# Technical data sheets for the SafeIO and SafeLogic modules

3.3.0 (March 2026)

Translation of the original documentation

**Publishing information**

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# 1 About this document

## 1.1 Version history

| Version | Date | Comment |
|---|---|---|
| 3.3.0 | February 2026 | Updated chapter Technical data.<br>Updated chapter LED status indicators.<br>Updated chapter Connecting safety-related actuators.<br>Updated chapter SafeIOs - Channel list.<br>Updated chapter I/O update time.<br>Editorial changes. |
| 3.2.0 | November 2025 | Updated Register description.<br>Chapter Connecting safety-related actuators has been updated.<br>Chapter Safety characteristics (B10d values for X20SO6530 module) has been updated.<br>Editorial changes. |
| 3.1.0 | August 2025 | X20SC0xxx - Derating: Added derating bonus for UL applications.<br>Updated Technical data of all modules. Removed the following sections from tables:<br>• System requirements<br>• Safety characteristics<br>• Functionality<br>Updated Register description. |
| 3.0.0 | May 2025 | First edition |

## 1.2 Using this document

This document contains technical information for X20 and X67 safety products.

Section Module-specific information contains overview pages for X20 and X67 safety modules. These overview pages contain links to the chapters with technical information. At the end of each section there are links that lead back to the overview pages.

## 1.3 Declaration of conformity

This document was originally written in the German language. The German edition therefore represents the original operating instructions in accordance with Machinery Directive 2006/42/EC. Documents in other languages should be interpreted as translations of the original operating instructions.

**Product manufacturer:**

B&R Industrial Automation GmbH

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Commercial register number: FN 111651 v
Commercial registry: Regional court Ried im Innkreis
UID number: ATU62367156
Legal structure: Limited liability company
Corporate headquarters: Municipality of Eggelsberg (Upper Austria)

Declarations of conformity for B&R products are available for download on the B&R website (www.br-automation.com).

# 1.4 Safety guidelines

## 1.4.1 Organization of notices

Particularly important information is marked as follows:

**Safety notices**

Signal words that warn of dangerous functions or situations.

| Signal word | Description |
|---|---|
| **Danger!** | Failure to observe these safety guidelines and notices will result in death, severe injury or substantial damage to property. |
| **Warning!** | Failure to observe these safety guidelines and notices can result in death, severe injury or substantial damage to property. |
| **Caution!** | Failure to observe these safety guidelines and notices can result in minor injury or damage to property. |
| **Notice!** | Failure to observe these safety guidelines and notices can result in damage to property. |

**General notices**

Signal words for **useful** information for users and information for avoiding malfunctions.

| Signal word | Description |
|---|---|
| **Information:** | Useful information, application tips and information for avoiding malfunctions. |

## 1.4.2 Target group of this document

These operating instructions contain all the necessary information for the entire life cycle of the product.

These operating instructions are intended exclusively for:

- **Qualified personnel** who are familiar with relevant safety concepts for automation technology as well as applicable standards and regulations, or
- **Qualified personnel** who plan, develop, install and commission safety equipment in machines and systems.

Qualified personnel in the context of this manual's safety guidelines are those who, due to their training, experience and instruction combined with their knowledge of relevant standards, regulations, accident prevention guidelines and operating conditions, are qualified to carry out essential tasks and to recognize and avoid potentially dangerous situations.

It is required that these persons have sufficient language skills to understand this manual.

These operating instructions are primarily addressed to the configuration and integration of the products into industrial machines or systems. The operating instructions must be made accessible to all persons who work with the product. If necessary, the relevant information in these operating instructions and referenced documents must be prepared, condensed or translated into the necessary languages for the target group (e.g. for maintenance instructions for a machine).

This is a translation of the original documentation, which is written in German. All other languages are derived from the German original.

**Danger!**

**Danger from incorrect use of safety-related products/functions**

**Proper functionality is only ensured if the products/functions are used in accordance with their intended use by qualified personnel and the provided safety information is taken into account. The aforementioned conditions must be observed or covered by supplementary measures on your own responsibility in order to ensure the specified protective functions.**

It is the task of the user's "functional safety management" to become familiar with the instructions in the documentation relevant to the application and to ensure the qualification of the personnel.

### 1.4.3 Validity of the documentation

This documentation is valid for the use of the product in conjunction with the B&R Safety+ safety system.

This documentation explains functionality and operation, describes installation and provides information about connecting the module. For more detailed information, see section "Safety technology" in Automation Help.

This documentation has been prepared with the utmost care. Since the products described are regularly revised, the documentation may not fully comply with current or older performance data, standards or other characteristics. We reserve the right to change or update the documentation at any time and without prior notice.

It must be ensured that the current and valid version of this document is used. The latest version is always available on the B&R website (Downloads → Safety technology).

## 1.5 Other applicable documents

For additional and supplementary information, see the following documents.

| Document name | Linking |
|---|---|
| Integrated safety technology user's manual | Integrated safety technology user's manual |
| X20 System user's manual | X20 System user's manual |
| X67 System user's manual | X67 System user's manual |
| Installation/EMC guide in the most current version | Installations / EMV guide |

# 2 General information

## 2.1 System requirements

| Module | Safety Release | mapp Safety | Safety+ |
|---|---|---|---|
| X20(c)SIx1x0 | ✓ | ✓ | ✓ |
| X20(c)SO6300<br>X20(c)SOx1x<br>X20(c)SOx530 | ✓ | ✓ | ✓ |
| X20SC0xxx<br>X20(c)SC2212<br>X20(c)SC2432 | ✓ | ✓ | ✓ |
| X20(c)SLXxxx-1 | ✗ | ✗ | ✓ |
| X20(c)SLXxxx | ✓ | ✓ | ✗ |
| X20(c)SL81xx | ✓ | ✓ | ✗ |
| X20(c)SL82xx | ✗ | ✗ | ✓ |
| X20SP1130 | ✓ | ✓ | ✓ |
| X20(c)SA4430 | ✓ | ✓ | ✓ |
| X20ST4492 | ✓ | ✓ | ✓ |
| X20(c)SD1207 | ✓ | ✓ | ✓ |
| X67SI8103<br>X67SC4122.L12 | ✓ | ✓ | ✓ |

# 3 Module-specific information

## 3.1 X20(c)SIx1x0

### Module overview

| Order number | Short description |
|---|---|
| X20SI2100 | X20 safe digital input module, 2 safe type A digital inputs, configurable input filter, 2 pulse outputs, 24 VDC |
| X20SI4100 | X20 safe digital input module, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20cSI4100 | X20 safe digital input module, coated, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20SI4110 | X20 safe digital input module, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, single-width |
| X20SI8110 | X20 safe digital input module, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, single-width |
| X20SI9100 | X20 safe digital input module, 20 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20cSI9100 | X20 safe digital input module, coated, 20 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |

### Module-specific information

X20(c)SIx1x0 modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SIx1x0 - Order data" on page 32 |
| Technical data | "X20(c)SIx1x0 - Technical data" on page 41 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SIx1x0 - Derating" on page 99 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SIx1x0 - State of I/O channels" on page 136<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20(c)SIx1x0 - Pinouts" on page 144 |
| Input circuit diagram | "X20(c)SIx1x0 - Input circuit diagram" on page 151 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186 |
| Channel list | • "General channels" on page 195<br>• "Channels for modules with safe digital inputs" on page 196 |
| Connection examples | "Type A input channels - Connection examples" on page 255<br>• "Connecting single-channel sensors with contacts" on page 255<br>• "Connecting two-channel sensors with contacts" on page 256<br>• "Connecting multi-channel sensors with contacts" on page 257<br>• "Connecting electronic sensors" on page 258<br>• "Connecting DYNlink sensors in a loop" on page 259<br>• "Connecting DYNlink sensors - Possible connection error" on page 260<br>• "Connecting DYNlink sensors via connection block Tina 4A / Tina 8A" on page 261<br>• "Using the same pulse signals" on page 262 |
| Additional information | "Safe digital inputs" on page 250:<br>• "Type A input channels - Fault detection coverage" on page 265<br>• "Filter" on page 251<br>• "PLCopen state diagrams "Antivalent" / "Equivalent"" on page 270 |

# 3.2 X20(c)SO6300

## Module overview

| Order number | Short description |
|---|---|
| X20SO6300 | X20 safe digital output module, 6 safe type B1 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20cSO6300 | X20 safe digital output module, coated, 6 safe type B1 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |

## Module-specific information

X20(c)SO6300 modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SO6300 - Order data" on page 33 |
| Technical data | "X20(c)SO6300 - Technical data" on page 44 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SO6300 - Derating" on page 101 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SO6300 - State of I/O channels" on page 136<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20(c)SO6300 - Pinout" on page 145 |
| Output circuit diagram | "X20(c)SO6300 - Output circuit diagram " on page 160 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183 |
| Channel list | • "General channels" on page 195<br>• "Channels for modules with safe digital outputs" on page 196 |
| Connection examples | • "Type B output channels - Connection of safety-related actuators" on page 223<br>• "Connection of ACOPOS/ACOPOSmulti" on page 227<br>• "Electronic actuator connection" on page 226 |
| Additional information | "Safe digital outputs" on page 221:<br>• "Type B output channels - Fault detection coverage" on page 245<br>• "Module behavior when GND connection is lost" on page 229<br>• "Error interlock - State diagram" on page 248 |

# 3.3 X20(c)SOx1x0

## Module overview

| Order number | Short description |
|---|---|
| X20SO2110 | X20 safe digital output module, 2 safe type A digital outputs, with current monitoring, 24 VDC, 0.5 A, OSSD <500 µs |
| X20SO2120 | X20 safe digital output module, 2 safe type A digital outputs, with current monitoring, 24 VDC, 2 A, OSSD <500 µs |
| X20SO4110 | X20 safe digital output module, 4 safe type A digital outputs, with current monitoring, 24 VDC, 0.5 A, OSSD <500 µs |
| X20cSO4110 | X20 safe digital output module, coated, 4 safe type A digital outputs, with current monitoring, 24 VDC, 0.5 A, OSSD <500 µs |
| X20SO4120 | X20 safe digital output module, 4 safe type A digital outputs, with current monitoring, 24 VDC, 2 A, OSSD <500 µs |
| X20cSO4120 | X20 safe digital output module, coated, 4 safe type A digital outputs, with current monitoring, 24 VDC, 2 A, OSSD <500 µs |

## Module-specific information

The X20(c)SOx1x0 module family has the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SOx1x0 - Order data " on page 33 |
| Technical data | "X20(c)SOx1x0 - Technical data" on page 46 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SOx1x0 - Derating" on page 102 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SOx1x0 - State of I/O channels " on page 136<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20(c)SOx1x0 - Pinouts" on page 145 |
| Output circuit diagram | "Type A - Output circuit diagram" on page 156 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183 |
| Channel list | • "General channels" on page 195<br>• "Channels for modules with safe digital outputs" on page 196 |
| Connection examples | • "Type A output channels - Connection of safety-related actuators" on page 223<br>• "Connection of ACOPOS/ACOPOSmulti" on page 228 |
| Additional information | "Safe digital outputs" on page 221:<br>• "Type A output channels - Fault detection coverage" on page 244<br>• "Error interlock - State diagram" on page 248 |

# 3.4 X20(c)SOx530

## Module overview

| Order number | Short description |
|---|---|
| X20SO2530 | X20 safe digital output module, 2 relays with 1 normally open contact each, 230 VAC / 6 A, 24 VDC / 6 A |
| X20cSO2530 | X20 safe digital output module, coated, 2 relays with 1 normally open contact each, 230 VAC / 6 A, 24 VDC / 6 A |
| X20SO6530 | X20 safe digital output module, 6 relays with 1 normally open contact each, 230 VAC / 6 A, 24 VDC / 6 A |

## Module-specific information

X20(c)SOx530 modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SOx530 - Order data" on page 34 |
| Technical data | "X20(c)SOx530 - Technical data" on page 48 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SOx530 - Derating" on page 104 |
| Contact service life of relay outputs | "X20(c)SOx530 - Contact service life for relay outputs" on page 131 |
| Load limit curve for direct current | "X20(c)SOx530 - Load limit curve for direct current" on page 132 |
| Inrush current behavior for output channels | "Inrush current behavior for output channels - X20(c)SOx530" on page 122 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SOx530 - State of I/O channels " on page 136<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20(c)SOx530 - Pinouts" on page 145 |
| Output circuit diagram | "Relay - Output circuit diagram" on page 159 |
| UL certification information | "UL certification information" on page 97 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190 |
| Channel list | • "General channels" on page 195<br>• "Channels for modules with safe digital outputs" on page 196<br>• "Channels for modules with safe relay outputs" on page 197 |
| Connection examples | "Type relay output channels" on page 225 |
| Additional information | "Safe digital outputs" on page 221:<br>• "Type A relay output channels - Fault detection coverage" on page 245<br>• "Error interlock - State diagram" on page 248 |

# 3.5 X20SC0xxx

## Module overview

| Order number | Short description |
|---|---|
| X20SC0402 | X20 safe digital mixed module, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 2 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20SC0806 | X20 safe digital mixed module, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 6 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20SC0842 | X20 safe digital mixed module, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B2 digital outputs, 24 VDC, 50 mA, OSSD <500 µs |

## Module-specific information

X20SC0xxx modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20SC0xxx - Order data" on page 35 |
| Technical data | "X20SC0xxx - Technical data" on page 50 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20SC0xxx - Derating" on page 105 |
| Inrush current behavior for output channels | "X20SC0xxx - Inrush current behavior" on page 124 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20SC0xxx - State of I/O channels" on page 137<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20SC0xxx - Pinouts " on page 146 |
| Input circuit diagram | "X20SC0xxx - Input circuit diagram" on page 152 |
| Output circuit diagram | "Type A - Output circuit diagram" on page 156<br>"Type B of X20 modules - Output circuit diagram" on page 157 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186 |
| Channel list | • "General channels" on page 195<br>• "Channels for modules with safe digital inputs" on page 196<br>• "Channels for modules with safe digital outputs" on page 196 |
| Connection examples | "Type A input channels - Connection examples:" on page 255<br>• "Connecting single-channel sensors with contacts" on page 255<br>• "Connecting two-channel sensors with contacts" on page 256<br>• "Connecting multi-channel sensors with contacts" on page 257<br>• "Connecting electronic sensors" on page 258<br>• "Connecting DYNlink sensors in a loop" on page 259<br>• "Connecting DYNlink sensors - Possible connection error" on page 260<br>• "Connecting DYNlink sensors via connection block Tina 4A / Tina 8A" on page 261<br>• "Using the same pulse signals" on page 262<br>Type A output channels: "Connection of safety-related actuators" on page 223<br>Type B output channels: "Connection of safety-related actuators" on page 223 |

**Module-specific information**

| Module-specific information | Link |
|---|---|
| Additional information | "Safe digital inputs" on page 250:<br>• "Type A input channels - Fault detection coverage" on page 265<br>• "Filter" on page 251<br>• "PLCopen state diagrams "Antivalent" / "Equivalent"" on page 270<br>"Safe digital outputs" on page 221:<br>• "Type A output channels - Fault detection coverage" on page 244<br>• "Type B output channels - Fault detection coverage" on page 245<br>• "Module behavior when GND connection is lost" on page 229<br>• "Error interlock - State diagram" on page 248 |

# 3.6 X20(c)SC2212

## Module overview

| Order number | Short description |
|---|---|
| X20SC2212 | X20 safe digital mixed module, 6 safe type A digital inputs, configurable input filter, 6 pulse outputs, 24 VDC, 2 safe type B1 digital outputs, 24 VDC, 0.5 A, OSSD <500 µs |
| X20cSC2212 | X20 safe digital mixed module, coated, 6 safe type A digital inputs, configurable input filter, 6 pulse outputs, 24 VDC, 2 safe type B1 digital outputs, 24 VDC, 0.5 A, OSSD <500 µs |

## Module-specific information

X20(c)SC2212 modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SC2212 - Order data" on page 35 |
| Technical data | "X20(c)SC2212 - Technical data" on page 53 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SC2212 - Derating" on page 108 |
| Inrush current behavior for output channels | "Inrush current behavior for output channels - X20(c)SC2212" on page 126 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SC2212 - State of I/O channels" on page 137<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20SC2212 - Pinout" on page 146 |
| Input circuit diagram | "X20SC2212 - Input circuit diagram" on page 151 |
| Output circuit diagram | "Type B of X20 modules - Output circuit diagram" on page 157 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186 |
| Channel list | • "General channels" on page 195<br>• "Channels for modules with safe digital inputs" on page 196<br>• "Channels for modules with safe digital outputs" on page 196 |
| Connection examples | "Type A input channels" on page 255<br>• "Connecting single-channel sensors with contacts" on page 255<br>• "Connecting two-channel sensors with contacts" on page 256<br>• "Connecting multi-channel sensors with contacts" on page 257<br>• "Connecting electronic sensors" on page 258<br>• "Connecting DYNlink sensors in a loop" on page 259<br>• "Connecting DYNlink sensors - Possible connection error" on page 260<br>• "Connecting DYNlink sensors via connection block Tina 4A / Tina 8A" on page 261<br>• "Using the same pulse signals" on page 262<br>Type B output channels:<br>• "Connecting safety-related actuators" on page 223 |
| Additional information | "Safe digital inputs" on page 250:<br>• "Type A input channels - Fault detection coverage" on page 265<br>• "Filter" on page 251<br>• "PLCopen state diagrams "Antivalent" / "Equivalent"" on page 270<br>"Safe digital outputs" on page 221:<br>• "Type B output channels - Fault detection coverage" on page 245<br>• "Module behavior when GND connection is lost" on page 229<br>• "Error interlock - State diagram" on page 248 |

# 3.7 X20(c)SC2432

## Module overview

| Order number | Short description |
|---|---|
| X20SC2432 | X20 safe digital mixed module, 2 safe type A digital inputs, configurable input filter, 2 pulse outputs, 24 VDC, 2 relays with 1 normally open contact each, 48 VAC / 6 A, 24 VDC / 6 A |
| X20cSC2432 | X20 safe digital mixed module, coated, 2 safe type A digital inputs, configurable input filter, 2 pulse outputs, 24 VDC, 2 relays with 1 normally open contact each, 48 VAC / 6 A, 24 VDC / 6 A |

## Module-specific information

X20(c)SC2432 modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SC2432 - Order data" on page 36 |
| Technical data | "X20(c)SC2432 - Technical data" on page 56 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SC2432 - Derating" on page 109 |
| Contact service life of relay outputs | "X20(c)SC2432 - Contact service life for relay outputs" on page 131 |
| Load limit curve for direct current | "X20(c)SC2432 - Load limit curve for direct current" on page 132 |
| Inrush current behavior for output channels | "Inrush current behavior for output channels - X20(c)SC2432" on page 127 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SC2432 - State of I/O channels" on page 137<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20(c)SC2432 - Pinout" on page 147 |
| Input circuit diagram | "X20(c)SC2432 - Input circuit diagram" on page 151 |
| Output circuit diagram | "Relay - Output circuit diagram" on page 159 |
| UL certification information | "UL certification information" on page 97 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186 |
| Channel list | • "General channels" on page 195<br>• "Channels for modules with safe digital inputs" on page 196<br>• "Channels for modules with safe digital outputs" on page 196<br>• "Channels for modules with safe relay outputs" on page 197 |
| Connection examples | "Type A input channels" on page 255<br>• "Connecting single-channel sensors with contacts" on page 255<br>• "Connecting two-channel sensors with contacts" on page 256<br>• "Connecting multi-channel sensors with contacts" on page 257<br>• "Connecting electronic sensors" on page 258<br>• "Connecting DYNlink sensors in a loop" on page 259<br>• "Connecting DYNlink sensors - Possible connection error" on page 260<br>• "Connecting DYNlink sensors via connection block Tina 4A / Tina 8A" on page 261<br>• "Using the same pulse signals" on page 262<br>"Type relay output channels" on page 225 |
| Additional information | "Safe digital inputs" on page 250:<br>• "Type A input channels - Fault detection coverage" on page 265<br>• "Filter" on page 251<br>• "PLCopen state diagrams "Antivalent" / "Equivalent"" on page 270<br>"Safe digital outputs" on page 221:<br>• "Type A relay output channels - Fault detection coverage" on page 245<br>• "Error interlock - State diagram" on page 248 |

# 3.8 X20SLXxxx-1

## Module overview

| Order number | Short description |
|---|---|
| X20SLX806-1 | X20 SafeLOGIC-X controller (Safety+) 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 6 safe type B digital outputs, 24 VDC, 200 mA, OSSD <10 µs |
| X20SLX842-1 | X20 SafeLOGIC-X controller (Safety+) 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B digital outputs, 24 VDC, 50 mA, OSSD <500 µs |
| X20SLX411-1 | X20 SafeLOGIC-X controller (Safety+) 4 safe type A digital inputs, 4 pulse outputs, 24 VDC |
| X20SLX811-1 | X20 SafeLOGIC-X controller (Safety+) 8 safe type A digital inputs, 4 pulse outputs, 24 VDC |

## Module-specific information

X20(c)SLXxxx-1 modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20SLXxxx-1 - Order data" on page 36 |
| Technical data | "X20SLXxxx-1 - Technical data" on page 59 |
| Functionality | "X20SLXxxx-1 - Functionality" on page 61 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20SLXxxx-1 - Derating" on page 110 |
| Inrush current behavior for output channels | "X20SLXxxx-1 - Inrush current behavior for output channels" on page 124 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20SLXxxx-1 - State of I/O channels" on page 138<br>• "Operating and error states: Safety SE-LED - SafeLogic-X controller" on page 143 |
| Pinout | "X20SLXxxx-1 - Pinout" on page 147 |
| Input circuit diagram | "X20SLXxxx-1 - Input circuit diagram" on page 152 |
| Output circuit diagram | "Type A - Output circuit diagram" on page 156<br>"Type B of X20 modules - Output circuit diagram" on page 157 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 175<br>• "Group: General (Safety+)" on page 176<br>• "Group: Output signal path " on page 174<br>• "Group: SafeDesigner(+)-to-SafeLogic communication" on page 176<br>• "Group: CPU-to-SafeLogic communication" on page 176<br>• "Group: SafeLogic-to-CPU communication" on page 177<br>**Parameters in SafeDesigner+ of SafeLogic(-X) modules**<br>• "Group: Basic" on page 188<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186<br>**Parameters in SafeDesigner+: "Domain settings"**<br>• "Group: SpServer settings" on page 181<br>• "Group: Basic" on page 181 |
| Channel list | "X20 SafeLogic-X modules - Channel list" on page 200<br>• "General channels" on page 200<br>• "Channels for modules with safe digital inputs" on page 196<br>• "Channels for modules with safe digital outputs" on page 196<br>• "Communication channels - CPU to SafeLogic, SafeLogic to CPU" on page 201 |
| Connection examples | Type A input channels:<br>• "Connecting single-channel sensors with contacts" on page 255<br>• "Connecting two-channel sensors with contacts" on page 256<br>• "Connecting multi-channel sensors with contacts" on page 257<br>• "Connecting electronic sensors" on page 258<br>• "Connecting DYNlink sensors in a loop" on page 259<br>• "Connecting DYNlink sensors - Possible connection error" on page 260<br>• "Connecting DYNlink sensors via connection block Tina 4A / Tina 8A" on page 261<br>• "Using the same pulse signals" on page 262<br>Type A output channels: "Connection of safety-related actuators" on page 223<br>Type B output channels: "Connection of safety-related actuators" on page 223 |

**Module-specific information**

| Module-specific information | Link |
|---|---|
| Additional information | "Safe digital inputs" on page 250:<br>• "Type A input channels - Fault detection coverage" on page 265<br>• "Filter" on page 251<br>• "PLCopen state diagrams "Antivalent" / "Equivalent"" on page 270<br>"Safe digital outputs" on page 221:<br>• "Type A output channels - Fault detection coverage" on page 244<br>• "Type B output channels - Fault detection coverage" on page 245<br>• "Module behavior when GND connection is lost" on page 229<br>• "Error interlock - State diagram" on page 248 |
| Additional information for SafeLogic | "SafeLogic (Safety+)" on page 288 |

# 3.9 X20(c)SLXxxx

## Module overview

| Order number | Short description |
|---|---|
| X20SLX402 | X20 safe digital mixed module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 2 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20cSLX402 | X20 safe digital mixed module, coated, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 2 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20SLX806 | X20 safe digital mixed module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 6 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20SLX842 | X20 safe digital mixed module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B2 digital outputs, 24 VDC, 50 mA, OSSD <500 µs |
| X20SLX210 | X20 safe digital input module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 2 safe type A digital inputs, configurable input filter, 2 pulse outputs, 24 VDC |
| X20SLX410 | X20 safe digital input module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20cSLX410 | X20 safe digital input module, coated, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20SLX811 | X20 safe digital input module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, single-width |
| X20SLX910 | X20 safe digital input module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 20 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20cSLX910 | X20 safe digital input module, coated, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 20 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |

## Module-specific information

X20(c)SLXxxx modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SLXxxx - Order data" on page 37 |
| Technical data | "X20(c)SLXxxx - Technical data" on page 62 |
| Functionality | "X20(c)SLXxxx - Functionality" on page 67 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SLXxxx - Derating" on page 112 |
| Inrush current behavior for output channels | X20(c)SLXx0x and X20SLX842: "X20(c)SLXxxx - Inrush current behavior for output channels" on page 124 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SLXxxx - State of I/O channels" on page 139<br>• "Operating and error states: Safety SE-LED - SafeLogic-X controller" on page 143 |
| Pinout | "X20(c)SLXxxx - Pinout" on page 148 |
| Input circuit diagram | "X20(c)SLXx0x, X20SLX842 - Input circuit diagram" on page 152<br>"X20(c)SLXx1x - Input circuit diagram" on page 151 |
| Output circuit diagram | "Type A - Output circuit diagram" on page 156<br>"Type B of X20 modules - Output circuit diagram" on page 157 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 175<br>• "Group: General (mapp Safety)" on page 175<br>• "Group: Output signal path " on page 174<br>• "Group: SafeDesigner(+)-to-SafeLogic communication" on page 176<br>• "Group: CPU-to-SafeLogic communication" on page 176<br>• "Group: SafeLogic-to-CPU communication" on page 177<br>• "Group: SafeDomain-to-SafeDomain communication" on page 177<br>**Parameters in SafeDesigner - SafeLogic controller basic settings**<br>• "Group: Basic" on page 191<br>• "Group: Safety response time default values" on page 192<br>• "Group: Module configuration - For SafeLogic(-X) modules" on page 192<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186<br>**Parameters in SafeDesigner - Parameters of the Connected SafeDomain**<br>• "Group: Basic" on page 193<br>• "Group: Safety response time" on page 194 |

**Module-specific information**

| Module-specific information | Link |
|---|---|
| Channel list | "X20 SafeLogic-X modules - Channel list" on page 200<br>• "General channels" on page 200<br>• "Channels for modules with safe digital inputs" on page 196<br>• "Channels for modules with safe digital outputs" on page 196<br>• "Communication channels - CPU to SafeLogic, SafeLogic to CPU" on page 201<br>• "SafeDomain to SafeDomain communication channels" on page 202<br>• "Internal channels for Safe Commissioning Options" on page 202 |
| Connection examples | Type A input channels:<br>• "Connecting single-channel sensors with contacts" on page 255<br>• "Connecting two-channel sensors with contacts" on page 256<br>• "Connecting multi-channel sensors with contacts" on page 257<br>• "Connecting electronic sensors" on page 258<br>• "Connecting DYNlink sensors in a loop" on page 259<br>• "Connecting DYNlink sensors - Possible connection error" on page 260<br>• "Connecting DYNlink sensors via connection block Tina 4A / Tina 8A" on page 261<br>• "Using the same pulse signals" on page 262<br>Type A output channels: "Connection of safety-related actuators" on page 223<br>Type B output channels: "Connection of safety-related actuators" on page 223 |
| Additional information | "Safe digital inputs" on page 250:<br>• "Type A input channels - Fault detection coverage" on page 265<br>• "Filter" on page 251<br>• "PLCopen state diagrams "Antivalent" / "Equivalent"" on page 270<br>"Safe digital outputs" on page 221:<br>• "Type A output channels - Fault detection coverage" on page 244<br>• "Type B output channels - Fault detection coverage" on page 245<br>• "Module behavior when GND connection is lost" on page 229<br>• "Error interlock - State diagram" on page 248 |
| Additional information for SafeLogic | "SafeLogic controller (mapp Safety)" on page 289 |

# 3.10 X20(c)SL81xx

## Module overview

| Order number | Short description |
|---|---|
| X20SL8100 | X20 SafeLOGIC, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, controlled node, integrated 2-port hub, including power supply module, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| X20cSL8100 | X20 SafeLOGIC, coated, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, controlled node, integrated 2-port hub, including power supply module, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| X20SL8101 | X20 SafeLOGIC with X20 bus controller, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, controlled node, integrated 2-port hub, including power supply module for internal I/O power supply and X2X Link power supply, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| X20cSL8101 | X20 SafeLOGIC with X20 bus controller, coated, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, controlled node, integrated 2-port hub, including power supply module for internal I/O power supply and X2X Link power supply, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| X20SL8110 | X20 SafeLOGIC, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, 1 slot for X20 interface module, controlled node, integrated 2-port hub, including power supply module, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |

## Module-specific information

X20(c)SL81xx modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SL81xx - Order data" on page 38 |
| Technical data | "X20(c)SL81xx - Technical data" on page 69 |
| Functionality | "X20(c)SL81xx - Functionality" on page 71 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SL81xx - Derating" on page 115 |
| Operating and connection elements | "Operating and connection elements of X20(c)SL81xx modules" on page 162:<br>• "Safety processor" on page 162<br>• "Slot for application memory (SafeKEY)" on page 164<br>• "POWERLINK interface" on page 164<br>• "Integrated power supply unit" on page 167 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: POWERLINK parameters " on page 178<br>• "Group: Function model" on page 178<br>• "Group: General" on page 178<br>• "Group: SafeDESIGNER-to-SafeLogic communication" on page 179<br>• "Group: CPU-to-SafeLogic communication" on page 179<br>• "Group: SafeLogic-to-CPU communication" on page 179<br>• "Group: SafeDomain-to-SafeDomain communication" on page 180<br>• For X20SL8101: "Group: Power supply parameters (X20SL8101 only)" on page 180<br>**Parameters in SafeDesigner - SafeLogic controller basic settings**<br>• "Group: Basic" on page 191<br>• "Group: Safety response time default values" on page 192<br>• "Group: Module configuration - For SafeLogic(-X) modules" on page 192<br>**Parameters in SafeDesigner - Parameters of the Connected SafeDomain**<br>• "Group: Basic" on page 193<br>• "Group: Safety response time" on page 194 |
| Channel list | "X20SL81xx - Channel list" on page 203<br>For X20SL8101: "Power supply module (X20SL8101 only) - Channel list" on page 207 |

# 3.11 X20SP1130

## Module overview

| Order number | Short description |
|---|---|
| X20SP1130 | X20 power supply module, with integrated safe cutoff function, for internal I/O power supply, 24 VDC, 10 A, 1 safe type B1 digital output, 24 VDC, 10 A, without OSSD, note the list of permitted modules in the potential group |

## Module-specific information

Module X20SP1130 has the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20SP1130 - Order data" on page 38 |
| Technical data | "X20SP1130 - Technical data " on page 73 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20SP1130 - Derating" on page 116 |
| Inrush current behavior | "Inrush current behavior for output channels - X20SP1130" on page 128 |
| Switching inductive loads | "X20SP1130 - Switching inductive loads" on page 133 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20SP1130 - State of I/O channels" on page 139<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20SP1130 - Pinout" on page 149 |
| Output circuit diagram | "X20SP1130 - Output circuit diagram" on page 161 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190 |
| Channel list | • "General channels" on page 195<br>• "Channels for X20SP1130" on page 197 |
| Connection examples | "Type B output channels: Connection of safety-related actuators" on page 223 |
| Additional information | "Safe digital outputs" on page 221:<br>• "Type B output channels - Fault detection coverage" on page 245<br>• "Module behavior when GND connection is lost" on page 229<br>• "Error interlock - State diagram" on page 248<br>"Safe cutoff of a potential group" on page 238 |

# 3.12 X20(c)SA4430

## Module overview

| Order number | Short description |
|---|---|
| X20SA4430 | X20 safe current input module, 2x 2 safe type A analog inputs, 0.5 to 25 mA, channels individually galvanically isolated, configurable input filter and switching thresholds |
| X20cSA4430 | X20 safe current input module, coated, 2x 2 safe type A analog inputs, 0.5 to 25 mA, channels individually galvanically isolated, configurable input filter and switching thresholds |

## Module-specific information

X20(c)SA4430 modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SA4430 - Order data" on page 39 |
| Technical data | "X20(c)SA4430 - Technical data" on page 75 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SA4430 - Derating" on page 117 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SA4430 - State of I/O channels" on page 140<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20(c)SA4430 - Pinout" on page 149 |
| Input circuit diagram | "Input circuit diagram for X20(c)SA4430" on page 153 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - For modules with safe analog inputs" on page 184<br>• "Group: SafeCurrentxxyy - X20(c)SA4430" on page 186<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - For modules with safe analog inputs" on page 184<br>• "Group: SafeCurrentxxyy - X20(c)SA4430" on page 186 |
| Channel list | • "General channels" on page 195<br>• "Channels for X20(c)SA4430" on page 198 |
| Connection examples | "Type A input channels" on page 213 |
| Additional information | "Safe analog inputs" on page 211:<br>• "Type A input channels - Fault detection coverage" on page 218 |

# 3.13 X20ST4492

## Module overview

| Order number | Short description |
|---|---|
| X20ST4492 | X20 safe temperature input module, 2x 2 safe analog inputs for thermocouples, Type: J, K, N, S, R, C, T, resolution 0.1°C, 1x 2 safe analog inputs for PT100/PT1000 sensors, channel pairs galvanically isolated, integrated compensation of terminal temperature, integrated temperature sensor in terminal block X20TB5E, configurable input filter and switching thresholds |

## Module-specific information

Module X20ST4492 has the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20ST4492 - Order data" on page 39 |
| Technical data | "X20ST4492 - Technical data" on page 78 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20ST4492 - Derating" on page 117 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20ST4492 - State of I/O channels" on page 140<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20ST4492 - Pinout" on page 150 |
| Input circuit diagram | "Input circuit diagram for X20ST4492" on page 154 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - For modules with safe analog inputs" on page 184<br>• "Group: SafeTemperatureInputxx - X20ST4492" on page 187<br>• "Group: SafeTemperaturexxyy - X20ST4492" on page 187<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - For modules with safe analog inputs" on page 184<br>• "Group: SafeTemperatureInputxx - X20ST4492" on page 187<br>• "Group: SafeTemperaturexxyy - X20ST4492" on page 187 |
| Channel list | • "General channels" on page 195<br>• "Channels for X20ST4492" on page 198 |
| Connection examples | "Channel pair applications" on page 273 |
| Additional information | "Safe temperature measurement" on page 272:<br>• "Type Pt100 / Pt1000 safe inputs - Fault detection coverage" on page 275<br>• "Type thermocouple safe inputs - Fault detection coverage" on page 275 |

# 3.14 X20(c)SD1207

## Module overview

| Order number | Short description |
|---|---|
| X20SD1207 | X20 safe digital counter module, 1 safe type A digital counter channel, 7 kHz, 24 VDC |
| X20cSD1207 | X20 safe digital counter module, coated, 1 safe type A digital counter channel, 7 kHz, 24 VDC |

## Module-specific information

X20(c)SD1207 modules have the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X20(c)SD1207 - Order data" on page 39 |
| Technical data | "X20(c)SD1207 - Technical data" on page 81 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Derating | "X20(c)SD1207 - Derating" on page 118 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X20(c)SD1207 - State of I/O channels" on page 140<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Pinout | "X20(c)SD1207 - Pinout" on page 150 |
| Input circuit diagram | "Input circuit diagram for X20(c)SD1207" on page 155 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - X20(c)SD1207" on page 184<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - X20(c)SD1207" on page 184 |
| Channel list | • "General channels" on page 195<br>• "Channels for X20(c)SD1207" on page 199 |
| Connection examples | "Type A counter inputs" on page 278<br>• "Function mode A-A - Single-channel encoder" on page 278<br>• "Function mode A-A - Two-channel encoder" on page 279<br>• "Function mode A-B" on page 280<br>• "Function mode A-A/-B-B/" on page 281 |
| Additional information | "Safe counter function" on page 277:<br>• "Function mode A-A and A-B - Fault detection coverage" on page 286<br>• "Function mode A-A/B-B - Fault detection coverage" on page 287<br>• "Error acknowledgment - Fault detection coverage" on page 287 |

# 3.15 X67SI8103

## Module overview

| Order number | Short description |
|---|---|
| X67SI8103 | X67 safe digital input module, 2x M12 interface each with 2 safe type A digital inputs, configurable input filter and 2 pulse outputs, 24 VDC, 2x standardized 8-pin M12 device interface each with 1 digital input without safety function and 2 safe type A digital inputs, configurable input filter and 2 pulse outputs, 24 VDC and 1 digital output without safety function, 24 VDC, 0.6 A and 1 device power supply, 24 VDC, 2 A |

## Module-specific information

Module X67SI8103 has the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X67SI8103 - Order data" on page 40 |
| Technical data | "X67SI8103 - Technical data" on page 83 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Inrush current behavior for output channels | "X67SI8103 - Inrush current behavior for output channels" on page 129 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X67SI8103 - State of I/O channels" on page 141<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Connection elements | "Connection elements of the X67 modules" on page 169 |
| Input circuit diagram | "X67SI8103 - Input circuit diagram" on page 151<br>"Standard input without safety function for X67SI8103 - Input circuit diagram" on page 155 |
| Output circuit diagram | "Standard output without safety function for X67SI8103 - Output circuit diagram " on page 161 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186 |
| Channel list | Module X67SI8103 is equipped with the following channels:<br>• "General channels" on page 195<br>• "Channels for modules with safe digital inputs" on page 196<br>• "X67SI8103 - Output channels" on page 199 |
| Connection examples | The following connection examples can be used for module X67SI8103:<br>"Type A input channels - Connection examples" on page 255<br>• "Connecting single-channel sensors with contacts" on page 255<br>• "Connecting two-channel sensors with contacts" on page 256<br>• "Connecting multi-channel sensors with contacts" on page 257<br>• "Connecting electronic sensors" on page 258<br>• "Using the same pulse signals" on page 262 |
| Additional information | "Safe digital inputs" on page 250:<br>• "Type A input channels - Fault detection coverage" on page 265<br>• "Filter" on page 251<br>• "PLCopen state diagrams "Antivalent" / "Equivalent"" on page 270 |

# 3.16 X67SC4122.L12

## Module overview

| Order number | Short description |
|---|---|
| X67SC4122.L12 | X67 safe digital mixed module, 8 safe type A digital inputs, configurable input filter, 8 pulse outputs, 24 VDC, 4 safe type B1 digital outputs, 24 VDC, 2 A, OSSD <500 µs, M12 connectors, high-density module |

## Module-specific information

Module X67SC4122.L12 has the following module-specific information:

| Module-specific information | Link |
|---|---|
| Order data | "X67SC4122.L12 - Order data" on page 40 |
| Technical data | "X67SC4122.L12 - Technical data" on page 86 |
| Safety characteristics | "Safety characteristics" on page 89 |
| Inrush current behavior for output channels | "X67SC4122.L12 - Inrush current behavior for output channels" on page 130 |
| LED status indicators | • "Operating and error states of the r/e LEDs" on page 135<br>• "X67SC4122.L12 - State of I/O channels" on page 141<br>• "Operating and error states: Safety SE LED - SafeIOs" on page 142 |
| Connection elements | "Connection elements of the X67 modules" on page 169 |
| Input circuit diagram | "X67SC4122.L12 - Input circuit diagram" on page 151 |
| Parameter description | **Parameters in the I/O configuration**<br>• "Group: Function model" on page 173<br>• "Group: General " on page 173<br>• "Group: Output signal path " on page 174<br>**Parameters in SafeDesigner+**<br>• "Group: Basic" on page 182<br>• "Group: Safety_Response_Time" on page 182<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186<br>**Parameters in SafeDesigner**<br>• "Group: Basic " on page 189<br>• "Group: Safety response time" on page 190<br>• "Group: Module configuration - For modules with safe digital outputs" on page 183<br>• "Group: SafeDigitalInputxx" on page 185<br>• "Group: PulseOutput" on page 186 |
| Channel list | Module X67SC4122.L12 is equipped with the following channels:<br>• "General channels" on page 195<br>• "Channels for modules with safe digital inputs" on page 196<br>• "Channels for modules with safe digital outputs" on page 196 |
| Connection examples | The following connection examples can be used for module X67SC4122.L12:<br>"Type A input channels - Connection examples" on page 255<br>• "Connecting single-channel sensors with contacts" on page 255<br>• "Connecting two-channel sensors with contacts" on page 256<br>• "Connecting multi-channel sensors with contacts" on page 257<br>• "Connecting electronic sensors" on page 258<br>• "Using the same pulse signals" on page 262<br>Type B output channels: "Connection of safety-related actuators" on page 223 |
| Additional information | "Safe digital inputs" on page 250:<br>• "Type A input channels - Fault detection coverage" on page 265<br>• "Filter" on page 251<br>• "PLCopen state diagrams "Antivalent" / "Equivalent"" on page 270<br>"Safe digital outputs" on page 221:<br>• "Type B output channels - Fault detection coverage" on page 245<br>• "Module behavior when GND connection is lost" on page 229<br>• "Error interlock - State diagram" on page 248 |

# 4 Order data

## 4.1 X20(c)SIx1x0 - Order data


X20SI2100 / X20SI4100


X20SI4110 / X20SI8110


X20SI9100

| Order number | Short description |
|---|---|
| | **Digital input modules** |
| X20SI2100 | X20 safe digital input module, 2 safe type A digital inputs, configurable input filter, 2 pulse outputs, 24 VDC |
| X20SI4100 | X20 safe digital input module, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20cSI4100 | X20 safe digital input module, coated, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20SI4110 | X20 safe digital input module, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, single-width |
| X20SI8110 | X20 safe digital input module, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, single-width |
| X20SI9100 | X20 safe digital input module, 20 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20cSI9100 | X20 safe digital input module, coated, 20 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| | **Required accessories** |
| | **Bus modules** |
| X20BM13 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through, single-width |
| X20BM16 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through, single-width |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through |
| | **Terminal blocks** |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed |

Table 1: X20SI2100, X20SI4100, X20cSI4100, X20SI4110, X20SI8110, X20SI9100, X20cSI9100 - Order data

For additional module-specific information, see "X20(c)SIx1x0" on page 13.

## 4.2 X20(c)SO6300 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Digital output modules** |  |
| X20SO6300 | X20 safe digital output module, 6 safe type B1 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs | |
| X20cSO6300 | X20 safe digital output module, coated, 6 safe type B1 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs | |
| | **Required accessories** | |
| | **Bus modules** | |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through | |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through | |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through | |
| | **Terminal blocks** | |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed | |

Table 2: X20SO6300, X20cSO6300 - Order data

For additional module-specific information, see "X20(c)SO6300" on page 14.

## 4.3 X20(c)SOx1x0 - Order data

X20SO21x0

X20SO41x0

| Order number | Short description |
|---|---|
| | **Digital output modules** |
| X20SO2110 | X20 safe digital output module, 2 safe type A digital outputs, with current monitoring, 24 VDC, 0.5 A, OSSD <500 µs |
| X20SO2120 | X20 safe digital output module, 2 safe type A digital outputs, with current monitoring, 24 VDC, 2 A, OSSD <500 µs |
| X20SO4110 | X20 safe digital output module, 4 safe type A digital outputs, with current monitoring, 24 VDC, 0.5 A, OSSD <500 µs |
| X20cSO4110 | X20 safe digital output module, coated, 4 safe type A digital outputs, with current monitoring, 24 VDC, 0.5 A, OSSD <500 µs |
| X20SO4120 | X20 safe digital output module, 4 safe type A digital outputs, with current monitoring, 24 VDC, 2 A, OSSD <500 µs |
| X20cSO4120 | X20 safe digital output module, coated, 4 safe type A digital outputs, with current monitoring, 24 VDC, 2 A, OSSD <500 µs |
| | **Required accessories** |
| | **Bus modules** |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through |
| | **Terminal blocks** |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed |

Table 3: X20SO2110, X20SO2120, X20SO4110, X20cSO4110, X20SO4120, X20cSO4120 - Order data

For additional module-specific information, see "X20(c)SOx1x0" on page 15.

## 4.4 X20(c)SOx530 - Order data

X20SO2530

X20SO6530

| Order number | Short description |
|---|---|
| | **Digital output modules** |
| X20SO2530 | X20 safe digital output module, 2 relays with 1 normally open contact each, 230 VAC / 6 A, 24 VDC / 6 A |
| X20cSO2530 | X20 safe digital output module, coated, 2 relays with 1 normally open contact each, 230 VAC / 6 A, 24 VDC / 6 A |
| X20SO6530 | X20 safe digital output module, 6 relays with 1 normally open contact each, 230 VAC / 6 A, 24 VDC / 6 A |
| | **Required accessories** |
| | **Bus modules** |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through |
| | **Terminal blocks** |
| X20TB72 | X20 terminal block, 12-pin, safety-keyed, 240 VAC, red |

Table 4: X20SO2530, X20cSO2530, X20SO6530 - Order data

For additional module-specific information, see "X20(c)SOx530" on page 16.

## 4.5 X20SC0xxx - Order data


X20SC0402


X20SC0806


X20SC0842

| Order number | Short description |
|---|---|
| | **Digital mixed modules** |
| X20SC0402 | X20 safe digital mixed module, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 2 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20SC0806 | X20 safe digital mixed module, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 6 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20SC0842 | X20 safe digital mixed module, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B2 digital outputs, 24 VDC, 50 mA, OSSD <500 µs |
| | **Required accessories** |
| | **Bus modules** |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through |
| | **Terminal blocks** |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed |

Table 5: X20SC0402, X20SC0806, X20SC0842 - Order data

For additional module-specific information, see "X20SC0xxx" on page 17.

## 4.6 X20(c)SC2212 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Digital mixed modules** |  |
| X20SC2212 | X20 safe digital mixed module, 6 safe type A digital inputs, configurable input filter, 6 pulse outputs, 24 VDC, 2 safe type B1 digital outputs, 24 VDC, 0.5 A, OSSD <500 µs | |
| X20cSC2212 | X20 safe digital mixed module, coated, 6 safe type A digital inputs, configurable input filter, 6 pulse outputs, 24 VDC, 2 safe type B1 digital outputs, 24 VDC, 0.5 A, OSSD <500 µs | |
| | **Required accessories** | |
| | **Bus modules** | |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through | |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through | |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through | |
| | **Terminal blocks** | |
| X20TB5F | X20 terminal block, 16-pin, safety-keyed | |

Table 6: X20SC2212, X20cSC2212 - Order data

For additional module-specific information, see "X20(c)SC2212" on page 19.

## 4.7 X20(c)SC2432 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Digital mixed modules** |  |
| X20SC2432 | X20 safe digital mixed module, 2 safe type A digital inputs, configurable input filter, 2 pulse outputs, 24 VDC, 2 relays with 1 normally open contact each, 48 VAC / 6 A, 24 VDC / 6 A | |
| X20cSC2432 | X20 safe digital mixed module, coated, 2 safe type A digital inputs, configurable input filter, 2 pulse outputs, 24 VDC, 2 relays with 1 normally open contact each, 48 VAC / 6 A, 24 VDC / 6 A | |
| | **Required accessories** | |
| | **Bus modules** | |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through | |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through | |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through | |
| | **Terminal blocks** | |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed | |

Table 7: X20SC2432, X20cSC2432 - Order data

For additional module-specific information, see "X20(c)SC2432" on page 20.

## 4.8 X20SLXxxx-1 - Order data

X20SLX806-1

X20SLX842-1

X20SLX411-1

X20SLX811-1

| Order number | Short description |
|---|---|
| | **Intelligent programmable modules** |
| X20SLX806-1 | X20 SafeLOGIC-X controller (Safety+) 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 6 safe type B digital outputs, 24 VDC, 200 mA, OSSD <10 µs |
| X20SLX842-1 | X20 SafeLOGIC-X controller (Safety+) 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B digital outputs, 24 VDC, 50 mA, OSSD <500 µs |
| X20SLX411-1 | X20 SafeLOGIC-X controller (Safety+) 4 safe type A digital inputs, 4 pulse outputs, 24 VDC |
| X20SLX811-1 | X20 SafeLOGIC-X controller (Safety+) 8 safe type A digital inputs, 4 pulse outputs, 24 VDC |
| | **Required accessories** |
| | **Bus modules** |
| X20BM13 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through, single-width |
| X20BM16 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through, single-width |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through |
| | **Terminal blocks** |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed |

Table 8: X20SLX806-1, X20SLX842-1, X20SLX411-1, X20SLX811-1 - Order data

For additional module-specific information, see "X20SLXxxx-1" on page 21.

# 4.9 X20(c)SLXxxx - Order data

| Order number | Short description |
|---|---|
| | **Intelligent programmable modules** |
| X20SLX402 | X20 safe digital mixed module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 2 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20cSLX402 | X20 safe digital mixed module, coated, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 2 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20SLX806 | X20 safe digital mixed module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 6 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs |
| X20SLX842 | X20 safe digital mixed module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B2 digital outputs, 24 VDC, 50 mA, OSSD <500 µs |
| X20SLX210 | X20 safe digital input module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 2 safe type A digital inputs, configurable input filter, 2 pulse outputs, 24 VDC |
| X20SLX410 | X20 safe digital input module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20cSLX410 | X20 safe digital input module, coated, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 4 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20SLX811 | X20 safe digital input module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 8 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, single-width |
| X20SLX910 | X20 safe digital input module, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 20 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| X20cSLX910 | X20 safe digital input module, coated, safety controller, openSAFETY, 10 openSAFETY nodes, 4 SafeMOTION axes, 20 safe type A digital inputs, configurable input filter, 4 pulse outputs, 24 VDC |
| | **Required accessories** |
| | **Bus modules** |
| X20BM13 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through, single-width |
| X20BM16 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through, single-width |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through |
| | **Terminal blocks** |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed |

Table 9: X20SLX402, X20cSLX402, X20SLX806, X20SLX842, X20SLX210, X20SLX410, X20cSLX410, X20SLX811, X20SLX910, X20cSLX910 - Order data

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

## 4.10 X20(c)SL81xx - Order data

X20SL8100

X20SL8101

X20SL8110

| Order number | Short description |
|---|---|
| | **CPUs** |
| X20SL8100 | X20 SafeLOGIC, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, controlled node, integrated 2-port hub, including power supply module, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| X20cSL8100 | X20 SafeLOGIC, coated, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, controlled node, integrated 2-port hub, including power supply module, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| X20SL8101 | X20 SafeLOGIC with X20 bus controller, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, controlled node, integrated 2-port hub, including power supply module for internal I/O power supply and X2X Link power supply, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| X20cSL8101 | X20 SafeLOGIC with X20 bus controller, coated, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, controlled node, integrated 2-port hub, including power supply module for internal I/O power supply and X2X Link power supply, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| X20SL8110 | X20 SafeLOGIC, safety controller, openSAFETY gateway, removable application memory: SafeKEY, 1 POWERLINK interface, 1 slot for X20 interface module, controlled node, integrated 2-port hub, including power supply module, 1x terminal block X20TB52 and X20 end cover plate X20AC0SR1 (right) included, order SafeKEY and SafeLOGIC range of functions using the X20MK configurator! |
| | **Required accessories** |
| | **Accessories** |
| X20MK0223 | X20 SafeKEY, 8 MB, for the X20SL81xx series, exclusively for mapp Safety, range of license functions determined via a package-based licensing model or via Technology Guarding in Automation Runtime |

Table 10: X20SL8100, X20cSL8100, X20SL8101, X20cSL8101, X20SL8110 - Order data

For additional module-specific information, see "X20(c)SL81xx" on page 25.

## 4.11 X20SP1130 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Power supply modules** |  |
| X20SP1130 | X20 power supply module, with integrated safe cutoff function, for internal I/O power supply, 24 VDC, 10 A, 1 safe type B1 digital output, 24 VDC, 10 A, without OSSD, note the list of permitted modules in the potential group | |
| | **Required accessories** | |
| | **Bus modules** | |
| X20BM23 | X20 power supply bus module, for X20 SafeIO power supply modules, internal I/O power supply interrupted to the left | |
| X20BM26 | X20 power supply bus module, for X20 SafeIO power supply modules, with node number switch, internal I/O power supply interrupted to the left | |
| | **Terminal blocks** | |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed | |

Table 11: X20SP1130 - Order data

For additional module-specific information, see "X20SP1130" on page 26.

## 4.12 X20(c)SA4430 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Analog input modules** |  |
| X20SA4430 | X20 safe current input module, 2x 2 safe type A analog inputs, 0.5 to 25 mA, channels individually galvanically isolated, configurable input filter and switching thresholds | |
| X20cSA4430 | X20 safe current input module, coated, 2x 2 safe type A analog inputs, 0.5 to 25 mA, channels individually galvanically isolated, configurable input filter and switching thresholds | |
| | **Required accessories** | |
| | **Bus modules** | |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through | |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through | |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through | |
| | **Terminal blocks** | |
| X20TB5F | X20 terminal block, 16-pin, safety-keyed | |

Table 12: X20SA4430, X20cSA4430 - Order data

For additional module-specific information, see "X20(c)SA4430" on page 27.

## 4.13 X20ST4492 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Analog input modules** |  |
| X20ST4492 | X20 safe temperature input module, 2x 2 safe analog inputs for thermocouples, Type: J, K, N, S, R, C, T, resolution 0.1°C, 1x 2 safe analog inputs for PT100/PT1000 sensors, channel pairs galvanically isolated, integrated compensation of terminal temperature, integrated temperature sensor in terminal block X20TB5E, configurable input filter and switching thresholds | |
| | **Required accessories** | |
| | **Bus modules** | |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through | |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through | |
| | **Terminal blocks** | |
| X20TB5E | X20 terminal block, 16-pin, safety-keyed, 2x Pt1000 integrated for terminal temperature compensation | |
| X20TB5F | X20 terminal block, 16-pin, safety-keyed | |

Table 13: X20ST4492 - Order data

For additional module-specific information, see "X20ST4492" on page 28.

## 4.14 X20(c)SD1207 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Counter and positioning modules** |  |
| X20SD1207 | X20 safe digital counter module, 1 safe type A digital counter channel, 7 kHz, 24 VDC | |
| X20cSD1207 | X20 safe digital counter module, coated, 1 safe type A digital counter channel, 7 kHz, 24 VDC | |
| | **Required accessories** | |
| | **Bus modules** | |
| X20BM33 | X20 bus module, for X20 SafeIO modules, internal I/O power supply connected through | |
| X20BM36 | X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply connected through | |
| X20cBM33 | X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply connected through | |
| | **Terminal blocks** | |
| X20TB52 | X20 terminal block, 12-pin, safety-keyed | |

Table 14: X20SD1207, X20cSD1207 - Order data

For additional module-specific information, see "X20(c)SD1207" on page 29.

## 4.15 X67SI8103 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Digital input modules** | |
| X67SI8103 | X67 safe digital input module, 2x M12 interface each with 2 safe type A digital inputs, configurable input filter and 2 pulse outputs, 24 VDC, 2x standardized 8-pin M12 device interface each with 1 digital input without safety function and 2 safe type A digital inputs, configurable input filter and 2 pulse outputs, 24 VDC and 1 digital output without safety function, 24 VDC, 0.6 A and 1 device power supply, 24 VDC, 2 A |  |

Table 15: X67SI8103 - Order data

| Required accessories: |
|---|
| For an overview of wiring X67 modules and associated order numbers for cables, see the module's download section on the B&R website (www.br-automation.com). |

For additional module-specific information, see "X67SI8103" on page 30.

## 4.16 X67SC4122.L12 - Order data

| Order number | Short description | Figure |
|---|---|---|
| | **Digital mixed modules** | |
| X67SC4122.L12 | X67 safe digital mixed module, 8 safe type A digital inputs, configurable input filter, 8 pulse outputs, 24 VDC, 4 safe type B1 digital outputs, 24 VDC, 2 A, OSSD <500 µs, M12 connectors, high-density module |  |

Table 16: X67SC4122.L12 - Order data

| Required accessories: |
|---|
| For an overview of wiring X67 modules and associated order numbers for cables, see the module's download section on the B&R website (www.br-automation.com). |

For additional module-specific information, see "X67SC4122.L12" on page 31.

# 5 Technical data

## 5.1 X20(c)SIx1x0 - Technical data

| Order number | X20SI2100 | X20SI4100 | X20cSI4100 | X20SI4110 | X20SI8110 | X20SI9100 | X20cSI9100 |
|---|---|---|---|---|---|---|---|
| **Short description** | | | | | | | |
| I/O module | 2 safe type A digital inputs, 2 pulse outputs, 24 VDC | 4 safe type A digital inputs, 4 pulse outputs, 24 VDC | | | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC | 20 safe type A digital inputs, 4 pulse outputs, 24 VDC | |
| **General information** | | | | | | | |
| B&R ID code | 0x1F15 | 0x1DBD | 0xDD5A | 0x2D13 | 0xE742 | 0xAEC8 | 0xDD5B |
| Status indicators | I/O function per channel, operating state, module status | | | | | | |
| Diagnostics | | | | | | | |
| Module run/error | Yes, using LED status indicator and software | | | | | | |
| Inputs | Yes, using LED status indicator and software | | | | | | |
| Blackout mode | | | | | | | |
| Scope | Module | | | | | | |
| Function | Module functionality | | | | | | |
| Standalone mode | No | | | | | | |
| Power consumption | | | | | | | |
| Bus | 0.25 W | 0.32 W | | 0.4 W | | | |
| Internal I/O | 1 W | 1.25 W | | 2.5 W | | 1.6 W | |
| Additional power dissipation caused by actuators (resistive) [W] [1] | 0.3 | 0.6 | | 0.8 | | 0.6 | |
| Electrical isolation | | | | | | | |
| Channel - Bus | Yes | | | | | | |
| Channel - Channel | No | | | | | | |
| Certifications | | | | | | | |
| CE | Yes | | | | | | |
| UKCA | Yes | | | | | | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | | | - | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | | | | | | |
| Functional safety | EN 50156-1:2004 | | | - | EN 50156-1:2004 | | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | | | | | | |
| UL | cULus E115267<br>Industrial control equipment | | | | | | |
| HazLoc | cCSAus 244665<br>Process control equipment for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | | | - | | cCSAus 244665<br>Process control equipment for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | | | - | | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | |
| CCS | Yes | | - | | | Yes | - |
| LR | ENV1 | | | - | | ENV1 | |
| KR | Yes | | | - | | Yes | |
| ABS | Yes | | | - | | Yes | |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | | | - | | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | |
| KC | Yes | | - | | | Yes | - |
| **Safety characteristics** | | | | | | | |
| Note | See section "Safety characteristics". | | | | | | |
| **I/O power supply** | | | | | | | |
| Nominal voltage | 24 VDC | | | | | | |
| Voltage range | 24 VDC -15% / +20% | | | | | | |
| Integrated protective function | Reverse polarity protection | | | | | | |

Table 17: X20SI2100, X20SI4100, X20cSI4100, X20SI4110, X20SI8110, X20SI9100, X20cSI9100 - Technical data

## Technical data

| Order number | X20SI2100 | X20SI4100 | X20cSI4100 | X20SI4110 | X20SI8110 | X20SI9100 | X20cSI9100 |
|---|---|---|---|---|---|---|---|
| **Safe digital inputs** | | | | | | | |
| Quantity | 2 | 4 | | | 8 | 20 | |
| Variant | Type A | | | | | | |
| Nominal voltage | 24 VDC | | | | | | |
| Input characteristics per EN 61131-2 | Type 1 | | | | | | |
| Input filter | | | | | | | |
| Hardware | ≤150 µs | | | | | | |
| Software | Configurable between 0 and 500 ms | | | | | | |
| Input circuit | Sink | | | | | | |
| Input voltage | 24 VDC -15% / +20% | | | | | | |
| Input current at 24 VDC [2] | Min. 2 mA to max. 4.59 mA. Hardware revision J0 and later: Min. 2 mA to max. 3.28 mA. | | | Min. 2 mA to max. 3.28 mA | | | |
| Input resistance | Min. 5.23 kΩ, hardware revision J0 and later: Min. 7.33 kΩ | | | Min. 7.33 kΩ | | | |
| Error detection time | 100 ms | | | | | 200 ms | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | | | | | |
| Switching threshold | | | | | | | |
| Low | <5 VDC | | | | | | |
| High | >15 VDC | | | | | | |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line | | | | | | |
| **Pulse outputs** | | | | | | | |
| Quantity | 2 | 4 | | | | | |
| Variant | Push-Pull | | | | | | |
| Nominal output current | 100 mA, hardware revision J0 and later: 50 mA | | | 50 mA | | | |
| Output protection | Thermal shutdown of all channels in the event of overload or short circuit, hardware revision J0 and later: Shutdown of individual channels in the event of overload or short circuit [3] | | | Shutdown of individual channels in the event of overload or short circuit [3] | | | |
| Peak short-circuit current | 300 mA, hardware revision J0 and later: 25 A for 15 µs | | | 0.5 A for 120 µs | | 25 A for 5 ms, hardware revision D0 and later: 25 A for 15 µs | |
| Short-circuit current | 100 $mA_{eff}$ | | | 15 $mA_{eff}$ | | 100 $mA_{eff}$ | |
| Leakage current when the output is switched off | 0.1 mA | | | | | | |
| $R_{DS(on)}$ | 60 Ω | | | 80 Ω | | 60 Ω | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | | | | | |
| Total nominal current | 200 mA, hardware revision J0 and later: 100 mA | 400 mA, hardware revision J0 and later: 200 mA | | 200 mA | | | |
| **Operating conditions** | | | | | | | |
| Mounting orientation | | | | | | | |
| Horizontal | Yes | | | | | | |
| Vertical | Yes | | | | | | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | | | | | | |
| Degree of protection per EN 60529 | IP20 | | | | | | |
| **Ambient conditions** | | | | | | | |
| Temperature | | | | | | | |
| Operation | | | | | | | |
| Horizontal mounting orientation | 0 to 60°C | | -25 to 60°C | 0 to 60°C | | | -25 to 60°C |
| Vertical mounting orientation | 0 to 50°C | | -25 to 50°C | 0 to 50°C | | | -25 to 50°C |
| Derating | See section "Derating". | | | | | | |
| Starting temperature | - | | Yes, -40°C | - | | | Yes, -40°C |
| Storage | -40 to 85°C | | | | | | |
| Transport | -40 to 85°C | | | | | | |

Table 17: X20SI2100, X20SI4100, X20cSI4100, X20SI4110, X20SI8110, X20SI9100, X20cSI9100 - Technical data

| Order number | X20SI2100 | X20SI4100 | X20cSI4100 | X20SI4110 | X20SI8110 | X20SI9100 | X20cSI9100 |
|---|---|---|---|---|---|---|---|
| Relative humidity | | | | | | | |
| Operation | 5 to 95%, non-condensing | | Up to 100%, condensing | 5 to 95%, non-condensing | | | Up to 100%, condensing |
| Storage | 5 to 95%, non-condensing | | | | | | |
| Transport | 5 to 95%, non-condensing | | | | | | |
| **Mechanical properties** | | | | | | | |
| Note | Order 1x safety-keyed terminal block separately. Order 1x safety-keyed bus module separately. | | | Order 1x safety-keyed terminal block separately. Order 1x safety-keyed bus module (single-width) separately. | | Order 2x safety-keyed terminal block separately. Order 1x safety-keyed bus module separately. | |
| Pitch | $25^{+0.2}$ mm | | | $12.5^{+0.2}$ mm | | $25^{+0.2}$ mm | |

Table 17: X20SI2100, X20SI4100, X20cSI4100, X20SI4110, X20SI8110, X20SI9100, X20cSI9100 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) The input current specifications refer to the switched-on state of the input.
3) The protective function is provided for max. 30 minutes for a continuous short circuit.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SIx1x0" on page 13.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SIx1x0 - Derating" on page 99

# 5.2 X20(c)SO6300 - Technical data

| Order number | X20SO6300 | X20cSO6300 |
|---|---|---|
| **Short description** | | |
| I/O module | 6 safe type B1 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs | |
| **General information** | | |
| B&R ID code | 0xB815 | 0xDD88 |
| Status indicators | I/O function per channel, operating state, module status | |
| Diagnostics | | |
| Module run/error | Yes, using LED status indicator and software | |
| Outputs | Yes, using LED status indicator and software | |
| Blackout mode | | |
| Scope | Module | |
| Function | Module functionality | |
| Standalone mode | No | |
| Power consumption | | |
| Bus | 0.32 W | |
| Internal I/O | 1.4 W | |
| Additional power dissipation caused by actuators (resistive) [W] [1)] | 1.128 | |
| Electrical isolation | | |
| Channel - Bus | Yes | |
| Channel - Channel | No | |
| Certifications | | |
| CE | Yes | |
| UKCA | Yes | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | |
| Functional safety | EN 50156-1:2004 | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | |
| UL | cULus E115267<br>Industrial control equipment | |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | |
| KC | Yes | - |
| **Safety characteristics** | | |
| Note | See section "Safety characteristics". | |
| **I/O power supply** | | |
| Nominal voltage | 24 VDC | |
| Voltage range | 24 VDC -15% / +20% | |
| Integrated protective function | Reverse polarity protection | |
| **Safe digital outputs** | | |
| Quantity | 6 | |
| Variant | FET, 2x positive switching, type B1, output level readable | |
| Nominal voltage | 24 VDC | |
| Nominal output current | 0.2 A | |
| Total nominal current | 1.2 A | |
| Output protection | See section "Inrush current behavior for output channels". | |
| Braking voltage when switching off inductive loads | Max. 45 VDC | |
| Error detection time | 1 s | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | |
| Peak short-circuit current | See section "Inrush current behavior for output channels". | |
| Leakage current when the output is switched off | <100 µA | |
| $R_{DS(on)}$ | 4.7 Ω | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | |
| Max. switching frequency | See section "Inrush current behavior for output channels". | |
| Test pulse length | Max. 10 µs | |
| Max. capacitive load | 100 nF | |
| **Current on loss of ground** | | |
| $I_{OUT}$ | <100 µA | |
| $I_{GND}$ | <70 mA | |

Table 18: X20SO6300, X20cSO6300 - Technical data

| Order number | X20SO6300 | X20cSO6300 |
|---|---|---|
| **Operating conditions** | | |
| Mounting orientation | | |
| Horizontal | Yes | |
| Vertical | Yes | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | |
| Degree of protection per EN 60529 | IP20 | |
| **Ambient conditions** | | |
| Temperature | | |
| Operation | | |
| Horizontal mounting orientation | 0 to 60°C | -25 to 60°C |
| Vertical mounting orientation | 0 to 50°C | -25 to 50°C |
| Derating | See section "Derating". | |
| Starting temperature | - | Yes, -25°C |
| Storage | -40 to 85°C | |
| Transport | -40 to 85°C | |
| Relative humidity | | |
| Operation | 5 to 95%, non-condensing | Up to 100%, condensing |
| Storage | 5 to 95%, non-condensing | |
| Transport | 5 to 95%, non-condensing | |
| **Mechanical properties** | | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | |
| Pitch | $25^{+0.2}$ mm | |

Table 18: X20SO6300, X20cSO6300 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current². For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SO6300" on page 14.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SO6300 - Derating" on page 101
- "Inrush current behavior for output channels - X20(c)SO6300" on page 119

# 5.3 X20(c)SOx1x0 - Technical data

| Order number | X20SO2110 | X20SO2120 | X20SO4110 | X20cSO4110 | X20SO4120 | X20cSO4120 |
|---|---|---|---|---|---|---|
| **Short description** | | | | | | |
| I/O module | 2 safe type A digital outputs, with current monitoring, 24 VDC, 0.5 A, OSSD <500 µs | 2 safe type A digital outputs, with current monitoring, 24 VDC, 2 A, OSSD <500 µs | 4 safe type A digital outputs, with current monitoring, 24 VDC, 0.5 A, OSSD <500 µs | | 4 safe type A digital outputs, with current monitoring, 24 VDC, 2 A, OSSD <500 µs | |
| **General information** | | | | | | |
| B&R ID code | 0x1F16 | 0x2009 | 0x1DBE | 0xDD84 | 0x2007 | 0xDD5C |
| Status indicators | I/O function per channel, operating state, module status | | | | | |
| Diagnostics | | | | | | |
| Module run/error | Yes, using LED status indicator and software | | | | | |
| Outputs | Yes, using LED status indicator and software | | | | | |
| Blackout mode | | | | | | |
| Scope | Module | | | | | |
| Function | Module functionality | | | | | |
| Standalone mode | No | | | | | |
| Power consumption | | | | | | |
| Bus | 0.25 W | | | | | |
| Internal I/O | 0.98 W | | 1.3 W | | | |
| Additional power dissipation caused by actuators (resistive) [W] [1] | 0.12 | 1.92 | 0.24 | | 2.16 | |
| Electrical isolation | | | | | | |
| Channel - Bus | Yes | | | | | |
| Channel - Channel | No | | | | | |
| Certifications | | | | | | |
| CE | Yes | | | | | |
| UKCA | Yes | | | | | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | | | | | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | | | | | |
| Functional safety | EN 50156-1:2004 | | | | | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | | | | | |
| UL | cULus E115267<br>Industrial control equipment | | | | | |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | | | | | |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | | | | | |
| CCS | | Yes | | - | Yes | - |
| LR | ENV1 | | | | | |
| KR | Yes | | | | | |
| ABS | Yes | | | | | |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | | | | | |
| KC | | Yes | | - | Yes | - |
| **Safety characteristics** | | | | | | |
| Note | See section "Safety characteristics". | | | | | |
| **I/O power supply** | | | | | | |
| Nominal voltage | 24 VDC | | | | | |
| Voltage range | 24 VDC -15% / +20% | | | | | |
| Integrated protective function | Reverse polarity protection | | | | | |
| **Safe digital outputs** | | | | | | |
| Quantity | 2 | | 4 | | | |
| Variant | FET, 1x positive switching, 1x negative switching, type A, output level readable, open-circuit detection | | | | | |
| Nominal voltage | 24 VDC | | | | | |
| Nominal output current | 0.5 A | 2 A | 0.5 A | | 2 A | |
| Total nominal current | 1 A | 4 A | 2 A | | 5 A | |
| Output protection | See section "Inrush current behavior for output channels". | | | | | |
| Braking voltage when switching off inductive loads | Max. 90 VDC [2] | | | | | |

Table 19: X20SO2110, X20SO2120, X20SO4110, X20cSO4110, X20SO4120, X20cSO4120 - Technical data

| Order number | X20SO2110 | X20SO2120 | X20SO4110 | X20cSO4110 | X20SO4120 | X20cSO4120 |
|---|---|---|---|---|---|---|
| Open-circuit detection | Via internal current measurement,<br>output current <10 mA: Signal "CurrentOK" = FALSE,<br>output current 10 to 50 mA: Signal "CurrentOK" = Undefined,<br>output current >50 mA: Signal "CurrentOK" = TRUE | | | | | |
| Error detection time | 1 s | | | | | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | | | | |
| Peak short-circuit current | See section "Inrush current behavior for output channels". | | | | | |
| Leakage current when the output is switched off | <10 µA | | | | | |
| $R_{DS(on)}$ | 240 mΩ | | | | | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | | | | |
| Max. switching frequency | See section "Inrush current behavior for output channels". | | | | | |
| Test pulse length | Max. 500 µs | | | | | |
| Time between two test pulses | Min. 49.5 ms | | | | | |
| Max. capacitive load | 100 nF | | | | | |
| **Operating conditions** | | | | | | |
| Mounting orientation | | | | | | |
| Horizontal | Yes | | | | | |
| Vertical | Yes | | | | | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | | | | | |
| Degree of protection per EN 60529 | IP20 | | | | | |
| **Ambient conditions** | | | | | | |
| Temperature | | | | | | |
| Operation | | | | | | |
| Horizontal mounting orientation | 0 to 60°C | | | -25 to 60°C | 0 to 60°C | -25 to 60°C |
| Vertical mounting orientation | 0 to 50°C | | | -25 to 50°C | 0 to 50°C | -25 to 50°C |
| Derating | See section "Derating". | | | | | |
| Starting temperature | - | | | Yes, -40°C | - | Yes, -40°C |
| Storage | -40 to 85°C | | | | | |
| Transport | -40 to 85°C | | | | | |
| Relative humidity | | | | | | |
| Operation | 5 to 95%, non-condensing | | | Up to 100%, condensing | 5 to 95%, non-condensing | Up to 100%, condensing |
| Storage | 5 to 95%, non-condensing | | | | | |
| Transport | 5 to 95%, non-condensing | | | | | |
| **Mechanical properties** | | | | | | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | | | | | |
| Pitch | $25^{+0.2}$ mm | | | | | |

Table 19: X20SO2110, X20SO2120, X20SO4110, X20cSO4110, X20SO4120, X20cSO4120 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) Due to the internal protective circuit, this braking voltage only takes effect starting at a load of typ. 250 mA.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SOx1x0" on page 15.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SOx1x0 - Derating" on page 102
- "Inrush current behavior for output channels - X20(c)SOx1x0" on page 120

# 5.4 X20(c)SOx530 - Technical data

| Order number | X20SO2530 | X20cSO2530 | X20SO6530 |
|---|---|---|---|
| **Short description** | | | |
| I/O module | 2 relays with 1 normally open contact each, 230 VAC / 6 A, 24 VDC / 6 A | | 6 relays with 1 normally open contact each, 230 VAC / 2 A (6 A), 24 VDC / 6 A |
| **General information** | | | |
| B&R ID code | 0xD205 | 0xDD86 | 0xF22A |
| Status indicators | I/O function per channel, operating state, module status | | |
| Diagnostics | | | |
| Module run/error | Yes, using LED status indicator and software | | |
| Outputs | Yes, using LED status indicator and software | | |
| Blackout mode | | | |
| Scope | Module | | |
| Function | Module functionality | | |
| Standalone mode | No | | |
| Power consumption | | | |
| Bus | 0.26 W | | |
| Internal I/O | 1.15 W | | 1.65 W |
| Additional power dissipation caused by actuators (resistive) [W] [1)] | 1.44 | | 4.32 |
| Electrical isolation | | | |
| Channel - Bus | Yes | | |
| Channel - Channel | Yes | | |
| Certifications | | | |
| CE | Yes | | |
| UKCA | Yes | | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | | |
| Functional safety | EN 50156-1:2004 | | - |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | | |
| UL | cULus E115267<br>Industrial control equipment | | cULus E115267<br>Industrial control equipment<br>cULus E537419<br>Engine generator controller |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | | - |
| KC | Yes | - | |
| Relays | | | |
| EN 50155 | Yes | | No |
| EN 61810-3 | Yes | | |
| **Safety characteristics** | | | |
| Note | See section "Safety characteristics". | | |
| **I/O power supply** | | | |
| Nominal voltage | 24 VDC | | |
| Voltage range | 24 VDC -15% / +20% | | |
| Integrated protective function | Reverse polarity protection | | |
| **Relay outputs** | | | |
| Quantity | 2 | | 6 |
| Variant | Relay / Normally open contact, internal high-side and low-side control | | |
| Nominal output current | 5 mA to 6 A | | 5 mA to 6 A (hardware revision <B5: 2 A) |
| Diagnostic status | Contact position determined by positively driven contacts | | |
| Max. switching frequency | See section "Inrush current behavior for output channels". | | |
| Switching delay | | | |
| 0 → 1 | <50 ms | | |
| 1 → 0 | <50 ms | | <50 ms<br>Hardware upgrade 2.2.0.0 or later: <20 ms |
| Insulation voltage between channel and bus | Safe disconnection of 300 VAC per EN 50178 | | |
| Insulation voltage between channel and channel | Tested at 1350 VAC | | |
| Contact resistance (without terminal block) | 20 mΩ | | |
| Contact service life | See "Contact service life". | | |
| Short-circuit/Overload protection | External 6 A gL/gG fuse (melting fuse), LS automat C characteristic 1.6 A | | |
| Switching voltage range | 5 to 24 VDC, 5 to 230 VAC | | |

Table 20: X20SO2530, X20cSO2530, X20SO6530 - Technical data

| Order number | X20SO2530 | X20cSO2530 | X20SO6530 |
|---|---|---|---|
| Coil voltage | 24 VDC -15% / +20% | | |
| Short-circuit proof | Yes, 1000 A (with specified short-circuit/overload protection) | | |
| Max. inrush current | 30 A for 20 ms | | AC: 50 A for 100 ms,<br>DC: 10 A for 200 ms |
| Overvoltage category per EN 60664-1 | II | | |
| Max. switching capacity | | | |
| UL 508 | B300 / R300 | | |
| **Operating conditions** | | | |
| Mounting orientation | | | |
| Horizontal | Yes | | |
| Vertical | Yes | | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | | |
| Degree of protection per EN 60529 | IP20 | | |
| **Ambient conditions** | | | |
| Temperature | | | |
| Operation | | | |
| Horizontal mounting orientation [2] | 0 to 60°C | -25 to 60°C | 0 to 60°C |
| Vertical mounting orientation | 0 to 50°C | -25 to 50°C | 0 to 50°C |
| Derating | See section "Derating". | | |
| Starting temperature | - | Yes, -25°C | - |
| Storage | -40 to 85°C | | |
| Transport | -40 to 85°C | | |
| Relative humidity | | | |
| Operation | 5 to 95%, non-condensing | Up to 100%, condensing | 5 to 95%, non-condensing |
| Storage | 5 to 95%, non-condensing | | |
| Transport | 5 to 95%, non-condensing | | |
| **Mechanical properties** | | | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | | |
| Pitch | 25$^{+0.2}$ mm | | |

Table 20: X20SO2530, X20cSO2530, X20SO6530 - Technical data

1) Number of outputs x Contact resistance x Nominal output current$^2$. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) Compared to the value in the X20 system user's manual, where the angle of the horizontal mounting orientation is specified as 70°, this only applies up to an angle of 85° for the X20(c)SO2530. Below this, the derating for face-up installation must be applied.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SOx530" on page 16.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SOx530 - Derating" on page 104
- "Inrush current behavior for output channels - X20(c)SOx530" on page 122

# 5.5 X20SC0xxx - Technical data

| Order number | X20SC0402 | X20SC0806 | X20SC0842 |
|---|---|---|---|
| **Short description** | | | |
| I/O module | 4 safe type A digital inputs, 4 pulse outputs, 24 VDC, 2 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 6 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B2 digital outputs, 24 VDC, 50 mA, OSSD <500 µs |
| **General information** | | | |
| B&R ID code | 0xE7F8 | 0xE75A | 0xE7F9 |
| Status indicators | I/O function per channel, operating state, module status | | |
| Diagnostics | | | |
| Module run/error | Yes, using LED status indicator and software | | |
| Outputs | Yes, using LED status indicator and software | | |
| Inputs | Yes, using LED status indicator and software | | |
| Blackout mode | | | |
| Scope | Module | | |
| Function | Module functionality | | |
| Standalone mode | No | | |
| Power consumption | | | |
| Bus | 0.4 W | | |
| Internal I/O | 2.5 W | | |
| Additional power dissipation caused by actuators (resistive) [W] [1] | | | |
| Safe digital HS-LS outputs | - | | 0.84 |
| Safe digital HS-HS outputs | 0.4 | 1.2 | 0.175 |
| Pulse outputs | 0.8 | | |
| Electrical isolation | | | |
| Channel - Bus | Yes | | |
| Channel - Channel | No | | |
| Certifications | | | |
| CE | Yes | | |
| UKCA | Yes | | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | | |
| Functional safety | EN 50156-1:2004 | | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | | |
| UL | cULus E115267<br>Industrial control equipment | | |
| **Safety characteristics** | | | |
| Note | See section "Safety characteristics". | | |
| **I/O power supply** | | | |
| Nominal voltage | 24 VDC | | |
| Voltage range | 24 VDC -15% / +20% | | |
| Integrated protective function | Reverse polarity protection | | |
| **Safe digital inputs** | | | |
| Quantity | 4 | 8 | |
| Variant | Type A | | |
| Nominal voltage | 24 VDC | | |
| Input characteristics per EN 61131-2 | Type 1 | | |
| Input filter | | | |
| Hardware | ≤150 µs | | |
| Software | Configurable between 0 and 500 ms | | |
| Input circuit | Sink | | |
| Input voltage | 24 VDC -15% / +20% | | |
| Input current at 24 VDC [2] | Min. 2 mA to max. 3.28 mA | | |
| Input resistance | Min. 7.33 kΩ | | |
| Error detection time | 100 ms | | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | |
| Switching threshold | | | |
| Low | <5 VDC | | |
| High | >15 VDC | | |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line | | |

Table 21: X20SC0402, X20SC0806, X20SC0842 - Technical data

| Order number | X20SC0402 | X20SC0806 | X20SC0842 |
|---|---|---|---|
| **Safe digital HS-LS outputs** | | | |
| Quantity | - | | 4 |
| Variant | - | | FET, 1x positive switching, 1x negative switching, type A, output level readable |
| Nominal voltage | - | | 24 VDC |
| Nominal output current | - | | 3 A |
| Total nominal current | - | | 10 A [3] |
| Output protection | - | | See section "Inrush current behavior for output channels". |
| Braking voltage when switching off inductive loads | - | | Max. 90 VDC [4] |
| Error detection | - | | 1 s |
| Insulation voltage between channel and bus | - | | 500 $V_{eff}$ |
| Peak short-circuit current | - | | See section "Inrush current behavior for output channels". |
| Leakage current when the output is switched off | - | | <1 mA |
| $R_{DS(on)}$ | - | | 30 mΩ |
| Switching voltage | - | | I/O power supply minus voltage drop due to $R_{DS(on)}$ |
| Max. switching frequency | - | | See section "Inrush current behavior for output channels". |
| Test pulse length | - | | Max. 500 µs |
| Max. capacitive load | - | | 100 nF |
| **Safe digital HS-HS outputs** | | | |
| Quantity | 2 | 6 | 2 |
| Variant | FET, 2x positive switching, type B2, output level readable | | |
| Nominal voltage | 24 VDC | | |
| Nominal output current | 0.2 A | | 50 mA |
| Total nominal current | 0.4 A | 1.2 A | 100 mA |
| Output protection | See section "Inrush current behavior for output channels". | | |
| Braking voltage when switching off inductive loads | Max. 45 VDC | | |
| Error detection time | 1 s | | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | |
| Peak short-circuit current | See section "Inrush current behavior for output channels". | | |
| Leakage current when the output is switched off | <100 µA | | <1 mA |
| $R_{DS(on)}$ | 5 Ω | | 35 Ω |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | |
| Max. switching frequency | See section "Inrush current behavior for output channels". | | |
| Test pulse length | Max. 10 µs | | Max. 500 µs |
| Max. capacitive load | 100 nF | | |
| **Current on loss of ground** | | | |
| $I_{OUT}$ | <100 µA | | |
| $I_{GND}$ | <200 mA | | <50 mA [5] |
| **Pulse outputs** | | | |
| Quantity | 4 | | |
| Variant | Push-Pull | | |
| Nominal output current | 50 mA | | |
| Output protection | Shutdown of individual channels in the event of overload or short circuit [6] | | |
| Peak short-circuit current | 0.5 A for 120 µs | | |
| Short-circuit current | 15 $mA_{eff}$ | | |
| Leakage current when the output is switched off | 0.1 mA | | |
| $R_{DS(on)}$ | 80 Ω | | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | |
| Total nominal current | 200 mA | | |
| **Operating conditions** | | | |
| Mounting orientation | | | |
| Horizontal | Yes | | |
| Vertical | Yes | | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | | |
| Degree of protection per EN 60529 | IP20 | | |
| **Ambient conditions** | | | |
| Temperature | | | |
| Operation | | | |
| Horizontal mounting orientation | 0 to 60°C | | |
| Vertical mounting orientation | 0 to 50°C | | |
| Derating | See section "Derating". | | |
| Storage | -40 to 85°C | | |
| Transport | -40 to 85°C | | |

Table 21: X20SC0402, X20SC0806, X20SC0842 - Technical data

### Technical data

| Order number | X20SC0402 | X20SC0806 | X20SC0842 |
|---|---|---|---|
| Relative humidity | | | |
| Operation | | 5 to 95%, non-condensing | |
| Storage | | 5 to 95%, non-condensing | |
| Transport | | 5 to 95%, non-condensing | |
| **Mechanical properties** | | | |
| Note | | Order 2x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | |
| Pitch | | $25^{+0.2}$ mm | |

Table 21: X20SC0402, X20SC0806, X20SC0842 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) The input current specifications refer to the switched-on state of the input.
3) The module's total nominal current is limited to 10 A. The output currents of group "Safe digital HS-HS outputs" must be included.
4) Due to the internal protective circuit, this braking voltage only takes effect starting at a load of typ. 250 mA.
5) The value for this module is limited to 50 mA by the nominal output current of the HS-HS outputs.
6) The protective function is provided for max. 30 minutes for a continuous short circuit.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20SC0xxx" on page 17.

**Additional information:**

- "Safety characteristics" on page 89
- "X20SC0xxx - Derating" on page 105
- "Inrush current behavior for output channels - X20(c)SC0xxx" on page 124

# 5.6 X20(c)SC2212 - Technical data

| Order number | X20SC2212 | X20cSC2212 |
|---|---|---|
| **Short description** | | |
| I/O module | 6 safe type A digital inputs, 6 pulse outputs, 24 VDC, 2 safe type B1 digital outputs, 24 VDC, 0.5 A, OSSD <500 µs | |
| **General information** | | |
| B&R ID code | 0xBDA5 | 0xDD9D |
| Status indicators | I/O function per channel, operating state, module status | |
| Diagnostics | | |
| Module run/error | Yes, using LED status indicator and software | |
| Outputs | Yes, using LED status indicator and software | |
| Inputs | Yes, using LED status indicator and software | |
| Blackout mode | | |
| Scope | Module | |
| Function | Module functionality | |
| Standalone mode | No | |
| Power consumption | | |
| Bus | 0.25 W | |
| Internal I/O | 1.4 W | |
| Additional power dissipation caused by actuators (resistive) [W] [1)] | | |
| Safe digital outputs | 0.075 | |
| Pulse outputs | 0.264 | |
| Electrical isolation | | |
| Channel - Bus | Yes | |
| Channel - Channel | No | |
| Certifications | | |
| CE | Yes | |
| UKCA | Yes | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | |
| Functional safety | EN 50156-1:2004 | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | |
| UL | cULus E115267<br>Industrial control equipment | |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | |
| CCS | Yes | - |
| LR | ENV1 | |
| KR | Yes | |
| ABS | Yes | |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | |
| KC | Yes | - |
| **Safety characteristics** | | |
| Note | See section "Safety characteristics". | |
| **I/O power supply** | | |
| Nominal voltage | 24 VDC | |
| Voltage range | 24 VDC -15% / +20% | |
| Integrated protective function | Reverse polarity protection | |
| **Safe digital inputs** | | |
| Quantity | 6 | |
| Variant | Type A | |
| Nominal voltage | 24 VDC | |
| Input characteristics per EN 61131-2 | Type 1 | |
| Input filter | | |
| Hardware | ≤150 µs | |
| Software | Configurable between 0 and 500 ms | |
| Input circuit | Sink | |

Table 22: X20SC2212, X20cSC2212 - Technical data

## Technical data

| Order number | X20SC2212 | X20cSC2212 |
|---|---|---|
| Input voltage | 24 VDC -15% / +20% | |
| Input current at 24 VDC [2] | Min. 2 mA to max. 3.28 mA | |
| Input resistance | Min. 7.33 kΩ | |
| Error detection time | 100 ms | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | |
| Switching threshold | | |
| Low | <5 VDC | |
| High | >15 VDC | |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line | |
| **Safe digital outputs** | | |
| Quantity | 2 | |
| Variant | FET, 2x positive switching, type B1, output level readable | |
| Nominal voltage | 24 VDC | |
| Nominal output current | 0.5 A | |
| Total nominal current | 1 A | |
| Output protection | See section "Inrush current behavior for output channels". | |
| Braking voltage when switching off inductive loads | Max. 45 VDC | |
| Error detection time | 1 s | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | |
| Peak short-circuit current | See section "Inrush current behavior for output channels". | |
| Leakage current when the output is switched off | <500 µA | |
| $R_{DS(on)}$ | 150 mΩ | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | |
| Max. switching frequency | See section "Inrush current behavior for output channels". | |
| Test pulse length | Max. 500 µs | |
| Max. capacitive load | 100 nF | |
| **Current on loss of ground** | | |
| $I_{OUT}$ | <1 mA | |
| $I_{GND}$ | <180 mA | |
| **Pulse outputs** | | |
| Quantity | 6 | |
| Variant | Push-Pull | |
| Nominal output current | 20 mA | |
| Output protection | Shutdown of individual channels in the event of overload or short circuit [3] | |
| Peak short-circuit current | 25 A for 15 µs | |
| Short-circuit current | 100 $mA_{eff}$ | |
| Leakage current when the output is switched off | 0.1 mA | |
| $R_{DS(on)}$ | 110 Ω | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | |
| Total nominal current | 120 mA | |
| **Operating conditions** | | |
| Mounting orientation | | |
| Horizontal | Yes | |
| Vertical | Yes | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | |
| Degree of protection per EN 60529 | IP20 | |
| **Ambient conditions** | | |
| Temperature | | |
| Operation | | |
| Horizontal mounting orientation | 0 to 60°C | -25 to 60°C |
| Vertical mounting orientation | 0 to 50°C | -25 to 50°C |
| Derating | See section "Derating". | |
| Starting temperature | - | Yes, -40°C |
| Storage | -40 to 85°C | |
| Transport | -40 to 85°C | |
| Relative humidity | | |
| Operation | 5 to 95%, non-condensing | Up to 100%, condensing |
| Storage | 5 to 95%, non-condensing | |
| Transport | 5 to 95%, non-condensing | |
| **Mechanical properties** | | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | |
| Pitch | $25^{+0.2}$ mm | |

Table 22: X20SC2212, X20cSC2212 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) The input current specifications refer to the switched-on state of the input.
3) The protective function is provided for max. 30 minutes for a continuous short circuit.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SC2212" on page 19.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SC2212 - Derating" on page 108
- "Inrush current behavior for output channels - X20(c)SC2212" on page 126

# 5.7 X20(c)SC2432 - Technical data

| Order number | X20SC2432 | X20cSC2432 |
|---|---|---|
| **Short description** | | |
| I/O module | 2 safe type A digital inputs, 2 pulse outputs, 24 VDC, 2 relays with 1 normally open contact each, 48 VAC / 6 A, 24 VDC / 6 A | |
| **General information** | | |
| B&R ID code | 0xA7A4 | 0xDD5D |
| Status indicators | I/O function per channel, operating state, module status | |
| Diagnostics | | |
| Module run/error | Yes, using LED status indicator and software | |
| Outputs | Yes, using LED status indicator and software | |
| Inputs | Yes, using LED status indicator and software | |
| Blackout mode | | |
| Scope | Module | |
| Function | Module functionality | |
| Standalone mode | No | |
| Power consumption | | |
| Bus | 0.26 W | |
| Internal I/O | 1.15 W | |
| Additional power dissipation caused by actuators (resistive) [W] | | |
| Relay outputs [1)] | 1.44 | |
| Pulse outputs [2)] | 0.1 | |
| Electrical isolation | | |
| Channel - Bus | Yes | |
| Channel - Channel | Yes | |
| Certifications | | |
| CE | Yes | |
| UKCA | Yes | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | |
| Functional safety | EN 50156-1:2004 | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | |
| UL | cULus E115267<br>Industrial control equipment | |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | |
| CCS | Yes | - |
| LR | ENV1 | |
| KR | Yes | |
| ABS | Yes | |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | |
| KC | Yes | - |
| Relays | | |
| EN 50155 | Yes | |
| EN 61810-3 | Yes | |
| **Safety characteristics** | | |
| Note | See section "Safety characteristics". | |
| **I/O power supply** | | |
| Nominal voltage | 24 VDC | |
| Voltage range | 24 VDC -15% / +20% | |
| Integrated protective function | Reverse polarity protection | |
| **Safe digital inputs** | | |
| Quantity | 2 | |
| Variant | Type A | |
| Nominal voltage | 24 VDC | |
| Input characteristics per EN 61131-2 | Type 1 | |

Table 23: X20SC2432, X20cSC2432 - Technical data

| Order number | X20SC2432 | X20cSC2432 |
|---|---|---|
| Input filter | | |
| Hardware | ≤150 µs | |
| Software | Configurable between 0 and 500 ms | |
| Input circuit | Sink | |
| Input voltage | 24 VDC -15% / +20% | |
| Input current at 24 VDC [3] | Min. 2 mA to max. 4.59 mA | |
| Input resistance | Min. 5.23 kΩ | |
| Error detection time | 100 ms | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | |
| Switching threshold | | |
| Low | <5 VDC | |
| High | >15 VDC | |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line | |
| **Relay outputs** | | |
| Quantity | 2 | |
| Variant | Relay / Normally open contact, internal high-side and low-side control | |
| Nominal output current | 5 mA to 6 A | |
| Diagnostic status | Contact position determined by positively driven contacts | |
| Max. switching frequency | See section "Inrush current behavior for output channels". | |
| Switching delay | | |
| 0 → 1 | <50 ms | |
| 1 → 0 | <50 ms | |
| Insulation voltage between channel and bus | Safe disconnection of 300 VAC per EN 50178 | |
| Insulation voltage between channel and channel | 48 VAC | |
| Contact resistance (without terminal block) | 20 mΩ | |
| Contact service life | See "Contact service life". | |
| Short-circuit/Overload protection | External 6 A gL/gG fuse (melting fuse), LS automat C characteristic 1.6 A | |
| Switching voltage range | 5 to 24 VDC, 5 to 48 VAC | |
| Coil voltage | 24 VDC -15% / +20% | |
| Short-circuit proof | Yes, 1000 A (with specified short-circuit/overload protection) | |
| Max. inrush current | 30 A for 20 ms | |
| Overvoltage category per EN 60664-1 | II | |
| Max. switching capacity | | |
| AC1 | 48 VAC / 6 A | |
| AC15 | 48 VAC / 3 A | |
| DC1 | 24 VDC / 6 A | |
| DC13 | 24 VDC / 5 A / 0.1 Hz | |
| UL 508 | B300 / R300 | |
| **Pulse outputs** | | |
| Quantity | 2 | |
| Variant | Push-Pull | |
| Nominal output current | 50 mA | |
| Output protection | Shutdown of individual channels in the event of overload or short circuit [4] | |
| Peak short-circuit current | 25 A for 5 ms | |
| Short-circuit current | 1.4 $A_{eff}$ | |
| Leakage current when the output is switched off | 0.1 mA | |
| $R_{DS(on)}$ | 20 Ω | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | |
| Total nominal current | 100 mA | |
| **Operating conditions** | | |
| Mounting orientation | | |
| Horizontal | Yes | |
| Vertical | Yes | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | |
| Degree of protection per EN 60529 | IP20 | |
| **Ambient conditions** | | |
| Temperature | | |
| Operation | | |
| Horizontal mounting orientation [5] | 0 to 60°C | -25 to 60°C |
| Vertical mounting orientation | 0 to 50°C | -25 to 50°C |
| Derating | See section "Derating". | |
| Starting temperature | - | Yes, -25°C |
| Storage | -40 to 85°C | |
| Transport | -40 to 85°C | |

Table 23: X20SC2432, X20cSC2432 - Technical data

### Technical data

| Order number | X20SC2432 | X20cSC2432 |
|---|---|---|
| Relative humidity | | |
| Operation | 5 to 95%, non-condensing | Up to 100%, condensing |
| Storage | 5 to 95%, non-condensing | |
| Transport | 5 to 95%, non-condensing | |
| **Mechanical properties** | | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | |
| Pitch | $25^{+0.2}$ mm | |

Table 23: X20SC2432, X20cSC2432 - Technical data

1) Number of outputs x Contact resistance x Nominal output current$^2$. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
3) The input current specifications refer to the switched-on state of the input.
4) The protective function is provided for max. 30 minutes for a continuous short circuit.
5) Compared to the value in the X20 system user's manual, where the angle of the horizontal mounting orientation is specified as 70°, this only applies up to an angle of 85° for the X20(c)SC2432. Below this, the derating for face-up installation must be applied.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SC2432" on page 20.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SC2432 - Derating" on page 109
- "Inrush current behavior for output channels - X20(c)SC2432" on page 127

# 5.8 X20SLXxxx-1 - Technical data

| Order number | X20SLX806-1 | X20SLX842-1 | X20SLX411-1 | X20SLX811-1 |
|---|---|---|---|---|
| **Short description** | | | | |
| I/O module | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 6 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs, SafeLOGIC-X technology | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B2 digital outputs, 24 VDC, 50 mA, OSSD <500 µs, SafeLOGIC-X technology | 4 safe type A digital inputs, 4 pulse outputs, 24 VDC | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, SafeLOGIC-X technology |
| **General information** | | | | |
| B&R ID code | 0x2F1F | 0x2F20 | 0x2F23 | 0x2F21 |
| Status indicators | I/O function per channel, operating state, module status | | | |
| Diagnostics | | | | |
| Module run/error | Yes, using LED status indicator and software | | | |
| Outputs | Yes, using LED status indicator and software | | - | |
| Inputs | Yes, using LED status indicator and software | | | |
| Blackout mode | | | | |
| Scope | Module | | - | |
| Function | Programmable | | - | |
| Standalone mode | Yes | | - | |
| Power consumption | | | | |
| Bus | 0.4 W | | | |
| Internal I/O | 2.5 W | | | |
| Additional power dissipation caused by actuators (resistive) [W] [1] | | | | |
| Safe digital HS-LS outputs | - | 0.84 | - | |
| Safe digital HS-HS outputs | 1.2 | 0.175 | - | |
| Pulse outputs | 0.8 | | | |
| Electrical isolation | | | | |
| Channel - Bus | Yes | | | |
| Channel - Channel | No | | | |
| Certifications | | | | |
| CE | Yes | | | |
| UKCA | Yes | | | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | | | |
| Functional safety | EN 50156-1:2004 | | | |
| ATEX | In preparation | | | |
| UL | In preparation | | | |
| **Safety characteristics** | | | | |
| Note | See section "Safety characteristics". | | | |
| **Safe digital inputs** | | | | |
| Quantity | 8 | | 4 | 8 |
| Variant | Type A | | | |
| Nominal voltage | 24 VDC | | | |
| Input characteristics per EN 61131-2 | Type 1 | | | |
| Input filter | | | | |
| Hardware | ≤150 µs | | | |
| Software | Configurable between 0 and 500 ms | | | |
| Input circuit | Sink | | | |
| Input voltage | 24 VDC -15% / +20% | | | |
| Input current at 24 VDC [2] | Min. 2 mA to max. 3.28 mA | | | |
| Input resistance | Min. 7.33 kΩ | | | |
| Error detection time | 100 ms | | | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | | |
| Switching threshold | | | | |
| Low | <5 VDC | | | |
| High | >15 VDC | | | |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line | | | |
| **Safe digital HS-LS outputs** | | | | |
| Quantity | - | 4 | - | |
| Variant | - | FET, 1x positive switching, 1x negative switching, type A, output level readable | - | |
| Nominal voltage | - | 24 VDC | - | |
| Nominal output current | - | 3 A | - | |

Table 24: X20SLX806-1, X20SLX842-1, X20SLX411-1, X20SLX811-1 - Technical data

## Technical data

| Order number | X20SLX806-1 | X20SLX842-1 | X20SLX411-1 | X20SLX811-1 |
|---|---|---|---|---|
| Total nominal current | - | 10 A [3] | - | |
| Output protection | - | See section "Inrush current behavior for output channels". | - | |
| Braking voltage when switching off inductive loads | - | Max. 90 VDC [4] | - | |
| Error detection | - | 1 s | - | |
| Insulation voltage between channel and bus | - | 500 $V_{eff}$ | - | |
| Peak short-circuit current | - | See section "Inrush current behavior for output channels". | - | |
| Leakage current when the output is switched off | - | <1 mA | - | |
| $R_{DS(on)}$ | - | 30 mΩ | - | |
| Switching voltage | - | I/O power supply minus voltage drop due to $R_{DS(on)}$ | - | |
| Max. switching frequency | - | See section "Inrush current behavior for output channels". | - | |
| Test pulse length | - | Max. 500 µs | - | |
| Max. capacitive load | - | 100 nF | - | |
| **Safe digital HS-HS outputs** | | | | |
| Quantity | 6 | 2 | - | |
| Variant | FET, 2x positive switching, type B2, output level readable | | - | |
| Nominal voltage | 24 VDC | | - | |
| Nominal output current | 0.2 A | 50 mA | - | |
| Total nominal current | 1.2 A | 100 mA | - | |
| Output protection | See section "Inrush current behavior for output channels". | | - | |
| Braking voltage when switching off inductive loads | Max. 45 VDC | | - | |
| Error detection time | 1 s | | - | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | - | |
| Peak short-circuit current | See section "Inrush current behavior for output channels". | | - | |
| Leakage current when the output is switched off | <100 µA | <1 mA | - | |
| $R_{DS(on)}$ | 5 Ω | 35 Ω | - | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | - | |
| Max. switching frequency | See section "Inrush current behavior for output channels". | | - | |
| Test pulse length | Max. 10 µs | Max. 500 µs | - | |
| Max. capacitive load | 100 nF | | - | |
| **Current on loss of ground** | | | | |
| $I_{OUT}$ | <100 µA | | - | |
| $I_{GND}$ | <200 mA | <50 mA [5] | - | |
| **Pulse outputs** | | | | |
| Quantity | 4 | | | |
| Variant | Push-Pull | | | |
| Nominal output current | 50 mA | | | |
| Output protection | Shutdown of individual channels in the event of overload or short circuit [6] | | | |
| Peak short-circuit current | 0.5 A for 120 µs | | | |
| Short-circuit current | 15 $mA_{eff}$ | | | |
| Leakage current when the output is switched off | 0.1 mA | | | |
| $R_{DS(on)}$ | 80 Ω | | | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | | |
| Total nominal current | 200 mA | | | |
| **Operating conditions** | | | | |
| Mounting orientation | | | | |
| Horizontal | Yes | | | |
| Vertical | Yes | | | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | | | |
| Degree of protection per EN 60529 | IP20 | | | |

Table 24: X20SLX806-1, X20SLX842-1, X20SLX411-1, X20SLX811-1 - Technical data

| Order number | X20SLX806-1 | X20SLX842-1 | X20SLX411-1 | X20SLX811-1 |
|---|---|---|---|---|
| **Ambient conditions** | | | | |
| Temperature | | | | |
| Operation | | | | |
| Horizontal mounting orientation | 0 to 60°C | | | |
| Vertical mounting orientation | 0 to 50°C | | | |
| Derating | See section "Derating". | | | |
| Storage | -40 to 85°C | | | |
| Transport | -40 to 85°C | | | |
| Relative humidity | | | | |
| Operation | 5 to 95%, non-condensing | | | |
| Storage | 5 to 95%, non-condensing | | | |
| Transport | 5 to 95%, non-condensing | | | |
| **Mechanical properties** | | | | |
| Note | Order 2x safety-keyed terminal block separately. Order 1x safety-keyed bus module separately. | | Order 1x safety-keyed terminal block separately. Order 1x safety-keyed bus module (single-width) separately. | |
| Pitch | $25^{+0.2}$ mm | | $12.5^{+0.2}$ mm | |

Table 24: X20SLX806-1, X20SLX842-1, X20SLX411-1, X20SLX811-1 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current[2]. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 System user's manual.
2) The input current specifications refer to the switched-on state of the input.
3) The module's total nominal current is limited to 10 A. The output currents of group "Safe digital HS-HS outputs" must be included.
4) Due to the internal protective circuit, this braking voltage only takes effect starting at a load of typ. 250 mA.
5) The value for this module is limited to 50 mA by the nominal output current of the HS-HS outputs.
6) The protective function is provided for max. 30 minutes for a continuous short circuit.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20SLXxxx-1" on page 21.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SLXxxx - Derating" on page 112
- "X20SLXxxx-1 - Inrush current behavior for output channels" on page 124

### 5.8.1 X20SLXxxx-1 - Functionality

**Communication with each other:** Max. 1 active SafeLogic-X per standard CPU (e.g. X20(c)CPxxxx).
If there are multiple SafeLogic-X controllers in the Automation Studio hardware tree, all but 1 must be disabled.

**SafeMotion support:**

- **Max. number of SafeMotion axes:** 6, depends on the data width of the modules used

**Time accuracy:** Time * 5% + Cycle time of the safety application

**Max. number of SafeNodes:** 10, depends on the data width of the modules used

**Data exchange between the CPU and SafeLogic controller**

**Max. total data width per direction:** 300 bytes

Each 8 BOOL are combined to 1 byte. Possible pad bytes due to alignment must be taken into account. For additional information, see section "Real-time operating system → Target systems → Target systems - SG4 → Runtime behavior - SG4 → Alignment" in Automation Help.

For additional module-specific information, see "X20SLXxxx-1" on page 21.

# 5.9 X20(c)SLXxxx - Technical data

## X20(c)SLXx0x and X20SLX842

| Order number | X20SLX402 | X20cSLX402 | X20SLX806 | X20SLX842 |
|---|---|---|---|---|
| **Short description** | | | | |
| I/O module | 4 safe type A digital inputs, 4 pulse outputs, 24 VDC, 2 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs, SafeLOGIC-X technology | | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 6 safe type B2 digital outputs, 24 VDC, 0.2 A, OSSD <10 µs, SafeLOGIC-X technology | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, 4 safe type A digital outputs, 24 VDC, 3 A, OSSD <500 µs, 2 safe type B2 digital outputs, 24 VDC, 50 mA, OSSD <500 µs, SafeLOGIC-X technology |
| **General information** | | | | |
| B&R ID code | 0xE7EA | 0xF210 | 0xE758 | 0xE7EB |
| Status indicators | I/O function per channel, operating state, module status | | | |
| Diagnostics | | | | |
| Module run/error | Yes, using LED status indicator and software | | | |
| Outputs | Yes, using LED status indicator and software | | | |
| Inputs | Yes, using LED status indicator and software | | | |
| Blackout mode | | | | |
| Scope | Module | | | |
| Function | Programmable | | | |
| Standalone mode | Yes | | | |
| Power consumption | | | | |
| Bus | 0.4 W | | | |
| Internal I/O | 2.5 W | | | |
| Additional power dissipation caused by actuators (resistive) [W] [1] | | | | |
| Safe digital HS-LS outputs | - | | | 0.84 |
| Safe digital HS-HS outputs | 0.4 | | 1.2 | 0.175 |
| Pulse outputs | 0.8 | | | |
| Electrical isolation | | | | |
| Channel - Bus | Yes | | | |
| Channel - Channel | No | | | |
| Certifications | | | | |
| CE | Yes | | | |
| UKCA | Yes | | | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | | | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | | | |
| Functional safety | EN 50156-1:2004 | EN 50156-1 in preparation | EN 50156-1:2004 | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | | | |
| UL | cULus E115267<br>Industrial control equipment | | | |
| **Safety characteristics** | | | | |
| Note | See section "Safety characteristics". | | | |
| **Limit values for SafeDESIGNER application** | | | | |
| Max. resources available for SafeDESIGNER info window entries [2] | | | | |
| FB instances | 256 | | | |
| Marker memory | 5120 bytes (0x1400) | | | |
| Stack memory | 4096 bytes | | | |
| Memory for safe input data | 128 bytes, 68 bytes of which are usable for modules | | | |
| Memory for safe output data | 64 bytes | | | |
| Memory for standard input data | 64 bytes | | | |
| Memory for standard output data | 64 bytes | | | |
| Marker count | 256 | | | |
| Additional SafeDESIGNER limit values | | | | |
| Max. number of function block types | 64 | | | |
| Max. number of force variables | 8 | | | |
| Max. number of variable with variable status | 128 | | | |
| **I/O power supply** | | | | |
| Nominal voltage | 24 VDC | | | |
| Voltage range | 24 VDC -15% / +20% | | | |

Table 25: X20SLX402, X20cSLX402, X20SLX806, X20SLX842 - Technical data

| Order number | X20SLX402 | X20cSLX402 | X20SLX806 | X20SLX842 |
|---|---|---|---|---|
| Integrated protective function | Reverse polarity protection | | | |
| **Safe digital inputs** | | | | |
| Quantity | 4 | | 8 | |
| Variant | Type A | | | |
| Nominal voltage | 24 VDC | | | |
| Input characteristics per EN 61131-2 | Type 1 | | | |
| Input filter | | | | |
| Hardware | ≤150 µs | | | |
| Software | Configurable between 0 and 500 ms | | | |
| Input circuit | Sink | | | |
| Input voltage | 24 VDC -15% / +20% | | | |
| Input current at 24 VDC [3] | Min. 2 mA to max. 3.28 mA | | | |
| Input resistance | Min. 7.33 kΩ | | | |
| Error detection time | 100 ms | | | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | | |
| Switching threshold | | | | |
| Low | <5 VDC | | | |
| High | >15 VDC | | | |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line | | | |
| **Safe digital HS-LS outputs** | | | | |
| Quantity | - | | | 4 |
| Variant | - | | | FET, 1x positive switching, 1x negative switching, type A, output level readable |
| Nominal voltage | - | | | 24 VDC |
| Nominal output current | - | | | 3 A |
| Total nominal current | - | | | 10 A [4] |
| Output protection | - | | | See section "Inrush current behavior for output channels". |
| Braking voltage when switching off inductive loads | - | | | Max. 90 VDC [5] |
| Error detection | - | | | 1 s |
| Insulation voltage between channel and bus | - | | | 500 $V_{eff}$ |
| Peak short-circuit current | - | | | See section "Inrush current behavior for output channels". |
| Leakage current when the output is switched off | - | | | <1 mA |
| $R_{DS(on)}$ | - | | | 30 mΩ |
| Switching voltage | - | | | I/O power supply minus voltage drop due to $R_{DS(on)}$ |
| Max. switching frequency | - | | | See section "Inrush current behavior for output channels". |
| Test pulse length | - | | | Max. 500 µs |
| Max. capacitive load | - | | | 100 nF |
| **Safe digital HS-HS outputs** | | | | |
| Quantity | 2 | | 6 | 2 |
| Variant | FET, 2x positive switching, type B2, output level readable | | | |
| Nominal voltage | 24 VDC | | | |
| Nominal output current | 0.2 A | | | 50 mA |
| Total nominal current | 0.4 A | | 1.2 A | 100 mA |
| Output protection | See section "Inrush current behavior for output channels". | | | |
| Braking voltage when switching off inductive loads | Max. 45 VDC | | | |
| Error detection time | 1 s | | | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | | |
| Peak short-circuit current | See section "Inrush current behavior for output channels". | | | |
| Leakage current when the output is switched off | <100 µA | | | <1 mA |
| $R_{DS(on)}$ | 5 Ω | | | 35 Ω |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | | |
| Max. switching frequency | See section "Inrush current behavior for output channels". | | | |
| Test pulse length | Max. 10 µs | | | Max. 500 µs |
| Max. capacitive load | 100 nF | | | |
| **Current on loss of ground** | | | | |
| $I_{OUT}$ | <100 µA | | | |
| $I_{GND}$ | <200 mA | | | <50 mA [6] |

Table 25: X20SLX402, X20cSLX402, X20SLX806, X20SLX842 - Technical data

## Technical data

| Order number | X20SLX402 | X20cSLX402 | X20SLX806 | X20SLX842 |
|---|---|---|---|---|
| **Pulse outputs** | | | | |
| Quantity | 4 | | | |
| Variant | Push-Pull | | | |
| Nominal output current | 50 mA | | | |
| Output protection | Shutdown of individual channels in the event of overload or short circuit [7] | | | |
| Peak short-circuit current | 0.5 A for 120 µs | | | |
| Short-circuit current | 15 $mA_{eff}$ | | | |
| Leakage current when the output is switched off | 0.1 mA | | | |
| $R_{DS(on)}$ | 80 Ω | | | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | | |
| Total nominal current | 200 mA | | | |
| **Operating conditions** | | | | |
| Mounting orientation | | | | |
| Horizontal | Yes | | | |
| Vertical | Yes | | | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | | | |
| Degree of protection per EN 60529 | IP20 | | | |
| **Ambient conditions** | | | | |
| Temperature | | | | |
| Operation | | | | |
| Horizontal mounting orientation | 0 to 60°C | -25 to 60°C | 0 to 60°C | |
| Vertical mounting orientation | 0 to 50°C | -25 to 50°C | 0 to 50°C | |
| Derating | See section "Derating". | | | |
| Starting temperature | - | Yes, -40°C | - | |
| Storage | -40 to 85°C | | | |
| Transport | -40 to 85°C | | | |
| Relative humidity | | | | |
| Operation | 5 to 95%, non-condensing | Up to 100%, condensing | 5 to 95%, non-condensing | |
| Storage | 5 to 95%, non-condensing | | | |
| Transport | 5 to 95%, non-condensing | | | |
| **Mechanical properties** | | | | |
| Note | Order 2x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | | | |
| Pitch | $25^{+0.2}$ mm | | | |

Table 25: X20SLX402, X20cSLX402, X20SLX806, X20SLX842 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) For a parameter description, see section "Message window" in the SafeDESIGNER documentation.
3) The input current specifications refer to the switched-on state of the input.
4) The module's total nominal current is limited to 10 A. The output currents of group "Safe digital HS-HS outputs" must be included.
5) Due to the internal protective circuit, this braking voltage only takes effect starting at a load of typ. 250 mA.
6) The value for this module is limited to 50 mA by the nominal output current of the HS-HS outputs.
7) The protective function is provided for max. 30 minutes for a continuous short circuit.

## X20(c)SLXx1x

| Order number | X20SLX210 | X20SLX410 | X20cSLX410 | X20SLX811 | X20SLX910 | X20cSLX910 |
|---|---|---|---|---|---|---|
| **Short description** | | | | | | |
| I/O module | 2 safe type A digital inputs, 2 pulse outputs, 24 VDC, SafeLOGIC-X technology | 4 safe type A digital inputs, 4 pulse outputs, 24 VDC, SafeLOGIC-X technology | | 8 safe type A digital inputs, 4 pulse outputs, 24 VDC, SafeLOGIC-X technology | 20 safe type A digital inputs, 4 pulse outputs, 24 VDC, SafeLOGIC-X technology | |
| **General information** | | | | | | |
| B&R ID code | 0xC5B0 | 0xC5B2 | 0xE288 | 0xE757 | 0xC5B1 | 0xE4D1 |
| Status indicators | I/O function per channel, operating state, module status | | | | | |
| Diagnostics | | | | | | |
| Module run/error | Yes, using LED status indicator and software | | | | | |
| Inputs | Yes, using LED status indicator and software | | | | | |
| Power consumption | | | | | | |
| Bus | 0.25 W | 0.32 W | | 0.4 W | | |
| Internal I/O | 1 W | 1.25 W | | 2.5 W | 1.6 W | |
| Additional power dissipation caused by actuators (resistive) [W] [1] | 0.3 | 0.6 | | 0.8 | 0.6 | |
| Electrical isolation | | | | | | |
| Channel - Bus | Yes | | | | | |
| Channel - Channel | No | | | | | |

Table 26: X20SLX210, X20SLX410, X20cSLX410, X20SLX811, X20SLX910, X20cSLX910 - Technical data

| Order number | X20SLX210 | X20SLX410 | X20cSLX410 | X20SLX811 | X20SLX910 | X20cSLX910 |
|---|---|---|---|---|---|---|
| Certifications | | | | | | |
| CE | Yes | | | | | |
| UKCA | Yes | | | | | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | | | | | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | | | | | |
| Functional safety | EN 50156-1:2004 | | | | | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | | | | | |
| UL | cULus E115267<br>Industrial control equipment | | | | | |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | | | - | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | | | - | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | |
| CCS | Yes | | - | | Yes | - |
| LR | ENV1 | | | - | ENV1 | |
| KR | Yes | | | - | Yes | |
| ABS | Yes | | | - | Yes | |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | | | - | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | |
| KC | Yes | | - | | Yes | - |
| **Safety characteristics** | | | | | | |
| Note | See section "Safety characteristics". | | | | | |
| **Limit values for SafeDESIGNER application** | | | | | | |
| Max. resources available for SafeDESIGNER info window entries [2] | | | | | | |
| FB instances | 256 | | | | | |
| Marker memory | 5120 bytes (0x1400) | | | | | |
| Stack memory | 2048 bytes | | | 4096 bytes | 2048 bytes | |
| Memory for safe input data | 128 bytes, 68 bytes of which are usable for modules | | | | | |
| Memory for safe output data | 64 bytes | | | | | |
| Memory for standard input data | 64 bytes | | | | | |
| Memory for standard output data | 64 bytes | | | | | |
| Marker count | 256 | | | | | |
| Additional SafeDESIGNER limit values | | | | | | |
| Max. number of function block types | 64 | | | | | |
| Max. number of force variables | 8 | | | | | |
| Max. number of variable with variable status | 128 | | | | | |
| **I/O power supply** | | | | | | |
| Nominal voltage | 24 VDC | | | | | |
| Voltage range | 24 VDC -15% / +20% | | | | | |
| Integrated protective function | Reverse polarity protection | | | | | |
| **Safe digital inputs** | | | | | | |
| Quantity | 2 | 4 | | 8 | 20 | |
| Variant | Type A | | | | | |
| Nominal voltage | 24 VDC | | | | | |
| Input characteristics per EN 61131-2 | Type 1 | | | | | |
| Input filter | | | | | | |
| Hardware | ≤150 µs | | | | | |
| Software | Configurable between 0 and 500 ms | | | | | |
| Input circuit | Sink | | | | | |
| Input voltage | 24 VDC -15% / +20% | | | | | |
| Input current at 24 VDC [3] | Min. 2 mA to max. 3.28 mA | | | | | |
| Input resistance | Min. 7.33 kΩ | | | | | |
| Error detection time | 200 ms | | | 100 ms | 200 ms | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | | | | | |

Table 26: X20SLX210, X20SLX410, X20cSLX410, X20SLX811, X20SLX910, X20cSLX910 - Technical data

## Technical data

| Order number | X20SLX210 | X20SLX410 | X20cSLX410 | X20SLX811 | X20SLX910 | X20cSLX910 |
|---|---|---|---|---|---|---|
| Switching threshold | | | | | | |
| Low | <5 VDC | | | | | |
| High | >15 VDC | | | | | |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line | | | | | |
| **Pulse outputs** | | | | | | |
| Quantity | 2 | 4 | | | | |
| Variant | Push-Pull | | | | | |
| Nominal output current | 50 mA | | | | | |
| Output protection | Shutdown of individual channels in the event of overload or short circuit [4] | | | | | |
| Peak short-circuit current | 25 A for 15 µs | | | 0.5 A for 120 µs | 25 A for 15 µs | |
| Short-circuit current | 100 $mA_{eff}$ | | | 15 $mA_{eff}$ | 100 $mA_{eff}$ | |
| Leakage current when the output is switched off | 0.1 mA | | | | | |
| $R_{DS(on)}$ | 60 Ω | | | 80 Ω | 60 Ω | |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | | | | | |
| Total nominal current | 100 mA | 200 mA | | | | |
| **Operating conditions** | | | | | | |
| Mounting orientation | | | | | | |
| Horizontal | Yes | | | | | |
| Vertical | Yes | | | | | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | | | | | |
| Degree of protection per EN 60529 | IP20 | | | | | |
| **Ambient conditions** | | | | | | |
| Temperature | | | | | | |
| Operation | | | | | | |
| Horizontal mounting orientation | 0 to 60°C | | -25 to 60°C | 0 to 60°C | | -25 to 60°C |
| Vertical mounting orientation | 0 to 50°C | | -25 to 50°C | 0 to 50°C | | -25 to 50°C |
| Derating | See section "Derating". | | | | | |
| Starting temperature | - | | Yes, -40°C | - | | Yes, -40°C |
| Storage | -40 to 85°C | | | | | |
| Transport | -40 to 85°C | | | | | |
| Relative humidity | | | | | | |
| Operation | 5 to 95%, non-condensing | | Up to 100%, condensing | 5 to 95%, non-condensing | | Up to 100%, condensing |
| Storage | 5 to 95%, non-condensing | | | | | |
| Transport | 5 to 95%, non-condensing | | | | | |
| **Mechanical properties** | | | | | | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | | | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module (single-width) separately. | Order 2x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | |
| Pitch | $25^{+0.2}$ mm | | | $12.5^{+0.2}$ mm | $25^{+0.2}$ mm | |

Table 26: X20SLX210, X20SLX410, X20cSLX410, X20SLX811, X20SLX910, X20cSLX910 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) For a parameter description, see section "Message window" in the SafeDESIGNER documentation.
3) The input current specifications refer to the switched-on state of the input.
4) The protective function is provided for max. 30 minutes for a continuous short circuit.

### Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SLXxxx - Derating" on page 112
- "Inrush current behavior for output channels - X20(c)SLXxxx" on page 124

### 5.9.1 X20(c)SLXxxx - Functionality

**Communication with each other:** Max. 1 active SafeLogic-X per standard CPU (e.g. X20(c)CPxxxx).
If there are multiple SafeLogic-X controllers in the Automation Studio hardware tree, all but 1 must be disabled.

**Support for Safe Commissioning Options - For modules X20(c)SLX402, X20SLX806, X20SLX842 and X20SLX811**

- BOOL: 64
- INT: 16
- UINT: 16
- DINT: 16
- UDINT: 16

**SafeMotion support:**

- **Max. number of SafeMotion axes:** 6, depends on the data width of the modules used
  It is important to note that module X20(c)SLX910 only supports SafeMotion 1-axis module.

**Time accuracy:** Time * 5% + Cycle time of the safety application

**Shortest task class cycle time for modules X20SLX210, X20(c)SLX410 and X20(c)SLX910:** 2 ms

**Max. number of SafeNodes:** 10, depends on the data width of the modules used

**Data exchange between the CPU and SafeLogic controller**

**Max. total data width per direction:** 16 bytes

Each 8 BOOL are combined to 1 byte. Possible pad bytes due to alignment must be taken into account. For additional information, see section "Real-time operating system → Target systems → Target systems - SG4 → Runtime behavior - SG4 → Alignment" in Automation Help.

**Max. number of data points for each direction:**

- BOOL: 96
- INT: 8
- UINT: 8
- DINT: 4
- UDINT: 4

**Data exchange between SafeDomain and SafeDomain**

**Use as Managing SafeDomain:** Starting with mapp Safety 5.10.0 and hardware upgrade 2.2.1.0

**Use as Connected SafeDomain:**
Only when using X20(c)SLX402, X20SLX806, X20SLX842 and X20SLX811:
Starting with mapp Safety 5.13.0, hardware upgrade 2.4.0.0 and Automation Runtime A4.90

**Max. total data width per direction:** 8 bytes

Each 8 BOOL are combined to 1 byte. Possible pad bytes due to alignment must be taken into account. For additional information, see section "Real-time operating system → Target systems → Target systems - SG4 → Runtime behavior - SG4 → Alignment" in Automation Help.

**Max. total number of data points for each direction:**
It is important to note that 8 BOOL count as 1 data point.

- For modules X20(c)SLX402, X20SLX806, X20SLX842 and X20SLX811: 4
- For modules X20SLX210, X20(c)SLX410 and X20(c)SLX910: 2

**Max. number of data points for each direction:**

- BOOL: 16
- INT: 2
- UINT: 2
- DINT: 2
- UDINT: 2

**Max. number of linked Managing SafeDomains:**

- For modules X20(c)SLX402, X20SLX806, X20SLX842 and X20SLX811:
  - 0
  - Starting with mapp Safety 5.13.0, hardware upgrade 2.4.0.0 and Automation Runtime A4.90: 1
- For modules X20SLX210, X20(c)SLX410 and X20(c)SLX910: 0

## Information:

**For additional information about SafeDomain-to-SafeDomain communication, see section "SafeDomain-to-SafeDomain communication" in Automation Help.**

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

# 5.10 X20(c)SL81xx - Technical data

| Order number | X20SL8100 | X20cSL8100 | X20SL8101 | X20cSL8101 | X20SL8110 |
|---|---|---|---|---|---|
| **Short description** | | | | | |
| Interfaces | POWERLINK | | | | |
| System module | CPU | | | | |
| **General information** | | | | | |
| B&R ID code | 0xDD61 | 0xE287 | 0xE649 | 0xE926 | 0xE64A |
| Cooling | Fanless | | | | |
| Status indicators | CPU function, POWERLINK, SafeKEY | | | | |
| Diagnostics | | | | | |
| CPU function | Yes, using LED status indicator | | | | |
| POWERLINK | Yes, using LED status indicator | | | | |
| SafeKEY | Yes, using LED status indicator | | | | |
| Support | | | | | |
| Dynamic node allocation (DNA) | Yes | | | | |
| Blackout mode | | | | | |
| Scope | - | | Network segment | | - |
| Function | - | | Programmable | | - |
| Standalone mode | - | | Yes | | - |
| Power consumption | 4.3 W | | 5.3 W | | 3.9 W [1] |
| Power consumption for X2X Link power supply | - | | 1.42 W [2] | | - |
| Power consumption | | | | | |
| Internal I/O | - | | 0.6 W [2] | | - |
| Additional power dissipation caused by actuators (resistive) [W] | - | | | | |
| Electrical isolation | | | | | |
| Fieldbus - X2X Link | - | | Yes | | - |
| Fieldbus - I/O | - | | Yes | | - |
| Certifications | | | | | |
| CE | Yes | | | | |
| UKCA | Yes | | | | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | | | | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | | | | |
| Functional safety | EN 50156-1:2004 | | | | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | | | | |
| UL | cULus E115267<br>Industrial control equipment | | | | |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | | | | - |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | | | | - |
| CCS | Yes | - | Yes | - | |
| LR | ENV1 | | | | - |
| KR | Yes | | | | - |
| ABS | Yes | | | | - |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | | | | - |
| **Safety characteristics** | | | | | |
| Note | See section "Safety characteristics". | | | | |

Table 27: X20SL8100, X20cSL8100, X20SL8101, X20cSL8101, X20SL8110 - Technical data

## Technical data

| Order number | X20SL8100 | X20cSL8100 | X20SL8101 | X20cSL8101 | X20SL8110 |
|---|---|---|---|---|---|
| **Limit values for SafeDESIGNER application** | | | | | |
| Max. resources available for SafeDESIGNER info window entries [3] | | | | | |
| FB instances | 4096 | | | | |
| Marker memory | 262,144 bytes | | | | |
| Stack memory | 32,768 bytes | | | | |
| Memory for safe input data | 6144 bytes | | | | |
| Memory for safe output data | 2048 bytes | | | | |
| Memory for standard input data | 1024 bytes | | | | |
| Memory for standard output data | 1024 bytes | | | | |
| Marker count | 16,382 | | | | |
| Additional SafeDESIGNER limit values | | | | | |
| Max. number of function block types | 512 | | | | |
| Max. number of force variables | 64 | | | | |
| Max. number of variable with variable status | 1023 | | | | |
| **Input SL / BC / X2X Link power supply** | | | | | |
| Input voltage | 24 VDC -15% / +20% | | | | |
| Input current | Max. 0.25 A | | Max. 0.9 A | | Max. 0.25 A |
| Fuse | - | | Integrated, cannot be replaced | | - |
| Reverse polarity protection | Yes | | | | |
| **Output SL / BC / X2X Link power supply** | | | | | |
| Nominal output power | - | | 7 W | | - |
| Parallel connection | - | | Yes [4] | | - |
| Redundant operation | - | | Yes | | - |
| Overload characteristics | - | | Short-circuit proof, temporary overload | | - |
| **Input I/O power supply** | | | | | |
| Input voltage | - | | 24 VDC -15% / +20% | | - |
| Fuse | - | | Required line fuse: Max. 10 A, slow-blow | | - |
| Reverse polarity protection | - | | No | | - |
| **Output I/O power supply** | | | | | |
| Nominal output voltage | - | | 24 VDC | | - |
| Behavior on short circuit | - | | Required line fuse | | - |
| Permissible contact load | - | | 10 A | | - |
| **Interfaces** | | | | | |
| Fieldbus | POWERLINK controlled node | | | | |
| Variant | 2x shielded RJ45 port (hub) | | | | |
| Line length | Max. 100 m between 2 nodes (segment length) | | | | |
| Transfer rate | 100 Mbit/s | | | | |
| Transfer | | | | | |
| Physical layer | 100BASE-TX | | | | |
| Half-duplex | Yes | | | | |
| Full-duplex | No | | | | |
| Autonegotiation | Yes | | | | |
| Auto-MDI/MDIX | Yes | | | | |
| Min. cycle time [5] | | | | | |
| Fieldbus | 200 µs | | | | |
| X2X Link | - | | 200 µs | | - |
| Synchronization between bus systems possible | - | | Yes | | - |
| **Operating conditions** | | | | | |
| Mounting orientation | | | | | |
| Horizontal | Yes | | | | |
| Vertical | Yes | | | | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | | | | |
| Degree of protection per EN 60529 | IP20 | | | | |
| **Ambient conditions** | | | | | |
| Temperature | | | | | |
| Operation | | | | | |
| Horizontal mounting orientation | 0 to 60°C | -25 to 60°C | 0 to 60°C | -25 to 60°C | 0 to 60°C |
| Vertical mounting orientation | 0 to 45°C | -25 to 45°C | 0 to 45°C | -25 to 45°C | 0 to 45°C |
| Derating | - | | See section "Derating". | | - |
| Starting temperature | - | Yes, -40°C | - | Yes, -40°C | - |
| Storage | -40 to 85°C | | | | |
| Transport | -40 to 85°C | | | | |
| Relative humidity | | | | | |
| Operation | 5 to 95%, non-condensing | Up to 100%, condensing | 5 to 95%, non-condensing | Up to 100%, condensing | 5 to 95%, non-condensing |
| Storage | 5 to 95%, non-condensing | | | | |
| Transport | 5 to 95%, non-condensing | | | | |

Table 27: X20SL8100, X20cSL8100, X20SL8101, X20cSL8101, X20SL8110 - Technical data

| Order number | X20SL8100 | X20cSL8100 | X20SL8101 | X20cSL8101 | X20SL8110 |
|---|---|---|---|---|---|
| **Mechanical properties** | | | | | |
| Note | Order SafeKEY and SafeLOGIC range of functions using the X20MK configurator.<br>X20 end cover plate (right) included in delivery<br>12-pin X20 terminal block, safety-keyed, included in delivery<br>SafeKEY cover included in delivery | | | | |
| Dimensions | | | | | |
| Width | 62.5$^{+0.2}$ mm | | | | 87.5$^{+0.2}$ mm |
| Height | 99 mm | | | | |
| Depth | 75 mm | | | | |
| Weight | 190 g | | | | |

Table 27: X20SL8100, X20cSL8100, X20SL8101, X20cSL8101, X20SL8110 - Technical data

1) Power consumption without interface module
2) The specified values are maximum values. For examples of the exact calculation, see section "Mechanical and electrical configuration" in the X20 system user's manual.
3) For a parameter description, see section "Message window" in the SafeDESIGNER documentation.
4) In parallel operation, it is only permitted to expect 75% of the nominal power. It is important to make sure that all power supply units operated in parallel are switched on and off at the same time.
5) The minimum cycle time specifies how far the bus cycle can be reduced without communication errors occurring.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SL81xx" on page 25.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SL81xx - Derating" on page 115

### 5.10.1 X20(c)SL81xx - Functionality

**Communication with each other**: Yes

**Support for Safe Commissioning Options**

- BOOL: 512
- INT: 64
- UINT: 64
- DINT: 64
- UDINT: 64

**Support of SafeMotion:**: Yes, depends on the available function licenses on the SafeKEY

- **Max. number of SafeMotion axes:** 70, depends on the data width of the modules used

**Time accuracy:** Time * 5% + Cycle time of the safety application

**Shortest task class cycle time:** 1 ms

**Max. number of SafeNodes:**

- **For X20(c)SL8100 modules:**: 100, depends on the available function licenses on the SafeKEY
- **For modules X20(c)SL8101 and X20SL8110:** 280, depends on the available function licenses on the SafeKEY and available resources

**Max. number of POWERLINK controlled nodes:**

- **For module X20(c)SL8100:** 50
- **For modules X20(c)SL8101 and X20SL8110:** 100

### Data exchange between the CPU and SafeLogic controller

If hardware upgrades <2.2.0.0 or Automation Runtime versions <AR 4.72 are used, legacy bandwidths apply.

**Max. total data width per direction:** 512 bytes

Each 8 BOOL are combined to 1 byte. Possible pad bytes due to alignment must be taken into account. For additional information, see section "Real-time operating system → Target systems → Target systems - SG4 → Runtime behavior - SG4 → Alignment" in Automation Help.

**Max. number of data points for each direction:**

- BOOL: 1024
- INT: 128
- UINT: 128
- DINT: 64
- UDINT: 64

### Data exchange between SafeDomain and SafeDomain

**Use as Managing SafeDomain:** Starting with mapp Safety 5.10.0 and hardware upgrade 2.2.1.0

**Use as Connected SafeDomain:** Starting with mapp Safety 5.10.0 and hardware upgrade 2.2.1.0

**Max. total data width per direction:** 64 bytes

Each 8 BOOL are combined to 1 byte. Possible pad bytes due to alignment must be taken into account. For additional information, see section "Real-time operating system → Target systems → Target systems - SG4 → Runtime behavior - SG4 → Alignment" in Automation Help.

**Max. total number of data points for each direction:** 16
It is important to note that 8 BOOL count as 1 data point.

**Max. number of data points for each direction:**

- BOOL: 128
- INT: 16
- UINT: 16
- DINT: 16
- UDINT: 16

**Max. number of linked Managing SafeDomains:**

- **For module X20(c)SL8100:** 10, starting with mapp Safety 5.10.0 and hardware upgrade 2.2.1.0
- **For modules X20(c)SL8101 and X20SL8110:** 20, starting with mapp Safety 5.10.0 and hardware upgrade 2.2.1.0

For additional module-specific information, see "X20(c)SL81xx" on page 25.

# 5.11 X20SP1130 - Technical data

| Order number | X20SP1130 |
|---|---|
| **Short description** | |
| I/O module | 1 safe type B1 digital output, 24 VDC, 10 A, without OSSD,<br>note list of permitted modules in the potential group |
| **General information** | |
| B&R ID code | 0x1DBF |
| Status indicators | I/O function per channel, operating state, module status |
| Diagnostics | |
| Module run/error | Yes, using LED status indicator and software |
| Outputs | Yes, using LED status indicator and software |
| Blackout mode | |
| Scope | Module |
| Function | Module functionality |
| Standalone mode | No |
| Power consumption | |
| Bus | 0.2 W |
| Internal I/O | 1.5 W |
| Additional power dissipation caused by actuators (resistive) [W] [1)] | 3 |
| Electrical isolation | |
| Channel - Bus | Yes |
| Certifications | |
| CE | Yes |
| UKCA | Yes |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 |
| Functional safety | EN 50156-1:2004 |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X |
| UL | cULus E115267<br>Industrial control equipment |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 |
| KC | Yes |
| **Safety characteristics** | |
| Note | See section "Safety characteristics". |
| **Input I/O power supply [2)]** | |
| Input voltage | 24 VDC -15% / +20% |
| Fuse | Required line fuse: Max. 10 A, slow-blow |
| Reverse polarity protection | No |
| **Safe digital outputs** | |
| Quantity | 1 |
| Variant | FET, 2x positive switching, type B1, output level readable |
| Nominal voltage | 24 VDC |
| Nominal output current | 10 A |
| Output protection | See section "Inrush current behavior for output channels". |
| Braking voltage when switching off inductive loads | 1 VDC |
| Diagnostic status | Output monitoring, current measurement (shutdown in the event of overcurrent) |
| Error detection time | 2 s |
| Insulation voltage between channel and bus | 500 $V_{eff}$ |
| Peak short-circuit current | See section "Inrush current behavior for output channels". |
| Leakage current when the output is switched off | 1 mA |
| $R_{DS(on)}$ | 30 mΩ |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ |
| Max. switching frequency | 5 times per minute with max. 2 Hz<br>Hardware upgrade 2.2.0.0 and later: 120 times per minute with max. 2 Hz<br>See section "Inrush current behavior for output channels" and table "Switching inductive loads". |
| Test pulse length | Without test pulse |
| Max. capacitive load | 1 mF |
| Minimum load | 15 mA |
| **Current on loss of ground** | |
| $I_{OUT}$ | <1 mA |

Table 28: X20SP1130 - Technical data

### Technical data

| Order number | X20SP1130 |
|---|---|
| $I_{GND}$ | <50 mA |
| **Operating conditions** | |
| Mounting orientation | |
| Horizontal | Yes |
| Vertical | Yes |
| Installation elevation above sea level | 0 to 2000 m, no limitation |
| Degree of protection per EN 60529 | IP20 |
| **Ambient conditions** | |
| Temperature | |
| Operation | |
| Horizontal mounting orientation | 0 to 60°C |
| Vertical mounting orientation | 0 to 35°C |
| Derating | See section "Derating". |
| Storage | -40 to 85°C |
| Transport | -40 to 85°C |
| Relative humidity | |
| Operation | 5 to 95%, non-condensing |
| Storage | 5 to 95%, non-condensing |
| Transport | 5 to 95%, non-condensing |
| **Mechanical properties** | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. |
| Pitch | $25^{+0.2}$ mm |

Table 28: X20SP1130 - Technical data

1) $R_{DS(on)}$ x Nominal output current². For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) If a hardware revision <B9 is used, then the power supply unit used must be able to charge a capacitance of 4 mF in a time period of 2 ms.

**Information:**

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20SP1130" on page 26.

**Additional information:**

- "Safety characteristics" on page 89
- "X20SP1130 - Derating" on page 116
- "Inrush current behavior for output channels - X20SP1130" on page 128

# 5.12 X20(c)SA4430 - Technical data

| Order number | X20SA4430 | X20cSA4430 |
|---|---|---|
| **Short description** | | |
| I/O module | 2x 2 safe type A analog inputs, 0.5 to 25 mA, channels individually galvanically isolated | |
| **General information** | | |
| B&R ID code | 0xB8B5 | 0xDD9F |
| Status indicators | I/O function per channel, operating state, module status | |
| Diagnostics | | |
| Module run/error | Yes, using LED status indicator and software | |
| Inputs | Yes, using LED status indicator and software | |
| Blackout mode | | |
| Scope | Module | |
| Function | Module functionality | |
| Standalone mode | No | |
| Power consumption | | |
| Bus | 0.25 W | |
| Internal I/O | 1.7 W | |
| Additional power dissipation caused by actuators (resistive) [W] [1)] | 0.36 | |
| Electrical isolation | | |
| Channel - Bus | Yes | |
| Channel - Channel | Yes | |
| Channel pair - Channel pair | Yes | |
| Certifications | | |
| CE | Yes | |
| UKCA | Yes | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | |
| Functional safety | EN 50156-1:2004 | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | |
| UL | cULus E115267<br>Industrial control equipment | |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | |
| CCS | Yes | - |
| LR | ENV1 | |
| KR | Yes | |
| ABS | Yes | |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | |
| KC | Yes | - |
| **Safety characteristics** | | |
| Note | See section "Safety characteristics". | |
| **I/O power supply** | | |
| Nominal voltage | 24 VDC | |
| Voltage range | 24 VDC -15% / +20% | |
| **Safe analog inputs** | | |
| Quantity | 2 safe input channel pairs | |
| Variant | Type A | |
| Input type | Differential input | |
| Digital converter resolution | 24-bit | |
| Conversion time | See chapter "I/O update time". | |
| Output format | SAFEINT | |
| Load | Up to hardware revision D3: 230 to 420 Ω, hardware revision E0 or later: 185 to 245 Ω | |
| Input protection | Protection against external supply voltages and overcurrent | |
| Open-circuit detection | Yes, using software | |
| Permissible input signal | | |
| Voltage | Max. 30.5 V | |
| Conversion procedure | Sigma-delta | |

Table 29: X20SA4430, X20cSA4430 - Technical data

## Technical data

| Order number | X20SA4430 | X20cSA4430 |
|---|---|---|
| Max. error at 25°C | | |
| Gain | | |
| 0.5 to <4 mA | <0.3% [2] | |
| 4 to 25 mA | <0.08% [2] | |
| Offset | | |
| 0.5 to <4 mA | <2 µA | |
| 4 to 25 mA | <6.3 µA | |
| Max. gain drift | | |
| 0.5 to <4 mA | <1.225 µA/°C | |
| 4 to 25 mA | <1.225 µA/°C | |
| Max. offset drift | | |
| 0.5 to <4 mA | <0.735 µA/°C | |
| 4 to 25 mA | <0.735 µA/°C | |
| Common-mode rejection | | |
| DC | >70 dB | |
| 50 Hz | >70 dB | |
| Common-mode range | Between the inputs ±50 V | |
| Nonlinearity | <0.003% | |
| Measurement range | 0.5 to 25 mA | |
| Input filter | | |
| Hardware | First-order low-pass filter / cutoff frequency 500 Hz | |
| Software | Sinc³ filter | |
| Resolution | 1 µA/LSB | |
| Overload detection | Yes, using software | |
| Test voltage | | |
| Channel - Bus | 500 VDC | |
| Channel pair - Channel pair | 500 VDC | |
| Channel - Ground | 500 VDC | |
| Safety-related accuracy per channel | | |
| Cat. 3 | 0.184 mA | |
| Cat. 4 | 0.49 mA | |
| Filter time | Configurable between 1 and 66.7 ms | |
| **Sensor power supply** | | |
| Nominal voltage | 29 VDC ±5% | |
| Nominal output current | Max. 60 mA | |
| Short-circuit proof | Yes, continuous | |
| Electrical isolation | | |
| Sensor power supply - Channel | No | |
| Sensor power supply - Sensor power supply | Yes | |
| $R_{DS(on)}$ | 50 Ω | |
| Behavior on short circuit | Voltage cutoff | |
| **Operating conditions** | | |
| Mounting orientation | | |
| Horizontal | Yes | |
| Vertical | Yes | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | |
| Degree of protection per EN 60529 | IP20 | |
| **Ambient conditions** | | |
| Temperature | | |
| Operation | | |
| Horizontal mounting orientation | 0 to 60°C | -25 to 60°C |
| Vertical mounting orientation | 0 to 40°C | -25 to 40°C |
| Derating | See section "Derating". | |
| Starting temperature | - | Yes, -40°C |
| Storage | -40 to 85°C | |
| Transport | -40 to 85°C | |
| Relative humidity | | |
| Operation | 5 to 95%, non-condensing | Up to 100%, condensing |
| Storage | 5 to 95%, non-condensing | |
| Transport | 5 to 95%, non-condensing | |
| **Mechanical properties** | | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | |
| Pitch | $25^{+0.2}$ mm | |

Table 29: X20SA4430, X20cSA4430 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current². This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) Based on the current measured value

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SA4430" on page 27.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SA4430 - Derating" on page 117

# 5.13 X20ST4492 - Technical data

| Order number | X20ST4492 |
|---|---|
| **Short description** | |
| I/O module | 2x 2 safe analog inputs for thermocouples, 1x 2 safe analog inputs for PT100/ PT1000 sensors, channel pairs galvanically isolated, integrated terminal temperature compensation, integrated temperature sensor in terminal block X20TB5E |
| **General information** | |
| B&R ID code | 0xB419 |
| Status indicators | I/O function per channel, operating state, module status |
| Diagnostics | |
| Module run/error | Yes, using LED status indicator and software |
| Inputs | Yes, using LED status indicator and software |
| Blackout mode | |
| Scope | Module |
| Function | Module functionality |
| Standalone mode | No |
| Power consumption | |
| Bus | 0.25 W |
| Internal I/O | 1.2 W |
| Additional power dissipation caused by actuators (resistive) [W] | - |
| Electrical isolation | |
| Channel - Bus | Yes |
| Channel - Channel | No |
| Channel pair - Channel pair | Yes |
| Certifications | |
| CE | Yes |
| UKCA | Yes |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 |
| Functional safety | EN 50156-1:2004 |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X |
| UL | cULus E115267<br>Industrial control equipment |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) |
| CCS | Yes |
| LR | ENV1 |
| KR | Yes |
| ABS | Yes |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck |
| KC | Yes |
| **Safety characteristics** | |
| Note | See section "Safety characteristics". |
| **I/O power supply** | |
| Nominal voltage | 24 VDC |
| Voltage range | 24 VDC -15% / +20% |
| **Thermocouple temperature inputs** | |
| Quantity | 2 safe input channel pairs |
| Variant | Type thermocouple |
| Digital converter resolution | 24-bit |
| Filter time | Configurable between 1 and 66.7 ms |
| Output format | SAFEINT |

Table 30: X20ST4492 - Technical data

| Order number | X20ST4492 |
|---|---|
| Measurement range | |
| Sensor temperature | |
| Type J: Fe-CuNi | -210.0 to 1200.0°C |
| Type K: NiCr-Ni | -270.0 to 1372.0°C |
| Type N: NiCrSi-NiSi | -270.0 to 1300.0°C |
| Type S: PtRh10-Pt | -50.0 to 1768.0°C |
| Type R: PtRh13-Pt | -50.0 to 1768.0°C |
| Type C: WRe5-WRe26 | 0 to 2320.0°C |
| Type T: Cu-CuNi | -270.0 to 400.0°C |
| Voltage | ±65 mV |
| Max. internal resistance of source during voltage measurement | 20 Ω |
| Terminal temperature compensation | Internal / External |
| Sensor standard | EN 60584 |
| Resolution | |
| Sensor temperature | 1 LSB = 0.1°C |
| Voltage | 1 LSB = 2 µV |
| Conversion procedure | Sigma-delta |
| Linearization method | Internal |
| Permissible input signal | Max. ±1 V |
| Input filter | First-order low-pass filter / cutoff frequency 500 Hz |
| Basic accuracy [1] | |
| Type J: Fe-CuNi | 1.41°C |
| Type K: NiCr-Ni | 1.81°C |
| Type N: NiCrSi-NiSi | 1.73°C |
| Type S: PtRh10-Pt | 3.10°C |
| Type R: PtRh13-Pt | 3.10°C |
| Type C: WRe5-WRe26 | 3.48°C |
| Type T: Cu-CuNi | 0.74°C |
| Voltage | 78 µV |
| Max. gain drift [2] | 0.013 %/°C |
| Max. offset drift | |
| Type J: Fe-CuNi | 0.0297°C per °C |
| Type K: NiCr-Ni | 0.0427°C per °C |
| Type N: NiCrSi-NiSi | 0.0471°C per °C |
| Type S: PtRh10-Pt | 0.1637°C per °C |
| Type R: PtRh13-Pt | 0.1455°C per °C |
| Type C: WRe5-WRe26 | 0.1068°C per °C |
| Type T: Cu-CuNi | 0.0335°C per °C |
| Voltage | 1.69 µV per °C |
| Terminal temperature compensation | |
| Accuracy of internal terminal temperature | 15°C at static temperatures and during safe operation |
| Common-mode rejection | |
| DC | >70 dB |
| 50 Hz | >70 dB |
| Common-mode range | ±4 V within channel pair, ±50 V between 2 channel pairs |
| Crosstalk between channels | ≤70 dB |
| Insulation voltage between channel and bus | 500 VDC |
| Safety-related accuracy per channel | |
| Type J: Fe-CuNi | 35.25°C |
| Type K: NiCr-Ni | 47.62°C |
| Type N: NiCrSi-NiSi | 51.81°C |
| Type S: PtRh10-Pt | 150.90°C |
| Type R: PtRh13-Pt | 134.54°C |
| Type C: WRe5-WRe26 | 111.36°C |
| Type T: Cu-CuNi | 30.82°C |
| Voltage | 2080 µV |
| **Resistance measurement temperature inputs** | |
| Quantity | 1 safe input channel pair |
| Variant | Type PT100/PT1000 |
| Measurement range | |
| Pt100 | -200.0 to 850.0°C |
| Pt1000 | -200.0 to 850.0°C |
| Basic accuracy [1] | |
| Pt100 | 1.89°C |
| Pt1000 | 0.53°C |
| Measuring current | 262 µA ±5% |
| Max. gain drift [2] | 0.004 %/°C |
| Max. offset drift | |
| Pt100 | 0.0525°C per °C |
| Pt1000 | 0.0053°C per °C |

Table 30: X20ST4492 - Technical data

### Technical data

| Order number | X20ST4492 |
|---|---|
| Temperature sensor resolution | |
| Pt100 | 1 LSB = 0.1°C |
| Pt1000 | 1 LSB = 0.1°C |
| Input filter | |
| Cutoff frequency | 500 Hz first-order |
| Max. line length | 50 m |
| Max. line resistance | 5 Ω |
| Safety-related accuracy per channel | |
| Pt100 | 12.60°C |
| Pt1000 | 8.93°C |
| **Operating conditions** | |
| Mounting orientation | |
| Horizontal | Yes |
| Vertical | Yes |
| Installation elevation above sea level | 0 to 2000 m, no limitation |
| Degree of protection per EN 60529 | IP20 |
| **Ambient conditions** | |
| Temperature | |
| Operation | |
| Horizontal mounting orientation | 0 to 60°C |
| Vertical mounting orientation | 0 to 50°C |
| Derating | See section "Derating". |
| Storage | -40 to 85°C |
| Transport | -40 to 85°C |
| Relative humidity | |
| Operation | 5 to 95%, non-condensing |
| Storage | 5 to 95%, non-condensing |
| Transport | 5 to 95%, non-condensing |
| **Mechanical properties** | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. |
| Pitch | $25^{+0.2}$ mm |

Table 30: X20ST4492 - Technical data

1) At 25°C
2) Based on the measured value

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20ST4492" on page 28.

**Additional information:**

- "Safety characteristics" on page 89
- "X20ST4492 - Derating" on page 117

# 5.14 X20(c)SD1207 - Technical data

| Order number | X20SD1207 | X20cSD1207 |
|---|---|---|
| **Short description** | | |
| I/O module | 1 safe type A digital counter channel, 7 kHz, 24 VDC | |
| **General information** | | |
| B&R ID code | 0xCAC1 | 0xE1CB |
| Status indicators | I/O function per channel, operating state, module status | |
| Diagnostics | | |
| Module run/error | Yes, using LED status indicator and software | |
| Inputs | Yes, using LED status indicator and software | |
| Blackout mode | | |
| Scope | Module | |
| Function | Module functionality | |
| Standalone mode | No | |
| Power consumption | | |
| Bus | 0.25 W | |
| Internal I/O | 0.75 W | |
| Additional power dissipation caused by actuators (resistive) [W] [1)] | 0.064 | |
| Electrical isolation | | |
| Channel - Bus | Yes | |
| Channel - Channel | No | |
| Certifications | | |
| CE | Yes | |
| UKCA | Yes | |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 | |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 | |
| Functional safety | EN 50156-1:2004 | |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X | |
| UL | cULus E115267<br>Industrial control equipment | |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 | |
| DNV | Temperature: **A** (0 to 45°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **A** (0.7 g)<br>EMC: **B** (bridge and open deck) | |
| CCS | Yes | - |
| LR | ENV1 | |
| KR | Yes | |
| ABS | Yes | |
| BV | **EC21B**<br>Temperature: 5 - 45°C<br>Vibration: 0.7 g<br>EMC: Bridge and open deck | |
| KC | Yes | - |
| **Safety characteristics** | | |
| Note | See section "Safety characteristics". | |
| **Encoder power supply** | | |
| Output voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ | |
| Nominal output current | 80 mA | |
| $R_{DS(on)}$ | 10 Ω | |
| Protective measures | | |
| Short-circuit proof | Thermal limit determined by PTC | |
| **I/O power supply** | | |
| Nominal voltage | 24 VDC | |
| Voltage range | 24 VDC -15% / +20% | |
| Integrated protective function | Reverse polarity protection | |
| **Safe digital counter inputs** | | |
| Quantity | 1 | |
| Variant | Type A | |
| Nominal voltage | 24 VDC | |
| Input characteristics per EN 61131-2 | Type 1 | |

Table 31: X20SD1207, X20cSD1207 - Technical data

### Technical data

| Order number | X20SD1207 | X20cSD1207 |
|---|---|---|
| Input filter | | |
| Hardware | <10 µs | |
| Software | Configurable between 0 and 100 s | |
| Input frequency | Max. 7 kHz | |
| Input circuit | Sink | |
| Input voltage | 24 VDC -15% / +20% | |
| Input current at 24 VDC 2) | Min. 2 mA to max. 2.48 mA | |
| Input resistance | 9.68 kΩ | |
| Insulation voltage between channel and bus | 500 $V_{eff}$ | |
| Switching threshold | | |
| Low | <5 VDC | |
| High | >15 VDC | |
| Line length | Max. 30 m shielded | |
| **Operating conditions** | | |
| Mounting orientation | | |
| Horizontal | Yes | |
| Vertical | Yes | |
| Installation elevation above sea level | 0 to 2000 m, no limitation | |
| Degree of protection per EN 60529 | IP20 | |
| **Ambient conditions** | | |
| Temperature | | |
| Operation | | |
| Horizontal mounting orientation | 0 to 60°C | -25 to 60°C |
| Vertical mounting orientation | 0 to 50°C | -25 to 50°C |
| Derating | See section "Derating". | |
| Starting temperature | - | Yes, -40°C |
| Storage | -40 to 85°C | |
| Transport | -40 to 85°C | |
| Relative humidity | | |
| Operation | 5 to 95%, non-condensing | Up to 100%, condensing |
| Storage | 5 to 95%, non-condensing | |
| Transport | 5 to 95%, non-condensing | |
| **Mechanical properties** | | |
| Note | Order 1x safety-keyed terminal block separately.<br>Order 1x safety-keyed bus module separately. | |
| Pitch | $25^{+0.2}$ mm | |

Table 31: X20SD1207, X20cSD1207 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current². This value also applies to encoders that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) The input current specifications refer to the switched-on state of the input.

## Information:

**For additional information about installation, see section "Installation notes for X20 modules" in Automation Help.**

For additional module-specific information, see "X20(c)SD1207" on page 29.

**Additional information:**

- "Safety characteristics" on page 89
- "X20(c)SD1207 - Derating" on page 118

# 5.15 X67SI8103 - Technical data

| Order number | X67SI8103 |
|---|---|
| **Short description** | |
| I/O module | 2x M12 interface each with 2 safe type A digital inputs and 2 pulse outputs, 24 VDC, 2x standardized 8-pin M12 device interface each with 1 digital input without safety function and 2 safe type A digital inputs and 2 pulse outputs, 24 VDC and 1 digital output without safety function, 24 VDC, 0.6 A and 1 device power supply, 24 VDC, 2 A |
| **General information** | |
| B&R ID code | 0xBB7C |
| Status indicators | I/O function per channel, operating state, module status |
| Diagnostics | |
| Module run/error | Yes, using LED status indicator and software |
| I/O function | Yes, using LED status indicator and software |
| Blackout mode | |
| Scope | Module |
| Function | Module functionality |
| Standalone mode | No |
| Connection type | |
| X2X Link | M12, B-coded |
| Inputs/Outputs | M12 8-pin or M12 5-pin, A-coded |
| I/O power supply | M8, 4-pin |
| Power consumption | |
| Bus | 0.9 W |
| Internal I/O | 2.1 W |
| Additional power dissipation caused by actuators (resistive) [W] [1)] | |
| Digital outputs | 0.216 |
| Pulse outputs | 0.192 |
| Electrical isolation | |
| Channel - Bus | Yes |
| Channel - Channel | No |
| Certifications | |
| CE | Yes |
| UKCA | Yes |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 |
| Functional safety | EN 50156-1:2004 |
| ATEX | Zone 2, II 3G Ex nA IIA T5 Gc<br>IP67, Ta = 0 - Max. 60°C<br>TÜV 05 ATEX 7201X |
| UL | cULus E115267<br>Industrial control equipment |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 |
| KC | Yes |
| **Safety characteristics** | |
| Note | See section "Safety characteristics". |
| **24 VDC output** | |
| Output voltage | 24 VDC -15% / +20% |
| Output current | 2 A |
| **I/O power supply** | |
| Nominal voltage | 24 VDC |
| Voltage range | 18 to 30 VDC |
| Integrated protective function | Reverse polarity protection |
| **Digital inputs** | |
| Quantity | 2 |
| Nominal voltage | 24 VDC |
| Input characteristics per EN 61131-2 | Type 1 |
| Input voltage | 24 VDC -15% / +20% |
| Input current at 24 VDC [2)] | Min. 2 mA to max. 7.24 mA |
| Input circuit | Sink |
| Input filter | |
| Hardware | ≤150 µs |
| Input resistance | Min. 3.3 kΩ |

Table 32: X67SI8103 - Technical data

## Technical data

| Order number | X67SI8103 |
|---|---|
| Switching threshold | |
| Low | <5 VDC |
| High | >15 VDC |
| Insulation voltage between channel and bus | 500 $V_{eff}$ |
| **Safe digital inputs** | |
| Quantity | 8 |
| Variant | Type A |
| Nominal voltage | 24 VDC |
| Input characteristics per EN 61131-2 | Type 1 |
| Input filter | |
| Hardware | ≤150 µs |
| Software | Configurable between 0 and 500 ms |
| Input circuit | Sink |
| Input voltage | 24 VDC -15% / +20% |
| Input current at 24 VDC [2] | Min. 2 mA to max. 8.28 mA |
| Input resistance | Min. 2.9 kΩ |
| Error detection time | 200 ms |
| Insulation voltage between channel and bus | 500 $V_{eff}$ |
| Switching threshold | |
| Low | <5 VDC |
| High | >15 VDC |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line |
| **Digital outputs** | |
| Quantity | 2 |
| Variant | FET, positive switching, output level readable |
| Nominal voltage | 24 VDC |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ |
| Max. switching frequency | See section "Inrush current behavior for output channels". |
| Nominal output current | 0.6 A |
| Total nominal current | 1.2 A |
| Output protection | See section "Inrush current behavior for output channels". |
| Leakage current when the output is switched off | <500 µA |
| $R_{DS(on)}$ | 300 mΩ |
| Peak short-circuit current | See section "Inrush current behavior for output channels". |
| Braking voltage when switching off inductive loads | 50 VDC |
| Insulation voltage between channel and bus | 500 $V_{eff}$ |
| Max. capacitive load | 100 nF |
| Peak output current | 1 A |
| **Pulse outputs** | |
| Quantity | 8 |
| Variant | Push-Pull |
| Nominal output current | 40 mA |
| Output protection | Shutdown of individual channels in the event of overload or short circuit [3] |
| Peak short-circuit current | 25 A for 15 µs |
| Short-circuit current | 100 $mA_{eff}$ |
| Leakage current when the output is switched off | 0.1 mA |
| $R_{DS(on)}$ | 60 Ω |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ |
| Total nominal current | 80 mA |
| **Operating conditions** | |
| Mounting orientation | |
| Any | Yes |
| Installation elevation above sea level | 0 to 2000 m, no limitation |
| Degree of protection per EN 60529 | IP67 |
| **Ambient conditions** | |
| Temperature | |
| Operation | -40 to 60°C [4] |
| Storage | -40 to 85°C |
| Transport | -40 to 85°C |
| **Mechanical properties** | |
| Dimensions | |
| Width | 53 mm |
| Height | 85 mm |
| Depth | 42 mm |

Table 32: X67SI8103 - Technical data

| Order number | X67SI8103 |
|---|---|
| Weight | 190 g |
| Torque for connections | |
| M8 | Max. 0.4 Nm |
| M12 | Max. 0.6 Nm |

Table 32: X67SI8103 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) The input current specifications refer to the switched-on state of the input.
3) The protective function is provided for max. 30 minutes for a continuous short circuit.
4) Up to hardware revision <G0: -25 to 60°C

## Information:

**For additional information about installation, see section "Installation notes for X67 modules" in Automation Help.**

For additional module-specific information, see "X67SI8103" on page 30.

**Additional information:**

- "Safety characteristics" on page 89
- "X67SI8103 - Inrush current behavior for output channels" on page 129

# 5.16 X67SC4122.L12 - Technical data

| Order number | X67SC4122.L12 |
|---|---|
| **Short description** | |
| I/O module | 8 safe type A digital inputs, 8 pulse outputs, 24 VDC, 4 safe type B1 digital outputs, 24 VDC, 2 A, OSSD <500 µs |
| **General information** | |
| B&R ID code | 0xA7A6 |
| Status indicators | I/O function per channel, operating state, module status |
| Diagnostics | |
| Module run/error | Yes, using LED status indicator and software |
| Outputs | Yes, using LED status indicator and software |
| Inputs | Yes, using LED status indicator and software |
| Blackout mode | |
| Scope | Module |
| Function | Module functionality |
| Standalone mode | No |
| Connection type | |
| X2X Link | M12, B-coded |
| Inputs/Outputs | M12, A-coded |
| I/O power supply | M8, 4-pin |
| Power consumption | |
| Bus | 0.8 W |
| Internal I/O | 1.8 W |
| Additional power dissipation caused by actuators (resistive) [W] [1)] | |
| Safe digital outputs | 2.25 |
| Pulse outputs | 0.08 |
| Electrical isolation | |
| Channel - Bus | Yes |
| Channel - Channel | No |
| Certifications | |
| CE | Yes |
| UKCA | Yes |
| Functional safety | cULus FSPC E361559<br>Energy and industrial systems<br>Certified for functional safety<br>ANSI UL 1998:2013 |
| Functional safety | IEC 61508:2010, SIL 3<br>EN 62061:2005/A2:2015, SIL 3<br>EN ISO 13849-1:2015, Cat. 4 / PL e<br>IEC 61511:2004, SIL 3 |
| Functional safety | EN 50156-1:2004 |
| ATEX | Zone 2, II 3G Ex nA IIA T5 Gc<br>IP67, Ta = 0 - Max. 60°C<br>TÜV 05 ATEX 7201X |
| UL | cULus E115267<br>Industrial control equipment |
| HazLoc | cCSAus 244665<br>Process control equipment<br>for hazardous locations<br>Class I, Division 2, Groups ABCD, T5 |
| KC | Yes |
| **Safety characteristics** | |
| Note | See section "Safety characteristics". |
| **I/O power supply** | |
| Nominal voltage | 24 VDC |
| Voltage range | 18 to 30 VDC |
| Integrated protective function | Reverse polarity protection |
| **Safe digital inputs** | |
| Quantity | 8 |
| Variant | Type A |
| Nominal voltage | 24 VDC |
| Input characteristics per EN 61131-2 | Type 1 |
| Input filter | |
| Hardware | ≤150 µs |
| Software | Configurable between 0 and 500 ms |
| Input circuit | Sink |
| Input voltage | 24 VDC -15% / +20% |
| Input current at 24 VDC [2)] | Min. 2 mA to max. 4.59 mA |
| Input resistance | Min. 5.23 kΩ |
| Error detection time | 200 ms |
| Insulation voltage between channel and bus | 500 $V_{eff}$ |

Table 33: X67SC4122.L12 - Technical data

| Order number | X67SC4122.L12 |
|---|---|
| Switching threshold | |
| Low | <5 VDC |
| High | >15 VDC |
| Line length between signal source (pulse output or external signal) and input | Max. 60 m with unshielded line<br>Max. 400 m with shielded line |
| **Safe digital outputs** | |
| Quantity | 4 |
| Variant | FET, 2x positive switching, type B1, output level readable |
| Nominal voltage | 24 VDC |
| Nominal output current | 2 A |
| Total nominal current | 5 A |
| Output protection | See section "Inrush current behavior for output channels". |
| Braking voltage when switching off inductive loads | Max. 45 VDC |
| Error detection time | 1 s |
| Insulation voltage between channel and bus | 500 $V_{eff}$ |
| Peak short-circuit current | See section "Inrush current behavior for output channels". |
| Leakage current when the output is switched off | 100 µA |
| $R_{DS(on)}$ | 250 mΩ |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ |
| Max. switching frequency | See section "Inrush current behavior for output channels". |
| Test pulse length | Max. 1 ms |
| Max. capacitive load | 100 nF |
| Peak output current | 2.5 A (effective current ≤2 A) |
| Minimum load | 12 mA, hardware revision I0 and later: 0 mA |
| **Current on loss of ground** | |
| $I_{OUT}$ | <3 mA, hardware revision B2 and later: <1 mA, hardware revision I0 and later: <100 µA |
| $I_{GND}$ | <110 mA |
| **Pulse outputs** | |
| Quantity | 8 |
| Variant | Push-Pull |
| Nominal output current | 50 mA |
| Output protection | Shutdown of individual channels in the event of overload or short circuit [3] |
| Peak short-circuit current | 25 A for 5 ms |
| Short-circuit current | 1.4 $A_{eff}$ |
| Leakage current when the output is switched off | 0.1 mA |
| $R_{DS(on)}$ | 4 Ω |
| Switching voltage | I/O power supply minus voltage drop due to $R_{DS(on)}$ |
| Total nominal current | 400 mA |
| **Operating conditions** | |
| Mounting orientation | |
| Any | Yes |
| Installation elevation above sea level | 0 to 2000 m, no limitation |
| Degree of protection per EN 60529 | IP67 |
| **Ambient conditions** | |
| Temperature | |
| Operation | -40 to 60°C [4] |
| Storage | -40 to 85°C |
| Transport | -40 to 85°C |
| **Mechanical properties** | |
| Dimensions | |
| Width | 53 mm |
| Height | 155 mm |
| Depth | 42 mm |
| Weight | 350 g |
| Torque for connections | |
| M8 | Max. 0.4 Nm |
| M12 | Max. 0.6 Nm |

Table 33: X67SC4122.L12 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current$^2$. This value also applies to sensors that are supplied via these outputs. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) The input current specifications refer to the switched-on state of the input.
3) The protective function is provided for max. 30 minutes for a continuous short circuit.
4) Up to hardware revision <D0: 0 to 60°C

## Information:

**For additional information about installation, see section "Installation notes for X67 modules" in Automation Help.**

For additional module-specific information, see "X67SC4122.L12" on page 31.

**Additional information:**

- "Safety characteristics" on page 89
- "X67SC4122.L12 - Inrush current behavior for output channels" on page 130

# 6 Safety-related information

## 6.1 Safety characteristics

### openSAFETY - Safety characteristics

| Standard | Criteria | Characteristic value |
|---|---|---|
| IEC 61508-1:2010<br>IEC 61508-2:2010<br>IEC 61508-3:2010<br>IEC 61511-1:2016/A1:2017<br>IEC 62061:2021 | PFH / $PFH_d$: openSAFETY wired | Negligible |
| | PFH / $PFH_d$: openSAFETY wireless | $<1*10^{-14}$ * Number of openSAFETY packets per hour |

### Safety level for standard safety technology

| | ISO 13849-1:2023 | | | | | IEC 61508:2010, IEC 61511-1:2016/A1:2017, IEC 62061:2021 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Category | PL | DC | MTTFd [1] | Mission time [1] | SIL CL | SFF | PFH | PFD | Proof test interval (PT) [1] |
| X20 SafeLOGIC controller | 4 | e | >94% | 2500 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| X20 SafeLOGIC-X controllers | 4 | e | >94% | 2500 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Safe analog inputs - Type A | | | | | | | | | | |
| The following characteristic values apply only to the use of input channel pairs. Assessing the channels from a safety point of view when they are used individually is not possible. | | | | | | | | | | |
| SHUNTTEST disabled | 3 | d | >60% | 100 | Max. 20 | 3 | >60% | $<1*10^{-9}$ | $<1*10^{-4}$ | 20 |
| SHUNTTEST enabled | 4 | e | >94% | 2200 | Max. 20 | 3 | >90% | $<1*10^{-9}$ | $<1*10^{-4}$ | 20 |
| Safe digital outputs - Type A and type B | | | | | | | | | | |
| Disable OSSD = Yes - Warning | 3 | d | >60% | 100 | Max. 20 | 2 | >60% | $<5*10^{-8}$ | $<1*10^{-3}$ | 20 |
| Disable OSSD = No | 4 | e | >94% | 2500 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Type power supply | 4 | e | >94% | 2500 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Safe digital outputs - Type relay | | | | | | | | | | |
| Single relay channel | 1 | c | - | 100 | Max. 20 | 1 | - | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Relay channels connected in series | 4 | e | - | 2500 | Max. 20 | 3 | - | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Safe digital inputs - Type A | | | | | | | | | | |
| Individual | 3 | e | >94% | 100 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| In pairs | 4 | e | >94% | 2500 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Safe temperature measurement | | | | | | | | | | |
| The following characteristic values apply only to the use of input channel pairs. Assessing the channels from a safety point of view when they are used individually is not possible. | | | | | | | | | | |
| In pairs | 4 | e | >94% | 2200 | Max. 20 | 3 | >90% | $<1*10^{-9}$ | $<1*10^{-4}$ | 20 |
| Safe counter function - Type A | | | | | | | | | | |
| The special instructions in chapter "Connection examples" must be taken into account. | | | | | | | | | | |
| Mode A-A, single-channel | 2 | d | >94% | 2500 | Max. 20 | 2 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Mode A-A, dual-channel | 4 | e | >94% | 2500 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Mode A-B | 4 | e | >94% | 2500 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |
| Mode A-A/-B-B/ | 4 | e | >94% | 2500 | Max. 20 | 3 | >90% | $<1*10^{-10}$ | $<2*10^{-5}$ | 20 |

Table 34: Safety level for standard safety technology

1) Value in years

## B10d at maximum switching capacity (safe digital outputs - type relay)

| ISO 13849-1:2023 | | | |
|---|---|---|---|
| **B10d** | **X20(c)SC2432** | **X20(c)SO2530** | **X20SO6530** |
| DC1, 24 VDC | 6 A / 780,000 | | 6 A / 1,000,000 |
| AC1, 70 VAC | - | | 6 A /600,000 (80°C / 0.1Hz / 10% active)<br>6 A / 80,000 (80°C / 1 Hz / 10% active) |
| AC1, 230 VAC single-channel | 6 A / 780,000 | | 2 A / 260,000 (23°C / 0.1 Hz / 50% active)<br>2 A / 428,000 (80°C / 1 Hz / 10% active) |
| AC1, 230 VAC dual-channel [2] | - | | 6 A / 368,910 (80°C / 0.1 Hz / 50% active) |
| AC15, 230 VAC single-channel | 3 A / 1,960,000 | | 2 A / 1,000,000 (80°C / 0.1 Hz / 16.67% active) |
| AC15, 230 VAC dual-channel [2] | - | | 5 A / 472,893 (80°C / 0.1 Hz / 10% active) |
| DC13, 24 VDC | 5 A / 780,000 [1] | | 2 A / 600,000 (80°C / 0.1 Hz / 16.67% active)<br>4 A / 300,000 [1]<br>4 A / 50,000 (80°C / 0.1 Hz / 10% active) |

1 In this case, a protective circuit (standard diode) is required.
2 Additional requirements for X20SO6530 in HazLoc applications: Only two-channel output structure permitted, use SafeDigitalOutputxxyy data points, maximum 20,000 switching cycles permitted for >2 A.

## For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## 6.2 Reasonably foreseeable misuse

### 6.2.1 Operation outside permissible limit values

**Warning!**

**Failure of the module's internal safety structure can result in dangerous states.**

**Operation outside the limit values listed in this section can cause permanent irreparable damage to the module's internal safety structure.**

**Operation outside this technical data is not permitted. It is your responsibility to ensure an operating environment within the specified safety-related technical data.**

The following specifications from the technical data should be understood as safety-related maximum values. Exceeding the values specified in the technical data of the module used can result in permanent irreparable damage to the module's internal safety structures:

**I/O power supply**

- Voltage range

**Safe analog inputs and thermocouple temperature inputs**

- Permissible input signal

**Safe digital inputs and safe digital counter inputs**

- Input voltage
- Line length between signal source (pulse output or external signal) and input

**Warning!**

**Signal interference due to cross-talk can result in dangerous states.**

**If the maximum line length specified in the technical data is exceeded, signal interference may occur on the cables due to cross-talk, resulting in faulty signals in the safety application.**

**It is your responsibility to ensure that the operating environment complies with the specified maximum cable length.**

**Safe digital outputs (type A, type B)**

- Nominal output current
- Total nominal current
- Max. switching frequency
- Max. capacitive load

**Relay outputs**

- Nominal output current
- Max. switching frequency
- Short-circuit/Overload protection
- Switching voltage range

**Safe relay channels**

- B10d

**Operating conditions**

- Installation elevation above sea level
- Degree of protection per EN 60529

**Ambient conditions**

- Temperature
  - Derating
  - Storage
  - Transport

- Relative humidity
  - Operation
  - Storage
  - Transport

### 6.2.2 Operation in "standalone mode"

## Warning!

**Danger due to an incorrect safety-related function**

**Modules with standalone mode enabled behave identically to blackout mode while the system is booting up and until the network connection is established. This means the modules switch to state Operational. The safety-related functions are saved with the internally stored parameters. The usual alignment of the parameters with the data on the Safety+ server cannot take place in this phase due to the missing network connection. If there is an incorrect parameter set on the module, e.g. because the module is used as a replacement part in another machine, this results in an incorrect safety-related function and can result in dangerous states.**

**It is your responsibility to ensure the following:**

- **Modules with standalone mode enabled are not confused with other modules, e.g. by a suitable marking on the module.**
- **Maintenance technicians must be familiar with the special behavior of these modules.**
- **Before connecting the terminal block to a module with enabled standalone function, it is checked once again that this module with the stored parameters is actually suitable for this installation location on the machine/application.**

### 6.2.3 Correct timing behavior

**Warning!**

**Incorrect timing can result in dangerous states.**

**Incorrect configuration of the products in SafeDesigner(+) or incorrect selection of the products can result in incorrect timing behavior. In addition, the times of the connected sensors and actuators and the times until the actuator is stopped must also be taken into account when calculating the safety response time.**

**It is your responsibility to ensure correct configuration and correct selection of the products in order to achieve the required protection target within the specified time. In addition, depending on the protection target, suitable tests to check the overall response time of the application are also necessary as part of validation.**

The following parameters or technical data can result in timing behavior that can negatively influence the safety-related function:

**Technical data**

- Max. I/O cycle time
- Input filter
- Error detection time
- Timing precision

**Parameters in SafeDesigner(+)**

- Parameter "Filter on"
- Parameter "Max. safe data duration" for Safety+
  For additional information, see section "Safety response time" in Automation Help.
- Parameter "Safe data duration" and parameter "Additional tolerated packet loss" for mapp Safety
  For additional information, see section "Safety response time" in Automation Help.
- Parameter "Time base"

**Warning!**

**Danger due to brief switch-on pulses**

**Errors caused by cross faults to other signals may be interpreted by the module as high signals. Such errors are detected by the module within the error detection time at the latest. By default, the switch-on filter is pre-assigned with the value of the fault detection time, which allows the false signals caused by possible cross faults to be suppressed.**

**If the switch-on filter is configured to a value less than the fault detection time, however, faulty signals can result in brief switch-on pulses.**

**It is your responsibility to ensure that the input filters are correctly configured.**

**Warning!**

**Danger from loss of signals due to short pulse length**

**The transfer of safe signals via the network is monitored using a "timeout procedure". Network disturbances whose effect is shorter than the configured timeout are tolerated. As a result, signals whose length is shorter than the timeout may not be recognized by the data receiver and may therefore be lost.**

**It is your responsibility to ensure that the signals are always longer than the configured timeout values. The signal lengths can be influenced by the following means:**

- **The low phase of a signal on an input module can be extended with the switch-on filter.**
- **Low phases of signals from the SafeLogic controller can be lengthened with restart interlock functions of PLCopen function blocks or timer blocks.**

### 6.2.4 Compatibility of connected sensors/actuators

**Warning!**

**Sensors or actuators whose technical specifications are incompatible with the technical interface of SafeIO products can cause the safety function to fail, resulting in dangerous states.**

**It is your responsibility to ensure that the technical interfaces between SafeIO products and the sensors/actuators used are correct and complete.**

The following technical properties must be checked against the compatibility of the sensors and actuators:

- Braking voltage
- Leakage current when the output is switched off
- Switching voltage
- Switching thresholds (low, high)

### 6.2.5 Electrical safety and supply voltage

**Danger!**

**Excessive electrical voltages irreparably damage the safety structures within the module.**

**In order to ensure a defined power supply, a SELV or PELV power supply unit per IEC 61010-2-201 must be used for the bus, SafeIO and SafeLogic power supply. This also applies to all digital signal sources that are connected to the modules.**

**If the power supply is grounded (PELV system), then only a GND connection is permitted for grounding. Grounding types that have ground connected to +24 VDC are not permitted.**

**The external circuits to be connected to the SELV / PELV part of the device must be galvanically isolated from the power grid or dangerous voltage by reinforced or double insulation and must meet the requirements of the SELV / PELV circuit.**

**Danger!**

**The voltage classes on the terminal block are not permitted to be mixed! Only operation with the mains voltage (e.g. 230 VAC) OR with safety extra-low voltage (e.g. 24 VDC SELV) is permitted.**

**Danger!**

**Risk of electric shock!**

**The terminal block is only permitted to conduct voltage when it is connected. It is not permitted to be disconnected or connected while voltage is applied or have voltage applied to it while it is removed under any circumstances.**

### 6.2.6 Defective modules

**Warning!**

**Failure of the module's internal safety structure can result in dangerous states.**

**Continuously lighting "SE" LEDs indicate a possible defect in the module's internal safety structure.**

**Temporary problems can be solved either by correct configuration and/or powering the module down/up. Should the problem persist despite correct configuration, this is a strong indication that the module's internal safety structure is permanently damaged. In this case, the module must be replaced.**

### 6.2.7 Safe analog inputs

**Warning!**

**With "Disable shunt test = Yes - Warning", the module has reduced error detection capabilities and no longer meets the requirements of Cat. 4 per ISO 13849-1:2023.**
**As a result, the module meets the requirements up to max. Cat. 3 per ISO 13849-1:2023.**

**Warning!**

**The use or configuration of an incorrect TC sensor type CANNOT be detected by the module. The temperature value acquired by the module is incorrect.**

**Make sure during validation that the correct TC sensor type is installed and configured.**

**Warning!**

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**The validity of analog signals is represented by the associated status signals. These binary status signals (data type SAFEBOOL) must also be evaluated each time the analog signals are used. A binary status signal with state FALSE indicates an invalid value in the analog signal. In these situations, the analog signal is no longer permitted to be used for safety-related assessments.**

**The correct use of analog signals must be observed.**

### 6.2.8 Safe digital inputs

**Warning!**

**Configuring a switch-off filter lengthens the safety response time!**
**The configured filter value must be added to the total response time.**

**Warning!**

**Signals with a low phase shorter than the safety response time can potentially be lost. Such signals should be lengthened accordingly using the "switch-on filter" function on the input module.**

**Warning!**

**Configuring a switch-off filter causes signals with a low phase shorter than the switch-off filter to be filtered out. If this results in a problem concerning safety functionality, then the switch-off filter must be set to 0. Lengthening the low phase with a switch-on filter is not possible in these cases.**

**Warning!**

**On the X67SC4122.L12, SI 4 is connected twice to female connectors 2 and 3 as a wiring aid. This means that SI 4 can be used for both single-channel sensors and dual-channel sensors.**

**Connecting two sensors to SI 4 in female connector 2 and SI 4 in female connector 3 is not permitted since this would represent a parallel connection of two sensors on one input channel.**

### 6.2.9 Safe digital outputs

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**Configuring "Disable OSSD = Yes - Warning" greatly reduces the internal error detection of the module.**
**Subsequently, the information listed in chapter section "Detecting module-internal errors" in Automation Help must be observed.**

**The correct use and necessary tests of the safety function must be observed.**

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**If the output channel is switched with an output frequency of 1.25 Hz or more for more than 8 hours in safety-related applications according to category 4 or PL e per ISO 13849-1:2023, the output channel must be switched on and off for 1 second every 8 hours.**

**The correct use and necessary tests of the safety function must be observed.**

### 6.2.10 Relay modules

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**The two relay contacts of the two relays must be connected in series for applications greater than category 1 per ISO 13849-1:2023. In this application, signal "SafeDigitalOutputxxyy" must be used to control the two relays.**

**Controlling the two relay contacts using the individual "SafeDigitalOutputxx" signals is not permitted for applications greater than category 1 per ISO 13849-1:2023 since in certain operating states this may result in simultaneously welding of both relay contacts.**

**The correct application must be observed.**

### 6.2.11 Remanent data

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**If parameter "Keep remanent" is set to "Yes - Warning", it is important when saving data after a project download to note that the data still has the same meaning in the application program.**

**The correct application must be observed.**

### 6.2.12 UL certification information

The following rules must be observed to install modules according to the UL standard.

## Information:

- **Only use copper cables. Minimum temperature resistance of the cable connected to the field wiring terminals: 80°C, 28 to 14 AWG.**
- **All models are intended for use in a terminating safety enclosure that meets fire spread protection requirements and has adequate stiffness per UL 61010-1 and UL 61010-2-201.**
- **All safety modules are designed to be maintenance-free. Repairs are not permitted to be carried out on safety modules.**

## Information:

**The following items must be added for connections to overcurrent protection devices:**

- **A single-pole circuit breaker that serves as an overcurrent protection device must be connected to the ungrounded supply conductor. An "ungrounded" power supply line is a conductor that is not connected to protective ground at any point in the building installation. A "grounded" power supply line is a conductor that is connected to protective ground at a specific point in the building installation. It is sometimes referred to as the "neutral conductor".**
- **A multi-pole circuit breaker used as an overcurrent protective device or equipment must be designed to interrupt all neutral (grounded) and ungrounded conductors of the MAINS power supply simultaneously.**
- **A single fuse used as an overcurrent protection device must be connected in the ungrounded power supply line.**
- **If fuses are used as overcurrent protection devices in both the neutral (grounded) and ungrounded power supply lines, the fuse holders must be installed side by side and the fuses must have the same RATING and characteristics.**
- **The screw housing of a plug-in fuse holder and the ACCESSIBLE contact of a trigger fuse holder connected to the ungrounded power supply line must be connected toward the load. The ACCESSIBLE contact or screw housing of the fuse holders connected in the neutral conductor (grounded) must be in the direction of the grounded power supply line.**

## Information:

**The use of a circuit breaker is required. The circuit breaker or switch must meet the following requirements:**

- **An equipment circuit breaker used as a disconnect device must comply with the relevant requirements of IEC 60947-2 and be suitable for the application.**
- **A device switch used as a disconnect device must comply with the relevant requirements of IEC 60947-3 and be suitable for the application.**
- **If a switch or circuit breaker is used as a disconnect device, this function must be marked. If there is only one device – a switch or a circuit breaker – symbols 9 and 10 in table 1 are sufficient if the symbols are attached to or next to the switch or circuit breaker.**

## Danger!

**The external circuits to be connected to the SELV / PELV part of the device must be galvanically isolated from the power grid or dangerous voltage by reinforced or double insulation and must meet the requirements of the SELV / PELV circuit.**

## Danger!

**The voltage classes on the terminal block are not permitted to be mixed! Only operation with the mains voltage (e.g. 230 VAC) OR with safety extra-low voltage (e.g. 24 VDC SELV) is permitted.**

For additional module-specific information, see:


- "X20(c)SOx530" on page 16
- "X20(c)SC2432" on page 20

## 6.3 Derating

In principle, the products are designed for use in the specified ambient conditions. However, heat-generating functions in the module's own electronics or in neighboring modules can cause the electronics to overheat. Heat generation can be effectively reduced with suitable derating measures.

In order to ensure proper module functionality, appropriate derating measures must be taken at higher ambient temperatures. The following chapter provides the relevant information.

### 6.3.1 X20(c)SIx1x0 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

The derating curve requires that the pulse outputs are used exclusively for supplying the safe digital inputs and not for supplying power to electronic actuators.

| Module | X20SI2100 | X20SI4100 | X20SI4110 | X20SI8110 | X20SI9100 |
|---|---|---|---|---|---|
| **Derating bonus** | | | | | |
| I/O power supply / Input voltage: Max. 24 VDC | +2.5°C | | | | +5°C |
| I/O power supply / Input voltage: Max. 20.4 VDC | +2.5°C | | +5°C | | +5°C |
| Dummy module on the left | +0°C | | +2.5°C | | +0°C |
| Dummy module on the right | +2.5°C | | | | |
| Dummy module on the left and right | +5°C | | | | |
| With double PFH / $PFH_d$ | +0°C | | +15°C | +15°C [1] | +0°C |

Table 35: Derating bonus

1) Hardware revision E0 and later

The number of inputs to be used simultaneously depends on the ambient temperature during operation and the mounting orientation. The resulting amount is listed in the following table.

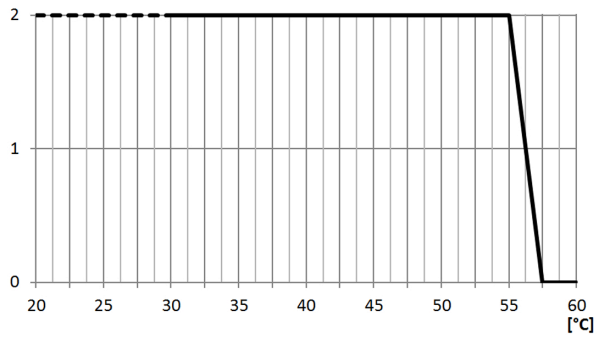
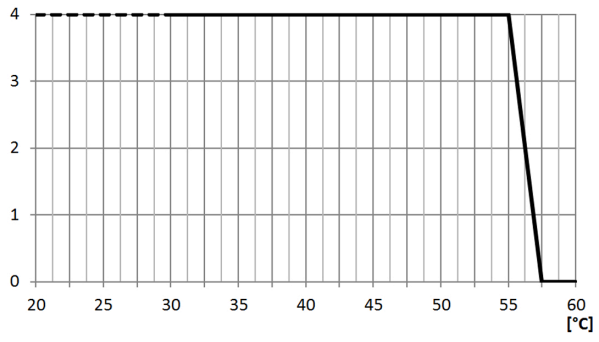
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SI2100** | |
|  | No derating |
| **X20SI4100** | |
|  | No derating |

Table 36: Derating in relation to operating temperature and mounting orientation

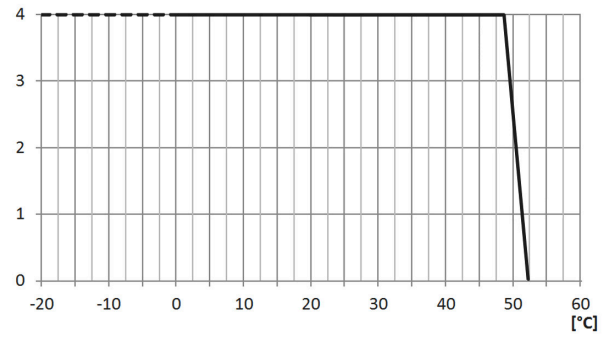
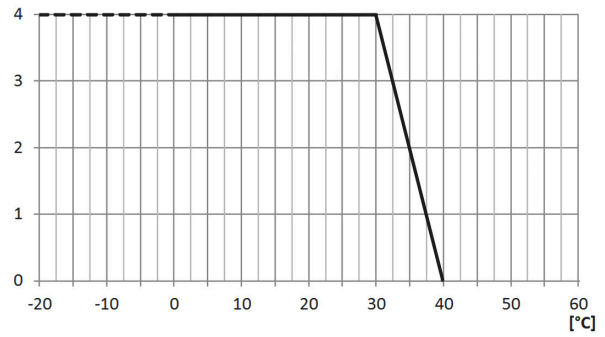
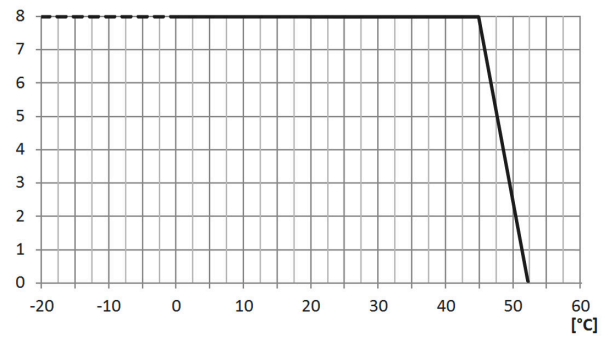
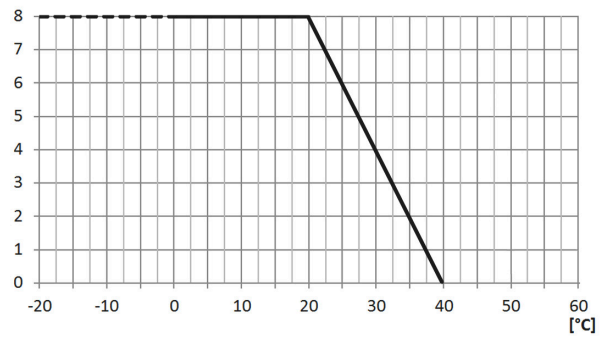
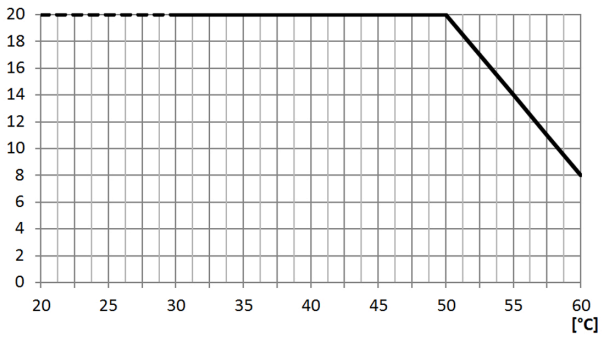
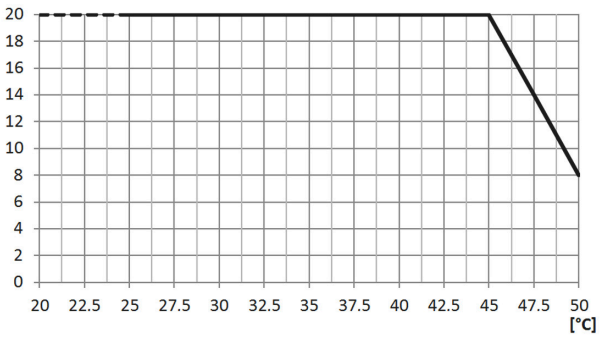
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SI4110** | |
|  |  |
| **X20SI8110** | |
|  |  |
| **X20SI9100** | |
|  |  |

Table 36: Derating in relation to operating temperature and mounting orientation

## Information:

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SIx1x0" on page 13.

### 6.3.2 X20(c)SO6300 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

| Module | X20SO6300 |
|---|---|
| **Derating bonus** | |
| I/O power supply / Input voltage: Max. 24 VDC | +0°C |
| Dummy module on the left | +2.5°C |
| Dummy module on the right | +0°C |
| Dummy module on the left and right | +5°C |
| With double PFH / $PFH_d$ | +0°C |

Table 37: Derating bonus

The maximum total nominal current depends on the operating temperature and the mounting orientation. The resulting total nominal current can be looked up in the following table.

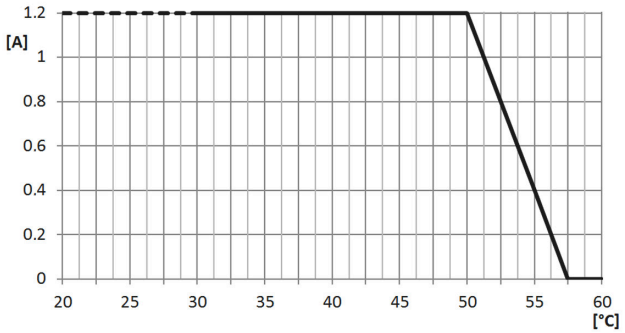
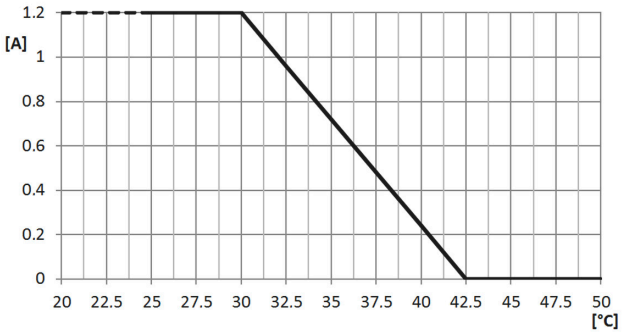
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
|  |  |





Table 38: Derating in relation to operating temperature and mounting orientation

**Information:**

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SO6300" on page 14.

## 6.3.3 X20(c)SOx1x0 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

| Module | X20SO2110 | X20SO2120 | X20SO4110 | X20SO4120 |
|---|---|---|---|---|
| **Derating bonus** | | | | |
| I/O power supply / Input voltage: Max. 24 VDC | +0°C | | | |
| Dummy module on the left | +2.5°C | | | |
| Dummy module on the right | +0°C | | | |
| Dummy module on the left and right | +5°C | | | |
| With double PFH / $PFH_d$ | +0°C | | | |

Table 39: Derating bonus

The maximum total nominal current depends on the operating temperature and the mounting orientation. The resulting total nominal current can be looked up in the following table.

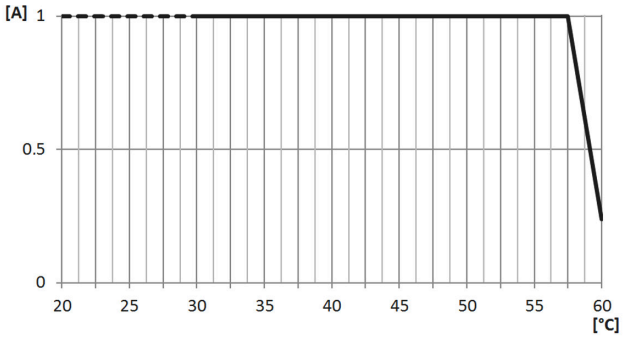
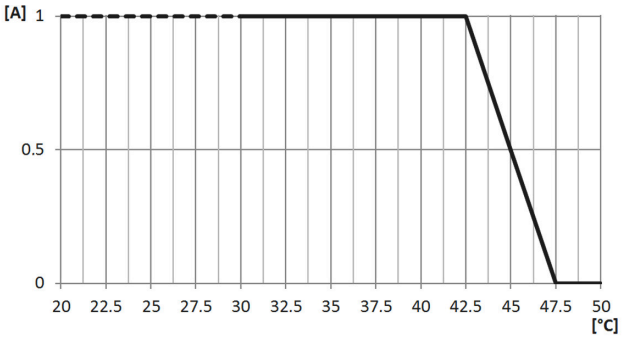
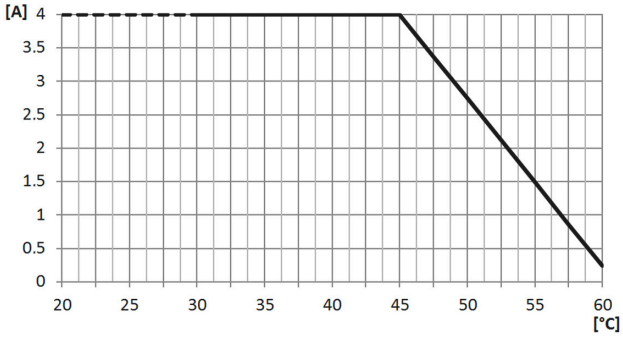
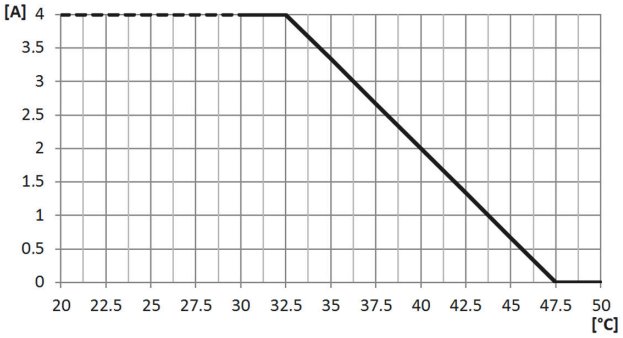
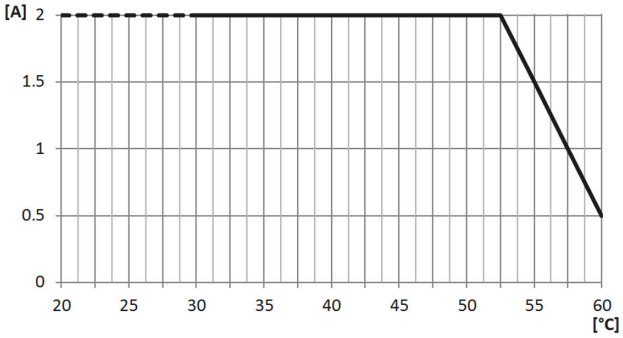
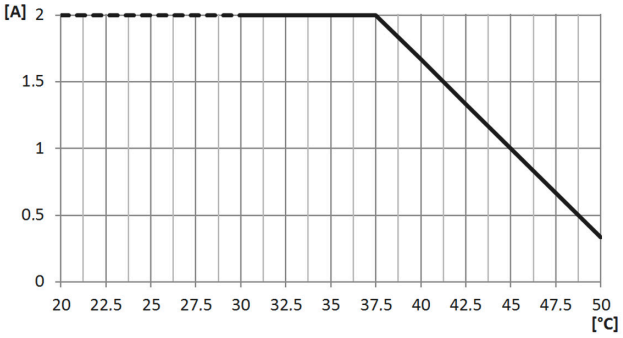
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SO2110** | |
|  |  |
| **X20SO2120** | |
|  |  |
| **X20SO4110** | |
|  |  |

Table 40: Derating in relation to operating temperature and mounting orientation

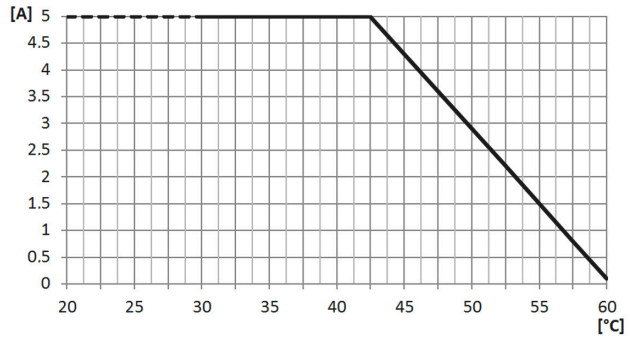
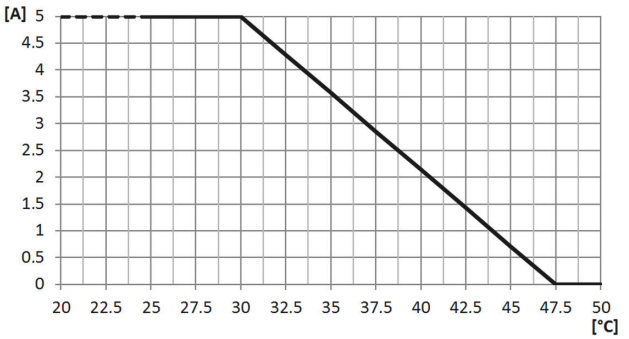
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| X20SO4120 | |
|  |  |

Table 40: Derating in relation to operating temperature and mounting orientation

## Information:

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SOx1x0" on page 15.

### 6.3.4 X20(c)SOx530 - Derating

The derating curve refers to standard operation and can be shifted to the right by the specified derating bonus or to the left by the derating penalty by the following measures in a horizontal mounting orientation.

| Module | X20SO2530 | X20SO6530 |
|---|---|---|
| **Derating bonus** | | |
| I/O power supply / Input voltage: Max. 24 VDC | +0°C | |
| Dummy module on the left | +0°C | |
| Dummy module on the right | +2.5°C | |
| Dummy module on the left and right | +2.5°C | |
| With double PFH / $PFH_d$ | +0°C | |
| Hardware revision <B5 | +0°C | -5°C |

Table 41: Derating bonus / Derating penalty

The max. nominal output current per channel depends on the operating temperature and mounting orientation. The resulting nominal output current per channel is listed in the following diagrams.

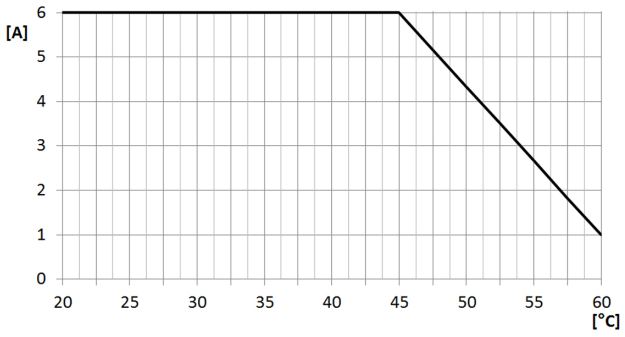
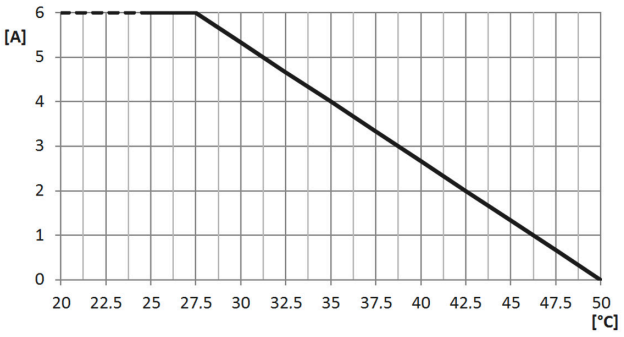
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SO2530** | |
|  |  |

Table 42: Derating in relation to operating temperature and mounting orientation

The max. squared summation current (i.e. sum of the squares of the nominal output currents per channel) depends on the operating temperature and mounting orientation. The resulting max. squared summation current is listed in the following diagrams.

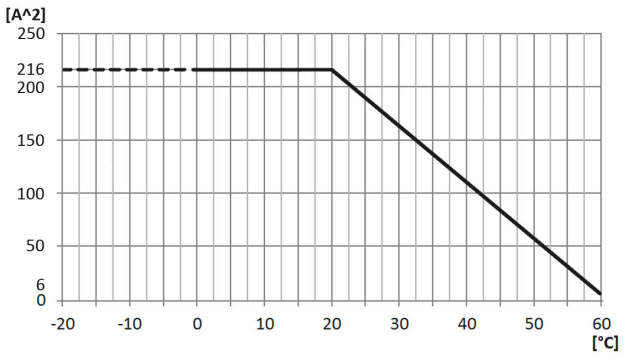
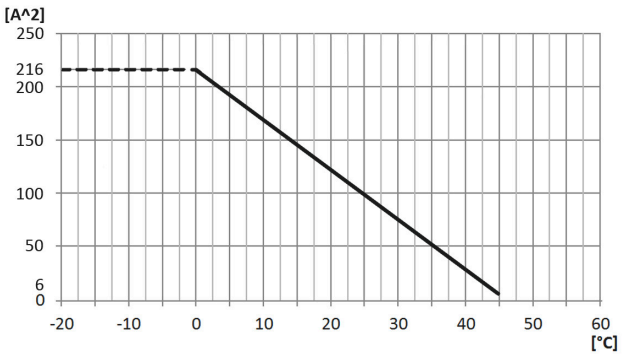
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SO6530** | |
|  |  |

Table 43: Derating in relation to operating temperature and mounting orientation

Example:

Series connection of channel 1 (NO 1 and COM 1) and channel 2 (NO 2 and COM 2) with a load of 6 A, channel 3 to channel 6 not loaded:

6 A * 6 A (channel 1) + 6 A * 6 A (channel 2) = 72 $A^2$

**Information:**

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SOx530" on page 16.

### 6.3.5 X20SC0xxx - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

The derating curve requires that the pulse outputs are used exclusively for supplying the safe digital inputs and not for supplying power to electronic actuators.

| Module | X20SC0402 | X20SC0806 | X20SC0842 |
|---|---|---|---|
| **Derating bonus (not permitted for use in UL applications)** | | | |
| I/O power supply / Input voltage: Max. 24 VDC | +2.5°C | | +5°C |
| I/O power supply / Input voltage: Max. 20.4 VDC | +7.5°C | | +10°C |
| Dummy module on the left | +2.5°C | | |
| Dummy module on the right | +0°C | | |
| Dummy module on the left and right | +2.5°C | | +5°C |
| 4 safe inputs (SI) | +0°C | +2.5°C [1] | +0°C |
| For double PFH / $PFH_d$ or triple PFD | +15°C [2] | | |
| **Derating bonus for UL applications** | | | |
| For double PFH / $PFH_d$ or triple PFD<br>Horizontal mounting orientation | +0°C | | +15°C [3] |
| For double PFH / $PFH_d$ or triple PFD<br>Vertical mounting orientation | +0°C | | +5°C [3] |

Table 44: Derating bonus

1) Only 4 safe inputs (SI) in use. Bonus valid only for derating curve of outputs.
2) Hardware revision E0 and later
3) Hardware revision H0 and later

## Inputs

The number of inputs to be used simultaneously depends on the ambient temperature during operation and the mounting orientation. The resulting amount is listed in the following table.

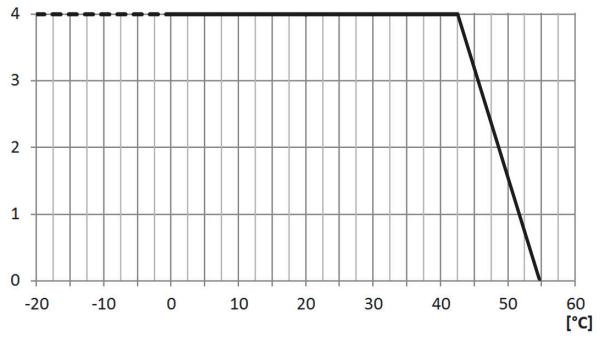
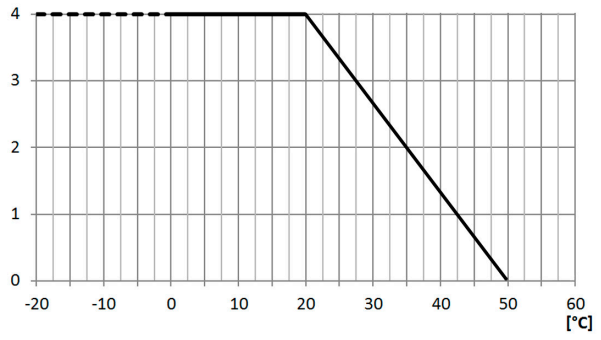
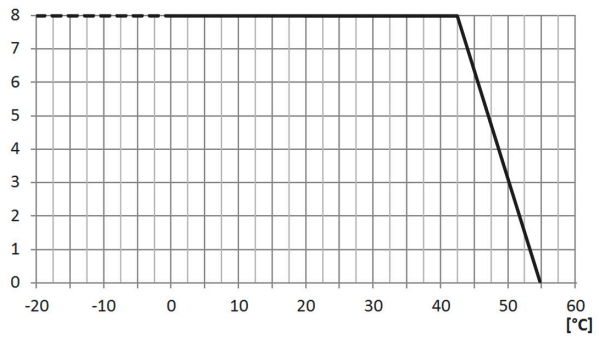
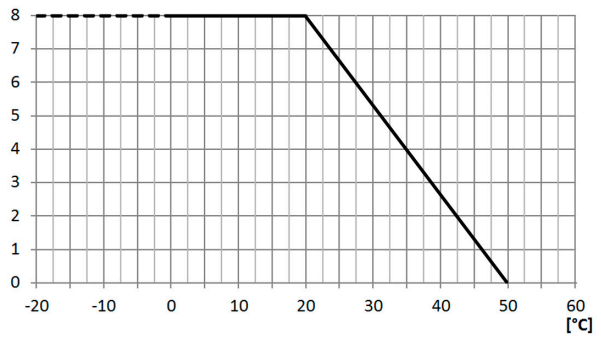
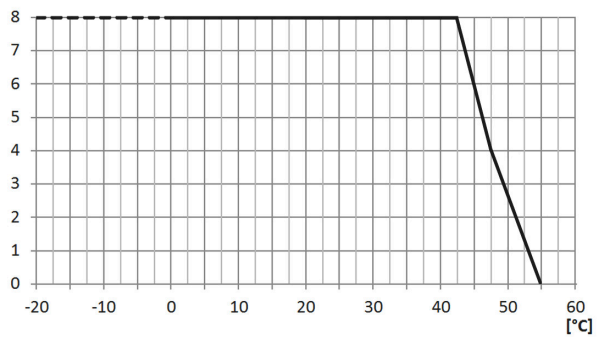
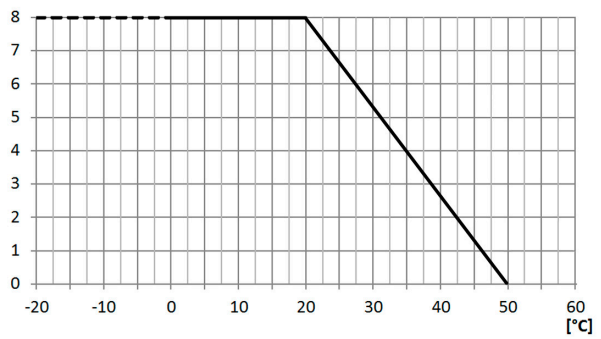
| Horizontal (0 to 60°C) | Vertical (0 to 50°C) |
|---|---|
| **X20SC0402** | |
|  |  |
| **X20SC0806** | |
|  |  |
| **X20SC0842** | |
|  |  |

Table 45: Derating in relation to operating temperature and mounting orientation

### Outputs

The maximum total nominal current depends on the operating temperature and the mounting orientation. The resulting total nominal current can be looked up in the following table.

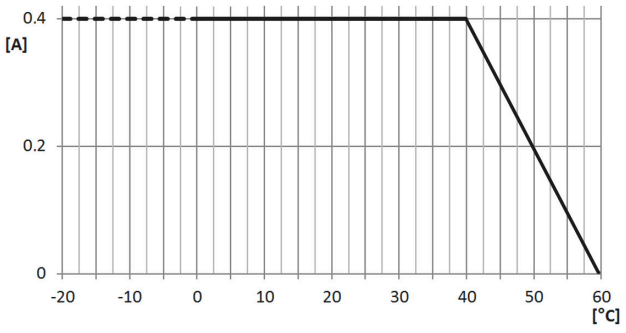
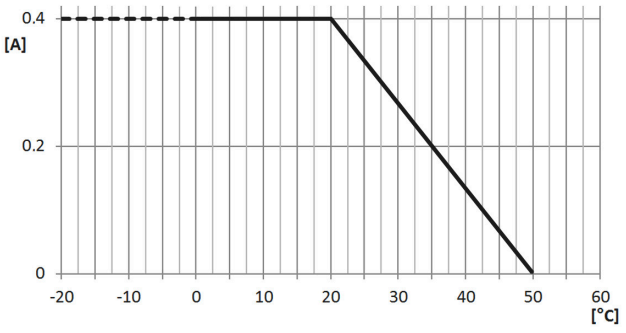
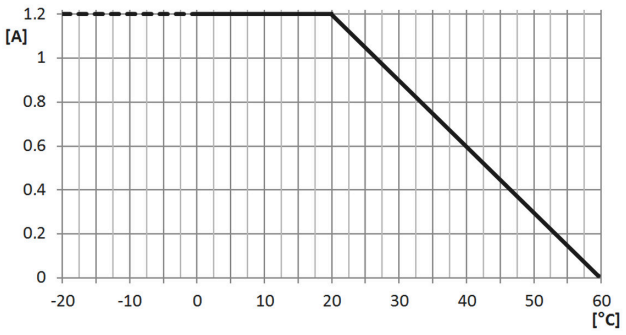
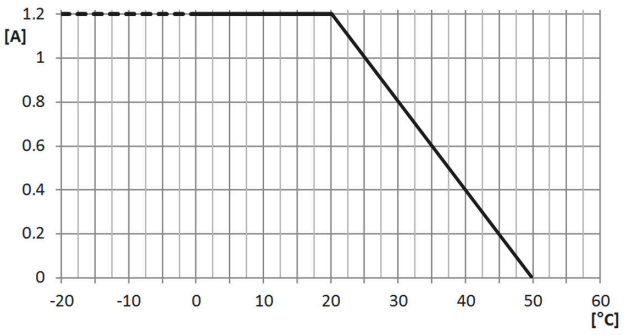
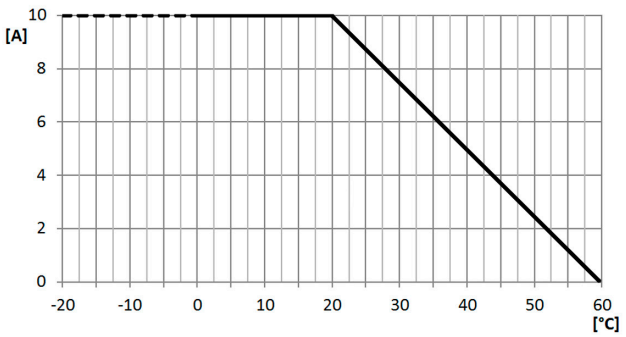
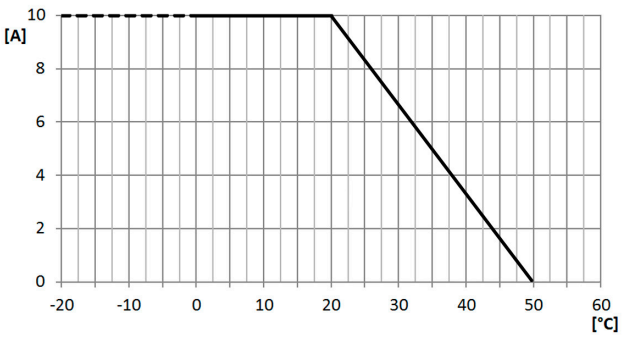
| Horizontal (0 to 60°C) | Vertical (0 to 50°C) |
|---|---|
| **X20SC0402** | |
|  |  |
| **X20SC0806** | |
|  |  |
| **X20SC0842** | |
|  |  |

Table 46: Derating in relation to operating temperature and mounting orientation

## Information:

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20SC0xxx" on page 17.

### 6.3.6 X20(c)SC2212 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

The derating curve requires that the pulse outputs are used exclusively for supplying the safe digital inputs and not for supplying power to electronic actuators.

| Module | X20SC2212 |
|---|---|
| **Derating bonus** | |
| I/O power supply / Input voltage: Max. 24 VDC | +5°C |
| Dummy module on the left | +2.5°C |
| Dummy module on the right | +0°C |
| Dummy module on the left and right | +5°C |
| With double PFH / $PFH_d$ | +0°C |

Table 47: Derating bonus

#### Inputs

The number of inputs to be used simultaneously depends on the ambient temperature during operation and the mounting orientation. The resulting amount is listed in the following table.

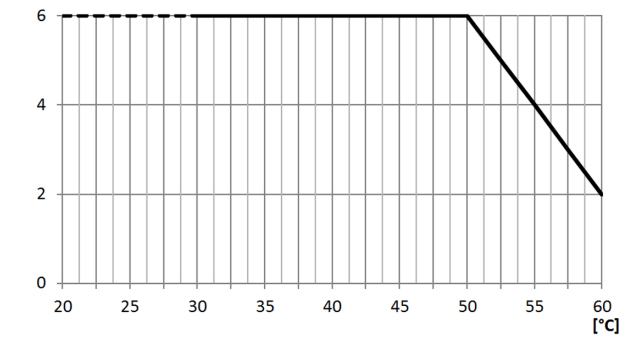
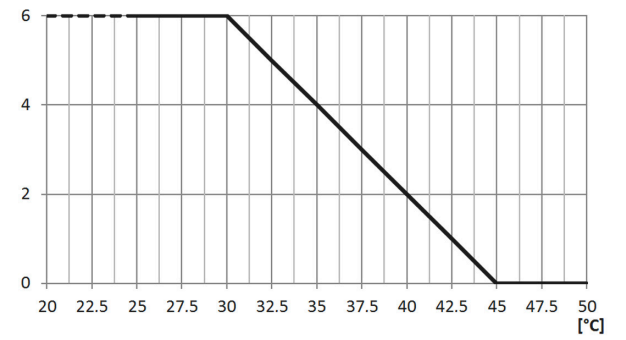
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
|  |  |



Table 48: Derating in relation to operating temperature and mounting orientation

#### Outputs

The maximum total nominal current depends on the operating temperature and the mounting orientation. The resulting total nominal current can be looked up in the following table.

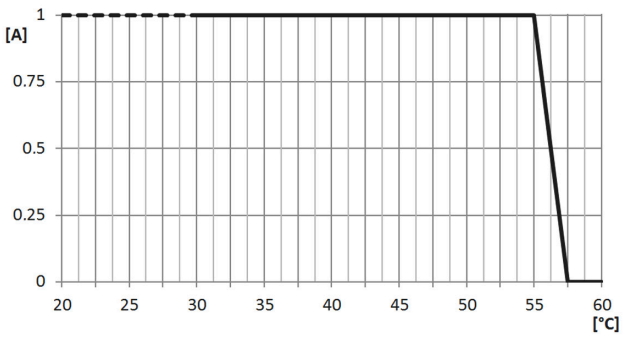
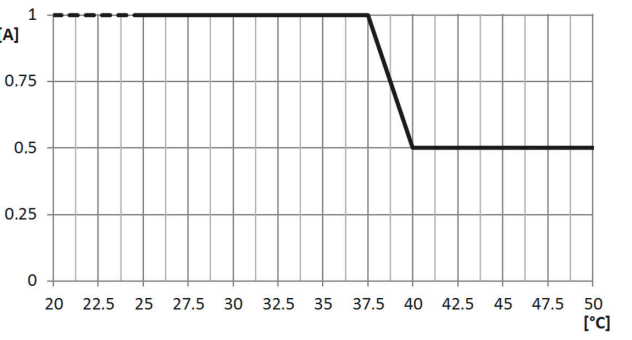
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
|  |  |



Table 49: Derating in relation to operating temperature and mounting orientation

**Information:**

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SC2212" on page 19.

### 6.3.7 X20(c)SC2432 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

The derating curve requires that the pulse outputs are used exclusively for supplying the safe digital inputs and not for supplying power to electronic actuators.

| Module | X20SC2432 |
|---|---|
| **Derating bonus** | |
| I/O power supply / Input voltage: Max. 24 VDC | +0°C |
| Dummy module on the left | +0°C |
| Dummy module on the right | +2.5°C |
| Dummy module on the left and right | +2.5°C |
| With double PFH / $PFH_d$ | +0°C |

Table 50: Derating bonus

The max. nominal output current per channel depends on the operating temperature and mounting orientation. The resulting nominal output current per channel is listed in the following table.

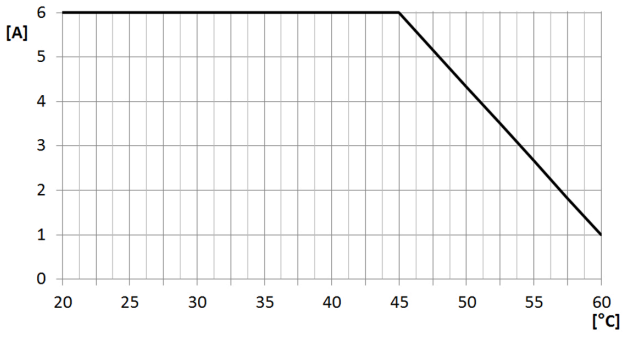
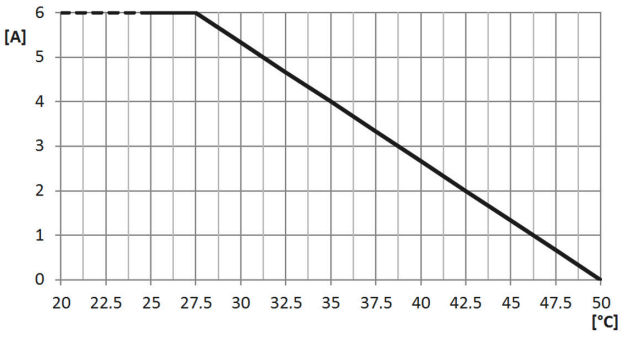
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
|  |  |





Table 51: Derating in relation to operating temperature and mounting orientation

**Information:**

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SC2432" on page 20.

## 6.3.8 X20SLXxxx-1 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

| Module | X20SLX806-1 | X20SLX842-1 | X20SLX411-1 | X20SLX811-1 |
|---|---|---|---|---|
| **Derating bonus** | | | | |
| I/O power supply / Input voltage: Max. 24 VDC | +2.5°C | +5°C | +2.5°C | |
| I/O power supply / Input voltage: Max. 20.4 VDC | +7.5°C | +10°C | +5°C | |
| Dummy module on the left | +2.5°C | | | |
| Dummy module on the right | +0°C | | +2.5°C | |
| Dummy module on the left and right | +2.5°C | +5°C | | |
| 4 safe inputs (SI) [2] | +2.5°C [1] | +0°C | - | |
| For double PFH / $PFH_d$ or triple PFD | +0°C | | | |

Table 52: Derating bonus

1) Only 4 safe inputs (SI) in use. Bonus valid only for derating curve of outputs.
2) The derating curve requires that the pulse outputs are used exclusively for supplying the safe digital inputs and not for supplying power to electronic actuators.

### Derating curve for the inputs

The number of inputs to be used simultaneously depends on the ambient temperature during operation and the mounting orientation. The resulting amount is listed in the following table.

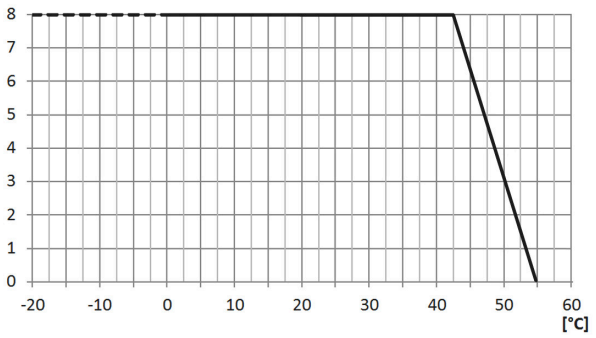
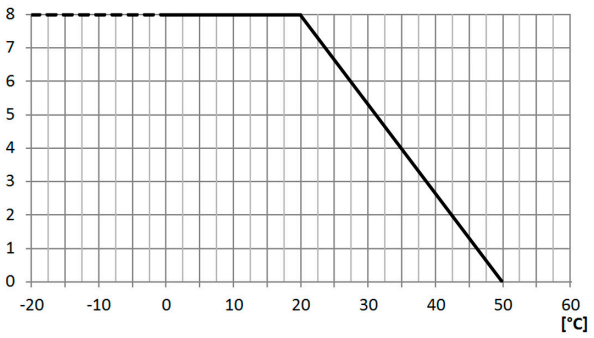
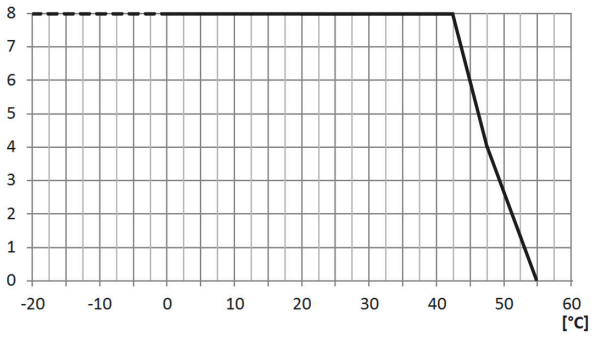
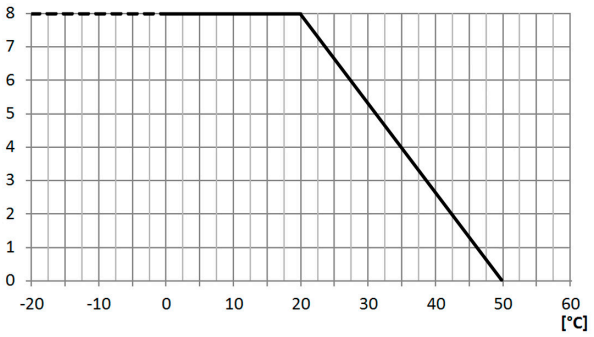
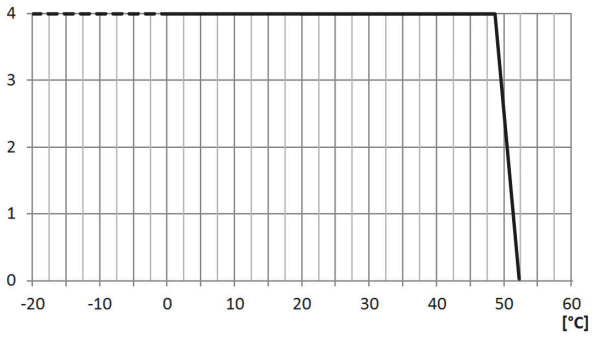
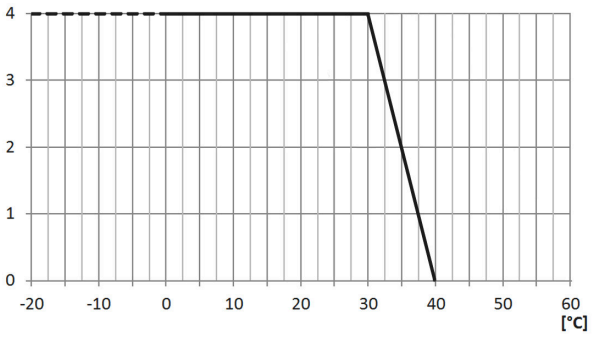
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SLX806-1** | |
|  |  |
| **X20SLX842-1** | |
|  |  |
| **X20SLX411-1** | |
|  |  |

Table 53: Derating depending on the ambient temperature during operation

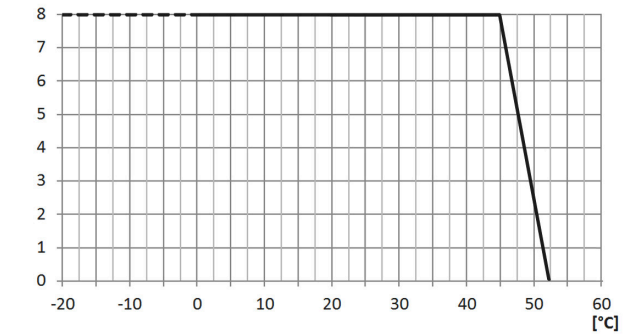
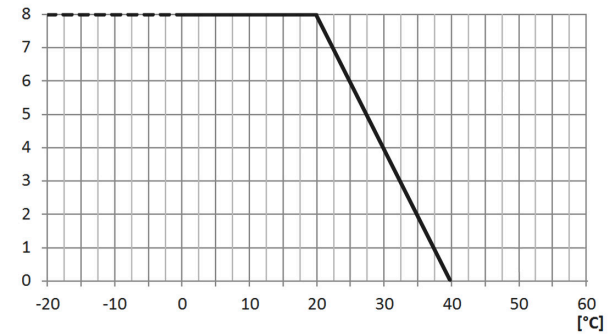
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SLX811-1** | |
|  |  |

Table 53: Derating depending on the ambient temperature during operation

### Derating curve for the outputs

The maximum total nominal current depends on the operating temperature and the mounting orientation. The resulting total nominal current can be looked up in the following table.

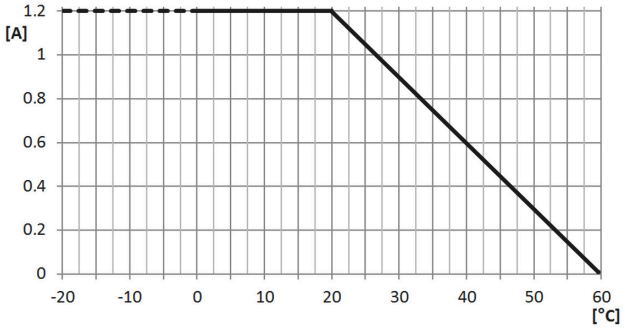
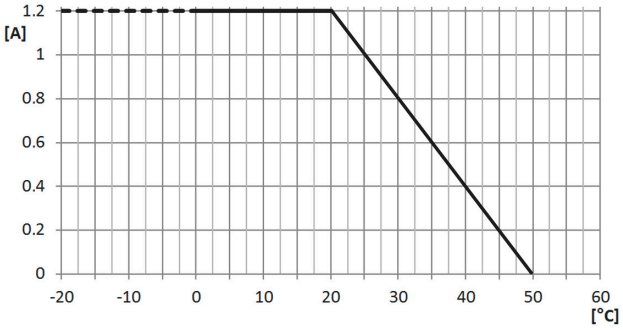
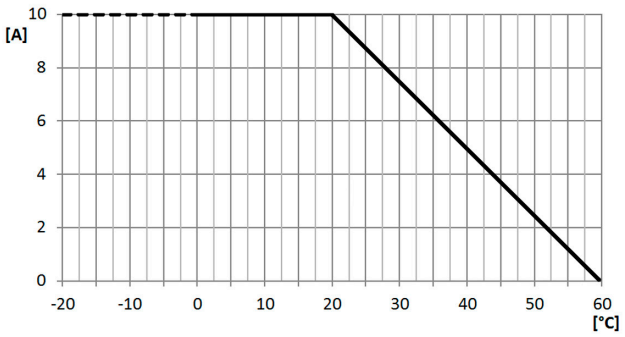
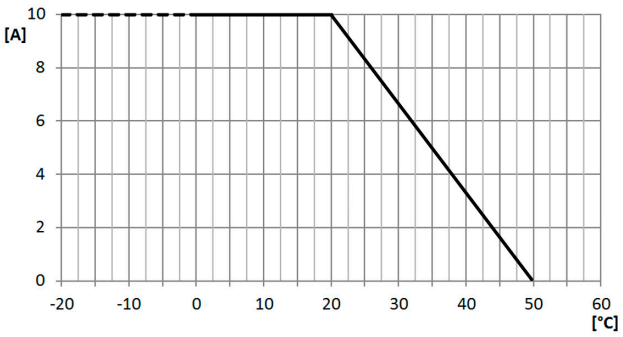
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SLX806-1** | |
|  |  |
| **X20SLX842-1** | |
|  |  |

Table 54: Derating in relation to operating temperature and mounting orientation

## Information:

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20SLXxxx-1" on page 21.

## 6.3.9 X20(c)SLXxxx - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

The derating curve requires that the pulse outputs are used exclusively for supplying the safe digital inputs and not for supplying power to electronic actuators.

| Module | X20SLX402 | X20SLX806 | X20SLX842 | X20SLX210 | X20SLX410 | X20SLX811 | X20SLX910 |
|---|---|---|---|---|---|---|---|
| **Derating bonus** | | | | | | | |
| I/O power supply / Input voltage: Max. 24 VDC | +2.5°C | | +5°C | +2.5°C | | | +5°C |
| I/O power supply / Input voltage: Max. 20.4 VDC | +7.5°C | | +10°C | +2.5°C | | +5°C | +5°C |
| Dummy module on the left | +2.5°C | | | +0°C | | +2.5°C | +0°C |
| Dummy module on the right | +0°C | | | +2.5°C | | | |
| Dummy module on the left and right | +2.5°C | | +5°C | | | | |
| 4 safe inputs (SI) | +0°C | +2.5°C [1] | +0°C | - | - | - | - |
| For double PFH / $PFH_d$ or triple PFD | +0°C | | | | | | |

Table 55: Derating bonus

1) Only 4 safe inputs (SI) in use. Bonus valid only for derating curve of outputs.

### Inputs

The number of inputs to be used simultaneously depends on the ambient temperature during operation and the mounting orientation. The resulting amount is listed in the following table.

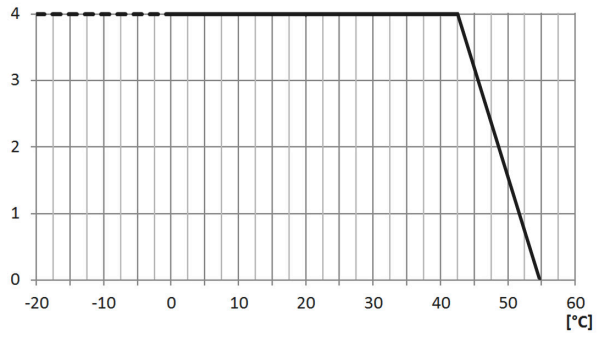
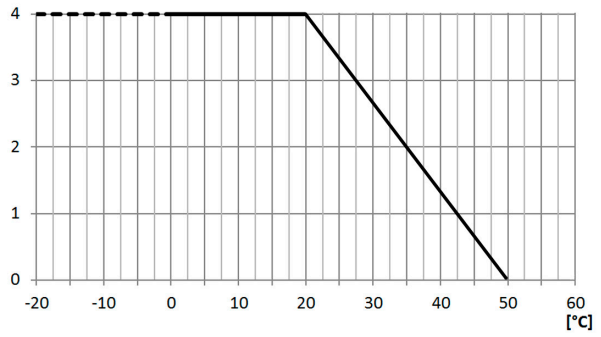
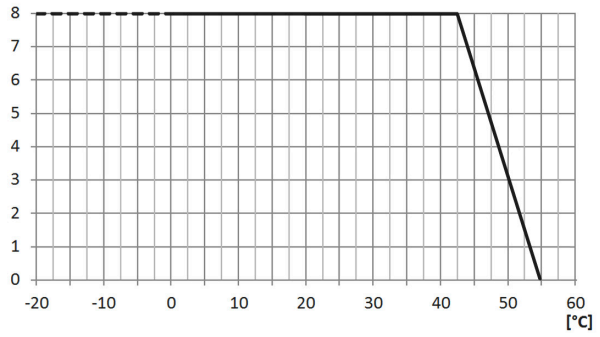
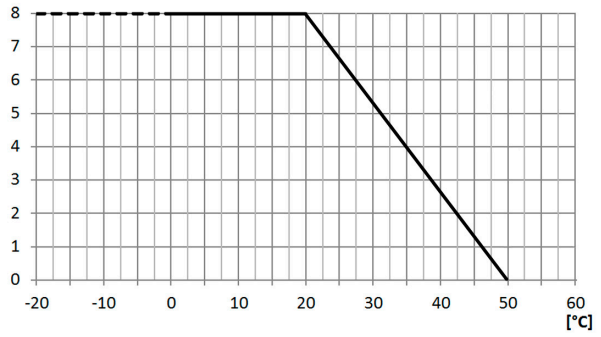
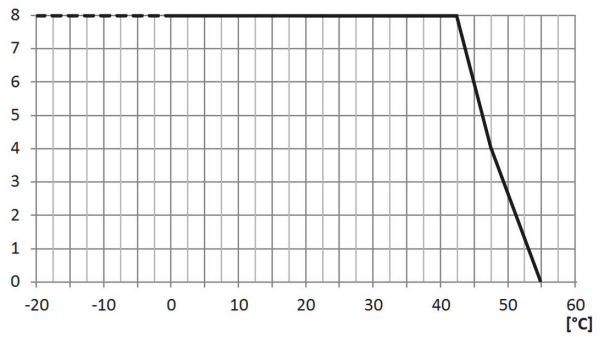
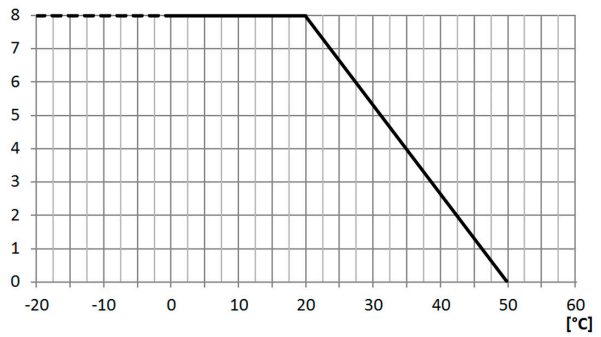
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SLX402** | |
|  |  |
| **X20SLX806** | |
|  |  |
| **X20SLX842** | |
|  |  |

Table 56: Derating in relation to operating temperature and mounting orientation

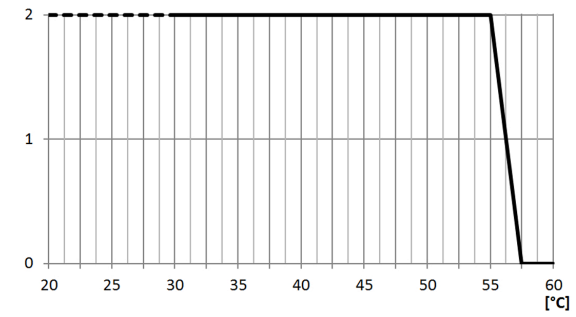
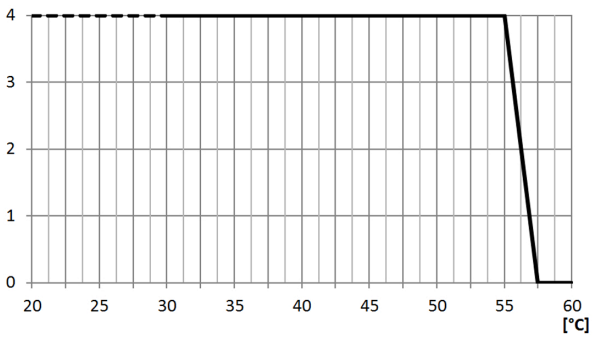
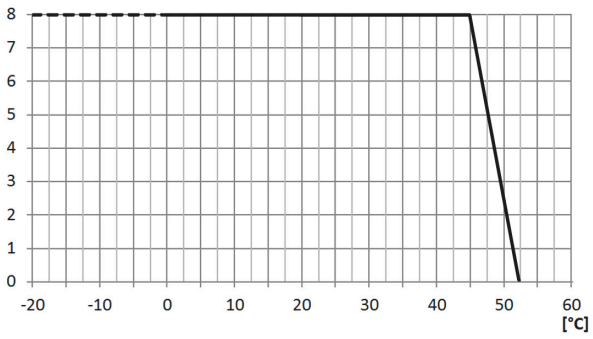
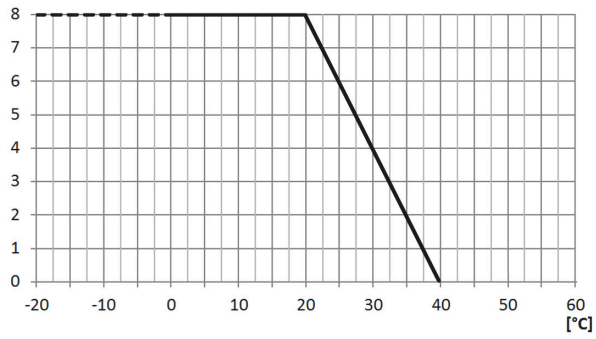
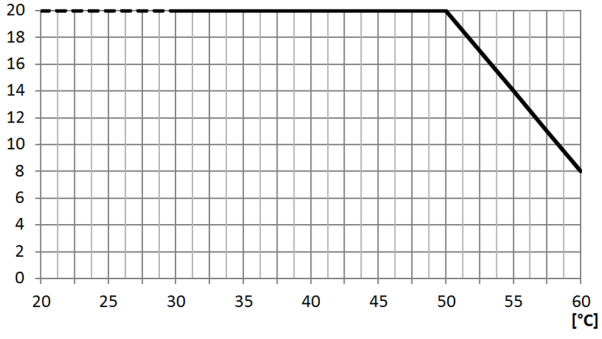
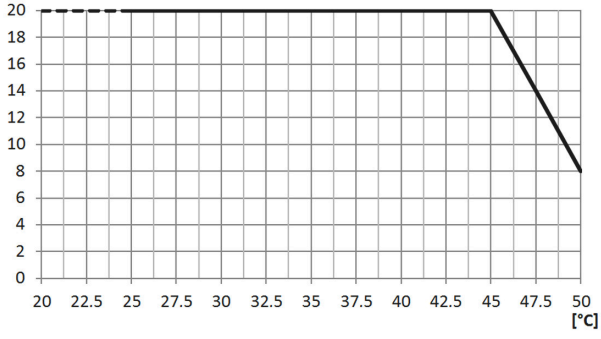
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SLX210** | |
|  | No derating |
| **X20SLX410** | |
|  | No derating |
| **X20SLX811** | |
|  |  |
| **X20SLX910** | |
|  |  |

Table 56: Derating in relation to operating temperature and mounting orientation

## Outputs

The maximum total nominal current depends on the operating temperature and the mounting orientation. The resulting total nominal current can be looked up in the following table.

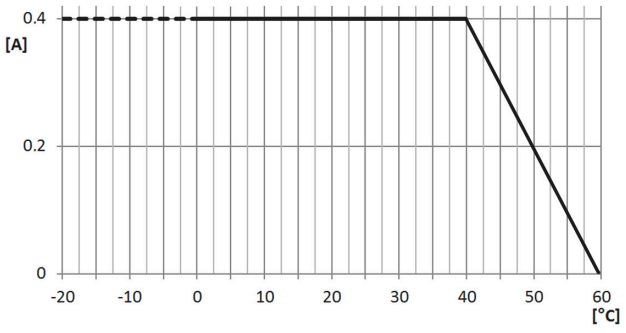
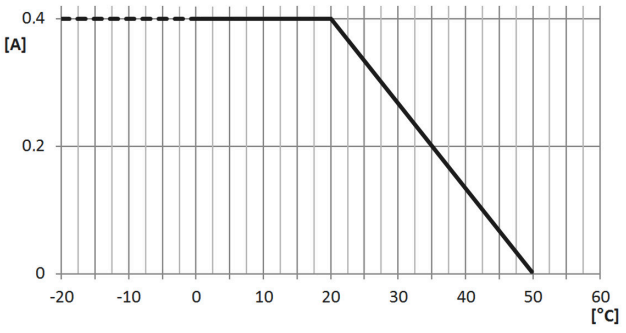
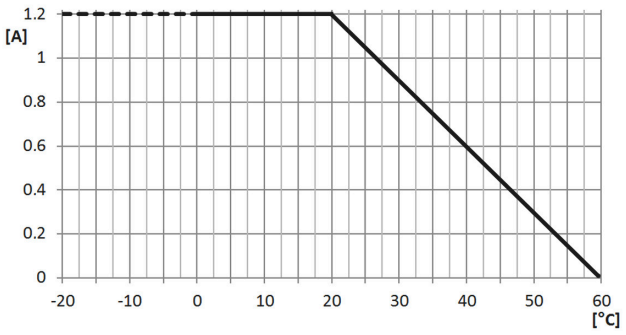
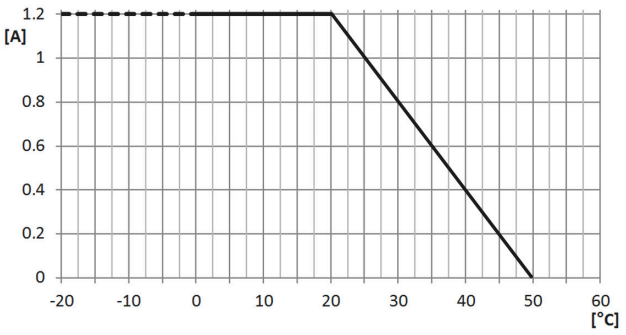
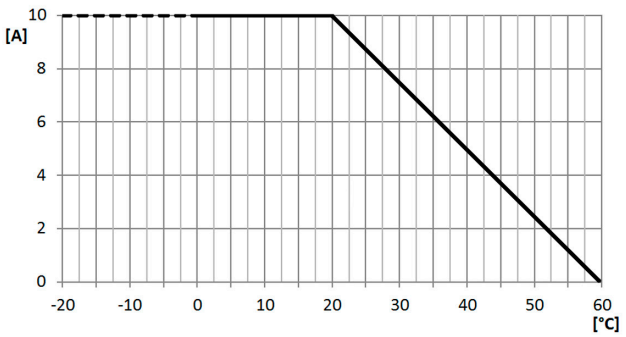
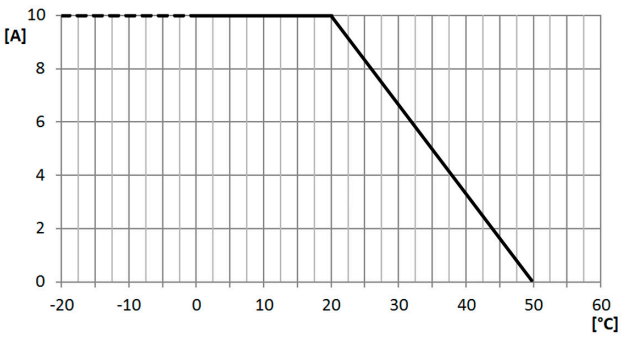
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
| **X20SLX402** | |
|  |  |
| **X20SLX806** | |
|  |  |
| **X20SLX842** | |
|  |  |

Table 57: Derating in relation to operating temperature and mounting orientation

### Information:

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

## 6.3.10 X20(c)SL81xx - Derating

### X20SL8101: Derating for SafeLOGIC / Bus controller / X2X Link power supply

The nominal output power of the X2X Link power supply is 7 W and depends on the operating temperature and mounting orientation.
The derating curve must be shifted to the left with a horizontal mounting orientation depending on the I/O output current.

| Module | X20SL8101 |
|---|---|
| **Derating penalty** | |
| Load at 24 VDC I/O, max. 10 A | -5°C |
| Load at 24 VDC I/O, max. 3 A | +0°C |

Table 58: Derating penalty

The resulting nominal output power is listed in the following table.

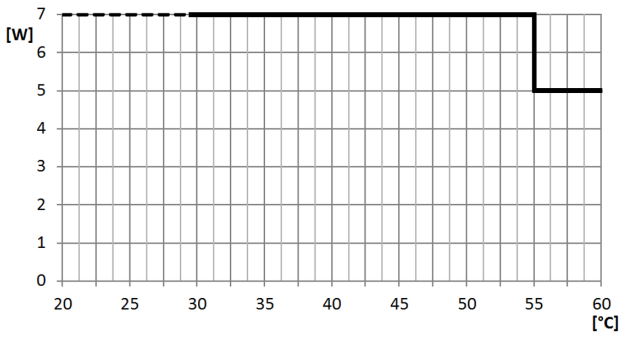
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 45°C, coated: -25 to 45°C) |
|---|---|
|  | No derating |

Table 59: Derating for SafeLOGIC / Bus controller / X2X Link power supply

**Information:**

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 6.3.11 X20SP1130 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

| Module | X20SP1130 |
|---|---|
| **Derating bonus** | |
| I/O power supply / Input voltage: Max. 24 VDC | +0°C |
| Dummy module on the left | +2.5°C |
| Dummy module on the right | +0°C |
| Dummy module on the left and right | +5°C |
| With double PFH / $PFH_d$ | +0°C |

Table 60: Derating bonus

The max. nominal output current per channel depends on the operating temperature and mounting orientation. The resulting nominal output current per channel is listed in the following table.

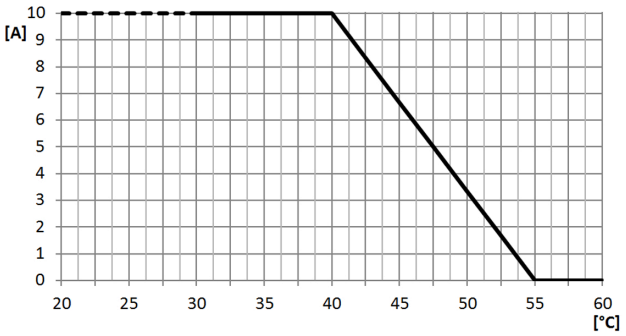
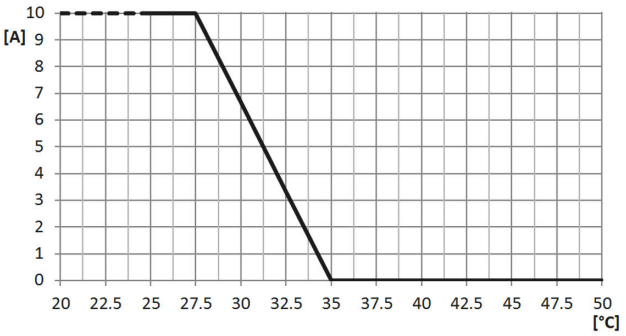
| Horizontal (0 to 60°C) | Vertical (0 to 35°C) |
|---|---|
|  |  |





Table 61: Derating in relation to operating temperature and mounting orientation

**Information:**

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20SP1130" on page 26.

### 6.3.12 X20(c)SA4430 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

| Derating bonus | X20SA4430 |
|---|---|
| Dummy module on the left | +2.5°C |
| Dummy module on the right | +0°C |
| Dummy module on the left and right | +5°C |

Table 62: Derating bonus

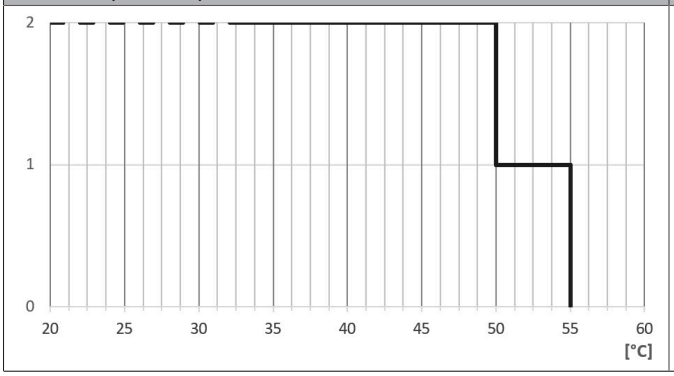
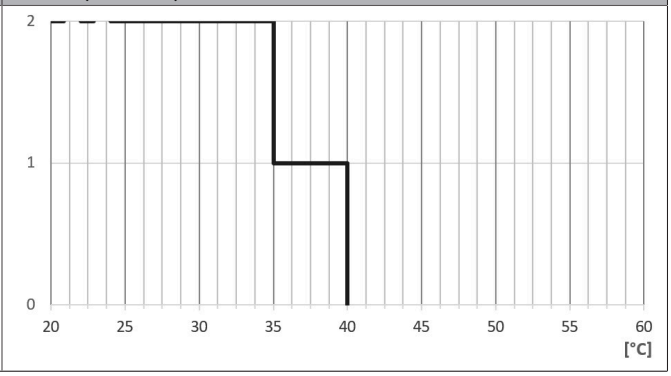
| Horizontal (0 to 55°C) | Vertical (0 to 40°C) |
|---|---|
|  |  |



Table 63: Derating in relation to operating temperature and mounting orientation

For additional module-specific information, see "X20(c)SA4430" on page 27.

### 6.3.13 X20ST4492 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

| Module | X20ST4492 |
|---|---|
| **Derating bonus** | |
| Dummy module on the left | +2.5°C |
| Dummy module on the right | +0°C |
| Dummy module on the left and right | +5°C |

Table 64: Derating bonus

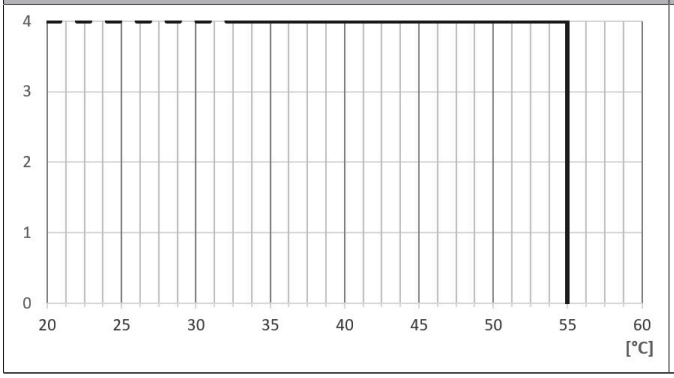
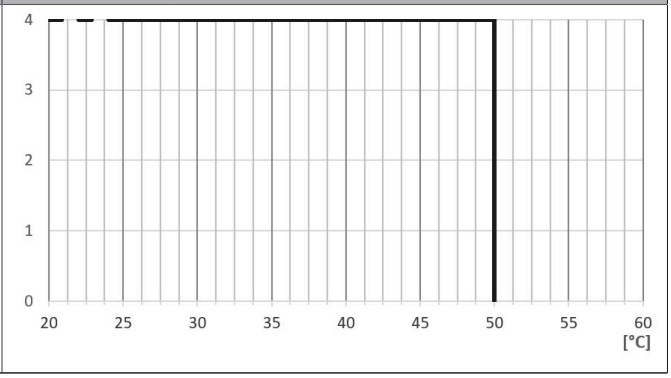
| Horizontal (0 to 55°C) | Vertical (0 to 50°C) |
|---|---|
|  |  |



Table 65: Derating in relation to operating temperature and mounting orientation

For additional module-specific information, see "X20ST4492" on page 28.

### 6.3.14 X20(c)SD1207 - Derating

The derating curve refers to standard operation and must be observed. With a horizontal mounting orientation, the curve can be shifted to the right by the specified derating bonus by taking the following measures.

| Module | X20SD1207 |
|---|---|
| **Derating bonus** | |
| I/O power supply / Input voltage: Max. 24 VDC | +2.5°C |
| Dummy module on the left | +0°C |
| Dummy module on the right | +2.5°C |
| Dummy module on the left and right | +5°C |
| With double PFH / $PFH_d$ | +0°C |

Table 66: Derating bonus

The maximum operating temperature depends on the number of signals to be used (function mode) for the counter function. The resulting temperature can be looked up in the following table.

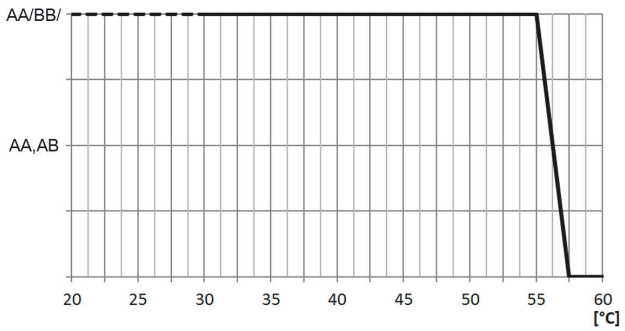
| Horizontal (0 to 60°C, coated: -25 to 60°C) | Vertical (0 to 50°C, coated: -25 to 50°C) |
|---|---|
|  | No derating |

Table 67: Derating in relation to operating temperature and mounting orientation

**Information:**

**Regardless of the values specified in the derating curve, the module cannot be operated above the values specified in the technical data.**

For additional module-specific information, see "X20(c)SD1207" on page 29.

# 6.4 Inrush current behavior for output channels

### Inrush current behavior for output channels - X20(c)SO6300

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

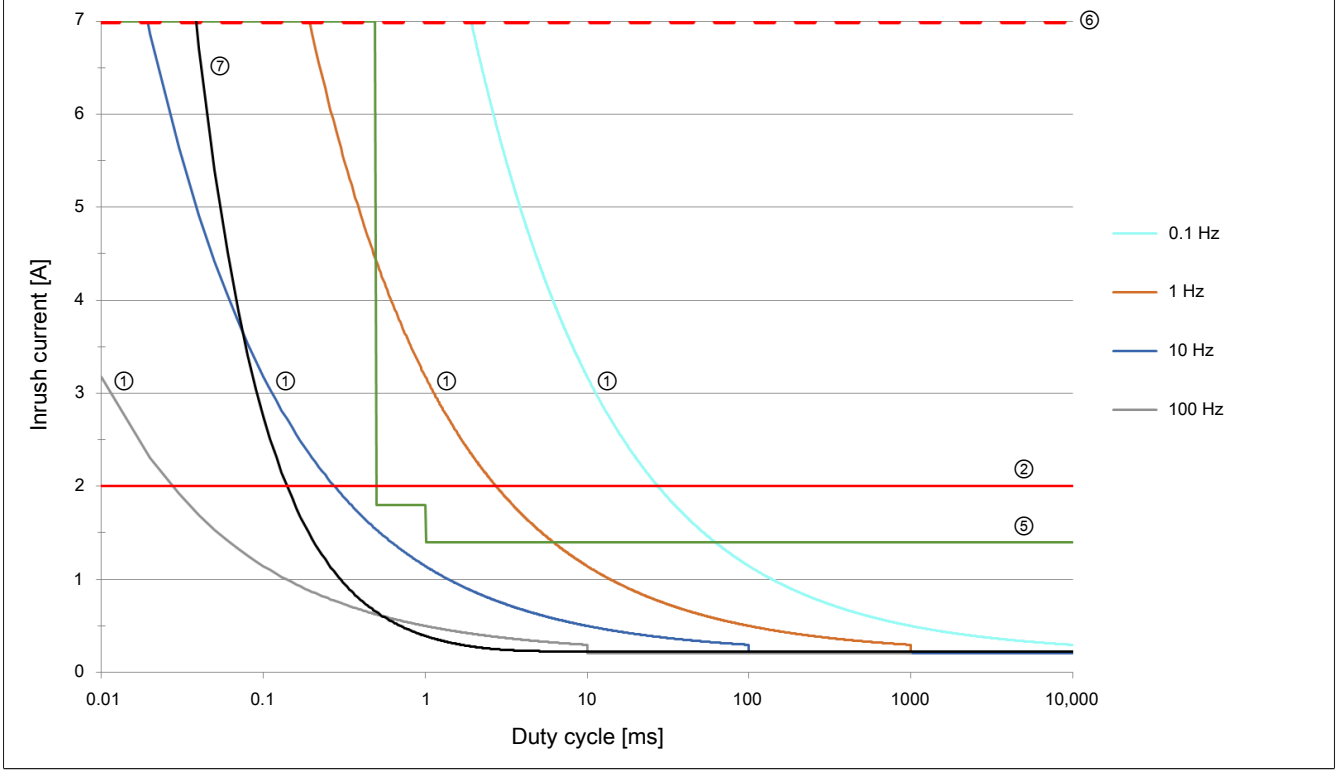



Table 68: Inrush current behavior for output channels

Legend:

| | |
|---|---|
| ① | **Limits during cyclic switching operations**<br>These curves show the maximum possible total inrush currents of all channels of the module during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |
| ② | **Current limiting of the power drivers per channel**<br>These output channels are equipped with power drivers with integrated current limiting.<br>The curve shows the maximum possible inrush current per channel.<br>Overshooting is not possible since the power driver limits the current. |
| ⑤ | **Current monitoring of the firmware - Maximum total inrush current**<br>These output channels are equipped with overcurrent detection in the module's firmware.<br>The curve shows the maximum ensured total inrush current of all channels of the module.<br>Overshooting results in the shutdown of all of the module's output channels. In addition, when assessing the maximum possible inrush current, the melting integral of the external fuse of the potential group must of course also be taken into account. |
| ⑥ | **Component load capacity of the module**<br>This limit shows the total inrush current from which individual components of the module are overloaded.<br>Overshooting can result in irreparable damage to the module. |
| ⑦ | **Overcurrent shutdown of the hardware per channel**<br>These output channels are equipped with overcurrent detection in the module's hardware.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting can result in the shutdown of the output channel. |

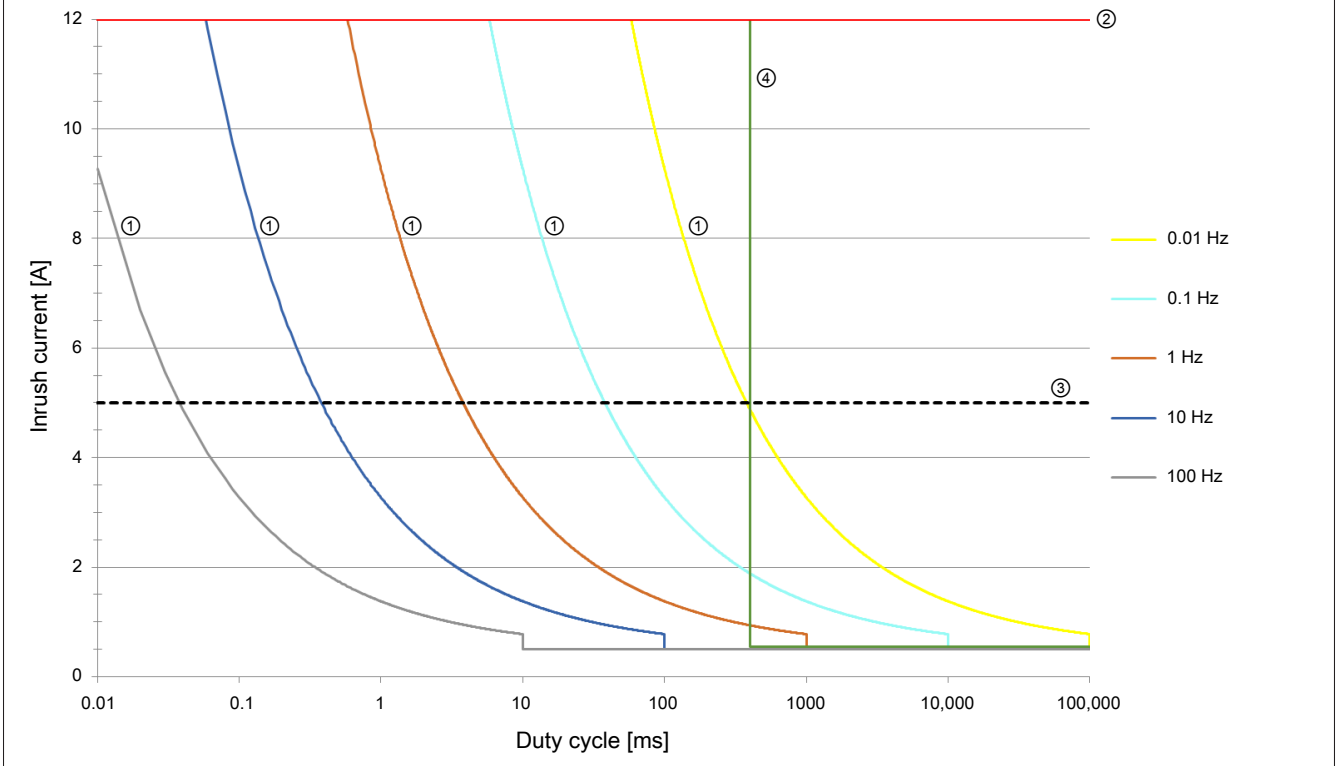
For additional module-specific information, see "X20(c)SO6300" on page 14.

## Inrush current behavior for output channels - X20(c)SOx1x0

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

**Nominal output current 0.5 A**




**Nominal output current 2 A**

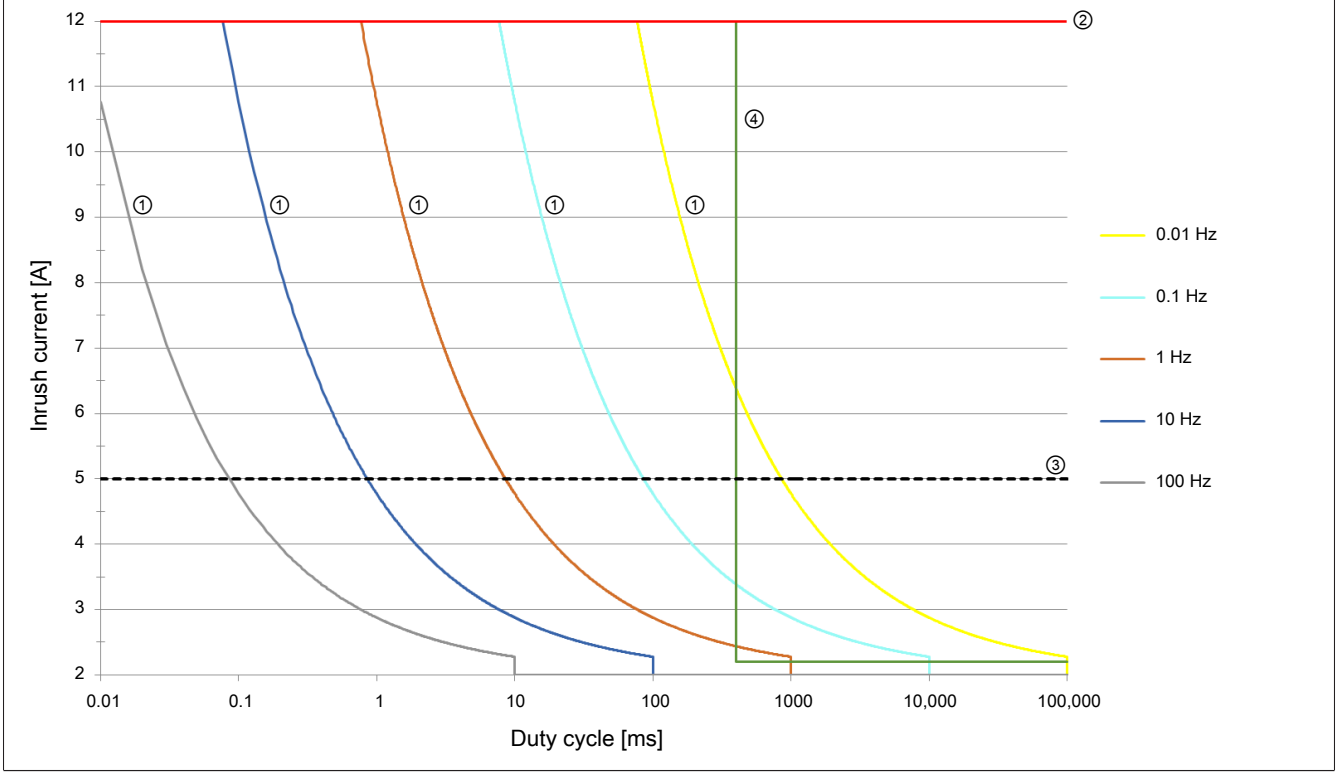



Table 69: Inrush current behavior for output channels

Legend:

| | |
|---|---|
| ① | **Limits during cyclic switching operations**<br>These curves show the maximum possible total inrush currents of all channels of the module during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |
| ② | **Current limiting of the power drivers per channel**<br>These output channels are equipped with power drivers with integrated current limiting.<br>The curve shows the maximum possible inrush current per channel.<br>Overshooting is not possible since the power driver limits the current. |
| ③ | **Shutdown of power drivers on overload per channel**<br>These output channels are equipped with power drivers with integrated shutdown on overload.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting can result in the shutdown of the output channel. |
| ④ | **Current monitoring of the firmware - Maximum inrush current per channel**<br>These output channels are equipped with overcurrent detection in the module's firmware.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting results in the shutdown of the output channel. |

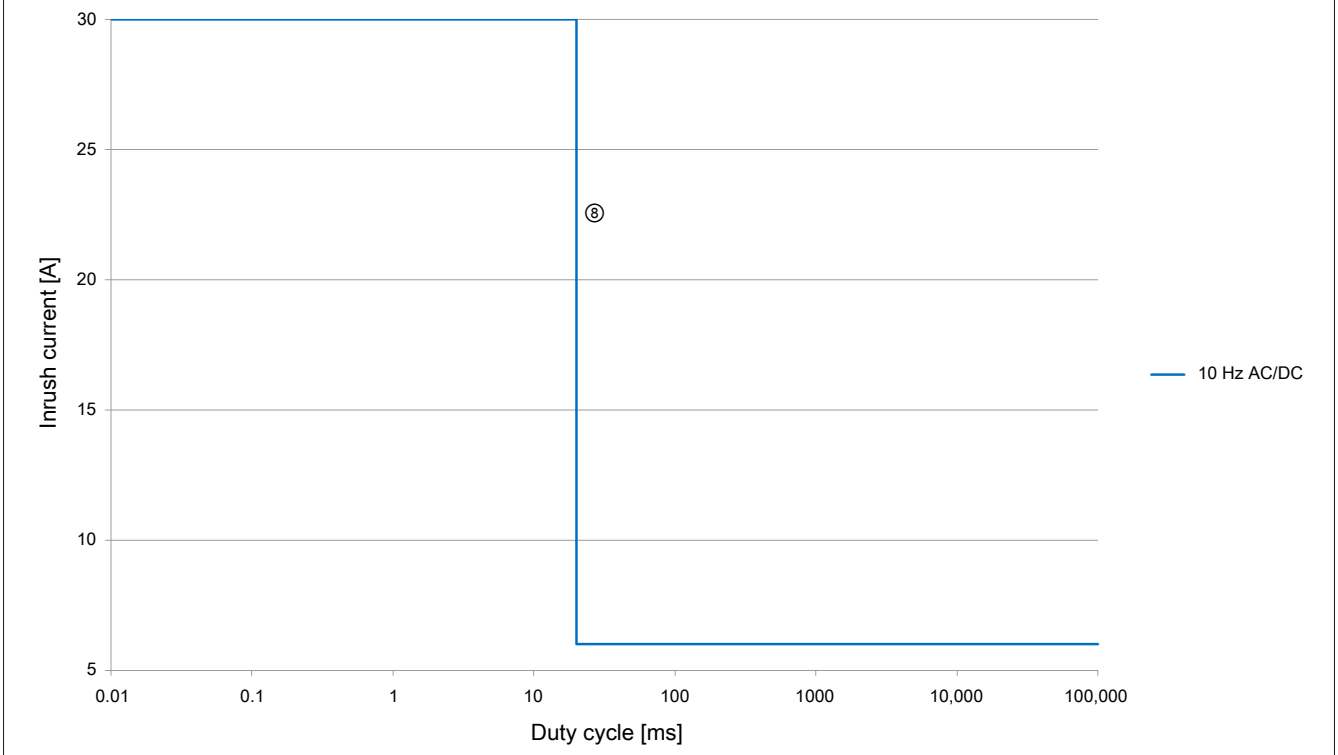
For additional module-specific information, see "X20(c)SOx1x0" on page 15.

## Inrush current behavior for output channels - X20(c)SOx530

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

**X20SO2530**




**X20SO6530**

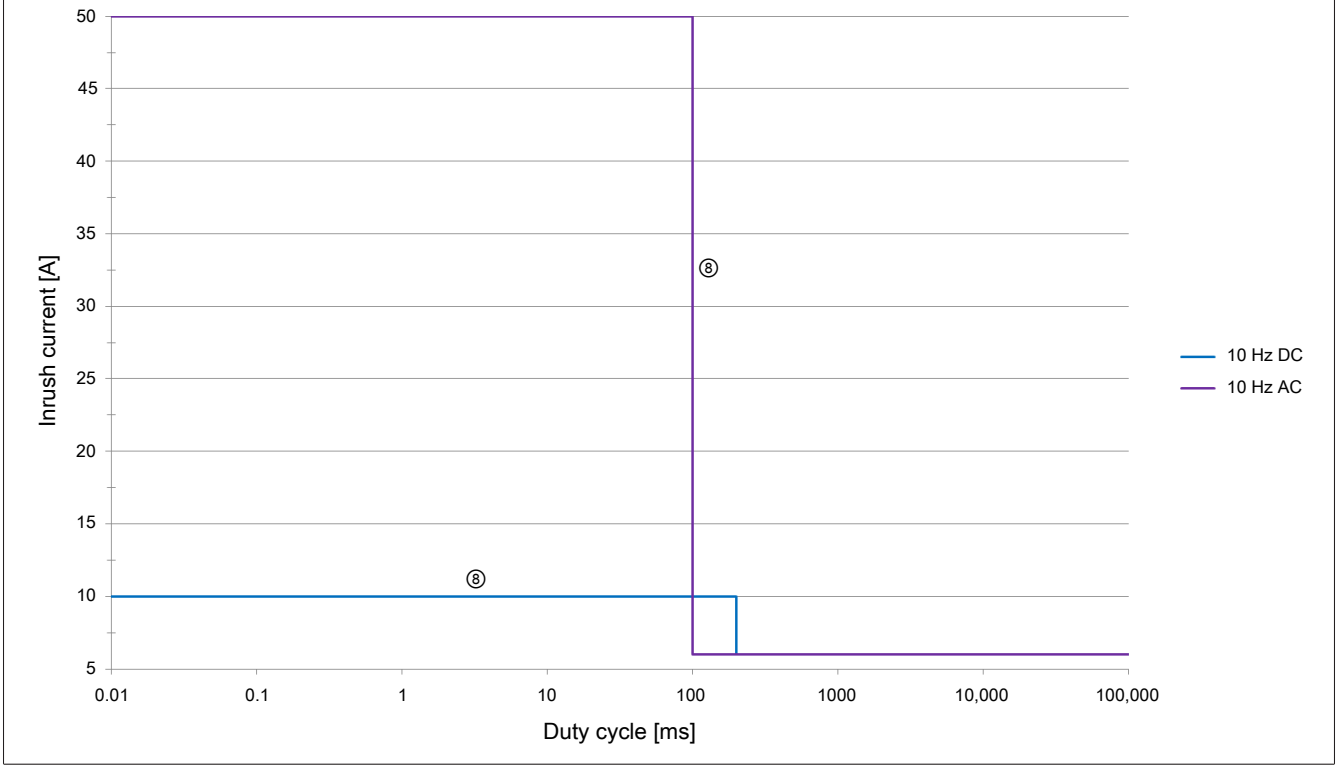



Table 70: Inrush current behavior for output channels

Legend:

| | |
|---|---|
| ⑧ | **Limits during cyclic switching operations of the relays**<br>These curves show the maximum possible inrush currents of each channel during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |

## Information:

**The effective current must be less than or equal to the permissible nominal output current of 6 A.**

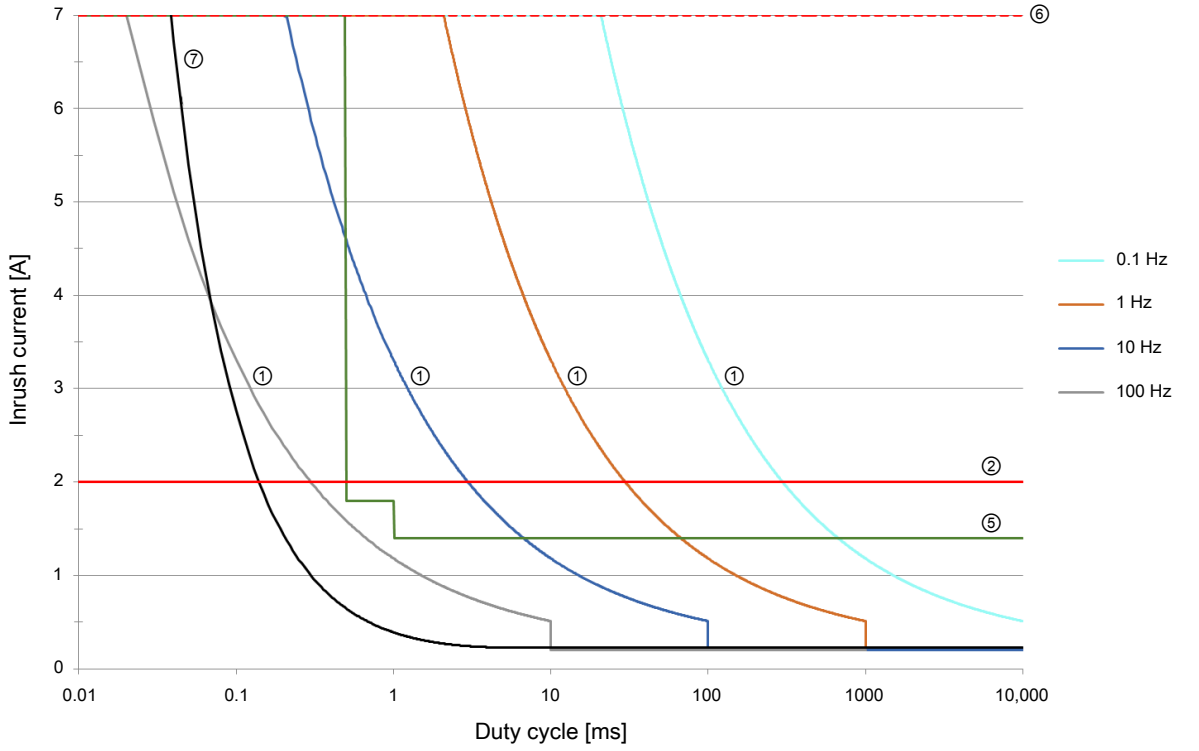
For additional module-specific information, see "X20(c)SOx530" on page 16.

## X20SC0xxx, X20(c)SLXxxx, X20SLXxxx-1 - Inrush current behavior for output channels

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

**X20SC0x0x**, **X20SLXx0x** and **X20SLXx0x-1**




**X20SC0842 type A**, **X20SLX842 type A** and **X20SLX842-1 type A**

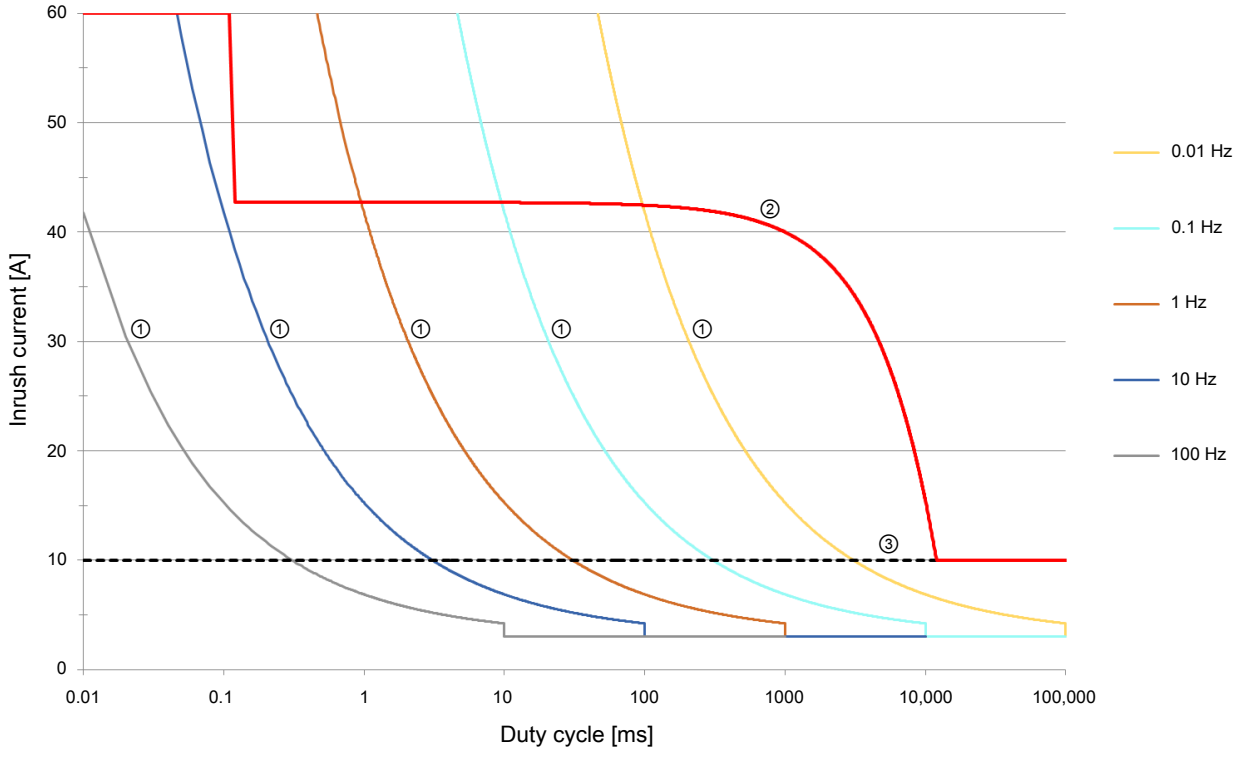



Table 71: Inrush current behavior for output channels

**Inrush current behavior for output channels**
**X20SC0842 type B, X20SLX842 type B** and **X20SLX842-1 type B**

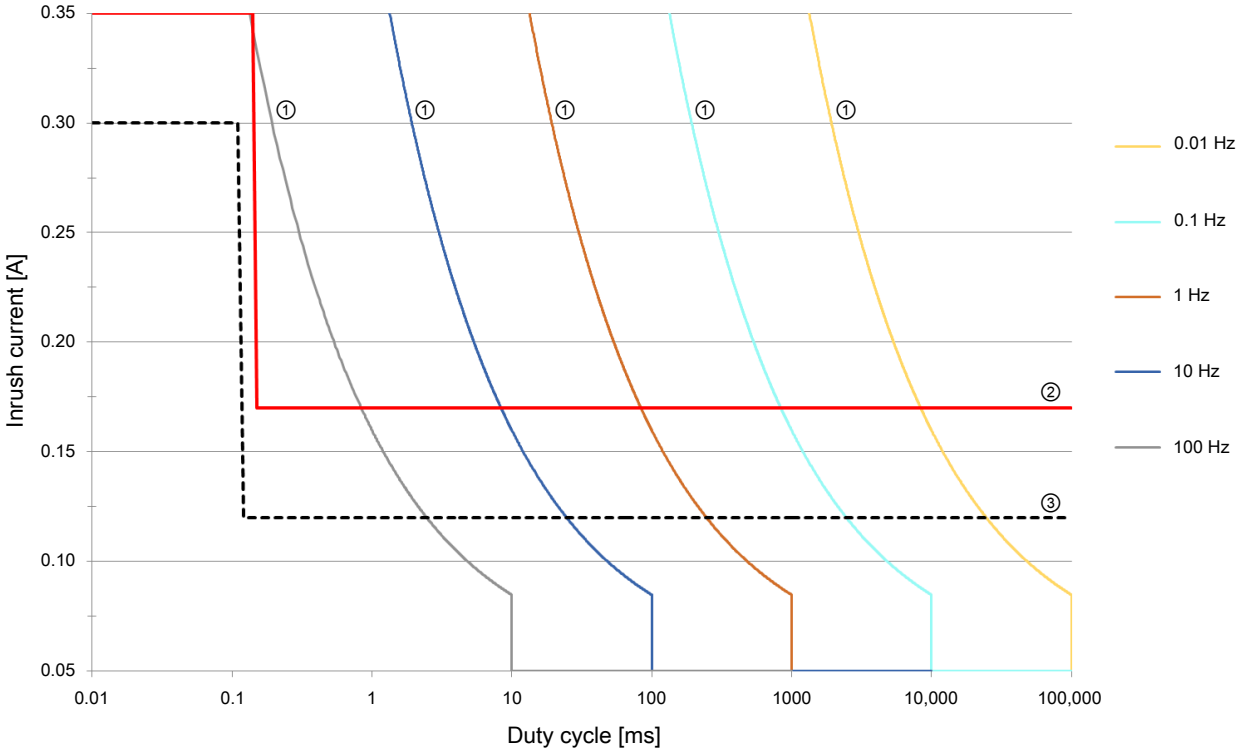



Table 71: Inrush current behavior for output channels

## Legend:

| | |
|---|---|
| ① | **Limits during cyclic switching operations**<br>These curves show the maximum possible total inrush currents of all channels of the module during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |
| ② | **Current limiting of the power drivers per channel**<br>These output channels are equipped with power drivers with integrated current limiting.<br>The curve shows the maximum possible inrush current per channel.<br>Overshooting is not possible since the power driver limits the current. |
| ③ | **Shutdown of power drivers on overload per channel**<br>These output channels are equipped with power drivers with integrated shutdown on overload.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting can result in the shutdown of the output channel. |
| ⑤ | **Current monitoring of the firmware - Maximum total inrush current**<br>These output channels are equipped with overcurrent detection in the module's firmware.<br>The curve shows the maximum ensured total inrush current of all channels of the module.<br>Overshooting results in the shutdown of all of the module's output channels. In addition, when assessing the maximum possible inrush current, the melting integral of the external fuse of the potential group must of course also be taken into account. |
| ⑥ | **Component load capacity of the module**<br>This limit shows the total inrush current from which individual components of the module are overloaded.<br>Overshooting can result in irreparable damage to the module. |
| ⑦ | **Overcurrent shutdown of the hardware per channel**<br>These output channels are equipped with overcurrent detection in the module's hardware.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting can result in the shutdown of the output channel. |

## For additional module-specific information, see:


- "X20SC0xxx" on page 17
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23

## Inrush current behavior for output channels - X20(c)SC2212

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

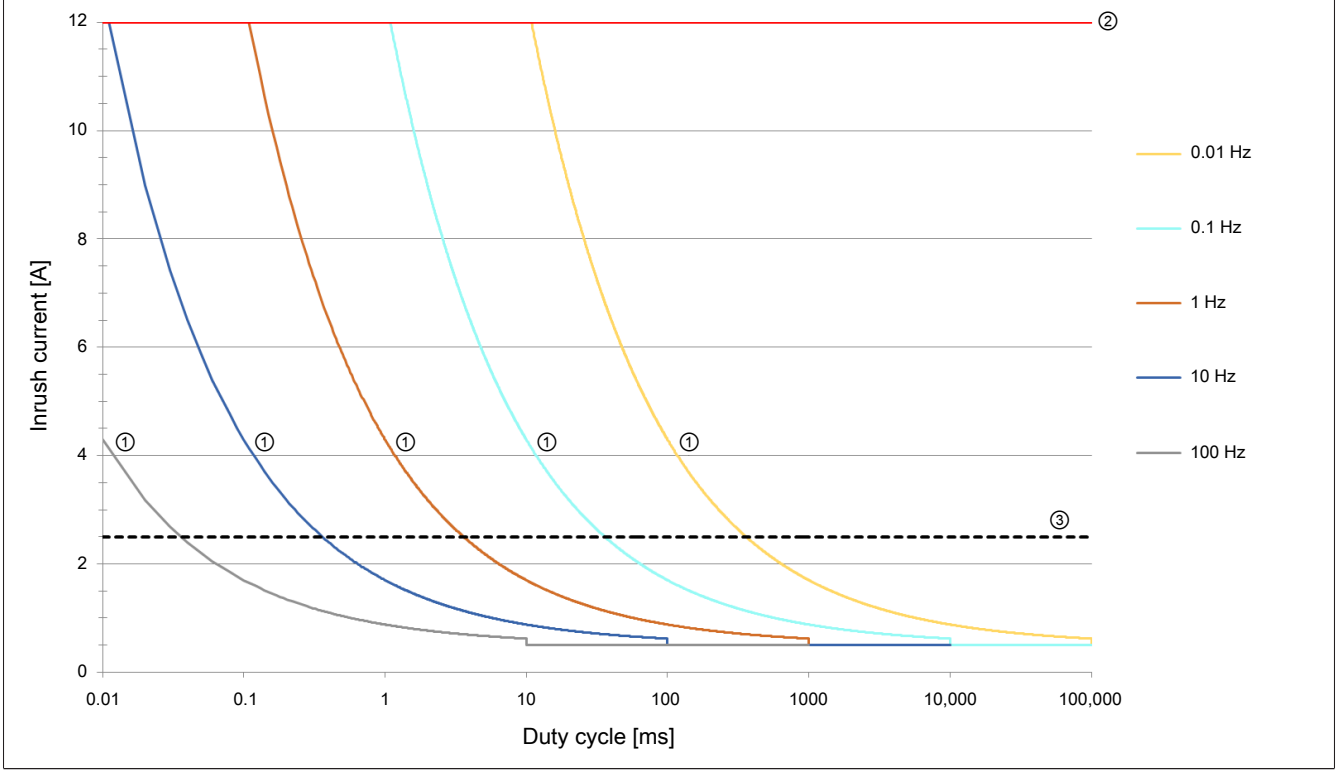



Table 72: Inrush current behavior for output channels

Legend:

| | |
|---|---|
| ① | **Limits during cyclic switching operations**<br>These curves show the maximum possible total inrush currents of all channels of the module during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |
| ② | **Current limiting of the power drivers per channel**<br>These output channels are equipped with power drivers with integrated current limiting.<br>The curve shows the maximum possible inrush current per channel.<br>Overshooting is not possible since the power driver limits the current. |
| ③ | **Shutdown of power drivers on overload per channel**<br>These output channels are equipped with power drivers with integrated shutdown on overload.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting can result in the shutdown of the output channel. |

For additional module-specific information, see "X20(c)SC2212" on page 19.

### Inrush current behavior for output channels - X20(c)SC2432

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

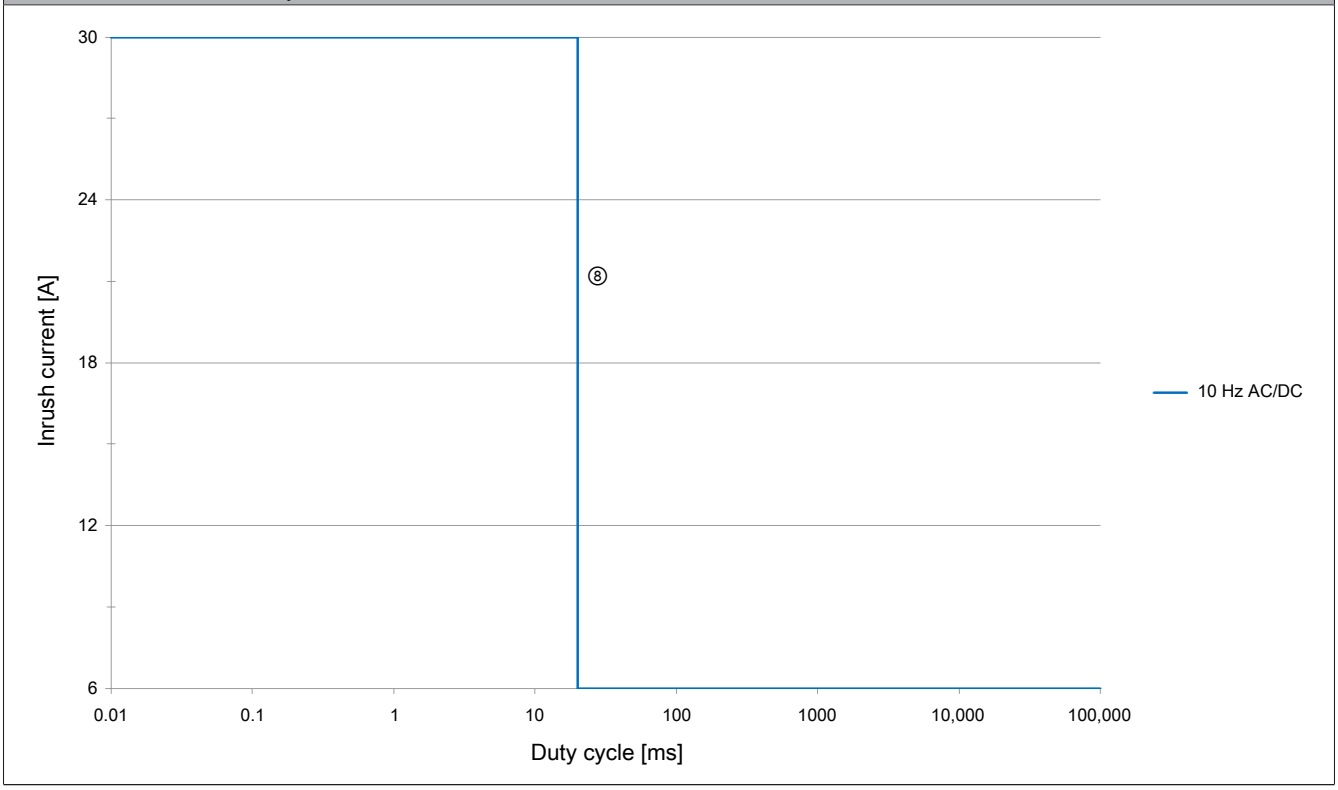



Table 73: Inrush current behavior for output channels

Legend:

| | |
|---|---|
| ⑧ | **Limits during cyclic switching operations of the relays**<br>These curves show the maximum possible inrush currents of each channel during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |

## Information:

**The effective current must be less than or equal to the permissible nominal output current of 6 A.**

For additional module-specific information, see "X20(c)SC2432" on page 20.

### Inrush current behavior for output channels - X20SP1130

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

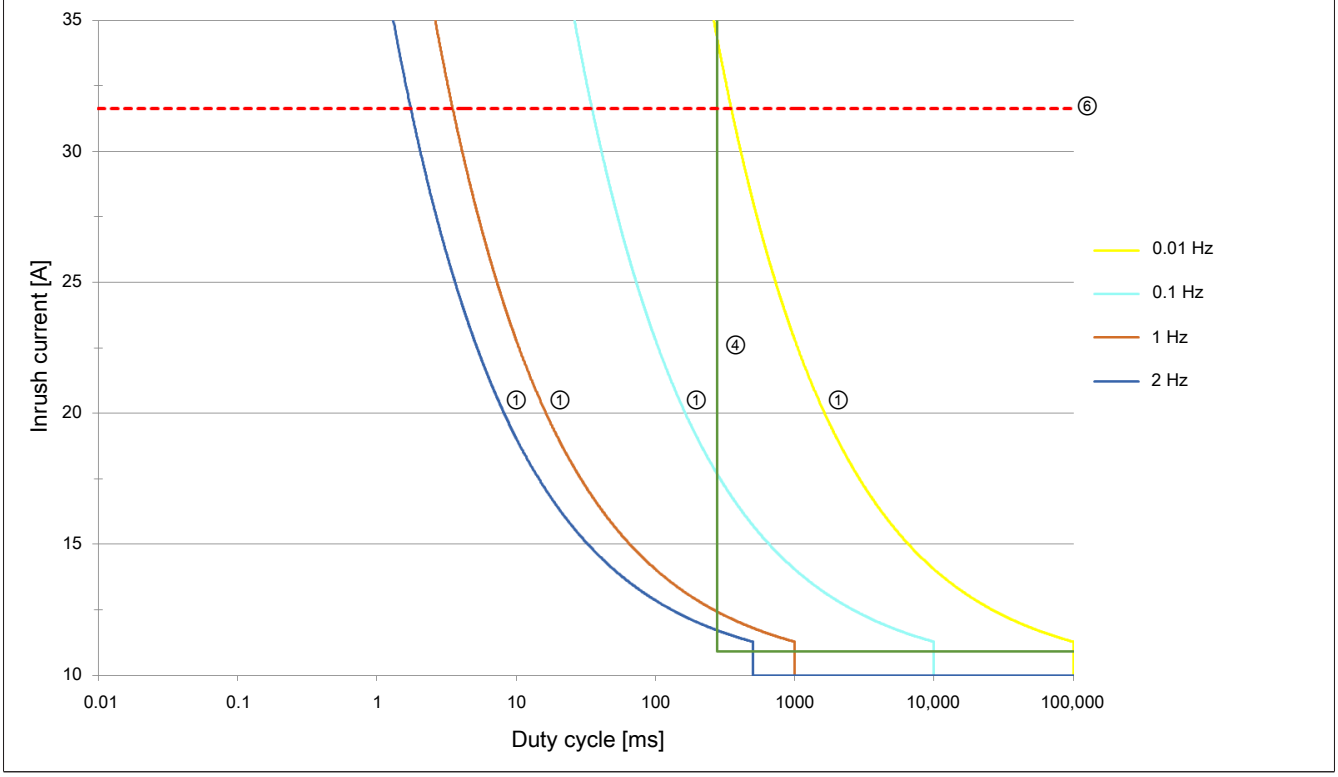



Table 74: Inrush current behavior for output channels

Legend:

| | |
|---|---|
| ① | **Limits during cyclic switching operations**<br>These curves show the maximum possible total inrush currents of all channels of the module during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |
| ④ | **Current monitoring of the firmware - Maximum inrush current per channel**<br>These output channels are equipped with overcurrent detection in the module's firmware.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting results in the shutdown of the output channel. |
| ⑥ | **Component load capacity of the module**<br>This limit shows the total inrush current from which individual components of the module are overloaded.<br>Overshooting can result in irreparable damage to the module. |

For additional module-specific information, see "X20SP1130" on page 26.

### X67SI8103 - Inrush current behavior for output channels

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

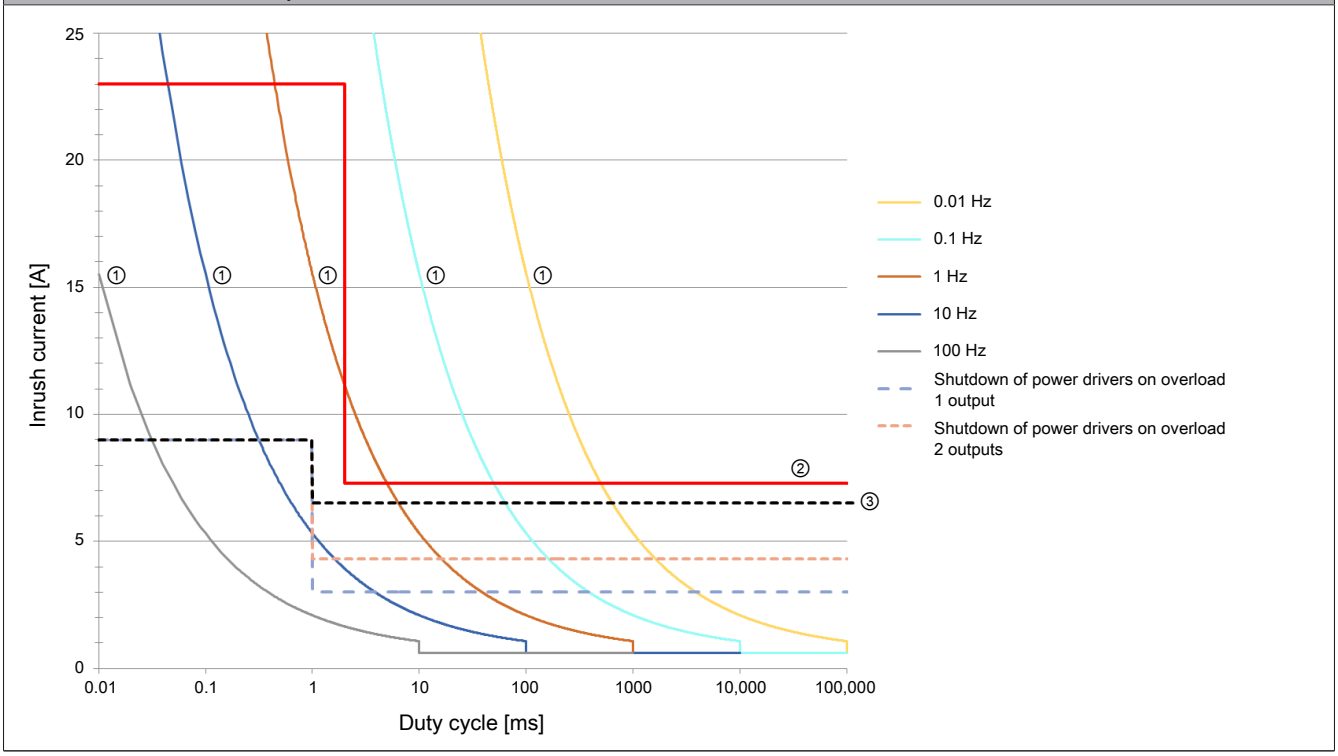



Table 75: Inrush current behavior for output channels

Legend:

| | |
|---|---|
| ① | **Limits during cyclic switching operations**<br>These curves show the maximum possible total inrush currents of all channels of the module during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |
| ② | **Current limiting of the power drivers per channel**<br>These output channels are equipped with power drivers with integrated current limiting.<br>The curve shows the maximum possible inrush current per channel.<br>Overshooting is not possible since the power driver limits the current. |
| ③ | **Shutdown of power drivers on overload per channel**<br>These output channels are equipped with power drivers with integrated shutdown on overload.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting can result in the shutdown of the output channel. |

For additional module-specific information, see "X67SI8103" on page 30.

## X67SC4122.L12 - Inrush current behavior for output channels

In addition to the nominal output current specified in the technical data, the output channels indicate the following possibilities for increased inrush current.

**Inrush current behavior for output channels**

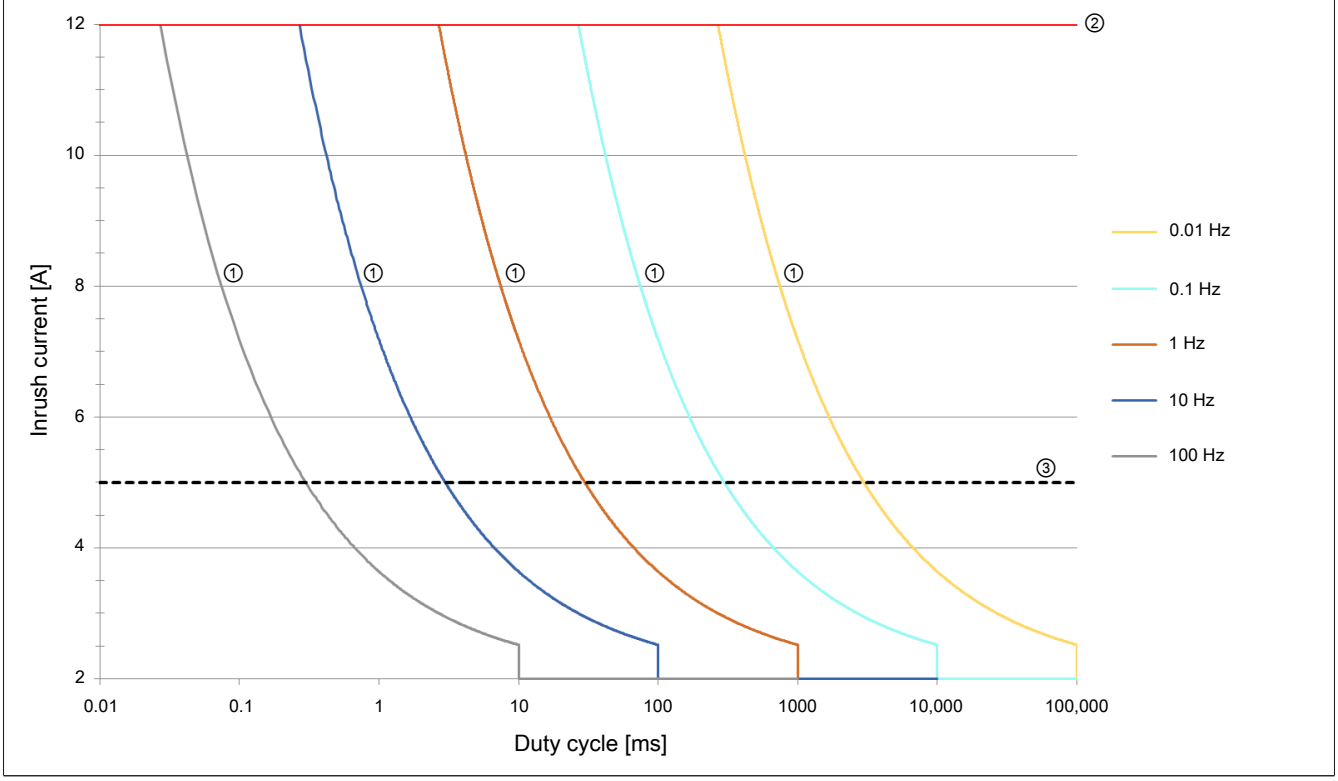



Table 76: Inrush current behavior for output channels

Legend:

| | |
|---|---|
| ① | **Limits during cyclic switching operations**<br>These curves show the maximum possible total inrush currents of all channels of the module during cyclic switching operations depending on the switching frequency.<br>Overshooting these values results in overheating of the module. |
| ② | **Current limiting of the power drivers per channel**<br>These output channels are equipped with power drivers with integrated current limiting.<br>The curve shows the maximum possible inrush current per channel.<br>Overshooting is not possible since the power driver limits the current. |
| ③ | **Shutdown of power drivers on overload per channel**<br>These output channels are equipped with power drivers with integrated shutdown on overload.<br>The curve shows the maximum ensured inrush current per channel.<br>Overshooting can result in the shutdown of the output channel. |

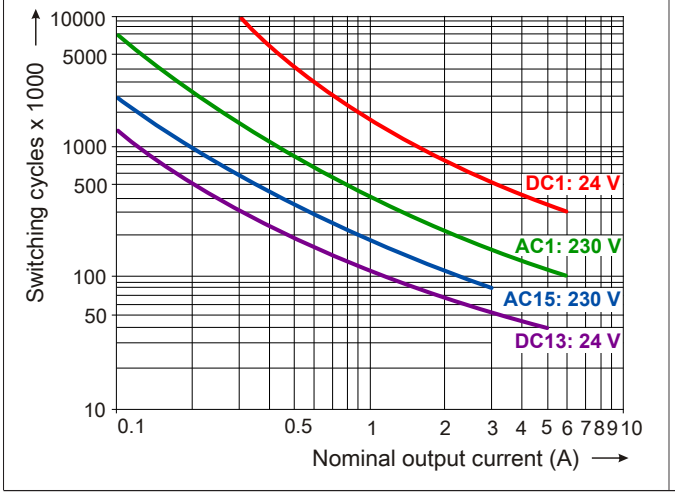
For additional module-specific information, see "X67SC4122.L12" on page 31.

# 6.5 Contact service life of relay outputs

## X20(c)SOx530 - Contact service life for relay outputs

**Contact service life of relay outputs**

**X20SO2530**




**X20SO6530**

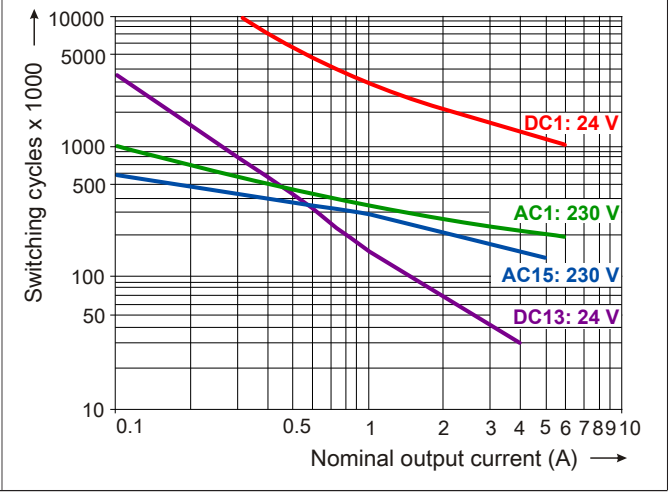



Table 77: Contact service life of relay outputs

For additional module-specific information, see "X20(c)SOx530" on page 16.

## X20(c)SC2432 - Contact service life for relay outputs

**Contact service life of relay outputs**

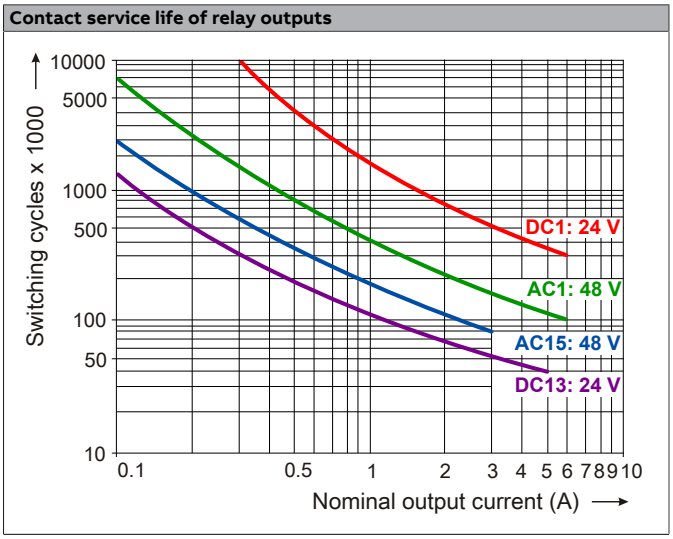



Table 78: Contact service life of relay outputs

For additional module-specific information, see "X20(c)SC2432" on page 20.

# 6.6 Load limit curve for direct current

## X20(c)SOx530 - Load limit curve for direct current

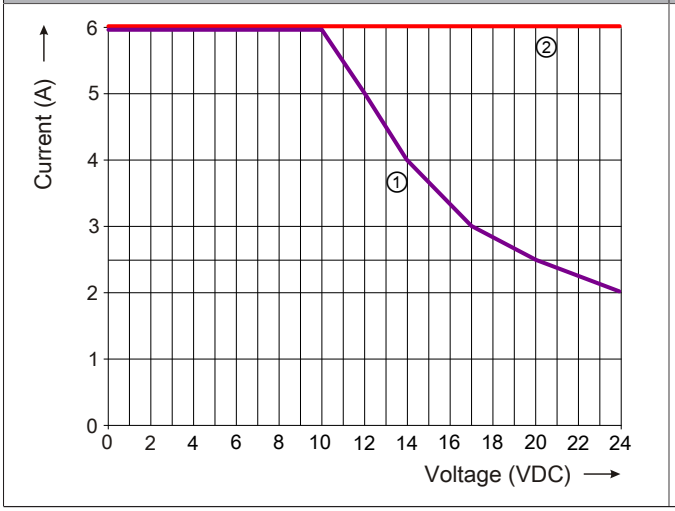
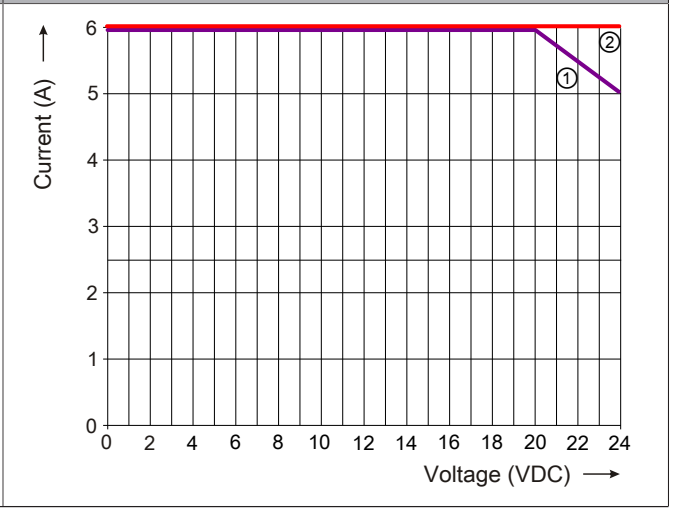
| Load limit curve for direct current | |
|---|---|
| X20SO2530 | X20SO6530 |
|  |  |



Table 79: Load limit curve for direct current

Legend:

| | |
|---|---|
| ① | Inductive load L/R 40 ms |
| ② | Resistive load |

For additional module-specific information, see "X20(c)SOx530" on page 16.

## X20(c)SC2432 - Load limit curve for direct current

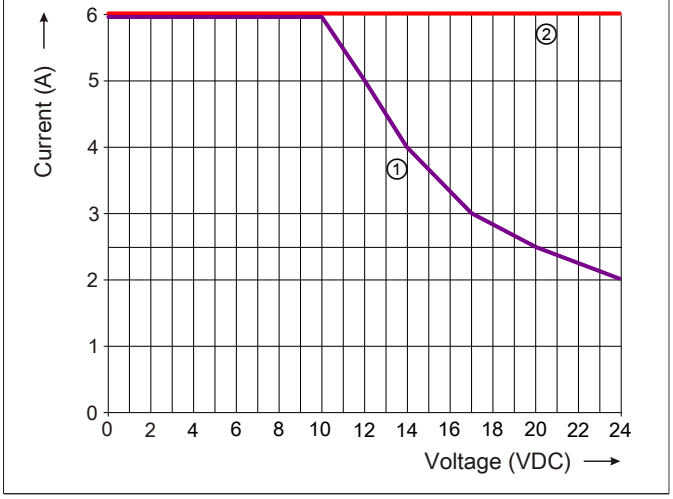
| Load limit curve for direct current |
|---|
|  |



Table 80: Load limit curve for direct current

Legend:

| | |
|---|---|
| ① | Inductive load L/R 40 ms |
| ② | Resistive load |

For additional module-specific information, see "X20(c)SC2432" on page 20.

## 6.7 X20SP1130 - Switching inductive loads

The information in this table applies exclusively to hardware upgrade 2.2.0.0 and later.

**Switching inductive loads**

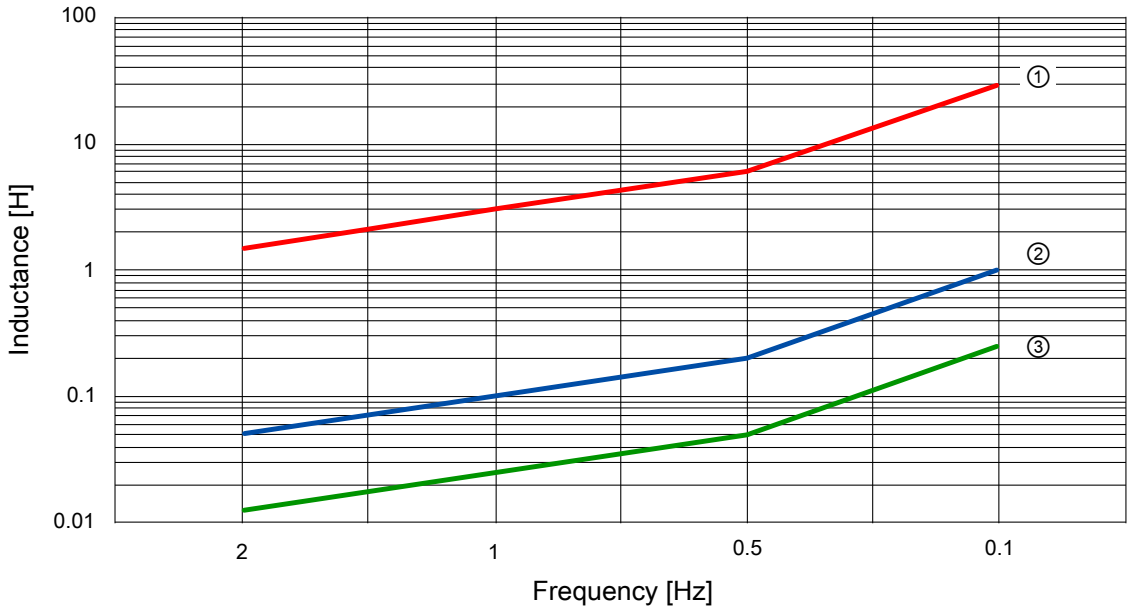



Table 81: Switching inductive loads

Legend:

| | |
|---|---|
| ① | Max. permissible output current 1 A |
| ② | Max. permissible output current 5 A |
| ③ | Max. permissible output current 10 A |

For additional module-specific information, see "X20SP1130" on page 26.

## 6.8 Coated modules

Coated modules are X20 modules with a protective coating for the electronics component. The coating protects X20c modules from condensation.
The modules' electronics are fully compatible with the corresponding X20 modules.

### Information:

**For simplification purposes, only images and module IDs of uncoated modules are used in this document.**

The coating has been certified according to the following standards:

- Condensation: BMW GS 95011-4, 2x 1 cycle

Contrary to the specifications for X20 System modules without safety certification, X20 safety modules are **NOT suitable for applications with harmful gas (EN 60068-2-60)** despite the tests carried out!

## 6.9 Starting temperature

The starting temperature describes the minimum permissible ambient temperature in a voltage-free state at the time the coated module is switched on. This is permitted to be as low as -40°C. During operation, the conditions as specified in the technical data continue to apply.

### Information:

**It is important to absolutely ensure that there is no forced cooling by air currents in the closed control cabinet, e.g. due to the use of a fan or ventilation slots.**

### Information:

**The starting temperature is not supported by all modules. For the modules that are actually supported, see the technical data.**

# 7 Installation

## 7.1 General X20 installation notes

The general X20 installation notes in chapter "3 - X20 System" of the "Installation/EMC guide" version 1.43 (or newer version) also apply to the products.

### Warning!

**Failure of the module's internal safety structure can result in dangerous states.**

**Improper installation or operation of the modules can cause permanent irreparable damage to the module's internal safety structure.**

**Proper installation and intended operation of the products is a fundamental requirement for preventing damage to the module's internal safety structure. It is your responsibility to ensure proper installation and operation in accordance with chapter "3 - X20 System" of the "Installation/EMC guide".**

## 7.2 LED status indicators

### Operating and error states

| LED | Color | Status | Description |
|---|---|---|---|
| All | | All LEDs off | No power to module. |

### Operating and error states of the r/e LEDs

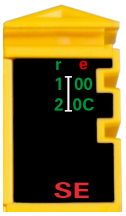
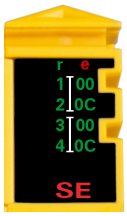
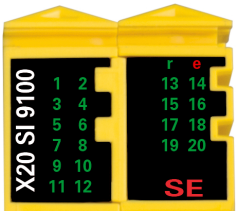
| LED | Color | Status | Description |
|---|---|---|---|
| r | Green | Off | The module has no power supply. |
| | | Single flash | Mode "Reset" |
| | | Double flash | Firmware update |
| | | Blinking | Mode PREOPERATIONAL |
| | | On | Mode RUN |
| e | Red | Off | Module not supplied with power or everything OK |
| | | Single flash inverted | Bootloader mode |
| | | Double flash inverted [1)] | Mode STOP - Safe firmware is not being executed. |
| | | Triple flash inverted | Updating the safety-related firmware |
| | | On | Error or I/O component not supplied with voltage. |
| e + r | Solid red / Single green flash | | The firmware is invalid. |

1) Only for X20SLXxxx-1 modules

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### X20(c)SIx1x0 - State of I/O channels

| | LED | Color | Status | Description |
|---|---|---|---|---|
|  X20SI2100  X20SI4100  X20SI4110  X20SI8110  X20SI9100 | 1 to 20 | Input state of the corresponding digital input<br>The number of channel LEDs varies depending on the number of channels on the module type. | | |
| | | Red | On | Warning/Error on an input channel |
| | | | Blinking<br>(only for X20SI9100, X20SI4110 and X20SI8110) | Error in dual-channel evaluation (synchronous blinking of 2 affected channels) |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Input set |
| | OO | These LEDs may not be available depending on the module type. Errors in dual-channel evaluation are indicated by channel LEDs 1 to 20 in this case. | | Open - Open: Dual-channel evaluation on channels 1 and 2 using function block "Equivalent" |
| | | Red | On | Warning/Error on this evaluation channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Evaluation channel set |
| | OC | These LEDs may not be available depending on the module type. Errors in dual-channel evaluation are indicated by channel LEDs 1 to 20 in this case. | | Open - Closed: Dual-channel evaluation on channels 1 and 2 using function block "Antivalent" |
| | | Red | On | Warning/Error on this evaluation channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Evaluation channel set |

For additional module-specific information, see "X20(c)SIx1x0" on page 13.

### X20(c)SO6300 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | 1 to 6 | Output state of the corresponding digital output | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Orange | On | Output set |

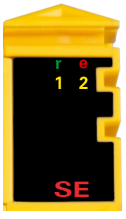
For additional module-specific information, see "X20(c)SO6300" on page 14.

### X20(c)SOx1x0 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  X20SO21x0  X20SO41x0 | 1 to 4 | Output state of the corresponding digital output.<br>The number of channel LEDs varies depending on the number of channels on the module type. | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Orange | On | Output set |

For additional module-specific information, see "X20(c)SOx1x0" on page 15.

### X20(c)SOx530 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  X20SO2530  X20SO6530 | 1 to 6 | Output state of the corresponding digital output | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Orange | On | Output set |

For additional module-specific information, see "X20(c)SOx530" on page 16.

### X20SC0xxx - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | 1 to 8 | Input state of the corresponding digital input<br>The number of channel LEDs varies depending on the number of channels on the module type. | | |
| | | Red | On | Warning/Error on an input channel |
| | | | Blinking | Error in dual-channel evaluation (synchronous blinking of 2 affected channels) |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Input set |
| | 1 to 6 | Output state of the corresponding digital output.<br>The number of channel LEDs varies depending on the number of channels on the module type. | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Orange | On | Output set |

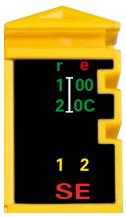
For additional module-specific information, see "X20SC0xxx" on page 17.

### X20(c)SC2212 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | 1 to 6 | Input state of the corresponding digital input | | |
| | | Red | On | Warning/Error on an input channel |
| | | | Blinking | Error in dual-channel evaluation (synchronous blinking of 2 affected channels) |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Input set |
| | 1 to 2 | Output state of the corresponding digital output | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Orange | On | Output set |

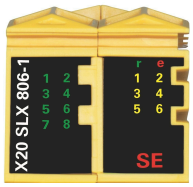
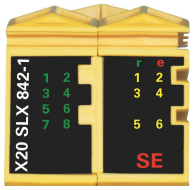
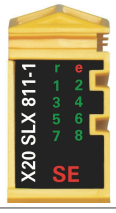
For additional module-specific information, see "X20(c)SC2212" on page 19.

### X20(c)SC2432 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | 1 to 2 | Input state of the corresponding digital input | | |
| | | Red | On | Warning/Error on an input channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Input set |
| | OO | Open - Open: Dual-channel evaluation on channels 1 and 2 using function block "Equivalent" | | |
| | | Red | On | Warning/Error on this evaluation channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Evaluation channel set |
| | OC | Open - Closed: Dual-channel evaluation on channels 1 and 2 using function block "Antivalent" | | |
| | | Red | On | Warning/Error on this evaluation channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Evaluation channel set |
| | 1 to 2 | Output state of the corresponding digital output | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Orange | On | Output set |

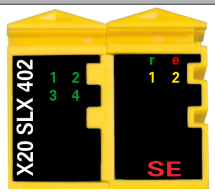
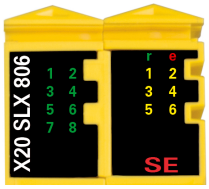
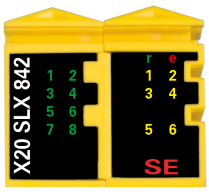
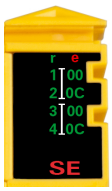
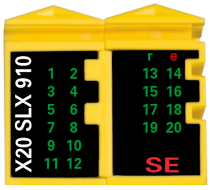
For additional module-specific information, see "X20(c)SC2432" on page 20.

## X20SLXxxx-1 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|     | 1 to 8 | Input state of the corresponding digital input<br>The number of channel LEDs varies depending on the number of channels on the module type. | | |
| | | Red | On | Warning/Error on an input channel |
| | | | Blinking | Error in dual-channel evaluation (synchronous blinking of 2 affected channels) |
| | | | All on | Error on all channels or startup not yet completed |
| | | Green | On | Input set |
| | 1 to 6 | Output state of the corresponding digital output.<br>The number of channel LEDs varies depending on the number of channels on the module type. | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels or startup not yet completed |
| | | Orange | On | Output set |

For additional module-specific information, see "X20SLXxxx-1" on page 21.

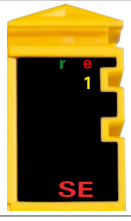
## X20(c)SLXxxx - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | 1 to 20 | Input state of the corresponding digital input<br>The number of channel LEDs varies depending on the number of channels on the module type. | | |
| | | Red | On | Warning/Error on an input channel |
| | | | Blinking[1] | Error in dual-channel evaluation (synchronous blinking of 2 affected channels) |
| | | | All on | Error on all channels or startup not yet completed |
| | | Green | On | Input set |
|  | 1 to 6 | Output state of the corresponding digital output.<br>The number of channel LEDs varies depending on the number of channels on the module type. | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels or startup not yet completed |
| | | Orange | On | Output set |
|  | OO | These LEDs may not be available depending on the module type. Errors in dual-channel evaluation are indicated by channel LEDs 1 to 20 in this case. | | Open - Open: Dual-channel evaluation on channels 1 and 2 using function block "Equivalent" |
| | | Red | On | Warning/Error on this evaluation channel |
| | | | All on | Error on all channels or startup not yet completed |
| | | Green | On | Evaluation channel set |
|  <br>X20SLX210  <br>X20SLX410 | OC | These LEDs may not be available depending on the module type. Errors in dual-channel evaluation are indicated by channel LEDs 1 to 20 in this case. | | Open - Closed: Dual-channel evaluation on channels 1 and 2 using function block "Antivalent" |
| | | Red | On | Warning/Error on this evaluation channel |
| | | | All on | Error on all channels or startup not yet completed |
| | | Green | On | Evaluation channel set |
|  <br>X20SLX811 | | | | |
|  <br>X20SLX910 | | | | |

1 Only for modules X20(c)SLX402, X20SLX806, X20SLX842, X20SLX811 and X20(c)SLX910

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

## X20SP1130 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | 1 | Output state of the digital output | | |
| | | Red | On | Warning/Error of the output channel, connection to the SafeLogic controller not OK or startup not yet completed |
| | | Orange | On | Output set |

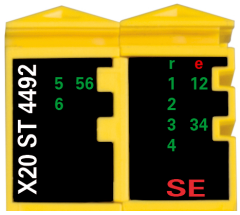
For additional module-specific information, see "X20SP1130" on page 26.

### X20(c)SA4430 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | 1 to 4 | Input state of the corresponding analog input | | |
| | | Red | On | Warning/Error on an input channel |
| | | | Blinking | Open circuit on the corresponding channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | The channel is in use and the signal is OK. |
| | | | Blinking | The channel is outside the limits configured in SafeDesigner(+). |
| | | | Off | The channel is not being used. |
| | 12, 34 | Input state of the corresponding analog input channel pair | | |
| | | Red | On | Warning/Error of this channel pair |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | The signal on the channel pair is OK. |
| | | | Off | The signal on the channel pair is not OK. |

For additional module-specific information, see "X20(c)SA4430" on page 27.

### X20ST4492 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | 1 to 6 | Input state of the corresponding analog input | | |
| | | Red | On | Warning/Error of the input channel |
| | | | Blinking | Open circuit on the corresponding channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | The channel is in use and the signal is OK. |
| | | | Blinking | The channel is outside the limits configured in SafeDESIGNER. |
| | | | Off | The channel is not being used. |
| | 12, 34, 56 | Input state of the corresponding analog input channel pair | | |
| | | Red | On | Warning/Error of this channel pair |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | The signal on the channel pair is OK. |
| | | | Off | The signal on the channel pair is not OK. |

For additional module-specific information, see "X20ST4492" on page 28.

### X20(c)SD1207 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | A, B, $\overline{A}$, $\overline{B}$ | Input state of the corresponding digital input | | |
| | | Red | On | Warning/Error of the input channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | | Off | No warning / No error |
| | | Green | On | Input set |
| | | | Off | Input not set |
| | p | This LED is reserved for future functional expansions. | | |
| | v | Status of velocity evaluation | | |
| | | Red | On | Warning/Error of the evaluation channel, connection to the SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Evaluation channel set |

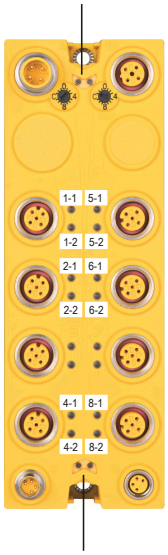
For additional module-specific information, see "X20(c)SD1207" on page 29.

### X67SI8103 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
| Status indicator re:<br>Left: Green (r), Right: Red (e)<br>  <br><br>Status indicator SE<br>Left: Red (S), Right: Red (E) | 1<br>2<br>3<br>4 | State of the corresponding device | | |
| | | | Off | Without signal function:<br>No error, all signals of the female connector off (low state)<br><br>Dual-channel evaluation:<br>No error, dual-channel evaluation FALSE (low state) |
| | | Green | On | Without signal function:<br>All inputs on the female connector are set (high state).<br><br>Dual-channel evaluation:<br>Dual-channel evaluation signal TRUE (high state) |
| | | | Blinking | Without signal function:<br>A single input on the female connector is set (high state).<br><br>Dual-channel evaluation:<br>- |
| | | Red | On | Without signal function:<br>Error on all inputs of the female connector<br><br>Dual-channel evaluation:<br>Error in dual-channel evaluation |
| | | | Blinking | Without signal function:<br>Error on a single input of the female connector. The signal is not set on the second input (low state).<br><br>Dual-channel evaluation:<br>- |
| | | Red/Green | Blinking | Without signal function:<br>Error on a single input of the female connector. The signal is set on the second input (high state).<br><br>Dual-channel evaluation:<br>- |

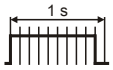
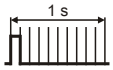
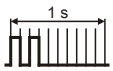
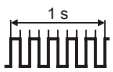
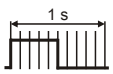
For additional module-specific information, see "X67SI8103" on page 30.

### X67SC4122.L12 - State of I/O channels

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
| Status indicator re:<br>Left: Green (r), Right: Red (e)<br>  <br><br>Status indicator SE<br>Left: Red (S), Right: Red (E) | 1-1<br>1-2<br>2-1<br>2-2<br>5-1<br>5-2<br>6-1<br>6-2 | Input state of the corresponding digital input | | |
| | | Red | On | Warning/Error on an input channel |
| | | | Blinking | Error in dual-channel evaluation (synchronous blinking of 2 affected channels) |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Green | On | Input set |
| | 4-1<br>4-2<br>8-1<br>8-2 | Output state of the corresponding digital output | | |
| | | Red | On | Warning/Error on an output channel |
| | | | All on | Error on all channels, connection to SafeLogic controller not OK or startup not yet completed |
| | | Orange | On | Output set |

For additional module-specific information, see "X67SC4122.L12" on page 31.

### Operating and error states: Safety SE LED - SafeIOs

| LED | Color | Status | Description |
|---|---|---|---|
| SE | Red | Off | Mode RUN or I/O component not provided with voltage |
| | | Single flash, inverted   | Boot phase, missing X2X Link or defective processor |
| | | Single flash   | Safety PREOPERATIONAL state<br>Modules that are not used in the safety application remain in state PREOPERATIONAL. |
| | | Double flash   | Safe communication channel not OK |
| | | Flashes   | The firmware for this module is a non-certified pilot customer version. |
| | | Blinking slowly   | Boot phase, faulty firmware |
| | | On | Safety state active for the entire module (state "FailSafe") |
| | The "SE" LEDs separately indicate the status of safety processor 1 (LED "S") and safety processor 2 (LED "E"). | | |

## Warning!

**Failure of the module's internal safety structure can result in dangerous states.**

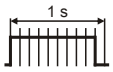
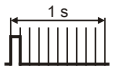
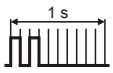
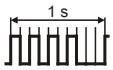
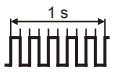
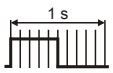
**Continuously lighting "SE" LEDs indicate a possible defect in the module's internal safety structure.**

**Temporary problems can be solved either by correct configuration and/or powering the module down/up. Should the problem persist despite correct configuration, this is a strong indication that the module's internal safety structure is permanently damaged. In this case, the module must be replaced.**

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Operating and error states: Safety SE-LED - SafeLogic-X controller

| LED | Color | Status | Description |
|---|---|---|---|
| SE | Red | Off | Mode RUN or I/O component not supplied with voltage. Safety firmware in state OPERATIONAL. |
| | | Single flash, inverted   | Boot phase, missing X2X Link or defective processor |
| | | Single flash   | **Safety+:** Safety PREOPERATIONAL state or "SafeApplication!=RUN"<br>**mapp Safety:** Safety PREOPERATIONAL state or "SafeOSstate!"=RUN" |
| | | Double flash   | **Safety+:** Safe communication channel not OK, openSAFETY connection valid problem<br>**mapp Safety:** Safe communication channel not OK, openSAFETY connection valid problem or "SafeOSstate!"=RUN" |
| | | Quadruple flash   | SafeDomain in "Debug" mode |
| | | Flashes   | Test/Pilot firmware or safety application created with test/pilot version of SafeDesigner(+) |
| | | Blinking slowly   | Boot phase, faulty firmware, setup mode active<br>Only for Safety+: SafeDomain is not in the safe state.<br>For details about setup mode, see section "Setup mode" in Automation Help. |
| | | On | Safety state active for the entire module (state "FailSafe") |
| | The "SE" LEDs separately indicate the status of safety processor 1 (LED "S") and safety processor 2 (LED "E"). | | |

## Warning!

**Failure of the module's internal safety structure can result in dangerous states.**

**Continuously lighting "SE" LEDs indicate a possible defect in the module's internal safety structure.**

**Temporary problems can be solved either by correct configuration and/or powering the module down/up. Should the problem persist despite correct configuration, this is a strong indication that the module's internal safety structure is permanently damaged. In this case, the module must be replaced.**

For additional module-specific information, see:


- "X20(c)SLXxxx" on page 23
- "X20SLXxxx-1" on page 21

# 7.3 Pinouts of X20 SafeIO and SafeLogic-X modules

## X20(c)SIx1x0 - Pinouts

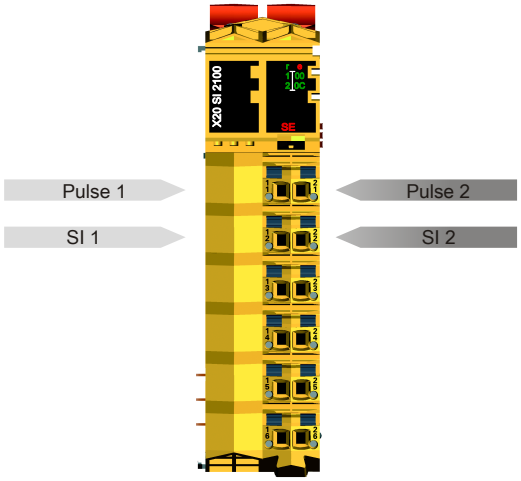



Figure 1: X20SI2100 - Pinout

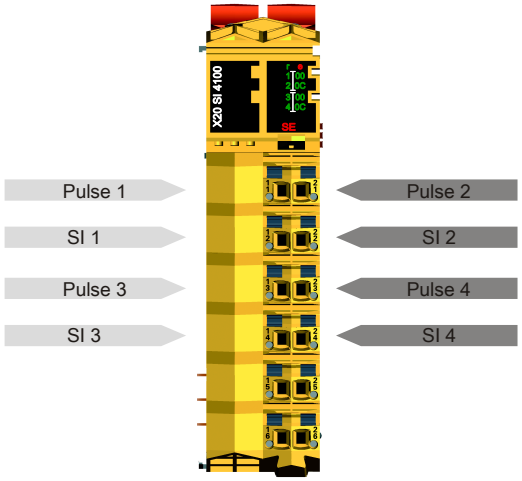



Figure 2: X20SI4100 - Pinout

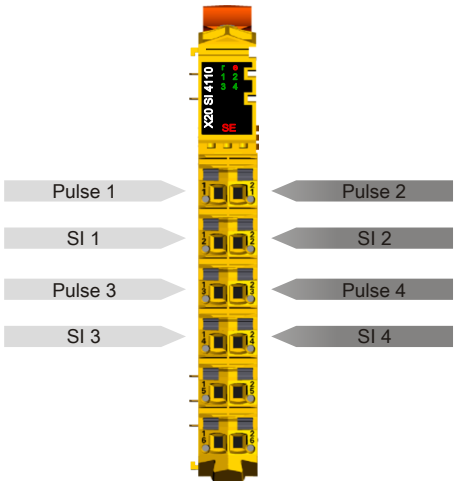



Figure 3: X20SI4110 - Pinout

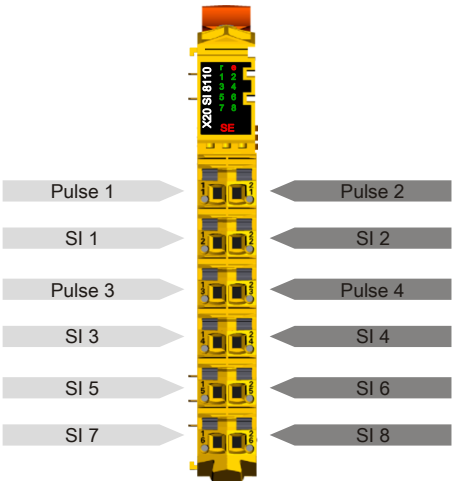



Figure 4: X20SI8110 - Pinout

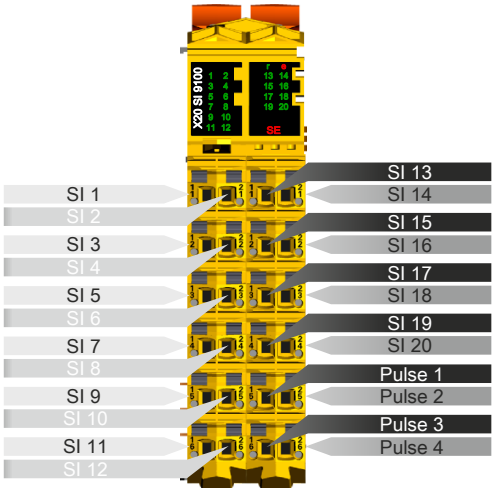



Figure 5: X20SI9100 - Pinout

For additional module-specific information, see "X20(c)SIx1x0" on page 13.

### X20(c)SO6300 - Pinout

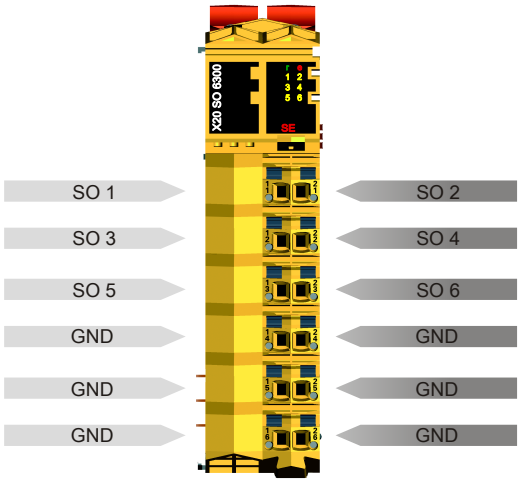



Figure 6: X20SO6300 - Pinout

For additional module-specific information, see "X20(c)SO6300" on page 14.

### X20(c)SOx1x0 - Pinouts

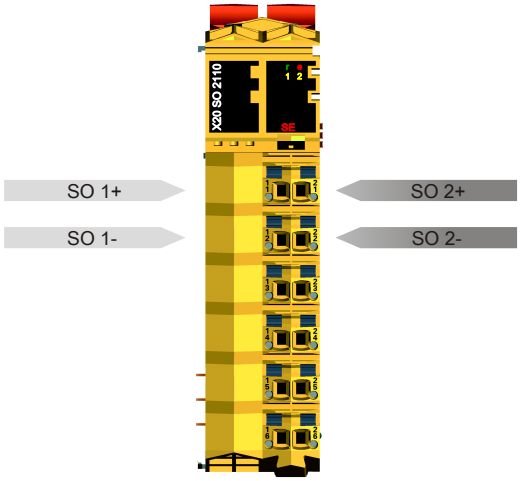



Figure 7: X20SO21x0 - Pinout

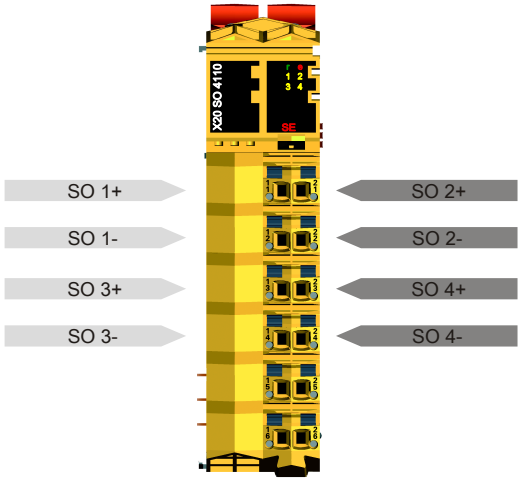



Figure 8: X20SO41x0 - Pinout

For additional module-specific information, see "X20(c)SOx1x0" on page 15.

### X20(c)SOx530 - Pinouts

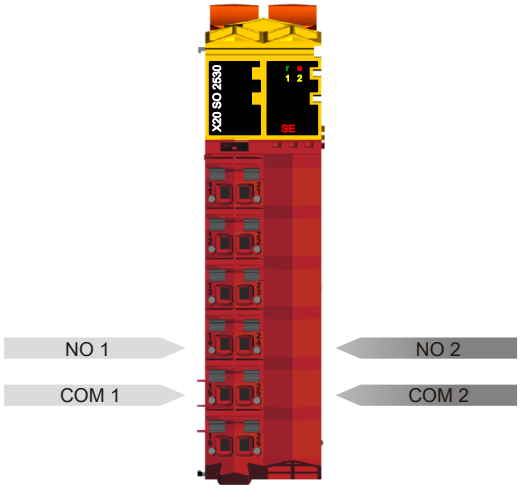



Figure 9: X20SO2530 - Pinout

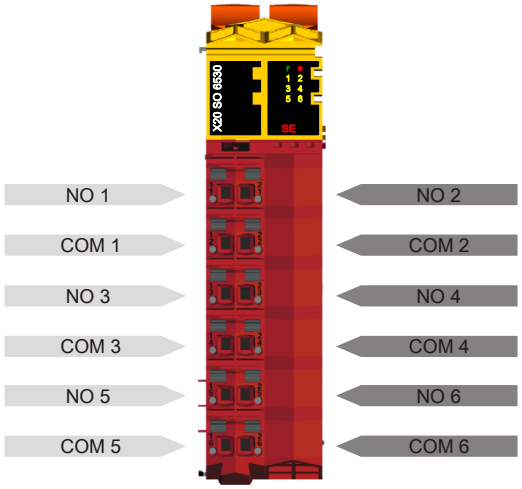



Figure 10: X20SO6530 - Pinout

For additional module-specific information, see "X20(c)SOx530" on page 16.

## X20SC0xxx - Pinouts

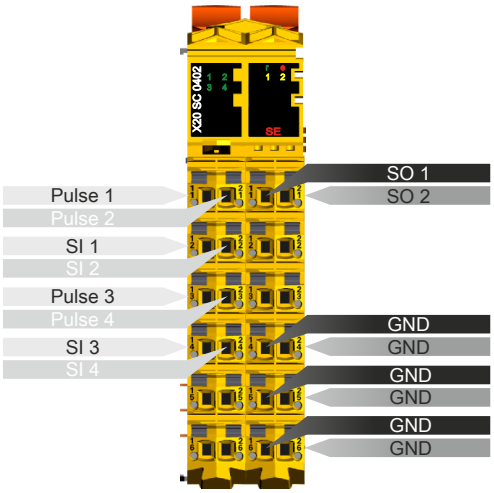



Figure 11: X20SC0402 - Pinout

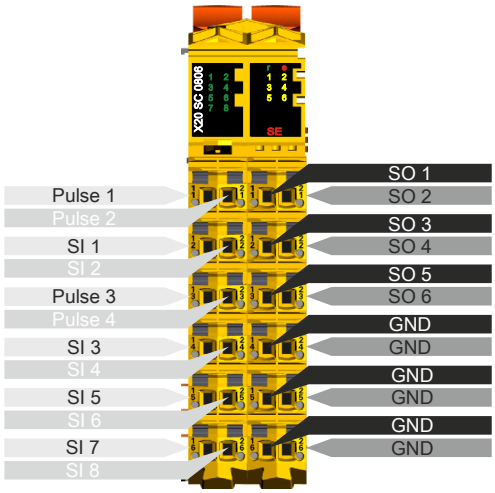



Figure 12: X20SC0806 - Pinout

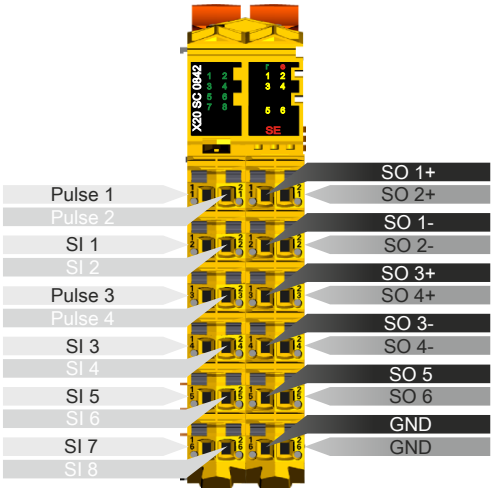



Figure 13: X20SC0842 - Pinout

For additional module-specific information, see "X20SC0xxx" on page 17.

## X20(c)SC2212 - Pinouts

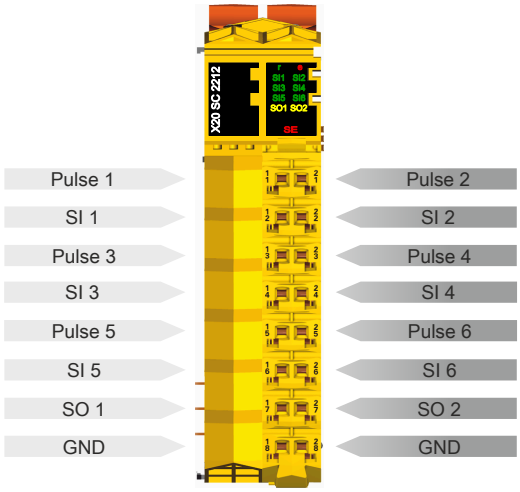



Figure 14: X20SC2212 - Pinout

For additional module-specific information, see "X20(c)SC2212" on page 19.

### X20(c)SC2432 - Pinout

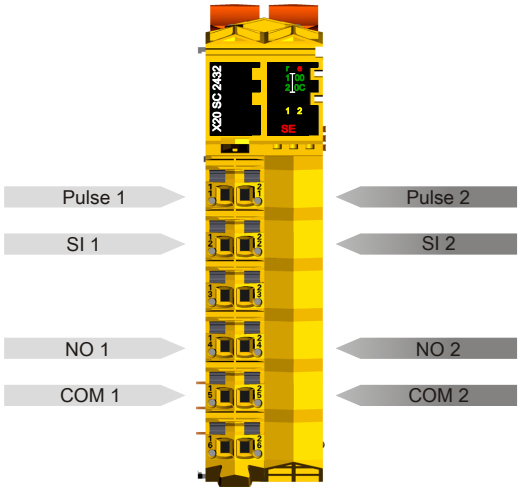



Figure 15: X20SC2432 - Pinout

For additional module-specific information, see "X20(c)SC2432" on page 20.

### X20SLXxxx-1 - Pinout

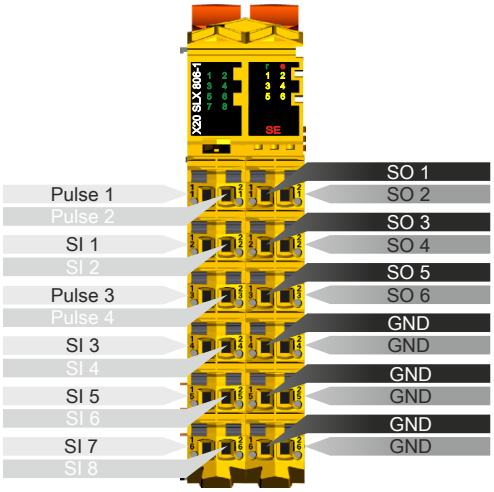



Figure 16: X20SLX806-1 - Pinout

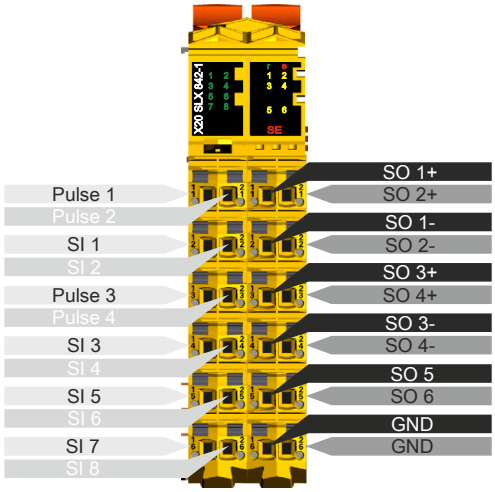



Figure 17: X20SLX842-1 - Pinout

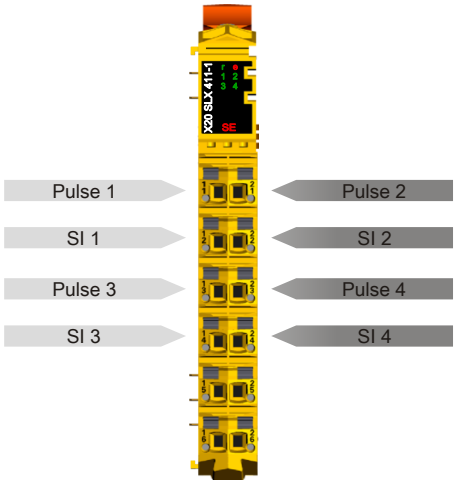



Figure 18: X20SLX411-1 - Pinout

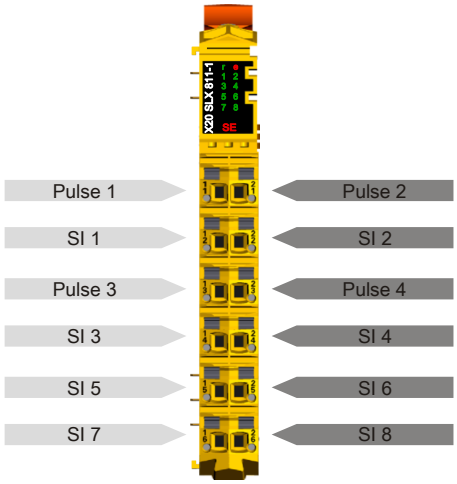



Figure 19: X20SLX811-1 - Pinout

For additional module-specific information, see "X20SLXxxx-1" on page 21.

## X20(c)SLXxxx - Pinout

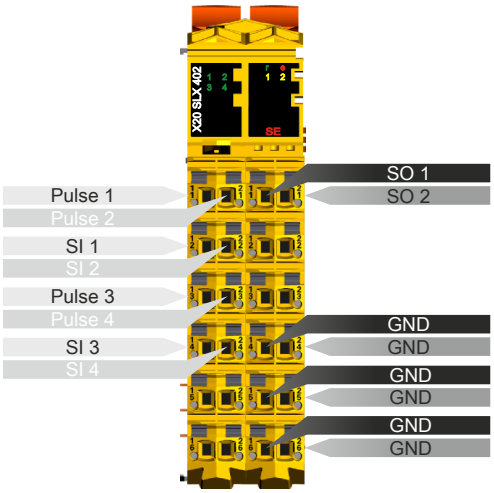



Figure 20: X20SLX402 - Pinout

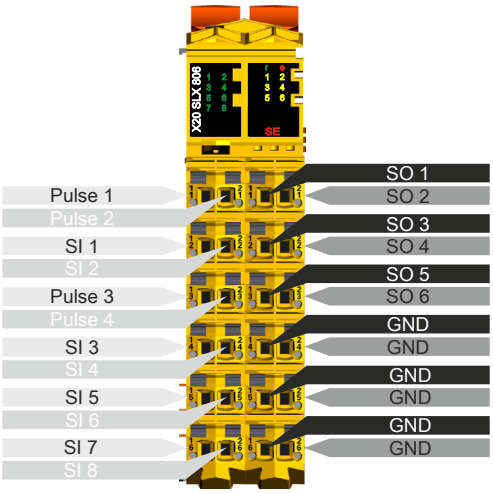



Figure 21: X20SLX806 - Pinout

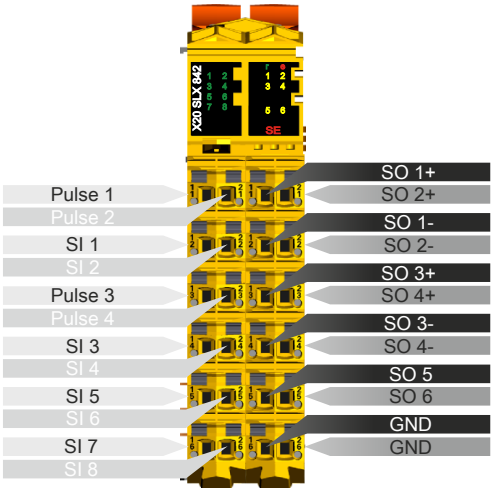



Figure 22: X20SLX842 - Pinout

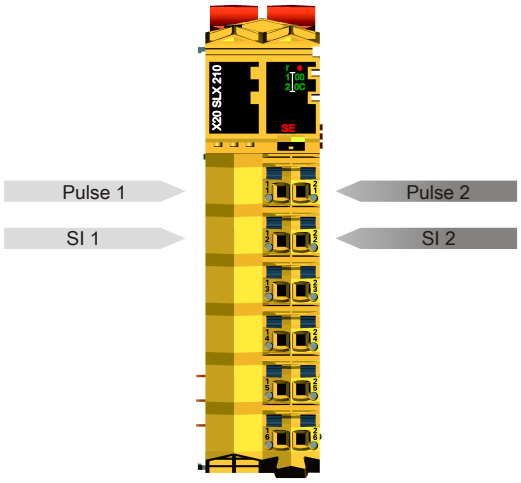



Figure 23: X20SLX210 - Pinout

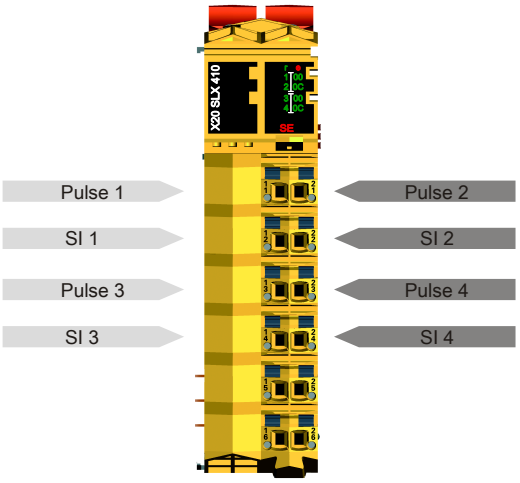



Figure 24: X20SLX410 - Pinout

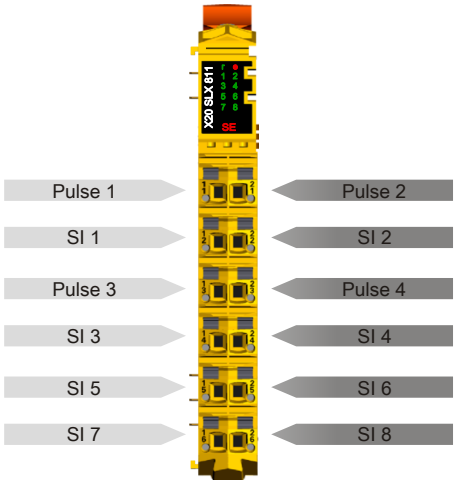



Figure 25: X20SLX811 - Pinout

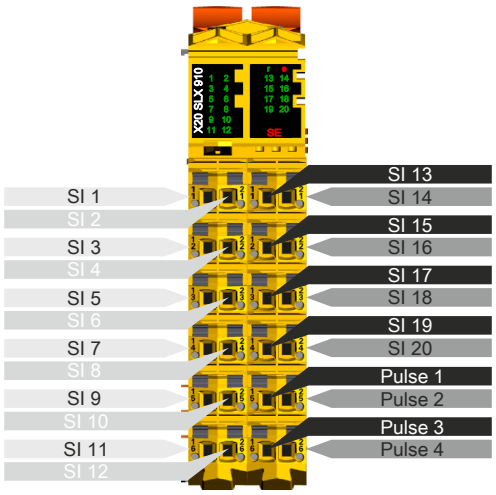



Figure 26: X20SLX910 - Pinout

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

### X20SP1130 - Pinout

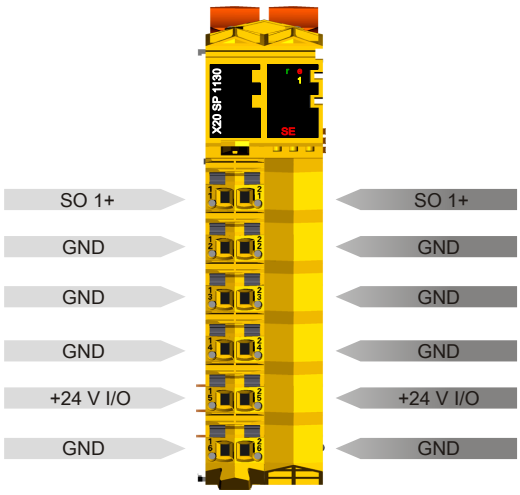



Figure 27: X20SP1130 - Pinout

For additional module-specific information, see "X20SP1130" on page 26.

### X20(c)SA4430 - Pinout

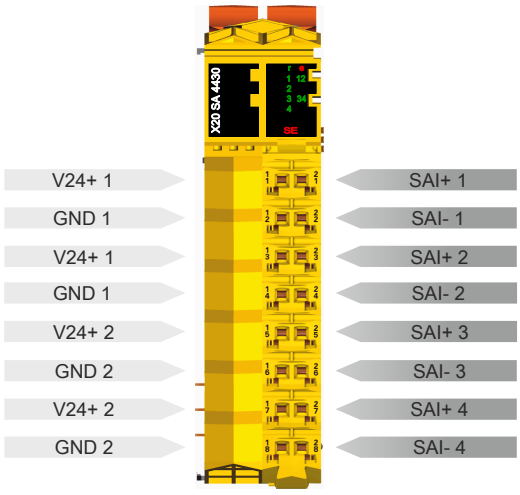



Figure 28: X20SA4430 - Pinout

For additional module-specific information, see "X20(c)SA4430" on page 27.

### X20ST4492 - Pinout

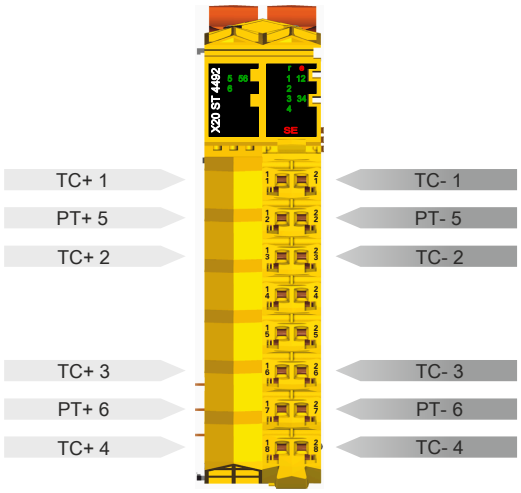



Figure 29: X20ST4492 - Pinout

For additional module-specific information, see "X20ST4492" on page 28.

### X20(c)SD1207 - Pinout

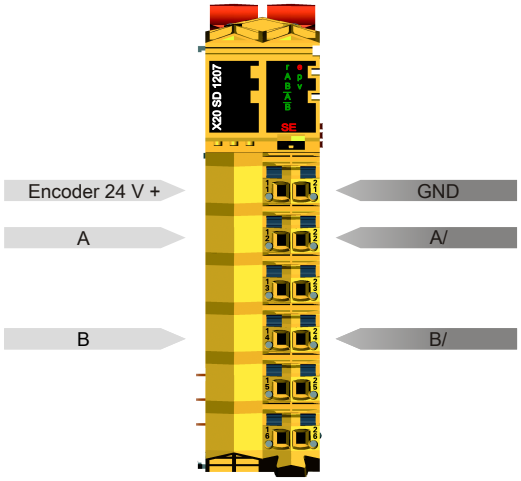



Figure 30: X20SD1207 - Pinout

For additional module-specific information, see "X20(c)SD1207" on page 29.

## 7.4 Input circuit diagram

**Input circuit diagram for X20(c)SIx1x0, X20(c)SC2212, X20(c)SC2432, X20SLX210, X20(c)SLX410, X20(c)SLX910 and X67 modules**

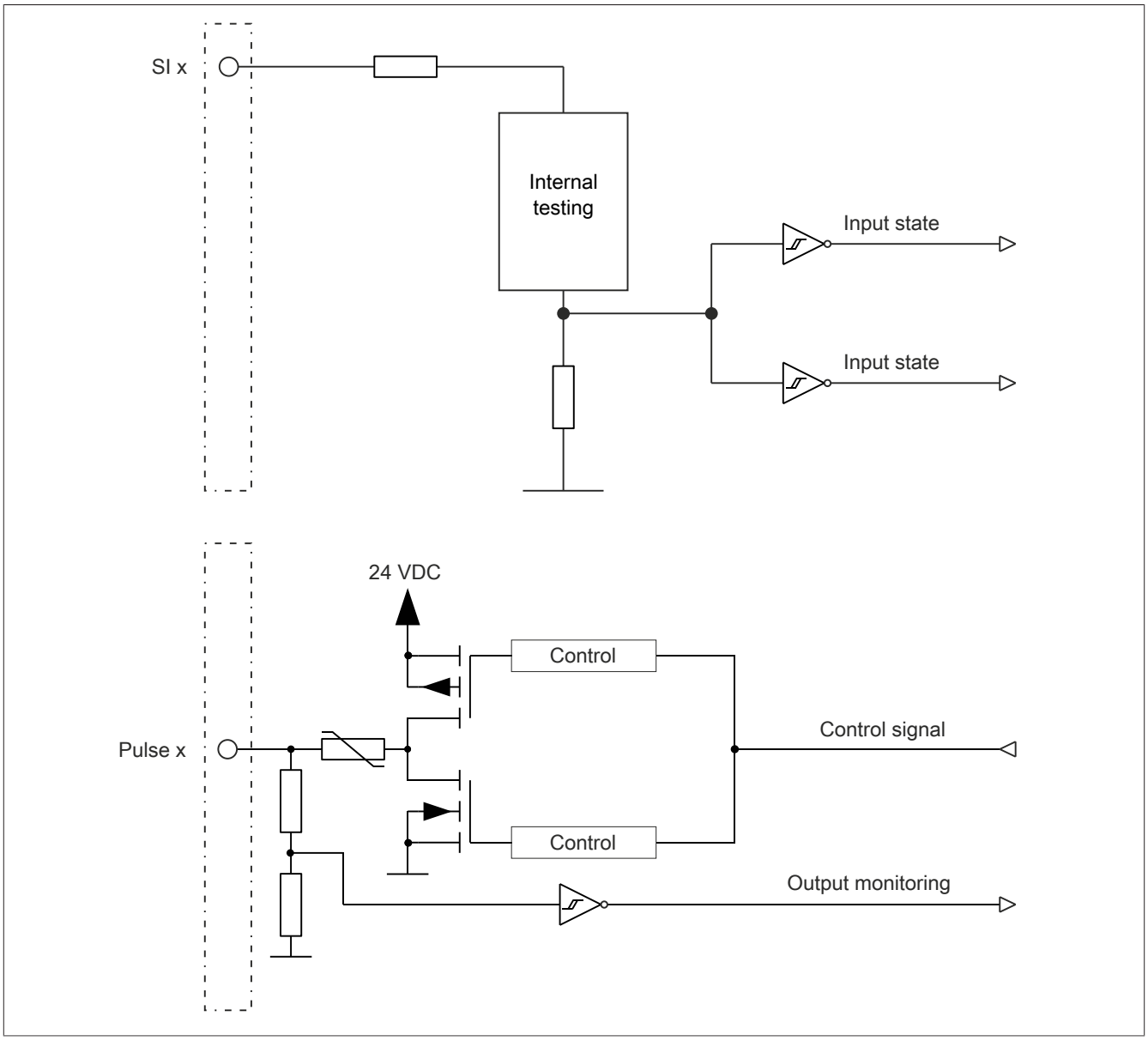



Figure 31: Input circuit diagram

For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Input circuit diagram for X20SC0xxx, X20SLXxxx-1 and X20(c)SLX402, X20SLX806, X20SLX842, X20SLX811

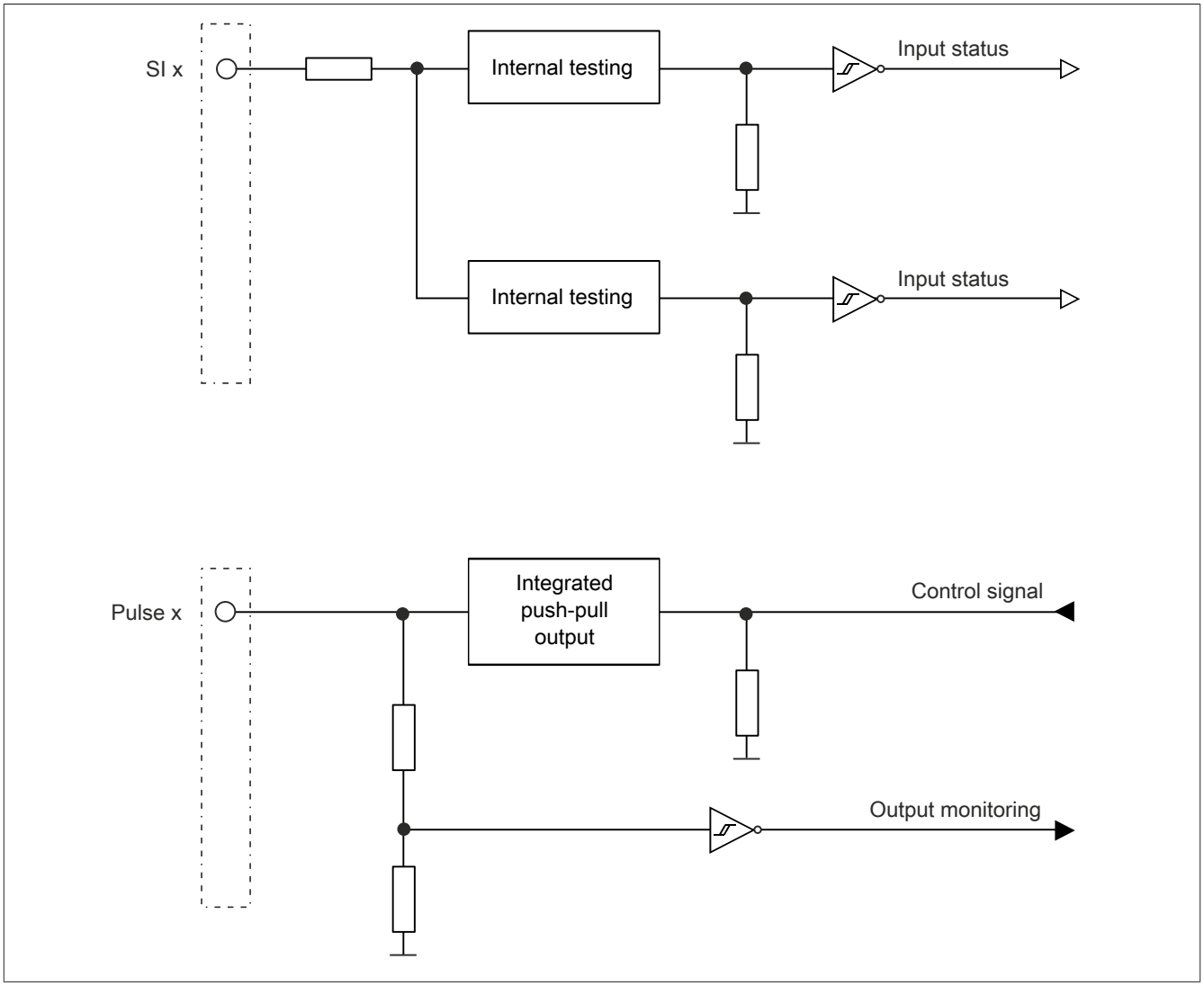



Figure 32: Input circuit diagram

For additional module-specific information, see:

- "X20SC0xxx" on page 17
- "X20(c)SLXxxx" on page 23
- "X20SLXxxx-1" on page 21

## Input circuit diagram for X20(c)SA4430

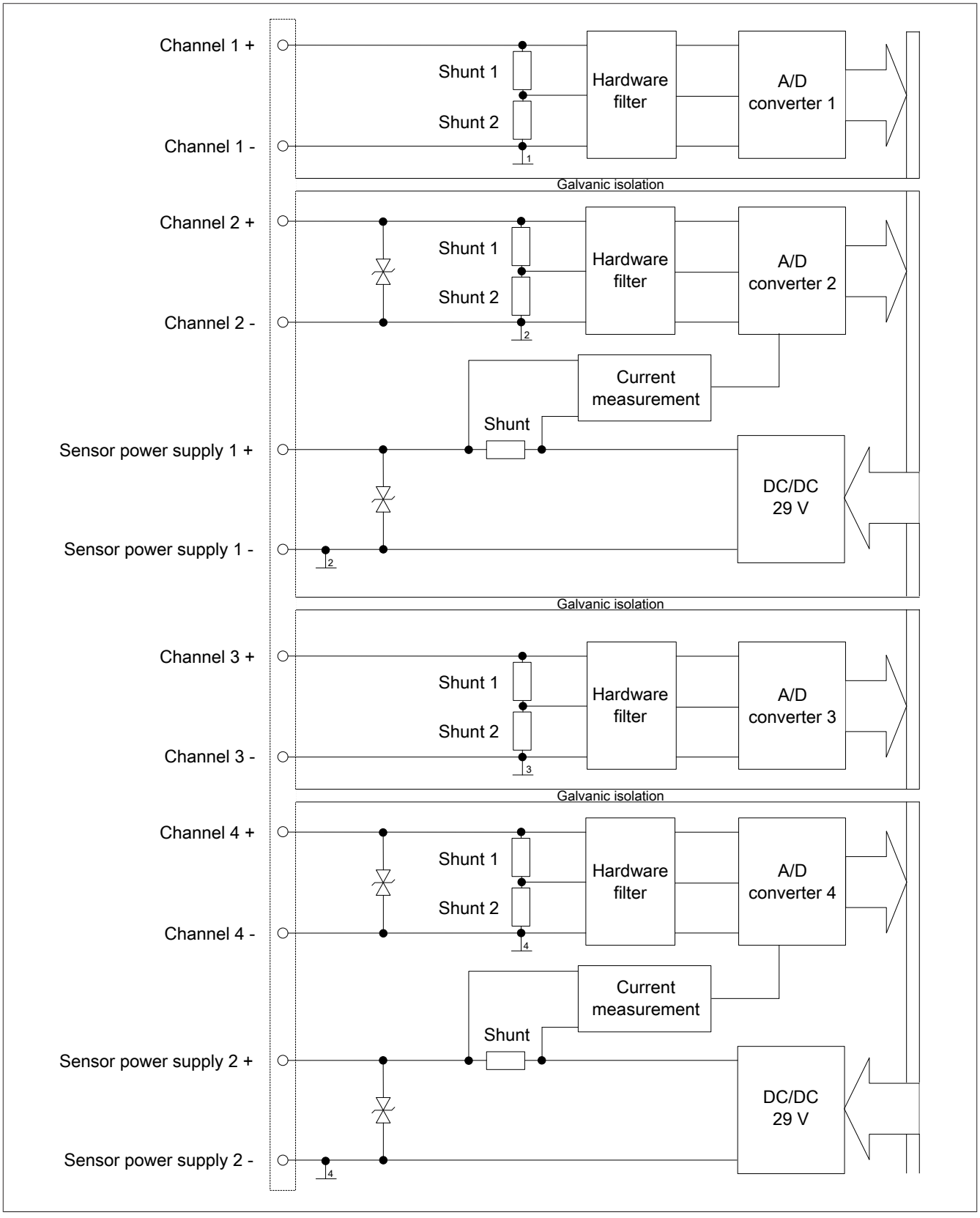



Figure 33: Input circuit diagram

For additional module-specific information, see "X20(c)SA4430" on page 27.

## Input circuit diagram for X20ST4492

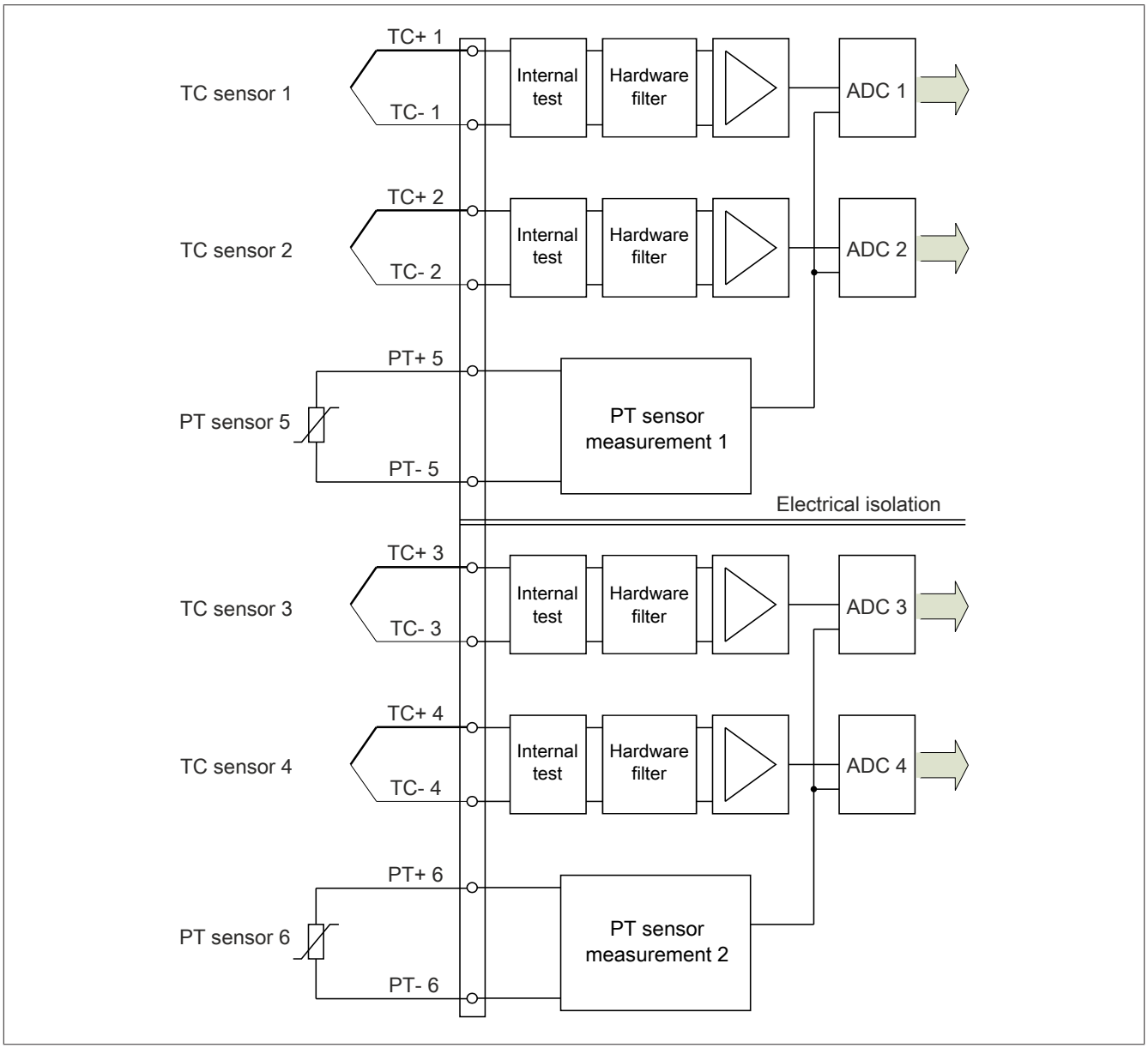



Figure 34: Input circuit diagram

For additional module-specific information, see "X20ST4492" on page 28.

### Input circuit diagram for X20(c)SD1207

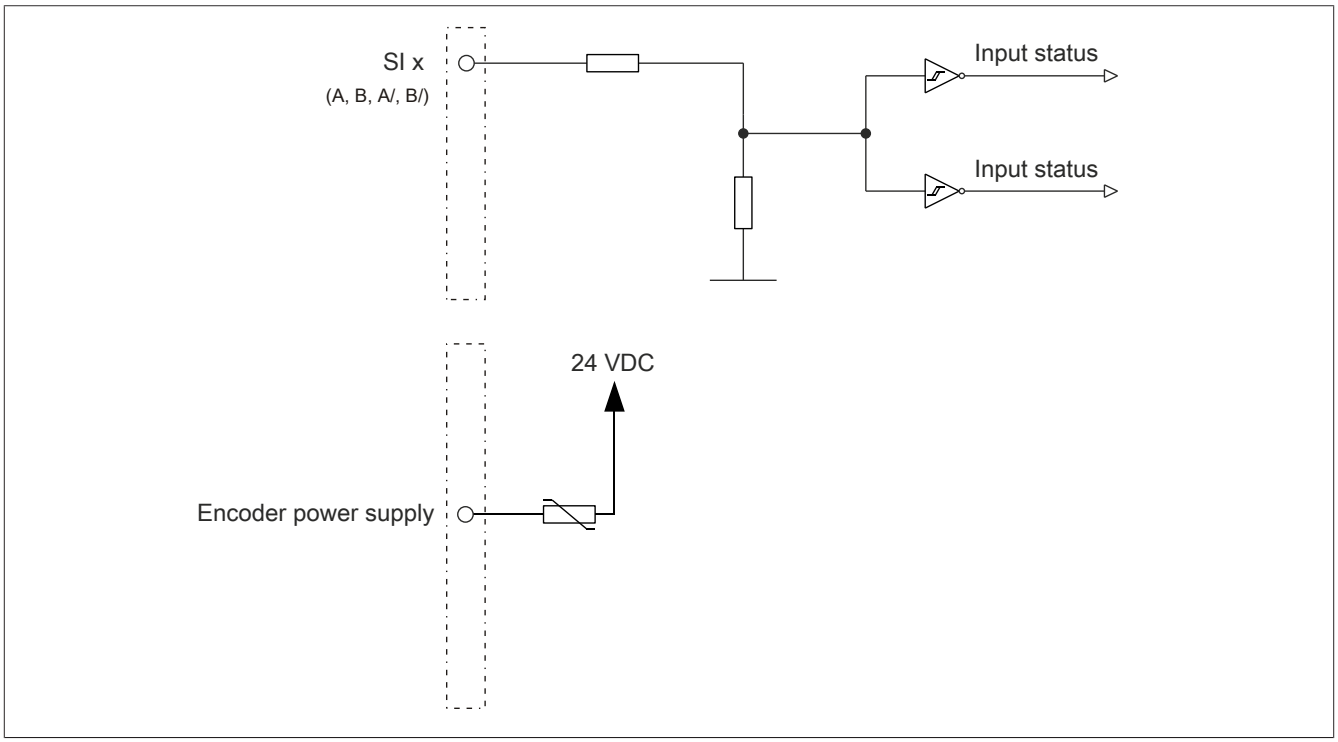



Figure 35: Input circuit diagram

For additional module-specific information, see "X20(c)SD1207" on page 29.

### Standard input without safety function for X67SI8103 - Input circuit diagram

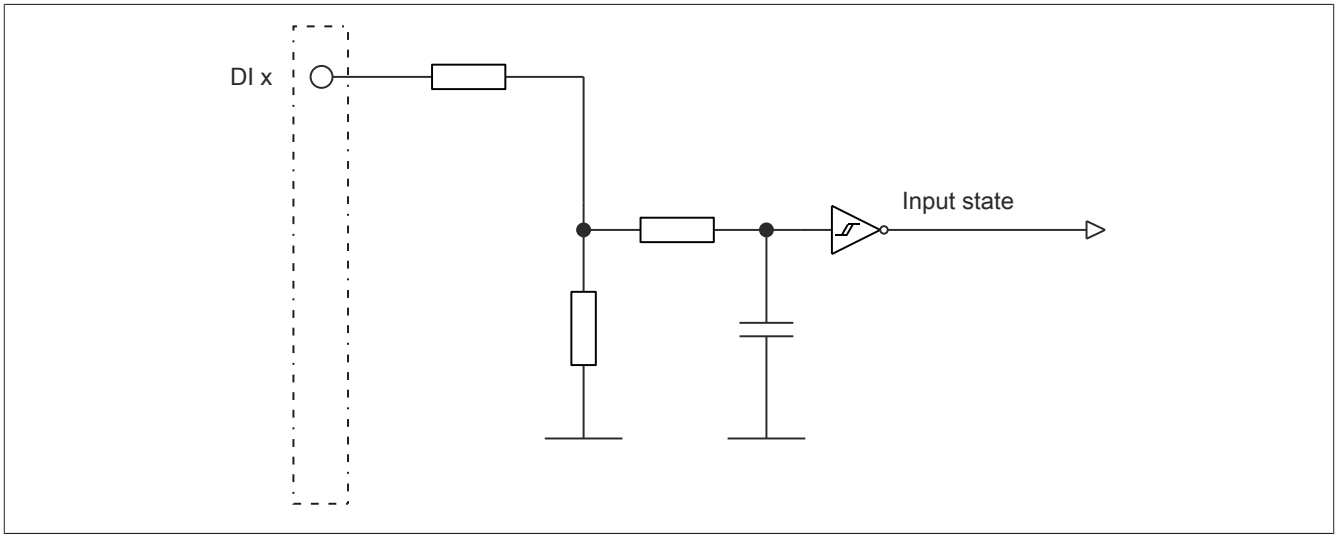



Figure 36: Input circuit diagram - Standard input without safety function

For additional module-specific information, see "X67SI8103" on page 30.

## 7.5 Output circuit diagram

### Type A - Output circuit diagram

Type A digital output channels are designed for positive and GND switching within the module.

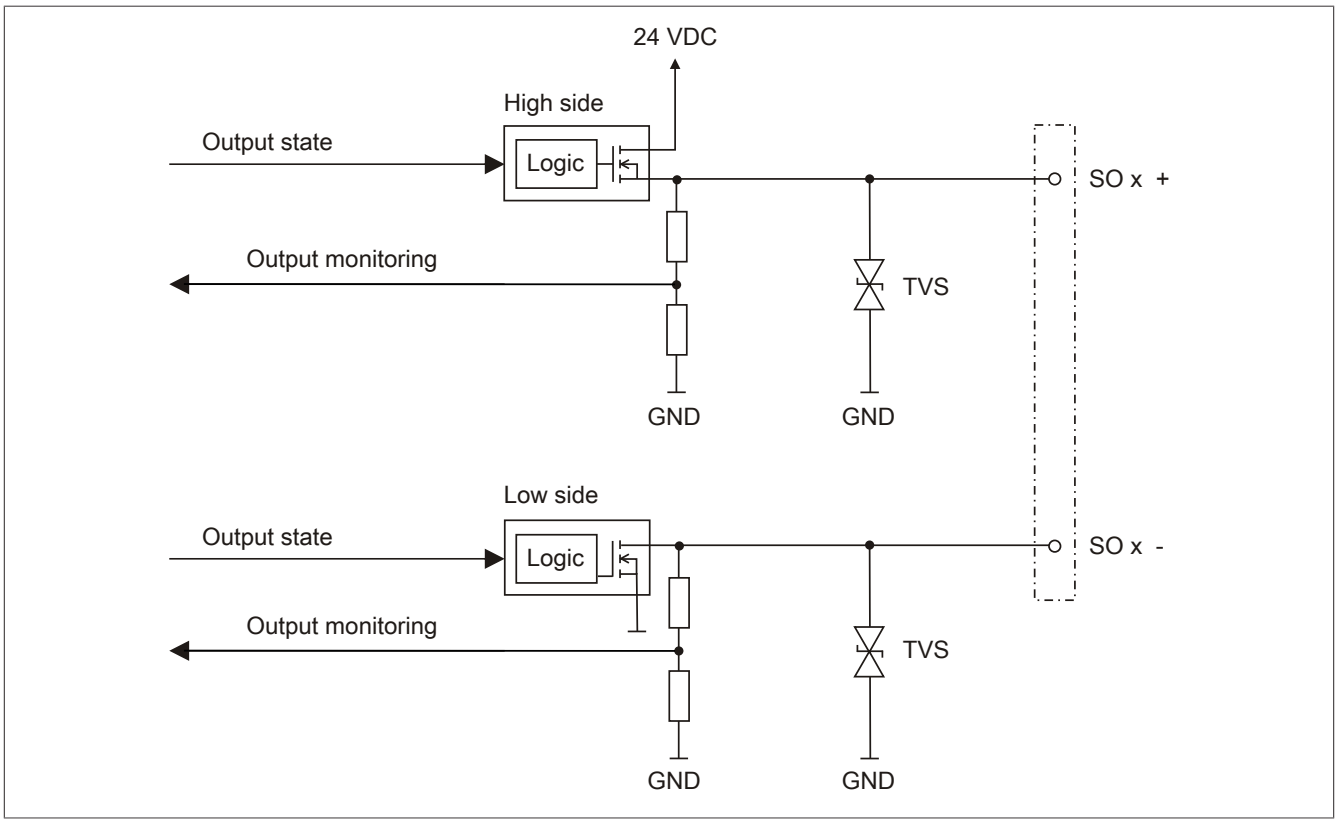



Figure 37: Type A output circuit diagram

For additional module-specific information, see:

- "X20SC0xxx" on page 17
- "X20(c)SOx1x0" on page 15
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23

### Type B of X20 modules - Output circuit diagram

Type B digital output channels are designed for positive and current-sourcing within the module.

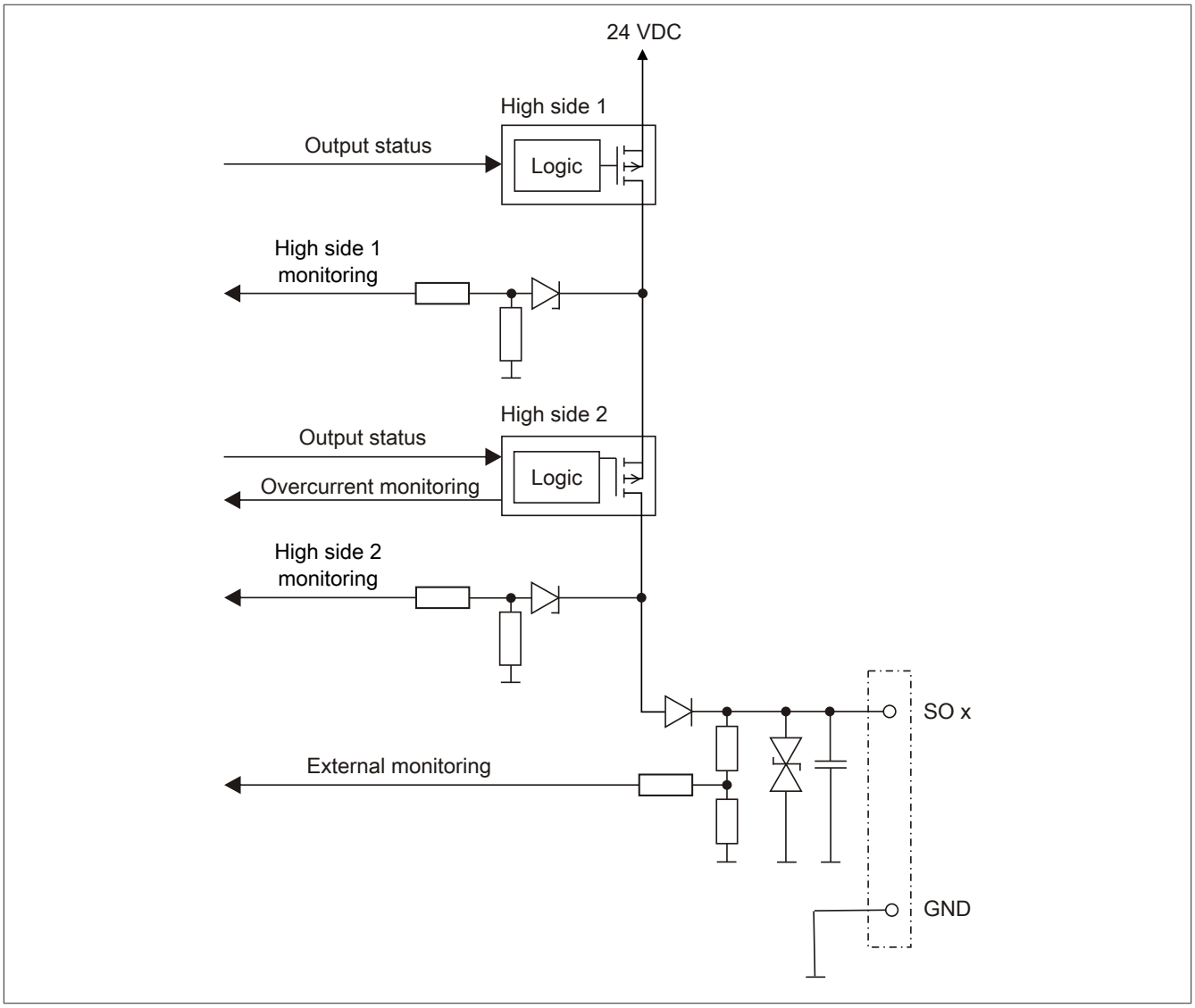



Figure 38: Type B output circuit diagram

For additional module-specific information, see:

- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23

### Type B for X67SC4122.L12 - Output circuit diagram

Type B digital output channels are designed for positive and current-sourcing within the module.

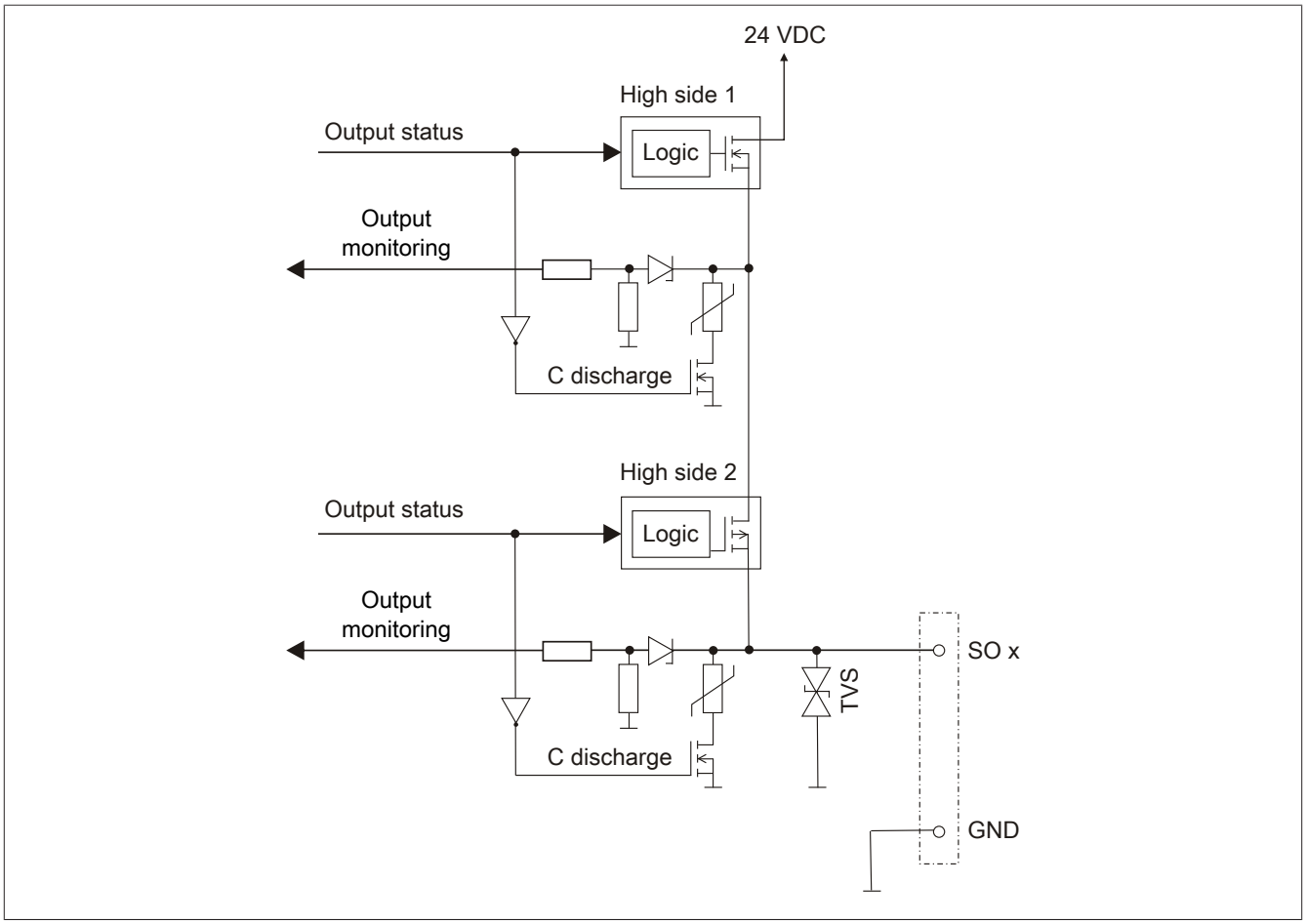



Figure 39: Type B output circuit diagram

For additional module-specific information, see "X67SC4122.L12" on page 31.

**Relay - Output circuit diagram**

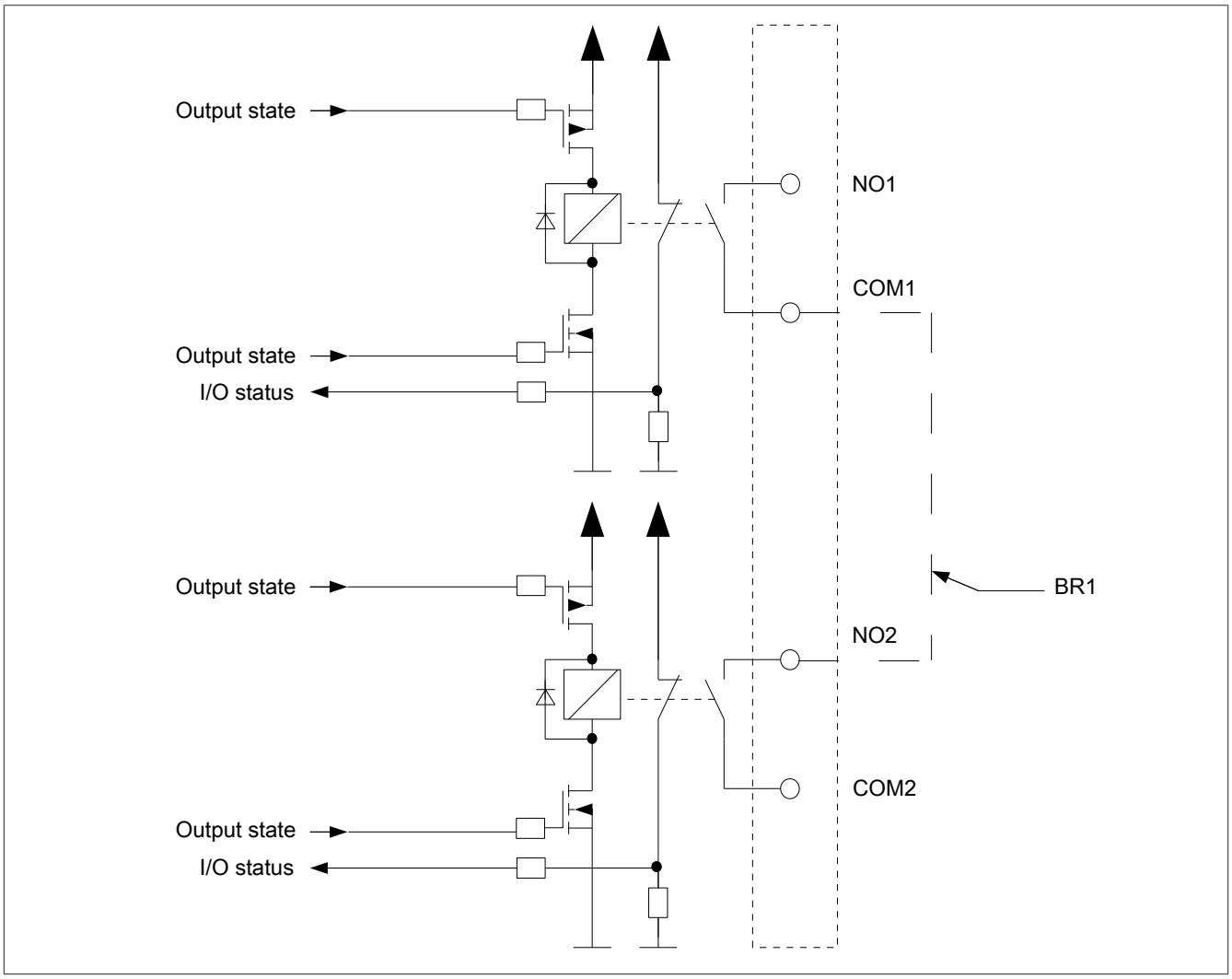



Figure 40: Output circuit diagram

For additional module-specific information, see:

- "X20(c)SOx530" on page 16
- "X20(c)SC2432" on page 20

### X20(c)SO6300 - Output circuit diagram

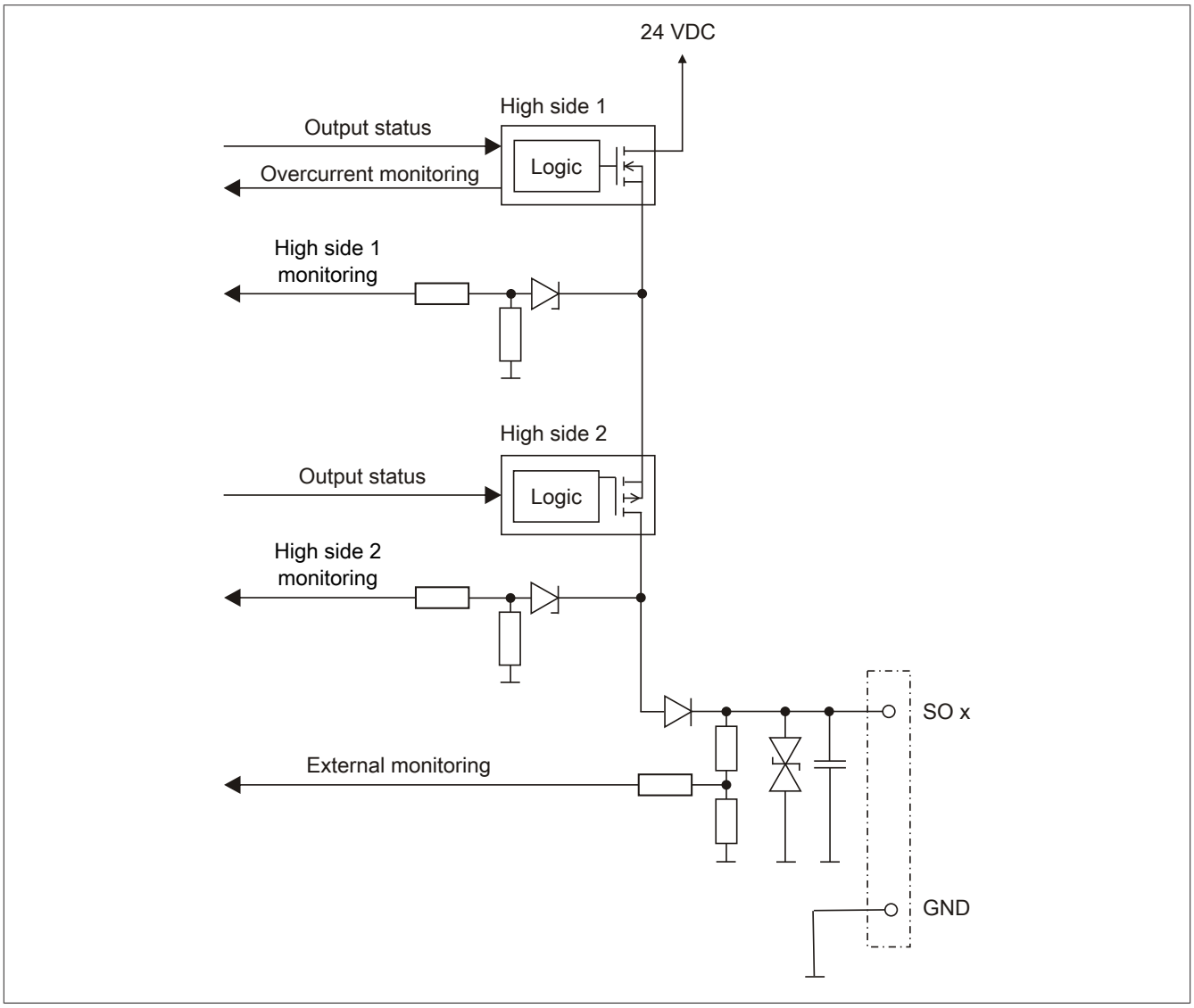



Figure 41: Output circuit diagram

For additional module-specific information, see "X20(c)SO6300" on page 14.

### X20SP1130 - Output circuit diagram

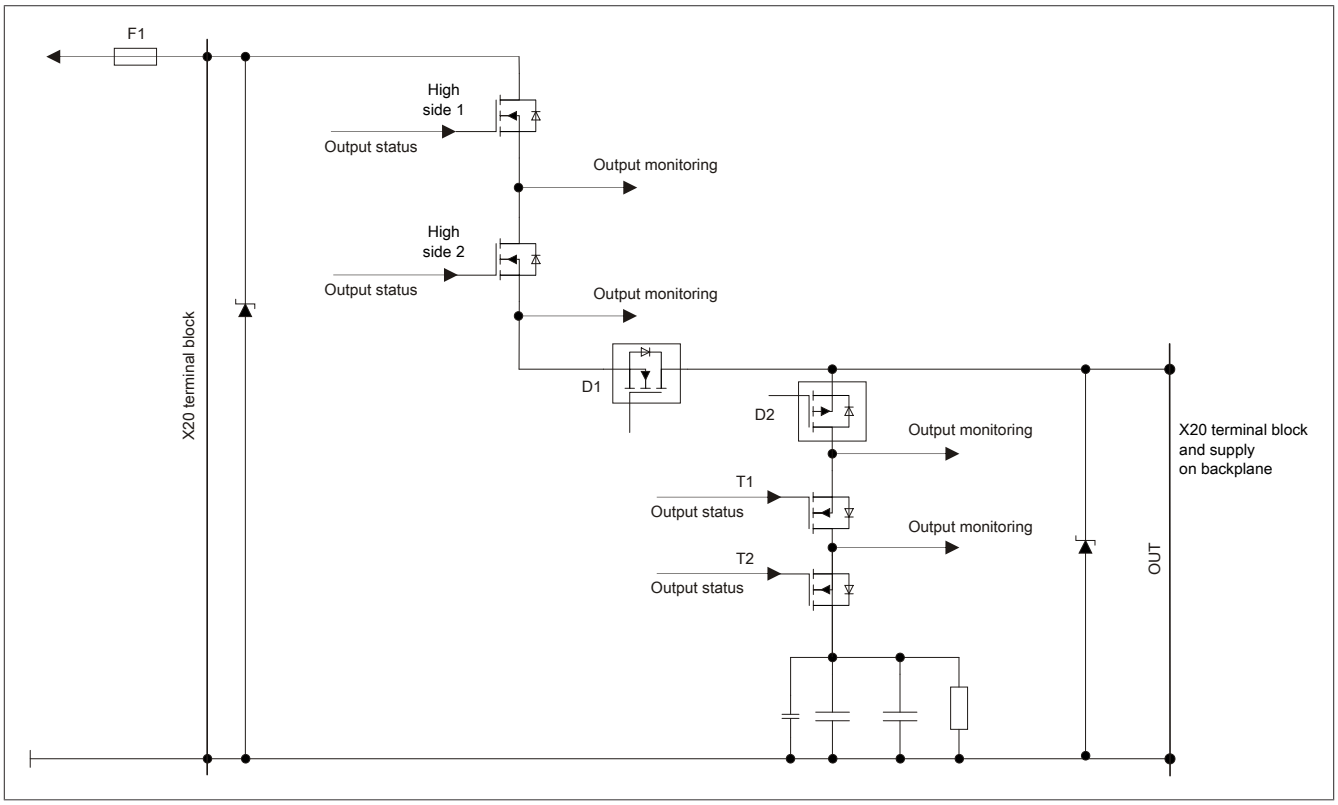



Figure 42: Output circuit diagram

For additional module-specific information, see "X20SP1130" on page 26.

### Standard output without safety function for X67SI8103 - Output circuit diagram

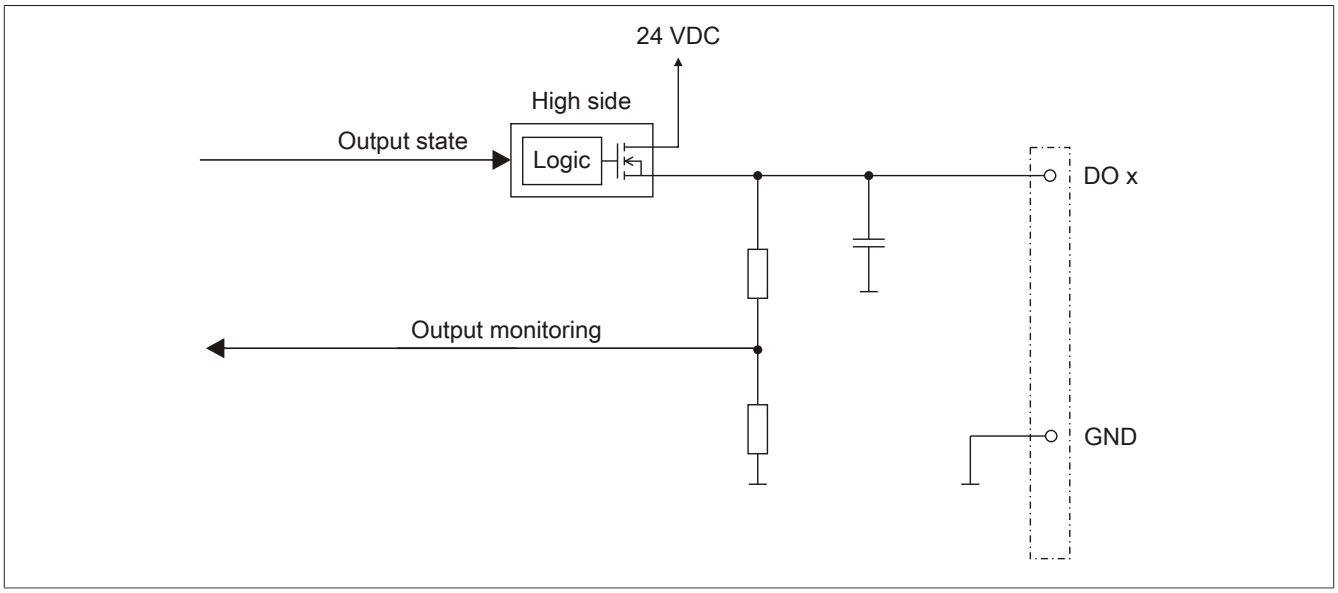



Figure 43: Output circuit diagram - Standard output without safety function

For additional module-specific information, see "X67SI8103" on page 30.

# 7.6 Operating and connection elements of X20(c)SL81xx modules

## 7.6.1 Safety processor

### 7.6.1.1 LED status indicators of the safety processor

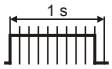
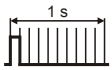
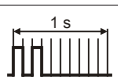
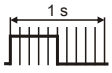
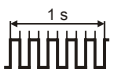
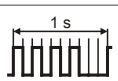
| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | R/E | | Off | Startup phase |
| | | Green | On | The application is present and being executed. |
| | | | Blinking | The application is available but not being executed ("Automatic start" was not selected in the SafeDESIGNER download dialog box OR startup phase, i.e. not all necessary safe modules on the network have been configured correctly).<br>In addition, boot states 0x1840 to 0x3440 under index:subindex 0x2410:0x01 must be checked in section "X20SL81xx - Channel list" on page 203. |
| | | Orange | On | SafeDESIGNER is in mode "Debug". |
| | | | Blinking at 0.5 Hz | SafeDESIGNER is in mode "Debug"; the application is in "Stop". |
| | | | Blinking at 1 Hz | No application present on the SafeKEY |
| | ENTER | Green | On | Missing authorization |
| | | | 1x blinking for 0.8 s | Confirmation of correct input |
| | | | Blinking (1 Hz) for 5 s | Operating error |
| | MXCHG | Orange | Off | Module configuration OK |
| | | |  | Replacement of 1 module detected |
| | | |  | Replacement of 2 modules detected |
| | | |  | Replacement of 3 modules detected |
| | | |  | Replacement of 4 modules detected |
| | | |  | Replacement of more than 4 modules detected |
| | | |  | Missing module detected |
| | FW-ACKN | Orange | Off | Firmware configuration OK |
| | | | Blinking | A firmware update was carried out. |
| | | | On | The SafeKEY was replaced. |
| | ENTER<br>MXCHG<br>FW-ACKN | Green<br>Orange<br>Orange | Continuous sequence | A module scan is being performed or startup phase (note: check LED STATUS, see section "LED status indicators for the POWERLINK interface" on page 164). |
| | FAILSAFE | Red | | LED FAILSAFE indicates the startup behavior or, after startup, state "FailSafe" of the entire module. |
| | | | Off | Safety firmware OPERATIONAL state |
| | | |  | Boot phase |
| | | |  | Safety firmware PRE_OPERATIONAL state or "SafeOSstate!=RUN" |
| | | |  | Safe communication channel not OK, openSAFETY connection valid problem or "SafeOSstate!=RUN"<br>If the SafeLOGIC controller remains in this state for a longer time, parameter "Default safe data duration" of the "Group: Safety response time default values" on page 192 must be checked. |
| | | |  | Boot phase, faulty firmware, setup mode active<br>For details about setup mode, see section "Setup mode" in Automation Help. |
| | | |  | Test/Pilot firmware or safety application created with test/pilot version of SafeDESIGNER |
| | | |  | SafeDESIGNER in mode "Debug" |
| | | | On | Safety state active for the entire module (state "FailSafe") |
| | SKEY | Orange | Off | No access to the SafeKEY |
| | | | Blinking | Access to the SafeKEY |

Table 82: Safety processor status indicators

**Warning!**

**Failure of the module's internal safety structure can result in dangerous states.**

**A statically lit FAILSAFE LED indicates a possible safety-related system error.**

**Temporary problems can be solved either by correct configuration and/or powering the module down/up. Should the problem persist despite correct configuration, this is a strong indication that the module's internal safety structure is permanently damaged. In this case, the module must be replaced.**

For additional module-specific information, see "X20(c)SL81xx" on page 25.

#### 7.6.1.2 LED test

Functionality of the LEDs can be tested using the following procedure:

- Set the selector switch to TEST.
- Press the ENTER confirmation button.
- All LEDs of the safety processor (left-hand module of the SafeLOGIC controller) are switched on for the exact duration of the confirmation button being pressed.

For additional module-specific information, see "X20(c)SL81xx" on page 25.

#### 7.6.1.3 Selector switch and confirmation button

If configuration confirmations by the user are required, they are carried out by preselecting the desired function using the selector switch and then pressing the ENTER confirmation button.


Figure 44: Selector switch and confirmation button

| Switch position | Functionality | Description |
|---|---|---|
| FW-ACKN | Firmware acknowledgment | Acknowledges a firmware replacement on one or more modules |
| Unlabeled position between FW-ACKN and SK-COPY (0xD) | Setup mode | Enables/Disables setup mode.<br>For details about setup mode, see section "Setup mode" in Automation Help. |
| SK-COPY | SafeKEY copy | Copy of the configuration data from the SafeKEY[1)] |
| TEST | Test | Performs an LED test |
| Unlabeled position between TEST and n | CLEAR DATA | Deletes the following "User data":<br>• Remanent data<br>• Configuration file of the standard application<br>• SafeOPTION |
| 1,2,3,4,n | Module replacement | Confirms replacement of 1, 2, 3, 4 or more than 4 modules |
| SCAN | Scan | Triggers a module scan |
| SK-XCHG | SafeKEY exchange | Confirmation of a SafeKEY replacement |
| Unlabeled position between FW-ACKN and SK-XCHG | SafeKEY format | Formats the SafeKEY[1)] |

Table 83: Confirmation modes

1) Triggers an automatic restart.

**Confirmation**

To confirm, the confirmation button must be pressed for a duration of 0.5 to 5 s. After 0.5 s, LED ENTER (see section "LED status indicators of the safety processor") lights up. After releasing the confirmation button, LED ENTER lights up for an additional 0.8 s. This sequence indicates correct input.

- If the confirmation button is released before 0.5 s, this has no effect.
- If the confirmation button is pressed for longer than 5 s, LED ENTER blinks for 5 s to indicate incorrect operation.

Another possible reason for an error is an improper placement of the selector switch. If e.g. a module replacement of exactly one module should be confirmed, the selector switch must be set to "1" (see section "Replacing an individual module" in Automation Help). If in these cases a position other than "1" is confirmed using the confirmation button, this is considered an operating error and LED ENTER also blinks for 5 s.

#### Confirmation of "setup mode", "CLEAR DATA" and "SafeKEY format"

To confirm, the confirmation button must be pressed for a duration of 20 to 30 s. After 20 s, LED ENTER lights up. After releasing the confirmation button, LED ENTER lights up for an additional 0.8 s. This sequence indicates correct input.

- If the confirmation button is released before 20 s, this has no effect.
- If the confirmation button is pressed for longer than 30 s, LED ENTER blinks for 5 s to indicate incorrect operation.

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 7.6.2 Slot for application memory (SafeKEY)

In order to operate the SafeLOGIC controller, application memory (SafeKEY) is required to save the program, the parameters and the system configuration.

The SafeKEY is equipped with a mechanical locking mechanism to make it more difficult to inadvertently remove during operation.

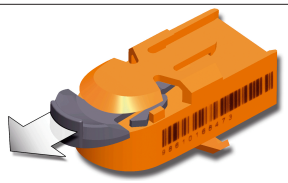


Figure 45: SafeKEY unlocked

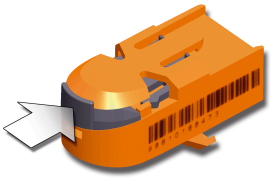


Figure 46: SafeKEY locked

**Information:**

**Removing a SafeKEY during operation causes the X20 SafeLOGIC controller to be restarted and all safety-related actuators to be cut off.**

**Removing a SafeKEY during operation can destroy the data on the SafeKEY.**

**Removing a SafeKEY during operation must therefore always be avoided.**

**The "Backing up the SafeKEY" sequence is not affected by this general rule.**

**Information:**

**It must be taken into account that modules operated on the local X2X Link network of the X20SL8101 are only correctly configured if a valid SafeDESIGNER project exists on the SafeKEY. Otherwise, channel "ModuleOk" of the modules as well as the SafeLOGIC controllers in Automation Studio remains FALSE.**

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 7.6.3 POWERLINK interface

#### 7.6.3.1 LED status indicators for the POWERLINK interface

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | STATUS[1)] | Green/Red | | Status/Error LED.<br>LED states are described in section "LED STATUS" on page 165. |
| | L/A IFx | Green | On | The link to the remote station is established. |
| | | | Blinking | The link to the remote station is established. The LED blinks if Ethernet activity is taking place on the bus. |

Table 84: Status indicators for the POWERLINK interface

1) LED "Status/Error" is a green/red dual LED.

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 7.6.3.2 LED STATUS

LED "Status/Error" is a green and red dual LED. The color green (status) is superimposed on the color red (error).

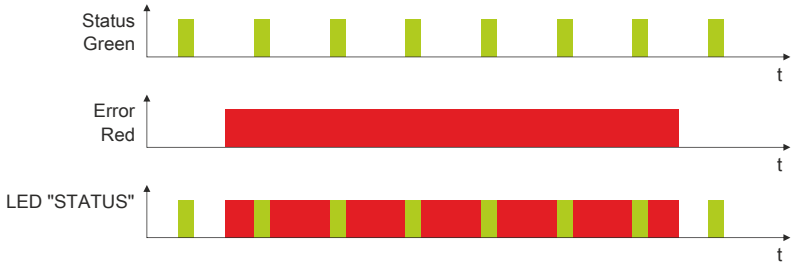
| Color red - Error | Description |
|---|---|
| On | The controlled node (CN) is in an error state (failed Ethernet frames, increased number of collisions on the network, etc.).<br>If an error occurs in the following states, the red LED is superimposed by the green flashing LED:<br>• PRE_OPERATIONAL_1<br>• PRE_OPERATIONAL_2<br>• READY_TO_OPERATE<br>  <br>Note:<br>• Several red blinking signals are displayed immediately after the device is switched on. This is not an error, however.<br>• The LED lights up red for CNs with set physical node number 0 that have not yet been assigned a node number via dynamic node allocation (DNA). |

Table 85: Status/Error LED lit red: LED indicating error state

| Color green - Status | Description |
|---|---|
| Off | No power supply or mode NOT_ACTIVE.<br>The controlled node (CN) is either not supplied with power or it is in state NOT_ACTIVE. The CN waits in this state for about 5 s after a restart. Communication is not possible with the CN. If no POWERLINK communication is detected during these 5 s, the CN changes to state BASIC_ETHERNET (flickering).<br>If POWERLINK communication is detected before this time expires, however, the CN immediately changes to state PRE_OPERATIONAL_1. |
| Green flickering (approx. 10 Hz) | Mode BASIC_ETHERNET.<br>The CN has not detected any POWERLINK communication. In this state, it is possible to communicate directly with the CN (e.g. with UDP, IP).<br>If POWERLINK communication is detected while in this state, the CN enters state PRE_OPERATIONAL_1. |
| Single flash (approx. 1 Hz) | Mode PRE_OPERATIONAL_1.<br>The CN waits until it receives an SoC frame and then switches to state PRE_OPERATIONAL_2. |
| Double flash (approx. 1 Hz) | Mode PRE_OPERATIONAL_2.<br>The CN is normally configured by the manager in this state. A command then switches the CN to state READY_TO_OPERATE. |
| Triple flash (approx. 1 Hz) | Mode READY_TO_OPERATE.<br>The manager switches the CN via command to the OPERATIONAL state. |
| On | Mode OPERATIONAL.<br>PDO mapping is active and cyclic data is evaluated. |
| Blinking (approx. 2.5 Hz) | Mode STOPPED.<br>Output data is not being output, and no input data is being provided. It is only possible to switch to or leave this state after the manager has given the appropriate command. |

Table 86: Status/Error LED lit green: LED indicating operating state

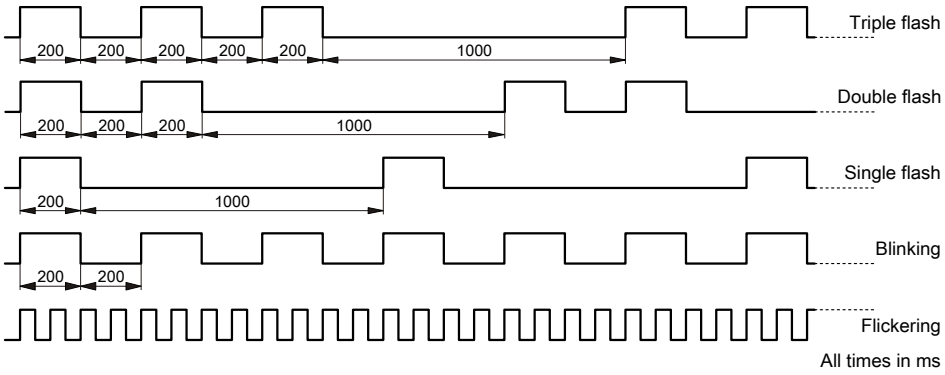



Figure 47: LED status indicators - Blink times

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 7.6.3.3 POWERLINK station number

The station number of the POWERLINK station is set using the two number switches. Station numbers in the range 0x01 to 0xEF are permitted.

| Figure | Switch position | Description |
|---|---|---|
|  Figure 48: POWERLINK node number switches | 0x00 | Dynamic node allocation (DNA) |
| | 0x01 to 0xEF | Station number of the POWERLINK station, operation as controlled node (CN). |
| | 0xF0 to 0xFF | Reserved, switch position not permitted. |

Table 87: POWERLINK station number

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 7.6.3.4 RJ45 ports

For information about wiring X20 modules with an Ethernet interface, see section "Mechanical and electrical configuration - Wiring guidelines for X20 modules with Ethernet cables" in the X20 user's manual.

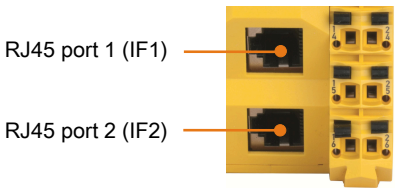



Figure 49: RJ45 ports

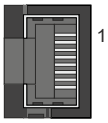
| Interface | Pinout | | |
|---|---|---|---|
| | Pin | Ethernet | |
|  Shielded RJ45 port | 1 | RXD | Receive data |
| | 2 | RXD\ | Receive data\ |
| | 3 | TXD | Transmit data |
| | 4 | Termination | |
| | 5 | Termination | |
| | 6 | TXD\ | Transmit data\ |
| | 7 | Termination | |
| | 8 | Termination | |

Table 88: Pinout for the RJ45 port

For additional module-specific information, see "X20(c)SL81xx" on page 25.

## 7.6.4 Integrated power supply unit

A power supply unit is integrated for the power supply of the SafeLogic controller.

### 7.6.4.1 LED status indicators for the integrated power supply unit

#### X20SL81x0

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | DCOK | Green | On | Module supplied with power |
| | | | Off | Module not supplied with power |

Table 89: X20SL81x0 - Status indicators for the integrated power supply unit

#### X20SL8101

| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
|  | r | Green | Off | No power to module |
| | | | Single flash | Mode RESET |
| | | | Blinking | Mode PREOPERATIONAL |
| | | | On | Mode RUN |
| | e | Red | Off | Module not supplied with power or everything OK |
| | | | Double flash | The LED indicates one of the following states:<br>• The SafeLogic controller / bus controller / X2X Link power supply of the power supply unit is overloaded.<br>• I/O power supply too low<br>• The input voltage for the SafeLogic controller / bus controller / X2X Link power supply too low. |
| | e + r | Solid red / Single green flash | | Invalid firmware |
| | l | Red | Off | The SafeLogic controller / bus controller / X2X Link power supply is within the valid range. |
| | | | On | The SafeLogic controller / bus controller / X2X Link power supply of the power supply unit is overloaded. |

Table 90: X20SL8101 - Status indicators for the integrated power supply unit

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 7.6.4.2 Pinouts for the integrated power supply unit

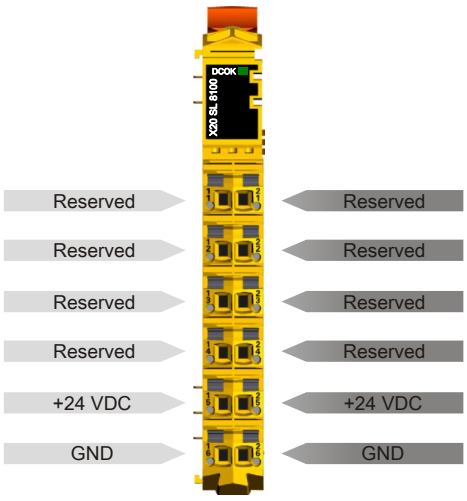



Figure 50: X20SL81x0 - Pinout of the integrated power supply unit

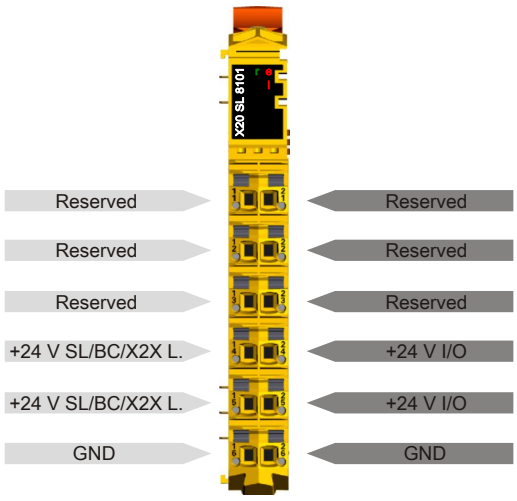



Figure 51: X20SL8101 - Pinout of the integrated power supply unit

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 7.6.4.3 Connection examples

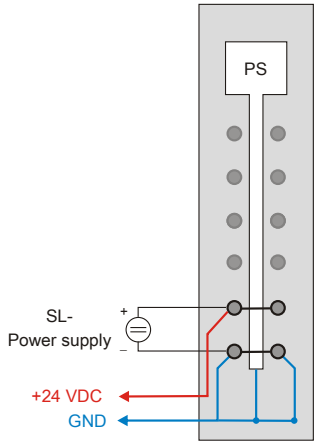



Figure 52: X20SL81x0 - Connection example

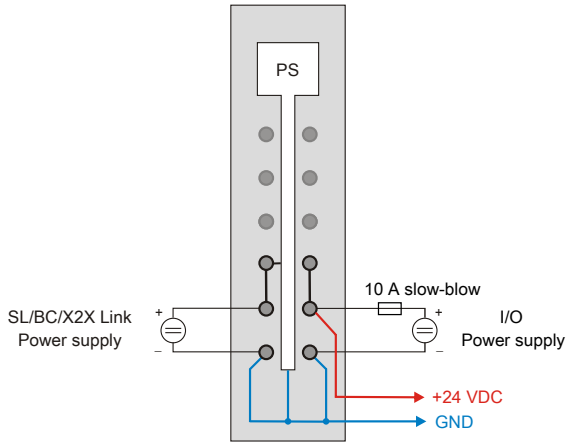



Figure 53: X20SL8101 - Connection example with 2 isolated power supplies

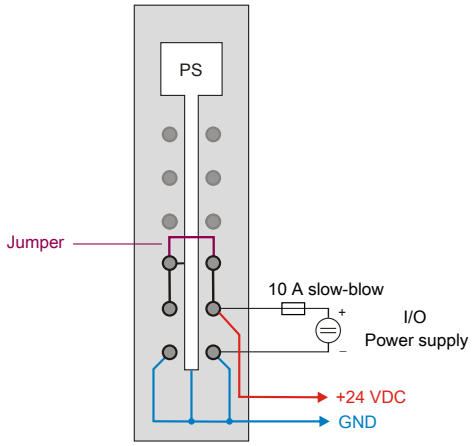



Figure 54: X20SL8101 - Connection example with power supply and jumper

For additional module-specific information, see "X20(c)SL81xx" on page 25.

# 7.7 Connection elements of the X67 modules

### Connection elements - X67SI8103

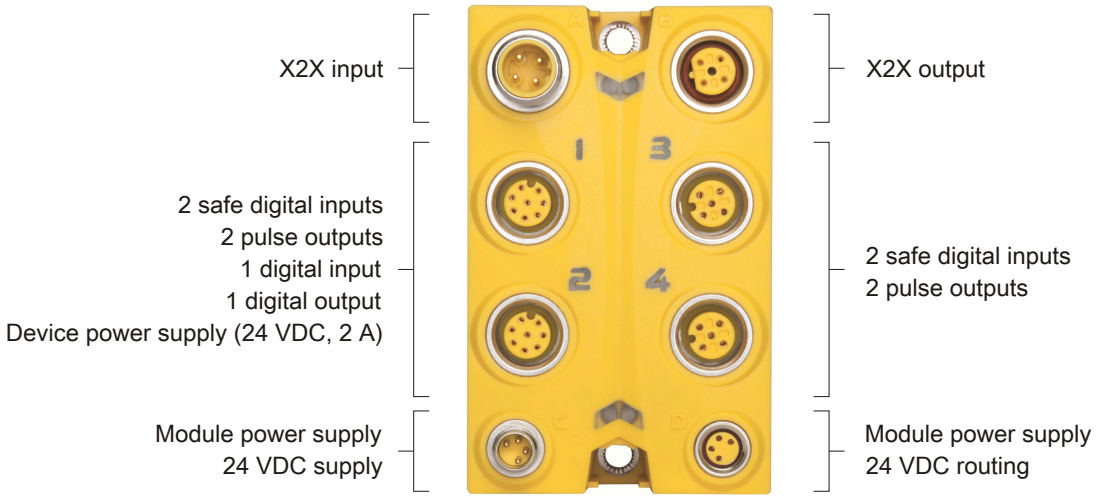



Figure 55: X67SI8103 - Connection elements

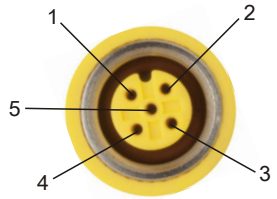
| Pinout | Female connector | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 |
|---|---|---|---|---|---|---|
|  | 3 (IN) | Pulse 1 | SI 5 | GND | SI 6 | Pulse 2 |
| | 4 (IN) | Pulse 1 | SI 7 | GND | SI 8 | Pulse 2 |



Table 91: Pinout

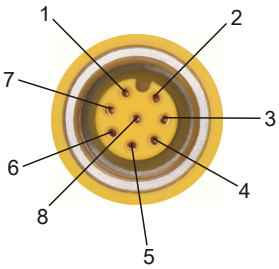
| Pinout | Female connector | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 |
|---|---|---|---|---|---|---|---|---|---|
|  | 1 (IN/OUT) | +24 VDC | Pulse 1 | GND | SI 1 | DI 1 | Pulse 2 | SI 2 | DO 1 |
| | 2 (IN/OUT) | +24 VDC | Pulse 1 | GND | SI 3 | DI 2 | Pulse 2 | SI 4 | DO 2 |



Table 92: Pinout

## Information:

**A sensor can be supplied with operating voltage without test pulses via pulse outputs Pulse 1 and 2. Parameter "Pulse Mode" in SafeDesigner(+) must be configured to "internal" to do this, and the pulse output is not permitted to be used with any safe digital input. The load capacity of the pulse outputs is listed in the technical data of the module.**

For additional module-specific information, see "X67SI8103" on page 30.

## Connection elements - X67SC4122.L12

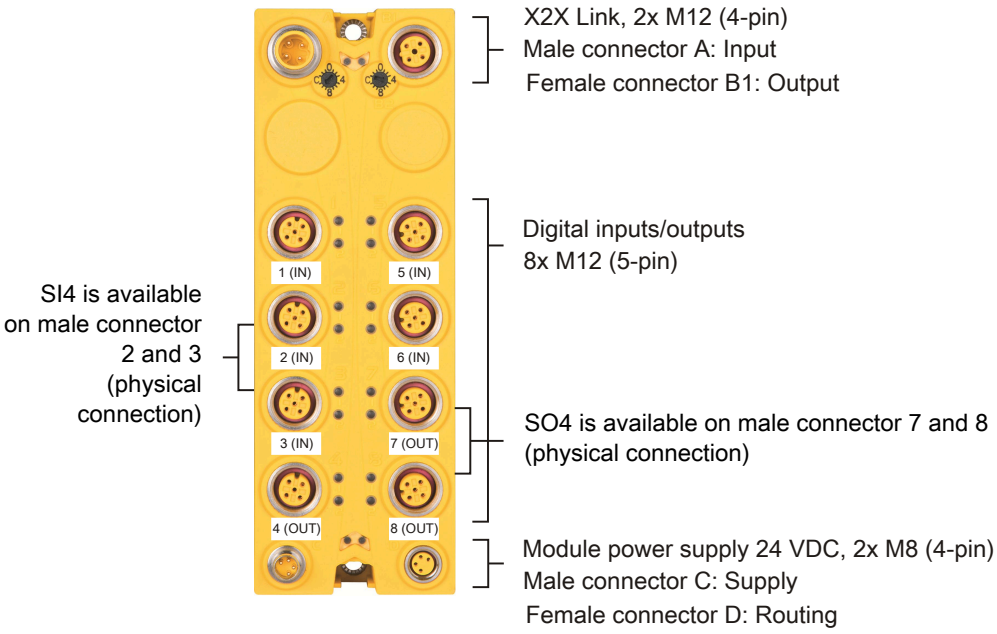



Figure 56: X67SC4122.L12 - Connection elements

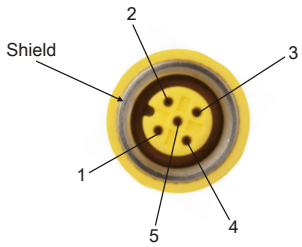
| Pinout | Female connector | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 |
|---|---|---|---|---|---|---|
|  | 1 (IN) | Pulse 1 | SI 1 | GND | SI 2 | Pulse 2 |
| | 2 (IN) | Pulse 3 | SI 3 | GND | SI 4 | Pulse 4 |
| | 3 (IN) | NC | NC | GND | SI 4 | Pulse 4 |
| | 5 (IN) | Pulse 5 | SI 5 | GND | SI 6 | Pulse 6 |
| | 6 (IN) | Pulse 7 | SI 7 | GND | SI 8 | Pulse 8 |
| | | | | | | |
| | 4 (OUT) | GND | SO 1 | GND | SO 2 | GND |
| | 7 (OUT) | GND | NC | GND | SO 4 | GND |
| | 8 (OUT) | GND | SO 3 | GND | SO 4 | GND |



Table 93: Pinout

### Information:

**A sensor can be supplied with operating voltage without test pulses via pulse outputs Pulse 1 to 8. Parameter "Pulse Mode" in SafeDesigner(+) must be configured to "internal" to do this, and the pulse output is not permitted to be used with any safe digital input. The load capacity of the pulse outputs is listed in the technical data of the module.**

### Information:

**When using cables from B&R's line of accessories, cross faults between the two channels of a female connector cannot be ruled out in accordance with EN ISO 13849-2:2012. This is why shared error handling is implemented for both output channels of a female connector. This means that both output channels on this female connector are switched off as soon as an error has been detected on one of them. Comparable behavior applies to the acknowledgment of an error state. As soon as a channel error has been acknowledged, the error state on the other channel of the same female connector is also acknowledged.**

### Warning!

**On the X67SC4122.L12, SI 4 is connected twice to female connectors 2 and 3 as a wiring aid. This means that SI 4 can be used for both single-channel sensors and dual-channel sensors.**

**Connecting two sensors to SI 4 in female connector 2 and SI 4 in female connector 3 is not permitted since this would represent a parallel connection of two sensors on one input channel.**

## Information:

**SO 4 is provided dually on female connectors 7 and 8 to make wiring easier. This makes it possible to use SO 4 for both one-channel actuators as well as dual-channel actuators.**

**Connecting two actuators to SO 4 in female connector 7 and SO 4 in female connector 8 results in a parallel connection of both actuators.**

For additional module-specific information, see "X67SC4122.L12" on page 31.

### X2X Link

This module is connected to X2X Link using pre-assembled cables. The connection is made using a circular connector (2x M12, 4-pin).

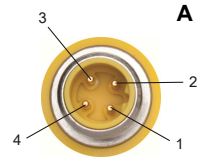
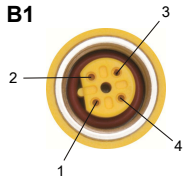
| Connection | Pinout | |
|---|---|---|
|  | **Pin** | **Name** |
| | 1 | X2X+ |
| | 2 | X2X |
| | 3 | X2X⊥ |
| | 4 | X2X\ |
|  | A ... B-coded male connector on the module, input<br>B1 ... B-coded female connector on the module, output<br>SHLD ... Shield via threaded insert in the module | |

Table 94: X2X Link

For additional module-specific information, see:

- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### 24 VDC module power supply

The module power supply is connected with pre-assembled cables via circular connectors (2x M8, 4-pin). The power supply is fed via male connector C. Female connector D is used to route the power supply to other modules.

The maximum permissible current per power supply is 4 A (in summation 8 A)!

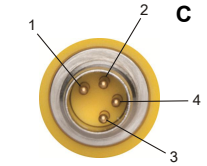
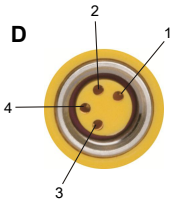
| Connection | Pinout | |
|---|---|---|
|  | **Pin** | **Name** |
| | 1 | 24 VDC module power supply[1)] |
| | 2 | 24 VDC module power supply[1)] |
| | 3 | GND |
| | 4 | GND |
|  | C ... Male connector on the module, supply<br>D ... Female connector on the module, routing<br><br>1) Both supply pins must be supplied. Cutting off the outputs is only ensured if **both** pins are disconnected from the power supply.<br>If the summation current of the outputs is >4 A, current must also be supplied via female connector D, pin 2. | |

Table 95: 24 VDC module power supply

For additional module-specific information, see:

- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### X67SC4122.L12 - Node number switches


Figure 57: Node number switches for setting the X2X Link address

The decentralized X2X Link backplane, which connects individual X67 modules with one another, is set up to be self-addressing. Because of this, it is not necessary to set the node numbers. The module address is assigned according to its position in the X2X Link line.

In certain applications, e.g. with changing configurations of modular machines, it is necessary to assign certain module groups to a fixed address regardless of the modules in front of them in the segment.

For this purpose, the module is equipped with a node number switch that can be used to set the X2X Link address. All subsequent modules refer to this offset and use it automatically for addressing purposes.

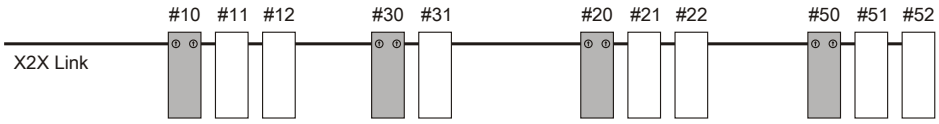



Figure 58: Example configuration

If the node number on the module is set to 0x00, then the module address is assigned according to its position in the X2X Link line.

For additional module-specific information, see "X67SC4122.L12" on page 31.

# 8 Register description

## 8.1 Parameters in the I/O configuration

### 8.1.1 Parameters in the I/O configuration of SafeIO modules

#### Group: Function model

| Parameter | Description | Default value |
|---|---|---|
| Function model | This parameter is reserved for future functional expansions. | Default |

For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

#### Group: General

| Parameter | Description | Default value |
|---|---|---|
| Module supervised | System behavior when a module is missing<br>**Parameter value** / **Description**<br>On: A missing module triggers service mode.<br>Off: A missing module is ignored. | On |
| Blackout mode | This parameter enables blackout or standalone mode (see section "Blackout mode" in Automation Help under Hardware → X20 System → Additional information → Blackout mode).<br>**Parameter value** / **Description**<br>On: Blackout mode is enabled.<br>Off: Blackout mode is disabled. | Off |
| SafeDomain ID | In applications with multiple SafeLogic controllers, this parameter defines the module's association with a particular SafeLogic controller.<br>• Permissible values: 1 to 1000 | Assigned automatically |
| SafeNode ID | Unique safety address of the module<br>• Permissible values: 2 to 1023 | Assigned automatically |
| **For module families**: X20(c)SIx1x0, X20(c)SO6300, X20(c)SOx1x0, X20(c)SOx530, X20SC0xxx, X20(c)SC2212, X20(c)SC2432, X20SP1130, X67SI8103 and X67SC4122.L12 | | |
| Channel state information | This parameter enables/disables the channel-specific status information in the I/O mapping. | On |
| State number for start interlock on error | This parameter enables/disables the status information for the error interlock. | Off |
| **For module families:** X20SC0xxx, X20(c)SC2212, X20(c)SC2432 and X67SC4122.L12 | | |
| State number for dual-channel evaluation | This parameter enables/disables the status information of dual-channel evaluation. | Off |

For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## Group: Output signal path

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Digital output xxyy</td><td>This parameter specifies the mode that can be used by the standard application to access the output channel.<br>xxyy = Name of the individual channel or the dual-channel signal
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Direct:</td><td>The output channel can be accessed directly by the standard application. Signals "DigitalOutputxx" are available in the I/O mapping accordingly.</td></tr>
<tr><td>Via SafeLogic controller:</td><td>The output channel cannot be accessed directly by the standard application. Signals "DigitalOutputxx" are not available in the I/O mapping accordingly. It is only possible for the standard application to influence the output channel via the communication channels from the CPU to the SafeLogic controller.</td></tr>
</table></td><td>Direct</td></tr>
</table>

For additional module-specific information, see:


- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X20SP1130" on page 26
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## 8.1.2 Parameters in the I/O configuration of SafeLogic-X modules

### Group: Function model

| Parameter | Description | Default value |
|---|---|---|
| Function model | This parameter is reserved for future functional expansions. | Default |

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20SLXxxx-1" on page 21

### Group: General (mapp Safety)

| Parameter | Description | Default value |
|---|---|---|
| Module supervised | System behavior when a module is missing<br>Parameter value: On — A missing module triggers service mode.<br>Parameter value: Off — A missing module is ignored. | On |
| Channel state information | This parameter enables/disables channel-specific status information in the I/O mapping. | On |
| State number for dual-channel evaluation | This parameter enables/disables the status information of dual-channel evaluation.<br>This parameter may be omitted depending on the module type. | Off |
| State number for start interlock on error[1] | This parameter enables/disables the status information for the error interlock. | Off |
| SafeNode ID | Unique safety address of the module<br>• Permissible values: 1 | 1 |
| SafeDomain ID | In applications with multiple SafeLogic controllers, this parameter defines the module's association with a particular SafeLogic controller.<br>• Permissible values: 1 to 1000 | Assigned automatically |
| Manual cycle time configuration | Specification for the cycle time mode<br>Parameter value: Yes — Operation with a fixed cycle time (according to parameter "Cycle time").<br>Parameter value: No — Operation with a dynamic cycle time. The actual cycle time is influenced by the SafeDESIGNER application and the value of data point "SLXioCycle" and can change at runtime. The actual cycle time of the safety application can be seen in the SafeLogic "Info" dialog box. | No |
| Cycle time<br>(only visible if "Manual cycle time configuration = Yes") | This parameter is used to define the cycle time of the safety application.<br>• Permissible values: 2400 to 28,000 µs (corresponds to 2.4 to 28 ms) | 8000 µs |
| Blackout mode[1] | This parameter enables blackout or standalone mode (see section "Blackout mode" in Automation Help under Hardware → X20 System → Additional information → Blackout mode).<br>Parameter value: Off — Both blackout mode and standalone mode are disabled.<br>Parameter value: Blackout mode — Blackout mode is enabled.<br>Parameter value: Standalone mode — Standalone mode is enabled. This makes it possible to start up the SafeLogic-X controller without an active communication connection. | Off |

1 Only applies to modules X20(c)SLX402, X20SLX806 and X20SLX842.

**Information:**

**Parameter "Cycle time" must be greater than the processing time for the safety application. The processing time can be determined in the online dialog window using function "Info". If the parameter "Cycle time" is less than or too close to the necessary processing time, a cycle time violation can occur.**

**For additional information, see section "Dialog box 'SafePLC info' in SafeDESIGNER" in Automation Help.**

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

### Group: General (Safety+)

| Parameter | Description | Default value |
|---|---|---|
| Module supervised | System behavior when a module is missing<br>**Parameter value** / **Description**<br>On: A missing module triggers service mode.<br>Off: A missing module is ignored. | On |
| Channel state information | This parameter enables/disables channel-specific status information in the I/O mapping. | On |
| State number for dual-channel evaluation | This parameter enables/disables the status information of dual-channel evaluation.<br>This parameter may be omitted depending on the module type. | Off |
| State number for start interlock on error | This parameter enables/disables the status information for the error interlock. | Off |
| Blackout mode | This parameter enables blackout or standalone mode (see section "Blackout mode" in Automation Help under Hardware → X20 System → Additional information → Blackout mode).<br>**Parameter value** / **Description**<br>Off: Both blackout mode and standalone mode are disabled.<br>Blackout mode: Blackout mode is enabled.<br>Standalone mode: Standalone mode is enabled. This makes it possible to start up the SafeLogic-X controller without an active communication connection. | Off |
| SafeNode ID | Unique safety address of the module<br>• Permissible values: 1 to 500 | Can be adjusted |
| SafeDomain ID | In applications with multiple SafeLogic controllers, this parameter defines the module's association with a particular SafeLogic controller.<br>• Permissible values: 1 | 1 |

For additional module-specific information, see "X20SLXxxx-1" on page 21.

### Group: Output signal path

See "Group: Output signal path " on page 174.

### Group: SafeDesigner(+)-to-SafeLogic communication

With SPROXY enabled, the SafeLogic controller can be reached via a TCP/IP port of the standard CPU.

This uses SafeDesigner setting "SL communication via the CPU".

| Parameter | Description | Default value |
|---|---|---|
| Server communication port | TCP/IP port number used to reach the SafeLogic controller<br>• Recommended values: 50,000 to 50,100<br><br>**Note:**<br>If there are several SafeLogic controllers in the project, a different port number must be set for each SafeLogic controller! | Assigned automatically |

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20SLXxxx-1" on page 21

### Group: CPU-to-SafeLogic communication

| Parameter | Description | Default value |
|---|---|---|
| Number of BOOL channels | Number of BOOL channels from the CPU to the SafeLogic controller.<br>• Permissible values: 0, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96. | 8 |
| Number of INT channels | Number of INT channels from the CPU to the SafeLogic controller.<br>• Permissible values: 0 to 8. | 0 |
| Number of UINT channels | Number of UINT channels from the CPU to the SafeLogic controller.<br>• Permissible values: 0 to 8. | 0 |
| Number of DINT channels | Number of DINT channels from the CPU to the SafeLogic controller<br>• Permissible values: 0 to 4. | 0 |
| Number of UDINT channels | Number of UDINT channels from the CPU to the SafeLogic controller.<br>• Permissible values: 0 to 4. | 0 |

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20SLXxxx-1" on page 21

### Group: SafeLogic-to-CPU communication

| Parameter | Description | Default value |
|---|---|---|
| Number of BOOL channels | Number of BOOL channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96. | 8 |
| Number of INT channels | Number of INT channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0 to 8. | 0 |
| Number of UINT channels | Number of UINT channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0 to 8. | 0 |
| Number of DINT channels | Number of DINT channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0 to 4. | 0 |
| Number of UDINT channels | Number of UDINT channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0 to 4. | 0 |

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20SLXxxx-1" on page 21

### Group: SafeDomain-to-SafeDomain communication

When using modules X20(c)SLX402, X20SLX806, X20SLX842 and X20SLX811.

Starting with mapp Safety 5.13.0, hardware upgrade 2.4.0.0 and Automation Runtime A4.90

For additional information about SafeDomain-to-SafeDomain communication, see section "SafeDomain-to-SafeDomain communication" in Automation Help.

| Parameter | Description | Default value |
|---|---|---|
| **Group: Managing SafeDomain connection xx**<br>Configuration of the SafeDomains to which this SafeDomain establishes a connection. | | |
| SafeDomain ID of connection xx | SafeDomain ID of the Managing SafeDomain to which a connection should be established | 0 |
| **Group: Output channels**<br>This data is generated by the connected Managing SafeDomain. | | |
| Number of BOOL channels | Number of BOOL channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0, 8, 16. | 8 |
| Number of INT channels | Number of INT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 2. | 0 |
| Number of UINT channels | Number of UINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 2. | 0 |
| Number of DINT channels | Number of DINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 2. | 0 |
| Number of UDINT channels | Number of UDINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 2. | 0 |
| **Group: Input channels**<br>This data is received by the connected Managing SafeDomain. | | |
| Number of BOOL channels | Number of BOOL channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0, 8, 16. | 8 |
| Number of INT channels | Number of INT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 2. | 0 |
| Number of UINT channels | Number of UINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 2. | 0 |
| Number of DINT channels | Number of DINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 2. | 0 |
| Number of UDINT channels | Number of UDINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 2. | 0 |

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

### 8.1.3 Parameters in the I/O configuration of X20(c)SL81xx modules

#### Group: POWERLINK parameters

| Parameter | Description | Default value |
|---|---|---|
| Mode | The SafeLogic controller can only be operated as a "controlled node" (CN). A "managing node" (MN) is not supported. | Controlled node |

**Information:**

**There are additional configuration parameters available.**
**For details, see Automation Help under "Communication → POWERLINK → AR configuration → POWERLINK controlled node configuration (SG4)".**

For additional module-specific information, see "X20(c)SL81xx" on page 25.

#### Group: Function model

| Parameter | Description | Default value |
|---|---|---|
| Function model | This parameter is reserved for future functional expansions. | Default |

For additional module-specific information, see "X20(c)SL81xx" on page 25.

#### Group: General

| Parameter | Description | Default value |
|---|---|---|
| Module supervised | System behavior when a module is missing<br>Parameter value: On — A missing module triggers service mode.<br>Parameter value: Off — A missing module is ignored. | On |
| Interface slot enable (X20SL8110 only) | This parameter enables data transfer on the interface card.<br>Parameter value: On — Data transfer on the interface card is enabled.<br>Parameter value: Off — Data transfer on the interface card is disabled. | On |
| Node used as IP gateway | This parameter is reserved for future functional expansions. | 240 |
| Standalone mode (X20SL8101 only) | This parameter enables standalone mode (see section Blackout mode in Automation Help under: Hardware → X20 System → Additional information → Blackout mode) and allows the SafeLogic controller to be started up without an active master.<br>Parameter value: On — Standalone mode is enabled.<br>Parameter value: Off — Standalone mode is disabled. | Off |
| SafeDomain ID | For applications with several SafeLogic controllers, this parameter defines the unique SafeLogic address.<br>• Permissible values: 1 to 1000 | Assigned automatically |
| SafeNode ID | Unique safety address of the module<br>• Permissible values: 1 | 1 |
| Manual cycle time configuration | Specification for the cycle time mode<br>Parameter value: Yes — Operation with a fixed cycle time (according to parameter "Cycle time"). | Yes |
| Cycle time | This parameter is used to define the cycle time of the safety application.<br>• Permissible values: 800 to 20,000 µs (corresponds to 0.8 to 20 ms)<br>The set value must correspond to an integer multiple of the POWERLINK cycle time! | 4000 µs |

**Information:**

**Parameter "Cycle time" must be greater than the processing time for the safety application and must correspond to an integer multiple of the POWERLINK cycle time. The processing time can be determined in the online dialog window using function "Info". If the parameter "Cycle time" is less than or too close to the necessary processing time, a cycle time violation can occur.**

**For additional information, see section "Dialog box 'SafePLC info' in SafeDESIGNER" in Automation Help.**

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### Group: SafeDESIGNER-to-SafeLogic communication

With SPROXY enabled, the SafeLogic controller can be reached via a TCP/IP port of the standard CPU.

This uses SafeDesigner setting "SL communication via the CPU".

| Parameter | Description | Default value |
|---|---|---|
| Server communication port | TCP/IP port number used to reach the SafeLogic controller<br>• Recommended values: 50,000 to 50,100<br><br>**Note:**<br>If there are several SafeLogic controllers in the project, a different port number must be set for each SafeLogic controller! | Assigned automatically |

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### Group: CPU-to-SafeLogic communication

| Parameter | Description | Default value |
|---|---|---|
| Number of BOOL channels | Number of BOOL channels from the CPU to the SafeLogic controller.<br>• Permissible values: 0, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 128, 256, 384, 512, 640, 768, 896, 1024. | 8 |
| Number of INT channels | Number of INT channels from the CPU to the SafeLogic controller.<br>• Permissible values: 0 to 128. | 0 |
| Number of UINT channels | Number of UINT channels from the CPU to the SafeLogic controller.<br>• Permissible values: 0 to 128. | 0 |
| Number of DINT channels | Number of DINT channels from the CPU to the SafeLogic controller<br>• Permissible values: 0 to 64. | 0 |
| Number of UDINT channels | Number of UDINT channels from the CPU to the SafeLogic controller.<br>• Permissible values: 0 to 64. | 0 |

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### Group: SafeLogic-to-CPU communication

| Parameter | Description | Default value |
|---|---|---|
| Number of BOOL channels | Number of BOOL channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 128, 256, 384, 512, 640, 768, 896, 1024. | 8 |
| Number of INT channels | Number of INT channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0 to 128. | 0 |
| Number of UINT channels | Number of UINT channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0 to 128. | 0 |
| Number of DINT channels | Number of DINT channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0 to 64. | 0 |
| Number of UDINT channels | Number of UDINT channels from the SafeLogic controller to the CPU.<br>• Permissible values: 0 to 64. | 0 |

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### Group: SafeDomain-to-SafeDomain communication

Starting with mapp Safety 5.10.0 and hardware upgrade 2.2.1.0

For additional information about SafeDomain-to-SafeDomain communication, see section "SafeDomain-to-SafeDomain communication" in Automation Help.

| Parameter | Description | Default value |
|---|---|---|
| **Group: Managing SafeDomain connection xx**<br>Configuration of the SafeDomains to which this SafeDomain establishes a connection. | | |
| SafeDomain ID of connection xx | SafeDomain ID of the Managing SafeDomain to which a connection should be established | 0 |
| **Group: Output channels**<br>This data is generated by the connected Managing SafeDomain. | | |
| Number of BOOL channels | Number of BOOL channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120, 128. | 8 |
| Number of INT channels | Number of INT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 16. | 0 |
| Number of UINT channels | Number of UINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 16. | 0 |
| Number of DINT channels | Number of DINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 16. | 0 |
| Number of UDINT channels | Number of UDINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 16. | 0 |
| **Group: Input channels**<br>This data is received by the connected Managing SafeDomain. | | |
| Number of BOOL channels | Number of BOOL channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120, 128. | 8 |
| Number of INT channels | Number of INT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 16. | 0 |
| Number of UINT channels | Number of UINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 16. | 0 |
| Number of DINT channels | Number of DINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 16. | 0 |
| Number of UDINT channels | Number of UDINT channels from the SafeDomain to the SafeDomain<br>• Permissible values: 0 to 16. | 0 |

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### Group: Power supply parameters (X20SL8101 only)

| Parameter | Description | Default value |
|---|---|---|
| Module status information | This parameter enables/disables additional status information in the I/O mapping. | On |
| Current/voltage information | This parameter enables/disables additional current and voltage information in the I/O mapping. | Off |

For additional module-specific information, see "X20(c)SL81xx" on page 25.

# 8.2 Parameters in SafeDesigner+

## 8.2.1 Parameters in SafeDesigner+: "SafeDomain settings"

The "Safety parameters" for both the SafeDomain and the SCM local node (1023) are configured in "SafeDomain settings".

### Group: Basic

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Engineering sample allowed</td><td>This parameter is used to define the minimum required safety-rated version of library SpServer.<br><table><tr><th>Parameter value</th><th>Description</th></tr><tr><td>Yes - ATTENTION</td><td>Required safety-rated version of library SpServer ≥ 1</td></tr><tr><td>No</td><td>Required safety-rated version of library SpServer ≥ 256</td></tr></table></td><td>No</td></tr>
</table>

For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Group: SpServer settings

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Node guarding timeout</td><td>Timeout for changing the safety modules to the PRE_OPERATIONAL state after the SpServer drops out or if there is a communication problem between the safety module and SpServer.<br>This parameter also defines how long it takes for the SpServer to detect a missing module.<br>• Permissible values: 30 to 300 s<br>Notes<br>• The shorter the time, the greater the amount of asynchronous data traffic.<br>• This setting is not critical to safety functionality. The time for safely switching off the actuators is determined independently of this.</td><td>60 s</td></tr>
</table>

For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## 8.2.2 Parameters in SafeDesigner+ of SafeIO modules

### Group: Basic

| Parameter | Description | Default value |
|---|---|---|
| Engineering sample allowed | This parameter determines whether non-certified engineering sample firmware or only certified firmware is accepted.<br>**Parameter value** / **Description**<br>Yes - ATTENTION: Non-certified engineering sample firmware is accepted for the affected module.<br>No: Only certified firmware is accepted for the affected module. | No |

For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Group: Safety_Response_Time

| Parameter | Description | Default value |
|---|---|---|
| Max. safe data duration | This parameter specifies the maximum permissible data transmission time between the SafeLogic controller and SafeIO module.<br>For additional information about the actual data transmission time, see section Diagnostics and service → Diagnostics tools → Network analyzer → Editor → Calculation of safety runtime in Automation Help.<br>The following formula can be used as the lower limit:<br>"Value of the Network Analyzer" * 2 + SafeLogic cycle time * 2<br>The stability of the system cannot be ensured for smaller values.<br>• Permissible values: 2000 to 10,000,000 µs (corresponds to 2 ms to 10 s) | 40000 µs |
| Node guarding packets | This parameter specifies the maximum number of packets used for node guarding.<br>• Permissible values: 1 to 255<br>**Note**<br>• The larger the configured value, the greater the amount of asynchronous data traffic.<br>• This setting is not critical to safety functionality. The time for safely cutting off actuators is determined independently of this. | 5 packets |

For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Group: Module configuration - For modules with safe digital outputs

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Disable OSSD</td><td>This parameter can be used to switch off automatic testing of the output driver for all of the module's channels.<table><tr><th>Parameter value</th><th>Description</th></tr><tr><td>Yes - Warning</td><td>Automatic testing of the output driver is switched off.</td></tr><tr><td>No</td><td>Automatic testing of the output driver is enabled.</td></tr></table></td><td>No</td></tr>
</table>

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**Configuring "Disable OSSD = Yes - Warning" greatly reduces the internal error detection of the module.**
**Subsequently, the information listed in chapter section "Detecting module-internal errors" in Automation Help must be observed.**

**The correct use and necessary tests of the safety function must be observed.**

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**If the output channel is switched with an output frequency of 1.25 Hz or more for more than 8 hours in safety-related applications according to category 4 or PL e per ISO 13849-1:2023, the output channel must be switched on and off for 1 second every 8 hours.**

**The correct use and necessary tests of the safety function must be observed.**

**For additional module-specific information, see:**


- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## Group: Module configuration - For modules with safe analog inputs

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Disable shunt test<br>(X20(c)SA4430 only)</td><td>This parameter can be used to disable automatic testing of the measurement shunts for all of the module's channels. This increases the tolerance of the module in relation to the interference on the input signal.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Yes - Warning</td><td>Automatic testing of the measurement shunts is disabled ("Yes - Warning" = SHUNTTEST disabled).</td></tr>
<tr><td>No</td><td>Automatic testing of the measurement shunts is not disabled ("No" = SHUNTTEST enabled).</td></tr>
</table>
Warning!<br>With "Disable shunt test = Yes - Warning", the module has reduced error detection capabilities and no longer meets the requirements of Cat. 4 per ISO 13849-1:2023.<br>As a result, the module meets the requirements up to max. Cat. 3 per ISO 13849-1:2023.</td><td>No</td></tr>
<tr><td>Dual-channel mode<br>(X20ST4492 only)</td><td>This value sets the channels being used for dual-channel evaluation.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Channel 12</td><td>Channels 1 and 2 as well as Channels 3 and 4 are used for dual-channel evaluation.</td></tr>
<tr><td>Channel 13</td><td>Channels 1 and 3 as well as Channels 2 and 4 are used for dual-channel evaluation.</td></tr>
</table></td><td>Channel 12</td></tr>
<tr><td>Input filter</td><td>This parameter sets the filter time of A/D converters.<br>• Permissible values: 1 ms, 2 ms, 10 ms, 16.7 ms, 20 ms, 33.3 ms, 40 ms, 66.7 ms</td><td>1 ms</td></tr>
</table>

### For additional module-specific information, see:

- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28

## Group: Module configuration - X20(c)SD1207

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Function mode</td><td>This parameter can be used to select the mode for input signal evaluation.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Mode A-A</td><td>In this mode, the frequency of the pulses on the inputs is determined. The frequencies of the relevant inputs are checked to see if they are the same, and a channel error is triggered if there are any deviations.<br>The frequency setting can only accept positive values in this mode.</td></tr>
<tr><td>Mode A-B</td><td>In this mode, the frequency of the pulses on the inputs is determined. The frequencies of the relevant inputs are checked to see if they are the same, and a channel error is triggered if there are any deviations.<br>The frequency setting can only accept positive values in this mode.</td></tr>
<tr><td>Mode A-A/-B-B/</td><td>In this mode, the frequency of the pulses on the inputs is determined. The frequencies of the relevant inputs are checked to see if they are the same, and a channel error is triggered if there are any deviations.<br>The combination of the inputs can be used to differentiate between a positive and negative direction.<br>The frequency setting can accept positive and negative values in this mode.</td></tr>
</table></td><td>Mode A-B</td></tr>
<tr><td>Unit</td><td>This parameter can be used to set the unit in which the frequency should be transferred from the module.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Increments/s</td><td>The frequency that has been determined will be shown in increments per second.</td></tr>
<tr><td>Increments/min</td><td>The frequency that has been determined will be shown in increments per minute.</td></tr>
<tr><td>Increments/h</td><td>The frequency that has been determined will be shown in increments per hour.</td></tr>
</table></td><td>Increments/s</td></tr>
<tr><td>Time base</td><td>This parameter specifies the time for calculating the average value of the frequency.<br>• Permissible values: 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1,000 ms, 2,000 ms, 5,000 ms, 10,000 ms, 20,000 ms, 50,000 ms, 100,000 ms<br>Warning!<br>Incorrect use can result in failure of the safety function and subsequently to dangerous states.<br>Configuring parameter "Time base" lengthens the safety response time!<br>The correct application must be observed.</td><td>10 ms</td></tr>
</table>

For additional module-specific information, see "X20(c)SD1207" on page 29.

### Group: SafeDigitalInputxx

Available for module families with safe digital inputs.

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Pulse source</td><td>This parameter can be used to define the pulse source for the input channel.<table><tr><th>Parameter value</th><th>Description</th></tr><tr><td>Pulse x</td><td>The input expects a test pulse from the pulse output (pulse x).</td></tr><tr><td>No pulse</td><td>The input does not expect a test pulse.</td></tr><tr><td>Other module</td><td>The input expects an external test pulse.</td></tr></table></td><td>Pulse x</td></tr>
<tr><td>Filter off</td><td>Switch-off filter for the channel to remove any interfering low phases from the signal.<br>• Permissible values: 0 to 500,000 µs (corresponds to 0 to 0.5 s)</td><td>0 µs</td></tr>
<tr><td>Filter on</td><td>Switch-on filter for the channel that can be used to "debounce" the signals. This function also makes it possible for the module to lengthen a switch-off signal that would otherwise be too short.<br>• Permissible values: 0 to 500,000 µs (corresponds to 0 to 0.5 s)<br>Note for X20SC0xxx, X20(c)SC2212, X20(c)SC2432, X20(c)SIx1x0 and X20(c)SLXxxx:<br>• At least 5 ms must be configured for "Filter on" when using DYNlink.</td><td>200000 µs</td></tr>
<tr><td>Discrepancy time</td><td>Parameter only available for odd-numbered channels.<br>For function "dual-channel evaluation", this parameter specifies the maximum time in which the selected "Dual-channel processing mode" is permitted to be violated by one of the input channels without an error being output.<br>• Permissible values: 0 to 10,000,000 µs (corresponds to 0 to 10 s)</td><td>50000 µs</td></tr>
<tr><td>Dual-channel processing mode</td><td>Parameter only available for odd-numbered channels.<br>This parameter specifies the type of dual-channel evaluation.<br>Permissible values:<br>• Equivalent<br>• Antivalent</td><td>Equivalent</td></tr>
</table>

## Warning!

**Configuring a switch-off filter lengthens the safety response time!**
**The configured filter value must be added to the total response time.**

## Warning!

**Signals with a low phase shorter than the safety response time can potentially be lost. Such signals should be lengthened accordingly using the "switch-on filter" function on the input module.**

## Warning!

**Configuring a switch-off filter causes signals with a low phase shorter than the switch-off filter to be filtered out. If this results in a problem concerning safety functionality, then the switch-off filter must be set to 0. Lengthening the low phase with a switch-on filter is not possible in these cases.**

**For additional module-specific information, see:**


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Group: PulseOutput

Available for module families with pulse outputs.

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Pulse x mode</td><td>This parameter can be used to define the pulse pattern of the associated pulse output. Parameter "Pulse source" defines the input channel from which this pulse output is used.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Internal</td><td>The channel generates a unique pulse pattern that can only be processed by input channels where this pulse output is defined as the pulse source.</td></tr>
<tr><td>External</td><td>The channel generates a pulse pattern that can be processed by all input channels where an external test pulse is defined as the pulse source.</td></tr>
<tr><td>DYNlink[1)]</td><td>The channel generates a pulse pattern that is compatible with DYNlink sensors and can be processed by input channels where this pulse output is defined as the pulse source.<br>If several DYNlink sensors are connected in series, this setting should be used for an even number of sensors.<br>For additional information, see section 9.5.2 "DYNlink".</td></tr>
<tr><td>DYNlink inverted[1)]</td><td>The channel generates a pulse pattern that is compatible with DYNlink sensors and can be processed by input channels where this pulse output is defined as the pulse source.<br>If several DYNlink sensors are connected in series, this setting should be used for an odd number of sensors.<br>For additional information, see section 9.5.2 "DYNlink".</td></tr>
</table>
1) When using mapp Safety:<br>• Starting with hardware upgrade 2.3.0.0: X20(c)SIx1x0, X20(c)SC0xxx and X20(c)SC2212<br>• Starting with hardware upgrade 2.4.0.0: X20(c)SC2432</td><td>Internal</td></tr>
</table>

**For additional module-specific information, see:**


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31


### Group: SafeCurrentxxyy - X20(c)SA4430

| Parameter | Description | Default value |
|---|---|---|
| Limit threshold equivalent x | This parameter specifies the maximum permissible deviation between the analog input values.<br>• Permissible values: 0 to 25,000 µA (corresponds to 0 to 25 mA) | 100 µA |
| Discrepancy time x | This parameter specifies the maximum time for function "dual-channel evaluation" in which the difference between both analog input values is permitted to exceed the limit value.<br>• Permissible values: 0 to 10,000 ms (corresponds to 0 to 10 s) | 0 ms |

Parameters "Limit threshold equivalent x" and "Discrepancy time x" together form a parameter set. Channels "SafeThresholdSelector_xxyy_Bit1" and "SafeThresholdSelector_xxyy_Bit2" are available in the SafeDesigner application to determine which parameter set in the module is enabled, i.e. it is possible to change the parameter set at runtime.

For additional module-specific information, see "X20(c)SA4430" on page 27.

### Group: SafeTemperatureInputxx - X20ST4492

| Parameter | Description | Default value | Unit |
|---|---|---|---|
| Sensor type<br>(for SafeTemperatureInput01-04) | This parameter can be used to specify the type of sensor connected.<br>• Permissible values: Type J, Type K, Type N, Type S, Type R, Type C, Type T, Voltage [µV] | Type J | - |
| Sensor type<br>(for SafeTemperatureInput05-06) | This parameter can be used to specify the type of sensor connected.<br>• Permissible values: PT100, PT1000 | PT1000 | - |

## Warning!

**The use or configuration of an incorrect TC sensor type CANNOT be detected by the module. The temperature value acquired by the module is incorrect.**

**Make sure during validation that the correct TC sensor type is installed and configured.**

## Information:

**The use or configuration of an incorrect PT sensor type is detected by the module. The module will switch to the FAILSAFE state.**

For additional module-specific information, see "X20ST4492" on page 28.

### Group: SafeTemperaturexxyy - X20ST4492

| Parameter | Description | Default value | Unit |
|---|---|---|---|
| Limit threshold equivalent x | This parameter specifies the limit value for the "Dual-channel evaluation" function for the maximum temperature difference between the two channels.<br>• Permissible values during temperature measurement: Corresponds to the thermocouple type<br>• Permissible values during voltage measurement: -2,147,483,648 to +2,147,483,647 | 1000 | 0.1°C<br>2 µV |
| Discrepancy time x | This parameter specifies the maximum time for the "Dual-channel evaluation" function in which the difference between both analog input values is permitted to exceed the limit value.<br>• Permissible values: 0 to 10,000 ms (corresponds to 0 to 10 s) | 0 | ms |

Parameters "Limit threshold equivalent x" and "Discrepancy time x" together form a parameter set. Channels "SafeThresholdSelector_xxyy_Bit1" and "SafeThresholdSelector_xxyy_Bit2" are available in the SafeDESIGNER application to determine which parameter set in the module is enabled, i.e. it is possible to change the parameter set at runtime.

For additional module-specific information, see "X20ST4492" on page 28.

### 8.2.3 Parameters in SafeDesigner+ of SafeLogic(-X) modules

#### Group: Basic

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Engineering sample allowed</td><td>This parameter determines whether non-certified engineering sample firmware or only certified firmware is accepted.<table><tr><th>Parameter value</th><th>Description</th></tr><tr><td>Yes - ATTENTION</td><td>Non-certified engineering sample firmware is accepted for the affected module.</td></tr><tr><td>No</td><td>Only certified firmware is accepted for the affected module.</td></tr></table></td><td>No</td></tr>
</table>

For additional module-specific information, see "X20SLXxxx-1" on page 21.

The SafeLogic-X modules also have safe I/Os; for a description of the parameters, see section "Parameters in SafeDesigner+ of SafeIO modules" on page 182.

# 8.3 Parameters in SafeDesigner

## 8.3.1 Parameters in SafeDesigner of SafeIO modules

### Group: Basic

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Min. required firmware revision</td><td>This parameter is reserved for future functional expansions.</td><td>Basic release</td></tr>
<tr><td>Availability</td><td>This parameter can be used to configure the module as "optional". Optional modules do not have to be present, i.e. the SafeLogic controller will not indicate that these modules are not present. However, this parameter does not influence the module's signal or status data.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Permanent</td><td>This module is mandatory for the application.<br>The module must be in OPERATIONAL mode after startup, and safe communication with the SafeLogic controller must be established without errors ("SafeModuleOK = SAFETRUE"). Processing of the safety application on the SafeLogic controller is delayed after startup until this state is achieved for all modules with "Availability = Permanent".<br>After startup, module problems are indicated by a quickly blinking "MXCHG" LED on the SafeLogic controller. An entry is also made in the logbook.</td></tr>
<tr><td>Optional</td><td>The module is not required for the application.<br>The module is not taken into account during startup, i.e. the safety application is started regardless of whether the modules with "Availability = Optional" are in mode OPERATIONAL or if safe communication is properly established between these modules and the SafeLogic controller.<br>After startup, module problems are NOT indicated by a quickly blinking "MXCHG" LED on the SafeLogic controller. An entry is NOT made in the logbook.</td></tr>
<tr><td>Startup</td><td>This module is optional. The system determines how the module will proceed during startup.<br>If it is determined that the module is physically present during startup (regardless of whether it is in OPERATIONAL mode or not), then the module behaves as if "Availability = Permanent" is set.<br>If it is determined that the module is not physically present during startup, then the module behaves as if "Availability = Optional" is set.</td></tr>
<tr><td>Never</td><td>The module is not required for the application.<br>The module is not taken into account during startup, which means the safety application is started regardless of whether the modules with "Availability = Never" are physically present.<br>Unlike when "Availability = Optional" is configured, the module is not started with "Availability = Never", which optimizes system startup behavior.<br>After startup, module problems are NOT indicated by a quickly blinking "MXCHG" LED on the SafeLogic controller. An entry is NOT made in the logbook.</td></tr>
</table></td><td>Permanent</td></tr>
</table>

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## Group: Safety response time

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Manual configuration</td><td>This parameter makes it possible to manually and individually configure the safety response time for the module.<br>The parameters for the safety response time are generally set in the same way for all stations involved in the application. For this reason, these parameters are configured for the SafeLogic controller in SafeDesigner. For application situations in which individual safety functions require optimal response time behavior, the parameters for the safety response time can be configured individually on the respective module.<br><table><tr><th>Parameter value</th><th>Description</th></tr><tr><td>Yes</td><td>The data from group "Safety response time" of the module is used to calculate the safety response time for the signals of the module.</td></tr><tr><td>No</td><td>The parameters for the safety response time are taken from the "Safety response time" group on the SafeLogic controller.</td></tr></table></td><td>No</td></tr>
<tr><td>Safe data duration</td><td>This parameter specifies the maximum permissible data transmission time between the SafeLogic controller and SafeIO module.<br>For additional information about the actual data transmission time, see section Diagnostics and service → Diagnostics tools → Network analyzer → Editor → Calculation of safety runtime in Automation Help.<br>The following formula can be used as the lower limit:<br>"Value of the Network Analyzer" * 2 + SafeLogic cycle time * 2<br>The stability of the system cannot be ensured for smaller values.<br>• Permissible values: 2000 to 10,000,000 µs (corresponds to 2 ms to 10 s)</td><td>20000 µs</td></tr>
<tr><td>Additional tolerated packet loss</td><td>This parameter specifies the number of additional tolerated lost packets during data transfer.<br>• Permissible values: 0 to 10</td><td>1 packet</td></tr>
<tr><td>Node guarding packets</td><td>This parameter specifies the maximum number of packets used for node guarding.<br>• Permissible values: 1 to 255<br>Note<br>• The larger the configured value, the greater the amount of asynchronous data traffic.<br>• This setting is not critical to safety functionality. The time for safely cutting off actuators is determined independently of this.</td><td>5 packets</td></tr>
</table>

For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

For additional parameters in SafeDesigner of the SafeIO modules, see section "Parameters in SafeDesigner+ of SafeIO modules" on page 182.

## 8.3.2 Parameters in SafeDesigner - Basic settings of SafeLogic controllers

### Group: Basic

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Min. required firmware revision</td><td>This parameter is reserved for future functional expansions.</td><td>Basic Release</td></tr>
<tr><td>Asynchronous communication load (X20SL81xx only)</td><td>This parameter can be used to influence the processing mode and thus the load in the SafeLogic cycle. This parameter can be used to influence how much asynchronous bandwidth is used for the configuration of the SafeNodes.<br>Increasing the value usually shortens the startup time as long as the network provides sufficient asynchronous bandwidth.<br>Increasing the value also requires more computing time in the SafeLogic cycle, however.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Low</td><td>Processing of a SSDO/SNMT service is divided across 5 SafeLogic cycles, i.e. the load in the cycle is low, but startup takes longer because a SSDO/SNMT service is processed only every 5 SafeLogic cycles.<br>Time required per SafeLogic cycle: 145 µs</td></tr>
<tr><td>Medium</td><td>One SSDO/SNMT service is processed in each SafeLogic cycle, i.e. the load in the cycle is low, and optimized startup has the same importance.<br>Time required per SafeLogic cycle: 260 µs</td></tr>
<tr><td>High</td><td>5 SSDO/SNMT services are processed in each SafeLogic cycle, i.e. the load in the cycle is relatively high to favor optimized startup behavior.<br>Time required per SafeLogic cycle: 860 µs</td></tr>
<tr><td>Auto</td><td>For SafeLogic cycles <3 ms, this setting results in the behavior "Asynchronous communication load = Low"; for SafeLogic cycles >3 ms, it results in the behavior "Asynchronous communication load = High".</td></tr>
</table></td><td>Auto</td></tr>
<tr><td>Node guarding timeout</td><td>Timeout for changing the safety modules to state PRE_OPERATIONAL after the SafeLogic controller drops out or if there is a communication problem between the safety module and the SafeLogic controller.<br>This parameter also defines how long it takes for the SafeLogic controller to detect a missing module.<br>• Permissible values: 30 to 300 s<br>Notes<br>• The shorter the time, the greater the amount of asynchronous data traffic.<br>• This setting is not critical to safety functionality. The time for safely switching off the actuators is determined independently of this.</td><td>60 s</td></tr>
<tr><td>Auto-acknowledge SafeKEY exchange</td><td>This parameter enables the automatic acknowledgment of a SafeKEY replacement ("SafeKEY Exchange" acknowledgment request).
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Yes - Warning</td><td>The automatic acknowledgment of a SafeKEY replacement is enabled.</td></tr>
<tr><td>No</td><td>The automatic acknowledgment of a SafeKEY replacement is not enabled.</td></tr>
</table></td><td>No</td></tr>
<tr><td>Process data transfer rate</td><td>This parameter defines the base transfer rate for process data.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>High</td><td>Normal transfer rate.</td></tr>
<tr><td>Low</td><td>Reduced transfer rate to support networks with low transfer rates (data transmission time > 1 s).<br>In rare cases, the connection to SafeNodes present in the network may be aborted. Connection aborts to Connected SafeDomains are not affected.<br>Connection aborts to SafeNODEs can be avoided by setting up a new SafeDomain in a separate network with a normal transfer rate and connecting this network to the original network with a reduced transfer rate via SafeDomain-to-SafeDomain communication.</td></tr>
</table></td><td>High</td></tr>
<tr><td>Availability source</td><td>This parameter sets the source for the availability settings of individual SafeNodes.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>SafeDesigner</td><td>Availability of the SafeNodes is defined in SafeDesigner.</td></tr>
<tr><td>SafeCOMMISSIONING</td><td>Availability of the SafeNodes is defined via the SafeNode availability parameters in SafeCOMMISSIONING.</td></tr>
</table></td><td>SafeDesigner</td></tr>
<tr><td>Maximum number of simultaneous module startups<br>(X20SL81xx only starting with hardware upgrade 2.4.0.0)</td><td>This parameter specifies how many modules are addressed simultaneously by the SafeLogic controller during startup. Reducing the parameter increases the startup time but reduces the number of transfer errors.<br>• Permissible values: 1 to 280</td><td>280</td></tr>
</table>

## Information:

**Startup time is also affected by the asynchronous bandwidth on the POWERLINK network. For ways to optimize, see section Communication → POWERLINK → General information → Multiple asynchronous send in Automation Help.**

## Information:

**The information in section "Automatic acknowledgment" in Automation Help must be observed when using parameter "Auto-acknowledge SafeKEY exchange".**

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25

### Group: Safety response time default values

The parameters for the safety response time are generally set in the same way for all stations involved in the application. This is why these parameters are configured for the SafeLogic controller in group "Safety Response Time Defaults" in SafeDESIGNER.

If "Manual configuration = No" is set for the individual modules, then these default values are used.

| Parameter | Description | Default value |
|---|---|---|
| Default safe data duration | This parameter specifies the maximum permissible data transmission time between the SafeLogic controller and SafeIO module.<br>For additional information about the actual data transmission time, see section Diagnostics and service → Diagnostics tools → Network analyzer → Editor → Calculation of safety runtime in Automation Help.<br>The following formula can be used as the lower limit:<br>"Value of the Network Analyzer" * 2 + SafeLogic cycle time * 2<br>The stability of the system cannot be ensured for smaller values.<br>• Permissible values: 2000 to 10,000,000 µs (corresponds to 2 ms to 10 s) | SLX:<br>150000 µs<br>SL:<br>20000 µs |
| Default additional tolerated packet loss | This parameter specifies the number of additional tolerated lost packets during data transfer.<br>• Permissible values: 0 to 10 | 1 packet |
| Default node guarding packets | This parameter specifies the maximum number of packets used for node guarding.<br>• Permissible values: 1 to 255<br>**Note**<br>• The larger the configured value, the greater the amount of asynchronous data traffic.<br>• This setting is not critical to safety functionality. The time for safely cutting off actuators is determined independently of this. | 5 packets |

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25

### Group: Module configuration - For SafeLogic(-X) modules

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Keep remanent</td><td>Automatically resets the remanent data (see Automation Help for SafeDesigner function block "SF_RemanentData_SAFEDINT" or "SF_RemanentData_SAFEDWORD").
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Yes - Warning</td><td>Remanent data is not automatically reset.</td></tr>
<tr><td>No</td><td>Remanent data is automatically reset if a modified SafeDesigner project (modified CRC and/or timestamp) is loaded to the SafeLogic controller.</td></tr>
</table>

Warning!<br>Incorrect use can result in failure of the safety function and subsequently to dangerous states.<br>If parameter "Keep remanent" is set to "Yes - Warning", it is important when saving data after a project download to note that the data still has the same meaning in the application program.<br>The correct application must be observed.</td><td>No</td></tr>
<tr><td>Max. cycle time</td><td>Parameter for checking whether a maximum time between 2 SafeLogic cycles is exceeded.<br>Permissible values:<br>• SafeLogic-X: 2100 to 41,000 µs (corresponds to 2.1 to 41 ms)<br>• SafeLogic: 2000 to 21,000 µs (corresponds to 2 to 21 ms)<br><br>IMPORTANT:<br>This value should not be the same as the actual cycle time; jitter must also be taken into account.</td><td>SLX:<br>40000 µs<br>SL:<br>20000 µs</td></tr>
</table>

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25

The SafeLogic-X modules also have safe I/Os; for a description of the parameters, see section "Parameters in SafeDesigner+ of SafeIO modules" on page 182.

### 8.3.2.1 Settings for the SafeDomain-to-SafeDomain connection

Starting with mapp Safety 5.10.0 and hardware upgrade 2.2.1.0

A connection between 2 SafeDomains must be set up in order to exchange data.
Setting up the connection and defining the safe data to be transferred takes place in the Connected SafeDomain.

For additional information about SafeDomain-to-SafeDomain communication, see section "SafeDomain-to-SafeDomain communication" in Automation Help.

## Information:

**Since SafeDomain-to-SafeDomain communication is represented as an additional safety module on the Managing SafeDomain, the parameters for the connection are only available and set in the Managing SafeDomain project.**

#### 8.3.2.1.1 Connected SafeDomain parameters

Starting with mapp Safety 5.13.0, hardware upgrade 2.4.0.0 and Automation Runtime A4.90

**Group: Basic**

<table>
<tr><th>Parameter</th><th>Description</th><th>Default value</th></tr>
<tr><td>Min. required firmware revision</td><td>This parameter is reserved for future functional expansions.</td><td>Basic release</td></tr>
<tr><td>Availability</td><td>This parameter can be used to configure the module as "optional". Optional modules do not have to be present, i.e. the SafeLogic controller will not indicate that these modules are not present. However, this parameter does not influence the module's signal or status data.
<table>
<tr><th>Parameter value</th><th>Description</th></tr>
<tr><td>Permanent</td><td>This module is mandatory for the application.<br>The module must be in OPERATIONAL mode after startup, and safe communication with the SafeLogic controller must be established without errors ("SafeModuleOK = SAFETRUE"). Processing of the safety application on the SafeLogic controller is delayed after startup until this state is achieved for all modules with "Availability = Permanent".<br>After startup, module problems are indicated by a quickly blinking "MXCHG" LED on the SafeLogic controller. An entry is also made in the logbook.</td></tr>
<tr><td>Optional</td><td>The module is not required for the application.<br>The module is not taken into account during startup, i.e. the safety application is started regardless of whether the modules with "Availability = Optional" are in mode OPERATIONAL or if safe communication is properly established between these modules and the SafeLogic controller.<br>After startup, module problems are NOT indicated by a quickly blinking "MXCHG" LED on the SafeLogic controller. An entry is NOT made in the logbook.</td></tr>
<tr><td>Startup</td><td>This module is optional. The system determines how the module will proceed during startup.<br>If it is determined that the module is physically present during startup (regardless of whether it is in OPERATIONAL mode or not), then the module behaves as if "Availability = Permanent" is set.<br>If it is determined that the module is not physically present during startup, then the module behaves as if "Availability = Optional" is set.</td></tr>
<tr><td>Never</td><td>The module is not required for the application.<br>The module is not taken into account during startup, which means the safety application is started regardless of whether the modules with "Availability = Never" are physically present.<br>Unlike when "Availability = Optional" is configured, the module is not started with "Availability = Never", which optimizes system startup behavior.<br>After startup, module problems are NOT indicated by a quickly blinking "MXCHG" LED on the SafeLogic controller. An entry is NOT made in the logbook.</td></tr>
</table></td><td>Permanent</td></tr>
</table>

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25

## Group: Safety response time

| Parameter | Description | Default value |
|---|---|---|
| Safe data duration | This parameter specifies the maximum permissible data transmission time between the SafeLogic controller and SafeIO module.<br>For additional information about the actual data transmission time, see section Diagnostics and service → Diagnostics tools → Network analyzer → Editor → Calculation of safety runtime in Automation Help.<br>The following formula can be used as the lower limit:<br>"Value of the Network Analyzer" * 2 + SafeLogic cycle time * 2<br>The stability of the system cannot be ensured for smaller values.<br>• Permissible values: 2000 to 10,000,000 µs (corresponds to 2 ms to 10 s) | 50000 µs |
| Additional tolerated packet loss | This parameter specifies the number of additional tolerated lost packets during data transfer.<br>• Permissible values: 0 to 10 | 1 packet |
| Slow connection | This parameter specifies whether this connection is a slow connection.<br>**Parameter value** / **Description**<br>Yes: This is a connection with a large ratio between the SafeLogic cycle time and the telegram runtime (affects the parameter calculation internally). Rule of thumb: "Yes" from ratio 50:1 (telegram runtime: SafeLogic cycle time)<br>No: Default connection, parameter calculation unchanged | No |
| Node guarding packets | This parameter specifies the maximum number of packets used for node guarding.<br>• Permissible values: 1 to 255<br>**Note**<br>• The larger the configured value, the greater the amount of asynchronous data traffic.<br>• This setting is not critical to safety functionality. The time for safely cutting off actuators is determined independently of this. | 5 packets |

## Information:

**Parameter "Slow connection" can also be used to specify that the connection between the Connected SafeDomain and Managing SafeDomain is slow. If a value of a few seconds is needed for the connection timeout, then this parameter must be enabled ("Slow connection = Yes").**

For additional module-specific information, see:


- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25

# 8.4 Channel list

## 8.4.1 SafeIOs - Channel list

### General channels

<table>
<tr><th>Channel name</th><th>Access via Automation Studio</th><th>Access via SafeDesigner(+)</th><th>Data type</th><th>Description</th></tr>
<tr><td>ModuleOk</td><td>I/O mapping (read)</td><td>-</td><td>BOOL</td><td>Indicates whether the module is physically present in the slot and configured.</td></tr>
<tr><td>SerialNumber</td><td>I/O mapping (read)</td><td>-</td><td>UDINT</td><td>Module serial number</td></tr>
<tr><td>ModuleID</td><td>I/O mapping (read)</td><td>-</td><td>UINT</td><td>Module ID</td></tr>
<tr><td>HardwareVariant</td><td>I/O mapping (read)</td><td>-</td><td>UINT</td><td>Hardware variant</td></tr>
<tr><td>FirmwareVersion</td><td>I/O mapping (read)</td><td>-</td><td>UINT</td><td>Firmware version of the module</td></tr>
<tr><td>UDID_low</td><td>AsIOAcc (read)</td><td>-</td><td>UDINT</td><td>UDID, lower 4 bytes</td></tr>
<tr><td>UDID_high</td><td>AsIOAcc (read)</td><td>-</td><td>UINT</td><td>UDID, upper 2 bytes</td></tr>
<tr><td>SafetyFWversion1</td><td>AsIOAcc (read)</td><td>-</td><td>UINT</td><td>Firmware version - Safety processor 1</td></tr>
<tr><td>SafetyFWversion2</td><td>AsIOAcc (read)</td><td>-</td><td>UINT</td><td>Firmware version - Safety processor 2</td></tr>
<tr><td>SafetyFWcrc1</td><td>AsIOAcc (read)</td><td>-</td><td>UINT</td><td>CRC of the firmware header on safety processor 1</td></tr>
<tr><td>SafetyFWcrc2</td><td>AsIOAcc (read)</td><td>-</td><td>UINT</td><td>CRC of the firmware header on safety processor 2</td></tr>
<tr><td>Bootstate</td><td>AsIOAcc (read)</td><td>-</td><td>UINT</td><td>Startup state of the module.<br>Notes:<ul><li>Some of the boot states do not occur during normal startup or are cycled through so quickly that they are not visible externally.</li><li>The boot states usually cycle through in ascending order. There are cases, however, in which a previous value is captured.</li></ul>
<table>
<tr><th>Value</th><th>Description</th></tr>
<tr><td>0x0003</td><td>Startup of communication processor OK, no communication with the safety processors (check the 24 V supply voltage!)</td></tr>
<tr><td>0x0010</td><td>FAILSAFE. At least one of the safety processors is in the safe state.</td></tr>
<tr><td>0x0020</td><td>Internal communication with safety processors started</td></tr>
<tr><td>0x0024</td><td>Firmware update of the safety processors or download of the SafeDesigner(+) application to the safety processors</td></tr>
<tr><td>0x0040</td><td>Firmware of safety processors started</td></tr>
<tr><td>0x0440</td><td>Firmware of safety processors running</td></tr>
<tr><td>0x0840</td><td>Waiting for openSAFETY Operational (loading the SafeDesigner(+) application or no valid application available; waiting for acknowledgments such as module replacement)</td></tr>
<tr><td>0x3440</td><td>Stabilizing cyclic openSAFETY data exchange.<br>Note:<br>If the boot state remains here, SafeDesigner(+) parameters "(Default) Safe data duration" and "(Default) Additional tolerated packet loss" must be checked.</td></tr>
<tr><td>0x4040</td><td>RUN. Final state, startup completed.</td></tr>
</table></td></tr>
<tr><td>Diag1_Temp</td><td>AsIOAcc (read)</td><td>-</td><td>INT</td><td>Module temperature in °C</td></tr>
<tr><td>oS_PropDelayStat<br>(for mapp Safety: starting with hardware upgrade 2.3.0.0)</td><td>AsIOAcc (read)</td><td>-</td><td>UDINT</td><td>Propagation delay statistics (average value of the data transmission time).<br>The unit depends on parameter "Process data transfer rate" of the SafeLOGIC controller.<ul><li>If the value of the parameter is "High", the unit is 100 µs.</li><li>If the value of the parameter is "Low", the unit is 1 ms.</li></ul>This value corresponds to the measurement of the forward and return channels and thus twice the theoretical runtime that is determined by the Network Analyzer.</td></tr>
<tr><td>SafeModuleOK</td><td>I/O mapping (read)</td><td>Read</td><td>SAFEBOOL</td><td>Indicates whether the safe communication channel is OK</td></tr>
</table>

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SP1130" on page 26
- "X20(c)SA4430" on page 27
- "X20ST4492" on page 28
- "X20(c)SD1207" on page 29
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## Channels for modules with safe digital inputs

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| FBInputStatexxyy | I/O mapping (read)<br>X20SI9100,<br>X20SLX910:<br>AsIOAcc (read) | - | USINT | State number of dual-channel evaluation (PLCopen function block "Equivalent" or "Antivalent") |
| InputErrorStates | AsIOAcc (read) | - | UDINT | Channel status, additional information for channel error<br>**Type of error**<br>**Inputs**<br>**Input stuck at high**<br>Bit no. 0 to x-1 = Channel 1 to x<br>(depends on the number of channels of the module)<br>If a bit is set, the corresponding error has been detected on the respective channel. |
| PulseOutputErrors | AsIOAcc (read) | - | UDINT | Channel status, additional information for channel error<br>**Type of error**<br>**Pulse outputs**<br>**Feedback stuck at high (shorted to 24 VDC)** / **Feedback stuck at low (ground fault)**<br>Bit no. 8 to 11 = Pulse 1 to 4 / Bit no. 0 to 3 = Pulse 1 to 4<br>If a bit is set, the corresponding error has been detected on the respective channel. |
| SafeDigitalInputxx | I/O mapping (read) | Read | SAFEBOOL | Physical channel SI xx |
| SafeTwoChannelInputxxyy | I/O mapping (read) | Read | SAFEBOOL | Dual-channel evaluation of channel SI xx/yy |
| SafeInputOKxx | I/O mapping (read) | Read | SAFEBOOL | Status of physical channel SI xx |
| SafeTwoChannelOKxxyy | I/O mapping (read) | Read | SAFEBOOL | Status of dual-channel evaluation of channel SI xx/yy |

### For additional module-specific information, see:

- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## Channels for modules with safe digital outputs

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| DigitalOutputxx | I/O mapping (write) | - | BOOL | Enable signal - Channel SO xx |
| SafeDigitalOutputxx | - | Write | SAFEBOOL | Safe channel SO xx |
| SafeOutputOKxx | I/O mapping (read) | Read | SAFEBOOL | Status of channel SO xx |
| ReleaseOutput | - | Write | BOOL | Release signal for error interlock |
| PhysicalStateOutputxx | I/O mapping (read) | Read | BOOL | Read-back value of physical channel SO xx |
| FBOutputStatexxyy | I/O mapping (read) | - | USINT | Status number of the error interlock of channel x, see section "Error interlock - State diagram".<br>**Bit 7 to 4** / **Bit 3 to 0**<br>Channel yy / Channel xx |

### For additional module-specific information, see:

- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SC4122.L12" on page 31

### Channels for modules with safe relay outputs

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| DigitalOutputxxyy | I/O mapping (write) | - | BOOL | Enable signal for combined channel SO xx/yy |
| SafeDigitalOutputxxyy | - | Write | SAFEBOOL | Safe combined channel SO xx/yy |
| RelayCycles01 | AsIOAcc (read) | - | UDINT | Number of switching cycles of the relay[1] |
| RelayCycles02 | AsIOAcc (read) | - | UDINT | Number of switching cycles of the relay[1] |
| RelayCycles03 | AsIOAcc (read) | - | UDINT | Number of switching cycles of the relay[1] |
| RelayCycles04 | AsIOAcc (read) | - | UDINT | Number of switching cycles of the relay[1] |
| RelayCycles05 | AsIOAcc (read) | - | UDINT | Number of switching cycles of the relay[1] |
| RelayCycles06 | AsIOAcc (read) | - | UDINT | Number of switching cycles of the relay[1] |

1 Available starting with upgrade 3.0.2.x. Maximum number of switching cycles; the value is updated every 10 s. If the power supply is lost during these 10 s, the last switching cycles may not be saved in a nonvolatile manner. Switching cycles prior to upgrade 3.0.2.x are not taken into account.

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**The two relay contacts of the two relays must be connected in series for applications greater than category 1 per ISO 13849-1:2023. In this application, signal "SafeDigitalOutputxxyy" must be used to control the two relays.**

**Controlling the two relay contacts using the individual "SafeDigitalOutputxx" signals is not permitted for applications greater than category 1 per ISO 13849-1:2023 since in certain operating states this may result in simultaneously welding of both relay contacts.**

**The correct application must be observed.**

## Information:

**Using signal "SafeDigitalOutputxxyy" and "SafeDigitalOutputxx" at the same time is not permitted and prevented by the system.**

**Using signal "SafeDigitalOutputxxyy" causes a switch-on sequence to be activated that switches on relay 2 with a 20 ms delay. This behavior is necessary to prevent simultaneous melting of the two relay contacts in certain operating states.**
**Release signal "ReleaseOutput" must then be in state "High" for the duration of the switch-on delay so that a rising edge is also detected on the second channel.**
**Controlling two independent ISO 13849-1:2023 Category 1 actuators using signal "SafeDigitalOutputxxyy" must therefore be avoided since this causes delayed activation of the actuator on channel 2.**

**For additional module-specific information, see:**


- "X20(c)SOx530" on page 16
- "X20(c)SC2432" on page 20


### Channels for X20SP1130

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| DigitalOutputxx | I/O mapping (write) | - | BOOL | Enable signal - Channel SO xx |
| SafeDigitalOutputxx | - | Write | SAFEBOOL | Safe channel SO xx |
| SafeOutputOKxx | I/O mapping (read) | Read | SAFEBOOL | Status of channel SO xx |
| ReleaseOutput | - | Write | BOOL | Release signal for error interlock |
| PhysicalStateOutputxx | I/O mapping (read) | Read | BOOL | Read-back value of physical channel SO xx |
| CurrentOKxx | I/O mapping (read) | Read | BOOL | Status of current measurement of channel SO xx |
| FBOutputStatexx | I/O mapping (read) | - | USINT | Status number of the error interlock of channel x, see section "Error interlock - State diagram". |

For additional module-specific information, see "X20SP1130" on page 26.

## Channels for X20(c)SA4430

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| SafeCurrentOKxx | I/O mapping (read) | Read | SAFEBOOL | Status of current range evaluation for channel xx |
| SafeCurrentOKxxyy | I/O mapping (read) | Read | SAFEBOOL | Status of dual-channel current evaluation for channel xxyy |
| TestActive | I/O mapping (read) | Read | BOOL | Indication of an active channel test |
| EquivalentThresholdxxyy | AsIOAcc (read) | - | UINT | Currently used limit value "Limit threshold equivalent" (see "Limit threshold equivalent x") |
| DiscrepancyTimeThresholdxxyy | AsIOAcc (read) | - | UINT | Currently used limit value "Discrepancy time" (see "Discrepancy time x") |
| SafeCurrentxxyy | I/O mapping (read) | Read | SAFEINT | (Current channel xx + Current channel yy)/2<br>Values: 0 to 20000 — Input signal: Current signal 0 to 20 mA |
| Currentxx | I/O mapping (read) | Read | INT | Current channel xx<br>Values: 0 to 20000 — Input signal: Current signal 0 to 20 mA |
| SafeThresholdSelector_xxyy_Bit1 | - | Write | SAFEBOOL | **_Bit1 / **_Bit2 / Parameters currently being used |
| SafeThresholdSelector_xxyy_Bit2 | - | Write | SAFEBOOL | 0 / 0 / Parameter set 1<br>1 / 0 / Parameter set 2<br>0 / 1 / Parameter set 3<br>1 / 1 / Parameter set 4 |
| SafeReleasexxyy | - | Write | SAFEBOOL | Release signal - Channel xxyy |

### Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**The validity of analog signals is represented by the associated status signals. These binary status signals (data type SAFEBOOL) must also be evaluated each time the analog signals are used. A binary status signal with state FALSE indicates an invalid value in the analog signal. In these situations, the analog signal is no longer permitted to be used for safety-related assessments.**

**The correct use of analog signals must be observed.**

For additional module-specific information, see "X20(c)SA4430" on page 27.

## Channels for X20ST4492

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| SafeTemperatureOKxxyy | I/O mapping (read) | Read | SAFEBOOL | Status of dual-channel temperature evaluation xx/yy |
| SafeTemperaturexxyy | I/O mapping (read) | Read | SAFEINT | (Temperature channel xx + Temperature channel yy)/2 |
| TestActive | I/O mapping (read) | Read | BOOL | Indication of an active channel test |
| EquivalentThresholdxxyy | AsIOAcc (read) | - | UINT | Currently used limit value "Limit threshold equivalent" (see Parameters in SafeDesigner - Group: SafeCurrentxxyy) |
| DiscrepancyTimeThresholdxxyy | AsIOAcc (read) | - | UINT | Currently used limit value "Discrepancy time" (see Parameters in SafeDesigner - Group: SafeCurrentxxyy) |
| TemperatureOKxx | I/O mapping (read) | Read | BOOL | Status of temperature evaluation xx |
| Temperature_A | I/O mapping (read) | - | INT | Temperature of the temperature channel selected with "TempChannel_Select_A" |
| TempChannel_Select_A | I/O mapping (write) | - | USINT | Selects the temperature to be transferred on channel "Temperature_A".<br>Value / Description:<br>0 — The value of channel 2 is being transferred.<br>1 — The value of channel 1 is being transferred.<br>2 — The value of channel 2 is being transferred.<br>3 — The value of channel 3 is being transferred.<br>4 — The value of channel 4 is being transferred.<br>5 — The value of channel 5 is being transferred.<br>6 — The value of channel 6 is being transferred.<br>≥7 — The value of channel 2 is being transferred. |
| SafeThresholdSelector_xxyy_Bit1 | - | Write | SAFEBOOL | **_Bit1 / **_Bit2 / Parameters currently being used |
| SafeThresholdSelector_xxyy_Bit2 | - | Write | SAFEBOOL | 0 / 0 / Parameter set 1<br>1 / 0 / Parameter set 2<br>0 / 1 / Parameter set 3<br>1 / 1 / Parameter set 4 |
| SafeReleasexxyy | - | Write | SAFEBOOL | Release signal - Channel xxyy |

For additional module-specific information, see "X20ST4492" on page 28.

### Channels for X20(c)SD1207

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| SafeFrequency | I/O mapping (read) | Read | SAFEINT | Current frequency |
| SafeFrequencyOK | I/O mapping (read) | Read | SAFEBOOL | Indicates whether the frequency being output is OK |
| Reset | - | Write | BOOL | Release signal.<br>To acknowledge an error, the cause of error (e.g. open circuit) must be corrected and the input frequency must be 0 for hardware upgrades <2.5.0.0 of the module. The error can then be acknowledged with a rising edge on channel "Reset". |

For additional module-specific information, see "X20(c)SD1207" on page 29.

### X67SI8103 - Output channels

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| DigitalInputxx | I/O mapping (read) | Read | BOOL | Physical channel DI xx |
| DigitalOutputxx | I/O mapping (write) | - | BOOL | Physical channel DO xx |
| DigitalOutputOKxx | I/O mapping (read) | Read | BOOL | Status of channel DO xx |
| PhysicalStateOutputxx | I/O mapping (read) | Read | BOOL | Read-back value of physical channel DO xx |

For additional module-specific information, see "X67SI8103" on page 30.

## 8.4.2 X20 SafeLogic-X modules - Channel list

### General channels

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| ModuleOk | I/O mapping (read) | - | BOOL | Indicates whether the module is physically present in the slot and configured |
| SerialNumber | I/O mapping (read) | - | UDINT | Module serial number |
| ModuleID | I/O mapping (read) | - | UINT | Module ID |
| HardwareVariant | I/O mapping (read) | - | UINT | Hardware variant |
| FirmwareVersion | I/O mapping (read) | - | UINT | Firmware version of the module |
| SLXioCycle | I/O mapping (read) | - | UDINT | Cyclic data exchange between the SafeLogic-X controller and CPU (time in microseconds).<br>This value is influenced by:<br>• Quantity and data width of SafeNodes<br>• Cycle times set in Automation Studio (POWERLINK, X2X, crosslink task)<br>• Automation Studio configuration (see items above)<br>The value must be <30 ms; otherwise, the max. SafeLogic-X cycle time (parameter "Max. cycle time") is exceeded.<br>In addition, values <15 ms are recommended since large values slow down the SafeDesigner(+) online connection. |
| UDID_low | AsIOAcc (read) | - | UDINT | UDID, lower 4 bytes |
| UDID_high | AsIOAcc (read) | - | UINT | UDID, upper 2 bytes |
| SafetyFWversion1 | AsIOAcc (read) | - | UINT | Firmware version - Safety processor 1 |
| SafetyFWversion2 | AsIOAcc (read) | - | UINT | Firmware version - Safety processor 2 |
| SafetyFWcrc1 | AsIOAcc (read) | - | UINT | CRC of the firmware header on safety processor 1 |
| SafetyFWcrc2 | AsIOAcc (read) | - | UINT | CRC of the firmware header on safety processor 2 |
| Bootstate | AsIOAcc (read) | - | UINT | Startup state of the module.<br>Notes:<br>• Some of the boot states do not occur during normal startup or are cycled through so quickly that they are not visible externally.<br>• The boot states usually cycle through in ascending order. There are cases, however, in which a previous value is captured.<br>For the boot state values, see the following table. |
| Diag1_Temp | AsIOAcc (read) | - | INT | Module temperature in °C |
| **Only when using mapp Safety:** | | | | |
| SafetyFWversionSCM | AsIOAcc (read) | - | UINT | Firmware version - SCMar |
| ApplSDcrc | AsIOAcc (read) | - | UDINT | CRC of the SafeDESIGNER application on the module |
| ApplSDtime | AsIOAcc (read) | - | UDINT | Timestamp of the SafeDESIGNER application on the module in UNIX format |
| ApplMOptCRC | AsIOAcc (read) | - | UDINT | CRC of bit Safe Commissioning Options on the module |
| ApplMOptTime | AsIOAcc (read) | - | UDINT | Timestamp of bit Safe Commissioning Options on the module in UNIX format |
| ApplMOpt2CRC | AsIOAcc (read) | - | UDINT | CRC of integer Safe Commissioning Options on the module |
| ApplMOpt2Time | AsIOAcc (read) | - | UDINT | Timestamp of integer Safe Commissioning Options on the module in UNIX format |
| SLXbootState | AsIOAcc (read) | - | USINT | Startup state of the SafeLOGIC-X system<br>**Status** / **Description**<br>0 – Invalid - Firmware not yet running<br>1 – Start - Waiting for synchronization of internal cyclic systems<br>4 – Start OK - Application data valid<br>25 – Safety PREOPERATIONAL state or "SafeOSstate!=RUN"<br>34 – Waiting on X2X parameters from Automation Runtime<br>50[2)] – Ready for RUN - Waiting on "SafeModuleOK" of the modules<br>52[2)] – Waiting period for stable valid "SafeModuleOK" in progress<br>54[2)] – Startup complete - SafeRUN<br>[2)] Connection to SafeLOGIC-X controller possible via SafePLC window in SafeDESIGNER (see section "SafePLC dialog box" in Automation Help). |

| Channel name | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|
| SafeOsState | AsIOAcc (read) | - | USINT | Status of the safety application. For details, see section "Dialog box 'SafePLC info' in SafeDESIGNER" in Automation Help. |

| Status | Description |
|---|---|
| 0x00 | Invalid (e.g. SafeKEY blank) or startup still active (BOOT_STATE!=0x12) |
| 0x0F | ON (startup / internal initialization) or error (check logbook) |
| 0x33 | Loading (startup / internal initialization) |
| 0x55 | Stop [Safe] |
| 0x66 | Run [Safe] |
| 0x99 | Halt [Debug] |
| 0xAA | Stop [Debug] |
| 0xCC | Run [Debug] |
| 0xF0 | No execution |

### Boot state values:

| Value | Safety+ | mapp Safety | Description |
|---|---|---|---|
| 0x0003 | • | • | Startup of communication processor OK, no communication with the safety processors (check the 24 V supply voltage!) |
| 0x0010 | • | • | FAILSAFE. At least one of the safety processors is in the safe state. |
| 0x0020 | • | • | Internal communication with safety processors started |
| 0x0024 | • | • | Firmware update of the safety processors or download of the SafeDesigner(+) application to the safety processors |
| 0x0040 | • | • | Firmware of safety processors started |
| **Microprocessor firmware boot state values** | | | |
| 0x0440 | • | • | Firmware of safety processors running |
| 0x0840 | • | • | Waiting for openSAFETY Operational (loading the SafeDesigner(+) application or no valid application available; waiting for acknowledgments such as module replacement) |
| 0x0940 | • | - | Invalid application files; files are not empty, but not valid (e.g. SafeIdent check failed). |
| 0x0A40 | • | - | Application files OK<br>Waiting for openSAFETY Operational |
| 0x1040 | • | - | Waiting for MFW PreOperational process |
| 0x3440 | • | • | Stabilizing cyclic openSAFETY data exchange.<br>**Note for mapp Safety:**<br>If the boot state remains here, parameters"(Default) Safe data duration" and "(Default) Additional tolerated packet loss" must be checked.<br>**Note for Safety+:**<br>If the boot state remains here, the "Max safe data duration" parameters must be checked. |
| 0x3640 | • | - | Waiting for start command (availability list) from SpServer |
| 0x4040 | • | • | Run. Final state, startup completed. |
| 0x4140 | • | - | Stop |
| 0x4240 | • | - | Run [Debug] |

Table 96: Boot state values

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20SLXxxx-1" on page 21

### Channel list for modules with safe digital inputs and outputs

See:

- "Channels for modules with safe digital inputs" on page 196
- "Channels for modules with safe digital outputs" on page 196

### Communication channels - CPU to SafeLogic, SafeLogic to CPU

| Channel name | Safety+ | mapp Safety | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|---|---|
| BOOL1xxxx | • | • | I/O mapping (write) | Read | BOOL | CPU to SafeLogic communication channel |
| INT1xxx | • | • | I/O mapping (write) | Read | INT | CPU to SafeLogic communication channel |
| UINT1xxx | • | • | I/O mapping (write) | Read | UINT | CPU to SafeLogic communication channel |
| DINT1xxx | • | • | I/O mapping (write) | Read | DINT | CPU to SafeLogic communication channel |
| UDINT1xxx | • | • | I/O mapping (write) | Read | UDINT | CPU to SafeLogic communication channel |

**Register description**

| Channel name | Safety+ | mapp Safety | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|---|---|
| BOOL0xxxx | • | • | I/O mapping (read) | Write | BOOL | SafeLogic to CPU communication channel |
| INT0xxx | • | • | I/O mapping (read) | Write | INT | SafeLogic to CPU communication channel |
| UINT0xxx | • | • | I/O mapping (read) | Write | UINT | SafeLogic to CPU communication channel |
| DINT0xxx | • | • | I/O mapping (read) | Write | DINT | SafeLogic to CPU communication channel |
| UDINT0xxx | • | • | I/O mapping (read) | Write | UDINT | SafeLogic to CPU communication channel |

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20SLXxxx-1" on page 21

### SafeDomain to SafeDomain communication channels

When using modules X20(c)SLX402, X20SLX806, X20SLX842 and X20SLX811.

| Channel name | Safety+ | mapp Safety | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|---|---|
| SafeModuleOK [1)] | - | • | - | Read | SAFEBOOL | Indicates whether the safe communication channel between SafeDomain and SafeDomain is OK |
| SafeBOOLxxx [1)] | - | • | I/O mapping (read) | Read/Write | SAFEBOOL | SafeDomain-to-SafeDomain communication channel |
| SafeINTxx [1)] | - | • | I/O mapping (read) | Read/Write | SAFEINT | SafeDomain-to-SafeDomain communication channel |
| SafeUINTxx [1)] | - | • | I/O mapping (read) | Read/Write | SAFEWORD | SafeDomain-to-SafeDomain communication channel |
| SafeDINTxx [1)] | - | • | I/O mapping (read) | Read/Write | SAFEDINT | SafeDomain-to-SafeDomain communication channel |
| SafeUDINTxx [1)] | - | • | I/O mapping (read) | Read/Write | SAFEDWORD | SafeDomain-to-SafeDomain communication channel |

1) Starting with mapp Safety 5.13.0, hardware upgrade 2.4.0.0 and Automation Runtime A4.90. For additional information about SafeDomain-to-SafeDomain communication, see section "SafeDomain-to-SafeDomain communication" in Automation Help.

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

### Internal channels for Safe Commissioning Options

| Channel name | Safety+ | mapp Safety | Access via Automation Studio | Access via SafeDesigner(+) | Data type | Description |
|---|---|---|---|---|---|---|
| SafeCommissioningOptionBITxxx | - | • | - | Read | SAFEBOOL | Internal channels for Safe Commissioning Options |
| **Only for modules X20(c)SLX402, X20SLX806, X20SLX842 and X20SLX811:** | | | | | | |
| SafeCommissioningOptionINTxx | - | • | - | Read | SAFEINT | Internal channels for Safe Commissioning Options |
| SafeCommissioningOptionUINTxx | - | • | - | Read | SAFEWORD | Internal channels for Safe Commissioning Options |
| SafeCommissioningOptionDINTxx | - | • | - | Read | SAFEDINT | Internal channels for Safe Commissioning Options |
| SafeCommissioningOptionUDINTxx | - | • | - | Read | SAFEDWORD | Internal channels for Safe Commissioning Options |

For additional module-specific information, see "X20(c)SLXxxx" on page 23.

### 8.4.3 X20SL81xx - Channel list

| Channel name | Access via Automation Studio | Access via SafeDESIGNER | Data type | Description |
|---|---|---|---|---|
| ModuleOk | Read | - | BOOL | Indicates whether the module is physically present and configured and whether a SafeDESIGNER project is present. |
| SerialNumber | Read | - | UDINT | Module serial number |
| ModuleID | Read | - | UDINT | Module ID |
| HardwareVariant | Read | - | UDINT | Hardware variant |
| FirmwareVersion | Read | - | UDINT | Firmware version of the module |
| SafeFirmwareVersion | Read | - | UINT | Channel for reading the version of the safe firmware |
| UDID_low | Read | - | UDINT | UDID, lower 4 bytes |
| UDID_high | Read | - | UINT | UDID, upper 2 bytes |
| BOOL1xxxx | Write | Read | BOOL | CPU to SafeLogic communication channel |
| INT1xxx | Write | Read | INT | CPU to SafeLogic communication channel |
| UINT1xxx | Write | Read | UINT | CPU to SafeLogic communication channel |
| DINT1xxx | Write | Read | DINT | CPU to SafeLogic communication channel |
| UDINT1xxx | Write | Read | UDINT | CPU to SafeLogic communication channel |
| BOOL0xxxx | Read | Write | BOOL | SafeLogic to CPU communication channel |
| INT0xxx | Read | Write | INT | SafeLogic to CPU communication channel |
| UINT0xxx | Read | Write | UINT | SafeLogic to CPU communication channel |
| DINT0xxx | Read | Write | DINT | SafeLogic to CPU communication channel |
| UDINT0xxx | Read | Write | UDINT | SafeLogic to CPU communication channel |
| SafeModuleOK [1)] | - | Read | SAFEBOOL | Indicates whether the safe communication channel between SafeDomain and SafeDomain is OK |
| SafeBOOLxxx [1)] | Read | Read/Write | SAFEBOOL | SafeDomain-to-SafeDomain communication channel |
| SafeINTxx [1)] | Read | Read/Write | SAFEINT | SafeDomain-to-SafeDomain communication channel |
| SafeUINTxx [1)] | Read | Read/Write | SAFEWORD | SafeDomain-to-SafeDomain communication channel |
| SafeDINTxx [1)] | Read | Read/Write | SAFEDINT | SafeDomain-to-SafeDomain communication channel |
| SafeUDINTxx [1)] | Read | Read/Write | SAFEDWORD | SafeDomain-to-SafeDomain communication channel |
| SafeCommissioningOptionBITxxx | - | Read | SAFEBOOL | Internal channels for Safe Commissioning Options |
| SafeCommissioningOptionINTxx | - | Read | SAFEINT | Internal channels for Safe Commissioning Options |
| SafeCommissioningOptionUINTxx | - | Read | SAFEWORD | Internal channels for Safe Commissioning Options |
| SafeCommissioningOptionDINTxx | - | Read | SAFEDINT | Internal channels for Safe Commissioning Options |
| SafeCommissioningOptionUDINTxx | - | Read | SAFEDWORD | Internal channels for Safe Commissioning Options |

1) Starting with mapp Safety 5.10.0 and hardware upgrade 2.2.1.0. For additional information about SafeDomain-to-SafeDomain communication, see section "SafeDomain-to-SafeDomain communication" in Automation Help.

## Information:

**Additional diagnostic data points are available on the X20SL8101 and the X20SL8110.**

**For details, see section Communication → POWERLINK → Diagnostics → Diagnostic data points → Bus controller in Automation Help.**

**Register description**

In addition, the following data can be read via POWERLINK registers:

| Index:Subindex | Object name | Data type | Access | Values | Description |
|---|---|---|---|---|---|
| 0x2000:0x04 | SafetyFWversion1 | UDINT | Read | - | Higher-order 2 bytes: Hardware variant of the module<br>Lower-order 2 bytes: Firmware version for safety processor 1 |
| 0x2000:0x05 | SafetyFWversion2 | UDINT | Read | - | Higher-order 2 bytes: Hardware variant of the module<br>Lower-order 2 bytes: Firmware version for safety processor 2 |
| 0x2000:0x08 | Project_CRC | UDINT | Read | - | CRC of the SafeDESIGNER project |
| 0x2000:0x09 | Project_Time | DATE_AND_TIME | Read | - | Timestamp of the SafeDESIGNER project |
| 0x2000:0x0C | Project_Name | STRING<br>(without zero termination) | Read | - | Project name of the SafeDESIGNER project |
| 0x2000:0x0D | Project_Author | STRING<br>(without zero termination) | Read | - | Name of the author of the SafeDESIGNER project |
| 0x2000:0x0E | SafeOS_RUN_STATE | BOOL | Read | 0 | SafeOS is not in RUN (identical to SafeOSstate!=0x66) |
| | | | | 1 | SafeOS is in RUN (identical to SafeOSstate==0x66) |
| 0x2000:0x0F | BOOT_STATE | UDINT | Read | General firmware startup status.<br>Using the updated "Bootstate" object (0x2410:0x01) is recommended. | |
| | | | | 0x00 | Startup not yet begun |
| | | | | 0x01 | Initialization started |
| | | | | 0x10 | Cyclic hardware tests running |
| | | | | 0x11 | openSAFETY stack running |
| | | | | 0x12 | SafeOS running |
| 0x2000:0x10 | openSAFETYstate | UDINT | Read | 0 | State PREOPERATIONAL (all cyclic safe data zeroed out) |
| | | | | 1 | State OPERATIONAL |
| 0x2000:0x11 | SafeOsState | UDINT | Read | State of the safety application (corresponds to LED "R/E"on the SafeLogic controller). For details, see section "States of the safety controller" in Automation Help. | |
| | | | | 0x00 | Invalid (e.g. SafeKEY blank) or startup still active (BOOT_STATE!=0x12) |
| | | | | 0x0F | ON (startup / internal initialization) or error (check logbook) |
| | | | | 0x33 | Loading (startup / internal initialization) |
| | | | | 0x55 | Stop [Safe] |
| | | | | 0x66 | Run [Safe] |
| | | | | 0x99 | Halt [Debug] |
| | | | | 0xAA | Stop [Debug] |
| | | | | 0xCC | Run [Debug] |
| | | | | 0xF0 | No execution |
| 0x2000:0x12 | Temperature | INT | Read | - | Measured temperature in 0.1°C |
| 0x2000:0x14 | SafeKEY_TotalMemory | UDINT | Read | - | Total memory on the SafeKEY.<br>Specification in sectors (1 sector = 0x10000 bytes) |
| 0x2000:0x15 | SafeKEY_AvailableMemory | UDINT | Read | - | Free memory on the SafeKEY.<br>Specification in sectors (1 sector = 0x10000 bytes) |

The following objects are also available:

| Index:Subindex | Data type | Access | Values | Description |
|---|---|---|---|---|
| 0x2410:0x01 | UDINT | Read | Boot state.<br>Startup state of the SafeLogic controller.<br>Notes:<br>• Some of the boot states do not occur during normal startup or are cycled through so quickly that they are not visible externally.<br>• The boot states usually cycle through in ascending order. There are cases, however, in which a previous value is captured. | |
| | | | 0x0003 | Startup communication processor OK, no communication with the safety processors |
| | | | 0x0008 | SafeKEY check (valid SafeKEY not connected) |
| | | | 0x0010 | FAILSAFE. At least one of the safety processors is in the safe state. |
| | | | 0x0020 | Internal communication with safety processors started |
| | | | 0x0024 | Firmware update of safety processors |
| | | | 0x0030 | Startup of safety processors |
| | | | 0x0040 | Firmware of safety processors started |
| | | | 0x0440 | Firmware of safety processors running |
| | | | 0x0840 | SafeDESIGNER application loading or no valid SafeDESIGNER application found. |
| | | | 0x1840 | Waiting for acknowledgments (e.g. module replacement) |
| | | | 0x2040 ... 0x2A40 | SCAN: The safety modules being used are being looked for in the network and configured.<br>Several SCAN runs are performed until all modules have been found:<br>0x2040: First cycle<br>0x2140: Second cycle<br>0x2240: Third cycle<br>... |
| | | | 0x3040 | Missing modules.<br>Startup cannot be resumed since modules are missing that are configured with "Availability = Permanent". |
| | | | 0x3440 | Configuration of existing safety modules completed. Stabilizing cyclic openSAFETY data exchange.<br>**Note:**<br>If the boot state remains here, SafeDESIGNER parameters "(Default) Safe data duration" and "(Default) Additional tolerated packet loss" must be checked. |
| | | | 0x4040 | RUN. Final state, startup completed. |
| 0x2410:0x02 | UDINT | Read | - | SCAN progress (how many modules have already been processed in the current scan) |
| 0x2410:0x03 | UDINT | Read | - | Supply voltage (in mV) |
| 0x2410:0x04 | UDINT | Read | - | CRC of the firmware header on safety processor 1 |
| 0x2410:0x05 | UDINT | Read | - | CRC of the firmware header on safety processor 2 |
| 0x2410:0x06 | UDINT | Read | - | Maximum cycle time (time from cycle start to cycle end) |
| 0x2410:0x07 | UDINT | Read | - | Cycle start interval (time from one cycle start to next cycle start) |
| 0x2410:0x08 | UDINT | Read | - | SafeLogic status word |
| 0x2410:0x09 | UDINT | Read | - | Number of missing modules |
| 0x2410:0x0A | UDINT | Read | - | Number of UDID mismatches |
| 0x2410:0x0B | UDINT | Read | - | Number of firmware mismatches |
| 0x2410:0x0C | UDINT | Read | - | Number of configured modules |
| 0x2410:0x0D | UDINT | Read | - | Flag for missing subsequently loadable files:<br>Bit 0: Safe Commissioning Options missing in AUTOCNF.BIN<br>Bit 1: SafeNode Availability missing in AUTOCNF.BIN<br>Bit 2: EMODATA1.BIN missing<br>Bit 3: TABDATA1.BIN |
| 0x2410:0x0E | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_LENGTH |
| 0x2410:0x0F | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_TOO_LONG |
| 0x2410:0x10 | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_FRM_ID |
| 0x2410:0x11 | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_SADR_INV |
| 0x2410:0x12 | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_SDN_INV |
| 0x2410:0x13 | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_TADR_INV |
| 0x2410:0x14 | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_CRC1 |
| 0x2410:0x15 | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_CRC2 |
| 0x2410:0x16 | UDINT | Read | - | openSAFETY common event counter SERR_k_SFS_DATA |
| 0x2410:0x17 | UDINT | Read | - | openSAFETY common event counter SERR_k_CYC_REJECT |
| 0x2410:0x18 | UDINT | Read | - | openSAFETY common event counter SERR_k_CYC_ERROR |
| 0x2410:0x19 | UDINT | Read | - | openSAFETY common event counter SERR_k_ACYC_REJECT |
| 0x2410:0x1A | UDINT | Read | - | openSAFETY common event counter SERR_k_ACYC_RETRY |
| 0x2410:0x1B to 0x2410:0x1F | UDINT | Read | - | Reserved for future openSAFETY common event counters |
| 0x2410:0x20 | UDINT | Read | - | Number of SCFM errors |
| 0x2410:0x21 | UDINT | Read | - | Number of SCM errors |
| 0x2410:0x22 | UDINT | Read | - | Number of SDN errors |
| 0x2410:0x23 | UDINT | Read | - | Number of SFS errors |
| 0x2410:0x24 | UDINT | Read | - | Number of SHNF errors |
| 0x2410:0x25 | UDINT | Read | - | Number of SNMTM errors |
| 0x2410:0x26 | UDINT | Read | - | Number of SNMTS errors |

**Register description**

| Index:Subindex | Data type | Access | Values | Description |
|---|---|---|---|---|
| 0x2410:0x27 | UDINT | Read | - | Number of SOD errors |
| 0x2410:0x28 | UDINT | Read | - | Number of SPDO errors |
| 0x2410:0x29 | UDINT | Read | - | Number of SSC errors |
| 0x2410:0x2A | UDINT | Read | - | Number of SSDOC errors |
| 0x2410:0x2B | UDINT | Read | - | Number of SSDOS errors |
| 0x2410:0x2C | UDINT | Read | - | Total memory for parameter files |
| 0x2410:0x2D | UDINT | Read | - | Free memory for parameter files |
| 0x2410:0x2E | UDINT | Read | - | Total memory for project files |
| 0x2410:0x2F | UDINT | Read | - | Free memory for project files |
| 0x2410:0x30 | UDINT | Read | - | Total memory for reloadable C libraries and tables |
| 0x2410:0x31 | UDINT | Read | - | Free memory for reloadable C libraries and tables |
| 0x2410:0x32 | UDINT | Read | - | Total memory for dynamic memory management in reloadable C libraries |
| 0x2410:0x33 | UDINT | Read | - | Free memory for dynamic memory management in reloadable C libraries |
| 0x2410:0x34 to 0x2410:0xFE | UDINT | Read | - | Reserved for future expansions |
| 0x2424:0x01 | UDINT | Read | - | AutoCnf.bin - Timestamp |
| 0x2424:0x02 | UDINT | Read | - | AutoCnf.bin - Number of CRCs |
| 0x2424:0x03 | UDINT | Read | - | AutoCnf.bin - Size of file in bytes |
| 0x2424:0x04 to 0x2424:0x0A | UDINT | Read | - | AutoCnf.bin - Reserved for future expansions |
| 0x2424:0x0B to 0x2424:0xn | UDINT | Read | - | AutoCnf.bin - CRC 1 to N |
| 0x2424:0xn+1 to 0x2424:0xFE | UDINT | Read | - | AutoCnf.bin - Reserved for future expansions |
| 0x2425:0x01 | UDINT | Read | - | EmoData1.bin - Timestamp |
| 0x2425:0x02 | UDINT | Read | - | EmoData1.bin - Number of CRCs |
| 0x2425:0x03 | UDINT | Read | - | EmoData1.bin - Size of file in bytes |
| 0x2425:0x04 to 0x2425:0x0A | UDINT | Read | - | EmoData1.bin - Reserved for future expansions |
| 0x2425:0x0B to 0x2425:0xn | UDINT | Read | - | EmoData1.bin - CRC 1 to N |
| 0x2425:0xn+1 to 0x2425:0xFE | UDINT | Read | - | EmoData1.bin - Reserved for future expansions |
| 0x2426:0x01 | UDINT | Read | - | TabData1.bin - Timestamp |
| 0x2426:0x02 | UDINT | Read | - | TabData1.bin - Number of CRCs |
| 0x2426:0x03 | UDINT | Read | - | TabData1.bin - Size of file in bytes |
| 0x2426:0x04 to 0x2426:0x0A | UDINT | Read | - | TabData1.bin - Reserved for future expansions |
| 0x2426:0x0B to 0x2426:0xn | UDINT | Read | - | TabData1.bin - CRC 1 to N |
| 0x2426:0xn+1 to 0x2426:0xFE | UDINT | Read | - | TabData1.bin - Reserved for future expansions |
| 0x2427:0x01 | UDINT | Read | - | ParData1.bin - Timestamp |
| 0x2427:0x02 | UDINT | Read | - | ParData1.bin - Number of CRCs |
| 0x2427:0x03 | UDINT | Read | - | ParData1.bin - Size of file in bytes |
| 0x2427:0x04 to 0x2427:0x0A | UDINT | Read | - | ParData1.bin - Reserved for future expansions |
| 0x2427:0x0B to 0x2427:0xn | UDINT | Read | - | ParData1.bin - CRC 1 to N |
| 0x2427:0xn+1 to 0x2427:0xFE | UDINT | Read | - | ParData1.bin - Reserved for future expansions |

The following information about each openSAFETY node can be retrieved in object range 0x2416 to 0x2423 (data type: UDINT, Access: Read):

| Parameter ID | Value |
|---|---|
| 0 | SafeModule ID |
| 1 | Status word<br>Bit 0: Missing module<br>Bit 1: Firmware mismatch on module<br>Bit 2: UDID mismatch on module<br>Bit 3: Reserved<br>Bit 4: Reserved<br>Bit 5: "Connection valid" bit of module<br>Bit 6 to 31: Reserved |
| 2 | Connection valid statistics (number of negative edges of the connection valid bit) |
| 3 | Propagation delay statistics (average value of the data transmission time).<br>The unit depends on parameter "Process data transfer rate".<br>• If the value of the parameter is "High", the unit is 100 µs.<br>• If the value of the parameter is "Low", the unit is 1 ms.<br>This value corresponds to the measurement of the forward and return channels and thus twice the theoretical runtime that is determined by the Network Analyzer. |

The following formulas must be used to calculate the index/subindex:

$$Index = \frac{Module\ number}{23} + 0x2416$$

$$Subindex = Parameter\ ID + \{[(Module\ number - 1)\ \%\ 23] \times 11\}\ \%\ 254 + 1$$

Module number: Sequential number of the desired module
Parameter ID: See previous table
% Modulo division

Division when calculating the index must be carried out as integer division without a remainder. The module number corresponds to the consecutive numbering of the SafeNODEs connected to the X20 SafeLogic controller. The X20 SafeLogic controller itself corresponds to module number 1, and the SafeNODEs correspond to the following module numbers without gaps. If the SafeNode IDs have no gaps, the SafeNode ID corresponds to the module number. If there are gaps in the SafeNode IDs, however, the associated module number is incremented by 1 digit without gaps. To ensure that the correct index and subindex have been calculated for a SafeNode, "Parameter ID 0" can be used for checking. The following table shows an example:

| Module | SafeNode ID | Module number | Index to be read | Subindex to be read |
|---|---|---|---|---|
| X20 SafeLogic controller | 1 | 1 | 0x2416 | 1 to 4 |
| SafeNode | 10 | 2 | 0x2416 | 12 to 15 |
| SafeNode | 15 | 3 | 0x2416 | 23 to 26 |
| ... | ... | ... | ... | ... |
| SafeNode | 40 | 23 | 0x2416 | 253 to 246 |
| SafeNode | 50 | 24 | 0x2417 | 1 to 4 |
| SafeNode | 60 | 25 | 0x2417 | 12 to 15 |

For additional module-specific information, see "X20(c)SL81xx" on page 25.

### 8.4.3.1 Power supply module (X20SL8101 only) - Channel list

A power supply module is already integrated in station 1 on the X2X Link network.

| Channel name | Access via Automation Studio | Access via SafeDESIGNER | Data type | Description |
|---|---|---|---|---|
| ModuleOk | Read | - | BOOL | Indicates whether the module is physically present in the slot and configured |
| ModuleID | Read | - | UINT | Module ID |
| HardwareVariant | Read | - | UINT | Hardware variant |
| FirmwareVersion | Read | - | UINT | Firmware version of the module |
| StatusInput01 | Read | - | BOOL | Warning for overcurrent (>2.3 A) or undervoltage (<4.7 V) |
| StatusInput02 | Read | - | BOOL | I/O power supply below the warning limit of 20.4 V |
| SupplyCurrent | Read | - | USINT | Bus supply current with a resolution of 0.1 A |
| SupplyVoltage | Read | - | USINT | Bus supply voltage with a resolution of 0.1 V |

For additional module-specific information, see "X20(c)SL81xx" on page 25.

## 8.5 Minimum cycle time

The minimum cycle time specifies the time up to which the bus cycle can be reduced without communication errors occurring.

| Minimum cycle time |
|---|
| 200 µs |

## 8.6 I/O update time

The time needed by the module to generate a sample is specified by the I/O update time.

| Module group / Module [2] | | Maximum I/O update time | |
|---|---|---|---|
| | | For input channels | For output channels |
| X20SIx1x0 | X20SI2100, X20SI4100, X20SI4110, X20SI8110 | 1750 µs + Filter time [1] | - |
| | X20SI9100 | 3350 µs + Filter time [1] | - |
| X20SO6300 | | - | 2300 µs |
| X20SOx1x0 | | - | 1900 µs |
| X20SOx530 | X20SO2530 | - | 2000 µs + 50 ms |
| | X20SO6530 | - | 800 µs + 20 ms |
| X20SC0xxx | | 1750 µs + Filter time [1] | 1900 µs |
| X20SC2212 | | 2150 µs + Filter time [1] | 2300 µs |
| X20SC2432 | | 2150 µs + Filter time [1] | 2000 µs + 50 ms |
| X20SLXxxx-1 | | 1750 µs + Filter time [1] | 1900 µs |
| X20SLXxxx | X20SLX402, X20SLX806, X20SLX842, X20SLX811 | 1750 µs + Filter time [1] | 1900 µs |
| | X20SLX210, X20SLX410, X20SLX910 | 3350 µs + Filter time [1] | 1900 µs |
| X20SP1130 | | - | 1600 µs |
| X20SA4430 | | The I/O update time depends on the configured filter in the safety application. See table. | - |
| X20ST4492 | | The I/O update time depends on the configured filter in the safety application. See table. | - |
| X20SD1207 | | The I/O update time depends on the configured filter in the safety application. See table. | - |
| X67SI8103 | | 2150 µs + Filter time [1] | - |
| X67SC4122.L12 | | 2150 µs + Filter time [1] | 2300 µs |

1) For details, see section "Filter".
2) Also applies to coated modules, if available.

### X20(c)SA4430 - Maximum I/O update time for input channels

The time needed by the module to generate a sample is specified by the I/O update time.

| Set filter | Maximum I/O update time |
|---|---|
| 1 ms | 17 ms |
| 2 ms | 19 ms |
| 10 ms | 35 ms |
| 16.7 ms | 50 ms |
| 20 ms | 55 ms |
| 33.3 ms | 82 ms |
| 40 ms | 95 ms |
| 66.7 ms | 122 ms |

### X20ST4492 - Maximum I/O update time for input channels

The time needed by the module to generate a sample is specified by the I/O update time.

| Set filter | Maximum I/O update time |
|---|---|
| 1 ms | 32 ms |
| 2 ms | 40 ms |
| 10 ms | 86 ms |
| 16.7 ms | 132 ms |
| 20 ms | 152 ms |
| 33.3 ms | 240 ms |
| 40 ms | 284 ms |
| 66.7 ms | 372 ms |

## Information:

**The worst-case I/O update time for SafeTemperature_A after switching via TempChannel_Select_A is 256 ms. This is the processing time of the module; the configuration of the networks and query of the AR task must also be taken into account.**

### X20(c)SD1207 - Maximum I/O update time for input channels

The time needed by the module to generate a sample is specified by the I/O update time. This depends on the "Time base" set in SafeDesigner(+).

| Time base | I/O update time | Maximum I/O update time - Function modes A-A and A-B | Maximum I/O update time - Function mode A-A/-B-B/ |
|---|---|---|---|
| 10 ms | 2 ms | 12 ms | 22 ms |
| 20 ms | 2 ms | 22 ms | 42 ms |
| 50 ms | 2 ms | 52 ms | 102 ms |
| 100 ms | 2 ms | 102 ms | 202 ms |
| 200 ms | 2 ms | 202 ms | 402 ms |
| 500 ms | 5 ms | 505 ms | 1005 ms |
| 1000 ms | 10 ms | 1010 ms | 2010 ms |
| 2000 ms | 20 ms | 2020 ms | 4020 ms |
| 5000 ms | 50 ms | 5050 ms | 10.05 s |
| 10 s | 0.1 s | 10.1 s | 20.1 s |
| 20 s | 0.2 s | 20.2 s | 40.2 s |
| 50 s | 0.5 s | 50.5 s | 100.5 s |
| 100 s | 1 s | 101 s | 201 s |

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**Configuring parameter "Time base" lengthens the safety response time!**

**The correct application must be observed.**

# 9 SafeIO

## 9.1 Wiring errors

The wiring errors described in section "Error detection" are indicated by the red channel LED according to the application.

If a module detects an error, then:

- The channel LED is lit constantly red.
- The status signal (e.g. (Safe)InputOK, (Safe)OutputOK, etc.) is set to (SAFE)FALSE.
- The safe channel (e.g. "SafeDigitalInputxx", "SafeDigitalOutputxx", etc.) is set to SAFEFALSE.
- An entry is generated in the logbook.

### Danger!

**Recognizable errors (see chapter "Error detection" of the corresponding module function) are detected by the module within the error detection time. Errors not recognized by the module (or not recognized on time) that can result in safety-critical states must be detected using additional measures.**

### Danger!

**It is your responsibility to ensure that all necessary repair measures are initiated after an error occurs since subsequent errors can result in a hazard!**

## 9.2 Restart behavior

Digital input channels may not be equipped with an internal error interlock (see type), which means that the associated channel data reverts back to the proper state automatically after an error situation on the module and/or network.
It is the responsibility of the user to connect the channel data of the safe input channels correctly and to provide them with a restart interlock. The restart interlocks of PLCopen function blocks can be used here, for example.
Using input channels without a correctly connected restart interlock can result in an automatic restart.

All other channel types are equipped with an internal error interlock, i.e. to switch on the channel after error situations on the module and/or network.
The following sequence is required in this order:

- Correct all module, channel or communication errors.
- Acknowledge the error with a rising edge on the release channel.
- For digital output modules: Enable the output as described in section "Error interlock - State diagram".

This sequence is necessary in the following situations:

- After switching on
- After correcting an error on the safe communication channel
- After correcting a channel error

For switching the release signal, the notes for manual reset function in ISO 13849-1:2023 must be observed.

## 9.3 Safe analog inputs

The analog value taken via the input terminals is converted into measurement voltages, smoothed by the hardware filters and digitized in the subsequent A/D converters.

The filter values configured in the software are applied during digitalization in the A/D converter.

The signals then pass through the 2 stages of digital signal processing.

The safe analog input channels (data type SAFEINT) are formed by the arithmetic mean value of the two individual signals. At this point, also note the information about channel diagnostics.

The validity of analog signals is represented by the associated status signals. These binary status signals (data type SAFEBOOL) must also be evaluated each time the analog signals are used. A binary status signal with state SAFEFALSE indicates an invalid value in the analog signal. In these situations, the analog signal is no longer permitted to be used for safety-related assessments.

To exit an error state, a reset must be carried out. For this to be possible, a valid signal must be received at the analog input for the duration of the I/O update time. The error can then be corrected by a rising edge on signal "SafeReleasexxyy" (type A) or signal "Release" (type B).

### Danger!

**Possible failure of safety function**
**Dangerous system behavior due to incorrect use of analog signal values**

**When using analog signal values, note the information listed regarding the functionality, accuracy and validity of the data.**

#### Type A

The safe analog input module is suitable for safely acquiring current signals for safety-related applications up to PL e or SIL 3.

An optional sensor power supply is available to provide power to the sensors. Current measurement protects the module-internal sensor power supply against overload.

#### Type B

The safe analog input module is suitable for safely acquiring current or voltage signals for safety-related applications up to PL d or SIL 2.

#### Overview of types supported by the system

The following table provides a rough overview of which input types are supported by which system. For the actual variant of the respective modules, see the linked module overview or corresponding module data sheet.

| | X20 System | X67 System | X90 mobile system |
|---|---|---|---|
| Type A | ✓ | ✗ | ✗ |
| Type B | ✗ | ✗ | ✓ |

### 9.3.1 Safety-related measurement accuracy

The following aspects need to be taken into consideration with regard to the safety-related measurement accuracy of a safe analog input module or temperature module:

- The safety-related accuracy per channel is specified in the technical data.
- The measurement accuracy of a signal is a result of: Safety-related accuracy of the channel + Measurement accuracy of the sensor + Quality of the signal link of the sensor at the measurement point (depends on the installation)
- From a safety standpoint, a channel pair (i.e. signal pair) must always be observed. The measurement accuracy acquired for the signal pair must be taken into consideration when specifying the "Limit threshold equivalent x" parameter. The "Limit threshold equivalent x" parameter must be set as small as possible, but its value should not fall below the functional measurement accuracy.
- From a safety point of view, a guaranteed measurement accuracy per signal pair is the result of:
  ± ("Limit threshold equivalent x" + Measurement accuracy of signal)

## 9.3.2 Connection examples

The typical connection examples in this section only represent a selection of the different wiring methods.

The following must be taken into consideration during installation:

- The line resistance must be added to the module's load.
- Ensure that long lines are laid cleanly.
- All lines must be shielded.
- All lines must be installed in such a way that they are short-circuit proof and voltage-disturbance proof (fault exclusion per EN ISO 13849-2:2012, appendix D.2.4, table D.4).

### 9.3.2.1 Type A input channels

This section only shows variants where the sensor power supply of the module is used. Using an external sensor power supply is also permitted, however. If an external sensor power supply is used, galvanic isolation may also need to be observed (see section Input circuit diagram of the module's data sheet).

For additional module-specific information, see "X20(c)SA4430" on page 27.

#### Channel pair applications with 2 sensors

The following channel pair applications are sufficient to achieve max. PL e (ISO 13849-1:2023), max. SIL 3 (IEC 62061:2021), max. SIL 3 (IEC 61508:2010) or max. SIL 3 (IEC 61511-1:2016/A1:2017).

#### 2-wire connections, 2x SIL 2

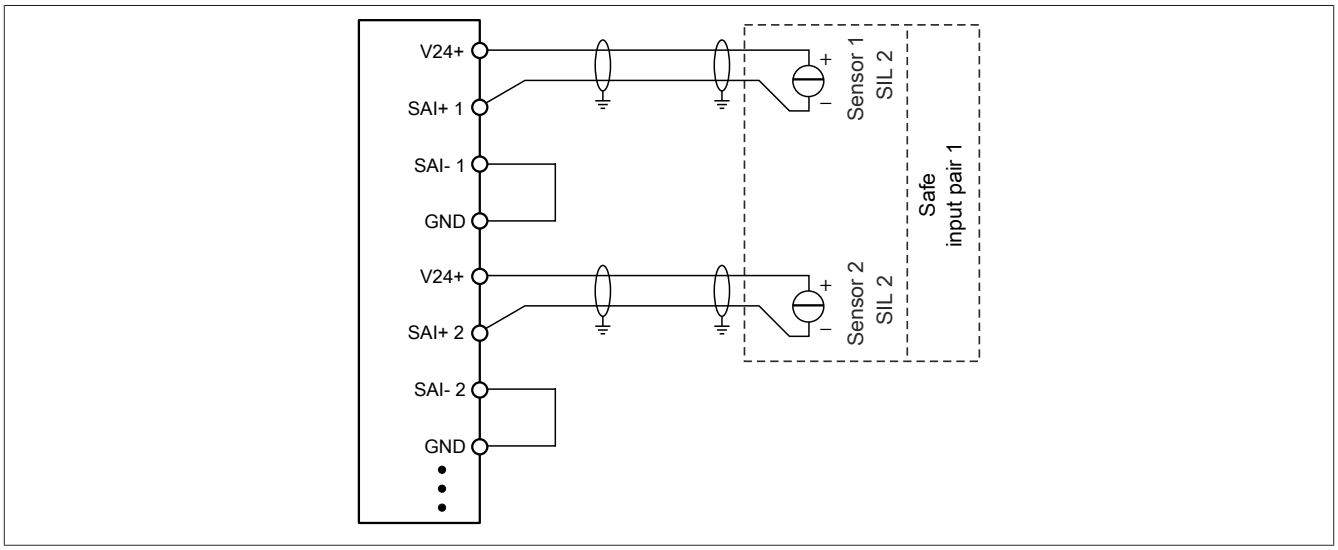



Figure 59: 2-wire connections, 2x SIL 2

### 3-wire connections, 2x SIL 2

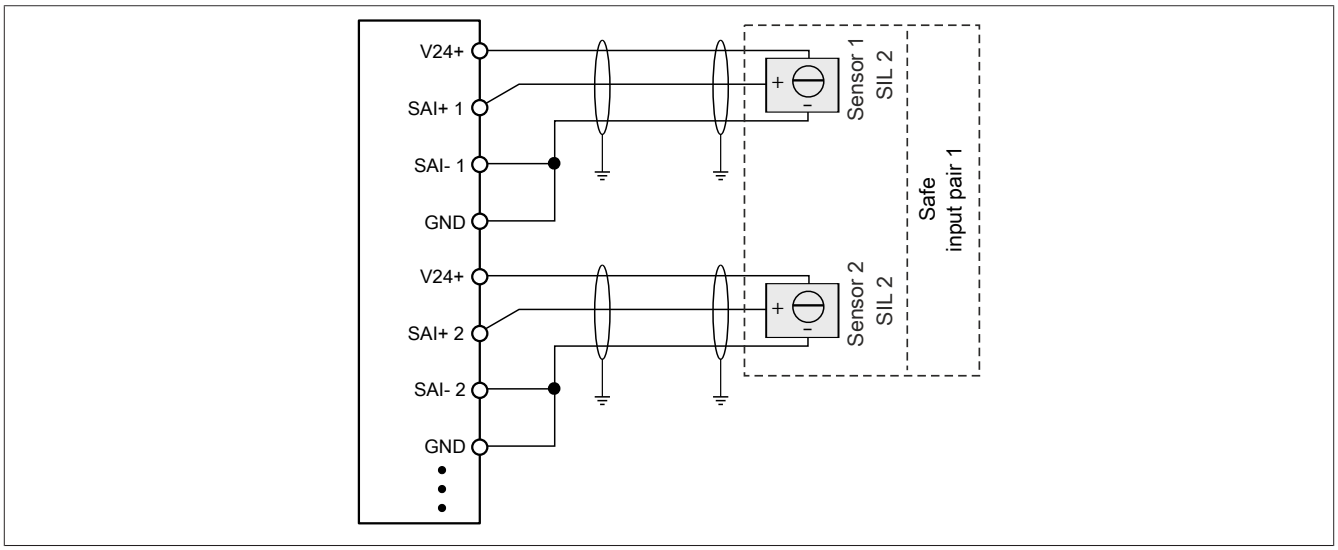



Figure 60: 3-wire connections, 2x SIL 2

### 4-wire connections, 2x SIL 2

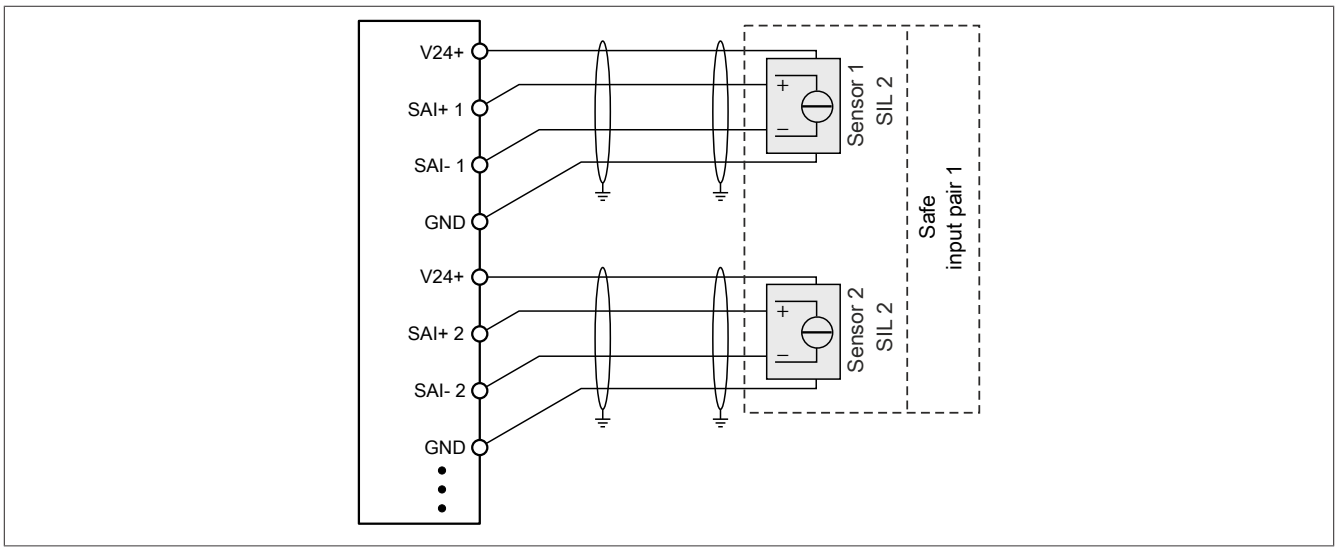



Figure 61: 4-wire connections, 2x SIL 2

For additional module-specific information, see "X20(c)SA4430" on page 27.

### Channel pair applications with only one sensor

The following channel pair applications are sufficient to achieve max. PL e (ISO 13849-1:2023), max. SIL 3 (IEC 62061:2021), max. SIL 3 (IEC 61508:2010) or max. SIL 3 (IEC 61511-1:2016/A1:2017).

#### 2-wire connections, 1x SIL 3

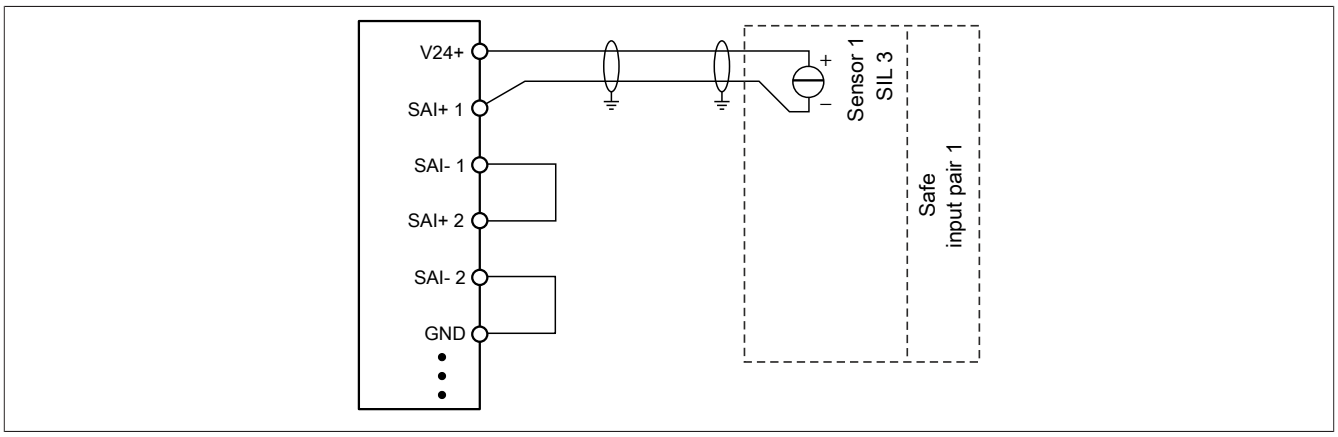



Figure 62: 2-wire connections, 1x SIL 3

#### 3-wire connections, 1x SIL 3

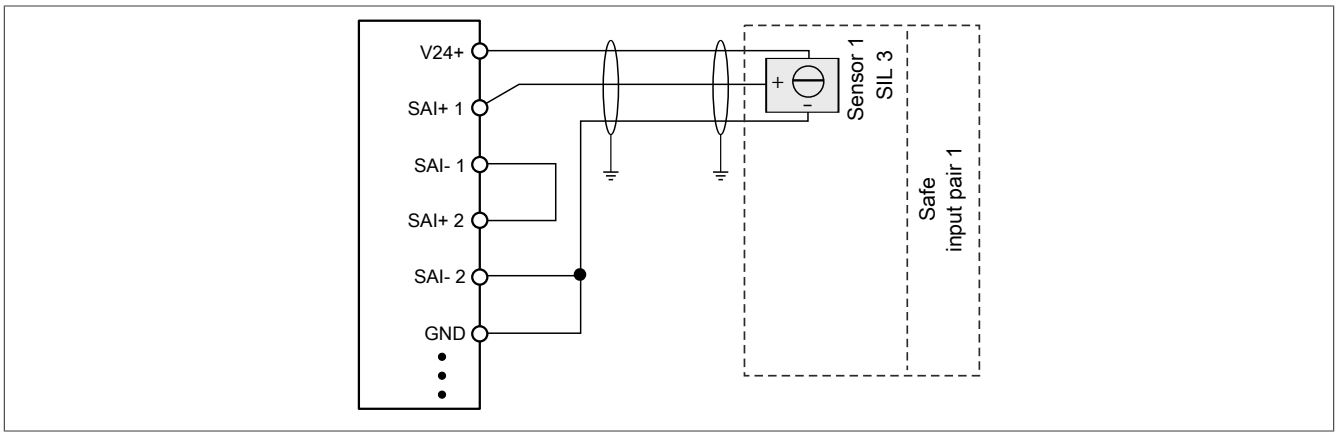



Figure 63: 3-wire connections, 1x SIL 3

#### 4-wire connections, 1x SIL 3

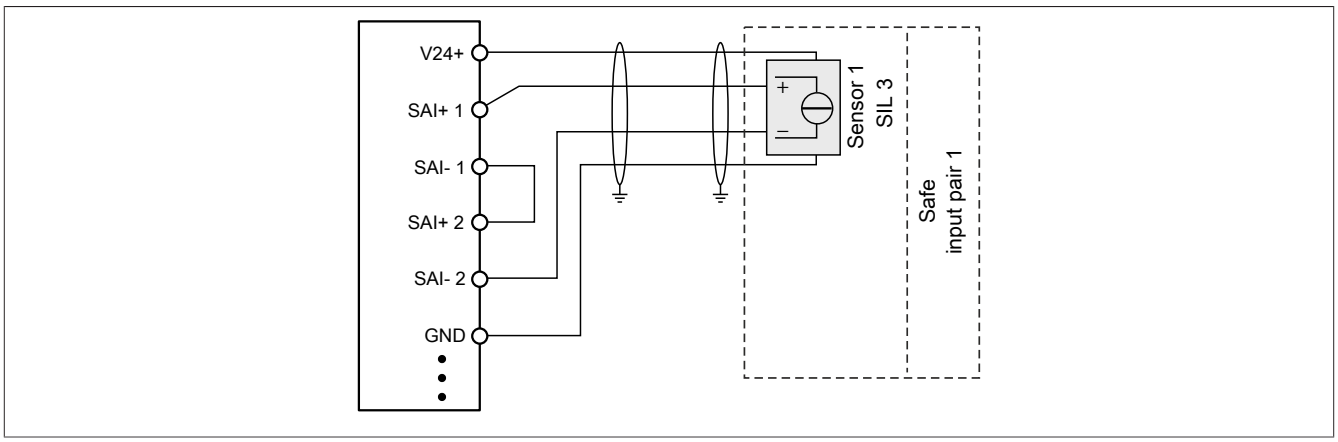



Figure 64: 4-wire connections, 1x SIL 3

For additional module-specific information, see "X20(c)SA4430" on page 27.

### 9.3.2.2 Type B input channels

#### Channel pair applications with 2 sensors

The following channel pair applications are sufficient to achieve max. PL d (ISO 13849-1:2023), max. SIL 2 (IEC 62061:2021), max. SIL 2 (IEC 61508:2010) or max. SIL 2 (IEC 61511-1:2016/A1:2017).

#### 2-wire connections, 2x SIL 2 - Current measurement

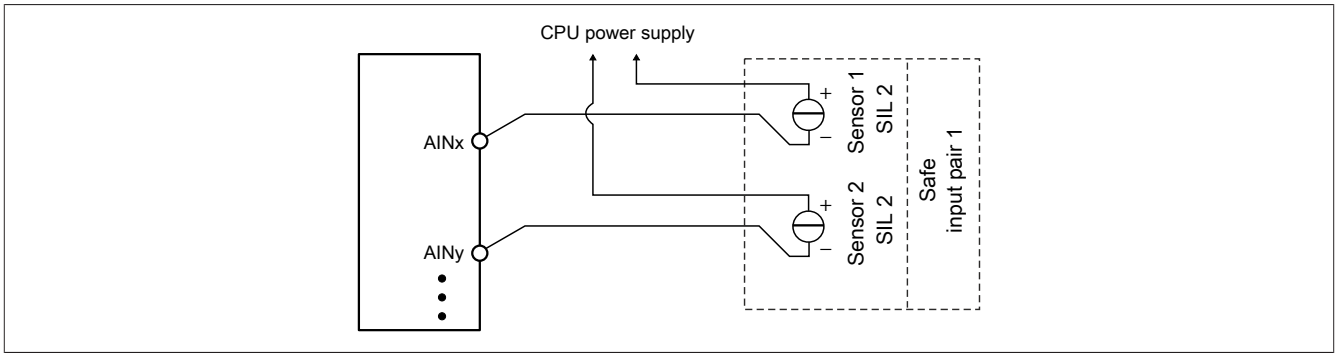



Figure 65: 2-wire connections, 2x SIL 2 - Current measurement

#### 2-wire connections, 2x SIL 2 - Voltage measurement

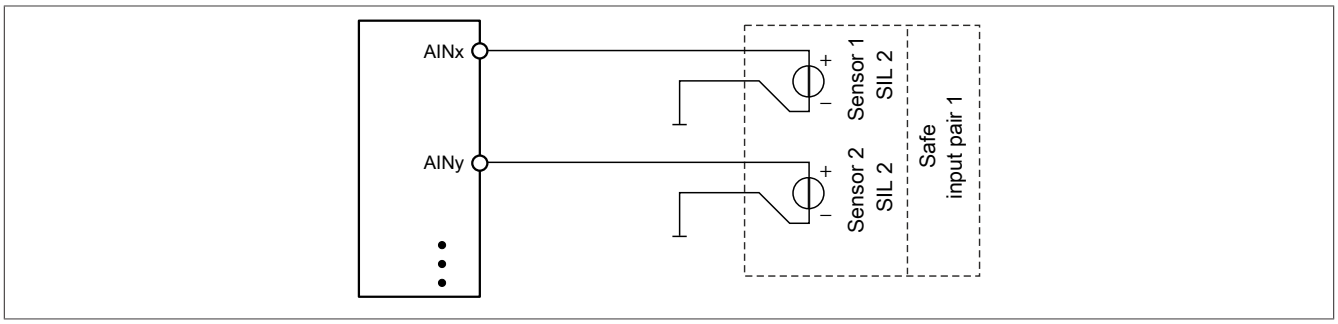



Figure 66: 2-wire connections, 2x SIL 2 - Voltage measurement

#### 2-wire connections, 2x SIL 2 - Safe resistance measurement

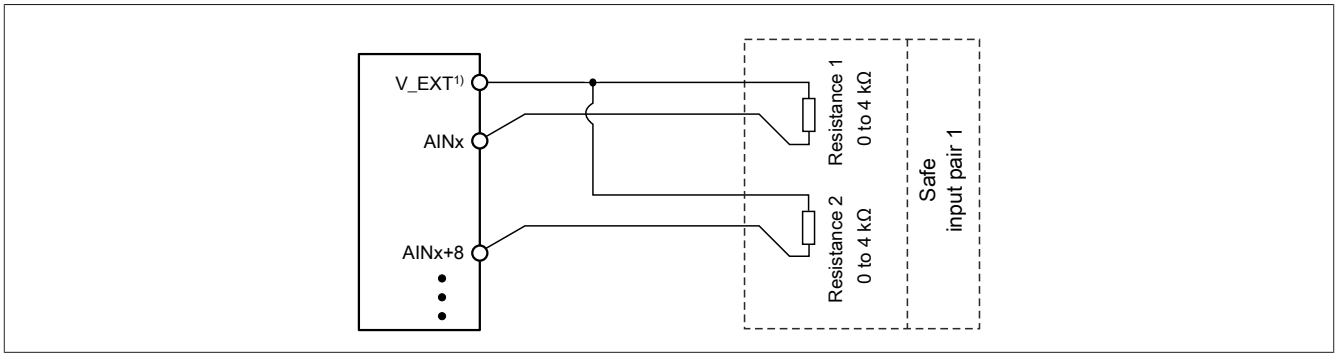



Figure 67: 2-wire connections, 2x SIL 2 - Resistance measurement

1) The sensor power supply must be configured to 10 V.

### 3-wire connections, 2x SIL 2 - Current measurement

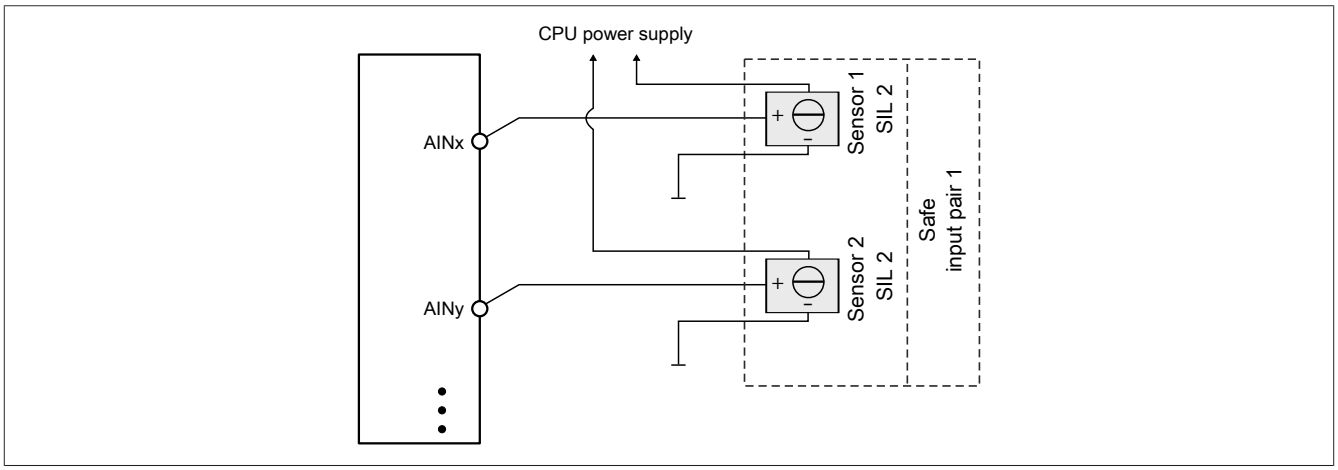



Figure 68: 3-wire connections, 2x SIL 2 - Current measurement

### 3-wire connections, 2x SIL 2 - Voltage measurement

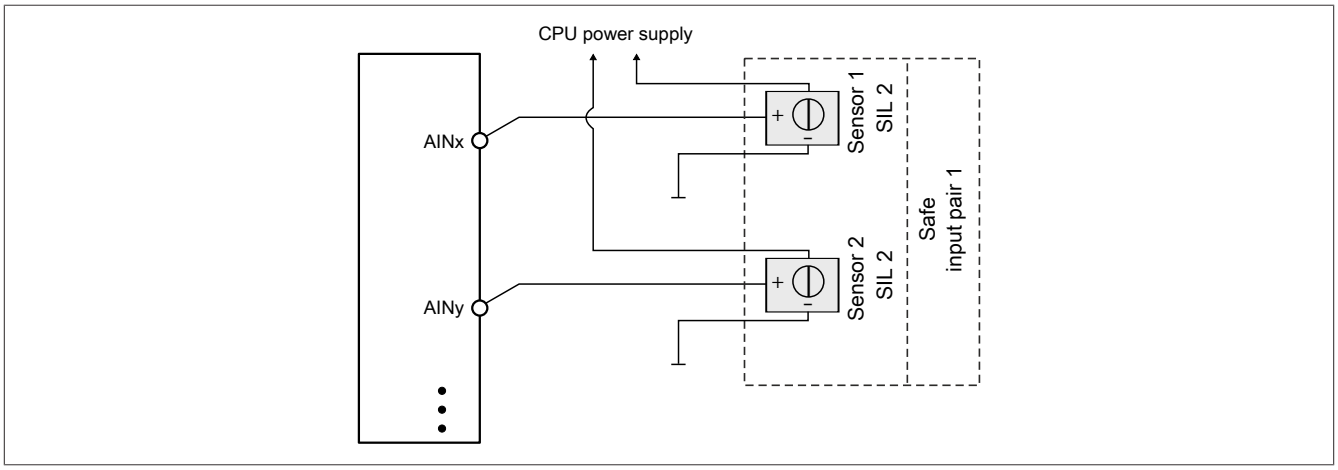



Figure 69: 3-wire connections, 2x SIL 2 - Voltage measurement

## 9.3.3 Error detection

### 9.3.3.1 Type A input channels

The following table applies when using safe current measurement.

| Error | Detection | Comment |
|---|---|---|
| Open circuit | Detected | Channel errors |
| Short circuit between signal lines | May not be detected | The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per EN ISO 13849-2:2012, table D.5. |
| Short circuit between signal and supply line | May not be detected | The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per EN ISO 13849-2:2012, table D.5. |
| Reverse polarity of signal lines | Detected | Module switches to the FAILSAFE state |
| Disturbance voltage | Not detected | This error results in signal distortion that may be detected by dual-channel evaluation in some circumstances.<br>Shielded cables are mandatory for all signal lines.<br>Different installation paths must be used for routing the lines of both signals of the signal pair.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state. |

Table 97: Error detection for safe inputs of type "Current"

For additional module-specific information, see "X20(c)SA4430" on page 27.

### 9.3.3.2 Type B input channels

The following table applies when using safe current or voltage measurement.

| Error | Detection | Comment |
|---|---|---|
| Open circuit | May not be detected | This error results in signal distortion that may be detected by dual-channel evaluation in some circumstances.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state. |
| Short circuit between AIN and external 24 V or GND | May not be detected | The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per EN ISO 13849-2:2012, table D.5. |
| Short circuit between AINx and AINy | May not be detected | This error results in signal distortion that may be detected by dual-channel evaluation in some circumstances.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per EN ISO 13849-2:2012, table D.5. |
| Disturbance voltage | May not be detected | This error results in signal distortion that may be detected by dual-channel evaluation in some circumstances.<br>Different installation paths must be used for routing the lines of both signals of the signal pair.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state. |

Table 98: Error detection for safe inputs of type "Current" or "Voltage"

| Error | Detection | Comment |
|---|---|---|
| Open circuit | Detected | (Dual-)Channel error |
| Short circuit between AIN and external 24 V | Detected | (Dual-)Channel error |
| Short circuit between AINx and AINx+8 | Not detected | The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per table D.5 in EN ISO 13849-2:2012. |
| Disturbance voltage | May not be detected | The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per table D.5 in EN ISO 13849-2:2012. |
| Value change of a resistor | May not be detected | The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per table D.5 in EN ISO 13849-2:2012. |

Table 99: Error detection for safe inputs of type "Resistance"

### 9.3.3.3 Signal errors

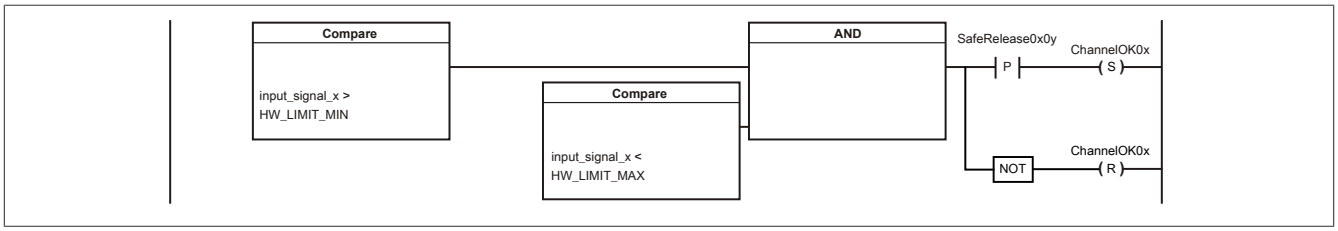
"HW_LIMIT_MIN" designates the lower limit of the measurement range specified in the technical data.
"HW_LIMIT_MAX" designates the upper limit of the measurement range specified in the technical data.

To exit an error state, a reset must be carried out.
For this to be possible, a valid signal must be received at the analog input for the duration of the I/O update time.

The error can then be corrected by a positive edge on signal "SafeReleasexxyy" (type A) or "Release" (type B).

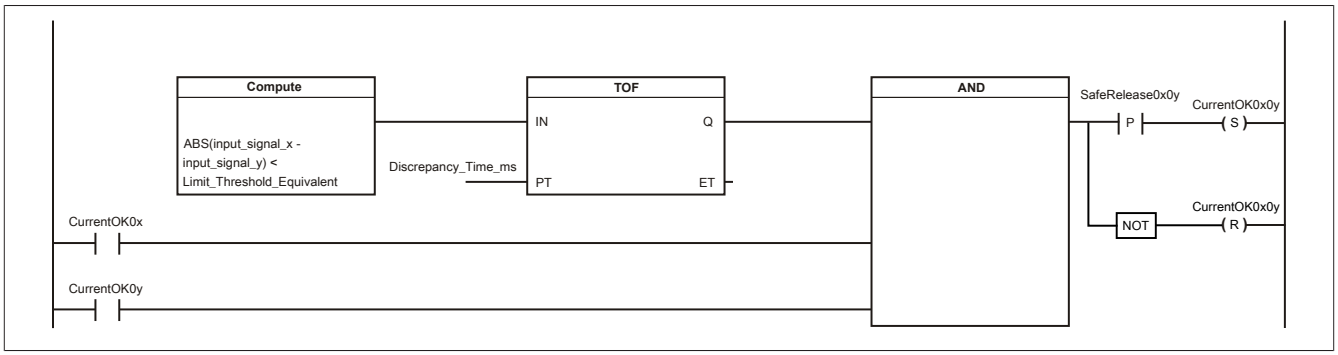
Signal evaluation takes place in 2 stages:

**Stage 1: Evaluation of signals against absolute limits**




**Stage 2: Evaluation of signals against configurable signal pair limits**

Safe inputs - Type A / Type B:



#### 9.3.3.4 Channel diagnostics

Channel electronics are automatically tested within the module. For this purpose, a test signal is applied to each channel within the module. To avoid signal distortion, the signal value of the channel being tested is frozen during this time.

Only one channel is tested at a time. Per IEC 61508:2010, the module is considered a 1oo2D system for the duration of the channel test. The resulting probability of a dangerous state was taken into account in the safety characteristics (see the module's technical data).

The behavior for the duration of channel diagnostics is structured as follows:

The safe analog dual-channel inputs (data type SAFEINT) are formed by the arithmetic mean value of the two individual signals. For the duration of channel diagnostics, however, it is not the arithmetic mean value that is used, but the signal value of the channel that is not currently being diagnosed.

**Type A**

An active channel test is indicated by channel "TestActive". For this purpose, a test signal is applied to each channel within the module once per hour for a maximum time of 1 s.

The sequence for channel diagnostics is independent of the firmware version and structured as follows:

| | Test interval | Test channel |
|---|---|---|
| Diagnostic window 1 | Hourly | SAI1 |
| Diagnostic window 2 | Hourly, 15 min after diagnostic window 1 | SAI3 |
| Diagnostic window 3 | Hourly, 30 min after diagnostic window 1 | SAI4 |
| Diagnostic window 4 | Hourly, 45 min after diagnostic window 1 | SAI2 |

Table 100: Channel diagnostics sequence

In order to meet the stringent requirements of Cat. 4 per ISO 13849-1:2023, the shunts of the channel electronics must be tested (shunt test) despite the multi-channel structure. For a proper shunt test, the slew rate of the input signals must be limited to 220 µA/ms.

For steeper signal edges and parameter configuration "Disable shunt test = No", the module switches to state FAILSAFE if necessary, which affects the entire module. Note that very noisy signal sources or signals with high frequencies likewise result in excessively steep signal edges and can trigger a shunt test error.

**Information:**

**If problems with the slew rate of input signals or shunt test occur, the shunt test can be disabled with parameter "Disable Shunt test = Yes - Warning". In this context, note that the module meets only the requirements of Cat. 3 per ISO 13849-1:2023.**

**Type B**

An active channel test is indicated by channel "ChannelUnderTestxx". The test duration varies between 10 ms and 100 ms and repeats every hour. Therefore, a task in a fast task class (>5 ms) is required to reliably read the channel.

## 9.4 Safe digital outputs

Safe digital outputs are equipped with an error interlock in the event of network errors. Function blocks needed to fulfill additional requirements regarding protection against automatic restart are available in SafeDESIGNER. The outputs can also be controlled by the standard application. The combination of safety-related control and standard control is arranged such that the execution of a cutoff request always has top priority. For diagnostic purposes, the outputs are readable.

**Type A / Type B**

The safe digital output channels can be used for flexible control of actuators in safety-related applications up to PL e or SIL 3.

The outputs are designed using semiconductor technology so that the safety-related characteristics do not depend on the number of switching cycles. In order to handle all situations involving actuators, there are basically 2 different types of output channels: the high-side - low-side variant (type A) and the high-side - high-side variant (type B). Type A outputs have safety-related advantages since the actuator can be cut off in its connection cable in all error scenarios. Type A outputs are limited to actuators without reference potential (e.g. relays, valves). Type B outputs are required for actuators with reference potential (e.g. enable inputs of frequency inverters); the special instructions for wiring must be observed in this case.

Depending on the product, the safe digital output channels are equipped with current measurement for detecting open circuits. This function can also be used to monitor muting lamps, for example.

The testing of the semiconductors that is necessary from a safety point of view results in what are known as OSSD low phases in many products. The effect of this is that when an output is active (high state), a switch-off situation (low state) occurs for a very brief amount of time. The test can be cut off if this behavior results in problems in the application. Observe the associated safety-related notices!

**Type C**

The safe digital output channels can be used for flexible control of actuators in safety-related applications up to PL d or SIL 2.

The outputs are designed using semiconductor technology so that the safety-related characteristics do not depend on the number of switching cycles. These outputs have an upstream relay for shutting down all outputs at once. This relay is enabled during module startup and disabled only in the event of error. Type C outputs are suitable for actuators with reference potential (e.g. enable inputs of frequency inverters) and without reference potential (e.g. relays, valves). The special instructions for wiring must be observed.

The testing of the semiconductors that is necessary from a safety point of view results in what are known as OSSD low phases in many products. The effect of this is that when an output is active (high state), a switch-off situation (low state) occurs for a very brief amount of time.

**Type relay**

The safe relay outputs are suitable for controlling floating actuators in safety-related applications up to PL e or SIL 3.

Safety relays are installed within the module. The positively driven feedback contacts are evaluated within the module. The B10d values are specified in the technical data for the safety-related perspective of the relay contacts. These values apply up to the specified maximum contact service life.

### Type power supply

A type B safe digital output channel (see description above) is integrated in the module for cutting off the I/O power supply of connected X20 modules in safety-related applications up to PL e or SIL 3.

The modules arranged in the X20 potential group must support the "safe cutoff of an X20 potential group" operating principle.

The potential switched with the safe digital output channel is conducted on pins 11 and 21 of the terminal block so that externally connected actuators can be cut off in this way as well. The output is designed using semiconductor technology so that the safety-related characteristics do not depend on the number of operating cycles.

### Overview of types supported by the system

The following table provides a rough overview of which output channel types are supported by which system. For the actual variant of the respective modules, see the linked module overview or corresponding module data sheet.

| | X20 System | X67 System | X90 mobile system |
|---|---|---|---|
| Type A | ✓ | ✓ | ✗ |
| Type B | ✓ | ✓ | ✗ |
| Type C | ✗ | ✗ | ✓ |
| Type relay | ✓ | ✗ | ✓ |
| Type power supply | ✓ | ✗ | ✗ |

## 9.4.1 Enabling principle

Each output channel has an additional standard switching signal that can be used to access the output channel from the standard application. As soon as the output channel has been enabled from a safety-related point of view (the setting of the channel is enabled from the point of view of the safety technology), the output channel can be set or cleared in the standard application independently of the additional runtime and jitter times.

Use of the enabling principle is specified in the I/O configuration in Automation Studio.
Exception: Type C output channels. The enabling principle is always active for these channels.

### 9.4.2 Connection examples

The typical connection examples in this section only represent a selection of the different wiring methods. The user must take error detection into account in each case.

**Information:**

**For details about connection examples (such as circuit examples, compatibility class, max. number of supported channels, terminal assignments, etc.), see section "Using sensors and actuators" in Automation Help.**

#### 9.4.2.1 Type A output channels

**Connecting safety-related actuators**

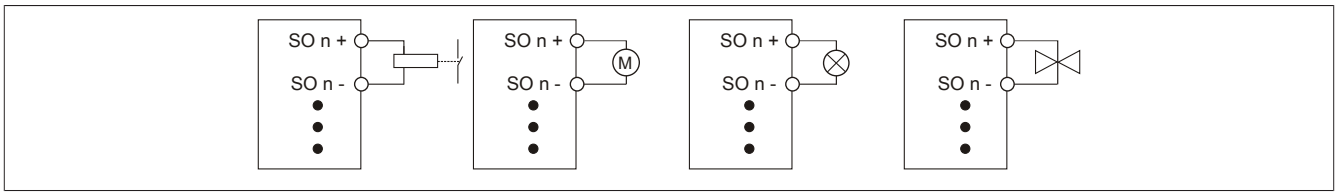



Figure 70: Connecting safety-related actuators

Safety actuators (contactors, motors, muting lamps, valves) that are compatible with module performance data can be connected directly.

With this connection, the module corresponds to category 4 per ISO 13849-1:2023. It is important to note that this statement applies exclusively to the module and not to the wiring shown. It is your responsibility to ensure that the wiring of the actuator are selected according to the required category and conditions of the actuator.

For additional module-specific information, see:

- "X20(c)SOx1x0" on page 15
- "X20SC0xxx" on page 17
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23

#### 9.4.2.2 Type B / Type C output channels

**Connecting safety-related actuators**

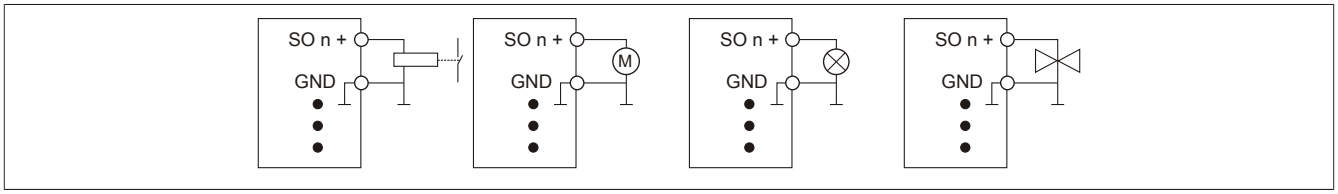



Figure 71: Connecting safety-related actuators

Safety actuators (contactors, motors, muting lamps, valves) that are compatible with module performance data can be connected directly.

The type B output channels in this connection correspond to category 4 per ISO 13849-1:2023. The type C output channels in this connection correspond to category 3 per ISO 13849-1:2023. It is important to note that these statements apply exclusively to the module and not to the wiring shown. It is your responsibility to ensure that the wiring of the actuator are selected according to the required category and conditions of the actuator.

If the actuators contain an inverse diode or electronic components, then the special instructions in section "Module behavior when GND connection is lost" must be followed.

**SafeIO**

For additional module-specific information, see:

### 9.4.2.3 Type relay output channels

#### Connecting safety-related actuators

The connection example shown here only represents a selection of the possible wiring methods. However, the following must always be taken into consideration:

- Two relay channels must be connected in series for applications with categories greater than 1 per ISO 13849-1:2023.
- Relay contacts must be protected with a fuse (see technical data for the module).

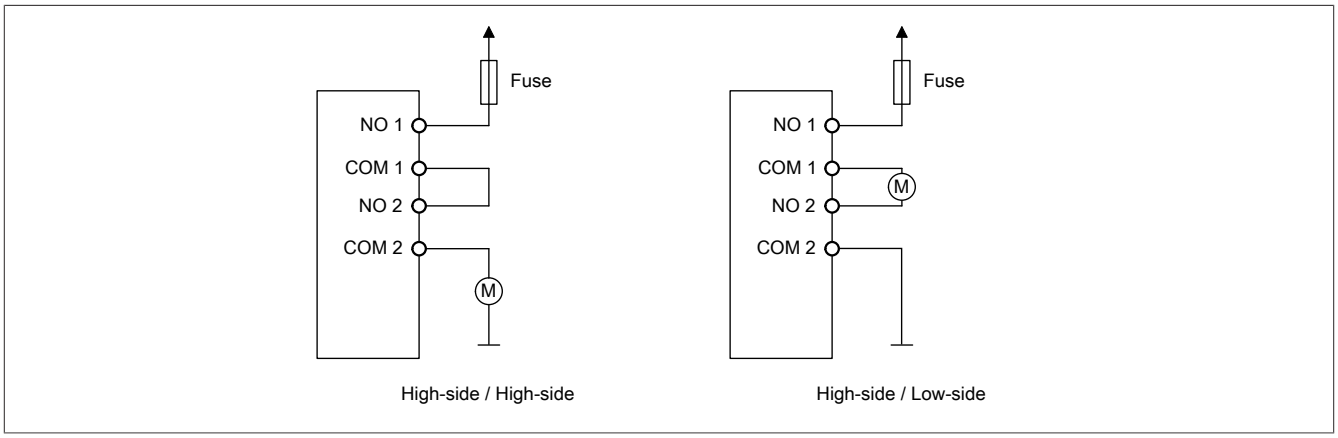



Figure 72: Connecting safety-related actuators

**Danger!**

**This "high-side / low-side" connection variant is only permitted if the GND-switching relay is not bypassed by a protective circuit in the drive (e.g. to ground).**

**Danger!**

**Make sure that a proper protective circuit is used for the relay contacts (see technical data for the module). Also consider that operation outside of the specification is not permitted.**

**Operating outside of the specification or not using a protective circuit can cause the relay contacts to melt simultaneously, resulting in a loss of safety functionality.**

**Danger!**

**To prevent possible faults caused by short circuits to other voltage levels, wiring that protects against short circuits is needed for the actuator connection. The measures referenced in EN ISO 13849-2:2012, appendix D.2.4, table D.4 must be selected.**

**Warning!**

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**The two relay contacts of the two relays must be connected in series for applications greater than category 1 per ISO 13849-1:2023. In this application, signal "SafeDigitalOutputxxyy" must be used to control the two relays.**

**Controlling the two relay contacts using the individual "SafeDigitalOutputxx" signals is not permitted for applications greater than category 1 per ISO 13849-1:2023 since in certain operating states this may result in simultaneously welding of both relay contacts.**

**The correct application must be observed.**

## Information:

**Using signal "SafeDigitalOutputxxyy" and "SafeDigitalOutputxx" at the same time is not permitted and prevented by the system.**

**Using signal "SafeDigitalOutputxxyy" causes a switch-on sequence to be activated that switches on relay 2 with a 20 ms delay. This behavior is necessary to prevent simultaneous melting of the two relay contacts in certain operating states.**
**Release signal "ReleaseOutput" must then be in state "High" for the duration of the switch-on delay so that a rising edge is also detected on the second channel.**
**Controlling two independent ISO 13849-1:2023 Category 1 actuators using signal "SafeDigitalOutputxxyy" must therefore be avoided since this causes delayed activation of the actuator on channel 2.**

For additional module-specific information, see:

- "X20(c)SOx530" on page 16
- "X20(c)SC2432" on page 20

### 9.4.2.4 Electronic actuator connection

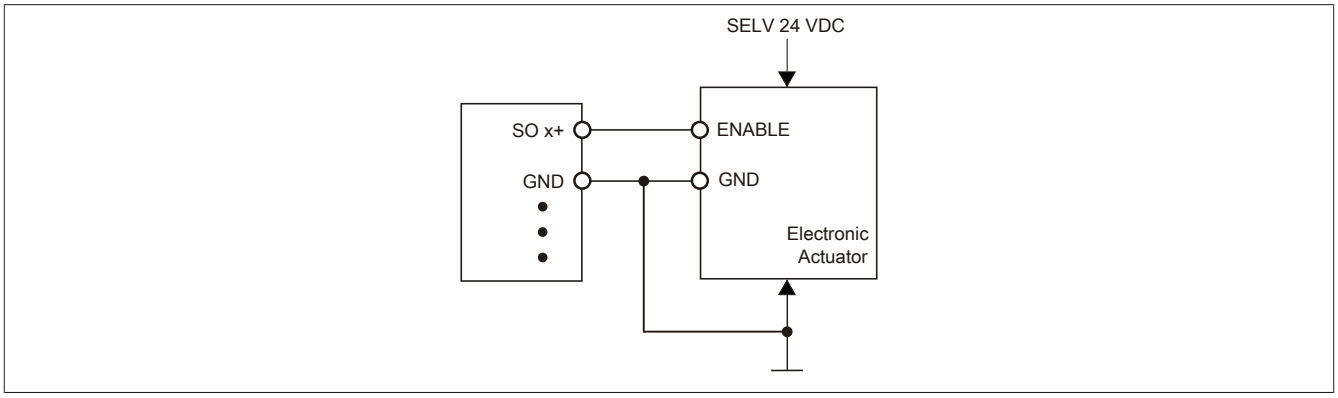



Figure 73: Connecting electronic actuators

The X20SO6300 module can be directly connected with the safe inputs of conventional electronic actuators. To prevent possible faults caused by the loss of the GND connection, additional GND connections must be implemented on the output module as well as on the actuator.

## Danger!

**Due to the "only-plus-switching" design used for the outputs, any short circuits on SOx to high potentials will result in active actuators that cannot be cut off. Make sure that the wiring is correct in order to rule out SOx short circuits to high potentials (see EN ISO 13849-2:2012, annex D.2.4, table D.4).**

## Information:

**For detailed information concerning the safety guidelines and the connection/function of the electronic actuator, see the corresponding user's manuals.**

For additional module-specific information, see "X20(c)SO6300" on page 14.

### 9.4.2.5 ACOPOS / ACOPOSmulti connection

#### X20SO6300

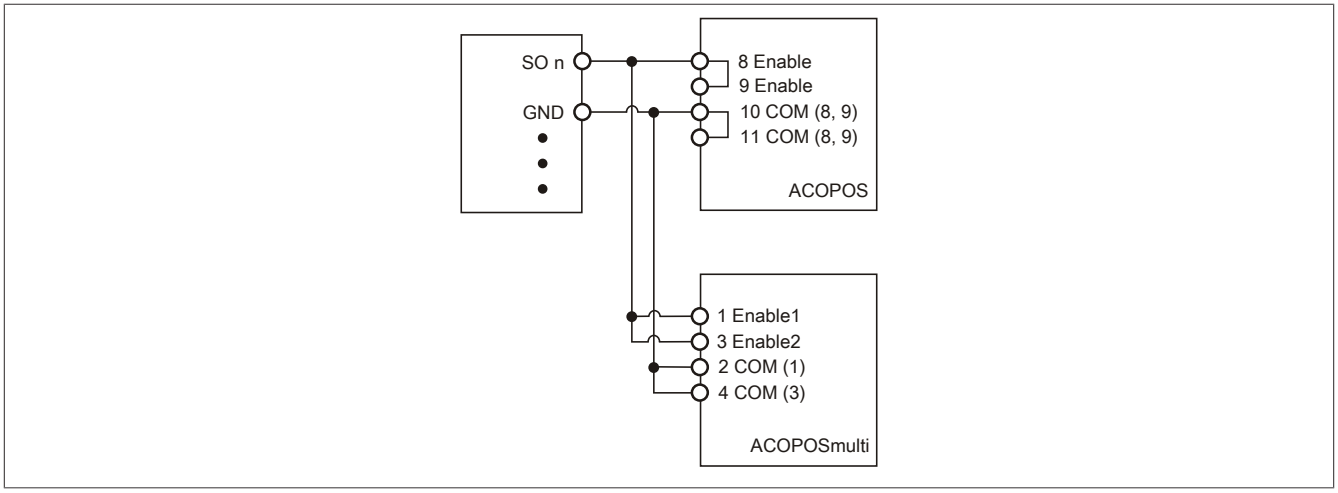



Figure 74: Connecting ACOPOS/ACOPOSmulti

The SO module can be directly connected to the ACOPOS or ACOPOSmulti safe inputs.

With this connection, the module corresponds to category 4 per ISO 13849-1:2023. It is important to note that this statement applies exclusively to the module and not to the ACOPOS or ACOPOSmulti. In this wiring, the ACOPOS corresponds to category 3 according per ISO 13849-1:2023. In this connection, the ACOPOSmulti corresponds to category 4 per ISO 13849-1:2023.

**Information:**

**For detailed information about the connection/function of ACOPOS and ACOPOSmulti drives, see the corresponding user's manuals.**

For additional module-specific information, see "X20(c)SO6300" on page 14.

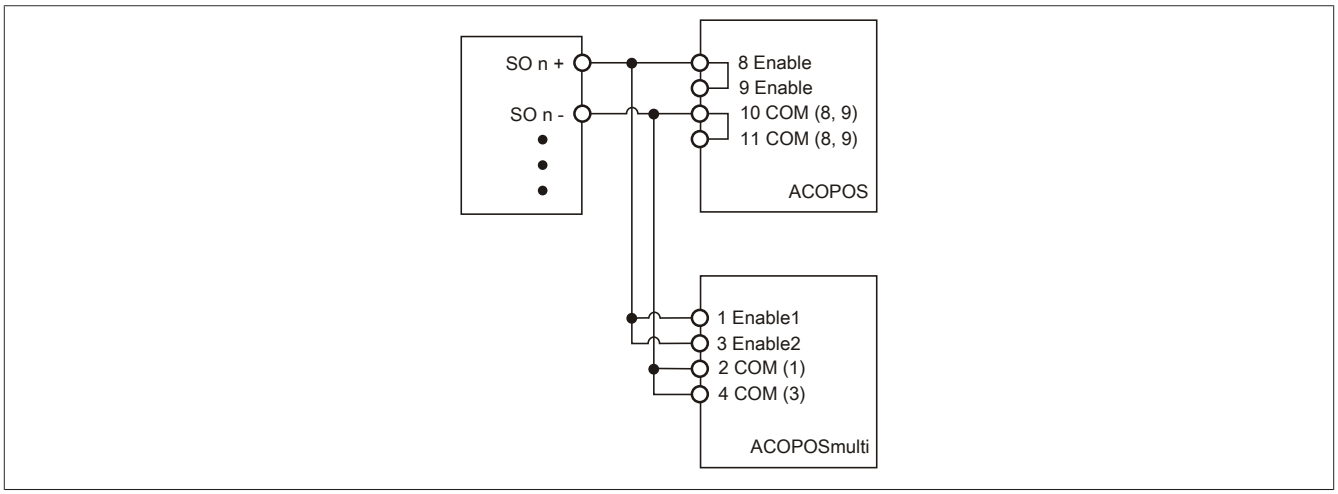



Figure 75: Connecting ACOPOS/ACOPOSmulti

The SO module can be directly connected to the ACOPOS or ACOPOSmulti safe inputs.

With this connection, the module corresponds to category 4 per ISO 13849-1:2023. It is important to note that this statement applies exclusively to the module and not to the ACOPOS or ACOPOSmulti. In this wiring, the ACOPOS corresponds to category 3 according per ISO 13849-1:2023. In this connection, the ACOPOS-multi corresponds to category 4 per ISO 13849-1:2023.

## Information:

**When connecting the SO module to the ACOPOS drive, the module-internal test of the output circuit must be disabled using module parameter "Disable OSSD = Yes - Warning"; otherwise, the OSSD gaps may cause the ACOPOS drive to switch off unintentionally.**

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**Configuring "Disable OSSD = Yes - Warning" greatly reduces the internal error detection of the module.**
**Subsequently, the information listed in chapter section "Detecting module-internal errors" in Automation Help must be observed.**

**The correct use and necessary tests of the safety function must be observed.**

## Information:

**For detailed information about the connection/function of ACOPOS and ACOPOSmulti drives, see the corresponding user's manuals.**

For additional module-specific information, see "X20(c)SOx1x0" on page 15.

### 9.4.3 Module behavior when GND connection is lost

In this section and all of its subsections, the term "connection element" is understood as follows for the respective system (X20, X67, X90 mobile):

- X20: e.g. terminal block
- X67: e.g. M12, M8
- X90: CMC header

A loss of GND on the module may cause current to flow from the module via the output or the GND connection of the connection element.

If power supply units, actuators or GND connections are grounded, the user must ensure that no grounding lines or any associated potential short circuits or open circuits will cause any additional impermissible GND connections.

The two currents $I_{OUT}$ and $I_{GND}$ are module-specific and must be taken from the technical data.

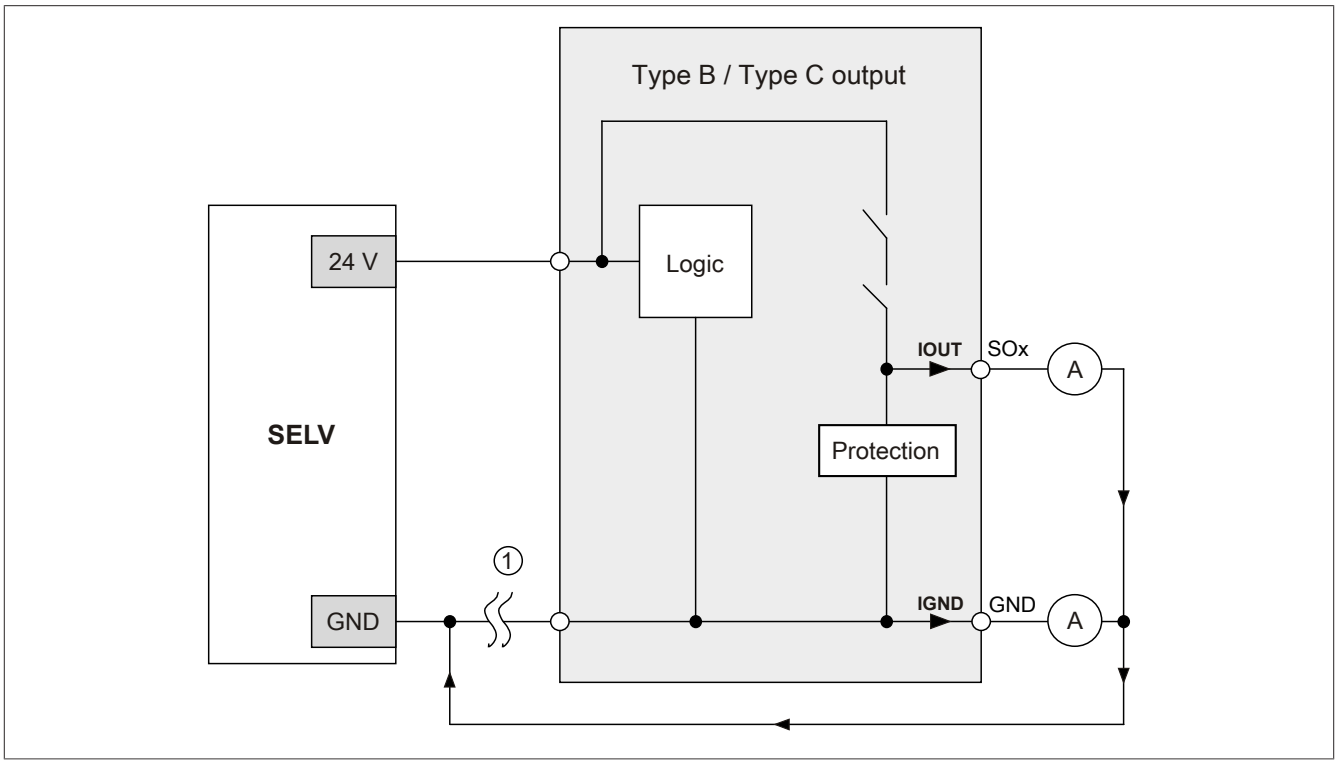



Figure 76: Module behavior when GND connection is lost

**Danger!**

**The user is responsible for preventing any safety problems that could occur as a result of the $I_{OUT}$ and $I_{GND}$ currents specified in the technical data and the selected method of installation.**

For additional module-specific information, see:


- "X20(c)SO6300" on page 14
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X20SP1130" on page 26
- "X67SC4122.L12" on page 31

### 9.4.3.1 GND feedback to connection element, no external GND

If the module is used in the following wiring mode, then a loss of GND will not cause any problems because current is not able to flow via $I_{OUT}$ or $I_{GND}$.

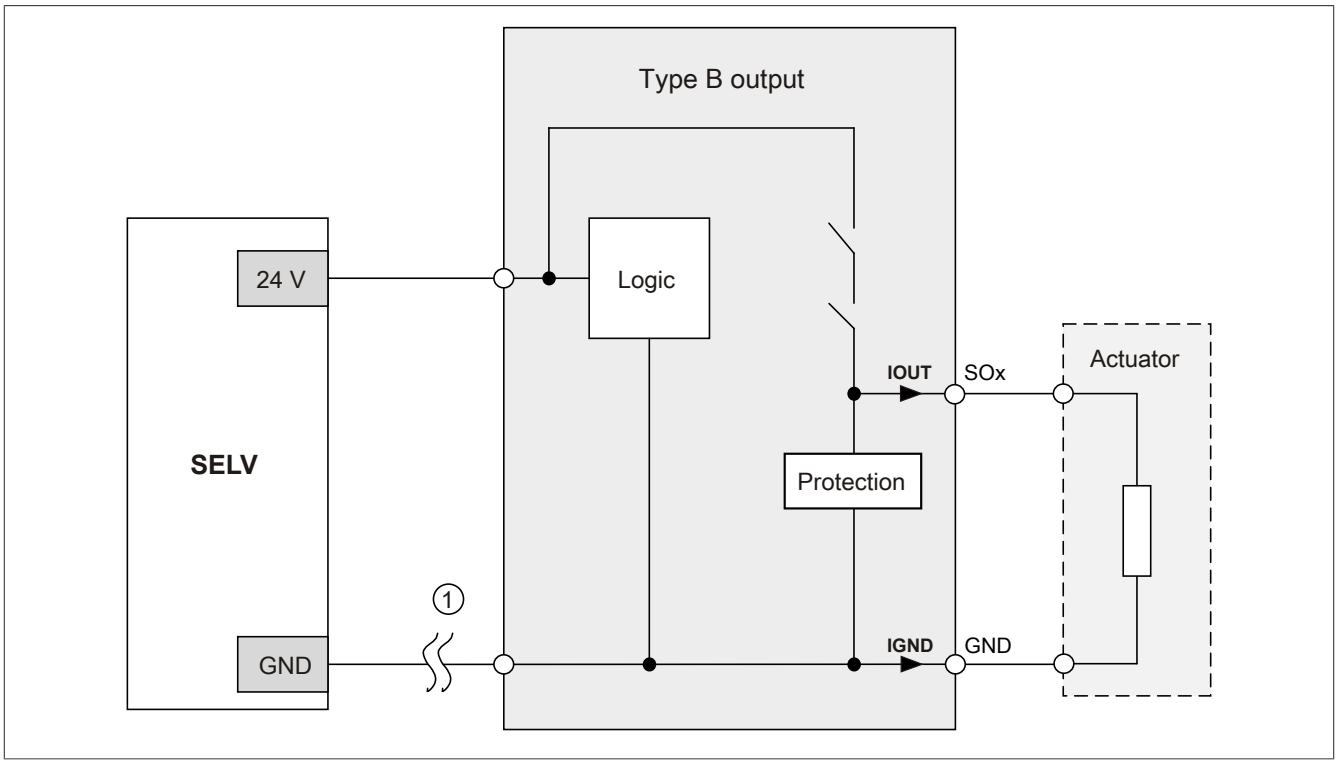



Figure 77: GND feedback to connection element

## Danger!

**Other wiring methods**

**If another wiring method is used, the user must ensure that a safety-critical state cannot occur if there are 2 external faults (open circuit, etc.). In addition, the current specifications for $I_{OUT}$ and $I_{GND}$ must be taken into account in the event that the GND connection is lost.**

### 9.4.3.2 Using external GND without GND from connection element

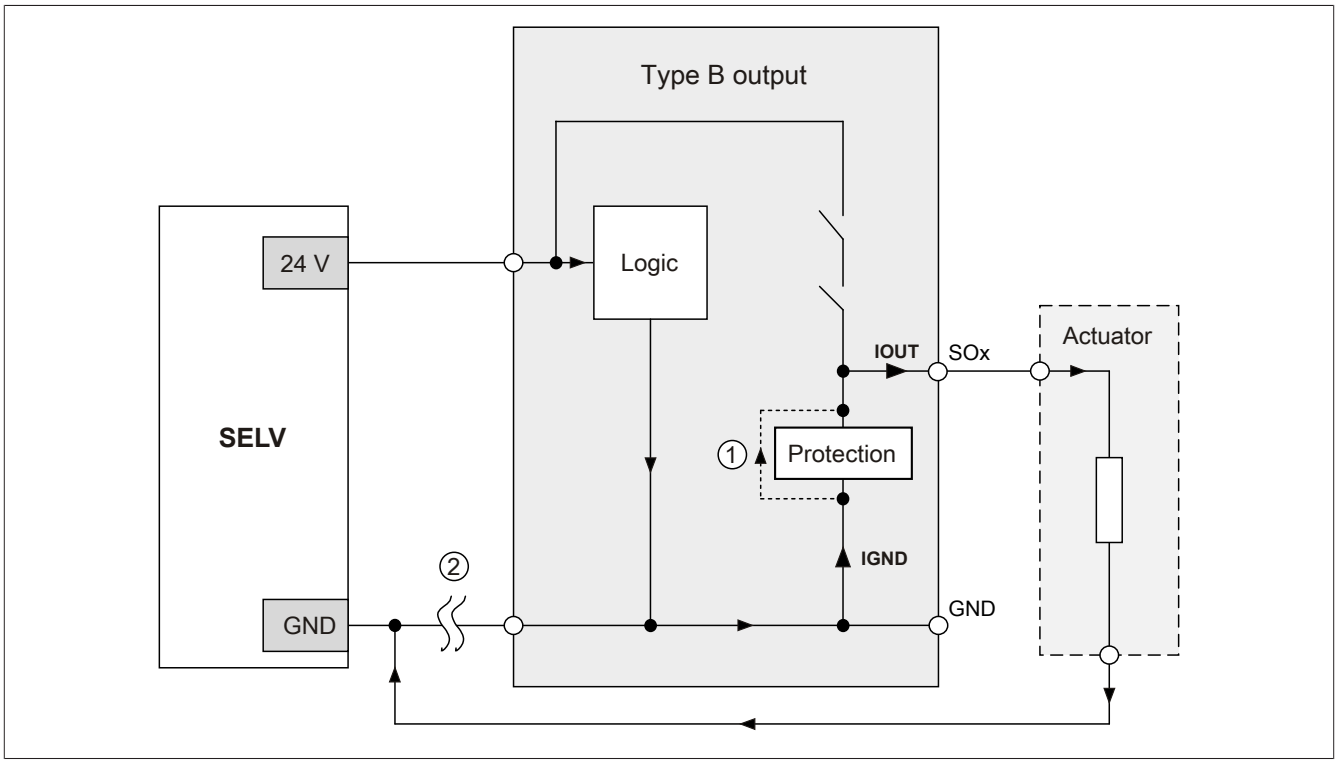



Figure 78: External GND only

**Fault sequence:**

- Fault ① (defective protective component):
  A component connected to GND on the output short circuits or behaves like an ohmic resistor. This fault is not always detected.
- Fault ② (open circuit on module GND):
  The module loses its direct connection to GND and current begins to flow through the defective protective component → $I_{GND}$ → actuator.
  As a result, current above the maximum value permitted by the module is supplied to the actuator!

**Danger!**

**This type of installation can cause hazardous situations and is therefore NOT permitted.**

### 9.4.3.3 Using external GND and GND from connection element

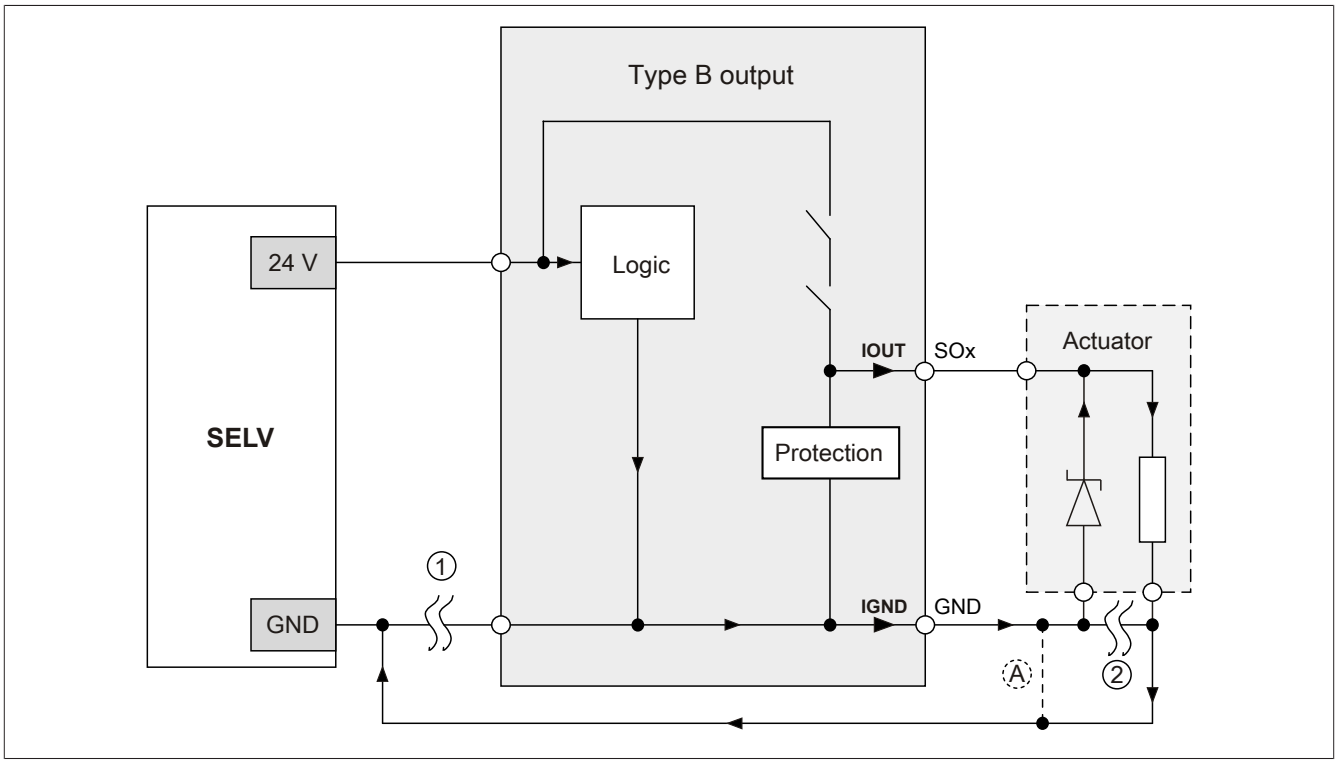



Figure 79: Possible connection error

**Fault sequence:**

- Fault ① (open circuit on module GND):
  No error is detected and the module continues to operate normally due to the additional external GND connection.
- Fault ② (open circuit on actuator's protective circuit):
  The module loses its direct connection to GND and current begins to flow through $I_{GND}$ → damping diode → actuator.
  As a result, current above the maximum value permitted by the module is supplied to the actuator!

## Danger!

**This type of installation can cause hazardous situations and is therefore NOT permitted.**

**Possible workaround**

This wiring method could be made possible, for example, by using two lines to complete the connection that experienced the open-circuit fault in ② → see connection Ⓐ.

## Information:

**The diode in the actuator shown in the "Possible connection error" image is intended only to illustrate the error and is not mandatory.**

### 9.4.3.4 Power supply module with permissible modules and external GND

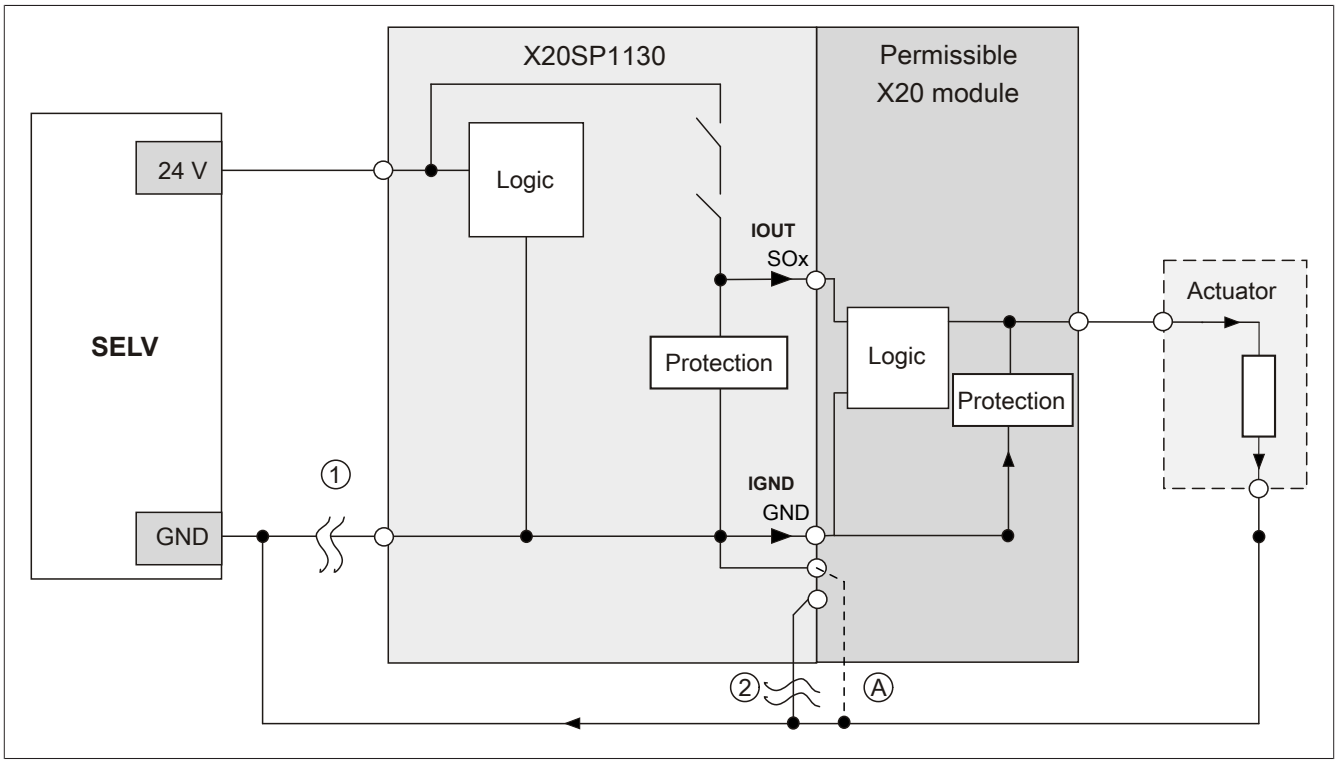



Figure 80: Power supply module - Possible connection error

If the permissible module is wired without external GND, then current will not flow on the safe power supply module if the GND connection is lost. However, if an external GND connection is used, then current $I_{GND}$ could flow in the following scenarios:

**Fault sequence:**

- Fault ①: GND loss on safe power supply module
- Fault ②: GND loss of feedback to the terminal block of the safe power supply module

**Danger!**

**This type of installation can cause hazardous situations and is therefore NOT permitted.**

**Possible workaround**

This wiring method could be made possible, for example, by using two lines to complete the connection that experienced the open-circuit fault in ② → see connection Ⓐ.

### 9.4.3.5 Multiple feedback of the module GND

If the module is used in the following wiring mode, then a loss of GND will not cause any problems because current is not able to flow via $I_{OUT}$ or $I_{GND}$.

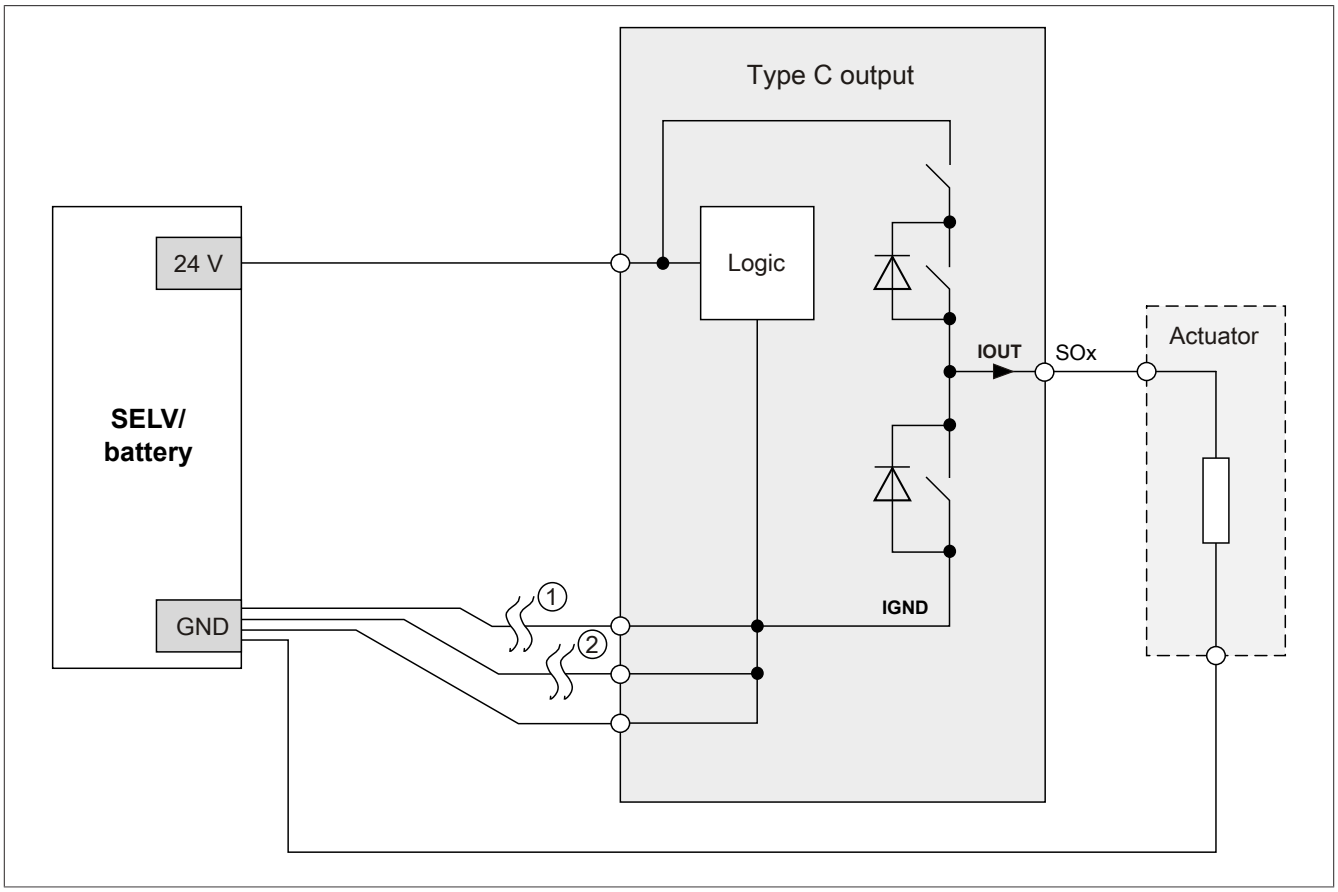



Figure 81: Multiple feedback of the module GND

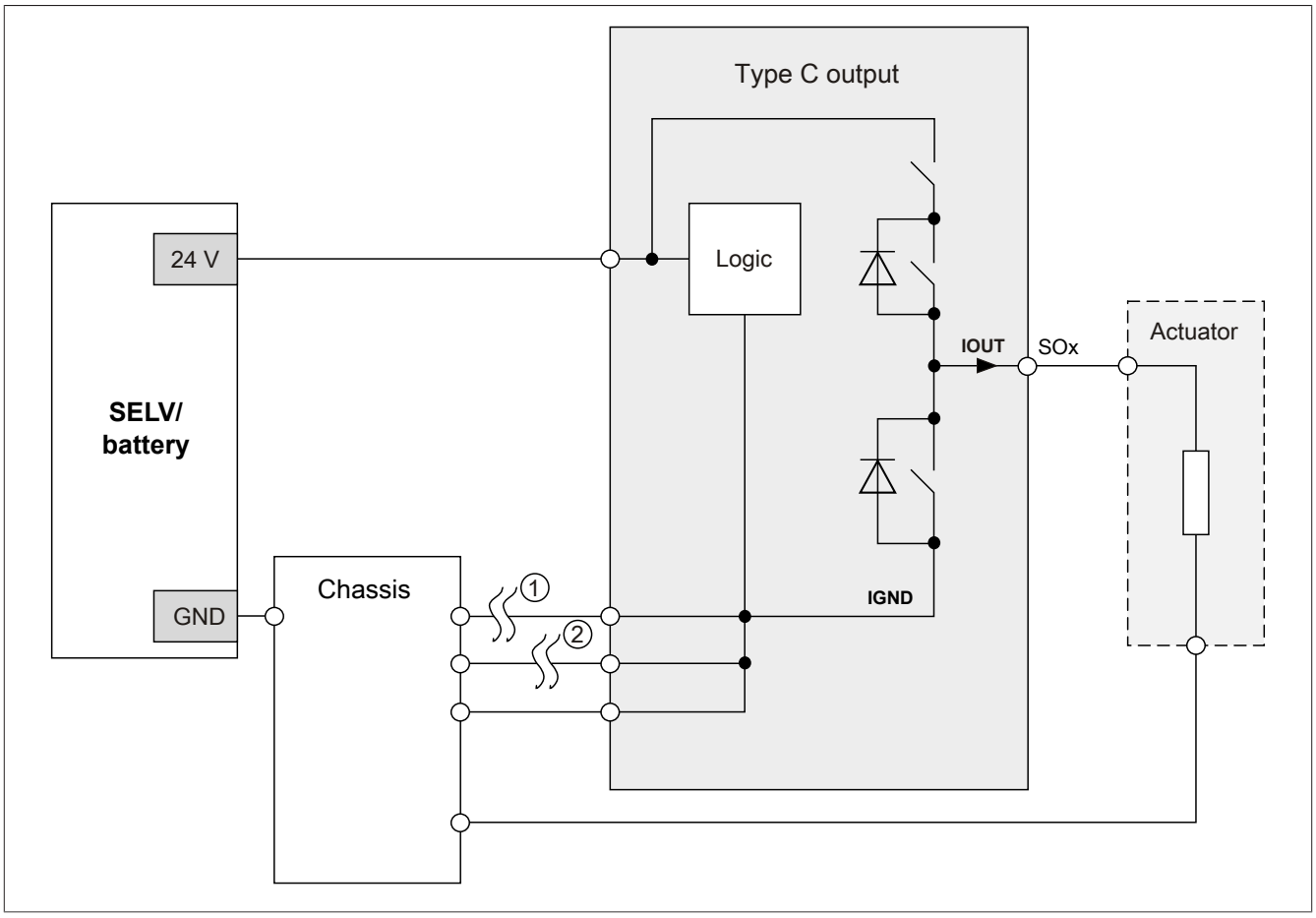



Figure 82: Multiple feedback of the module GND via the module chassis

## Danger!

**Other wiring methods**

**If another wiring method is used, the user must ensure that a safety-critical state cannot occur if there are 2 external faults (open circuit, etc.). In addition, the current specifications for $I_{OUT}$ and $I_{GND}$ must be taken into account in the event that the GND connection is lost.**

## Danger!

**At least 3 GND connections must be individually connected to GND. It must be ruled out that a single fault can cause several GND lines to loosen.**

### 9.4.3.6 Single feedback of the module GND

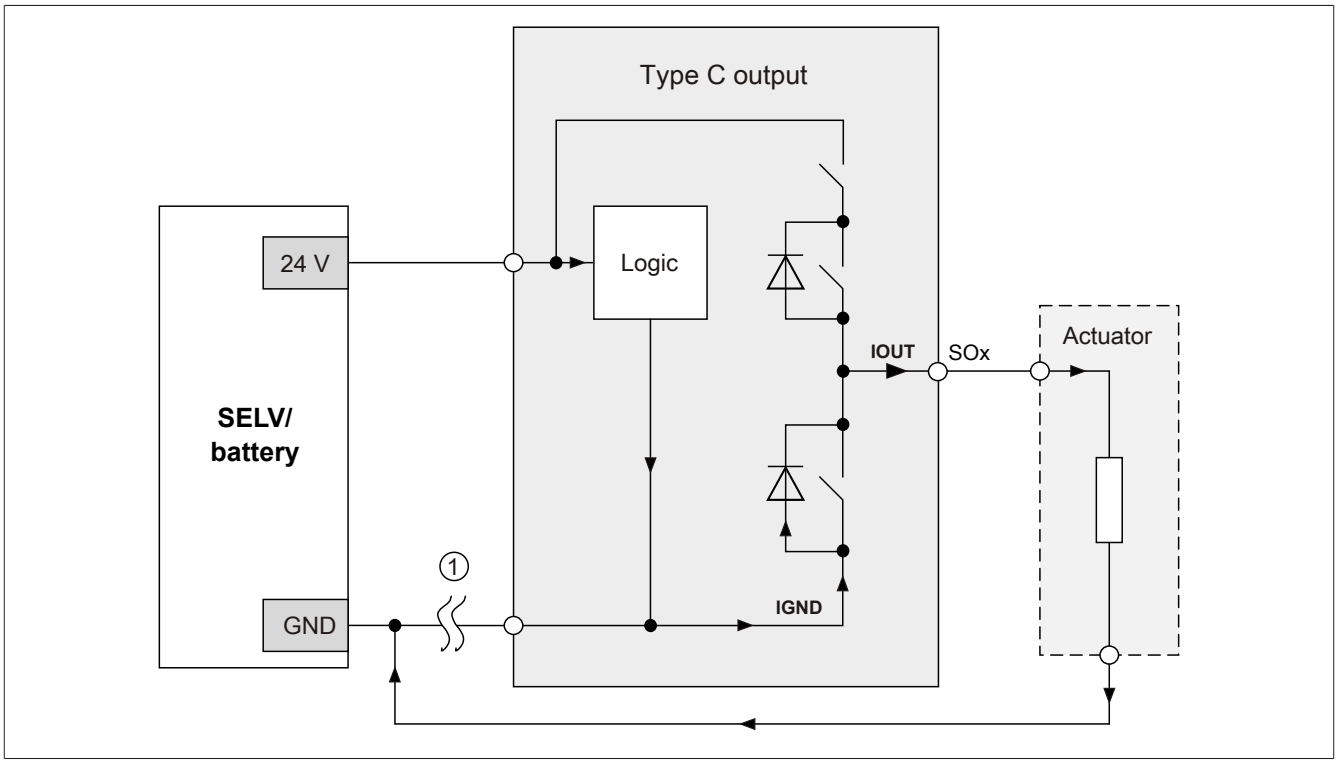



Figure 83: Possible connection error - Example 1

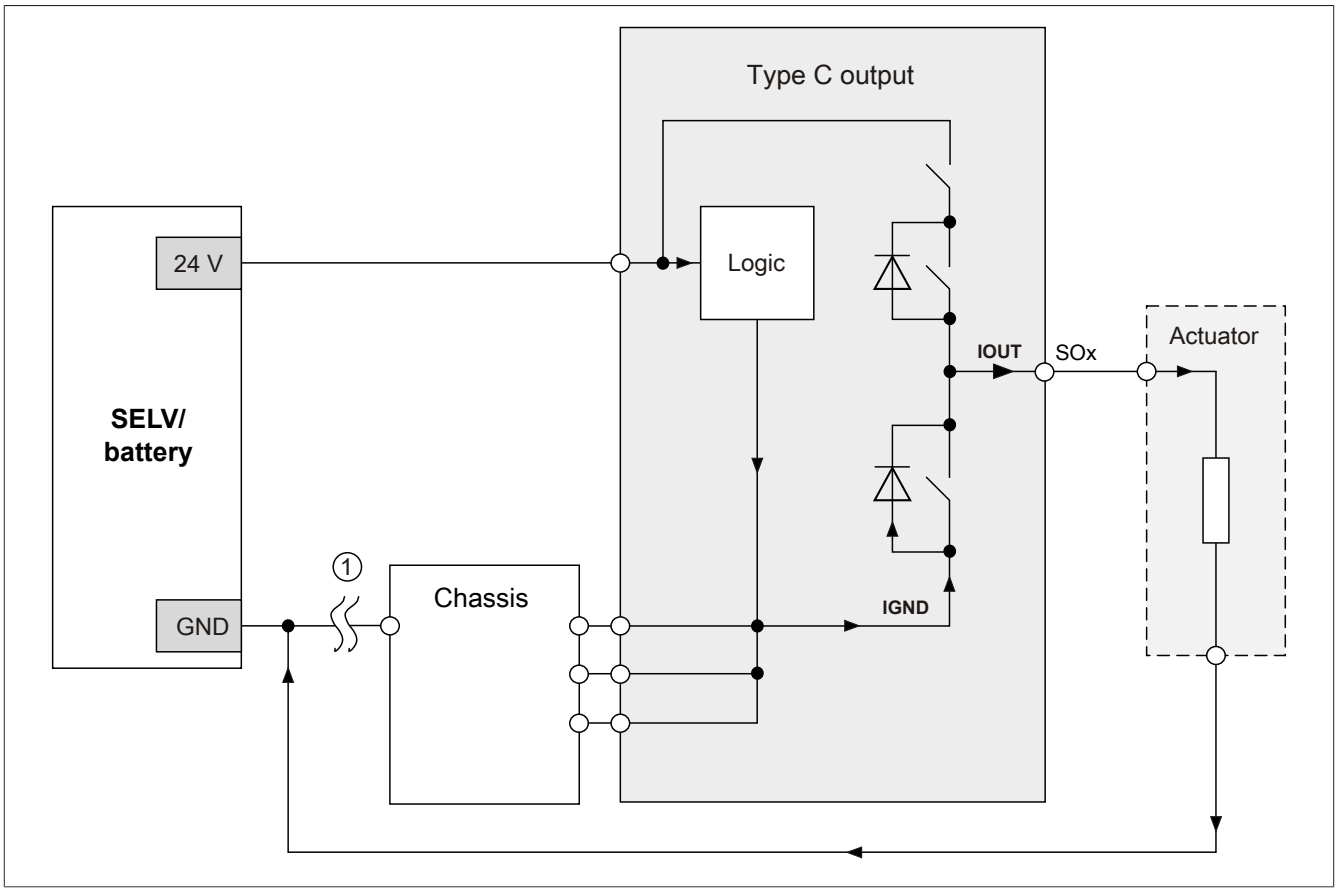



Figure 84: Possible connection error - Example 2

**Fault sequence:**

- Fault ① (open circuit on module GND):
  The module loses its direct connection to GND and current begins to flow through the defective protective component → $I_{GND}$ → actuator.
  As a result, current above the maximum value permitted by the module is supplied to the actuator!

## Danger!

**This type of installation can cause hazardous situations and is therefore NOT permitted.**

## 9.4.4 Safe cutoff of a potential group

### 9.4.4.1 Description of function

The operating principle "Safe cutoff of a potential group" enables the user to execute safety-related functions within a B&R system in combination with an external safety relay.
The safety function is limited to cutting off or interrupting the power to connected actuators.

**Functionality**

An external safety relay is connected to the I/O power supply for the potential group or an X20SP1130 power supply module is used. When the functional safe state is requested or state "Failsafe" occurs, then this feed cuts off the I/O power supply of the potential group. The power is then also cut off for all actuators connected to this potential group. However, module-internal energy storage devices (e.g. capacitors) remain charged and must be taken into account in the assessment of the safety function.

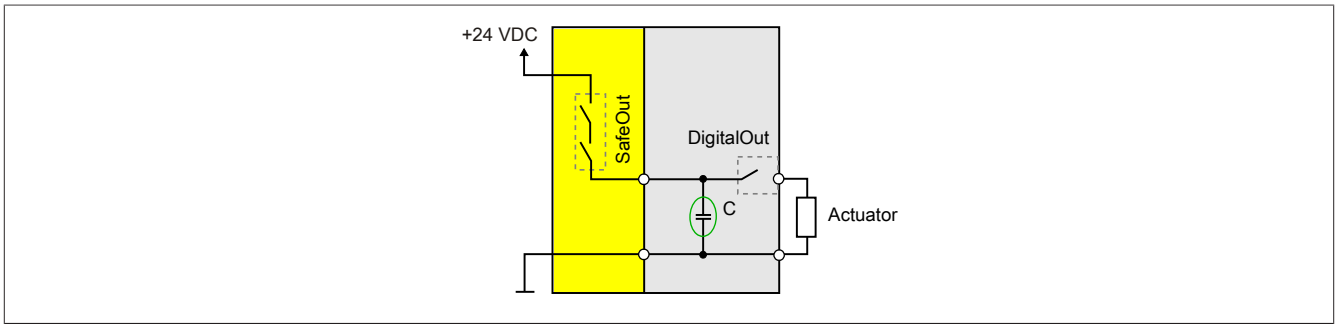



Figure 85: Functionality with internal energy storage

### 9.4.4.2 Scope of application / Standards referenced

The operating principle is confined to machine manufacturing applications and therefore implicitly to the following standards:

- ISO 13849-1:2023 or EN ISO 13849-2:2012

Requirements of other standards are not taken into consideration.

#### 9.4.4.3 System-specific information

The operating principle applies to a potential group.

All potential groups are generally only permitted to be supplied by 1 power supply module. The possible further processing of the power supply on the module is not permitted to result in multiple supply instances.

In the X20 system, only modules of type X20BM01, X20BM23 and X20BM26 that ensure the interruption of the internal I/O power supply to the left are permitted to be used as bus modules for power supply modules. On modules X20PS9400 and X20PS3300, only the I/O power supply (+24 V I/O) is permitted to be switched with the safety relay. The bus power supply (+24 V BC/X2X L.) must be isolated.

When using module X67PS1300 to supply power to the X67 potential group, only the I/O power supply (+24 V I/O) is permitted to be switched with the safety relay. The bus power supply (+24 V BC/X2X L.) must be isolated.

The operating principle is limited to the modules listed in the following certificate.


**Certificate**
Website > Downloads > Certificates > Safety technology > X20, X67 > Safe cutoff of potential groups

### 9.4.4.4 Safety guidelines

This section provides a summary of safety notices for the user.

## Danger!

**Failure of the safety function due to misuse**

**Observe the following safety guidelines. Failure to observe any of the following notices can result in the failure of the safety function and may result in serious injury.**

- **When using the operating principle, it is the user's responsibility to adhere to the relevant standards and safety directives. In addition, the guidelines for proper use must be observed.**
- **For all potentials supplying the modules, SELV/PELV power supplies must be used.**
- **The potential groups for which the operating principle is applied are only permitted to contain modules listed from certificate "Safe cutoff of potential groups".**
- **Uncoated X20 modules in which the operating principle is used are not permitted to be operated in condensing air humidity or at temperatures below 0°C.**
- **It is not permitted to mix modules from different systems (X20, X67, 7XV) within a potential group.**
- **It is not permitted to install multiple power supplies in a potential group (particularly with regard to power supply modules that also supply the bus supply).**
- **Ensure that the upstream safety relay is wired properly.**
- **Ensure that ALL sensors and actuators connected to the potential group are wired properly.**
- **Note possible impairments of the safety function due to the internal energy storage devices. If this is sufficient to enable a connected actuator and subsequently results in a dangerous state, the protection objective is not given and alternatives or supplementary measures must be installed.**
- **The switch-off time must be verified by a control measurement!**
- **For modules with isolated I/O potential for sensors and actuators, the upstream safety relay must shut off the supply for both the sensors and actuators.**
- **The ground connections should be used as functional ground and not as protective ground and must not be connected to the 24 V supply voltage (GND is permitted). In addition, no protective components are permitted to be used between the ground and the 24 V supply voltage.**

#### 9.4.4.4.1 Capacitances within the potential group

The module-internal capacitances remain charged at the time of shutdown. The total capacitance of the potential group results from the sum of the capacitances of the individual modules, upstream external safety relay and actuator.

$$C_{total} = \sum_{i=1}^{n} C_i$$

The capacitances of the corresponding B&R modules are listed in the certificate.

**Certificate**
Website > Downloads > Certificates > Safety technology > X20, X67 > Safe cutoff of potential groups

At the time a safety function is requested, it is not ensured that the standard outputs are enabled. If an output is disabled at the time of the request, the affected module-internal capacitances remain permanently charged. If the output is enabled by the standard application, an unexpected voltage peak occurs on the output.

In connection with the supply voltage, the total capacitance present in the system results in a charge that must be taken into account during cutoff. In the worst case scenario, it can be assumed that the total capacitance present in the system buffers each output present in the potential group. This behavior is not permitted to result in a safety-critical state due to actuators in the potential group; alternatives or supplementary corrective measures must be installed.

#### 9.4.4.4.2 Potential group structure

The potential group is only permitted to be made up of modules listed in the following certificate. Modules not listed in this certificate endanger the "absence of feedback" of the external cutoff and therefore the safety function.

**Certificate**
Website > Downloads > Certificates > Safety technology > X20, X67 > Safe cutoff of potential groups

To ensure clarity and that the external cutoff is triggered when a fault occurs, installing multiple power supply sources in a potential group is not permitted.

SELV/PELV power supplies must be used for both the bus supply (X2X) and the I/O power supply; otherwise, safety-related malfunctions can occur due to overvoltages.

For modules with isolated I/O potential for sensors and actuators, the upstream safety relay must shut off the supply for both the sensors and actuators; otherwise, feedback cannot be excluded.

### 9.4.4.4.3 Circuit examples

**Example with power supply module X20SP1130**

The following examples show a load being cut off using safe power supply module X20SP1130 along with safe input module X20SI4100 and the "emergency stop" safety function.

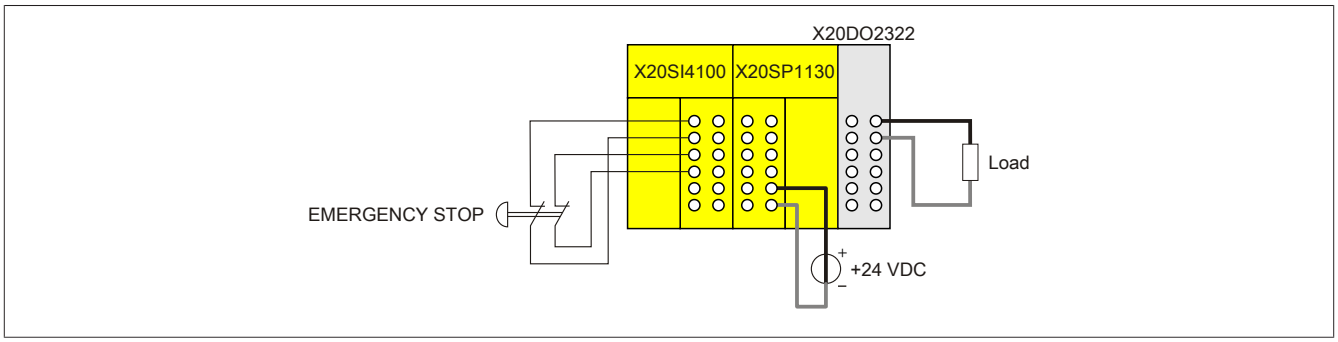



Figure 86: Circuit example with power supply module X20SP1130

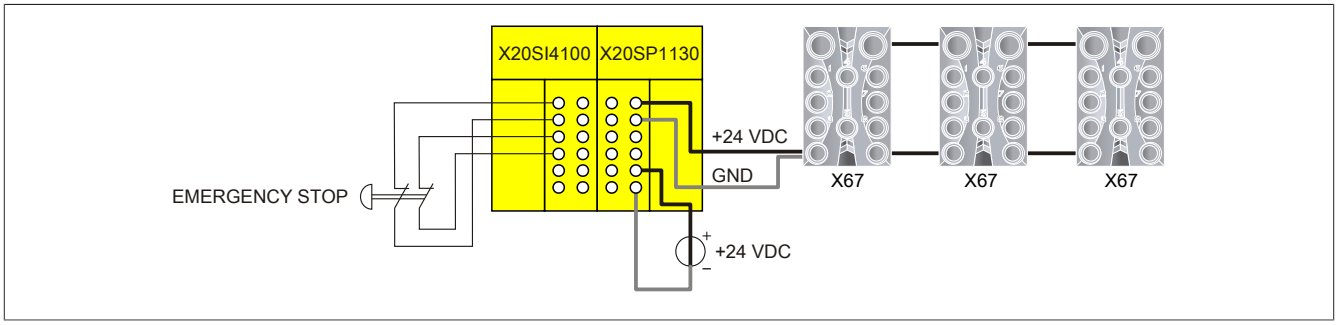



Figure 87: Circuit example with power supply module X20SP1130 and X67

Provided that the external components being used (emergency stop switch, load) satisfy the respective requirements, these examples can achieve PL e.

#### 9.4.4.4.4 Wiring information

The operating principle "Safe cutoff of a potential group" only applies to the B&R modules being used. All other parts of the safety chain such as the application, upstream sensors or downstream actuators are NOT included in this principle.

For this reason, it is important to take the following points into account:

- Ensure proper wiring of the safety relays with the I/O supply. A short circuit between the output of the safety relay and an external 24 V voltage source can cause an unintended supply of 24 V to the internal supply voltage of the potential group. As a result, the safety function can no longer be ensured, i.e. **ALL** channels of the potential group can no longer be switched off by the upstream safety relay.
- Ensure proper wiring of **ALL** input and output channels of the potential group and the connected sensors or actuators. A short circuit between an input or output of the potential group and an external 24 V voltage source can cause the unintended feedback of 24 V to the internal supply voltage of the potential group. As a result, the safety function can no longer be ensured, i.e. **ALL** output channels of the potential group can no longer be switched off by the upstream safety relay.
- In accordance with EN ISO 13849-2:2012, appendix D.2, table D.4, a short circuit between any 2 conductors can be excluded, provided that:
  - They are permanently installed and protected against external damage (e.g. using a cable duct or armored conduit)
  - OR they are in separate plastic-sheathed cables
  - OR they are installed within an electrical enclosure. This requires that the lines as well as the area for electrical equipment meet the respective requirements [see EN 60204-1]
  - OR they are individually shielded with a ground connection.

## 9.4.5 Error detection

### 9.4.5.1 Type A output channels

**Danger!**

**Type A output channels also cut off the load on the GND side. Check whether the actuator you have connected permits a cutoff on the GND side. X20 and X67 systems do not support this type of cutoff, for example.**

**Danger!**

**Note that wiring SOx+ directly to GND via an actuator is not permitted; wiring 24 VDC directly to SOx- via an actuator is also not permitted.**

**These types of errors will not be detected by the module. The user must prevent these types of errors through careful wiring.**

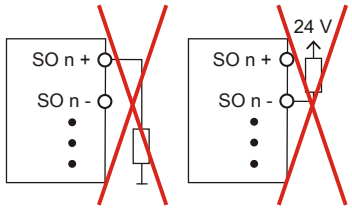



Figure 88: Invalid wiring

### 9.4.5.2 Type B / Type C output channels

**Danger!**

**As illustrated in the following circuit examples, the connected actuators can be connected to GND on the load side. Connecting actuators on just one side without a GND supply is not permitted, however. This would cause a series connection of the actuators in the event of an open circuit, which could then cause a hazardous module error.**

**Danger!**

**Possible high signal on defective type C output when switching on the module or after resetting the standard CPU**

**If a defective module is switched on, short high impulses on the type C output must be expected due to the necessary tests during the module switch-on process and due to internal capacitances. If the internal capacitances are sufficient to enable the connected actuator, the desired level of protection is not provided and alternatives or supplementary measures must be installed.**

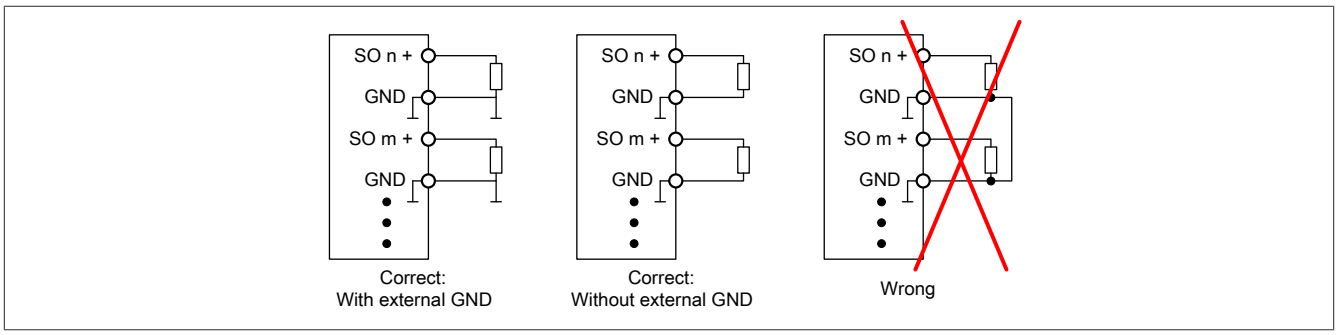



Figure 89: Invalid wiring

For additional module-specific information, see:

- "X20(c)SO6300" on page 14
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X20SP1130" on page 26
- "X67SC4122.L12" on page 31

### 9.4.5.3 Type relay output channels

**Danger!**

**A relay channel does not have error detection for wiring problems. All errors resulting from incorrect or faulty wiring must be handled through supplementary measures or by the connected device.**

**Danger!**

**The user is responsible for ensuring that each relay channel is cut off at least 1x per week so that the appropriate internal tests can be completed.**

### 9.4.5.4 Connecting safety-related actuators

| Error / module | Disable OSSD = No | | Disable OSSD = Yes - Warning | |
|---|---|---|---|---|
| | Output switched off | Output switched on | Output switched off | Output switched on |
| **All SO types** | | | | |
| Short circuit supply voltage to GND | ✗ | ✗ | ✗ | ✗ |
| Short circuit SOx+ or SOx- to GND | ✗ | ✓ | ✗ | ✓ |
| **Type A output channel** | | | | |
| Short circuit SOx+ to supply voltage | ✓ | ✓ | ✓ | ✗ |
| Short circuit SOx to supply voltage | ✓ | ✓ | ✓ | ✓ |
| Short circuit SOx- to GND | ✗ | ✓ | ✗ | ✗ |
| Short circuit between SOx+ and the other signal (high) | ✓ | ✓ | ✓ | ✗ |
| Short circuit between SOx- and the other signal (high) | ✓ | ✓ | ✓ | ✗ |
| Short circuit between SOx+ and SOx- | ✗ | ✓ | ✗ | ✓ |
| Open circuit | ✗ | ✗ 2) | ✗ | ✗ 2) |
| **Type B output channel** | | | | |
| Short circuit SOx to supply voltage | ✓ 1) | ℹ 1) | ✓ 1) | ✗ |
| Short circuit between SOx and the other signal (high) | ✓ 1) | ℹ 1) | ✓ 1) | ✗ |
| Open circuit | ✗ | ✗ | ✗ | ✗ |
| **Type C output channel** | | | | |
| Short circuit SOx to supply voltage | ✓ 1)3) | ✓ 1)3) | ✓ 1) | ✗ |
| Short circuit between SOx and the other signal (high) | ✓ 1)3) | ✓ 1)3) | ✓ 1) | ✗ |
| Open circuit | ✗ | ✗ | ✗ | ✗ |
| **Type relay output channel** | | | | |
| Short circuit NOx to supply voltage / GND / NO / COM | ✗ | ✗ | ✗ | ✗ |
| Short circuit COMx to supply voltage / GND / NO / COM | ✗ | ✗ | ✗ | ✗ |
| Open circuit | ✗ | ✗ | ✗ | ✗ |

Table 101: SO error detection

✓ Error detected

✗ Error not detected

ℹ Error detection depends on the module type. The errors are not detected for the following modules: X20SC0xxx, X20SLXxxx, X20SRTxxx, X20SO6300, X20SP1130.

1) If SOx is shorted to high potentials, this will be detected by the module, but the connected actuator cannot be cut off due to the "current-sourcing only" design of the channel.

2) If possible, an open circuit can be detected via signal "CurrentOK" (depends on the presence of the channel). However, this signal cannot be used for safety purposes.

3) An error is only detected if the residual voltage is above 20% of the supply voltage or 3.5 V, depending on which value is higher.

## Warning!

**Incorrect use can result in failure of the safety function and subsequently to dangerous states.**

**Configuring "Disable OSSD = Yes - Warning" greatly reduces the internal error detection of the module.**
**Subsequently, the information listed in chapter section "Detecting module-internal errors" in Automation Help must be observed.**

**The correct use and necessary tests of the safety function must be observed.**

## Danger!

**Possible error behavior of the actuators must be analyzed and avoided using corresponding responses (positively driven read-back contacts on a contactor, pressure switch on valves, etc.).**

## Danger!

**This danger warning applies to all the modules listed in the "SO error detection" table with the exception of output channels of type A!**

**If SOx is shorted to high potentials, this will be detected by the module, but the connected actuator cannot be cut off due to the "only-plus-switching" design of the channel. Make sure that the wiring is correct in order to rule out SOx short circuits to high potentials (see EN ISO 13849-2:2012, annex D.2.4, table D.4).**

### 9.4.6 Error interlock - State diagram

The error interlock works independently of the "Enabling principle", i.e. the behavior described in section "Restart behavior" is not influenced by the configuration of the enabling principle or by the chronological position of standard switching signal "DigitalOutputxx". The status of standard switching signal "DigitalOutputxx" has no influence on the state of the state diagram for type C outputs.

The following state diagram illustrates the effect of the error interlock integrated in the module. The hexadecimal value in parentheses corresponds to the state number that is provided via the channel "FBOutputState".

**Information:**

**To set an output channel, at least one time interval from one network cycle is required between the rising edge on signal "SafeDigitalOutputxx" and the rising edge on signal "ReleaseOutput". If this timing is not adhered to, the output channel remains inactive.**

**Information:**

**For the maximum switching frequency, see the technical data for the module.**

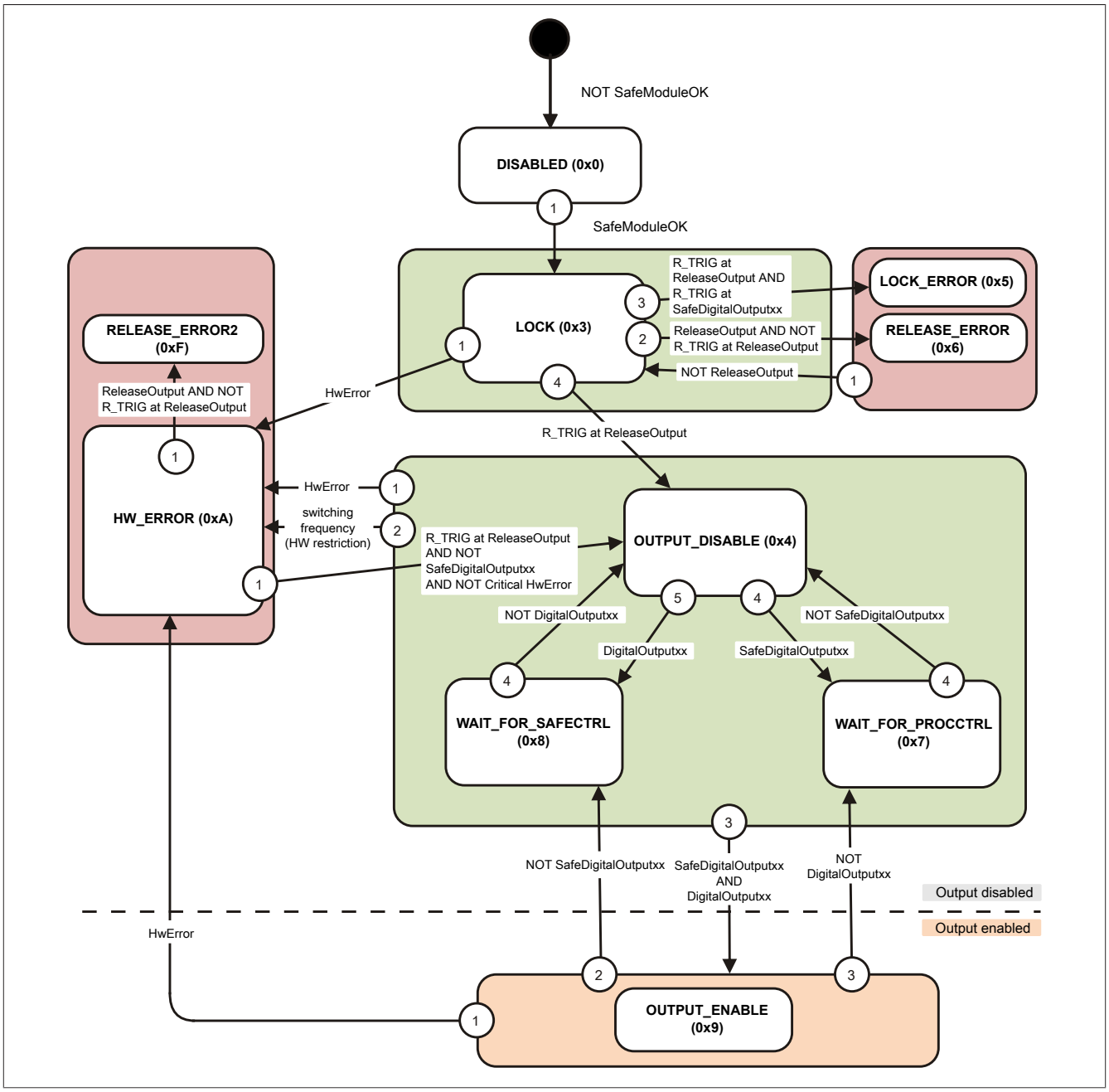



Figure 90: Error interlock - State diagram

For additional module-specific information, see:

- "X20(c)SO6300" on page 14
- "X20(c)SOx1x0" on page 15
- "X20(c)SOx530" on page 16
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X20SP1130" on page 26
- "X67SC4122.L12" on page 31

## 9.5 Safe digital inputs

Safe digital inputs are equipped with filters that are individually configurable for switch-on and switch-off behavior. Switch-on filters are used to filter out signal disturbances. Switch-off filters are used to smooth testing gaps in external signal sources – i.e. OSSD signals – so that unintended cutoffs can be avoided.

The input signals of the signal pairs are monitored for simultaneity in the module. The maximum permissible discrepancy of inputs of a signal pair is configurable. Here, the signals of dual-channel evaluation directly represent the safe signal of a 2-channel sensor, such as from an emergency switching-off device or safety light curtain.

### Type A

The module is equipped with safe digital input channels. It can be flexibly used for a wide range of tasks involving the reading of digital signals in safety-related applications up to PL e or SIL 3.

The module provides pulse signals for diagnosing the sensor line. By default, each pulse signal provides a unique pulse pattern derived from the module's serial number and pulse channel number. This allows any pulse signals to be combined in one signal cable and still cover any cross fault combinations in the cable. The pulse check can also be disabled to connect electronic sensors with separate line monitoring (OSSD signals).

Type A input channels are not equipped with an internal error interlock (see chapter 9.2 "Restart behavior").

### Type B

The module is equipped with safe digital input channels. It can be flexibly used for a wide range of tasks involving the reading of digital signals in safety-related applications up to PL d or SIL 2.

The module is not equipped with pulse signals.

Type B input channels are equipped with an internal error interlock (see chapter 9.2 "Restart behavior").

### Overview of types supported by the system

The following table provides a rough overview of which input types are supported by which system. For the actual variant of the respective modules, see the linked module overview or corresponding module data sheet.

| | X20 System | X67 System | X90 mobile system |
|---|---|---|---|
| Type A | ✓ | ✓ | ✗ |
| Type B | ✗ | ✗ | ✓ |

### 9.5.1 Filter

All safe digital input modules are equipped with separately configurable switch-on and switch-off filters. 1x the TOFF filter time must be added to the total response time. The functionality of these filters is shown in the following figure:

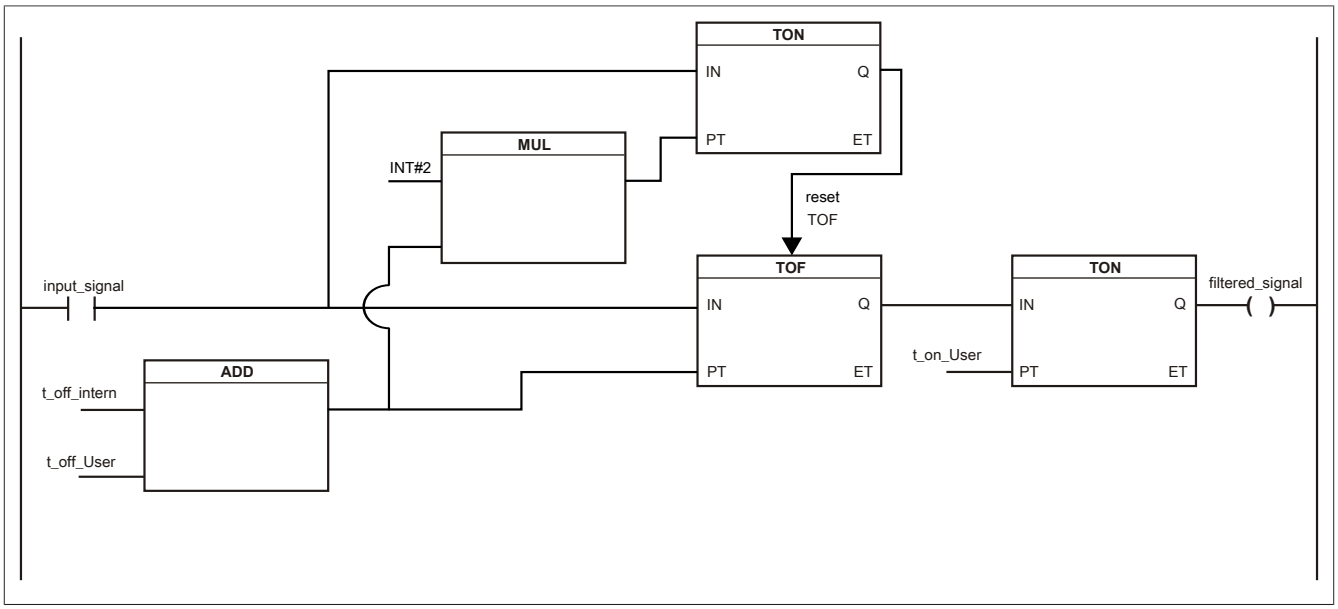



Figure 91: SI input filter

Legend:

- input_signal: Status of the input channel
- filtered_signal: Filtered status of the input channel. This is used as an input for the PLCopen function block and forwarded to the SafeLOGIC controller
- t_off_intern: Internal parameter (5 ms) for suppressing "external" test pulses (only with "Pulse source = Other module")
- t_off_User: Parameter for the switch-off filter
- t_on_User: Parameter for the switch-on filter

**Unfiltered**

The input state is collected with a fixed offset to the network cycle and transferred.

### Input filter

An input filter is available for each input. The input delay can be configured; limit values are listed in the technical data. Disturbance pulses which are shorter than the input delay are suppressed by the input filter.

The switch-off filter can be configured separately from the input filter. This makes it possible to use the switch-off filter in actual applications (e.g. testing gaps of the light curtain) and to shorten response times.

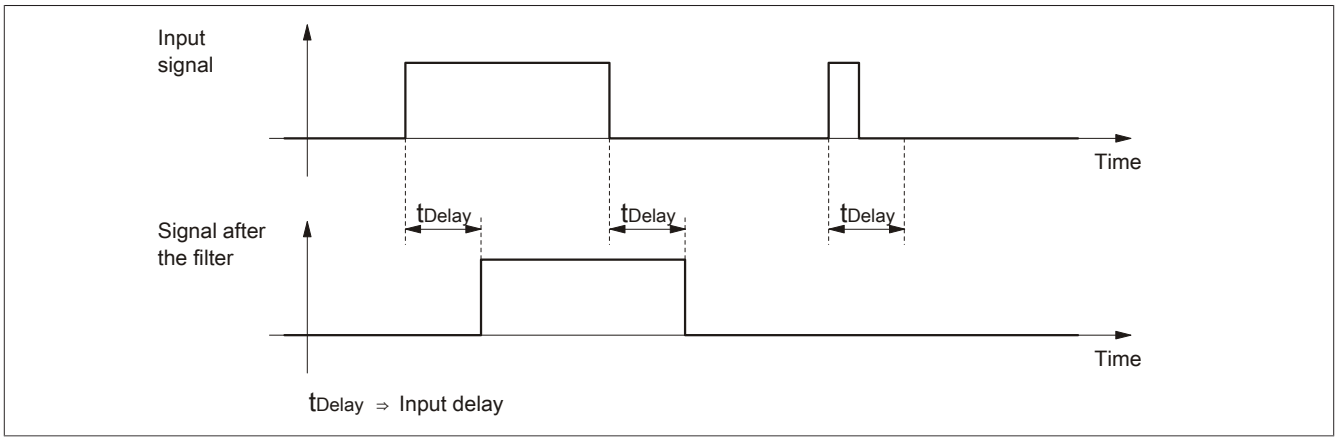



Figure 92: Input filter

## Information:

**The actual effective filter depends on the I/O cycle time of the module. The actual effective filter can therefore deviate below the input value by the I/O cycle time (see the technical data for the module). If filter times are set less than the I/O cycle time of the module, no filter is effective.**

## Warning!

**Danger due to brief switch-on pulses**

**Errors caused by cross faults to other signals may be interpreted by the module as high signals. Such errors are detected by the module within the error detection time at the latest. By default, the switch-on filter is pre-assigned with the value of the fault detection time, which allows the false signals caused by possible cross faults to be suppressed.**

**If the switch-on filter is configured to a value less than the fault detection time, however, faulty signals can result in brief switch-on pulses.**

**It is your responsibility to ensure that the input filters are correctly configured.**

## Danger!

**Configuring a switch-off filter lengthens the safety response time!**
**The configured filter value must be added once to the total response time (for details, see section "Filter").**
**Configuring a switch-off filter causes signals with a low phase shorter than the switch-off filter to be filtered out. If this results in a problem concerning safety functionality, then the switch-off filter must be set to 0.**
**To minimize the effect of EMC interference, the max. line length between the pulse output and input specified in the technical data must be taken into account.**
**When connecting devices with OSSD signals (signals with test pulses), you must select a switch-off filter in each case that is substantially smaller than the repeat rate of the test pulses.**

**Danger!**

**If "Pulse source = Other module" is used in the channel configuration, then an additional TOFF filter with 5 ms is enabled within the module. Channel configuration "Pulse x mode = DYNlink" or "Pulse x mode = DYNlink inverted" also causes an additional TOFF filter of 5 ms to be enabled if a pulse output configured to DYNlink is set for "Pulse source". The corresponding information about the TOFF filter must therefore also be applied to configuration "Pulse source = Other module" and "Pulse x mode = DYNlink" or "Pulse x mode = DYNlink inverted".**

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### 9.5.2 DYNlink

The DYNlink method allows safety sensors to be connected in series (DYNlink loop). In addition, DYNlink sensors occupy only a single safe input channel (SI). Nevertheless, this method achieves up to category 3 and up to PL e per ISO 13849-1:2023. DYNlink thus makes it possible to significantly reduce the number of safe input channels and to implement cost-effective solutions.

The sensors of a DYNlink loop are logically "ANDed" in the process. For this purpose, the pulse output of the modules generates a signal that is inverted by each sensor in the DYNlink loop. Depending on whether the number of sensors in the loop is even or odd, the same signal or an inverted signal appears on the safe input channel. If a sensor has responded to the safety request (emergency switching-off device actuated), the sensor outputs state "Low".

The following requirements must be met to use DYNlink:

- X20 modules: Supported. For the required hardware upgrade version, see the data sheet of the corresponding module.
- X67 modules: Not supported
- X90 modules: Not supported

For details about connection examples and error detection, see the following sections:

- Connection examples: Type A input channels
- Error detection: Type A input channels

### 9.5.3 Connection examples

The typical connection examples in this section only represent a selection of the different wiring methods. The user must take error detection into account in each case.

**Information:**

**For details about connection examples (such as circuit examples, compatibility class, max. number of supported channels, terminal assignments, etc.), see section "Using sensors and actuators" in Automation Help.**

#### 9.5.3.1 Type A input channels

**Connecting single-channel sensors with contacts**

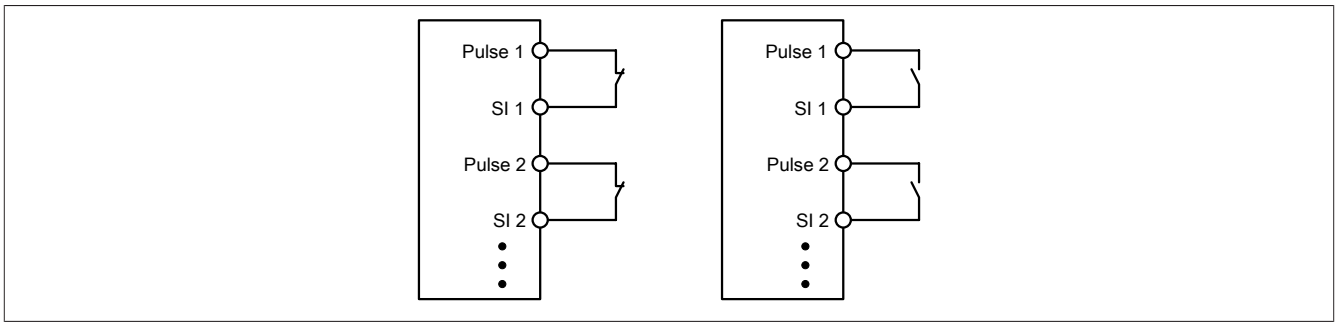



Figure 93: Connecting single-channel sensors with contacts

Single-channel sensors with contacts are the simplest connection.

With this connection, the module corresponds to category 3 per ISO 13849-1:2023. It is important to note that this statement applies exclusively to the module and not to the wiring shown. It is your responsibility to ensure that the wiring of the sensor is selected according to the required category.

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Connecting two-channel sensors with contacts

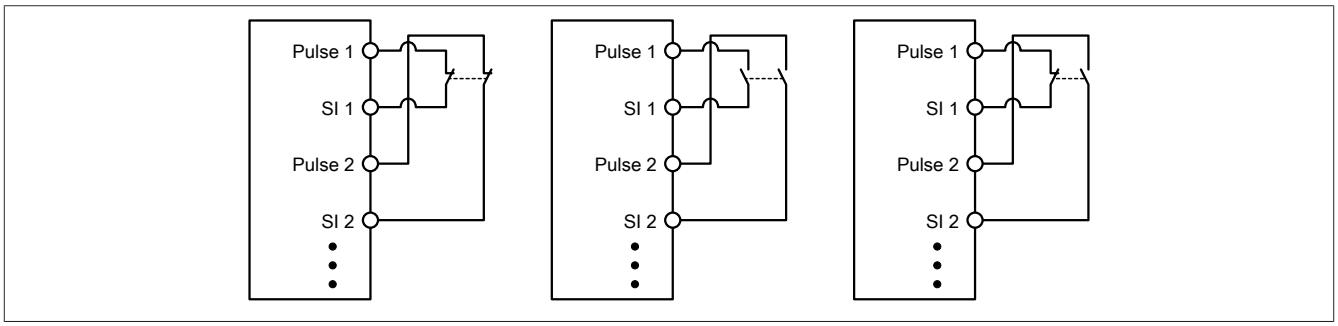



Figure 94: Connecting two-channel sensors with contacts

Sensors with contacts can be connected directly to a safe digital input module via two channels. Dual-channel evaluation is handled directly by the module.

With this connection, the module corresponds to category 4 per ISO 13849-1:2023. Be aware that this statement applies only to the module and not to the wiring shown. It is your responsibility to ensure that the wiring of the sensor is selected according to the required category.

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Connecting multi-channel sensors with contacts

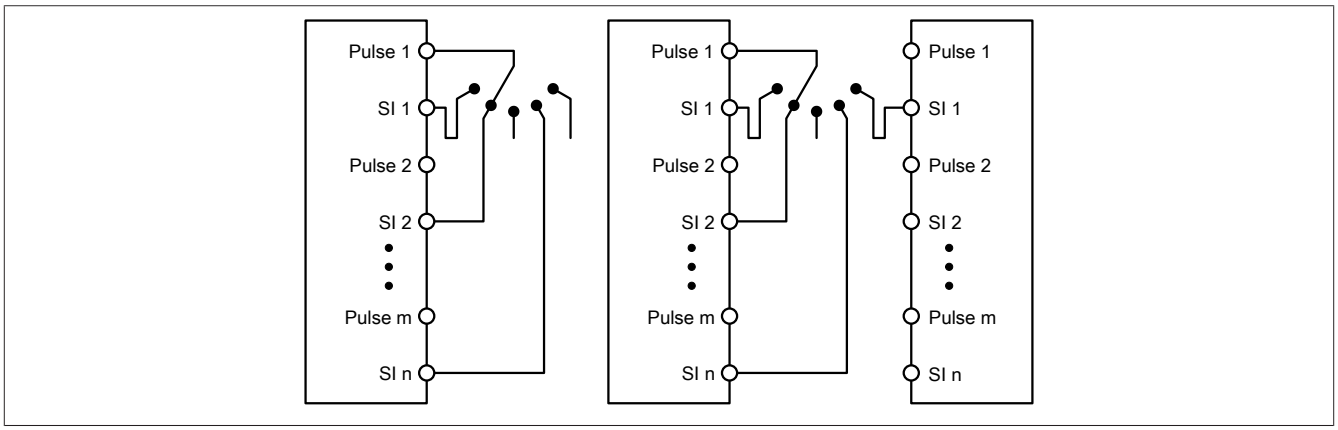



Figure 95: Connecting multi-channel sensors with contacts

Multi-channel switches (mode selector switches, switching devices with "shift key" capability) can be connected to multiple safe digital input modules.

If module-internal signal evaluation is used (see left figure), the same pulse must be set for all of the inputs being used. If signals are evaluated across all modules (see right figure), all of the inputs must be configured to use an external pulse. In this type of application, pulse evaluation with the "default" pulse is not suitable; therefore, a separate pulse signal with approx. 4 ms low-phase is available.

In this case, multi-channel evaluation must be handled in the safety application (PLCopen function block "SF_ModeSelector"). The category achieved per ISO 13849-1:2023 in this way depends on the error models of the switching element (e.g. mode selector switch) and must be examined in combination with the error detection present in the PLCopen function block.

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Connecting electronic sensors

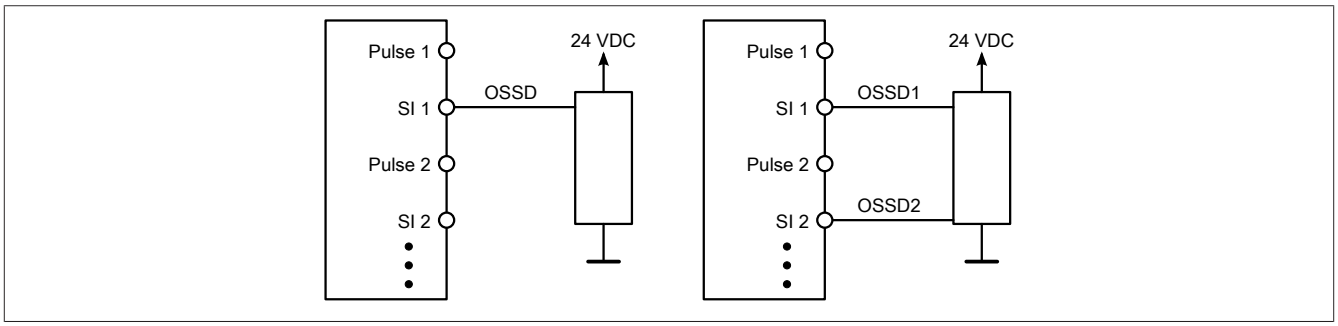



Figure 96: Connecting electronic sensors

Electronic sensors (light curtains, laser scanners, inductive sensors, etc.) can be connected directly to safe digital input modules. The switching thresholds of the input channels must be taken into account for these types of applications.

With a single-channel connection (see left figure), the module corresponds to category 3 per ISO 13849-1:2023. With a dual-channel connection (see right figure), the module corresponds to category 4 per ISO 13849-1:2023. Be aware that this statement applies only to the module and not the wiring or connected electronic sensor. It is your responsibility to ensure that the wiring of the sensor is selected according to the required category and the specifications of the electronic sensor manufacturer.

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### Connecting DYNlink sensors in a loop

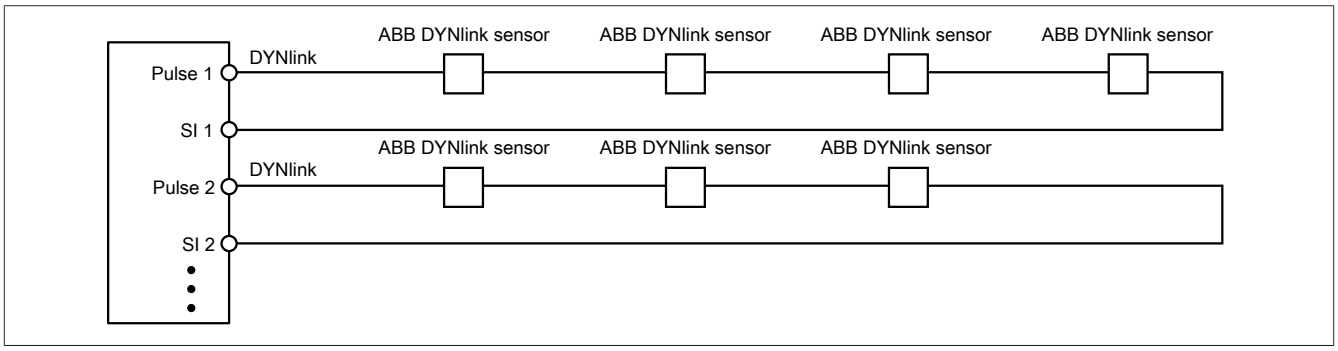



Figure 97: Connecting DYNlink sensors in a loop

In this connection, the module corresponds up to category 3 or up to PL e per ISO 13849-1:2023. Be aware that this statement applies only to the module and not to the wiring shown. It is your responsibility to ensure that the wiring of the sensors is selected according to the required category.

The pulse output of the safe input module is connected to the input of the first sensor. A maximum of 10 sensors are supported in a DYNlink loop. The output signal of the first sensor is connected to the input of the next sensor. This process is repeated until the last sensor is reached. The output of the last sensor is connected to a safe input channel (SI) of the safe input module. To avoid short circuits, the pulse output and sensor signal are not permitted to be routed in the same cable.
If there is an even number of sensors, setting "DYNlink" must be selected for parameter "Pulse x mode" in SafeDESIGNER. If the number of sensors is odd, setting "DYNlink inverted" must be selected. For additional information, see the data sheet for the corresponding module (see register description → Parameters in SafeDESIGNER: Group "PulseOutput").

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23

### Connecting DYNlink sensors - Possible connection error

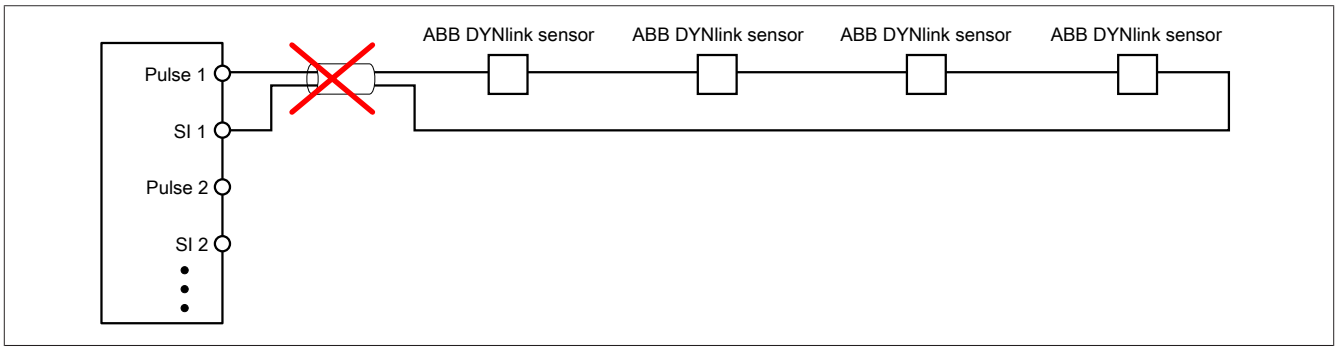



Figure 98: Connecting DYNlink sensors - Possible connection error

When using an even number of sensors, the lines for the pulse output and safe input must be isolated from one another. Otherwise, damage to the cables may cause errors that are not detected by the module.

**Danger!**

**If the same pulse signals are routed in the same cable, damage to the cable can cause cross faults between the signals to occur that are not detected by the module. This can result in dangerous situations.**

**For this reason, signal lines with the same pulse signal should be routed in different cables, or you should implement other error prevention measures per EN ISO 13849-2:2012.**

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23

### Connecting DYNlink sensors via connection block Tina 4A / Tina 8A

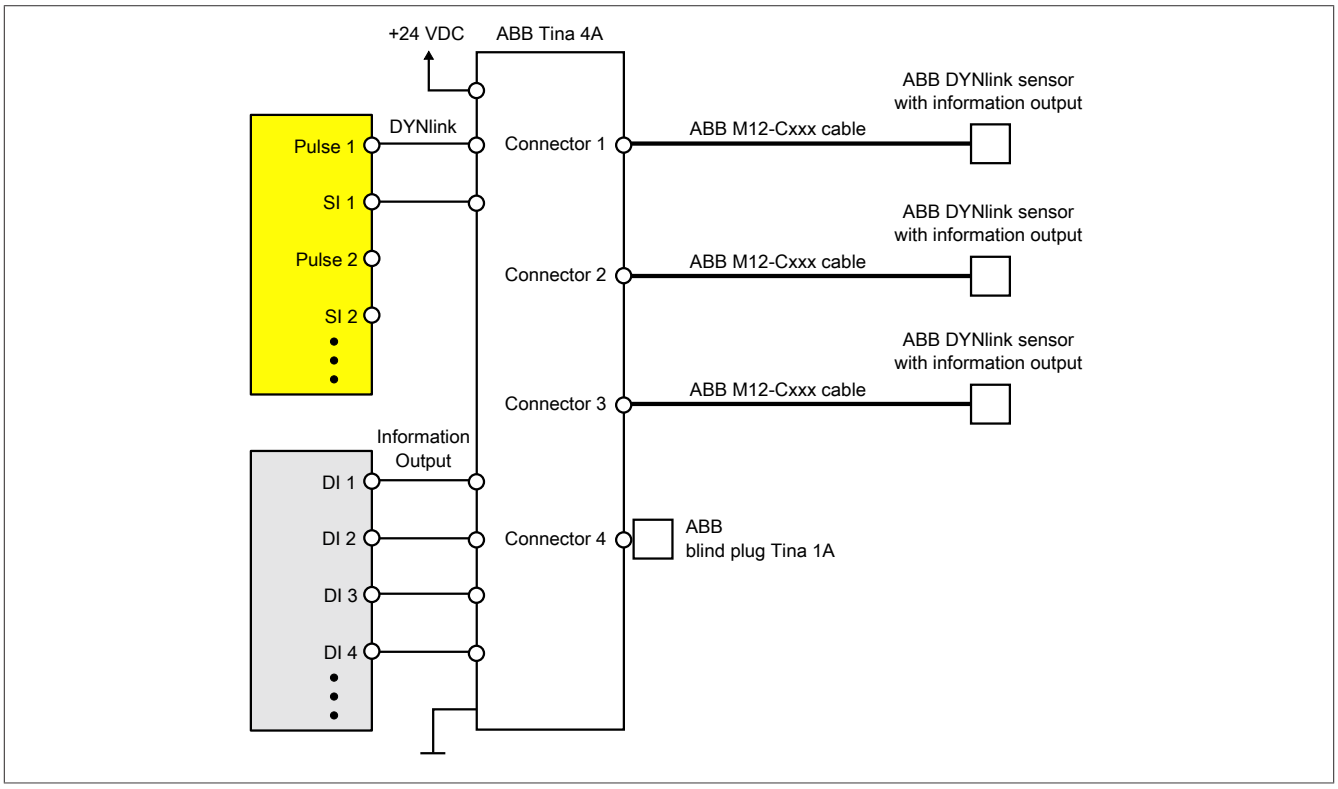



Figure 99: Connecting DYNlink sensors via connection block Tina 4A

In this connection, the module corresponds up to category 3 or up to PL e per ISO 13849-1:2023. Be aware that this statement applies only to the X20 module and not to the wiring shown. It is your responsibility to ensure that the wiring of the sensors is selected according to the required category.

4 or 8 sensors can be connected to Tina 4A / Tina 8A connection blocks. The connection blocks and corresponding cables (M12-Cxxx) considerably simplify installation and produce a series connection of the sensors. If fewer sensors are required, Tina 1A blind plugs must be connected to the free connectors of the connection block. Each sensor and also the blind plugs invert the test pulse. The Tina 4A / Tina 8A connection blocks also invert the signal. As a result, the number of sensors is always odd from the perspective of the B&R module, which allows short circuits in the attachment cable to be determined. This makes it possible to connect Tina 4A / Tina 8A connection blocks to the X20 module using a single cable.
Instead of one sensor, a loop with multiple sensors can be connected to an M12 connector. It is important to note that the test pulse and return signal are in phase opposition only with an odd number of sensors and connection block Tina 4A / Tina 8A. A short circuit in the Tina attachment cable can only be detected with signals in phase opposition. An even number of sensors is not permitted in this wiring variant.
When using connection block Tina 4A / Tina 8A, the number of connected sensors is always odd from the perspective of the B&R input module. Setting "DYNlink inverted" must therefore be selected in SafeDESIGNER for parameter "Pulse x mode". For additional information, see the data sheet for the corresponding module (see register description → Parameters in SafeDESIGNER: Group "PulseOutput").

ABB DYNlink sensors of type "With information output" also provide a digital signal (without safety function) as the sensor status. These signals are available on the Tina 4A / Tina 8A connection blocks and can be evaluated with standard input channels.

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23

### Using the same pulse signals

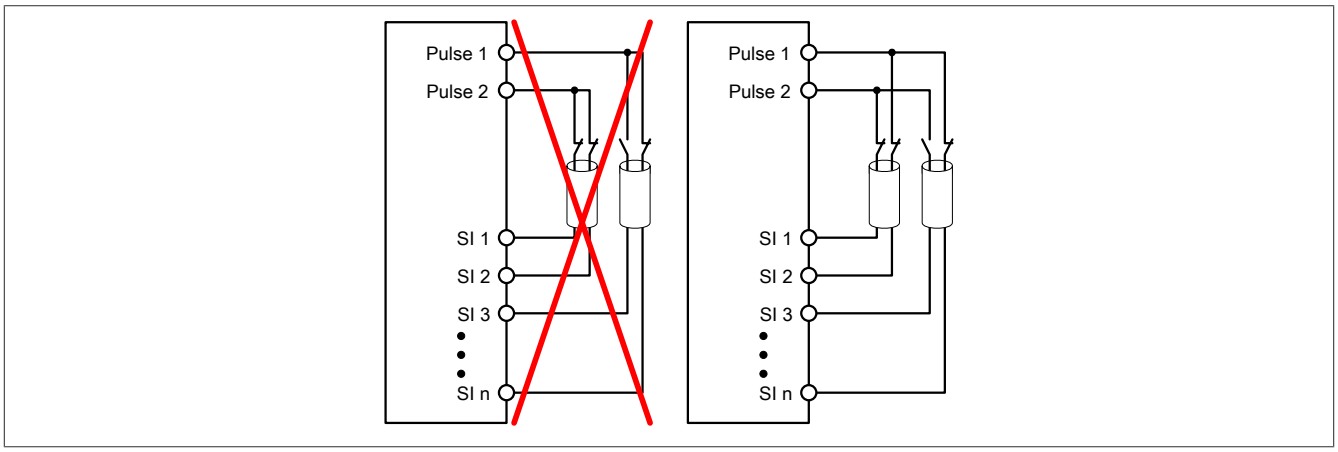



Figure 100: Using the same pulse signals

When using the same pulse signals for different inputs, they must be isolated from one another. Otherwise, damage to the cables may cause errors that are not detected by the module.

**Danger!**

**If the same pulse signals are routed in the same cable, damage to the cable can cause cross faults between the signals to occur that are not detected by the module. This can result in dangerous situations.**

**For this reason, signal lines with the same pulse signal should be routed in different cables, or you should implement other error prevention measures per EN ISO 13849-2:2012.**

**Danger!**

**It is especially important to check the wiring when using the same pulse signal for two inputs that are located next to each other on the terminal. Pay special attention to ensure that poor wiring has not resulted in the two inputs being connected together.**

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### 9.5.3.2 Type B input channels

**Connecting single-channel sensors with contacts**

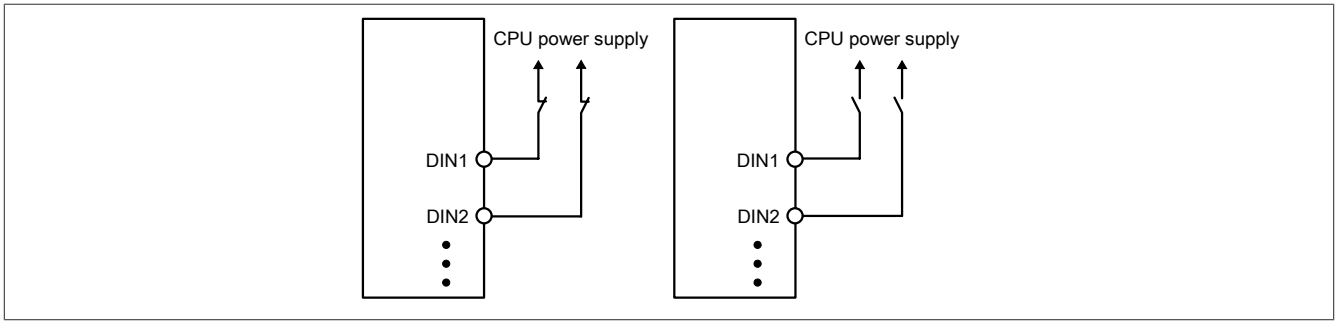



Figure 101: Connecting single-channel sensors with contacts

Single-channel sensors with contacts are the simplest connection.

With this connection, the module corresponds to category 2 per ISO 13849-1:2023. Be aware that this statement applies only to the module and not to the wiring shown. It is your responsibility to ensure that the wiring of the sensor is selected according to the required category.

**Connecting two-channel sensors with contacts**

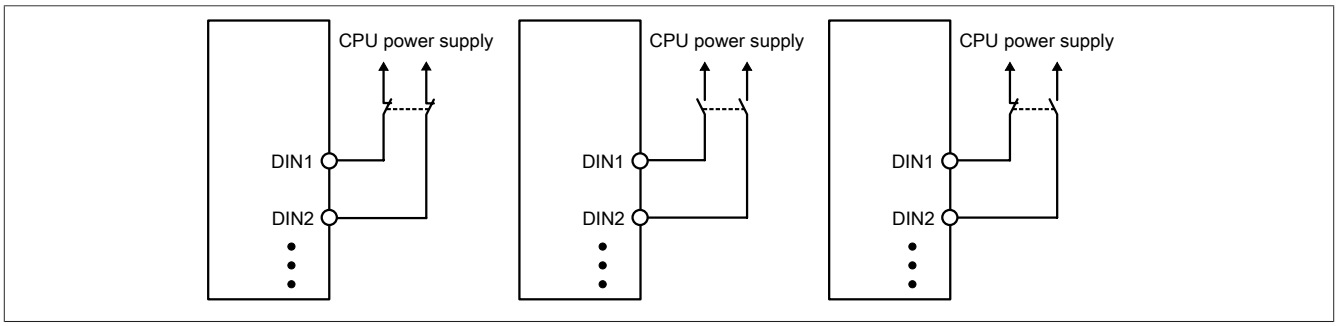



Figure 102: Connecting two-channel sensors with contacts

Sensors with contacts can be connected directly to a safe digital input module via two channels. Dual-channel evaluation is handled directly by the module.

With this connection, the module corresponds to category 3 per ISO 13849-1:2023. Be aware that this statement applies only to the module and not to the wiring shown. It is your responsibility to ensure that the wiring of the sensor is selected according to the required category.

### Connecting multi-channel sensors with contacts

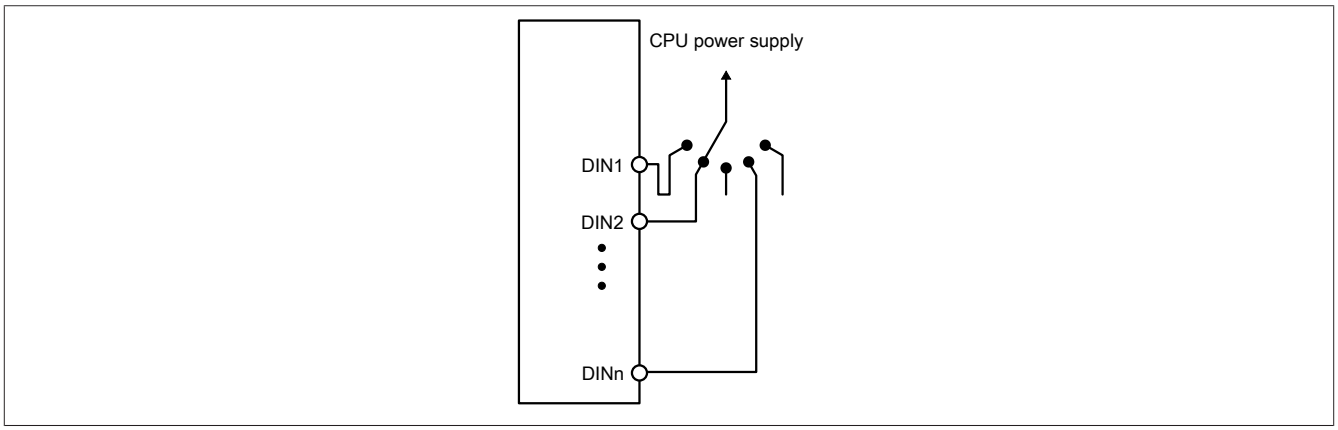



Figure 103: Connecting multi-channel sensors with contacts

Multi-channel switches (mode selector switches, switching devices with "shift key" capability) can be connected to multiple safe digital inputs.

In this case, multi-channel evaluation must be handled in the safety application (PLCopen function block "SF_ModeSelector"). The category achieved per ISO 13849-1:2023 in this way depends on the error models of the switching element (e.g. mode selector switch) and must be examined in combination with the error detection present in the PLCopen function block.

### Connecting electronic sensors

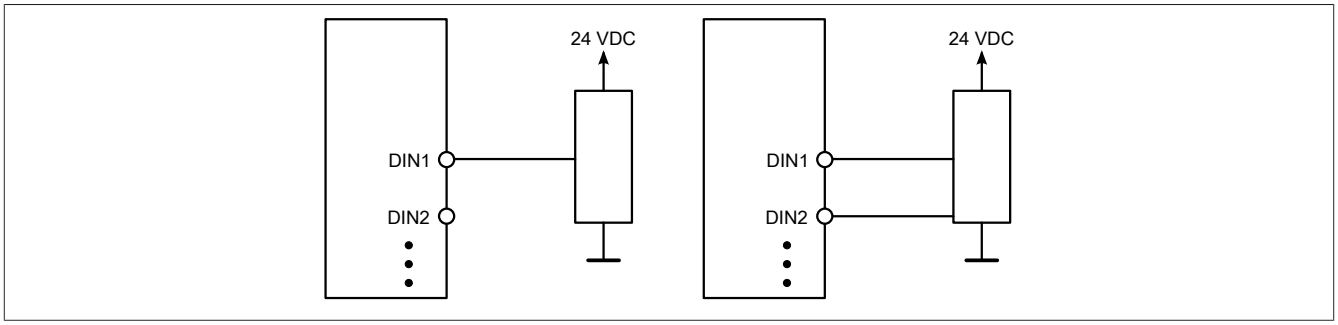



Figure 104: Connecting electronic sensors

Electronic sensors (light curtains, laser scanners, inductive sensors, etc.) can be connected directly to safe digital inputs. The switching thresholds of the input channels must be taken into account for these types of applications.

With a single-channel connection (see left figure), the module corresponds to category 2 per ISO 13849-1:2023. With a dual-channel connection (see right figure), the module corresponds to category 3 per ISO 13849-1:2023. Be aware that this statement applies only to the module and not the wiring or connected electronic sensor. It is your responsibility to ensure that the wiring of the sensor is selected according to the required category and the specifications of the electronic sensor manufacturer.

## 9.5.4 Error detection

### 9.5.4.1 Type A input channels

#### Connecting single-channel sensors with contacts

By default, every input channel is assigned a dedicated pulse output. This pulse output issues a specific signal that helps detect wiring problems, such as a short circuit to 24 VDC, GND or other signal channels. The status of the connected switches is indicated by channel-specific LEDs. LEDs "OO" and "OC" have no significance with this circuit variant.

With this circuit in combination with the configuration "Pulse source = Pulse x", the modules can detect the following errors:

| Error | Contact | |
|---|---|---|
| | Open | Closed |
| Short circuit pulse output to GND | ✓ | ✓ |
| Short circuit pulse output to 24 VDC | ✓ | ✓ |
| Short circuit between the pulse output and the other pulse signal | ✓ | ✓ |
| Short circuit signal input to GND | ✗ | ✓ |
| Short circuit signal input to 24 VDC | ✓ | ✓ |
| Short circuit between the signal input and the other pulse signal | ✓ | ✓ |
| Short circuit between the pulse output and the signal input | ✗ | ✗ |
| Open circuit | ✗ | ✗ |

Table 102: SI error detection when "Pulse source = Pulse x"

✓ Error detected

✗ Error not detected

#### Connecting two-channel sensors with contacts

By default, every input channel is assigned a dedicated pulse output. This pulse output issues a specific signal that helps detect wiring problems, such as a short circuit to 24 VDC, GND or other signal channels.

The status of the connected switches is signaled via channel-specific LEDs, and the status of the dual-channel evaluation is signaled via the "OO" (for combinations with N.C./N.C. contacts) or "OC" LED (for combinations with N.C./N.O. contacts). On module types that do not have these LEDs, errors detected in the dual-channel evaluation are indicated by the respective channel LED blinking red.

With this circuit in combination with the configuration "Pulse source = Pulse x" and combined with dual-channel evaluation in the module or in SafeDESIGNER, the modules can detect the following errors:

| Error | Contact | |
|---|---|---|
| | Open | Closed |
| Short circuit pulse output to GND | ✓ | ✓ |
| Short circuit pulse output to 24 VDC | ✓ | ✓ |
| Short circuit between the pulse output and the other pulse signal | ✓ | ✓ |
| Short circuit signal input to GND | ✗ | ✓ |
| Short circuit signal input to 24 VDC | ✓ | ✓ |
| Short circuit between the signal input and the other pulse signal | ✓ | ✓ |
| Short circuit between the pulse output and the signal input | ✓[1)] | ✗ |
| Open circuit | ✗ | ✓[1)] |

Table 103: SI error detection with "Pulse source = Pulse x" combined with dual-channel evaluation in the module or in SafeDESIGNER

✓ Error detected

✗ Error not detected

1) Dual-channel evaluation of the module.

### Connecting multi-channel sensors with contacts

The status of the connected switches is indicated by channel-specific LEDs. LEDs "OO" and "OC" have no significance with this circuit variant.

With this circuit, the following errors can be detected:

| Error | |
|---|---|
| Short circuit pulse output to GND | ✓ |
| Short circuit pulse output to 24 VDC | ✓ |
| Short circuit between the pulse output and the other pulse signal | ✓ 1) |
| Short circuit signal input to GND (active signal) | ✓ 1) |
| Short circuit signal input to GND (inactive signal) | ✗ |
| Short circuit signal input to 24 VDC | ✓ |
| Short circuit between the signal input and the other pulse signal | ✓ 1) |
| Short circuit between the pulse output and the signal input (active signal) | ✗ |
| Open circuit (active signal) | ✓ 1) |
| Short circuit between the pulse output and the signal input (inactive signal) | ✓ 1) |
| Open circuit (inactive signal) | ✗ |

Table 104: SI error detection when "Pulse source = Other module"

✓ Error detected

✗ Error not detected

1) Detected by PLCopen function block "SF_ModeSelector" in the application.

## Danger!

**If "Pulse source = Other module" is used in the channel configuration, then an additional TOFF filter with 5 ms is enabled within the module. Channel configuration "Pulse x mode = DYNlink" or "Pulse x mode = DYNlink inverted" also causes an additional TOFF filter of 5 ms to be enabled if a pulse output configured to DYNlink is set for "Pulse source". The corresponding information about the TOFF filter must therefore also be applied to configuration "Pulse source = Other module" and "Pulse x mode = DYNlink" or "Pulse x mode = DYNlink inverted".**

## Information:

**With configuration "Pulse x mode = Internal", the pulses have a low phase of approximately 300 µs. This low phase is designed such that no additional degradation of the total response time can occur in the system.**

### Connecting electronic sensors

A pulse pattern cannot be used with electronic sensors. The input channels must therefore be configured to "Pulse source = No pulse".

Any gaps when testing the connected OSSD outputs must be masked out with the module's switch-off filter in order to avoid an unintended shutdown.

## Danger!

**With the configuration "Pulse source = No pulse", the module itself is not able to detect wiring errors. Internal errors are still detected, however. All errors resulting from incorrect or faulty wiring must be handled through supplementary measures per EN ISO 13849-2:2012 or by the connected device.**

## Warning!

**Configuring a switch-off filter lengthens the safety response time!**
**The configured filter value must be added to the total response time.**

### Connecting DYNlink sensors

The status of the connected switches is indicated by channel-specific LEDs. LEDs "OO" and "OC" have no significance with this circuit variant.

With this circuit, the following errors can be detected:

| Error | |
|---|---|
| Short circuit pulse output to GND | ✓ |
| Short circuit pulse output to 24 VDC | ✓ |
| Short circuit between the pulse output and the other pulse signal | ✗ |
| Short circuit signal input to GND (active signal) | ✓ |
| Short circuit signal input to GND (inactive signal) | ✗ |
| Short circuit signal input to 24 VDC | ✓ |
| Short circuit between the signal input and the other pulse signal | ✗ |
| Short circuit between the pulse output and the signal input (active signal) | ✗ |
| Open circuit (active signal) | ✓ |
| Short circuit between the pulse output and the signal input (inactive signal) | ✓ |
| Open circuit (inactive signal) | ✗ |

Table 105: SI error detection for "Pulse x mode = DYNlink / DYNlink inverted" and "Pulse source = Pulse x", where DYNlink is configured

✓ Error detected
✗ Error not detected

**Danger!**

**If "Pulse x mode = DYNlink" or "Pulse x mode = DYNlink inverted" is used in the channel configuration and a pulse output is set to DYNlink for "Pulse source", an additional TOFF filter with 5 ms is enabled within the module. The corresponding information about the TOFF filter must therefore also be applied to configuration "Pulse x mode = DYNlink" or "Pulse x mode = DYNlink inverted".**

**Information:**

**Using DYNlink sensors extends the safety response time. The response time of the DYNlink sensors must be added to the total response time.**

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

### 9.5.4.2 Type B input channels

#### Connecting single-channel sensors with contacts

With this circuit, the modules can detect the following errors:

| Error | |
|---|---|
| Short circuit signal input to GND | ✗ |
| Short circuit signal input to 24 VDC | ✗ |
| Open circuit | ✗ |

Table 106: SI error detection of single-channel sensors with contacts

✓ Error detected
✗ Error not detected

#### Connecting two-channel sensors with contacts

With this circuit in combination with dual-channel evaluation in the module or in SafeDESIGNER, the modules can detect the following errors:

| Error | Contact | |
|---|---|---|
| | Open | Closed |
| Short circuit signal input to GND | ✗ | ✓[1)] |
| Short circuit signal input to 24 VDC | ✓[1)] | ✗ |
| Open circuit | ✗ | ✓[1)] |

Table 107: SI error detection of dual-channel sensors with contacts in combination with dual-channel evaluation in the module or in SafeDESIGNER

✓ Error detected
✗ Error not detected
1) Dual-channel evaluation of the module.

#### Connecting multi-channel sensors with contacts

With this circuit, the following errors can be detected:

| Error | |
|---|---|
| Short circuit signal input to GND (active signal) | ✓[1)] |
| Short circuit signal input to GND (inactive signal) | ✗ |
| Short circuit signal input to 24 VDC (active signal) | ✗ |
| Short circuit signal input to 24 VDC (inactive signal) | ✓[1)] |
| Open circuit (active signal) | ✓[1)] |
| Open circuit (inactive signal) | ✗ |

Table 108: SI error detection of multi-channel sensors with contacts

✓ Error detected
✗ Error not detected
1) Detected by PLCopen function block "SF_ModeSelector" in the application.

### Connecting electronic sensors

Any gaps when testing the connected OSSD outputs must be masked out with the module's switch-off filter in order to avoid an unintended shutdown.

| Error | Contact | |
|---|---|---|
| | Open | Closed |
| Short circuit signal input to GND | ✔ 1) | ✘ |
| Short circuit signal input to 24 VDC | ✘ | ✔ 1) |
| Open circuit | ✘ | ✔ 1) |

Table 109: SI error detection of electronic sensors

✔ Error detected

✘ Error not detected

1) Dual-channel evaluation of the module.

**Warning!**

**Configuring a switch-off filter lengthens the safety response time!**
**The configured filter value must be added to the total response time.**

### 9.5.5 PLCopen state diagrams "Antivalent" / "Equivalent"

The following state diagrams illustrate the effect of PLCopen function blocks "Antivalent" and "Equivalent" integrated in the module.
The hexadecimal value in parentheses corresponds to the state number that is provided via channel "FBInputStatexxyy".

The following PLCopen state diagrams show the function of the dual-channel evaluation. The same diagrams apply for channel "SafeTwoChannelInputxxyy"; "SafeDigitalInput01" and "SafeDigitalInput02" must be replaced by the corresponding input.

In addition to the PLCopen specification, state SignalOK of channels "SafeInputOK01" and "SafeInputOK02" are checked.
If state SignalOK of at least one of the two channels is not ok, the function block changes to an error state and the output signal is set to 0.
Error state "ERROR 4" is not taken from the PLCopen specification.

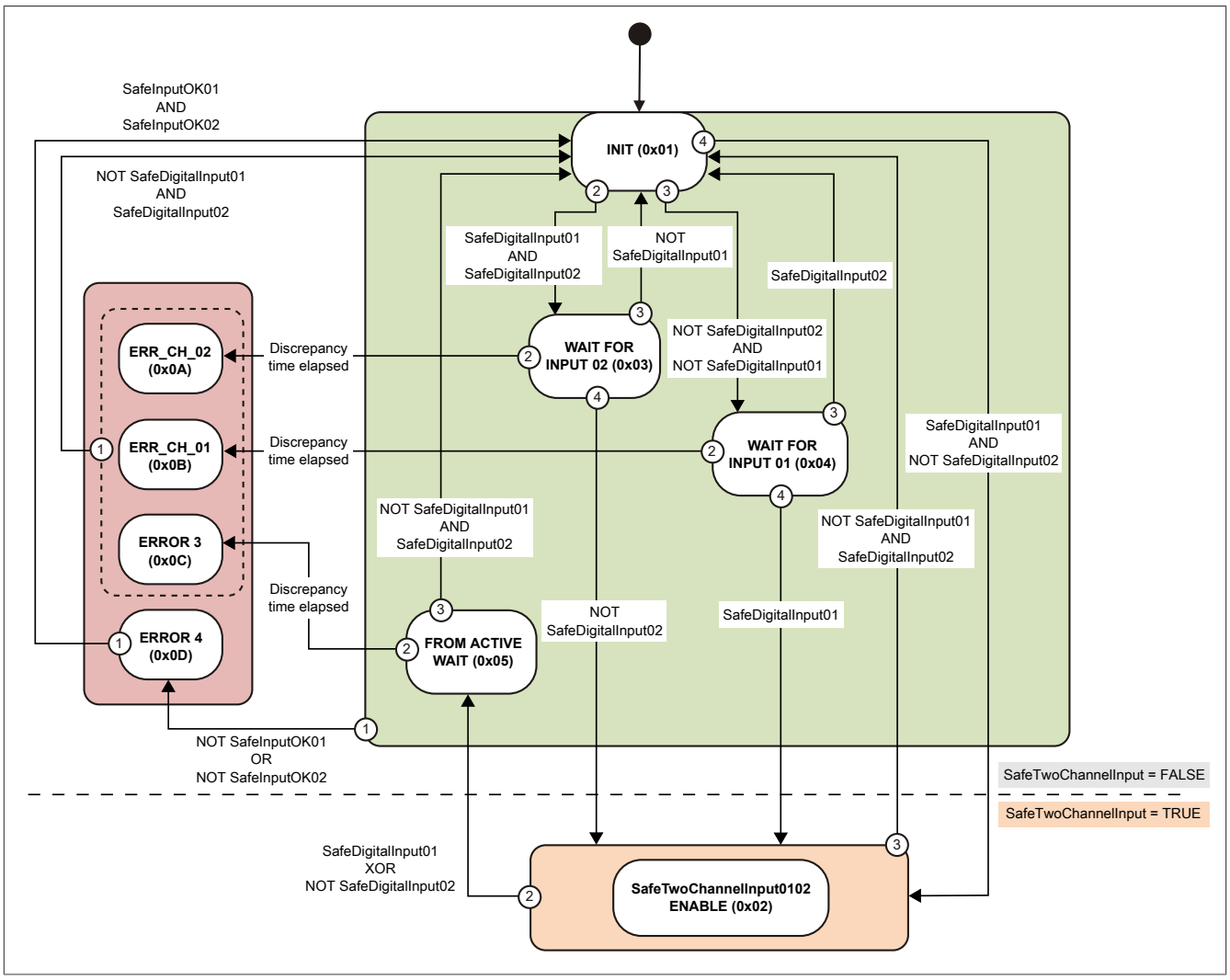



Figure 105: Function block "Antivalent" - State diagram

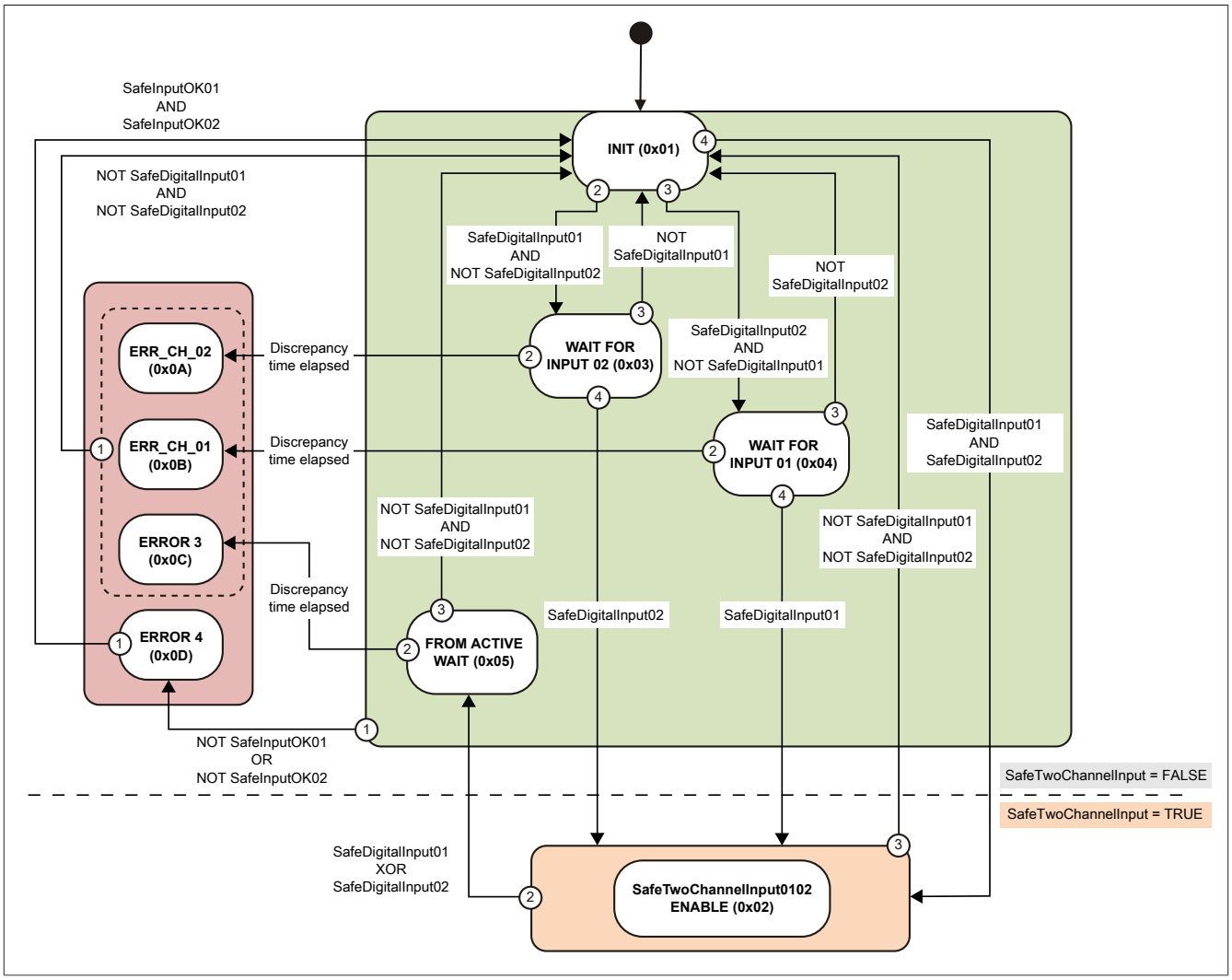



Figure 106: Function block "Equivalent" - State diagram

For additional module-specific information, see:


- "X20(c)SIx1x0" on page 13
- "X20SC0xxx" on page 17
- "X20(c)SC2212" on page 19
- "X20(c)SC2432" on page 20
- "X20SLXxxx-1" on page 21
- "X20(c)SLXxxx" on page 23
- "X67SI8103" on page 30
- "X67SC4122.L12" on page 31

## 9.6 Safe temperature measurement

The safe temperature module is suitable for safely connecting PT100, PT1000 or thermocouples for safety-related applications up to PL e or SIL 3.

**Danger!**

**Possible failure of safety function**
**Dangerous system behavior due to incorrect use of analog signal values**

**When using analog signal values, note the information listed regarding the functionality, accuracy and validity of the data.**

The signal taken via the input terminals is smoothed by the hardware filter (first-order low-pass filter / cutoff frequency 500 Hz) and digitalized in the subsequent A/D converters.

The filter values configured in the software are applied during digitalization in the A/D converter.

The signals then pass through the 2 stages of digital signal processing.

The safe analog input channels (data type SAFEINT) are formed by the arithmetic mean value of the two individual signals. At this point, also note the information about channel diagnostics.

The validity of analog signals is represented by the associated status signals. These binary status signals (data type SAFEBOOL) must also be evaluated each time the analog signals are used. A binary status signal with state SAFEFALSE indicates an invalid value in the analog signal. In these situations, the analog signal is no longer permitted to be used for safety-related assessments.

To exit an error state, a reset must be carried out. For this to be possible, a valid signal must be received at the analog input for the duration of the I/O update time. The error can then be acknowledged by a rising edge on signal "SafeReleasexxyy".

### 9.6.1 Safety-related measurement accuracy

The following aspects need to be taken into consideration with regard to the safety-related measurement accuracy of a safe analog input module or temperature module:

- The safety-related accuracy per channel is specified in the technical data.
- The measurement accuracy of a signal is a result of: Safety-related accuracy of the channel + Measurement accuracy of the sensor + Quality of the signal link of the sensor at the measurement point (depends on the installation)
- From a safety standpoint, a channel pair (i.e. signal pair) must always be observed. The measurement accuracy acquired for the signal pair must be taken into consideration when specifying the "Limit threshold equivalent x" parameter. The "Limit threshold equivalent x" parameter must be set as small as possible, but its value should not fall below the functional measurement accuracy.
- From a safety point of view, a guaranteed measurement accuracy per signal pair is the result of:
  ± ("Limit threshold equivalent x" + Measurement accuracy of signal)
- On input channels for PT100/PT1000 sensors, the line resistance must be taken into consideration from a safety point of view.
- On input channels for thermocouples, the measurement accuracy of the signal for the terminal temperature must also be added.
- When using the X20TB5E terminal, the measurement accuracy of the signal for the terminal temperature is specified in the technical data.

### 9.6.2 Connection examples

The typical connection examples in this section only represent a selection of the different wiring methods.

The following must be taken into consideration during installation:

- The maximum permissible line length is 50 m.
- The maximum resistance per stranded wire is 5 ohms.
- All lines must be shielded.
- All lines must be installed in such a way that they are short-circuit proof and voltage-disturbance proof (fault exclusion per EN ISO 13849-2:2012, appendix D.2.4, table D.4).
- The lines for the PT100/PT1000 channels must be installed in such a way that contact resistances do not change. This is because they must be included in the safety-related measurement accuracy (see section "Safety-related measurement accuracy").

**Information:**

**The thermocouple inputs must be wired, otherwise, the module switches to the "FailSafe" state.**

#### 9.6.2.1 Channel pair applications

The following channel pair applications are sufficient to achieve max. PL e (ISO 13849-1:2023), max. SIL 3 (IEC 62061:2021), max. SIL 3 (IEC 61508:2010) or max. SIL 3 (IEC 61511-1:2016/A1:2017).

**Safe thermocouple input pair with X20TB5E for acquiring terminal temperature**

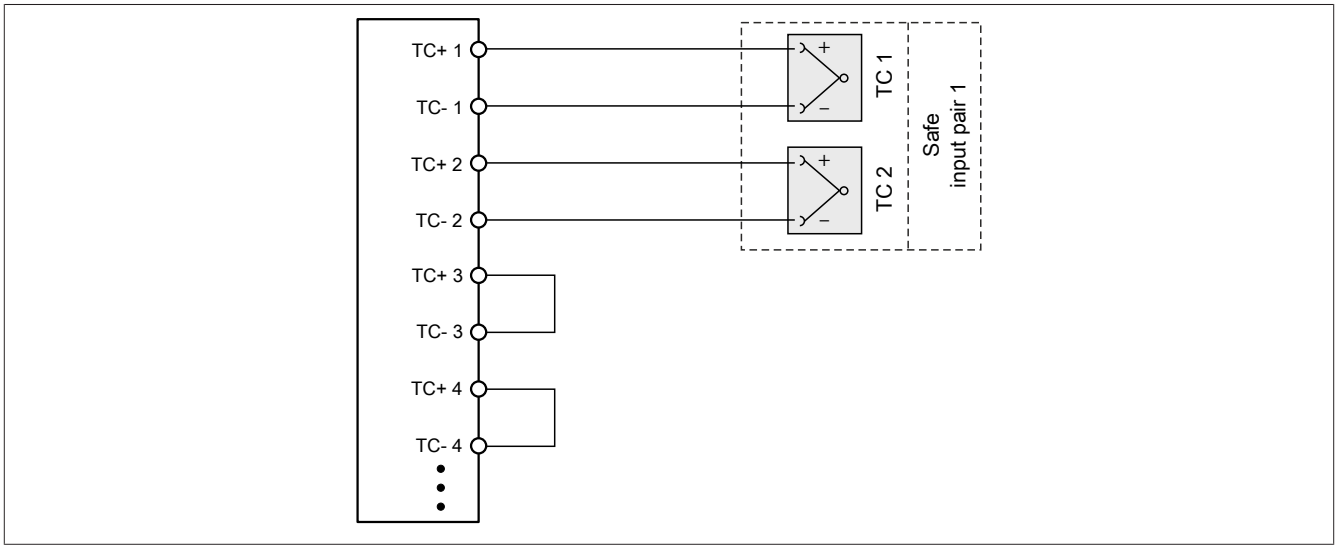



Figure 107: Safe thermocouple input pair with X20TB5E for acquiring terminal temperature

For additional module-specific information, see "X20ST4492" on page 28.

### Safe thermocouple input pair, remote terminal temperature compensation, PT100/PT1000 2-wire connections

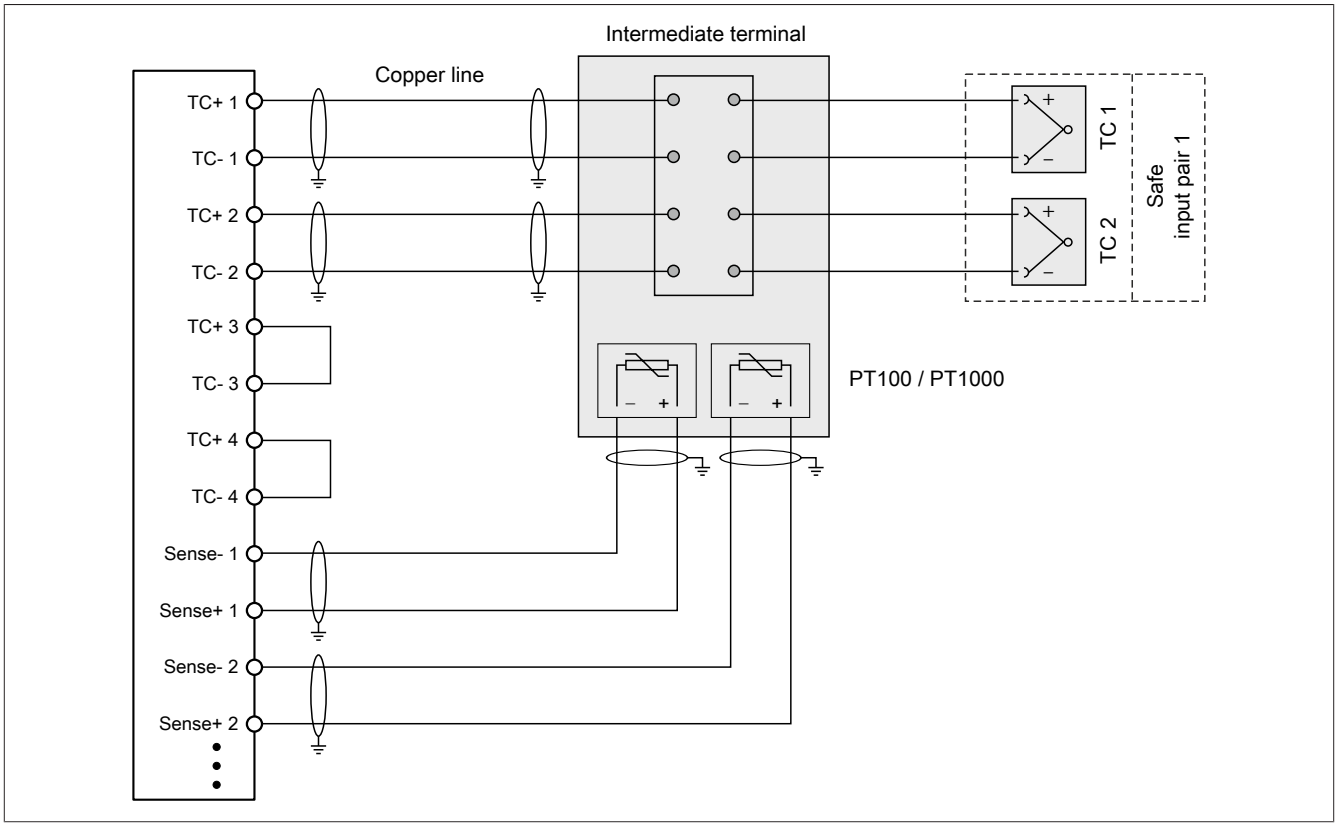



Figure 108: Safe thermocouple input pair, remote terminal temperature compensation, PT100/PT1000 2-wire connections

For additional module-specific information, see "X20ST4492" on page 28.

### Safe PT100/PT1000 input pair, 2-wire connections

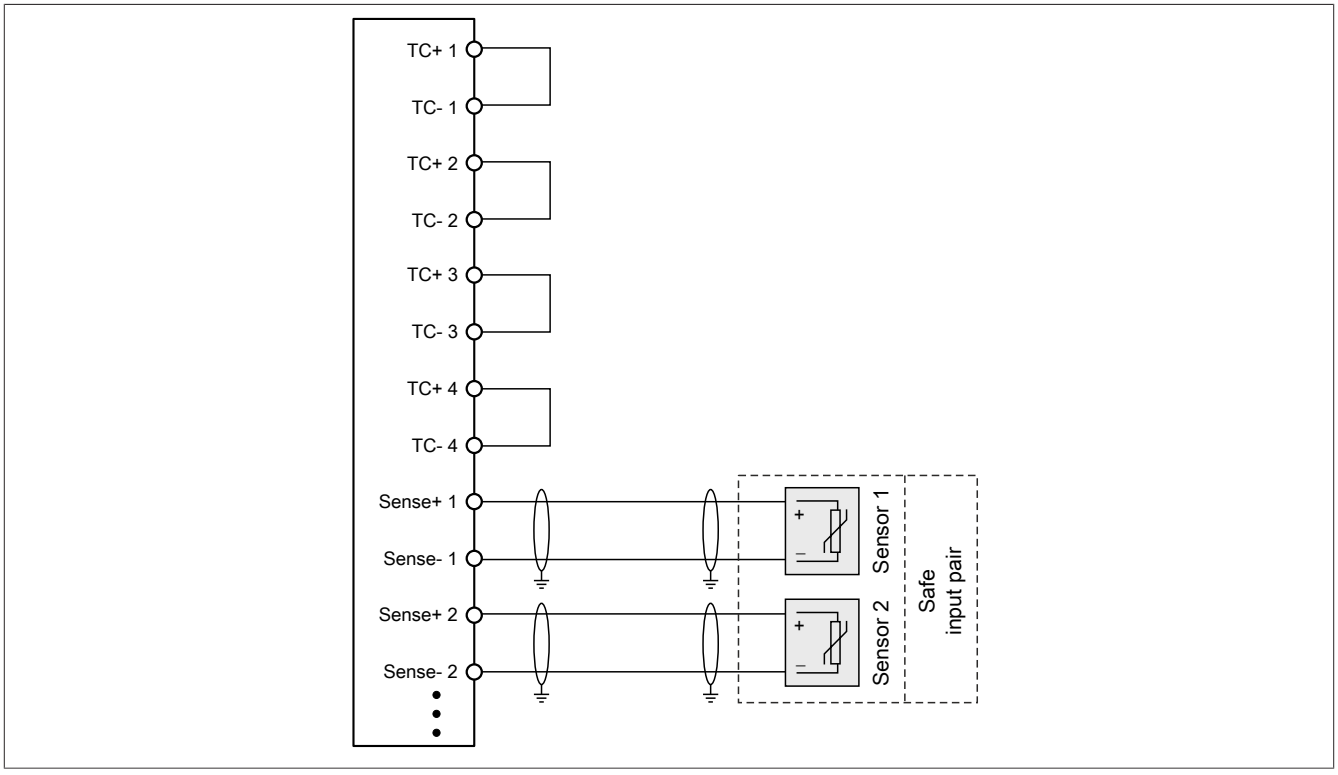



Figure 109: Safe PT100/PT1000 input pair, 2-wire connections

For additional module-specific information, see "X20ST4492" on page 28.

## 9.6.3 Error detection

### 9.6.3.1 Safe inputs - Type "PT100 / PT1000"

| Error | Detection | Comment |
|---|---|---|
| Open circuit on Sense+ or Sense- | Detected | Channel errors |
| Short circuit between Sense+, Sense- and external 24 V or GND | Not detected | Signal distortion usually does not result due to the electrical isolation of the channels; nevertheless, it is mandatory to use shielded signal lines.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per EN ISO 13849-2:2012, table D.5. |
| Short circuit between Sense+ and Sense- | Detected | Channel errors |
| Disturbance voltage | Not detected | This error results in signal distortion that may be detected by dual-channel evaluation in some circumstances.<br>Shielded cables are mandatory for all signal lines.<br>Different installation paths must be used for routing the lines of both signals of the signal pair.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state. |

Table 110: Error detection for safe inputs of type "PT100 / PT1000"

For additional module-specific information, see "X20ST4492" on page 28.

### 9.6.3.2 Safe inputs - Type "Thermocouple"

| Error | Detection | Comment |
|---|---|---|
| Open circuit | Detected | Module switches to the FAILSAFE state |
| Short circuit between T+ or T- and external 24 V or GND | Not detected | Signal distortion usually does not result due to the electrical isolation of the channels; nevertheless, it is mandatory to use shielded signal lines.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per EN ISO 13849-2:2012, table D.5. |
| Short circuit between T+ and T- | Not detected | This error results in signal distortion that may be detected by dual-channel evaluation in some circumstances.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per EN ISO 13849-2:2012, table D.5. |
| Reverse polarity of T+ and T- | Not detected | This error results in signal distortion that may be detected by dual-channel evaluation in some circumstances.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state.<br>Signal and supply lines must be installed in such a way that fault exclusion is possible per EN ISO 13849-2:2012, table D.5. |
| Disturbance voltage | Not detected | This error results in signal distortion that may be detected by dual-channel evaluation in some circumstances.<br>Shielded cables are mandatory for all signal lines.<br>Different installation paths must be used for routing the lines of both signals of the signal pair.<br>The user must take appropriate measures to ensure that this error does not result in a safety-critical state. |

Table 111: Error detection for safe inputs of type "Thermocouple"

For additional module-specific information, see "X20ST4492" on page 28.

### 9.6.3.3 Signal errors

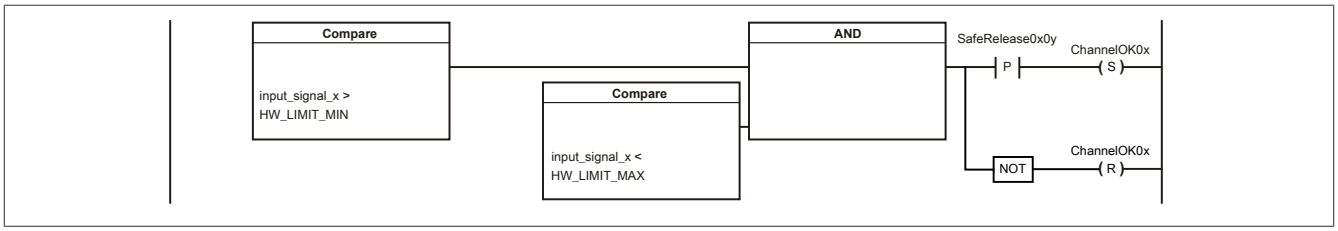
"HW_LIMIT_MIN" designates the lower limit of the measurement range specified in the technical data.
"HW_LIMIT_MAX" designates the upper limit of the measurement range specified in the technical data.

To exit an error state, a reset must be carried out.
For this to be possible, a valid signal must be received at the analog input for the duration of the I/O update time.

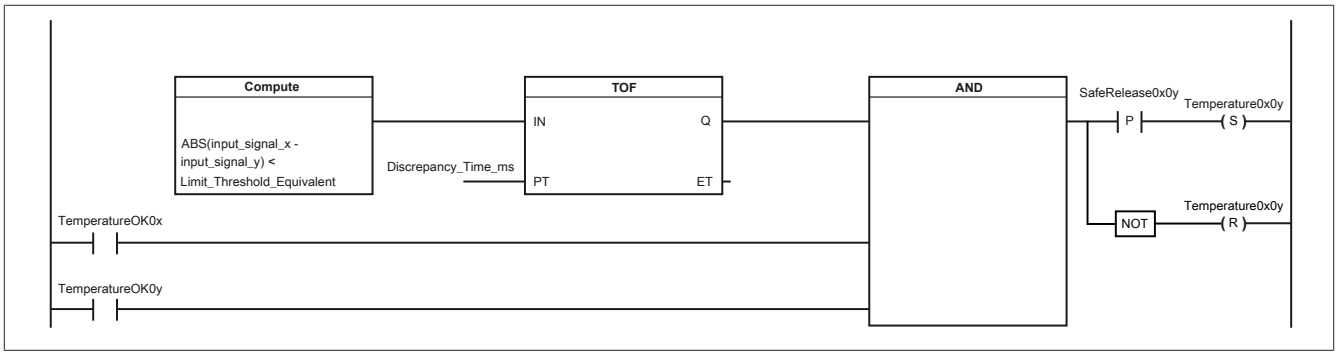
The error can then be acknowledged by a positive edge on signal "SafeReleasexxyy".

Signal evaluation takes place in 2 stages:

**Stage 1: Evaluation of signals against absolute limits**




**Stage 2: Evaluation of signals against configurable signal pair limits**




### 9.6.3.4 Channel diagnostics

Channel electronics are automatically tested within the module. For this purpose, a test signal is applied to each channel within the module. To avoid signal distortion, the signal value of the channel being tested is frozen during this time.

Only one channel is tested at a time. Per IEC 61508:2010, the module is considered a 1oo2D system for the duration of the channel test. The resulting probability of a dangerous state was taken into account in the safety characteristics (see the module's technical data).

The behavior for the duration of channel diagnostics is structured as follows:

The safe analog dual-channel inputs (data type SAFEINT) are formed by the arithmetic mean value of the two individual signals. For the duration of channel diagnostics, however, it is not the arithmetic mean value that is used, but the signal value of the channel that is not currently being diagnosed.

An active channel test is indicated by channel "TestActive". For this purpose, a test signal is applied to each channel within the module once per hour for a maximum time of 1 s.

The sequence for channel diagnostics is independent of the firmware version and structured as follows:

| | Test interval | Test channel |
|---|---|---|
| Diagnostic window 1 | Hourly | TC1, Sense 1 |
| Diagnostic window 2 | Hourly, 15 min after diagnostic window 1 | TC4, Sense 2 |
| Diagnostic window 3 | Hourly, 30 min after diagnostic window 1 | TC3 |
| Diagnostic window 4 | Hourly, 45 min after diagnostic window 1 | TC2 |

Table 112: Channel diagnostics sequence

## 9.7 Safe counter function

### Type A

The safe counter module is suitable for safely acquiring speed information from AB signals up to a maximum frequency of 7 kHz for safety-related applications up to PL e or SIL 3.

### Type B

The safe counter module is suitable for safely acquiring speed information from AB signals up to a maximum frequency of 50 kHz for safety-related applications up to PL d or SIL 2.

### Overview of types supported by the system

The following table provides a rough overview of which input types are supported by which system. For the actual variant of the respective modules, see the linked module overview or corresponding module data sheet.

| | X20 System | X67 System | X90 mobile system |
|---|---|---|---|
| Type A | ✔ | ✖ | ✖ |
| Type B | ✖ | ✖ | ✔ |

### 9.7.1 Precision

The precision of the frequency value measured by the module is determined by the module's resolution and basic accuracy.

| Configuring parameter "Unit" | | | Basic accuracy |
|---|---|---|---|
| Inc/s | Inc/min | Inc/h | |
| ±1 Inc/s | ±1 Inc/min | ±1 Inc/h | ±3% of measured value |

Table 113: Precision

**Danger!**

**The safe precision of the safe counter module is the result of adding the resolution and the basic accuracy (see table above).**

## 9.7.2 Connection examples

The typical connection examples in this section only represent a selection of the different wiring methods. The user must take error detection into account in each case.

**Information:**

**For details about connection examples (such as circuit examples, compatibility class, max. number of supported channels, terminal assignments, etc.), see section "Using sensors and actuators" in Automation Help.**

### 9.7.2.1 Type A counter inputs

#### Function mode A-A - Single-channel encoder

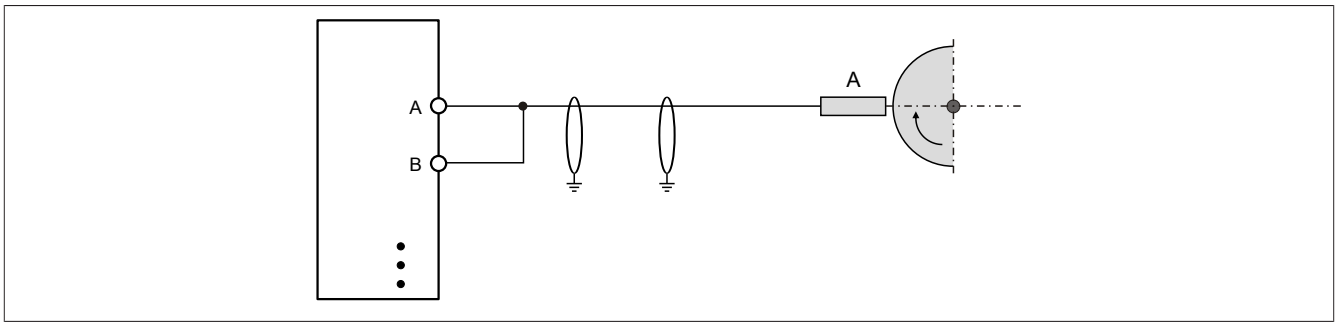



Figure 110: Function mode A-A - Single-channel encoder

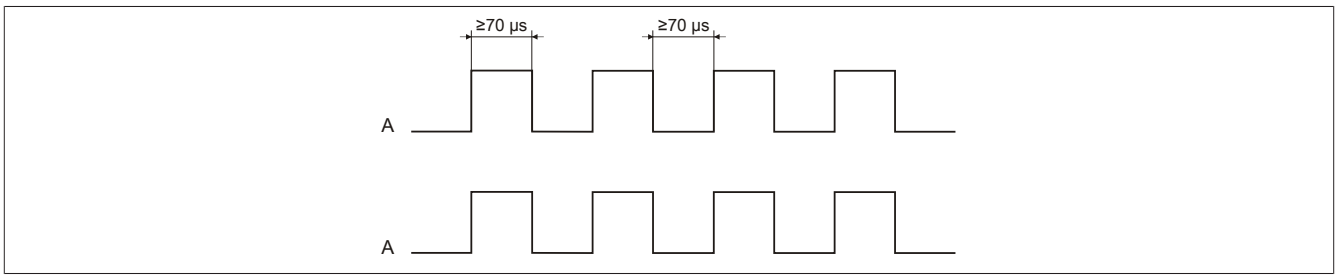



Figure 111: Signal form A-A

| Function mode | A-A - Single-channel encoder |
|---|---|
| Category per ISO 13849-1:2023 (module and encoder) | Cat. 2 |
| Safe recording of the speed | Yes if speed >0 |
| Safe recording of the direction of rotation | No |
| Safe standstill detection | No |
| **Encoder wiring instructions** | |
| • Shielded lines must be used for the encoder wiring.<br>• Line length max. 30 m | |
| **Information regarding the encoder** | |
| • The encoder must be taken into account when assessing and validating the safety chain.<br>• Encoders with output signal test pulses (OSSD) are not permitted to be used because the test pulses would result in incorrect measurement results on the counter channel.<br>• The encoder signal levels must be compatible with the input channels. Here, the characteristic values listed in the technical data must be taken into account. | |
| **Information regarding the encoder power supply** | |
| • The variant of the encoder power supply must ensure proper operation and the correct signal level (<5 VDC low, >15 VDC high). | |

For additional module-specific information, see "X20(c)SD1207" on page 29.

## Function mode A-A - Two-channel encoder

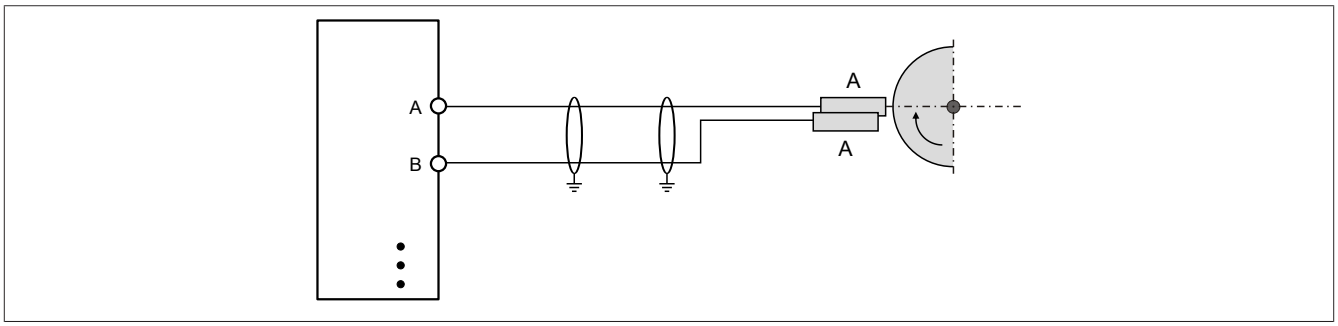



Figure 112: Function mode A-A - Two-channel encoder

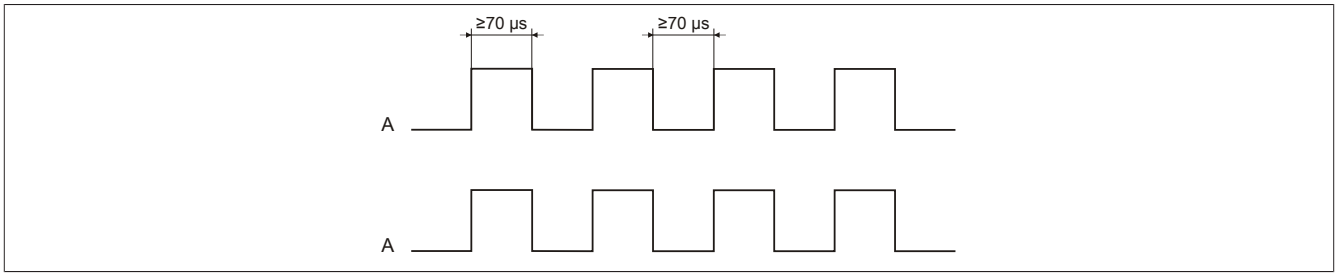



Figure 113: Signal form A-A

| Function mode | A-A - Two-channel encoder |
|---|---|
| Category per ISO 13849-1:2023 (module and encoder) | Cat. 4 |
| Safe recording of the speed | Yes if speed >0 |
| Safe recording of the direction of rotation | No |
| Safe standstill detection | No |
| **Encoder wiring instructions** | |
| • 2 separate and shielded lines must be used to wire both encoders. | |
| **Information regarding the encoder** | |
| • The encoder must be taken into account when assessing and validating the safety chain.<br>• Encoders with output signal test pulses (OSSD) are not permitted to be used because the test pulses would result in incorrect measurement results on the counter channel.<br>• The encoder signal levels must be compatible with the input channels. Here, the characteristic values listed in the technical data must be taken into account.<br>• The two "A" signals must be generated by independent encoders. | |
| **Information regarding the encoder power supply** | |
| • The variant of the encoder power supply must ensure proper operation and the correct signal level (<5 VDC low, >15 VDC high). | |

For additional module-specific information, see "X20(c)SD1207" on page 29.

## Function mode A-B

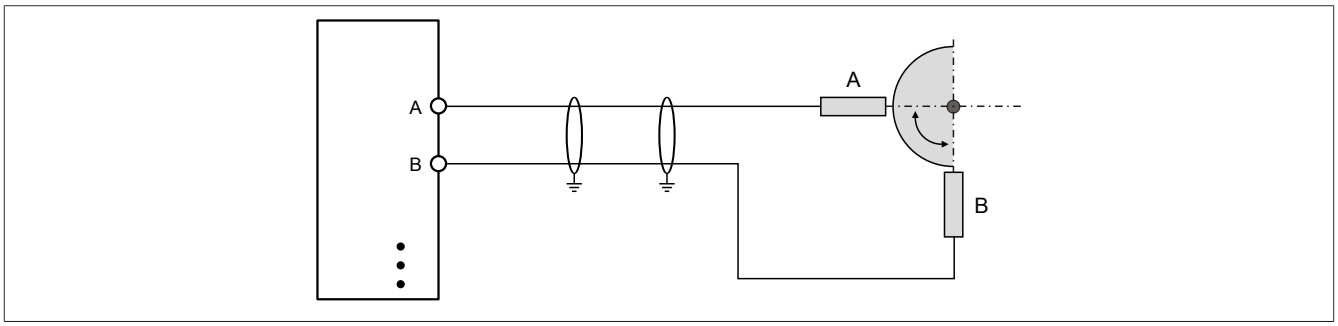



Figure 114: Function mode A-B

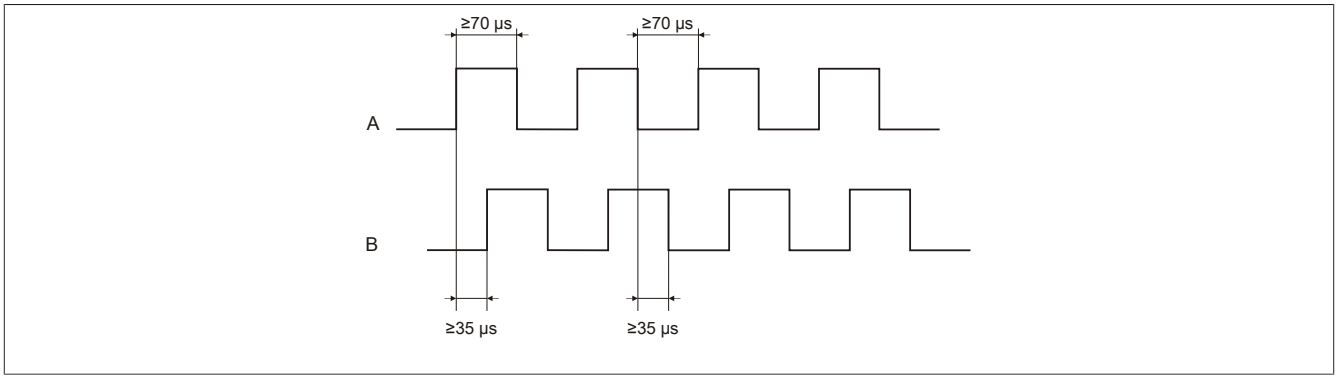



Figure 115: Signal form A-B

| Function mode | A-B |
|---|---|
| Category per ISO 13849-1:2023 (module and encoder) | Cat. 4 |
| Safe recording of the speed | Yes if speed >0 |
| Safe recording of the direction of rotation | No |
| Safe standstill detection | No |
| **Encoder wiring instructions** | |
| • Shielded lines must be used for the encoder wiring.<br>• Line length max. 30 m | |
| **Information regarding the encoder** | |
| • The encoder must be taken into account when assessing and validating the safety chain.<br>• Encoders with output signal test pulses (OSSD) are not permitted to be used because the test pulses would result in incorrect measurement results on the counter channel.<br>• The encoder signal levels must be compatible with the input channels. Here, the characteristic values listed in the technical data must be taken into account.<br>• The "A" and "B" signals must be generated by independent encoders. If "AB" encoders are used, it is necessary to ensure that the "A" signal is generated in the encoder independent of the "B" signal. | |
| **Information regarding the encoder power supply** | |
| • The variant of the encoder power supply must ensure proper operation and the correct signal level (<5 VDC low, >15 VDC high). | |

For additional module-specific information, see "X20(c)SD1207" on page 29.

## Function mode A-A/-B-B/

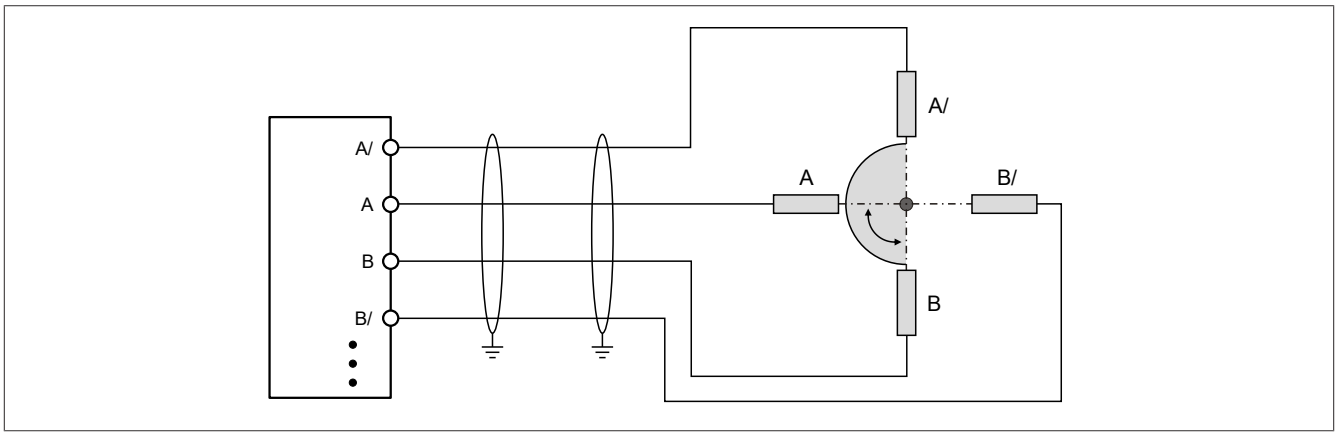



Figure 116: Function mode A-A/-B-B/

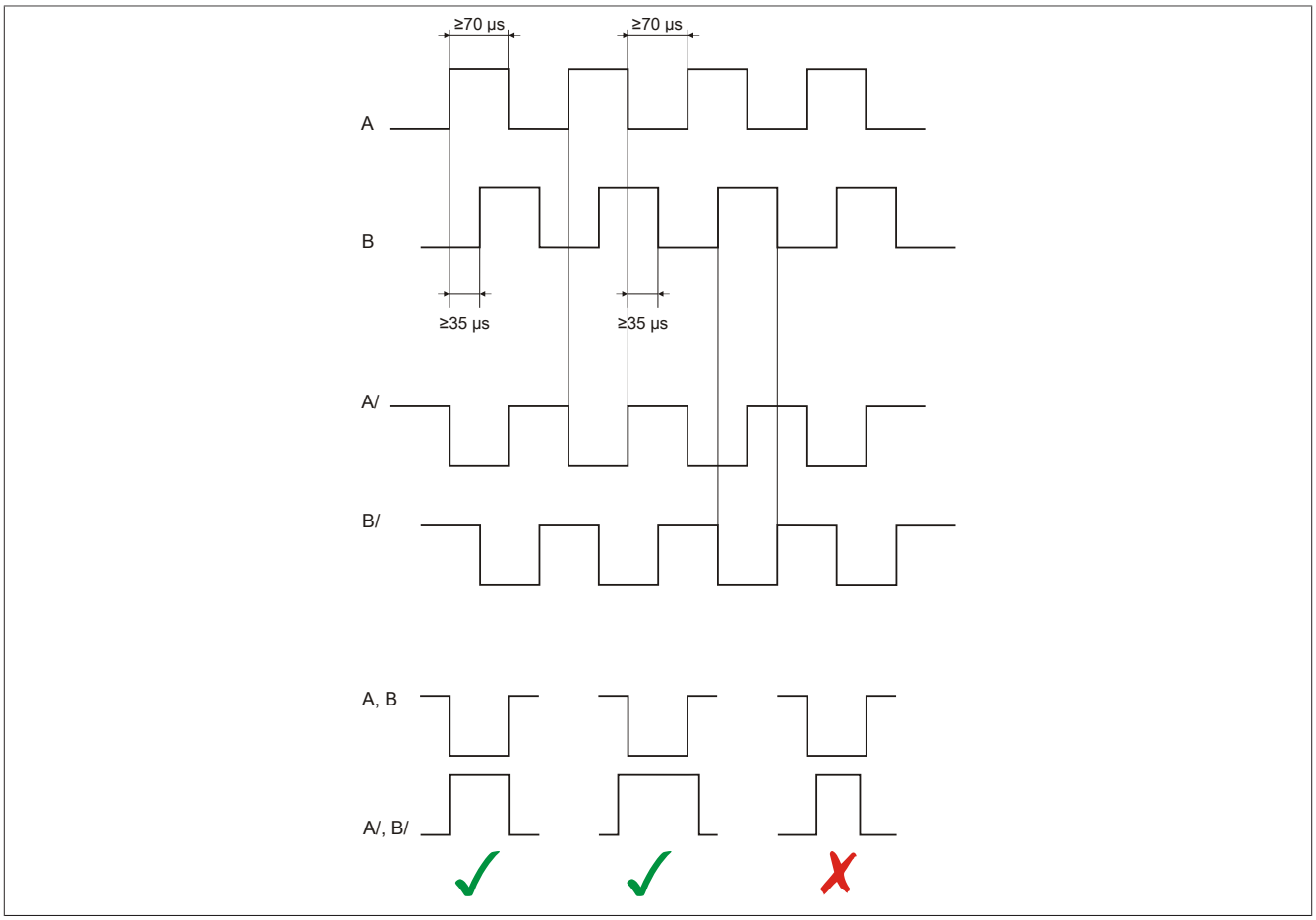



Figure 117: Signal form A-A/-B-B/

| Function mode | A-A/-B-B/ |
|---|---|
| Category per ISO 13849-1:2023 (module and encoder) | Cat. 4 |
| Safe recording of the speed | Yes if speed >0 |
| Safe recording of the direction of rotation | Yes |
| Safe standstill detection | Yes |
| **Encoder wiring instructions** | |
| • Shielded lines must be used for the encoder wiring.<br>• Line length max. 30 m | |
| **Information regarding the encoder** | |
| • The encoder must be taken into account when assessing and validating the safety chain.<br>• Encoders with output signal test pulses (OSSD) are not permitted to be used because the test pulses would result in incorrect measurement results on the counter channel.<br>• The encoder signal levels must be compatible with the input channels. Here, the characteristic values listed in the technical data must be taken into account.<br>• The "A", "A/", "B" and "B/" signals must be generated by independent encoders. If "AA/BB/" encoders are used, it is necessary to ensure that all signals are generated in the encoder independent of the others. | |
| **Information regarding the encoder power supply** | |
| • The variant of the encoder power supply must ensure proper operation and the correct signal level (<5 VDC low, >15 VDC high). | |

For additional module-specific information, see "X20(c)SD1207" on page 29.

### 9.7.2.2 Type B counter inputs

### Function mode A-A - Single-channel encoder

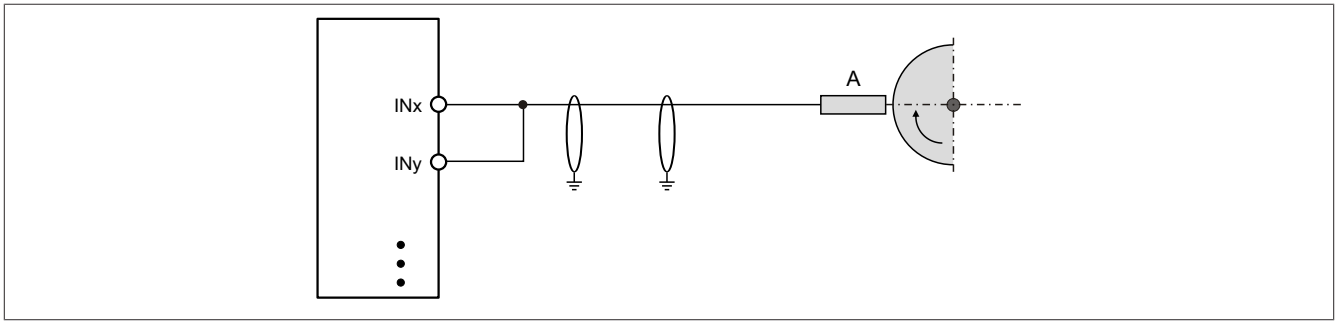



Figure 118: Function mode A-A - Single-channel encoder

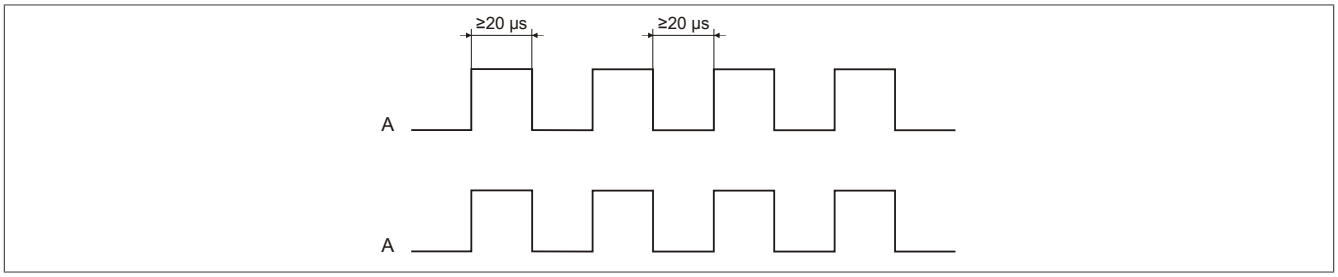



Figure 119: Signal form A-A

| Function mode | A-A - Single-channel encoder |
|---|---|
| Category per ISO 13849-1:2023 (module and encoder) | Cat. 2 |
| Safe recording of the speed | Yes if speed >0 |
| Safe recording of the direction of rotation | No |
| Safe standstill detection | No |
| **Encoder wiring instructions** | |
| • Shielded lines must be used for the encoder wiring.<br>• Line length max. 30 m | |
| **Information regarding the encoder** | |
| • The encoder must be taken into account when assessing and validating the safety chain.<br>• Encoders with output signal test pulses (OSSD) are not permitted to be used because the test pulses would result in incorrect measurement results on the counter channel.<br>• The encoder signal levels must be compatible with the input channels. Here, the characteristic values listed in the technical data must be taken into account. | |
| **Information regarding the encoder power supply** | |
| • The variant of the encoder power supply must ensure proper operation and signal levels. | |

## Function mode A-A - Two-channel encoder

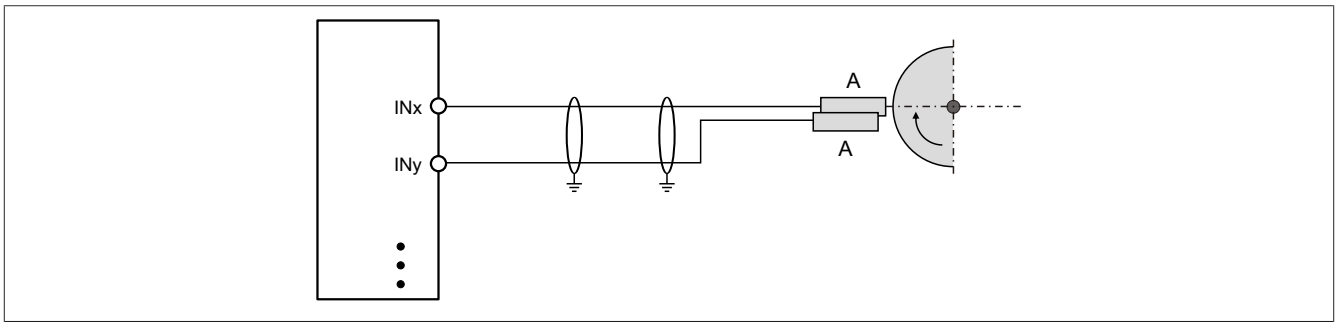



Figure 120: Function mode A-A - Two-channel encoder

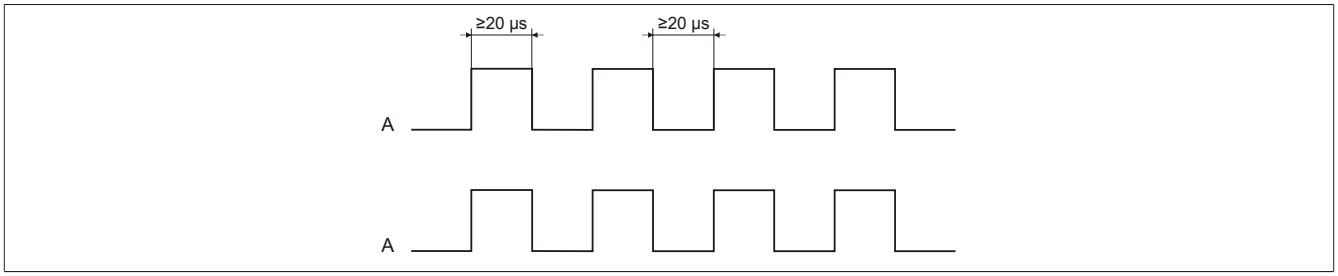



Figure 121: Signal form A-A

| Function mode | A-A - Two-channel encoder |
|---|---|
| Category per ISO 13849-1:2023 (module and encoder) | Cat. 3 |
| Safe recording of the speed | Yes if speed >0 |
| Safe recording of the direction of rotation | No |
| Safe standstill detection | No |
| **Encoder wiring instructions** | |
| • 2 separate and shielded lines must be used to wire both encoders. | |
| **Information regarding the encoder** | |
| • The encoder must be taken into account when assessing and validating the safety chain.<br>• Encoders with output signal test pulses (OSSD) are not permitted to be used because the test pulses would result in incorrect measurement results on the counter channel.<br>• The encoder signal levels must be compatible with the input channels. Here, the characteristic values listed in the technical data must be taken into account.<br>• The two "A" signals must be generated by independent encoders. | |
| **Information regarding the encoder power supply** | |
| • The variant of the encoder power supply must ensure proper operation and signal levels. | |

## Function mode A-B

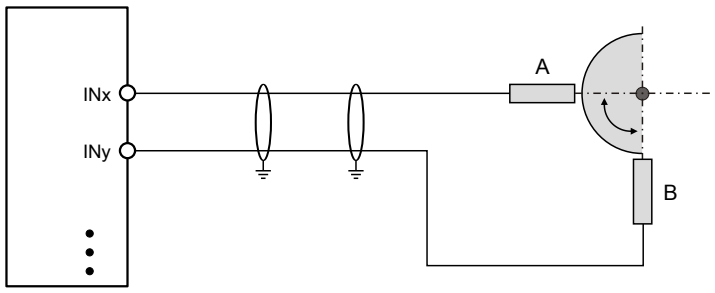



Figure 122: Function mode A-B

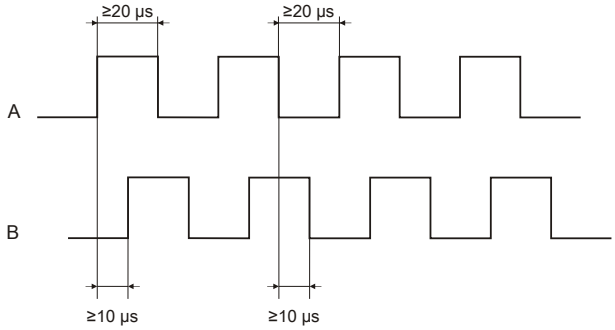



Figure 123: Signal form A-B

| Function mode | A-B |
|---|---|
| Category per ISO 13849-1:2023 (module and encoder) | Cat. 3 |
| Safe recording of the speed | Yes if speed >0 |
| Safe recording of the direction of rotation | Yes |
| Safe standstill detection | No |
| **Encoder wiring instructions** | |
| • Shielded lines must be used for the encoder wiring.<br>• Line length max. 30 m | |
| **Information regarding the encoder** | |
| • The encoder must be taken into account when assessing and validating the safety chain.<br>• Encoders with output signal test pulses (OSSD) are not permitted to be used because the test pulses would result in incorrect measurement results on the counter channel.<br>• The encoder signal levels must be compatible with the input channels. Here, the characteristic values listed in the technical data must be taken into account.<br>• The "A" and "B" signals must be generated by independent encoders. If "AB" encoders are used, it is necessary to ensure that the "A" signal is generated in the encoder independent of the "B" signal. | |
| **Information regarding the encoder power supply** | |
| • The variant of the encoder power supply must ensure proper operation and signal levels. | |

## 9.7.3 Error detection

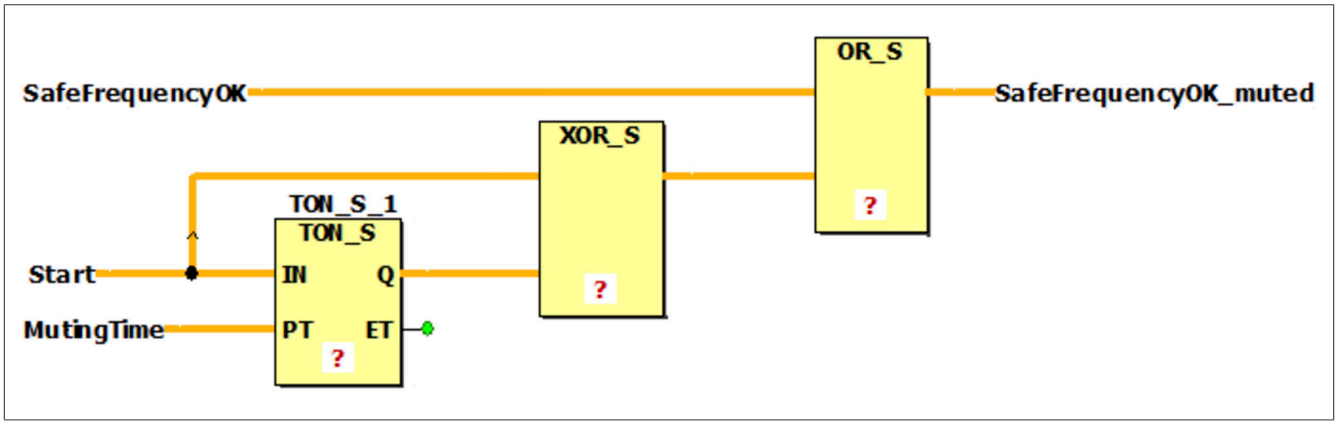
### 9.7.3.1 Function mode A-A and A-B

In these modes, the module identifies a safe frequency signal ("SafeFrequency").
Wiring faults are only detected with dynamic signals and not at standstill. Signal "SafeFrequency" is therefore not permitted to be evaluated at standstill.
This situation is indicated by status signal "SafeFrequencyOK".

Status signal "SafeFrequencyOK" is determined as follows:

- SAFEFALSE if no pulses are detected on the counter channel within time "Time base"
- SAFEFALSE if the maximum frequency is exceeded
- SAFEFALSE if the maximum acceleration is exceeded
- SAFEFALSE if the range of values of the data type of signal "SafeFrequency" is exceeded
- SAFEFALSE if a different, module-internal problem is detected
- SAFETRUE if none of the items listed above occur

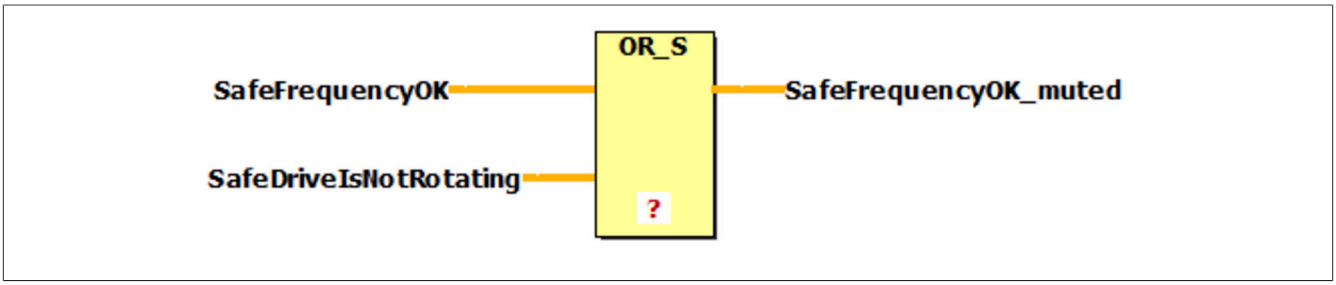
Since "SafeFrequency" is not permitted to be evaluated at standstill, a deadlock situation can occur, for example in an application that monitors the max. speed when starting up the drive (drive cannot start up because signal "SafeFrequencyOK" is not SAFETRUE, and signal "SafeFrequencyOK" simultaneously cannot become SAFETRUE because the drive does not start up).
The following SafeDESIGNER code snippet could be used, for example, to solve this problem:




| Variable | Type | Source | Description |
|---|---|---|---|
| SafeFrequencyOK | SAFEBOOL | Module | This status signal indicates the validity of signal "SafeFrequency". |
| Start | SAFEBOOL | Application | A positive edge on this signal indicates that a start request has been sent for the rotary movement. |
| MutingTime | SAFETIME | Application | This signal defines the max. time the drive needs to detect pulses on the counter channel.<br>Parameter "Time base" must also be taken into consideration during this time.<br><br>**Important:**<br>**Monitoring functions are not active during this time. Therefore, this time must be as short as possible. Alternate methods must be used to ensure that no dangerous states can occur within this time.** |
| SafeFrequencyOK_muted | SAFEBOOL | - | This signal can now be used to further evaluate the rotary movement. |

Table 114: Code snippet: Timed muting of signal "SafeFrequencyOK"

As soon as a safe signal for determining the rotary movement is available, the following SafeDESIGNER code snippet can be used:




| Variable | Type | Source | Description |
|---|---|---|---|
| SafeFrequencyOK | SAFEBOOL | Module | This status signal describes the validity of signal "SafeFrequency". |
| SafeDriveIsNotRotating | SAFEBOOL | Application | This signal describes whether a rotary movement is taking place. |
| SafeFrequencyOK_muted | SAFEBOOL | - | This signal can now be used to further evaluate the rotary movement. |

Table 115: Code snippet: Muting signal "SafeFrequencyOK" using an additional signal

For additional module-specific information, see "X20(c)SD1207" on page 29.

#### 9.7.3.2 Function mode A-A/-B-B/ (only for type A counter inputs)

In mode "A-A/-B-B/", wiring faults are always detected regardless of standstill. In this mode, it is therefore also permitted to evaluate signal "SafeFrequency" at standstill and to implement safe standstill detection.

The "SafeFrequencyOK" status signal is determined as follows:

- SAFEFALSE if the maximum frequency is exceeded
- SAFEFALSE if the maximum acceleration is exceeded
- SAFEFALSE if the range of values of the data type of signal "SafeFrequency" is exceeded
- SAFEFALSE if a different, module-internal problem is detected
- SAFETRUE if none of the items listed above occur

For additional module-specific information, see "X20(c)SD1207" on page 29.

#### 9.7.3.3 Error acknowledgment (only for type A counter inputs)

To acknowledge an error, the cause of error (e.g. open circuit) must be corrected and the input frequency must be 0 for hardware upgrades <2.5.0.0 of the module. The error can then be acknowledged with a rising edge on channel "Reset".

For additional module-specific information, see "X20(c)SD1207" on page 29.

# 10 SafeLogic (Safety+)

In the technical documentation, the term "SafeLogic" generally covers all safety controllers. In some cases, however, module-specific properties must be taken into account. The following terms are used for this:

- X20 SafeLogic controllers: Valid for products of the X20SL82xx series
- X20 SafeLogic-X controllers: Valid for products of the X20SLXxxx-1 series

The module is equipped with SafeLogic functionality that allows it to safely execute applications designed in SafeDesigner+. The module can be used in safety applications up to PL e or SIL 3.

In addition, the SafeLogic controller coordinates the safety-related communication of all modules involved in the application. In this context, the SafeLogic controller also monitors the configuration of these modules and autonomously carries out parameter downloads to the modules if necessary. This guarantees a consistent and correct module configuration in the network from a safety point of view in all scenarios involving module replacement and service. For X20 SafeLogic products, these services are executed by the X20 SafeLogic controller. For X20 SafeLogic-X products, these services are executed on the standard CPU in interaction with Automation Runtime. The safety-related characteristics up to PL e or SIL 3 for applications are provided with both variants, however.
X20 SafeLogic-X products are also equipped with the I/O properties described in chapter 9 "SafeIO".

# 11 SafeLogic controller (mapp Safety)

In the technical documentation, the term "SafeLogic" generally covers all safety controllers. In some cases, however, module-specific properties must be taken into account. The following terms are used for this:

- X20 SafeLogic controllers: Valid for products of the X20SL81xx series
- X20 SafeLogic-X controllers: Valid for products of the X20SLXxxx series
- X90 SafeLogic controllers: Valid for X90CP1xx.xx-S1

The module is equipped with SafeLogic functionality that allows it to safely execute applications designed in SafeDESIGNER. The module can be used in safety applications up to PL e or SIL 3.

In addition, the SafeLogic controller coordinates the safety-related communication of all modules involved in the application. In this context, the SafeLogic controller also monitors the configuration of these modules and autonomously carries out parameter downloads to the modules if necessary. This guarantees a consistent and correct module configuration in the network from a safety point of view in all scenarios involving module replacement and service. For X20 SafeLogic products, these services are executed by the X20 SafeLogic controller. For X20 SafeLogic-X and X90 SafeLogic products, these services are executed on the standard CPU in interaction with Automation Runtime. The safety-related characteristics up to PL e or SIL 3 for applications are provided with both variants, however.
X20 SafeLogic-X and X90 SafeLogic products also have the I/O properties described in section 9 "SafeIO".

## 11.1 Automatic acknowledgment

Automatic acknowledgment is usually not permitted. Provided that the user implements appropriate quality assurance measures and/or constraints, it is possible to deviate from this to permit the following automatic acknowledgments.

### Danger!

**The automatic acknowledgment of acknowledgment requests from the SafeLOGIC controller under false premises is not permitted and can result in dangerous states.**

**Additional measures may be necessary depending on the requirements of the safety application, the analysis of which is the sole responsibility of the user.**

### 11.1.1 "SafeKEY exchange" acknowledgment request

The SafeDESIGNER application and SafeOPTION are saved in the safety section of the CompactFlash card (X20 SafeLOGIC-X and X90 SafeLOGIC controllers) or on the SafeKEY (X20 SafeLOGIC controllers). Exchanging the CompactFlash card or SafeKEY may result in the unintended exchange of this data. The "SafeKEY exchange" acknowledgment request is meant to prevent this unintentional exchange of data.

It is important to ensure that the following criteria are met with automatic acknowledgment that potentially involves CompactFlash cards or SafeKEYs:

- The SafeDESIGNER application must be completely validated on a reference machine.
- The use of SafeOPTION must be fully validated on a reference machine.
- Sufficient measures must be implemented to prevent the SafeDESIGNER application or SafeOPTION from being mixed up across different machine types.
- No test versions of the SafeDESIGNER application or SafeOPTION are permitted.

Under the conditions listed, an automated update of the SafeDESIGNER application or SafeOPTION is permitted to be implemented on the SafeLOGIC controller.

### 11.1.2 "Firmware acknowledge" acknowledgment request

B&R Automation Runtime sees to it independently that the firmware versions stored on the CompactFlash card are transferred to the automation components in the network. This mechanism may cause other firmware versions to be enabled in the system than those that were active when the SafeDESIGNER application was validated. A change to the firmware of the safety modules always requires revalidation of the SafeDESIGNER application. The "Firmware acknowledge" acknowledgment request is meant to prevent an unintentional exchange of firmware versions.

It is important to ensure that the following criteria are met with automatic acknowledgment that potentially involves CompactFlash cards:

- The firmware files installed on the safety modules must be completely validated together with the SafeDESIGNER application on a reference machine.

### 11.1.3 "UDID mismatch" acknowledgment request

The "UDID mismatch" request occurs in the following situations:

- When modules are exchanged by the user (e.g. during a service call). In this case, it is possible for the connection lines to be mixed up.
- When errors occur in the standard application that result in a mix-up of modules.

To rule out these mix-ups, a wiring test must be performed after acknowledgment of a "UDID mismatch" request.

The "UDID mismatch" acknowledgment request is meant to prevent the unintentional mix-up of signals caused by exchanging a module or errors in the standard application.

- Service personnel are to be informed that the mandatory wiring test when exchanging modules must be performed independently of the automatic acknowledgment of the "UDID mismatch" request.
- It is not permitted to use more than 1 module per module type in the Automation Studio application or the SafeDESIGNER application.

If this last requirement cannot be met, a "UDID mismatch" acknowledgment request is not permitted to be acknowledged automatically since it would not cover the possible mix-up of signals caused by errors in the standard application.

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25

## 11.2 Dialog box 'SafePLC info' in SafeDESIGNER

Dialog box "Safety control info" appears when button "Info" is pressed in dialog box "Safety control' (control dialog box) or in dialog box "Debug".

The dialog box shows information about the current project in the safe programming system, the project stored/running on the safety controller, the current status of the safety controller, debugging information, etc.

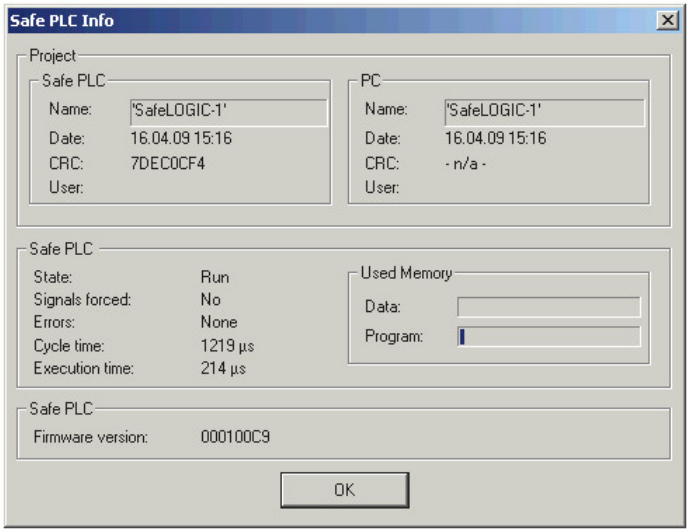



Figure 124: SafeLOGIC "Info" dialog box

| **Project** | **Project-defining data** | |
|---|---|---|
| Safe PLC | Project data saved on the SafeKEY being used for the SafeLOGIC controller | |
| | Name | Name of the project |
| | Date | Date of the last change |
| | CRC | CRC |
| | User | User who made the last change |
| PC | SafeDESIGNER project data on the PC | |
| | Name | Name of the project |
| | Date | Date of the last change |
| | CRC | CRC, "- n/a -" if the project is not yet compiled |
| | User | User who made the last change |
| **Safe PLC** | **Status and information about the SafeLOGIC controller** | |
| State | Displays the operating status of the safety controller. | |
| Signals forced | No | No variables are forced. |
| | Yes | Variables are forced. |
| Errors | Information regarding available error messages in the SafeDESIGNER message window | |
| Cycle time | Cycle time that is actually required, maximum value since the last power up<br>This value is only relevant if "Safe PLC State = Run". | |
| Execution time | Actual application execution time<br>This value corresponds to the "Safe PLC Cycle time" minus system and communication overhead. | |
| Used memory | Bar that shows the system resources being used | |
| | Data | Data memory for the safety application |
| | Program | Application memory for the safety application |
| Firmware version | Firmware version | |

For additional module-specific information, see:

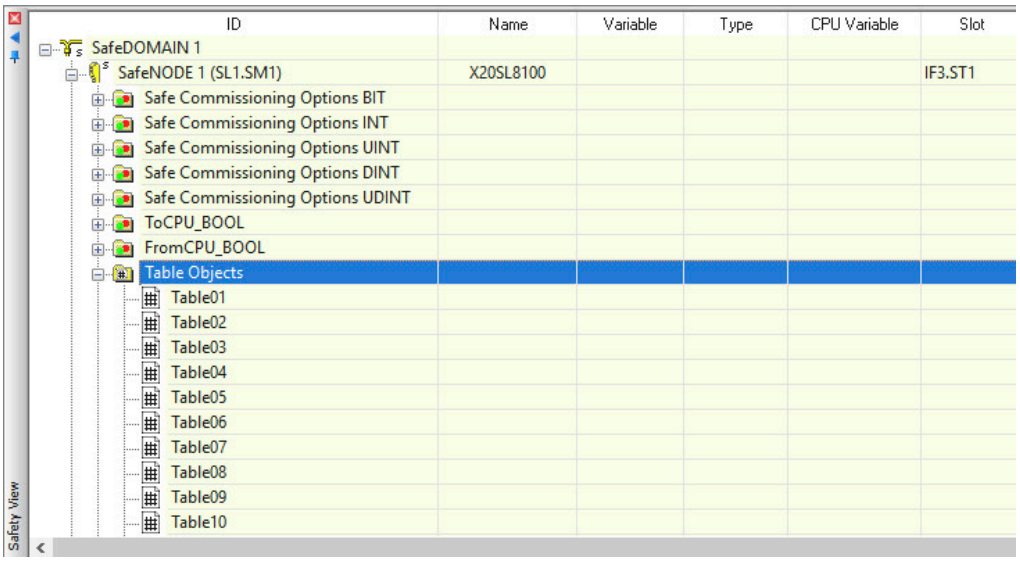
- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25

## 11.3 Safe Commissioning Tables

Safe Commissioning Tables refer to a CSV file with a certain structure and data. Up to 99 Safe Commissioning Tables are available in SafeDESIGNER under the X20 SafeLOGIC controller. Each table object represents the connection to a CSV file with the corresponding data. In addition, SafeDESIGNER contains library "Table_SF" for evaluating the various table objects. The function blocks of this library must be linked to a table object.

### Information:

**The validation and lock functions implemented in SafeDESIGNER, together with the validation of the table data by the user, allow the use of COTS (commercial off-the-shelf) editors for table data.**



The necessary settings for the table objects are controlled by X20 SafeLOGIC parameters. This contains tab "Safe Commissioning Tables". The following settings can be assigned for each table object:

- TableSource - Where does the table data come from?
  - NOT used - table object not used
  - SafeDESIGNER download - Data transferred with application
  - Remote download - Data not transferred with the application. These must be subsequently transferred to the X20 SafeLOGIC controller.
- TableType - Type of table
  - A - Q
  - R - Z - SafeROBOTIC table types

Order no.: X20SL8100
Description: X20 SafeLOGIC, POWERLINK V2, 24V, univ.
SafeNODE ID: 1
Import file: -

| Parameter | Value |
|---|---|
| **Tables** | |
| TableSource_01 | SafeDESIGNER download |
| TableType_01 | A |
| TableSource_02 | NOT used |
| TableType_02 | A |
| TableSource_03 | NOT used |
| TableType_03 | A |
| TableSource_04 | NOT used |
| TableType_04 | T |
| TableSource_05 | NOT used |
| TableType_05 | A |
| TableSource_06 | NOT used |
| TableType_06 | A |
| TableSource_07 | NOT used |

Tables | ALL

## Information:

**For details about the structure of the Safe Commissioning Tables or data, see the help documentation of the function block to be used.**

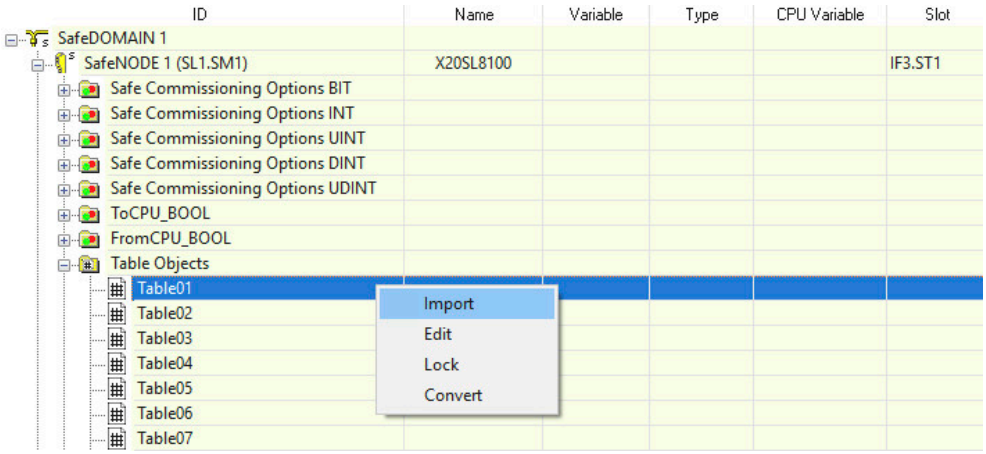
### Procedure

First, the correct type and source must be set for each table object.

## Information:

**If a table object is used in the application and parameter "TableSource" is set to "NOT used", an error message results during compilation.**

Various actions can be performed using the shortcut menu (right-click on a table object).



### Import

This menu item can be used to import an existing CSV file with corresponding data suitable to the selected table type.

## Information:

**If a file that does not match the table type is imported, then an error message will be generated when the project is compiled.**

### Edit

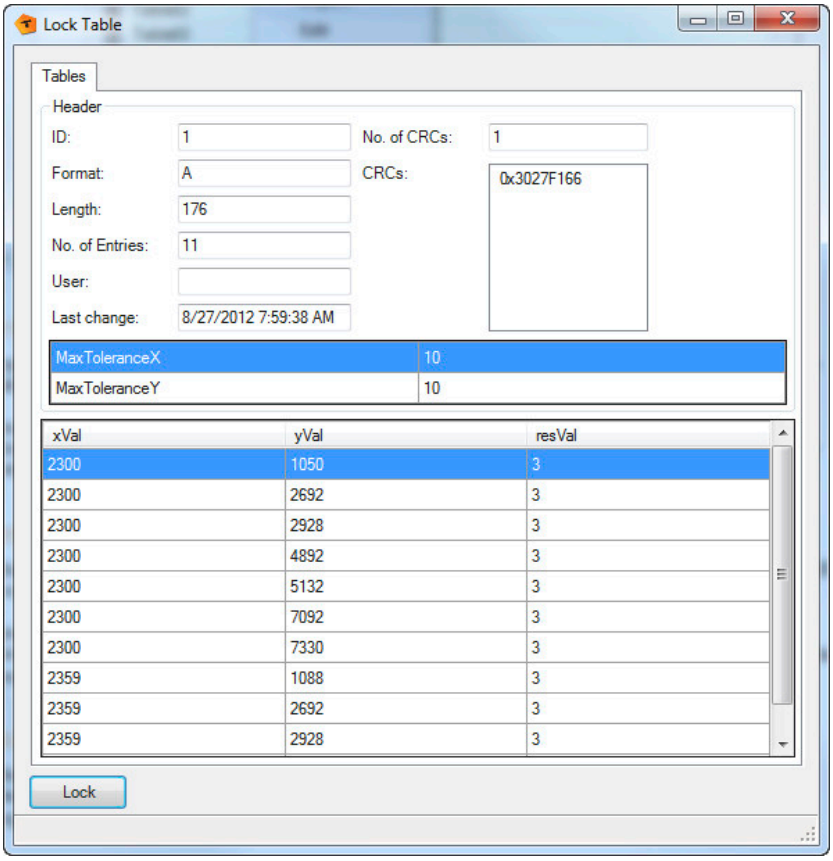
With this menu option the file can be edited with the standard program for CSV files (e.g. Excel).

## Information:

**If a file is edited, it is absolutely necessary to lock this file again - see Lock - otherwise the CRC of the file will not fit.**

### Lock

This menu option locks the file and calculates a CRC for the current content. At the same time, the data is displayed again in the window according to the selected table type.

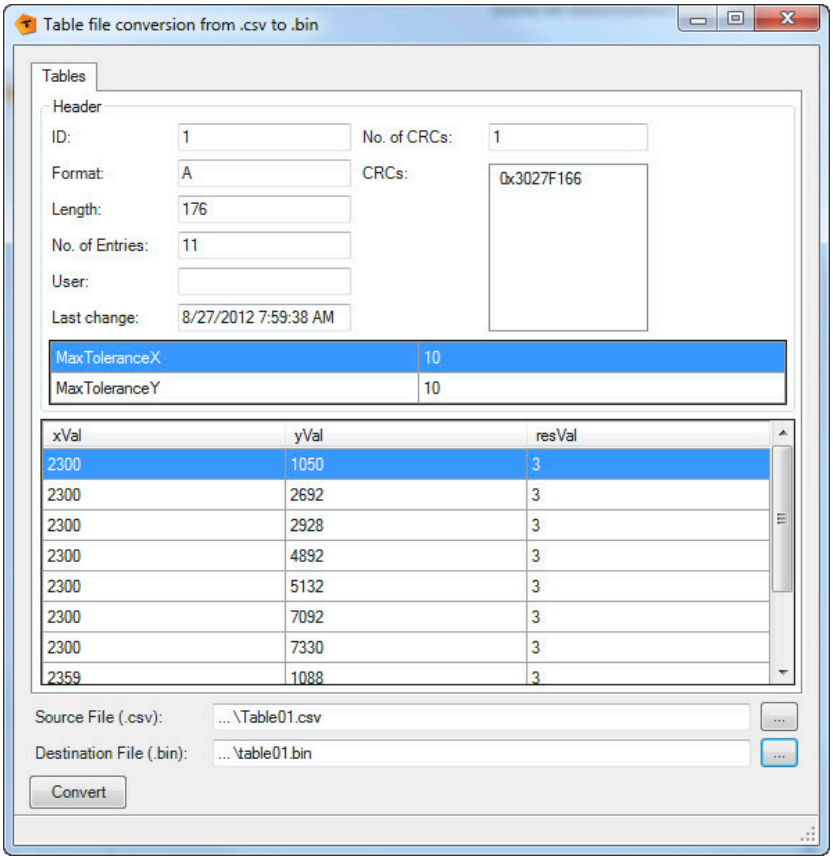



## Information:

**Error messages will also be displayed in this window if there are any problems with the file (e.g. invalid format, cannot open file). The SafeDESIGNER project must be recompiled after the file has been locked. Only then are the changes made in the Safe Commissioning Table taken into account for the download to the safety controller.**

### Convert

This menu option can be used to convert the file into binary format for the X20 SafeLOGIC controller. The appropriate path for storing the binary file must be specified.




**Information:**

**This binary file can be used for downloading via the standard CPU.**

### Use in the application

To use Safe Commissioning Tables, you must first use an associated function block in the application (see library "Table_SF").

Input "S_TableID" must be linked to a table object. To do this, the table object is selected in the Safety View and dragged into the application while holding down the left mouse button. Optionally, a descriptive name can be assigned for the connection.

**Information:**

**In the event of a problem or error, an error message is output when compiling.**

For additional module-specific information, see:

- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25

## 11.4 Setup mode

Setup mode supports the user during commissioning.

Active setup mode is indicated by both the FAILSAFE LED (X20 SafeLOGIC controllers) or SE LED (X20 SafeLOGIC-X and X90 SafeLOGIC controllers) as well as an entry in the logbook.

When setup mode is active, acknowledgment requests "SafeKEY Exchange", "Firmware Acknowledge" and "UDID Mismatch" are no longer necessary.

Setup mode can be enabled and disabled using the operating elements of the "Remote Control" in SafeDESIGNER or using the selector switch and acknowledgment button (X20 SafeLOGIC controllers).

### Danger!

**Setup mode is only permitted to be enabled during the commissioning of the machine/system.**
**Setup mode must be disabled during operation.**

### Danger!

**After setup mode is ended, functional testing including a wiring test must be carried out.**
**If a SafeKEY or SafeLOGIC controller is replaced while setup mode is active, then setup mode will be disabled.**
**Functional testing must also be carried out in this case.**

**Functional testing is only permitted to be performed by personnel familiar with the safety application and its functions.**

**Always validate the entire safety function!**

For additional module-specific information, see:


- "X20(c)SLXxxx" on page 23
- "X20(c)SL81xx" on page 25