Installation Manual
for
SMX Modules

Contents

1 Important notes

Definition of individual target groups

Project engineers for secure drive systems:
Engineers and technicians

Assembly, electric installation, maintenance and replacement of devices
Maintenance electricians and service technicians

Commissioning, operation and configuration:
Technicians and engineers

1.1 Definitions

The designation SMX is used as generic term for all derivatives from the SMX product range. Wherever this description refers to a certain derivative, the complete designation is used.

The term "safe" used in the following text in any case refers to the classification as a safe function for application up to Pl e acc. to EN ISO 13849-1 or SIL3 acc. to EN 61508.

The system software "SafePLC" serves the purpose of configuring and programming of the SMX modules.

The modules of the SMX series are internally built up of two independent processing units. In the following these are referred to as system A and system B.

1.2 Co-valid documents

Description	***Reference***
Configuration of the SMX module for standalone applications without fieldbus interfacing with the program "SafePLC"	SafePLC programming manual (System CD)
Validation report for implemented parameterization and PLC-program	Safety inspection with acceptance protocol
Acceptance test	TÜV certificate for product modules SMX10 SMX11 SMX12 SMX12A

Note:

- Thoroughly read the manuals before you start the installation and the commissioning of the SMX module.
- Paying attention to the documentation is a prerequisite for trouble-free operation and fulfilment of possible warranty claims.

1.3 Abbreviations used

Abbreviation	***Meaning***
AC	Alternating voltage
IL	Instruction list
ELIA	Employer's liability insurance association
CLK	Clock (cycle)
CPU	Central Processing Unit
DC	Direct voltage
DI1..DI14	Digital Input
DIN	Deutsches Institut für Normung (German Institute for Standardization)
DO	Digital Output
EMU	Emergency Monitoring Unit

Abbreviation	*Meaning*
EMC	Electromagnetic compatibility
ELC	Emergency Limit Control
EN	European Standard
HISIDE	Output with 24 VDC nominal level switching to plus
IP20	Degree of protection for housing
ISO	International Organisation for Standardisation
LED	Light Emitting Diode
LOSIDE	Output switching to reference potential
OLC	Operational Limit Control
PIA	Process image of outputs
PII	Process image of inputs
P1,P2	Pulse outputs
PLC	Programmable Logic Controller
POR	Power on Reset
PSC	Position Supervision Control
SELV	Safety Extra Low Voltage
SSI	Synchronous Serial Interface
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik e. V. (association for electrical engineering, electronics and information technology)

2 Safety regulations

2.1 Installation and commissioning

Do not install or operate damaged products. Report damages immediately to the responsible forwarding agent.

Only skilled electricians with profound knowledge of the accident prevention instructions may be entrusted with installation, commissioning and service work on the device.

Commissioning (i.e. starting up the intended operation) is only permitted in strict compliance with the EMC-directive. The EMC-testing regulations EN55011:2007 + A2:2007 and EN 61000-6-2:2005 are used as basis.

The wiring and connecting instructions in chapter "Installation" must be strictly followed.

The applicable VDE-regulations and other special safety regulations of relevance for the application must be strictly followed.

Evidence of the configured monitoring functions and links must be issued by means of a validation report.

The implementation of the module must be coordinated with the demands of the responsible acceptance testing authority (e.g. TÜV or ELIA).

2.2 Operation and service

The module must always be de-energized before installation and removal, or before disconnecting signal lines.

When installing or removing the module appropriate measures must be applied to prevent electrostatic discharge to the externally arranged terminal and plug connections.

2.3 Transport/storage

Information concerning transport, storage and proper handling must be strictly followed.
The climate related specifications in chapter "Technical data" must be complied with.

3 Device types

3.1 Module overview

3.1.1 SMX10

Type designation	*Device design*
	Design of module with the following periphery: 14 digital inputs 2 Pulse outputs 2 Relay outputs 2 LOSIDE 2 HISIDE 2 Signal outputs 1 Diagnostic and configuration interface 1 Function button 1 7-segment display 1 Status-LED 14 Status-LEDs for inputs 2 Status-LEDs for pulse outputs 2 Status-LEDs for relay outputs 2 Status-LEDs for HISIDE 1 Backplane bus interface

Characteristics of the module:

- Logic processing up to Pl e acc. to EN ISO 13849-1 or SIL 3 acc. to EN 61508
- Open programmable small control system for up to 800 IL instructions
- Logic diagram oriented programming
- Pulse outputs for cross-shorting detection of digital input signals
- Safety function of external contact monitoring for connected switchgear
- Monitored relay outputs for safety relevant functions
- Monitored HISIDE/LOSIDE outputs for safety relevant functions
- CAN-communication in connection with the SMX5x for diagnose via backplane bus system
  Mounting on top hat rail

3.1.2 SMX11

Type designation	*Device design*
	Design of module with the following periphery: 1 Sensor interface 14 digital inputs, alternatively 4 counting inputs 2 Pulse outputs 2 Relay outputs 2 LOSIDE 2 HISIDE 2 Signal outputs 1 Diagnostic and configuration interface 1 Function button 1 7-segment display 1 Status-LED 14 Status-LEDs for inputs 2 Status-LEDs for pulse outputs 2 Status-LEDs for relay outputs 2 Status-LEDs for HISIDE 1 Backplane bus interface

Characteristics of the module:

- Logic processing up to Pl e EN ISO 13849-1 or SIL 3 acc. to EN 61508
- Movement monitoring of one axis up to Pl e EN ISO 13849-1 or SIL 3 acc. to EN 61508
- Speed monitoring:
- RPM-monitoring
- Standstill monitoring
- Sense of rotation monitoring
- Secure incremental dimension
- Emergency Stop monitoring
- Position monitoring
- Position range monitoring
- Trend range monitoring
- Target position monitoring
- Open programmable small control system for up to 800 IL instructions
- Logic diagram oriented programming
- Pulse outputs for cross-shorting detection of digital input signals
- Counting inputs as alternatives to the digital inputs
- Safety function of external contact monitoring for connected switchgear
- Monitored relay outputs for safety relevant functions
- Monitored HISIDE/LOWSIDE outputs for safety relevant functions
- CAN-communication in connection with the SMX5x for diagnose via backplane bus system
  Mounting on top hat rail

3.1.3 SMX12

Type designation	*Device design*
	Design of module with the following periphery: 2 Sensor interfaces 14 digital inputs, alternatively 4 counting inputs 2 Pulse outputs 2 Relay outputs 2 LOSIDE 2 HISIDE 2 Signal outputs 1 Diagnostic and configuration interface 1 Function button 1 7-segment display 1 Status-LED 14 Status-LEDs for inputs 2 Status-LEDs for pulse outputs 2 Status-LEDs for relay outputs 2 Status-LEDs for HISIDE 1 Backplane bus interface

Characteristics of the module:

- Logic processing up to Pl e EN ISO 13849-1 or SIL 3 acc. to EN 61508
- Movement monitoring of one or two axes up to Pl e EN ISO 13849-1 or SIL 3 acc. to EN 61508
- Speed monitoring
- RPM-monitoring
- Standstill monitoring
- Sense of rotation monitoring
- Secure incremental dimension
- Emergency Stop monitoring
- Position monitoring
- Position range monitoring
- Trend range monitoring
- Target position monitoring
- Open programmable small control system for up to 800 IL instructions
- Logic diagram oriented programming
- Pulse outputs for cross-shorting detection of digital input signals
- Counting inputs as alternatives to the digital inputs
- Safety function of external contact monitoring for connected switchgear
- Monitored relay outputs for safety relevant functions
- Monitored HISIDE/LOWSIDE outputs for safety relevant functions
- CAN-communication in connection with the SMX5x for diagnose via backplane bus system
  Mounting on top hat rail

3.1.4 SMX12A

Type designation	*Device design*
	Design of module with the following periphery: 2 Sensor interfaces 14 digital inputs, alternatively 4 counting inputs 2 Pulse outputs 2 Relay outputs 2 LOSIDE 2 HISIDE 2 Signal outputs 2x2 Analog inputs 1 Diagnostic and configuration interface 1 Function button 1 7-segment display 1 Status-LED 14 Status-LEDs for inputs 2 Status-LEDs for pulse outputs 2 Status-LEDs for relay outputs 2 Status-LEDs for HISIDE 1 Backplane bus interface

Characteristics of the module:

- Logic processing up to Pl e EN ISO 13849-1 or SIL 3 acc. to EN 61508
- Movement monitoring of one or two axes up to Pl e EN ISO 13849-1 or SIL 3 acc. to EN 61508
- Speed monitoring
- RPM-monitoring
- Standstill monitoring
- Sense of rotation monitoring
- Secure incremental dimension
- Emergency Stop monitoring
- Position monitoring
- Position range monitoring
- Trend range monitoring
- Target position monitoring
- Open programmable small control system for up to 800 IL instructions
- Logic diagram oriented programming
- Pulse outputs for cross-shorting detection of digital input signals
- Secure analog signal monitoring up to SIL 3 acc. to EN 61508
- Counting inputs as alternatives to the digital inputs
- Safety function of external contact monitoring for connected switchgear
- Monitored relay outputs for safety relevant functions
- Monitored HISIDE/LOWSIDE outputs for safety relevant functions

- CAN-communication in connection with the SMX5x for diagnose via backplane bus system
  Mounting on top hat rail

3.1.5 SMX51

Type designation	***Device design***
	Design of module with the following periphery: 1 CAN-BUS interface 1 Backplane bus interface 1 Status LED for operating status 1 Status LED CAN-communication

Characteristics of the module:

- CAN communication module
- Use as insecure signal channel with CAN interface
- CAN-communication via backplane bus system, mounting on top hat rail

3.1.6 Type plate

The type plate is located on the left side wall of the module and contains the following information:

Type designation
Part number
Serial number
Identification of hardware release
Identification of software release
Safety category
Input characteristics
Output characteristics

Type plate SMX12 (image enlarged)

3.2 Scope of delivery

The scope of delivery contains:

SMX module:

- Plug for all signal terminals without encoder connection

Not included in the scope of delivery:

- SafePLC configuration software CD with
  - Installation manual
  - Programming manual
  - Driver for programming adapter
- Programming adapter
- Licence key (USB-Dongle) for SafePLC
- System CD with manuals
- Backplane bus plug (SMX31 and use of monitoring module)

4 Installation

4.1 General notes on installation

Strictly follow the safety regulations when installing!

Degree of protection IP52
Route all signal lines for the interfacing of digital inputs and contact monitoring separately.
In any case isolate 230 VAC voltages from low voltage lines, if these voltages are used in connection with the application.

The cable lengths for digital inputs and outputs must not exceed **30 m**.

Measures concerning the electromagnetic compatibility (EMC)

The SMX module is intended for use in the drive environment and meets the EMC-requirements mentioned above.
It is also assumed that the electromagnetic compatibility of the overall system is ensured by application of appropriate measures.

The following measures ensure the intended operation of the SMX module:

Electric power supply lines of the SMX and "discontinuous-action lines" of the drive controller must be isolated from each other.
Signal lines and power lines of the drive controller must be routed through separate cable ducts. The distance between the cable ducts should be minimum 10 mm.
The digital inputs and outputs of the SMX do not require shielded cables.
Only shielded cables must be used to connect the position and speed sensors. The signal transmission cable must be RS-485-standard compliant (lines twisted in pairs).
Care must be taken to ensure that the shielding is correctly connected in the 9-pin SUB-D plugs of the position and speed sensors. Only metal or metal coated plugs are permitted.
The shielding on the sensor side must comply with appropriate methods.
EMC-compliant installation of the drive controller technology in the environment of the SMX module must be assured. Special attention must be paid to the routing of cables, the shielding of motor cables and the connection of the braking resistor. Strict compliance with the installation instructions of the drive controller manufacturer is mandatory.
All contactors in the environment of the drive controller must be equipped with appropriate suppressor circuits.

4.2 Installation and assembly of the SMX module

The module is solely to be installed in control cabinets with a degree of protection of at least IP54.

The modules must be vertically fastened on a top hat rail

The ventilation slots must be kept unobstructed, to ensure adequate air circulation inside the module.

4.3 Installation of backplane bus system

Mounting several SMX modules (SMX10, SMX11, SMX12, SMX12A) on one top hat rail in connection with the backplane bus system is also possible. These modules can be combined with a communication extension. In this case the backplane bus system needs to be configured by BBH when placing the order and delivered in accordance with the application in question.

The backplane bus system consists of a 5-pin plug connector with snap-in contacts. In these plug connectors all 5 contacts are equipped by standard. In this case the component is not specially marked. On a second variant of the plug connector only 3 contacts are equipped.

Note:
Expansion modules have no own power supply unit and depend on a DC power supply via the backplane bus system. Base modules (SMX10, SMX11, SMX12, SMX12A) are equipped with a reinforced power supply unit and always feed in to the backplane bus.

There are two different types of backplane bus connectors:

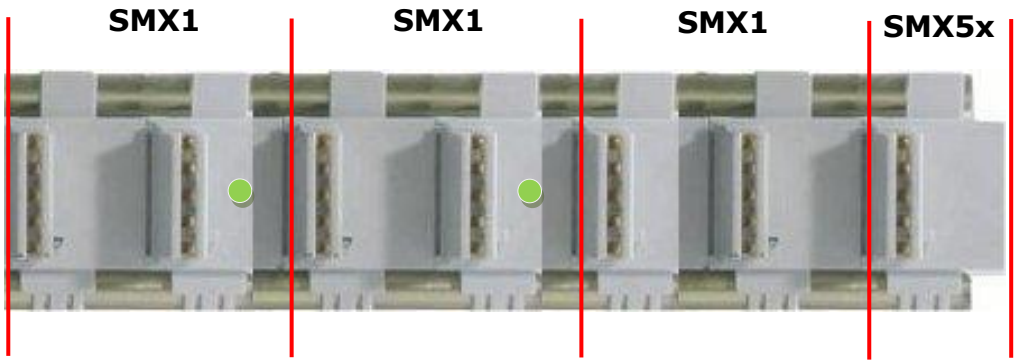
- **TB1:** Standard design (all contacts are present)
- **TB2:** Interrupter design (the two power conductors are not present and are marked with a green dot)

Using the backplane bus connector TB1:
The backplane bus connector TB1 can only be installed in connection with expansion modules without their own power supply. Connection of several standalone modules is not possible.

Using the backplane bus connector TB2:
The backplane bus connector TB2 is used for combining several base modules with expansion modules. A detailed description can be found under point 4.3.1.

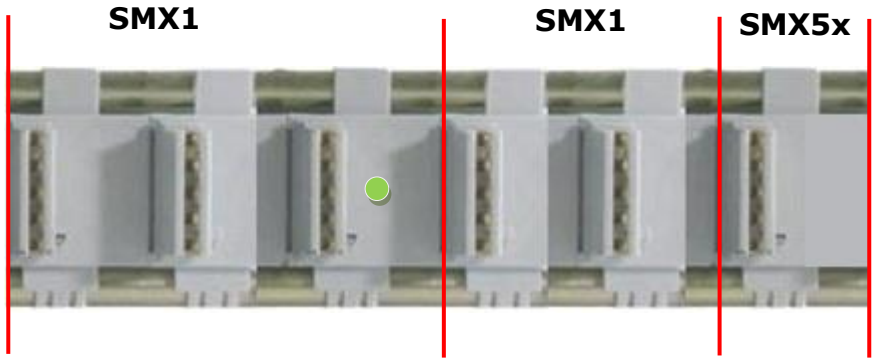
4.3.1 Arrangement examples

4.3.1.1 SMX11 + SMX11 + SMX11 + SMX5x



There is no TB2 between the last SMX11 module and the communication module SMX51, because the power supply for the SMX51 is fed in through the backplane bus system.

4.3.1.2 SMX12 + SMX11 + SMX5x



There is no TB2 between the last SMX11 module and the communication module SMX5, because the power supply for the SMX5 is fed in through the backplane bus system.

4.4 External 24 VDC – power supply

The SMX module requires a 24 VDC power supply (see also SELV or PELV, EN50178). Please comply with the following boundary conditions when planning and installing the specified power supply unit:

Strictly comply with the minimum and maximum supply voltage tolerance.

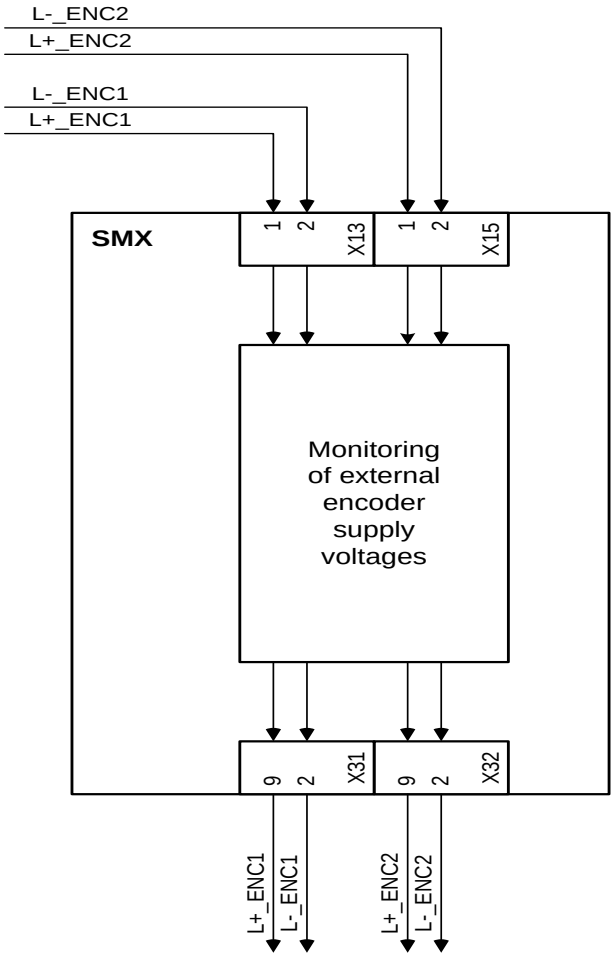
Nominal voltage	***DC 24 V***
Minimum: 24 VDC – 15 %	20.4 VDC
Maximum: 24 VDC + 20 %	28.8 VDC

We recommend the use of a 3-phase power supply unit or an electronically controlled device to achieve an as little as possible residual ripple of the supply voltage. The power supply unit must meet the requirements acc. to EN61000-4-11 (voltage dip).
Connecting cables must comply with local regulations.
The interference voltage resistance of the SMX module is 32 VDC (protected by suppressor diodes at the input).

Note:
The SMX module must be individually protected by a 2 A/24 VDC back-up fuse (single-pole thermo-magnetic quick-acting circuit breaker with).

Comments:
Reliable galvanic isolation from the 230 VAC or 400 VAC network must be guaranteed in any case. This requires the selection of power supply units complying with the regulations DIN VDE 0551, EN 60 742 and DIN VDE 0160. Besides choosing a suitable device you must also ensure equipotential bonding between PE and 0-VDC on the secondary side.

4.5 Connection of the external encoder supply



The SMX module supports encoder voltages of 5 V, 8 V, 10 V, 12 V and 24 V, which are internally monitored in accordance with the chosen configuration.
If an encoder system is not supplied through the SMX module, a supply voltage still needs to be connected to terminal X13 or X15 and configured accordingly.
The encoder supply must be protected with a fuse of max. 2 A.

Monitoring of the supply voltage in accordance with the chosen nominal voltage:

Nominal voltage	***Minimum voltage***	***Maximum voltage***
5 VDC	4.4 VDC	5.6 VDC
8 VDC	7 VDC	9 VDC
10 VDC	8 VDC	12 VDC
12 VDC	10 VDC	14 VDC
24 VDC	20 VDC	29 VDC

4.6 Connection of digital inputs DI1 to DI14

The SMX has 14 secure digital inputs These are suitable for connecting single or two-channel signals with and without cycling, or without cross-shorting test.

The connected signals must have a "High"-level of DC 24 V (DC +15 V...+ DC 30 V) and a "Low"-level of (DC -3 V...DC +5 V, type 1 acc. to EN61131-2). The inputs are provided with internal input filters.

A device internal diagnostic function cyclically tests the correct function of the inputs including the input filters. A detected fault will set the SMX into an alarm status. At the same time all outputs of the SMX are rendered passive.

Besides the actual signal inputs DI1 to DI14 the SMX module holds two clock inputs P1 and P2 available. The clock outputs are switching-type 24 VDC outputs.
The clock outputs are solely intended for monitoring the digital inputs (DI1 ... DI14) and cannot be used for any other function within the application.

The switching frequency is 125 Hz for each output. In the planning stage one must bear in mind that the outputs may only be loaded with a total current of max. 250 mA.

Furthermore, approved OSSD-outputs can be connected to the inputs DI1-DI4 and DI9-DI14 without limitation

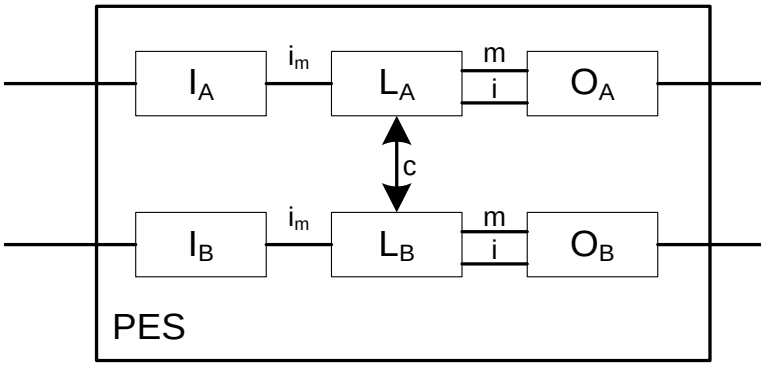
Note:
Digital inputs DI5 to DI8 are not suitable for OSSDs, because there is no compliance with EN 61131-2 Type 2 requirements.

Short circuits in the external wiring between different inputs and against the supply voltage for the SMX must be ruled out by external measures, appropriate routing of cables in particular.

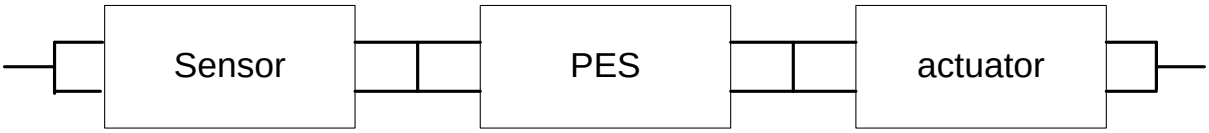
Each input of the SMX module can be configured individually for the following signal sources:

Input assigned to pulse P1
Input assigned to pulse P2
Input assigned to continuous voltage DC 24 V

The internal structure of the SMX-series corresponds with category 4 of EN 13849-1 with respect to architecture and function. Each input has the following internal architecture:

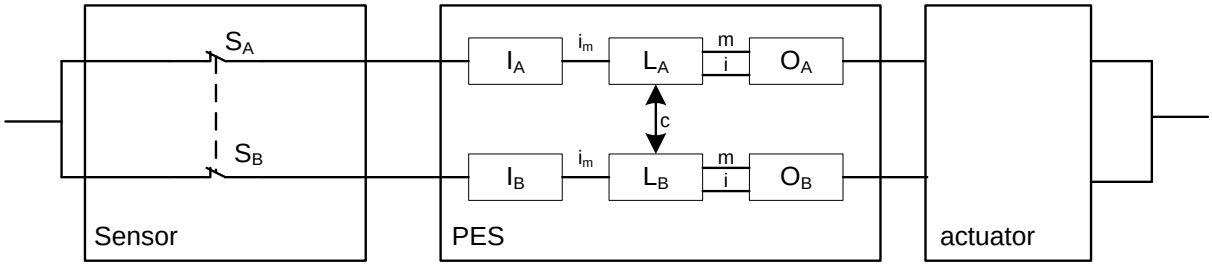


The overall architecture therefore corresponds with the following structure:

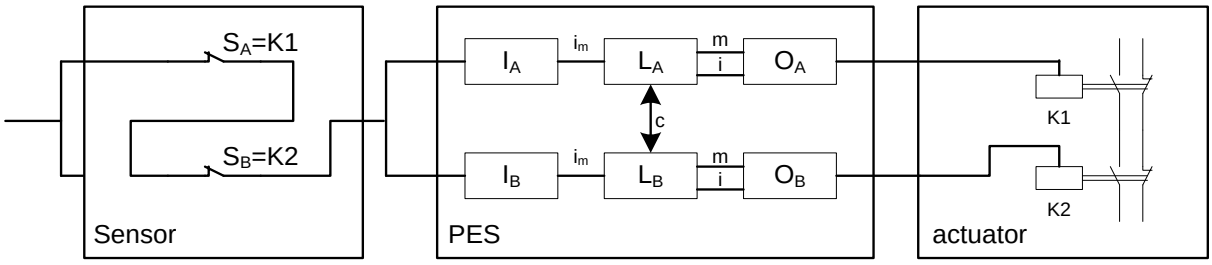


Dual reading of each input and diagnose by transverse differential

As an example, the following types of wiring are permissible on each input:



Signal processing in two channels and diagnose by transverse differential in the PES



Dual reading and signal processing in two channels, diagnose by transverse differential in the PES

Note:

- In the following circuitry examples it is assumed that the switching elements used comply with a safety approval according to the desired PI acc. to EN ISO 13849-1 or SIL acc. to EN 61508
- The safety regulations and EMC-directives must be strictly followed.
- Concerning the applicable fault exclusions please refer to the tables under D in the appendix of EN 13849-2.
- Arrangement in Performance Levels (Pl) acc. to EN 13849-1:

The following examples and their characteristic architecture are mainly responsible for the assignment to a category acc. to EN ISO 13849-1.

The maximum possible Performance Levels acc. to EN 13849 resulting from this still depend on the following factors of the external components:

- Structure (simple or redundant)
- Detection of common cause faults (CCF)
- Degree of diagnostic coverage on request (DC_{avg})
- Mean time to dangerous failure of a channel ($MTTF_d$)

4.7 Classification of digital inputs

4.7.1 Base group DI1 … DI12

Digital inputs	Performance Level	Comment
DI1 … DI4 DI9 … DI12	PL e	
DI5 … DI8	PL d	- Single-channel with pulse - Limitation in disconnection, - Fault detection upon request
DI5 … DI8	PL d	- Without pulse - Limitation in connection - Fault detection upon request
DI13, DI14	PL e	- Use of Pulse1/Pulse2

Examples

1. Single-channel sensor, without cross-shorting test

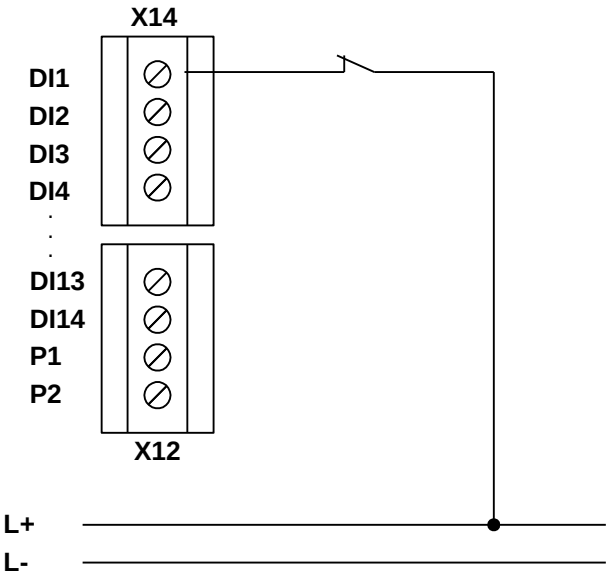


Fig.: Single-channel sensor, without cross-shorting test

The single-channel sensor is connected to the SMX without clocking or without cross-shorting test. This design is not recommended for safety applications. Pl b acc. to EN ISO 13849-1 can maximally be reached.

2. Single-channel sensor with cross-shorting test

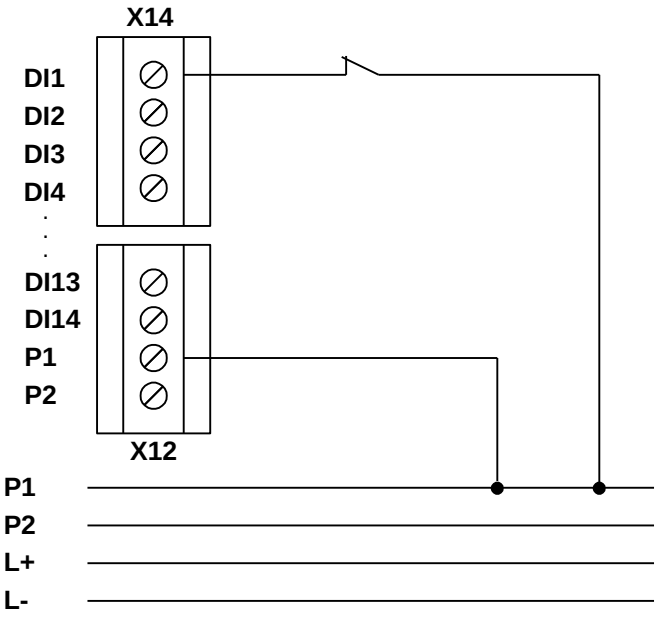


Fig.: Single-channel sensor with cross-shorting test

When using a single-channel sensor with clock one output is connected to the clock output P1 or P2. The clock must subsequently be assigned to the SMX.

The use of a single-channel sensor with clock detects:

short-circuit to supply voltage DC 24 V
short-circuit to DC 0 V
cable interruption (current interruption is secure state!)

However, be cautious in case of a cable short between the two sensor connections, because this is not detected! A short-circuit between P1 and DI1 is also not detected.
PI d acc. to EN ISO 13849-1 can be achieved by using a suitable switching element and with cautious wiring of the sensor.

Note:
Pl e acc. to EN ISO 13849-1 is achieved if the short-circuit between DI1 and P1 and the short-circuit between the sensor connections can be excluded. Here must take care that the in a fault scenario the switch must be positively opening. The sensor must additionally be triggered in regular intervals and the safety function requested. Fault exclusions can be achieved in accordance with EN ISO 13849-2 table D8.

3. Two-channel sensor with cross-shorting test

Cross-shorting as well as connections to DC 24 V and DC 0 V can be detected by using two independent clock signals on the homogeneous sensor. Only normally closed contacts should be used for safety related applications.

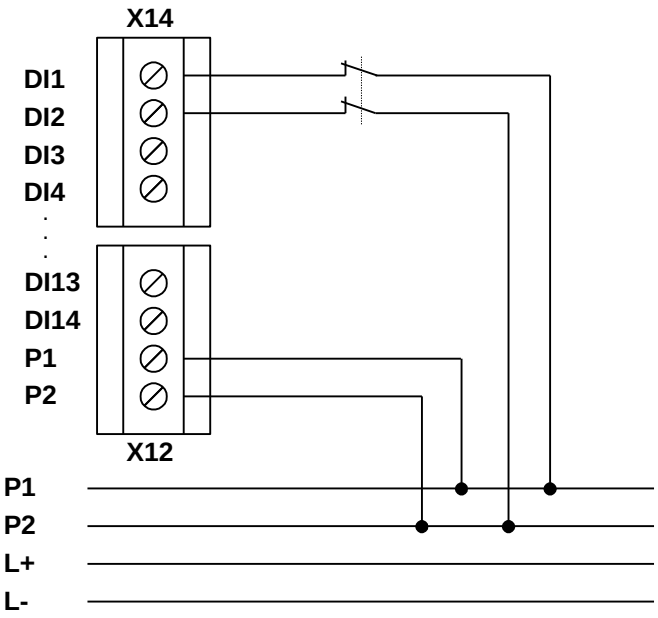


Fig.: two-channel sensor, homogeneous with clock

4.7.2 Expansion module EAE1 … EAE10

Digital inputs	Performance Level	Comment
EAE1 … EAE10		- Single-channel static signal -> auxiliary input
EAE1 … EAE10	PL e	- Two-channel static signal - Minimum one request/day - Fault detection only upon request
EAE1 … EAE10	PL d	- Less than one request/day
EAE1 … EAE10	PL e	- Single-channel with pulse - Minimum one request/day - Fault detection only upon request
EAE1 … EAE10	PL d	- Single-channel with pulse - Less than one request/day
EAE1 … EAE10	PL e	- Two-channel with 2 pulses

4.8 Connection of analog inputs

The version SMX12 with analog processing is able to reliably process max. 2 analog signals.

The analog inputs can be connected as follows:

	min	***max***
Voltage	−7 VDC	+10 VDC

Note:
The module is equipped with the fixed loading resistor of 500 Ohm as standard. This resistor can be omitted is required (voltage input).

5 Connection of position and speed sensors

5.1 General notes

Depending on module type the SMX module (SMX11/SMX12) has (1/2) external encoder interfaces for the connection of industrial incremental and absolute encoders. The encoder interfaces can be configured as incremental, SIN/COS, or as absolute SSI-encoders.
It is also possible to connect 2 incremental signal generating sensors (e.g. proximity switches) to the counting inputs of the SMX module. The signals must each be read in with normal and complementary track.

IMPORTANT
The voltage supply of the encoder system uses the dedicated terminal on the SMX module. This voltage is applied to the encoder plug and monitored by an internal diagnostic process. When the sensor is supplied with an external voltage, this voltage must be supplied through the encoder plug. The corresponding terminal (encoder supply voltage) on the SMX module remains unoccupied.

If an external sensor voltage supply is not recirculated through the encoder plug, any failure of this supply must be included in the fault examination of the overall system. This, in particular, requires evidence that this fault is detected or can be excluded when the specified operating voltage of the overall system is fallen short of / exceeded.

EMC - measures such as shielding etc. must be observed.
The two encoders must be non-interacting to each other. This applies for both the electrical as well as the mechanical part.
If both encoders are coupled to the facility to be monitored via common mechanical parts, the connection must be positively designed and should not have any parts that are susceptible to wear (chains, toothed belts, etc.). Should this be the case, additional monitoring features for the mechanical connection of the sensors (e.g. monitoring of a toothed belt) are required).
In case of an active position processing at least one absolute value encoder must be used.
When using two equivalent sensors one must make sure that the sensor with the higher resolution is configured as sensor 1 (process sensor) and the sensor with the lower resolution as sensor 2 (reference sensor).

Attention:
The sensor connections must neither be plugged on nor pulled off during operation. This could cause damage to electrical components of the encoder. Always de-energize connected encoders and the SMX module **before** plugging on or pulling off encoder connections.

Lines twisted in pairs for signal transmission acc. to RS485 standard must be used for data and clock signals or track A and track B. The wire cross-section must in each individual case be chosen in compliance with the current consumption of the encoder and the cable length required for the installation.

The following applies when using absolute encoders:

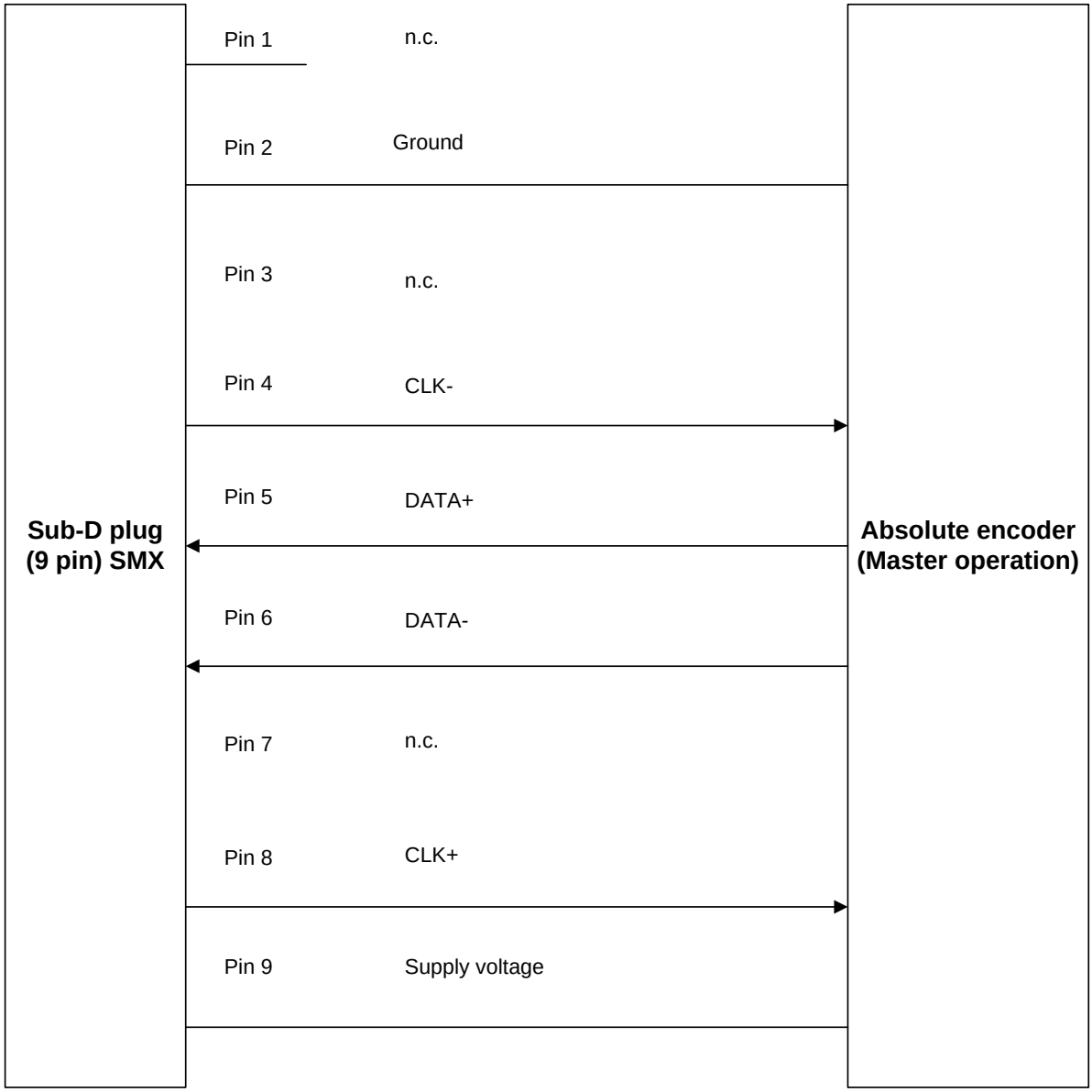
In Slave-mode the clock signal is generated by an external process and is read in by the SMX module together with the data signal. This type of reading causes a beat which results in a reading fault of the following magnitude:

F = (reading time of encoder by external system [ms] / 8 [ms]) * 100 %

The size of the resulting reading fault F must be taken into account when determining the thresholds in the applied monitoring functions, because this fault cannot be compensated!

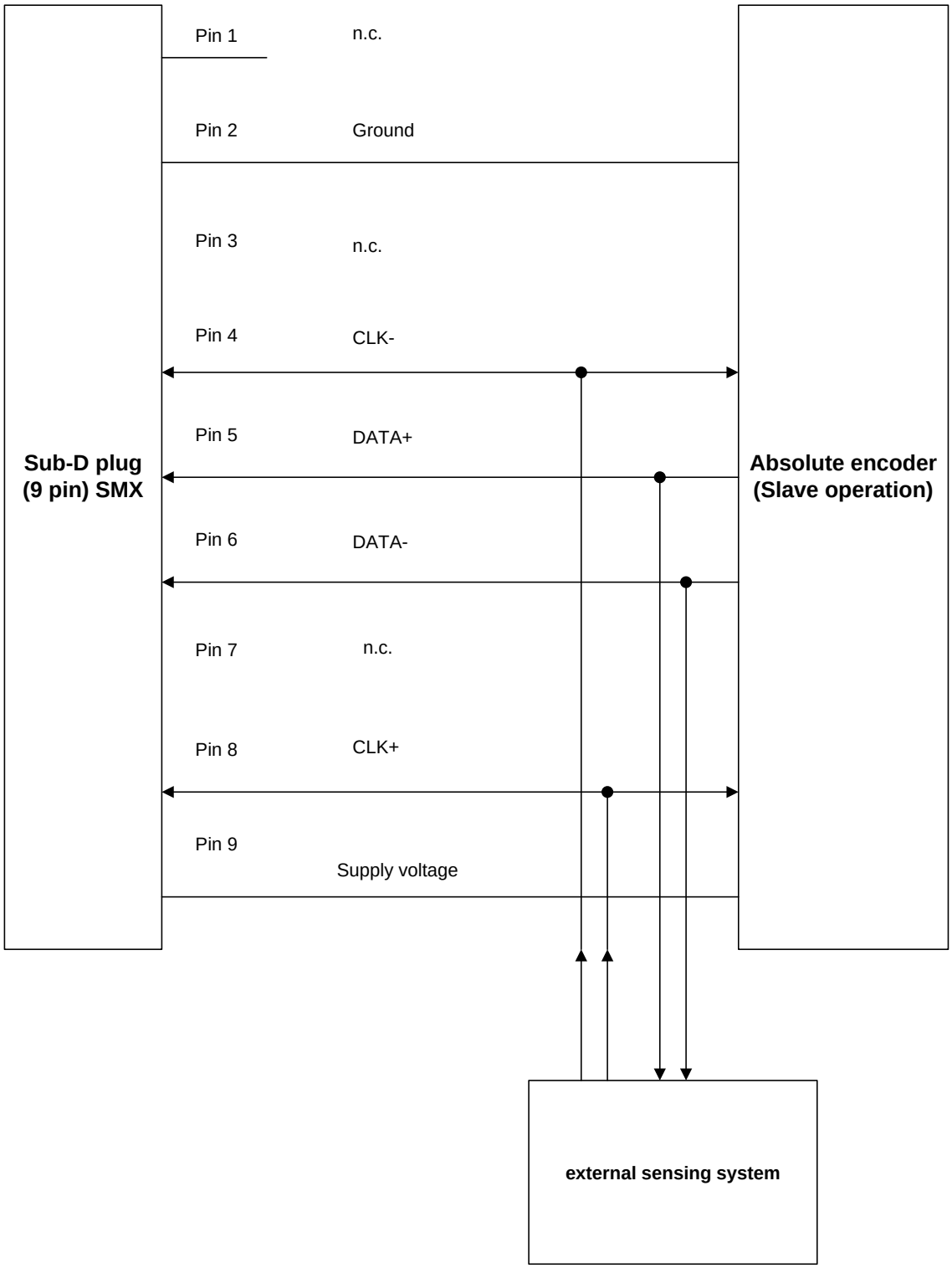
6 Connection variants

6.1 Connection of an absolute encoder as master



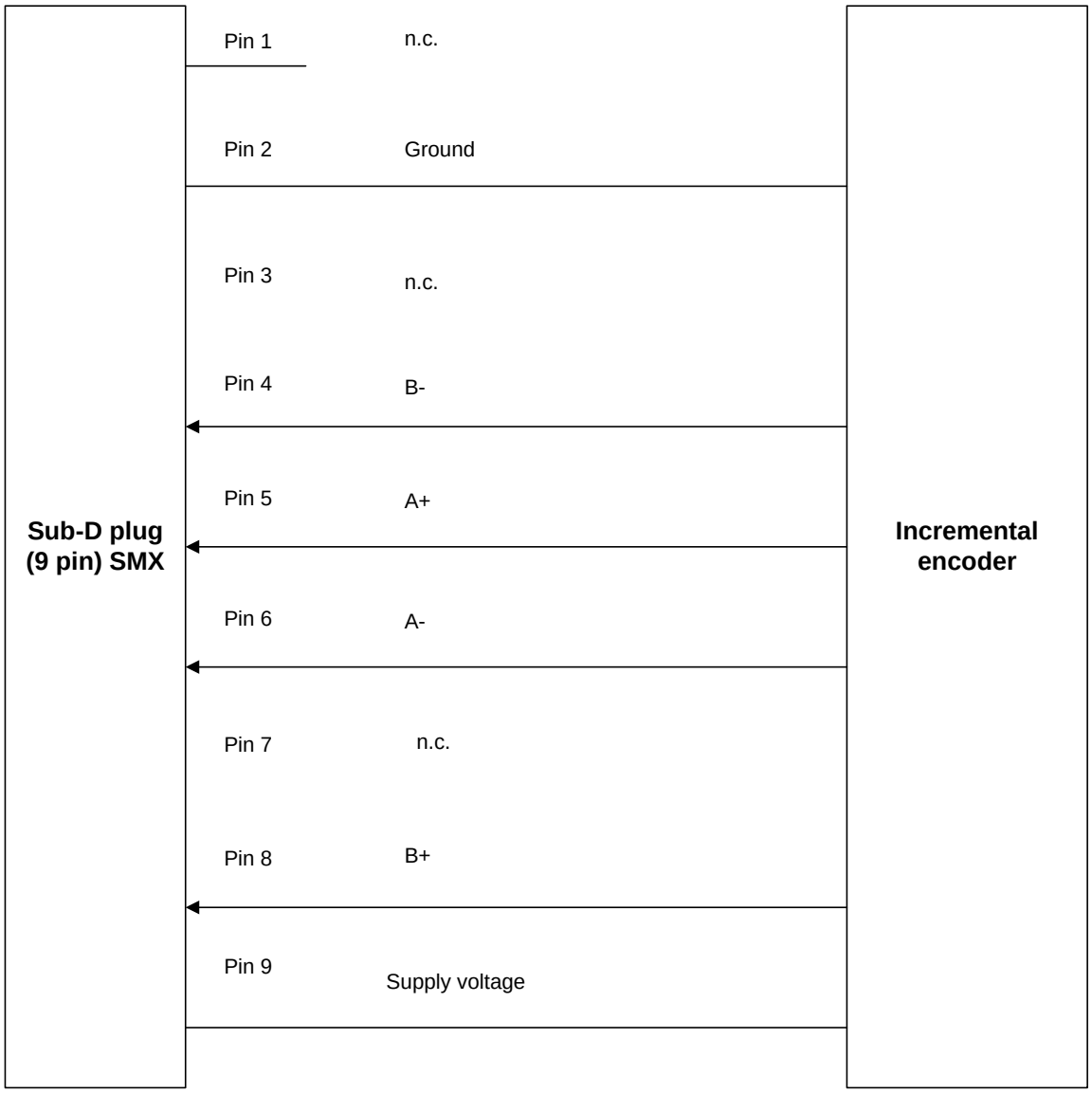
With this type of connection the clock signals are submitted from the SMX module to the absolute encoder and the data from the encoder to the SMX.

6.2 Connection of an absolute encoder as slave



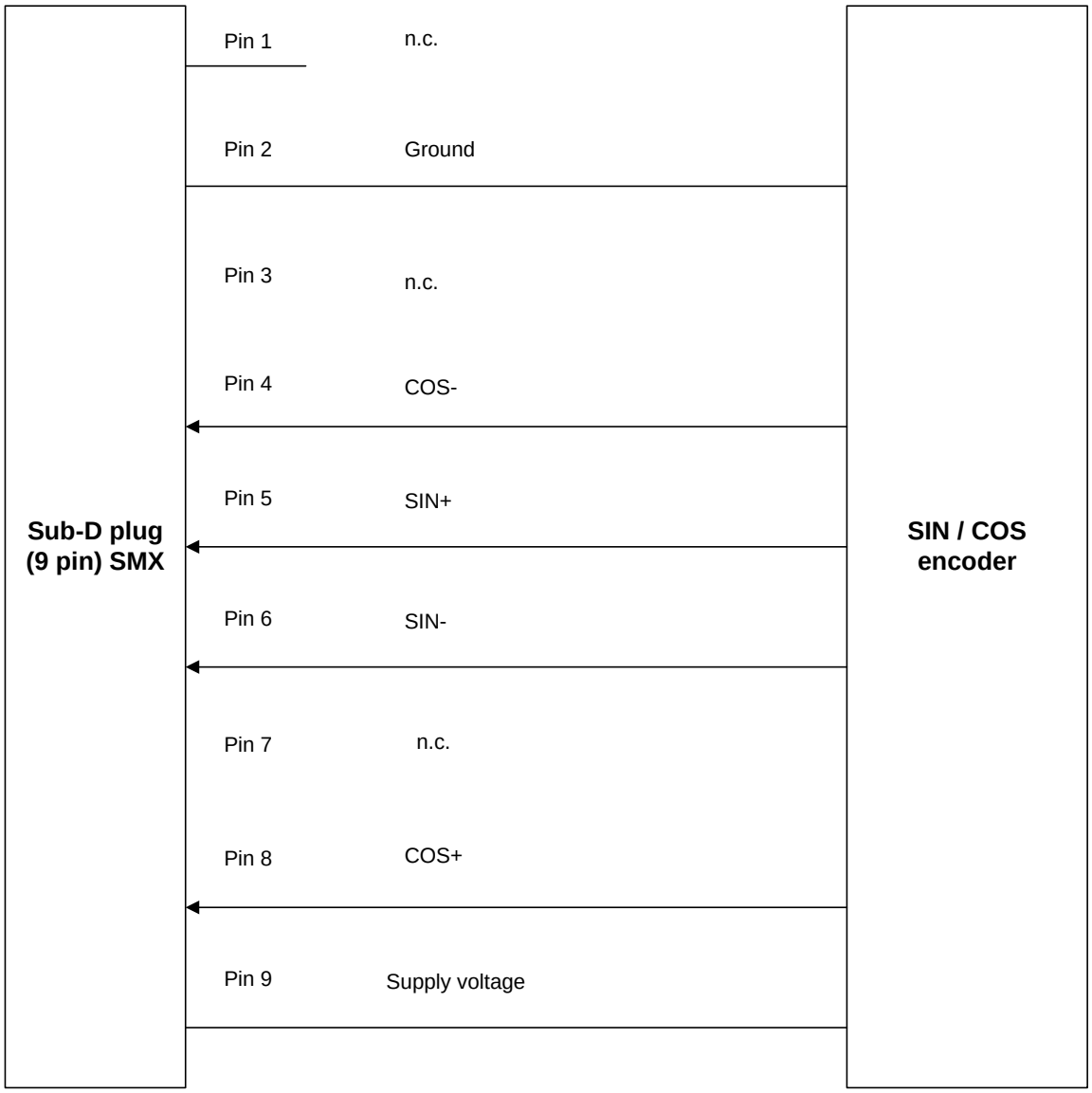
With this type of connection both clock signals and data are read in. In this example the module does not supply the encoder with voltage.

6.3 Connection of an incremental encoder



Pins 1, 3 and 7 stay open and are reserved for later expansions.

6.4 Connection of a SIN/COS encoder



Pins 1, 3 and 7 stay open and are reserved for later expansions.

6.5 Connection of HTL/proximity switch

The connection is made via plug connector X23 on the digital inputs DI5 … DI8.
The exact pin assignment depends on the encoder type and is shown in the connecting plan of the programming interface.

Note: When using HTL-encoders please bear in mind that the tracks A+ and B+ or A- and B- must be combined accordingly.

6.6 Combination of different encoder types

For applications with encoder systems please note that, due to the implemented monitoring features, the SMX-range does not place any particular requirements on the internal structure of the encoder electronics, i.e. standard encoders are normally do suffice. The following limitations do exist:

- SIN/COS encoder: The internal structure of the sensor system must be designed in such a way, that output signals for both tracks can be generated independently from each other and Common-Cause faults can be ruled out. Evidence of the mechanical design, e.g. fastening of the code disc on the shaft, must also be provided. Encoders with corresponding certificates and test reports are available in the market.
- Compact encoder with 2 x SSI or SSI + incremental: Also in this case evidence for the absence of interaction between both internal encoder units as well as the internal mechanical design must be provided.
- If only one encoder (e.g. compact encoder) is used, the fault exclusion "shaft breakage / fault in the mechanical encoder connection" is required. This requires positive connection of the encoder, e.g. by means of keyway and key or locking pin.

The SMX module detects the following faults in the external encoder system:

- Short-circuits between safety relevant signal lines
- Interruptions in safety relevant signal lines
- Stuck at 0 or 1 on one or all safety relevant signal lines

Note: See encoder types in appendix.

7 Configuration of measuring distances

7.1 General description of encoder configuration

The most important input variables for the monitoring functions of the module are safe position, speed and acceleration. These are obtained by dual-channel generation from the connected sensor system. A category 4 compliant architecture, i.e. continuous dual-channel recording with high degree of diagnostic coverage, is required for Pl e acc. to EN 13849-1. For possible single-channel components (e.g. mechanical connection of the sensors/encoders with only one shaft/fastening) fault exclusions acc. to EN ISO 13849-2 may be used, if this should be necessary. For Pl d acc. to EN 13849-1 one may work with a reduced degree or diagnostic coverage. Simple design sensor systems (speed monitoring only) may under certain circumstances be sufficient under due consideration of the permissible fault exclusions acc. to EN ISO 13849-2.
See also APPENDIX 1

Further configuration is described in the programming manual:
37350-820-01-xxF-SMX Programierhandbuch.pdf

8 Sensor type

Absolute encoders and incremental measuring systems are possible:
As well as counting pulse generating proximity switches.

8.1 Absolute encoder:

Data interface: Serial Synchronous Interface (SSI) with variable data length from 20 to 28 bit.
Data format binary or gray code, SSI-WCS (Path – Coding – System, Pepperl + Fuchs)
Physical Layer RS-422 compatible
SSI-Master operation:
Clock rate of 150 kHz
SSI-Listener operation (slave operation):
maximum external clock rate of 200 KHz.
minimum clock pause time of 30 µsec
maximum clock pause time of 2 msec

8.2 Incremental encoder:

Physical Layer RS-422 compatible
Measuring signal A/B – track with 90 degree phase difference
Maximum frequency of input clock pulses 200 KHz

8.3 SineCosine encoder:

Physical Layer +/− 0.5 Vss (without voltage offset)
Measuring signal A/B – track with 90 degree phase difference
Maximum frequency of input clock pulses 200 KHz

8.4 Proximity switch

24 V/0 V – Signal level
Max. counting pulse frequency 10 kHz
Circuit logic de-bounced

8.5 HTL - Sensor

24 V/0 V – Signal level
Measuring signal A/B – track with 90° phase difference
Max. counting pulse frequency 10 kHz

9 Safety related shut-down thresholds

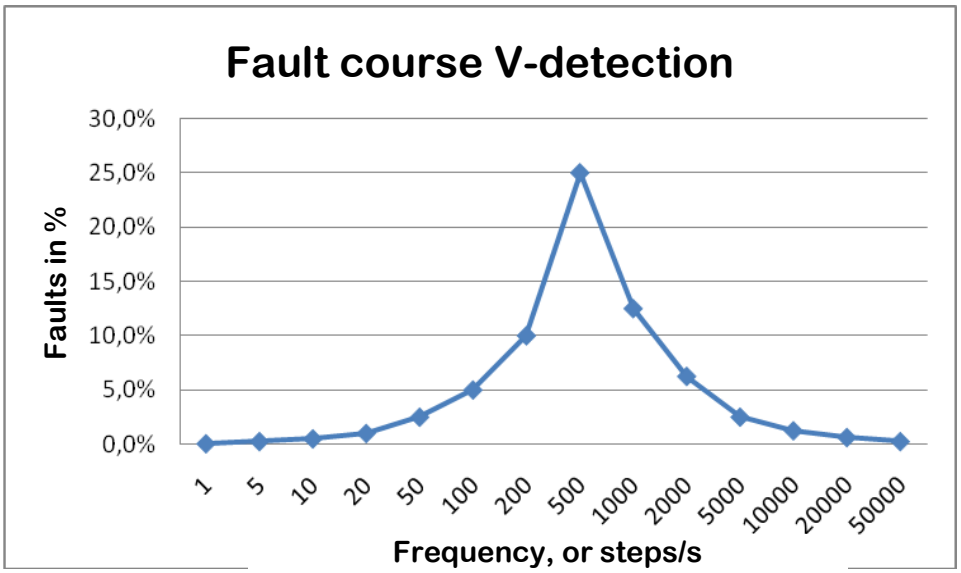
Plausibility tests with the current position and speed values are performed between both measuring channels A and B of the SMX module as a basic measure, which are then checked against parameterizable thresholds.

The ***incremental shut-down threshold*** describes the tolerable deviation of position between both sensing channels A and B in the unit of the measuring distance.

The ***speed shut-down threshold*** describes the tolerable deviation in speed between both sensing channels A and B.

Diagnostic functions for the determination of optimal parameter values for the applications are available within the SCOPE-dialog of the parameterization tool.

The speed is sensed up to a frequency of 500 Hz or
500 steps/s in the frequency measuring method, below this with a time measuring method.
This results in the following course of the sensing fault:



870870340

Note:
The fault can be optimized by choosing a suitable sensor resolution for the corresponding application.

For applications with limited resolution and/or time variance of the sensing signal, the functional performance of the monitoring function used can be improved by using an average filter. The average filter "smoothes" digital spurious components of the sensors. However, this is achieved at the cost of a longer response time of the overall system.

The filter time can be variably set between 0 and 64 in steps of 8. The dimension is "msec". In order to determine the response time of the overall system, the filter times must be added to the specified response times of the SMX systems (see chapter 11).

10 Wiring of outputs

10.1 Base module

The SMX module provides a total of 8 outputs, which can be interconnected individually or in groups.

Output	***Architecture acc. to EN ISO 13849-1***	***Comment***
K1 and K2	4	Complete tripping channel in compliance with architecture category 4 acc. to EN ISO 13849-1
K1	Not safe	Only functional
K2	Not safe	Only functional
DO0_P and DO0_M	4	Complete tripping channel in compliance with architecture category 4 acc. to EN ISO 13849-1
DO0_P	Not safe	Only functional
DO0_M	Not safe	Only functional
DO1_P and DO1_M	4	Complete tripping channel in compliance with architecture category 4 acc. to EN ISO 13849-1
DO1_P	Not safe	Only functional
DO1_M	Not safe	Only functional
O.1	Not safe	Signalling/auxiliary output
O.2	Not safe	Signalling/auxiliary output

The HISIDE and LOWSIDE outputs are subjected to a plausibility test in all operating states. In switched on state the correct function of all outputs is tested with a cyclic test pulse. For this purpose the output is switched to the corresponding inverse value for a test period TT < 300 µs, i.e. one P-output is switched instantaneously to 0 VDC potential, while one M-output is switched to 24 VDC potential.
The relay outputs are monitored for plausibility during each switching cycle. The relay outputs must be switched cyclically and thus tested to maintain the safety function. The switching/test cycle is determined in dependence on the application.

Note:
For applications with frequent safety shut-down requests these tests should be performed more frequently, e.g. at the beginning of the shift, 1 x per week. However, a test should at least be carried out cyclically 1 x year.

The test function for the outputs is performed for group and individual control. The auxiliary outputs are not tested.

The outputs can be loaded as follows:

Output	***Voltage***	***Current***
K1, K2	24 VDC	2.0 A
K1, K2	230 VAC	2.0 A
O.1, O.2	24 VDC	100 mA
DO.0_P, DO.1_P	24 VDC	250 mA
DO.0_M, DO.1_M	GNDEXT	250 mA

Note:
For safety related applications only external switching elements with a minimum withstand current of > 1.2mA may be used.

10.1.1 Single-pole switching HISIDE output without testing

For the connection of multi-phase applications or for higher current demands external contactors may be used. For a single-pole connection without external test please bear in mind that the SMX module will not recognize bonding of one or several external contacts. The following circuitry is not suitable for safety applications!

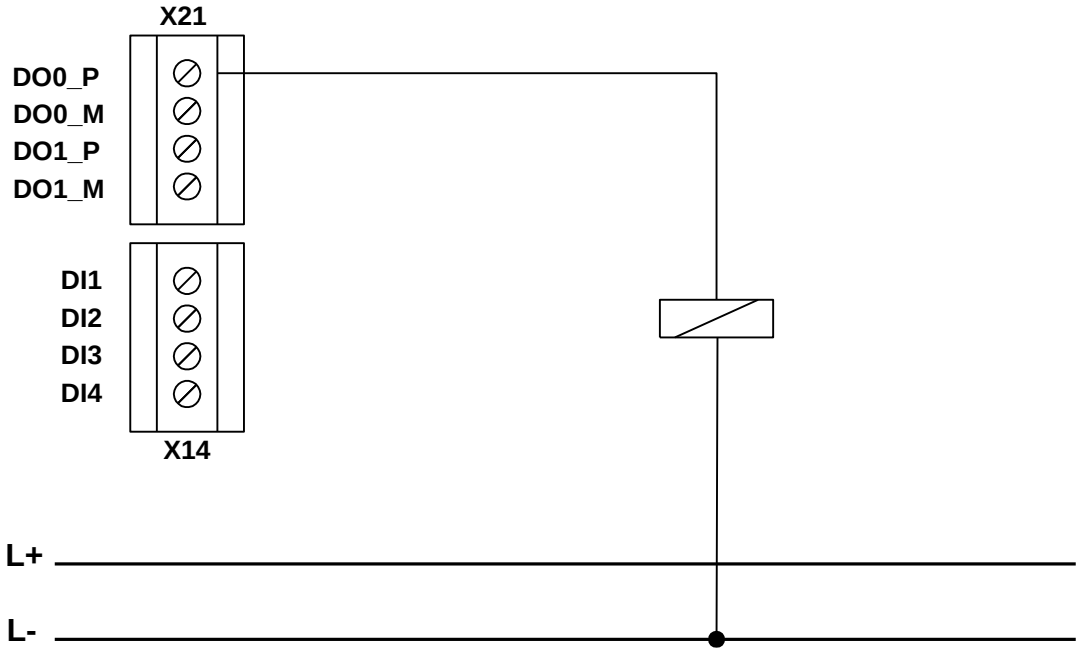


Fig.: Single-pole switching P-output.

Not suitable for safety applications!

10.1.2 Single-pole switching LOSIDE output without testing

Analogue to the circuitry shown above, the following example shows a single-pole M-output without testing. The following circuitry is not suitable for safety applications!

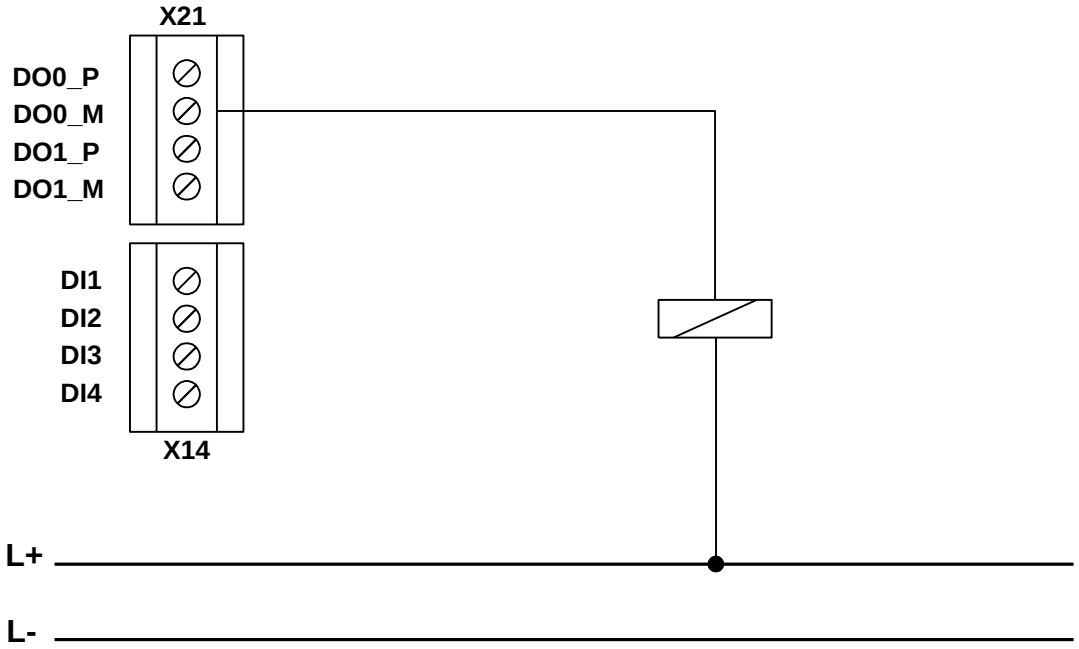


Fig.: Single-pole switching M-output.

Not suitable for safety applications!

10.1.3 Two-channel switching output DO0 with external monitoring

For safety applications from Pl d acc. to EN ISO 13849-1 it is recommended or even demanded to interconnect two complementary outputs as a group to be able to e.g. control 2 external power contactors.

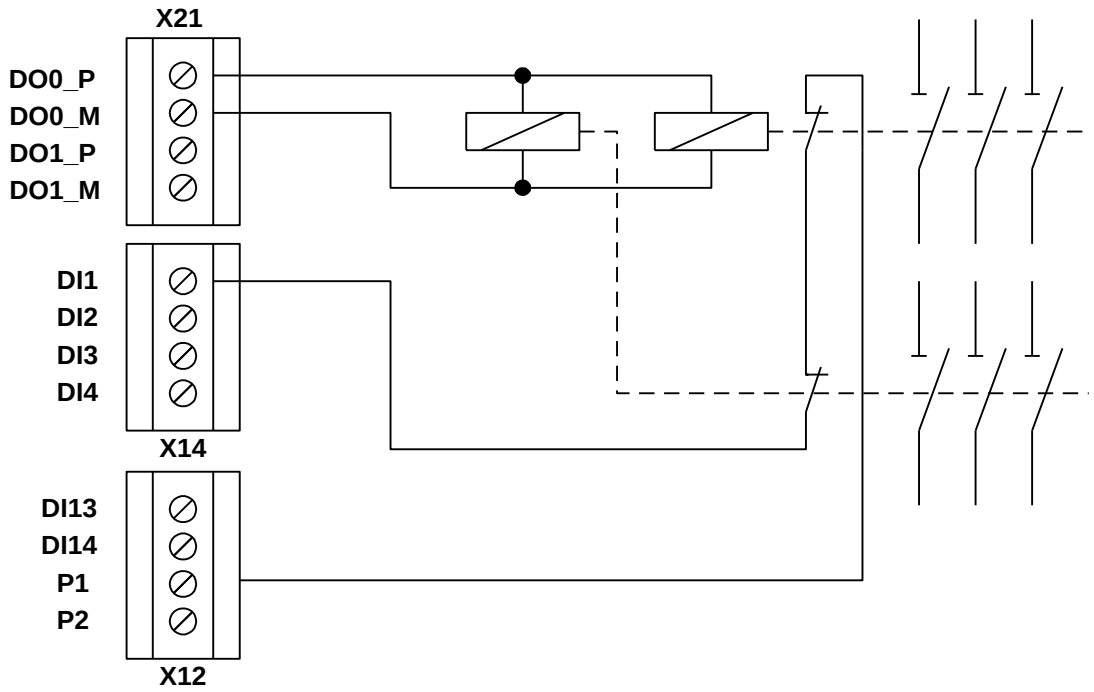


Fig.: Two-channel switching output DO0 with external monitoring on input 1 as group feedback

The two external monitoring contacts are switched in series, supplied by the clock signal P1 and read via input 1. Input 1 was chosen as readback input, but any other input can be assigned for this purpose.

For higher requirements you must make sure that at least 1 switching operation must take place every 24 hours, in order to test the switching ability of the external power contactor.

10.1.4 Single-pole switching relay output without testing

For connection of multi-phase applications or for increased current demands please bear in mind that the SMX module will not recognize bonding of one or several external contacts. The following circuitry is not suitable for safety applications!

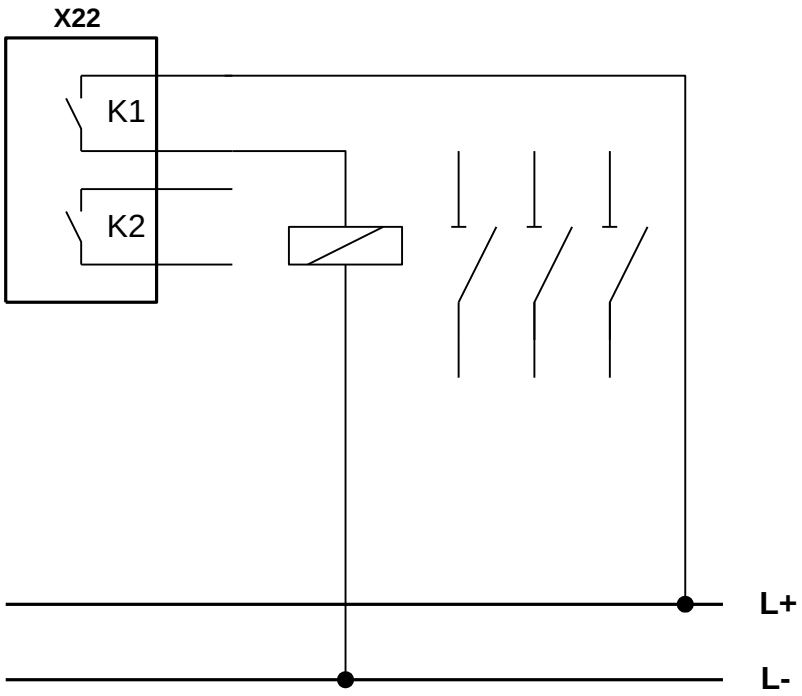


Fig.: Single-pole switching relay output.

Not suitable for safety applications!

10.1.5 Two-channel switching relay output with external monitoring – Group feedback

For safety related applications from Pl d acc. to EN ISO 13849-1 two relays on the SMX module and two external power contactors are used.

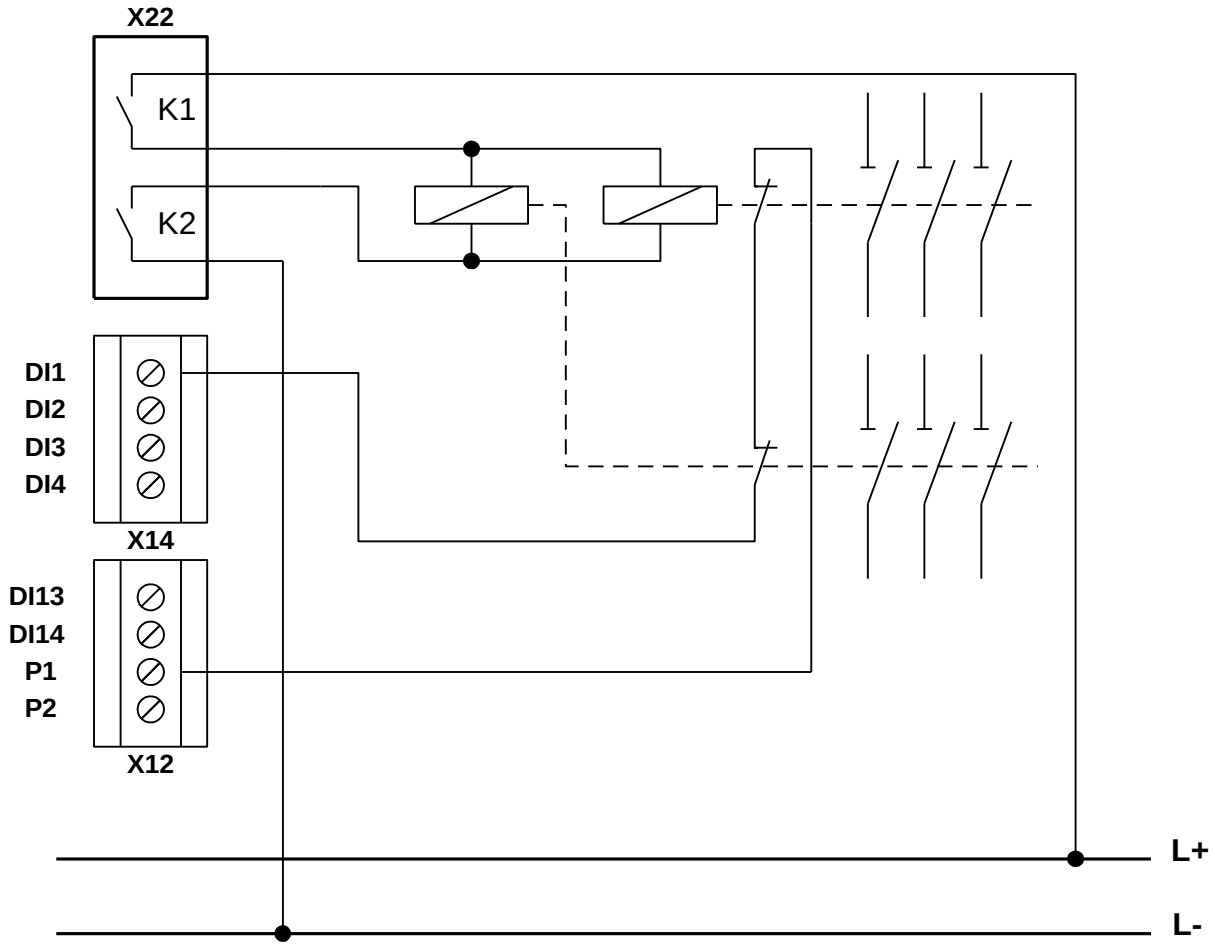


Fig.: Two-channel switching relay output with external monitoring – group feedback

The two external monitoring contacts are switched in series, supplied by the clock signal P1 and read in from DI1 (configured as EMU-input). In case of higher demands one must consider that at least 1 switching process must take place every 24 hours.

10.1.6 Wiring of an auxiliary output

Both semi-conductor outputs implemented on the SMX module can be wired for functional applications. These outputs are not pulsing.

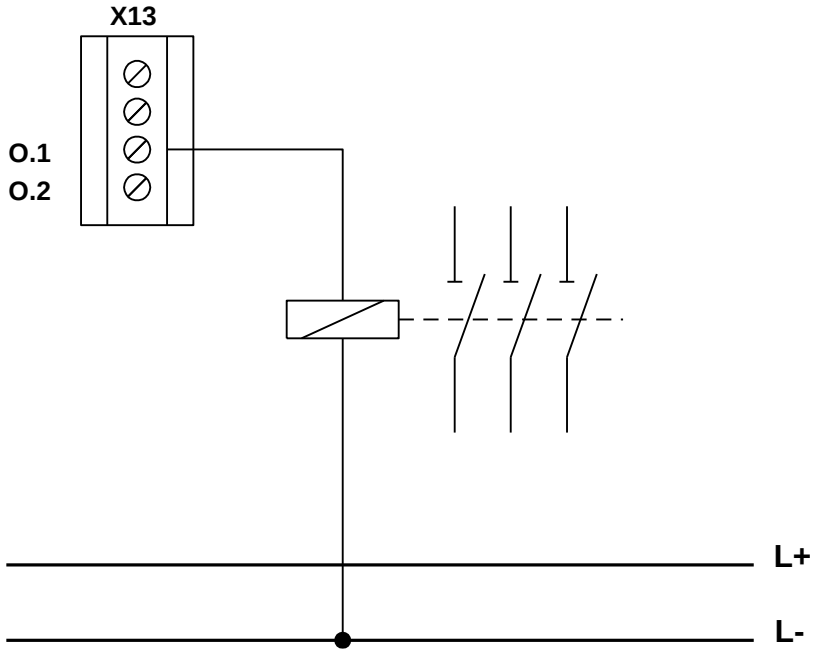


Fig.: Wiring of an auxiliary output

Applications with auxiliary outputs are not accepted for safety related applications!

10.2 Expansion module EAA1 … EAA10

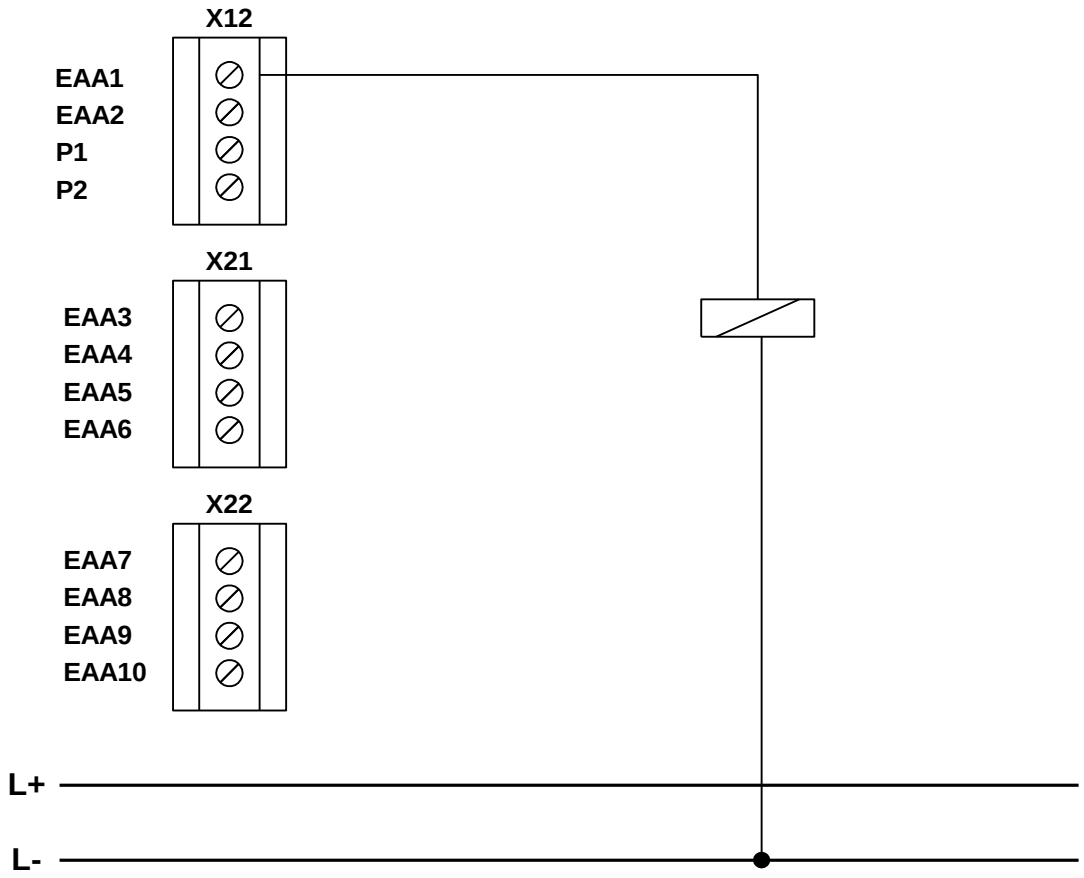
Architecture	Performance Level	Comment
Static single-channel	PL c	- Fault detection or fault reaction acc. to cat. 2
Static two-channel	PL e	- Different group
Static two-channel	PL d	- Same group - Time-shifted triggering on PLC level - Application instruction with specified time - Fault approach short-circuit on both outputs
Dynamically single-channel	PL e	
Dynamically two-channel	PL e	

Note:

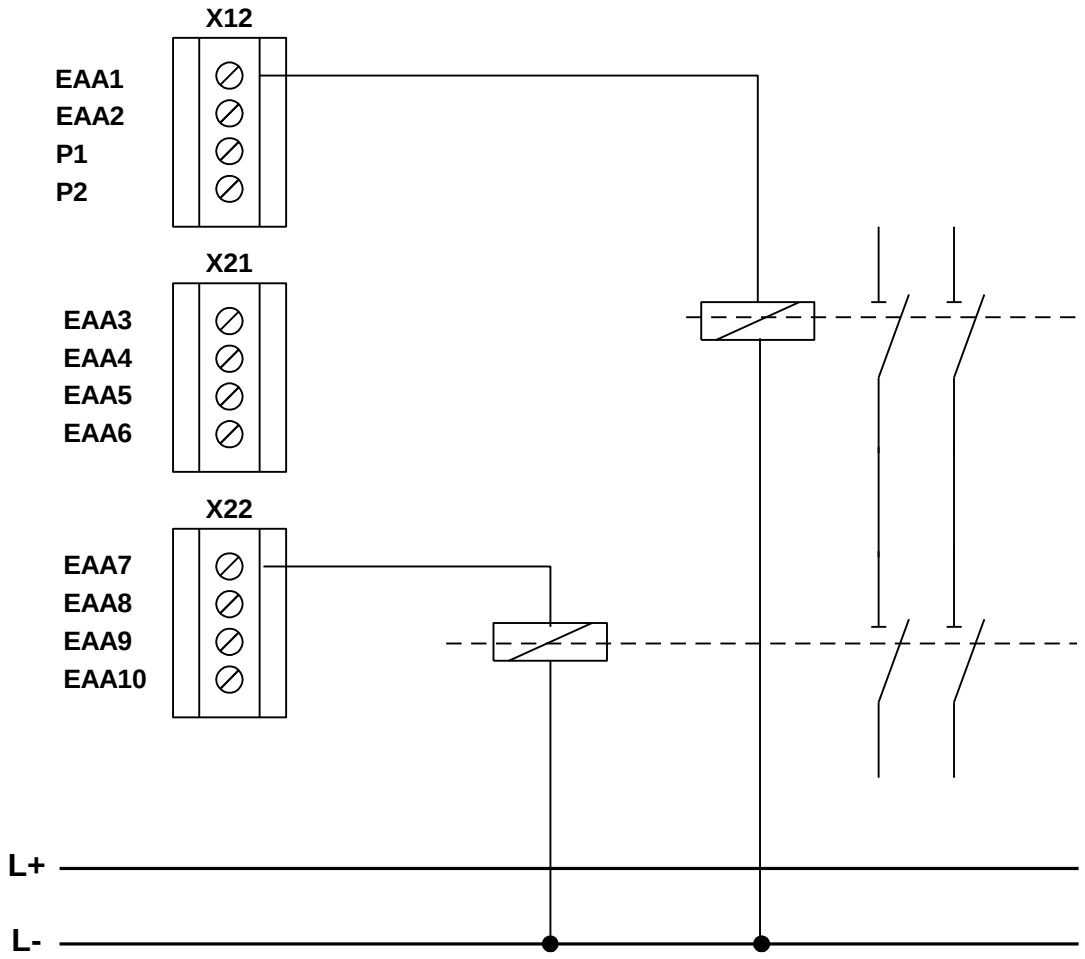
1) Group 1: EAA1 … EAA6
   Group 2: EAA7 … EAA10

2) Static: no pulse test on output
   Dynamic: Pulse test on output with $t_{Test} \leq 500$ µs

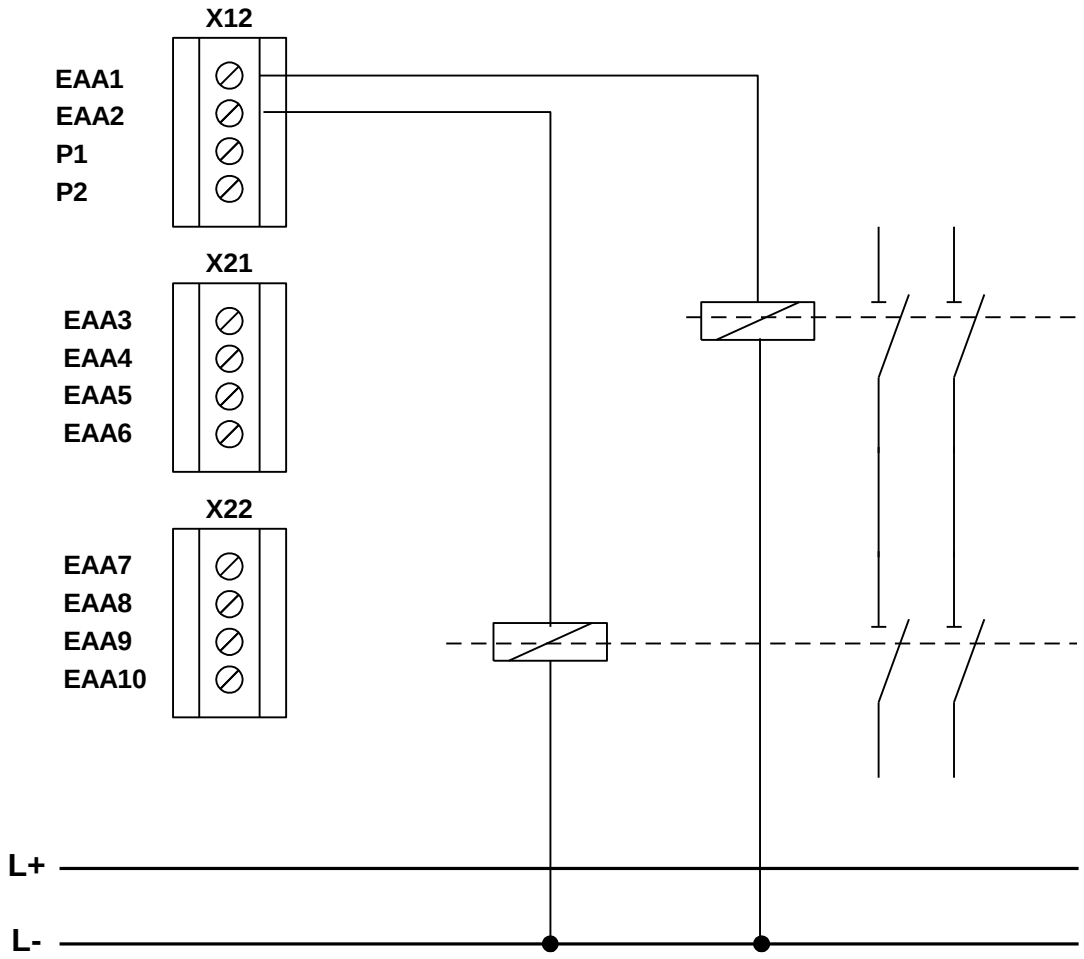
10.2.1 Wiring single-channel



10.2.2 Wiring two-channel (different group)



10.2.3 Wiring two-channel (same group)



Response times of the SMX

The SMX response times are specified in the following section.

10.3 Response times in standard operation

The cycle time of the SMX system serves as basis for calculating the response times. In operation this is **T_cycle = 8 ms**. The specified response times comply with the corresponding maximum running time for the actual application within the SMX module. Depending on the application, further, application dependent response times of the sensors and actuators used must be added, in order to obtain the total running time.

Function	***Response time [ms]***	***Explanation***
Activation of a monitoring function by means of ENABLE with subsequent shut-down via digital output	24 ***)***	Activation of a monitoring function by means of the ENABLE signal.
Activation of a monitoring function by means of ENABLE with subsequent shut-down via safety relay	47 ***)***	Activation of a monitoring function by means of the ENABLE signal.
Response of an already activated **monitoring function** including PLC editing in case of position and speed processing via digital output	16 ***)***	With a monitoring function that has already been activated via ENABLE, the module requires one cycle to calculate the current speed value. During the next cycle after calculation of the monitoring function the information is further processed and output by the PLC, i.e. according to the implemented logic this will lead to e.g. switching of an output.
Response of an already activated **monitoring function** including PLC editing in case of position and speed processing via digital output	39 ***)***	With a monitoring function that has already been activated via ENABLE, the module requires one cycle to calculate the current speed value. During the next cycle after calculation of the monitoring function the information is further processed and output by the PLC, i.e. according to the implemented logic this will lead to e.g. switching of an output.
Activation of digital output via digital input	16	Activation of an input and switching of the output
Activation output relay via digital input	26	Activation of an input and switching of the output
Deactivation of digital output via digital input	16	Deactivation of an input and thus deactivation of the output
Deactivation output relay via digital input	47	Deactivation of an input and thus deactivation of the output
Average filter (setting see encoder dialog SafePLC)	0 - 64	Group running time of the averager. This running time only effects the monitoring function in connection with position / speed / acceleration, but not the logic processing.

Function	*Response time [ms]*	*Explanation*
Analog filter • 1 (2 Hz) • 2 (2 Hz) • 3 (2 Hz) • 4 (4 Hz) • 5 (6 Hz) • 6 (8 Hz) • 7 (10 Hz) • 8 (20 Hz)	• 760 • 760 • 760 • 512 • 268 • 143 • 86 • 56	The analog filter only affects the safe analog inputs of the SMX-12 A module. Response times of the analog input filters in relation to the input frequency

Note:
*) : When using an average filter the response time of this filter must also be added

10.4 Response time for FAST_CHANNEL

FAST_CHANNEL describes a characteristic of SMX to respond quicker to speed requirements than this would be possible with the execution of the safety programs in normal cycle (= 8 msec). The sensing time of FAST_CHANNEL is 2 msec.

The following response times can be specified:

- 6 msec (Worst Case Condition)

Notes:

- When using FAST_CHANNEL you should bear in mind that shutting down within the time specified above for a given speed threshold is only possible, if the sensor information has a sufficient resolution. The smallest resolvable switching threshold of the FAST_CHANNEL requires at least 2 edge changes on the corresponding sensor system within a period of 2 msec.
- This function can only be used in connection with semi-conductor outputs.

11 Start-up

11.1 Procedure

Start-up must only be performed by qualified personnel! Strictly follow the safety regulations when commissioning!

11.2 Making sequences

The following phases are passed through and displayed by the front side seven segment display after each new start and fault-free running of the module:

7 segment display	***Mode***	***Description***
"1"	STARTUP	Synchronization between both processor systems and checking of configuration/firmware data
"2"	SENDCONFIG	Distribution of configuration/firmware data and renewed checking of these data. Subsequently area checking of configuration data.
"3"	STARTUP BUS	If available, initialization of a bus system
"4"	RUN	Normal system operation. All outputs are switched according to the current logic status.
"5"	STOP	In stop mode parameter and program data can be loaded externally.
"A"	ALARM	The alarm can be reset via the digital input or the front side reset button.
"E"	ECS-Alarm	The ECS alarm can be reset via the digital inputs or the front side reset button.
"F"	Fault	Fault can only be reset via ON/OFF of the module.

11.3 LED display

Colour	*Mode*	*Description*
green	"flashing"	System OK, configuration validated
yellow	"flashing"	System OK, configuration not yet validated
red	"flashing"	Alarm
red	"permanent"	Fatal Error

Note:
For all operating states except RUN the outputs are rendered passive by the firmware, i.e. safely switched off. In status RUN the state of the outputs depend on the implemented PLC-program.

11.4 Terminal assignment

Terminal	*Designation*	*Function*
X11:1 X11:2 X11:3 X11;4	U24 external U24 external GND external GND external	Voltage supply device +24 VDC Voltage supply device +24 VDC Voltage supply device 0 VDC Voltage supply device 0 VDC
X12:1 X12:2 X12:3 X12:4	DI13 DI14 P1 P2	Digital IN 13 Digital IN 14 Clock output P1 Clock output P2
X21:1 X21:2 X21:3 X21:4	DO0-HI DO0-LO DO1-HI DO1-LO	HISIDE-output 0 LOSIDE-output 0 HISIDE-output 1 LOSIDE-output 1
X22:1 X22:2 X22:3 X22:4	K1.1 K1.2 K2.1 K2.2	Relay output 1 Relay output 2
X13:1 X13:2 X13:3 X13:4	U_ENC_1 GND_ENC_1 DO 0.1 DO 0.2	Encoder supply voltage for encoder interface X31 Encoder supply voltage for encoder interface X31 Signalling and auxiliary output DO 0.1 Signalling and auxiliary output DO 0.2
X14:1 X14:2 X14:3 X14:4	DI01 DI02 DI03 DI04	Digital IN 01 Digital IN 02 Digital IN 03 Digital IN 04
X23:1 X23:2 X23:3 X23:4	DI05 DI06 DI07 DI08	Digital IN 05 Digital IN 06 Digital IN 07 Digital IN 08
X24:1 X24:2 X24:3 X24:4	DI09 DI10 DI11 DI12	Digital IN 09 Digital IN 10 Digital IN 11 Digital IN 12
X15:1 X15:2 X15:3 X15:4	U_ENC_2 GND_ENC_2 NC NC	Encoder supply voltage for encoder interface X32 Encoder supply voltage for encoder interface X32
X16:1 X16:2 X16:3 X16:4	NC NC NC NC	

Terminal	Designation	Function	
X25:1	AI 1+	Analog input AIN1 +	SMX12A
X25:2	AI 1−	Analog input AIN1 −	
X25:3	AI 2+	Analog input AIN2 +	
X25:4	AI 2−	Analog input AIN2 −	
X26:1	AI 3+	Analog input AIN3 +	SMX12A
X26:2	AI 3−	Analog input AIN3 −	
X26:3	AI 4+	Analog input AIN4 +	
X26:4	AI 4−	Analog input AIN4 −	

Terminal assignment SMX51

Terminal	Designation	Function
X41:1	NC	With terminating resistor 120 Ohm
X41:2	CAN_LO	
X41:3	CAN_GND	
X41:4	NC	
X41:5	NC	
X41:6	CAN_GND	
X41:7	CAN_HI	
X41:8	NC	
X41:9	NC	

11.5 Parameterization

Parameterization takes place via the program SafePLC SMX. The transmission of these data to the module requires a programming adapter, the drivers of which must first be installed by the user.
Parameterization is described in the *programming manual*.

11.6 Function test

As a measure to ensure the safety of the module, the reliability of all safety functions must be checked once every year. For this purpose the modules used in the parameterization (inputs, outputs, monitoring functions and logic modules) must be checked with respect to function or shut-down.
See *programming manual*.

11.7 Validation

In order to assure the reliability of the implemented safety functions the user must check and document the parameters and links after the start-up and parameterization has taken place. This is supported by a validation assistant in the programming desktop (see chapter "Safety related examination").

12 Safety related examination

In order to assure the reliability of the implemented safety functions the user must check and document the parameters and links after the start-up and parameterization has taken place. This is supported by the parameterization software SafePLC SMX (see programming manual).
On the first page one can enter general system data. The last page of the validation report contains individual evidence concerning the safety related examination.

Here the following entries are mandatory:
• Serial number (identical with the serial number on the type plate)
• Identity of the module
Here the responsible tester confirms that the CRC's displayed in the programming desktop are identical with the CRC stored in the SMX module.
Once all header data have been entered, the validation report can be generated by pressing the control button "Save". The parameterization tool then creates a text file (.TXT) with the file name of the program data set. The text file contains the following information:

- The 3 pages of header data edited above
- The configuration of the encoder
- The parameters of the existing monitoring function
- The PLC program as instruction list

After the transmission of the configuration and program data to the SMX module the status LED flashes yellow. This indicates that the configuration data have not yet been validated. Pressing the button "LOCK CONFIGURATION" at the end of the validation dialog highlights the data as "Validated" and the LED flashes in green.

13 Maintenance

13.1 Modification / handling changes to the device

Repair
Repair work on the device can only be performed in the factory.

Warranty
By opening the module without permission the warranty will become null and void.

Note:
By modifying the module the safety approval will become null and void!

13.2 Exchanging a module

The following should be noted when exchanging a module:

Disconnect the electric drive controller from the main supply.
Switch off the electric power supply for the device and disconnect.
Pull off the encoder plug.
Disconnect any other pluggable connections.
Take the module off the top hat rail and pack up EMC-compliant.
Mount the new module on the top hat rail.
Reconnect all connections.
Switch on the electric drive controller.
Switch on the supply voltage.
Configure the device

Note:
Pluggable connections of the SMX module must generally not be disconnected or connected in live condition. There is a danger of sensor damage, particularly with connected position or speed sensors.

13.3 Maintenance intervals

Module replacement	See technical data
Function test	See chapter "Start-up"

14 Technical data

14.1 Environmental conditions

Class of protection	IP 52
Ambient temperature	0°C* ... 50 °C
Climatic category	3 acc. to DIN 50 178
Lifetime	90000 h at 50 °C ambient

14.2 Safety related characteristic data

Max. obtainable safety class	• SIL 3 acc. to EN61508 • Category 4 acc. to EN945-1 • Performance-Level e acc. to EN ISO 13849-1
System structure	2-channel with diagnose (1002)
Rating of operating mode	"high demand" acc. to EN 61508 (high demand rate)
Probability of an endangering failure per hour (PFH-value)	SMX10, SMX11, SMX12 und SMX12A < 1,4 E-8 (14FIT)
Proof-Test-Interval (EN61508)	20 years, after this time the module must be replaced

15 Fault types SMX

The SMX generally differentiates between two types of faults as per assignment below:

Fault type	Description	Effect on the system	Reset condition
Fatal Error	Severe exceptional error caused by the program run in the SMX. Cyclic program sequence is no longer possible for safety related reasons. The last active process is the operation of the 7-segment display by system A. System B is in stop mode.	All outputs are switched off!	Reset possible by switching the SMX(POR) off/on.
Alarm	Functional fault, caused by an external process. Both systems continue to run cyclically and serve all requests from the communication interfaces. Sensing of the external process is also maintained.	All outputs are switched off!	Reset possible via parameterizable input
ECS-Alarm	When using the ECS function in the programming desktop, the encoder alarm messages are marked "E" instead of "A".	ECS function block delivers "0" as a result.	Reset possible via parameterizable input

Recognizing faults system, A and system B:

- System A: odd numbered
- System B: even numbered

15.1 Fault indication

There are two possible ways of displaying the fault number

15.1.1 SMX.. without expansion modules

F,A or E __ __ __ __
Fault number

15.1.2 SMX.. with expansion modules

F,A or E __ __ __ __ __
1) Fault number

Note 1) 0: Base module
1: Expansion module with logic address 1
2: Expansion module with logic address 2

15.2 Alarm list SMX

Alarm code	A 2101 / A 2102
Alarm message	Timeout receive message SMX31 (address 1)
Cause	Message from expansion module not received in time
Remedy	Check connection to expansion module

Alarm code	A 2105 / A 2106
Alarm message	CRC fault transmission message SMX31 (address 1)
Cause	Transmission message faulty
Remedy	Check configuration of SMX31 serial number

Alarm code	A 2107 / A 2108
Alarm message	CRC fault transmission message
Cause	Transmission message faulty
Remedy	• Check configuration of SMX31 serial number • Check connection to expansion module

Alarm code	A 2109 / A 2110
Alarm message	CRC fault receive message
Cause	Receive message faulty
Remedy	• Check configuration of SMX31 serial number • Check connection to expansion module

Alarm code	A 2111
Alarm message	Timeout communication with expansion module SMX31 (address 1)
Cause	Installation of expansion module faulty
Remedy	• Check connection to expansion module

Alarm code	A 2113
Alarm message	Expansion module SMX31 (address 1) present, but not configured
Cause	Faulty configuration
Remedy	• Check configuration

Alarm code	A 2121 / A 2122
Alarm message	Timeout receive message SMX31 (address 2)
Cause	Message from expansion module not received in time
Remedy	Check connection to expansion module

Alarm code	A 2125 / A 2126
Alarm message	CRC fault transmission message SMX31 (address 2)
Cause	Transmission message faulty
Remedy	Check configuration of SMX31 serial number

Alarm code	A 2131
Alarm message	Timeout communication with expansion module SMX31 (address 2)
Cause	Installation of expansion module faulty
Remedy	• Check connection to expansion module

Alarm code	A 2133
Alarm message	Expansion module SMX31 (address 2) present, but not configured
Cause	Faulty configuration
Remedy	• Check configuration

Alarm code	A 3031 / A 3032
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.1
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3031 / A 3032
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.1
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3033 / A 3034
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.1
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3035 / A 3036
Alarm message	Faulty 24 V signal on EAEx.1
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3037 / A 3038
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.2
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3039 / A 3040
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.2
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3041 / A 3042
Alarm message	Faulty 24 V signal on EAEx.2
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3043 / A 3044
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.3
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3045 / A 3046
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.3
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3047 / A 3048
Alarm message	Faulty 24 V signal on EAEx.3
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3049 / A 3050
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.4
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3051 / A 3052
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.4
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3053 / A 3054
Alarm message	Faulty 24 V signal on EAEx.4
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3055 / A 3056
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.5
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3057 / A 3058
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.5
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3059 / A 3060
Alarm message	Faulty 24 V signal on EAEx.5
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3061 / A 3062
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.6
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3063 / A 3064
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.6
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3065 / A 3066
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.7
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3067 / A 3068
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.7
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3069 / A 3070
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.7
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3071 / A 3072
Alarm message	Faulty 24 V signal on EAEx.7
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3073 / A 3074
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.8
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3075 / A 3076
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.8
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3077 / A 3078
Alarm message	Faulty 24 V signal on EAEx.8
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3079 / A 3080
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.9
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3081 / A 3082
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.9
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3083 / A 3084
Alarm message	Faulty 24 V signal on EAEx.9
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3085 / A 3086
Alarm message	Pulse1 plausibility fault on expansion inlet EAEx.10
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3087 / A 3088
Alarm message	Pulse2 plausibility fault on expansion inlet EAEx.10
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3089 / A 3090
Alarm message	Faulty 24 V signal on EAEx.10
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3101 / A 3102
Alarm message	Pulse1 plausibility fault on input DI1
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3103 / A 3104
Alarm message	Pulse1 plausibility fault on input DI2
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3105 / A 3106
Alarm message	Pulse1 plausibility fault on input DI3
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3107 / A 3108
Alarm message	Pulse1 plausibility fault on input DI4
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3109 / A 3110
Alarm message	Pulse1 plausibility fault on input DI5
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3111 / A 3112
Alarm message	Pulse1 plausibility fault on input DI6
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3113 / A 3114
Alarm message	Pulse1 plausibility fault on input DI7
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3115 / A 3116
Alarm message	Pulse1 plausibility fault on input DI8
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3117 / A 3118
Alarm message	Pulse2 plausibility fault on input DI1
Cause	No Pulse2 voltage applied to this input
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3119 / A 3120
Alarm message	Pulse2 plausibility fault on input DI2
Cause	No Pulse2 voltage applied to this input
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3121 / A 3122
Alarm message	Pulse2 plausibility fault on input DI3
Cause	No Pulse2 voltage applied to this input
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3123 / A 3124
Alarm message	Pulse2 plausibility fault on input DI4
Cause	No Pulse2 voltage applied to this input
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3125 / A 3126
Alarm message	Pulse2 plausibility fault on input DI5
Cause	No Pulse2 voltage applied to this input
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3127 / A 3128
Alarm message	Pulse2 plausibility fault on input DI6
Cause	No Pulse2 voltage applied to this input
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3129 / A 3130
Alarm message	Pulse2 plausibility fault on input DI7
Cause	No Pulse2 voltage applied to this input
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3131 / A 3132
Alarm message	Pulse2 plausibility fault on input DI8
Cause	No Pulse2 voltage applied to this input
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3133 / A 3134
Alarm message	Pulse1 plausibility fault on input DI9
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3135 / A 3136
Alarm message	Pulse1 plausibility fault on input DI10
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3137 / A 3138
Alarm message	Pulse1 plausibility fault on input DI11
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3139 / A 3140
Alarm message	Pulse1 plausibility fault on input DI12
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3141 / A 3142
Alarm message	Pulse1 plausibility fault on input DI13
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3143 / A 3144
Alarm message	Pulse1 plausibility fault on input DI14
Cause	Configured Pulse1 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3147 / A 3148
Alarm message	Pulse2 plausibility fault on input DI9
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input DI9 acc. to planning and circuit diagram • Check wiring

Alarm code	A 3149 / A 3150
Alarm message	Pulse2 plausibility fault on input DI10
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input DI10 acc. to planning and circuit diagram • Check wiring

Alarm code	A 3151 / A 3152
Alarm message	Pulse2 plausibility fault on input DI11
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input DI11 acc. to planning and circuit diagram • Check wiring

Alarm code	A 3153 / A 3154
Alarm message	Pulse2 plausibility fault on input DI12
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3155 / A 3156
Alarm message	Pulse2 plausibility fault on input DI13
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3157 / A 3158
Alarm message	Pulse2 plausibility fault on input DI14
Cause	Configured Pulse2 voltage not applied to this input.
Remedy	• Check the configuration of the digital input acc. to planning and circuit diagram • Check wiring

Alarm code	A 3159 / A 3160
Alarm message	Faulty 24 V signal on DI1
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3161 / A 3162
Alarm message	Faulty 24 V signal on DI2
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3163 / A 3164
Alarm message	Faulty 24 V signal on DI3
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3165 / A 3166
Alarm message	Faulty 24 V signal on DI4
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3167 / A 3168
Alarm message	Faulty 24 V signal on DI5
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3169 / A 3170
Alarm message	Faulty 24 V signal on DI6
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3171 / A 3172
Alarm message	Faulty 24 V signal on DI7
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3173 / A 3174
Alarm message	Faulty 24 V signal on DI8
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3175 / A 3176
Alarm message	Faulty 24 V signal on DI9
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3177 / A 3178
Alarm message	Faulty 24 V signal on DI10
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3179 / A 3180
Alarm message	Faulty 24 V signal on DI11
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3181 / A 3182
Alarm message	Faulty 24 V signal on DI12
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3183 / A 3184
Alarm message	Faulty 24 V signal on DI13
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3185 / A 3186
Alarm message	Faulty 24 V signal on DI14
Cause	No permanent 24 V voltage applied to this input
Remedy	• Check the voltage on the digital input! • Check wiring • Check whether Pulse1 or Pulse2 is applied

Alarm code	A 3197 / A 3198
Alarm message	Faulty OSSD input test
Cause	OSSD test faulty
Remedy	• 24 V check the input voltage on all OSSD inputs

Alarm code	A 3209 / A 3210
Fault message	Encoder supply voltage X31 faulty.
Cause	• Encoder supply voltage does not comply with configured threshold • Component fault in module
Remedy	• Check configuration! • Check encoder supply voltage • Switch device off/on.

Alarm code	A 3213 / A 3214
Fault message	Encoder supply voltage X32 faulty.
Cause	• Encoder supply voltage does not comply with configured threshold • Component fault in module
Remedy	• Check configuration! • Check encoder supply voltage • Switch device off/on.

Alarm code	A 3225 / A 3226
Fault message	Deviation Ain1 to AIn2 too big
Cause	• Different voltages on both inputs • configured threshold too low
Remedy	• Check voltages on Ain1! • Check configuration of threshold/input filter • Switch device off/on.

Alarm code	A 3227 / A 3228
Fault message	Deviation Ain3 to AIn4 too big
Cause	• Different voltages on both inputs • configured threshold too low
Remedy	• Check voltages on Ain1! • Check configuration of threshold/input filter • Switch device off/on.

Alarm code	A 3229 / A 3230
Fault message	Plausibility test for encoder voltage faulty
Cause	• Encoder voltage value
Remedy	• Check encoder voltage supply • Check wiring of encoder voltage supply

Alarm code	A 3231 / A 3232
Fault message	Plausibility test for analog inputs faulty
Cause	• Fault in analog input signal
Remedy	• Check connection of analog inputs • Analog input voltage out of range

Alarm code	A 3233 / A 3234
Fault message	Open-circuit monitoring AIN1 has triggered
Cause	• Open-circuit monitoring is activated
Remedy	• Check configuration of activation/sensor • Check sensor connection

Alarm code	A 3235 / A 3236
Fault message	Open-circuit monitoring AIN2 has triggered
Cause	• Open-circuit monitoring is activated
Remedy	• Check configuration of activation/sensor • Check sensor connection

Alarm code	A 3301 / A 3302
Alarm message	Plausibility fault speed sensing axis 1
Cause	The difference between the two speed sensors is higher than the configured speed shut-down threshold
Remedy	Check the theory of the distance once again using the data set in the encoder configuration Check the speed sensor Use the SCOPE function to adjust super imposable speed signals

Alarm code	A 3303 / A 3304
Alarm message	Plausibility fault position sensing axis 1
Cause	The difference between the two position sensors is higher than the configured incremental shut-down threshold
Remedy	Check the theory of the distance using the configured data or the sensor setting Check the position signal Are all signals correctly connected to the 9-pole encoder plug? Check the encoder plug for correct wiring. Is bridge 1-2 connected to the 9-pole plug (SSI absolute value encoder) Use the SCOPE function to adjust super imposable position signals

Alarm code	A 3307 / A 3308
Alarm message	Plausibility fault position range axis 1
Cause	The current position is outside the configured measuring length
Remedy	Check the theory of the distance using the configured data or the sensor setting Check the position signal, if necessary correct the offset Use the SCOPE function to read out the position and to set into relation to configured values

Alarm code	A 3309 / A 3310
Alarm message	Plausibility fault because of faulty speed axis 1
Cause	The current speed is outside the configured maximum speed
Remedy	The drive moves outside the permissible and configured speed range Check configuration Use the SCOPE function to analyse the course of speed

Alarm code	A 3311 / A 3312
Alarm message	Configuration fault: Acceleration axis 1
Cause	The current acceleration is outside the configured acceleration range
Remedy	The drive has exceeded the permissible acceleration range Check the configuration of maximum speed Use the SCOPE function to analyse the course of speed/acceleration

Alarm code	A 3313 / A 3314
Fault message	SSI sensor fault
Cause	• Encoder step change SSI-value within a cycle too big
Remedy	• Check encoder wiring • Check encoder configuration

Alarm code	A 3321 / A 3322
Alarm message	Plausibility fault speed sensing axis 2
Cause	The difference between the two speed sensors is higher than the configured speed shut-down threshold
Remedy	Check the theory of the distance once again using the data set in the encoder configuration Check the speed sensor Use the SCOPE function to adjust super imposable speed signals

Alarm code	A 3323 / A 3324
Alarm message	Plausibility fault position sensing axis 2
Cause	The difference between the two position sensors is higher than the configured incremental shut-down threshold
Remedy	Check the theory of the distance using the configured data or the sensor setting Check the position signal Are all signals correctly connected to the 9-pole encoder plug? Check the encoder plug for correct wiring. Is bridge 1-2 connected to the 9-pole plug (SSI absolute value encoder) Use the SCOPE function to adjust super imposable position signals

Alarm code	A 3327 / A 3328
Alarm message	Plausibility fault position range axis 2
Cause	The current position is outside the configured measuring length
Remedy	Check the theory of the distance using the configured data or the sensor setting Check the position signal, if necessary correct the offset Use the SCOPE function to read out the position and to set into relation to configured values

Alarm code	A 3329 / A 3330
Alarm message	Plausibility fault because of faulty speed axis 2
Cause	The current speed is outside the configured maximum speed
Remedy	The drive moves outside the permissible and configured speed range Check configuration Use the SCOPE function to analyse the course of speed

Alarm code	A 3331 / A 3332
Alarm message	Configuration fault: Acceleration axis 2
Cause	The current acceleration is outside the configured acceleration range
Remedy	The drive has exceeded the permissible acceleration range Check the configuration of maximum speed Use the SCOPE function to analyse the course of speed/acceleration

Alarm code	A 3333 / A 3334
Alarm message	Plausibility fault of SinCos encoder
Cause	Wrong encoder type connected
Remedy	Check configuration Check encoder assignment

Alarm code	A 3407 / A 3408
Alarm message	Difference level RS485Treiber1 fault INC_B or SSI_CLK faulty
Cause	• No encoder connection • Wrong encoder type connected
Remedy	• Check encoder connection • Check encoder wiring

Alarm code	A 3409 / A 3410
Alarm message	Difference level RS485Treiber2 fault INC_A or SSI_DATA faulty
Cause	• No encoder connection • Wrong encoder type connected
Remedy	• Check encoder connection • Check encoder wiring

Alarm code	A 3411 / A 3412
Fault message	Fault Sine/Cosine plausibility X31
Cause	• Plausibility monitoring of individual tracks faulty
Remedy	• Check encoder wiring • Sine- to Cosine- track must be linear

Alarm code	A 3413 / A 3414
Fault message	Fault Sine/Cosine plausibility X32
Cause	• Plausibility monitoring of individual tracks faulty
Remedy	• Check encoder wiring • Sine- to Cosine- track must be linear

Alarm code	A 3505 / A 3506
Fault message	Read head fault WCS encoder system axis 1
Cause	• WCS read head has detected a fault
Remedy	• Read out fault types from WCS encoder system

Alarm code	A 3507 / A 3508
Fault message	Read head fault WCS encoder system axis 1
Cause	• WCS read head has detected a fault
Remedy	• Read out fault types from WCS encoder system

Alarm code	A 4001 / A 4002
Alarm message	CCW and CW rotation monitoring DMC1 activated at the same time
Cause	Multiple activation
Remedy	In programming make sure that only one "Enable" is activated

Alarm code	A 4003 / A 4004
Alarm message	CCW and CW rotation monitoring DMC2 activated at the same time
Cause	Multiple activation
Remedy	In programming make sure that only one "Enable" is activated

Alarm code	A 4601 / A 4602
Alarm message	Monitoring range left and right of OLC1 activated at the same time
Cause	Multiple activation
Remedy	In programming make sure that only one "Enable" is activated

Alarm code	A 4603 / A 4604
Alarm message	Monitoring range left and right of OLC2 activated at the same time
Cause	Multiple activation
Remedy	In programming make sure that only one "Enable" is activated

Alarm code	A 4605 / A 4606
Alarm message	OLC1 Teach In status fault
Cause	SET and QUIT input have a faulty switching sequence
Remedy	Check input configuration Check switching sequence

Alarm code	A 4607 / A 4608
Alarm message	OLC2 Teach In status fault
Cause	SET and QUIT input have a faulty switching sequence
Remedy	Check configuration Check switching sequence

Alarm code	A 4609 / A 4610
Alarm message	OLC1 Teach In position fault
Cause	Teach In position outside measuring range
Remedy	Check transfer position

Alarm code	A 4611 / A 4612
Alarm message	OLC2 Teach In position fault
Cause	Teach In position outside measuring range
Remedy	Check transfer position

Alarm code	A 4613 / A 4614
Alarm message	OLC1 Teach In ZSC activation fault
Cause	The drive moved during Teach In (ZSC fault)
Remedy	The drive must be stopped when using the Teach In function Check whether ZSC has already triggered

Alarm code	A 4615 / A 4616
Alarm message	OLC2 Teach In ZSC activation fault
Cause	The drive moved during Teach In (ZSC fault)
Remedy	The drive must be stopped when using the Teach In function Check whether ZSC has already triggered

Alarm code	A 4901 / A 4902
Alarm message	CCW and CW rotation monitoring JSS1 activated at the same time
Cause	Multiple activation
Remedy	In programming make sure that only one "Enable" is activated

Alarm code	A 4903 / A 4904
Alarm message	CCW and CW rotation monitoring JSS2 activated at the same time
Cause	Multiple activation
Remedy	In programming make sure that only one "Enable" is activated

Alarm code	A 5001 / A 5002
Alarm message	Test deactivation of digital inputs 1...14 faulty
Cause	Inputs are still active after deactivation
Remedy	Check wiring of digital inputs

Alarm code	A 6701 / A 6702
Alarm message	Timeout fault MET
Cause	Input element with time monitoring is faulty
Remedy	Check wiring of input element Input element faulty

Alarm code	A 6703 / A 6704
Alarm message	Timeout fault MEZ
Cause	Two-hand control element with time monitoring is faulty
Remedy	Check wiring of input element Input element faulty

15.3 Fatal Error list SMX

Fatal Error Code	F 1001
Fault message	Configuration data were incorrectly loaded into the monitoring device
Cause	Disturbed connection when loading the program into the monitoring device.
Remedy	Reload the configuration data, then switch module off/on.

Fatal Error Code	F 1003
Fault message	Configuration data invalid for software version of module!
Cause	Module configured with incorrect software version of the programming desktop.
Remedy	Parameterize the module with the approved version of the programming desktop, the switch the module off/on.

Fatal Error Code	F 1007
Fault message	Device not programmed with the correct programming desktop
Cause	Program or configuration data transferred to the device using the wrong programming desktop
Remedy	Check the module design and parameterize again with a valid programming desktop. Then switch device off/on.

Fatal Error Code	F 1307
Fault message	Error when deleting configuration data from the Flash Memory

Fatal Error Code	F 1311 / F1312
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 1330
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 1401 / F 1402
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 1403 / F 1404
Fault message	CRC of configuration data invalid!
Cause	Configuration data were incorrectly transferred
Remedy	Transfer the configuration data again

Fatal Error Code	F 1406
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 1407 / F 1408
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 1501 / F 1502
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 1503 / F 1504
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 1505 / F 1506
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 1601 / F 1602
Fault message	Range test of device description is faulty.

Fatal Error Code	F 1603 / F 1604
Fault message	Range test of Access Data faulty

Fatal Error Code	F 1605 / F 1606
Fault message	Range test of EMU faulty

Fatal Error Code	F 1607 / F 1608
Fault message	Range test of PCS faulty

Fatal Error Code	F 1609 / F 1610
Fault message	Range test of ESS faulty

Fatal Error Code	F 1611 / F 1612
Fault message	Range test of ELC faulty

Fatal Error Code	F 1613 / F 1614
Fault message	Range test of OLC faulty

Fatal Error Code	F 1615 / F 1616
Fault message	Range test of ZSC faulty

Fatal Error Code	F 1617 / F 1618
Fault message	Range test of MSC faulty

Fatal Error Code	F 1619 / F 1620
Fault message	Range test of DMC faulty

Fatal Error Code	F 1621 / F 1622
Fault message	Range test of JSS faulty.

Fatal Error Code	F 1623 / F 1624
Fault message	Range test of PLC faulty

Fatal Error Code	F 1625 / F 1626
Fault message	Range test of shut-down channel faulty

Fatal Error Code	F 1627 / F 1628
Fault message	Range test of outputs faulty

Fatal Error Code	F 1629 / F 1630
Fault message	Range test of digital inputs faulty.

Fatal Error Code	F 1631 / F 1632
Fault message	Range test of analog input

Fatal Error Code	F 1633 / F 1634
Fault message	Range test of encoder type faulty

Fatal Error Code	F 1635 / F 1636
Fault message	Range test of encoder processing faulty

Fatal Error Code	F 1637 / F 1638
Fault message	Range test of encoder position faulty

Fatal Error Code	F 1639 / F 1640
Fault message	Range test of PDM faulty.

Fatal Error Code	F 1641 / F 1642
Fault message	Range test of adder circuitry faulty

Fatal Error Code	F 1645 / F 1646
Fault message	Range test of axis management faulty

Fatal Error Code	F 1647 / F 1648
Fault message	Range test of expansion modules faulty

Fatal Error Code	F 1649 / F 1650
Fault message	Range test of PLC timer faulty

Fatal Error Code	F 1651 / F 1652
Fault message	Range test of system faulty

Fatal Error Code	F 1653 / F 1654
Fault message	Range test connection table faulty

Fatal Error Code	F 1655 / F 1656
Fault message	Range test AMC faulty

Fatal Error Code	F 1657 / F 1658
Fault message	Range test of diagnose faulty

Fatal Error Code	F 2001 / F 2002
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 2003 / F 2004
Fault message	Timeout when transmitting configuration and firmware data

Fatal Error Code	F 2005
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 2007
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 2009
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 2011
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 2013 / F 2014
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3001 / F 3002
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3201 / F 3202
Fault message	Processor voltage 2.5 V outside defined range
Cause	• Supply voltage for module not correct! • Component fault in module
Remedy	• Check device supply voltage! • Switch device off/on.

Fatal Error Code	F 3203
Fault message	Supply voltage 24 V module faulty.
Cause	• Supply voltage for module not correct! • Component fault in module
Remedy	• Check device supply voltage! • Switch device off/on.

Fatal Error Code	F 3204
Fault message	Internal supply voltage 5.7V faulty
Cause	• Supply voltage for module not correct! • Component fault in module
Remedy	• Check device supply voltage! • Switch device off/on.

Fatal Error Code	F 3217 / F 3218
Fault message	Internal supply voltage 5 V faulty
Cause	• Supply voltage for module not correct! • Component fault in module
Remedy	• Check device supply voltage! • Switch device off/on.

Fatal Error Code	F 3306
Alarm message	Plausibility fault position switching axis 1
Cause	During position switching ZSC, JSS or DMC is permanently activated.
Remedy	• Check activation of ZSC • Check activation of JSS • Activation of DMC (only for monitoring via position)

Fatal Error Code	F 3316
Fault message	Fault in encoder alignment axis 1
Cause	• Incorrect position triggering by system A
Remedy	• Check encoder configuration • Switch device off/on.

Fatal Error Code	F 3326
Fault message	Plausibility fault position switching axis 2
Cause	During position switching ZSC, JSS or DMC is permanently activated.
Remedy	• Check activation of ZSC • Check activation of JSS • Activation of DMC (only for monitoring via position)

Fatal Error Code	F 3336
Fault message	Fault in encoder alignment axis 2
Cause	• Incorrect position triggering by system A
Remedy	• Check encoder configuration • Switch device off/on.

Fatal Error Code	F 3603 / F 3604
Fault message	Faulty switching of relay K1
Cause	Internal triggering of relay faulty
Remedy	Switch device off/on

Fatal Error Code	F 3605 / F 3606
Fault message	Faulty switching of relay K2
Cause	Internal triggering of relay faulty
Remedy	Switch device off/on

Fatal Error Code	F 3609
Fault message	Faulty switching of "0 V" driver DO1_L
Cause	Switching state of output faulty
Remedy	Switch device off/on

Fatal Error Code	F 3610
Fault message	Faulty switching of "24 V" driver DO1_H
Cause	Switching state of output faulty
Remedy	Switch device off/on

Fatal Error Code	F 3611
Fault message	Faulty switching of "0 V" driver DO2_L
Cause	Switching state of output faulty
Remedy	Switch device off/on

Fatal Error Code	F 3612
Fault message	Faulty switching of "24 V" driver DO2_H
Cause	Switching state of output faulty
Remedy	Switch device off/on

Fatal Error Code	F 3613
Fault message	Faulty switching of "0 V" driver DO1_L
Cause	Short-circuit of output with "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3614
Fault message	Faulty testing of "24 V" driver DO1_H
Cause	Short-circuit of output with "24 V"
Remedy	Switch device off/on

Fatal Error Code	F 3615
Fault message	Faulty testing of "0 V" driver DO2_L
Cause	Short-circuit of output with "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3616
Fault message	Faulty testing of "24 V" driver DO2_H
Cause	Short-circuit of output with "24 V"
Remedy	Switch device off/on

Fatal Error Code	F 3617
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3618
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3619
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3620
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3621
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3622
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3701 / F 3702
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3821
Fault message	Faulty switching of output EAAx.1
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3823
Fault message	Faulty switching of output EAAx.2
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3825
Fault message	Faulty switching of output EAAx.3
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3827
Fault message	Faulty switching of output EAAx.4
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3829
Fault message	Faulty switching of output EAAx.5
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3831
Fault message	Faulty switching of output EAAx.6
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3833
Fault message	Faulty switching of output EAAx.7
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3835
Fault message	Faulty switching of output EAAx.8
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3837
Fault message	Faulty switching of output EAAx.9
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3839
Fault message	Faulty switching of output EAAx.10
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3841 / F 3842
Fault message	Faulty testing of output EAAx.1
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3843 / F 3844
Fault message	Faulty testing of output EAAx.2
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3845 / F 3846
Fault message	Faulty testing of output EAAx.3
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3847 / F 3848
Fault message	Faulty testing of output EAAx.4
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3849 / F 3850
Fault message	Faulty testing of output EAAx.5
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3851 / F 3852
Fault message	Faulty testing of output EAAx.6
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3853 / F 3854
Fault message	Faulty testing of output EAAx.7
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3855 / F 3856
Fault message	Faulty testing of output EAAx.8
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3857 / F 3858
Fault message	Faulty testing of output EAAx.9
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3859 / F 3860
Fault message	Faulty testing of output EAAx.10
Cause	Short-circuit of output with "24 V" or "0 V"
Remedy	Switch device off/on

Fatal Error Code	F 3872
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3874
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3892
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 3894
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 6801 / F 6802
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 6803 / F 6804
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 6805 / F 6806
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 6807 / F 6808
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 6809 / F 6810
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 6811 / F 6812
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 6813 / F 6814
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8205 / F 8206
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8207 / F 8208
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8213 / F 8214
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8220
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8221 / F 8222
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8223 / F 8224
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8225
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8227
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 8228
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 9001 / F 9002
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 9007 / F 9008
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 9009 / F 9010
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 9011 / F 9012
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 9013 / F 9014
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 9015 / F 9016
Fault message	Internal error – please contact the manufacturer!

Fatal Error Code	F 9017 / F 9018
Fault message	Internal error – please contact the manufacturer!

16 Encoder types

SMX 11 / SMX 12 in 2-axis operation

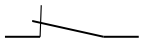
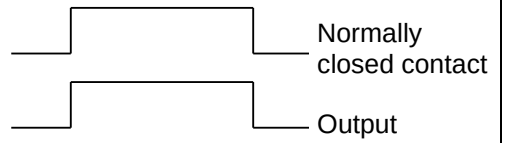
Type	Encoder A			Encoder B			Disabled Modes	Configurable axis	Entry Info field	
	Type	Pulse multiple	Enable direction	Type	Pulse multiple	Enable direction			Fault exclusion/comment	PI
0	NC	0	No	NC	0	No	all	1 and 2		B
1	Incremental	2	No	NC	2	No	ZSC, DMC, ELC, OLC, PSC(position),JSS	1 and 2	Fault exclusion mech. shaft breakage, positive encoder shaft connection required.	d
2	SINCOS	4	Yes	NC	4	No	ELC, OLC, PSC(position)	1 and 2	Fault exclusion mech. shaft breakage, positive encoder shaft connection required.	d
3	Incremental	2	Yes	Proxi sw. 1 count. inp.	1	No	ZSC,DMC,JSS,ELC, OLC, PSC(position)	1 and 2		e
4	SINCOS	4	Yes	Proxi sw. 1 count. inp.	1	No	ELC, OLC, PSC(position)	1 and 2	(not implemented in phase 1)	e
5	Incremental	4	Yes	Proxi sw. 2 count. inp. w. 90° - signal	4	Yes	ELC, OLC, PSC(position)	1		e
6	SINCOS	4	Yes	HTL/incremental	4	Yes	ELC, OLC, PSC(position)	1		e
7	SSI	1	Yes	Proxi sw. 1 count. inp.	1	No		1	(not implemented in phase 1)	d
8	SSI	1	Yes	Proxi sw. 2 count. inp. w. 90° - signal	4	Yes		1		e
9	Proxi sw. 1 count. inp.	1	No	Proxi sw. 1 count. inp.	1	No	ZSC, DMC, ELC, OLC,JSS, PSC(position)	1		d
10	Proxi sw. 2 count. inp. w. 90° - signal	4	Yes	Proxi sw. 2 count. inp. w. 90° - signal	4	Yes	ELC, OLC, PSC(position)	1		d

11	Proxi sw. 2 count. inp. w. 90° - signal	4	Yes	Incremental	4	Yes	ELC, OLC, PSC(position)	2		e
12	HTL/increment al	4	Yes	SINCOS	4	Yes	ELC, OLC, PSC(position)	2		e
13	Proxi sw. 1 count. inp.	1	No	SSI	1	Yes		2	(not implemented in phase 1)	d
14	Proxi sw. 2 count. inp. w. 90° - signal	4	Yes	SSI	1	Yes		2		e

SMX12 (1 axis):

Type	**Encoder A**			**Encoder B**			**Disabled Modes**	**Configurable axis**	**Entry Info field**	
	Type	**Pulse multiple**	**Enable direction**	**Type**	**Pulse multiple**	**Enable direction**			**Fault exclusion/comment**	**PI**
32	Incremental	4	Yes	Incremental	4	Yes	ELC, OLC, PSC(position)	1		e
33	SINCOS	4	Yes	Incremental	4	Yes	ELC, OLC, PSC(position)	1		e
34	SINCOS	4	Yes	SINCOS	4	Yes	ELC, OLC, PSC(position)	1		e
35	Incremental	4	Yes	SSI	1	Yes		1		e
36	SINCOS	4	Yes	SSI	1	Yes		1		e
37	SSI	1	Yes	SSI	1	Yes		1		e

17 Switch types

<table>
<tr><th>Type</th><th>Graphic symbols</th><th>Truth table</th><th>Logic function</th><th>Function block</th><th>Function</th><th></th></tr>
<tr><td>1</td><td> 
eSwitch_1o</td><td><table><tr><td>Ö</td><td>A</td></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td></tr></table></td><td>LD E.1
ST IE.X</td><td></td><td>Normally open, only shown normally closed</td><td>  </td></tr>
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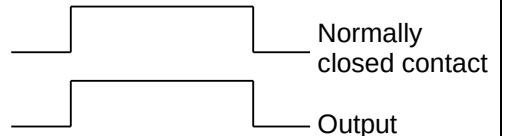
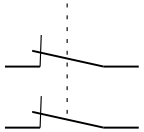
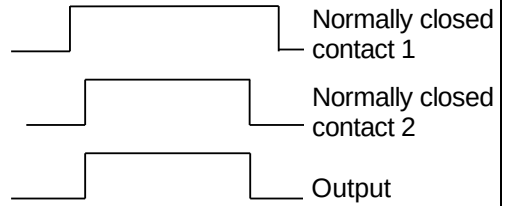
sSwitch_1s</td><td><table><tr><td>S</td><td>A</td></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td></tr></table></td><td>LD E.1
ST IE.X</td><td></td><td>Normally open, as type 1</td><td>  </td></tr>
<tr><td>3</td><td> 
eSwitch_2o</td><td><table><tr><td>Ö1</td><td>Ö2</td><td>A</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>LD E.1
AND E.2
ST IE.X</td><td></td><td>AND operation of both inputs</td><td>  </td></tr>
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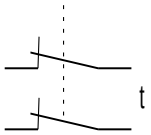
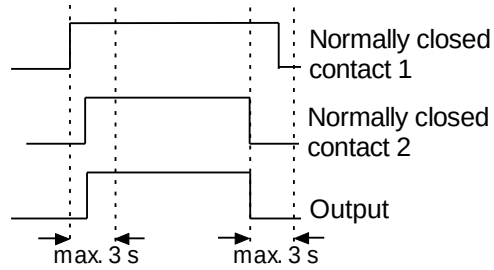
4	 eSwitch_2oT	Ö1 | Ö2 | A 0 | 0 | 0 1 | 0 | 0 0 | 1 | 0 1 | 1 | 1	LD E.1 OR E.2 ST META_EN.1 LD E.1 AND E.2 ST METB_EN.1 LD MET.1 ST IE.X	Time monitoring MET1..MET4	Like 3, but with time monitoring of state changes. In case of signal changes at S or Ö a complementary signal must follow within a period of t=3 s. If not, detect fault and A=0	

<table>
<tr><th>Type</th><th>Graphic symbols</th><th>Truth table</th><th></th><th></th><th>Function</th><th></th></tr>
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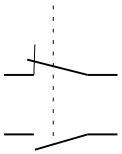
<td> 
eSwitch_1s1o</td>
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<tr><th>S</th><th>Ö</th><th>A</th></tr>
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<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
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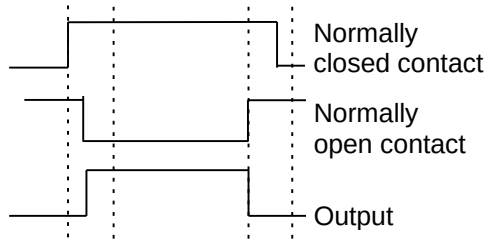
</td>
<td>LD E.1
AND NOT E.2
ST IE.X</td>
<td></td>
<td>Monitoring for S=inactive and Ö=active</td>
<td> 
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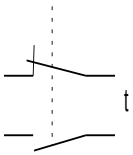
<td> 

eSwitch_1s1oT</td>
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<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
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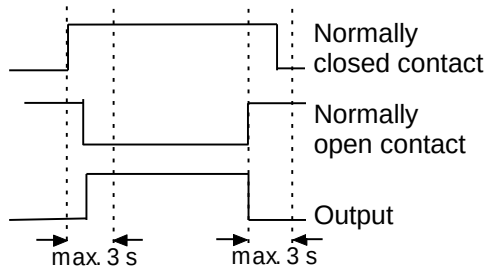
</td>
<td>LD E.1
OR NOT E.2
ST META_EN.1

LD E1
AND NOT E2
ST METB_EN.1

LD MET.1
ST IE.X</td>
<td>Time monitoring MET1..MET4</td>
<td>Like 5, but with time monitoring of state changes. In case of signal changes at S or Ö a complementary signal must follow within a period of t=3 s. If not, detect fault and A=0</td>
<td> 
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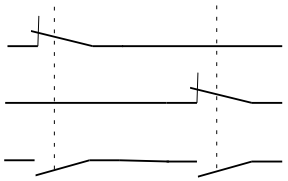
<td> 
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<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
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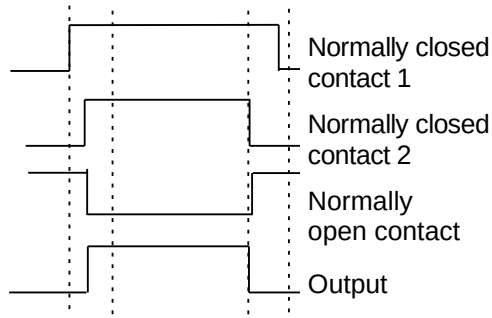
</td>
<td>LD E.1
AND E.2
AND NOT E.3
ST IE.X</td>
<td></td>
<td>Monitoring for S1*S2=inactive and Ö1*Ö2=active</td>
<td> 
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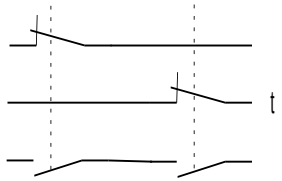
<td> 

eSwitch_2s2oT</td>
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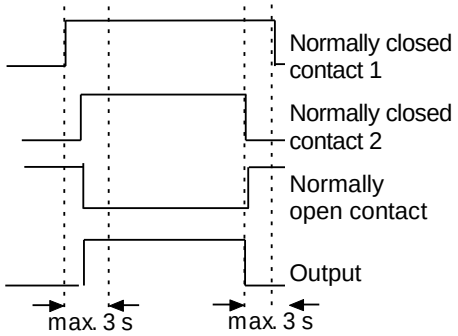
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
</table>
</td>
<td>LD E.1
OR E.2
OR NOT E.3
ST META_EN.1

LD E.1
AND E.2
AND NOT E.3
ST METB_EN.1

LD MET.1
ST IE.X</td>
<td>Time monitoring
MET1..MET4</td>
<td>Like 6, but with time monitoring of state changes.
In case of signal changes at S (Attention: Bus line) or Ö a complementary signal must follow within a period of t=3 s. If not, detect fault and A=0</td>
<td> 
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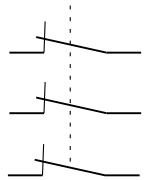
<td> 
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<td>
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<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
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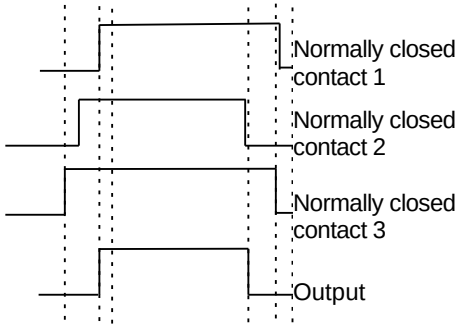
</td>
<td>LD E.1
AND E.2
AND E.3
ST IE.X</td>
<td></td>
<td>AND operation of both inputs</td>
<td> 
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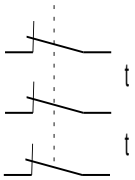
<td> 

eSwitch_3oT</td>
<td>
<table>
<tr><th>Ö1</th><th>Ö2</th><th>Ö3</th><th>A</th></tr>
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<tr><td>1</td><td>0</td><td>0</td><td>0</td></tr>
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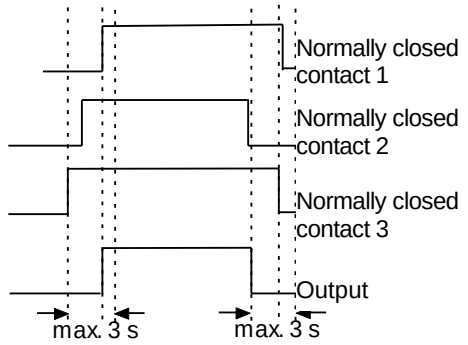
<tr><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
</td>
<td>LD E.1
OR E.2
OR E.3
ST META_EN.1

LD E.1
AND E.2
AND E.3
ST METB_EN.1
LD MET.1

ST IE.X</td>
<td>Time monitoring
MET1..MET4</td>
<td>Like 8, but with time monitoring of state changes.
In case of signal change on one of the Ö-inputs the other inputs must follow within a period of t=3 s. If not, detect fault and A=0</td>
<td> 
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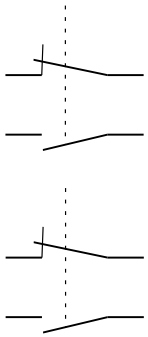
<td>11</td>
<td> 
eTwoHand_2o</td>
<td>
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<tr><th>Ö 1</th><th>S 1</th><th>Ö 2</th><th>S 2</th><th>A</th></tr>
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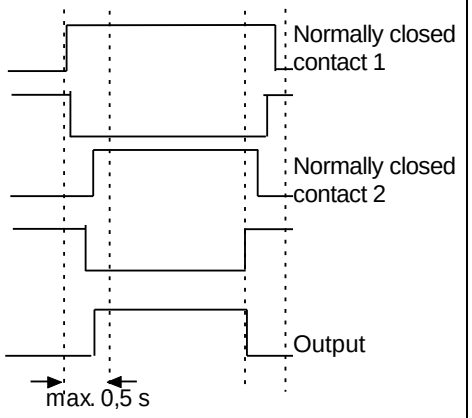
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
</table>
</td>
<td>LD NOT E.1
OR E.2
OR NOT E.3
OR E.4
ST MEZ_EN.1

LD E.1
AND NOT E2
AND E3
AND NOT E4
ST MEZ_EN.2

LD NOT E1
AND E.2
AND NOT E3
AND E.4
ST MEZ_EN.3

LD MEZ.1
ST IE.X</td>
<td>Two-hand operation
MEZ</td>
<td>Monitoring for S1*S2=inactive and Ö1*Ö2=active + temporal monitoring <u>of this</u> status. This means that in case of a signal change of an S from 1->0 or Ö from 0->1, the other signals (i.e. further S=0 or Ö=1) must follow within a period of 0.5 s. If not, the output = 0.
No interference evaluation! No temporal monitoring when changing to inactive state.</td>
<td> 
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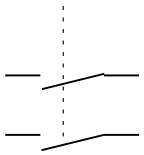
<td>  </td>
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<table>
<tr><th>S1</th><th>S2</th><th>A</th></tr>
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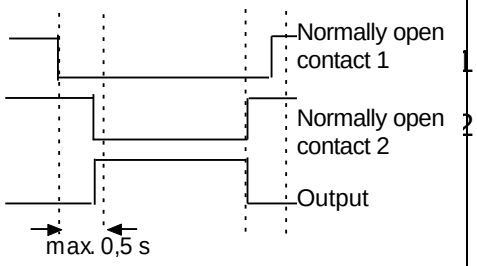
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
</table>
</td>
<td>LD E.1
OR E.2
ST MEZ_EN.1

LD NOT E.1
AND NOT E.2
ST MEZ_EN.2

LD E.1
AND E.2
ST MEZ_EN.3</td>
<td>Two-hand operation
MEZ</td>
<td>Monitoring for S1*S2=inactive + temporal monitoring <u>of this</u> status. This means that in case of a signal change of one S from 1->0 the other signal (i.e. another S=0) must follow within a period of 0.5 s. If not, the output = 0.
No interference evaluation! No temporal monitoring when changing to inactive state.</td>
<td> 
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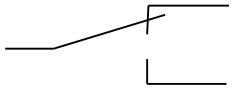
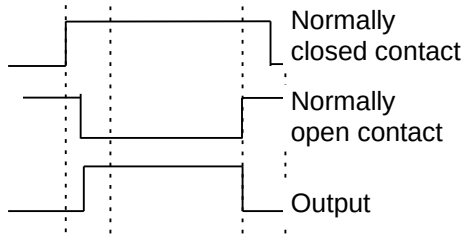
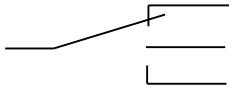
<tr><td></td><td>eTwoHand_2s</td><td></td><td>LD MEZ.1
ST IE.X</td><td></td><td></td><td></td></tr>
<tr><td>13</td><td> 
eMode_1s1o</td><td><table><tr><th>S1</th><th>S2</th><th>A 1</th><th>A 2</th></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td></tr></table></td><td>LD E.1
AND NOT E.2
ST IE.X

LD NOT E.1
AND E.2
ST IE.X2</td><td>Selector switch</td><td>Clear linkage of permissible switch positions</td><td>  </td></tr>
<tr><td>14</td><td> 
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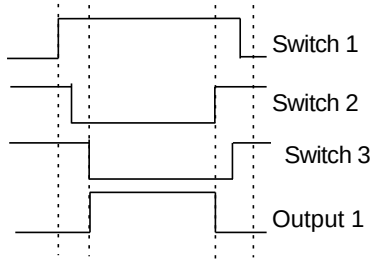
AND NOT E.2
AND NOT E.3
ST IE.X

LDN E.1
AND E2
AND NOT E.3
ST IE.X2

LDN E.1
AND NOT E.2
AND E.3
ST IE.X3</td><td>Selector switch</td><td>Clear linkage of permissible switch positions</td><td>  </td></tr>
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18 Appendix

18.1 Appendix A

General note:

The individual switches of the following input elements can be assigned to the digital inputs DI1 to DI8 as desired.

Enable switch

Switch type	Comment	Classification PI acc. to EN ISO 13849-1	Classification SIL acc. to EN 61508
1 normally closed	Enable switch standard	PI d	SIL 2
1 normally open	Enable switch standard	PI d	SIL 2
2 normally closed	Enable switch higher requirements	PI e	SIL 3
2 normally closed time monitored	Enable switch monitored	PI e	SIL 3

Emergency Stop

Switch type	Comment	Classification category	Classification SIL
1 normally closed	Emergency Stop standard	PI d[1)]	SIL 2
2 normally closed	Emergency stop higher requirements	PI e	SIL 3
2 normally closed time monitored	Emergency Stop monitored	PI e	SIL 3

[1)] Fault exclusions and boundary conditions acc. to EN 13849-2 must be observed!

Door monitoring

Switch type	Comment	Classification category	Classification SIL
2 normally closed	Door monitoring higher requirements	PI e	SIL 3
2 normally closed time monitored	Door monitoring monitored	PI e	SIL 3
1 normally open + 1 normally closed	Door monitoring higher requirements	PI e	SIL 3
1 normally open + 1 normally closed time monitored	Door monitoring monitored		SIL 3
2 normally open + 2 normally closed	Door monitoring higher requirements	PI e	SIL 3
2 normally open + 2 normally closed time monitored	Door monitoring monitored	PI e	SIL 3
3 normally closed	Door monitoring higher requirements	PI e	SIL 3
3 normally closed time monitored	Door monitoring monitored	PI e	SIL 3

Two-hand button

Switch type	Comment	Classification category	Classification SIL
2 two-way switch	Two-hand button higher requirements	Type III C Pl e	SIL3
2 normally open	Two-hand button monitored	Type III A Pl e	SIL1

Note: With these input elements a fixed pulse assignment takes place, which cannot be influenced by the user!

Light curtain

Switch type	Comment	Classification category	Classification SIL
2 normally closed	Light curtain higher requirements	Pl e	SIL 3
2 normally closed time monitored	Light curtain monitored	Pl e	SIL 3
1 normally open + 1 normally closed	Light curtain higher requirements	Pl e	SIL 3
1 normally open + 1 normally closed time monitored	Light curtain monitored	Pl e	SIL 3

Mode selector switch

Switch type	Comment	Classification category	Classification SIL
2 positions	Mode selector switch monitored	Pl e	SIL 3
3 positions	Mode selector switch monitored	Pl e	SIL 3

Safety note: When changing the status of the switch the SafePLC program to be created must ensure that the outputs of the module are deactivated (note: Standard 60204-Part1-Paragraph 9.2.3).

Sensor

Switch type	Comment	Classification category	Classification SIL
1 normally closed	Sensor input standard	Pl d	SIL 2
1 normally open	Sensor input standard	Pl d	SIL 2
2 normally closed	Sensor input higher requirements	Pl e	SIL 3
2 normally closed time monitored	Sensor input monitored	Pl e	SIL 3
1 normally open + 1 normally closed	Sensor input higher requirements	Pl e	SIL 3
1 normally open + 1 normally closed time monitored	Sensor input monitored	Pl e	SIL 3

Start / reset element

Switch type	Comment	Classification category	Classification SIL
1 normally open	Alarm reset standard (evaluation of edge)	--	--
1 normally open	Logic reset standard	Pl d	SIL 2
1 normally open	Start monitoring standard (optional function)	--	--

Note:
The alarm reset input can be operated with 24 V continuous voltage and is edge triggered.