Please read carefully before commissioning!

Foreword

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards. It is essential that the following notes and explanations are followed when installing and commissioning these components.
The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

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. In the event that it contains technical or editorial errors, we retain the right to make alterations at any time and without warning.
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.

Copyright

Appropriate use

The AX5801 Safety Card is designed exclusively for installation in the optional safety slot of a servo drive from the AX5000 series. The cards are installed together with the servo drive as components in electrical systems and machinery and may only be used in this way.

Scope of supply

The scope of supply includes the following components:

AX5801 Safety Card, 4-pin connector, 6-pin connector, technical documentation and packaging

If one of the components is damaged please notify the logistics company and Beckhoff Automation GmbH immediately.

Security

Safety rules

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations and guidelines.

DANGER	**Caution – Danger of death!** 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 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 fallen below 50 V.

WARNING	**Caution – Risk of injury!** 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.

Attention	**Caution – electrostatic charging may lead to destruction of the Safety Card!** The Safety Card is an ESD-sensitive component. Follow the usual ESD safety procedures when handling the card (anti-static wrist straps, earthing of the relevant components, etc.).

Exclusion of liability

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.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards. Knowledge of machine safety legislation is compulsory.

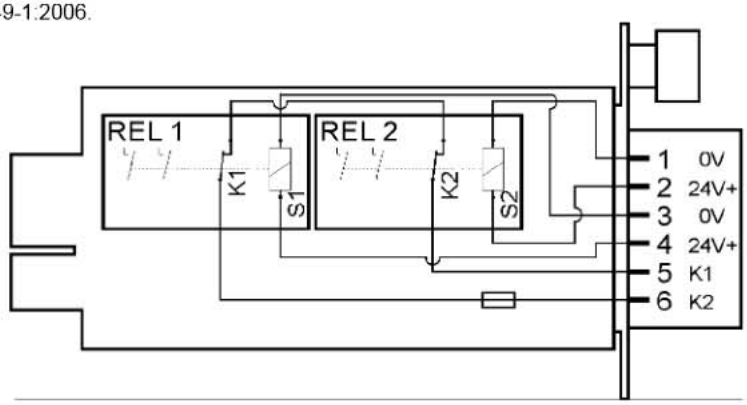
Product Description

The AX5801 Safety Card from Beckhoff is used to realise the safe stop functions "STO or SS1 according to IEC 61800-5-2". STO stands for SafeTorqueOff, SS1 for SafeStop1.
Through 2-channel monitoring integrated in the AX5000, stop category 0 or 1 according to IEC 60204-1 can be realised with minimum effort and additional TwinSAFE blocks from Beckhoff, resulting in category 4 according to ISO 13849-1:2006.

Two-channel monitoring is achieved through certified relays (Rel1 and Rel2). The relays are equipped with positively driven contacts including feedback contacts (K1 and K2). The feedback contacts are connected in series and potential-free with terminals (5) and (6) of the 6-pin connector.

The two coils (S1 and S2) have to be supplied with 24 V DC via terminals 1 and 2 or 3 and 4 of the 6-pin or 4-pin connector.
Terminals1-1, 2-2, 3-3 and 4-4 of the two connectors are bridged internally.

If a relay releases, the de-energising circuit of the AX5000 servo drive range ensures that the connected motors (both channels) become torque-free.



Technical data

Relay operating voltage (terminal 1-4)	24 V_{DC} -15% +20%
Conductor cross-section of terminals 1-6	0.2 –1.5 mm^2

Feedback contacts operating voltage (5-6)	24 V_{DC} -15% +20%
Conductor strip length of terminals 1-6	10mm

Max. switching current of the feedback contacts (5-6)	0.35 A
current consumption	50 mA

We recommend using wire end sleeves!

Installation of the AX5801 Safety Card

WARNING

Caution – Risk of injury!

Before installing the Safety Card disconnect the servo drive from the mains and system voltage. Dangerous voltage continues to be present at the X02 terminals of the DC link for 5 minutes. Never touch the terminals within this period.

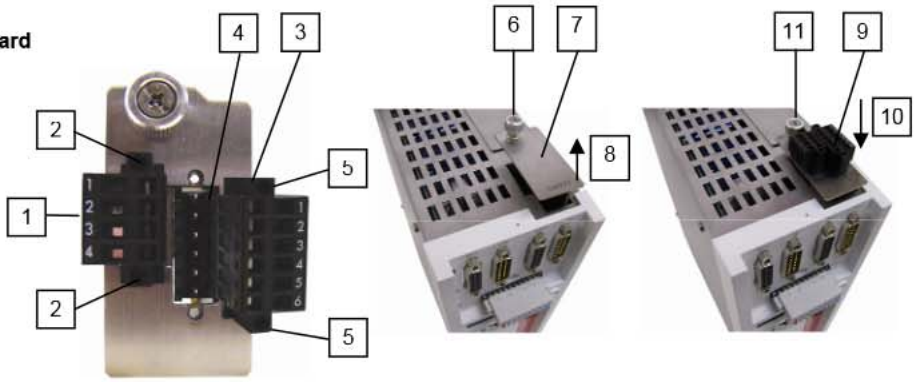
Mechanical installation

Installation of the two connectors on the AX5801 Safety Card

- Insert the enclosed 4-pin connector (1) into the socket.
- Tighten the two bolts (2).
- Insert the 6-pin connector (3) into the socket (4).
- Tighten the two bolts (5).

Installation of the AX5801 Safety Card

- Fully release the bolt (6).
- Remove the insert (7) in the direction of the arrow (8).
- Carefully insert the Safety Card (9) into the opening in the direction of the arrow (10). The slot has guides for the card on the short sides.
  Ensure that the card is inserted into these guides.
- Tighten the bolt (11).



Electrical installation

Configure the safety operation of servo drive via IDN P-0-2000. During the next system start-up the servo drive automatically detects whether a Safety Card was inserted and whether the IDN P-0-2000 parameterisation is correct. Error message "0xFDD4" indicates incorrect configuration. If the servo drive with the Safety Card does not reach the safe state, error message "0xFDD5" appears on the display of servo drive. In this case please contact Beckhoff.

CAUTION

Danger for persons!

If an error message appears on the display of the AX5000 the servo drive must not be put into service if the servo drive in the system or machine represents a safety-relevant part of the control system.

Application example (emergency stop – stop category 1)

Components involved:

- Emergency stop device (control switch S1) according to ISO 13850 and control switch S2
- 1 safety input terminal (KL1904) and 1 input terminal (KL 1404)
- 1 safety logic terminal (KL6904) with function block "ESTOP"
- AX5801 Safety Card and servo drive from the AX5000 range
- Programmable logic controller (PLC) and EtherCAT fieldbus

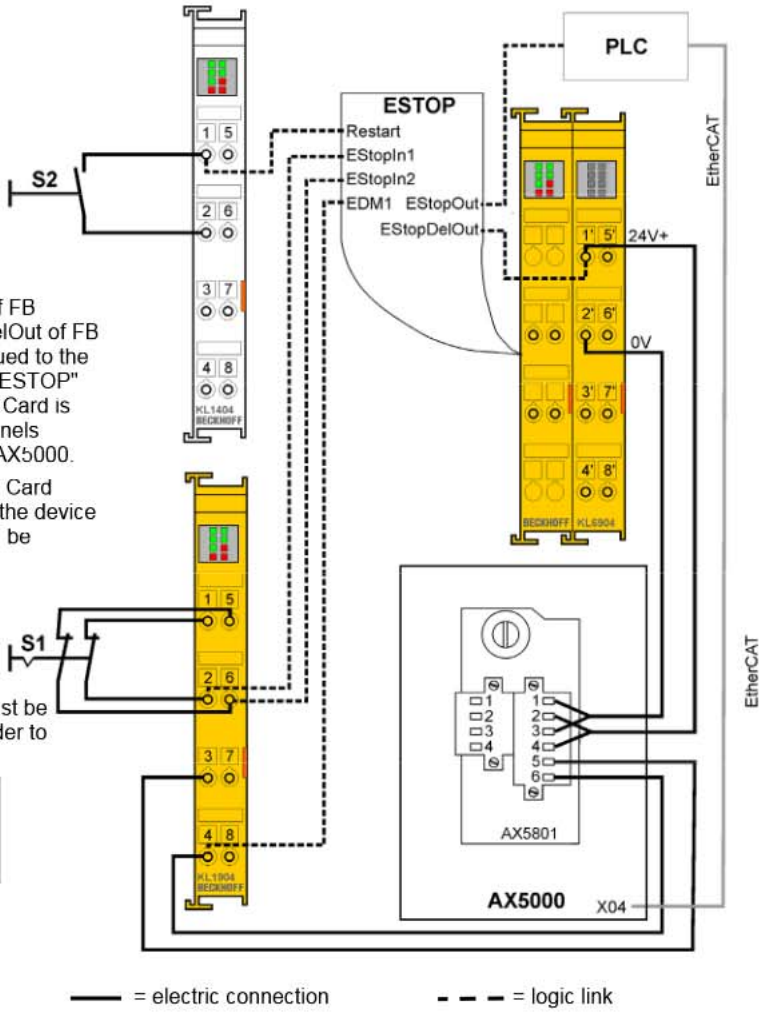
By activating the emergency stop device (S1) inputs EStopIn1 and EStopIn2 of FB "ESTOP" are switched to state "0", resulting in outputs EStopOut and EStopDelOut of FB "ESTOP" being switched to state "0". As a result, a quick stop command is issued to the PLC and therefore the AX5000 via EtherCAT. The output EStopDelOut of FB "ESTOP" ensures that after a specified delay time the 24 V supply of the AX5801 Safety Card is interrupted. This causes the relays (REL1 and REL2) to release and both channels (motors) to be made torque-free via the internal deactivation procedure of the AX5000.

In the event of a fault the controlled shutdown (quick stop) may fail. The Safety Card becomes active once the delay time has elapsed, and all motors connected to the device run out. The risk analysis for the machine must indicate that this behaviour can be tolerated. An interlock may be required.

The delay time must be set slightly longer than the maximum braking time of the quick stop.

Sticking relay contacts on the Safety Card are detected via input EDM1 of FB "ESTOP", and restarting is prevented.

When the emergency stop device is released again, the control switch (S2) must be operated (first rising then falling edge at the restart input of FB "ESTOP") in order to restart the AX5000.



Note

Industrial safety with several axes

An application example for a safety circuit with several AX5000 devices can be found in the servo drive manual.