AMKASYN
Functional safety
Application examples KW-R07 / -R17 / -R27

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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)

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Content

1 About this documentation

1.1 Purpose

This document offers examples of application for safe stop functions and safe operation modes.
The connection of the safety board and the values of the safe parameters are exemplary for the used layout.

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

- Projecting, planning and dimensioning of the application
- Electrical connections
- Startup and operation

1.2 Target group

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

- Projecting
- Parameterization
- Testing and maintenance

1.3 Display conventions

Display	Meaning
	This symbol points to parts of the text to which particular attention should be paid!
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

1.4 Appendant Documents

Functional descriptions

AMK part no.	Titel
203446	Safety manual; functional safety excerpt for KW-R07 / -R17 / -R27

2 Important information

- As these application examples figure only parts of the safety device of a machine, no risk assessment was carried out.
- For real machines, a risk assessment must be carried out and the application and parameterisation must be adapted.
- Depending on the applied motor encoder type, the safety functions can reach different safety classification.
  See document Safety manual; functional safety (Part no. 203446), chapter Projecting, subtopic Achievable safety classification.
- The application examples contain devices which were used together with the AMK controller card KW-R07.
  Siehe 'Reference lists' auf Seite 29.
  - The results are only valid for the hardware revisions of these devices at the date of testing. Revisions of these products cannot be taken into account.
  - Respect the according manufacturer's information about known and fixed problems and verify the relevance for the machine application.
- For information about functional safety, the properties of the functions, parameterisation and diagnostics:
  See document Safety manual; functional safety (Part no. 203446)

3 Safe stop functions

3.1 Stop function STO

Task

- In normal operation, the motor of a machine is monitored for 'SMS safe maximum speed'.
- If the emergency stop push-button on safety input SE3 is pressed, the drive of the machine must be switched torque free immediately.

Safety functions

Safety input	function
SE1	inactive
SE2	inactive
SE3	STO

Normal operation:

'Safe maximum speed (SMS)'

Properties

- Special case of the SSR safety function according to DIN EN 61800-5-2:2008-04.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The SMS safety function is automatically started after the system booting and cannot be deactivated.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe torque off (STO)' is selected as error reaction

Safe stop function:

'Safe torque off (STO)'

Properties:

- Safety function acc. 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.
- Stop functions are prioritised over other safety functions.

Description

- Safe stop functions are edge-sensitive and cannot be interrupted.
- Protection against unexpected start of the motor.

Notes on structure and wiring

All established standards and guidelines as well as instructions of the manufacturer of the safety elements must be observed.

3.1.1 Relevant safe parameters

The parameters of the groups 'Safety Settings', Safety IOs' and 'Safe maximum speed (SMS)' are active at any time and cannot be switched off.

Safety settings

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm2	'Switch-off threshold position'	Pos_Diff	Inkr	100	-
Prm3	'Switch-off threshold velocity'	Vel_Diff	1/min	20	-
Prm4	'Channel 1 encoder type'	Enc_Ch1	-	0	Resolver
Prm5	'Channel 2 encoder type'	Enc_Ch2	-	0	Resolver
Prm6	'Sine encoder period'	Enc_Per	-	128	-
Prm7	'Commanding'	Cmd_Src	-	1	inputs SE1..SE3
Prm8	'Output control'	Out_Src	-	1	system

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm9	'Transition time in case of standstill'	T(warn)	min	360	-
Prm10	'Reaction time in case of standstill'	T(err)	min	120	-

Safety IOs

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
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	-	1	active dynamic sampling
Prm82	'SE3 input level'	SE3_INV	-	1	inverted input level
Prm83	'SE3.1 dynamic sampling impulse duration'	SE3.1_ Puls	µs	1000	-
Prm84	'SE3.1 dynamic sampling period'	SE3.1_ Time	ms	50	-
Prm85	'SE3.2 dynamic sampling impulse duration'	SE3.2_ Puls	µs	2000	-
Prm86	'SE3.2 dynamic sampling period'	SE3.2_ Time	ms	100	-
Prm99	'SDYN1 dynamic sampling impulse duration'	SDYN1_ Puls	µs	1000	-
Prm100	'SDYN1 dynamic sampling period'	SDYN1_ Time	ms	50	-
Prm101	'SDYN2 dynamic sampling impulse duration'	SDYN2_ Puls	µs	2000	-
Prm102	'SDYN2 dynamic sampling period'	SDYN2_ Time	ms	100	-

Safe maximum speed(SMS)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm67	'SMS safe maximum speed'	N(max,SMS)	1/min	6000	-
Prm68	'SMS error reaction'	SMS_ERR	-	0	STO

3.2 Stop function SS1

Task

- In normal operation, the motor of a machine is monitored for 'Safe maximum speed (SMS)'.
- If the emergency stop push-button on safety input SE3 is pressed, the drive of the machine must be decelerated under control and subsequently transferred into 'Safe torque off (STO)'

Safety functions

Safety input	function
SE1	inactive
SE2	inactive
SE3	SS1

Normal operation:

'Safe maximum speed (SMS)'

Properties

- Special case of the SSR safety function according to DIN EN 61800-5-2:2008-04.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The SMS safety function is automatically started after the system booting and cannot be deactivated.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe torque off (STO)' is selected as error reaction

Safe stop function:

'Safe stop 1 (SS1)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Controlled stop according to EN 60204-1, stop category 1.
- Safe monitoring of the deceleration procedure.
- Safe 2-channel monitoring of the actual speed value.
- Protection against restart.
- Stop functions are prioritised over other safety functions.

Description:

- Safe stop functions are edge-sensitive and cannot be interrupted.
- The initialised safety function monitors the deceleration procedure of the drive and subsequently transfers the drive into 'Safe torque off (STO)'.
- 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)' and an error message is sent.
- The deceleration procedure is automatically initiated by the safety function or by the user's control unit.
- In this application example, the drive is decelerated by automatic withdrawal of 'controller enable' RF

Notes on structure and wiring

All established standards and guidelines as well as instructions of the manufacturer of the safety elements must be observed.

3.2.1 Relevant safe parameters

The parameters of the groups 'Safety Settings', Safety IOs' and 'Safe maximum speed (SMS)' are active at any time and cannot be switched off.

Safety settings

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm2	'Switch-off threshold position'	Pos_Diff	Inkr	100	-
Prm3	'Switch-off threshold velocity'	Vel_Diff	1/min	20	-
Prm4	'Channel 1 encoder type'	Enc_Ch1	-	0	Resolver

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm5	'Channel 2 encoder type'	Enc_Ch2	-	0	Resolver
Prm6	'Sine encoder period'	Enc_Per	-	128	-
Prm7	'Commanding'	Cmd_Src	-	1	inputs SE1..SE3
Prm8	'Output control'	Out_Src	-	1	system
Prm9	'Transition time in case of standstill'	T(warn)	min	360	-
Prm10	'Reaction time in case of standstill'	T(err)	min	120	-

Safety IOs

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm15	'SE1 safety function'	SF_SE1	-	16	OFF
Prm16	'SE2 safety function'	SF_SE2	-	16	OFF
Prm17	'SE3 emergency stop function'	StF_SE3	-	1	SS1
Prm81	'SE3 dynamic sampling'	SE3_DYN	-	1	active dynamic sampling
Prm82	'SE3 input level'	SE3_INV	-	1	inverted input level
Prm83	'SE3.1 dynamic sampling impulse duration'	SE3.1_ Puls	µs	1000	-
Prm84	'SE3.1 dynamic sampling period'	SE3.1_ Time	ms	50	-
Prm85	'SE3.2 dynamic sampling impulse duration'	SE3.2_ Puls	µs	2000	-
Prm86	'SE3.2 dynamic sampling period'	SE3.2_ Time	ms	100	-
Prm99	'SDYN1 dynamic sampling impulse duration'	SDYN1_ Puls	µs	1000	-
Prm100	'SDYN1 dynamic sampling period'	SDYN1_ Time	ms	50	-
Prm101	'SDYN2 dynamic sampling impulse duration'	SDYN2_ Puls	µs	2000	-
Prm102	'SDYN2 dynamic sampling period'	SDYN2_ Time	ms	100	-

Safe Stop 1 (SS1)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm18	'SS1 transition period'	T(d,SS1)	ms	500	-
Prm20	'SS1 brake ramp time'	T(SS1)	ms	500	-
Prm21	'SS1 safe speed standstill window'	N(zero,SS1)	1/min	10	-

Safe maximum speed(SMS)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm67	'SMS safe maximum speed'	N(max,SMS)	1/min	6000	-
Prm68	'SMS error reaction'	SMS_ERR	-	0	STO

3.2.2 Relevant unsafe parameters

Parameter	Name	Unit	Min	Max	Default	Value *)
ID32781	'Deceleration ramp'	ms	1	1200000	100	300
ID32782	'Deceleration ramp RF inactive'	ms	1	1200000	100	300
ID33203	'Safety bits'	-	0	0xFFFF	0x0001	0x0001

*) The column 'value' contains the values of this application example.

3.3 Stop function SS2

Task

- In normal operation, the motor of a machine is monitored for 'Safe maximum speed (SMS)'.
- If the emergency stop push-button on safety input SE3 is pressed, the drive of the machine must be decelerated and subsequently stay in safe standstill under control

Safety functions

Safety input	function
SE1	inactive
SE2	inactive
SE3	SS2

Normal operation:

'Safe maximum speed (SMS)'

Properties

- Special case of the SSR safety function according to DIN EN 61800-5-2:2008-04.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The SMS safety function is automatically started after the system booting and cannot be deactivated.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe stop 1 (SS1)' is selected as error reaction

Safe operation mode:

'Safe operating stop (SOS)'

Properties

- Safety function acc. 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 started safety function monitors the actual speed value and monitors the compliance with the safe speed standstill window and the safe position standstill window.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive will be set to the 'Safe torque off (STO)' state.

Safe stop functions:

'Safe stop 1 (SS1)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Controlled stop according to EN 60204-1, stop category 1.
- Safe monitoring of the deceleration procedure.
- Safe 2-channel monitoring of the actual speed value.
- Protection against restart.
- Stop functions are prioritised over other safety functions.

Description:

- Safe stop functions are edge-sensitive and cannot be interrupted.
- The initialised safety function monitors the deceleration procedure of the drive and subsequently transfers the drive into 'Safe torque off (STO)'.
- 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)' and an error message is sent.
- The deceleration procedure is automatically initiated by the safety function or by the user's control unit.
- In this application example, the drive is decelerated by automatic withdrawal of 'controller enable' RF
- In this application example, SS1 is started as soon as the SMS safety function detects an error.

'Safe stop 2 (SS2)'

Properties:

- Safety function acc. 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 value.
- Stop functions are prioritised over other safety functions.

Description:

- Safe stop functions are edge-sensitive and cannot be interrupted.
- The initialised SS2 safety function monitors the deceleration process of the drive and finally the secure standstill in regular operations.
- The deceleration procedure must be initiated from the user controller.
- Final state: 'Safe operating stop (SOS)'.
- In case of an error, the drive is set to the safe state 'Safe torque off (STO)' and an error message is sent.

Notes on structure and wiring

All established standards and guidelines as well as instructions of the manufacturer of the safety elements must be observed.

3.3.1 Relevant safe parameters

The parameters of the groups 'Safety Settings', Safety IOs' and 'Safe maximum speed (SMS)' are active at any time and cannot be switched off.

Safety settings

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm2	'Switch-off threshold position'	Pos_Diff	Inkr	100	-
Prm3	'Switch-off threshold velocity'	Vel_Diff	1/min	20	-
Prm4	'Channel 1 encoder type'	Enc_Ch1	-	0	Resolver
Prm5	'Channel 2 encoder type'	Enc_Ch2	-	0	Resolver
Prm6	'Sine encoder period'	Enc_Per	-	128	-
Prm7	'Commanding'	Cmd_Src	-	1	inputs SE1..SE3
Prm8	'Output control'	Out_Src	-	1	system
Prm9	'Transition time in case of standstill'	T(warn)	min	360	-
Prm10	'Reaction time in case of standstill'	T(err)	min	120	-

Safety IOs

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm15	'SE1 safety function'	SF_SE1	-	16	OFF
Prm16	'SE2 safety function'	SF_SE2	-	16	OFF
Prm17	'SE3 emergency stop function'	StF_SE3	-	2	SS2
Prm81	'SE3 dynamic sampling'	SE3_DYN	-	1	active dynamic sampling
Prm82	'SE3 input level'	SE3_INV	-	1	inverted input level
Prm83	'SE3.1 dynamic sampling impulse duration'	SE3.1_ Puls	µs	1000	-
Prm84	'SE3.1 dynamic sampling period'	SE3.1_ Time	ms	50	-
Prm85	'SE3.2 dynamic sampling impulse duration'	SE3.2_ Puls	µs	2000	-
Prm86	'SE3.2 dynamic sampling period'	SE3.2_ Time	ms	100	-

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm99	'SDYN1 dynamic sampling impulse duration'	SDYN1_ Puls	µs	1000	-
Prm100	'SDYN1 dynamic sampling period'	SDYN1_ Time	ms	50	-
Prm101	'SDYN2 dynamic sampling impulse duration'	SDYN2_ Puls	µs	2000	-
Prm102	'SDYN2 dynamic sampling period'	SDYN2_ Time	ms	100	-

Safe Stop 1 (SS1)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm18	'SS1 transition period'	T(d,SS1)	ms	500	-
Prm20	'SS1 brake ramp time'	T(SS1)	ms	500	-
Prm21	'SS1 safe speed standstill window'	N(zero,SS1)	1/min	10	-

Safe Stop 2 (SS2)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm23	'SS2 transition period'	T(d,SS2)	ms	500	-
Prm25	'SS2 brake ramp time'	T(SS2)	ms	500	-
Prm26	'SS2 safe speed standstill window'	N(zero,SS2)	1/min	10	-
Prm27	'SS2 safe position standstill window'	S(zero,SS2)	Inkr.	200	-

Safe operating stop (SOS)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm28	'SOS safe speed standstill window'	N(zero,SOS)	1/min	10	-
Prm29	'SOS safe position standstill window'	S(zero,SOS)	Inkr.	200	-

Safe maximum speed (SMS)

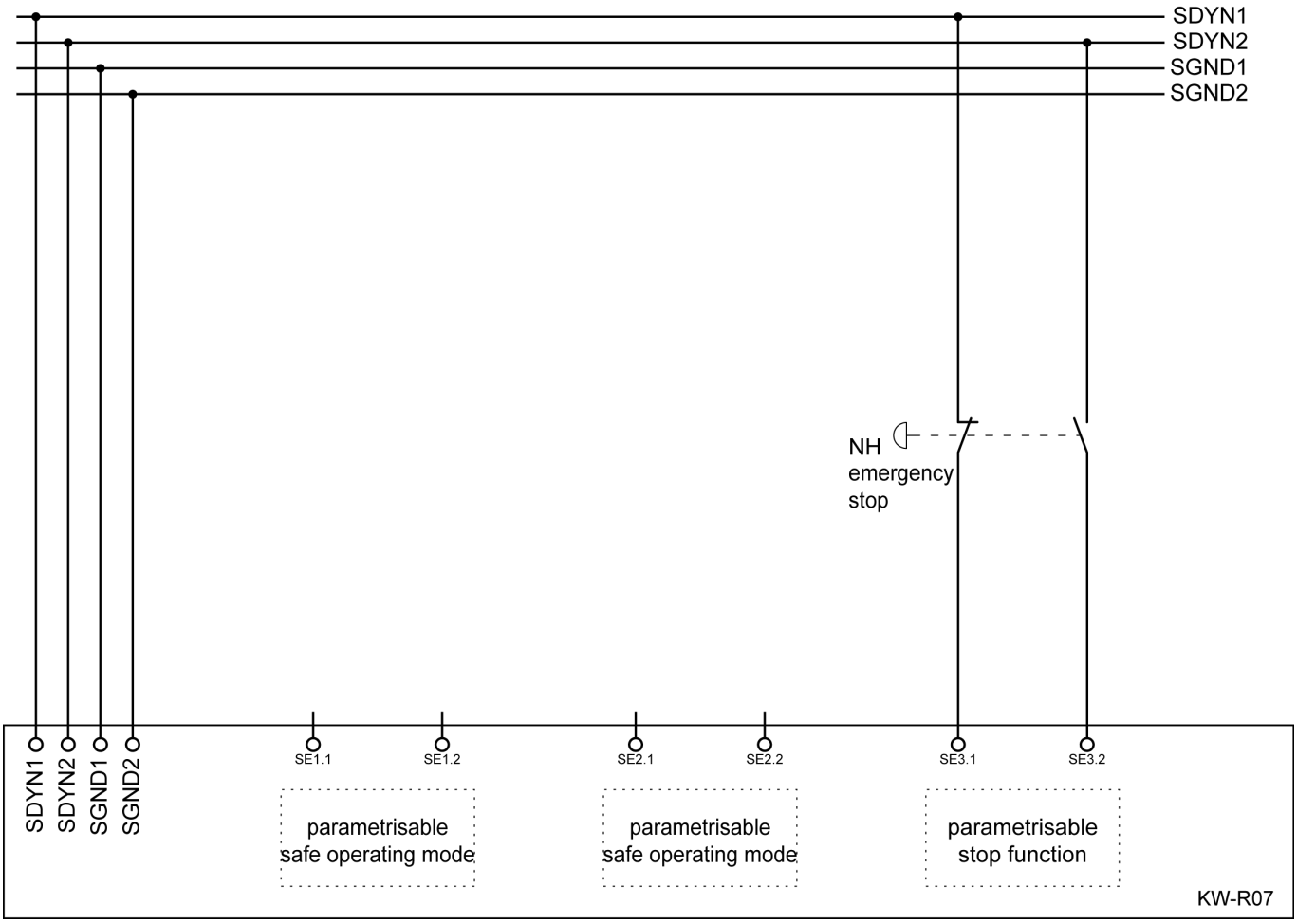
Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm67	'SMS safe maximum speed'	N(max,SMS)	1/min	6000	-
Prm68	'SMS error reaction'	SMS_ERR	-	1	SS1

3.3.2 Relevant unsafe parameters

Parameter	Name	Unit	Min	Max	Default	Value *)
ID32781	'Deceleration ramp'	ms	1	1200000	100	300
ID32782	'Deceleration ramp RF inactive'	ms	1	1200000	100	300
ID33203	'Safety bits'	-	0	0xFFFF	0x0001	0x0001

*) The column 'value' contains the values of this application example.

3.4 Wiring example



4 Safe operating modes

4.1 Operating mode switch

Task

- With the operating mode switch on safety input SE1, the machine is switched over from operating mode 'automatic' to 'maintenance'.
- In automatic mode, the drive is monitored for 'Safe maximum speed (SMS)'.
- In maintenance mode, the drive is additionally monitored for 'Safely-limited speed 1 (SLS1)'.
- If the emergency stop push-button on safety input SE3 is pressed, the drive must be switched to 'Safe torque off (STO)' immediately.

Safety functions

Safety input	function
SE1	SLS1
SE2	inactive
SE3	STO

Normal operation:

'Safe maximum speed (SMS)'

Properties

- Special case of the SSR safety function according to DIN EN 61800-5-2:2008-04.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The SMS safety function is automatically started after the system booting and cannot be deactivated.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe stop 1 (SS1)' was selected.
- The speed adjustment must be initiated by the user's control unit.

Safe operating mode:

'Safely-limited speed 1 (SLS1)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Parameterisable safe speed range.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The parameterised speed limit is automatically used as positive and negative speed limit value.
- 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 started by the user's control unit.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe stop 1 (SS1)' was selected.
- The safety function SLS1 is started by level 0 at the safety input SE1.

Safe stop functions:

'Safe torque off (STO)'

Properties:

- Safety function acc. 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.
- Stop functions are prioritised over other safety functions.

Description

- Safe stop functions are edge-sensitive and cannot be interrupted.
- Protection against unexpected start of the motor.

'Safe stop 1 (SS1)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Controlled stop according to EN 60204-1, stop category 1.
- Safe monitoring of the deceleration procedure.
- Safe 2-channel monitoring of the actual speed value.
- Protection against restart.
- Stop functions are prioritised over other safety functions.

Description:

- Safe stop functions are edge-sensitive and cannot be interrupted.
- The initialised safety function monitors the deceleration procedure of the drive and subsequently transfers the drive into 'Safe torque off (STO)'.
- 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)' and an error message is sent.
- The deceleration procedure is automatically initiated by the safety function or by the user's control unit.
- In this application example, the deceleration is initiated by the user's control unit
- In this application example, the safety function SS1 is started in case of error of the safety functions SMS and SLS1. SS1 cannot be interrupted.

Function table:

Operating mode switch	**SE3** Stop function	**Limit values** of the selected safety function	**Safety function/ reaction**
Automatic	Not activated	Met	SMS
		Exceeded	SS1
Maintenance	Not activated	Met	SLS1
		Exceeded	SS1
Any state	Activated		STO

Notes on structure and wiring

All established standards and guidelines as well as instructions of the manufacturer of the safety elements must be observed.

4.1.1 Relevant safe parameters

The parameters of the groups 'Safety Settings', Safety IOs' and 'Safe maximum speed (SMS)' are active at any time and cannot be switched off.

Safety settings

Parameter	**Name**	**Code**	**Unit**	**Application-specific settings**	
				Value	**SafePMT selection**
Prm2	'Switch-off threshold position'	Pos_Diff	Inkr	100	-
Prm3	'Switch-off threshold velocity'	Vel_Diff	1/min	20	-
Prm4	'Channel 1 encoder type'	Enc_Ch1	-	0	Resolver
Prm5	'Channel 2 encoder type'	Enc_Ch2	-	0	Resolver
Prm6	'Sine encoder period'	Enc_Per	-	128	-
Prm7	'Commanding'	Cmd_Src	-	1	inputs SE1..SE3

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm8	'Output control'	Out_Src	-	1	system
Prm9	'Transition time in case of standstill'	T(warn)	min	360	-
Prm10	'Reaction time in case of standstill'	T(err)	min	120	-

Safety IOs

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm15	'SE1 safety function'	SF_SE1	-	12	SLS1
Prm16	'SE2 safety function'	SF_SE2	-	16	OFF
Prm17	'SE3 emergency stop function'	StF_SE3	-	0	STO
Prm69	'SE1 dynamic sampling'	SE1_DYN	-	1	active dynamic sampling
Prm70	'SE1 input level'	SE1_INV	-	1	inverted input level
Prm71	'SE1.1 dynamic sampling impulse duration'	SE1.1_ Puls	µs	1000	-
Prm72	'SE1.1 dynamic sampling period'	SE1.1_ Time	ms	50	-
Prm73	'SE1.2 dynamic sampling impulse duration'	SE1.2_ Puls	µs	2000	-
Prm74	'SE1.2 dynamic sampling period'	SE1.2_ Time	ms	100	-
Prm81	'SE3 dynamic sampling'	SE3_DYN	-	1	active dynamic sampling
Prm82	'SE3 input level'	SE3_INV	-	1	inverted input level
Prm83	'SE3.1 dynamic sampling impulse duration'	SE3.1_ Puls	µs	1000	-
Prm84	'SE3.1 dynamic sampling period'	SE3.1_ Time	ms	50	-
Prm85	'SE3.2 dynamic sampling impulse duration'	SE3.2_ Puls	µs	2000	-
Prm86	'SE3.2 dynamic sampling period'	SE3.2_ Time	ms	100	-
Prm99	'SDYN1 dynamic sampling impulse duration'	SDYN1_ Puls	µs	1000	-
Prm100	'SDYN1 dynamic sampling period'	SDYN1_ Time	ms	50	-
Prm101	'SDYN2 dynamic sampling impulse duration'	SDYN2_ Puls	µs	2000	-
Prm102	'SDYN2 dynamic sampling period'	SDYN2_ Time	ms	100	-

Safe Stop 1 (SS1)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm18	'SS1 transition period'	T(d,SS1)	ms	500	-
Prm20	'SS1 brake ramp time'	T(SS1)	ms	500	-
Prm21	'SS1 safe speed standstill window'	N(zero,SS1)	1/min	10	-

Safely-limited speed 1 (SLS1)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm54	'SLS1 transition period'	T(d,SLS1)	ms	500	-
Prm56	'SLS1 brake ramp time'	T(SLS1)	ms	500	-
Prm57	'SLS1 safe limit speed'	N(limit,SLS1)	1/min	60	-
Prm58	'SLS1 error reaction'	SLS1_ERR	-	1	SS1

Safe maximum speed(SMS)

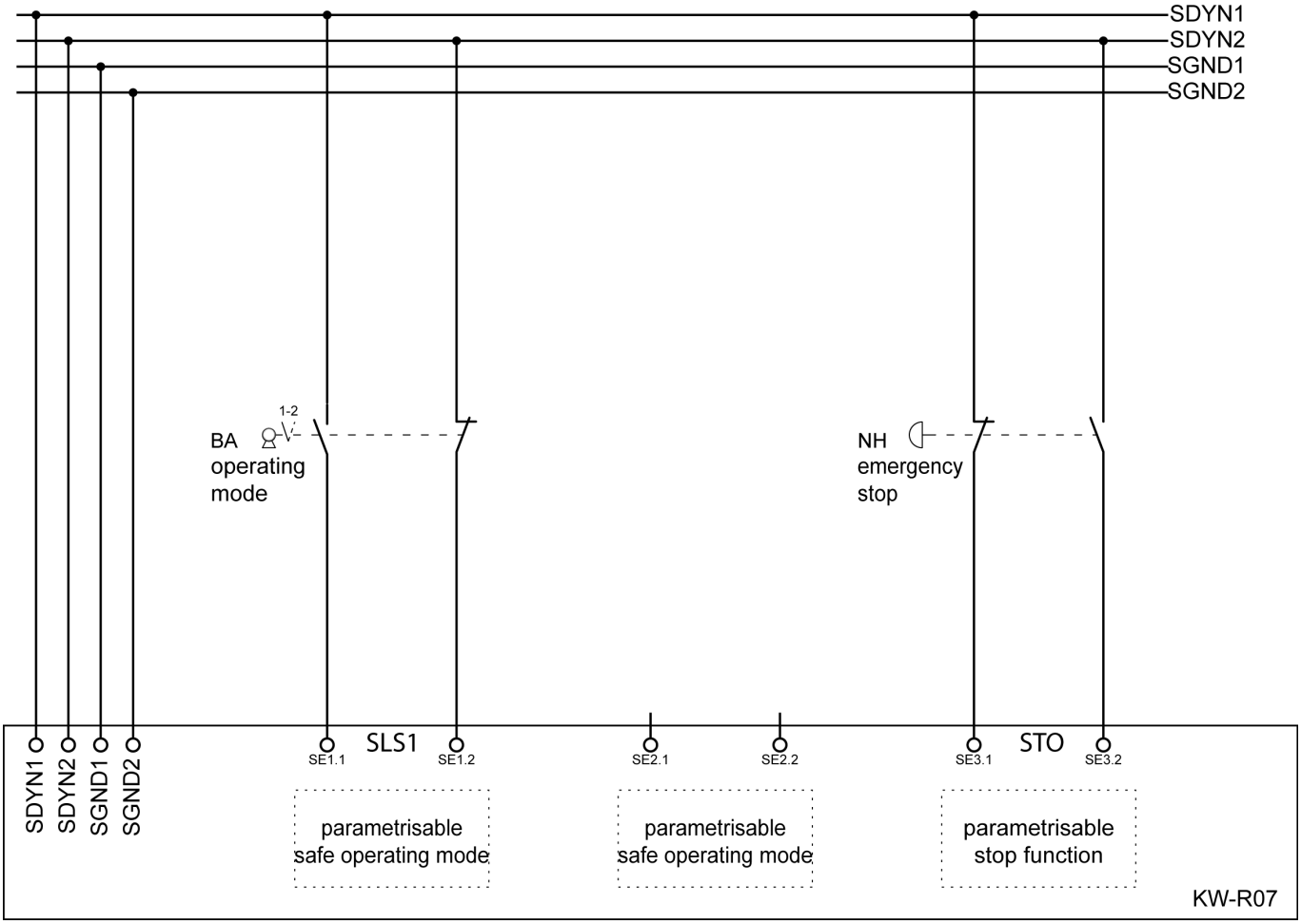
Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm67	'SMS safe maximum speed'	N(max,SMS)	1/min	6000	-
Prm68	'SMS error reaction'	SMS_ERR	-	1	SS1

4.1.2 Relevant unsafe parameters

Parameter	Name	Unit	Min	Max	Default	Value *)
ID32781	'Deceleration ramp'	ms	1	1200000	100	300
ID32782	'Deceleration ramp RF inactive'	ms	1	1200000	100	300
ID33203	'Safety bits'	-	0	0xFFFF	0x0001	0x0001

*) The column 'value' contains the values of this application example.

4.1.3 Wiring example



4.2 Three-step enabling switch

Task

- With the operating mode switch, the machine is switched over from operating mode 'setting' to 'automatic'.
- In automatic mode, the drive is monitored for 'Safe maximum speed (SMS)'.
- If the enabling switch is not activated or pressed to end stop (panic) in setting mode, the drive is monitored for 'Safe operating stop (SOS)' (standstill).
- By activating the enabling switch in setting mode, the drive is monitored for 'Safely-limited increment (SLI)'. The movement must be initiated by the user's control unit.
- If the emergency stop push-button on safety input SE3 is pressed, the drive must be switched torque free immediately by use of 'Safe torque off (STO)'.

Safety functions

Safety input	Function
SE1	SOS
SE2	SLI
SE3	STO

Normal operation:

Operating mode switch = automatic

'Safe maximum speed (SMS)'

Properties

- Special case of the SSR safety function according to DIN EN 61800-5-2:2008-04.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The SMS safety function is automatically started after the system booting and cannot be deactivated.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe stop 1 (SS1)' was selected.
- In this application example, the deceleration process is initiated automatically.

Safe operating modes:

Operating mode switch = setting; enabling switch not activated or pressed to end stop

'Safe operating stop (SOS)'

Properties

- Safety function acc. 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 started safety function monitors the actual speed value and monitors the compliance with the safe speed standstill window and the safe position standstill window.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive will be set to the 'Safe torque off (STO)' state.
- The safety function SOS is started by level 0 at the safety input SE1.

Operating mode switch = setting; enabling switch activated

'Safely-limited increment (SLI)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Safe 2-channel monitoring of the parameterisable position range.

Description:

- The started SLI safety function monitors whether the actual position of the drive is located within a parameterisable range.
  - The permitted position range results from the actual position at the time when the SLI safety function is started.
  - The upper position limit is the start position value plus the higher value of Prm65 'SLI Safely limited position change 1' and Prm66 'SLI Safely limited position change 2'.
    The lower position limit is the start position plus the lower of the two values.
- The position change must be started by the user's control unit.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe stop 1 (SS1)' was selected.
- The safety function SLI is started by level 0 at the safety input SE2.

Safe stop functions:

'Safe torque off (STO)'

Properties:

- Safety function acc. 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.
- Stop functions are prioritised over other safety functions.

Description

- Safe stop functions are edge-sensitive and cannot be interrupted.
- Protection against unexpected start of the motor.

'Safe stop 1 (SS1)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Controlled stop according to EN 60204-1, stop category 1.
- Safe monitoring of the deceleration procedure.
- Safe 2-channel monitoring of the actual speed value.
- Protection against restart.
- Stop functions are prioritised over other safety functions.

Description:

- Safe stop functions are edge-sensitive and cannot be interrupted.
- The initialised safety function monitors the deceleration procedure of the drive and subsequently transfers the drive into 'Safe torque off (STO)'.
- 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)' and an error message is sent.
- The deceleration procedure is automatically initiated by the safety function or by the user's control unit.
- In this application example, the safety function SS1 is started in case of error of the safety functions SMS, SLS1 and SSR1.

Function table

Operating mode switch	**Enabling switch**	**SE1**	**SE2**	**SE3** Stop function	**active safety function**
Automatic	-	Not activated	Not activated	Not activated	'Safe maximum speed (SMS)'
Automatic	-	-	-	Activated	'Safe torque off (STO)'
Setting	Not activated	Activated	Activated	Not activated	'Safe operating stop (SOS)'+ 'Safely-limited increment (SLI)' => SOS dominates

Operating mode switch	Enabling switch	SE1	SE2	SE3 Stop function	active safety function
Setting	Activated	Not activated	Activated	Not activated	'Safely-limited increment (SLI)'
Setting	Panic	Activated	Activated	Not activated	'Safe operating stop (SOS)'+ 'Safely-limited increment (SLI)' => SOS dominates
Setting	-	-	-	Activated	'Safe torque off (STO)'

Notes on structure and wiring

All established standards and guidelines as well as instructions of the manufacturer of the safety elements must be observed.

4.2.1 Relevant safe parameters

The parameters of the groups 'Safety Settings', Safety IOs' and 'Safe maximum speed (SMS)' are active at any time and cannot be switched off.

Safety settings

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm2	'Switch-off threshold position'	Pos_Diff	Inkr	100	-
Prm3	'Switch-off threshold velocity'	Vel_Diff	1/min	20	-
Prm4	'Channel 1 encoder type'	Enc_Ch1	-	0	Resolver
Prm5	'Channel 2 encoder type'	Enc_Ch2	-	0	Resolver
Prm6	'Sine encoder period'	Enc_Per	-	128	-
Prm7	'Commanding'	Cmd_Src	-	1	inputs SE1..SE3
Prm8	'Output control'	Out_Src	-	1	system
Prm9	'Transition time in case of standstill'	T(warn)	min	360	-
Prm10	'Reaction time in case of standstill'	T(err)	min	120	-

Safety IOs

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm15	'SE1 safety function'	SF_SE1	-	3	SOS
Prm16	'SE2 safety function'	SF_SE2	-	14	SLI
Prm17	'SE3 emergency stop function'	StF_SE3	-	0	STO
Prm69	'SE1 dynamic sampling'	SE1_DYN	-	1	active dynamic sampling
Prm70	'SE1 input level'	SE1_INV	-	0	identical input level
Prm71	'SE1.1 dynamic sampling impulse duration'	SE1.1_ Puls	µs	1000	-
Prm72	'SE1.1 dynamic sampling period'	SE1.1_ Time	ms	50	-
Prm73	'SE1.2 dynamic sampling impulse duration'	SE1.2_ Puls	µs	2000	-
Prm74	'SE1.2 dynamic sampling period'	SE1.2_ Time	ms	100	-
Prm75	'SE2 dynamic sampling'	SE2_DYN	-	1	active dynamic sampling
Prm76	'SE2 input level'	SE2_INV	-	1	inverted input level
Prm77	'SE2.1 dynamic sampling impulse duration'	SE2.1_ Puls	µs	1000	-

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm78	'SE2.1 dynamic sampling period'	SE2.1_ Time	ms	50	-
Prm79	'SE2.2 dynamic sampling impulse duration'	SE2.2_ Puls	µs	2000	-
Prm80	'SE2.2 dynamic sampling period'	SE2.2_ Time	ms	100	-
Prm81	'SE3 dynamic sampling'	SE3_DYN	-	1	active dynamic sampling
Prm82	'SE3 input level'	SE3_INV	-	1	inverted input level
Prm83	'SE3.1 dynamic sampling impulse duration'	SE3.1_ Puls	µs	1000	-
Prm84	'SE3.1 dynamic sampling period'	SE3.1_ Time	ms	50	-
Prm85	'SE3.2 dynamic sampling impulse duration'	SE3.2_ Puls	µs	2000	-
Prm86	'SE3.2 dynamic sampling period'	SE3.2_ Time	ms	100	-
Prm99	'SDYN1 dynamic sampling impulse duration'	SDYN1_ Puls	µs	1000	-
Prm100	'SDYN1 dynamic sampling period'	SDYN1_ Time	ms	50	-
Prm101	'SDYN2 dynamic sampling impulse duration'	SDYN2_ Puls	µs	2000	-
Prm102	'SDYN2 dynamic sampling period'	SDYN2_ Time	ms	100	-

Safe Stop 1 (SS1)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm18	'SS1 transition period'	T(d,SS1)	ms	500	-
Prm20	'SS1 brake ramp time'	T(SS1)	ms	500	-
Prm21	'SS1 safe speed standstill window'	N(zero,SS1)	1/min	10	-

Safe operating stop (SOS)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm28	'SOS safe speed standstill window'	N(zero,SOS)	1/min	5	-
Prm29	'SOS safe position standstill window'	S(zero,SOS)	Incr	1000	-

Safely-limited increment (SLI)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm65	'SLI Safely limited position change 1'	S(ul,SLI)	Incr	+6553600	-
Prm66	'SLI Safely limited position change 2'	S(ll,SLI)	Incr	-6553600	-
Prm103	'SLI error reaction'	SLI_ERR	-	1	SS1

Safe maximum speed(SMS)

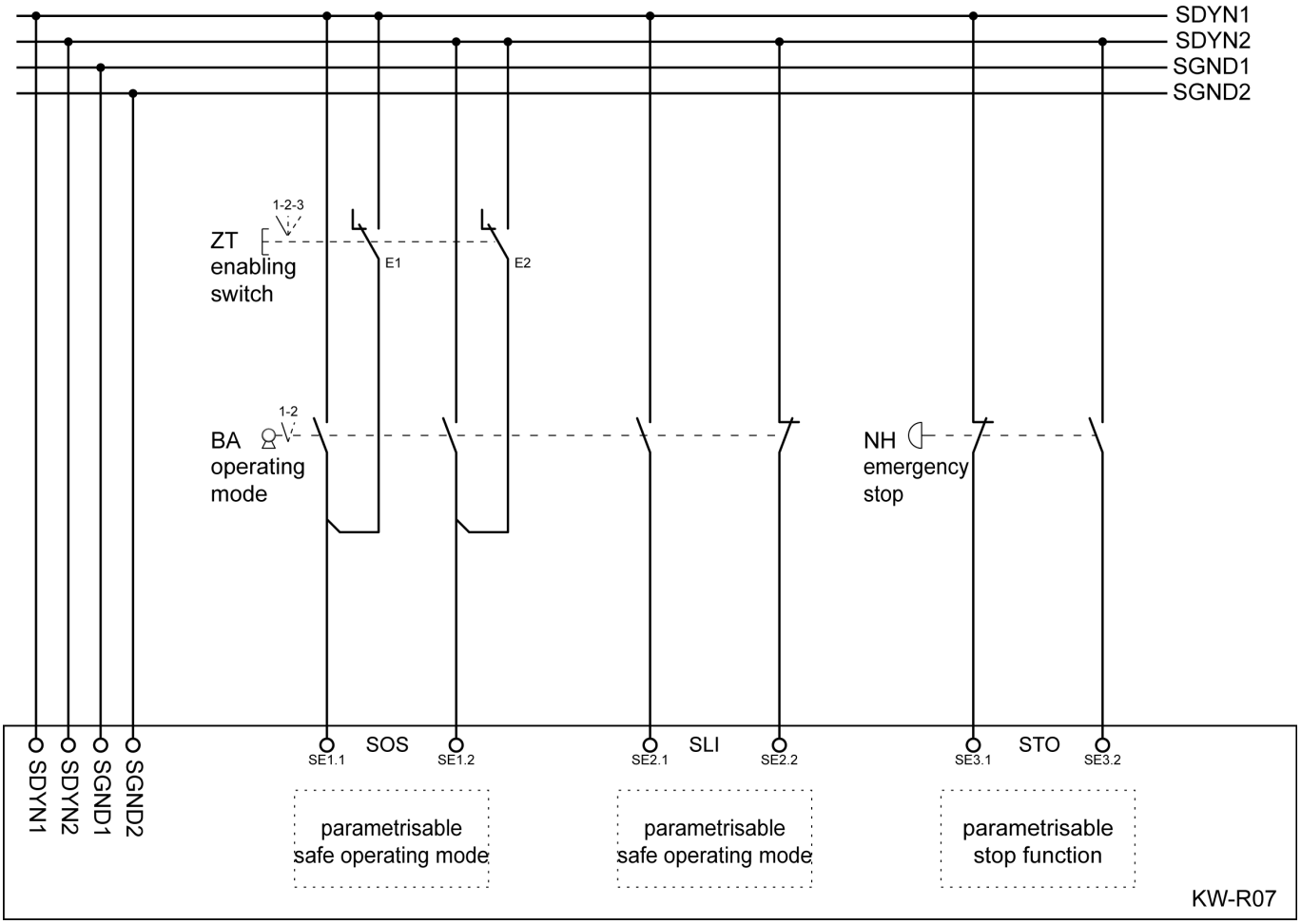
Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm67	'SMS safe maximum speed'	N(max,SMS)	1/min	3000	-
Prm68	'SMS error reaction'	SMS_ERR	-	1	SS1

4.2.2 Relevant unsafe parameters

Parameter	Name	Unit	Min	Max	Default	Value *)
ID32781	'Deceleration ramp'	ms	1	1200000	100	300
ID32782	'Deceleration ramp RF inactive'	ms	1	1200000		300
ID33203	'Safety bits'	-	0	0xFFFF	0x0001	0x0001

*) The column 'value' contains the values of this application example.

4.2.3 Wiring example



4.3 Guard door

Task

- With the operating mode switch, the machine is switched over from operating mode 'setting' to 'automatic'
- Operation mode 'automatic'
  - In automatic mode, if the guard door is closed and locked, the drive is monitored for 'Safe maximum speed (SMS)'.
  - If automatic mode is selected but the guard door is not closed, the drive is additionally monitored for 'Safely-limited speed 2 (SLS2)'.
- Operation mode 'setting'
  - In setting mode, if the guard door is unlocked but closed, the drive is monitored for 'Safely-limited speed 1 (SLS1)'.
  - In service mode, if the guard door is unlocked and opened, the drive is monitored for 'Safely-limited speed 2 (SLS2)'.
- If the emergency stop push-button on safety input SE3 is pressed, the drive must be switched torque free immediately by use of 'Safe torque off (STO)'.

Safety functions

Safety input	Function
SE1	SLS1
SE2	SLS2
SE3	STO

Normal operation:

Operating mode switch = automatic, guard door closed and locked

'Safe maximum speed (SMS)'

Properties

- Special case of the SSR safety function according to DIN EN 61800-5-2:2008-04.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The SMS safety function is automatically started after the system booting and cannot be deactivated.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe stop 1 (SS1)' was selected.
- The speed adjustment must be initiated by the user's control unit.

Safe operating modes:

Operating mode switch = setting, guard door closed

'Safely-limited speed 1 (SLS1)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Parameterisable safe speed range.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The parameterised speed limit is automatically used as positive and negative speed limit value.
- 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 started by the user's control unit.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe stop 1 (SS1)' was selected.
- The safety function SLS1 is started by level 0 at the safety input SE1.

Operating mode switch = setting or automatic, guard door opened

'Safely-limited speed 2 (SLS2)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Parameterisable safe speed range.
- Safe 2-channel monitoring of the actual speed value.

Description:

- The parameterised speed limit is automatically used as positive and negative speed limit value.
- 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 started by the user's control unit.
- As soon as the started safety function registers that the limits of the monitored values are exceeded, the drive executes the parameterised save stop function.
- In this application example, 'Safe stop 1 (SS1)' was selected.
- The safety function SLS2 is started by level 0 at the safety input SE2.

Safe stop functions:

'Safe torque off (STO)'

Properties:

- Safety function acc. 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.
- Stop functions are prioritised over other safety functions.

Description

- Safe stop functions are edge-sensitive and cannot be interrupted.
- Protection against unexpected start of the motor.

'Safe stop 1 (SS1)'

Properties:

- Safety function acc. to DIN EN 61800-5-2:2008-04.
- Controlled stop according to EN 60204-1, stop category 1.
- Safe monitoring of the deceleration procedure.
- Safe 2-channel monitoring of the actual speed value.
- Protection against restart.
- Stop functions are prioritised over other safety functions.

Description:

- Safe stop functions are edge-sensitive and cannot be interrupted.
- The initialised safety function monitors the deceleration procedure of the drive and subsequently transfers the drive into 'Safe torque off (STO)'.
- 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)' and an error message is sent.
- The deceleration procedure is automatically initiated by the safety function or by the user's control unit.
- In this application example, the deceleration procedure is initiated by the user's control unit
- In this application example, the safety function SS1 is started in case of error of the safety functions SMS, SLS1 and SLS2.

Function table

Operating mode switch	**Guard door**	**SE1**	**SE2**	**SE3** Stop function	**Safety function**
Automatic	Closed and locked	Inactive	Inactive	Inactive	'Safe maximum speed (SMS)'
Automatic	Opened	Inactive	Active	Inactive	'Safely-limited speed 2 (SLS2)'
Setting	Closed	Active	Inactive	Inactive	'Safely-limited speed 1 (SLS1)'
Setting	Opened	Active	Active	Inactive	'Safely-limited speed 2 (SLS2)'
Any state	Any state	-	-	Activated	'Safe torque off (STO)'

Notes on structure and wiring

All established standards and guidelines as well as instructions of the manufacturer of the safety elements must be observed.

4.3.1 Relevant safe parameters

The parameters of the groups 'Safety Settings', Safety IOs' and 'Safe maximum speed (SMS)' are active at any time and cannot be switched off.

Safety settings

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm2	'Switch-off threshold position'	Pos_Diff	Inkr	100	-
Prm3	'Switch-off threshold velocity'	Vel_Diff	1/min	20	-
Prm4	'Channel 1 encoder type'	Enc_Ch1	-	0	Resolver
Prm5	'Channel 2 encoder type'	Enc_Ch2	-	0	Resolver
Prm6	'Sine encoder period'	Enc_Per	-	128	-
Prm7	'Commanding'	Cmd_Src	-	1	inputs SE1..SE3
Prm8	'Output control'	Out_Src	-	1	system
Prm9	'Transition time in case of standstill'	T(warn)	min	360	-
Prm10	'Reaction time in case of standstill'	T(err)	min	120	-

Safety IOs

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm15	'SE1 safety function'	SF_SE1	-	12	SLS1
Prm16	'SE2 safety function'	SF_SE2	-	13	SLS2
Prm17	'SE3 emergency stop function'	StF_SE3	-	0	STO
Prm69	'SE1 dynamic sampling'	SE1_DYN	-	1	active dynamic sampling
Prm70	'SE1 input level'	SE1_INV	-	1	inverted input level
Prm71	'SE1.1 dynamic sampling impulse duration'	SE1.1_Puls	µs	1000	-
Prm72	'SE1.1 dynamic sampling period'	SE1.1_Time	ms	50	-
Prm73	'SE1.2 dynamic sampling impulse duration'	SE1.2_Puls	µs	2000	-
Prm74	'SE1.2 dynamic sampling period'	SE1.2_Time	ms	100	-
Prm75	'SE2 dynamic sampling'	SE2_DYN	-	1	active dynamic sampling
Prm76	'SE2 input level'	SE2_INV	-	0	identical input level
Prm77	'SE2.1 dynamic sampling impulse duration'	SE2.1_Puls	µs	1000	-
Prm78	'SE2.1 dynamic sampling period'	SE2.1_Time	ms	50	-
Prm79	'SE2.2 dynamic sampling impulse duration'	SE2.2_Puls	µs	2000	-
Prm80	'SE2.2 dynamic sampling period'	SE2.2_Time	ms	100	-
Prm81	'SE3 dynamic sampling'	SE3_DYN	-	1	active dynamic sampling
Prm82	'SE3 input level'	SE3_INV	-	1	inverted input level
Prm83	'SE3.1 dynamic sampling impulse duration'	SE3.1_Puls	µs	1000	-
Prm84	'SE3.1 dynamic sampling period'	SE3.1_Time	ms	50	-

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm85	'SE3.2 dynamic sampling impulse duration'	SE3.2_Puls	µs	2000	-
Prm86	'SE3.2 dynamic sampling period'	SE3.2_Time	ms	100	-
Prm87	'SA1 dynamic sampling'	SA1_DYN	-	1	active dynamic sampling
Prm88	'SA1.1 dynamic sampling impulse duration'	SA1.1_Puls	µs	1000	-
Prm89	'SA1.1 dynamic sampling period'	SA1.1_Time	ms	50	-
Prm90	'SA1.2 dynamic sampling impulse duration'	SA1.2_Puls	µs	2000	-
Prm91	'SA1.2 dynamic sampling period'	SA1.2_Time	ms	100	-
Prm92	'SA1 output level'	SA1.2_INV	-	1	inverted output level
Prm99	'SDYN1 dynamic sampling impulse duration'	SDYN1_ Puls	µs	1000	-
Prm100	'SDYN1 dynamic sampling period'	SDYN1_ Time	ms	50	-
Prm101	'SDYN2 dynamic sampling impulse duration'	SDYN2_ Puls	µs	2000	-
Prm102	'SDYN2 dynamic sampling period'	SDYN2_ Time	ms	100	-
Prm104	'SA1.2 output type'	SA1.2_ Outputtype	-	1	Load connected to SA1.1

Safe stop 1 (SS1)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm18	'SS1 transition period'	T(d,SS1)	ms	500	-
Prm20	'SS1 brake ramp time'	T(SS1)	ms	500	-
Prm21	'SS1 safe speed standstill window'	N(zero,SS1)	1/min	10	-

Safely-limited speed 1 (SLS1)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm54	'SLS1 transition period'	T(d,SLS1)	ms	500	-
Prm56	'SLS1 brake ramp time'	T(SLS1)	ms	500	-
Prm57	'SLS1 safe limit speed'	N(limit,SLS1)	1/min	200	-
Prm58	'SLS1 error reaction'	SLS1_ERR	-	1	SS1

Safely-limited speed 2 (SLS2)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm59	'SLS2 transition period'	T(d,SLS2)	ms	500	-
Prm61	'SLS2 brake ramp time'	T(SLS2)	ms	500	-
Prm62	'SLS2 safe limit speed'	N(limit,SLS2)	1/min	60	-
Prm63	'SLS2 error reaction'	SLS2_ERR	-	1	SS1

Safe maximum speed(SMS)

Parameter	Name	Code	Unit	Application-specific settings	
				Value	SafePMT selection
Prm67	'SMS safe maximum speed'	N(max,SMS)	1/min	3000	-
Prm68	'SMS error reaction'	SMS_ERR	-	1	SS1

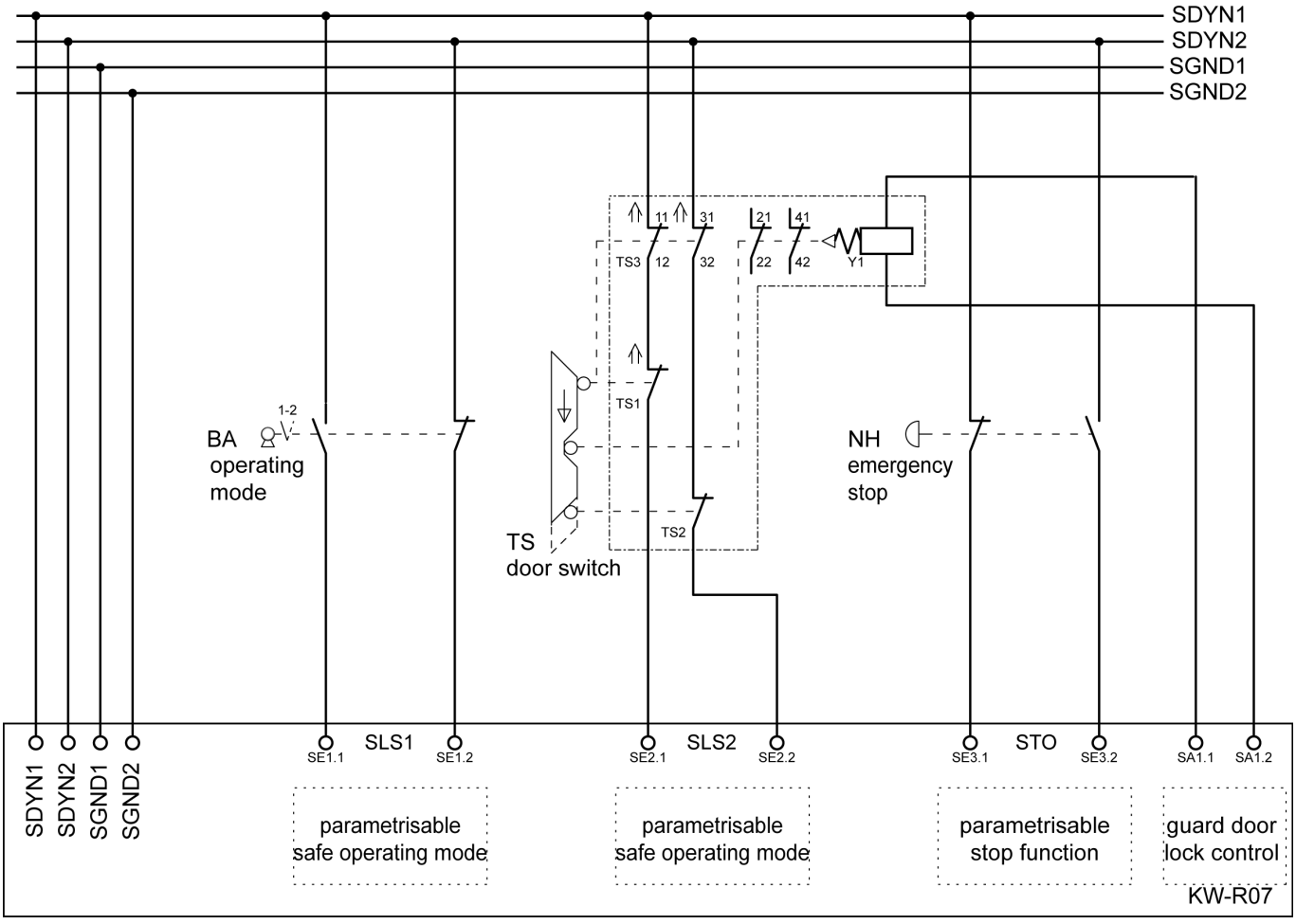
*) The column 'value' contains the values of this application example.

4.3.2 Relevant unsafe parameters

Parameter	Name	Unit	Min	Max	Default	Value *)
ID32781	'Deceleration ramp'	ms	1	1200000	100	300
ID32782	'Deceleration ramp RF inactive'	ms	1	1200000	100	300
ID33203	'Safety bits'	-	0	0xFFFF	0x0001	0x0001

*) The column 'value' contains the values of this application example.

4.3.3 Wiring example



5 Reference lists

5.1 AMK components

Description	Type	Part no.	Firmware	Part no.
Software package safety KW-R07 V1.04 2013/16	-	204543	-	-
Compact power supply	KEN5	E793	KE-E03 V3.04 2013/03	204405
Compact inverter	KW5	E767	-	-
Controller card	KW-R07	O807	AER5-6_SW V1.10 2013/15	204486
			AESF1_SW V1.04 2013/16	204502
Controller	A5D-M00-07T	E897	A5 V4.05 2012/13	204071
Motor	DT4-1-10-ROO	D740AD	-	-

5.2 Third-party components for 'safe stop functions'

State: 4. quarter 2012

Component	Type	Order no.	Manufacturer / supplier	Safety category / standard	Remarks
Emergency stop button	Series KOMBITAST-R	KRFV	Schlegel	EN 60947 part 5-1	release by twist, anti-lock collar
Module holder 3 elements	Series contact blocks M	MHR_3	Schlegel		module holder for emergency stop
Self-monitoring emergency contact block 1nc+1no	Series contact blocks M	MTOSFE	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection
Contact block 1no	Series contact blocks M	MTI	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection

5.3 Third-party components for 'operating mode switch'

State: 4. quarter 2012

Component	Type	Order no.	Manufacturer / supplier	Safety category / standard	Remarks
Operating mode switch	Series KOMBITAST-R	KRSSA15E	Schlegel	EN 60947 part 5-1	key actuator, 2 switch positions, key can be removed in any position
Emergency stop button	Series KOMBITAST-R	KRFV	Schlegel	EN 60947 part 5-1	release by twist, anti-lock collar
Module holder 3 elements	Series contact blocks M	MHR_3	Schlegel		module holder for emergency stop and operating mode switch
Self-monitoring emergency contact block 1nc+1no	Series contact blocks M	MTOSFE	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection
Contact block 1no	Series contact blocks M	MTI	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection

5.4 Third-party components for 'enabling switch'

State: 4. quarter 2012

Component	Type	Order no.	Manufacturer / supplier	Safety category / standard	Remarks
Enabling switch	ZSM4204-105645	105645	Euchner	EN 60947 part 5-1	3-step function, emergency stop device, coiled connection cable, flying lead
Operating mode switch	Series KOMBITAST-R	KRSSA15E	Schlegel	EN 60947 part 5-1	key actuator, 2 switch positions, key can be removed in any position
Emergency stop button	Series KOMBITAST-R	KRFV	Schlegel	EN 60947 part 5-1	release by twist, anti-lock collar
Module holder 3 elements	Series contact blocks M	MHR_3	Schlegel		module holder for emergency stop
Module holder 5 elements	Series contact blocks M	MHR_5	Schlegel		module holder for operating mode switch
Self-monitoring emergency contact block 1nc+1no	Series contact blocks M	MTOSFE	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection
Contact block 1no	Series contact blocks M	MTI	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection
Contact block 1nc	Series contact blocks M	MTO	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection

5.5 Third-party components for 'guard door'

State: 4. quarter 2012

Component	Type	Order no.	Manufacturer / supplier	Safety category / standard	Remarks
Safety switch with guard locking and guard locking monitoring	STP3A-4141A024M	099272	Euchner	EN 60947 Teil 5-1 EN 1088	guard door: closed-circuit principle, guard locking by spring tension. door contact (nc): Release by applying voltage to the guard locking solenoid. 4 nc, thereof 2 nc as door contacts
Mechanical actuator for safety switch STP3A	S-GT-SN	095738	Euchner		actuator S standard straight with rubber bushings; overtravel 5 mm incl. 2 safety screws M4 x 14
Safety switch	NM11KBA-MC2069	095371	Euchner	EN 60947 Teil 5-1	position monitoring: guard door with roller arm, short housing slow-action switching contact 1 nc + 1 no
Operating mode switch	Series KOMBITAST-R	KRSSA15E	Schlegel	EN 60947 part 5-1	key actuator, 2 switch positions, key can be removed in any position
Emergency stop button	Series KOMBITAST-R	KRFV	Schlegel	EN 60947 part 5-1	release by twist, anti-lock collar
Module holder 3 elements	Series contact blocks M	MHR_3	Schlegel		module holder for emergency stop
Self-monitoring emergency contact block 1nc+1no	Series contact blocks M	MTOSFE	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection

Component	Type	Order no.	Manufacturer / supplier	Safety category / standard	Remarks
Contact block 1no	Series contact blocks M	MTI	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection
Contact block 1nc	Series contact blocks M	MTO	Schlegel	acc. to EN 60947-5-1, appendix K	screw connection

Glossary

A

A4 / A5 / A6
AMKAMAC controller A4 / A5 / A6

B

BA
Operation mode

E

E/A
In- and outputs

F

FSoE
Fail-Safe over EtherCAT

I

I/O
Input / output

K

KEN
AMKASYN compact power supply without recovery

KW
AMKASYN compact inverter

KW-Rxx
AMKASYN controller card for installation into compact inverter

P

PDK_xxxxxx_abcdefgh
Product documentation; xxxxxx - AMK part no. , abcdefgh - name

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

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)

SLS
Safely-limited speed (Safety function acc. to DIN EN 61800-5-2)

SA
Safe output

SEM
Safe encoder monitoring

SE
Safe input

SDI
Safe direction. Safety function acc. to DIN EN 61800-5-2

SafePMT
Safe parameter editor

SSR
Safe speed range (Safety function acc. to DIN EN 61800-5-2)

SLI
Safely-limited increment (Safety function acc. to DIN EN 61800-5-2)

STO
Safe torque off (Safety function acc. to DIN EN 61800-5-2)

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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.

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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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