring by the SLI safety function is active.

Reaction in case of an error

As soon as the safety function detects a deviation from the limits of the monitored values, the drive executes a safe stop function that has previously been set by parameter ('Safe torque off (STO)', 'Safe stop 1 (SS1)' or 'Safe stop 2 (SS2)') **(example 2)**.

⚠ DANGER

Danger to life due to unexpected movements!

The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down).

Steps to prevent:

- Install an external, mechanical brake that prevents a movement.
- Install a counterweight in order to maintain the axis in balance.

⚠ WARNING

Danger due to unexpected stop function!

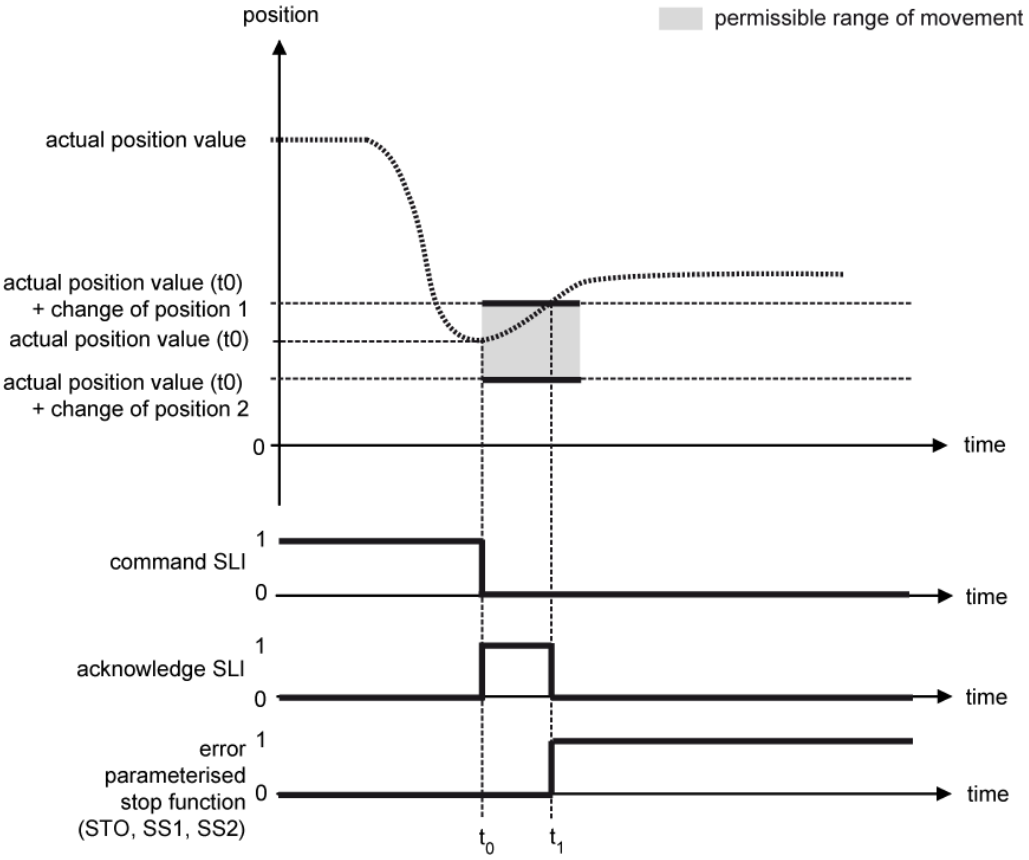
If there are different error reactions projected for the safety functions, an unexpected final state can occur in case of error.

Example:
Two safety functions are active at the same time with error reactions SS1 respectively SS2. STO will result definitely.

Steps to prevent:

- We recommend to project the same stop function for all safety functions!
- If it is not possible to project the same stop function, the different reactions must be considered!

Example 2: Deviation from the permissible position range



Time t	Explanation
$t = t_0$	The safety function is started and the SLI acknowledgement bit is set.
$t_0 < t < t_1$	The safety function monitors whether the position feedback value meets the position limits.
$t = t_1$	The safety function detects an error, starts the parameterised stop function and sets the error bit. The SLI acknowledgement bit is reset.
$t > t_1$	The behaviour is dependant on the parameterised stop function.

Acknowledge an error with "Clear error"

As soon as an active safety function detects a deviation from the limits of the monitored values, the drive is set to the intended stop function. The error bit (FSoE status bit 7) is set and the acknowledgment of the safe status is withdrawn.

With the 'Clear error' signal (FSoE control bit 7 or the 'Clear error' command in the drive controller) the

error status ist acknowledged (deleted). If during and after the 'Clear error' the start signal from a previous safety function is still active and no other changes to the settings of the safety function have been made, the safety function restarts and also transition times (if available) work again.

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm65	'SLI Safely limited position change 1'	S(ul,SLI)	Incr.	-2147483647	2147483647
Prm66	'SLI Safely limited position change 2'	S(ll,SLI)	Incr.	-2147483647	2147483647
Prm103	'SLI error reaction'	SLI_ERR	-	0	2

The values of the position limits Prm65 / Prm66 must be entered appropriately signed.
Example:
Prm65 = 1000, Prm66 = -100, actual position value (t_0) = 10000 increments
=> monitored range 9900 ... 11000 increments

It is the responsibility of the user to enter reasonable values.

7 Application

7.1 Safety functions via local safe inputs and outputs

7.1.1 Safe inputs

Safe input pair	Use	'0' status	'1' status
SE1.1 / SE1.2	Parametrisable safety function 1	Function activated	Function disabled
SE2.1 / SE2.2	Parametrisable safety function 2		
SE3.1 / SE3.2	Parametrisable stop function (STO, SS1 or SS2)		

The stop functions are prioritised on the other safety functions. STO has the highest priority:

1. STO (highest priority)
2. SS1
3. SS2 (lowest priority)

Only one safety function can be allocated to each couple of safe inputs.
(E.g. 1 = SOS, 0 = SLI is not possible)

Parameters

Relevant parameters

Parameter	Name	Code	Unit	Min	Max
Prm15	'SE1 safety function'	SF_SE1	-	0	16
Prm16	'SE2 safety function'	SF_SE2	-	0	16
Prm17	'SE3 emergency stop function'	StF_SE3	-	0	2
Prm69	'SE1 dynamic sampling'	SE1_DYN	-	0	1
Prm70	'SE1 input level'	SE1_INV	-	0	1
Prm71	'SE1.1 dynamic sampling impulse duration'	SE1.1_Puls	µs	250	65500
Prm72	'SE1.1 dynamic sampling period'	SE1.1_Time	ms	50	64000
Prm73	'SE1.2 dynamic sampling impulse duration'	SE1.2_Puls	µs	250	65500
Prm74	'SE1.2 dynamic sampling period'	SE1.2_Time	ms	50	64000
Prm75	'SE2 dynamic sampling'	SE2_DYN	-	0	1
Prm76	'SE2 input level'	SE2_INV	-	0	1
Prm77	'SE2.1 dynamic sampling impulse duration'	SE2.1_Puls	µs	250	65500
Prm78	'SE2.1 dynamic sampling period'	SE2.1_Time	ms	50	64000
Prm79	'SE2.2 dynamic sampling impulse duration'	SE2.2_Puls	µs	250	65500
Prm80	'SE2.2 dynamic sampling period'	SE2.2_Time	ms	50	64000
Prm81	'SE3 dynamic sampling'	SE3_DYN	-	0	1
Prm82	'SE3 input level'	SE3_INV	-	0	1

Parameter	Name	Code	Unit	Min	Max
Prm83	'SE3.1 dynamic sampling impulse duration'	SE3.1_Puls	µs	250	65500
Prm84	'SE3.1 dynamic sampling period'	SE3.1_Time	ms	50	64000
Prm85	'SE3.2 dynamic sampling impulse duration'	SE3.2_Puls	µs	250	65500
Prm86	'SE3.2 dynamic sampling period'	SE3.2_Time	ms	50	64000

7.1.2 Safe outputs

Safe output pair	Use	'0' status	'1' status
SA1.1 / SA1.2	Acknowledgement of the safe status The acknowledgement is set if a function is called up via safe input 1 or 2. If two safety functions are called up **simultaneously** with safe inputs 1 and 2, the acknowledgement is set only when both safety functions are active. If the safety functions 1 and 2 are called up **successively**, the acknowledgement is withdrawn for a short time when the second input is activated. The acknowledgement will be set again when both safety functions are active. This interruption of the safe status lasts different times and depends on the parameterised times of the safety functions. Safe output 1 can switch an actuator (e.g. a relay) that is connected between connection 1.1 and 1.2 directly. If one of the safety functions detects an error, the acknowledgement will be reset.	Acknowledgement disabled	Acknowledgement activated
SA2.1 / SA2.2	Drive without torque (STO) acknowledgement Safe output 2 switches an actuator that is connected to connections 2.1 and 2.2 against GND.		

- Prm7 = 1 OR Prm7 = 0 and Prm8 = 1:
  The functionalities of the safe outputs are fixed and cannot be changed
- Prm7 = 0 and Prm8 = 0:
  The safe outputs can be set via FSoE

(Siehe 'Prm8 'Output control'' auf Seite 121.

The safe output pairs SAx.1 and SAx.2 are not synchronised.

Crossfaults between safe outputs will be detected if one of the following conditions is met:

- The dynamic sampling pulses differ by more than 2 ms

OR

- The dynamic sampling periods differ by more than 2 ms AND the dynamic sampling pulses differ by more than 1 ms

Crossfaults between the monitoring channels will be detected as well if the second channel is inverted.

Short circuits between a safe output and the power supply (SVCC, SGND) will be detected if the short-circuit resistance is less than 0.5
Ω.

The short-circuit impedance has also to be less than 0.5 Ω in order to detect a distant short circuit on the output terminals.

Short circuits are momentary connections of the safe outputs to SGND (GND of 24 V supply), SVCC (+24 V), or short circuits to any other safe output terminal on the same supply network.

So feed line and return line to the loads may not exceed 30 m with a wire cross-section of 1 mm^2.

The power supply voltage of the safe outputs must meet the range of 24 V ±20 %. A current of ≥ 3 A must be made available for more than 1 sec.

Parameters

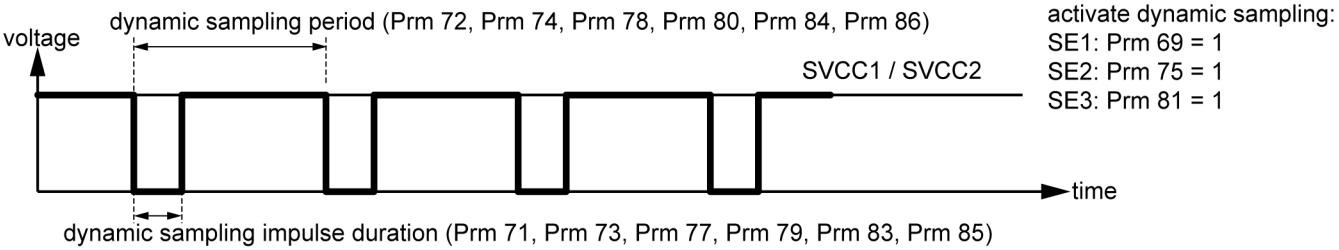
Safety-relevant parameters for safe outputs

Parameter	Name	Code	Unit	Min	Max
Prm8	'Output control'	Out_Src	-	0	1
Prm92	'SA1 output level'	SA1.2_INV	-	0	1
Prm98	'SA2 output level'	SA2.2_INV	-	0	1
Prm104	'SA1.2 output type'	SA1.2_ Outputtype	-	0	1

7.1.3 Dynamic sampling

The safe inputs SE1..SE3 can be monitored for dynamic sampling. The safe outputs SA1 and SA2 can be dynamically sampled. Dynamic sampling means that a clocked 24 VDC signal is installed or sent instead of a static 24 VDC signal. "Static signal errors" can be detected through dynamically sampled input and output signals by cyclically monitoring the signals at the signal inputs for the dynamic sampling pattern.

Dynamic sampling of the safe inputs



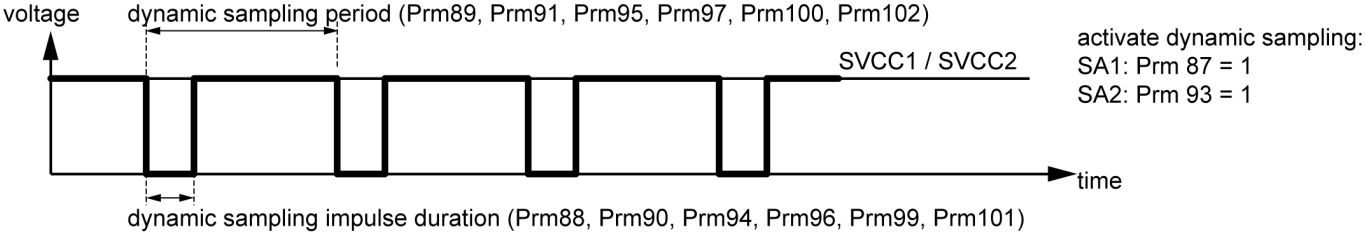
In order to be able to detect cross circuits in the safe input pair, the period durations Prm72 / Prm74, Prm78 / Prm80 and Prm84 / Prm86 must be selected differently.

The dynamically sampled signal can be supplied externally or be removed at the SDYN1 and SDYN2 outputs. The dynamic sampling outputs (SDYN1 and SDYN2) supply a dynamically sampled 24 VDC supply voltage that can be connected to the safe inputs via a switch contact. The outputs SDYN1 and SDYN2 are not safe. The monitoring throught the inputs SE1..SE3 is safe.

Application notes:

- If the **dynamic sampling of the safe inputs is activated**, they must be supplied by the dynamic sampling outputs SDYN. Siehe 'Controller card KW-Rx7: [XS20] safety I/O ' auf Seite 24.
- If the **safe inputs are not dynamically sampled**, they must be supplied by an external 24 VDC supply.
- Conversely: If the safe inputs are connected to a not dynamic sampled 24 VDC supply, dynamic sampling must not be activated.

Dynamic sampling of the safe outputs and the dynamic sampling outputs



The ratio of dynamic sampling impulse duration to dynamic sampling period (e. g. Prm88/Prm89) must be greater than 1:10.

Notes for parameter setting

The parameters of the dynamic sampling periods SEx.x and SDYNx must be set the same so that the output dynamization signal and the monitoring of the dynamization of the input signal do not diverge.

For the duration of the dynamic sampling pulse, we recommend setting the parameters SEx.x at least 100 µs longer than the corresponding generated dynamization pulse SDYNx. The filtering of the safety inputs critically assesses exceeding the specified pulse length, while falling below is tolerated.

Explanation:

If the parameters are set the same, jitter can lead to longer dynamization pulses, which unintentionally but functionally correctly lead to the switching command driver being switched off and thus triggering the error message 2320 'Output stage enable is inactive' Info1:1 Info2:5. The error message occurs regardless of whether the dynamization of the safe inputs is activated or not.

Setting or adaptation of the dynamization pulse duration SEx.1 and SEx.2 (Prm 71, 73, 77, 79, 83 and 85) in the safe parameter editor.

Parameter, Safety IO

No.	Parameter	Value	Unit
15	SE1 safety function, SF_SE1	off	
16	SE2 safety function, SF_SE2	off	
17	SE3 emergency stop function, StF_SE3	STO	
69	SE1 dynamic sampling, SE1_DYN	disable dynamic sa...	
70	SE1 input level, SE1_INV	identical input level	
71	SE1.1 dynamic sampling impulse duration, SE1.1_Puls	1100	[µs]
72	SE1.1 dynamic sampling period, SE1.1_Time	50	[ms]
73	SE1.2 dynamic sampling impulse duration, SE1.2_Puls	2100	[µs]
74	SE1.2 dynamic sampling period, SE1.2_Time	100	[ms]
75	SE2 dynamic sampling, SE2_DYN	disable dynamic sa...	
76	SE2 input level, SE2_INV	identical input level	
77	SE2.1 dynamic sampling impulse duration, SE2.1_Puls	1100	[µs]
78	SE2.1 dynamic sampling period, SE2.1_Time	50	[ms]
79	SE2.2 dynamic sampling impulse duration, SE2.2_Puls	2100	[µs]
80	SE2.2 dynamic sampling period, SE2.2_Time	100	[ms]
81	SE3 dynamic sampling, SE3_DYN	disable dynamic sa...	
82	SE3 input level, SE3_INV	identical input level	
83	SE3.1 dynamic sampling impulse duration, SE3.1_Puls	1100	[µs]
84	SE3.1 dynamic sampling period, SE3.1_Time	50	[ms]
85	SE3.2 dynamic sampling impulse duration, SE3.2_Puls	2100	[µs]
86	SE3.2 dynamic sampling period, SE3.2_Time	100	[ms]
87	SA1 dynamic sampling, SA1_DYN	disable dynamic sa...	
88	SA1.1 dynamic sampling impulse duration, SA1.1_Puls	1000	[µs]
89	SA1.1 dynamic sampling period, SA1.1_Time	50	[ms]
90	SA1.2 dynamic sampling impulse duration, SA1.2_Puls	2000	[µs]
91	SA1.2 dynamic sampling period, SA1.2_Time	100	[ms]
92	SA1.2 output level, SA1.2_INV	identical output level	
93	SA2 dynamic sampling, SA2_DYN	disable dynamic sa...	
94	SA2.1 dynamic sampling impulse duration, SA2.1_Puls	1000	[µs]
95	SA2.1 dynamic sampling period, SA2.1_Time	50	[ms]
96	SA2.2 dynamic sampling impulse duration, SA2.2_Puls	2000	[µs]
97	SA2.2 dynamic sampling period, SA2.2_Time	100	[ms]
98	SA2.2 output level, SA2.2_INV	identical output level	
99	SDYN1 dynamic sampling impulse duration, SDYN1_Puls	1000	[µs]
100	SDYN1 dynamic sampling period, SDYN1_Time	50	[ms]
101	SDYN2 dynamic sampling impulse duration, SDYN2_Puls	2000	[µs]
102	SDYN2 dynamic sampling period, SDYN2_Time	100	[ms]

Parameters

Safety-relevant parameters for safe outputs and dynamic sampling outputs

Parameter	Name	Code	Unit	Min	Max
Prm8	'Output control'	Out_Src	-	0	1
Prm87	'SA1 dynamic sampling'	SA1_DYN	-	0	1
Prm88	'SA1.1 dynamic sampling impulse duration'	SA1.1_Puls	µs	500	65500
Prm89	'SA1.1 dynamic sampling period'	SA1.1_Time	ms	50	65500
Prm90	'SA1.2 dynamic sampling impulse duration'	SA1.2_Puls	µs	500	65500
Prm91	'SA1.2 dynamic sampling period'	SA1.2_Time	ms	50	65500
Prm93	'SA2 dynamic sampling'	SA2_DYN	-	0	1
Prm94	'SA2.1 dynamic sampling impulse duration'	SA2.1_Puls	µs	500	65500
Prm95	'SA2.1 dynamic sampling period'	SA2.1_Time	ms	50	65500
Prm96	'SA2.2 dynamic sampling impulse duration'	SA2.2_Puls	µs	500	65500
Prm97	'SA2.2 dynamic sampling period'	SA2.2_Time	ms	50	65500
Prm99	'SDYN1 dynamic sampling impulse duration'	SDYN1_Puls	µs	500	65500
Prm100	'SDYN1 dynamic sampling period'	SDYN1_Time	ms	50	65500
Prm101	'SDYN2 dynamic sampling impulse duration'	SDYN2_Puls	µs	500	65500
Prm102	'SDYN2 dynamic sampling period'	SDYN2_Time	ms	50	65500
Prm104	'SA1.2 output type'	SA1.2_ Outputtype	-	0	1

7.2 FSoE protocol

FSoE is a safe protocol (Safety Integrity Level 3 according to IEC 61508). With it, safety functions ('functional safety') can be implemented via EtherCAT. For more details: see IEC 61784-3 'Functional safety fieldbus'.

The FSoE cycle time is 15 ms and cannot be changed.

The transmission via EtherCAT is carried by one channel and is not relevant for the safety assessment.

FSoE transmits control and status data. The FSoE data exchange is mirrored via the standard unsafe parameters ID33210 'FSoE master command' to ID33249 'FSoE slave ConnID'.

Controller enable

After switching-on the device, FSoE master and FSoE slave build a save connection via EtherCAT. The FSoE master recognises the valid date from FSoE slave and evaluates bit 28 'VALID' of the status word.

Controller enable RF cannot be set and safe operation is not started, until the FSoE master signals that the monitoring can be started and the controller sets the system ready message SBM.

Reaction in case of an error

Maloperation of the FSoE communication causes 'Safe torque off (STO)'.

Commanding

During commanding via FSoE (Prm7 = 0), the safe inputs will not be analysed by the safety functions but by the PLC controller. The kind of activation of the safe outputs SA1 and SA2 is defined by parameter Prm8

Parameters

Safe parameters

Parameter	Name	Code	Unit	Min	Max
Prm7	'Commanding'	Cmd_Src	-	0	1
Prm8	'Output control'	Out_Src	-	0	1

7.2.1 Control data

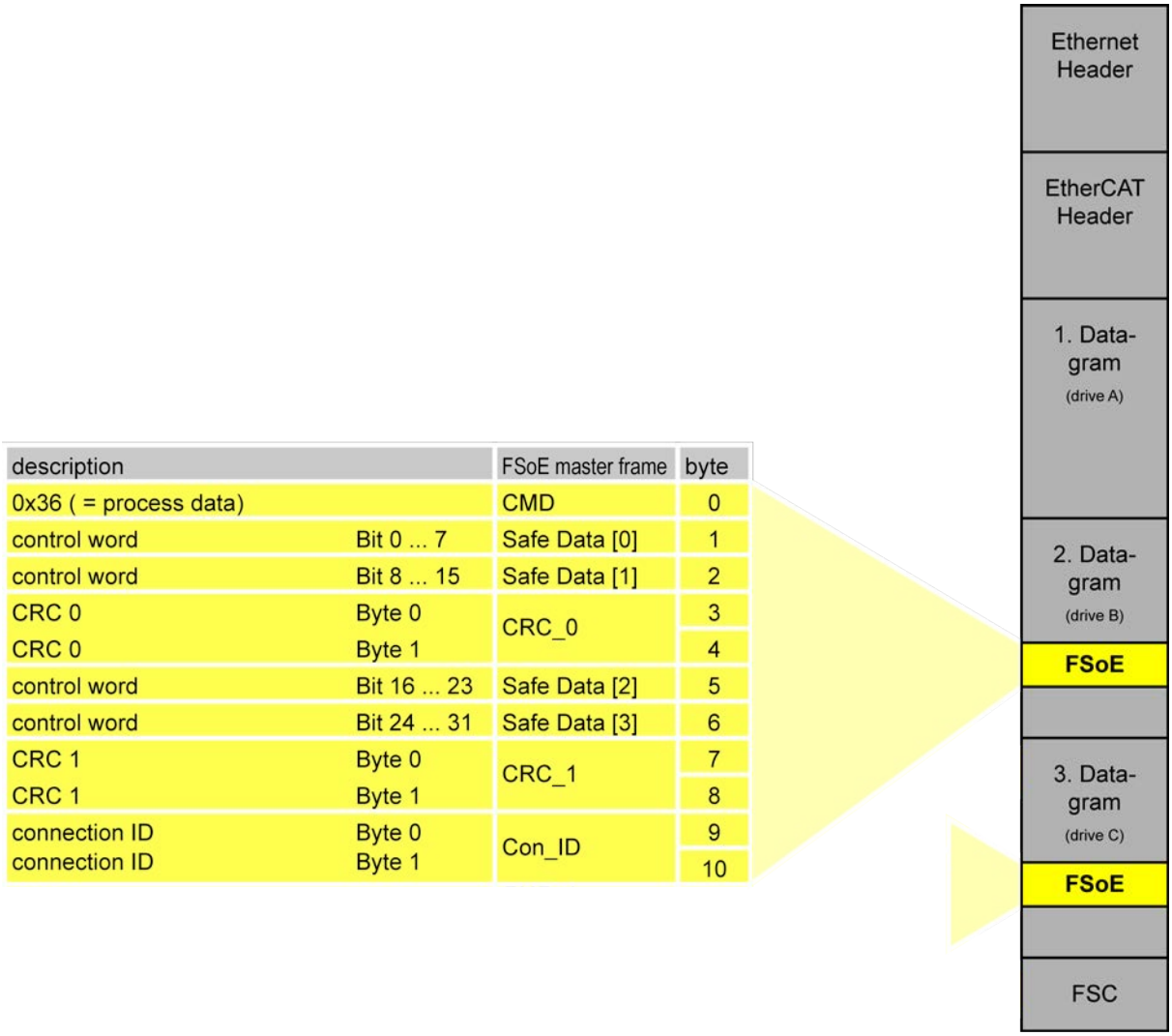
Safety functions are commanded bit by bit to the drive in the control data. A parallel selection of several safety functions in the control word is possible.

The stop functions are prioritised on the other safety functions. STO has the highest priority:

1. STO (highest priority)
2. SS1
3. SS2 (lowest priority)

The FSoE data are part of the EtherCAT telegram. The data frame is designed according to the following structure:

FSoE master frame: control word



description		FSoE master frame	byte
0x36 (= process data)		CMD	0
control word	Bit 0 ... 7	Safe Data [0]	1
control word	Bit 8 ... 15	Safe Data [1]	2
CRC 0	Byte 0	CRC_0	3
CRC 0	Byte 1		4
control word	Bit 16 ... 23	Safe Data [2]	5
control word	Bit 24 ... 31	Safe Data [3]	6
CRC 1	Byte 0	CRC_1	7
CRC 1	Byte 1		8
connection ID	Byte 0	Con_ID	9
connection ID	Byte 1		10

Bit	Safety function	Description	Status description
0	STO	'Safe torque off (STO)'	0: Function selected 1: Function not selected
1	SS1	'Safe stop 1 (SS1)'	0: Function selected 1: Function not selected
2	SS2	'Safe stop 2 (SS2)'	0: Function selected 1: Function not selected
3	SOS	'Safe operating stop (SOS)'	0: Function selected 1: Function not selected
4	SSR1	'Safe speed range 1 (SSR1)'	0: Function selected 1: Function not selected

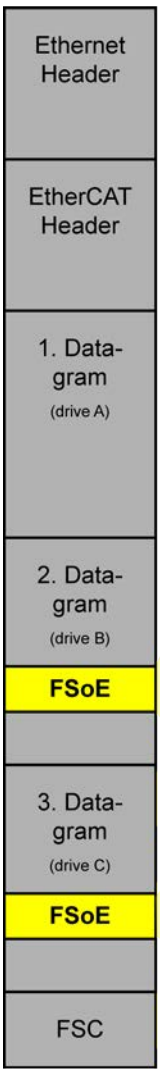
Bit	Safety function	Description	Status description
5	SDIp	'Safe direction positive (SDIp)'	0: Function active, positive direction of rotation allowed 1: Function not selected
6	SDIn	'Safe direction negative (SDIn)'	0: Function active, negative direction of rotation allowed 1: Function not selected
7	ErrorAck	Error acknowledgement	0: no acknowledgement 0-1 flank: current error in drive acknowledged
8	Reserved	-	-
9	SSR2	'Safe speed range 2 (SSR2)'	0: Function selected 1: Function not selected
10	SSR3	'Safe speed range 3 (SSR3)'	0: Function selected 1: Function not selected
11	SSR4	'Safe speed range 4 (SSR4)'	0: Function selected 1: Function not selected
12	SLS1	'Safely-limited speed 1 (SLS1)'	0: Function selected 1: Function not selected
13	SLS2	'Safely-limited speed 2 (SLS2)'	0: Function selected 1: Function not selected
14	SLI	'Safely-limited increment (SLI)'	0: Function selected 1: Function not selected
15..29	Reserved	-	-
30	SA1	SA1 safe output control	0: Default 1: -
31	SA2	SA2 safe output control	0: Default 1: -

7.2.2 Status data

The drive writes status information about the selected safety functions and of the safe inputs into the FSoE status data that can be evaluated from the controller.

The FSoE data are part of the EtherCAT telegram. The data frame is designed according to the following structure:

FSoE slave frame: status word, safe actual values



byte	FSoE slave frame	description	
0	CMD	0x36 (= process data)	
1	Safe Data [0]	control word	bit 0 ... 7
2	Safe Data [1]	control word	bit 8 ... 15
3	CRC_0	CRC 0	byte 0
4		CRC 0	byte 1
5	Safe Data [2]	control word	bit 16 ... 23
6	Safe Data [3]	control word	bit 24 ... 31
7	CRC_1	CRC 1	byte 0
8		CRC 1	byte 1
9	Safe Data [4]	safe actual position	byte 0
10	Safe Data [5]	safe actual position	byte 1
11	CRC_2	CRC 1	byte 0
12		CRC 1	byte 1
13	Safe Data [6]	safe actual position	byte 2
14	Safe Data [7]	safe actual position	byte 3
15	CRC_3	CRC 1	byte 0
16		CRC 1	byte 1
17	Safe Data [8]	safe actual speed	byte 0
18	Safe Data [9]	safe actual speed	byte 1
19	CRC_4	CRC 1	byte 0
20		CRC 1	byte 1
21	Safe Data [10]	safe actual speed	byte 2
22	Safe Data [11]	safe actual speed	byte 3
23	CRC_5	CRC 1	byte 0
24		CRC 1	byte 1
25	Con_ID	connection ID	Byte 0
26		connection ID	Byte 1

Bit	Safety function	Meaning	Status description
0	STO	Safe torque off	0: Function disabled 1: Function activated
1	Reserved	-	1)
2	Reserved	-	1)
3	SOS	Safe operating stop	0: Function disabled 1: Function activated
4	SSR1	Safe speed range 1	0: Function disabled 1: Function activated
5	SDIp	Safe direction positive	0: Function disabled 1: Function activated
6	SDIn	Safe direction negative	0: Function disabled 1: Function activated

Bit	Safety function	Meaning	Status description
7	Error	Error message	0: No error 1: Error in drive
8	SMS	Safe maximum speed	0: Function disabled 1: Function activated
9	SSR2	Safe speed range 2	0: Function disabled 1: Function activated
10	SSR3	Safe speed range 3	0: Function disabled 1: Function activated
11	SSR4	Safe speed range 4	0: Function disabled 1: Function activated
12	SLS1	Safely-limited speed 1	0: Function disabled 1: Function activated
13	SLS2	Safely-limited speed 2	0: Function disabled 1: Function activated
14	SLI	Safely-limited increment	0: Function disabled 1: Function activated
15..25	Reserved	-	1)
26	SS1 active	Safe stop 1	0: Function SS1 inactive 1: Function SS1 started
27	SS2 active	Safe stop 2	0: Function SS2 inactive 1: Function SS2 started
28	VALID	Functional safety: system ready message	0: Functional safety not ready 1: Functional safety ready
29	SE1	SE1 safe input status	Value 0 or 1 possible
30	SE2	SE2 safe input status	Value 0 or 1 possible
31	SE3	SE3 safe input status	Value 0 or 1 possible

1) Reserved bits can accept any status at any time!

8 Startup

8.1 Startup procedure

State of delivery

- The drive controller contain the actual firmware versions for drive control and safety functions
- The drive parameters are set to its default values
- The safety parameters are set to its default values according to AMK-PrmTable_default
  all velocity limits are set to 1 rpm, error reactions are set to STO
  => if the drive moves, the safety functions respond and set the drive to STO

Preparation

- Installation and connection
- Establish a direct connection between PC and controller card
- Deactivate safety functions
  KW-Rx7: Siehe 'Running KW-Rx7 without functional safety' auf Seite 112.

Drive startup

Startup motor according to documentation
Initial startup KE/KW, Part no. 204539

- Basic parameterisation
- Setting control circuit

Startup functional safety

- Re-activate safety functions
- Parameterisation with SafePMT (Siehe 'Parameterisation' auf Seite 89.)
  - Basic parameterisation
  - Parametrise stop functions if necessary
  - Parametrise safe operating modes if necessary
  - Transfer parameters to device and validate
- Create validation report (Siehe 'Validation report' auf Seite 110.)
- File the validation report in the Machine Manual

Field bus connection

- Establish a physical connection to FSoE resp. EtherCAT master
- Set drive address (Siehe 'FSoE addressing' auf Seite 80.)
  - Commanding via FSoE:

Either	addressing by dip switch S1
or	set ID33201 'Safety address' and ID34023 'BUS address participant'

  - Commanding by safe inputs:

Either	addressing by dip switch S1
or	set ID34023 'BUS address participant'

8.2 FSoE addressing

The controller can operate as FSoE slave device. For this purpose, the FSoE device address must be set.

The FSoE device address must not be confused with the EtherCAT device address.

The FSoE device address can be set with the DIP switch S1 on the circuit board of the controller card or with AIPEX PRO in the ID33201 'Safety address' parameter.

Fieldbus	Addressing possible by ...			Range
	Bus master (automatic)	DIP switch S1	Parameter	
KW-R07				
EtherCAT Slave	■	■	ID34023 Instance 1	1 ≤ ID34023 ≤ 65535 1 ≤ S1 ≤ 63
FSoE	-	■	ID33201	1 ≤ ID33201 ≤ 65535 1 ≤ S1 ≤ 63
KW-R17				
EtherCAT Slave	■	■	ID34023 Instance 1	1 ≤ ID34023 ≤ 65535 1 ≤ S1 ≤ 63
FSoE	-	■	ID33201	1 ≤ ID33201 ≤ 65535 1 ≤ S1 ≤ 63
KW-R27				
EtherCAT Slave (SoE, CoE)	■	■	ID34023 Instance 1	1 ≤ ID34023 ≤ 65535[1)] 1 ≤ S1 ≤ 250[2)]
FSoE	-	■	ID33201	1 ≤ ID33201 ≤ 65535 1 ≤ S1 ≤ 250[2)]

1) with firmware V2.12 2018/40, the participant address must be in the range 1 to 63 via ID34023 'BUS address participant'.

2) From firmware V2.14 2021/13, the node address with DIP switch S1 can be in the range 1 to 250.

DIP switch for FSoE device address

You can get information concerning the properties of the parameters from the document Parameter description (AMK part no. 203704).

8.2.1 FSoE: Addressing by parameter ID33201 'Safety address'

On delivery ex works AMK of the controller, the DIP switch S1 as well as the parameter ID33201 'Safety address' are set to 0. If neither the DIP switch nor the 'Safety address' are set ≠ 0, the FSoE master cannot start communication.

The parameter ID33201 'Safety address' is only valid for FSoE communication. It is not instanced and has to be set only once, independent of the fieldbus system.

During firmware update or initial program loading, the address parameter ID33201 will be reset to 0.

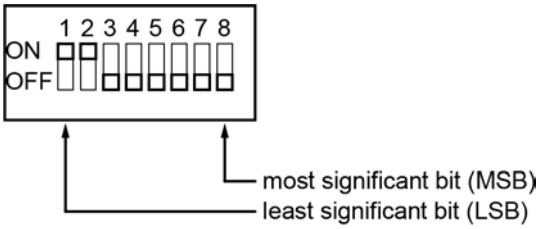
8.2.2 EtherCAT and FSoE: Addressing by DIP switch S1

NOTICE	
Material Damage!	On the open unit a dry, non-conductive pollution may only occur. The penetrating pollution into the open housing may not affect the functionality of the device (EN 61800-5-1, pollution degree 1). Ensure that no objects fall into the housing when working on the open housing. Foreign objects can cause short-circuits during operation and thereby destroy the device.

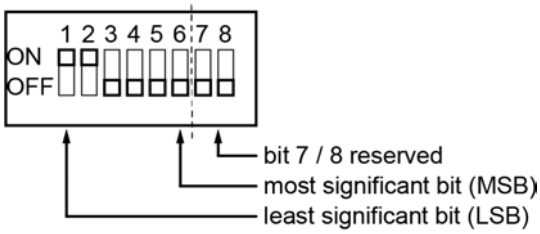
By means of the DIP switch, the EtherCAT and FSoE address of the controller will be set **simultaneously**.

The address setting by DIP switch is prior to addresses via parameter ID34023 'BUS address participant' or ID33201 'Safety address'.
The same value, set in the DIP switch will be written to the parameters ID34023 and ID33201.

Address range up to 250



Address range up to 63



Example: address = 3

If you change a fieldbus participant which is addressed by DIP switch, make sure that the address is set correctly to the new device.

Consequence of addressing

DIP switch	Parameter ID34023	Parameter ID33201	Active EtherCAT address	Active FSoE address
= 0	= 0	= 0	automatically set by master	no communication possible
= 0	= 0	≠ 0		ID33201
= 0	≠ 0	= 0	ID34023	no communication possible
= 0	≠ 0	≠ 0		ID33201
≠ 0	= 0	= 0	DIP switch	DIP switch
≠ 0	= 0	≠ 0		
≠ 0	≠ 0	= 0	DIP switch	DIP switch
≠ 0	≠ 0	≠ 0		

8.3 SafePMT parameter editor

8.3.1 Requirements

You need a PC with the following software versions:

- Operating system: WINDOWS XP SP3 or WINDOWS 7
- Microsoft .NET Framework 3.5
- File viewer for PDF documents (e.g. Adobe Reader)
- AMK software products: Siehe 'Product version:' auf Seite 3.
  - AIPEX PRO
  - AMK data base
  - Device description file
  - Parameter editor
  - Safe parameter table

The following software must be installed on the safety module KW-Rx7:

- Controller firmware: Siehe 'Product version:' auf Seite 3.
- Safety firmware: Siehe 'Product version:' auf Seite 3.

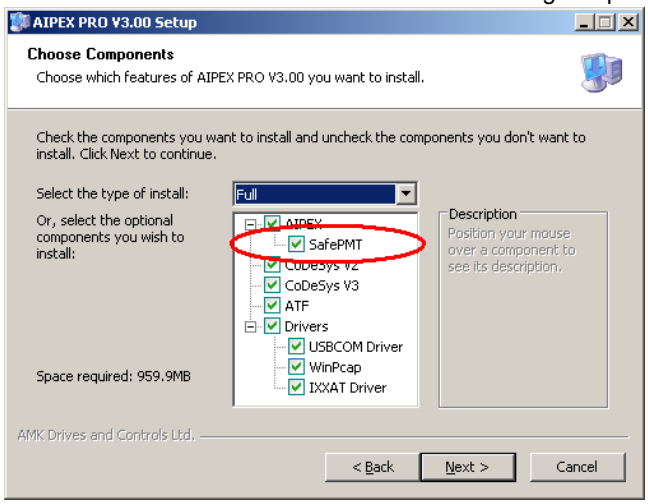
8.3.2 Installation of the parameter editor

The SafePMT parameter editor is part of the software package AIPEX PRO and will be installed in common.

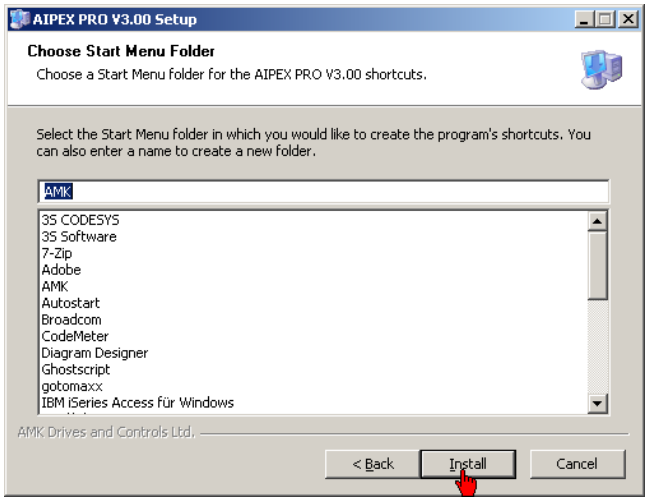
1. Uninstall the previous SafePMT parameter editor:
   Start -> Control Panel -> Programs and Features -> Add or Remove Programs -> remove 'Safety Parameter Editor'

2. Start the 'SetupAipexPro.exe' file and follow the instructions.

3. Make sure that 'SafePMT' is selected when choosing components:

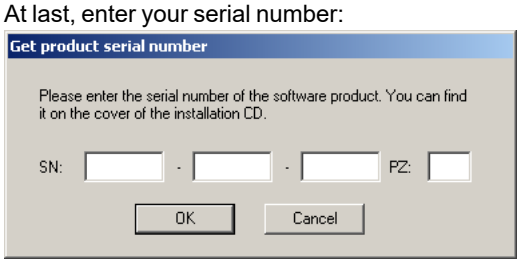


4. Select the install location and the start menu folder and start the installation:



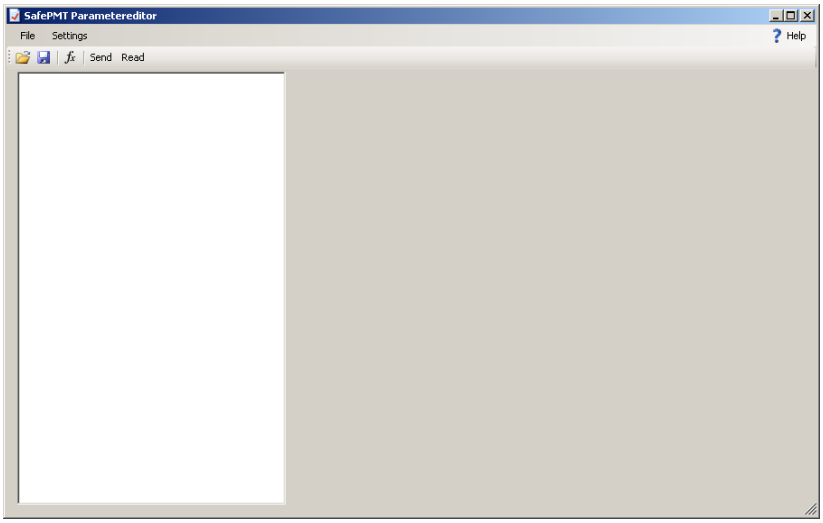
5. Wait for the different installation steps to be done and follow the subsequent instructions.

6. At last, enter your serial number:



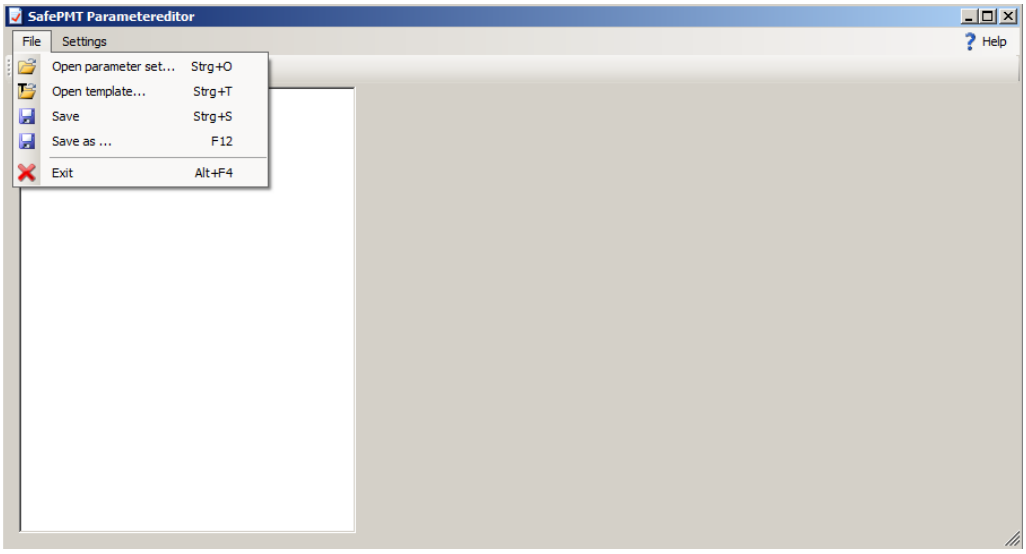
8.3.3 Operation

The following figure shows the interface of the parameter editor:



'File' menu

The 'File' menu offers the functions for opening and closing the parameter sets.



Open parameter set ...

Opens a saved parameter set with customer specific values (file format *.blob).

Open template ...

Each firmware version a safe parameter set is assigned . The safe parameter set is mentioned in original condition as template. The template contains the list of all parameters, that are supported by the associated firmware. The parameters are configured with default values.

The SafePMT checked while downloading the compatibility of the firmware and the template by comparing the checksum.

Example template: AMK-PrmTable_default_nnnnnn_Vv.v.prm

Siehe 'Compatible versions up from...' auf Seite 4.

Save / Save as ...

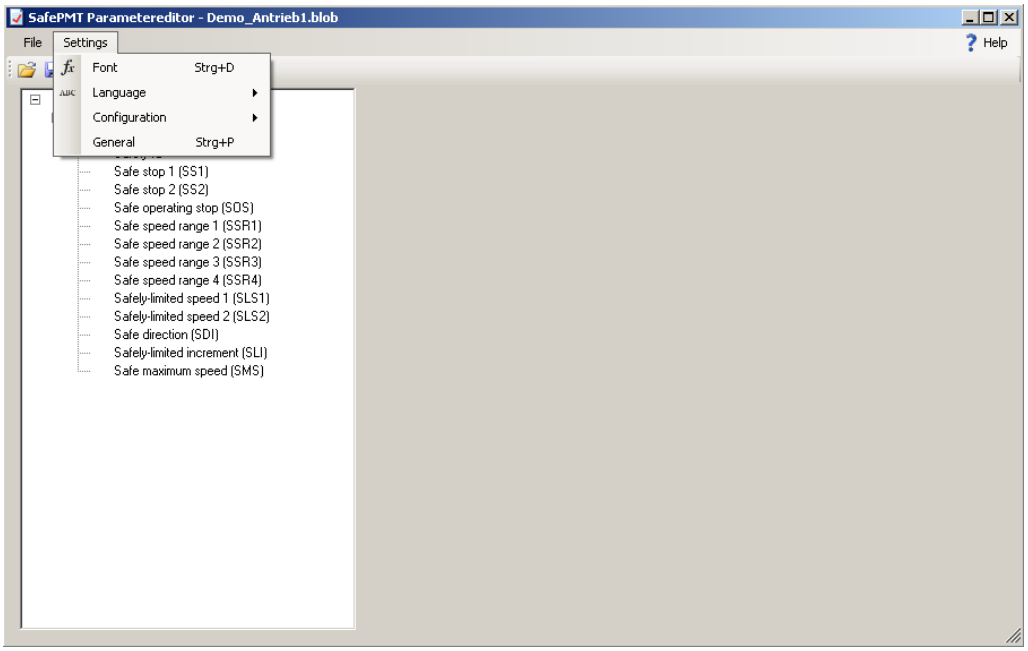
A safe parameter set with customer specific values will saved as file format *.blob.

Exit

Exit closes the SafePMT Parametereditor.

'Settings' menu

In this menu, basic settings can be made for handling the parameter editor.

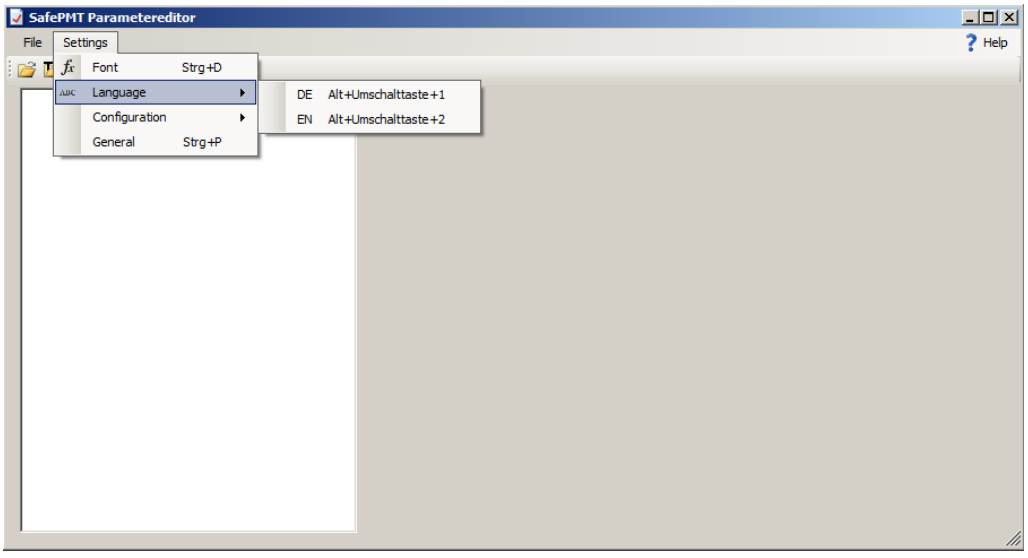


Font

With the 'Font' menu item, the font type and size can be changed in the windows of the parameter editor.

Language

The language for the interface of the parameter editor can be chosen here.

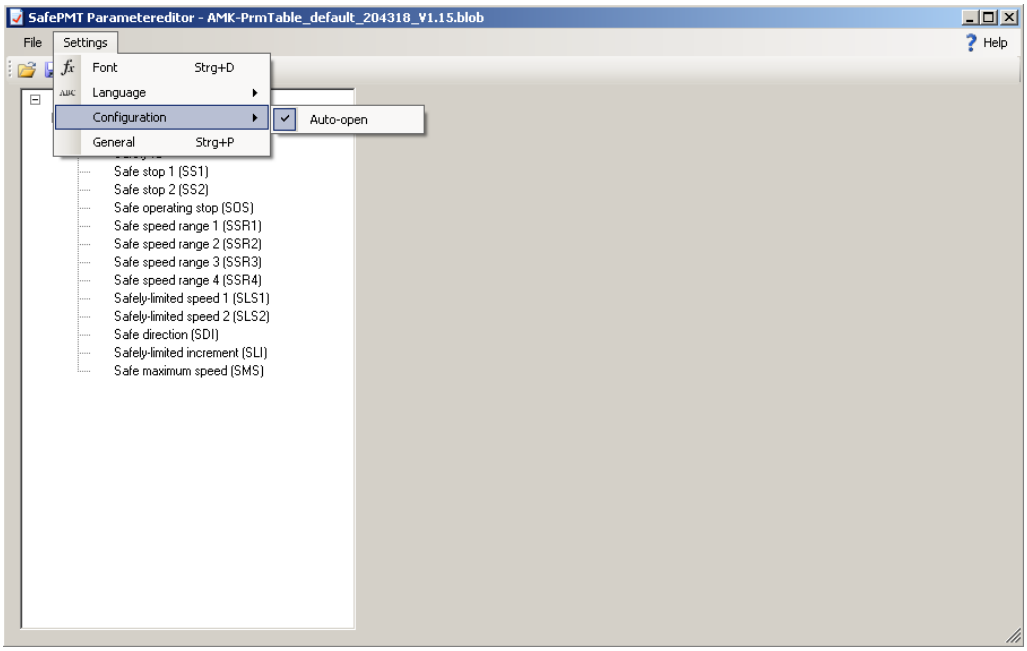


Currently, the following languages are offered:

- German
- English

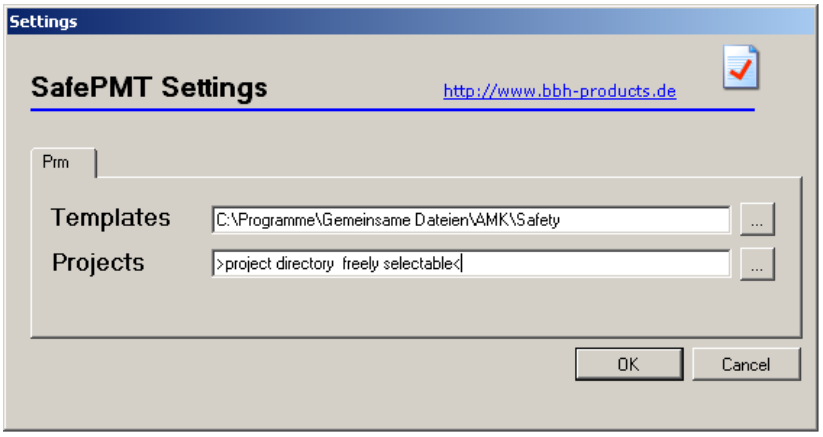
Configuration

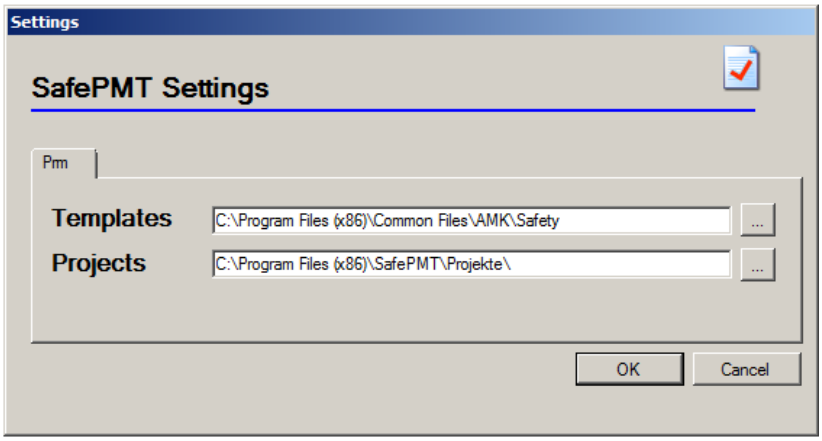
With 'Auto-open' the 'Configuration' tree structure is completely fanned out in the browser window of the parameter editor.



General

Under 'General', the path settings to the directory are made for the templates and the project files.





The 'Templates' path imperatively requires the folder where the default parameter set is stored.

The path for the templates may not be changed.

Note for Windows 7:

Depending on the personal user rights, you probably may not access to the C:\programs\common files\AMK\Safety (example Windows version)

C:\Program Files(x86)\Common Files\AMK\Safety\ (example Windows version) folder for reading or writing.

In this case, copy the default parameter set to a folder you can access to for reading and writing.

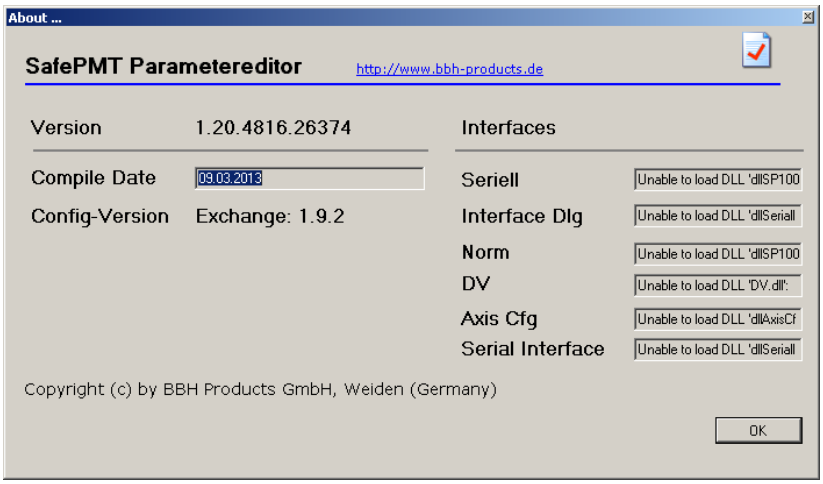
You will get the default parameter set from the software package SW_Paket_Safety_vvv_yyww_nnnnnn, sub-folder PMT.

Adjust the project path to your needs.
The project path determines where the generated parameter sets and report files are stored.

Confirm the path settings with **'OK'**.

'Help' menu

The 'Help' menu shows the version status of the parameter editor.



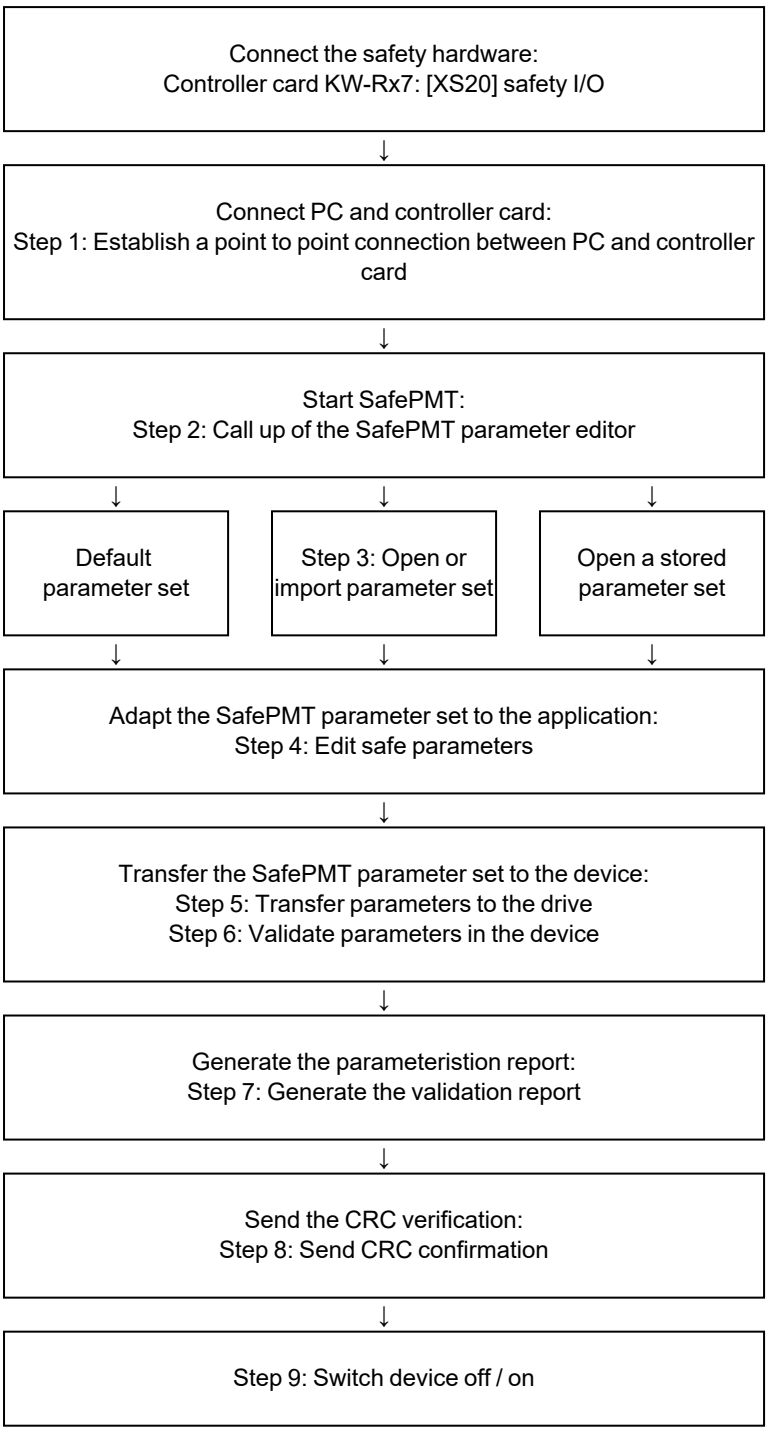
8.4 Parameterisation

DANGER	
	Danger of life to the operating staff from erroneous parameterisation! The parameterisation significantly influences the behaviour of the drive system. If the application of the stop and safety function is not suitable for the machine or the parameterisation is faulty, the operating staff will be endangered. **Steps to prevent:** • Recheck the entered values of all parameters by means of the validation report. • Test the behaviour of the drive with the selected parameters during different operation modes. • Test the error reactions of the system.

The safety functions use safe parameters that are parametrised with the safe parameter editor in AIPEX PRO or AIPEX LITE. The parameterisation of the safe parameters is only possible if the PC with installed AIPEX PRO and SafePMT is connected to the drive via a point-to-point connection.

This point-to-point connection can be established via the PC's USB interface directly with the USB connection of the controller card or via EtherCAT.

Flow chart


Connect the safety hardware:
Controller card KW-Rx7: [XS20] safety I/O
Connect PC and controller card:
Step 1: Establish a point to point connection between PC and controller card
Start SafePMT:
Step 2: Call up of the SafePMT parameter editor
Default parameter set
Step 3: Open or import parameter set
Open a stored parameter set
Adapt the SafePMT parameter set to the application:
Step 4: Edit safe parameters
Transfer the SafePMT parameter set to the device:
Step 5: Transfer parameters to the drive
Step 6: Validate parameters in the device
Generate the parameteristion report:
Step 7: Generate the validation report
Send the CRC verification:
Step 8: Send CRC confirmation
Step 9: Switch device off / on

LED H6

After power on

Colour	Meaning
LED OFF	Safe parameter set is NOT valid The reason can be detected by diagnostic message
Green	Safe parameter set is valid

During transmission of safe parameter set to the device

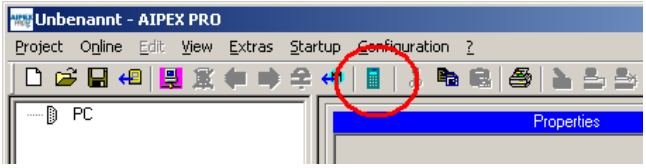
Colour	Meaning
Green flashing (1 second cycle)	Validation request: Enter the check sum
Orange	Safe parameter set was successfully transmitted Switch the device OFF and ON again
LED OFF	Safe parameter set was NOT transmitted successfully The reason can be detected by diagnostic message

Step 1: Establish a point to point connection between PC and controller card

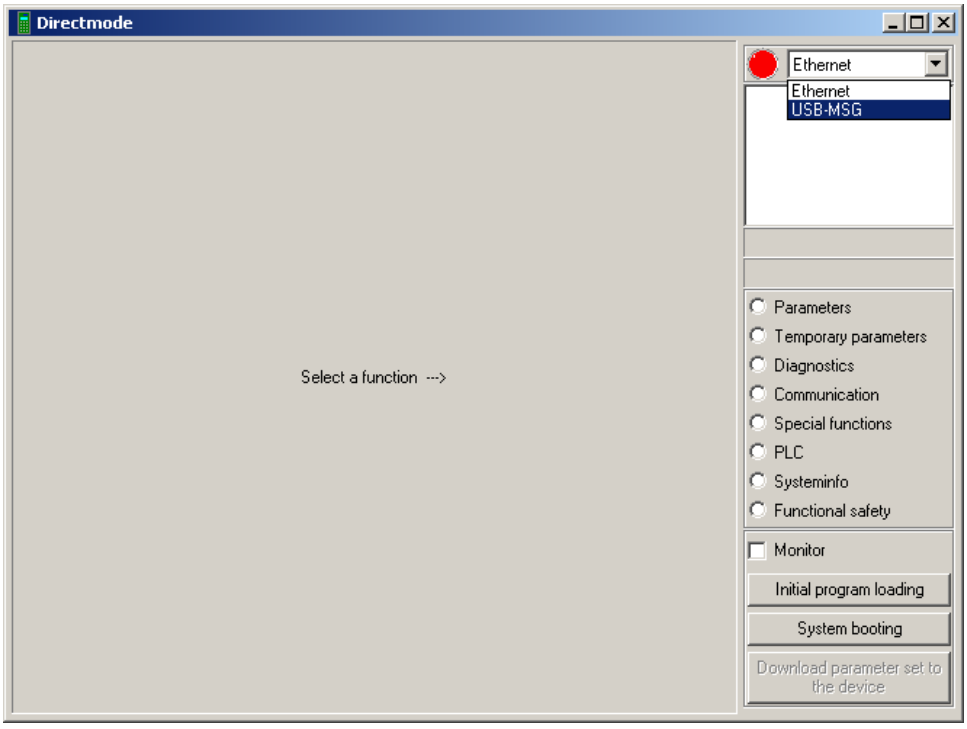
USB connection

1. Connect your PC with the USB connection (X235) of the controller card.

2. Start AIPEX LITE.
   OR
3. Start the 'direct mode' in AIPEX PRO



4. Set the 'USB-MSG' connection.

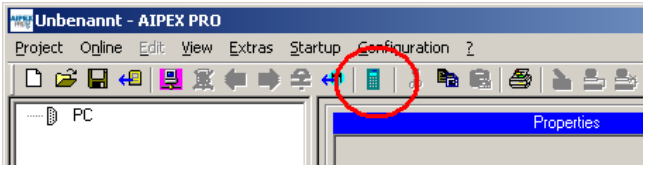


5. The software establishes the connection to the connected device. The connected device is shown.

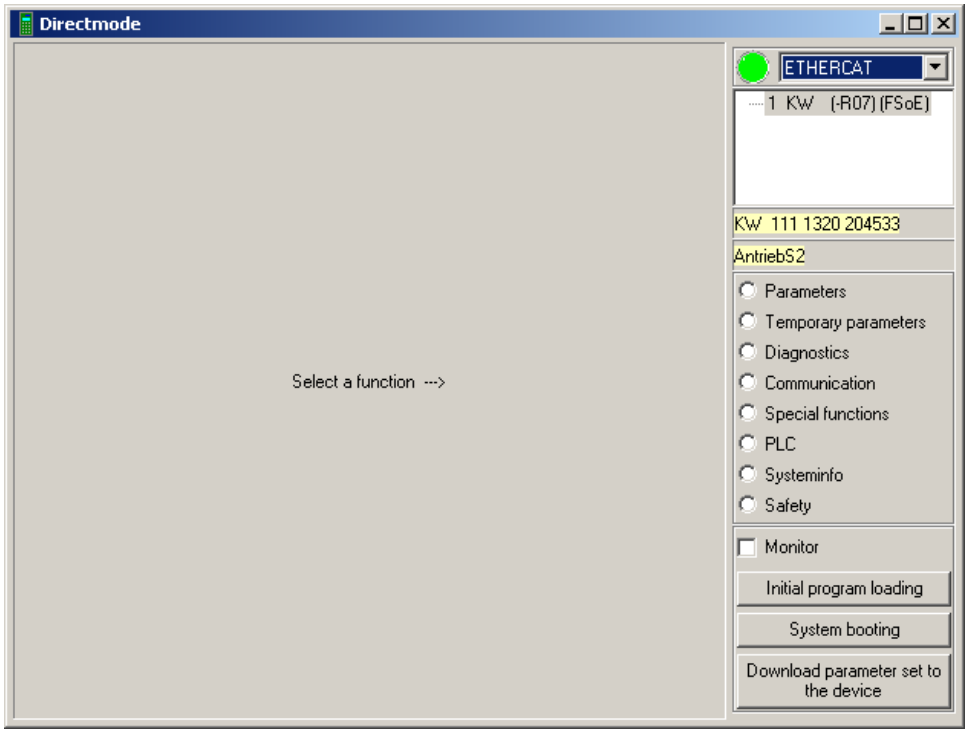
USB-MSG	Bus connection
KW 111 1320 204533	Inverter type KW, firmware version 1.11 2013/20, AMK part no. 204533
AntriebS2	Drive name from ID34071 'System name'

EtherCAT connection

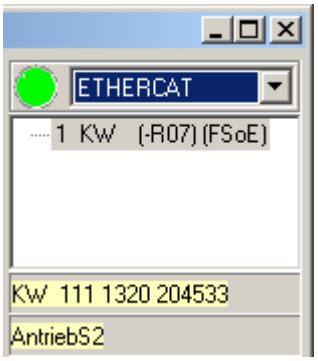
1. Separate the EtherCAT connections X85 and X86 of the controller card that you want to parametrise.
2. Connect your PC with the EtherCAT interface X85 of the controller card.
3. Start AIPEX LITE.
   OR
4. Start the 'direct mode' in AIPEX PRO



5. Set the 'EtherCAT' connection.

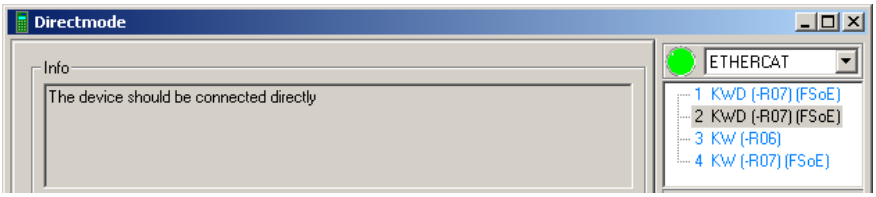


6. The software establishes the connection to the connected device. The connected device is shown.



ETHERCAT	Bus connection
KW 111 1320 204533	Inverter type KW, firmware version 1.11 2013/20, AMK part no. 204533
AntriebS2	Drive name from ID34071 'System name'

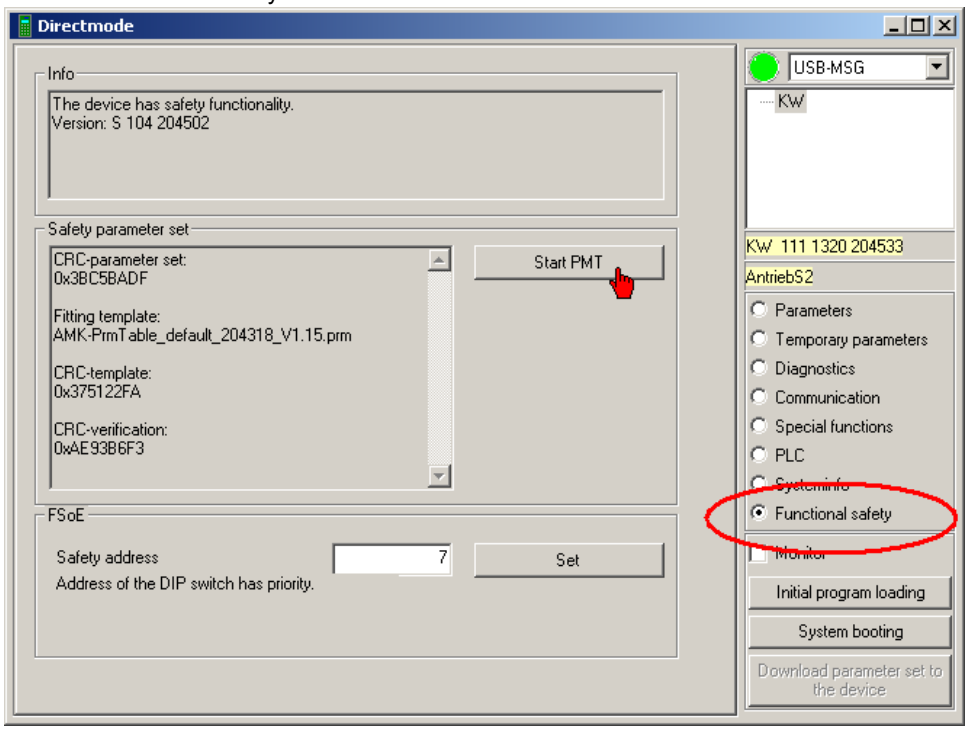
If you did not separate the controller card from the network system, you will receive the following error message:



Step 2: Call up of the SafePMT parameter editor

The entire following sequence is described using a USB connection between PC and controller card.

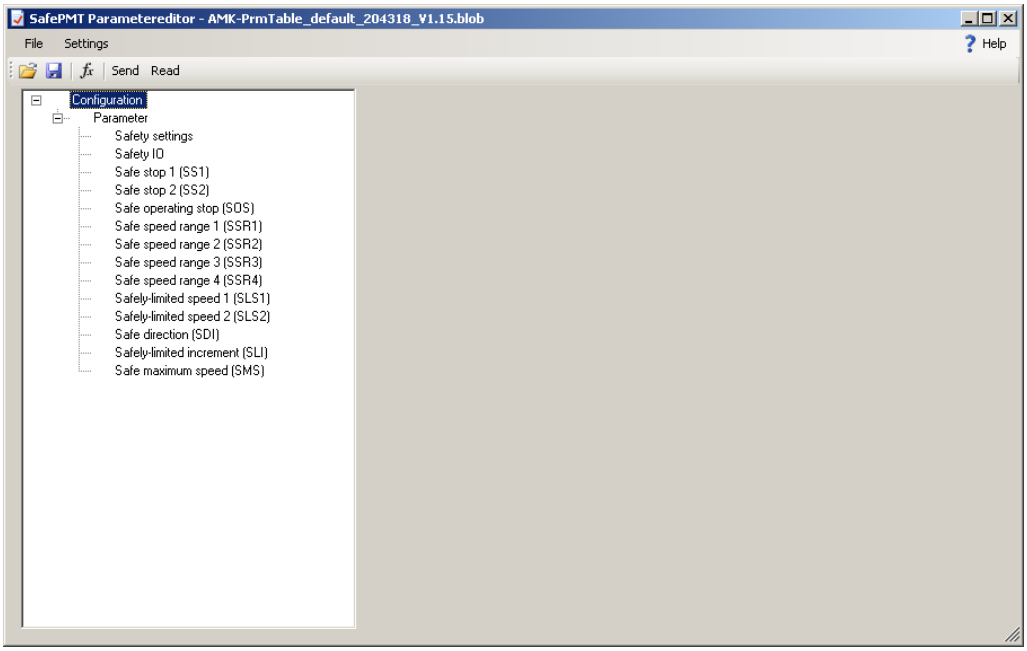
1. Activate 'Functional safety'.



2. Call up the parameter editor for the safe parameterisation: **'Start PMT'**

Additional information about handling AIPEX PRO can be found in the 'Software description AIPEX PRO V3', AMK part no. 204979.

The SafePMT opens automatically the corresponding template to the firmware on the safety board.



Step 3: Open or import parameter set

The function 'Open ...' opens a customer specific parameter set or a template with default values. The function 'Read' import an existing configuration from a safety board.

With an active connection, the SafePMT opens automatically the corresponding template to the firmware on the safety board.

Open parameter set

Open the parameter set that you want to edit:

Open parameter set ...

This function opens a saved parameter set with customer specific values (file format *.blob).

The open parameters set must be compatible with the firmware on the safety board to which it is subsequently transferred.

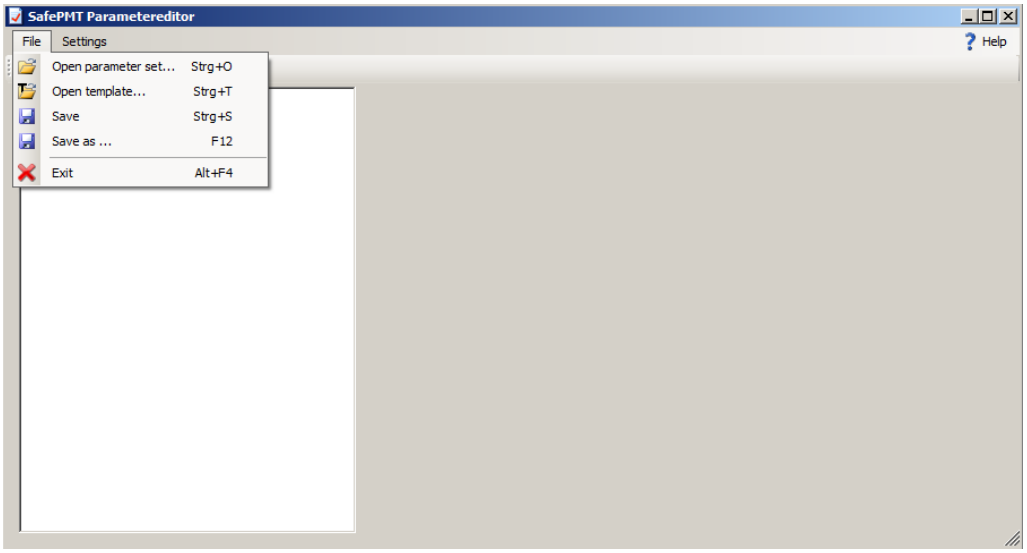
Siehe 'Compatible versions up from...' auf Seite 4.

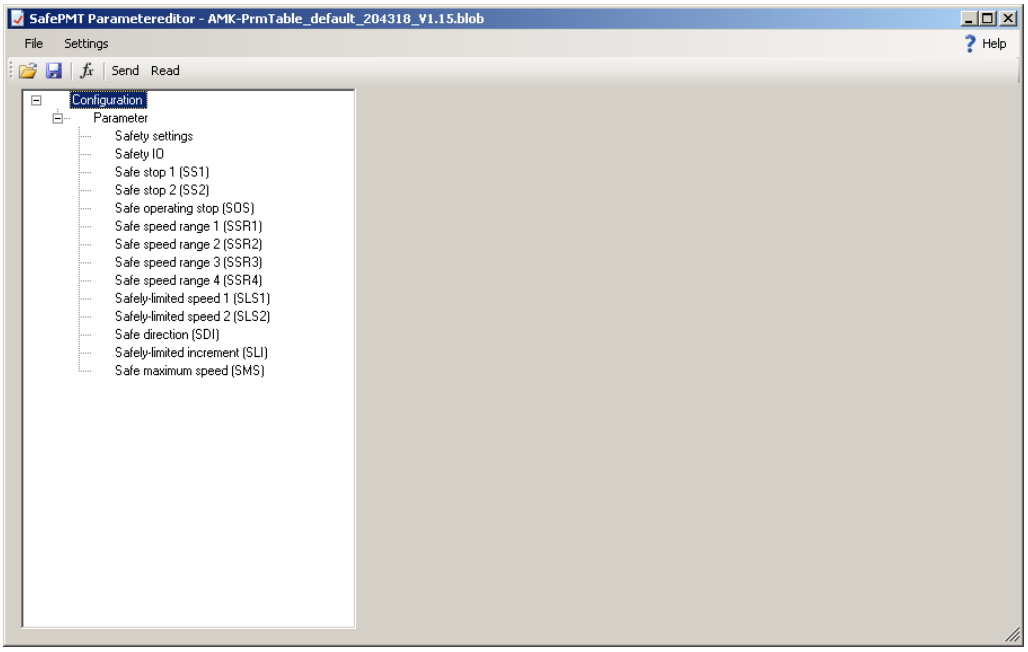
Open template ...

This function opens a template with default values (PrmTable_default_yyww_nnnnnn_Vv.v.v.prm).

Open the corresponding template to the firmware on the safety board.

Siehe 'Compatible versions up from...' auf Seite 4.

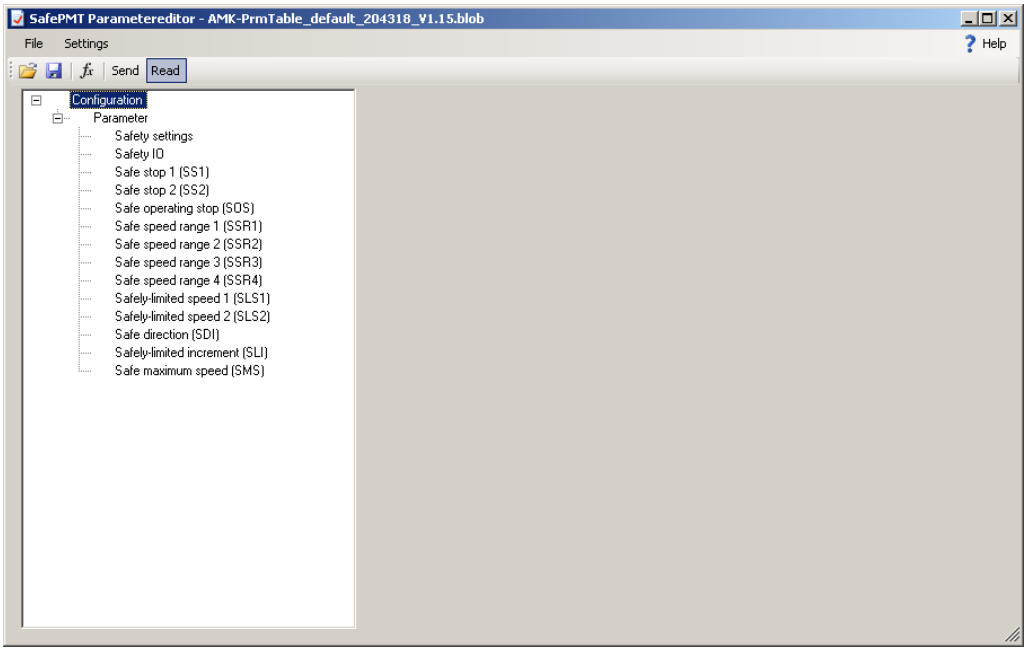


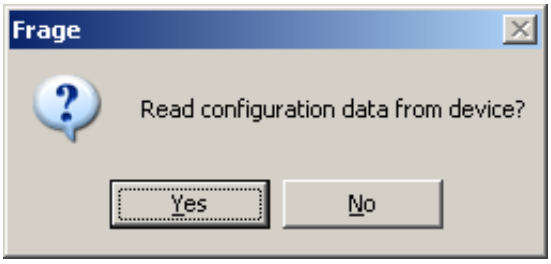


Import parameter set

It is only necessary to import parameters if the configuration of an existing safety board is to be changed.

With an active connection, the SafePMT opens automatically the corresponding template to the firmware on the safety board.
By clicking the button 'Read' the existing configuration is imported from the safety board.





After this query has been confirmed, the data is uploaded from the device.
The function is ended with the following message:

The imported data must then be stored in a new data set via 'File' -> 'Save as'.

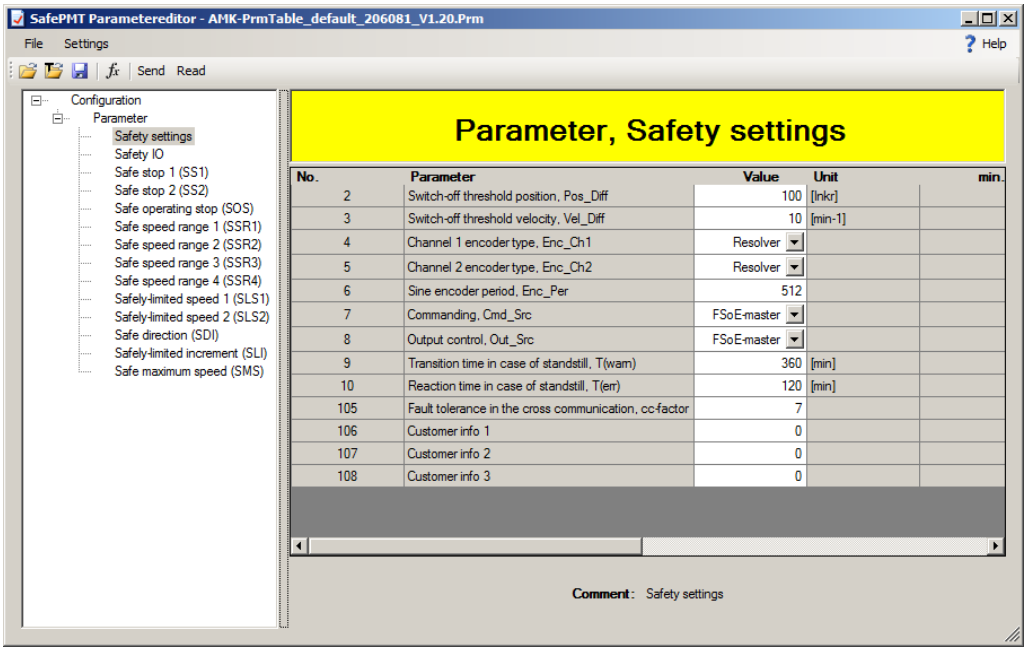
Step 4: Edit safe parameters

⚠ DANGER	
⚠	**Danger from parameter changes!** An incorrect parameterisation of the controller card in the converter significantly influences the behaviour of the drive system and causes an increased risk of injury and damage! **Steps to prevent:** • Parameters may not be changed by the machine operator or only changed in consultation with the machine manufacturer. • Only change parameters if you know the meaning and consequences. If you are unsure, read the parameter documentation or ask the manufacturer or supplier.

NOTE	
Material damage!	**Material damage from faulty parameterisation!** The drive parameterisation is the responsibility of the machine manufacturer. Input of incorrect parameters can lead to malfunction and therefore errors and damage to the system! **Steps to prevent:** • Only personnel trained by AMK may parametrise the drives

Basic parameterisation

Safety settings



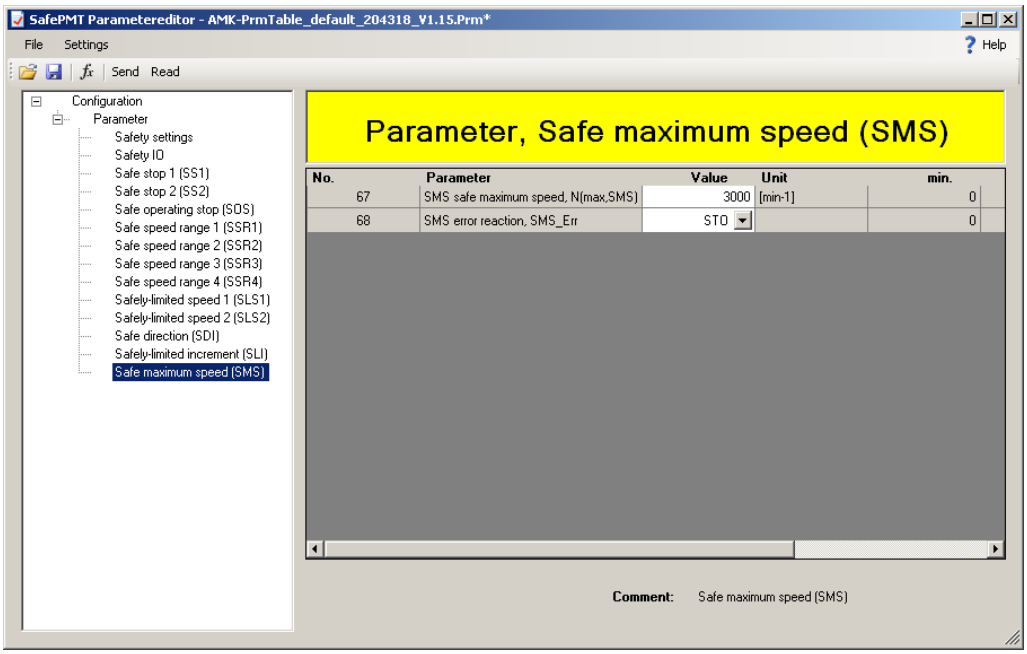
Select the safety settings and give the basic properties to your configuration, e.g. encoder types, type of commanding, machine downtime, downtime criteria.

Siehe 'Safe sine encoder monitoring (SEM)' auf Seite 27.

Motor encoder			Resolver	Sine encoder
Safety function	**Parameters**	**Name**	**Value**	**Value**
Safety settings	Prm4	'Channel 1 encoder type'	0: Resolver	1: Sine / cosine encoder
Safety settings	Prm5	'Channel 2 encoder type'	0: Resolver	1: Sine / cosine encoder

Motor encoder			Resolver	Sine encoder
Safety function	**Parameters**	**Name**	**Value**	**Value**
Safety settings	Prm6	'Sine encoder period'	not relevant	according to ID32776 'Sine encoder period'
Safety settings	Prm7	'Commanding'	1 Commanding of the safety / stop functions via the local safe inputs SE1-SE3. The safe outputs SA1 and SA2 issue the internal system state (e.g. STO).	

'Safe maximum speed (SMS)'



The 'SMS safe maximum speed' Prm67 establishes the brake ramps of the safety functions SS1, SS2, SSR and SLS.

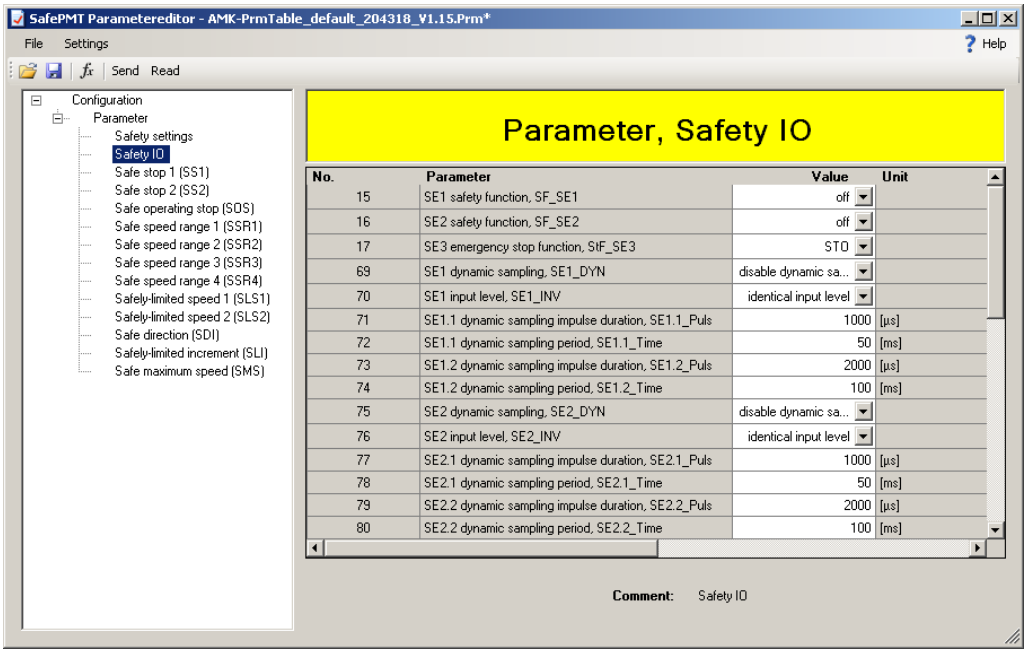
Siehe 'Safe maximum speed (SMS)' auf Seite 45.

Safety function	Parameters	Name	Value
'Safe maximum speed (SMS)'	Prm67	'SMS safe maximum speed'	The speed that is to be safely monitored for the application as the maximum speed, see ID113. 'Maximum speed'

The monitoring of the safe maximum speed can be "switched off" in principle by setting the Prm67 'SMS safe maximum speed', N(max,SMS), to its maximum value.

In this case, you must consider that the safe maximum speed directly governs the steepness of the braking ramps of the stop fuctions SS1 and SS2 as well as the safe operation modes SSR and SLS.

Safe inputs and outputs



If the safety functions are commanded via the secure inputs (Prm7 = 1, inputs SE1-SE3), then the inputs are to be occupied with the corresponding safety functions and, if necessary, the dynamisation properties are to be determined.

Regardless of whether the commanding takes place via FSoE or safe inputs, the system state is issued via the safe outputs. SA1 and SA2 must be set accordingly.

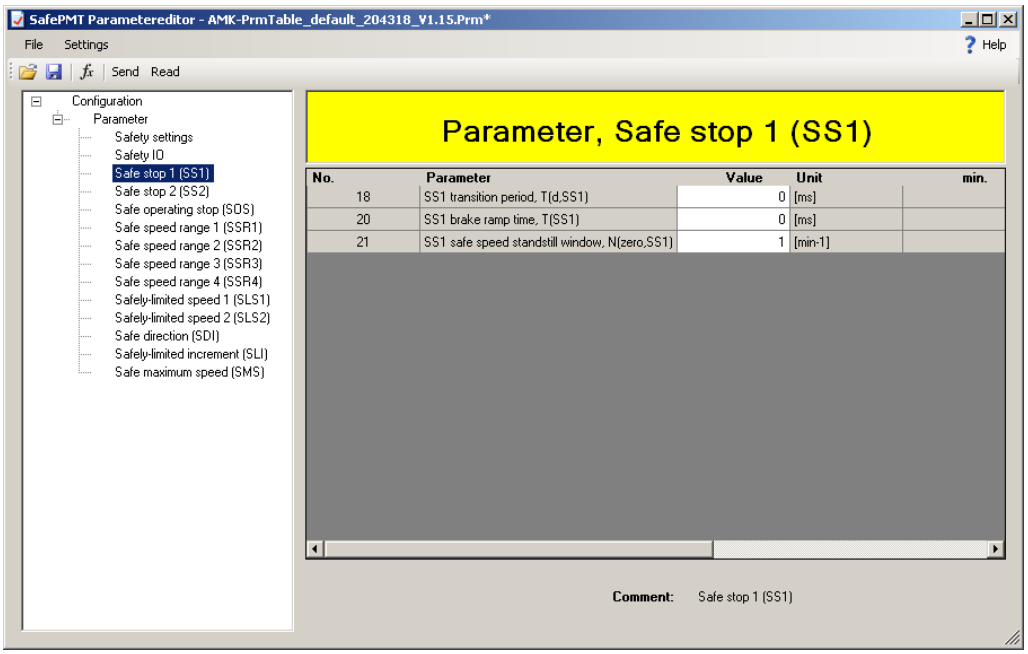
Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Parameterisation of the stop and safety functions

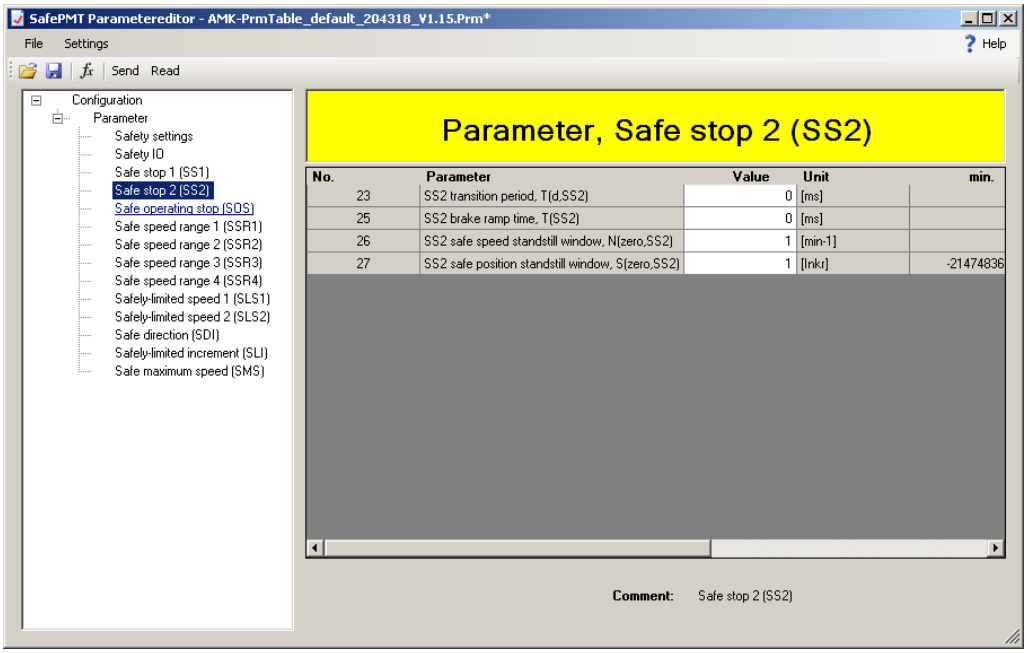
Depending on your application, you can configure the desired stop and safety functions.

One after the other, select all safety functions that you would like to use and assign values to the relevant safety parameters that are adapted to the application.

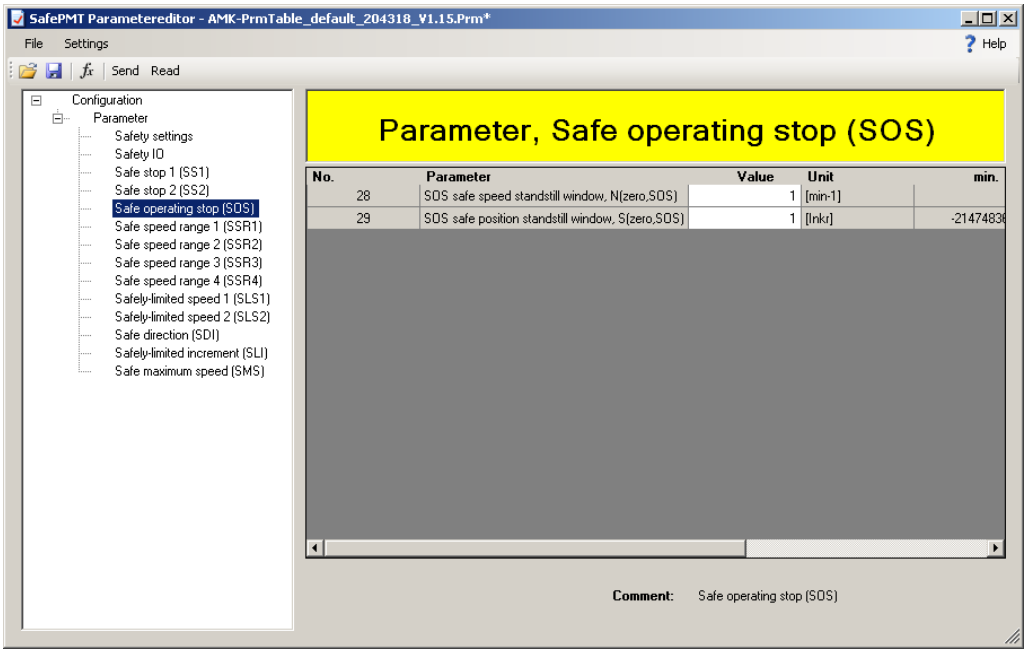
'Safe stop 1 (SS1)'



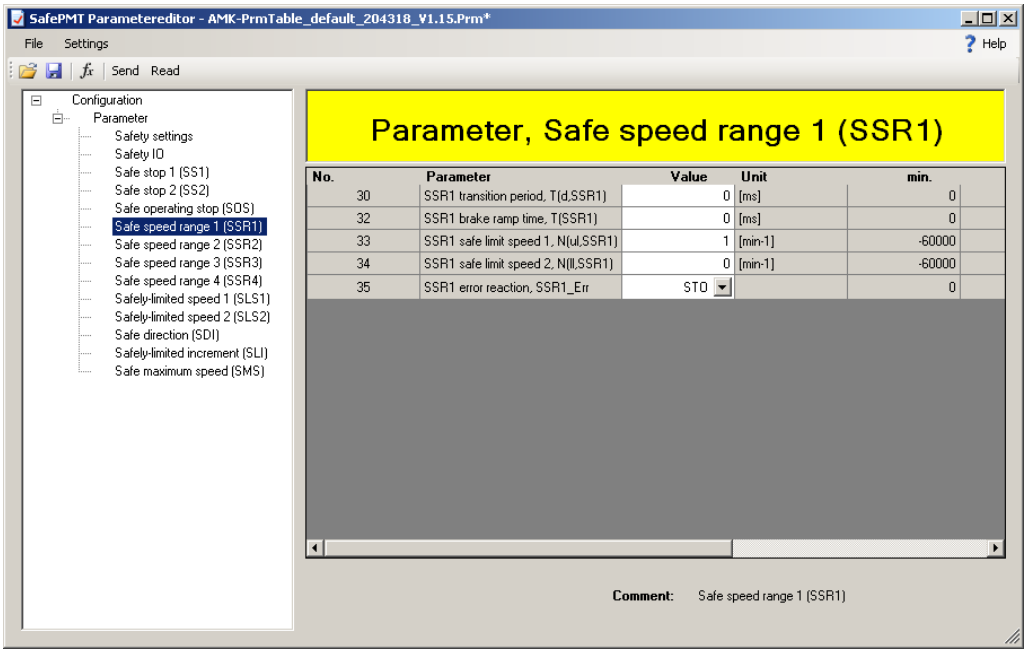
'Safe stop 2 (SS2)'



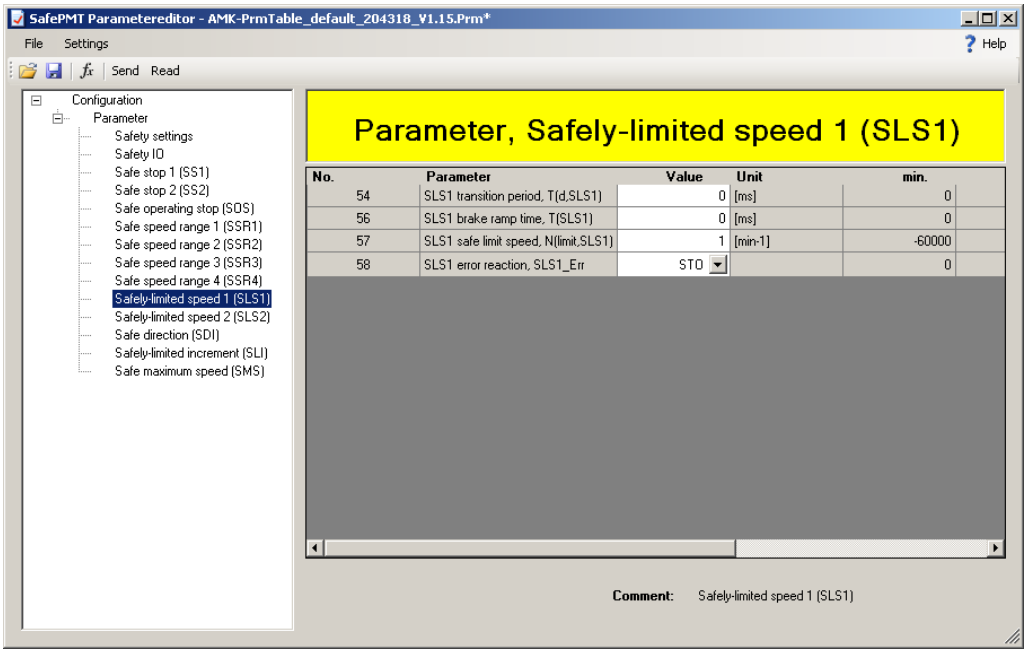
'Safe operating stop (SOS)'



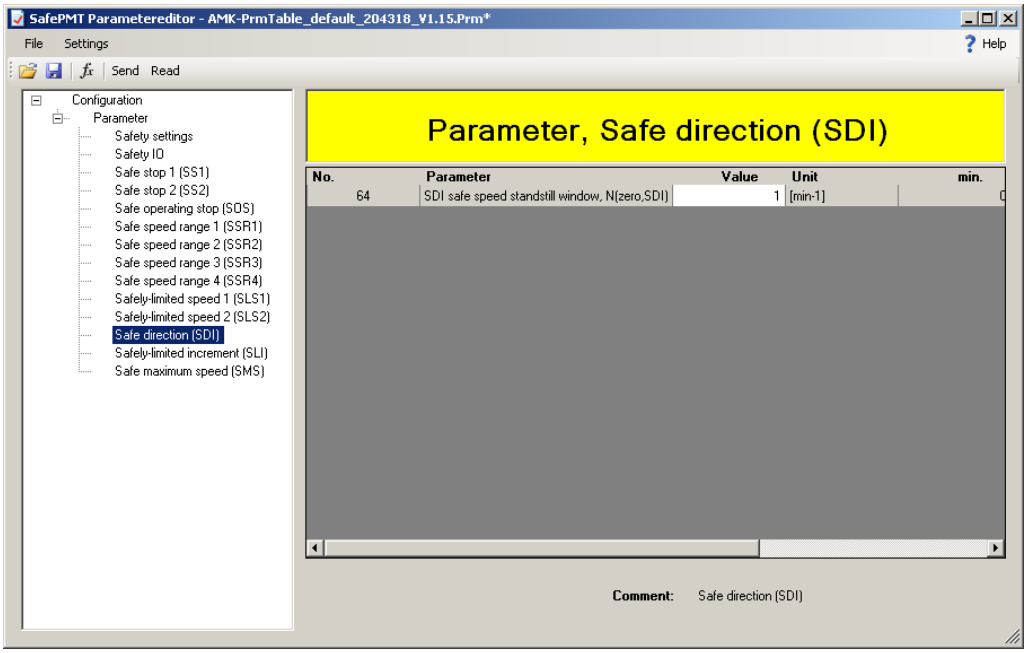
'Safe speed range (SSR)' (SSR1 - SSR4)



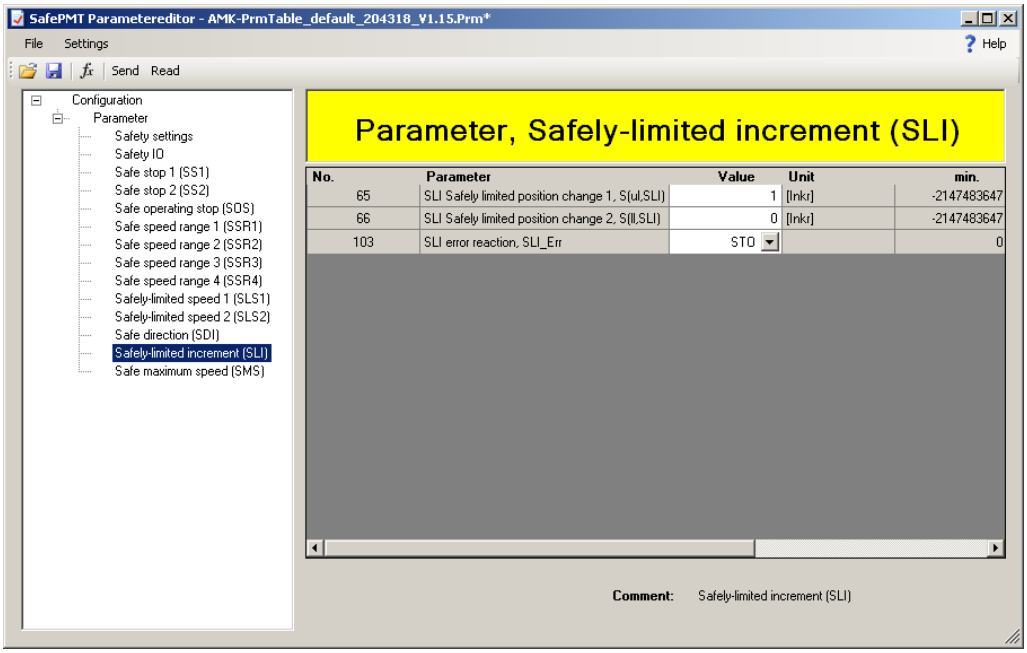
'Safely-limited speed (SLS)' (SLS1 - SLS2)



'Safe direction (SDI)'



'Safely-limited increment (SLI)'

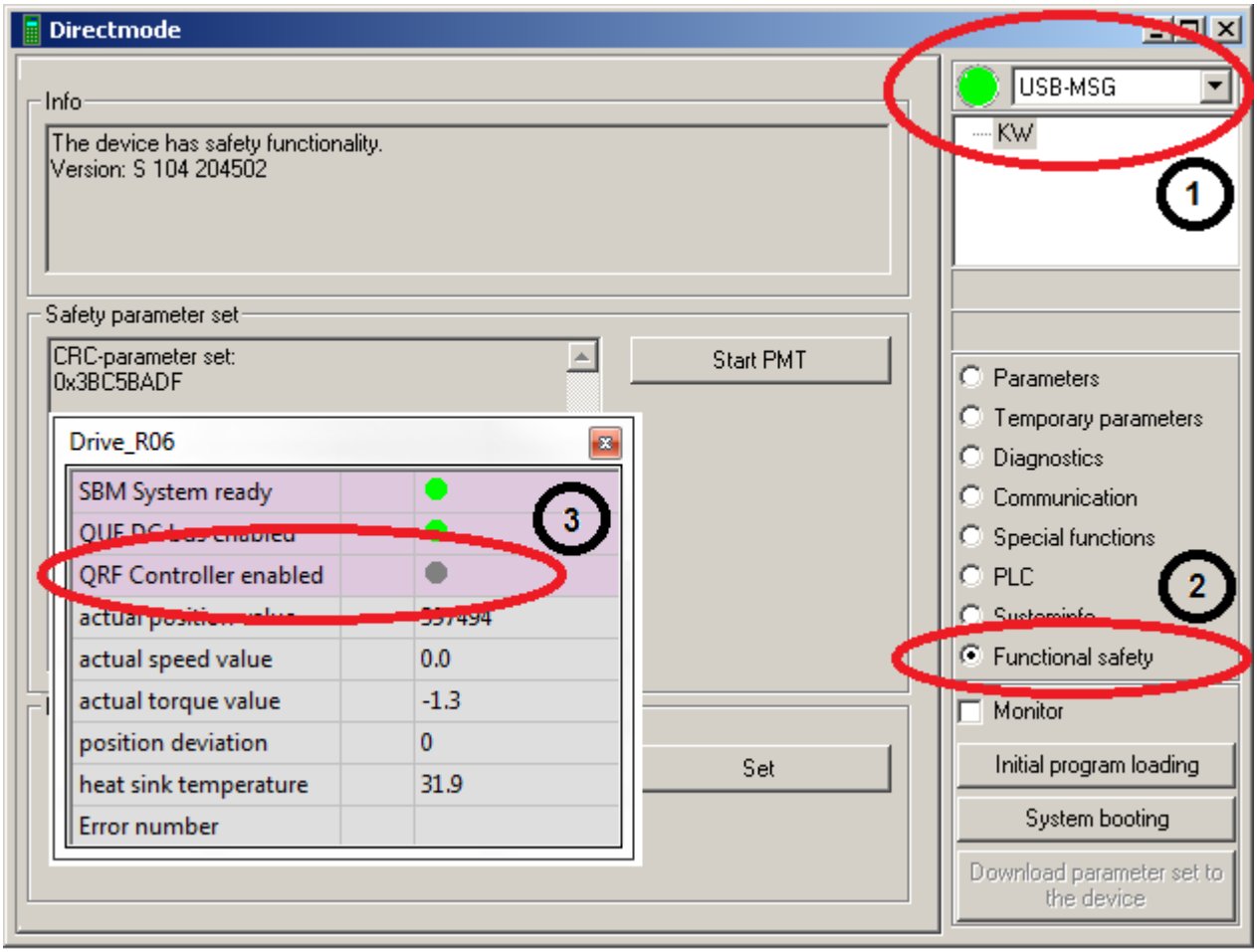


Step 5: Transfer parameters to the drive

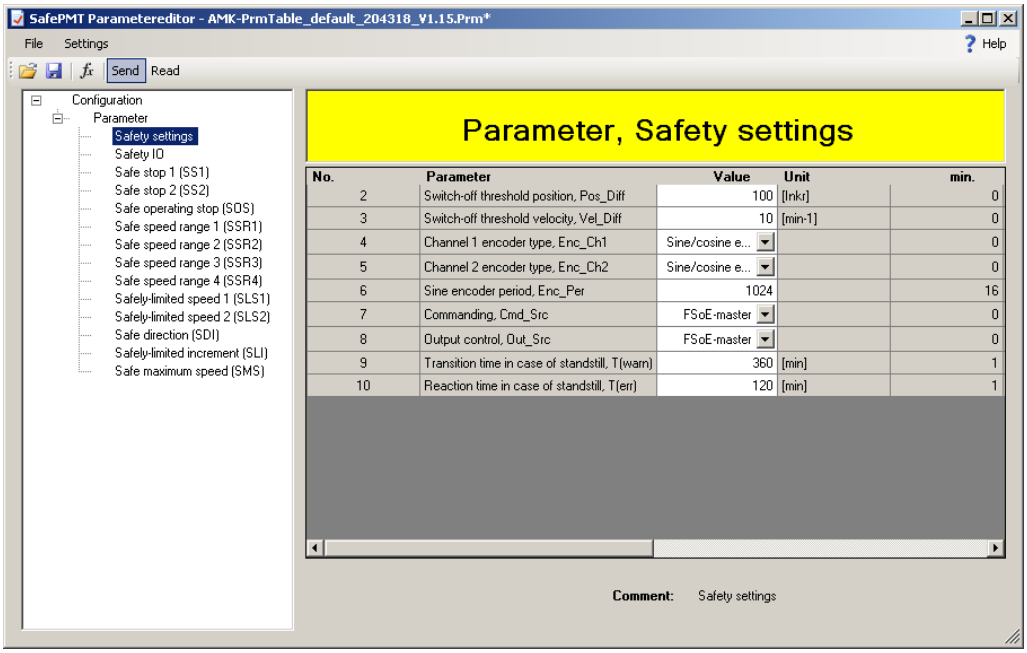
⚠ DANGER	
⚠	**Danger to life! Parts of the drive can move.** While a parameter set is being transmitted from the PC to the drive, all safety functions in the drive are deactivated. No monitoring of the limit values occurs and the drive is not safe in the sense of functional safety. Movable parts can move dangerously and thus lead to life-threatening injuries (e.g. bruises). **Steps to prevent:** • Secure movable parts. • Ensure that no persons are in the range of movement of the machine. • Block the range of movement of the machine.

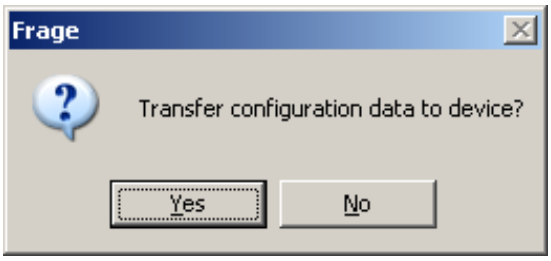
The following requirements must be met, thus the safe parameter set is transmitted to the safety board:

1. Between the AIPEX PRO 'Directmode' / AIPEX LITE and AIPEX LITE must be a active direct connection
2. Menu 'Functional safety' must be selected
3. Controller enable disabled (QRF = inactive) / (QRF = 1 a warning is generated)



Transfer the parameter set from the PC to the drive by selecting **'Send'** in the parameter editor.





After you confirmed this query, you have to authorise yourself by entering your password.

When you start the parameter transmission the first time after installing the SafePMT, the standard password **AMK500591** is activated.

Enter this password and select **'Change password'** at once to specifiy your own password.

Otherwise, it is not sure that exclusively you can transmit changed parameters to the device.

Change password:

Enter a password of at least 8 characters. You may use small and capital letters A to Z as well as numbers from 0 to 9. Special characters are not allowed.

Keep your password in mind well.
If you forgot your password, please contact the AMK service.

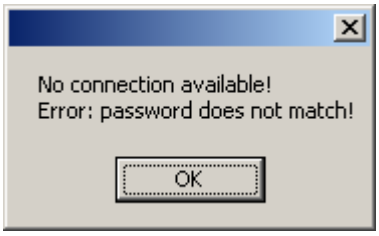
In case of a faulty input, one of the following messages will appear:

No password entered

Wrong password entered

'Change password' selected
but no new password entered

'Change password' selected
but new password and its repeat do not match



After you entered the correct password and confirmed with **'OK'**, the data will be transferred to the device.

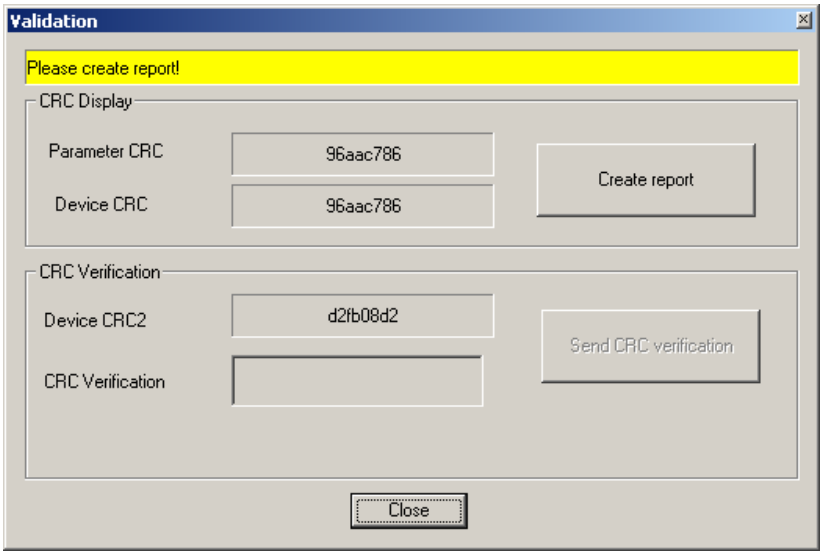
During the transfer of data until the completion of the verification, the connection between the PC and controller card may not be interrupted!
Otherwise, the device must be switched off and on and the transfer of data repeated.

The parameter set is written in the remanent memory, but is not yet effective for the safety function. After the parameter set has been transferred, the LED (H6) flashes green and indicates that the validation must be carried out. If the drive is switched off and back on again before validation, the remanent memory is cleared and the parameter set needs to be transferred again.

Step 6: Validate parameters in the device

After the data has been transferred into the device, the parameter set must be validated.

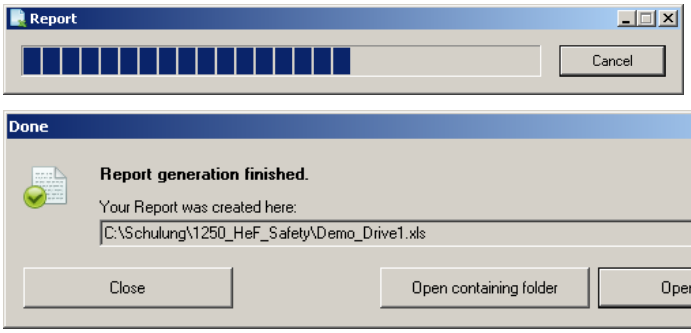
The value in the 'Parameter CRC' display field is calculated from the current parameter set in the safety editor. After the parameter set transfer, the CRC of the transferred parameters is calculated in the drive and shown in the validation window in the 'CRC devices' display field.
The 'CRC devices' and the 'CRC parameter' values must be equal, otherwise the data has not been transferred correctly.



The CRC is stored in the drive. At the next system booting, it is checked whether the CRC stored in the drive is identical to the CRC calculated via the parameter set. The CRC of the parameter set and the CRC of the sent confirmation are stored in two different memories.

Step 7: Generate the validation report

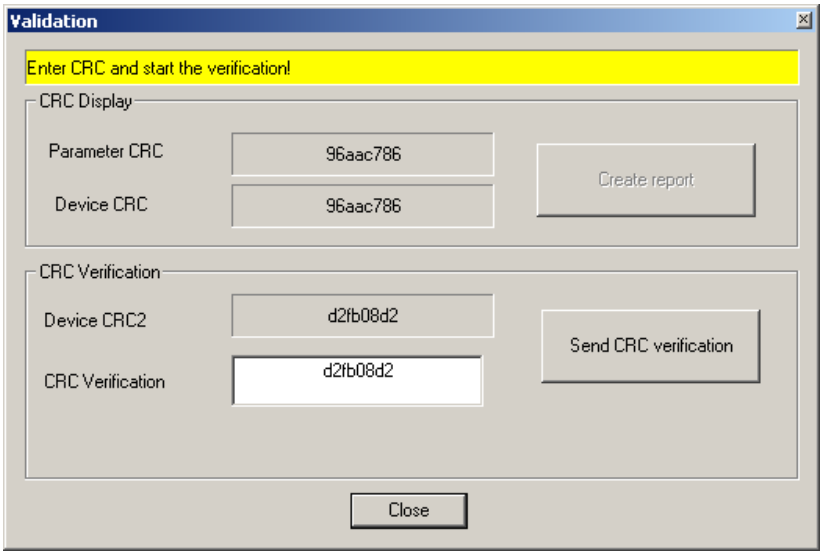
Select **'Create report'** and enter the path and file name under which the report is to be stored.



The report is a PDF file in which the parametrised values are listed, separated into groups of safety functions. Pursuant to the TÜV release, the report must be confirmed and released according to the required directives. (Siehe 'Validation report' auf Seite 110.)

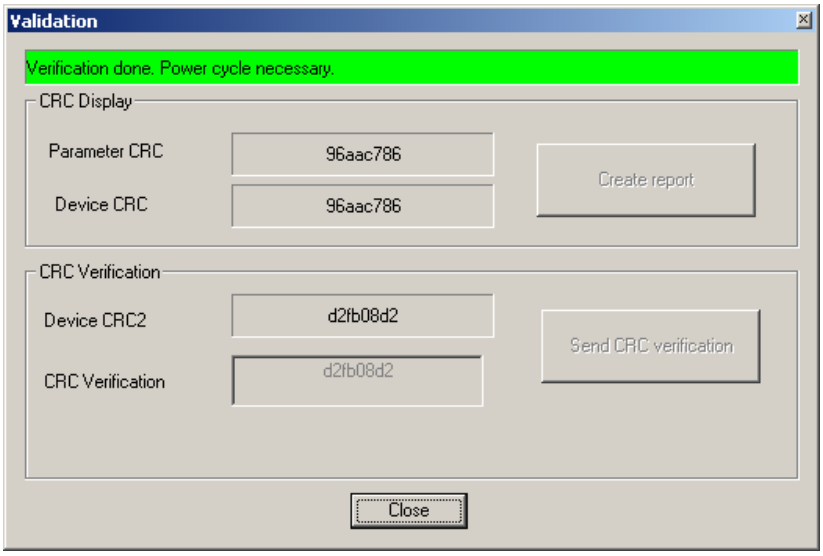
The printed report serves as a basis for the technical safety inspection.

Step 8: Send CRC confirmation



Enter the CRC code that is displayed in 'Device CRC2' of the validation window into the 'CRC verification' input field and confirm the input with **'Send CRC verification'**.

'OK'



Close the validation window.

Step 9: Switch device off / on

1. Switch the drive OFF
2. Re-establish the fieldbus connections X85 / X86.
3. Switch the drive back ON.
4. If an error is displayed after switching the drive on, the parameterisation process must be run through again.

8.5 Validation report

DANGER	
	**Danger of life to the operating staff from erroneous parameterisation!** The parameterisation significantly influences the behaviour of the drive system. If the application of the stop and safety function is not suitable for the machine or the parameterisation is faulty, the operating staff will be endangered. **Steps to prevent:** • Recheck the entered values of all parameters by means of the validation report. • Test the behaviour of the drive with the selected parameters during different operation modes. • Test the error reactions of the system.

With the 'Create report' function during the validation of the parameter set, an Adobe PDF file is created, which, in addition to information about the system, contains the transferred values of the safety parameters.

By means of the validation report, recheck the entered values up on incorrect input, e.g. transposed numbers, decimal places, ...

The report header (2 pages) is to be completed before printing.
Then, all fields of the report are to be filled out by hand. The report is to be signed separately by the person who has made the parameterisation.
The entire validation report is comprised of 8 pages:

Header (1st page)

Date	Date of the report generation
Customer	Operator of the system (e.g. name, telephone number, fax number)
System	General designation (e.g. name, version, internal designations)

Header (2nd page)

Supplier	Manufacturer of the safety module	
System description	Installer	Commissioning engineer of the system (e.g. name / company, telephone number, fax number)
	Labelling	Functionality and application of the system
	Location	Location / setting where the system is located
	End customer	Operator of the system
	Short description	Critical safety features of the system
	Functional characteristics	

Individual check of each system component (1 page)

Visual inspections	
Component documentation	Among other, this includes the safety manual at hand (Part no. 203446) and the Device description Controller cards KW-R06 / -R16 / -R07 / -R17 (Part no. 202744), both contained in the 'AMK Online Documentation'.
Device description	Device type, serial number Software versions
CRC vaules	The CRC values are displayed in the AIPEX PRO direct mode in the 'Safety parameter set' window.

Itemisations (5 pages)

- Safety settings
- Safety I/O
- Safe stop 1 (SS1)
- Safe stop 2 (SS2)
- Safe operating stop (SOS)
- Safe speed range 1 (SSR1)
- Safe speed range 2 (SSR2)
- Safe speed range 3 (SSR3)
- Safe speed range 4 (SSR4)
- Safety-limited speed 1 (SLS1)
- Safety-limited speed 2 (SLS2)
- Safe direction (SDI)
- Safety-limited increment (SLI)
- Safe maximum speed (SMS)

The completed and signed report must be stored in the machine manual in order to be able to understand the parameterisation in the case of damage.

8.6 Running KW-Rx7 without functional safety

In order to be able to operate the controller card without triggering the monitoring of the functional safety, the safe inputs of the connection XS20, B1 to B8, are to be switched to "high". The A4 and A8 connections must be connected to GND.

It is not possible to disable the safety functions 'Safe maximum speed (SMS)' and 'Safe encoder monitoring (SEM)'.

Therefore, the following safety parameters have to be checked and adapted to the machine:

Safety settings

Parameter	Name	Code	Unit	Recommended value
Prm2	'Switch-off threshold position'	Pos_Diff	incr	2147483647
Prm3	'Switch-off threshold velocity'	Vel_Diff	rpm	60000
Prm4	'Channel 1 encoder type'	Enc_Ch1		depends on machine configuration
Prm5	'Channel 2 encoder type'	Enc_Ch2		depends on machine configuration
Prm6	'Sine encoder period'	Enc_Per		depends on encoder
Prm7	'Commanding'	Cmd_Src		1 (safe inputs)
Prm8	'Output control'	Out_Src		0
Prm9	'Transition time in case of standstill'	T(warn)	min	60000
Prm10	'Reaction time in case of standstill'	T(err)	min	60000
Prm105	'cc-factor'	cc-factor		7
Prm106	'Customer info 1'	Customer info 1		
Prm107	'Customer info 2'	Customer info 2		
Prm108	'Customer info 3'	Customer info 3		

Safety I/O

Parameter	Name	Code	Unit	Recommended value
Prm15	'SE1 safety function'	SF_SE1		16 (off)
Prm16	'SE2 safety function'	SF_SE2		16 (off)
Prm17	'SE3 emergency stop function'	StF_SE3		0 (STO)
Prm81	'SE3 dynamic sampling'	SE3_DYN		0 (disable dynamic sampling)
Prm82	'SE3 input level'	SE3_INV		0 (identical input level)

Safe maximum speed (SMS)

Parameter	Name	Code	Unit	Recommended value
Prm67	'SMS safe maximum speed'	N(max,SMS)	rpm	60000
Prm68	'SMS error reaction'	SMS_ERR		0 (STO)

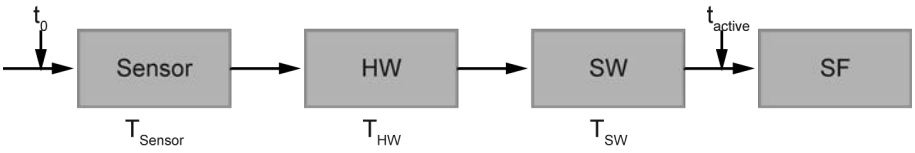
9 Operation

9.1 Propagation delay times

The propagation delay to the activation / deactivation of a safety function consists of several parts:

- Response time of the external safety sensors
- Hardware delay of the safe inputs
- Software processing time of safe inputs (i.e. dynamic sampling, ...)
- With use of FSoE
  - Processing time of the safety PLC
  - Transmission between FSoE master and slave
- Reaction time of the stop function STO
- Software processing time of safe outputs (i.e. dynamic sampling, ...)
- Hardware delay of the safe outputs

9.1.1 Propagation delay of safe inputs



Sensor	External safe input
HW	Input circuit of the AE-SF1, incl optocoupler
SW	Internal software processing
SF	Activated safety function

t_0	External event	--
T_{Sensor}	Response time of the safe sensors	Customised
T_{HW}	Hardware delay of the safe inputs	0,25 ms
T_{SW}	Internal processing time The parameters Prm71, Prm73, Prm77, Prm79, Prm83 and Prm85 'Dynamic sampling impulse duration' always influence the reaction time, even if the dynamization is not used. Adapt the response time of the safe inputs to the application as best as possible using these parameters.	SE1: Max (Prm71|Prm73) SE2: Max(Prm77|Prm79) SE3: Max(Prm83|Prm85)
t_{aktiv}	Activation carried out after	Σ

The delay time between activating the save input SEn.1 and SEn.2 must be less than the fault tolerance time. The fault tolerance time depends on the value in parameter Prm105.

9.1.1.1 Filtering of the safe inputs, contact bounce

In the software of the module AE-SF1 a filtering is implemented which depends on the safe parameters.

The following relationship applies:

- SE1: (Prm71 'SE1.1 dynamic sampling impulse duration' I Prm73 'SE1.2 dynamic sampling impulse duration')
- SE2: (Prm77 'SE2.1 dynamic sampling impulse duration' I Prm79 'SE2.2 dynamic sampling impulse duration')
- SE3: (Prm83 'SE3.1 dynamic sampling impulse duration' I Prm85 'SE3.2 dynamic sampling impulse duration')

The safe inputs also support dynamization, the filtering has 2 tasks:

- Level changes in the signal through the dynamization are filtered out
- Level changes caused by the bouncing of contacts are filtered out

To set the filter time, there is a parameter for each input called 'SEx.x dynamic sampling impuls duration'. Even if dynamization is not used, the filtering is active. The filter is constructed in 2 stages. It consists of a glitch filter and a downstream time filter described with the above parameters. After passing through the time filter, the determined level is processed further.

For processing in the glitch filter, the input signal is sampled in a 62.5 µs cycle. The glitch filter detects a state change if 4 consecutive samples have the same value. For the state change of the time filter at least, a constant value of the glitch filter must be present for the time set in the safe parameters Prm71, Prm73, Prm77, Prm79, Prm83 and Prm85.

9.1.1.1.1 Relationship between the filter time and the maximum bounce time of a contact

How long may a contact bounce take for a set filter time without resulting in error pulses and thus malfunctions?

For an estimate: contact bounce time < 2 x filter time

The exact response depends on the type of bounce and the resulting signal after the glitch filter.

9.1.1.1.2 Example

With the beginning of the bounce, the state 1 (time t_0) is sampled. This leads after the filter time to a state change from 0 to 1 (time t_1) at the filter output. For a state change from 1 to 0, a 0 would have to be scanned now again for the filter time (time t_2 - diagram 2). If the filter time is adjusted so that the contact bounce time < 2 x filter time, the filter output remains stable on state 1 (time t_2 - diagram 1).

Diagram 1:

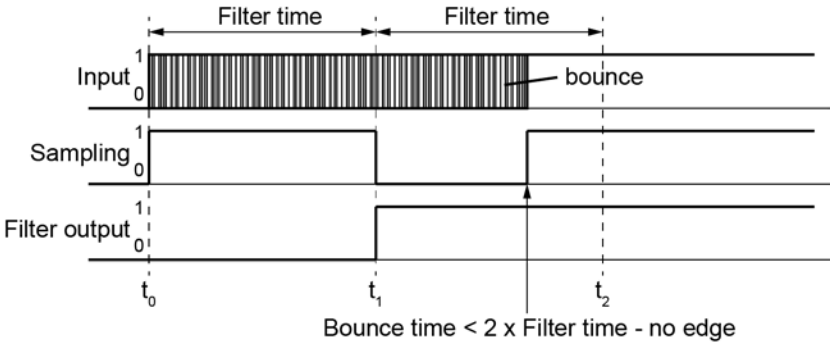
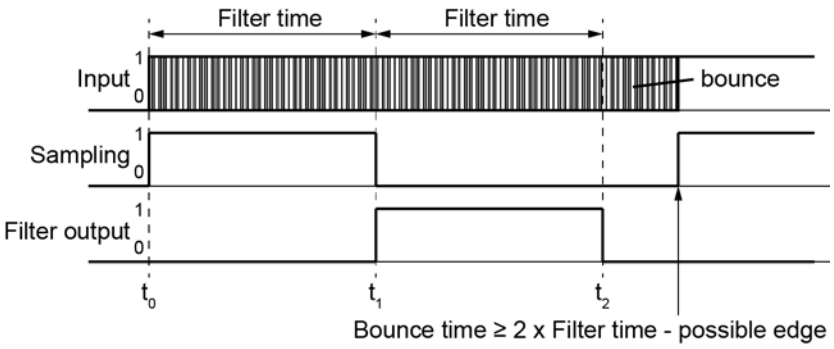
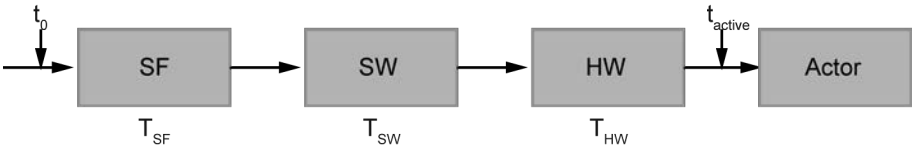


Diagram 2:



To determine the maximum response time of the safe Inputs, the bounce time of the contact and the filter time must be taken into account in the calculation.

9.1.2 Propagation delay of safe outputs



SF	Activated safety function
SW	Internal software processing
HW	Input circuit of the AE-SF1 incl optocoupler
Actor	External safe actor

t_0	Internal event	--
T_{SF}	Reaction time of the safety function	2 ms
T_{SW}	Internal processing time The parameters Prm88, Prm90, Prm94 and Prm96,'Dynamic sampling impulse duration' are only effective with active dynamization.	SA1: Max (Prm88|Prm90) SA2: Max(Prm94|Prm96)
T_{HW}	Hardware delay of the safe outputs	max. 0,40 ms
t_{aktiv}	Activation carried out after	Σ

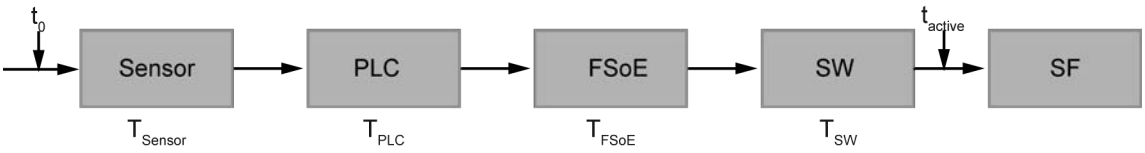
9.1.3 Propagation delay of the encoder monitoring

	Time to detect static errors of the resolver interface	0,125 ms
	Time to detect static errors of the sine encoder inteface	0,187 ms

9.1.4 Propagation delay time STO

	Propagation delay time of the stop function STO	2 ms

9.1.5 Propagation delay time FSoE



Sensor	External safe sensor
PLC	Safe PLC
FSoE	Fail-safe over EtherCAT
SW	Internal software processing
SF	Activated safety function

t_0	External event	--
T_{Sensor}	Response time of the safe sensors	Customised
T_{PLC}	Processing time of the safe PLC	Customised
T_{FSoE}	FSoE cycle time and EtherCAT transmission time	Customised

T_{SW}	Internal processing time	15 ms
t_{aktiv}	Activation carried out after	∑

10 Service

10.1 Replacing the controller card

⚠ WARNING	
	**Danger because of interchanging controller cards!** If controller cards are interchanged, the safe parameter sets do not fit the drives. The safety functions cannot be monitored correctly any longer. **Steps to prevent:** • Only personnel trained by AMK may change controller cards. • Make sure that the correct safe parameter set is relocated to the drive.

NOTICE	
Material Damage!	**Electronic components could be destroyed through static discharge!** Therefore touching of the electrical connections (e. g. signal and power supply cable) must be avoided. Otherwise you can be damaged the components when touching by static discharge. **Steps to prevent:** • Avoid touching electrical connections and contacts. • During handling the electronic component discharge yourself by touching PE. • Pay attention to the ESD-notes (electrostatic discharge).

The controller card KW-Rx7 contains two components:

- Controller card AE-Rx6
- Safety board AE-SF1

This 'package' is not allowed to be changed by the customer!

Only this way, the safety-related parameter set can be associated explicitly to the device.

In case of replacement, the entire KW-Rx7 controller card has to be replaced!

The replacement of individual parts of the controller card is not permitted and leads to the loss of all warranty claims.

The procedure to change the controller card is described in the hardware documentation.
See device description Controller cards KW-R06 / -R16 / -R07 / -R17 (AMK part no. 202744), chapter 'Dismounting / installing the controller card' or device description Controller cards KW-R24(-R) / -R25 / -R26 / -R27 (AMK part no. 204918), chapter 'Dismounting / installing the controller card'.

The replacement of the complete compact inverter is described in the device description Servo drives KE/KW (AMK part no. 28932), chapter 'Dismounting and replacing a compact inverter'.

10.1.1 Parameterisation

⚠ WARNING	
	**Hazard due to changing parameters!** The incorrect entering of parameters into the controller card significantly influences the drive system characteristics and creates an increased risk of accidents and damages! **Steps to prevent:** • Parameters may not be modified by the machine operator unless consultation takes place with the machine manufacturer. • Change parameters only if you are sure of the meanings and the consequences. If you are unsure, read the parameter documentation or ask the manufacturer or supplier.

NOTE	
Material damage!	**Material damage from faulty parameterisation!** The drive parameterisation is the responsibility of the machine manufacturer. Input of incorrect parameters can lead to malfunction and therefore errors and damage to the system! **Steps to prevent:** • Only personnel trained by AMK may parametrise the drives

The startup of the replaced drive (KW-Rx7 controller card) has to be executed as follows: Siehe 'Parameterisation' auf Seite 89.

11 Safe parameters

Prm2 'Switch-off threshold position'

Parameter	Name	Code	Unit	Min	Max
Prm2	'Switch-off threshold position'	Pos_Diff	Incr.	0	2147483647

Description

The two monitoring channels calculate one respective actual position value from the control information according to different procedures, so that a deviation between the two channels might occur. The maximum permitted offset between the two monitoring channels is determined with the Prm2 parameter. The drive is switched torque-free ('Safe torque off (STO)') when the difference of the current position feedback values of the two monitoring channels exceeds the value in the Prm2 parameter.

The resolution of the position is standardised to 65536 increments/revolution.

Recommandation:

The value of Prm2 should be set at least to 50 Incr. For each speed increase of 1000 rpm Prm 2 should be increased by 100 Incr.

Example:

At 4000 rpm speed Prm2 should be set to the following value:

Prm2 ≥ 50 [Incr] (minimum value) + 4000 [rpm] * 100 [Incr] / 1000 [rpm] = 450 Incr.

Prm3 'Switch-off threshold velocity'

Parameter	Name	Code	Unit	Min	Max
Prm3	'Switch-off threshold velocity'	Vel_Diff	rpm	0	60000

Description

The two monitoring channels calculate one respective actual speed value from the control information according to different procedures so that a deviation between the two channels might occur. The maximum permitted offset between the two monitoring channels is determined with the Prm3 parameter. The drive is switched torque-free ('Safe torque off (STO)') when the difference of the current actual speed values of the two monitoring channels exceeds the value in the Prm3 parameter.

Recommandation:

Prm3 ≥ 15 rpm + (Prm67 * 10 %)

Prm4 'Channel 1 encoder type'

Parameter	Name	Code	Unit	Min	Max
Prm4	'Channel 1 encoder type'	Enc_Ch1	-	0	1

Description

The Prm4 parameter determines which encoder type shall be evaluated by the monitoring channel 1.

One sine encoder and / or one resolver can be connected to the KW-R07 controller card.

To the KW-R17 and KW-R27 controller cards, only one sine encoder can be connected.

Prm value	Meaning
Relevant for KW-R07:	
0	Resolver
Relevant for any type of drive controller:	
1	Sine encoder

Prm5 'Channel 2 encoder type'

Parameter	Name	Code	Unit	Min	Max
Prm5	'Channel 2 encoder type'	Enc_Ch2	-	0	1

Description

The Prm5 parameter determines which encoder type shall be evaluated by the monitoring channel 2.

One sine encoder and / or one resolver can be connected to the KW-R07 controller card.

To the KW-R17 and KW-R27 controller cards, only one sine encoder can be connected.

Prm value	Meaning
Relevant for KW-R07:	
0	Resolver
Relevant for any type of drive controller:	
1	Sine encoder

Prm6 'Sine encoder period'

Parameter	Name	Code	Unit	Min	Max
Prm6	'Sine encoder period'	Enc_Per	-	16	65536

Description

This parameter specifies the number of sine and cosine periods of an encoder per rotation.

Prm6 corresponds with ID32776 'Sine encoder period'

⚠ WARNING

Excessive speed of the motor shaft!

The actual speed value of the motor shaft is wrong if not ID32776 'Sine encoder period' = Prm6 'Sine encoder period' is set.

Example:
ID32776 = 32
Prm6 = 64

For this parameter setting the real actual speed value would be double of the value that is calculated for the safe speed monitoring.

Steps to prevent:

- The value in ID32776 and Prm6 must be identical!

This parameter is not evaluated in case of the resolver encoder type.

The maximum possible speed is also defined by the frequency limit of the hardware. The sine signal has to drop below 200 000 Hz. Depending on the encoder type, different maximum speeds arise.

In case of low encoder period values, Prm2 'Switch-off threshold position' and Prm3 'Switch-off threshold velocity' must be adapted if necessary.

Prm7 'Commanding'

Parameter	Name	Code	Unit	Min	Max
Prm7	'Commanding'	Cmd_Src	-	0	1

Description

The safety and stop functions can either be controlled only via the safe communication (FSoE) or solely via the local safe inputs on the controller card. A mixed mode operation is not possible.

Prm value	Meaning
0	Commanding of the safety / stop functions via the safe communication (FSoE). The state of the safe outputs depends on Prm8.
1	Commanding the safety / stop functions via the SE1 - SE3 local safe inputs. The SA1 and SA2 safe outputs put out the internal system status (e.g. STO).

Prm8 'Output control'

Parameter	Name	Code	Unit	Min	Max
Prm8	'Output control'	Out_Src	-	0	1

Description

This parameter specifies whether the safe outputs are controlled via the FSoE protocol or by parameterised assignments in the controller card.

Prm value	Meaning
Prm7 = 0 and Prm8 = 0	Commanding through FSoE The state of the SA1 and SA2 safe outputs is the state from the Bit 30 and 31 FSoE control word.
Prm7 = 0 and Prm8 = 1	Commanding through FSoE The state of the SA1 and SA2 safe outputs is the internal system state (e.g. STO).
Prm7 = 1 and Prm8 = 0 / 1	Commanding the safety / stop functions via the SE1 - SE3 local safe inputs. The SA1 and SA2 safe outputs put out the internal system status (e.g. STO).

Prm9 'Transition time in case of standstill'

Parameter	Name	Code	Unit	Min	Max
Prm9	'Transition time in case of standstill'	T(warn)	min	1	60000

Description

Siehe 'Safe sine encoder monitoring (SEM)' auf Seite 27.

Prm10 'Reaction time in case of standstill'

Parameter	Name	Code	Unit	Min	Max
Prm10	'Reaction time in case of standstill'	T(err)	min	1	60000

Description

Siehe 'Safe sine encoder monitoring (SEM)' auf Seite 27.

Prm15 'SE1 safety function'

Parameter	Name	Code	Unit	Min	Max
Prm15	'SE1 safety function'	SF_SE1	-	0	16

Description

This parameter assigns a safety function to safe input 1. The safety function is activated when the level 0 is applied at safe input 1 and if the setting is made at the Prm7 parameter 'Commanding' that the safety functions are commanded by binary inputs (Prm7 = 1).

Prm value	Meaning
0	Reserved
1	Reserved
2	Reserved
3	SOS
4	SSR1
5	SDIp
6	SDIn
7	Reserved
8	Reserved
9	SSR2
10	SSR3
11	SSR4
12	SLS1
13	SLS 2
14	SLI
15	Reserved
16	No safety function selected

Each safety function may only be assigned once in the parameters Prm15, 16 and 17.

Prm16 'SE2 safety function'

Parameter	Name	Code	Unit	Min	Max
Prm16	'SE2 safety function'	SF_SE2	-	0	16

Description

This parameter assigns a safety function to safe input 2. The safety function is activated when level 0 is applied at safe input 2 and if the setting is made at the Prm7 parameter 'Commanding' that the safety functions are commanded by binary inputs (Prm7 = 1).

Prm value	Meaning
0	Reserved
1	Reserved
2	Reserved
3	SOS
4	SSR1
5	SDIp
6	SDIn
7	Reserved
8	Reserved
9	SSR2
10	SSR3
11	SSR4
12	SLS1
13	SLS 2
14	SLI
15	Reserved
16	No safety function selected

Each safety function may only be assigned once in the parameters Prm15, 16 and 17.

Prm17 'SE3 emergency stop function'

Parameter	Name	Code	Unit	Min	Max
Prm17	'SE3 emergency stop function'	StF_SE3	-	0	2

Description

This parameter assigns a safe stop function to safe input 3. The safe stop function is activated when the static level 0 is applied at safe input 3 and if the setting is made at the Prm7 parameter 'Commanding' that the safety functions are commanded by binary inputs (Prm7 = 1).

Prm value	Meaning
0	STO
1	SS1
2	SS2

Each safety function may only be assigned once in the parametersPrm15, 16 and 17.

Prm18 'SS1 transition period'

Parameter	Name	Code	Unit	Min	Max
Prm18	'SS1 transition period'	T(d,SS1)	ms	0	65535

Description

Siehe 'Safe stop 1 (SS1)' auf Seite 31.

Prm20 'SS1 brake ramp time'

Parameter	Name	Code	Unit	Min	Max
Prm20	'SS1 brake ramp time'	T(SS1)	ms	0	65535

Description

Siehe 'Safe stop 1 (SS1)' auf Seite 31.

Prm21 'SS1 safe speed standstill window'

Parameter	Name	Code	Unit	Min	Max
Prm21	'SS1 safe speed standstill window'	N(zero,SS1)	U/min	0	60000

Description

Siehe 'Safe stop 1 (SS1)' auf Seite 31.

Prm23 'SS2 transition period'

Parameter	Name	Code	Unit	Min	Max
Prm23	'SS2 transition period'	T(d,SS2)	ms	0	65535

Description

Siehe 'Safe stop 2 (SS2)' auf Seite 40.

Prm25 'SS2 brake ramp time'

Parameter	Name	Code	Unit	Min	Max
Prm25	'SS2 brake ramp time'	T(SS2)	ms	0	65535

Description

Siehe 'Safe stop 2 (SS2)' auf Seite 40.

Prm26 'SS2 safe speed standstill window'

Parameter	Name	Code	Unit	Min	Max
Prm26	'SS2 safe speed standstill window'	N(zero,SS2)	U/min	0	60000

Description

Siehe 'Safe stop 2 (SS2)' auf Seite 40.

Prm27 'SS2 safe position standstill window'

Parameter	Name	Code	Unit	Min	Max
Prm27	'SS2 safe position standstill window'	S(zero,SS2)	Incr.	-2147483647	2147483647

Description

The resolution of the position is standardised to 65536 increments/revolution.

Parameter value 0 is not allowed and generates an error message.

Siehe 'Safe stop 2 (SS2)' auf Seite 40.

Prm28 'SOS safe speed standstill window'

Parameter	Name	Code	Unit	Min	Max
Prm28	'SOS safe speed standstill window'	N(zero,SOS)	U/min	0	60000

Description

Siehe 'Safe operating stop (SOS)' auf Seite 35.

Prm29 'SOS safe position standstill window'

Parameter	Name	Code	Unit	Min	Max
Prm29	'SOS safe position standstill window'	S(zero,SOS)	Incr.	-2147483647	2147483647

Description

The resolution of the position is standardised to 65536 increments/revolution.

Parameter value 0 is not allowed and generates an error message.

Siehe 'Safe operating stop (SOS)' auf Seite 35.

Prm30 'SSR1 transition period'

Parameter	Name	Code	Unit	Min	Max
Prm30	'SSR1 transition period'	T(d,SSR1)	ms	0	65535

Description

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm32 'SSR1 brake ramp time'

Parameter	Name	Code	Unit	Min	Max
Prm32	'SSR1 brake ramp time'	T(SSR1)	ms	0	65535

Description

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm33 'SSR1 safe limit speed 1'

Parameter	Name	Code	Unit	Min	Max
Prm33	'SSR1 safe limit speed 1'	N(ul,SSR1)	rpm	-60000	60000

Description

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm34 'SSR1 safe limit speed 2'

Parameter	Name	Code	Unit	Min	Max
Prm34	'SSR1 safe limit speed 2'	N(ll,SSR1)	rpm	-60000	60000

Description

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm35 'SSR1 error reaction'

Parameter	Name	Code	Unit	Min	Max
Prm35	'SSR1 error reaction'	SSR1_ERR	-	0	2

Description

Prm value	Meaning
0	STO error reaction
1	SS1 error reaction
2	SS2 error reaction

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm36 'SSR2 transition period'

Parameter	Name	Code	Unit	Min	Max
Prm36	'SSR2 transition period'	T(d,SSR2)	ms	0	65535

Description

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm38 'SSR2 brake ramp time'

Parameter	Name	Code	Unit	Min	Max
Prm38	'SSR2 brake ramp time'	T(SSR2)	ms	0	65535

Description

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm39 'SSR2 safe limit speed 1'

Parameter	Name	Code	Unit	Min	Max
Prm39	'SSR2 safe limit speed 1'	N(ul,SSR2)	rpm	-60000	60000

Description

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm40 'SSR2 safe limit speed 2'

Parameter	Name	Code	Unit	Min	Max
Prm40	'SSR2 safe limit speed 2'	N(ll,SSR2)	rpm	-60000	60000

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm41 'SSR2 error reaction'

Parameter	Name	Code	Unit	Min	Max
Prm41	'SSR2 error reaction'	SSR2_ERR	-	0	2

Description

Prm value	Meaning
0	STO error reaction
1	SS1 error reaction
2	SS2 error reaction

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm42 'SSR3 transition period'

Parameter	Name	Code	Unit	Min	Max
Prm42	'SSR3 transition period'	T(d,SSR3)	ms	0	65535

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm44 'SSR3 brake ramp time'

Parameter	Name	Code	Unit	Min	Max
Prm44	'SSR3 brake ramp time'	T(SSR3)	ms	0	65535

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm45 'SSR3 safe limit speed 1'

Parameter	Name	Code	Unit	Min	Max
Prm45	'SSR3 safe limit speed 1'	N(ul,SSR3)	rpm	-60000	60000

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm46 'SSR3 safe limit speed 2'

Parameter	Name	Code	Unit	Min	Max
Prm46	'SSR3 safe limit speed 2'	N(ll,SSR3)	rpm	-60000	60000

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm47 'SSR3 error reaction'

Parameter	Name	Code	Unit	Min	Max
Prm47	'SSR3 error reaction'	SSR3_ERR	-	0	2

Description

Prm value	Meaning
0	STO error reaction
1	SS1 error reaction
2	SS2 error reaction

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm48 'SSR4 transition period'

Parameter	Name	Code	Unit	Min	Max
Prm48	'SSR4 transition period'	T(d,SSR4)	ms	0	65535

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm50 'SSR4 brake ramp time'

Parameter	Name	Code	Unit	Min	Max
Prm50	'SSR4 brake ramp time'	T(SSR4)	ms	0	65535

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm 51 'SSR4 safe limit speed 1'

Parameter	Name	Code	Unit	Min	Max
Prm51	'SSR4 safe limit speed 1'	N(ul,SSR4)	rpm	-60000	60000

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm52 'SSR4 safe limit speed 2'

Parameter	Name	Code	Unit	Min	Max
Prm52	'SSR4 safe limit speed 2'	N(ll,SSR4)	rpm	-60000	60000

Description
Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm53 'SSR4 error reaction'

Parameter	Name	Code	Unit	Min	Max
Prm53	'SSR4 error reaction'	SSR4_ERR	-	0	2

Description

Prm value	Meaning
0	STO error reaction
1	SS1 error reaction
2	SS2 error reaction

Siehe 'Safe speed range (SSR)' auf Seite 48.

Prm54 'SLS1 transition period'

Parameter	Name	Code	Unit	Min	Max
Prm54	'SLS1 transition period'	T(d,SLS1)	ms	0	65535

Description

Siehe 'Safely-limited speed (SLS)' auf Seite 55.

Prm56 'SLS1 brake ramp time'

Parameter	Name	Code	Unit	Min	Max
Pmr56	'SLS1 brake ramp time'	T(SLS1)	ms	0	65535

Description

Siehe 'Safely-limited speed (SLS)' auf Seite 55.

Prm57 'SLS1 safe limit speed'

Parameter	Name	Code	Unit	Min	Max
Prm57	'SLS1 safe limit speed'	N(limit,SLS1)	rpm	-60000	60000

Description

Parameter value 0 is not allowed and generates an error message.

Siehe 'Safely-limited speed (SLS)' auf Seite 55.

Prm58 'SLS1 error reaction'

Parameter	Name	Code	Unit	Min	Max
Prm58	'SLS1 error reaction'	SLS1_ERR	-	0	2

Description

Prm value	Meaning
0	STO error reaction
1	SS1 error reaction
2	SS2 error reaction

Siehe 'Safely-limited speed (SLS)' auf Seite 55.

Prm59 'SLS2 transition period'

Parameter	Name	Code	Unit	Min	Max
Prm59	'SLS2 transition period'	T(d,SLS2)	ms	0	65535

Description

Siehe 'Safely-limited speed (SLS)' auf Seite 55.

Prm61 'SLS2 brake ramp time'

Parameter	Name	Code	Unit	Min	Max
Prm61	'SLS2 brake ramp time'	T(SLS2)	ms	0	65535

Description

Siehe 'Safely-limited speed (SLS)' auf Seite 55.

Prm62 'SLS2 safe limit speed'

Parameter	Name	Code	Unit	Min	Max
Prm62	'SLS2 safe limit speed'	N(limit,SLS2)	rpm	-60000	60000

Description

Parameter value 0 is not allowed and generates an error message.

Siehe 'Safely-limited speed (SLS)' auf Seite 55.

Prm63 'SLS2 error reaction'

Parameter	Name	Code	Unit	Min	Max
Prm63	'SLS2 error reaction'	SLS2_ERR	-	0	2

Description

Prm value	Meaning
0	STO error reaction
1	SS1 error reaction
2	SS2 error reaction

Siehe 'Safely-limited speed (SLS)' auf Seite 55.

Prm64 'SDI safe speed standstill window'

Parameter	Name	Code	Unit	Min	Max
Prm64	'SDI safe speed standstill window'	N(zero,SDI)	rpm	0	60000

Description

Siehe 'Safe direction positive (SDIp)' auf Seite 60.
Siehe 'Safe direction negative (SDIn)' auf Seite 62.

Prm65 'SLI Safely limited position change 1'

Parameter	Name	Code	Unit	Min	Max
Prm65	'SLI Safely limited position change 1'	S(ul,SLI)	Incr.	-2147483647	2147483647

Description

The resolution of the position is standardised to 65536 increments/revolution.

The values of the position limits Prm65 / Prm66 must be entered appropriately signed.
Example:
Prm65 = 1000, Prm66 = -100, actual position value (t_0) = 10000 increments
=> monitored range 9900 ... 11000 increments

Siehe 'Safely-limited increment (SLI)' auf Seite 65.

Prm66 'SLI Safely limited position change 2'

Parameter	Name	Code	Unit	Min	Max
Prm66	'SLI Safely limited position change 2'	S(ll,SLI)	Incr.	-2147483647	2147483647

Description

The resolution of the position is standardised to 65536 increments/revolution.

The values of the position limits Prm65 / Prm66 must be entered appropriately signed.
Example:
Prm65 = 1000, Prm66 = -100, actual position value (t_0) = 10000 increments
=> monitored range 9900 ... 11000 increments

Siehe 'Safely-limited increment (SLI)' auf Seite 65.

Prm67 'SMS safe maximum speed'

Parameter	Name	Code	Unit	Min	Max
Prm67	'SMS safe maximum speed'	N(max,SMS)	rpm	0	60000

Description

Siehe 'Safe maximum speed (SMS)' auf Seite 45.

The monitoring of the safe maximum speed can be "switched off" in principle by setting the Prm67 'SMS safe maximum speed', N(max,SMS), to its maximum value.
In this case, you must consider that the safe maximum speed directly governs the steepness of the braking ramps of the stop fuctions SS1 and SS2 as well as the safe operation modes SSR and SLS.

The maximum possible speed is also defined by the frequency limit of the hardware. The sine signal has to drop below 200 000 Hz. Depending on the encoder type, different maximum speeds arise.

Prm68 'SMS error reaction'

Parameter	Name	Code	Unit	Min	Max
Prm68	'SMS error reaction'	SMS_ERR	-	0	2

Description

Prm value	Meaning
0	STO error reaction
1	SS1 error reaction
2	SS2 error reaction

Siehe 'Safe maximum speed (SMS)' auf Seite 45.

Prm69 'SE1 dynamic sampling'

Parameter	Name	Code	Unit	Min	Max
Prm69	'SE1 dynamic sampling'	SE1_DYN	-	0	1

Description

Prm value	Meaning
0	Input 1 dynamic sampling disabled
1	Input 1 dynamic sampling activated

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm70 'SE1 input level'

Parameter	Name	Code	Unit	Min	Max
Prm70	'SE1 input level'	SE1_INV	-	0	1

Description

Prm value	Description
0	Identical (not inverted) SE1.1 and SE 1.2 input levels
1	Inverted SE1.1 and SE1.2 input levels

Prm71 'SE1.1 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm71	'SE1.1 dynamic sampling impulse duration'	SE1.1_Puls	µs	250	65500

Description

The input value must be a multiple of 62.5 µs, rounded up to whole-number.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Information on propagation delay times:

Siehe 'Propagation delay of safe inputs' auf Seite 113.
Siehe 'Filtering of the safe inputs, contact bounce' auf Seite 113.

Prm72 'SE1.1 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm72	'SE1.1 dynamic sampling period'	SE1.1_Time	ms	50	64000

Description

The input has to be entered in steps of 1 ms.

The safe input monitors whether a dynamic sampling signal is applied per dynamic sampling period.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm73 'SE1.2 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm73	'SE1.2 dynamic sampling impulse duration'	SE1.2_Puls	µs	250	65500

Description

The input value must be a multiple of 62.5 µs, rounded up to whole-number.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Information on propagation delay times:

Siehe 'Propagation delay of safe inputs' auf Seite 113.

Siehe 'Filtering of the safe inputs, contact bounce' auf Seite 113.

Prm74 'SE1.2 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm74	'SE1.2 dynamic sampling period'	SE1.2_Time	ms	50	64000

Description

The input has to be entered in steps of 1 ms.

The safe input monitors whether a dynamic sampling signal is applied per dynamic sampling period.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm75 'SE2 dynamic sampling'

Parameter	Name	Code	Unit	Min	Max
Prm75	'SE2 dynamic sampling'	SE2_DYN	-	0	1

Description

Prm value	Meaning
0	Input 1 dynamic sampling disabled
1	Input 1 dynamic sampling activated

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm76 'SE2 input level'

Parameter	Name	Code	Unit	Min	Max
Prm76	'SE2 input level'	SE2_INV	-	0	1

Description

Prm value	Meaning
0	Identical (not inverted) SE2.1 and SE 2.2 input levels
1	Inverted SE2.1 and SE2.2 input levels

Prm77 'SE2.1 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm77	'SE2.1 dynamic sampling impulse duration'	SE2.1_Puls	µs	250	65500

Description

The input value must be a multiple of 62.5 µs, rounded up to whole-number.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Information on propagation delay times:

Siehe 'Propagation delay of safe inputs' auf Seite 113.
Siehe 'Filtering of the safe inputs, contact bounce' auf Seite 113.

Prm78 'SE2.1 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm78	'SE2.1 dynamic sampling period'	SE2.1_Time	ms	50	64000

Description

The input has to be entered in steps of 1 ms.

The safe input monitors whether a dynamic sampling signal is applied per dynamic sampling period.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm79 'SE2.2 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm79	'SE2.2 dynamic sampling impulse duration'	SE2.2_Puls	µs	250	65500

Description

The input value must be a multiple of 62.5 µs, rounded up to whole-number.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Information on propagation delay times:

Siehe 'Propagation delay of safe inputs' auf Seite 113.
Siehe 'Filtering of the safe inputs, contact bounce' auf Seite 113.

Prm80 'SE2.2 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm80	'SE2.2 dynamic sampling period'	SE2.2_Time	ms	50	64000

Description

The input has to be entered in steps of 1 ms.

The safe input monitors whether a dynamic sampling signal is applied per dynamic sampling period.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm81 'SE3 dynamic sampling'

Parameter	Name	Code	Unit	Min	Max
Prm81	'SE3 dynamic sampling'	SE3_DYN	-	0	1

Description

Prm value	Meaning
0	Input 1 dynamic sampling disabled
1	Input 1 dynamic sampling activated

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm82 'SE3 input level'

Parameter	Name	Code	Unit	Min	Max
Prm82	'SE3 input level'	SE3_INV	-	0	1

Description

Prm value	Meaning
0	Identical (not inverted) SE3.1 and SE 3.2 input levels
1	Inverted SE3.1 and SE3.2 input levels

Prm83 'SE3.1 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm83	'SE3.1 dynamic sampling impulse duration'	SE3.1_Puls	µs	250	65500

Description

The input value must be a multiple of 62.5 µs, rounded up to whole-number.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Information on propagation delay times:

Siehe 'Propagation delay of safe inputs' auf Seite 113.

Siehe 'Filtering of the safe inputs, contact bounce' auf Seite 113.

Prm84 'SE3.1 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm84	'SE3.1 dynamic sampling period'	SE3.1_Time	ms	50	64000

Description

The input has to be entered in steps of 1 ms.

The safe input monitors whether a dynamic sampling signal is applied per dynamic sampling period.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm85 'SE3.2 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm85	'SE3.2 dynamic sampling impulse duration'	SE3.2_Puls	µs	250	65500

Description

The input value must be a multiple of 62.5 µs, rounded up to whole-number.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Information on propagation delay times:

Siehe 'Propagation delay of safe inputs' auf Seite 113.

Siehe 'Filtering of the safe inputs, contact bounce' auf Seite 113.

Prm86 'SE3.2 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm86	'SE3.2 dynamic sampling period'	SE3.2_Time	ms	50	64000

Description

The input has to be entered in steps of 1 ms.

The safe input monitors whether a dynamic sampling signal is applied per dynamic sampling period.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm87 'SA1 dynamic sampling'

Parameter	Name	Code	Unit	Min	Max
Prm87	'SA1 dynamic sampling'	SA1_DYN	-	0	1

Description

Prm value	Meaning
0	Dynamic sampling output inactive
1	Dynamic sampling output active

Prm88 'SA1.1 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm88	'SA1.1 dynamic sampling impulse duration'	SA1.1_Puls	µs	500	65500

Description

The input value must be a multiple of 125 µs.

The dynamic sampling pulse duration has to be ≤ dynamic sampling period duration/10.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm89 'SA1.1 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm89	'SA1.1 dynamic sampling period'	SA1.1_Time	ms	50	65500

Description

The input has to be entered in steps of 1 ms.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm90 'SA1.2 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm90	'SA1.2 dynamic sampling impulse duration'	SA1.2_Puls	µs	500	65500

Description

The input value must be a multiple of 125 µs.

The dynamic sampling pulse duration has to be ≤ dynamic sampling period duration/10.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm91 'SA1.2 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm91	'SA1.2 dynamic sampling period'	SA1.2_Time	ms	50	65500

Description

The input has to be entered in steps of 1 ms.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm92 'SA1 output level'

Parameter	Name	Code	Unit	Min	Max
Prm92	'SA1 output level'	SA1.2_INV	-	0	1

Description

This parameter specifies if both connections of a safe output should output levels that are identical or inverted to each other.

Prm value	Meaning
0:	Identical (not inverted) output level
1:	Inverted output level

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm93 'SA2 dynamic sampling'

Parameter	Name	Code	Unit	Min	Max
Prm93	'SA2 dynamic sampling'	SA2_DYN	-	0	1

Description

Prm value	Meaning
0	Dynamic sampling output inactive
1	Dynamic sampling output active

Prm94 'SA2.1 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm94	'SA2.1 dynamic sampling impulse duration'	SA2.1_Puls	µs	500	65500

Description

The input value must be a multiple of 125 µs.

The dynamic sampling pulse duration has to be ≤ dynamic sampling period duration/10.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm95 'SA2.1 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm95	'SA2.1 dynamic sampling period'	SA2.1_Time	ms	50	65500

Description

The input has to be entered in steps of 1 ms.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm96 'SA2.2 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm96	'SA2.2 dynamic sampling impulse duration'	SA2.2_Puls	µs	500	65500

Description

The input value must be a multiple of 125 µs.

The dynamic sampling pulse duration has to be ≤ dynamic sampling period duration/10.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm97 'SA2.2 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm97	'SA2.2 dynamic sampling period'	SA2.2_Time	ms	50	65500

Description

The input has to be entered in steps of 1 ms.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm98 'SA2 output level'

Parameter	Name	Code	Unit	Min	Max
Prm98	'SA2 output level'	SA2.2_INV	-	0	1

Description

This parameter specifies if both connections of a safe output put out levels that are identical or inverted to each other.

Prm value	Meaning
0:	Identical (not inverted) output level
1:	Inverted output level

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm99 'SDYN1 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm99	'SDYN1 dynamic sampling impulse duration'	SDYN1_Puls	µs	500	65500

Description

The input value must be a multiple of 125 µs.

The dynamic sampling pulse duration has to be ≤ dynamic sampling period duration/10.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm100 'SDYN1 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm100	'SDYN1 dynamic sampling period'	SDYN1_Time	ms	50	65500

Description

The input has to be entered in steps of 1 ms.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm101 'SDYN2 dynamic sampling impulse duration'

Parameter	Name	Code	Unit	Min	Max
Prm101	'SDYN2 dynamic sampling impulse duration'	SDYN2_Puls	µs	500	65500

Description

The input value must be a multiple of 125 µs.

The dynamic sampling pulse duration has to be ≤ dynamic sampling period duration/10.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm102 'SDYN2 dynamic sampling period'

Parameter	Name	Code	Unit	Min	Max
Prm102	'SDYN2 dynamic sampling period'	SDYN2_Time	ms	50	65500

Description

The input has to be entered in steps of 1 ms.

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.

Prm103 'SLI error reaction'

Parameter	Name	Code	Unit	Min	Max
Prm103	'SLI error reaction'	SLI_ERR	-	0	2

Description

Prm value	Meaning
0	STO error reaction
1	SS1 error reaction
2	SS2 error reaction

Siehe 'Safely-limited increment (SLI)' auf Seite 65.

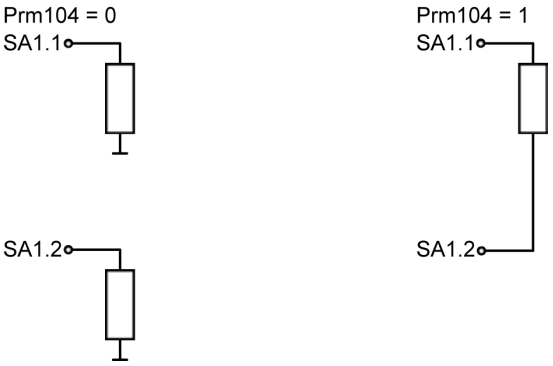
Prm104 'SA1.2 output type'

Parameter	Name	Code	Unit	Min	Max
Prm104	'SA1.2 output type'	SA1.2_ Outputtype	-	0	1

Description

Prm value	Description
0	Load to GND
1	Load to SA1.1 (min. 20 mA)

Siehe 'Safety functions via local safe inputs and outputs' auf Seite 69.



Prm105 'cc-factor'

Parameter	Name	Code	Unit	Min	Max
Prm105	'cc-factor'	cc-factor	-	7	199

Description

The fault tolerance time in the cross communication defines the time in which an unequal status between the monitoring units will be tolerated. The minimum fault tolerance time is 120 ms and is recommended as a default value for the FSoE commanding.

For the commanding of safety functions via local IO has been found that 2-channel enabling switch and mode selector need greater fault tolerance times.

The response time of a safety function is independent of the fault tolerance time. If a safety function is requested via a safe input, the monitoring of variables acts immediately after the transition periods have expired, which have been configured in the secure parameter set.

Calculation of the fault tolerance time of the cross communication:

t_{cc} = [Value(Prm105) + 1] *15 ms

Example: minimum fault tolerance time (recommended standard value)

t_{cc} = [7+1] *15 ms = 120 ms

Prm106 'Customer info 1'

Parameter	Name	Code	Unit	Min	Max
Prm106	'Customer info 1'	Customer info 1	-	0	2147483647

Description

In this parameter can be stored application specific information , e.g the number of a machine. Special characters and letters are not possible to use.

Prm107 'Customer info 2'

Parameter	Name	Code	Unit	Min	Max
Prm107	'Customer info 2'	Customer info 2	-	0	2147483647

Description

In this parameter can be stored application specific information , e.g the number of a machine. Special characters and letters are not possible to use.

Prm108 'Customer info 3'

Parameter	Name	Code	Unit	Min	Max
Prm108	'Customer info 3'	Customer info 3	-	0	2147483647

Description

In this parameter can be stored application specific information , e.g the number of a machine. Special characters and letters are not possible to use.

12 Unsafe parameters

ID113 'Maximum speed'

Sphere of action:	DRIVE	**Default value:**	60000000
Access:	READING / WRITING	**Scale:**	0.0001
Temporarily changeable:	NO	**Unit:**	1/min
Data length:	4 byte	**Min. value:**	1 1/min
Signed:	NO	**Max. value:**	100000 1/min
Format:	DEC		
List:	NO		

NOTICE	
Material Damage!	**Material damage from high speeds!** ID113 must be set so that the input speed value plus 25% does not cause any damage in the process.

If the actual speed value increases to the value in ID113 x 1.25, the output stage is automatically internally blocked and the motor runs down. The user must set the value for ID113 depending on the process without exceeding the motor's maximum speed in the process. For sine encoders, the limit frequency at the sine encoder input may not be exceeded. The limit frequency for the sine encoder input can be found in the respective device description.

Formula: Determination of n_{max} for sine encoder input

Example:

Encoder division ID32776 = 1024 (I-encoder) limit frequency at the sine encoder input = 200 kHz

Observe the manufacturer's specified maximum encoder speed!

ID32776 'Sine encoder period'

Sphere of action:	DRIVE	**Default value:**	1024
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	8
Signed:	NO	**Max. value:**	64000
Format:	DEC		
List:	NO		

The 'Sine encoder period' is to be taken from the type plate and data sheet of the motor or the encoder and gives the number of sine periods per rotation of the encoder, which is connected to the sine encoder input connection X131.

For linear motors, the number of sine periods per pole period must be entered in ID32776.

If the sine encoder division is entered incorrectly, the motor is not controllable and can carry out uncontrolled movements as soon as the controller enable is set!

EnDat encoder:

1st Linear measuring stick type: LC481, LC483

For EnDat linear measuring sticks, ID32776 must be calculated from the encoder's signal periods and ID123 according to the following relationship:

Example:

ID123 = 24 mm (linear motor pole period from the linear motor data sheet)
Signal period (encoder) = 16 µm (encoder data sheet)
PV (position refinement factor = 100 (see ID116)

ID32776 = 1500 signal periods / pole period
ID116 = 600000 increments / pole period

Special cases:

1. ID32776 is smaller than the minimum value:
   e. g.: ID123 = 5 mm, signal period = 1 mm --> ID32776 = 5
2. The distance between the two pole pairs is not to be divided by the length of the signal period without a remainder.
   e. g. ID123 = 24 mm, signal period = 5 mm --> ID32776 = 4.8

Solution:

ID123 refers to ID32775 'Pole number motor'. This is assuming that the 'Pole number motor' in the aforementioned special case was 2. For the solution approach, ID123 should not be based on ID32775 = 2, but rather on, e.g., ID32775 =20. The pole period in ID123 must also be multiplied by a factor of 10 because of the motor with the assumed number of poles by a factor of 10.

1. ID123 = 5 * 10 = 50 mm (instead of 5 mm), signal period = 1 mm --> ID32776 = 50
2. ID123 = 24 * 10 =240 mm (instead of 24 mm), signal period = 5 mm --> ID32776 = 48

ID32780 'Acceleration ramp'

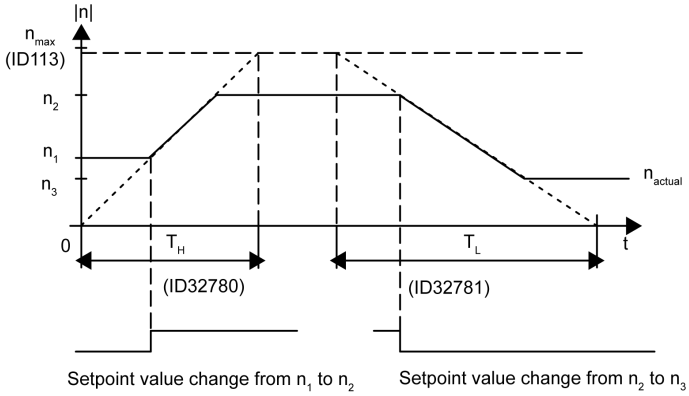
Sphere of action:	DRIVE	**Default value:**	1000
Access:	READING / WRITING	**Scale:**	0.1
Temporarily changeable:	YES	**Unit:**	ms
Data length:	4 byte	**Min. value:**	1 ms
Signed:	YES	**Max. value:**	1200000 ms
Format:	DEC		
List:	NO		

By setting bit 6 = 1 in the operating mode parameter (ID32800ff), a ramp generator (acceleration / deceleration) acts on the speed controller input. The entered times apply for acceleration and deceleration between the speed 0 U/min and ±ID113 'Maximum speed'.

The following figure shows the effect of the acceleration and deceleration time parameters. The following applies to the speed setpoint specification:

$|n_2| > |n_1|$ →acceleration ramp
$|n_3| < |n_2|$ →deceleration ramp

Acceleration and deceleration times refer to the maximum speed



ID32781 'Deceleration ramp'

Sphere of action:	DRIVE	**Default value:**	1000
Access:	READING / WRITING	**Scale:**	0.1
Temporarily changeable:	YES	**Unit:**	ms
Data length:	4 byte	**Min. value:**	1 ms
Signed:	NO	**Max. value:**	1200000 ms
Format:	DEC		
List:	NO		

By setting bit 6 = 1 in the operating mode parameter (ID32800ff), a ramp generator (acceleration / deceleration) acts on the speed controller input. The entered times apply for acceleration and deceleration between the speed 0 U/min and ±ID113 'Maximum speed'.

The figure in ID32780 shows the effect of the acceleration and deceleration time parameters.

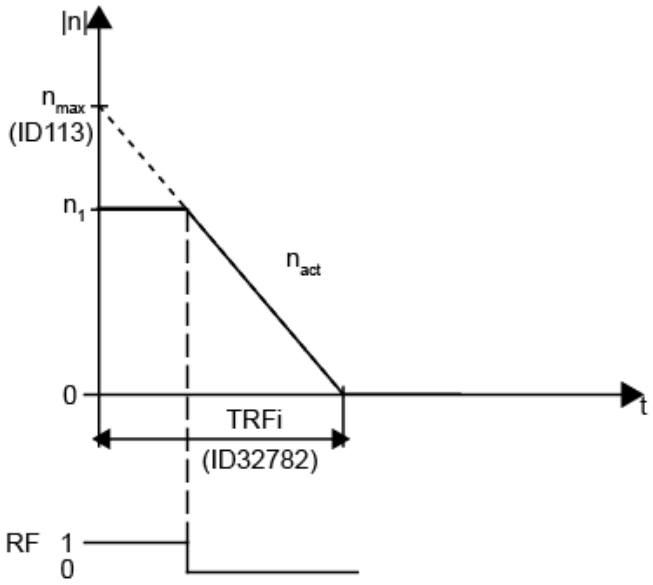
Siehe ID32780 'Acceleration ramp' auf Seite 143.

ID32782 'Deceleration ramp RF inactive'

Sphere of action:	DRIVE	**Default value:**	1000
Access:	READING / WRITING	**Scale:**	0.1
Temporarily changeable:	YES / NO	**Unit:**	ms
Data length:	4 byte	**Min. value:**	1 ms
Signed:	NO	**Max. value:**	1200000 ms
Format:	DEC		
List:	NO		

When removing the controller enable, the motor is braked to a standstill according to the ramp ID32782 'Deceleration ramp RF inactive' and then is torque-free. The time entered is valid for deceleration from maximum speed (ID113) to speed 0.

Deceleration time for RF inactive



TRFi: Deceleration time RF inactive (ID32782)

ID33200 'Info safety parameterisation'

Reserved for AMK internal use!

ID33201 'Safety address'

Sphere of action:	GLOBAL	**Default value:**	0
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	4 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

If the address switch S1 is set to 0, the ID 33201 'Safety address' is the FSoE address.
If the address switch is different from 0, the content of ID33201 is overwritten and the value set on the address switch is the FSoE participant address.

Siehe 'FSoE addressing' auf Seite 80.

ID33202 Safety parameters'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	4 byte / element	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	HEX	**Current list length:***	0
List:	YES	**Max. list length:***	127

* The list length is the number of usage data elements without 4 byte head elements.

Configuration ID33202 Safety parameters'

List element	Content	Meaning
0	x	List head: Current list length without list head [byte] (x = n elements x 4 byte / element)
1	508	List head: Maximum list length without list head [byte]
2		CRC of the device (inclusive the serial number)
3		CRC via the contents of the safety parameters (Prm)
4		CRC of the parameter description file
5		Values of the secure parameter Prm
...		...

ID33203 'Safety bits'

Sphere of action:	GLOBAL	**Default value:**	0000 0000 0000 0001
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	BIN		
List:	NO		

Configuration ID33203 'Safety bits'

Bit no.	Condition	Meaning
0	0	The safety function SS1 does not initiate the braking process. The drive must be braked by the controller and the controller enable be withdrawn.
	1	The safety function SS1 withdraws controller enable (RF) from the drive internally and the drive brakes according to ID32782 'Deceleration ramp RF inactive' and becomes torque-free (STO status).
1-15	0	Reserved
	1	Reserved

ID33204 'Safety password'

Sphere of action:	GLOBAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte / element	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	HEX	**Current list length:***	12
List:	YES	**Max. list length:***	12

* The list length is the number of usage data elements without 4 byte head elements.

The safety parameters can only be transferred to the drive if the password was entered in the safety parameter editor. The function 'initial program loading' does not delete the defined password.

Siehe 'Step 5: Transfer parameters to the drive' auf Seite 103.

ID33210 'FSoE master command'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33211 'Safety data master 0'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

ID33211 'Safety data master 0' mirrors bit 0..15 of the FSoE control data.

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

Siehe 'Control data' auf Seite 76.

ID33212 'FSoE master CRC 0'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33213 'Safety data master 1'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

ID33213 'Safety data master 1' mirrors bit 16..31 of the FSoE control data.

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

Siehe 'Control data' auf Seite 76.

ID33214 'FSoE master CRC 1'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33229 'FSoE master ConnID'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING / WRITING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33230 'FSoE slave command'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33231 'Safety data slave 0'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

ID33231 'Safety data slave 0' mirrors bit 0..15 of the FSoE status data.

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

Siehe 'Status data' auf Seite 78.

ID33232 'FSoE Slave CRC 0'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33233 'Safety data slave 1'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

ID33233 'Safety data slave 1' mirrors bit 16..31 of the FSoE status data.

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

Siehe 'Status data' auf Seite 78.

ID33234 'FSoE slave CRC 1'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33235 'Safety data slave 2'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

ID33235 mirrors byte 0 and 1 of the safely detected actual position value.

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

Siehe 'Status data' auf Seite 78.

ID33236 'FSoE slave CRC 2'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33237 'Safety data slave 3'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

ID33237 mirrors byte 2 and 3 of the safely detected actual position value.

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

Siehe 'Status data' auf Seite 78.

ID33238 'FSoE slave CRC 3'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33239 'Safety data slave 4'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

ID33239 mirrors byte 0 and 1 of the safely detected velocity.

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

Siehe 'Status data' auf Seite 78.

ID33240 'FSoE slave CRC 4'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33241 'Safety data slave 5'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

ID33241 mirrors byte 2 and 3 of the safely detected velocity.

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

Siehe 'Status data' auf Seite 78.

ID33242 'FSoE slave CRC 5'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

ID33249 'FSoE slave ConnID'

Sphere of action:	GLOBAL / FORMAL	**Default value:**	0
Access:	READING	**Scale:**	1
Temporarily changeable:	NO	**Unit:**	-
Data length:	2 byte	**Min. value:**	-
Signed:	NO	**Max. value:**	-
Format:	DEC		
List:	NO		

The parameter content is a component of the FSoE protocol data according to the standard IEC 61784-3 Ed. 2.0 (profiles for functional safe communications in industrial networks)

Reserved for AMK internal use!

13 Diagnosis

3605 'Safety - Invalid parameterisation'

• Invalid parameterisation	
Device	Functional safety Controller cards KW-R07 / -R17 / -R27
Description	An invalid parameterisation was detected during the evaluation of the safety parameters, e.g. invalid values
Class	Error
Drive behaviour	The drive remains torque-free (STO)
Device behaviour	The safety monitoring does not switch to the operational state, i.e. the safety functions cannot be put into operation

3605	Info1	7	Encoder error, sine encoder evaluation, monitoring channel 1
			Info2 = 1: Prm6 'Sine encoder period' Specification for the sine encoder period too small (Prm6 < 16)
			Info2 = 2: Prm6 'Sine encoder period' Specification for the sine encoder period too large (Prm6 > 65536)
Error rectification	• Parameter to be checked: • Prm6: 'Sine encoder period' • Generate a correct parameter set and load on the target device		

3605	Info1	13	Error message during cross-communication monitoring
			Info2 = 9: Error during plausibility check: Fault tolerance in the cross-communication is out of range.
Error rectification	• Parameter to be checked: • Info2 = 9: Prm 9 'cc-factor'		

3605	Info1	16	Error message for the safe inputs, monitoring channel 1
			Info2 = 1: Dynamic sampling impulse duration is too small
			Info2 = 3: Dynamic sampling impulse duration is too large
			Info3 = 1: Input 1
			Info3 = 2: Input 2
			Info3 = 3: Input 3

Error rectification	• Parameter to be checked:
	  • Prm71: 'SE1.1 dynamic sampling impulse duration'
	  • Prm73: 'SE1.2 dynamic sampling impulse duration'
	  • Prm77: 'SE2.1 dynamic sampling impulse duration'
	  • Prm79: 'SE2.2 dynamic sampling impulse duration'
	  • Prm83: 'SE3.1 dynamic sampling impulse duration'
	  • Prm85: 'SE3.2 dynamic sampling impulse duration'
	• Generate a correct parameter set and load on the target device		

<table>
<tr><td>3605</td><td>Info1</td><td>17</td><td>Error message for the safe inputs,
monitoring channel 2
<table><tr><td>Info2</td><td>1</td><td>Dynamic sampling impulse duration is too small</td></tr><tr><td></td><td>3</td><td>Dynamic sampling impulse duration is too large</td></tr></table><table><tr><td>Info3</td><td>1</td><td>Input 1</td></tr><tr><td></td><td>2</td><td>Input 2</td></tr><tr><td></td><td>3</td><td>Input 3</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
• Prm71: 'SE1.1 dynamic sampling impulse duration'
• Prm73: 'SE1.2 dynamic sampling impulse duration'
• Prm77: 'SE2.1 dynamic sampling impulse duration'
• Prm79: 'SE2.2 dynamic sampling impulse duration'
• Prm83: 'SE3.1 dynamic sampling impulse duration'
• Prm85: 'SE3.2 dynamic sampling impulse duration'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>18</td><td>Error message for the safe inputs,
monitoring channel 1
<table><tr><td>Info2</td><td>2</td><td>Dynamic sampling period is too large</td></tr><tr><td></td><td>3</td><td>Dynamic sampling period is too small</td></tr><tr><td></td><td>5</td><td>Ratio between dynamic sampling period and impulse duration is too small</td></tr></table><table><tr><td>Info3</td><td>1</td><td>Input 1</td></tr><tr><td></td><td>2</td><td>Input 2</td></tr><tr><td></td><td>3</td><td>Input 3</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
• Prm71: 'SE1.1 dynamic sampling impulse duration'
• Prm72: 'SE1.1 dynamic sampling period'
• Prm73: 'SE1.2 dynamic sampling impulse duration'
• Prm74: 'SE1.2 dynamic sampling period'
• Prm77: 'SE2.1 dynamic sampling impulse duration'
• Prm78: 'SE2.1 dynamic sampling period'
• Prm79: 'SE2.2 dynamic sampling impulse duration'
• Prm80: 'SE2.2 dynamic sampling period'
• Prm83: 'SE3.1 dynamic sampling impulse duration'
• Prm84: 'SE3.1 dynamic sampling period'
• Prm85: 'SE3.2 dynamic sampling impulse duration'
• Prm86: 'SE3.2 dynamic sampling period'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>19</td><td>Error message for the safe inputs,
monitoring channel 2
<table><tr><td>Info2</td><td>2</td><td>Dynamic sampling period is too large</td></tr><tr><td></td><td>3</td><td>Dynamic sampling period is too small</td></tr><tr><td></td><td>5</td><td>Ratio between dynamic sampling period and impulse duration is too small</td></tr><tr><td></td><td>6</td><td>Invalid value of input level</td></tr></table><table><tr><td>Info3</td><td>1</td><td>Input 1</td></tr><tr><td></td><td>2</td><td>Input 2</td></tr><tr><td></td><td>3</td><td>Input 3</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">Parameter to be checked:
Prm70: 'SE1 input level'
Prm71: 'SE1.1 dynamic sampling impulse duration'
Prm72: 'SE1.1 dynamic sampling period'
Prm73: 'SE1.2 dynamic sampling impulse duration'
Prm74: 'SE1.2 dynamic sampling period'
Prm76: 'SE2 input level'
Prm77: 'SE2.1 dynamic sampling impulse duration'
Prm78: 'SE2.1 dynamic sampling period'
Prm79: 'SE2.2 dynamic sampling impulse duration'
Prm80: 'SE2.2 dynamic sampling period'
Prm82: 'SE3 input level'
Prm83: 'SE3.1 dynamic sampling impulse duration'
Prm84: 'SE3.1 dynamic sampling period'
Prm85: 'SE3.2 dynamic sampling impulse duration'
Prm86: 'SE3.2 dynamic sampling period'
Generate a correct parameter set and load on the target device</td></tr>
<tr><td>3605</td><td>Info1</td><td>20</td><td>Error message for safe input selection,
monitoring channel 1
<table><tr><td>Info2</td><td>1</td><td>Prm17 'SE3 emergency stop function':
invalid value</td></tr><tr><td></td><td>2</td><td>Prm15 'SE1 safety function':
invalid value</td></tr><tr><td></td><td>3</td><td>Prm16 'SE2 safety function':
invalid value</td></tr><tr><td></td><td>4</td><td>Prm15 'SE1 safety function' and Prm17 'SE3 emergency stop function' same value</td></tr><tr><td></td><td>5</td><td>Prm16 'SE2 safety function' and Prm17 'SE3 emergency stop function' same value</td></tr><tr><td></td><td>6</td><td>Prm15 'SE1 safety function' and Prm16 'SE2 safety function' same value</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">Parameter to be checked:
Prm15: 'SE1 safety function'
Prm16: 'SE2 safety function'
Prm17: 'SE3 emergency stop function'</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>22</td><td>Error message for safe input selection,
monitoring channel 2
<table><tr><td>Info2</td><td>1</td><td>Prm17 'SE3 emergency stop function':
invalid value</td></tr><tr><td></td><td>2</td><td>Prm15 'SE1 safety function':
invalid value</td></tr><tr><td></td><td>3</td><td>Prm16 'SE2 safety function':
invalid value</td></tr><tr><td></td><td>4</td><td>Prm15 'SE1 safety function' and Prm17 'SE3 emergency stop function' same value</td></tr><tr><td></td><td>5</td><td>Prm16 'SE2 safety function' and Prm17 'SE3 emergency stop function' same value</td></tr><tr><td></td><td>6</td><td>Prm15 'SE1 safety function' and Prm16 'SE2 safety function' same value</td></tr><tr><td></td><td>16</td><td>Prm70 'SE1 input level':
invalid value</td></tr><tr><td></td><td>17</td><td>Prm76 'SE2 input level':
invalid value</td></tr><tr><td></td><td>18</td><td>Prm82 'SE3 input level':
invalid value</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
• Prm15: 'SE1 safety function'
• Prm16: 'SE2 safety function'
• Prm17: 'SE3 emergency stop function'
• Prm70 'SE1 input level'
• Prm76 'SE2 input level'
• Prm82 'SE3 input level'</td></tr>
<tr><td>3605</td><td>Info1</td><td>23</td><td>Error message for safe output selection,
monitoring channel 1
<table><tr><td>Info2</td><td>2</td><td>Prm7 'Commanding' and Prm8 'Output control':
Invalid parameters Prm7 and Prm8</td></tr><tr><td></td><td>3</td><td>Prm7 'Commanding':
Invalid parameter Prm7</td></tr><tr><td></td><td>4</td><td>Prm8 'Output control':
Invalid parameter Prm8</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
• Prm7: 'Commanding'
• Prm8: 'Output control'</td></tr>
<tr><td>3605</td><td>Info1</td><td>24</td><td>Error message for safe output selection,
monitoring channel 2
<table><tr><td>Info2</td><td>2</td><td>Prm7 'Commanding' and Prm8 'Output control':
Invalid parameters Prm7 and Prm8</td></tr><tr><td></td><td>3</td><td>Prm7 'Commanding':
Invalid parameter Prm7</td></tr><tr><td></td><td>4</td><td>Prm8 'Output control':
Invalid parameter Prm8</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
• Prm7: 'Commanding'
• Prm8: 'Output control'</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>25</td><td>Error messages of the dynamic sampling of the safe outputs, monitoring channel 1
<table>
<tr><td>Info2</td><td>1</td><td>Dynamic sampling period A1 exceeds maximum</td></tr>
<tr><td></td><td>2</td><td>Dynamic sampling period A1 drops below minimum</td></tr>
<tr><td></td><td>3</td><td>Dynamic sampling impulse duration A1 exceeds maximum</td></tr>
<tr><td></td><td>4</td><td>Dynamic sampling impulse duration A1 drops below minimum</td></tr>
<tr><td></td><td>5</td><td>Dynamic sampling impulse duration A1 does not fit the 125 µs pattern</td></tr>
<tr><td></td><td>6</td><td>Dynamic sampling period < 10 x Dynamic sampling impulse duration</td></tr>
<tr><td></td><td>7</td><td>Prm87 'SA1 dynamic sampling':
Invalid parameter Prm87</td></tr>
</table>
<table>
<tr><td>Info2</td><td>10</td><td>Dynamic sampling period A2 exceeds maximum</td></tr>
<tr><td></td><td>11</td><td>Dynamic sampling period A2 drops below minimum</td></tr>
<tr><td></td><td>12</td><td>Dynamic sampling impulse duration A2 exceeds maximum</td></tr>
<tr><td></td><td>13</td><td>Dynamic sampling impulse duration A2 drops below minimum</td></tr>
<tr><td></td><td>14</td><td>Dynamic sampling impulse duration A2 does not fit the 125 µs pattern</td></tr>
<tr><td></td><td>15</td><td>Dynamic sampling period < 10 x Dynamic sampling impulse duration</td></tr>
<tr><td></td><td>17</td><td>Prm93 'SA2 dynamic sampling':
Invalid parameter Prm93</td></tr>
</table>
<table>
<tr><td>Info2</td><td>20</td><td>Dynamic sampling period Dyn exceeds maximum</td></tr>
<tr><td></td><td>21</td><td>Dynamic sampling period Dyn drops below minimum</td></tr>
<tr><td></td><td>22</td><td>Dynamic sampling impulse duration Dyn exceeds maximum</td></tr>
<tr><td></td><td>23</td><td>Dynamic sampling impulse duration Dyn drops below minimum</td></tr>
<tr><td></td><td>24</td><td>Dynamic sampling impulse duration Dyn does not fit the 125 µs pattern</td></tr>
<tr><td></td><td>25</td><td>Dynamic sampling period < 10 x Dynamic sampling impulse duration</td></tr>
</table></td></tr>
<tr><td>Error rectification</td><td colspan="3">

Parameter to be checked:

Prm87: 'SA1 dynamic sampling'
Prm88: 'SA1.1 dynamic sampling impulse duration'
Prm89: 'SA1.1 dynamic sampling period'
Prm90: 'SA1.2 dynamic sampling impulse duration'
Prm91: 'SA1.2 dynamic sampling period'
Prm93: 'SA2 dynamic sampling'
Prm94: 'SA2.1 dynamic sampling impulse duration'
Prm95: 'SA2.1 dynamic sampling period'
Prm96: 'SA2.2 dynamic sampling impulse duration'
Prm97: 'SA2.2 dynamic sampling period'
Prm99: 'SDYN1 dynamic sampling impulse duration'
Prm100: 'SDYN1 dynamic sampling period'
Prm101: 'SDYN2 dynamic sampling impulse duration'
Prm102: 'SDYN2 dynamic sampling period'

Generate a correct parameter set and load on the target device
AMK service

</td></tr>
</table>

<table>
<tr>
<td>3605</td>
<td>Info1</td>
<td>26</td>
<td>Error messages of the dynamic sampling of the safe outputs, monitoring channel 2
<table>
<tr><td>Info2</td><td>1</td><td>Dynamic sampling period A1 exceeds maximum</td></tr>
<tr><td></td><td>2</td><td>Dynamic sampling period A1 drops below minimum</td></tr>
<tr><td></td><td>3</td><td>Dynamic sampling impulse duration A1 exceeds maximum</td></tr>
<tr><td></td><td>4</td><td>Dynamic sampling impulse duration A1 drops below minimum</td></tr>
<tr><td></td><td>5</td><td>Dynamic sampling impulse duration A1 does not fit the 125 µs pattern</td></tr>
<tr><td></td><td>6</td><td>Dynamic sampling period < 10 x Dynamic sampling impulse duration</td></tr>
<tr><td></td><td>7</td><td>Prm87 'SA1 dynamic sampling':
Invalid parameter Prm87</td></tr>
<tr><td></td><td>8</td><td>Prm92 'SA1 output level':
Invalid parameter Prm92</td></tr>
</table>
<table>
<tr><td>Info2</td><td>10</td><td>Dynamic sampling period A2 exceeds maximum</td></tr>
<tr><td></td><td>11</td><td>Dynamic sampling period A2 drops below minimum</td></tr>
<tr><td></td><td>12</td><td>Dynamic sampling impulse duration A2 exceeds maximum</td></tr>
<tr><td></td><td>13</td><td>Dynamic sampling impulse duration A2 drops below minimum</td></tr>
<tr><td></td><td>14</td><td>Dynamic sampling impulse duration A2 does not fit the 125 µs pattern</td></tr>
<tr><td></td><td>15</td><td>Dynamic sampling period < 10 x Dynamic sampling impulse duration</td></tr>
<tr><td></td><td>17</td><td>Prm93 'SA2 dynamic sampling':
Invalid parameter Prm93</td></tr>
<tr><td></td><td>18</td><td>Prm98 'SA2 output level':
Invalid parameter Prm98</td></tr>
</table>
<table>
<tr><td>Info2</td><td>20</td><td>Dynamic sampling period Dyn exceeds maximum</td></tr>
<tr><td></td><td>21</td><td>Dynamic sampling period Dyn drops below minimum</td></tr>
<tr><td></td><td>22</td><td>Dynamic sampling impulse duration Dyn exceeds maximum</td></tr>
<tr><td></td><td>23</td><td>Dynamic sampling impulse duration Dyn drops below minimum</td></tr>
<tr><td></td><td>24</td><td>Dynamic sampling impulse duration Dyn does not fit the 125 µs pattern</td></tr>
<tr><td></td><td>25</td><td>Dynamic sampling period < 10 x Dynamic sampling impulse duration</td></tr>
<tr><td></td><td>28</td><td>Prm104 'SA1.2 output type':
Invalid parameter Prm104</td></tr>
</table>
</td>
</tr>
</table>

Error rectification	• Parameter to be checked:
	  • Prm87: 'SA1 dynamic sampling'
	  • Prm88: 'SA1.1 dynamic sampling impulse duration'
	  • Prm89: 'SA1.1 dynamic sampling period'
	  • Prm90: 'SA1.2 dynamic sampling impulse duration'
	  • Prm91: 'SA1.2 dynamic sampling period'
	  • Prm92: 'SA1 output level'
	  • Prm93: 'SA2 dynamic sampling'
	  • Prm94: 'SA2.1 dynamic sampling impulse duration'
	  • Prm95: 'SA2.1 dynamic sampling period'
	  • Prm96: 'SA2.2 dynamic sampling impulse duration'
	  • Prm97: 'SA2.2 dynamic sampling period'
	  • Prm98: 'SA2 output level'
	  • Prm99: 'SDYN1 dynamic sampling impulse duration'
	  • Prm100: 'SDYN1 dynamic sampling period'
	  • Prm101: 'SDYN2 dynamic sampling impulse duration'
	  • Prm102: 'SDYN2 dynamic sampling period'
	  • Prm104: 'SA1.2 output type'
	• Generate a correct parameter set and load on the target device
	• AMK service

3605	Info1	38	Error message of 'Safe encoder monitoring (SEM)', monitoring channel 1
			Info2: 1 – Prm9 'Transition time in case of standstill' Prm9 > 60000 min Info2: 2 – Prm10 'Reaction time in case of standstill' Prm10 > 60000 min

Error rectification	• Parameter to be checked:
	  • Prm9: 'Transition time in case of standstill'
	  • Prm10: 'Reaction time in case of standstill'		

3605	Info1	39	Error message of 'Safe encoder monitoring (SEM)', monitoring channel 2
			Info2: 1 – Prm9 'Transition time in case of standstill' Prm9 > 60000 min Info2: 2 – Prm10 'Reaction time in case of standstill' Prm10 > 60000 min

Error rectification	• Parameter to be checked:
	  • Prm9: 'Transition time in case of standstill'
	  • Prm10: 'Reaction time in case of standstill'		

<table>
<tr><td>3605</td><td>Info1</td><td>101</td><td>
Error message for the stop function 'Safe stop 1 (SS1)'
Movement monitoring
<table>
<tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr>
<tr><td></td><td>7</td><td>Prm21 'SS1 safe speed standstill window'
Prm21 exceeds the maximum permissible value
(Prm21 > 60000 1/min)</td></tr>
<tr><td></td><td>8</td><td>Prm21 'SS1 safe speed standstill window'
Prm21 drops below the minimum permissible value
(Prm21 < -60000 1/min)</td></tr>
</table>
Ramp monitoring
<table>
<tr><td>Info3</td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr>
<tr><td></td><td>2</td><td>Prm21 'SS1 safe speed standstill window':
Prm21 drops below the minimum permissible value
(Prm21 < -60000 1/min)</td></tr>
<tr><td></td><td>3</td><td>Prm21 'SS1 safe speed standstill window':
Prm21 exceeds the maximum permissible value
(Prm21 > 60000 1/min)</td></tr>
<tr><td></td><td>4</td><td>Prm21 'SS1 safe speed standstill window':
Limits of the speed standstill window have the same value
(Prm21 = 0)</td></tr>
<tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds maximum permissible value
(Prm67 > 60000 1/min)</td></tr>
<tr><td></td><td>6</td><td>Prm20 'SS1 brake ramp time':
Prm20 = 0</td></tr>
<tr><td></td><td>7</td><td>Prm 67/Prm 20:
Relation of maximum speed to deceleration ramp n/t too small. (Ramp too flat)
(only monitoring channel 1)</td></tr>
<tr><td></td><td>10</td><td>Prm20 'SS1 brake ramp time':
Ramp time too long (only monitoring channel 2)</td></tr>
<tr><td></td><td>11</td><td>Current deceleration ramp violates the permissible range
(only monitoring channel 2)</td></tr>
<tr><td></td><td>13</td><td>Prm 67/Prm 20:
Relation of maximum speed to ramp time wrong
(only monitoring channel 2)</td></tr>
</table>
</td></tr>
<tr><td>Error rectification</td><td colspan="3">

Parameter to be checked:

Prm20: 'SS1 brake ramp time'
Prm21: 'SS1 safe speed standstill window'
Prm67: 'SMS safe maximum speed'

Generate a correct parameter set and load on the target device

</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>102</td><td>Error message for the stop function 'Safe stop 2 (SS2)'
Movement monitoring
<table>
<tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr>
<tr><td></td><td>1</td><td>Prm26 'SS2 safe speed standstill window'
Speed limits are identical (Prm26 = 0)</td></tr>
<tr><td></td><td>2</td><td>Prm27 'SS2 safe position standstill window'
Position limits are identical (Prm27 = 0)</td></tr>
<tr><td></td><td>7</td><td>Prm26 'SS2 safe speed standstill window'
Prm26 exceeds the maximum permissible value
(Prm26 > 60000 1/min)</td></tr>
<tr><td></td><td>8</td><td>Prm26 'SS2 safe speed standstill window'
Prm26 drops below the minimum permissible value
(Prm26 < -60000 1/min)</td></tr>
</table>
Ramp monitoring
<table>
<tr><td>Info3</td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr>
<tr><td></td><td>2</td><td>Prm26 'SS2 safe speed standstill window':
Prm26 drops below the minimum permissible value
(Prm21 < -60000 1/min)</td></tr>
<tr><td></td><td>3</td><td>Prm26 'SS2 safe speed standstill window':
Prm26 exceeds the maximum permissible value
(Prm21 > 60000 1/min)</td></tr>
<tr><td></td><td>4</td><td>Prm26 'SS2 safe speed standstill window':
Limits of the speed standstill window have the same value
(Prm26 = 0)</td></tr>
<tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds maximum permissible value
(Prm67 > 60000 1/min)</td></tr>
<tr><td></td><td>6</td><td>Prm25 'SS2 brake ramp time':
Prm25 = 0</td></tr>
<tr><td></td><td>7</td><td>Prm 67/Prm 25:
Relation of maximum speed to deceleration ramp n/t too small. (Ramp too flat)
(only monitoring channel 1)</td></tr>
<tr><td></td><td>10</td><td>Prm25 'SS2 brake ramp time':
Ramp time too long (only monitoring channel 2)</td></tr>
<tr><td></td><td>11</td><td>Current deceleration ramp violates the permissible range
(only monitoring channel 2)</td></tr>
<tr><td></td><td>13</td><td>Prm67/Prm25: Relation of maximum speed to ramp time wrong
(only monitoring channel 2)</td></tr>
</table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
  • Prm 25: 'SS2 brake ramp time'
  • Prm 26: 'SS2 safe speed standstill window'
  • Prm 27: 'SS2 safe position standstill window'
  • Prm 67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>103</td><td>Error message for the safety function 'Safe operating stop (SOS)'
Movement monitoring
<table>
<tr><td>Info2</td><td>1</td><td>Prm28 'SOS safe speed standstill window'
Speed limits are identical (Prm 28 = 0)</td></tr>
<tr><td></td><td>2</td><td>Prm 29 'SOS safe position standstill window'
Position limits are identical (Prm 29 = 0)</td></tr>
<tr><td></td><td>7</td><td>Prm28 'SOS safe speed standstill window'
Prm28 exceeds the maximum permissible value
(Prm28 > 60000 1/min)</td></tr>
<tr><td></td><td>8</td><td>Prm28 'SOS safe speed standstill window'
Prm28 drops below the minimum permissible value
(Prm28 < -60000 1/min)</td></tr>
</table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
  • Prm 28: 'SOS safe speed standstill window'
  • Prm 29: 'SOS safe position standstill window'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>104</td><td>Error message for the safety function 'Safe speed range 1 (SSR1)'
Movement monitoring
<table><tr><td>Info2</td><td>1</td><td>Prm33 'SSR1 safe limit speed 1';
Prm34 'SSR1 safe limit speed 2':
Speed limits are identical (Prm33 = Prm34)</td></tr><tr><td></td><td>7</td><td>Prm33 'SSR1 safe limit speed 1'
Prm33 exceeds the maximum permissible value
(|Prm33| > 60000 1/min)</td></tr><tr><td></td><td>8</td><td>Prm34 'SSR1 safe limit speed 2'
Prm34 exceeds the maximum permissible value
(|Prm34| > 60000 1/min)</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr><tr><td></td><td>2</td><td>Prm33 'SSR1 safe limit speed 1':
Prm33 exceeds the maximum permissible value
(|Prm33| > 60000 1/min)</td></tr><tr><td></td><td>3</td><td>Prm34 'SSR1 safe limit speed 2':
Prm34 exceeds the maximum permissible value
(|Prm34| > 60000 1/min)</td></tr><tr><td></td><td>4</td><td>Prm33 'SSR1 safe limit speed 1';
Prm34 'SSR1 safe limit speed 2':
Limits of the speed standstill window have the same value
(Prm33 = Prm34)</td></tr><tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds maximum permissible value
(Prm67 > 60000 1/min)</td></tr><tr><td></td><td>6</td><td>Prm32 'SSR1 brake ramp time'
Prm32 = 0</td></tr><tr><td></td><td>7</td><td>Prm67/Prm32:
Relation of maximum speed to deceleration ramp n/t too small. (Ramp too flat)
(only monitoring channel 1)</td></tr><tr><td></td><td>10</td><td>Prm32 'SSR1 brake ramp time':
Ramp time too long (only monitoring channel 2)</td></tr><tr><td></td><td>11</td><td>Current deceleration ramp violates the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>13</td><td>Prm67/Prm32:
Relation of maximum speed to ramp time
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
  • Prm32: 'SSR1 brake ramp time'
  • Prm33: 'SSR1 safe limit speed 1'
  • Prm34: 'SSR1 safe limit speed 2'
  • Prm67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>105</td><td>Error message for the safety function 'Safe direction positive (SDIp)'
Movement monitoring<table><tr><td>Info2</td><td>1</td><td>Prm64 'SDI safe speed standstill window';
Prm67 'SMS safe maximum speed':
Speed limits are identical (Prm67 = Prm64)</td></tr><tr><td></td><td>7</td><td>Prm64 'SDI safe speed standstill window':
Prm64 exceeds the maximum permissible value
(|Prm64| > 60000 1/min)</td></tr><tr><td></td><td>8</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds the maximum permissible value
(|Prm67| > 60000 1/min)</td></tr></table>Ramp monitoring<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds maximum permissible value
(Prm67 > 60000 1/min)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
• Prm 64: 'SDI safe speed standstill window'
• Prm 67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>106</td><td>Error message for the safety function 'Safe direction negative (SDIn)'
Movement monitoring<table><tr><td>Info2</td><td>1</td><td>Prm64 'SDI safe speed standstill window';
Prm67 'SMS safe maximum speed':
Speed limits are identical (Prm67 = Prm64)</td></tr><tr><td></td><td>7</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds the maximum permissible value
(|Prm67| > 60000 1/min)</td></tr><tr><td></td><td>8</td><td>Prm64 'SDI safe speed standstill window':
Prm64 exceeds the maximum permissible value
(|Prm64| > 60000 1/min)</td></tr></table>Ramp monitoring<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds maximum permissible value
(Prm67 > 60000 1/min)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
• Prm 64: 'SDI safe speed standstill window'
• Prm 67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>108</td><td>Error message for the safety function 'Safe maximum speed (SMS)'
Movement monitoring
<table>
<tr><td>Info2</td><td>1</td><td>Prm67 'SMS safe maximum speed':
Speed limits are identical (Prm67 = 0)</td></tr>
<tr><td></td><td>7</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds the maximum permissible value
(Prm67 > 60000 1/min)</td></tr>
<tr><td></td><td>8</td><td>Prm67 'SMS safe maximum speed':
Prm67 drops below the minimum permissible value
(Prm67 < -60000 1/min)</td></tr>
</table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
• Prm 67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>109</td><td>Error message for the safety function 'Safe speed range 2 (SSR2)'
Movement monitoring
<table><tr><td>Info2</td><td>1</td><td>Prm39 'SSR2 safe limit speed 1';
Prm40 'SSR2 safe limit speed 2':
Speed limits are identical (Prm39 = Prm40)</td></tr><tr><td></td><td>7</td><td>Prm39 'SSR2 safe limit speed 1':
Prm39 exceeds the maximum permissible value
(|Prm39| > 60000 1/min)</td></tr><tr><td></td><td>8</td><td>Prm40 'SSR2 safe limit speed 2':
Prm40 exceeds the maximum permissible value
(|Prm40| > 60000 1/min)</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr><tr><td></td><td>2</td><td>Prm39 'SSR2 safe limit speed 1':
Prm39 exceeds the maximum permissible value
(|Prm39| > 60000 1/min)</td></tr><tr><td></td><td>3</td><td>Prm40 'SSR2 safe limit speed 2':
Prm40 exceeds the maximum permissible value
(|Prm40| > 60000 1/min)</td></tr><tr><td></td><td>4</td><td>Prm39 'SSR2 safe limit speed 1';
Prm40 'SSR2 safe limit speed 2':
Limits of the speed standstill window have the same value
(Prm39 = Prm40)</td></tr><tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds the maximum permissible value
(Prm67 > 60000 1/min)</td></tr><tr><td></td><td>6</td><td>Prm38 'SSR2 brake ramp time':
Prm38 = 0</td></tr><tr><td></td><td>7</td><td>Prm38 'SSR2 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to deceleration ramp n/t too small. (Ramp too flat)
(only monitoring channel 1)</td></tr><tr><td></td><td>10</td><td>Prm38 'SSR2 brake ramp time':
Ramp time too long (only monitoring channel 2)</td></tr><tr><td></td><td>11</td><td>Current deceleration ramp violates the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>13</td><td>Prm38 'SSR2 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to ramp time wrong (Prm67/Prm38)
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
  • Prm 38: 'SSR2 brake ramp time'
  • Prm 39: 'SSR2 safe limit speed 1'
  • Prm 40: 'SSR2 safe limit speed 2'
  • Prm 67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>110</td><td>Error message for the safety function 'Safe speed range 3 (SSR3)'
Movement monitoring
<table><tr><td>Info2</td><td>1</td><td>Prm45 'SSR3 safe limit speed 1';
Prm46 'SSR3 safe limit speed 2':
Speed limits are identical (Prm45 = Prm46)</td></tr><tr><td></td><td>7</td><td>Prm45 'SSR3 safe limit speed 1':
Prm45 exceeds the maximum permissible value
(|Prm45| > 60000 1/min)</td></tr><tr><td></td><td>8</td><td>Prm46 'SSR3 safe limit speed 2':
Prm46 exceeds the maximum permissible value
(|Prm46| > 60000 1/min)</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr><tr><td></td><td>2</td><td>Prm45 'SSR3 safe limit speed 1':
Prm45 exceeds the maximum permissible value
(|Prm45| > 60000 1/min)</td></tr><tr><td></td><td>3</td><td>Prm46 'SSR3 safe limit speed 2':
Prm46 exceeds the maximum permissible value
(|Prm46| > 60000 1/min)</td></tr><tr><td></td><td>4</td><td>Prm45 'SSR3 safe limit speed 1';
Prm46 'SSR3 safe limit speed 2':
Prm45 = Prm46</td></tr><tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds the maximum permissible value
(Prm67 > 60000 1/min)</td></tr><tr><td></td><td>6</td><td>Prm44 'SSR3 brake ramp time':
(Prm44 = 0)</td></tr><tr><td></td><td>7</td><td>Prm44 'SSR3 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to deceleration ramp n/t too small. (Ramp too flat)
(only monitoring channel 1)</td></tr><tr><td></td><td>10</td><td>Prm44 'SSR3 brake ramp time':
Ramp time too long (only monitoring channel 2)</td></tr><tr><td></td><td>11</td><td>Current deceleration ramp violates the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>13</td><td>Prm44 'SSR3 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to ramp time wrong (Prm67/Prm44)
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
  • Prm 44: 'SSR3 brake ramp time'
  • Prm 45: 'SSR3 safe limit speed 1'
  • Prm 46: 'SSR3 safe limit speed 2'
  • Prm 67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>111</td><td>Error message for the safety function 'Safe speed range 4 (SSR4)'
Movement monitoring
<table><tr><td>Info2</td><td>1</td><td>Prm51 'SSR4 safe limit speed 1';
Prm52 'SSR4 safe limit speed 2':
Speed limits are identical (Prm51 = Prm52)</td></tr><tr><td></td><td>7</td><td>Prm51 'SSR4 safe limit speed 1':
Prm51 exceeds the maximum permissible value
(|Prm51| > 60000 1/min)</td></tr><tr><td></td><td>8</td><td>Prm52 'SSR4 safe limit speed 2':
Prm52 exceeds the maximum permissible value
(|Prm52| > 60000 1/min)</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr><tr><td></td><td>2</td><td>Prm51 'SSR4 safe limit speed 1':
Prm51 exceeds the maximum permissible value
(|Prm51| > 60000 1/min)</td></tr><tr><td></td><td>3</td><td>Prm52 'SSR4 safe limit speed 2':
Prm52 exceeds the maximum permissible value
(|Prm52| > 60000 1/min)</td></tr><tr><td></td><td>4</td><td>Prm51 'SSR4 safe limit speed 1';
Prm52 'SSR4 safe limit speed 2':
Prm51 = Prm52</td></tr><tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds the maximum permissible value
(Prm67 > 60000 1/min)</td></tr><tr><td></td><td>6</td><td>Prm50 'SSR4 brake ramp time':
Prm50 = 0</td></tr><tr><td></td><td>7</td><td>Prm50 'SSR4 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to deceleration ramp n/t too small. (Ramp too flat)
(only monitoring channel 1)</td></tr><tr><td></td><td>10</td><td>Prm50 'SSR4 brake ramp time':
Ramp time too long (only monitoring channel 2)</td></tr><tr><td></td><td>11</td><td>Current deceleration ramp violates the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>13</td><td>Prm50 'SSR4 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to ramp time wrong (Prm67/Prm50)
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
  • Prm 50: 'SSR4 brake ramp time'
  • Prm 51: 'SSR4 safe limit speed 1'
  • Prm 52: 'SSR4 safe limit speed 2'
  • Prm 67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>112</td><td>Error message for the safety function 'Safely-limited speed 1 (SLS1)'
Movement monitoring
<table><tr><td>Info2</td><td>1</td><td>Prm57 'SLS1 safe limit speed':
Speed limits are identical (Prm51 = Prm52)</td></tr><tr><td></td><td>7</td><td>Prm57 'SLS1 safe limit speed':
Prm57 exceeds the maximum permissible value
(Prm57 > 60000 1/min)</td></tr><tr><td></td><td>8</td><td>Prm57 'SLS1 safe limit speed':
Prm57 drops below the minimum permissible value
(Prm57 < -60000 1/min)</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr><tr><td></td><td>2</td><td>Prm57 'SLS1 safe limit speed':
Prm57 exceeds the maximum permissible value
(Prm57 > 60000 1/min)</td></tr><tr><td></td><td>3</td><td>Prm57 'SLS1 safe limit speed':
Prm57 drops below the minimum permissible value
(Prm57 < -60000 1/min)</td></tr><tr><td></td><td>4</td><td>Prm57 'SLS1 safe limit speed':
Limits of the speed window have the same value
(Prm57 = 0)</td></tr><tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds the maximum permissible value
(Prm67 > 60000 1/min)</td></tr><tr><td></td><td>6</td><td>Prm56 'SLS1 brake ramp time':
Prm56 = 0</td></tr><tr><td></td><td>7</td><td>Prm56 'SLS1 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to deceleration ramp n/t too small. (Ramp too flat)
(only monitoring channel 1)</td></tr><tr><td></td><td>10</td><td>Prm56 'SLS1 brake ramp time':
Ramp time too long (only monitoring channel 2)</td></tr><tr><td></td><td>11</td><td>Current deceleration ramp violates the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>13</td><td>Prm56 'SLS1 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to ramp time wrong
(Prm67/Prm56)
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">Parameter to be checked:
Prm 56: 'SLS1 brake ramp time'
Prm 57: 'SLS1 safe limit speed'
Prm 67: 'SMS safe maximum speed'
Generate a correct parameter set and load on the target device</td></tr>
</table>

<table>
<tr><td>3605</td><td>Info1</td><td>113</td><td>Error message for the safety function 'Safely-limited speed 2 (SLS2)'
Movement monitoring
<table>
<tr><td>Info2</td><td>1</td><td>Prm62 'SLS2 safe limit speed':
Speed limits are identical (Prm62 = 0)</td></tr>
<tr><td></td><td>7</td><td>Prm62 'SLS2 safe limit speed':
Prm62 exceeds the maximum permissible value
(Prm62 > 60000 1/min)</td></tr>
<tr><td></td><td>8</td><td>Prm62 'SLS2 safe limit speed':
Prm62 drops below the minimum permissible value
(Prm62 < -60000 1/min)</td></tr>
</table>
Ramp monitoring
<table>
<tr><td>Info3</td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr>
<tr><td></td><td>2</td><td>Prm62 'SLS2 safe limit speed':
Prm62 exceeds the maximum permissible value
(Prm62 > 60000 1/min)</td></tr>
<tr><td></td><td>3</td><td>Prm62 'SLS2 safe limit speed':
Prm62 drops below the minimum permissible value
(Prm62 < -60000 1/min)</td></tr>
<tr><td></td><td>4</td><td>Prm62 'SLS2 safe limit speed':
Limits of the speed window have the same value
(Prm62 = 0)</td></tr>
<tr><td></td><td>5</td><td>Prm67 'SMS safe maximum speed':
Prm67 exceeds the maximum permissible value
(Prm67 > 60000 1/min)</td></tr>
<tr><td></td><td>6</td><td>Prm61 'SLS2 brake ramp time':
Prm61 = 0</td></tr>
<tr><td></td><td>7</td><td>Prm61 'SLS2 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to deceleration ramp n/t too small. (Ramp too flat)
(only monitoring channel 1)</td></tr>
<tr><td></td><td>10</td><td>Prm61 'SLS2 brake ramp time':
Ramp time too long (only monitoring channel 2)</td></tr>
<tr><td></td><td>11</td><td>Current deceleration ramp violates the permissible range
(only monitoring channel 2)</td></tr>
<tr><td></td><td>13</td><td>Prm61 'SLS2 brake ramp time';
Prm67 'SMS safe maximum speed':
Relation of maximum speed to ramp time wrong
(Prm 67/Prm 61)
(only monitoring channel 2)</td></tr>
</table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Parameter to be checked:
  • Prm 61: 'SLS2 brake ramp time'
  • Prm 62: 'SLS2 safe limit speed'
  • Prm 67: 'SMS safe maximum speed'
• Generate a correct parameter set and load on the target device</td></tr>
</table>

3605	Info1	114	Error message for the safety function 'Safely-limited increment (SLI)' Movement monitoring

Info2	1	Prm67 'SMS safe maximum speed': Speed limits are identical (Prm67 = 0)
	2	Prm65 'SLI Safely limited position change 1'; Prm66 'SLI Safely limited position change 2' Position limits are identical (Prm65 = Prm66)
	7	Prm67 'SMS safe maximum speed': Prm67 exceeds the maximum permissible value (Prm67 > 60000 1/min)
	8	Prm67 'SMS safe maximum speed': Prm67 drops below the minimum permissible value (Prm67 < -60000 1/min)

Error rectification	• Parameter to be checked:
	  • Prm 65: 'SLI Safely limited position change 1'
	  • Prm 66: 'SLI Safely limited position change 2'
	  • Prm 67: 'SMS safe maximum speed'
	• Generate a correct parameter set and load on the target device

3605	Info1	200	faulty sine encoder period

Info2		value of the sine period from ID32776 (parameter in the drive controller)
Info3		value of the sine period from Prm6 (safe parameter)

Error rectification	• Parameter to be checked:
	  • Prm4: 'Channel 1 encoder type'
	  • Prm5: 'Channel 2 encoder type'
	  • Prm6 : 'Sine encoder period'
	  • ID32776 'Sine encoder period'
	• The sine encoder period must be set to the same value for ID32776 and Prm6.

3606 'Safety - Error during operation'

• Error in a monitoring during operation	
Device	Functional safety Controller cards KW-R07 / -R17 / -R27
Description	A monitoring has detected a deviation from a limit value during operations
Class	Error
Drive behaviour	See 'Error reaction' towards the individual additional information Info1
Device behaviour	

Additional information (Info AMK customer service)			
3606	Info1	3	Error messages of the encoder- / resolver monitorings, monitoring channel 1

Info2	1	Circle radius of the resolver traces too small (resolver evaluation)
	2	Circle radius of the resolver traces too great (resolver evaluation)

Error reaction	In case of an error in the encoder / resolver monitorings, 'Safe torque off (STO)' follows as error reaction

Error rectification	• Check parameterisation if correct encoder type was set
	  • Prm4 'Channel 1 encoder type'
	  • Prm5 'Channel 2 encoder type'
	• Check encoder / resolver signals and wiring

<table>
<tr><td>3606</td><td>Info1</td><td>4</td><td>Error messages of the encoder- / resolver monitorings,
monitoring channel 2
<table><tr><td>Info2</td><td>1</td><td>Circle radius of the resolver traces too small
(resolver evaluation)</td></tr><tr><td></td><td>2</td><td>Circle radius of the resolver traces too great
(resolver evaluation)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the encoder / resolver monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check parameterisation if correct encoder type was set
  • Prm4 'Channel 1 encoder type'
  • Prm5 'Channel 2 encoder type'
• Check encoder / resolver signals and wiring</td></tr>
<tr><td>3606</td><td>Info1</td><td>5</td><td>Error messages of the encoder- / resolver monitorings,
monitoring channel 1
<table><tr><td>Info2</td><td>1</td><td>Circle radius of the sine traces too great
(sine encoder detection)</td></tr><tr><td></td><td>2</td><td>Circle radius of the sine traces too small
(sine encoder detection)</td></tr><tr><td></td><td>3</td><td>Difference of the quadrants between traces and counter value greater than 1
(sine encoder detection)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the encoder / resolver monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check parameterisation if correct encoder type was set
  • Prm4 'Channel 1 encoder type'
  • Prm5 'Channel 2 encoder type'
• Check encoder / resolver signals and wiring
• AMK service</td></tr>
<tr><td>3606</td><td>Info1</td><td>6</td><td>Error messages of the encoder- / resolver monitorings,
monitoring channel 2
<table><tr><td>Info2</td><td>1</td><td>Circle radius of the sine traces too great
(sine encoder detection)</td></tr><tr><td></td><td>2</td><td>Circle radius of the sine traces too small
(sine encoder detection)</td></tr><tr><td></td><td>3</td><td>Difference of the quadrants between traces and counter value greater than 1
(sine encoder detection)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the encoder / resolver monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check parameterisation if correct encoder type was set
  • Prm4 'Channel 1 encoder type'
  • Prm5 'Channel 2 encoder type'
• Check encoder / resolver signals and wiring
• AMK service</td></tr>
<tr><td>3606</td><td>Info1</td><td>7</td><td>Error messages of the encoder- / resolver monitorings
<table><tr><td>Info2</td><td>3</td><td>Difference between 2 position values too great
(sine encoder evaluation)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the encoder / resolver monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check parameterisation if correct encoder type was set
  • Prm4 'Channel 1 encoder type'
  • Prm5 'Channel 2 encoder type'
• Check encoder / resolver signals and wiring</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>13</td><td>Error messages monitoring cross-communication<table>
<tr><td rowspan="8">Info2</td><td>1</td><td>monitoring of the other monitoring channel failed</td></tr>
<tr><td>2</td><td>Status difference between 2 monitoring channels detected => STO</td></tr>
<tr><td>3</td><td>Status difference between 2 monitoring channels detected => SS1</td></tr>
<tr><td>4</td><td>Status difference between 2 monitoring channels detected => SS2</td></tr>
<tr><td>5</td><td>Position switch-off threshold has been exceeded.
Position difference between monitoring channels is too great</td></tr>
<tr><td>6</td><td>Speed switch-off threshold has been exceeded.
Speed difference between monitoring channels is too great</td></tr>
<tr><td>7</td><td>Invalid specification of emergency stop bit</td></tr>
<tr><td>8</td><td>The status of 2 monitoring chnannels is different</td></tr>
</table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the cross communication, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Info2 = 1, 2, 3, 4, 8: resulting error
• Parameter to be checked:
  • Info2 = 5: Prm2 'Switch-off threshold position'
  • Info2 = 6: Prm3 'Switch-off threshold velocity'
• Check signals of safety inputs</td></tr>
</table>

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<tr><td>3606</td><td>Info1</td><td>18</td><td>Error messages of the input monitorings,
monitoring channel 1<table>
<tr><td rowspan="2">Info2</td><td>1</td><td>No dynamic sampling pulse detected at input</td></tr>
<tr><td>4</td><td>Measured dynamic sampling period is too small</td></tr>
</table><table>
<tr><td rowspan="3">Info3</td><td>1</td><td>Input 1</td></tr>
<tr><td>2</td><td>Input 2</td></tr>
<tr><td>3</td><td>Input 3</td></tr>
</table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the input monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check wiring of the inputs
• Check correctness of dynamic sampling
• Check parameterisation of dynamic sampling
• Hardware possibly faulty (e.g. bouncing switches) / check
• AMK service</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>19</td><td>Error messages of the input monitorings,
monitoring channel 2<table>
<tr><td rowspan="2">Info2</td><td>1</td><td>No dynamic sampling pulse detected at input</td></tr>
<tr><td>4</td><td>Measured dynamic sampling period is too small</td></tr>
</table><table>
<tr><td rowspan="3">Info3</td><td>1</td><td>Input 1</td></tr>
<tr><td>2</td><td>Input 2</td></tr>
<tr><td>3</td><td>Input 3</td></tr>
</table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the input monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check wiring of the inputs
• Check correctness of dynamic sampling
• Check parameterisation of dynamic sampling
• Hardware possibly faulty (e.g. bouncing switches) / check
• AMK service</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>27</td><td>Error messages of the output monitorings,
monitoring channel 1
<table><tr><td>Info2</td><td>1</td><td>Value of a safe output that has been read back not equal to the specification
Internal plausibility monitoring; possibly short circuit of the outputs.</td></tr></table><table><tr><td rowspan="2">Info3</td><td>1</td><td>Error safe output 1:
Signal that has been read back does not match the specification</td></tr><tr><td>2</td><td>Error safe output 2:
Signal that has been read back does not match the specification</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the output monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check wiring of the outputs
• Check correctness of dynamic sampling
• Check parameterisation of dynamic sampling
• Hardware possibly faulty / check</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>28</td><td>Error messages of the output monitorings,
monitoring channel 2
<table><tr><td>Info2</td><td>1</td><td>Value of a safe output that has been read back not equal to the specification
Internal plausibility monitoring; possibly short circuit of the outputs.</td></tr></table><table><tr><td rowspan="2">Info2</td><td>1</td><td>Error safe output 1:
Signal that has been read back does not match the specification</td></tr><tr><td>2</td><td>Error safe output 2:
Signal that has been read back does not match the specification</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the output monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check wiring of the outputs
• Check correctness of dynamic sampling
• Check parameterisation of dynamic sampling
• Hardware possibly faulty / check</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>38</td><td>Error messages of the 'Safe encoder monitoring (SEM)',
monitoring channel 1
<table><tr><td>Info2</td><td>4</td><td>Prm10 'Reaction time in case of standstill' was exceeded</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the encoder standstill monitoring, 'Safe stop 1 (SS1)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Siehe 'Safe sine encoder monitoring (SEM)' auf Seite 27.
• Move drive
• Restart device</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>39</td><td>Error messages of the 'Safe encoder monitoring (SEM)',
monitoring channel 2
<table><tr><td>Info2</td><td>4</td><td>Prm10 'Reaction time in case of standstill' was exceeded</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the encoder standstill monitoring, 'Safe stop 1 (SS1)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Siehe 'Safe sine encoder monitoring (SEM)' auf Seite 27.
• Move drive
• Restart device</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>52</td><td>Error messages of the hardware monitorings<table>
<tr><td>Info2</td><td>1</td><td>Overvoltage in the 1.8 V supply voltage</td></tr>
<tr><td></td><td>2</td><td>Undervoltage in the 1.8 V supply voltage</td></tr>
<tr><td></td><td>3</td><td>Overvoltage in the 3.3 V supply voltage</td></tr>
<tr><td></td><td>4</td><td>Undervoltage in the 3.3 V supply voltage</td></tr>
<tr><td></td><td>5</td><td>Overvoltage in the 1.5 V reference voltage</td></tr>
<tr><td></td><td>6</td><td>Undervoltage in the 1.5 V reference voltage</td></tr>
</table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the hardware monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Hardware possibly faulty -> check
• AMK service</td></tr>
</table>

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<tr><td>3606</td><td>Info1</td><td>70</td><td>Error messages of the FSoE handling<table>
<tr><td>Info2</td><td>3</td><td>monitoring channel 1<table>
<tr><td>Info3</td><td>1</td><td>Internal system error, pointer error</td></tr>
<tr><td></td><td>2</td><td>Internal system error, access in non-permissible area</td></tr>
<tr><td></td><td>3</td><td>Resulting error that occurs when the transmission telegram of the complementary channel differs from the own transmission telegram</td></tr>
<tr><td></td><td>4</td><td>Internal system error occurred while generating the CRC values (resulting error)</td></tr>
<tr><td></td><td>5</td><td>Faulty status in FSoE state machine</td></tr>
</table></td></tr>
<tr><td></td><td>4</td><td>monitoring channel 2<table>
<tr><td>Info3</td><td>1</td><td>Internal system error, pointer error</td></tr>
<tr><td></td><td>2</td><td>Internal system error, access in non-permissible area</td></tr>
<tr><td></td><td>3</td><td>Resulting error that occurs when the transmission telegram of the complementary channel differs from the own transmission telegram</td></tr>
<tr><td></td><td>4</td><td>Internal system error occurred while generating the CRC values (resulting error)</td></tr>
<tr><td></td><td>5</td><td>Faulty status in FSoE state machine</td></tr>
</table></td></tr>
<tr><td>Info2</td><td>6</td><td>The FSoE watchdog has expired, i.e. no new FSoE frame was received within the watchdog time<table>
<tr><td>Info3</td><td>3</td><td>Monitoring channel 1</td></tr>
<tr><td></td><td>4</td><td>Monitoring channel 2</td></tr>
</table></td></tr>
</table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the FSoE monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check FSoE communication
• Info2 = 3, 4: Info3 = 1, 2, 4, 5: AMK service
• Info2 = 3, 4; Info3 = 3: check FSoE communication and check safety configuration
• Info2 = 6: check FSoE communication and check safety configuration
• FSoE master: error analysis, error message</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>75</td><td>Error messages of the hardware monitorings, switch-off path monitoring channel 1
<table><tr><td>Info2</td><td>1</td><td>Malfunction of the line driver L</td></tr><tr><td></td><td>2</td><td>Malfunction of the line driver H</td></tr><tr><td></td><td>3</td><td>Error line driver status
status of the drivers not identical</td></tr><tr><td></td><td>4</td><td>Error line driver control
checking short circuit control line to supply</td></tr><tr><td></td><td>5</td><td>Error line drivers' control
checking short circuit control line to GND</td></tr><tr><td></td><td>7</td><td>Error internal data handling
plausibility check of control data</td></tr><tr><td></td><td>8</td><td>Error internal data handling
plausibility check of test data</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the hardware monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Hardware possibly faulty -> check
• AMK service</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>76</td><td>Error messages of the hardware monitorings, switch-off path monitoring channel 2
<table><tr><td>Info2</td><td>1</td><td>Malfunction of the line driver L</td></tr><tr><td></td><td>2</td><td>Malfunction of the line driver H</td></tr><tr><td></td><td>3</td><td>Error line driver status
status of the drivers not identical</td></tr><tr><td></td><td>4</td><td>Error line driver control
checking short circuit control line to supply</td></tr><tr><td></td><td>5</td><td>Error line drivers' control
checking short circuit control line to GND</td></tr><tr><td></td><td>7</td><td>Error internal data handling
plausibility check of control data</td></tr><tr><td></td><td>8</td><td>Error internal data handling
plausibility check of test data</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the hardware monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Hardware possibly faulty -> check
• AMK service</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>101</td><td>Error message of the stop function 'Safe stop 1 (SS1)'<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr></table>Ramp monitoring<table><tr><td rowspan="8">Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td>1</td><td>Actual value exceeds maximum permissible value (60000 1/min)</td></tr><tr><td>8</td><td>Permitted speed range was exceeded (only monitoring channel 1)</td></tr><tr><td>9</td><td>Permitted speed range was dropped below (only monitoring channel 1)</td></tr><tr><td>11</td><td>Prm20 'SS1 brake ramp time':
Current deceleration ramp deviates from the permissible range (only monitoring channel 2)</td></tr><tr><td>14</td><td>Permissible speed range was violated (only monitoring channel 2)</td></tr><tr><td>15</td><td>Standstill window following end of ramp violated (only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SS1 stop function, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why SS1 ramp was violated by the movement of the drive
• Adjust parameterisation to physical conditions</td></tr>
<tr><td>3606</td><td>Info1</td><td>102</td><td>Error message of the stop function 'Safe stop 2 (SS2)'
Movement monitoring<table><tr><td rowspan="5">Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td>3</td><td>Upper speed limit in standstill was violated</td></tr><tr><td>4</td><td>Lower speed limit in standstill was violated</td></tr><tr><td>5</td><td>Upper position limit in standstill was violated</td></tr><tr><td>6</td><td>Lower position limit in standstill was violated</td></tr></table>Ramp monitoring<table><tr><td rowspan="8">Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td>1</td><td>Actual speed value exceeds maximum permissible value (60000 1/min)</td></tr><tr><td>8</td><td>Permissible speed range was exceeded (only monitoring channel 1)</td></tr><tr><td>9</td><td>Permissible speed range was dropped below (only monitoring channel 1)</td></tr><tr><td>11</td><td>Prm25 'SS2 brake ramp time':
Current deceleration ramp deviates from the permissible range (only monitoring channel 2)</td></tr><tr><td>14</td><td>Permissible speed range was violated (only monitoring channel 2)</td></tr><tr><td>15</td><td>Standstill window following end of ramp violated (only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SS2 stop function, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why SS2 ramp was violated by the movement of the drive
• Adjust parameterisation to physical conditions</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>103</td><td>Error message of the safety function 'Safe operating stop (SOS)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit in standstill was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit in standstill was violated</td></tr><tr><td></td><td>5</td><td>Upper position limit in standstill was violated</td></tr><tr><td></td><td>6</td><td>Lower position limit in standstill was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual value exceeds maximum permissible value (60000 1/min)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SOS safety function, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check by what the invalid movement of the drive was triggered</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>104</td><td>Error message of the safety function 'Safe speed range 1 (SSR1)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds maximum permissible value (60000 1/min)</td></tr><tr><td></td><td>8</td><td>Permissible speed range was exceeded
(only monitoring channel 1)</td></tr><tr><td></td><td>9</td><td>Permissible speed range was dropped below
(only monitoring channel 1)</td></tr><tr><td></td><td>11</td><td>Prm32 'SSR1 brake ramp time':
Current deceleration ramp deviates from the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>14</td><td>Permissible speed range was violated
(only monitoring channel 2)</td></tr><tr><td></td><td>15</td><td>Monitoring window following end of ramp violated
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SSR1 safety function, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>105</td><td>Error message for the safety function 'Safe direction positive (SDIp)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual value exceeds maximum permissible value (60000 1/min)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SDIp safety function, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check by what the invalid movement of the drive was triggered</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>106</td><td>Error message of the safety function 'Safe direction negative (SDIn)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual value exceeds maximum permissible value
(60000 1/min)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SDIn safety function, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check by what the invalid movement of the drive was triggered</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>108</td><td>Error message for the safety function 'Safe maximum speed (SMS)'
Movement monitoring
<table><tr><td>Info2</td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SMS safety function, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>109</td><td>Error message of the safety function 'Safe speed range 2 (SSR2)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds the maximum permissible value
(60000 1/min)</td></tr><tr><td></td><td>8</td><td>Permissible speed range was exceeded
(only monitoring channel 1)</td></tr><tr><td></td><td>9</td><td>Permissible speed range was dropped below
(only monitoring channel 1)</td></tr><tr><td></td><td>11</td><td>Prm38 'SSR2 brake ramp time':
Current deceleration ramp deviates from the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>14</td><td>Permissible speed range was violated
(only monitoring channel 2)</td></tr><tr><td></td><td>15</td><td>Monitoring window following end of ramp violated
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SSR2 safety function, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>110</td><td>Error message of the safety function 'Safe speed range 3 (SSR3)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds maximum permissible value (60000 1/min)</td></tr><tr><td></td><td>8</td><td>Permissible speed range was exceeded
(only monitoring channel 1)</td></tr><tr><td></td><td>9</td><td>Permissible speed range was dropped below
(only monitoring channel 1)</td></tr><tr><td></td><td>11</td><td>Prm44 'SSR3 brake ramp time':
Current deceleration ramp deviates from the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>14</td><td>Permissible speed range was violated
(only monitoring channel 2)</td></tr><tr><td></td><td>15</td><td>Monitoring window following end of ramp violated
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SSR3 safety function, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>111</td><td>Error message of the safety function 'Safe speed range 4 (SSR4)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds maximum permissible value (60000 1/min)</td></tr><tr><td></td><td>8</td><td>Permissible speed range was exceeded
(only monitoring channel 1)</td></tr><tr><td></td><td>9</td><td>Permissible speed range was dropped below
(only monitoring channel 1)</td></tr><tr><td></td><td>11</td><td>Prm50 'SSR4 brake ramp time':
Current deceleration ramp deviates from the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>14</td><td>Permissible speed range was violated
(only monitoring channel 2)</td></tr><tr><td></td><td>15</td><td>Monitoring window following end of ramp violated
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SSR4 safety function, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

<table>
<tr><td>3606</td><td>Info1</td><td>112</td><td>Error message of the safety function 'Safely-limited speed 1 (SLS1)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds maximum permissible value (60000 1/min)</td></tr><tr><td></td><td>8</td><td>Permissible speed range was exceeded
(only monitoring channel 1)</td></tr><tr><td></td><td>9</td><td>Permissible speed range was dropped below
(only monitoring channel 1)</td></tr><tr><td></td><td>11</td><td>Prm56 'SLS1 brake ramp time':
Current deceleration ramp deviates from the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>14</td><td>Permissible speed range was violated
(only monitoring channel 2)</td></tr><tr><td></td><td>15</td><td>Monitoring window following end of ramp violated
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SLS1 safety function, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
<tr><td>3606</td><td>Info1</td><td>113</td><td>Error message of the safety function 'Safely-limited speed 2 (SLS2)'
Movement monitoring
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring
<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds maximum permissible value (60000 1/min)</td></tr><tr><td></td><td>8</td><td>Permissible speed range was exceeded
(only monitoring channel 1)</td></tr><tr><td></td><td>9</td><td>Permissible speed range was dropped below
(only monitoring channel 1)</td></tr><tr><td></td><td>11</td><td>Prm61 'SLS2 brake ramp time':
Current deceleration ramp deviates from the permissible range
(only monitoring channel 2)</td></tr><tr><td></td><td>14</td><td>Permissible speed range was violated
(only monitoring channel 2)</td></tr><tr><td></td><td>15</td><td>Monitoring window following end of ramp violated
(only monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the monitoring of the SLS2 safety function, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

3606	Info1	114	Error message for the safety function 'Safely-limited increment (SLI)' Movement monitoring Info2: 5 = Upper position limit of the monitoring range was violated Info2: 6 = Lower position limit of the monitoring range was violated
Error reaction	In case of an error in the monitoring of the SLI safety function, the parameterised error reaction follows (STO, SS1 or SS2)		
Error rectification	• Check why the movement of the drive has violated the limits • Adjust parameterisation to physical conditions		

3607 'Safety - Internal system error'

• Internal system error	
Device	Functional safety Controller cards KW-R07 / -R17 / -R27
Description	Internal error of a process monitoring or a self-test
Class	Error
Drive behaviour	The drive remains torque-free
Device behaviour	The safety monitoring does not switch to the operational state, i.e. the safety functions cannot be put into operation

Additional information (Info AMK customer service)			
3607	Info1	5	Encoder error, sine encoder detection, monitoring channel 1 Info2: 4 = No stable state of the counter in the determination of the offset Info2: 5 = Default branch run through
Error reaction	In case of an error in the encoder monitoring, 'Safe torque off (STO)' follows as error reaction		
Error rectification	• AMK service		

3607	Info1	6	Encoder error, sine encoder detection, monitoring channel 2 Info2: 4 = Counter value cannot be read Info2: 5 = Default branch run through Info2: 6 = No stable state of the counter
Error reaction	In case of an error in the encoder monitoring, 'Safe torque off (STO)' follows as error reaction		
Error rectification	• AMK service		

3607	Info1	16	Error messages of the input monitorings, monitoring channel 1 Info2: 2 = Faulty input value Info3: 1 = Input 1 Info3: 2 = Input 2 Info3: 3 = Input 3
Error reaction	In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction		
Error rectification	• Check wiring of the inputs • Check correctness of dynamic sampling • Check parameterisation of dynamic sampling • Hardware possibly faulty / check • AMK service		

<table>
<tr><td>3607</td><td>Info1</td><td>17</td><td>Error messages of the input monitorings,
monitoring channel 2
<table><tr><td>Info2</td><td>2</td><td>Faulty input value</td></tr></table><table><tr><td rowspan="3">Info3</td><td>1</td><td>Input 1</td></tr><tr><td>2</td><td>Input 2</td></tr><tr><td>3</td><td>Input 3</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check wiring of the inputs
• Check correctness of dynamic sampling
• Check parameterisation of dynamic sampling
• Hardware possibly faulty / check
• AMK service</td></tr>
</table>

<table>
<tr><td>3607</td><td>Info1</td><td>20</td><td>Error messages of the input monitorings,
monitoring channel 1
<table><tr><td rowspan="10">Info2</td><td>7</td><td>Invalid specification for the allocation of the input 1 in the status</td></tr><tr><td>8</td><td>Invalid specification for the allocation of the input 2 in the status</td></tr><tr><td>9</td><td>Invalid specification for the allocation of the input 3 in the status</td></tr><tr><td>10</td><td>Bit number for input 1 and input 2 in the status value identical</td></tr><tr><td>11</td><td>Bit number for input 1 and input 3 in the status value identical</td></tr><tr><td>12</td><td>Bit number for input 2 and input 3 in the status value identical</td></tr><tr><td>13</td><td>Value of input 1 is too large</td></tr><tr><td>14</td><td>Value of input 2 is too large</td></tr><tr><td>15</td><td>Value of input 3 is too large</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check wiring of the inputs
• Check correctness of dynamic sampling
• Check parameterisation of dynamic sampling
• Hardware possibly faulty / check
• Info2 = 7 ... 12: AMK service</td></tr>
</table>

3607	Info1	22	Error messages of the input monitorings, monitoring channel 2

Info2	7	Invalid specification for the allocation of the input 1 in the status
	8	Invalid specification for the allocation of the input 2 in the status
	9	Invalid specification for the allocation of the input 3 in the status
	10	Bit number for input 1 and input 2 in the status value identical
	11	Bit number for input 1 and input 3 in the status value identical
	12	Bit number for input 2 and input 3 in the status value identical
	13	Value of input 1 is too large
	14	Value of input 2 is too large
	15	Value of input 3 is too large

Error reaction	In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction
Error rectification	• Check wiring of the inputs • Check correctness of dynamic sampling • Check parameterisation of dynamic sampling • Hardware possibly faulty / check • Info2 = 7 ... 12: AMK service

3607	Info1	23	Error messages of the safe outputs monitoring channel 1

Info2	1	A safety function is reported as active although the function is not selected
	5	Internal error
	6	Internal error
	7	Internal error
	8	Internal error

Error reaction	In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction
Error rectification	• AMK service

3607	Info1	24	Error messages of the safe outputs monitoring channel 2

Info2	1	A safety function is reported as active although the function is not selected
	5	Internal error
	6	Internal error
	7	Internal error
	8	Internal error

Error reaction	In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction
Error rectification	• AMK service

3607	Info1	25	Error messages of the output monitorings, monitoring channel 1

Info2	26	Setpoint A1 > 1
	27	Setpoint A2 > 1
	28	Feed forward A1 > limit
	29	Feed forward A2 > limit
	30	Feed forward Dyn > limit

Error reaction	In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction
Error rectification	• AMK service

3607	Info1	26	Error messages of the output monitorings, monitoring channel 2
Error reaction	In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction		
Error rectification	• AMK service		

Info2		
	26	Setpoint A1 > 1
	27	Setpoint A2 > 1
	28	Prm104 'SA1.2 output type' > maximum value
	29	Feed forward A2 > limit
	30	Feed forward Dyn > limit

3607	Info1	27	Error messages of the output test, monitoring channel 1
Error reaction	In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction		
Error rectification	• AMK service		

Info2		
	1	

Info3		
	3	Read-back signal > 1
	4	Setpoint > 1
	5	Instance > 1
	6	Output no. > 1
	7	Test cycle > limit
	8	Signal changing without error monitoring > limit
	9	More than 4 signal changes per ms

3607	Info1	28	Error messages of the output test, monitoring channel 2
Error reaction	In case of an error in the input / output monitorings, 'Safe torque off (STO)' follows as error reaction		
Error rectification	• AMK service		

Info2		
	1	

Info3		
	3	Read-back signal > 1
	4	Setpoint > 1
	5	Instance > 1
	6	Output no. > 1
	7	Test cycle > limit
	8	Signal changing without error monitoring > limit
	9	More than 4 signal changes per ms

3607	Info1	29	Module sequence monitoring

Info2	1	me pointer is faulty

Info3	1	Reset
	2	Do step

Info2	2	PAU pointer is faulty

Info3	n	Software module no.

Info2	3	Index exceeds limit

Info3	n	Software module no.

Info2	4	Identifier is faulty

Info3	n	Software module no.

Info2	5	Cycle time exceeds tolerance (< minimum)

Info3	n	Time level no.

Info2	6	Cycle time exceeds tolerance (> maximum)

Info3	n	Time level no.

Error reaction	In case of an error in the module sequence monitoring, 'Safe torque off (STO)' follows as error reaction
Error rectification	• Hardware possibly faulty / check • AMK service

3607	Info1	30	Error during reading of a parameter from the safe parameter set Wrong parameter number or internal system error

Info2	nn	Parameter arrangement, position of the faulty parameter

Info3	0	Read unsigned integer 16-Bit parameter from the safe parameter set
	1	Read unsigned integer 32-Bit parameter from the safe parameter set
	2	Read signed integer 16-Bit parameter from the safe parameter set
	3	Read signed integer 32-Bit parameter from the safe parameter set

Error reaction	In case of an error while reading the parameters, 'Safe torque off (STO)' follows as error reaction
Error rectification	• AMK service

3607	Info1	38	Error message of 'Safe encoder monitoring (SEM)' monitoring channel 1

Info2	5	Wrong state selected

Error reaction	In case of an error in the safe encoder monitoring, 'Safe torque off (STO)' follows as error reaction
Error rectification	• AMK service

3607	Info1	39	Error message of 'Safe encoder monitoring (SEM)' monitoring channel 2

Info2	5	Wrong state selected

Error reaction	In case of an error in the safe encoder monitoring, 'Safe torque off (STO)' follows as error reaction
Error rectification	• AMK service

<table>
<tr><td>3607</td><td>Info1</td><td>40</td><td>Error messages communication to P1 system processor
monitoring channel 1 / 2
<table><tr><td>Info2</td><td>1</td><td>Data length is invalid</td></tr><tr><td></td><td>2</td><td>Index for list invalid</td></tr><tr><td></td><td>3</td><td>State in system booting false</td></tr><tr><td></td><td>4</td><td>State in error deletion false</td></tr><tr><td></td><td>5</td><td>Service -> SEEP data is read
(only monitoring channel 2)
<table><tr><td>Info3</td><td>0</td><td>No error</td></tr><tr><td></td><td>1</td><td>Reading SEEP is not possible because of system run-up</td></tr><tr><td></td><td>2</td><td>Reading SEEP is not possible because of data transmission</td></tr><tr><td></td><td>3</td><td>Maximum address exceeded</td></tr></table></td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the communication to the system processor, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• AMK service</td></tr>
<tr><td>3607</td><td>Info1</td><td>70</td><td>Error message FSoE handling
<table><tr><td>Info2</td><td>7</td><td>FSoE error while reading status</td></tr><tr><td></td><td>8</td><td>FSoE error while reading process data</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the FSoE handling, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• AMK service</td></tr>
<tr><td>3607</td><td>Info1</td><td>71</td><td>Error messages clock monitoring
monitoring channel 1
<table><tr><td>Info2</td><td>1</td><td>State monitoring</td></tr><tr><td></td><td>2</td><td>Clock monitoring is faulty</td></tr><tr><td></td><td>3</td><td>Faulty state</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the clock monitoring, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• AMK service</td></tr>
<tr><td>3607</td><td>Info1</td><td>72</td><td>Error messages clock monitoring
monitoring channel 2
<table><tr><td>Info2</td><td>1</td><td>State monitoring</td></tr><tr><td></td><td>2</td><td>Clock monitoring is faulty</td></tr><tr><td></td><td>3</td><td>Faulty state</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of an error in the clock monitoring, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• AMK service</td></tr>
<tr><td>3607</td><td>Info1</td><td>73</td><td>Error message system
monitoring channel 1
<table><tr><td>Info2</td><td>1</td><td>FSoE stack / cross communication / clock monitoring were not activated for 3 cycles successively</td></tr><tr><td></td><td>2</td><td>Life counter FSoE is activated</td></tr><tr><td></td><td>3</td><td>Outputs cannot be set</td></tr></table><table><tr><td>Info3</td><td>3</td><td>Monitoring channel 1</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of a system error, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• AMK service</td></tr>
</table>

<table>
<tr><td>3607</td><td>Info1</td><td>74</td><td>Error message system
monitoring channel 2
<table><tr><td>Info2</td><td>1</td><td>FSoE stack / cross communication / clock monitoring were not activated for 3 cycles successively</td></tr><tr><td></td><td>2</td><td>Life counter FSoE is activated</td></tr><tr><td></td><td>3</td><td>Outputs cannot be set</td></tr><tr><td></td><td>4</td><td>Writing history is failed during data transmission</td></tr></table><table><tr><td>Info3</td><td>4</td><td>Monitoring channel 2</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of a system error, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• AMK service</td></tr>
</table>

3607	Info1	100	Error message of the stop and safety functions		
			Info2	100	Start bit allocation > maximum value
				101	Reset bit allocation > maximum value
				102	Reset bit allocation = start bit allocation
				103	Active bit allocation > maximum value
				104	Status bit allocation > maximum value
				105	Error bit allocation > maximum value
				106	Active bit allocation = status bit allocation
				107	Active bit allocation = error bit allocation
				108	Error bit allocation = status bit allocation
				109	Wrong state selected
				114	Monitoring channel 1: SS1 Error reaction > maximum value
				115	Monitoring channel 2: SS1 Error reaction > maximum value
				116	Monitoring channel 1: SS2 Error reaction > maximum value
				117	Monitoring channel 2: SS2 Error reaction > maximum value
				118	Monitoring channel 1: Safety function Pointer not initialised
				119	Monitoring channel 1: Safety function Faulty state
				120	Monitoring channel 2: Safety function Pointer not initialised
				121	Monitoring channel 2: Safety function Faulty state
				122	Monitoring channel 1: SS1 Pointer not initialised
				123	Monitoring channel 1: SS1 Faulty state
				124	Monitoring channel 2: SS1 Pointer not initialised
				125	Monitoring channel 2: SS1 Faulty state
				126	Monitoring channel 1: SS2 Pointer not initialised
				127	Monitoring channel 1: SS2 Faulty state
				128	Monitoring channel 2: SS2 Pointer not initialised
				129	Monitoring channel 2: SS2 Faulty state

			Info3	100	Error message of stop function 'Safe torque off (STO)'
				101	Error message of stop function 'Safe stop 1 (SS1)'
				102	Error message of stop function 'Safe stop 2 (SS2)'
				103	Error message of safety function 'Safe operating stop (SOS)'
				104	Error message of safety function 'Safe speed range 1 (SSR1)'
				105	Error message of safety function 'Safe direction positive (SDIp)'
				106	Error message of safety function 'Safe direction negative (SDIn)'
				108	Error message of safety function 'Safe maximum speed (SMS)'
				109	Error message of safety function 'Safe speed range 2 (SSR2)'
				110	Error message of safety function 'Safe speed range 3 (SSR3)'
				111	Error message of safety function 'Safe speed range 4 (SSR4)'
				112	Error message of safety function 'Safely-limited speed 1 (SLS1)'
				113	Error message of safety function 'Safely-limited speed 2 (SLS2)'
				114	Error message of safety function 'Safely-limited increment (SLI)'
Error reaction	In case of an error, 'Safe torque off (STO)' follows as error reaction				
Error rectification	• AMK service				

3609 'Safety - Faulty parameter transfer'

• Faulty parameter transfer	
Device	Functional safety Controller cards KW-R07 / -R17 / -R27
Description	Parameterisation error during system booting or during parameter set transfer • During system booting, the safe parameter set is checked for validity • During parameter set transfer, the safe parameter set is checked for validity and the validation is also monitored during the transfer
Class	Error
Drive behaviour	The drive remains torque-free
Device behaviour	The safety monitoring does not switch to the operational state, i.e. the safety functions cannot be put into operation

<table>
<tr><td colspan="4">Additional information (Info AMK customer service)</td></tr>
<tr><td>3609</td><td>Info1</td><td>3</td><td>Error during sending of the status from monitoring channel 2 to monitoring channel 1
Status: Confirmation of the adoption of the transmitted safe parameter set is requested
<table>
<tr><td>Info2</td><td>11</td><td>Internal system error
Error during sending of the status from monitoring channel 2 to monitoring channel 1</td></tr>
<tr><td></td><td>15</td><td>Internal system error
Timeout during sending of the status from monitoring channel 2 to monitoring channel 1</td></tr>
</table>
<table>
<tr><td>Info3</td><td>58</td><td>Transfer of the safe parameter set is started (monitoring channel 2)</td></tr>
</table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Transmit the safe parameter set to the device once more
• If the error occurs again, contact AMK service</td></tr>
</table>

<table>
<tr><td>3609</td><td>Info1</td><td>5</td><td>Error during the importing of the safe parameter set into the SEEP
<table>
<tr><td>Info2</td><td>5</td><td>Internal system error:
Timeout import parameter set into the SEEP</td></tr>
<tr><td></td><td>7</td><td>Internal system error: Procedural error</td></tr>
<tr><td></td><td>8</td><td>Internal system error: Input parameter</td></tr>
</table>
<table>
<tr><td>Info3</td><td>57</td><td>Transfer of the safe parameter set is started (monitoring channel 1)</td></tr>
<tr><td></td><td>58</td><td>Transfer of the safe parameter set is started (monitoring channel 2)</td></tr>
</table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Transmit the safe parameter set to the device once more
• If the error occurs again, contact AMK service</td></tr>
</table>

<table>
<tr><td>3609</td><td>Info1</td><td>6</td><td>The error occurs if certain functions are not completed during the transfer of the safe parameter set to the device.
<table>
<tr><td>Info2</td><td></td><td>Not to be evaluated</td></tr>
</table>
<table>
<tr><td>Info3</td><td>55</td><td>Testing of the safe parameter set is started during system booting
(monitoring channel 1)</td></tr>
<tr><td></td><td>56</td><td>Testing of the safe parameter set is started during system booting
(monitoring channel 2)</td></tr>
<tr><td></td><td>57</td><td>Transfer of the safe parameter set is started (monitoring channel 1)</td></tr>
<tr><td></td><td>58</td><td>Transfer of the safe parameter set is started (monitoring channel 2)</td></tr>
</table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Switch the device off/on
• Possibly transmit the safe parameter set to the device once more</td></tr>
</table>

3609	Info1	7	Resulting error: Within a certain time, the expected status from monitoring channel 2 does not arrive
			Info2 / 7: Internal system error: Procedural error Info2 / 8: Internal system error: Input parameter Info2 / 12: Timeout during reading of the status from monitoring channel 2 Info3 / 55: Testing of the safe parameter set is started during system booting (monitoring channel 1) Info3 / 57: Transfer of the safe parameter set is started (monitoring channel 1)
Error rectification	• Switch the device off/on • Possibly transmit the safe parameter set to the device once more		

3609	Info1	8	Internal system error
			Info2 / : Not to be evaluated Info3 / 55: Testing of the safe parameter set is started during system booting (monitoring channel 1) Info3 / 56: Testing of the safe parameter set is started during system booting (monitoring channel 2) Info3 / 57: Transfer of the safe parameter set is started (monitoring channel 1) Info3 / 58: Transfer of the safe parameter set is started (monitoring channel 2) Info3 / 59: Testing of the safe parameter set is completed during system booting (monitoring channel 1) Info3 / 60: Testing of the safe parameter set is completed during system booting (monitoring channel 2) Info3 / 61: Transfer of the safe parameter set is completed (monitoring channel 1) Info3 / 62: Transfer of the safe parameter set is completed (monitoring channel 2)
Error rectification	• AMK service		

3609	Info1	9	Transfer of the safe parameter set is successfully completed
			Info2 / 0: "The transfer of the safe parameter set has been successfully completed, please restart." (This information is always displayed when the safe parameter set has been successfully transmitted to the device!) Info2 / 11: Internal system error: Error during sending of the status from monitoring channel 2 to monitoring channel 1 Info2 / 15: Internal system error: Timeout during sending of the status from monitoring channel 2 to monitoring channel 1 Info3 / 61: Transfer of the safe parameter set is completed (monitoring channel 1) Info3 / 62: Transfer of the safe parameter set is completed (monitoring channel 2)
Error rectification	• Switch the device off/on • Possibly transmit the safe parameter set to the device once more • If an internal system error occurs, contact AMK service		

<table>
<tr><td>3609</td><td>Info1</td><td>10</td><td>Internal system error
Error during reading of the verification number from the SEEP in monitoring channel 2
<table><tr><td>Info2</td><td>7</td><td>Internal system error: Procedural error</td></tr><tr><td></td><td>11</td><td>Internal system error:
Error during sending of the status from monitoring channel 2 to monitoring channel 1</td></tr><tr><td></td><td>13</td><td>Internal system error:
Reading of the check sum from the SEEP monitoring channel 2 has been completed incorrectly</td></tr><tr><td></td><td>14</td><td>Internal system error:
Timeout in the reading function of the check sum from the SEEP monitoring channel 2</td></tr><tr><td></td><td>15</td><td>Internal system error:
Timeout during sending of the status from monitoring channel 2 to monitoring channel 1</td></tr></table><table><tr><td>Info3</td><td>56</td><td>Testing of the safe parameter set is started during system booting
(monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Switch the device off/on
• Possibly transmit the safe parameter set to the device once more
• If an internal system error occurs, contact AMK service</td></tr>
<tr><td>3609</td><td>Info1</td><td>11</td><td>Internal system error
<table><tr><td>Info2</td><td>16</td><td>Secure the timeout in the check sum function in SEEP monitoring channel 2</td></tr></table><table><tr><td>Info3</td><td>58</td><td>Transfer of the safe parameter set is started
(monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Switch the device off/on
• Possibly transmit the safe parameter set to the device once more
• If an internal system error occurs, contact AMK service</td></tr>
<tr><td>3609</td><td>Info1</td><td>73</td><td>Internal system error
<table><tr><td>Info2</td><td>0</td><td>During system run-up, an error in checksum 2 was detected within CRC examination
<table><tr><td>Info3</td><td>3</td><td>Monitoring channel 1</td></tr></table></td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of a system internal error, 'Safe torque off (STO)' follows as error reaction</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Transmit the safe parameter set to the device once more
• Following error of 3605 'Safety - Invalid parameterisation' or 3609 'Safety - Faulty parameter transfer' at system startup. The initiating error was deleted by the controller.
  • Switch the device off/on
  • Check ID32840 'Diagnostic list'
  • Check parametrization
• AMK service</td></tr>
</table>

3609	Info1	74	Internal system error

Info2	0	During system run-up, an error in checksum 2 was detected within CRC examination
		Info3 | 4 | Monitoring channel 2
	5	New parameter set is transmitted

Error reaction	In case of a system internal error, 'Safe torque off (STO)' follows as error reaction

Error rectification	• Transmit the safe parameter set to the device once more
	• Info 2 = 0, Info 3 = 4: Following error of 3605 'Safety - Invalid parameterisation' or 3609 'Safety - Faulty parameter transfer' at system startup. The initiating error was deleted by the controller.
	  • Switch the device off/on
	  • Check ID32840 'Diagnostic list'
	  • Check parametrization
	• AMK service

3609	Info1	128	The current parameter set is invalid

Info2	4	Failed to calculate and compare the checksums. The checksum of the safe parameter set and the calculated checksum differ.
	6	This version of the checked parameter set is not compatible with the device version or the safe parameter set is not available on the device
	9	Error during comparison of test sums Check sum from the current safe parameter set and check sum from the SEEP, monitoring channel 2, are different Hardware was replaced
	10	The check sum read from the SEEP, monitoring channel 2 is 0

Info3	55	Testing of the safe parameter set is started during system booting (monitoring channel 1)
	56	Testing of the safe parameter set is started during system booting (monitoring channel 2)
	57	Transfer of the safe parameter set is started (monitoring channel 1)
	58	Transfer of the safe parameter set is started (monitoring channel 2)

Error rectification	• Transmit the valid safe parameter set to the device once more

3609	Info1	131	Error during sending of the status from monitoring channel 2 to monitoring channel 1 Status: Confirmation of the adoption of the transmitted safe parameter set is requested The current parameter set is invalid

Info2	11	Internal system error Error during sending of the status from monitoring channel 2 to monitoring channel 1
	15	Internal system error Timeout during sending of the status from monitoring channel 2 to monitoring channel 1

Info3	58	Transfer of the safe parameter set is started (monitoring channel 2)

Error rectification	• Transmit the safe parameter set to the device once more • If the error occurs again, contact AMK service

<table>
<tr><td>3609</td><td>Info1</td><td>133</td><td>Error during the importing of the safe parameter set into the SEEP
The current parameter set is invalid
<table><tr><td>Info2</td><td>5</td><td>Internal system error: Timeout import parameter set into the SEEP</td></tr><tr><td></td><td>7</td><td>Internal system error: Procedural error</td></tr><tr><td></td><td>8</td><td>Internal system error: Input parameter</td></tr></table><table><tr><td>Info3</td><td>57</td><td>Transfer of the safe parameter set is started (monitoring channel 1)</td></tr><tr><td></td><td>58</td><td>Transfer of the safe parameter set is started (monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Transmit the safe parameter set to the device once more
• If the error occurs again, contact AMK service</td></tr>
</table>

<table>
<tr><td>3609</td><td>Info1</td><td>135</td><td>Resulting error: Within a certain time, the expected status from monitoring channel 2 does not arrive
The current parameter set is invalid
<table><tr><td>Info2</td><td>7</td><td>Internal system error: Procedural error</td></tr><tr><td></td><td>8</td><td>Internal system error: Input parameter</td></tr><tr><td></td><td>12</td><td>Timeout during reading of the status from monitoring channel 2.</td></tr></table><table><tr><td>Info3</td><td>55</td><td>Testing of the safe parameter set is started during system booting (monitoring channel 1)</td></tr><tr><td></td><td>57</td><td>Transfer of the safe parameter set is started (monitoring channel 1)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Switch the device off/on
• Possibly transmit the safe parameter set to the device once more</td></tr>
</table>

<table>
<tr><td>3609</td><td>Info1</td><td>136</td><td>Internal system error
<table><tr><td>Info2</td><td></td><td>Not to be evaluated</td></tr></table><table><tr><td>Info3</td><td>55</td><td>Testing of the safe parameter set is started during system booting (monitoring channel 1)</td></tr><tr><td></td><td>56</td><td>Testing of the safe parameter set is started during system booting (monitoring channel 2)</td></tr><tr><td></td><td>57</td><td>Transfer of the safe parameter set is started (monitoring channel 1)</td></tr><tr><td></td><td>58</td><td>Transfer of the safe parameter set is started (monitoring channel 2)</td></tr><tr><td></td><td>59</td><td>Testing of the safe parameter set is completed during system booting (monitoring channel 1)</td></tr><tr><td></td><td>60</td><td>Testing of the safe parameter set is completed during system booting (monitoring channel 2)</td></tr><tr><td></td><td>61</td><td>Transfer of the safe parameter set is completed (monitoring channel 1)</td></tr><tr><td></td><td>62</td><td>Transfer of the safe parameter set is completed (monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• AMK service</td></tr>
</table>

<table>
<tr><td>3609</td><td>Info1</td><td>137</td><td>Transfer of the safe parameter set is successfully completed
The current parameter set is invalid
<table><tr><td>Info2</td><td>0</td><td>"The transfer of the safe parameter set has been successfully completed, please restart."
(This information is always displayed when the safe parameter set has been successfully transmitted to the device!)</td></tr><tr><td></td><td>11</td><td>Internal system error:
Error during sending of the status from monitoring channel 2 to monitoring channel 1</td></tr><tr><td></td><td>15</td><td>Internal system error:
Timeout during sending of the status from monitoring channel 2 to monitoring channel 1</td></tr></table><table><tr><td>Info3</td><td>61</td><td>Transfer of the safe parameter set is completed (monitoring channel 1)</td></tr><tr><td></td><td>62</td><td>Transfer of the safe parameter set is completed (monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Switch the device off/on
• Possibly transmit the safe parameter set to the device once more
• If an internal system error occurs, contact AMK service</td></tr>
<tr><td>3609</td><td>Info1</td><td>138</td><td>Internal system error
The current parameter set is invalid
<table><tr><td>Info2</td><td>13</td><td>Error in function 'Read checksum from SEEP monitoring channel 2'</td></tr><tr><td></td><td>14</td><td>Timeout in function 'Read checksum from SEEP monitoring channel 2'</td></tr><tr><td></td><td>15</td><td>Timeout during sending of the checksum to monitoring channel 1</td></tr></table><table><tr><td>Info3</td><td>56</td><td>Testing of the safe parameter set is started during system booting
(monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Switch the device off/on
• If the error occurs again, contact AMK service</td></tr>
<tr><td>3609</td><td>Info1</td><td>139</td><td>Internal system error
The current parameter set is invalid
<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>16</td><td>Timeout in function 'Secure checksum to SEEP monitoring channel 2'</td></tr></table><table><tr><td>Info3</td><td>58</td><td>Transfer of the safe parameter set is started (monitoring channel 2)</td></tr></table></td></tr>
<tr><td>Error rectification</td><td colspan="3">• Switch the device off/on
• Possibly transmit the safe parameter set to the device once more
• If an internal system error occurs, contact AMK service</td></tr>
</table>

3610 'Safety - Warning during operation'

• Warning in a monitoring during operation	
Device	Functional safety Controller cards KW-R07 / -R17 / -R27
Description	A monitoring has detected a deviation from a limit value during operations
Class	Warning
Drive behaviour	See error reaction towards the individual additional information Info1
Device behaviour	

3610	Info1	13	Warning message monitoring cross communication

Info2	3	Status difference between 2 monitoring channels detected: SS1
	4	Status difference between 2 monitoring channels detected: SS2

Info3	3	Monitoring channel 1
	4	Monitoring channel 2

Error reaction	In case of a warning in the monitoring of the cross communication, SS1 or SS2 follows
Error rectification	• Info2 = 3, 4: resulting error

3610	Info1	38	Warning messages of the 'Safe encoder monitoring (SEM)' Monitoring channel 1

Info2	3	Warning: Prm9 'Transition time in case of standstill' was exceeded

Error reaction	After the expiration of Prm10 'Reaction time in case of standstill' an error is generated and 'Safe stop 1 (SS1)' follows as error reaction
Error rectification	• Siehe 'Safe sine encoder monitoring (SEM)' auf Seite 27. • Move device

3610	Info1	39	Warning messages of the 'Safe encoder monitoring (SEM)' Monitoring channel 2

Info2	3	Warning: Prm9 'Transition time in case of standstill' was exceeded

Error reaction	After the expiration of Prm10 'Reaction time in case of standstill' an error is generated and 'Safe stop 1 (SS1)' follows as error reaction
Error rectification	• Siehe 'Safe sine encoder monitoring (SEM)' auf Seite 27. • Move device

3610	Info1	40	Warning message of communication to P1

Info2	0	Flashing process is started

Info3	0	RF is active
	1	Start identifier for flashing not found
	2	Identifier 'SPImon' not found
	3	Faulty state
	10	SEEP reading invalid if RF is active
	11	Parameter set transmission invalid if RF is active
	15	Parameter set transmission invalid if RF is active

Error reaction	A warning of communication to P1 can be cleared
Error rectification	• Withdraw RF • Start flash process again • AMK service

3610	Info1	75	Warning message of the hardware monitoring, switch-off path Monitoring channel 1
			Info2 / 6: For more than 1 hour, no dynamic check of the line drivers could be carried out. Possible cause: • Power output stage enable (EF) of the device is inactive • STO is active
Error reaction	A warning of hardware monitoring can be cleared		
Error rectification	• Probably hardware defect / check • AMK service • This warning message cannot be reset until a new dynamic check of the line drivers is done		

3610	Info1	76	Warning message of the hardware monitoring, switch-off path Monitoring channel 2
			Info2 / 6: For more than 1 hour, no dynamic check of the line drivers could be carried out. Possible cause: • Power output stage enable (EF) of the device is inactive • STO is active
Error reaction	A warning of hardware monitoring can be cleared		
Error rectification	• Probably hardware defect / check • AMK service • This warning message cannot be reset until a new dynamic check of the line drivers is done		

3610	Info1	104	Warning message for the safety function 'Safe speed range 1 (SSR1)'
			Movement monitoring
			Info2 / 0: Not to be evaluated 3: Upper speed limit of the monitoring range was violated 4: Lower speed limit of the monitoring range was violated
			Ramp monitoring
			Info3 / 0: Not to be evaluated 1: Actual speed value exceeds maximum permissible value (60000 1/min) 8: Permitted speed range was exceeded 9: Permitted speed range was fallen short of 14: Permitted speed range was violated 15: Monitoring window following end of ramp violated
Error reaction	In case of a warning in the monitoring of the safety function SSR1, the parameterised error reaction follows (STO, SS1 or SS2)		
Error rectification	• Check why the movement of the drive has violated the limits • Adjust parameterisation to physical conditions		

3610	Info1	108	Warning message for the safety function 'Safe maximum speed (SMS)'
			Movement monitoring
			Info2 / 3: Upper speed limit of the monitoring range was violated 4: Lower speed limit of the monitoring range was violated
Error reaction	In case of a warning in the monitoring of the safety function SMS, the parameterised error reaction follows (STO, SS1 or SS2)		
Error rectification	• Check why the movement of the drive has violated the limits • Adjust parameterisation to physical conditions		

3610	Info1	109	Warning message for the safety function 'Safe speed range 2 (SSR2)'
			Movement monitoring
			Info2: 0 – Not to be evaluated 3 – Upper speed limit of the monitoring range was violated 4 – Lower speed limit of the monitoring range was violated
			Ramp monitoring
			Info3: 0 – Not to be evaluated 1 – Actual speed value exceeds maximum permitted value (60000 1/min) 8 – Permitted speed range was exceeded 9 – Permitted speed range was fallen short of 14 – Permitted speed range was violated 15 – Monitoring window following end of ramp violated
Error reaction	In case of a warning in the monitoring of the safety function SSR2, the parameterised error reaction follows (STO, SS1 or SS2)		
Error rectification	• Check why the movement of the drive has violated the limits • Adjust parameterisation to physical conditions		

3610	Info1	110	Warning message for the safety function 'Safe speed range 3 (SSR3)'
			Movement monitoring
			Info2: 0 – Not to be evaluated 3 – Upper speed limit of the monitoring range was violated 4 – Lower speed limit of the monitoring range was violated
			Ramp monitoring
			Info3: 0 – Not to be evaluated 1 – Actual speed value exceeds maximum permitted value (60000 1/min) 8 – Permitted speed range was exceeded 9 – Permitted speed range was fallen short of 14 – Permitted speed range was violated 15 – Monitoring window following end of ramp violated
Error reaction	In case of a warning in the monitoring of the safety function SSR3, the parameterised error reaction follows (STO, SS1 or SS2)		
Error rectification	• Check why the movement of the drive has violated the limits • Adjust parameterisation to physical conditions		

3610	Info1	111	Warning message for the safety function 'Safe speed range 4 (SSR4)'
			Movement monitoring
			Info2: 0 – Not to be evaluated 3 – Upper speed limit of the monitoring range was violated 4 – Lower speed limit of the monitoring range was violated
			Ramp monitoring
			Info3: 0 – Not to be evaluated 1 – Actual speed value exceeds maximum permitted value (60000 1/min) 8 – Permitted speed range was exceeded 9 – Permitted speed range was fallen short of 14 – Permitted speed range was violated 15 – Monitoring window following end of ramp violated
Error reaction	In case of a warning in the monitoring of the safety function SSR4, the parameterised error reaction follows (STO, SS1 or SS2)		
Error rectification	• Check why the movement of the drive has violated the limits • Adjust parameterisation to physical conditions		

<table>
<tr><td>3610</td><td>Info1</td><td>112</td><td>Warning message for the safety function 'Safely-limited speed 1 (SLS1)'
Movement monitoring<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds maximum permitted value (60000 1/min)</td></tr><tr><td></td><td>8</td><td>Permitted speed range was exceeded</td></tr><tr><td></td><td>9</td><td>Permitted speed range was fallen short of</td></tr><tr><td></td><td>14</td><td>Permitted speed range was violated</td></tr><tr><td></td><td>15</td><td>Monitoring window following end of ramp violated</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of a warning in the monitoring of the safety function SLS1, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

<table>
<tr><td>3610</td><td>Info1</td><td>113</td><td>Warning message for the safety function 'Safely-limited speed 2 (SLS2)'
Movement monitoring<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper speed limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower speed limit of the monitoring range was violated</td></tr></table>Ramp monitoring<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds maximum permitted value (60000 1/min)</td></tr><tr><td></td><td>8</td><td>Permitted speed range was exceeded</td></tr><tr><td></td><td>9</td><td>Permitted speed range was fallen short of</td></tr><tr><td></td><td>14</td><td>Permitted speed range was violated</td></tr><tr><td></td><td>15</td><td>Monitoring window following end of ramp violated</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of a warning in the monitoring of the safety function SLS2, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

<table>
<tr><td>3610</td><td>Info1</td><td>114</td><td>Warning message for the safety function 'Safely-limited increment (SLI)'
Movement monitoring<table><tr><td>Info2</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>3</td><td>Upper position limit of the monitoring range was violated</td></tr><tr><td></td><td>4</td><td>Lower position limit of the monitoring range was violated</td></tr></table>Ramp monitoring<table><tr><td>Info3</td><td>0</td><td>Not to be evaluated</td></tr><tr><td></td><td>1</td><td>Actual speed value exceeds maximum permitted value (60000 1/min)</td></tr></table></td></tr>
<tr><td>Error reaction</td><td colspan="3">In case of a warning in the monitoring of the safety function SLS2, the parameterised error reaction follows (STO, SS1 or SS2)</td></tr>
<tr><td>Error rectification</td><td colspan="3">• Check why the movement of the drive has violated the limits
• Adjust parameterisation to physical conditions</td></tr>
</table>

14 Certificates

The certificates are available through AMKmotion sales or on the AMKmotion website.

- Declaration of conformity
- TUEV

You can get it as follows:

- AMKmotion homepage - service - download - registration - start online documentation - certificates
  (One-time manual activation by AMKmotion sales department is necessary.
  The auto-registration via AMKmotion homepage does not include access to the entire documentation.)
  www.amk-motion.com/en/content/download_area

EC Type-Examination Certificate

Functional Safety

TÜVRheinland® CERTIFIED

www.tuv.com
ID 0600000000

Reg.-No.: 01/205/5315.01/17

Product tested	Integrated Safety Functions STO, SS1, SS2, SOS, SLS, SRS, SDI, SLI, SMS within the drive systems KE/KW with integrated safety module AE-SF1	**Certificate holder**	AMK Arnold Müller GmbH & Co. KG Gaußstraße 37-39 73230 Kirchheim / Teck Germany
Type designation	O807 Module KW-R07, O873 Module KW-R17, O957 Module KW-R27		
Codes and standards	IEC 61800-5-2:2016 IEC 61800-5-1:2016 (in extracts) EN 61800-3:2004 + A1:2012		IEC 62061:2015 ISO 13849-1:2015 IEC 61508 Parts 1-7:2010
Intended application	The Safety Functions comply with the requirements of SIL 3 / SIL CL 3 acc. to IEC 61800-5-2/IEC 62061/IEC 61508, Cat. 4 / PL e acc. to ISO 13849-1 and can be used in applications up to these safety levels.		
Specific requirements	The instructions of the associated User Documentatiion shall be considered.		

It is confirmed that the product under test complies with the requirements for machines defined in Annex I of the EC Directive 2006/42/EC.

Valid until 2022-10-26

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/M 307.04/17 dated 2017-10-26.
This certificate is valid only for products which are identical with the product tested.

TÜVRheinland 0035 Notified Body

Berlin, 2017-10-26

Notified Body for Machinery, NB 0035

Dipl.-Ing. Eberhard Frejno

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TÜVRheinland®
Precisely Right.

Glossary

A

A1
Analog input 1

AIPEX
AMK startup and parameterizing software (PC software): Programming, parameterization, configuration, diagnosis, oscilloscope, status information

AWG
American Wire Gauge (Coding of wire diameter)

D

Dynamic sampling
Dynamic sampling means that a clocked signal is installed or sent instead of a static signal. "Static signal errors" can be detected through dynamically sampled input and output signals by cyclically monitoring the signals for the dynamic sampling pattern.

Dormant error
A dormant error is an error in inactive monitoring channels. The error does not occur because the switch-off path is currently inactive. Dormant errors are problematic because the higher-level system can not distinguish between a dormant error and an operation where monitoring limits are not violated.

E

E-encoder
Absolute encoder, singleturn, EnDAT 2.1 with additional sine and cosine track

EtherCAT
Real-time Ethernet bus

EF2
Power output stage enable

EF
Power output stage enable

F

F-encoder
Absolute encoder, multiturn, EnDAT 2.1 with additional sine and cosine track

FSoE
Fail-Safe over EtherCAT

G

GND
Ground potential

I

I-encoder
Incremental encoder, optical encoder with sine and cosine track and zero pulse

K

KE/KW
Modular AMK drive system (contains compact power supply KE, compact inverter KW with controller card and applicable option card)

KW
AMKASYN compact inverter

KW-Rxx
AMKASYN controller card for installation into compact inverter

P

PWM
Pulse width modulation

P-encoder
Absolute encoder singleturn, EnDAT 2.2 light

PELV
Protective Extra Low Voltage

Q

Q-encoder
Absolute encoder multiturn, EnDAT 2.2 light

R

Resolver
Absolute angle encoder singleturn (1 sine and cosine track per rotation)

RF
Command 'Controller enable'; the drive is energized and will be controlled depending on the selected operation mode. Controller enable can only be set if the device is error-free (SBM = TRUE) and acknowledgement DC bus on is set (QUE = TRUE).Acknowledgement controller enable (QRF) is set.

S

STO
Safe torque off (Safety function acc. to DIN EN 61800-5-2)

SSR
Safe speed range (Safety function acc. to DIN EN 61800-5-2)

SS2
Safe stop 2 (Safety function acc. to DIN EN 61800-5-2)

SS1
Safe Stop 1 (Safety function acc. to DIN EN 61800-5-2)

SoS
Safe operating stop (Safety function acc. to DIN EN 61800-5-2)

SMS
Safe maximum speed (Safety function)

SDI
Safe direction. Safety function acc. to DIN EN 61800-5-2

SLI
Safely-limited increment (Safety function acc. to DIN EN 61800-5-2)

S-encoder
Absolute encoder, singleturn, RS485 Hiperface with sine and cosine track

SEM
Safe encoder monitoring

SE
Safe input

SBM
System ready message; shows that the device is error-free In case of error. SBM will be reset

SafePMT
Safe parameter editor

SLS
Safely-limited speed (Safety function acc. to DIN EN 61800-5-2)

SA
Safe output

T

T-encoder
Absolute encoder, multiturn, RS485 Hiperface with sine and cosine track

TÜV
German Technical Inspectorate

U

U-encoder
Absolute encoder, singleturn, RS485 Hiperface with sine and cosine track

V

V-encoder
Absolute encoder, multiturn, RS485 Hiperface with sine and cosine track

Y

Y-encoder
Absolute encoder, singleturn or multiturn, RS485 Hiperface DSL

Your opinion is important!

With our documentation we want to offer you the highest quality support in handling the AMKmotion products.
That is why we are now working on optimizing our documentation.
Your comments or suggestions are always of interest to us.
We would be grateful if you take a bit of time and answer our questions. Please return a copy of this page to us.

e-mail: Documentation@amk-motion.com
or
fax no.: +49 7021/50 05-199

Thank you for your assistance.
Your AMKmotion documentation team

1. How would you rate the layout of our AMKmotion documentation?

   (1) very good (2) good (3) satisfactory (4) less than satisfactory (5) poor

2. Is the content structured well?

   (1) very good (2) good (3) moderate (4) hardly (5) not at all

3. How easy is it to understand the documentation?

   (1) very easy (2) easy (3) moderately easy (4) difficult (5) extremely difficult

4. Did you miss any topics in the documentation?

   (1) no (2) if yes, which ones:

5. How would you rate the overall service at AMKmotion?

   (1) very good (2) good (3) satisfactory (4) less than satisfactory (5) poor

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