

BECKHOFF New Automation Technology

Operating Instructions | EN

AMP8911

TwinSAFE card for the decentralized servo drive AMP8000

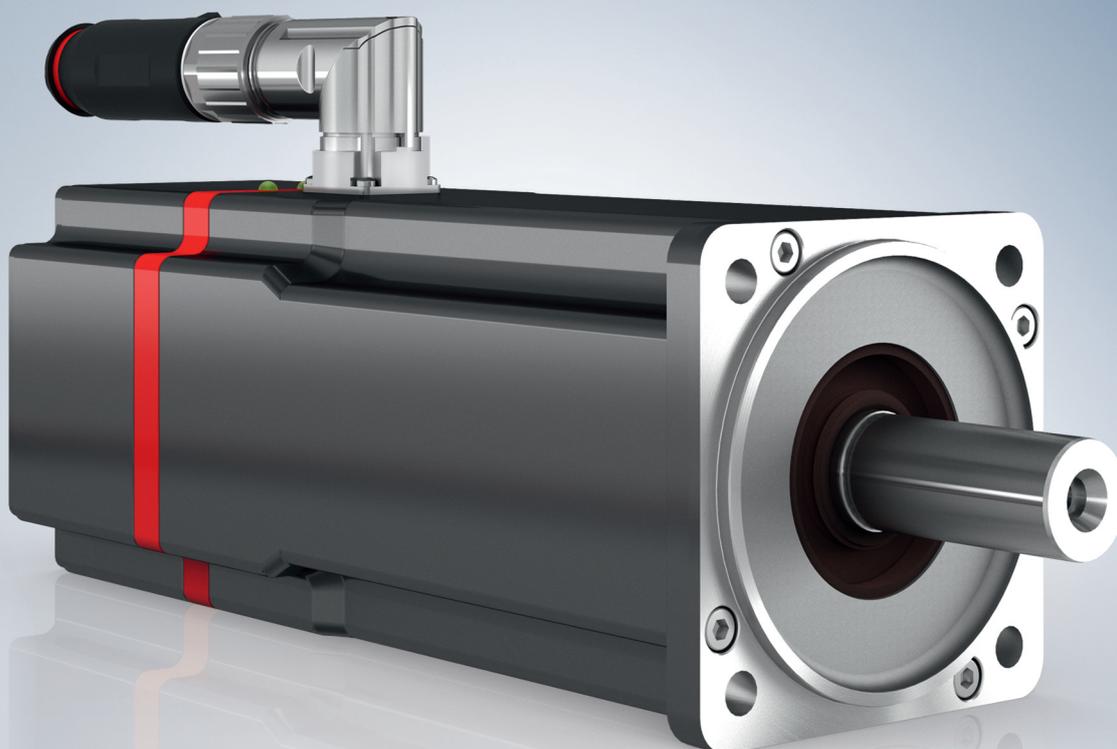


Table of contents

| | | |
|----------|--|-----------|
| 1 | Notes on the documentation | 5 |
| 1.1 | Disclaimer | 5 |
| 1.1.1 | Trademarks | 5 |
| 1.1.2 | Patents | 5 |
| 1.1.3 | Limitation of liability | 6 |
| 1.1.4 | Copyright | 6 |
| 1.2 | Version numbers | 7 |
| 1.3 | References | 8 |
| 1.3.1 | Document classification in the overall documentation | 8 |
| 1.4 | Staff qualification | 9 |
| 1.5 | Safety and instruction | 10 |
| 1.5.1 | Explanation of symbols | 10 |
| 1.6 | Beckhoff Support and Service | 11 |
| 1.7 | Notes on information security | 12 |
| 2 | For your safety | 13 |
| 2.1 | Due diligence | 13 |
| 2.2 | General safety instructions | 14 |
| 2.2.1 | Before operation | 14 |
| 2.2.2 | During operation | 15 |
| 2.2.3 | After operation | 15 |
| 3 | Product overview | 16 |
| 3.1 | Block diagram | 16 |
| 3.2 | Product characteristics | 17 |
| 3.3 | Type key | 17 |
| 3.4 | Intended use | 19 |
| 4 | Technical data | 20 |
| 4.1 | Product data | 20 |
| 4.2 | Target failure measures | 21 |
| 4.2.1 | STO | 21 |
| 4.2.2 | STO + SBC | 21 |
| 4.2.3 | STO + SBC + Safe Motion | 22 |
| 4.3 | Environmental conditions | 23 |
| 4.4 | Lifetime | 23 |
| 4.5 | Error reaction | 24 |
| 4.5.1 | Global Shutdown | 24 |
| 4.5.2 | Global Fault | 24 |
| 4.5.3 | Module Shutdown | 24 |
| 5 | Initial project | 25 |
| 5.1 | Description | 25 |
| 5.2 | Process image | 26 |
| 5.2.1 | Input | 26 |
| 5.2.2 | Output | 26 |
| 6 | Customer-specific safety application | 27 |

| | | |
|-----------|---|-----------|
| 6.1 | Local process image | 27 |
| 6.1.1 | STO | 27 |
| 6.1.2 | Safe Motion | 29 |
| 7 | Safety functions | 32 |
| 8 | Configuration in the Safety Editor | 33 |
| 8.1 | Creating a safety project | 33 |
| 8.2 | Import/export of a safety project..... | 33 |
| 8.3 | Address settings..... | 33 |
| 8.4 | Parameter Settings | 35 |
| 8.5 | Internal safety parameters | 36 |
| 8.5.1 | STO | 36 |
| 8.5.2 | Safe Motion | 36 |
| 9 | Diagnostic history | 38 |
| 10 | Appendix | 39 |
| 10.1 | Volatility | 39 |
| 10.2 | Focus of certificates | 40 |

1 Notes on the documentation

1.1 Disclaimer

Beckhoff products are subject to continuous further development. We reserve the right to revise the operating instructions at any time and without prior announcement. 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 these operating instructions.

In these operating instructions we define all permissible use cases whose properties and operating conditions we can guarantee. The use cases we define are fully tested and certified. Use cases beyond this, which are not described in these operating instructions, require the approval of Beckhoff Automation GmbH & Co KG.

1.1.1 Trademarks

Beckhoff®, TwinCAT®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, Safety over EtherCAT®, TwinSAFE®, XFC®, XTS® and XPlanar® are registered and licensed trademarks of Beckhoff Automation GmbH.

The use of other brand names or designations by third parties may lead to an infringement of the rights of the owners of the corresponding designations.

1.1.2 Patents

The EtherCAT technology is protected by patent rights through the following registrations and patents with corresponding applications and registrations in various other countries:

- EP1590927
- EP1789857
- EP1456722
- EP2137893
- DE102015105702



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



Safety over EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH.

1.1.3 Limitation of liability

All components in this product as described in the operating instructions are delivered in a specific configuration of hardware and software, depending on the application regulations. Modifications and changes to the hardware and/or software configuration that go beyond the documented options are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.

The following is excluded from the liability:

- Failure to observe these operating instructions
- Improper use
- Use of untrained personnel
- Use of unauthorized spare parts

1.1.4 Copyright

© Beckhoff Automation GmbH & Co. KG, Germany.

The distribution and reproduction of this document as well as the use and communication of its contents 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.

1.2 Version numbers

| Version | Comment |
|---------|--|
| 2.2.0 | <ul style="list-style-type: none">• Certificate removed• “Lifetime” and “target failure measures” renamed• Chapter “Notes on information security” added• Safety instructions for engineering tools revised• Chapters “Environmental conditions” adapted |
| 2.1.0 | <ul style="list-style-type: none">• Safety notice on protected cable routing added to chapter “Before operation”• SS1-d and target failure measures removed from chapter “Type key”• Certificate removed |
| 2.0.0 | <ul style="list-style-type: none">• Title changed to “Operating Instructions”• “Beckhoff Support and Service” updated• Certificate moved to the appendix• Appendix adapted and extended |
| 1.0.0 | <ul style="list-style-type: none">• First released issue• Certificate added |
| 0.0.1 | <ul style="list-style-type: none">• Preliminary (internal only) |

Currentness

Please check whether you are using the current and valid version of this document. The current version can be downloaded from the Beckhoff homepage at <http://www.beckhoff.de/twinsafe>. In case of doubt, please contact Technical Support (see [Beckhoff Support and Service \[► 11\]](#)).

Origin of the document

The original documentation is written in German. All other languages are derived from the German original.

Product features

Only the product properties specified in the current operating instructions are valid. Further information given on the product pages of the Beckhoff homepage, in emails or in other publications is not authoritative.

1.3 References

| No | Version | Title / description |
|-----|----------------|--|
| [1] | 1.4.0 or newer | Short information AMP8000 Accompanying document with general notes on handling the distributed servo drive system. Included with each product. |
| [2] | 1.0 or newer | Translation of the original instructions AMP8000 - Distributed servo drive system Description of the mechanical and electrical parameters as well as all information necessary for the use of the AMP8000 servo drive. |
| [3] | 1.4.1 or newer | Operating instructions for EL6910 TwinSAFE Logic module The document contains a description of the logic functions of the EL6910 and their programming. |
| [4] | 3.1.0 or newer | Documentation TwinSAFE-Logic-FB The document describes the safety function blocks that are available in the EL6910, and thus also in the TwinSAFE component, and form the safety application. |
| [5] | 1.8.0 or newer | TwinSAFE Application Guide The Application Guide provides the user with examples for the calculation of target failure measures for safety functions according to the standards DIN EN ISO 13849-1 and EN 62061 or EN 61508:2010, such as are typically used on machines. |
| [6] | 2006/42/EC | Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16-7/EC (recast) of 29 June 2006 This directive, also known as the Machinery Directive, defines requirements for the placing on the market of machines and machine-like components, such as safety components. |

1.3.1 Document classification in the overall documentation

This documentation applies exclusively to AMP8xxx servo drive variants with integrated safety technology, in accordance with the [Type key \[▶ 17\]](#).

This TwinSAFE card is a permanently installed part of a servo drive with integrated safety technology. For this reason, some life phases, such as decommissioning and disposal, apply exclusively to the servo drive as a complete system and are not listed in this documentation.

WARNING

Observe TwinSAFE card documentation as a matter of priority

The values and specifications defined in these operating instructions apply in addition and primarily to the documents [1] and [2] at [References \[▶ 8\]](#). Observe these operating instructions as a matter of priority.

Non-observance can endanger safety.

1.4 Staff qualification

These operating instructions are intended exclusively for trained specialists in control technology and automation with the relevant knowledge.

The trained specialist personnel must ensure that the applications and use of the described product meet all safety requirements. This includes all applicable and valid laws, regulations, provisions and standards.

Trained specialists

Trained specialists have extensive technical knowledge from studies, apprenticeships or technical training. Understanding of control technology and automation is available. Trained specialists can:

- Independently identify, avoid and eliminate sources of hazard.
- Apply relevant standards and directives.
- Implement specifications from accident prevention regulations.
- Evaluate, prepare and set up the workplaces.
- Evaluate, optimize and execute work independently.

1.5 Safety and instruction

Read the contents that refer to the activities you have to perform with the product. Always read the chapter [For your safety](#) [▶ 13] in the operating instructions.

Observe the warnings in the chapters so that you can handle and work with the product as intended and safely.

1.5.1 Explanation of symbols

Various symbols are used for a clear arrangement:

1. The numbering indicates an action that should be taken.
 - The bullet point indicates an enumeration.
- [...] The square brackets indicate cross-references to other text passages in the document.
- [1] The number in square brackets indicates the numbering of a referenced document.

1.5.1.1 Signal words

The signal words used in the documentation are classified below.

Warning of personal injuries

DANGER

Hazard with high risk of death or serious injury.

WARNING

Hazard with medium risk of death or serious injury.

CAUTION

There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE

Notes

The environment, equipment, or data may be damaged.

Information on handling the product



This information includes, for example:
Recommendations for action, assistance or further information on the product.

1.6 Beckhoff Support and Service

Support

Beckhoff Support offers technical advice on the use of individual Beckhoff products and system planning. The employees support you in the programming and commissioning of sophisticated automation systems.

Hotline: +49 5246/963-157
E-mail: support@beckhoff.com
Web: www.beckhoff.com/support

Training

Training in Germany takes place in our training center at the Beckhoff headquarters in Verl, at subsidiaries or, by arrangement, at the customer's premises.

Hotline: +49 5246/963-5000
E-mail: training@beckhoff.com
Web: www.beckhoff.com/training

Service

The Beckhoff Service Center supports you with after-sales services such as on-site service, repair service or spare parts service.

Hotline: +49 5246/963-460
E-mail: service@beckhoff.com
Web: www.beckhoff.com/service

Download area

In the download area you can obtain product information, software updates, the TwinCAT automation software, documentation and much more.

Web: www.beckhoff.com/download

Headquarters

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

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

For the addresses of our worldwide locations, please visit our website at [Global Presence](#).

1.7 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our <https://www.beckhoff.com/secguide>.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at <https://www.beckhoff.com/secinfo>.

2 For your safety

Read this chapter containing general safety information. In addition, always observe the safety instructions and warnings in these operating instructions for your own safety, the safety of other persons and the safety of the product.

When working with control and automation products, many dangers can result from careless or incorrect use. Work particularly thoroughly, not under time pressure and responsibly towards other people.

2.1 Due diligence

● **Read and observe the complete documentation of the TwinSAFE card**

i In addition to this document, the complete documentation for the TwinSAFE card includes documents [1] to [5], which are listed in chapter [References](#) [▶ 8].

Read and observe these documents.

The operator must comply with all the requirements and notes specified in these operating instructions in order to fulfill his duty of care. This includes in particular that you

- comply with the provisions defined in the chapter [Limitation of liability](#) [▶ 6].
- only operate the TwinSAFE drive option card when it is in perfect working order.
- provide the operating instructions in a legible condition and complete at the place of use of the TwinSAFE drive option card.
- do not remove the safety markings attached to the overall system and maintain their legibility.

2.2 General safety instructions

2.2.1 Before operation

Use in machines according to the Machinery Directive

Only use the overall system in machines in accordance with the Machinery Directive to ensure safe operation.

For more information, see the document [6] at [References](#) [▶ 8].

Traceability

Ensure traceability of the TwinSAFE drive option card via the serial number of the overall system.

For more information, see the document [2] at [References](#) [▶ 8].

Use of SELV/PELV power supply unit

To supply the overall system with 24 V_{DC}, use a SELV/PELV power supply unit with an output voltage limitation of $U_{\max} = 36 \text{ V}_{\text{DC}}$ in the event of a fault.

Use of permissible engineering tools and procedures

The TÜV SÜD certificate applies to the overall system with integrated TwinSAFE drive option card, the function blocks available in it, the documentation and the engineering tool. Engineering tools allowed are [TE9000 - TwinCAT 3 Safety Editor](#) and [TE9200 - TwinSAFE Loader](#). Use only the latest versions of the engineering tools. You will find this on the [Beckhoff website](#).

Procedures or engineering tools that deviate from this are not covered by the certificate. This is especially true for externally generated xml files for the TwinSAFE import.

Commissioning test

Before commissioning, application errors and wiring faults must be excluded. Before commissioning, carry out a commissioning test. After a successful commissioning test, you can use the TwinSAFE drive option card for the intended safety-related task.

Provide protected cable routing

When using a safe brake control, ensure that the cable routing between the drive and motor is fixed and protected. (fault exclusion short circuit; ISO 13849-2, Table D.4)

2.2.2 During operation

Impairment due to interference emissions

Do not operate the following devices in the vicinity of the overall system: mobile phones, radio equipment, transmitters or high-frequency systems.

The overall system with integrated TwinSAFE drive option card complies with the requirements of the applicable standards for electromagnetic compatibility with regard to interference emission and immunity. If you exceed the limits for interference emissions specified in the standards, the function of the TwinSAFE drive option card may be impaired.

Observe the GND concept

When grounding the servo drive, observe special conditions.

See the document [2] at [References](#) [▶ 8].

2.2.3 After operation

De-energize and switch off the overall system before working on it

Check all safety-relevant equipment for functionality before working on the overall system. Secure the working environment. Secure the machine or plant against being inadvertently started up.

3 Product overview

3.1 Block diagram

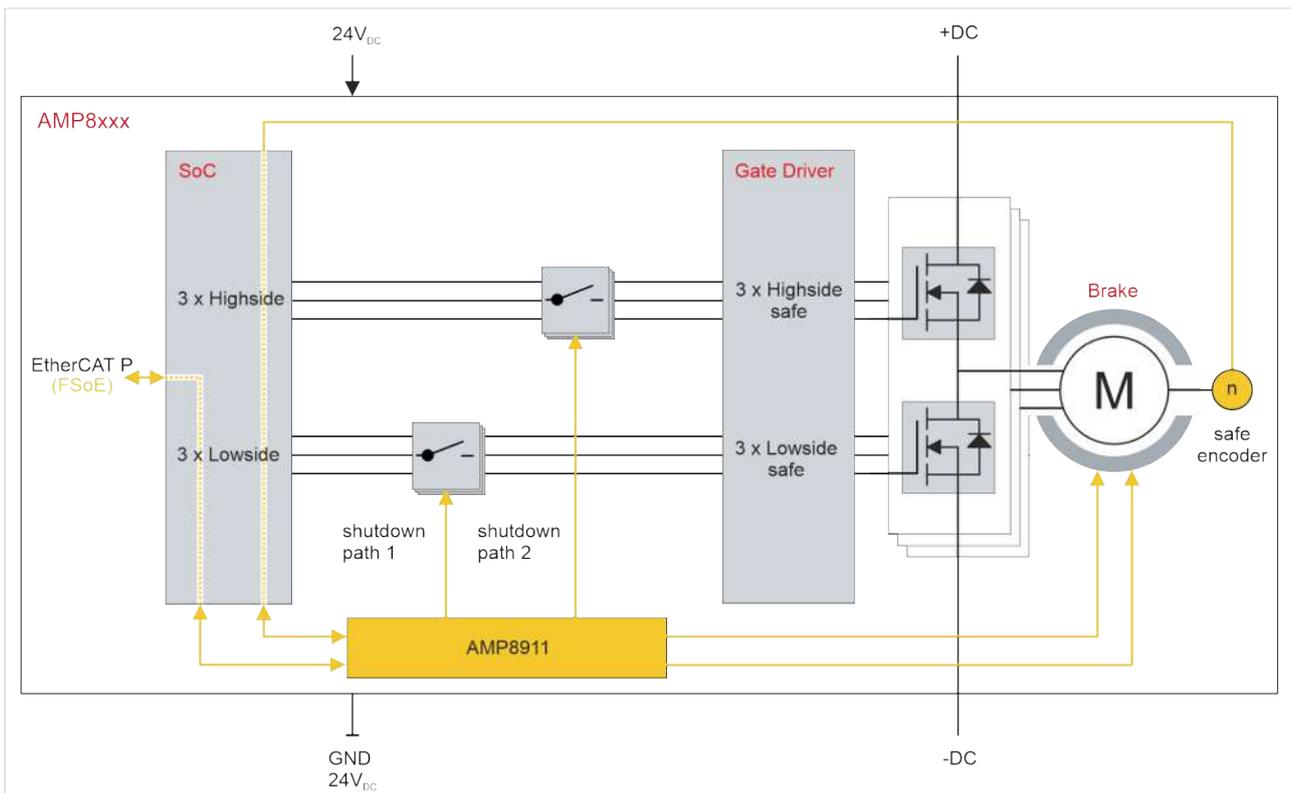
The TwinSAFE card is permanently integrated in the servo drive and has a passing or interrupting effect on the PWM control signals between the drive logic and output stage.

⚠ WARNING

Consider possible motor movements

Even if STO is triggered with interrupted PWM control, a jerky movement (with a maximum of 180° per pole pair) on the motor can occur, for example due to faults in the power circuit.

Consider this in your risk and hazard analysis.



The block diagram describes the mode of operation of the TwinSAFE card within the servo drive.

The TwinSAFE card has an internal two-channel structure based on a 1oo2 structure.

3.2 Product characteristics

AMP8911 - TwinSAFE card for servo drives of the AMP8xxx series

The AMP8911 TwinSAFE card is permanently installed in the servo drive and enables you to define the safety functions by application. The type key of the servo drive determines whether it is a servo drive with STO or Safe Motion. In the delivery state, an initial project with the safety function STO according to EN 61800-5-2 is integrated as an example. For further information, please refer to the chapter [Initial project](#) [▶ 25].

3.3 Type key

| AMP8 a b c - d e f g | Explanation |
|----------------------|---|
| AMP8 | Distributed Servo Drive |
| a | Version 0 = standard 5 = increased mass moment |
| b | Flange size F 3 = 72 mm 4 = 87 mm 5 = 104 mm |
| c | Overall length 1 2 3 4 |
| d | Winding code A to Z S = special winding |
| e | Shaft version 0 = smooth shaft 1 = shaft with groove and parallel key according to DIN 6885 2 = shaft with radial shaft sealing ring IP 65 and smooth shaft 3 = shaft with radial shaft sealing ring IP 65, groove and parallel key according to DIN 6885 4 = shaft with radial shaft sealing ring IP 65, smooth shaft and sealing air connection 5 = shaft with radial shaft sealing ring IP 65, groove, parallel key and sealing air connection |
| f | Feedback system 1 = single-turn absolute encoder, resolution 24-bit, STO, SS1 2 = multi-turn absolute encoder, resolution 24-bit, STO, SS1 3 = single-turn absolute encoder, resolution 24-bit, Safe Motion 4 = multi-turn absolute encoder, resolution 24-bit, Safe Motion |
| g | Holding brake 0 = without holding brake 1 = with holding brake |
| h - k | Variant coding |

Depending on the order identifier in the type key, the following safety functions are implemented in accordance with EN 61800-5-2.

| Order identifier | Safety functions |
|------------------|-----------------------|
| AMP8xxx-xx1x | Stop functions |

| Order identifier | Safety functions | | | |
|--|---------------------------|-------------------------|---------------------|-----------------|
| AMP8xxx-xx2x | STO | Safe torque off | | |
| | SS1 | Safe stop 1 | - t Time controlled | |
| AMP8xxx-xx3x | Stop functions | | | |
| AMP8xxx-xx4x | STO | Safe torque off | | |
| | SOS | Safe operating stop | | |
| | SS1 | Safe stop 1 | - t | Time controlled |
| | | | - r | Ramp monitored |
| | SS2 | Safe stop 2 | | |
| | Speed functions | | | |
| | SLS | Safely limited speed | | |
| | SSM | Safe speed monitor | | |
| | SSR | Safe speed range | | |
| | SMS | Safe maximum speed | | |
| | Position functions | | | |
| | SLP | Safely limited position | | |
| | SCA | Safe cam | | |
| SLI | Safely limited increment | | | |
| Acceleration functions | | | | |
| SAR | Safe acceleration range | | | |
| SMA | Safe maximum acceleration | | | |
| Direction of rotation functions | | | | |
| SDIp | Safe direction positive | | | |
| SDIn | Safe direction negative | | | |

| Order identifier | Safety functions | | | |
|--|---------------------------|-------------------------|-----|-----------------|
| AMP8xxx-xx31 | Stop functions | | | |
| AMP8xxx-xx41 | STO | Safe torque off | | |
| | SOS | Safe operating stop | | |
| | SS1 | Safe stop 1 | - t | Time controlled |
| | | | - r | Ramp monitored |
| | SS2 | Safe stop 2 | | |
| | Speed functions | | | |
| | SLS | Safely limited speed | | |
| | SSM | Safe speed monitor | | |
| | SSR | Safe speed range | | |
| | SMS | Safe maximum speed | | |
| | Position functions | | | |
| | SLP | Safely limited position | | |
| | SCA | Safe cam | | |
| SLI | Safely limited increment | | | |
| Acceleration functions | | | | |
| SAR | Safe acceleration range | | | |
| SMA | Safe maximum acceleration | | | |
| Direction of rotation functions | | | | |
| SDIp | Safe direction positive | | | |
| SDIn | Safe direction negative | | | |

| Order identifier | Safety functions | |
|------------------|------------------------|--------------------|
| | Brake functions | |
| | SBC | Safe brake control |
| | SBT | Safe brake test |

3.4 Intended use

Operate the TwinSAFE drive option card exclusively for the intended activities defined in this documentation, taking into account the prescribed values.

The TwinSAFE drive option card is designed for machine safety functions and directly associated industrial automation tasks. The TwinSAFE drive option cards are used to switch the overall system torque-free in hazardous situations.

TwinSAFE drive option cards are therefore only approved for applications with a defined fail-safe state. This safe state is the wattless state.

WARNING

Improper use

Any use which exceeds the permissible written values from the chapter Technical data or which does not observe other specifications from these operating instructions or other documents of the overall documentation is considered to be not in accordance with the intended use and is therefore prohibited.

This applies in particular to the use cases defined by Beckhoff Automation, which have been fully tested and certified and whose properties and operating conditions can be guaranteed. Use cases beyond this are regarded as inappropriate and require the approval of Beckhoff Automation.

Improper use will result in loss of safety and invalidation of certifications and approval.

4 Technical data

4.1 Product data

The current certificates of all TwinSAFE products with the underlying standards and directives can be found at https://www.beckhoff.com/media/downloads/downloads/twinsafe_certificates.pdf.

| Software data | | Explanation |
|-----------------------|--|---|
| Response times | | |
| • Cycle time | ≤ 10 ms according the project size | The internal cycle time is the runtime of the logic task plus the time difference until it is called again. |
| • Reaction time | ≤ 50 ms | Time between the request of a safety function until the output is switched off. |
| • Watchdog time | 2 ms to 60000 ms | |
| Process image | | |
| • Input | 6 to 51 bytes (1 to 24 bytes Safe Data) | For more information, see the chapter Process image ▶ 26 . |
| • Output | 6 to 59 bytes (1 to 28 bytes Safe Data) | |

| Other product data | | Explanation |
|-----------------------------------|--|--|
| • Supply voltage | 24 V _{DC} (+ 6 % / - 10 %) SELV/PELV with maximum 36 V _{DC} | |
| • internal switch-off temperature | 110 °C | If this value is exceeded, the TwinSAFE component switches to global shutdown. |
| • Safety-related accuracy | 0.439° | Deviating from the SICK encoder documentation, 4 increments are set. |

4.2 Target failure measures

i Calculation of the $MTTF_D$ value from the PFH_D value

For calculation and estimation of the values described in the following table, refer to the following documentation:

- TwinSAFE Application Guide
- EN ISO 13849-1:2015; table K.1.

The target failure measures that apply to your application are determined by the safety function used.

4.2.1 STO

In terms of target failure measures, the FSoE communication is considered with 1 % of SIL 3 according to the protocol specification.

| Target failure measures | | Explanation |
|-------------------------|------------|---|
| Lifetime | 20 a | |
| Proof test interval | / | Special proof tests during the entire lifetime of the TwinSAFE card are not required. |
| PFH_D | 1.7E-9/h | |
| $PF_{D,avg}$ | 8.1E-5 | |
| $MTTF_D$ | High | |
| DC | High, 96 % | |
| SFF | >99 % | |
| SIL CL | 3 | according to EN 62061:2005/A2:2015 |
| SIL | 3 | according to IEC 61508:2010. |
| Performance level | e | according to EN ISO 13849-1:2015. |
| CAT | 4 | according to EN ISO 13849-1:2015. |
| HFT | 1 | |
| Element classification | Type B | according to EN 61508-2:2010. |

For further information, please refer to the chapter [Lifetime](#) [► 23].

4.2.2 STO + SBC

⚠ WARNING

Calculate target failure measures of the complete device

The error analysis for safe brake control SBC is limited to the TwinSAFE card and ends at the connection points of the brake. Calculate the target failure measures of the complete device depending on the variant-specific brake installed. See document [2] at [References](#) [► 8]. For more information on the braking functions, see the chapters Safety function SBC and Safety function SBT.

Failure to comply may result in loss of safety.

In terms of target failure measures, the FSoE communication is considered with 1 % of SIL 3 according to the protocol specification.

| Target failure measures | | Explanation |
|-------------------------|------|---|
| Lifetime | 20 a | |
| Proof test interval | / | Special proof tests during the entire lifetime of the TwinSAFE card are not required. |

| Target failure measures | | Explanation |
|-------------------------|----------------|------------------------------------|
| PFH _D | 1.8E-9h | |
| PFD _{avg} | 1.4E-4 | |
| MTTF _D | High | |
| DC | High, 96 % | |
| SFF | >99 % | |
| SIL CL | 3 ¹ | According to EN 62061:2005/A2:2015 |
| SIL | 3 | According to IEC 61508:2010. |
| Performance Level | e | According to EN ISO 13849-1:2015. |
| CAT | 4 | According to EN ISO 13849-1:2015. |
| HFT | 1 | |
| Element classification | Type B | According to EN 61508-2:2010. |

For further information, please refer to the chapter [Lifetime](#) [► 23].

¹ The PLe / SIL 3 classification for SBC is limited to the TwinSAFE card and ends at the connection points of the brake.

4.2.3 STO + SBC + Safe Motion

⚠ WARNING

Calculate target failure measures of the complete device

The error analysis for safe brake control SBC is limited to the TwinSAFE card and ends at the connection points of the brake. Calculate the target failure measures of the complete device depending on the variant-specific brake installed. See document [2] at [References](#) [► 8]. For more information on the braking functions, see the chapters Safety function SBC and Safety function SBT.

Failure to comply may result in loss of safety.

| Target failure measures | | Explanation |
|-------------------------|---------|---|
| Lifetime | 20 a | |
| Proof test interval | / | Special proof tests during the entire lifetime of the TwinSAFE card are not required. |
| PFH _D | 3.3E-8h | |
| MTTF _D | High | |
| SIL CL | 2 | according to EN 62061:2005/A2:2015 |
| SIL | 2 | according to IEC 61508:2010. |
| Performance level | d | according to EN ISO 13849-1:2015. |
| CAT | 3 | according to EN ISO 13849-1:2015. |
| HFT | 1 | |
| Element classification | Type B | according to EN 61508-2:2010. |

For further information, please refer to the chapter [Lifetime](#) [► 23].

4.3 Environmental conditions

Beckhoff products are designed for operation under certain environmental conditions, which vary according to the product. The following specifications must be observed for operation and environment in order to achieve the optimum service life of the products as well as to ensure product safety.

WARNING

Do not use TwinSAFE drive option cards under the following operating conditions:

- under the influence of ionizing radiation (exceeding the natural background radiation)
- in corrosive environments¹
- in an environment that would lead to impermissible contamination of the TwinSAFE drive option card

¹ A corrosive environment exists when corrosion damage becomes apparent.

The environmental conditions of this TwinSAFE card are defined by the installation in the servo drive. For the conditions, refer to the "Data for operation and environment" in document [2] at [References \[▶ 8\]](#).

4.4 Lifetime

The TwinSAFE card has a lifetime of 20 years, during which the target failure measures are guaranteed. For more information, see the chapter [Target failure measures \[▶ 21\]](#).

The lifetime starts from the date of manufacture according to the name plate of the servo drive. For more information, see document [2] at [References \[▶ 8\]](#).

WARNING

Replace the servo drive after 20 years

After a lifetime of 20 years, the target failure measures are no longer guaranteed.

Use beyond the lifetime may result in loss of safety.

Replace encoder after service life has expired

After the encoder service life has elapsed, an error reaction appears. Refer to the SICK operating instructions with regard to the encoder type to find out the service life. Replacement is carried out by the encoder integrator in case of service.

Use beyond the service life may result in loss of safety.

4.5 Error reaction

The TwinSAFE card performs a permanent self-diagnosis. In the event of a detected malfunction, the TwinSAFE card switches to the safe state according to the fail-safe principle.

Depending on the severity of the cause of the error, the system enters one of the following error states:

- Global Shutdown
- Global Fault
- Module Shutdown

4.5.1 Global Shutdown

If transient faults are detected, such as overvoltage, undervoltage or EMC influences, the TwinSAFE card switches to the "Global Shutdown" state.

This operating state is a safe state and temporarily shuts down the TwinSAFE card.

Reset the operating state by disconnecting and reconnecting the 24 V supply to the servo drive.

4.5.2 Global Fault

When errors are detected that affect the integrity of the safety logic, such as memory errors, the TwinSAFE card switches to the "Global Fault" state.

This operating state permanently shuts down the TwinSAFE card.

Replace the servo drive.

4.5.3 Module Shutdown

If software errors are detected, the affected software module switches to the "Module Shutdown" state.

This operating state is a safe state and temporarily shuts down the software module.

An Error Acknowledge resets the operating state.

5 Initial project

5.1 Description

The servo drive with integrated safety technology cannot be operated without safety. The servo drive with integrated safety technology is supplied with an initial project as an example, which enables simple commissioning.

By using the initial project you have the option of triggering the STO safety function via Safety-over-EtherCAT (FSoE).

- **No safety functions when deleting the initial project**

i If you delete the initial project and do not load a customer-specific safety application on the TwinSAFE card, the PLC of the TwinSAFE card is empty and the outputs are switched off. The device is in a safe state.

Make sure that a safety project is always active on the TwinSAFE card before using the servo drive for safety purposes.

- **Address setting**

i In the delivery state, a safe address of "1" is set.

If you want to use more than one AMP8000, change the addresses of the additional AMP8000s to ensure specific addressing. Then download the project again.

For further information on address setting, please refer to the chapter [Address settings \[► 33\]](#).

5.2 Process image

⚠ WARNING

Use non-safe signals only functionally

For each signal in the process image, the column "Group" indicates whether it is a safety-related or a standard signal. Non-safe signals must not be used for safety-related evaluation or shutdown without additional measures.

● Process image valid for the initial project

i Note that the process image depends on the active project and the implemented safety functions. The process image listed in this document applies exclusively to the initial project. For customer-specific projects, the process image may differ from the process image shown here. For further information on customer-specific projects, please refer to the chapter [Customer-specific safety application](#) [▶ 27].

The process image of the TwinSAFE card consists of the input and the output process image. Detailed information can be found in the following tables.

5.2.1 Input

The process image of the input signals consists of 7 bytes of data, 2 bytes of which are usage data.

| Offset | Designation | Data type | Group | Description |
|--------|-------------|-----------|--------|---|
| 0.0 | ChA_STO | BOOL | Safety | True: no STO, STO outputs are enabled False: STO, safe state |

5.2.2 Output

The process image of the output signals consists of 7 bytes of data, 2 bytes of which are usage data.

| Offset | Designation | Data type | Group | Description |
|--------|----------------|-----------|--------|--|
| 0.0 | STO_active_ChA | BOOL | Safety | State of the signal reported to the Drive Application (standard firmware) True: no STO, STO outputs are enabled False: STO, safe state |

6 Customer-specific safety application

If you require other safety functions for your application apart from the function implemented in the initial project, you have the option of creating application-specific projects and loading them onto the TwinSAFE card.

The following local process image for the input signals and output signals is available for adapting the safety application.

6.1 Local process image

⚠ WARNING

Perform error evaluations

If you activate the brake control, perform the corresponding error evaluations of the module shutdown information in the application. The bits related to the module shutdown information are formatted in italics.

Failure to do so may result in loss of safety.

6.1.1 STO

With the ordering options AMP8xxx-xx1x and AMP8xxx-xx2x according to the [Type key \[► 17\]](#) the following local process image is available for your customer-specific safety application.

6.1.1.1 Input

| Offset | Designation | Data type | Group | Description |
|-------------|---------------------------------|-----------|----------|---|
| 0.0 | <i>ChA_STO_Error</i> | BOOL | Safety | True: error detected in the switch-off paths False: no error |
| 0.1 | ChA_STO_State | BOOL | Standard | True: axis enabled False: no error |
| 0.2 | <i>ChA_Brake_Error</i> | BOOL | Safety | True: brake control error detected False: no error |
| 0.3 | ChA_DriveReq_Activate_Brake | BOOL | Standard | True: brake is released according to drive False: brake is applied according to drive |
| 2.0 | ChA_EncoderVoltage_Underrange | BOOL | Standard | True: encoder undervoltage (OCT or Endat) False: no error |
| 2.1 | ChA_EncoderVoltage_Overrange | BOOL | Standard | True: encoder overvoltage (OCT or Endat) False: no error |
| 2.2 | <i>ChA_EncoderVoltage_Error</i> | BOOL | Standard | True: encoder voltage error False: no error |
| 2.3 | ChA_DriveReq_Activate_Encoder | BOOL | Standard | True: encoder is switched on according to drive. False: encoder is switched off according to drive |
| 4.0 - 5.7 | ChA_EncoderVoltage | UINT16 | Standard | Analog value of encoder voltage (OCT or Endat) in mV |
| 6.0 - 7.7 | ChA_ElectricalAngle | UINT16 | Standard | Electrical angle (2π per pole) |
| 8.0 - 11.7 | ChA_Current_Iq | INT32 | Standard | Analog value of current I _Q , torque-forming current |
| 12.0 - 15.7 | ChA_Current_Id | INT32 | Standard | Analog value of current I _D , field-forming current |
| 18.0 | ChA_DriveReq_Run | BOOL | Standard | Run signal of the drive control word |
| 18.1 | ChA_DriveReq_ErrAck | BOOL | Standard | Error acknowledge signal of the drive control word |

6.1.1.2 Output

| Offset | Designation | Data type | Group | Description |
|--------|-----------------------------|-----------|----------|---|
| 0.0 | ChA_STO_1 | BOOL | Safety | True: enable switch-off path 1 False: disable switch-off path 1 |
| 0.1 | ChA_STO_2 | BOOL | Safety | True: enable switch-off path 2 False: disable switch-off path 2 |
| 0.2 | ChA_STO_ErrAck | BOOL | Standard | Acknowledgement of an error in the switch-off paths |
| 0.3 | ChA_no_STO_to_Drive | BOOL | Standard | True: enable to drive: output stage is enabled for drive False: output stage is disabled for drive |
| 0.4 | ChA_Brake_Release | BOOL | Safety | True: release brake False: lock brake |
| 0.5 | ChA_Brake_ErrAck | BOOL | Standard | Acknowledgement of a brake control error |
| 2.0 | ChA_EncoderVoltage_ErrAck | BOOL | Standard | Acknowledgement of an error of the encoder voltage monitoring |
| 4.0 | ChA_DriveCmd_GroupError | BOOL | Standard | Status to drive: group error |
| 6.0 | ChA_DriveCmd_Emergency_Stop | BOOL | Standard | reserved |
| 6.1 | ChA_DriveCmd_2 | BOOL | Standard | reserved |
| 6.2 | ChA_DriveCmd_3 | BOOL | Standard | reserved |
| 6.3 | ChA_DriveCmd_4 | BOOL | Standard | reserved |
| 6.4 | ChA_DriveCmd_5 | BOOL | Standard | reserved |
| 6.5 | ChA_DriveCmd_6 | BOOL | Standard | reserved |
| 6.6 | ChA_DriveCmd_7 | BOOL | Standard | reserved |
| 6.7 | ChA_DriveCmd_8 | BOOL | Standard | reserved |
| 8.0 | ChA_DiagMessage_1 | BOOL | Standard | On falling edge, Diag message 0xD300 is entered in the Diag history. |
| 8.1 | ChA_DiagMessage_2 | BOOL | Standard | On falling edge, Diag message 0xD301 is entered in the Diag history. |
| 8.2 | ChA_DiagMessage_3 | BOOL | Standard | On falling edge, Diag message 0xD302 is entered in the Diag history. |
| 8.3 | ChA_DiagMessage_4 | BOOL | Standard | On falling edge, Diag message 0xD303 is entered in the Diag history. |
| 8.4 | ChA_DiagMessage_5 | BOOL | Standard | On falling edge, Diag message 0xD304 is entered in the Diag history. |
| 8.5 | ChA_DiagMessage_6 | BOOL | Standard | On falling edge, Diag message 0xD305 is entered in the Diag history. |
| 8.6 | ChA_DiagMessage_7 | BOOL | Standard | On falling edge, Diag message 0xD306 is entered in the Diag history. |
| 8.7 | ChA_DiagMessage_8 | BOOL | Standard | On falling edge, Diag message 0xD307 is entered in the Diag history. |
| 9.0 | ChA_DiagMessage_9 | BOOL | Standard | On falling edge, Diag message 0xD308 is entered in the Diag history. |
| 9.1 | ChA_DiagMessage_10 | BOOL | Standard | On falling edge, Diag message 0xD309 is entered in the Diag history. |
| 9.2 | ChA_DiagMessage_11 | BOOL | Standard | On falling edge, Diag message 0xD30A is entered in the Diag history. |
| 9.3 | ChA_DiagMessage_12 | BOOL | Standard | On falling edge, Diag message 0xD30B is entered in the Diag history. |

| Offset | Designation | Data type | Group | Description |
|--------|--------------------|-----------|----------|--|
| 9.4 | ChA_DiagMessage_13 | BOOL | Standard | On falling edge, Diag message 0xD30C is entered in the Diag history. |
| 9.5 | ChA_DiagMessage_14 | BOOL | Standard | On falling edge, Diag message 0xD30D is entered in the Diag history. |
| 9.6 | ChA_DiagMessage_15 | BOOL | Standard | On falling edge, Diag message 0xD30E is entered in the Diag history. |
| 9.7 | ChA_DiagMessage_16 | BOOL | Standard | On falling edge, Diag message 0xD30F is entered in the Diag history. |

6.1.2 Safe Motion

With the ordering options AMP8xxx-xx3x and AMP8xxx-xx4x according to the [Type key](#) [► 17] the following local process image is available for your customer-specific safety application.

6.1.2.1 Input

| Offset | Designation | Data type | Group | Description |
|-------------|----------------------------------|-----------|----------|---|
| 0.0 | ChA_STO_Error | BOOL | Safety | True: error detected in the switch-off paths False: no error |
| 0.1 | ChA_STO_State | BOOL | Standard | True: axis enabled False: no error |
| 0.2 | ChA_Brake_Error | BOOL | Safety | True: brake control error detected False: no error |
| 0.3 | ChA_DriveReq_Activate_Brake | BOOL | Standard | True: brake is released according to drive False: brake is applied according to drive |
| 2.0 | ChA_EncoderVoltage_Underderrange | BOOL | Standard | True: encoder undervoltage (OCT or Endat) False: no error |
| 2.1 | ChA_EncoderVoltage_Overerrange | BOOL | Standard | True: encoder overvoltage (OCT or Endat) False: no error |
| 2.2 | ChA_EncoderVoltage_Error | BOOL | Standard | True: encoder voltage error False: no error |
| 2.3 | ChA_DriveReq_Activate_Encoder | BOOL | Standard | True: encoder is switched on according to drive. False: encoder is switched off according to drive |
| 4.0 - 5.7 | ChA_EncoderVoltage | UINT16 | Standard | Analog value of encoder voltage (OCT or Endat) in mV |
| 6.0 - 7.7 | ChA_ElectricalAngle | UINT16 | Standard | Electrical angle (2π per pole) |
| 8.0 - 11.7 | ChA_Current_Iq | INT32 | Standard | Analog value of current I_q , torque-forming current |
| 12.0 - 15.7 | ChA_Current_Id | INT32 | Standard | Analog value of current I_d , field-forming current |
| 18.0 | ChA_DriveReq_Run | BOOL | Standard | Run signal for axis of the drive control word |
| 18.1 | ChA_DriveReq_ErrAck | BOOL | Standard | Error acknowledge signal for axis of the drive control word |
| 20.0 | ChA_PriFb_Error | BOOL | Safety | True: error in primary feedback module False: no error |
| 20.1 | ChA_PriFb_Encoder_Ready | BOOL | Standard | True: primary feedback module ready False: no error |
| 20.2 | ChA_PriFb_Position_Valid | BOOL | Safety | True: position of the primary feedback module valid False: no error |
| 20.3 | ChA_PriFb_SDI_p | BOOL | Safety | True: drive rotates in positive direction False: no error |

| Offset | Designation | Data type | Group | Description |
|-------------|--------------------------------------|-----------|----------|--|
| 20.4 | ChA_PriFb_SDI_n | BOOL | Safety | True: drive rotates in negative direction False: no error |
| 20.5 | ChA_PriFb_RefRequired | BOOL | Safety | True: reference position of primary feedback module required False: no error |
| 20.6 | ChA_PriFb_RefPosition_Valid | BOOL | Safety | True: reference position of the primary feedback module valid False: no error |
| 22.0 - 25.7 | ChA_PriFb_Safe_RefMultiTurnPosition | UINT32 | Safety | Multi-turn position value of the primary feedback module |
| 26.0 - 29.7 | ChA_PriFb_Standard_MultiTurnPosition | UINT32 | Standard | Multi-turn position value of the primary feedback module |
| 30.0 - 33.7 | ChA_PriFb_Safe_SingleTurnPosition | UINT32 | Safety | Single-turn position value of the primary feedback module |
| 34.0 - 37.7 | ChA_PriFb_Safe_RefSingleTurnPosition | UINT32 | Safety | Single-turn position value of the primary feedback module |
| 38.0 - 41.7 | ChA_PriFb_Acceleration_Maximum | INT32 | Safety | Analog value of maximum acceleration in the last logic cycle |
| 42.0 - 45.7 | ChA_PriFb_Acceleration_Average | INT32 | Safety | Analog value of the average acceleration according to the setting of the safety parameters |
| 46.0 - 49.7 | ChA_PriFb_Velocity_Maximum | INT32 | Safety | Analog value of the maximum velocity in the last logic cycle |
| 50.0 - 53.7 | ChA_PriFb_Velocity_Average | INT32 | Safety | Analog value of the average speed according to the setting of the safety parameters |

6.1.2.2 Output

| Offset | Designation | Data type | Group | Description |
|--------|-----------------------------|-----------|----------|---|
| 0.0 | ChA_STO_1 | BOOL | Safety | True: enable switch-off path 1 False: disable switch-off path 1 |
| 0.1 | ChA_STO_2 | BOOL | Safety | True: enable switch-off path 2 False: disable switch-off path 2 |
| 0.2 | ChA_STO_ErrAck | BOOL | Standard | Acknowledgement of an error in the switch-off paths |
| 0.3 | ChA_no_STO_to_Drive | BOOL | Standard | True: enable to drive: output stage is enabled for drive False: output stage is disabled for drive |
| 0.4 | ChA_Brake_Release | BOOL | Safety | True: release brake False: lock brake |
| 0.5 | ChA_Brake_ErrAck | BOOL | Standard | Acknowledgement of a brake control error |
| 2.0 | ChA_EncoderVoltage_ErrAck | BOOL | Standard | Acknowledgement of an error of the encoder voltage monitoring |
| 4.0 | ChA_DriveCmd_GroupError | BOOL | Standard | Status to drive: group error |
| 6.0 | ChA_DriveCmd_Emergency_Stop | BOOL | Standard | reserved |
| 6.1 | ChA_DriveCmd_2 | BOOL | Standard | reserved |
| 6.2 | ChA_DriveCmd_3 | BOOL | Standard | reserved |
| 6.3 | ChA_DriveCmd_4 | BOOL | Standard | reserved |
| 6.4 | ChA_DriveCmd_5 | BOOL | Standard | reserved |
| 6.5 | ChA_DriveCmd_6 | BOOL | Standard | reserved |
| 6.6 | ChA_DriveCmd_7 | BOOL | Standard | reserved |

| Offset | Designation | Data type | Group | Description |
|--------|--------------------|-----------|----------|--|
| 6.7 | ChA_DriveCmd_8 | BOOL | Standard | reserved |
| 8.0 | ChA_DiagMessage_1 | BOOL | Standard | On falling edge, Diag message 0xD300 is entered in the Diag history. |
| 8.1 | ChA_DiagMessage_2 | BOOL | Standard | On falling edge, Diag message 0xD301 is entered in the Diag history. |
| 8.2 | ChA_DiagMessage_3 | BOOL | Standard | On falling edge, Diag message 0xD302 is entered in the Diag history. |
| 8.3 | ChA_DiagMessage_4 | BOOL | Standard | On falling edge, Diag message 0xD303 is entered in the Diag history. |
| 8.4 | ChA_DiagMessage_5 | BOOL | Standard | On falling edge, Diag message 0xD304 is entered in the Diag history. |
| 8.5 | ChA_DiagMessage_6 | BOOL | Standard | On falling edge, Diag message 0xD305 is entered in the Diag history. |
| 8.6 | ChA_DiagMessage_7 | BOOL | Standard | On falling edge, Diag message 0xD306 is entered in the Diag history. |
| 8.7 | ChA_DiagMessage_8 | BOOL | Standard | On falling edge, Diag message 0xD307 is entered in the Diag history. |
| 9.0 | ChA_DiagMessage_9 | BOOL | Standard | On falling edge, Diag message 0xD308 is entered in the Diag history. |
| 9.1 | ChA_DiagMessage_10 | BOOL | Standard | On falling edge, Diag message 0xD309 is entered in the Diag history. |
| 9.2 | ChA_DiagMessage_11 | BOOL | Standard | On falling edge, Diag message 0xD30A is entered in the Diag history. |
| 9.3 | ChA_DiagMessage_12 | BOOL | Standard | On falling edge, Diag message 0xD30B is entered in the Diag history. |
| 9.4 | ChA_DiagMessage_13 | BOOL | Standard | On falling edge, Diag message 0xD30C is entered in the Diag history. |
| 9.5 | ChA_DiagMessage_14 | BOOL | Standard | On falling edge, Diag message 0xD30D is entered in the Diag history. |
| 9.6 | ChA_DiagMessage_15 | BOOL | Standard | On falling edge, Diag message 0xD30E is entered in the Diag history. |
| 9.7 | ChA_DiagMessage_16 | BOOL | Standard | On falling edge, Diag message 0xD30F is entered in the Diag history. |
| 10.0 | ChA_PriFb_Enable | BOOL | Standard | True: enable primary feedback False: disable primary feedback |
| 10.1 | ChA_PriFb_ErrAck | BOOL | Standard | Acknowledgement of a primary feedback error |
| 10.2 | ChA_PriFb_SetRef | BOOL | Standard | Setting the reference position of the primary feedback module |

7 Safety functions

Create the realizable safety functions analogously with the SafeMotion Wizard in the TwinCAT 3 Safety Editor.

Procedures and application examples can be found in the SafeMotion Wizard tutorials. The tutorials can be found at <https://www.beckhoff.com/de-de/support/webinare/index.html>.

Further application examples can be found in document [5] at [References \[▶ 8\]](#).

8 Configuration in the Safety Editor

This chapter describes configurations in the Safety Editor. A more comprehensive configuration description can be found in document [3] at [References \[▶ 8\]](#).

8.1 Creating a safety project

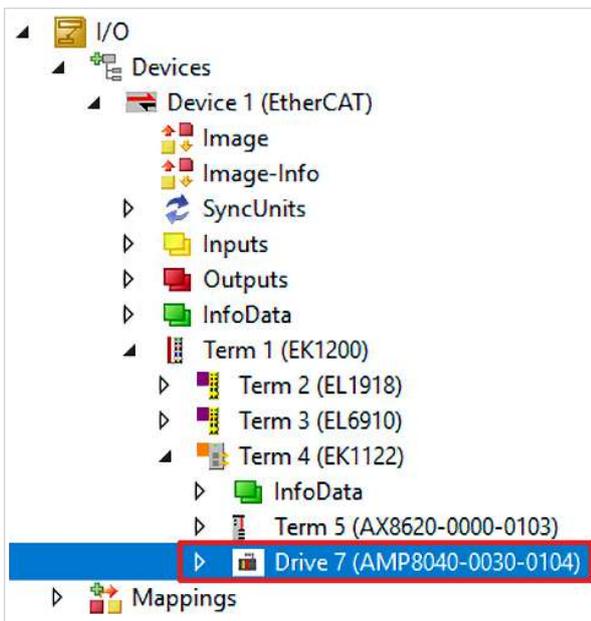
Information on creating a safety project in TwinCAT 3 can be found in chapter "Creating a safety project in TwinCAT 3" in document [3] at [References \[▶ 8\]](#).

For information on downloading a safety project to a target system, refer to chapter "Downloading the safety application" in document [3] at [References \[▶ 8\]](#).

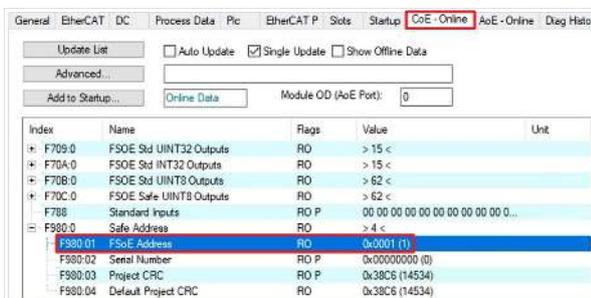
8.2 Import/export of a safety project

For information on importing or exporting an existing safety project, refer to chapter "Export/import of the safety project" in document [3] at [References \[▶ 8\]](#).

8.3 Address settings

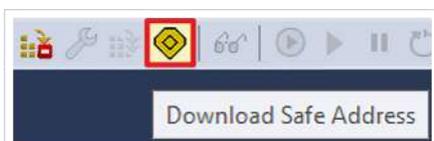


1. Open Safe Motion component



2. Open "CoE-Online" tab

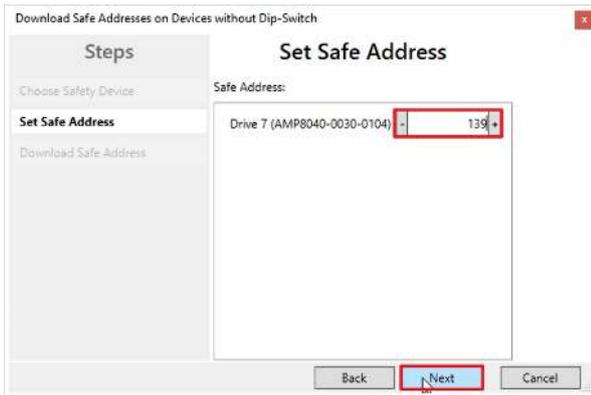
At index F980:01 you see the current FSoE address.



3. Click on "Download Safe Address" in the menu bar



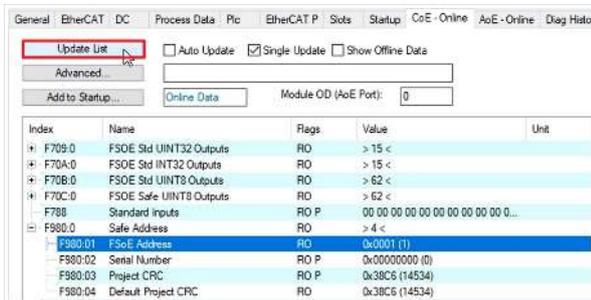
4. In the "Choose Safety Device" window, select Safe Motion component
5. Confirm the selection with "Next"



- The "Set Safe Address" window opens.
6. Enter desired address
 7. Confirm the entry with "Next"



8. Enter the user name and password in the "Download Safe Address" window
- Default username: Administrator
Default password: TwinSAFE
9. Select the Safe Motion component for which you want to load a new address
 10. Close the window with "Finish"



11. Click on "Update List"

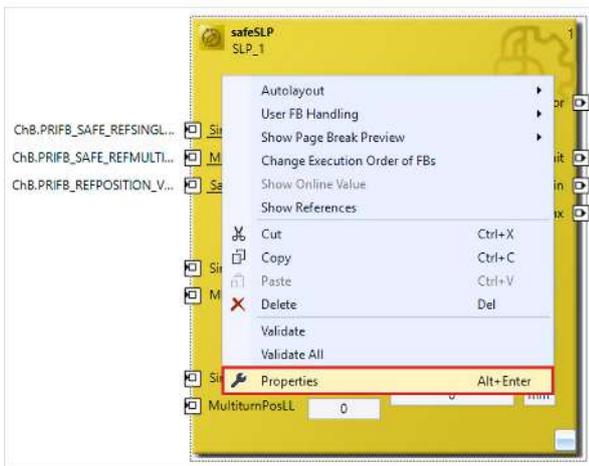
| Index | Name | Flags | Value | Unit |
|---------|-------------------------|-------|------------------------------|------|
| F709-0 | FSoE Std UINT32 Outputs | RO | > 15 < | |
| F70A-0 | FSoE Std INT32 Outputs | RO | > 15 < | |
| F70B-0 | FSoE Std UINT8 Outputs | RO | > 62 < | |
| F70C-0 | FSoE Safe UINT8 Outputs | RO | > 62 < | |
| F788 | Standard Inputs | RO P | 00 00 00 00 00 00 00 00 0... | |
| F980-0 | Safe Address | RO | > 4 < | |
| F980-01 | FSoE Address | RO | 0x0088 (138) | |
| F980-02 | Serial Number | RO P | 0x00000000 (0) | |
| F980-03 | Project CRC | RO P | 0x38C6 (14534) | |
| F980-04 | Default Project CRC | RO | 0x38C6 (14534) | |

You will now see at index F980:01 that the new FSoE address has been successfully set.

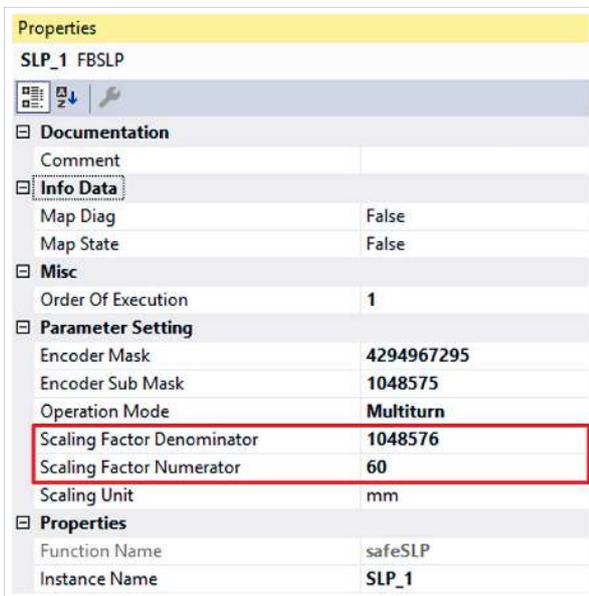
12. Download the safety project again

8.4 Parameter Settings

Open the parameter settings of the individual function blocks as follows:



1. Right-click on a function block
2. Click on "Properties"



The Properties window opens. Here you can find the available parameter settings depending on the function block. For the SLP functionality, for example, you can set the numerator and denominator of the scaling factor.

8.5 Internal safety parameters

You can access the internal safety parameters via the target system of your safety project.

8.5.1 STO

The following internal safety parameters apply to the ordering options AMP8xxx-xx1x and AMP8xxx-xx2x according to the [Type key \[▶ 17\]](#).

| Index | Designation | Data type | Description |
|----------|---|-----------|---|
| 0xC110:1 | ChA FSOUT BRAKE ModuloDiagTestPulse | UINT8 | Modulo value for the frequency of the generation of a test pulse. 0 -> every time 1 -> every second time and so on |
| 0xC110:2 | ChA FSOUT BRAKE MultiplierDiagTestPulse | UINT8 | Length of the test pulse in multiples of 625 µs |
| 0xC110:4 | ChA FSOUT BRAKE Diag TestPulse active | BOOL | True: test pulses active False: test pulses inactive |
| 0xC130:1 | ChA FSDRIVE Brake Control Enabled | BOOL | True: brake control active False: brake control inactive |

8.5.2 Safe Motion

The following internal safety parameters apply to the ordering options AMP8xxx-xx3x and AMP8xxx-xx4x according to the [Type key \[▶ 17\]](#).

⚠ WARNING

Testing of the brake control

In the parameter 0xC110:4 you have the possibility to deactivate the test pulses. In this case, control the brake cyclically every 8 hours.

Failure to comply may endanger safety.

| Index | Designation | Data type | Description |
|--|---|-----------|---|
| 0xC110:1 | ChA FSOUT BRAKE ModuloDiagTestPulse | UINT8 | Modulo value for the frequency of the generation of a test pulse. 0 -> every time 1 -> every second time and so on |
| 0xC110:2 | ChA FSOUT BRAKE MultiplierDiagTestPulse | UINT8 | Length of the test pulse in multiples of 625 µs |
| 0xC110:4 | ChA FSOUT BRAKE Diag TestPulse active | BOOL | True: test pulses active False: test pulses inactive |
| 0xC130:1 | ChA FSDRIVE Brake Control Enabled | BOOL | True: brake control active False: brake control inactive |
| 0xC130:2 | ChA FSDRIVE Primary Feedback Enabled | BOOL | True: feedback module active False: feedback module inactive |
| The following parameters are only evaluated if parameter 0xC130:2 is TRUE. | | | |
| 0xC140:01 | ChA Primary Feedback Average Calculation Acceleration | ENUM(4) | Average acceleration calculation |
| 0xC140:05 | ChA Primary Feedback Average Calculation Velocity | ENUM(4) | Average velocity calculation |
| 0xC140:17 | ChA Primary Feedback Encoder Direction Shift | BIT5 | Detection limit for direction of rotation detection |

| Index | Designation | Data type | Description |
|-----------|--|-----------|---|
| 0xC142:01 | ChA Primary Feedback Operation Mode | ENUM(4) | Referencing the operation mode <ul style="list-style-type: none"> • Automatic referencing, "Set reference position" activated • Automatic referencing, "Set reference position" deactivated • Manual referencing |
| 0xC142:17 | ChA Primary Feedback Reference SafePosition Singleturn | UINT32 | Safe single-turn reference position |
| 0xC142:18 | ChA Primary Feedback Reference SafePosition Multiturn | INT32 | Safe multi-turn reference position |
| 0xC142:19 | ChA Primary Feedback Speed at Reference Position | UINT32 | Maximum permissible speed at the reference position |
| 0xC142:20 | ChA Primary Feedback Maximum Singeltturn Referenced SafePosition | UINT32 | Maximum safe single-turn reference position |
| 0xC142:21 | ChA Primary Feedback Maximum Multiturn Referenced SafePosition | INT32 | Maximum safe multi-turn reference position |
| 0xC142:22 | ChA Primary Feedback Minimum Singletturn Referenced SafePosition | UINT32 | Minimum safe single-turn reference position |
| 0xC142:23 | ChA Primary Feedback Minimum Multiturn Referenced SafePosition | INT32 | Minimum safe multi-turn reference position |
| 0xC142:24 | ChA Primary Feedback Deviation Startup Position | UINT32 | Permissible deviation when initializing the reference position |

9 Diagnostic history

For information on diagnosis, refer to the chapters "Diag History tab" and "Diagnosis History" in document [3] at [References \[▶ 8\]](#).

10 Appendix

10.1 Volatility

If there are requirements concerning the volatility of products in your application, for example of the U.S. Department of Defense or similar authorities or security organizations, the following process applies:

The product has both volatile and non-volatile components. Volatile components lose their data immediately after removing power. Non-volatile components keep the data even after loss of power.

If there is customer specific data saved on the product, it cannot be ensured that this data might not be restored through for example forensic measures, even after the data is deleted through the provided tool chain. If this data is confidential, the scrapping of the product after usage is recommended to protect this data.

More Information:
www.beckhoff.com/AMP8911

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl
Germany
Phone: +49 5246 9630
info@beckhoff.com
www.beckhoff.com

