



Operating instructions for

AX5805 / AX5806

TwinSAFE drive option cards for the AX5000 servo drive

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BECKHOFF

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1 Foreword

1.1 Notes on the manual

1.1.1 Intendent audience

This description is aimed specifically at trained qualified persons with a control and automation technology background, who are familiar with the current national and international standards and guidelines. The following instructions and explanations must be followed during installation and commissioning of the components.

The qualified personnel must ensure that the application of the described products meets all safety requirements, including all applicable laws, specifications, regulations and standards.

1.1.2 Origin of the document

These operating instructions were originally written in German. All other languages are derived from the German original.

1.1.3 Actuality

Please check whether you have the latest and valid version of this document. On the Beckhoff homepage under the link <http://www.beckhoff.de/english/download/twinsafe.htm> you may find the latest version for download. If in doubt, please contact the technical support (see chapter 5.1 Beckhoff Support and Service).

1.1.4 Product properties

Valid are only the product properties that are specified in the respectively current user documentation. Other information, which is given on the product pages of the Beckhoff homepage, in emails or other publications is not relevant.

1.1.5 Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development. For that reason the documentation is not in every case checked for consistency with performance data, standards or other characteristics.

If it should contain technical or editorial errors, we reserve the right to make changes at any time and without notice.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

1.1.6 Trademarks

Beckhoff®, TwinCAT®, EtherCAT®, Safety over EtherCAT®, TwinSAFE® and XFC® are registered trademarks of and licensed by Beckhoff Automation GmbH.

Other designations used in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owners.

1.1.7 Patent Pending

The EtherCAT technology is patent protected, in particular by the following applications and patents: EP1590927, EP1789857, DE102004044764, DE102007017835 with the corresponding applications and registrations in various other countries.

The TwinCAT technology is patent protected, in particular by the following applications and patents: EP0851348, US6167425 with corresponding applications or registrations in various other countries.



EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany

1.1.8 Copyright

© Beckhoff Automation GmbH & Co. KG, Germany.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others without express authorization are prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

1.1.9 Delivery conditions

In addition, the general delivery conditions of the company Beckhoff Automation GmbH & Co. KG apply.

1.2 Safety instructions

1.2.1 Delivery state

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.






1.2.2 Operator's obligation to exercise diligence

The operator must ensure that

- the TwinSAFE products are only used as intended (see chapter Product description);
- the TwinSAFE products are only operated in sound condition and in working order (see chapter Cleaning).
- the TwinSAFE products are operated only by suitably qualified and authorized personnel.
- the personnel is instructed regularly about relevant occupational safety and environmental protection aspects, and is familiar with the operating instructions and in particular the safety instructions contained herein.
- the operating instructions are in good condition and complete, and always available for reference at the location where the TwinSAFE products are used.
- none of the safety and warning notes attached to the TwinSAFE products are removed, and all notes remain legible.

1.2.3 Description of safety symbols

The following safety symbols are used in these operating instructions. They are intended to alert the reader to the associated safety instructions.

| | |
|---|--|
|  DANGER | Serious risk of injury! Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons. |
|  WARNING | Caution - Risk of injury! Failure to follow the safety instructions associated with this symbol endangers the life and health of persons. |
|  CAUTION | Personal injuries! Failure to follow the safety instructions associated with this symbol can lead to injuries to persons. |
|  Attention | Damage to the environment or devices Failure to follow the instructions associated with this symbol can lead to damage to the environment or equipment. |
|  Note | Tip or pointer This symbol indicates information that contributes to better understanding. |

1.2.4 Documentation issue status

| Version | Comment |
|---------|---|
| 1.8.0 | <ul style="list-style-type: none"> Note <i>Restrictions in STO mode</i> extended Updating the foreword Certificate updated Note to EN 61800-5-2:2017 added Note to diagnosis data 0xFA10 added |
| 1.7.0 | <ul style="list-style-type: none"> Extension: notes to SLS, SSM, SSR, SMS, Speed_Compare_Window |
| 1.6.1 | <ul style="list-style-type: none"> Reliability document updated Foreword overworked |
| 1.6.0 | <ul style="list-style-type: none"> Extension: safety-parameter 0x2x20 / 0x2x21 / 0x2x22 Extension: setting the mode of operation Extension: intended use Extension: description of the SOS function Diagram of SLP state adapted Note on SOS function added |
| 1.5.4 | <ul style="list-style-type: none"> Certificate updated |
| 1.5.3 | <ul style="list-style-type: none"> EN 62061:2005 + A1:2013 mentioned |
| 1.5.2 | <ul style="list-style-type: none"> Reliability document added for AX5805 and AX5806 Note about permissible motors revised |
| 1.5.1 | <ul style="list-style-type: none"> Certificate updated |
| 1.5.0 | <ul style="list-style-type: none"> Documentation versions added Company address amended |
| 1.4.0 | <ul style="list-style-type: none"> Extension for AX5806 added |
| 1.3.1 | <ul style="list-style-type: none"> Document origin added |
| 1.3.0 | <ul style="list-style-type: none"> Note on parameter switching for AX5000 added Note on switching the AX5805 to EtherCAT state BOOT Extensions for AX5805 software version 05 Parameter description s_LL_SLI modified |
| 1.2.4 | <ul style="list-style-type: none"> Note on Speed_Compare_Window added |
| 1.2.2 | <ul style="list-style-type: none"> Description of the motor string entry expanded |
| 1.2.0 | <ul style="list-style-type: none"> Description of SDIn corrected in the default mapping control word Description of the parameters for the function SCA expanded Notes on error reaction SS1 added |
| 1.1.1 | <ul style="list-style-type: none"> Tables with axis 1 and 2 information expanded SOS and SLI parameters changed to increments Table with reason for shutdown added |
| 1.1.0 | <ul style="list-style-type: none"> Processing order of the safety functions amended Velocity calculation examples expanded |

| | |
|-------|--|
| 1.0.0 | <ul style="list-style-type: none">• First released version |
|-------|--|

2 System description

With the integration of safety technology in the drive technology, Beckhoff consistently developed the TwinSAFE system philosophy further. TwinSAFE enables integrated automation, ranging from digital inputs and logic systems to drives or digital outputs. Simple handling, diagnostic and support functions help the user to implement the required application quickly and safely.

Significant hazards to persons arise from the dynamic movements of the electrical drive equipment of machines. The controlling of these hazards whilst achieving a smooth production flow is a big challenge.

The Beckhoff servo drives from the AX5xxx series become fully-fledged safety drives with the AX5805/AX5806 TwinSAFE drive option card.

The option card is able to switch the motor torque-free or to monitor speed, position and direction of rotation (in accordance with EN ISO 13849-1:2006 to PLe). No further circuits are necessary for this, such as circuit breakers or contactors in the supply lines or special external encoder systems.

This enables a very lean installation and helps to lower costs and control cabinet space. No special encoder system is required for implementing the functions SDI (Safe Direction) or SLS (Safely-Limited Speed). All Beckhoff motors listed in the documents "AX5805 list of permitted motors" and "AX5806 list of permitted motors" can be used for these functions without additional measures and without additional encoder systems. Even safe position monitoring or position range monitoring is simple to implement with the aid of the AX5805/AX5806 module.

This does not result in any additional wiring, since EtherCAT communication is used in the AX5xxx basic controllers. The AX5805/AX5806 TwinSAFE drive option card is a self-contained EtherCAT Slave and communicates directly via the AX controller with a TwinSAFE logic terminal existing in the network.

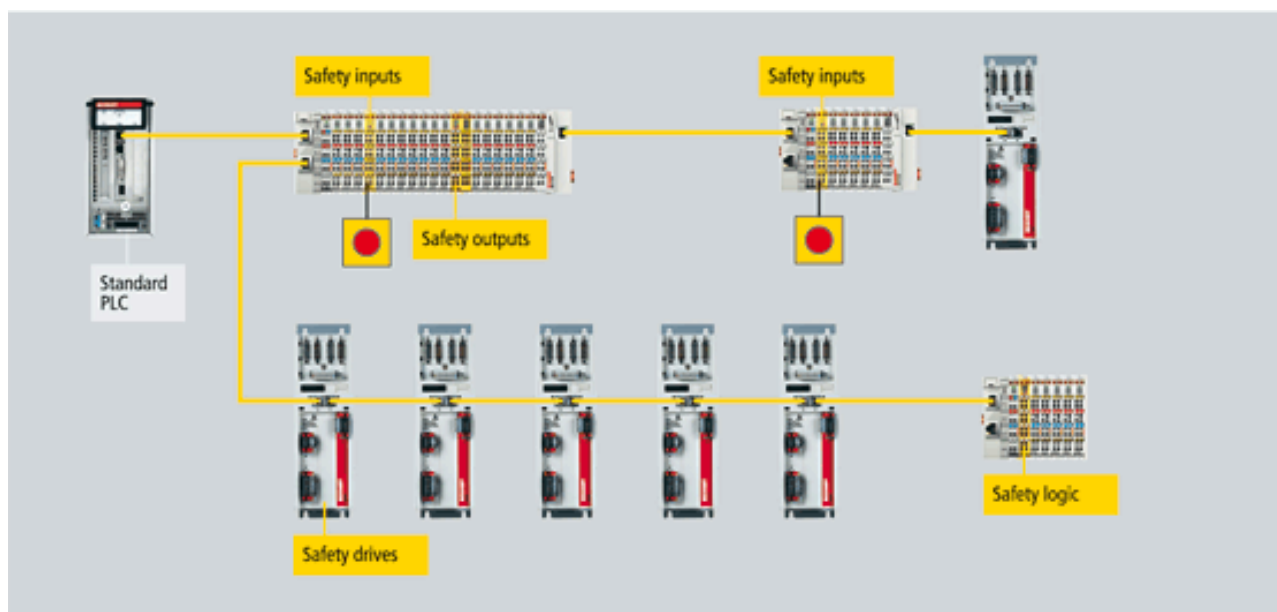


Fig. 1: TwinSAFE system overview

3 Product description

3.1 General description

AX5805/AX5806 – TwinSAFE drive option card for drive controllers from the AX5000 series


The AX5805/AX5806 TwinSAFE drive option card is an optional extension of the Beckhoff AX5000 servo drive series. The following safety functions can be implemented by the installation of the AX5805/AX5806 in the AX5000:


- Stop functions (STO, SOS, SS1, SS2)
- Speed functions (SLS, SSM, SSR, SMS)
- Position functions (SLP, SCA, SLI)
- Acceleration functions (SAR, SMA)
- Direction of rotation functions (SDIp, SDIn)


Like the programming or configuration of the safety application, the entire parameterization of the AX5805/AX5806 option card is performed from the TwinCAT software. All system-specific settings are stored together with the application in the TwinSAFE logic terminal or in the AX5805/AX5806 startup parameters. Therefore an exchange of the AX5805/AX5806 is possible at any time without changing the software. The AX5805/AX5806 receives all necessary parameters at the next switch on or boot-up.

The AX5805/AX5806 fulfils the requirements of IEC 61508:2010 SIL 3, EN 62061:2005 + A1:2013 SILCL3 and DIN EN ISO 13849-1:2006 (Cat 4, PL e).


The AX5805/AX5806 is intended for use in the safety option slot of a servo drive from the AX5000 series.

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|  Attention | <p>Compatibility of AX5000 and AX5805/AX5806</p> <p>The AX5805/AX5806 can be used only in servo drives of the new generation (AX5xxx-0000-x2xx).</p> <p>An attempt to install the AX5805/AX5806 into AX5000 servo drives of an older generation can lead to irreparable damage to the AX5000.</p> |
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|  CAUTION | <p>Supported AX5000 devices: AX5805</p> <p>The AX5805 may only be used in servo drives of types AX5101 to AX5140 and AX5201 to AX5206. Other combinations are not permitted.</p> |
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|---|---|
|  CAUTION | <p>Supported AX5000 devices: AX5806</p> <p>The AX5806 may only be used in servo drives of types AX5160 to AX5172 and AX5190 to AX5193. Other combinations are not permitted.</p> |
|---|---|


3.2 Intended use


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|  WARNING | <p>Observe the intended use!</p> <p>Use of the TwinSAFE drive option card other than for the intended purpose as described below is not permitted!</p> |
|---|---|


The AX5805/AX5806 TwinSAFE drive option card extends the field of use of the Beckhoff AX5000 servo drive by safety functions that allow it to also be used in the field of machine safety.


The following safety measures and safety instructions must be observed when using the TwinSAFE drive option card:


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|  DANGER | <p>Ensure that the power is switched off before installation!</p> <p>The servo drive must be disconnected from the mains and system voltage before installing the TwinSAFE drive option card. Even when the AX5000 is disconnected from the mains voltage, dangerous voltage continues to be present at the X02 terminals of the DC link for at least 5 minutes. Wait until the DC link capacitors are discharged before touching live terminals. The voltage measured between the DC+ and DC- terminals (X02) must have dropped to below 50 V.</p> |
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|  DANGER | <p>Parameter set switching in AX5000!</p> <p>The AX5000 parameter set switching may not be used in conjunction with the AX5805/AX5806.</p> |
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|  WARNING | <p>Caution - Risk of injury!</p> <p>Electronic equipment is not fail-safe. The machine manufacturer is responsible for ensuring that the connected motors and the machine are brought into a safe state in the event of a fault in the drive system.</p> |
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|  WARNING | <p>Check the parameterization of the TwinSAFE drive option card!</p> <p>The TwinSAFE Drive option card determines errors in the parameterization, but no logical testing of the parameters can take place. Hence, it is only possible to ensure that the parameterization is correct for the application by means of a corresponding acceptance test. This test must be performed by the machine manufacturer.</p> <p>In particular the Speed_Compare_Window parameter should be set to the smallest possible value (default: 180 increments). The larger the value for this window, the higher the availability of the drive may be. This parameter has a direct effect on the safety functions (see chapter 3.6.2).</p> <p>In order to set the Speed_Compare_Window as small as possible, the Speed_Compare_Filter can be incremented if necessary (filter steps 1 to 15, default 10).</p> |
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|  WARNING | <p>Provide for external safety measures for the STO function of the TwinSAFE Drive Option card!</p> <p>If the STO safety function is executed, the connected motors are not braked, but are switched torque-free. This leads to the motors coasting to a halt. The duration of this coasting depends on how much kinetic energy is present in the system. With suspended loads the motors may even be accelerated. In order to prevent this, appropriate external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
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|  WARNING | <p>Provide for external safety measures for the error reactions of the TwinSAFE drive option card!</p> <p>The preconfigured error reaction occurs if the TwinSAFE drive option card determines an error. The standard error reaction is STO, but the SS1 error reaction can also be parameterized. The following description applies only to the error reaction, not to the STO and SS1 safety functions.</p> <p>If the STO error reaction is executed, the connected motors are not braked, but are directly switched torque-free. This leads to the motors coasting to a halt. The duration of this coasting depends on how much kinetic energy is present in the system. With suspended loads the motors may even be accelerated. In order to prevent this, appropriate external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> <p>If the SS1 error reaction is executed, the AX5805/AX5806 TwinSAFE Drive option card triggers a stop ramp in the AX5000. This is purely functional and is not designed to be a safety feature. Subsequently, the STO safety function (motors are switched torque-free) is activated after the time set by the ESTOP_Ramp_Time parameter. Any motors that are still moving coast to a halt. With suspended loads the motors may even be accelerated. In order to avoid inadvertent movements, external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
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|  WARNING | <p>Avoid line interruptions!</p> <p>Line interruptions lead to switch-off. The AX5805/AX5806 switches the motors of the AX5000 servo drive torque-free. Any motors that are still moving coast to a halt. With suspended loads the motors may even be accelerated. In order to avoid inadvertent movements, external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
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|  WARNING | <p>Avoid faults and interruptions in the EtherCAT communication!</p> <p>Faults and interruptions in the EtherCAT communication lead to switch-off. The AX5805/AX5806 switches the motors of the AX5000 servo drive torque-free. Any motors that are still moving coast to a halt. With suspended loads the motors may even be accelerated. In order to avoid inadvertent movements, external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
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|  WARNING | <p>Activation or restart of a project in the TwinCAT System Manager</p> <p>The activation or restart of a project in the TwinCAT System Manager leads to switch-off. The AX5805/AX5806 switches the motors of the AX5000 servo drive torque-free. Any motors that are still moving coast to a halt. With suspended loads the motors may even be accelerated. In order to avoid inadvertent movements, external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
|  WARNING | <p>Downloading the safety project to the EL6900 TwinSAFE-Logic leads to switch-off!</p> <p>Downloading the safety project to the EL6900 TwinSAFE-Logic leads to switch-off. The AX5805/AX5806 switches the motors of the AX5000 servo drive torque-free. Any motors that are still moving coast to a halt. With suspended loads the motors may even be accelerated. In order to avoid inadvertent movements, external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
|  WARNING | <p>Avoid incorrect parameterization of the servo drive!</p> <p>Incorrect parameterization of the servo drive (e.g. current controller oscillates or is too lethargic) leads to switch-off. The AX5805/AX5806 switches the motors of the AX5000 servo drive torque-free. Any motors that are still moving coast to a halt. With suspended loads the motors may even be accelerated. In order to avoid inadvertent movements, external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
|  WARNING | <p>Avoid incorrect dimensioning of the servo drive!</p> <p>Loads that cannot be braked by the AX5000 servo drive (e.g. if the AX5000 servo drive is under-dimensioned) lead to switch-off. The AX5805/AX5806 switches the motors of the AX5000 servo drive torque-free. Any motors that are still moving coast to a halt. With suspended loads the motors may even be accelerated. In order to avoid inadvertent movements, external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
|  WARNING | <p>Changing the EtherCAT status</p> <p>If the AX5805/AX5806 is switched to EtherCAT state BOOT, the stop paths are switched off immediately, and the brake control remains in its current state. This may result in the brake not engaging, even when the axis is at a standstill.</p> <p>In general, the axis should be brought into a safe state before the EtherCAT status is changed. If this is not done, the axis is switched torque-free immediately.</p> |



Follow the machinery directive!

The TwinSAFE Drive option cards may be used in machines only as defined in the machine directive.




Ensure traceability!

The buyer has to ensure the traceability of the device via the serial number.

3.3 Technical data

| Product designation | AX5805 / AX5806 |
|--|---|
| Error reaction time | see tables in chapter 3.3.1 and 3.3.2 |
| Safety input process image (dependent on the AX5000) | 7 bytes (AX51XX) or 11 bytes (AX52XX) |
| Safety output process image (dependent on the AX5000) | 7 bytes (AX51XX) or 11 bytes (AX52XX) |
| Standard input process image (dependent on the AX5000) | 8 bytes (AX51XX) or 16 bytes (AX52XX) |
| Standard output process image (dependent on the AX5000) | 8 bytes (AX51XX) or 16 bytes (AX52XX) |
| Supply voltage of the AX5805 | Supplied by the AX5000 servo drive |
| Dimensions (W x H x D) including cover plate | 26 mm x 100 mm x 54 mm |
| Weight | approx. 75 g |
| Permissible ambient temperature (operation) | 0°C to +50°C |
| Permissible ambient temperature (transport/storage) | -25°C to +70°C |
| Permissible air humidity | 5% to 95%, non-condensing |
| Permissible air pressure (operation/storage/transport) | 750 hPa to 1100 hPa (this corresponds to a height of approx. -690 m to 2450 m over sea level assuming an international standard atmosphere) |
| Permissible level of contamination | Contamination level 2 according to EN 61800-5-1 (see also chapter Cleaning) |
| Impermissible operating conditions | TwinSAFE products must not be used under the following operating conditions: <ul style="list-style-type: none"> - under the influence of ionizing radiation (that exceeds the level of the natural environmental radiation) - in corrosive environments - in an environment that leads to unacceptable soiling of the component |
| EMC immunity / emission | conforms to EN 61800-5-1 / EN 61326-3-1 |
| Protection class | IP20 |
| Permitted operating environment | control cabinet or terminal box, with minimum protection class IP54 according to IEC 60529 |
| Permissible installation position | vertical |
| Approvals | CE, TÜV SÜD |

Please ensure that the TwinSAFE option cards are only transported, stored and operated under the specified conditions (see technical data)!

| | |
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|  WARNING | <p>Caution - Risk of injury!</p> <p>The TwinSAFE drive option cards may not be used under the following operating conditions:</p> <ul style="list-style-type: none"> • under the influence of ionizing radiation (that exceeds the level of the natural environmental radiation) • in corrosive environments • in an environment that would lead to impermissible contamination of the TwinSAFE Drive option cards |
|---|--|

3.3.1 Reaction times in the AX51xx servo drive

The measurement of the reaction times takes place from the input of the request to the AX5805/AX5806 until the switching off of the internal switch-off paths. If the TwinSAFE communication is to be included in the calculation, the watchdog time of the TwinSAFE connection must be added to this. For a worst-case consideration, the maximum time with update of the CoE data must always be used. This information is provided in the following table.

Firmware ≤ 04

| Operating mode | Minimum reaction time | Maximum reaction time |
|-----------------------|-----------------------|-----------------------|
| STO-MODE | 18 ms | 36 ms |
| Default process data | 22 ms | 44 ms |
| Extended process data | 23 ms | 46 ms |

Firmware > 04 (Revision number ≥ AX5805-0000-0017)

| Operating mode | Minimum reaction time | Maximum reaction time |
|-----------------------|-----------------------|-----------------------|
| STO-MODE | 15 ms | 30 ms |
| Default process data | 34 ms | 68 ms |
| Extended process data | 34 ms | 68 ms |

3.3.2 Reaction times in the AX52xx servo drive


The measurement of the reaction times takes place from the input of the request to the AX5805 until the switching off of the internal switch-off paths. If the TwinSAFE communication is to be included in the calculation, the watchdog time of the TwinSAFE connection must be added to this. For a worst-case consideration, the maximum time with update of the CoE data must always be used. This information is provided in the following table.

Firmware ≤ 04

| Operating mode | Minimum reaction time | Maximum reaction time |
|-----------------------|-----------------------|-----------------------|
| STO-MODE | 39 ms | 78 ms |
| Default process data | 47 ms | 94 ms |
| Extended process data | 48 ms | 96 ms |

Firmware > 04 (Revision number ≥ AX5805-0000-0017)

| Operating mode | Minimum reaction time | Maximum reaction time |
|-----------------------|-----------------------|-----------------------|
| STO-MODE | 15 ms | 30 ms |
| Default process data | 34 ms | 68 ms |
| Extended process data | 34 ms | 68 ms |

| | |
|--|--|
|  Note | <p>STO mode times</p> <p>The STO mode times are only applicable, if both axes are operated in STO mode.</p> |
|--|--|


3.4 Installation

3.4.1 Safety instructions


Before installing and commissioning the TwinSAFE drive option cards, please also read the safety instructions in the foreword of this documentation.

3.4.2 Transport / storage

For storage and transport of the digital TwinSAFE Drive option cards, use the original packaging in which they were delivered.


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|  CAUTION | <p>Note the specified environmental conditions</p> <p>Please ensure that the digital TwinSAFE option cards are only transported and stored under the specified environmental conditions (see technical data).</p> |
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3.4.3 Installation of the AX5805/AX5806

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|---|---|
|  DANGER | <p>Ensure that the power is switched off before installation!</p> <p>Before installing the Safety-Card disconnect the servo drive from the mains and system voltage. Even when the AX5000 is disconnected from the mains voltage, dangerous voltage continues to be present at the X02 terminals of the DC link for at least 5 minutes. Wait until the DC link capacitors are discharged before touching live terminals. The voltage measured between the DC+ and DC- terminals (X02) must have dropped to below 50 V.</p> |
|---|---|

3.4.3.1 Condition for the installation

The AX5805 can be used only in servo drives of the new generation (AX5xxx-0000-x2xx).

| | |
|---|--|
|  Attention | <p>Compatibility of AX5000 and AX5805/AX5806</p> <p>An attempt to install the AX5805/AX5806 into AX5000 servo drives of an older generation can lead to irreparable damage to the AX5000.</p> |
|---|--|

3.4.3.2 Setting the TwinSAFE address of the AX5805/AX5806

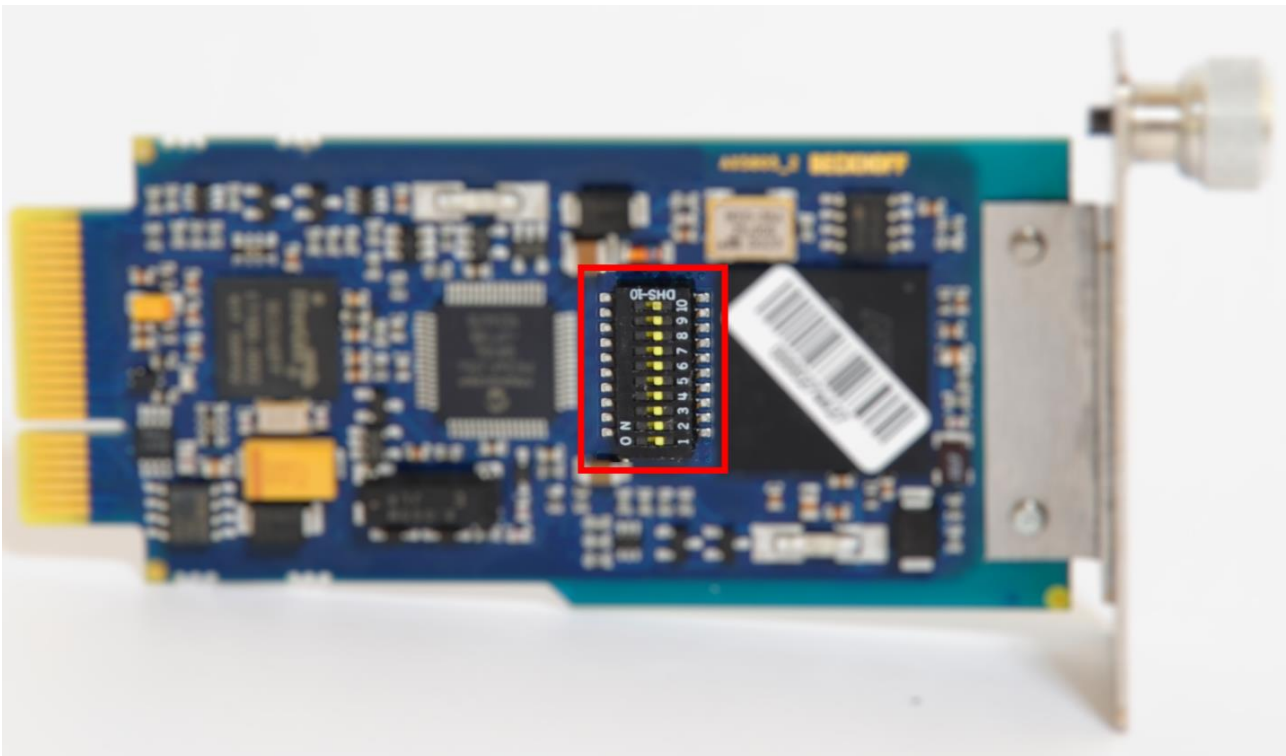



Fig. 2: DIP switch for setting the TwinSAFE address

You must set a unique TwinSAFE address using the 10-way DIP switch on the AX5805/AX5806 TwinSAFE drive option card. TwinSAFE addresses between 1 and 1023 are available. Address 0 is not permitted.

| DIP switch | | | | | | | | | | Address |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 1 |
| OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 2 |
| ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 3 |
| OFF | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 4 |
| ON | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 5 |
| OFF | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 6 |
| ON | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 7 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ON | ON | ON | ON | ON | ON | ON | ON | ON | ON | 1023 |


| | |
|---|--|
|  WARNING | <p>Assign unique TwinSAFE addresses!</p> <p>Each TwinSAFE address may only be used once within a network! The address 0 is not a valid TwinSAFE address!</p> |
|---|--|

3.4.3.3 Mounting the AX5805/AX5806



Fig. 3: Safety slot in the AX5000


The AX5805/AX5806 is inserted from above into card slot marked "Safety" in the AX5000 servo drive (see Fig. 3: Safety slot in the AX5000) and fixed by the screw.

| | |
|---|--|
|  Attention | Care when installing Insert carefully! Do not use force! |
|---|--|

3.4.3.4 Dismounting the AX5805/AX5806

Undo the screw of the AX5805 and carefully pull on the screw.

3.4.4 Permissible motors

| | |
|---|--|
|  CAUTION | <p>Restrictions in terms of permissible motors</p> <ul style="list-style-type: none"> • The certificate for the AX5805/5806 covers only the motors that are listed in the document "List of permissible motors". • No modifications may be made to the permitted motors • The certificate for the AX5805/5806 does not cover any motors or linear drives that are not listed in the document "List of permissible motors". • The customer must provide proof of the safety level attained for applications with third-party motors. |
|---|--|

Further details and the motor types can be found in the document “AX5805 – List of permissible motors” or “AX5806 – List of permissible motors”. The associated PFH values for a safety-related calculation can also be found in this document.

3.4.5 Firmware

Different safe parameter settings are possible, depending on the firmware installed on the AX5805.

| Firmware AX5805 | Revision number | Firmware AX5000 | Safe Parameter MotorDefaultData (0x2x40) |
|-----------------|------------------|-----------------|--|
| ≤ 04 | AX5805-0000-0016 | variable | according to document AX5805_DefaultMotorValues_de.pdf |
| ≥ 05 | AX5805-0000-0017 | ≥ 2.04 | 0x0000 |

3.5 Configuration of the AX5805 in the TwinCAT System Manager

3.5.1 Configuration requirements

Version 2.11 build 2041 or higher of the TwinCAT automation software is required for configuring the AX5805. The respective current version can be downloaded from the Beckhoff website at www.beckhoff.de. The AX5806 is configured in the same way.

3.5.2 Inserting an AX5805

The AX5805 TwinSAFE Drive option card must be inserted in the System Manager configuration underneath the AX5000 servo drive.

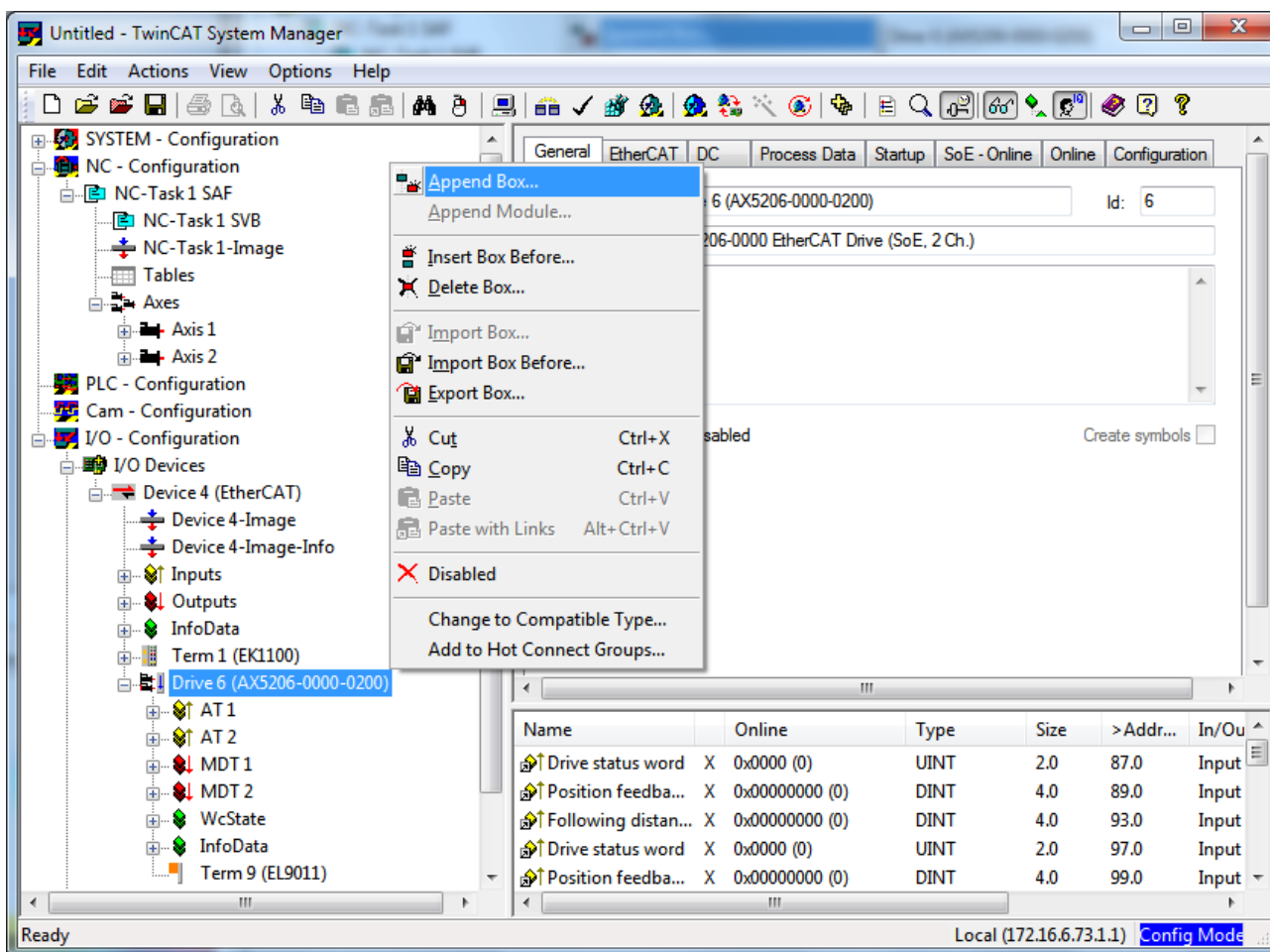


Fig. 4: Addition of an AX5805

Since the software of the AX5805 supports single-channel and two-channel servo drives (AX5000), the AX5805 (Safety Drive Option) must be selected as the basis.

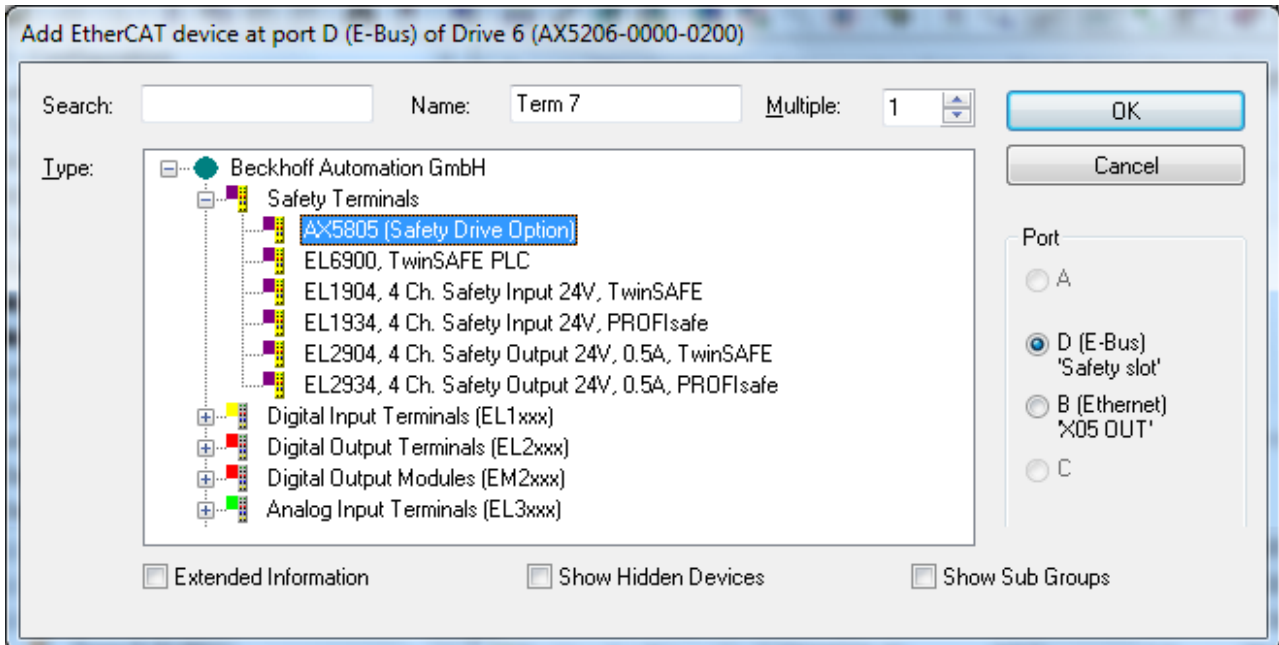


Fig. 5: Selecting the AX5805 as the basis

Depending on the servo drive used (AX5000 single-channel or two-channel), the corresponding modules (single-channel or two channel) must then be inserted. In doing so, care must be taken to insert a safety module and a standard module.

At start-up the AX5805 check whether the modules that have been set match the servo drive.

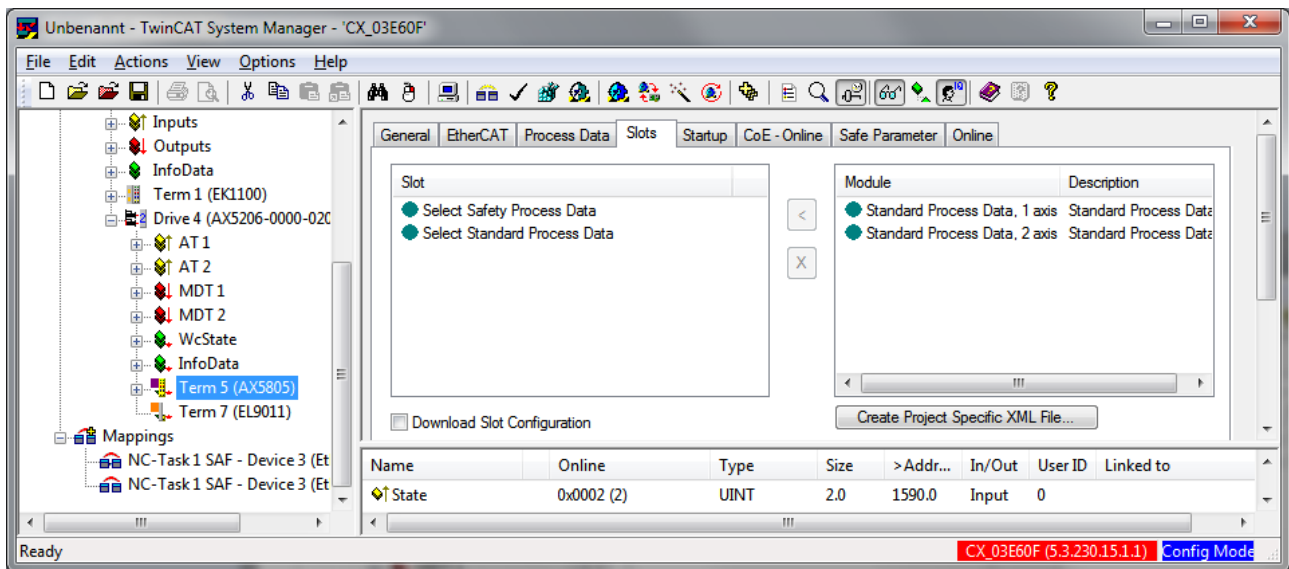


Fig. 6: Inserting the safety module into the AX5805

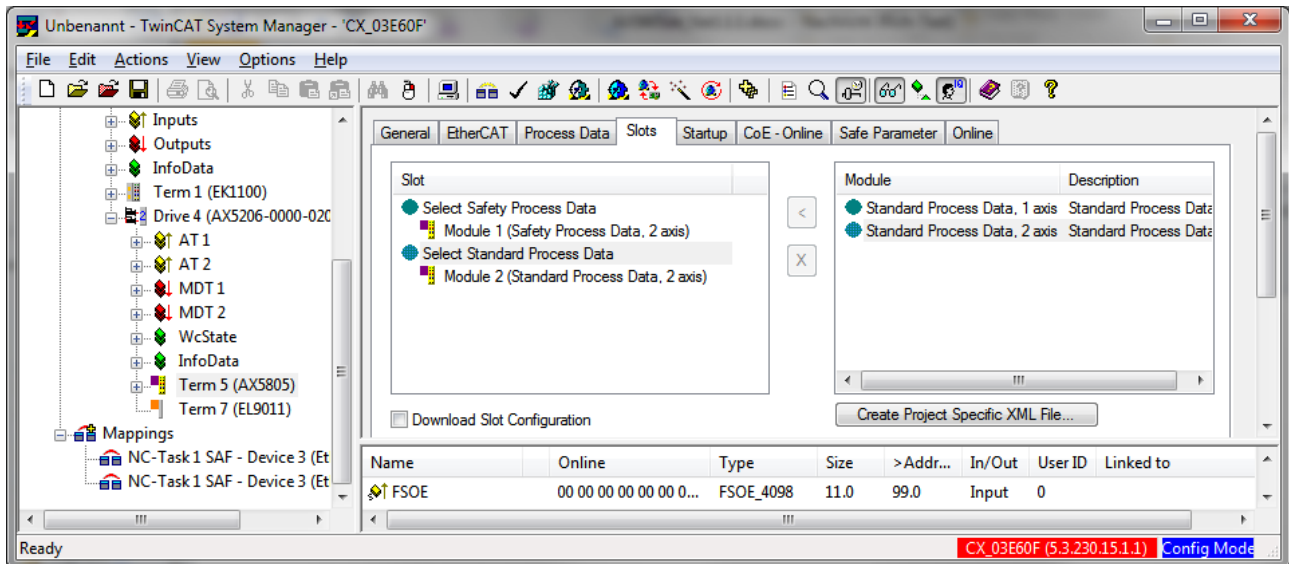


Fig. 7: Inserting the standard module into the AX5805

3.5.3 Registering the TwinSAFE address in the TwinCAT System Manager

The TwinSAFE address set using the DIP switch on the AX5805 TwinSAFE drive option card must also be set on the *Safe Parameter* tab (*FSOE Address* entry).

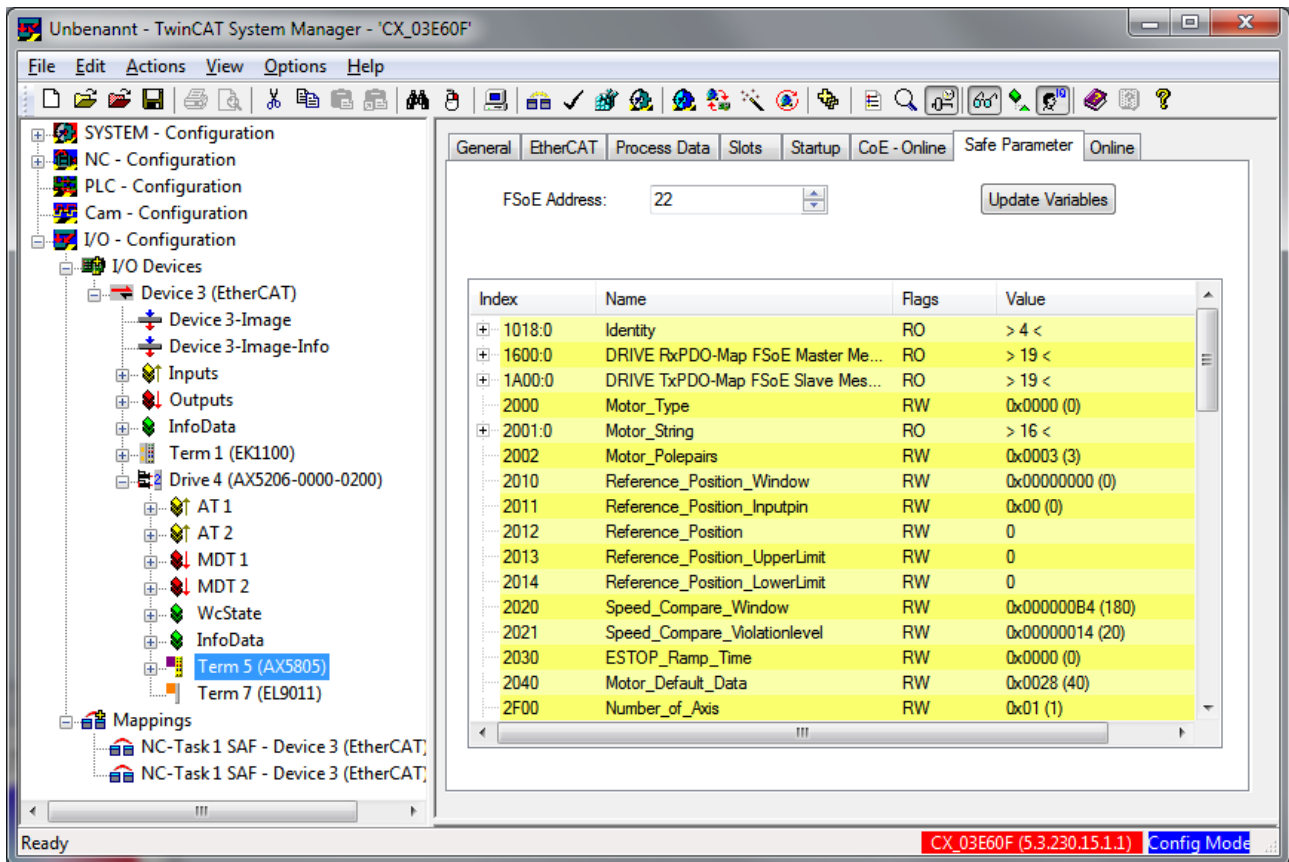


Fig. 8: Registering the TwinSAFE address in the TwinCAT System Manager

3.6 Parameterization of the AX5805/AX5806 in the TwinCAT System Manager

3.6.1 Units and calculations

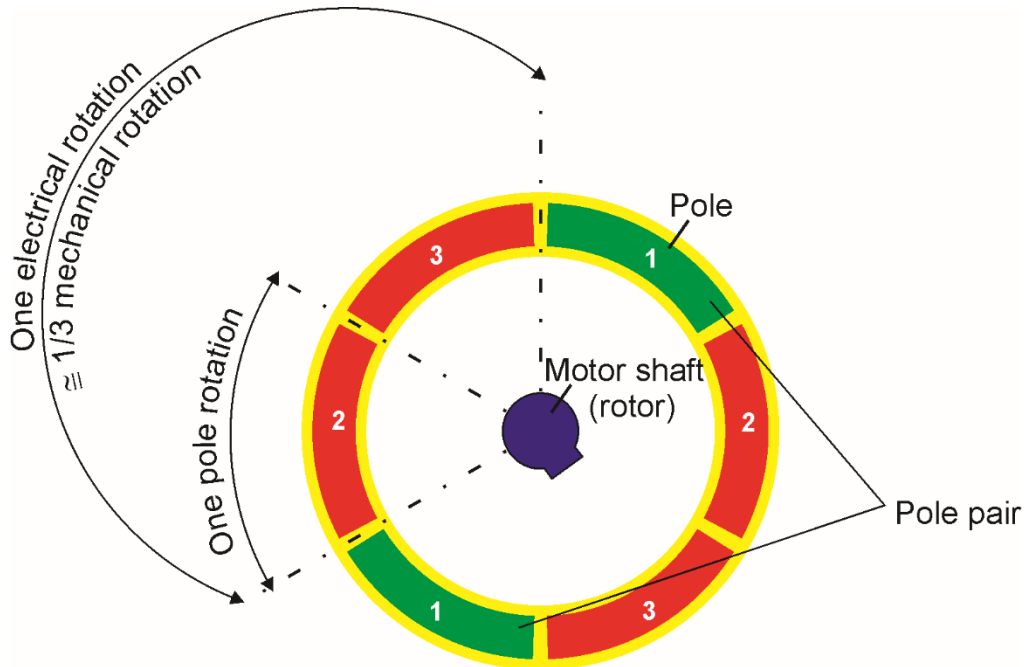


Fig. 9: Units and calculations

Relationship of electrical angle to 1 mechanical motor revolution:

$$1^\circ \text{ electrical angle} = \frac{1^\circ \text{ mechanical angle}}{\text{pole pairs}}$$

Position - increments relationship in mechanical angles:

$$\text{increment} = \frac{\text{pole pairs} * 65536}{360^\circ} * \text{mechanical angle (in } ^\circ \text{)}$$

Example position calculation SOS (AM302x - 3 pole pairs; traversing range - 10 turns):

$$\text{increments} = \frac{3 * 65536}{360^\circ} * 3600^\circ = 1,966,080 \text{ increments}$$

Position window (e.g. for SLP) (pole revolution)

$$\text{pole revolution} = \frac{\text{number of mechanical revolutions}}{\text{pole pairs} * 2} \text{ (Unit: mech. revolutions)}$$

Speed - calculation in increments/ms:

$$\text{increments per ms} = 2 * 65536 * \text{pole pair} * \text{revelutions per ms}$$

Example speed calculation SSR (window between 500 and 250 rpm, AM302x - 3 pole pairs):

$$500 \frac{R}{min} = 8.33 \frac{R}{s} = 0.00833 \frac{R}{ms}$$

$$250 \frac{R}{min} = 4.166 \frac{R}{s} = 0.004166 \frac{R}{ms}$$

$$\text{increments per ms} \left(500 \frac{R}{min} \right) = 2 * 65536 * 3 \frac{incr}{R} * 0.00833 \frac{R}{ms} = 3275 \frac{incr}{ms}$$

$$\text{increments per ms} \left(250 \frac{R}{min} \right) = 2 * 65536 * 3 \frac{incr}{R} * 0.004166 \frac{R}{ms} = 1638 \frac{incr}{ms}$$

Acceleration - calculation in increments/ms²:

$$\text{Increments per ms}^2 = 2 * 65536 * \text{pole pair} * \text{revelutions per ms}^2$$

Example acceleration calculation SAR (AM302x - 3 pole pairs, 100 R / ms²):


$$\text{Increments per ms}^2 = 2 * 65536 * 3 \frac{incr}{R} * 100 \frac{R}{s^2} = 39,321,600 \frac{incr}{s^2} = 39.32 \frac{incr}{ms^2}$$


Calculation - number of pole revolutions corresponding to mechanical revolutions (for SLP)


In this example, the window for SLP should correspond to two mechanical revolutions with a number of 3 pole pairs.

$$\begin{aligned} \text{pole revolution (SLP)} &= \text{mech. revolutions} * \text{pole pairs} * 2 = 2 * 3 * 2 \\ &= 12 \text{ (Unit: pole revolutions)} \end{aligned}$$

3.6.2 Parameterization of the Speed_Compare_Window (0x2020 und 0x2820)

| | |
|---|--|
|  WARNING | <p>Parameters 0x2020, 0x2021 and 0x2022 (0x2820, 0x2821 and 0x2822)</p> <p>Together with the parameters 0x2021/22 and 0x2821/22, the parameters 0x2020 and 0x2820 have a direct influence on the error detection options of the AX5805/AX5806 safety option card.</p> <p>In the default setting, the safe state is adopted for 20 cycles (of 125 µs each) after 180 increments per cycle are exceeded. This state is also reported accordingly in the CoE object 0xFA10.</p> <p>If the axis is optimally adjusted, the number of increments per cycle can be reduced accordingly, as can the number of cycles.</p> <p>A setting of the filter step 0x2022, or 0x2822 respectively, can be helpful here. The value can be set from 1 to 15.</p> <p>The machine manufacturer, or the user respectively, is solely responsible for the correct setting of the values to suit the application, which concerns both the number of increments (0x2x20) and the number of cycles (0x2x21) as well as the filter step (0x2x22). He must ensure that the detection of errors in his application is guaranteed.</p> |
|---|--|

| | |
|--|--|
|  WARNING | <p>Speed-dependent safety functions</p> <p>Speed limits for safety functions, such as SLS, SSM, SSR and SMS, which are below the speed resulting from the Speed_Compare_Window, can not be used.</p> <ul style="list-style-type: none"> • The user has to ensure and check this. • The user must also ensure that the parameterized speed limits are re-evaluated if the Speed_Compare_Window is changed. |
|--|--|

| | |
|---|--|
|  WARNING | <p>Value range for parameters 0x2021 and 0x2821</p> <p>The parameters 0x2021 and 0x2821 have a value range of 1 to 254 cycles. If the parameter is set to 255, the check function is deactivated.</p> |
|---|--|

The Speed_Compare_Window parameter is specified in increments per 125 µs. These increments are converted to revolutions per minute in the following example. A deviation of the speed within these limits will not be reported as an error. If this value is exceeded, a cut-off takes place after the number of 125-µs cycles specified in parameter 0x2021 or 0x2821 respectively.

Calculation with default values

$$SpeedCompareWindow = \frac{0x2020}{65535 * PolePairs} * 8 * 1000 * 60 = \frac{180}{65535 * 5} * 8 * 1000 * 60 = 264 U/min$$

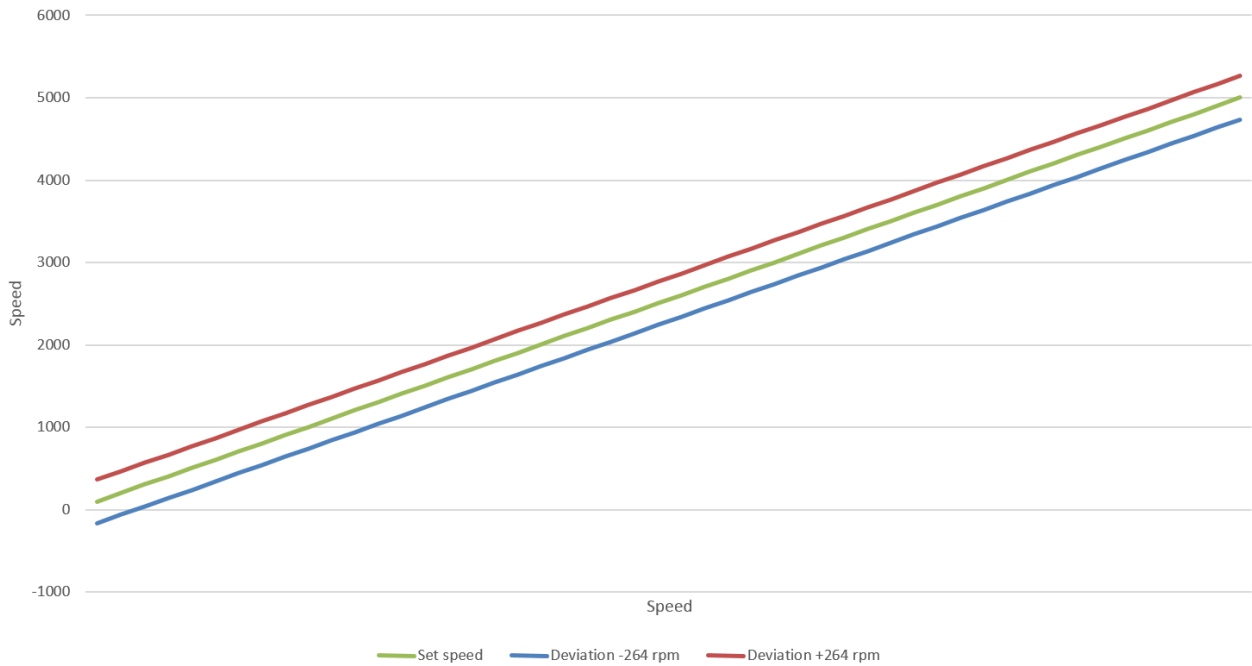


Figure 10: Speed detection and maximum deviation ±264 rpm

Calculation with 0x2020 of 50 increments per 125 μs

$$SpeedCompareWindow = \frac{0x2020}{65535 * PolePairs} * 8 * 1000 * 60 = \frac{50}{65535 * 5} * 8 * 1000 * 60 = 74 U/min$$

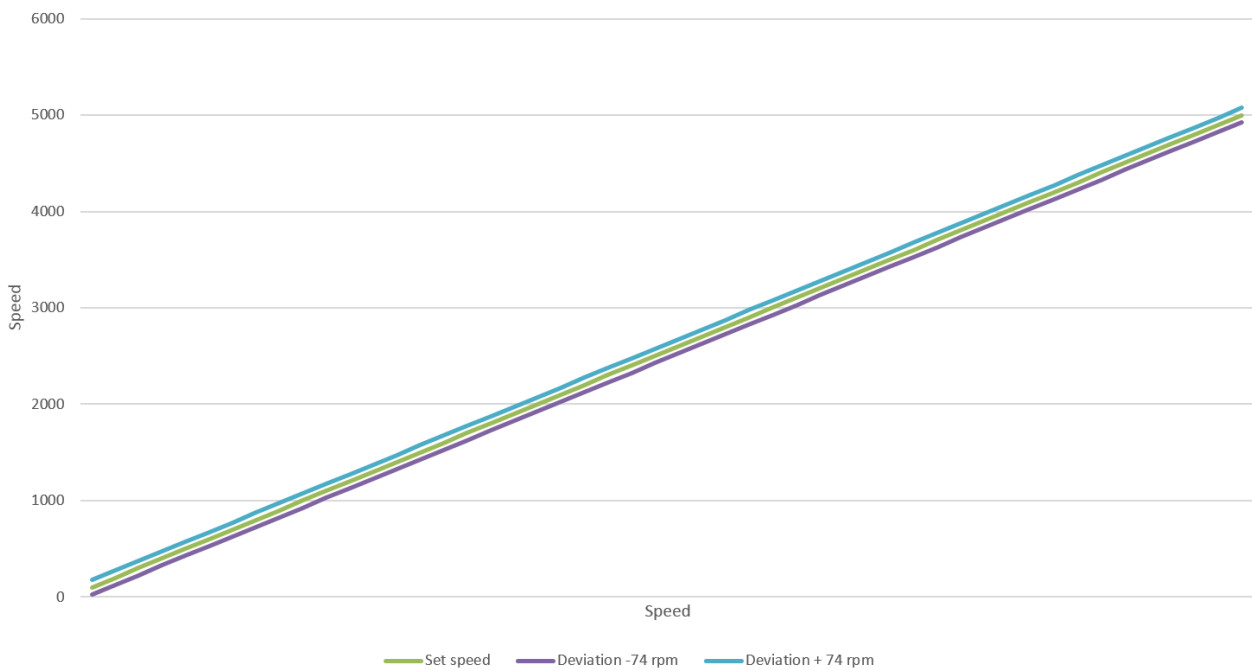



Figure 11: Speed detection and maximum deviation ±74 rpm

Calculation with 0x2020 of 5 increments per 125 µs with SOS at standstill function activated.

With the SOS function activated, a movement of the axis within the set Speed_Compare_Window does not lead to a cut-off as long as the axis is within the position window s_Zero_SOS set for SOS. If the axis moves outside the range s_Zero_SOS, this leads to a cut-off.

If the position value should freeze due to an error of the encoder, a movement will only be detected if a change of position occurs outside the Speed_Compare_Window. The user can calculate the maximum speed using the following equation and evaluate it for his application.

$$Max\ Drehwinkel\ in\ ^\circ\ pro\ s = \frac{0x2020}{65535 * PolePairs} * 8 * 1000 * 360^\circ = \frac{5}{65535 * 5} * 8 * 1000 * 360^\circ = 43,9^\circ /s$$

| | |
|---|---|
|  WARNING | <p>Case of error: encoder signal freezes</p> <p>If the encoder signal should fail (stuck-at error), there is a maximum undetected speed according to the previous calculation.</p> |
|---|---|

3.6.2.1 Parameters 0x2022 and 0x2822 Speed_Compare_Filter

The filter time constant is set in 15 steps via the Speed_Compare_Filter parameter. The sample time is 0.000125 seconds (125 µs).

| Filter step | Filter time constant τ in seconds |
|--------------|-----------------------------------|
| 1 | 0.000125 |
| 2 | 0.0005 |
| 3 | 0.001125 |
| 4 | 0.002375 |
| 5 | 0.00475 |
| 6 | 0.009625 |
| 7 | 0.0195 |
| 8 | 0.039125 |
| 9 | 0.078375 |
| 10 (Default) | 0.157 |
| 11 | 0.314125 |
| 12 | 0.628375 |
| 13 | 1.256875 |
| 14 | 2.514 |
| 15 | 5.028 |


3.6.3 Creation of the process image of the AX5805/AX5806


3.6.3.1 General


The safety functions of the AX5805 are activated or deactivated in the control word and the states of the safety functions are returned in the status word. They each consist of one byte with fixed bit occupancy and one byte with variable bit occupancy.

The mappings for control and status word are set via the objects 0x1600 and 0x1A00 in the *Safe Parameters* of the AX5805/AX5806.

Subsequently, the settings are confirmed by pressing the 'Update Variables' button.

| | |
|---|---|
|  | Creating and changing the process image |
| Note | <p>The creation of the process image should take place if possible before the creation of a Safety PLC project. The links to the Safety PLC are deleted after each change of the process image.</p> |

| | |
|---|---|
|  | Processing sequence of the safety functions |
| Note | <p>The order in which the safety functions are processed matches the order in the control word.</p> |

| | |
|---|--|
|  | Priorities of the safety functions |
| Note | <p>The safety function STO has the highest priority. This means that an enabled safety function, e.g. SLS, can be interrupted at any time through the activation of the safety function STO.</p> |

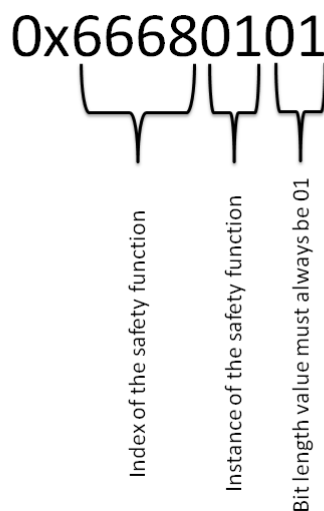



Fig. 12: Example for SOS_1:

| | |
|---|--|
|  | Instance of the safety function |
| Note | <p>For safety functions that have a maximum of one instance, the value for the instance must be set to 0 when setting the mapping.</p> |

3.6.3.2 Control word default mapping for axis 1 (1st byte, fixed occupancy)

Control word default mapping for axis 1 1600:02 – 1600:09

| Bit | Assignment | Possible setting | Default value |
|-----|---------------------------------------|------------------|---------------|
| 0 | Safe Torque Off (Axis 1 STO) | none | 0x66400001 |
| 1 | Safe Stop 1 (Axis 1 SS1_1) | none | 0x66500101 |
| 2 | Safe Stop 2 (Axis 1 SS2_1) | none | 0x66700101 |
| 3 | Safe Operating Stop (Axis 1 SOS_1) | none | 0x66680101 |
| 4 | Safe Speed Range (Axis 1 SSR_1) | none | 0x66800101 |
| 5 | Safe Direction positive (Axis 1 SDIp) | none | 0x66D00001 |
| 6 | Safe Direction negative (Axis 1 SDIn) | none | 0x66D10001 |
| 7 | Error Acknowledge (Axis 1 ErrAck) | none | 0x66320001 |

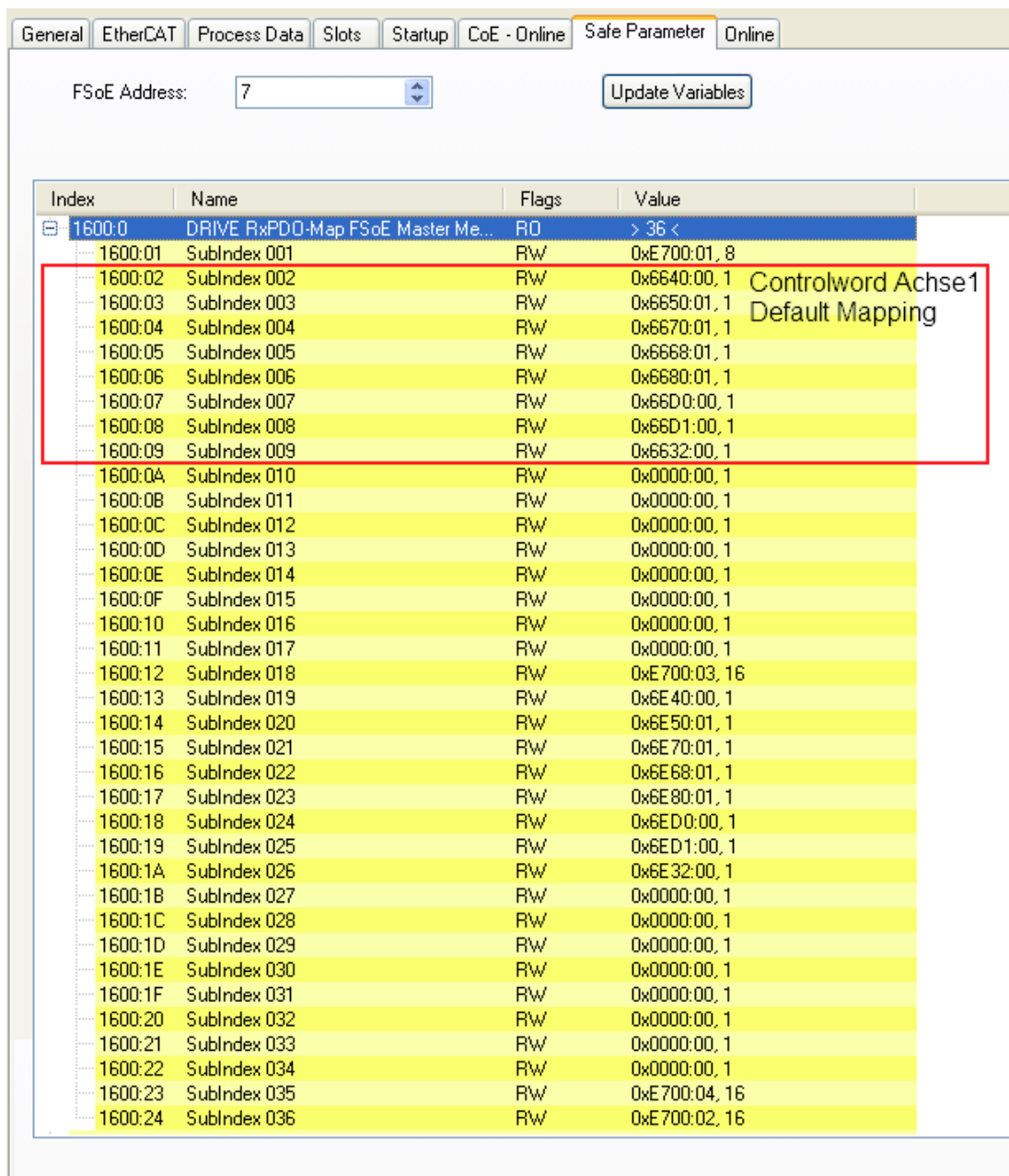


Fig. 13: Control word default mapping for axis 1

Control word user mapping for axis 1 (2nd byte, variable occupancy)

Control word user mapping for axis 1 1600:0A - 1600:11

The bits in the variable range of the control word for axis 1 can be occupied by the following functions.

| Index | Name | Maximum number of instances |
|--------|---------------------------------|-----------------------------|
| 0x6630 | Axis 1 Restart_Ack | 1 |
| 0x6650 | Axis 1 Safe Stop 1 | 8 |
| 0x6670 | Axis 1 Safe Stop 2 | 8 |
| 0x6668 | Axis 1 Safe Operating Stop | 8 |
| 0x6680 | Axis 1 Safe Speed Range | 8 |
| 0x6690 | Axis 1 Safely Limited Speed | 8 |
| 0x66A0 | Axis 1 Safely Limited Position | 8 |
| 0x66B8 | Axis 1 Safely Limited Increment | 8 |
| 0x66C0 | Axis 1 Safe Acceleration Range | 8 |

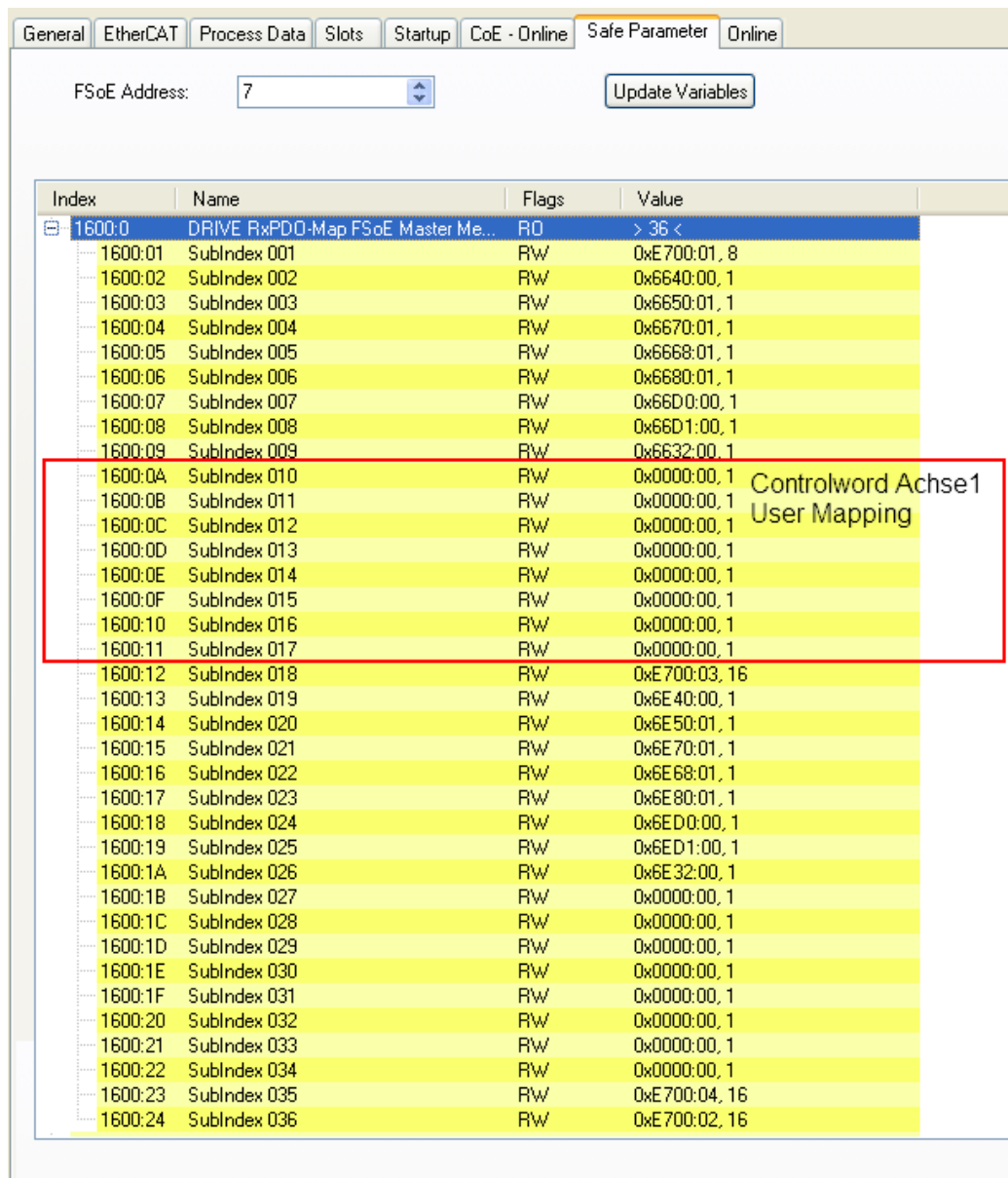


Fig. 14: Control word user mapping for axis 1

3.6.3.3 Control word default mapping for axis 2 (1st byte, fixed occupancy)

Control word default mapping for axis 2 1600:13 - 1600:1A

| Bit | Assignment | Possible setting | Default value |
|-----|---------------------------------------|------------------|---------------|
| 0 | Safe Torque Off (Axis 2 STO) | none | 0x6E400001 |
| 1 | Safe Stop 1 (Axis 2 SS1_1) | none | 0x6E500101 |
| 2 | Safe Stop 2 (Axis 2 SS2_1) | none | 0x6E700101 |
| 3 | Safe Operating Stop (Axis 2 SOS_1) | none | 0x6E680101 |
| 4 | Safe Speed Range (Axis 2 SSR_1) | none | 0x6E800101 |
| 5 | Safe Direction positive (Axis 2 SDIp) | none | 0x6ED00001 |
| 6 | Safe Direction negative(Axis 2 SDIn) | none | 0x6ED10001 |
| 7 | Error Acknowledge (Axis 2 ErrAck) | none | 0x6E320001 |

FSoE Address: 7 Update Variables

| Index | Name | Flags | Value |
|---------|-----------------------------------|-------|---------------|
| 1600:0 | DRIVE RxPDO-Map FSoE Master Me... | RO | > 36 < |
| 1600:01 | SubIndex 001 | RW | 0xE700:01, 8 |
| 1600:02 | SubIndex 002 | RW | 0x6640:00, 1 |
| 1600:03 | SubIndex 003 | RW | 0x6650:01, 1 |
| 1600:04 | SubIndex 004 | RW | 0x6670:01, 1 |
| 1600:05 | SubIndex 005 | RW | 0x6668:01, 1 |
| 1600:06 | SubIndex 006 | RW | 0x6680:01, 1 |
| 1600:07 | SubIndex 007 | RW | 0x66D0:00, 1 |
| 1600:08 | SubIndex 008 | RW | 0x66D1:00, 1 |
| 1600:09 | SubIndex 009 | RW | 0x6632:00, 1 |
| 1600:0A | SubIndex 010 | RW | 0x0000:00, 1 |
| 1600:0B | SubIndex 011 | RW | 0x0000:00, 1 |
| 1600:0C | SubIndex 012 | RW | 0x0000:00, 1 |
| 1600:0D | SubIndex 013 | RW | 0x0000:00, 1 |
| 1600:0E | SubIndex 014 | RW | 0x0000:00, 1 |
| 1600:0F | SubIndex 015 | RW | 0x0000:00, 1 |
| 1600:10 | SubIndex 016 | RW | 0x0000:00, 1 |
| 1600:11 | SubIndex 017 | RW | 0x0000:00, 1 |
| 1600:12 | SubIndex 018 | RW | 0xE700:03, 16 |
| 1600:13 | SubIndex 019 | RW | 0x6E40:00, 1 |
| 1600:14 | SubIndex 020 | RW | 0x6E50:01, 1 |
| 1600:15 | SubIndex 021 | RW | 0x6E70:01, 1 |
| 1600:16 | SubIndex 022 | RW | 0x6E68:01, 1 |
| 1600:17 | SubIndex 023 | RW | 0x6E80:01, 1 |
| 1600:18 | SubIndex 024 | RW | 0x6ED0:00, 1 |
| 1600:19 | SubIndex 025 | RW | 0x6ED1:00, 1 |
| 1600:1A | SubIndex 026 | RW | 0x6E32:00, 1 |
| 1600:1B | SubIndex 027 | RW | 0x0000:00, 1 |
| 1600:1C | SubIndex 028 | RW | 0x0000:00, 1 |
| 1600:1D | SubIndex 029 | RW | 0x0000:00, 1 |
| 1600:1E | SubIndex 030 | RW | 0x0000:00, 1 |
| 1600:1F | SubIndex 031 | RW | 0x0000:00, 1 |
| 1600:20 | SubIndex 032 | RW | 0x0000:00, 1 |
| 1600:21 | SubIndex 033 | RW | 0x0000:00, 1 |
| 1600:22 | SubIndex 034 | RW | 0x0000:00, 1 |
| 1600:23 | SubIndex 035 | RW | 0xE700:04, 16 |
| 1600:24 | SubIndex 036 | RW | 0xE700:02, 16 |

Controlword Achse2
Default Mapping

Fig. 15: Control word default mapping for axis 2

3.6.3.4 Control word user mapping for axis 2 (2nd byte, variable occupancy)

Control word user mapping for axis 2 1600:1B - 1600:22

The bits in the variable range of the control word for axis 2 can be occupied by the following functions.

| Index | Name | Maximum number of instances |
|--------|---------------------------------|-----------------------------|
| 0x6E30 | Axis 2 Restart_Acknowledge | 1 |
| 0x6E50 | Axis 2 Safe Stop 1 | 8 |
| 0x6E70 | Axis 2 Safe Stop 2 | 8 |
| 0x6E68 | Axis 2 Safe Operating Stop | 8 |
| 0x6E80 | Axis 2 Safe Speed Range | 8 |
| 0x6E90 | Axis 2 Safely Limited Speed | 8 |
| 0x6EA0 | Axis 2 Safely Limited Position | 8 |
| 0x6EB8 | Axis 2 Safely Limited Increment | 8 |
| 0x6EC0 | Axis 2 Safe Acceleration Range | 8 |

General EtherCAT Process Data Slots Startup CoE - Online **Safe Parameter** Online

FSoE Address: 7 Update Variables

| Index | Name | Flags | Value |
|---------|-----------------------------------|-------|---------------|
| 1600:0 | DRIVE RxDPO-Map FSoE Master Me... | RO | > 36 < |
| 1600:01 | SubIndex 001 | RW | 0xE700:01, 8 |
| 1600:02 | SubIndex 002 | RW | 0x6640:00, 1 |
| 1600:03 | SubIndex 003 | RW | 0x6650:01, 1 |
| 1600:04 | SubIndex 004 | RW | 0x6670:01, 1 |
| 1600:05 | SubIndex 005 | RW | 0x6668:01, 1 |
| 1600:06 | SubIndex 006 | RW | 0x6680:01, 1 |
| 1600:07 | SubIndex 007 | RW | 0x66D0:00, 1 |
| 1600:08 | SubIndex 008 | RW | 0x66D1:00, 1 |
| 1600:09 | SubIndex 009 | RW | 0x6632:00, 1 |
| 1600:0A | SubIndex 010 | RW | 0x0000:00, 1 |
| 1600:0B | SubIndex 011 | RW | 0x0000:00, 1 |
| 1600:0C | SubIndex 012 | RW | 0x0000:00, 1 |
| 1600:0D | SubIndex 013 | RW | 0x0000:00, 1 |
| 1600:0E | SubIndex 014 | RW | 0x0000:00, 1 |
| 1600:0F | SubIndex 015 | RW | 0x0000:00, 1 |
| 1600:10 | SubIndex 016 | RW | 0x0000:00, 1 |
| 1600:11 | SubIndex 017 | RW | 0x0000:00, 1 |
| 1600:12 | SubIndex 018 | RW | 0xE700:03, 16 |
| 1600:13 | SubIndex 019 | RW | 0x6E40:00, 1 |
| 1600:14 | SubIndex 020 | RW | 0x6E50:01, 1 |
| 1600:15 | SubIndex 021 | RW | 0x6E70:01, 1 |
| 1600:16 | SubIndex 022 | RW | 0x6E68:01, 1 |
| 1600:17 | SubIndex 023 | RW | 0x6E80:01, 1 |
| 1600:18 | SubIndex 024 | RW | 0x6ED0:00, 1 |
| 1600:19 | SubIndex 025 | RW | 0x6ED1:00, 1 |
| 1600:1A | SubIndex 026 | RW | 0x6E32:00, 1 |
| 1600:1B | SubIndex 027 | RW | 0x0000:00, 1 |
| 1600:1C | SubIndex 028 | RW | 0x0000:00, 1 |
| 1600:1D | SubIndex 029 | RW | 0x0000:00, 1 |
| 1600:1E | SubIndex 030 | RW | 0x0000:00, 1 |
| 1600:1F | SubIndex 031 | RW | 0x0000:00, 1 |
| 1600:20 | SubIndex 032 | RW | 0x0000:00, 1 |
| 1600:21 | SubIndex 033 | RW | 0x0000:00, 1 |
| 1600:22 | SubIndex 034 | RW | 0x0000:00, 1 |
| 1600:23 | SubIndex 035 | RW | 0xE700:04, 16 |
| 1600:24 | SubIndex 036 | RW | 0xE700:02, 16 |

Controlword Achse2 User Mapping

Fig. 16: Control word user mapping for axis 2

3.6.3.5 Status word default mapping for axis 1 (1st byte, fixed occupancy)

Status word default mapping for axis 1 1A00:02 - 1A00:09

| Bit | Assignment | Possible setting | Default value |
|-----|---------------------------------------|------------------|---------------|
| 0 | Safe Torque Off (Axis 1 STO) | none | 0x66400001 |
| 1 | Safe Speed Monitor (Axis 1 SSM_1) | none | 0x66E00101 |
| 2 | Safe Speed Monitor (Axis 1 SSM_2) | none | 0x66E00201 |
| 3 | Safe Operating Stop (Axis 1 SOS_1) | none | 0x66680101 |
| 4 | Safe Speed Range (Axis 1 SSR_1) | none | 0x66800101 |
| 5 | Safe Direction positive (Axis 1 SDIp) | none | 0x66D00001 |
| 6 | Safe Direction negative (Axis 1 SDIn) | none | 0x66D10001 |
| 7 | Error Acknowledge (Axis 1 ErrAck) | none | 0x66320001 |

General EtherCAT Process Data Slots Startup CoE - Online **Safe Parameter** Online

FSoE Address: 7 Update Variables

| Index | Name | Flags | Value |
|---------|-----------------------------------|-------|---------------|
| 1A00:0 | DRIVE TxPDO-Map FSoE Slave Mes... | RO | > 36 < |
| 1A00:01 | SubIndex 001 | RW | 0xE600:01, 8 |
| 1A00:02 | SubIndex 002 | RW | 0x6640:00, 1 |
| 1A00:03 | SubIndex 003 | RW | 0x66E0:01, 1 |
| 1A00:04 | SubIndex 004 | RW | 0x66E0:02, 1 |
| 1A00:05 | SubIndex 005 | RW | 0x6668:01, 1 |
| 1A00:06 | SubIndex 006 | RW | 0x6680:01, 1 |
| 1A00:07 | SubIndex 007 | RW | 0x66D0:00, 1 |
| 1A00:08 | SubIndex 008 | RW | 0x66D1:00, 1 |
| 1A00:09 | SubIndex 009 | RW | 0x6632:00, 1 |
| 1A00:0A | SubIndex 010 | RW | 0x0000:00, 1 |
| 1A00:0B | SubIndex 011 | RW | 0x0000:00, 1 |
| 1A00:0C | SubIndex 012 | RW | 0x0000:00, 1 |
| 1A00:0D | SubIndex 013 | RW | 0x0000:00, 1 |
| 1A00:0E | SubIndex 014 | RW | 0x0000:00, 1 |
| 1A00:0F | SubIndex 015 | RW | 0x0000:00, 1 |
| 1A00:10 | SubIndex 016 | RW | 0x0000:00, 1 |
| 1A00:11 | SubIndex 017 | RW | 0x0000:00, 1 |
| 1A00:12 | SubIndex 018 | RW | 0xE600:03, 16 |
| 1A00:13 | SubIndex 019 | RW | 0x6E40:00, 1 |
| 1A00:14 | SubIndex 020 | RW | 0x6EE0:01, 1 |
| 1A00:15 | SubIndex 021 | RW | 0x6EE0:02, 1 |
| 1A00:16 | SubIndex 022 | RW | 0x6E68:01, 1 |
| 1A00:17 | SubIndex 023 | RW | 0x6E80:01, 1 |
| 1A00:18 | SubIndex 024 | RW | 0x6ED0:00, 1 |
| 1A00:19 | SubIndex 025 | RW | 0x6ED1:00, 1 |
| 1A00:1A | SubIndex 026 | RW | 0x6E32:00, 1 |
| 1A00:1B | SubIndex 027 | RW | 0x0000:00, 1 |
| 1A00:1C | SubIndex 028 | RW | 0x0000:00, 1 |
| 1A00:1D | SubIndex 029 | RW | 0x0000:00, 1 |
| 1A00:1E | SubIndex 030 | RW | 0x0000:00, 1 |
| 1A00:1F | SubIndex 031 | RW | 0x0000:00, 1 |
| 1A00:20 | SubIndex 032 | RW | 0x0000:00, 1 |
| 1A00:21 | SubIndex 033 | RW | 0x0000:00, 1 |
| 1A00:22 | SubIndex 034 | RW | 0x0000:00, 1 |
| 1A00:23 | SubIndex 035 | RW | 0xE600:04, 16 |
| 1A00:24 | SubIndex 036 | RW | 0xE600:02, 16 |

Statusword Achse1 Default Mapping

Fig. 17: Status word default mapping for axis 1

3.6.3.6 Status word user mapping for axis 1 (2nd byte, variable occupancy)

Status word user mapping for axis 1 1A00:0A - 1A00:11

The bits in the variable range of the status word for axis 1 can be occupied by the following functions.

| Index | Name | Max. number of instances | Comment |
|--------|----------------------------------|--------------------------|--------------------------------------|
| 0x6630 | Axis 1 Restart_Request | 1 | |
| 0x6668 | Axis 1 Safe Operating Stop | 8 | |
| 0x6680 | Axis 1 Safe Speed Range | 8 | |
| 0x6690 | Axis 1 Safely Limited Speed | 8 | |
| 0x66A0 | Axis 1 Safely Limited Position | 8 | |
| 0x66A8 | Axis 1 Safe Maximum Speed | 1 | Activation by setting the parameters |
| 0x66B8 | Axis 1 Safely Limited Increment | 8 | |
| 0x66C0 | Axis 1 Safe Acceleration Range | 8 | |
| 0x66C8 | Axis 1 Safe Maximum Acceleration | 1 | Activation by setting the parameters |
| 0x66E0 | Axis 1 Safe Speed Monitor | 8 | Activation by setting the parameters |
| 0x66E8 | Axis 1 Safe CAM | 8 | Activation by setting the parameters |



Fig. 18: Status word user mapping for axis 1

3.6.3.7 Status word default mapping for axis 2 (1st byte, fixed occupancy)

Status word default mapping for axis 2 1A00:13 - 1A00:1A

| Bit | Assignment | Possible setting | Default value |
|-----|---------------------------------------|------------------|---------------|
| 0 | Safe Torque Off (Axis 2 STO) | none | 0x6E400001 |
| 1 | Safe Speed Monitor (Axis 2 SSM_1) | none | 0x6EE00101 |
| 2 | Safe Speed Monitor (Axis 2 SSM_2) | none | 0x6EE00201 |
| 3 | Safe Operating Stop Axis 2 (SOS_1) | none | 0x6E680101 |
| 4 | Safe Speed Range (Axis 2 SSR_1) | none | 0x6E800101 |
| 5 | Safe Direction positive (Axis 2 SDIp) | none | 0x6ED00001 |
| 6 | Safe Direction negative (Axis 2 SDIn) | none | 0x6ED10001 |
| 7 | Error Acknowledge (Axis 2 ErrAck) | none | 0x6E320001 |

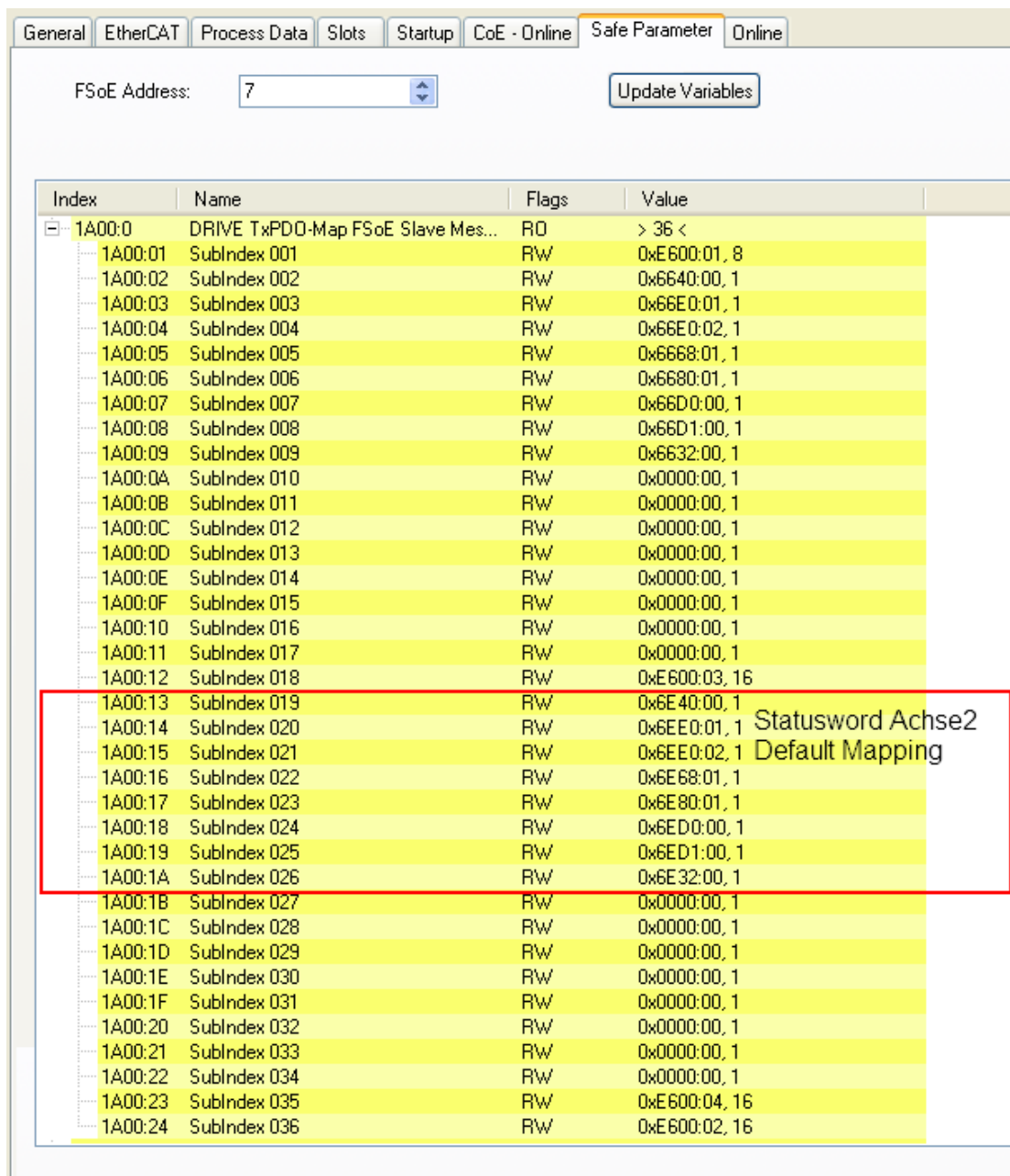


Fig. 19: Status word default mapping for axis 2

3.6.3.8 Status word user mapping for axis 2 (2nd byte, variable occupancy)

Status word user mapping for axis 2 1A00:1B - 1A00:22

The bits in the variable range of the status word for axis 2 can be occupied by the following functions.

| Index | Name | Maximum number of instances | Note |
|--------|----------------------------------|-----------------------------|--------------------------------------|
| 0x6E30 | Axis 2 Restart_Request | 1 | |
| 0x6E68 | Axis 2 Safe Operating Stop | 8 | |
| 0x6E80 | Axis 2 Safe Speed Range | 8 | |
| 0x6E90 | Axis 2 Safely Limited Speed | 8 | |
| 0x6EA0 | Axis 2 Safely Limited Position | 8 | |
| 0x6EA8 | Axis 2 Safe Maximum Speed | 1 | Activation by setting the parameters |
| 0x6EB8 | Axis 2 Safely Limited Increment | 8 | |
| 0x6EC0 | Axis 2 Safe Acceleration Range | 8 | |
| 0x6EC8 | Axis 2 Safe Maximum Acceleration | 1 | Activation by setting the parameters |
| 0x6EE0 | Axis 2 Safe Speed Monitor | 8 | Activation by setting the parameters |
| 0x6EE8 | Axis 2 Safe CAM | 8 | Activation by setting the parameters |

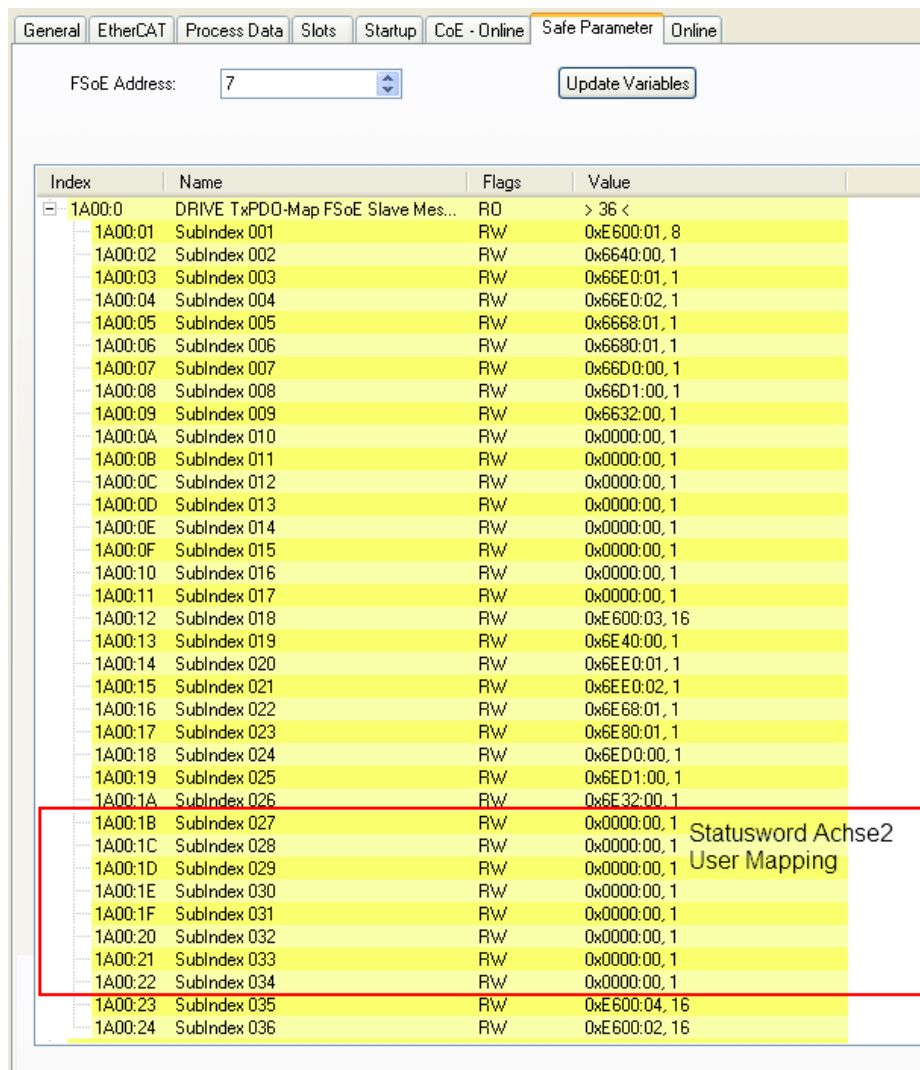


Fig. 20: Status word user mapping for axis 2

3.6.4 Setting the mode of operation

3.6.4.1 General

The AX5805/AX5806 has two modes of operation. Firstly, the standard mode with the full range of functions of the AX5805/AX5806 and secondly, the STO mode with a restricted range of functions.

3.6.4.2 Standard mode

In standard mode the AX5805/AX5806 supports all available safety functions. To ensure the correct function, at least the following objects must be parameterized correctly. These are checked when starting up the AX5805/AX5806.

The use of the safety functions is possible only after setting the associated parameters.

| Index | Name | Description | Unit | Default value |
|--------|--------------------------------|--|------|---------------|
| 0x2000 | Motor_Type | Motor type for axis 1 0x0000 = rotary synchronous motor with feedback | -- | 0x0000 |
| 0x2001 | Motor_String | Name of the motor | -- | -- |
| 0x2002 | Motor_Polepairs | Number of motor pole pairs | -- | -- |
| 0x2020 | Speed_Compare_Window | The value should be set as small as possible according to the application. | -- | 0x000000B4 |
| 0x2021 | Speed_Compare_Violationlevel | Number of 125 µs cycles in which the axis may be outside the Speed_Compare_Window (value range 0 to 254). The value 255 deactivates the function. | -- | 0x00000014 |
| 0x2022 | Speed_Compare_Filter | Setting of the filter steps for the raw values used for the comparison. | -- | 0x0000000A |
| 0x2030 | ESTOP_Ramp_Time | Error reaction time SS1, after which STO is activated. | ms | 0x0000 |
| 0x2040 | Motor_Default_Data | Motor-specific parameter This value can be found in document: AX5805_Defaultwerte_de.pdf | -- | 0x0028 |
| 0x2043 | Current_Compare_Violationlevel | not used | -- | -- |
| 0x2800 | Motor_Type | Motor type for axis 2 0x0000 = rotary synchronous motor with feedback | -- | 0x0000 |
| 0x2801 | Motor_String | Name of the motor | -- | -- |
| 0x2802 | Motor_Polepairs | Number of motor pole pairs | -- | -- |
| 0x2820 | Speed_Compare_Window | The value should be set as small as possible according to the application. | -- | 0x000000B4 |
| 0x2821 | Speed_Compare_Violationlevel | Number of 125 µs cycles in which the axis may be outside the Speed_Compare_Window (value range 0 to 254). The value 255 deactivates the function. | -- | 0x00000014 |
| 0x2822 | Speed_Compare_Filter | Setting of the filter steps for the raw values used for the comparison. | -- | 0x0000000A |
| 0x2830 | ESTOP_Ramp_Time | Error reaction time SS1, after which STO is activated. | ms | 0x0000 |

| Index | Name | Description | Unit | Default value |
|--------|--------------------------------|--|------|---------------|
| 0x2840 | Motor_Default_Data | Motor specific parameter This value can be found in document: AX5805_Defaultwerte_de.pdf | -- | 0x0028 |
| 0x2843 | Current_Compare_Violationlevel | not used | -- | -- |
| 0x2F00 | Number_of_Axis | Number of axes | -- | 0x0000 |
| 0x2F02 | Debug_Mode_Active | This value must set to FALSE. | -- | FALSE |

When parameterizing the motor string, please note that this is entered as ASCII code. More detailed information can be found in document AX5805_MotorDefaultValues_de.pdf.

Example

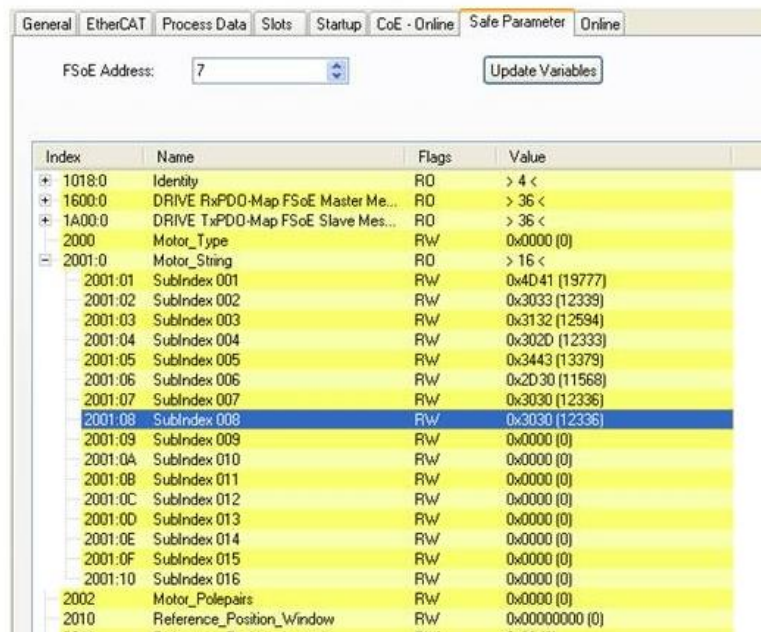
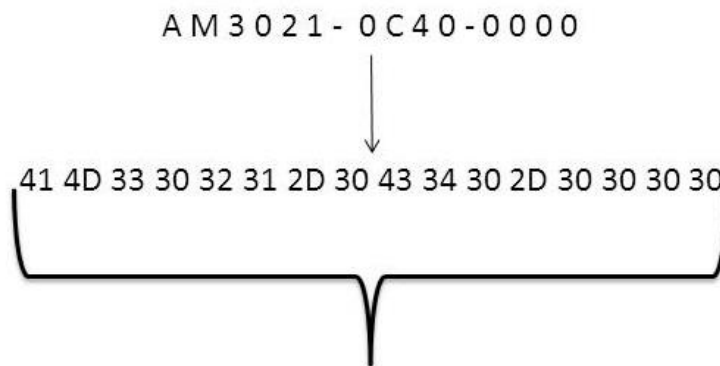


Fig. 21: Input of the motor string

From TwinCAT version 2.11 build 2230, the motor string can also be entered in text form.

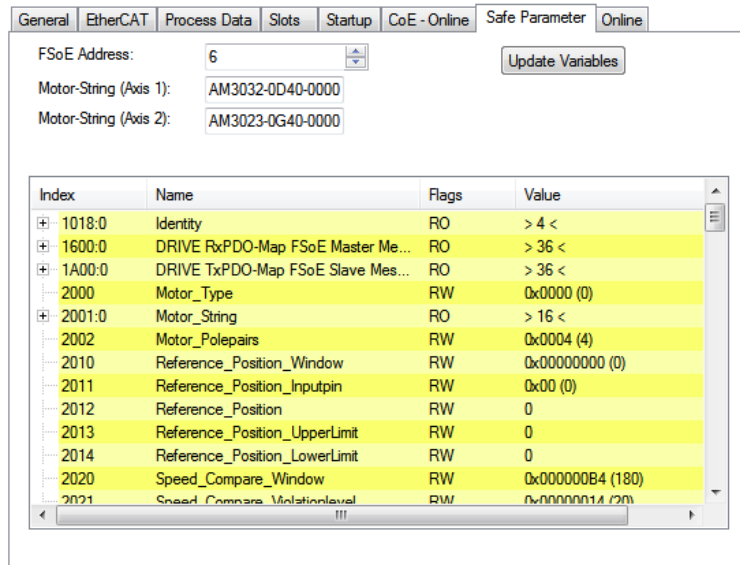


Fig. 22: Entering the text-based motor string

3.6.4.3 STO-mode

The AX5805/AX5806 can also be operated in the so-called STO mode. The AX5805/AX5806 does not evaluate any motor data and safety function parameters. It merely offers the STO function and tests the switch-off paths.

At least the following parameters must be set with this mode of operation (up to firmware 04):

| Index | Name | Description | Unit | Default value |
|--------|-------------------|-------------------------------|------|---------------|
| 0x2F00 | Number_of_Axis | Number of axes | -- | 0x0000 |
| 0x2F01 | STO_Mode_Active | Activate STO mode | -- | TRUE |
| 0x2F02 | Debug_Mode_Active | This value must set to FALSE. | -- | FALSE |

From firmware 05 and revision number AX5805-0000-0017, the following parameters must be set as a minimum in this mode:

| Index | Name | Description | Unit | Default value |
|--------|-------------------|-------------------------------|------|---------------|
| 0x2041 | STO_Mode_Active | Activate STO mode axis 1 | | FALSE |
| 0x2841 | STO_Mode_Active | Activate STO mode axis 2 | | FALSE |
| 0x2F00 | Number_of_Axis | Number of axes | -- | 0x0000 |
| 0x2F02 | Debug_Mode_Active | This value must set to FALSE. | -- | FALSE |



Note

Restrictions in STO mode

In STO mode only the function STO is supported. The AX5805/AX5806 does not monitor/evaluate motor data and safety function parameters.

In order to be able to activate the axis / axes, the bits of the safety functions STO and SS1 (including all instances) must be set to 1. The bits of safety function SS1 have no function!

Starting with firmware version 04, it is sufficient to set only the bit of the safety function STO in the control word.

3.6.5 Parameterization and referencing of the safe position

The SLP (Safely Limited Position) and SCA (Safe CAM) safety functions can be used only after the position is referenced.

3.6.5.1 Prerequisites

An external position (e.g. position of the NC) must be linked with the standard process image (Position Actual Value) of the AX5805/AX5806.

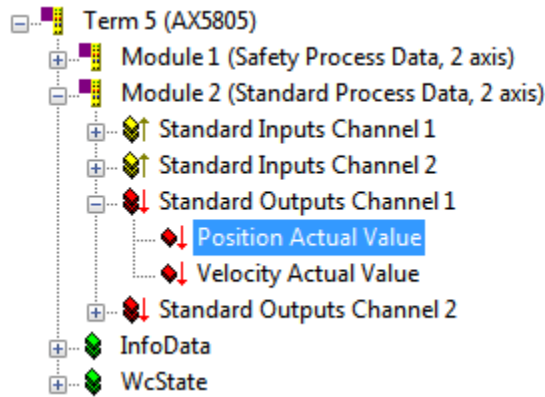


Fig. 23: An external position must be linked with the AX5805

A reference cam (e.g. proximity switch) must be connected to the digital inputs/outputs X06 (device front) of the AX5000. The corresponding number of the digital input (0 to 7) must be entered in the Reference_Position_Inputpin parameter.

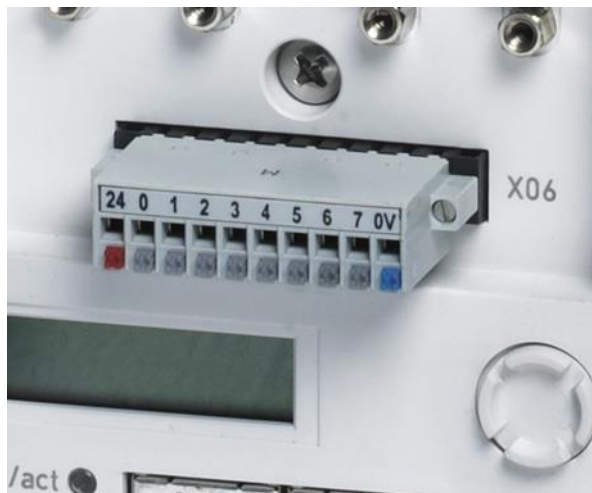




Fig. 24: GPIO (X06) on the AX5000

3.6.5.2 Parameterization

| | |
|--|--|
|  Note | <p>Monitoring the reference cam</p> <p>As soon as the parameters for the reference position have been entered and an external position is linked with the standard process image, the AX5805/AX5806 expects the reference cam at the preset position.</p> <p>To deactivate this function, an unused digital input should be assigned in the AX5805/AX5806 parameters.</p> |
|--|--|

| | |
|--|--|
|  Note | <p>Exceeding the maximum range of travel</p> <p>If the maximum range of travel is exceeded, the AX5805/AX5806 switches the AX5000 servo drive torque-free. There is no direct possibility to re-activate the axes. There are three possibilities to re-activate the axes:</p> <ul style="list-style-type: none"> • Bring the axis mechanically back within the defined range. • Force the external position accordingly (not recommended) • Parameterize the maximum limits of the range of travel accordingly (not recommended) |
|--|--|

| Index | Name | Description | Unit | Default value |
|--------|-------------------------------|---|------|---------------|
| 0x2010 | Reference_Position_Window | Window around the reference position at which the AX5805 expects the reference cam (axis 1) | -- | 0x00000000 |
| 0x2011 | Reference_Position_Inputpin | Number of the digital input on the AX5000 (0 to 7) to which the reference cam is connected (axis 1) | -- | 0x00 |
| 0x2012 | Reference_Position | External position / reference position, central point of the reference cam (axis 1) | -- | 0x00000000 |
| 0x2013 | Reference_Position_UpperLimit | Maximum external position (axis 1) | -- | 0x00000000 |
| 0x2014 | Reference_Position_LowerLimit | Minimum external position (axis 1) | -- | 0x00000000 |
| 0x2810 | Reference_Position_Window | Window around the reference position at which the AX5805 expects the reference cam (axis 2) | -- | 0x00000000 |
| 0x2811 | Reference_Position_Inputpin | Number of the digital input on the AX5000 (0 to 7) to which the reference cam is connected (axis 2) | -- | 0x00 |
| 0x2812 | Reference_Position | External position / reference position, central point of the reference cam. (axis 2) | -- | 0x00000000 |
| 0x2813 | Reference_Position_UpperLimit | Maximum external position (axis 2) | -- | 0x00000000 |
| 0x2814 | Reference_Position_LowerLimit | Minimum external position (axis 2) | -- | 0x00000000 |

| Index | Name | Flags | Value |
|--------|-----------------------------------|-------|------------------|
| 1018:0 | Identity | RO | > 4 < |
| 1600:0 | DRIVE RxPDO-Map FSoE Master Me... | RO | > 19 < |
| 1A00:0 | DRIVE TxPDO-Map FSoE Slave Mes... | RO | > 19 < |
| 2000 | Motor_Type | RW | 0x0000 (0) |
| 2001:0 | Motor_String | RO | > 16 < |
| 2002 | Motor_Polepairs | RW | 0x0000 (0) |
| 2010 | Reference_Position_Window | RW | 0x00000000 (0) |
| 2011 | Reference_Position_Inputpin | RW | 0x00 (0) |
| 2012 | Reference_Position | RW | 0 |
| 2013 | Reference_Position_UpperLimit | RW | 0 |
| 2014 | Reference_Position_LowerLimit | RW | 0 |
| 2020 | Speed_Compare_Window | RW | 0x000000B4 (180) |
| 2021 | Speed_Compare_Violationlevel | RW | 0x00000014 (20) |
| 2030 | ESTOP_Ramp_Time | RW | 0x0000 (0) |
| 2040 | Motor_Default_Data | RW | 0x0028 (40) |
| 2F00 | Number_of_Axis | RW | 0x00 (0) |
| 2F01 | STO_Mode_Active | RW | FALSE |
| 2F02 | Debug_Mode_Active | RW | FALSE |
| 2F03 | Reserved | RW | FALSE |
| 6642 | STO_Restart_Acknowledge_behavior | RW | FALSE |
| 6651:0 | t_SS1 | RO | > 8 < |
| 6653:0 | n_Zern_SS1_32_Bit | RO | > 8 < |

Fig. 25: Reference position

3.6.5.3 Reference run

As long as the external position has not been referenced, the safe position functions of the TwinSAFE drive option card are deactivated, i.e. the current position output by the AX5805/AX5806 is always 0. The status can also be read out via the CoE object 0x2015.

It is referenced when the external position matches the parameterized position and the reference cam was fully travelled over in positive or negative direction.

If the reference cam is set outside the window around the reference position, the AX5805/AX5806 detects an error and switches the AX5000 servo drive torque-free.

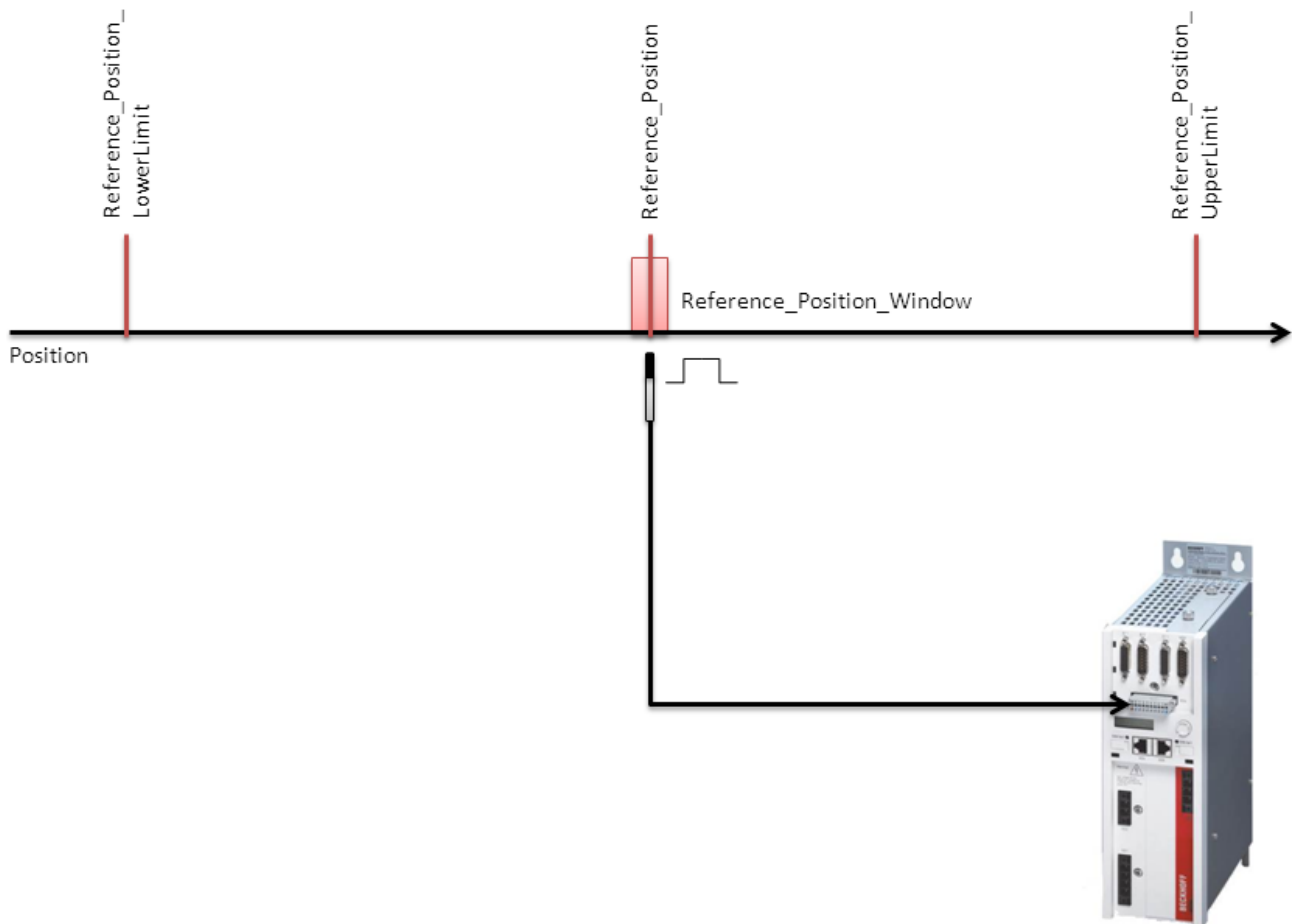




Fig. 26: Structure image for the reference position

| | |
|--|---|
|  Note | <p>Reference run</p> <p>During the reference run, the reference cam should be run over as slowly as possible, in order to enable the AX5805/AX5806 to detect the cam limits as accurately as possible.</p> |
|  Note | <p>Referencing</p> <p>If the AX5000 is switched to STO, the referencing is cleared and a reference run has to be performed again.</p> |

3.6.6 Parameterization of the integrated safety functions of the AX5805/AX5806

3.6.6.1 Description of the Error Acknowledge function

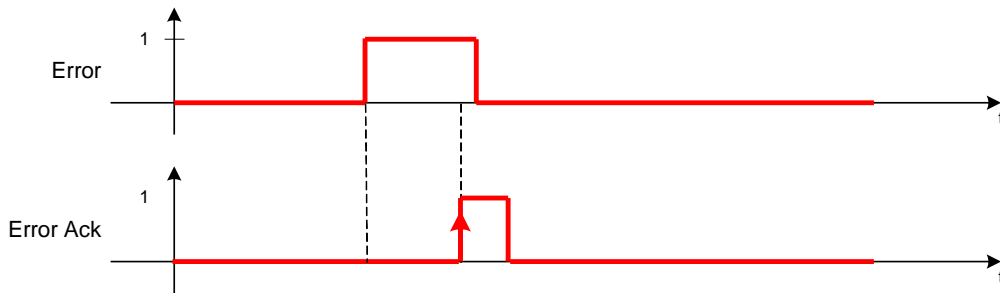


Fig. 27: Description of the Error Acknowledge function

Errors reported by the TwinSAFE Drive option card can be reset via rising edge of the Error Acknowledge signal. The error bit remains set if the reported error continues or occurs again immediately.

3.6.6.2 Description of the STO safety function

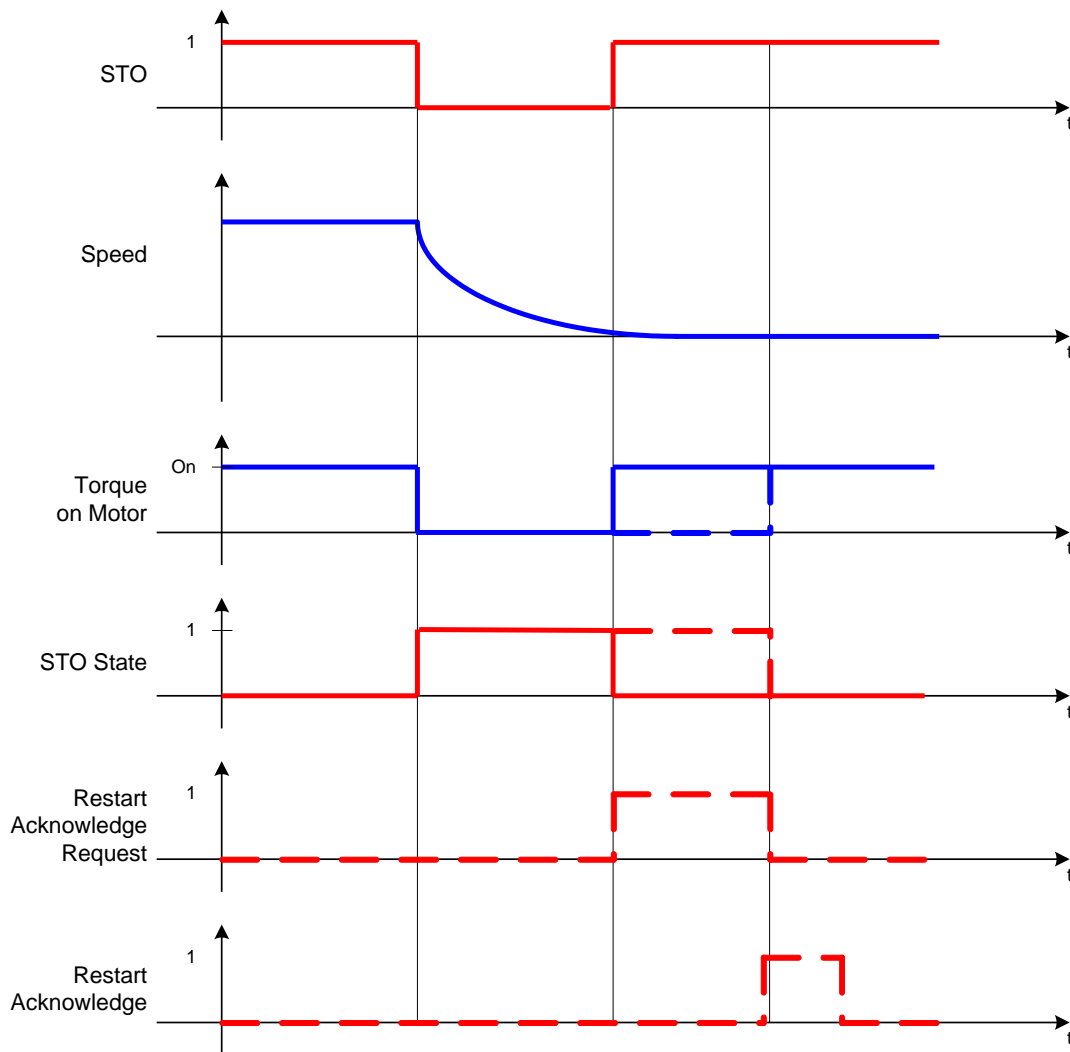


Fig. 28: Description of the Safe Torque Off function (STO)

The respective axis is switched torque-free as soon as the STO function is activated.

If the STO_Restart_Acknowledge_behavior parameter is set to TRUE, then the Restart_Acknowledge control bit must be set in order for the axis to restart.



Note

ControlBit Restart Acknowledge

The Restart Acknowledge control bit does not belong to the standard mapping of the AX5805/AX5806. It must be additionally mapped into the user range of the control word.

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|----------------------------------|---|-----------|------|---------------|
| 0x6642 | STO_Restart_Acknowledge_behavior | If this parameter is set, the AX5805/AX5806 needs a Restart_Acknowledge_Signal after the STO function is called | -- | -- | FALSE |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|----------------------------------|---|-----------|------|---------------|
| 0x6E42 | STO_Restart_Acknowledge_behavior | If this parameter is set, the AX5805/AX5806 needs a Restart_Acknowledge_Signal after the STO function is called | -- | -- | FALSE |

3.6.6.3 Description of the SS1 safety function

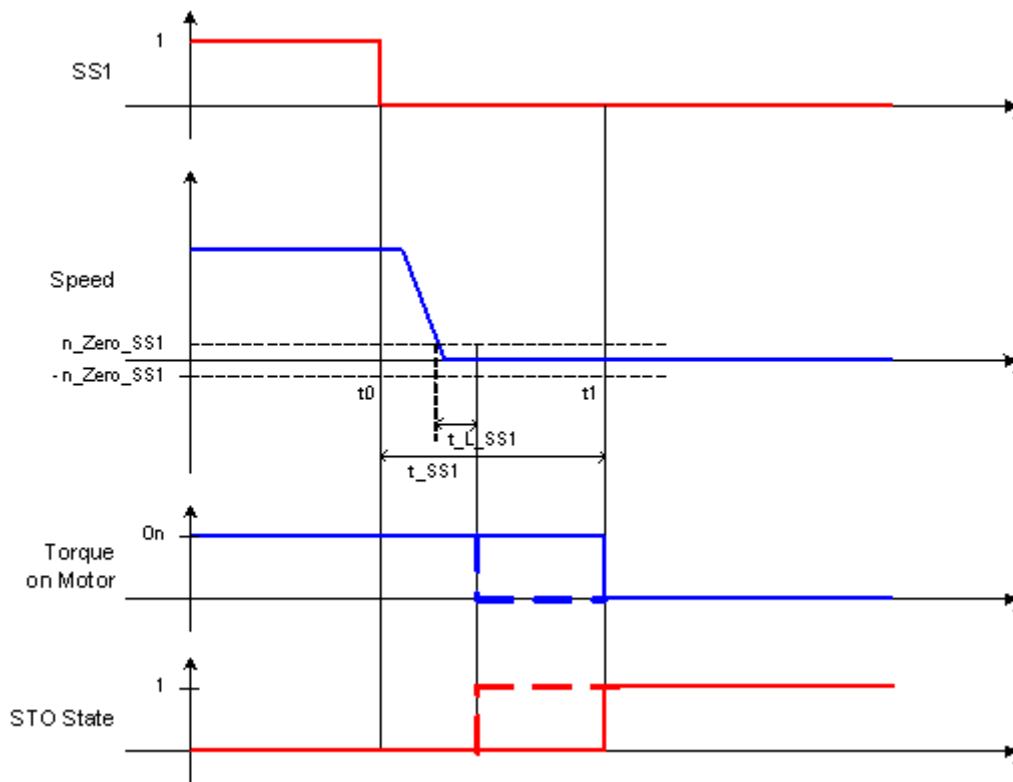


Fig. 29: Description of the Safe Stop 1 function (SS1) with time monitor

The time monitor t_{SS1} is started upon activation of the SS1 function. The standard control begins with the deceleration of the axis and the STO function is activated at the latest after t_{SS1} . Furthermore, a speed window (n_{Zero_SS1}) is also monitored. The STO function is activated after the time t_{L_SS1} as soon as the speed is within the window.



Note

EN 61800-5-2:2017

EN 61800-5-2:2017 distinguishes 3 types of SS1 functions. Only the safety function SS1-t (en: safe stop 1 time controlled) is supported by the AX5805/AX5806.

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|---------------------------|---|-----------|------------------------|---------------|
| 0x6651 | t_SS1 :001 | Maximum time until the activation of the STO safety function | 01 | 10 ms | 0x0000 |
| 0x6651 | t_SS1 :002 | Maximum time until the activation of the STO safety function | 02 | 10 ms | 0x0000 |
| 0x6651 | t_SS1 :003 | Maximum time until the activation of the STO safety function | 03 | 10 ms | 0x0000 |
| 0x6651 | t_SS1 :004 | Maximum time until the activation of the STO safety function | 04 | 10 ms | 0x0000 |
| 0x6651 | t_SS1 :005 | Maximum time until the activation of the STO safety function | 05 | 10 ms | 0x0000 |
| 0x6651 | t_SS1 :006 | Maximum time until the activation of the STO safety function | 06 | 10 ms | 0x0000 |
| 0x6651 | t_SS1 :007 | Maximum time until the activation of the STO safety function | 07 | 10 ms | 0x0000 |
| 0x6651 | t_SS1 :008 | Maximum time until the activation of the STO safety function | 08 | 10 ms | 0x0000 |
| 0x6653 | n_Zero_SS1 32 Bit :001 | Speed window for SS1_1 | 01 | Increments per 1 ms | 0x00000000 |
| 0x6653 | n_Zero_SS1 32 Bit :002 | Speed window for SS1_2 | 02 | Increments per 1 ms | 0x00000000 |
| 0x6653 | n_Zero_SS1 32 Bit :003 | Speed window for SS1_3 | 03 | Increments per 1 ms | 0x00000000 |
| 0x6653 | n_Zero_SS1 32 Bit :004 | Speed window for SS1_4 | 04 | Increments per 1 ms | 0x00000000 |
| 0x6653 | n_Zero_SS1 32 Bit :005 | Speed window for SS1_5 | 05 | Increments per 1 ms | 0x00000000 |
| 0x6653 | n_Zero_SS1 32 Bit :006 | Speed window for SS1_6 | 06 | Increments per 1 ms | 0x00000000 |
| 0x6653 | n_Zero_SS1 32 Bit :007 | Speed window for SS1_7 | 07 | Increments per 1ms | 0x00000000 |
| 0x6653 | n_Zero_SS1 32 Bit :008 | Speed window for SS1_8 | 08 | Increments per 1 ms | 0x00000000 |
| 0x6654 | t_L SS1 :001 | Minimum time until the activation of the STO safety function, if the speed is within the window | 01 | 1 ms | 0x0000 |
| 0x6654 | t_L SS1 :002 | Minimum time until the activation of the STO safety function, if the speed is within the window | 02 | 1 ms | 0x0000 |
| 0x6654 | t_L SS1 :003 | Minimum time until the activation of the STO safety function, if the speed is within the window | 03 | 1 ms | 0x0000 |
| 0x6654 | t_L SS1 :004 | Minimum time until the activation of the STO safety function, if the speed is within the window | 04 | 1 ms | 0x0000 |
| 0x6654 | t_L SS1 :005 | Minimum time until the activation of the STO safety function, if the speed is within the window | 05 | 1 ms | 0x0000 |
| 0x6654 | t_L SS1 :006 | Minimum time until the activation of the STO safety function, if the speed is within the window | 06 | 1 ms | 0x0000 |

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|--------------|---|-----------|------|---------------|
| 0x6654 | t_L SS1 :007 | Minimum time until the activation of the STO safety function, if the speed is within the window | 07 | 1 ms | 0x0000 |
| 0x6654 | t_L SS1 :008 | Minimum time until the activation of the STO safety function, if the speed is within the window | 08 | 1 ms | 0x0000 |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|---------------------------|---|-----------|------------------------|---------------|
| 0x6E51 | t_SS1 :001 | Maximum time until the activation of the STO safety function | 01 | 10 ms | 0x0000 |
| 0x6E51 | t_SS1 :002 | Maximum time until the activation of the STO safety function | 02 | 10 ms | 0x0000 |
| 0x6E51 | t_SS1 :003 | Maximum time until the activation of the STO safety function | 03 | 10 ms | 0x0000 |
| 0x6E51 | t_SS1 :004 | Maximum time until the activation of the STO safety function | 04 | 10 ms | 0x0000 |
| 0x6E51 | t_SS1 :005 | Maximum time until the activation of the STO safety function | 05 | 10 ms | 0x0000 |
| 0x6E51 | t_SS1 :006 | Maximum time until the activation of the STO safety function | 06 | 10 ms | 0x0000 |
| 0x6E51 | t_SS1 :007 | Maximum time until the activation of the STO safety function | 07 | 10 ms | 0x0000 |
| 0x6E51 | t_SS1 :008 | Maximum time until the activation of the STO safety function | 08 | 10 ms | 0x0000 |
| 0x6E53 | n_Zero_SS1 32 Bit :001 | Speed window for SS1_1 | 01 | Increments per 1 ms | 0x00000000 |
| 0x6E53 | n_Zero_SS1 32 Bit :002 | Speed window for SS1_2 | 02 | Increments per 1 ms | 0x00000000 |
| 0x6E53 | n_Zero_SS1 32 Bit :003 | Speed window for SS1_3 | 03 | Increments per 1 ms | 0x00000000 |
| 0x6E53 | n_Zero_SS1 32 Bit :004 | Speed window for SS1_4 | 04 | Increments per 1 ms | 0x00000000 |
| 0x6E53 | n_Zero_SS1 32 Bit :005 | Speed window for SS1_5 | 05 | Increments per 1 ms | 0x00000000 |
| 0x6E53 | n_Zero_SS1 32 Bit :006 | Speed window for SS1_6 | 06 | Increments per 1 ms | 0x00000000 |
| 0x6E53 | n_Zero_SS1 32 Bit :007 | Speed window for SS1_7 | 07 | Increments per 1 ms | 0x00000000 |
| 0x6E53 | n_Zero_SS1 32 Bit :008 | Speed window for SS1_8 | 08 | Increments per 1 ms | 0x00000000 |
| 0x6E54 | t_L SS1 :001 | Minimum time until the activation of the STO safety function, if the speed is within the window | 01 | 1 ms | 0x0000 |
| 0x6E54 | t_L SS1 :002 | Minimum time until the activation of the STO safety function, if the speed is within the window | 02 | 1 ms | 0x0000 |
| 0x6E54 | t_L SS1 :003 | Minimum time until the activation of the STO safety function, if the speed is within the window | 03 | 1 ms | 0x0000 |
| 0x6E54 | t_L SS1 :004 | Minimum time until the activation of the STO safety function, if the speed is within the window | 04 | 1 ms | 0x0000 |
| 0x6E54 | t_L SS1 :005 | Minimum time until the activation of the STO safety function, if the speed is within the window | 05 | 1 ms | 0x0000 |
| 0x6E54 | t_L SS1 :006 | Minimum time until the activation of the STO safety function, if the speed is within the window | 06 | 1 ms | 0x0000 |

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|--------------|---|-----------|------|---------------|
| 0x6E54 | t_L SS1 :007 | Minimum time until the activation of the STO safety function, if the speed is within the window | 07 | 1 ms | 0x0000 |
| 0x6E54 | t_L SS1 :008 | Minimum time until the activation of the STO safety function, if the speed is within the window | 08 | 1 ms | 0x0000 |

3.6.6.4 Description of the SS2 safety function

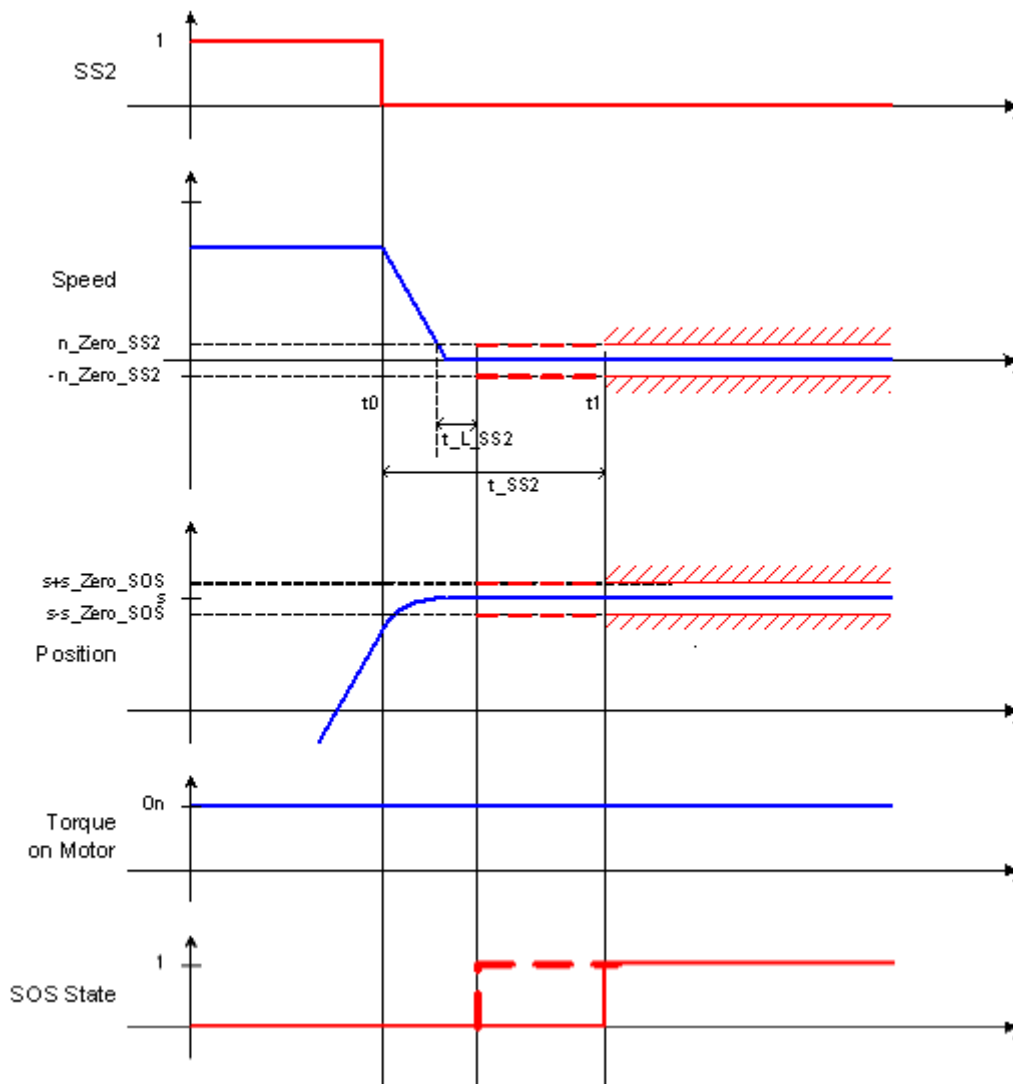




Fig. 30: Description of the Safe Stop 2 function (SS2) with time monitor

The time monitor t_{SS2} is started upon activation of the SS2 function. The standard control begins with the deceleration of the axis and the SOS function is activated at the latest after t_{SS2} . Furthermore, a speed window (n_{Zero_SS2}) is also monitored. The SOS function is activated after the time t_{L_SS2} as soon as the speed is within the window.

| | |
|--|--|
|  Note | <p>EN 61800-5-2:2017</p> <p>EN 61800-5-2:2017 distinguishes 3 types of SS2 functions. Only the safety function SS2-t (en: safe stop 2 time controlled) is supported by the AX5805/AX5806.</p> |
|--|--|

The corresponding instance of SOS is used for each instance of SS2.

| | |
|---|---|
|  WARNING | <p>Suspended loads</p> <p>Please observe the notes of the safety function SOS.</p> |
|---|---|

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|------------------------|---|-----------|---------------------|---------------|
| 0x6671 | t_SS2 :001 | Maximum time until the activation of the SOS_1 safety function | 01 | 10 ms | 0x0000 |
| 0x6671 | t_SS2 :002 | Maximum time until the activation of the SOS_2 safety function | 02 | 10 ms | 0x0000 |
| 0x6671 | t_SS2 :003 | Maximum time until the activation of the SOS_3 safety function | 03 | 10 ms | 0x0000 |
| 0x6671 | t_SS2 :004 | Maximum time until the activation of the SOS_4 safety function | 04 | 10 ms | 0x0000 |
| 0x6671 | t_SS2 :005 | Maximum time until the activation of the SOS_5 safety function | 05 | 10 ms | 0x0000 |
| 0x6671 | t_SS2 :006 | Maximum time until the activation of the SOS_6 safety function | 06 | 10 ms | 0x0000 |
| 0x6671 | t_SS2 :007 | Maximum time until the activation of the SOS_7 safety function | 07 | 10 ms | 0x0000 |
| 0x6671 | t_SS2 :008 | Maximum time until the activation of the SOS_8 safety function | 08 | 10 ms | 0x0000 |
| 0x6672 | t_L SS2 :001 | Minimum time until the activation of the SOS_1 safety function, if the speed is within the window | 01 | 1 ms | 0x0000 |
| 0x6672 | t_L SS2 :002 | Minimum time until the activation of the SOS_2 safety function, if the speed is within the window | 02 | 1 ms | 0x0000 |
| 0x6672 | t_L SS2 :003 | Minimum time until the activation of the SOS_3 safety function, if the speed is within the window | 03 | 1 ms | 0x0000 |
| 0x6672 | t_L SS2 :004 | Minimum time until the activation of the SOS_4 safety function, if the speed is within the window | 04 | 1 ms | 0x0000 |
| 0x6672 | t_L SS2 :005 | Minimum time until the activation of the SOS_5 safety function, if the speed is within the window | 05 | 1 ms | 0x0000 |
| 0x6672 | t_L SS2 :006 | Minimum time until the activation of the SOS_6 safety function, if the speed is within the window | 06 | 1 ms | 0x0000 |
| 0x6672 | t_L SS2 :007 | Minimum time until the activation of the SOS_7 safety function, if the speed is within the window | 07 | 1 ms | 0x0000 |
| 0x6672 | t_L SS2 :008 | Minimum time until the activation of the SOS_8 safety function, if the speed is within the window | 08 | 1 ms | 0x0000 |
| 0x6679 | n_Zero_SS2 32 Bit :001 | Speed window for SS2_1 | 01 | Increments per 1 ms | 0x00000000 |
| 0x6679 | n_Zero_SS2 32 Bit :002 | Speed window for SS2_2 | 02 | Increments per 1 ms | 0x00000000 |
| 0x6679 | n_Zero_SS2 32 Bit :003 | Speed window for SS2_3 | 03 | Increments per 1 ms | 0x00000000 |
| 0x6679 | n_Zero_SS2 32 Bit :004 | Speed window for SS2_4 | 04 | Increments per 1 ms | 0x00000000 |
| 0x6679 | n_Zero_SS2 32 Bit :005 | Speed window for SS2_5 | 05 | Increments per 1 ms | 0x00000000 |

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|---------------------------|------------------------|-----------|------------------------|---------------|
| 0x6679 | n_Zero_SS2 32 Bit :006 | Speed window for SS2_6 | 06 | Increments per 1 ms | 0x00000000 |
| 0x6679 | n_Zero_SS2 32 Bit :007 | Speed window for SS2_7 | 07 | Increments per 1 ms | 0x00000000 |
| 0x6679 | n_Zero_SS2 32 Bit :008 | Speed window for SS2_8 | 08 | Increments per 1 ms | 0x00000000 |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|------------------------|---|-----------|---------------------|---------------|
| 0x6E71 | t_SS2 :001 | Maximum time until the activation of the SOS_1 safety function | 01 | 10 ms | 0x0000 |
| 0x6E71 | t_SS2 :002 | Maximum time until the activation of the SOS_2 safety function | 02 | 10 ms | 0x0000 |
| 0x6E71 | t_SS2 :003 | Maximum time until the activation of the SOS_3 safety function | 03 | 10 ms | 0x0000 |
| 0x6E71 | t_SS2 :004 | Maximum time until the activation of the SOS_4 safety function | 04 | 10 ms | 0x0000 |
| 0x6E71 | t_SS2 :005 | Maximum time until the activation of the SOS_5 safety function | 05 | 10 ms | 0x0000 |
| 0x6E71 | t_SS2 :006 | Maximum time until the activation of the SOS_6 safety function | 06 | 10 ms | 0x0000 |
| 0x6E71 | t_SS2 :007 | Maximum time until the activation of the SOS_7 safety function | 07 | 10 ms | 0x0000 |
| 0x6E71 | t_SS2 :008 | Maximum time until the activation of the SOS_8 safety function | 08 | 10 ms | 0x0000 |
| 0x6E72 | t_L SS2 :001 | Minimum time until the activation of the SOS_1 safety function, if the speed is within the window | 01 | 1 ms | 0x0000 |
| 0x6E72 | t_L SS2 :002 | Minimum time until the activation of the SOS_2 safety function, if the speed is within the window | 02 | 1 ms | 0x0000 |
| 0x6E72 | t_L SS2 :003 | Minimum time until the activation of the SOS_3 safety function, if the speed is within the window | 03 | 1 ms | 0x0000 |
| 0x6E72 | t_L SS2 :004 | Minimum time until the activation of the SOS_4 safety function, if the speed is within the window | 04 | 1 ms | 0x0000 |
| 0x6E72 | t_L SS2 :005 | Minimum time until the activation of the SOS_5 safety function, if the speed is within the window | 05 | 1 ms | 0x0000 |
| 0x6E72 | t_L SS2 :006 | Minimum time until the activation of the SOS_6 safety function, if the speed is within the window | 06 | 1 ms | 0x0000 |
| 0x6E72 | t_L SS2 :007 | Minimum time until the activation of the SOS_7 safety function, if the speed is within the window | 07 | 1 ms | 0x0000 |
| 0x6E72 | t_L SS2 :008 | Minimum time until the activation of the SOS_8 safety function, if the speed is within the window | 08 | 1 ms | 0x0000 |
| 0x6E79 | n_Zero_SS2 32 Bit :001 | Speed window for SS2_1 | 01 | Increments per 1 ms | 0x00000000 |
| 0x6E79 | n_Zero_SS2 32 Bit :002 | Speed window for SS2_2 | 02 | Increments per 1 ms | 0x00000000 |
| 0x6E79 | n_Zero_SS2 32 Bit :003 | Speed window for SS2_3 | 03 | Increments per 1 ms | 0x00000000 |
| 0x6E79 | n_Zero_SS2 32 Bit :004 | Speed window for SS2_4 | 04 | Increments per 1 ms | 0x00000000 |
| 0x6E79 | n_Zero_SS2 32 Bit :005 | Speed window for SS2_5 | 05 | Increments per 1 ms | 0x00000000 |

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|---------------------------|------------------------|-----------|------------------------|---------------|
| 0x6E79 | n_Zero_SS2 32 Bit :006 | Speed window for SS2_6 | 06 | Increments per 1 ms | 0x00000000 |
| 0x6E79 | n_Zero_SS2 32 Bit :007 | Speed window for SS2_7 | 07 | Increments per 1 ms | 0x00000000 |
| 0x6E79 | n_Zero_SS2 32 Bit :008 | Speed window for SS2_8 | 08 | Increments per 1 ms | 0x00000000 |

3.6.6.5 Description of the SOS safety function

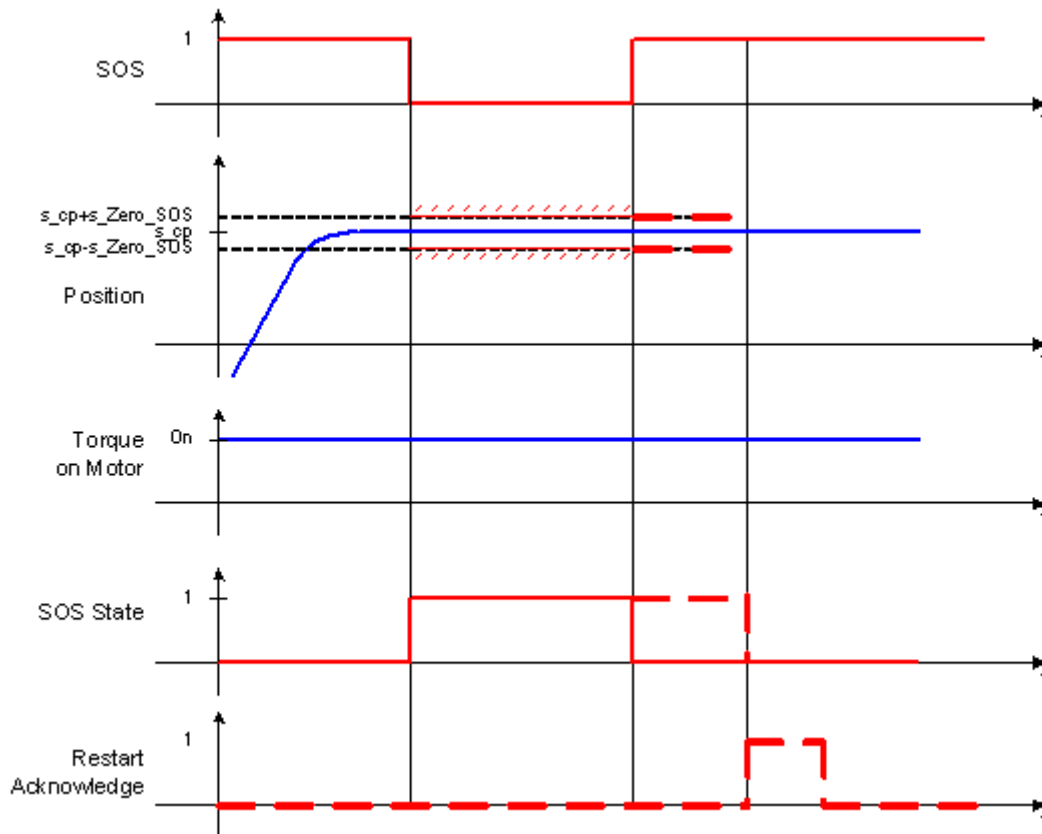



Fig. 31: Description of the Safe Operating Stop function (SOS)


| | |
|---|---|
|  WARNING | <p>Suspended loads</p> <p>The SOS function may not be used for suspended loads, since failure of the power supply and/or failure of the encoder signal can result in an undetected movement. This can lead to the endangering of people.</p> <p>In the case of suspended loads please provide for alternative measures to bring the axis safely to a standstill in an error state, such as Scotch derricks, safe service brakes or other measures. These safety measures must be controlled by the user application.</p> |
|---|---|

The monitoring of the current position (s_{cp}) is switched on upon the activation of SOS. The position may not leave the window (s_{Zero_SOS}), defined around this position. The motor remains activated and under torque.

If one of the limits is violated, the predefined function STO is executed as error reaction. This reaction cannot be parameterized.

If the position value should freeze due to an error of the encoder, a movement will only be detected if a change of position occurs outside the Speed_Compare_Window. The user can calculate the maximum speed using the following equation and evaluate it for his application.

$$\text{Max Drehwinkel in } ^\circ \text{ pro s} = \frac{0x2020}{65535 * \text{PolePairs}} * 8 * 1000 * 360^\circ = \frac{5}{65535 * 5} * 8 * 1000 * 360^\circ = 43,9^\circ /s$$

| | |
|---|---|
|  WARNING | <p>Case of error: encoder signal freezes</p> <p>If the encoder signal should fail (stuck-at error), there is a maximum undetected speed according to the previous calculation.</p> |
|---|---|

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|---------------------------|---|-----------|------------|---------------|
| 0x666A | s_Zero_SOS 32 Bit :001 | If the SOS_1 function is activated, the axis may move within the position window defined here | 01 | Increments | 0x0000 |
| 0x666A | s_Zero_SOS 32 Bit :002 | If the SOS_2 function is activated, the axis may move within the position window defined here | 02 | Increments | 0x0000 |
| 0x666A | s_Zero_SOS 32 Bit :003 | If the SOS_3 function is activated, the axis may move within the position window defined here | 03 | Increments | 0x0000 |
| 0x666A | s_Zero_SOS 32 Bit :004 | If the SOS_4 function is activated, the axis may move within the position window defined here | 04 | Increments | 0x0000 |
| 0x666A | s_Zero_SOS 32 Bit :005 | If the SOS_5 function is activated, the axis may move within the position window defined here | 05 | Increments | 0x0000 |
| 0x666A | s_Zero_SOS 32 Bit :006 | If the SOS_6 function is activated, the axis may move within the position window defined here | 06 | Increments | 0x0000 |
| 0x666A | s_Zero_SOS 32 Bit :007 | If the SOS_7 function is activated, the axis may move within the position window defined here | 07 | Increments | 0x0000 |
| 0x666A | s_Zero_SOS 32 Bit :008 | If the SOS_8 function is activated, the axis may move within the position window defined here | 08 | Increments | 0x0000 |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|---------------------------|---|-----------|------------|---------------|
| 0x6E6A | s_Zero_SOS 32 Bit :001 | If the SOS_1 function is activated, the axis may move within the position window defined here | 01 | Increments | 0x0000 |
| 0x6E6A | s_Zero_SOS 32 Bit :002 | If the SOS_2 function is activated, the axis may move within the position window defined here | 02 | Increments | 0x0000 |
| 0x6E6A | s_Zero_SOS 32 Bit :003 | If the SOS_3 function is activated, the axis may move within the position window defined here | 03 | Increments | 0x0000 |
| 0x6E6A | s_Zero_SOS 32 Bit :004 | If the SOS_4 function is activated, the axis may move within the position window defined here | 04 | Increments | 0x0000 |
| 0x6E6A | s_Zero_SOS 32 Bit :005 | If the SOS_5 function is activated, the axis may move within the position window defined here | 05 | Increments | 0x0000 |
| 0x6E6A | s_Zero_SOS 32 Bit :006 | If the SOS_6 function is activated, the axis may move within the position window defined here | 06 | Increments | 0x0000 |
| 0x6E6A | s_Zero_SOS 32 Bit :007 | If the SOS_7 function is activated, the axis may move within the position window defined here | 07 | Increments | 0x0000 |
| 0x6E6A | s_Zero_SOS 32 Bit :008 | If the SOS_8 function is activated, the axis may move within the position window defined here | 08 | Increments | 0x0000 |

3.6.6.6 Description of the SSR safety function

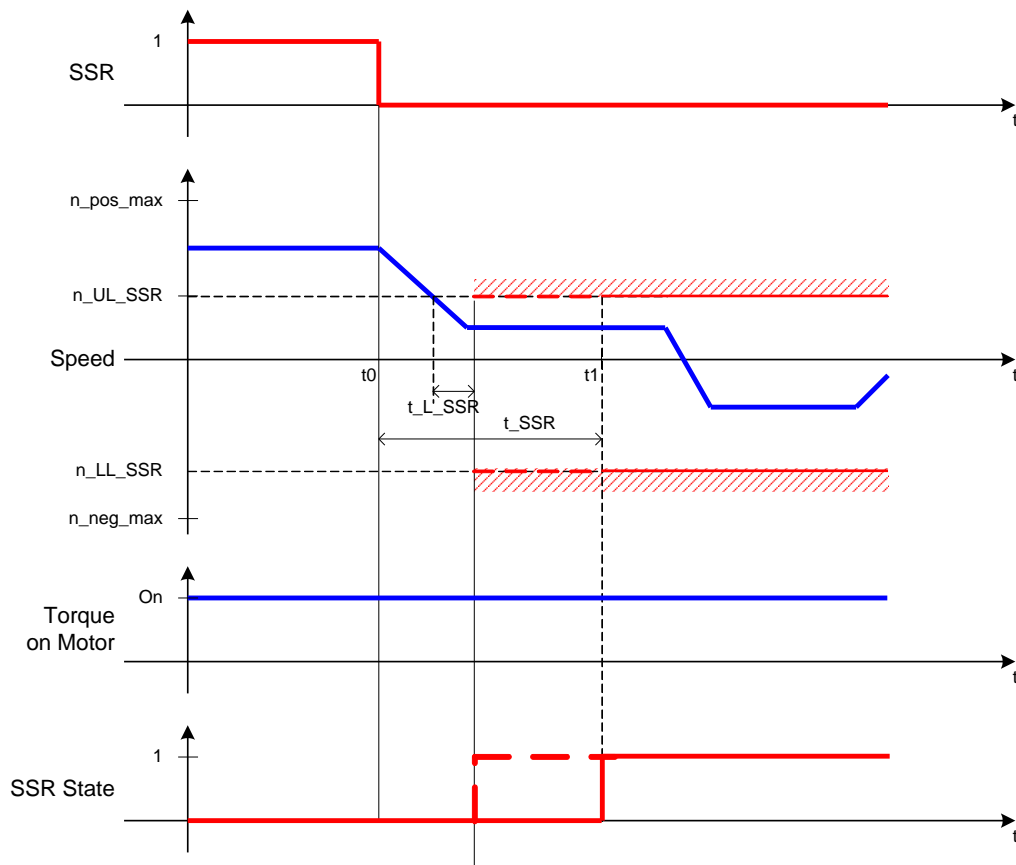



Fig. 32: Description of the Safe Speed Range function (SSR) with time monitor

The time monitor t_{SSR} is started upon activation of the SSR function. The standard control begins with the deceleration and the maximum speeds n_{UL_SSR} (UL-upper limit) and n_{LL_SSR} (LL-lower limit) are monitored at the latest upon the expiry of the time t_{SSR} .

If the axis is already within the defined speed window, the monitoring is activated after the time t_{L_SSR} .

If one of the limits is exceeded, the function defined under `ErrorReaction_SSR` is executed.

| | |
|---|---|
|  WARNING | <p>Parameter settings</p> <p>The setting of the speed limits must be above the calculated speed from the <code>Speed_Compare_Window</code>. (See also chapter 3.6.2)</p> |
|---|---|

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|----------------------|--|-----------|---------------------|---------------|
| 0x6681 | t_SSR :001 | Maximum time until the activation of the SSR_1 safety function | 01 | 1 ms | 0x0000 |
| 0x6681 | t_SSR :002 | Maximum time until the activation of the SSR_2 safety function | 02 | 1 ms | 0x0000 |
| 0x6681 | t_SSR: 003 | Maximum time until the activation of the SSR_3 safety function | 03 | 1 ms | 0x0000 |
| 0x6681 | t_SSR :004 | Maximum time until the activation of the SSR_4 safety function | 04 | 1 ms | 0x0000 |
| 0x6681 | t_SSR :005 | Maximum time until the activation of the SSR_5 safety function | 05 | 1 ms | 0x0000 |
| 0x6681 | t_SSR :006 | Maximum time until the activation of the SSR_6 safety function | 06 | 1 ms | 0x0000 |
| 0x6681 | t_SSR :007 | Maximum time until the activation of the SSR_7 safety function | 07 | 1 ms | 0x0000 |
| 0x6681 | t_SSR :008 | Maximum time until the activation of the SSR_8 safety function | 08 | 1 ms | 0x0000 |
| 0x6683 | n_UL_SSR 32 Bit :001 | Upper speed limit when the SSR_1 function is activated | 01 | Increments per 1 ms | 0x00000000 |
| 0x6683 | n_UL_SSR 32 Bit :002 | Upper speed limit when the SSR_2 function is activated | 02 | Increments per 1 ms | 0x00000000 |
| 0x6683 | n_UL_SSR 32 Bit :003 | Upper speed limit when the SSR_3 function is activated | 03 | Increments per 1 ms | 0x00000000 |
| 0x6683 | n_UL_SSR 32 Bit :004 | Upper speed limit when the SSR_4 function is activated | 04 | Increments per 1 ms | 0x00000000 |
| 0x6683 | n_UL_SSR 32 Bit :005 | Upper speed limit when the SSR_5 function is activated | 05 | Increments per 1 ms | 0x00000000 |
| 0x6683 | n_UL_SSR 32 Bit :006 | Upper speed limit when the SSR_6 function is activated | 06 | Increments per 1 ms | 0x00000000 |
| 0x6683 | n_UL_SSR 32 Bit :007 | Upper speed limit when the SSR_7 function is activated | 07 | Increments per 1 ms | 0x00000000 |
| 0x6683 | n_UL_SSR 32 Bit :008 | Upper speed limit when the SSR_8 function is activated | 08 | Increments per 1 ms | 0x00000000 |
| 0x6685 | n_LL_SSR 32 Bit :001 | Lower speed limit when the SSR_1 function is activated | 01 | Increments per 1 ms | 0x00000000 |
| 0x6685 | n_LL_SSR 32 Bit :002 | Lower speed limit when the SSR_2 function is activated | 02 | Increments per 1 ms | 0x00000000 |
| 0x6685 | n_LL_SSR 32 Bit :003 | Lower speed limit when the SSR_3 function is activated | 03 | Increments per 1 ms | 0x00000000 |
| 0x6685 | n_LL_SSR 32 Bit :004 | Lower speed limit when the SSR_4 function is activated | 04 | Increments per 1 ms | 0x00000000 |
| 0x6685 | n_LL_SSR 32 Bit :005 | Lower speed limit when the SSR_5 function is activated | 05 | Increments per 1 ms | 0x00000000 |
| 0x6685 | n_LL_SSR 32 Bit :006 | Lower speed limit when the SSR_6 function is activated | 06 | Increments per 1 ms | 0x00000000 |
| 0x6685 | n_LL_SSR 32 Bit :007 | Lower speed limit when the SSR_7 function is activated | 07 | Increments per 1 ms | 0x00000000 |
| 0x6685 | n_LL_SSR 32 Bit :008 | Lower speed limit when the SSR_8 function is activated | 08 | Increments per 1 ms | 0x00000000 |

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|------|------------------|
| 0x6686 | t_L_SSR :001 | Minimum time until the activation of the SSR_1 safety function, if the speed is within the window | 01 | 1 ms | 0x0000 |
| 0x6686 | t_L_SSR :002 | Minimum time until the activation of the SSR_2 safety function, if the speed is within the window | 02 | 1 ms | 0x0000 |
| 0x6686 | t_L_SSR :003 | Minimum time until the activation of the SSR_3 safety function, if the speed is within the window | 03 | 1 ms | 0x0000 |
| 0x6686 | t_L_SSR :004 | Minimum time until the activation of the SSR_4 safety function, if the speed is within the window | 04 | 1 ms | 0x0000 |
| 0x6686 | t_L_SSR :005 | Minimum time until the activation of the SSR_5 safety function, if the speed is within the window | 05 | 1 ms | 0x0000 |
| 0x6686 | t_L_SSR :006 | Minimum time until the activation of the SSR_6 safety function, if the speed is within the window | 06 | 1 ms | 0x0000 |
| 0x6686 | t_L_SSR :007 | Minimum time until the activation of the SSR_7 safety function, if the speed is within the window | 07 | 1 ms | 0x0000 |
| 0x6686 | t_L_SSR :008 | Minimum time until the activation of the SSR_8 safety function, if the speed is within the window | 08 | 1 ms | 0x0000 |
| 0x668A | Error Reaction SSR :001 | Error reaction of SSR_1 | 01 | -- | 0x66400001 (STO) |
| 0x668A | Error Reaction SSR :002 | Error reaction of SSR_2 | 02 | -- | 0x66400001 (STO) |
| 0x668A | Error Reaction SSR :003 | Error reaction of SSR_3 | 03 | -- | 0x66400001 (STO) |
| 0x668A | Error Reaction SSR :004 | Error reaction of SSR_4 | 04 | -- | 0x66400001 (STO) |
| 0x668A | Error Reaction SSR :005 | Error reaction of SSR_5 | 05 | -- | 0x66400001 (STO) |
| 0x668A | Error Reaction SSR :006 | Error reaction of SSR_6 | 06 | -- | 0x66400001 (STO) |
| 0x668A | Error Reaction SSR :007 | Error reaction of SSR_7 | 07 | -- | 0x66400001 (STO) |
| 0x668A | Error Reaction SSR :008 | Error reaction of SSR_8 | 08 | -- | 0x66400001 (STO) |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|------------------------|--|-----------|---------------------|---------------|
| 0x6E81 | t_SSR :001 | Maximum time until the activation of the SSR_1 safety function | 01 | 1 ms | 0x0000 |
| 0x6E81 | t_SSR :002 | Maximum time until the activation of the SSR_2 safety function | 02 | 1 ms | 0x0000 |
| 0x6E81 | t_SSR: 003 | Maximum time until the activation of the SSR_3 safety function | 03 | 1 ms | 0x0000 |
| 0x6E81 | t_SSR :004 | Maximum time until the activation of the SSR_4 safety function | 04 | 1 ms | 0x0000 |
| 0x6E81 | t_SSR :005 | Maximum time until the activation of the SSR_5 safety function | 05 | 1 ms | 0x0000 |
| 0x6E81 | t_SSR :006 | Maximum time until the activation of the SSR_6 safety function | 06 | 1 ms | 0x0000 |
| 0x6E81 | t_SSR :007 | Maximum time until the activation of the SSR_7 safety function | 07 | 1 ms | 0x0000 |
| 0x6E81 | t_SSR :008 | Maximum time until the activation of the SSR_8 safety function | 08 | 1 ms | 0x0000 |
| 0x6E83 | n_UL_SSR R 32 Bit :001 | Upper speed limit when the SSR_1 function is activated | 01 | Increments per 1 ms | 0x00000000 |
| 0x6E83 | n_UL_SSR R 32 Bit :002 | Upper speed limit when the SSR_2 function is activated | 02 | Increments per 1 ms | 0x00000000 |
| 0x6E83 | n_UL_SSR R 32 Bit :003 | Upper speed limit when the SSR_3 function is activated | 03 | Increments per 1 ms | 0x00000000 |
| 0x6E83 | n_UL_SSR R 32 Bit :004 | Upper speed limit when the SSR_4 function is activated | 04 | Increments per 1 ms | 0x00000000 |
| 0x6E83 | n_UL_SSR R 32 Bit :005 | Upper speed limit when the SSR_5 function is activated | 05 | Increments per 1 ms | 0x00000000 |
| 0x6E83 | n_UL_SSR R 32 Bit :006 | Upper speed limit when the SSR_6 function is activated | 06 | Increments per 1 ms | 0x00000000 |
| 0x6E83 | n_UL_SSR R 32 Bit :007 | Upper speed limit when the SSR_7 function is activated | 07 | Increments per 1 ms | 0x00000000 |
| 0x6E83 | n_UL_SSR R 32 Bit :008 | Upper speed limit when the SSR_8 function is activated | 08 | Increments per 1 ms | 0x00000000 |
| 0x6E85 | n_LL_SSR 32 Bit :001 | Lower speed limit when the SSR_1 function is activated | 01 | Increments per 1 ms | 0x00000000 |
| 0x6E85 | n_LL_SSR 32 Bit :002 | Lower speed limit when the SSR_2 function is activated | 02 | Increments per 1 ms | 0x00000000 |
| 0x6E85 | n_LL_SSR 32 Bit :003 | Lower speed limit when the SSR_3 function is activated | 03 | Increments per 1 ms | 0x00000000 |
| 0x6E85 | n_LL_SSR 32 Bit :004 | Lower speed limit when the SSR_4 function is activated | 04 | Increments per 1 ms | 0x00000000 |
| 0x6E85 | n_LL_SSR 32 Bit :005 | Lower speed limit when the SSR_5 function is activated | 05 | Increments per 1 ms | 0x00000000 |

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------------|---|-----------|------------------------|---------------------|
| 0x6E85 | n_LL_SSR 32 Bit :006 | Lower speed limit when the SSR_6 function is activated | 06 | Increments per 1 ms | 0x00000000 |
| 0x6E85 | n_LL_SSR 32 Bit :007 | Lower speed limit when the SSR_7 function is activated | 07 | Increments per 1 ms | 0x00000000 |
| 0x6E85 | n_LL_SSR 32 Bit :008 | Lower speed limit when the SSR_8 function is activated | 08 | Increments per 1 ms | 0x00000000 |
| 0x6E86 | t_L_SSR :001 | Minimum time until the activation of the SSR_1 safety function, if the speed is within the window | 01 | 1 ms | 0x0000 |
| 0x6E86 | t_L_SSR :002 | Minimum time until the activation of the SSR_2 safety function, if the speed is within the window | 02 | 1 ms | 0x0000 |
| 0x6E86 | t_L_SSR :003 | Minimum time until the activation of the SSR_3 safety function, if the speed is within the window | 03 | 1 ms | 0x0000 |
| 0x6E86 | t_L_SSR :004 | Minimum time until the activation of the SSR_4 safety function, if the speed is within the window | 04 | 1 ms | 0x0000 |
| 0x6E86 | t_L_SSR :005 | Minimum time until the activation of the SSR_5 safety function, if the speed is within the window | 05 | 1 ms | 0x0000 |
| 0x6E86 | t_L_SSR :006 | Minimum time until the activation of the SSR_6 safety function, if the speed is within the window | 06 | 1 ms | 0x0000 |
| 0x6E86 | t_L_SSR :007 | Minimum time until the activation of the SSR_7 safety function, if the speed is within the window | 07 | 1 ms | 0x0000 |
| 0x6E86 | t_L_SSR :008 | Minimum time until the activation of the SSR_8 safety function, if the speed is within the window | 08 | 1 ms | 0x0000 |
| 0x6E8A | Error Reaction SSR :001 | Error reaction of SSR_1 | 01 | -- | 0x66400001 (STO) |
| 0x6E8A | Error Reaction SSR :002 | Error reaction of SSR_2 | 02 | -- | 0x66400001 (STO) |
| 0x6E8A | Error Reaction SSR :003 | Error reaction of SSR_3 | 03 | -- | 0x66400001 (STO) |
| 0x6E8A | Error Reaction SSR :004 | Error reaction of SSR_4 | 04 | -- | 0x66400001 (STO) |
| 0x6E8A | Error Reaction SSR :005 | Error reaction of SSR_5 | 05 | -- | 0x66400001 (STO) |
| 0x6E8A | Error Reaction SSR :006 | Error reaction of SSR_6 | 06 | -- | 0x66400001 (STO) |
| 0x6E8A | Error Reaction SSR :007 | Error reaction of SSR_7 | 07 | -- | 0x66400001 (STO) |
| 0x6E8A | Error Reaction SSR :008 | Error reaction of SSR_8 | 08 | -- | 0x66400001 (STO) |

3.6.6.7 Description of the SDIp safety function

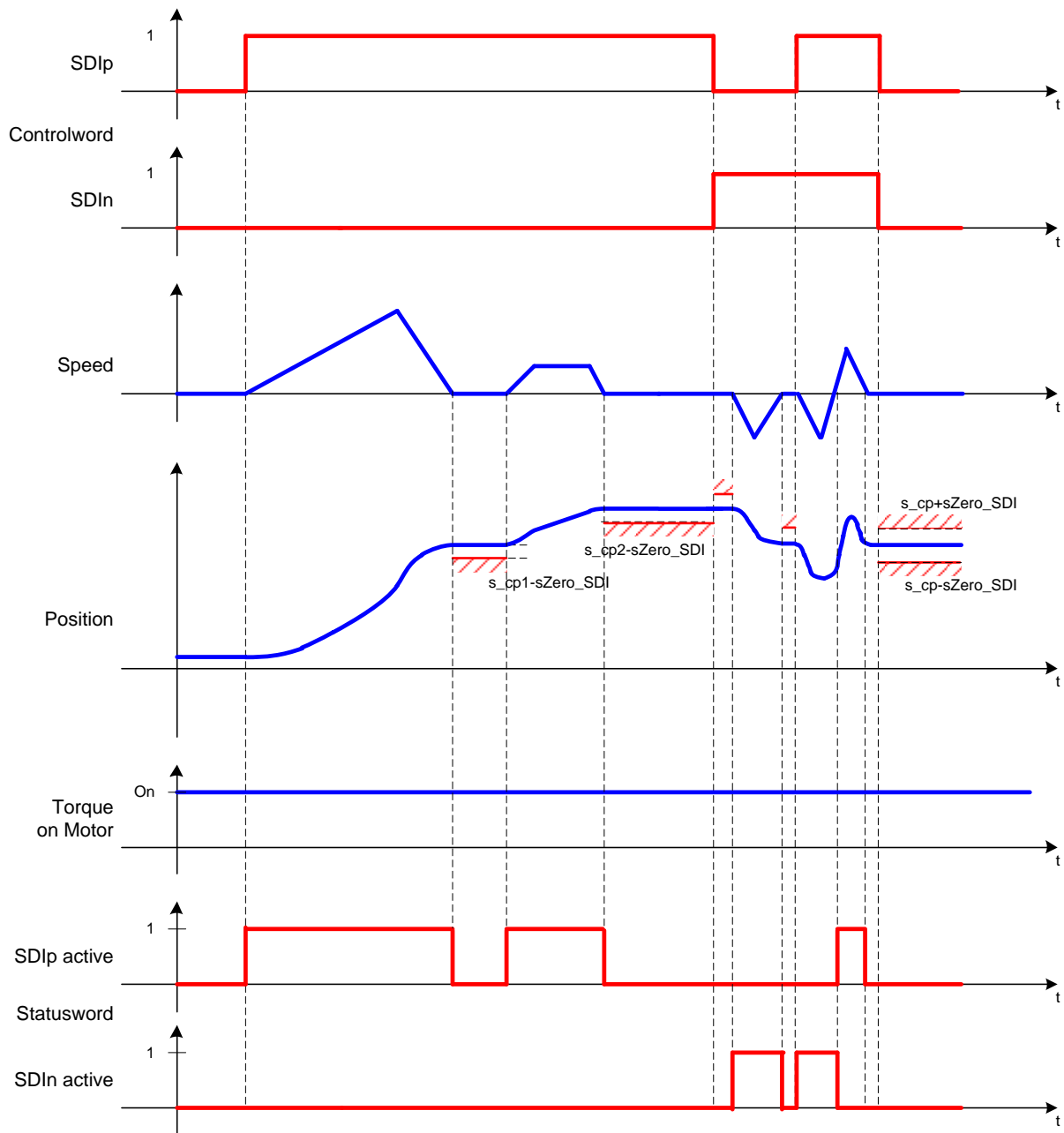


Fig. 33: Description of the Safe Direction positive function (SDIp)

A positive direction of rotation is permitted only if the SDIp bit is set in the control word. The SDIp and SDIn bits in the status word indicate the current direction of rotation. Both status bits are 0 if the axis is stationary. The position may not leave the window (s_Zero_SDI) defined around this position.

Only the negative direction of rotation is permitted if the SDIp function is activated ($SDIp = 0$).

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------|---|-----------|------------|---------------|
| 0x66D3 | s_Zero_SDI 32 Bit | Position window for the SDI safety function | -- | Increments | 0x00000000 |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------|---|-----------|------------|---------------|
| 0x6ED3 | s_Zero_SDI 32 Bit | Position window for the SDI safety function | -- | Increments | 0x00000000 |

3.6.6.8 Description of the SDIn safety function

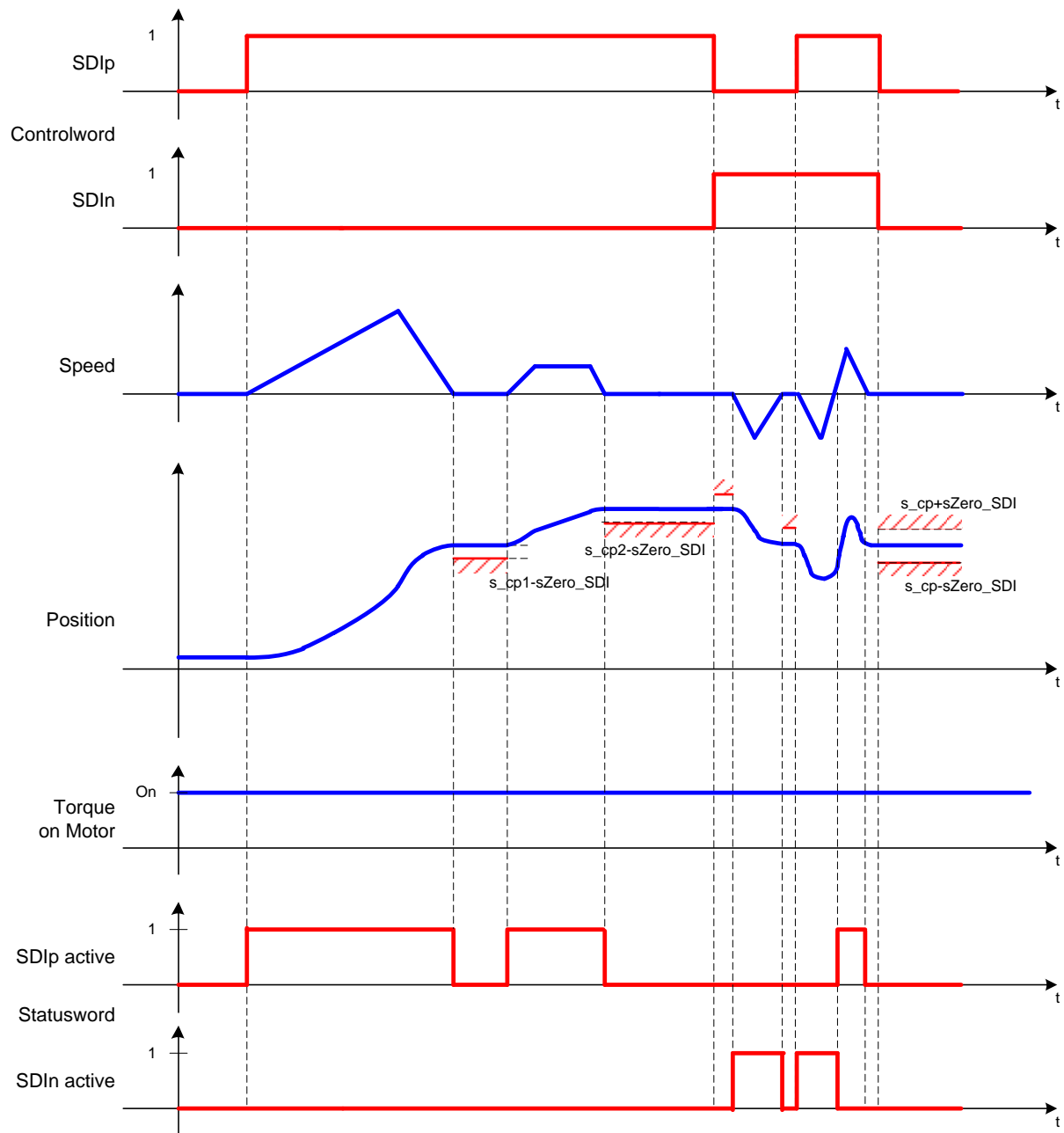


Fig. 34: Description of the Safe Direction negative function (SDIn)

A negative direction of rotation is permitted only if the SDIn bit is set in the control word. The SDIp and SDIn bits in the status word indicate the current direction of rotation. Both status bits are 0 if the axis is stationary. The position may not leave the window (s_Zero_SDI) defined around this position.

Only the positive direction of rotation is permitted if the SDIn function is activated (SDIn = 0).

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------|---|-----------|------------|---------------|
| 0x66D3 | s_Zero_SDI 32 Bit | Position window for the SDI safety function | -- | Increments | 0x00000000 |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------|---|-----------|------------|---------------|
| 0x6ED3 | s_Zero_SDI 32 Bit | Position window for the SDI safety function | -- | Increments | 0x00000000 |

3.6.6.9 Description of the SSM safety function

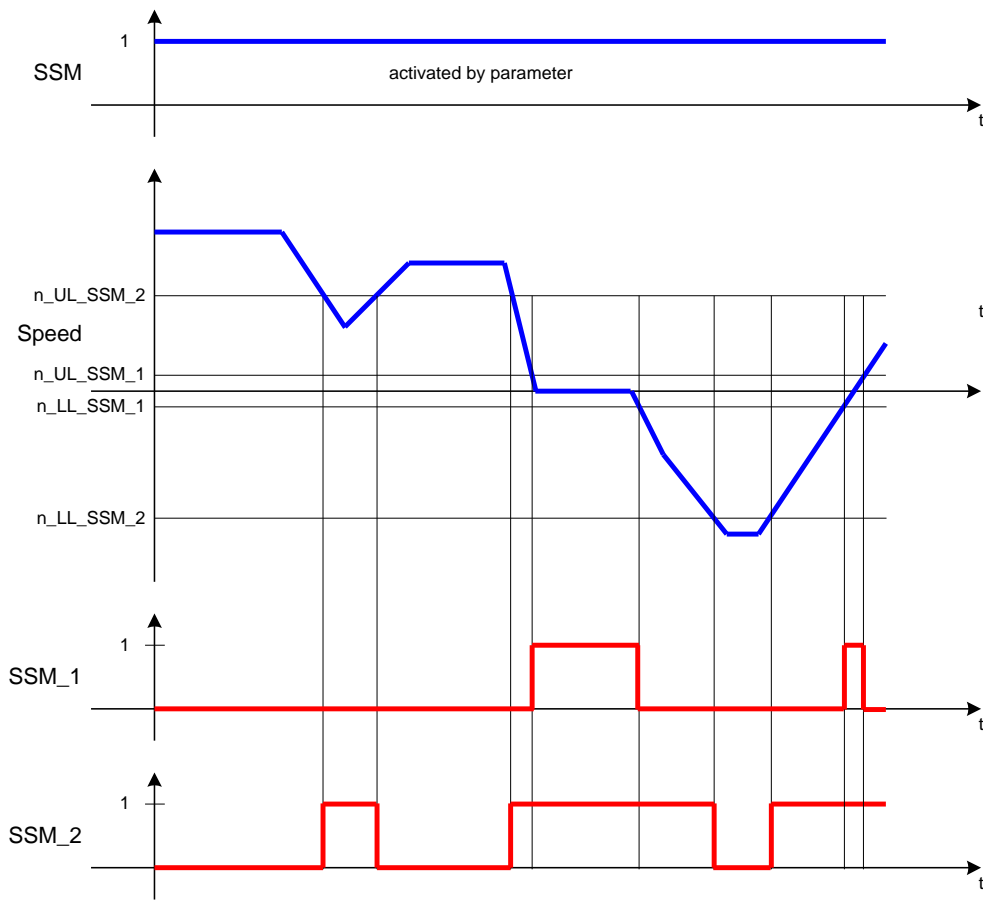



Fig. 35: Description of the Safe Speed Monitor function (SSM0, SSM1)

The SSM function is activated by the parameters (parameter values not equal to 0).

The status is set if the current speed is within the limits n_UL_SSM 32 Bit (UL-Upper limit) and n_LL_SSM 32 Bit (LL-Lower limit).

| | |
|---|--|
|  WARNING | <p>Parameter settings</p> <p>The setting of the speed limits must be above the calculated speed from the Speed_Compare_Window. (See also chapter 3.6.2)</p> |
|---|--|

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|----------------------|---|-----------|---------------------|---------------|
| 0x66E2 | n_UL_SSM 32 Bit :001 | Upper speed limit of the SSM_1 function | 01 | Increments per 1 ms | 0x00000000 |
| 0x66E2 | n_UL_SSM 32 Bit :002 | Upper speed limit of the SSM_2 function | 02 | Increments per 1 ms | 0x00000000 |
| 0x66E2 | n_UL_SSM 32 Bit :003 | Upper speed limit of the SSM_3 function | 03 | Increments per 1 ms | 0x00000000 |
| 0x66E2 | n_UL_SSM 32 Bit :004 | Upper speed limit of the SSM_4 function | 04 | Increments per 1 ms | 0x00000000 |
| 0x66E2 | n_UL_SSM 32 Bit :005 | Upper speed limit of the SSM_5 function | 05 | Increments per 1 ms | 0x00000000 |
| 0x66E2 | n_UL_SSM 32 Bit :006 | Upper speed limit of the SSM_6 function | 06 | Increments per 1 ms | 0x00000000 |
| 0x66E2 | n_UL_SSM 32 Bit :007 | Upper speed limit of the SSM_7 function | 07 | Increments per 1 ms | 0x00000000 |
| 0x66E2 | n_UL_SSM 32 Bit :008 | Upper speed limit of the SSM_8 function | 08 | Increments per 1 ms | 0x00000000 |
| 0x66E4 | n_LL_SSM 32 Bit :001 | Lower speed limit of the SSM_1 function | 01 | Increments per 1 ms | 0x00000000 |
| 0x66E4 | n_LL_SSM 32 Bit :002 | Lower speed limit of the SSM_2 function | 02 | Increments per 1 ms | 0x00000000 |
| 0x66E4 | n_LL_SSM 32 Bit :003 | Lower speed limit of the SSM_3 function | 03 | Increments per 1 ms | 0x00000000 |
| 0x66E4 | n_LL_SSM 32 Bit :004 | Lower speed limit of the SSM_4 function | 04 | Increments per 1 ms | 0x00000000 |
| 0x66E4 | n_LL_SSM 32 Bit :005 | Lower speed limit of the SSM_5 function | 05 | Increments per 1 ms | 0x00000000 |
| 0x66E4 | n_LL_SSM 32 Bit :006 | Lower speed limit of the SSM_6 function | 06 | Increments per 1 ms | 0x00000000 |
| 0x66E4 | n_LL_SSM 32 Bit :007 | Lower speed limit of the SSM_7 function | 07 | Increments per 1 ms | 0x00000000 |
| 0x66E4 | n_LL_SSM 32 Bit :008 | Lower speed limit of the SSM_8 function | 08 | Increments per 1 ms | 0x00000000 |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|----------------------|---|-----------|---------------------|---------------|
| 0x6EE2 | n_UL_SSM 32 Bit :001 | Upper speed limit of the SSM_1 function | 01 | Increments per 1 ms | 0x00000000 |
| 0x6EE2 | n_UL_SSM 32 Bit :002 | Upper speed limit of the SSM_2 function | 02 | Increments per 1 ms | 0x00000000 |
| 0x6EE2 | n_UL_SSM 32 Bit :003 | Upper speed limit of the SSM_3 function | 03 | Increments per 1 ms | 0x00000000 |
| 0x6EE2 | n_UL_SSM 32 Bit :004 | Upper speed limit of the SSM_4 function | 04 | Increments per 1 ms | 0x00000000 |
| 0x6EE2 | n_UL_SSM 32 Bit :005 | Upper speed limit of the SSM_5 function | 05 | Increments per 1 ms | 0x00000000 |
| 0x6EE2 | n_UL_SSM 32 Bit :006 | Upper speed limit of the SSM_6 function | 06 | Increments per 1 ms | 0x00000000 |
| 0x6EE2 | n_UL_SSM 32 Bit :007 | Upper speed limit of the SSM_7 function | 07 | Increments per 1 ms | 0x00000000 |
| 0x6EE2 | n_UL_SSM 32 Bit :008 | Upper speed limit of the SSM_8 function | 08 | Increments per 1 ms | 0x00000000 |
| 0x6EE4 | n_LL_SSM 32 Bit :001 | Lower speed limit of the SSM_1 function | 01 | Increments per 1 ms | 0x00000000 |
| 0x6EE4 | n_LL_SSM 32 Bit :002 | Lower speed limit of the SSM_2 function | 02 | Increments per 1 ms | 0x00000000 |
| 0x6EE4 | n_LL_SSM 32 Bit :003 | Lower speed limit of the SSM_3 function | 03 | Increments per 1 ms | 0x00000000 |
| 0x6EE4 | n_LL_SSM 32 Bit :004 | Lower speed limit of the SSM_4 function | 04 | Increments per 1 ms | 0x00000000 |
| 0x6EE4 | n_LL_SSM 32 Bit :005 | Lower speed limit of the SSM_5 function | 05 | Increments per 1 ms | 0x00000000 |
| 0x6EE4 | n_LL_SSM 32 Bit :006 | Lower speed limit of the SSM_6 function | 06 | Increments per 1 ms | 0x00000000 |
| 0x6EE4 | n_LL_SSM 32 Bit :007 | Lower speed limit of the SSM_7 function | 07 | Increments per 1 ms | 0x00000000 |
| 0x6EE4 | n_LL_SSM 32 Bit :008 | Lower speed limit of the SSM_8 function | 08 | Increments per 1 ms | 0x00000000 |

3.6.6.10 Description of the SAR safety function

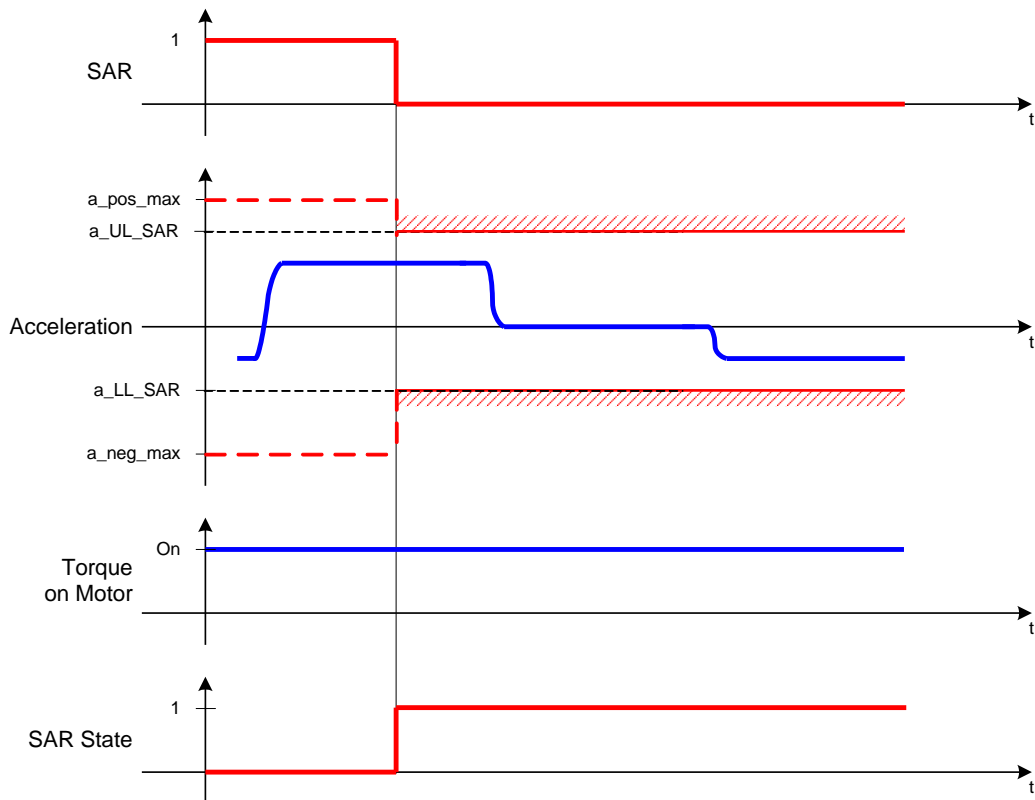


Fig. 36: Description of the Safe Acceleration Range function (SAR)

The monitoring of the acceleration window is started upon the activation of SAR (Safe Acceleration Range).

The acceleration must remain within the limits a_{UL_SAR} (UL - Upper Limit) and a_{LL_SAR} (LL - lower limit). If one of the limits is exceeded, the function defined under `ErrorReaction_SAR` is executed.

Parameters for axis 1


| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|----------------------------------|------------------|
| 0x66C2 | a_UL_SAR 32 Bit :001 | Upper acceleration limit of the SAR_1 safety function | 01 | Increments per 1 ms ² | 0x00000000 |
| 0x66C2 | a_UL_SAR 32 Bit :002 | Upper acceleration limit of the SAR_2 safety function | 02 | Increments per 1 ms ² | 0x00000000 |
| 0x66C2 | a_UL_SAR 32 Bit :003 | Upper acceleration limit of the SAR_3 safety function | 03 | Increments per 1 ms ² | 0x00000000 |
| 0x66C2 | a_UL_SAR 32 Bit :004 | Upper acceleration limit of the SAR_4 safety function | 04 | Increments per 1 ms ² | 0x00000000 |
| 0x66C2 | a_UL_SAR 32 Bit :005 | Upper acceleration limit of the SAR_5 safety function | 05 | Increments per 1 ms ² | 0x00000000 |
| 0x66C2 | a_UL_SAR 32 Bit :006 | Upper acceleration limit of the SAR_6 safety function | 06 | Increments per 1 ms ² | 0x00000000 |
| 0x66C2 | a_UL_SAR 32 Bit :007 | Upper acceleration limit of the SAR_7 safety function | 07 | Increments per 1 ms ² | 0x00000000 |
| 0x66C2 | a_UL_SAR 32 Bit :008 | Upper acceleration limit of the SAR_8 safety function | 08 | Increments per 1 ms ² | 0x00000000 |
| 0x66C4 | a_LL_SAR 32 Bit :001 | Lower acceleration limit of the SAR_1 safety function | 01 | Increments per 1 ms ² | 0x00000000 |
| 0x66C4 | a_LL_SAR 32 Bit :002 | Lower acceleration limit of the SAR_2 safety function | 02 | Increments per 1 ms ² | 0x00000000 |
| 0x66C4 | a_LL_SAR 32 Bit :003 | Lower acceleration limit of the SAR_3 safety function | 03 | Increments per 1 ms ² | 0x00000000 |
| 0x66C4 | a_LL_SAR 32 Bit :004 | Lower acceleration limit of the SAR_4 safety function | 04 | Increments per 1 ms ² | 0x00000000 |
| 0x66C4 | a_LL_SAR 32 Bit :005 | Lower acceleration limit of the SAR_5 safety function | 05 | Increments per 1 ms ² | 0x00000000 |
| 0x66C4 | a_LL_SAR 32 Bit :006 | Lower acceleration limit of the SAR_6 safety function | 06 | Increments per 1 ms ² | 0x00000000 |
| 0x66C4 | a_LL_SAR 32 Bit :007 | Lower acceleration limit of the SAR_7 safety function | 07 | Increments per 1 ms ² | 0x00000000 |
| 0x66C4 | a_LL_SAR 32 Bit :008 | Lower acceleration limit of the SAR_8 safety function | 08 | Increments per 1 ms ² | 0x00000000 |
| 0x66C5 | Error Reaction SAR :001 | Error reaction of SAR_1 | 01 | -- | 0x66400001 (STO) |
| 0x66C5 | Error Reaction SAR :002 | Error reaction of SAR_2 | 02 | -- | 0x66400001 (STO) |
| 0x66C5 | Error Reaction SAR :003 | Error reaction of SAR_3 | 03 | -- | 0x66400001 (STO) |
| 0x66C5 | Error Reaction SAR :004 | Error reaction of SAR_4 | 04 | -- | 0x66400001 (STO) |
| 0x66C5 | Error Reaction SAR :005 | Error reaction of SAR_5 | 05 | -- | 0x66400001 (STO) |
| 0x66C5 | Error Reaction SAR :006 | Error reaction of SAR_6 | 06 | -- | 0x66400001 (STO) |
| 0x66C5 | Error Reaction SAR :007 | Error reaction of SAR_7 | 07 | -- | 0x66400001 (STO) |
| 0x66C5 | Error Reaction SAR :008 | Error reaction of SAR_8 | 08 | -- | 0x66400001 (STO) |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|----------------------------------|------------------|
| 0x6EC2 | a_UL_SAR 32 Bit :001 | Upper acceleration limit of the SAR_1 safety function | 01 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC2 | a_UL_SAR 32 Bit :002 | Upper acceleration limit of the SAR_2 safety function | 02 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC2 | a_UL_SAR 32 Bit :003 | Upper acceleration limit of the SAR_3 safety function | 03 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC2 | a_UL_SAR 32 Bit :004 | Upper acceleration limit of the SAR_4 safety function | 04 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC2 | a_UL_SAR 32 Bit :005 | Upper acceleration limit of the SAR_5 safety function | 05 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC2 | a_UL_SAR 32 Bit :006 | Upper acceleration limit of the SAR_6 safety function | 06 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC2 | a_UL_SAR 32 Bit :007 | Upper acceleration limit of the SAR_7 safety function | 07 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC2 | a_UL_SAR 32 Bit :008 | Upper acceleration limit of the SAR_8 safety function | 08 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC4 | a_LL_SAR 32 Bit :001 | Lower acceleration limit of the SAR_1 safety function | 01 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC4 | a_LL_SAR 32 Bit :002 | Lower acceleration limit of the SAR_2 safety function | 02 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC4 | a_LL_SAR 32 Bit :003 | Lower acceleration limit of the SAR_3 safety function | 03 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC4 | a_LL_SAR 32 Bit :004 | Lower acceleration limit of the SAR_4 safety function | 04 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC4 | a_LL_SAR 32 Bit :005 | Lower acceleration limit of the SAR_5 safety function | 05 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC4 | a_LL_SAR 32 Bit :006 | Lower acceleration limit of the SAR_6 safety function | 06 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC4 | a_LL_SAR 32 Bit :007 | Lower acceleration limit of the SAR_7 safety function | 07 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC4 | a_LL_SAR 32 Bit :008 | Lower acceleration limit of the SAR_8 safety function | 08 | Increments per 1 ms ² | 0x00000000 |
| 0x6EC5 | Error Reaction SAR :001 | Error reaction of SAR_1 | 01 | -- | 0x66400001 (STO) |
| 0x6EC5 | Error Reaction SAR :002 | Error reaction of SAR_2 | 02 | -- | 0x66400001 (STO) |
| 0x6EC5 | Error Reaction SAR :003 | Error reaction of SAR_3 | 03 | -- | 0x66400001 (STO) |
| 0x6EC5 | Error Reaction SAR :004 | Error reaction of SAR_4 | 04 | -- | 0x66400001 (STO) |
| 0x6EC5 | Error Reaction SAR :005 | Error reaction of SAR_5 | 05 | -- | 0x66400001 (STO) |
| 0x6EC5 | Error Reaction SAR :006 | Error reaction of SAR_6 | 06 | -- | 0x66400001 (STO) |
| 0x6EC5 | Error Reaction SAR :007 | Error reaction of SAR_7 | 07 | -- | 0x66400001 (STO) |
| 0x6EC5 | Error Reaction SAR :008 | Error reaction of SAR_8 | 08 | -- | 0x66400001 (STO) |

3.6.6.11 Description of the SCA safety function

This function is available only if the safe position is referenced.

| | |
|--|---|
|  Note | <p>STO</p> <p>If the safety function STO is activated, the referencing is deleted.</p> |
|--|---|

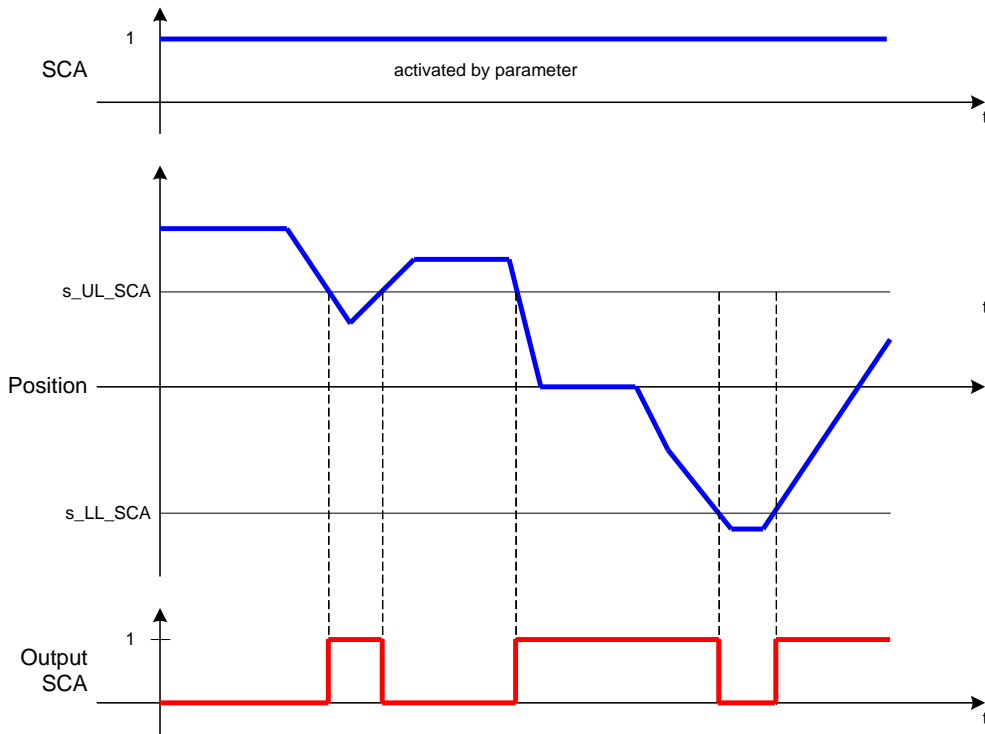


Fig. 37: Description of the Safe CAM function (SCA)

SCA (Safe CAM) can be implemented as a bit in the Safety status word. The SCA output is set to 1 as soon as the current position lies within the window between the upper limit s_UL_SCA (UL - Upper Limit) and the lower limit s_LL_SCA (LL - Lower Limit).

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|----------------------|---|-----------|--|---------------|
| 0x66EA | s_UL_SCA 32 Bit :001 | Upper position limit of the SCA_1 safety function | 01 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EA | s_UL_SCA 32 Bit :002 | Upper position limit of the SCA_2 safety function | 02 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EA | s_UL_SCA 32 Bit :003 | Upper position limit of the SCA_3 safety function | 03 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EA | s_UL_SCA 32 Bit :004 | Upper position limit of the SCA_4 safety function | 04 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EA | s_UL_SCA 32 Bit :005 | Upper position limit of the SCA_5 safety function | 05 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EA | s_UL_SCA 32 Bit :006 | Upper position limit of the SCA_6 safety function | 06 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EA | s_UL_SCA 32 Bit :007 | Upper position limit of the SCA_7 safety function | 07 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EA | s_UL_SCA 32 Bit :008 | Upper position limit of the SCA_8 safety function | 08 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EC | s_LL_SCA 32 Bit :001 | Lower position limit of the SCA_1 safety function | 01 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EC | s_LL_SCA 32 Bit :002 | Lower position limit of the SCA_2 safety function | 02 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EC | s_LL_SCA 32 Bit :003 | Lower position limit of the SCA_3 safety function | 03 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EC | s_LL_SCA 32 Bit :004 | Lower position limit of the SCA_4 safety function | 04 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EC | s_LL_SCA 32 Bit :005 | Lower position limit of the SCA_5 safety function | 05 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EC | s_LL_SCA 32 Bit :006 | Lower position limit of the SCA_6 safety function | 06 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EC | s_LL_SCA 32 Bit :007 | Lower position limit of the SCA_7 safety function | 07 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66EC | s_LL_SCA 32 Bit :008 | Lower position limit of the SCA_8 safety function | 08 | Pole revolution relative to the reference position | 0x00000000 |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|--|---------------|
| 0x6EEA | s_UL_SCA 32 Bit :001 | Upper position limit of the SCA_1 safety function | 01 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEA | s_UL_SCA 32 Bit :002 | Upper position limit of the SCA_2 safety function | 02 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEA | s_UL_SCA 32 Bit :003 | Upper position limit of the SCA_3 safety function | 03 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEA | s_UL_SCA 32 Bit :004 | Upper position limit of the SCA_4 safety function | 04 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEA | s_UL_SCA 32 Bit :005 | Upper position limit of the SCA_5 safety function | 05 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEA | s_UL_SCA 32 Bit :006 | Upper position limit of the SCA_6 safety function | 06 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEA | s_UL_SCA 32 Bit :007 | Upper position limit of the SCA_7 safety function | 07 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEA | s_UL_SCA 32 Bit :008 | Upper position limit of the SCA_8 safety function | 08 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEC | s_LL_SCA 32 Bit :001 | Lower position limit of the SCA_1 safety function | 01 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEC | s_LL_SCA 32 Bit :002 | Lower position limit of the SCA_2 safety function | 02 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEC | s_LL_SCA 32 Bit :003 | Lower position limit of the SCA_3 safety function | 03 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEC | s_LL_SCA 32 Bit :004 | Lower position limit of the SCA_4 safety function | 04 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEC | s_LL_SCA 32 Bit :005 | Lower position limit of the SCA_5 safety function | 05 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEC | s_LL_SCA 32 Bit :006 | Lower position limit of the SCA_6 safety function | 06 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEC | s_LL_SCA 32 Bit :007 | Lower position limit of the SCA_7 safety function | 07 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EEC | s_LL_SCA 32 Bit :008 | Lower position limit of the SCA_8 safety function | 08 | Pole revolution relative to the reference position | 0x00000000 |

3.6.6.12 Description of the SLI safety function

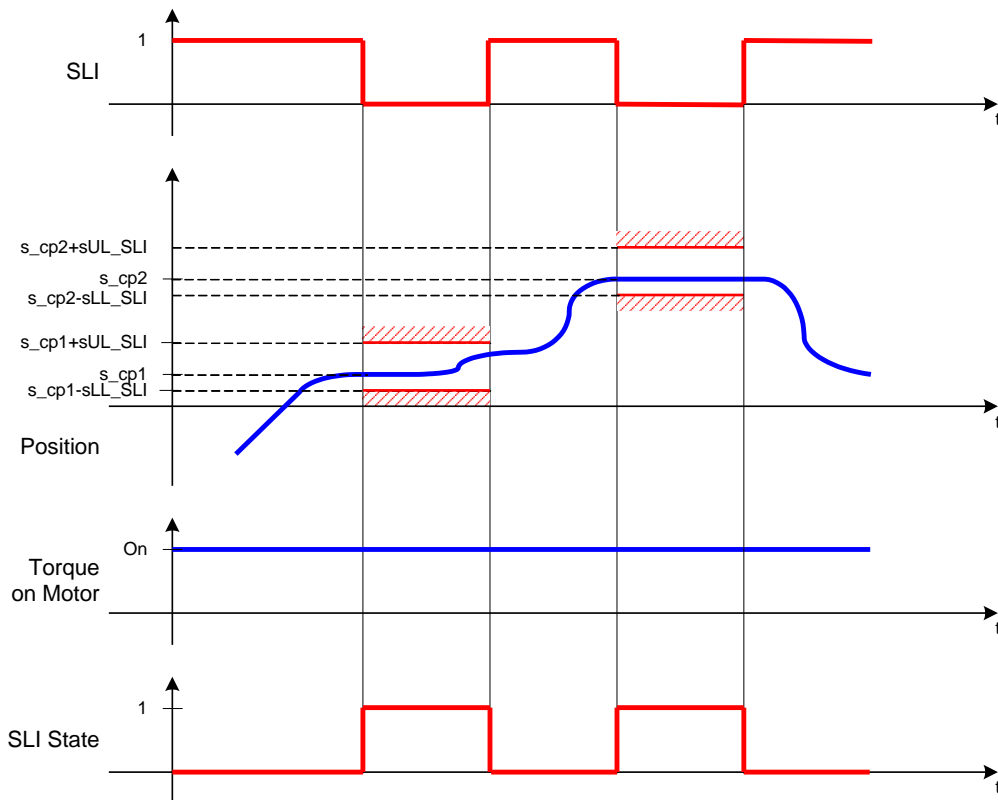



Fig. 38: Description of the Safely Limited Increment function (SLI)

The monitoring of the current position is started when the SLI function is activated (SLI = 0). The position saved upon activation may not leave the window defined between s_{UL_SLI} (UL-upper limit) and s_{LL_SLI} (LL-lower limit). If one of the limits is exceeded, the function defined under `ErrorReaction_SLI` is executed.

| | |
|--|--|
|  Note | <p>Difference between firmware 04 and firmware 05</p> <p>Up to firmware version 04, a positive value had to be entered for s_{LL_SLI}. From firmware version 05, this value has to be negative.</p> |
|--|--|

Parameters for axis 1


| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|------------|------------------|
| 0x66BA | s_UL_SLI 32 Bit :001 | Upper position limit of the SLI_1 safety function | 01 | Increments | 0x00000000 |
| 0x66BA | s_UL_SLI 32 Bit :002 | Upper position limit of the SLI_2 safety function | 02 | Increments | 0x00000000 |
| 0x66BA | s_UL_SLI 32 Bit :003 | Upper position limit of the SLI_3 safety function | 03 | Increments | 0x00000000 |
| 0x66BA | s_UL_SLI 32 Bit :004 | Upper position limit of the SLI_4 safety function | 04 | Increments | 0x00000000 |
| 0x66BA | s_UL_SLI 32 Bit :005 | Upper position limit of the SLI_5 safety function | 05 | Increments | 0x00000000 |
| 0x66BA | s_UL_SLI 32 Bit :006 | Upper position limit of the SLI_6 safety function | 06 | Increments | 0x00000000 |
| 0x66BA | s_UL_SLI 32 Bit :007 | Upper position limit of the SLI_7 safety function | 07 | Increments | 0x00000000 |
| 0x66BA | s_UL_SLI 32 Bit :008 | Upper position limit of the SLI_8 safety function | 08 | Increments | 0x00000000 |
| 0x66BC | s_LL_SLI 32 Bit :001 | Lower position limit of the SLI_1 safety function | 01 | Increments | 0x00000000 |
| 0x66BC | s_LL_SLI 32 Bit :002 | Lower position limit of the SLI_2 safety function | 02 | Increments | 0x00000000 |
| 0x66BC | s_LL_SLI 32 Bit :003 | Lower position limit of the SLI_3 safety function | 03 | Increments | 0x00000000 |
| 0x66BC | s_LL_SLI 32 Bit :004 | Lower position limit of the SLI_4 safety function | 04 | Increments | 0x00000000 |
| 0x66BC | s_LL_SLI 32 Bit :005 | Lower position limit of the SLI_5 safety function | 05 | Increments | 0x00000000 |
| 0x66BC | s_LL_SLI 32 Bit :006 | Lower position limit of the SLI_6 safety function | 06 | Increments | 0x00000000 |
| 0x66BC | s_LL_SLI 32 Bit :007 | Lower position limit of the SLI_7 safety function | 07 | Increments | 0x00000000 |
| 0x66BC | s_LL_SLI 32 Bit :008 | Lower position limit of the SLI_8 safety function | 08 | Increments | 0x00000000 |
| 0x66BD | Error Reaction SLI :001 | Error reaction of SLI_1 | 01 | -- | 0x66400001 (STO) |
| 0x66BD | Error Reaction SLI :002 | Error reaction of SLI_2 | 02 | -- | 0x66400001 (STO) |
| 0x66BD | Error Reaction SLI :003 | Error reaction of SLI_3 | 03 | -- | 0x66400001 (STO) |
| 0x66BD | Error Reaction SLI :004 | Error reaction of SLI_4 | 04 | -- | 0x66400001 (STO) |
| 0x66BD | Error Reaction SLI :005 | Error reaction of SLI_5 | 05 | -- | 0x66400001 (STO) |
| 0x66BD | Error Reaction SLI :006 | Error reaction of SLI_6 | 06 | -- | 0x66400001 (STO) |
| 0x66BD | Error Reaction SLI :007 | Error reaction of SLI_7 | 07 | -- | 0x66400001 (STO) |
| 0x66BD | Error Reaction SLI :008 | Error reaction of SLI_8 | 08 | -- | 0x66400001 (STO) |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|------------|------------------|
| 0x6EBA | s_UL_SLI 32 Bit :001 | Upper position limit of the SLI_1 safety function | 01 | Increments | 0x00000000 |
| 0x6EBA | s_UL_SLI 32 Bit :002 | Upper position limit of the SLI_2 safety function | 02 | Increments | 0x00000000 |
| 0x6EBA | s_UL_SLI 32 Bit :003 | Upper position limit of the SLI_3 safety function | 03 | Increments | 0x00000000 |
| 0x6EBA | s_UL_SLI 32 Bit :004 | Upper position limit of the SLI_4 safety function | 04 | Increments | 0x00000000 |
| 0x6EBA | s_UL_SLI 32 Bit :005 | Upper position limit of the SLI_5 safety function | 05 | Increments | 0x00000000 |
| 0x6EBA | s_UL_SLI 32 Bit :006 | Upper position limit of the SLI_6 safety function | 06 | Increments | 0x00000000 |
| 0x6EBA | s_UL_SLI 32 Bit :007 | Upper position limit of the SLI_7 safety function | 07 | Increments | 0x00000000 |
| 0x6EBA | s_UL_SLI 32 Bit :008 | Upper position limit of the SLI_8 safety function | 08 | Increments | 0x00000000 |
| 0x6EBC | s_LL_SLI 32 Bit :001 | Lower position limit of the SLI_1 safety function | 01 | Increments | 0x00000000 |
| 0x6EBC | s_LL_SLI 32 Bit :002 | Lower position limit of the SLI_2 safety function | 02 | Increments | 0x00000000 |
| 0x6EBC | s_LL_SLI 32 Bit :003 | Lower position limit of the SLI_3 safety function | 03 | Increments | 0x00000000 |
| 0x6EBC | s_LL_SLI 32 Bit :004 | Lower position limit of the SLI_4 safety function | 04 | Increments | 0x00000000 |
| 0x6EBC | s_LL_SLI 32 Bit :005 | Lower position limit of the SLI_5 safety function | 05 | Increments | 0x00000000 |
| 0x6EBC | s_LL_SLI 32 Bit :006 | Lower position limit of the SLI_6 safety function | 06 | Increments | 0x00000000 |
| 0x6EBC | s_LL_SLI 32 Bit :007 | Lower position limit of the SLI_7 safety function | 07 | Increments | 0x00000000 |
| 0x6EBC | s_LL_SLI 32 Bit :008 | Lower position limit of the SLI_8 safety function | 08 | Increments | 0x00000000 |
| 0x6EBD | Error Reaction SLI :001 | Error reaction of SLI_1 | 01 | -- | 0x66400001 (STO) |
| 0x6EBD | Error Reaction SLI :002 | Error reaction of SLI_2 | 02 | -- | 0x66400001 (STO) |
| 0x6EBD | Error Reaction SLI :003 | Error reaction of SLI_3 | 03 | -- | 0x66400001 (STO) |
| 0x6EBD | Error Reaction SLI :004 | Error reaction of SLI_4 | 04 | -- | 0x66400001 (STO) |
| 0x6EBD | Error Reaction SLI :005 | Error reaction of SLI_5 | 05 | -- | 0x66400001 (STO) |
| 0x6EBD | Error Reaction SLI :006 | Error reaction of SLI_6 | 06 | -- | 0x66400001 (STO) |
| 0x6EBD | Error Reaction SLI :007 | Error reaction of SLI_7 | 07 | -- | 0x66400001 (STO) |
| 0x6EBD | Error Reaction SLI :008 | Error reaction of SLI_8 | 08 | -- | 0x66400001 (STO) |

3.6.6.13 Description of the SLP safety function

This function is available only if the safe position is referenced.

| | |
|--|---|
|  Note | <p>STO</p> <p>If the safety function STO is activated, the referencing is deleted.</p> |
|--|---|

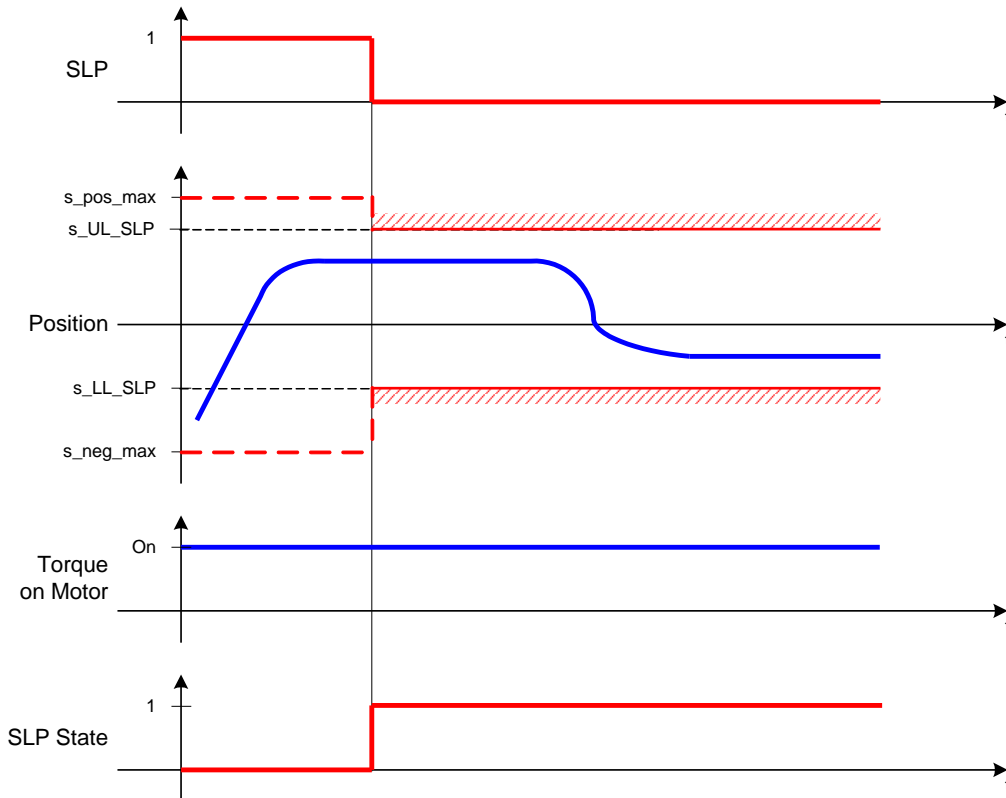


Fig. 39: Description of the Safely Limited Position function (SLP)

The monitoring of the current position is started upon the activation of the SLP function (SLP=0). The position limits are specified in s_UL_SLP (UL-upper limit) and s_LL_SLP (LL-lower limit). If one of the limits is exceeded, the function defined under ErrorReaction_SLP is executed.

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|--|------------------|
| 0x66A2 | s_UL_SLP 32 Bit :001 | Upper position limit of the SLP_1 safety function | 01 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A2 | s_UL_SLP 32 Bit :002 | Upper position limit of the SLP_2 safety function | 02 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A2 | s_UL_SLP 32 Bit :003 | Upper position limit of the SLP_3 safety function | 03 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A2 | s_UL_SLP 32 Bit :004 | Upper position limit of the SLP_4 safety function | 04 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A2 | s_UL_SLP 32 Bit :005 | Upper position limit of the SLP_5 safety function | 05 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A2 | s_UL_SLP 32 Bit :006 | Upper position limit of the SLP_6 safety function | 06 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A2 | s_UL_SLP 32 Bit :007 | Upper position limit of the SLP_7 safety function | 07 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A2 | s_UL_SLP 32 Bit :008 | Upper position limit of the SLP_8 safety function | 08 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A4 | s_LL_SLP 32 Bit :001 | Lower position limit of the SLP_1 safety function | 01 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A4 | s_LL_SLP 32 Bit :002 | Lower position limit of the SLP_2 safety function | 02 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A4 | s_LL_SLP 32 Bit :003 | Lower position limit of the SLP_3 safety function | 03 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A4 | s_LL_SLP 32 Bit :004 | Lower position limit of the SLP_4 safety function | 04 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A4 | s_LL_SLP 32 Bit :005 | Lower position limit of the SLP_5 safety function | 05 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A4 | s_LL_SLP 32 Bit :006 | Lower position limit of the SLP_6 safety function | 06 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A4 | s_LL_SLP 32 Bit :007 | Lower position limit of the SLP_7 safety function | 07 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A4 | s_LL_SLP 32 Bit :008 | Lower position limit of the SLP_8 safety function | 08 | Pole revolution relative to the reference position | 0x00000000 |
| 0x66A5 | Error Reaction SLP :001 | Error reaction of SLP_1 | 01 | -- | 0x66400001 (STO) |
| 0x66A5 | Error Reaction SLP :002 | Error reaction of SLP_2 | 02 | -- | 0x66400001 (STO) |
| 0x66A5 | Error Reaction SLP :003 | Error reaction of SLP_3 | 03 | -- | 0x66400001 (STO) |
| 0x66A5 | Error Reaction SLP :004 | Error reaction of SLP_4 | 04 | -- | 0x66400001 (STO) |
| 0x66A5 | Error Reaction SLP :005 | Error reaction of SLP_5 | 05 | -- | 0x66400001 (STO) |
| 0x66A5 | Error Reaction SLP :006 | Error reaction of SLP_6 | 06 | -- | 0x66400001 (STO) |
| 0x66A5 | Error Reaction SLP :007 | Error reaction of SLP_7 | 07 | -- | 0x66400001 (STO) |
| 0x66A5 | Error Reaction SLP :008 | Error reaction of SLP_8 | 08 | -- | 0x66400001 (STO) |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|--|------------------|
| 0x6EA2 | s_UL_SLP 32 Bit :001 | Upper position limit of the SLP_1 safety function | 01 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA2 | s_UL_SLP 32 Bit :002 | Upper position limit of the SLP_2 safety function | 02 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA2 | s_UL_SLP 32 Bit :003 | Upper position limit of the SLP_3 safety function | 03 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA2 | s_UL_SLP 32 Bit :004 | Upper position limit of the SLP_4 safety function | 04 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA2 | s_UL_SLP 32 Bit :005 | Upper position limit of the SLP_5 safety function | 05 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA2 | s_UL_SLP 32 Bit :006 | Upper position limit of the SLP_6 safety function | 06 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA2 | s_UL_SLP 32 Bit :007 | Upper position limit of the SLP_7 safety function | 07 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA2 | s_UL_SLP 32 Bit :008 | Upper position limit of the SLP_8 safety function | 08 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA4 | s_LL_SLP 32 Bit :001 | Lower position limit of the SLP_1 safety function | 01 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA4 | s_LL_SLP 32 Bit :002 | Lower position limit of the SLP_2 safety function | 02 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA4 | s_LL_SLP 32 Bit :003 | Lower position limit of the SLP_3 safety function | 03 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA4 | s_LL_SLP 32 Bit :004 | Lower position limit of the SLP_4 safety function | 04 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA4 | s_LL_SLP 32 Bit :005 | Lower position limit of the SLP_5 safety function | 05 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA4 | s_LL_SLP 32 Bit :006 | Lower position limit of the SLP_6 safety function | 06 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA4 | s_LL_SLP 32 Bit :007 | Lower position limit of the SLP_7 safety function | 07 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA4 | s_LL_SLP 32 Bit :008 | Lower position limit of the SLP_8 safety function | 08 | Pole revolution relative to the reference position | 0x00000000 |
| 0x6EA5 | Error Reaction SLP :001 | Error reaction of SLP_1 | 01 | -- | 0x66400001 (STO) |
| 0x6EA5 | Error Reaction SLP :002 | Error reaction of SLP_2 | 02 | -- | 0x66400001 (STO) |
| 0x6EA5 | Error Reaction SLP :003 | Error reaction of SLP_3 | 03 | -- | 0x66400001 (STO) |
| 0x6EA5 | Error Reaction SLP :004 | Error reaction of SLP_4 | 04 | -- | 0x66400001 (STO) |
| 0x6EA5 | Error Reaction SLP :005 | Error reaction of SLP_5 | 05 | -- | 0x66400001 (STO) |
| 0x6EA5 | Error Reaction SLP :006 | Error reaction of SLP_6 | 06 | -- | 0x66400001 (STO) |
| 0x6EA5 | Error Reaction SLP :007 | Error reaction of SLP_7 | 07 | -- | 0x66400001 (STO) |
| 0x6EA5 | Error Reaction SLP :008 | Error reaction of SLP_8 | 08 | -- | 0x66400001 (STO) |

3.6.6.14 Description of the SLS safety function

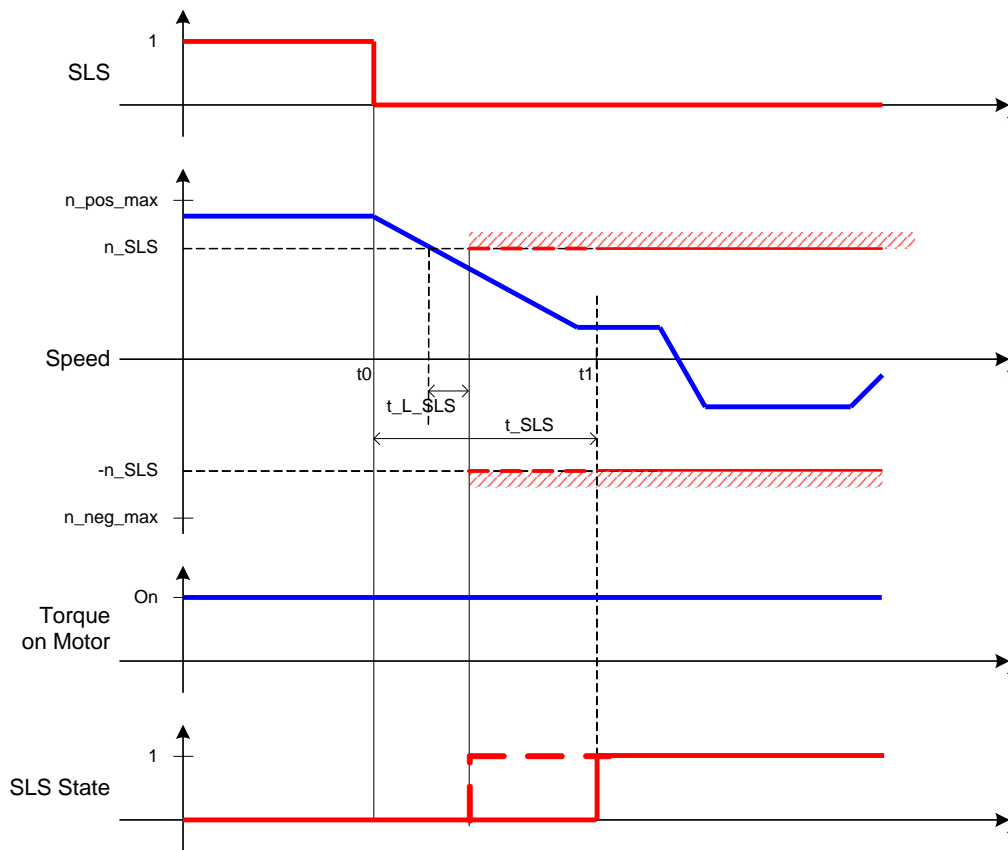



Fig. 40: Description of the Safely Limited Speed function (SLS) with time monitor

The time monitor t_{SLS} is started upon activation of the SLS function ($SLS = 0$). The standard control then starts with the deceleration and the speed is monitored with regard to the limits $\pm n_{SLS}$ at the latest on expiry of t_{SLS} .

Monitoring begins on expiry of the time t_{L_SLS} if the speed is within the limits. If one of the limits is exceeded, the function defined under $ErrorReaction_SLS$ is executed.

| | |
|---|---|
|  WARNING | <p>Parameter settings</p> <p>The setting of the speed limits must be above the calculated speed from the <code>Speed_Compare_Window</code>. (See also chapter 3.6.2)</p> |
|---|---|

Parameters for axis 1

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------|---|-----------|---------------------|---------------|
| 0x6691 | t_SLS :001 | Maximum time until the activation of the SLS safety function | 01 | 1 ms | 0x0000 |
| 0x6691 | t_SLS :002 | Maximum time until the activation of the SLS safety function | 02 | 1 ms | 0x0000 |
| 0x6691 | t_SLS :003 | Maximum time until the activation of the SLS safety function | 03 | 1 ms | 0x0000 |
| 0x6691 | t_SLS :004 | Maximum time until the activation of the SLS safety function | 04 | 1 ms | 0x0000 |
| 0x6691 | t_SLS :005 | Maximum time until the activation of the SLS safety function | 05 | 1 ms | 0x0000 |
| 0x6691 | t_SLS :006 | Maximum time until the activation of the SLS safety function | 06 | 1 ms | 0x0000 |
| 0x6691 | t_SLS :007 | Maximum time until the activation of the SLS safety function | 07 | 1 ms | 0x0000 |
| 0x6691 | t_SLS :008 | Maximum time until the activation of the SLS safety function | 08 | 1 ms | 0x0000 |
| 0x6693 | n_SLS 32 Bit :001 | Speed window for SLS_1 | 01 | Increments per 1 ms | 0x00000000 |
| 0x6693 | n_SLS 32 Bit :002 | Speed window for SLS_2 | 02 | Increments per 1 ms | 0x00000000 |
| 0x6693 | n_SLS 32 Bit :003 | Speed window for SLS_3 | 03 | Increments per 1 ms | 0x00000000 |
| 0x6693 | n_SLS 32 Bit :004 | Speed window for SLS_4 | 04 | Increments per 1 ms | 0x00000000 |
| 0x6693 | n_SLS 32 Bit :005 | Speed window for SLS_5 | 05 | Increments per 1 ms | 0x00000000 |
| 0x6693 | n_SLS 32 Bit :006 | Speed window for SLS_6 | 06 | Increments per 1 ms | 0x00000000 |
| 0x6693 | n_SLS 32 Bit :007 | Speed window for SLS_7 | 07 | Increments per 1 ms | 0x00000000 |
| 0x6693 | n_SLS 32 Bit :008 | Speed window for SLS_8 | 08 | Increments per 1 ms | 0x00000000 |
| 0x6694 | t_L SLS :001 | Minimum time until the activation of the SLS_1 safety function, if the speed is within the window | 01 | 1 ms | 0x0000 |
| 0x6694 | t_L SLS :002 | Minimum time until the activation of the SLS_2 safety function, if the speed is within the window | 02 | 1 ms | 0x0000 |
| 0x6694 | t_L SLS :003 | Minimum time until the activation of the SLS_3 safety function, if the speed is within the window | 03 | 1 ms | 0x0000 |

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|------|------------------|
| 0x6694 | t_L SLS :004 | Minimum time until the activation of the SLS_4 safety function, if the speed is within the window | 04 | 1 ms | 0x0000 |
| 0x6694 | t_L SLS :005 | Minimum time until the activation of the SLS_5 safety function, if the speed is within the window | 05 | 1 ms | 0x0000 |
| 0x6694 | t_L SLS :006 | Minimum time until the activation of the SLS_6 safety function, if the speed is within the window | 06 | 1 ms | 0x0000 |
| 0x6694 | t_L SLS :007 | Minimum time until the activation of the SLS_7 safety function, if the speed is within the window | 07 | 1 ms | 0x0000 |
| 0x6694 | t_L SLS :008 | Minimum time until the activation of the SLS_8 safety function, if the speed is within the window | 08 | 1 ms | 0x0000 |
| 0x6698 | Error Reaction SLS :001 | Error reaction of SLS_1 | 01 | -- | 0x66400001 (STO) |
| 0x6698 | Error Reaction SLS :002 | Error reaction of SLS_2 | 02 | -- | 0x66400001 (STO) |
| 0x6698 | Error Reaction SLS :003 | Error reaction of SLS_3 | 03 | -- | 0x66400001 (STO) |
| 0x6698 | Error Reaction SLS :004 | Error reaction of SLS_4 | 04 | -- | 0x66400001 (STO) |
| 0x6698 | Error Reaction SLS :005 | Error reaction of SLS_5 | 05 | -- | 0x66400001 (STO) |
| 0x6698 | Error Reaction SLS :006 | Error reaction of SLS_6 | 06 | -- | 0x66400001 (STO) |
| 0x6698 | Error Reaction SLS :007 | Error reaction of SLS_7 | 07 | -- | 0x66400001 (STO) |
| 0x6698 | Error Reaction SLS :008 | Error reaction of SLS_8 | 08 | -- | 0x66400001 (STO) |

Parameters for axis 2

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------|---|-----------|---------------------|---------------|
| 0x6E91 | t_SLS :001 | Maximum time until the activation of the SLS safety function | 01 | 1 ms | 0x0000 |
| 0x6E91 | t_SLS :002 | Maximum time until the activation of the SLS safety function | 02 | 1 ms | 0x0000 |
| 0x6E91 | t_SLS :003 | Maximum time until the activation of the SLS safety function | 03 | 1 ms | 0x0000 |
| 0x6E91 | t_SLS :004 | Maximum time until the activation of the SLS safety function | 04 | 1 ms | 0x0000 |
| 0x6E91 | t_SLS :005 | Maximum time until the activation of the SLS safety function | 05 | 1 ms | 0x0000 |
| 0x6E91 | t_SLS :006 | Maximum time until the activation of the SLS safety function | 06 | 1 ms | 0x0000 |
| 0x6E91 | t_SLS :007 | Maximum time until the activation of the SLS safety function | 07 | 1 ms | 0x0000 |
| 0x6E91 | t_SLS :008 | Maximum time until the activation of the SLS safety function | 08 | 1 ms | 0x0000 |
| 0x6E93 | n_SLS 32 Bit :001 | Speed window for SLS_1 | 01 | Increments per 1 ms | 0x00000000 |
| 0x6E93 | n_SLS 32 Bit :002 | Speed window for SLS_2 | 02 | Increments per 1 ms | 0x00000000 |
| 0x6E93 | n_SLS 32 Bit :003 | Speed window for SLS_3 | 03 | Increments per 1 ms | 0x00000000 |
| 0x6E93 | n_SLS 32 Bit :004 | Speed window for SLS_4 | 04 | Increments per 1 ms | 0x00000000 |
| 0x6E93 | n_SLS 32 Bit :005 | Speed window for SLS_5 | 05 | Increments per 1 ms | 0x00000000 |
| 0x6E93 | n_SLS 32 Bit :006 | Speed window for SLS_6 | 06 | Increments per 1 ms | 0x00000000 |
| 0x6E93 | n_SLS 32 Bit :007 | Speed window for SLS_7 | 07 | Increments per 1 ms | 0x00000000 |
| 0x6E93 | n_SLS 32 Bit :008 | Speed window for SLS_8 | 08 | Increments per 1 ms | 0x00000000 |
| 0x6E94 | t_L SLS :001 | Minimum time until the activation of the SLS_1 safety function, if the speed is within the window | 01 | 1 ms | 0x0000 |
| 0x6E94 | t_L SLS :002 | Minimum time until the activation of the SLS_2 safety function, if the speed is within the window | 02 | 1 ms | 0x0000 |
| 0x6E94 | t_L SLS :003 | Minimum time until the activation of the SLS_3 safety function, if the speed is within the window | 03 | 1 ms | 0x0000 |
| 0x6E94 | t_L SLS :004 | Minimum time until the activation of the SLS_4 safety function, if the speed is within the window | 04 | 1 ms | 0x0000 |
| 0x6E94 | t_L SLS :005 | Minimum time until the activation of the SLS_5 safety function, if the speed is within the window | 05 | 1 ms | 0x0000 |
| 0x6E94 | t_L SLS :006 | Minimum time until the activation of the SLS_6 safety function, if the speed is within the window | 06 | 1 ms | 0x0000 |

| Index | Name | Description | Sub Index | Unit | Default value |
|--------|-------------------------|---|-----------|------|------------------|
| 0x6E94 | t_L SLS :007 | Minimum time until the activation of the SLS_7 safety function, if the speed is within the window | 07 | 1 ms | 0x0000 |
| 0x6E94 | t_L SLS :008 | Minimum time until the activation of the SLS_8 safety function, if the speed is within the window | 08 | 1 ms | 0x0000 |
| 0x6E98 | Error Reaction SLS :001 | Error reaction of SLS_1 | 01 | -- | 0x66400001 (STO) |
| 0x6E98 | Error Reaction SLS :002 | Error reaction of SLS_2 | 02 | -- | 0x66400001 (STO) |
| 0x6E98 | Error Reaction SLS :003 | Error reaction of SLS_3 | 03 | -- | 0x66400001 (STO) |
| 0x6E98 | Error Reaction SLS :004 | Error reaction of SLS_4 | 04 | -- | 0x66400001 (STO) |
| 0x6E98 | Error Reaction SLS :005 | Error reaction of SLS_5 | 05 | -- | 0x66400001 (STO) |
| 0x6E98 | Error Reaction SLS :006 | Error reaction of SLS_6 | 06 | -- | 0x66400001 (STO) |
| 0x6E98 | Error Reaction SLS :007 | Error reaction of SLS_7 | 07 | -- | 0x66400001 (STO) |
| 0x6E98 | Error Reaction SLS :008 | Error reaction of SLS_8 | 08 | -- | 0x66400001 (STO) |

3.6.6.15 Description of the SMA safety function

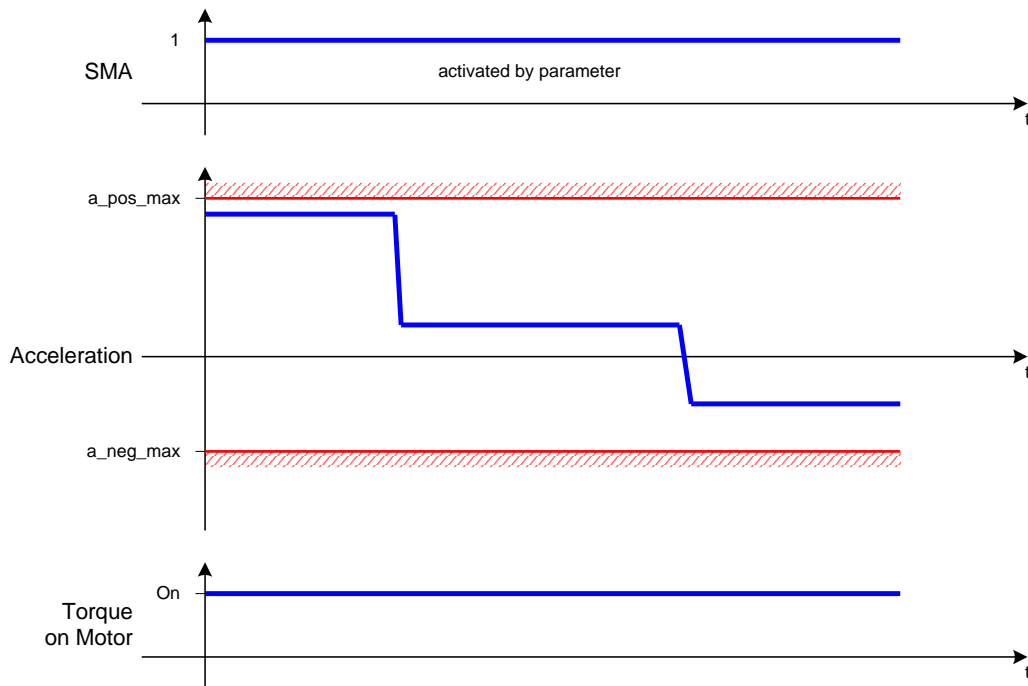


Fig. 41: Description of the Safe Maximum Acceleration function (SMA)

The SMA function is activated via the a_pos_max and a_neg_max parameters and monitors the maximum acceleration. The function is executed if one of the parameters is not equal to 0. If one of the limits is exceeded, the function defined under ErrorReaction_SMA is executed.

Parameters for axis 1

| Index | Name | Description | Unit | Default value |
|--------|------------------------|-------------------------------|----------------------------------|------------------|
| 0x66CA | a_pos_max_SMA 32Bit | Maximum positive acceleration | Increments per 1 ms ² | 0x0000 |
| 0x66CC | a_neg_max_SMA 32Bit | Maximum negative acceleration | Increments per 1 ms ² | 0x0000 |
| 0x66CD | Error Reaction SMA | Error reaction of SMA | -- | 0x66400001 (STO) |

Parameters for axis 2

| Index | Name | Description | Unit | Default value |
|--------|------------------------|-------------------------------|----------------------------------|------------------|
| 0x6ECA | a_pos_max_SMA 32Bit | Maximum positive acceleration | Increments per 1 ms ² | 0x0000 |
| 0x6ECC | a_neg_max_SMA 32Bit | Maximum negative acceleration | Increments per 1 ms ² | 0x0000 |
| 0x6ECD | Error Reaction SMA | Error reaction of SMA | -- | 0x66400001 (STO) |

3.6.6.16 Description of the SMS safety function

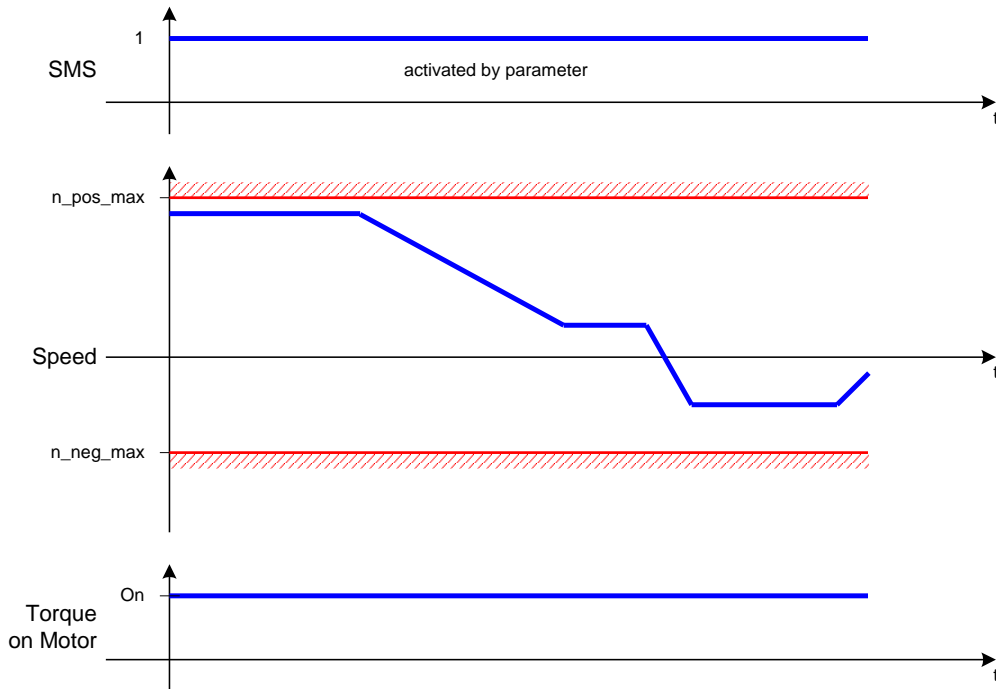


Fig. 42: Description of the Safe Maximum Speed function (SMS)


The SMS function is activated via the `n_pos_max` and `n_neg_max` parameters and monitors the maximum speed. The function is executed if one of the parameters is not equal to 0. If one of the limits is exceeded, the function defined under `ErrorReaction_SMS` is executed.

Parameters for axis 1

| Index | Name | Description | Unit | Default value |
|--------|-------------------------------------|------------------------|---------------------|------------------|
| 0x66AA | <code>n_pos_max_SMS</code> 32Bit | Maximum positive speed | Increments per 1 ms | 0x0000 |
| 0x66AC | <code>n_neg_max_SMS</code> 32Bit | Maximum negative speed | Increments per 1 ms | 0x0000 |
| 0x66AD | Error Reaction SMS | Error reaction of SMS | -- | 0x66400001 (STO) |

Parameters for axis 2

| Index | Name | Description | Unit | Default value |
|--------|-------------------------------------|------------------------|---------------------|------------------|
| 0x6EAA | <code>n_pos_max_SMS</code> 32Bit | Maximum positive speed | Increments per 1 ms | 0x0000 |
| 0x6EAC | <code>n_neg_max_SMS</code> 32Bit | Maximum negative speed | Increments per 1 ms | 0x0000 |
| 0x6EAD | Error Reaction SMS | Error reaction of SMS | -- | 0x66400001 (STO) |

| | |
|---|---|
|  WARNING | <p>Parameter settings</p> <p>The setting of the speed limits must be above the calculated speed from the <code>Speed_Compare_Window</code>. (See also chapter 3.6.2)</p> |
|---|---|


3.6.7 Setting the error reaction

In the AX5805/AX5806 the error reaction can be parameterized for some of the safety functions.

A distinction is made between two reactions, which are explained in more detail below:


3.6.7.1 Error reaction Safe Torque Off (STO 0x66400001)

If this reaction was parameterized, the AX5805/AX5806 switches the AX5000 torque-free immediately after an error is detected.

| | |
|---|---|
|  WARNING | <p>Provide for external safety measures for the STO function of the TwinSAFE Drive Option card!</p> <p>If the STO safety function is executed, the connected motors are not braked, but are switched torque-free. This leads to the motors coasting to a halt. The duration of this coasting depends on how much kinetic energy is present in the system. With suspended loads the motors may even be accelerated. In order to prevent this, appropriate external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
|---|---|


3.6.7.2 Error reaction Safe Stop 1 (SS1 0x66500001)

If this reaction was parameterized, the AX5805/AX5806 functionally instructs the AX5000 to run its emergency stop ramp.

| | |
|--|---|
|  Note | <p>Error reaction SS1</p> <p>This function is NOT a safety function, but is implemented purely functionally.</p> |
|--|---|

Once the time set in the parameters 0x2030 and 0x2830 has elapsed, the AX5805/AX5806 switches the AX5000 to state STO (torque-free).

If the drive does not execute this function, the motors may continue to turn or even accelerate for the set period. The time should therefore always be set such any danger at the machine is avoided, even of the drive accelerates during the set time. The time should be set long enough to enable the drive to be stopped during the set time.

| | |
|--|--|
|  DANGER | <p>Error reaction SS1!</p> <p>The time for the error reaction SS1 should be set such that an unsafe system state is avoided, even if the emergency stop ramp fails to be executed or the AX5000 continued to turn or even accelerate the motors during this time. Once the time has elapsed, the drive is switched to STO.</p> <p>If the STO safety function is executed, the connected motors are not braked, but are switched torque-free. This leads to the motors coasting to a halt. The duration of this coasting depends on how much kinetic energy is present in the system. With suspended loads the motors may even be accelerated. In order to prevent this, appropriate external safety mechanisms (e.g. mechanical brakes) must be provided by the user.</p> |
|--|--|

3.7 First Steps AX5805

In the following example the SDIn safety function (axis may only rotate in a positive direction) is parameterized and activated.

Hardware used:

- AX5103-0000-0200 servo drive
- TwinSAFE Drive option card AX5805
- TwinSAFE-Logic EL6900
- 3 x EL1904 TwinSAFE input terminals

3.7.1 Step 1: parameterize the AX5103 servo drive

The parameter P-0-2000 in the parameters of the servo amplifier AX5103 must be set to AX5805. Further parameters will probably also have to be set according to the motors in use. See AX5000 operating instructions.

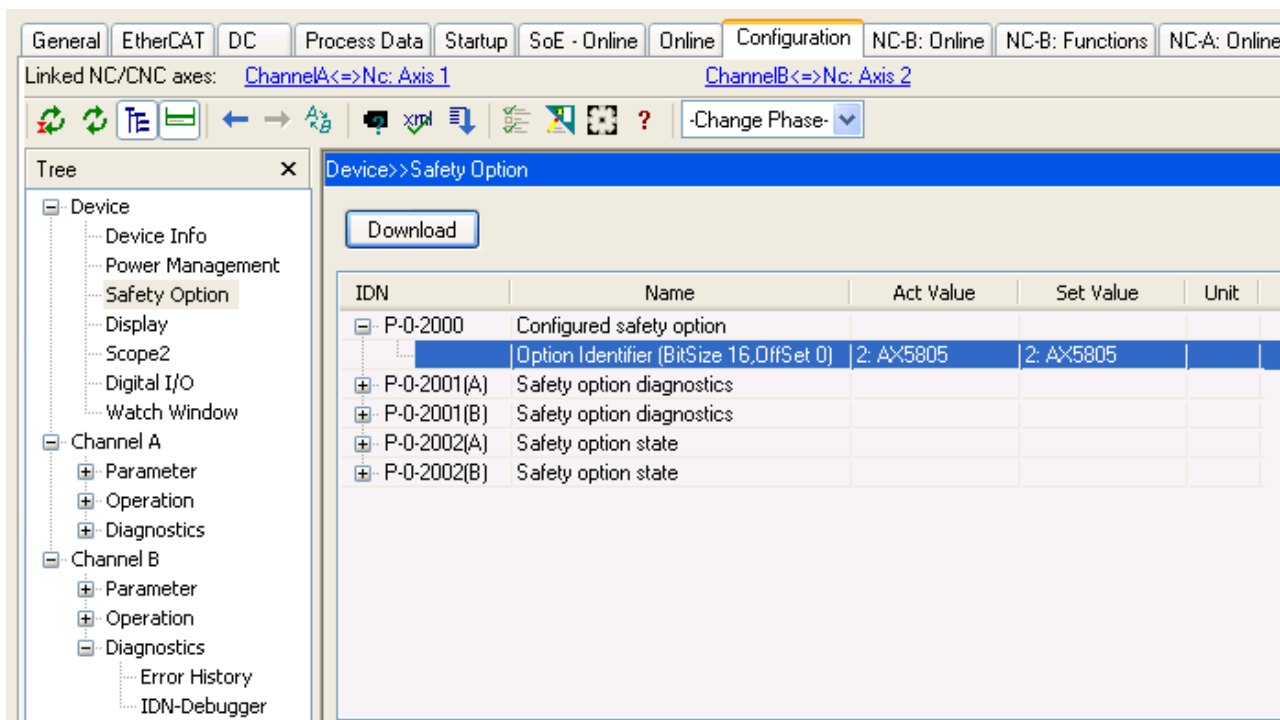


Fig. 43: P-0-2000 Configured Safety Option => AX5805

3.7.2 Step 2: parameterize the AX5805

The following parameters must be set in the safe parameters of the AX5805.

- Motor_String (Index 0x2001)
The motor in use is called AM3021-0C40-0000 => enter ASCII code 41 4D 33 30 32 31 2D 30 43 34 30 2D 30 30 30 30 or enter as text
- Motor_Polepairs (Index 0x2002)
The motor in use has 3 pairs of poles. => enter 3
- Number_of_Axis (Index 0x2F00)
The AX5103 servo drive in use is a single-channel device => enter 1
- s_Zero_SDI 32Bit (Index 0x66D3)
The window in which the direction of rotation is not monitored => enter e.g. 10 increments

FSoE Address:

| Index | Name | Flags | Value |
|---------|-----------------------------------|-------|-------------------------|
| 1018:0 | Identity | RO | > 4 < |
| 1600:0 | DRIVE RxPDO-Map FSoE Master Me... | RO | > 19 < |
| 1A00:0 | DRIVE TxPDO-Map FSoE Slave Mes... | RO | > 19 < |
| 2000 | Motor_Type | RW | 0x0000 (0) |
| 2001:0 | Motor_String | RO | > 16 < |
| 2001:01 | SubIndex 001 | RW | 0x4D41 (19777) |
| 2001:02 | SubIndex 002 | RW | 0x3033 (12339) |
| 2001:03 | SubIndex 003 | RW | 0x3132 (12594) |
| 2001:04 | SubIndex 004 | RW | 0x302D (12333) |
| 2001:05 | SubIndex 005 | RW | 0x3443 (13379) |
| 2001:06 | SubIndex 006 | RW | 0x2D30 (11568) |
| 2001:07 | SubIndex 007 | RW | 0x3030 (12336) |
| 2001:08 | SubIndex 008 | RW | 0x3030 (12336) |
| 2001:09 | SubIndex 009 | RW | 0x0000 (0) |
| 2001:0A | SubIndex 010 | RW | 0x0000 (0) |
| 2001:0B | SubIndex 011 | RW | 0x0000 (0) |
| 2001:0C | SubIndex 012 | RW | 0x0000 (0) |
| 2001:0D | SubIndex 013 | RW | 0x0000 (0) |
| 2001:0E | SubIndex 014 | RW | 0x0000 (0) |
| 2001:0F | SubIndex 015 | RW | 0x0000 (0) |
| 2001:10 | SubIndex 016 | RW | 0x0000 (0) |
| 2002 | Motor_Polepairs | RW | 0x0003 (3) |
| 2010 | Reference_Position_Window | RW | 0x00000000 (0) |
| 2011 | Reference_Position_Inputpin | RW | 0x00 (0) |
| 2012 | Reference_Position | RW | 0 |
| 2013 | Reference_Position_UpperLimit | RW | 0 |
| 2014 | Reference_Position_LowerLimit | RW | 0 |
| 2020 | Speed_Compare_Window | RW | 0x000000B4 (180) |
| 2021 | Speed_Compare_Violationlevel | RW | 0x00000014 (20) |
| 2030 | ESTOP_Ramp_Time | RW | 0x0000 (0) |
| 2040 | Motor_Default_Data | RW | 0x0028 (40) |
| 2F00 | Number_of_Axis | RW | 0x01 (1) |
| 2F01 | STO_Mode_Active | RW | FALSE |
| 2F02 | Debug_Mode_Active | RW | FALSE |
| 2F03 | Reserved | RW | FALSE |
| 6642 | STO_Restart_Acknowledge_behavior | RW | FALSE |
| 6651:0 | t_SS1 | RO | > 8 < |
| 6653:0 | n_Zero_SS1 32 Bit | RO | > 8 < |
| 6654:0 | t_LL_SS1 | RO | > 8 < |
| 666A:0 | s_Zero_SOS 32 Bit | RO | > 8 < |
| 6671:0 | t_SS2 | RO | > 8 < |
| 6672:0 | t_LL_SS2 | RO | > 8 < |
| 6676:0 | Reserved | RO | > 8 < |
| 6679:0 | n_Zero_SS2 32 Bit | RO | > 8 < |
| 6681:0 | t_SSR | RO | > 8 < |
| 6683:0 | n_UL_SSR 32 Bit | RO | > 8 < |
| 6685:0 | n_LL_SSR 32 Bit | RO | > 8 < |
| 6686:0 | t_LL_SSR | RO | > 8 < |
| 668A:0 | Error Reaction SSR | RO | > 8 < |
| 6691:0 | t_SLS | RO | > 8 < |
| 6693:0 | n_SLS 32 Bit | RO | > 8 < |
| 6694:0 | t_LL_SLS | RO | > 8 < |
| 6698:0 | Error Reaction SLS | RO | > 8 < |
| 66A2:0 | s_UL_SLP 32 Bit | RO | > 8 < |
| 66A4:0 | s_LL_SLP 32 Bit | RO | > 8 < |
| 66A5:0 | Error Reaction SLP | RO | > 8 < |
| 66AA | n_pos_max_SMS 32 Bit | RW | 0x00000000 (0) |
| 66AC | n_neg_max_SMS 32 Bit | RW | 0x00000000 (0) |
| 66AD | Error Reaction SMS | RW | 0x66400001 (1715470337) |
| 66BA:0 | s_UL_SLI 32 Bit | RO | > 8 < |
| 66BC:0 | s_LL_SLI 32 Bit | RO | > 8 < |
| 66BD:0 | Error Reaction SLI | RO | > 8 < |
| 66C2:0 | a_UL_SAR 32 Bit | RO | > 8 < |
| 66C4:0 | a_LL_SAR 32 Bit | RO | > 8 < |
| 66C5:0 | Error Reaction SAR | RO | > 8 < |
| 66CA | a_pos_max_SMA 32 Bit | RW | 0 |
| 66CC | a_neg_max_SMA 32 Bit | RW | 0 |
| 66CD | Error Reaction SMA | RW | 0x66400001 (1715470337) |
| 66D3 | s_Zero_SDI 32 Bit | RW | 0x0000000A (10) |
| 66E2:0 | n_UL_SSM 32 Bit | RO | > 8 < |
| 66E4:0 | n_LL_SSM 32 Bit | RO | > 8 < |
| 66EA:0 | s_UL_SCA 32 Bit | RO | > 8 < |
| 66EC:0 | s_LL_SCA 32 Bit | RO | > 8 < |
| F050:0 | Detected modules | RO | > 2 < |

Fig. 44: Setting the parameters

3.7.3 Step 3: link Error_Acknowledge in Safe PLC

In order to be able to acknowledge errors (e.g. axes move in the negative direction despite activated SDIn safety function), a safe input (in this case channel 1 of the first EL1904) is linked with the Error_Acknowledge bit in the control word of the AX5805.

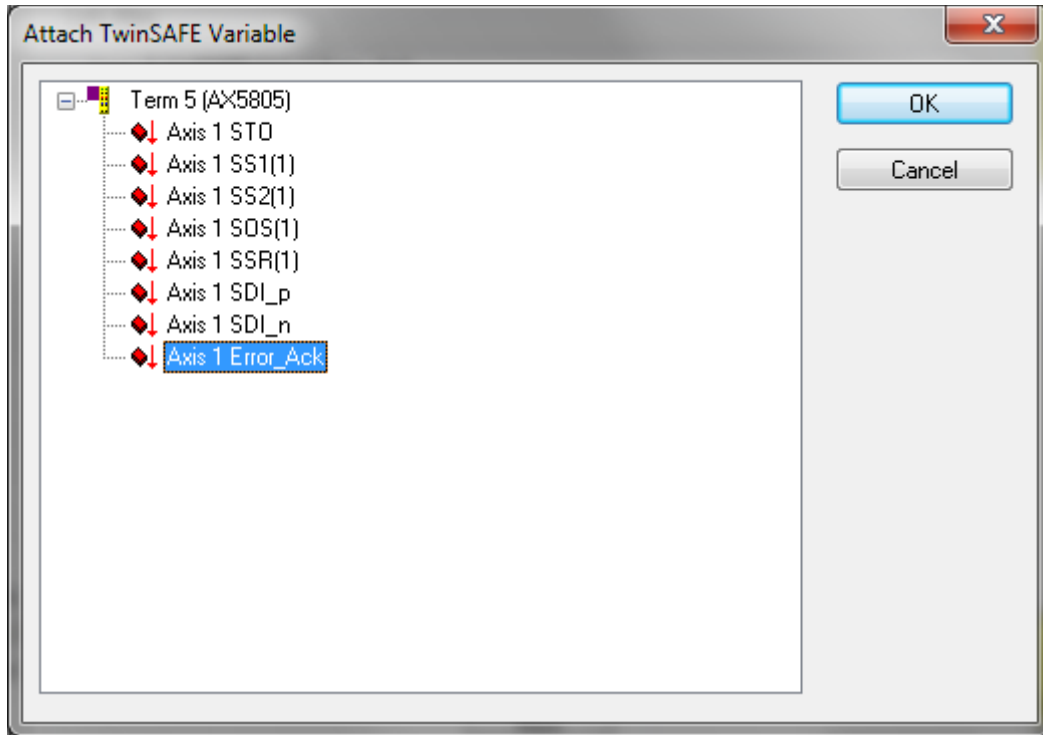


Fig. 45: AX5805 Error_Ack link

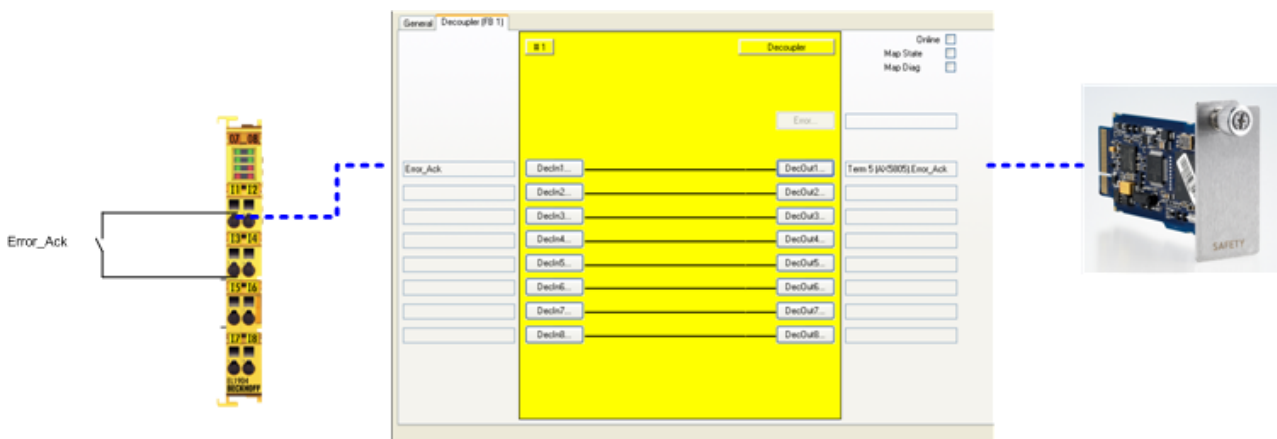


Fig. 46: Error_Acknowledge button on the AX5805

3.7.4 Step 4: Link the SDIn safety function in the Safe PLC

In this example we will activate the SDIn safety function by means of a light curtain, which is connected to the second safe EL1904 input terminal.

The safety function SDIn is activated if the light curtain is interrupted. The axis may only move in the positive direction of rotation. If it is nevertheless moved in a negative direction and the window limit is exceeded, the AX5805 switches the axis torque-free.

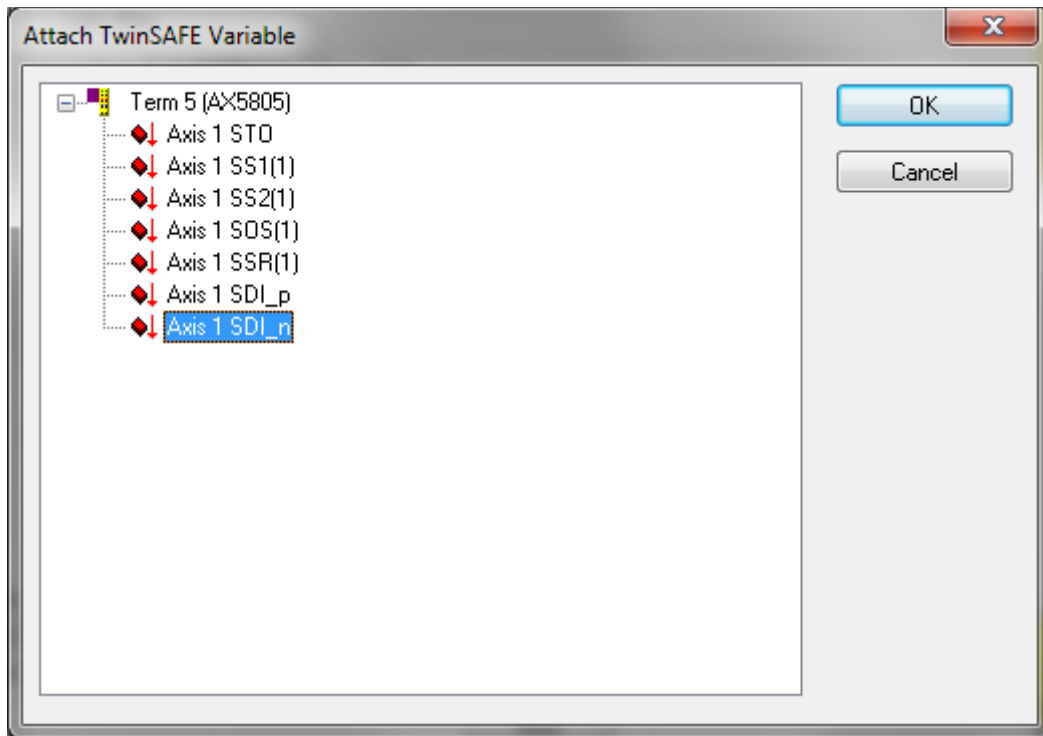


Fig. 47: AX5805 SDI_n link

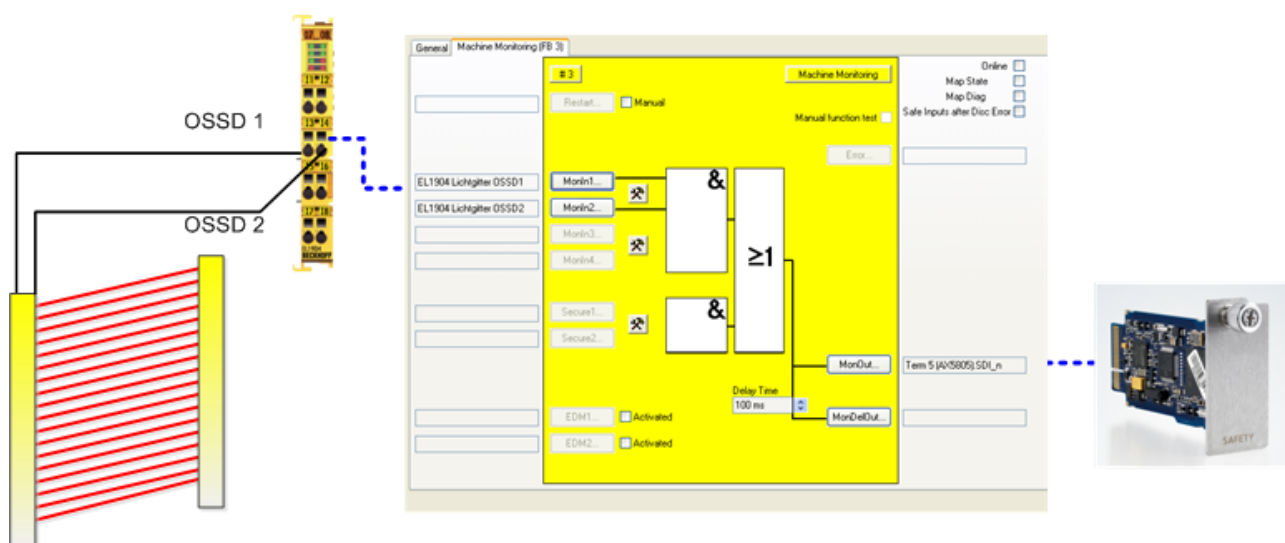



Fig. 48: Light curtain for SDIn of the AX5805

3.7.5 Step 5: Implementation of an EMERGENCY STOP button

The emergency stop function can be implemented as follows:

If the emergency stop button is pressed, the release of the servo drive, for example via a standard PLC, is cancelled. The servo drive then activates a non-safety-orientated STOP ramp (which must naturally be parameterized for this). After a preconfigured time, the STO safety function is activated and the motors are switched torque-free.

All undesired functions are also linked with the delayed output. This has no influence on the top-priority STO safety function, but the undesired functions are deactivated in normal operating mode as a result.

| | |
|---|--|
|  WARNING | <p>STOP ramp of the AX5000 servo drive</p> <p>The STOP ramp of the AX5000 servo drive is purely functional and is not designed to be a safety feature. In the event of a malfunction, the motors may coast to a halt or may even be accelerated. In order to avoid these dangerous situations and movements, external safety mechanisms are to be provided by the user.</p> |
|---|--|

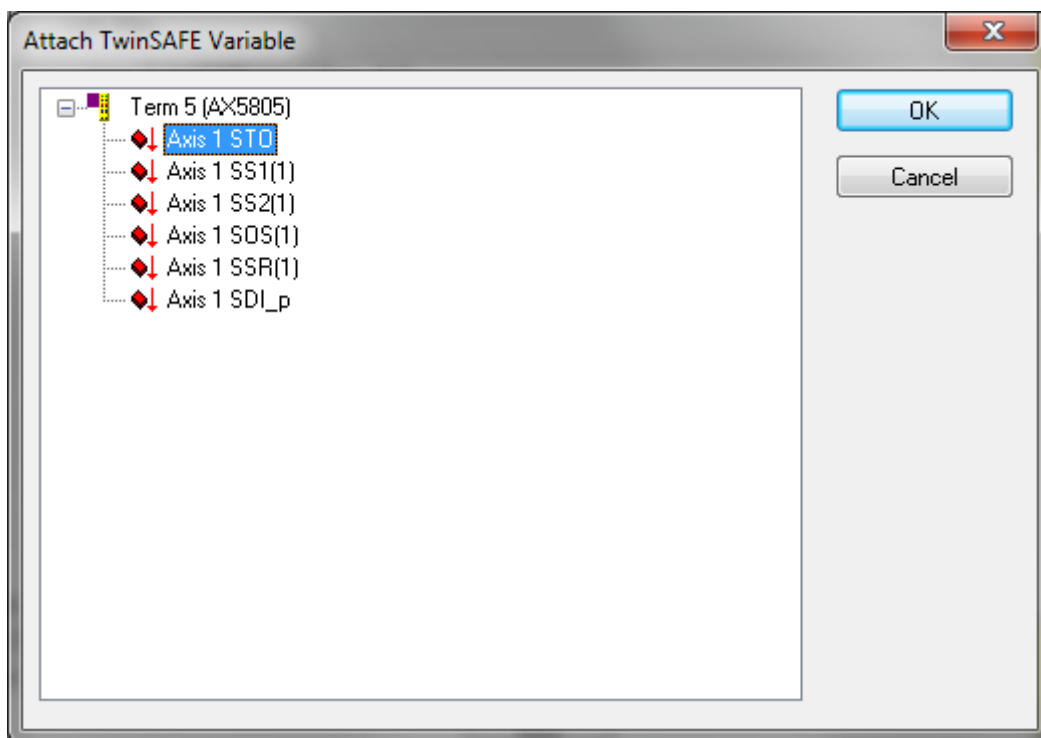


Fig. 49: AX5805 STO link

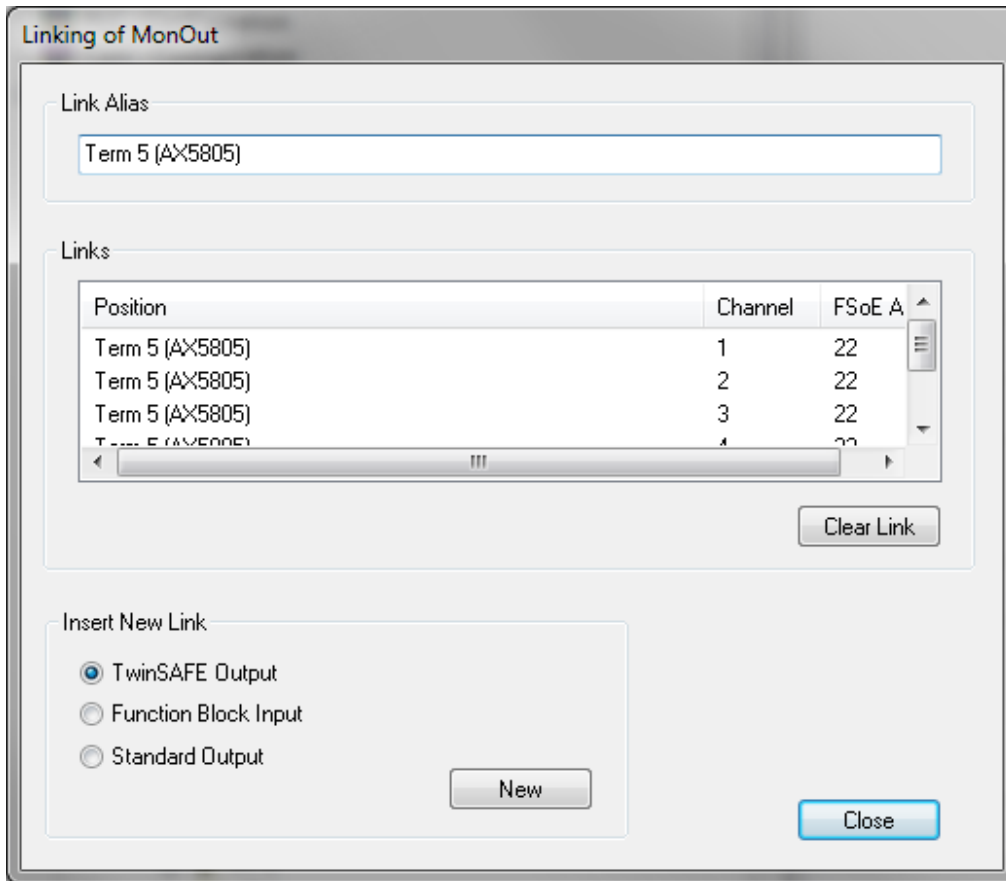


Fig. 50: Linking of the unused AX5805 functions

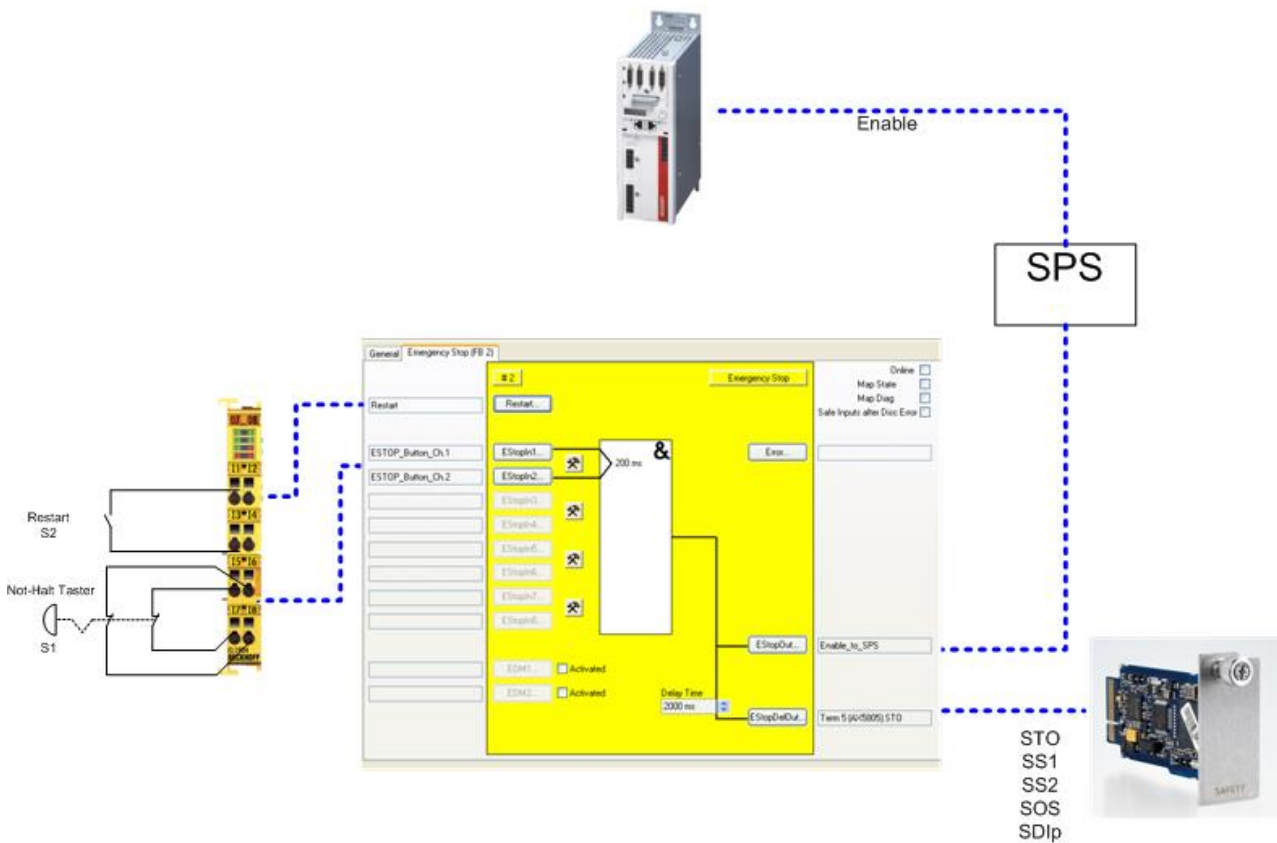


Fig. 51: Emergency stop button for STO of the AX5805

4 Error and diagnosis

The STO error reaction is executed for all errors detected by the AX5805/AX5806. This means that the connected motors are directly switched torque-free and can coast to a halt. The duration of this coasting depends on how much kinetic energy is present in the system. With suspended loads the motors may even be accelerated. In order to prevent this, appropriate external safety mechanisms (e.g. mechanical brakes) must be provided by the user.

The reason for switching off can be read from the diagnostic data (CoE object 0xFA82). The data within this object is divided into diagnosis and error.

Error indices that are smaller than 0x1000 or larger than 0x4FFF can be reset by the EtherCAT state transition from PREOP to SAFEOP. These include communication errors, parameter errors and environment errors.

All other errors are internal errors that can only be reset by a hardware reset or by switching the AX5805/AX5806 to the EtherCAT state BOOT.

4.1 Error indices in CoE object 0xFA82

| Error index in 0xFA82 | Error name | Description | Typical error reaction time |
|-----------------------|--------------------|---|-----------------------------|
| 0x0001 | FAULT_MAXT_C1 | The temperature has exceeded the maximum permissible temperature (μ C1). | |
| 0x0002 | FAULT_MAXT_C2 | The temperature has exceeded the maximum permissible temperature (μ C2). | |
| 0x0003 | FAULT_MINT_C1 | The temperature has fallen below the minimum permissible temperature (μ C1). | |
| 0x0004 | FAULT_MINT_C2 | The temperature has fallen below the minimum permissible temperature (μ C2). | |
| 0x0101 | HW_ERR_MAX_VCC_C1 | The maximum supply voltage was exceeded (3.3 V). | |
| 0x0102 | HW_ERR_MAX_VCC_C2 | The maximum supply voltage was exceeded (3.3 V). | |
| 0x0103 | HW_ERR_MIN_VCC_C1 | The supply voltage fell below the minimum value (3.3 V) | |
| 0x0104 | HW_ERR_MIN_VCC_C2 | The supply voltage fell below the minimum value (3.3 V) | |
| 0x0201 | FAULT_MCTC1_TO | The MCTests of μ C1 were not carried out completely within the specified time | |
| 0x0202 | FAULT_MCTC2_TO | The MCTests of μ C2 were not carried out completely within the specified time | |
| 0x0203 | FAULT_TIMER_C1 | The global timer was not updated in time. | |
| 0x0204 | FAULT_TIMER_C2 | The global timer was not updated in time. | |
| 0x020C | FAULT_TS_WDG_TO_C1 | The TwinSAFE module was not called within the watchdog time. | |
| 0x020D | FAULT_TS_WDG_TO_C2 | The TwinSAFE module was not called within the watchdog time. | |
| 0x020E | FAULT_RESET_MC1 | A reset has occurred in the operation of the controller for μ C1. μ C2 was not reset thereby. | |

| Error index in 0xFA82 | Error name | Description | Typical error reaction time |
|-----------------------|------------------------------------|--|-----------------------------|
| 0x0300 | FAULT_SERCOMC2 | an error occurred in the SerComp24C2 module during data transmission | |
| 0x0401-0x040B | FAULT_SERCOM | an error occurred in the SerComp24C1 module during data transmission | |
| 0x0501-0x0507 | FAULT_TEMPSENSOR | Error in the communication with one of the temperature sensors | |
| 0x0601 | FAULT_OUTPUTCOMPARE | The values output by μ C1 and μ C2 differ. | |
| 0x0602 | FAULT_OUTPUTCOMPAREC2 | The values output by μ C1 and μ C2 differ. | |
| 0x0700 | HW_ERR_MIN_VCC_FPGA | The FPGA supply voltage fell below the minimum value (5 V). | |
| 0x0701 | HW_ERR_MAX_VCC_FPGA | The FPGA supply voltage exceeded the maximum value (5 V). | |
| 0x0710 | FAULT_FEEDBACK_C1 | An error was detected in the feedback channels of μ C1. | |
| 0x0711 | FAULT_FEEDBACK_C2 | An error was detected in the feedback channels of μ C2. | |
| 0x0720 | FAULT_Parameter_C1 | General parameter error μ C1 | |
| 0x0721 | FAULT_Parameter_C2 | General parameter error μ C2 | |
| 0x0722 | FAULT_Parameter_C1_DRIVE_PROFILE | Parameter: unknown parameter index μ C1 drive profile | |
| 0x0723 | FAULT_Parameter_C1_VENDOR_SPECIFIC | Parameter: unknown parameter index μ C1 vendor-specific. | |
| 0x0724 | FAULT_Parameter_C2_DRIVE_PROFILE | Parameter: unknown parameter index μ C2 drive profile. | |
| 0x0725 | FAULT_Parameter_C2_VENDOR_SPECIFIC | Parameter: unknown parameter index μ C2 vendor-specific. | |
| 0x0726 | FAULT_PDO_MAPPING_FSOE_COMMAND | PDO mapping axis 1/2: FSOE COMMAND error. | |
| 0x0727 | FAULT_PDO_MAPPING_LENGTH | PDO mapping axis 1: Length_Error | |
| 0x0728 | FAULT_PDO_MAPPING_STO_K1 | PDO mapping axis 1: STO error | |
| 0x0729 | FAULT_PDO_MAPPING_SS1_1_K1 | PDO mapping axis 1: Error SS1_1 | |
| 0x072A | FAULT_PDO_MAPPING_SS2_1_K1 | PDO mapping axis 1: Error SS2_1 | |
| 0x072B | FAULT_PDO_MAPPING_SOS_1_K1 | PDO mapping axis 1: SS2_1 error | |
| 0x072C | FAULT_PDO_MAPPING_SSR_1_K1 | PDO mapping axis 1: SSR_1 error | |
| 0x072D | FAULT_PDO_MAPPING_SDlp_K1 | PDO mapping axis 1: SDlp error | |
| 0x072E | FAULT_PDO_MAPPING_SDln_K1 | PDO mapping axis 1: SDln error | |
| 0x072F | FAULT_PDO_MAPPING_Error_ACK_K1 | PDO mapping axis 1: Error_ACK error | |
| 0x0730 | FAULT_PDO_MAPPING_Error_CRC0 | PDO mapping axis 1/2: FSOE CRC0 error | |
| 0x0731 | FAULT_PDO_MAPPING_STO_K2 | PDO mapping axis 2: STO error | |
| 0x0732 | FAULT_PDO_MAPPING_SS1_1_K2 | PDO mapping axis 2: Error SS1_1 | |
| 0x0733 | FAULT_PDO_MAPPING_SS2_1_K2 | PDO mapping axis 2: Error SS2_1 | |
| 0x0734 | FAULT_PDO_MAPPING_SOS_1_K2 | PDO mapping axis 2: SS2_1 error | |
| 0x0735 | FAULT_PDO_MAPPING_SSR_1_K2 | PDO mapping axis 2: SSR_1 error | |
| 0x0736 | FAULT_PDO_MAPPING_SDlp_K2 | PDO mapping axis 2: SDlp error | |
| 0x0737 | FAULT_PDO_MAPPING_SDln_K2 | PDO mapping axis 2: SDln error | |

| Error index in 0xFA82 | Error name | Description | Typical error reaction time |
|-----------------------|--------------------------------------|---|-----------------------------|
| 0x0738 | FAULT_PDO_MAPPING_Error_ACK_K2 | PDO mapping axis 2: Error_ACK error | |
| 0x0739 | FAULT_PDO_MAPPING_Error_CRC1 | PDO mapping axis 2: FSOE CRC1 error | |
| 0x073A | FAULT_PDO_MAPPING_Error_ConnID | PDO mapping axis 1/2: FSOE ConnID error | |
| 0x073B | FAULT_PDO_MAPPING_SSM_1_K1 | PDO mapping axis 1: SSM_1_K1 error | |
| 0x073C | FAULT_PDO_MAPPING_SSM_1_K2 | PDO mapping axis 2: SSM_1_K2 error | |
| 0x073D | FAULT_PDO_MAPPING_SSM_2_K1 | PDO mapping axis 1: SSM_2_K1 error | |
| 0x073E | FAULT_PDO_MAPPING_SSM_2_K2 | PDO mapping axis 2: SSM_2_K2 error | |
| 0x0740 | FAULT_WRONG_MOTORCONSTRUCTIONTYPE_K1 | Register communication: parameterized motor type for axis 1 does not correspond to the connected motor. | |
| 0x0741 | FAULT_UNKNOWN_MOTOR_TYPE_K1 | Register communication: parameterized motor type for axis 1 is unknown | |
| 0x0742 | FAULT_WRONG_MOTORCONSTRUCTIONTYPE_K2 | Register communication: parameterized motor type for axis 2 does not correspond to the connected motor. | |
| 0x0743 | FAULT_UNKNOWN_MOTOR_TYPE_K2 | Register communication: parameterized motor type for axis 2 is unknown. | |
| 0x0744 | FAULT_NUM_OF_POLEPAIRS_K1 | Register communication: parameterized number of pole pairs for axis 1 does not correspond to the connected motor. | |
| 0x0745 | FAULT_NUM_OF_POLEPAIRS_K2 | Register communication: parameterized number of pole pairs for axis 2 does not correspond to the connected motor. | |
| 0x0746 | FAULT_WRONG_MOTOR_CONFIGURED_K1 | Register communication: parameterized motor type for axis 1 does not correspond to the connected motor. | |
| 0x0747 | FAULT_WRONG_MOTOR_CONFIGURED_K2 | Register communication: parameterized motor type for axis 2 does not correspond to the connected motor | |
| 0x0748 | FAULT_RXPDO_LENGTH | PDO mapping: RXPDO length is wrong. | |
| 0x0749 | FAULT_TXPDO_LENGTH | PDO mapping: TXPDO length is wrong. | |
| 0x074A | FAULT_UNKNOWN_RXPDO_INDEX | PDO mapping: RXPDO index is unknown | |
| 0x074B | FAULT_UNKNOWN_TXPDO_INDEX | PDO mapping: TXPDO index is unknown | |
| 0x074C | FAULT_WRONG_NUMBER_OF_AXLE | The parameterized number of axes does not correspond to the number detected. | |
| 0x1001 | FAULT_CRC_INIT_C1 | An incorrect checksum at μ C1 was determined during PowerOn reset. | |
| 0x1002 | FAULT_CRC_INIT_C2 | An incorrect checksum at μ C2 was determined during PowerOn reset. | |
| 0x1003 | FAULT_CRC_C1 | An incorrect checksum was determined for μ C1 during operation. | |
| 0x1004 | FAULT_CRC_C2 | An incorrect checksum was determined for μ C2 during operation. | |
| 0x1011 | FAULT_RAM_C1 | An error occurred during the RAM test of μ C1. | 125 μ s |
| 0x1012 | FAULT_RAM_C2 | An error occurred during the RAM test of μ C2. | 125 μ s |

| Error index in 0xFA82 | Error name | Description | Typical error reaction time |
|-----------------------|----------------------------------|---|-----------------------------|
| 0x1013 | FAULT_RAM_CHECKERBOARD_C1 | An error occurred during the RAM test of μ C1. | |
| 0x1014 | FAULT_RAM_CHECKERBOARD_C2 | An error occurred during the RAM test of μ C2. | |
| 0x1021 | FAULT_GLBL_TMR | The global timer is not working correctly. | 125 μ s |
| 0x1031 | FAULT_SPLIM1 | Stack overruns are no longer being intercepted correctly. | |
| 0x1032 | FAULT_SPLIM2 | Stack overruns are no longer being intercepted correctly. | |
| 0x1100 | FAULT_OPCT_GRP_C1 | The opcode test for μ C1 has failed. | |
| 0x1300 | FAULT_OPCT_GRP_C2 | The opcode test for μ C2 has failed. | |
| 0x1801 | FAULT_ESS_CRC_C1 | Different check sums were determined in the TwinSAFE telegrams. | |
| 0x1802 | FAULT_ESS_CRC_C2 | Different check sums were determined in the TwinSAFE telegrams. | |
| 0x1803 | FAULT_SW_MAIN1_C1 | The default case of the main loop of μ C1 was called. | |
| 0x1804 | FAULT_SW_MAIN1_C2 | The default case of the main loop of μ C2 was called. | |
| 0x1805 | FAULT_ESLCONID_PRJCRCRD | The Connection ID is not zero when reading the project CRC. | |
| 0x1806 | FAULT_ESLCONID_PRJCRCWR | The Connection ID is not zero when writing the project CRC. | |
| 0x1807 | FAULT_SIZE_EEVONDOR_EXID | An address was accessed that lies outside the vendor range in the EEPROM. | |
| 0x5100 | FAULT_COM_C1C2 | Communication between μ C1 and μ C2 is disturbed. | |
| 0x5101 | FAULT_ISR_SNT_FEEDBACK | High priority ISR: communication interrupted: switched mode power supply feedback | 125 μ s |
| 0x5102 | FAULT_ISR_ANGLE_K1 | High priority ISR: communication interrupted: axis 1 angle | 125 μ s |
| 0x5103 | FAULT_ISR_ANGLE_K2 | High priority ISR: communication interrupted: axis 2 angle | 125 μ s |
| 0x5104 | FAULT_ISR_DELTA_K1 | High priority ISR: communication interrupted: axis 1 distance travelled | 125 μ s |
| 0x5105 | FAULT_ISR_DELTA_K2 | High priority ISR: communication interrupted: axis 2 distance travelled | 125 μ s |
| 0x5106 | FAULT_ISR_VELO_K1 | High priority ISR: communication interrupted: axis 1 velocity | 125 μ s |
| 0x5107 | FAULT_ISR_VELO_K2 | High priority ISR: communication interrupted: axis 2 velocity | 125 μ s |
| 0x5108 | FAULT_ISR_TEST_FEEDBACK | High priority ISR: communication interrupted: feedback from switch-off channels | 125 μ s |
| 0x5109 | FAULT_TIMEOUT_REG_AX5000_CONTROL | Register communication: AX5000 does not answer in time: Controlword | |
| 0x510A | FAULT_TIMEOUT_REG_AX5000_STATUS | Register communication: AX5000 does not answer in time: Statusword | |

| Error index in 0xFA82 | Error name | Description | Typical error reaction time |
|-----------------------|----------------------------------|--|-----------------------------|
| 0x510B | FAULT_TIMEOUT_REG_AX5000_REGADR | Register communication: AX5000 does not answer in time: Register address | |
| 0x510C | FAULT_TIMEOUT_REG_AX5000_REGDATA | Register communication: AX5000 does not answer in time: Register data | |
| 0x510D | FAULT_TIMEOUT_REG_AX5000_CRC | Register communication: AX5000 does not answer in time: CRC | |
| 0x510E | FAULT_UNKNOWN_AX5000_INTERFACE | Register communication: unknown interface to the AX5000 | |
| 0x510F | FAULT_COMERROR_AX5000_INTERFACE | Register communication: the interface to the AX5000 has a communication error | |
| 0x5110-0x5113 | FAULT_WRITE_HW_VERSION_AX5805 | Values could not be written to the register in the AX5000 | |
| 0x5114 | FAULT_EXT_ADC_ADDRESS | High priority ISR: External ADC: an impermissible address was read | |
| 0x5115 | FAULT_REGISTER_AX5000_CRC_ERROR | Register communication with the AX5000: telegram has a CRC error. | |
| 0x5116 | FAULT_CYCLIC_AX5000_CRC_ERROR | High priority ISR: cyclic communication with the AX5000: telegram has a CRC error. | 125 µs |
| 0x5117 | FAULT_UNKNOWN_REGISTER_ADDRESS | Register communication: Addressed register is unknown. | |
| 0x5118 | FAULT_AX5000_NOT_READY | High priority ISR: cyclic communication with the AX5000: AX5000 signals a communication error. | 125 µs |
| 0x5119 | FAULT_C1C2_SYNC_LOST | High priority ISR: cyclic communication between µC1 and µC2: Communication error | 125 µs |
| 0x5C00 | FAULT_SET_MAPPED_STATE | Mapped safety functions: error while setting the state. | |
| 0x5C01 | FAULT_RESET_MAPPED_STATE | Mapped safety functions: error while resetting the state. | |
| 0x5C02 | FAULT_MAPPED_FUNCTION | Mapped safety functions: invalid mapping, function does not exist. | |
| 0x5C03 | FAULT_MAPPED_INSTANCE | Mapped safety functions: invalid mapping, instance does not exist. | |
| 0x5E02 | FAULT_STO_MODE | The requested STO mode is invalid. | |
| 0x5E04 | FAULT_UNDEFINED_ERRORREACTION | Error reaction: invalid error reaction, error reaction does not exist. | |
| 0x5E03 | FAULT_SDI_MODE | The requested SDI mode is invalid. | |
| 0x5F00 | FAULT_CRC_COMPARE_C1 | Incorrect checksum detected during comparison by µC1. | |
| 0x5F01 | FAULT_CRC_COMPARE_C2 | Incorrect checksum detected during comparison by µC2. | |
| 0x5F02 | FAULT_TMR2_INTERRUPT_C1 | MC_Test: Timer2 has triggered an interrupt on µC1. HighPriISR was not called in time. | |
| 0x5F03 | FAULT_TMR2_INTERRUPT_C2 | MC_Test: Timer2 has triggered an interrupt on µC2. HighPriISR was not called in time. | |
| 0x5F04 | FAULT_SWITCHOFF_TEST | MC_Test: the test of the switch-off channels has failed. | |
| 0x5F05 | FAULT_NO_SYNC | No SYNC signal | |
| 0x5F06 | FAULT_UNKNOWN_AXLE | The requested axis is unknown. | |

| Error index in 0xFA82 | Error name | Description | Typical error reaction time |
|-----------------------|--|---|-----------------------------|
| 0x5F07 | FAULT_FPGA_C2 | The status of the FPGA is incorrect. | |
| 0x5F08 | FAULT_ANGLE_FORMAT_C1 | The angles of μ C1 read-in have the wrong format. | 125 μ s |
| 0x5F09 | FAULT_ANGLE_FORMAT_C2 | The angles of μ C2 read-in have the wrong format. | 125 μ s |
| 0x5F0A | FAULT_SAFE_MAIN_STATE | Unknown state requested | |
| 0x5F0B | FAULT_STARTUP_FAILED | Error during start-up. | |
| 0x5F0C | FAULT_MOTION_DETECTION | Motion detection error | 125 μ s |
| 0x5F0E | FAULT_AX580x_NOT_SUITABLE_F OR_AX5000 | Incorrect option card or AX5000 software installed | |
| 0x6000 | FAULT_PARAMETER_ FSOE_VENDOR_ID | Incorrect vendor ID transmitted | |
| 0x6001 | FAULT_PARAMETER_ FSOE_MODULE_IDENT | Incorrect module ID transmitted | |
| 0x6002 | FAULT_PARAMETER_FSOE_CRC | CRC of the AX5805 parameters does not match the transmitted CRC (please check parameters; if necessary, activate System Manager configuration and reload safety project into the EL69xx). | |

4.2 Reason for shutdown of CoE objects 0xFA10:07 and 0xFA10:08

To read the shutdown reason, CoE object 0xFA10 subindex 01 must be set to 0.

| Value in 0xFA10:07 shutdown reason axis 1 0xFA10:08 shutdown reason axis 2 | Description |
|--|---|
| 0xXX00 | Error reaction: no error reaction |
| 0xXX40 | Error reaction: STO (Safe Torque Off) |
| 0xXX50 | Error reaction: SS1 (Safe Stop 1) |
| 0x01XX | Shutdown reason: The status word was calculated incorrectly. |
| 0x02XX | Shutdown reason: The parameters are wrong or not yet loaded |
| 0x03XX | Shutdown reason: FSOE protocol not in state DATA |
| 0x04XX | Shutdown reason: Internal comparison failed. Please check the motor/drive dimensioning/parameterization |
| 0x05XX | Reason for shutdown position detection: external cam detected unexpectedly |
| 0x06XX | Reason for shutdown position detection: external cam detected to the right of the cam window |
| 0x07XX | Reason for shutdown position detection: external cam detected to the left of the cam window |
| 0x08XX | Reason for shutdown position detection: the maximum traversing range was exceeded. |
| 0x50XX | Reason for shutdown safety function: The safety function SS1 has switched off. |
| 0x68XX | Reason for shutdown safety function: The safety function SOS has switched off. |
| 0x80XX | Reason for shutdown safety function: The safety function SSR has switched off. |
| 0x90XX | Reason for shutdown safety function: The safety function SLS has switched off. |
| 0xA0XX | Reason for shutdown safety function: The safety function SLP has switched off. |
| 0xA8XX | Reason for shutdown safety function: The safety function SMS has switched off. |
| 0xB8XX | Reason for shutdown safety function: The safety function SLI has switched off. |
| 0xC0XX | Reason for shutdown safety function: The safety function SAR has switched off. |
| 0xC8XX | Reason for shutdown safety function: The safety function SMA has switched off. |
| 0xD0xx | Reason for shutdown safety function: The safety function SDIp has switched off. |
| 0xD1xx | Reason for shutdown safety function: The safety function SDIn has switched off. |

4.3 Diagnostics CoE object 0xFA10

The CoE object 0xFA10 provides additional diagnostic data for the user. Subindex 01 is used to display various data (accordingly to the following tables) in subindices 02 to 08.

The error and diagnostic values match the information described in chapter 4.1.

4.3.1 0xFA10:01 = 0

| Index in 0xFA10 | Name | Description |
|-----------------|----------------------------|-----------------|
| 0xFA10:02 | - | - |
| 0xFA10:03 | Internal data | - |
| 0xFA10:04 | Internal data | - |
| 0xFA10:05 | Software CRC C1 | - |
| 0xFA10:06 | Software CRC C2 | - |
| 0xFA10:07 | Reason for shutdown axis 1 | see chapter 4.2 |
| 0xFA10:08 | Reason for shutdown axis 2 | see chapter 4.2 |

4.3.2 0xFA10:01 = 1

| Index in 0xFA10 | Name | Description |
|-----------------|---------------|-----------------|
| 0xFA10:02 | Error 1 on C1 | see chapter 4.1 |
| 0xFA10:03 | Error 2 on C1 | |
| 0xFA10:04 | Error 3 on C1 | |
| 0xFA10:05 | Error 4 on C1 | |
| 0xFA10:06 | Error 5 on C1 | |
| 0xFA10:07 | Error 6 on C1 | |
| 0xFA10:08 | Error 7 on C1 | |



Note

Internal speeds

In this setting the current internal speeds are also applied to the process image of the AX5805/AX5806. The parameter Speed_Compare_Window defines the maximum permitted difference between these speeds. The values displayed in the process image are typically read with a cycle time that is greater than the internal cycle time of 125µs.

- ▲ Klemme 8 (AX5805)
 - ▷ Module 1 (Safety Process Data, 2 axis)
 - ▲ Module 2 (Standard Process Data, 2 axis)
 - ▷ Standard Inputs Channel 1
 - ▷ Standard Inputs Channel 2
 - ▲ Standard Outputs Channel 1
 - ▷ Position Actual Value
 - ▷ Velocity Actual Value
 - ▷ Standard Outputs Channel 2

| Variable | Description | Data type | Unit |
|--|---|-----------|--------------------|
| Standard Outputs Channel 1 Position Actual Value | Internal velocity calculated from the encoder signal for axis 1 | INT16 | Increments / 125µs |
| Standard Outputs Channel 1 Velocity Actual Value | Internal velocity calculated from the motor model for axis 1 | INT16 | Increments / 125µs |
| Standard Outputs Channel 2 Position Actual Value | Internal velocity calculated from the encoder signal for axis 2 | INT16 | Increments / 125µs |
| Standard Outputs Channel 2 Velocity Actual Value | Internal velocity calculated from the motor model for axis 2 | INT16 | Increments / 125µs |

4.3.3 0xFA10:01 = 2

| Index in 0xFA10 | Name | Description |
|-----------------|----------------|-----------------|
| 0xFA10:02 | Error 8 on C1 | see chapter 4.1 |
| 0xFA10:03 | Error 9 on C1 | |
| 0xFA10:04 | Error 10 on C1 | |
| 0xFA10:05 | Error 11 on C1 | |
| 0xFA10:06 | Error 12 on C1 | |
| 0xFA10:07 | Error 13 on C1 | |
| 0xFA10:08 | Error 14 on C1 | |

4.3.4 0xFA10:01 = 3

| Index in 0xFA10 | Name | Description |
|-----------------|---------------|-----------------|
| 0xFA10:02 | Error 1 on C2 | see chapter 4.1 |
| 0xFA10:03 | Error 2 on C2 | |
| 0xFA10:04 | Error 3 on C2 | |
| 0xFA10:05 | Error 4 on C2 | |
| 0xFA10:06 | Error 5 on C2 | |
| 0xFA10:07 | Error 6 on C2 | |
| 0xFA10:08 | Error 7 on C2 | |

4.3.5 0xFA10:01 = 4

| Index in 0xFA10 | Name | Description |
|-----------------|----------------|-----------------|
| 0xFA10:02 | Error 8 on C2 | see chapter 4.1 |
| 0xFA10:03 | Error 9 on C2 | |
| 0xFA10:04 | Error 10 on C2 | |
| 0xFA10:05 | Error 11 on C2 | |
| 0xFA10:06 | Error 12 on C2 | |
| 0xFA10:07 | Error 13 on C2 | |
| 0xFA10:08 | Error 14 on C2 | |

4.3.6 0xFA10:01 = 5

| Index in 0xFA10 | Name | Description |
|-----------------|--------------------------|-----------------|
| 0xFA10:02 | Diagnostic value 1 on C1 | see chapter 4.1 |
| 0xFA10:03 | Diagnostic value 2 on C1 | |
| 0xFA10:04 | Diagnostic value 3 on C1 | |
| 0xFA10:05 | Diagnostic value 4 on C1 | |
| 0xFA10:06 | Diagnostic value 5 on C1 | |
| 0xFA10:07 | Diagnostic value 6 on C1 | |
| 0xFA10:08 | Diagnostic value 7 on C1 | |

4.3.7 0xFA10:01 = 6

| Index in 0xFA10 | Name | Description |
|-----------------|---------------------------|-----------------|
| 0xFA10:02 | Diagnostic value 8 on C1 | see chapter 4.1 |
| 0xFA10:03 | Diagnostic value 9 on C1 | |
| 0xFA10:04 | Diagnostic value 10 on C1 | |
| 0xFA10:05 | Diagnostic value 11 on C1 | |
| 0xFA10:06 | Diagnostic value 12 on C1 | |
| 0xFA10:07 | Diagnostic value 13 on C1 | |
| 0xFA10:08 | Diagnostic value 14 on C1 | |

4.3.8 0xFA10:01 = 7

| Index in 0xFA10 | Name | Description |
|-----------------|--------------------------|-----------------|
| 0xFA10:02 | Diagnostic value 1 on C2 | see chapter 4.1 |
| 0xFA10:03 | Diagnostic value 2 on C2 | |
| 0xFA10:04 | Diagnostic value 3 on C2 | |
| 0xFA10:05 | Diagnostic value 4 on C2 | |
| 0xFA10:06 | Diagnostic value 5 on C2 | |
| 0xFA10:07 | Diagnostic value 6 on C2 | |
| 0xFA10:08 | Diagnostic value 7 on C2 | |


4.3.9 0xFA10:01 = 8

| Index in 0xFA10 | Name | Description |
|-----------------|---------------------------|-----------------|
| 0xFA10:02 | Diagnostic value 8 on C2 | see chapter 4.1 |
| 0xFA10:03 | Diagnostic value 9 on C2 | |
| 0xFA10:04 | Diagnostic value 10 on C2 | |
| 0xFA10:05 | Diagnostic value 11 on C2 | |
| 0xFA10:06 | Diagnostic value 12 on C2 | |
| 0xFA10:07 | Diagnostic value 13 on C2 | |

| Index in 0xFA10 | Name | Description |
|-----------------|---------------------------|-------------|
| 0xFA10:08 | Diagnostic value 14 on C2 | |

4.4 Maintenance

The TwinSAFE Drive option cards are maintenance-free!


| | |
|---|---|
|  <p>WARNING</p> | <p>Observe the specified environmental conditions!</p> <p>Please ensure that the TwinSAFE option cards are only stored and operated under the specified conditions (see technical data).</p> |
|---|---|

If the terminal is operated outside the permitted temperature range it will switch to *Global Fault* state.

4.4.1 Cleaning

Protect the TwinSAFE Drive option cards against impermissible contamination during operation and storage!

The TwinSAFE Drive option cards may not be used any further if they have been exposed to impermissible contamination!


| | |
|---|--|
|  <p>WARNING</p> | <p>Have contaminated TwinSAFE Drive option cards checked!</p> <p>Cleaning of the TwinSAFE Drive option cards by the user is not permitted! Send contaminated TwinSAFE Drive option cards to the manufacturer for checking and cleaning!</p> |
|---|--|

4.4.2 Service life

The TwinSAFE Drive option cards have a service life of 20 years.

Due to the high diagnostic coverage within the lifecycle no special proof tests are required.

4.5 Decommissioning

| | |
|--|--|
|  <p>DANGER</p> | <p>Ensure that the power is switched off before de-installation!</p> <p>Place the AX5000 into a safe, de-energized state before commencing with the de-installation of the TwinSAFE Drive option cards!</p> |
|--|--|

4.5.1 Disposal

In order to dispose of the device, it must be removed and fully dismantled. Metal parts can be sent for metal recycling. Electronic parts such as disk drives and circuit boards must be disposed of in accordance with national electronics scrap regulations.

5 Appendix

5.1 Beckhoff Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

5.1.1 Beckhoff branches and partner companies Beckhoff Support

Please contact your Beckhoff branch office or partner company for [local support and service](#) on Beckhoff products!

The contact addresses for your country can be found in the list of Beckhoff branches and partner companies: www.beckhoff.com. You will also find further [documentation](#) for Beckhoff components there.

5.1.2 Beckhoff company headquarters

Beckhoff Automation GmbH & Co.KG
Huelshorstweg 20
33415 Verl
Germany

Phone: + 49 (0) 5246/963-0
Fax: + 49 (0) 5246/963-198
E-mail: info@beckhoff.com
Web: www.beckhoff.com

Beckhoff Support

Support offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

- world-wide support
- design, programming and commissioning of complex automation systems
- and extensive training program for Beckhoff system components

Hotline: + 49 (0) 5246/963-157
Fax: + 49 (0) 5246/963-9157
E-mail: support@beckhoff.com

Beckhoff Service

The Beckhoff Service Center supports you in all matters of after-sales service:

- on-site service
- repair service
- spare parts service
- hotline service

Hotline: + 49 (0) 5246/963-460
Fax: + 49 (0) 5246/963-479
E-mail: service@beckhoff.com

5.2 Certificate

Reliability of AX5805

BECKHOFF New Automation Technology

Reliability of AX5805

Test and Certification body

TÜV SÜD Rail GmbH
 Rail Automation - IQSE
 Barthstraße 16
 D-80339 Munich



Manufacturer

Beckhoff Automation GmbH & Co. KG
 Huelshorstweg 20
 D-33415 Verl

Safety parameters AX5805

| Key figures | AX5805 |
|---------------------------|--|
| Lifetime [a] | 20 |
| Prooftest Intervall [a] | not required ¹⁾ |
| PFH _b | see document "AX5805 List of permitted motors" |
| %SIL3 | see document "AX5805 List of permitted motors" |
| MTTF _d | High |
| B10 _a (cycles) | - |
| DC | High |
| Performance level | PL e |
| Category | 4 |
| HFT | 1 |
| Element classification* | Type B |

¹⁾ Classification according to IEC 61508-2:2010 (see chapters 7.4.4.1.2 and 7.4.4.1.3)

The AX5805 drive option card can be used for safety-related applications within the meaning of IEC 61508:2010 up to SIL3 and EN ISO 13849-1 up to PL e (Cat4).

¹⁾Special proof tests for the product are not required during the lifetime of the AX5805 drive option card as a result of the high diagnostic coverage of the system.

Munich, 2016-03-07

Günter Greil

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 Günter Greil
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 Automation, cn=Günter
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Reliability of AX5806

Test and Certification body

TÜV SÜD Rail GmbH
Rail Automation - IQSE
Barthstraße 16
D-80339 Munich



Manufacturer

Beckhoff Automation GmbH & Co. KG
Huelshorstweg 20
D-33415 Verl

Safety parameters AX5806

| Key figures | AX5806 |
|---------------------------|--|
| Lifetime [a] | 20 |
| Prooftest Intervall [a] | not required ¹⁾ |
| PFH _b | see document "AX5806 List of permitted motors" |
| %SIL3 | see document "AX5806 List of permitted motors" |
| MTTF _d | High |
| B10 _d (cycles) | - |
| DC | High |
| Performance level | PL e |
| Category | 4 |
| HFT | 1 |
| Element classification* | Type B |

*) Classification according to IEC 61508-2:2010 (see chapters 7.4.4.1.2 and 7.4.4.1.3)

The AX5806 drive option card can be used for safety-related applications within the meaning of IEC 61508:2010 up to SIL3 and EN ISO 13849-1 up to PL e (Cat4).

¹⁾Special proof tests for the product are not required during the lifetime of the AX5806 drive option card as a result of the high diagnostic coverage of the system.

Munich, 2016-03-07

Günter Greil

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ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT



Product Service

CERTIFICATE

No. Z10 18 03 62386 050

Holder of Certificate: Beckhoff Automation GmbH & Co. KG
 Hülshorstweg 20
 33415 Verl
 GERMANY

Factory(ies): 62386

Certification Mark:



Product: Safety components

Model(s): AX5805/5806 for use in AX5000-0000-0200-Series

Parameters:
 Safety Functions:
 STO, SS1, SS2, SOS,
 SLS, SSM, SSR, SMS,
 SLP, SCA, SLI, SAR,
 SMA, SDI
 PL e, CAT 4 (EN ISO 13849)
 SIL 3 (EN 61508)
 SILCL 3 (EN 62061)

Tested according to:
 2006/42/EC
 EN ISO 13849-1:2015 (Cat.4, PL e)
 EN 61508-1:2010 (SIL 3)
 EN 61508-2:2010 (SIL 3)
 EN 61508-3:2010 (SIL 3)
 EN 61508-4:2010 (SIL 3)
 EN 62061-2005/A2:2015 (SILCL 3)
 EN 61800-5-2:2017

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: BV83877T

Valid until: 2023-03-26

Date, 2018-03-27

(Signature)
 (Guido Neumann)



Page 1 of 1

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany

TUV®