

X20(c)SC2212

Information:

B&R makes every effort to keep data sheets as current as possible. From a safety point of view, however, the current version of the data sheet must always be used.

The certified, currently valid data sheet can be downloaded from the B&R website www.br-automation.com.

Information:

This data sheet must be used with mapp Safety.

B&R safety technology can still be used in Safety Releases ≤ 1.10 , however. Documentation for this is available for download on the B&R website www.br-automation.com.

For further information about mapp Safety, additional technical descriptions (e.g. connection examples and error detection) as well as generally valid contents (intended use, etc.), see section Safety technology of Automation Help.

Organization of notices

Safety notices

Contain **only** information that warns 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.

Table 1: Organization of safety notices

General notices

Contain **useful** information for users and instructions for avoiding malfunctions.

Signal word	Description
Information:	Useful information, application tips and instructions for avoiding malfunctions.

Table 2: Organization of general notices

1 General information

The modules are equipped with 6 safe digital inputs and 2 safe digital outputs. They are designed for a nominal voltage of 24 VDC.

The modules can be used to read in digital signals and control actuators in safety-related applications up to PL e or SIL 3.

The modules are equipped with filters that are individually configurable for switch-on and switch-off behavior. The modules also provide pulse signals for diagnosing the sensor line.

The outputs are designed using semiconductor technology so that the safety-related characteristics do not depend on the number of switching cycles. The "high-side high-side" variant (output type B) is required for actuators with reference potential (e.g. enable inputs on frequency inverters). It is important to observe the special notices for the cabling in this case. The safe digital output modules have a start interlock on error in the event of network errors.

These modules are designed for X20 16-pin terminal blocks.

- 6 safe digital inputs, sink circuit
- 6 pulse outputs
- Software input filter configurable for each channel
- 2 safe digital outputs, output type B with 0.5 A, source circuit
- Integrated output protection

1.1 Coated modules

Coated modules are X20 modules with a protective coating for the electronics component. This 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 data sheet.

The coating has been certified according to the following standards:

- Condensation: BMW GS 95011-4, 2x 1 cycle
- Corrosive gas: EN 60068-2-60, Method 4, exposure 21 days

Contrary to the specifications for X20 system modules without safety certification and despite the tests performed, X20 safety modules are **NOT suited for applications with corrosive gases (EN 60068-2-60)!**



2 Order data


Model 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 continuous	
X20BM36	X20 bus module, for X20 SafeIO modules, with node number switch, internal I/O power supply continuous	
X20cBM33	X20 bus module, coated, for X20 SafeIO modules, internal I/O power supply continuous	
	Terminal blocks	
X20TB5F	X20 terminal block, 16-pin, safety-keyed	

Table 3: X20SC2212, X20cSC2212 - Order data

3 Technical data

Model 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
System requirements		
Automation Studio	3.0.81.15 or later	4.0.16 or later
Automation Runtime	3.00 or later	V3.08 or later
SafeDESIGNER	2.70 or later	3.1.0 or later
Safety Release	1.2 or later	1.7 or later
Status indicators	I/O function per channel, operating state, module status	
Diagnostics		
Module run/error	Yes, using status LED and software	
Outputs	Yes, using status LED and software	
Inputs	Yes, using status LED and software	
Blackout mode		
Scope	Module	
Function	Module function	
Standalone mode	No	
Max. I/O cycle time	1 ms	
Power consumption		
Bus	0.25 W	
Internal I/O	1.4 W	
Electrical isolation		
Channel - Bus	Yes	
Channel - Channel	No	
Certifications		
CE	Yes	
Functional safety	cULus FSPC E361559 Energy and industrial systems Certified for functional safety ANSI UL 1998:2013	
Functional safety	IEC 61508:2010, SIL 3 EN 62061:2013, SIL 3 EN ISO 13849-1:2015, Cat. 4 / PL e IEC 61511:2004, SIL 3	
Functional safety	EN 50156-1:2004	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZU 09 ATEX 0083X	
UL	cULus E115267 Industrial control equipment	
HazLoc	cCSAus 244665 Process control equipment for hazardous locations Class I, Division 2, Groups ABCD, T5	
DNV GL	Temperature: A (0 - 45°C) Humidity: B (up to 100%) Vibration: A (0.7 g) EMC: B (bridge and open deck)	
KR	Yes	
EAC	Yes	
KC	Yes	-
Safety characteristics		
EN ISO 13849-1:2015		
MTTFD	2500 years	
Mission time	Max. 20 years	
IEC 61508:2010, IEC 61511:2004, EN 62061:2013		
PFH / PFH _a		
Module	<1*10 ⁻¹⁰	
openSAFETY wired	Negligible	
openSAFETY wireless	<1*10 ⁻¹⁴ * Number of openSAFETY packets per hour	
PFD	<2*10 ⁻⁵	
Proof test interval (PT)	20 years	

Table 4: X20SC2212, X20cSC2212 - Technical data

Model number	X20SC2212	X20cSC2212
Safe digital inputs		
EN ISO 13849-1:2015		
Category	Cat. 3 when using individual input channels, Cat. 4 when using input channel pairs (e.g. SI1 and SI2) or more than 2 input channels ¹⁾	
PL	PL e	
DC	>94%	
IEC 61508:2010, IEC 61511:2004, EN 62061:2013		
SIL CL	SIL 3	
SFF	>90%	
Safe digital outputs		
EN ISO 13849-1:2015		
Category	Cat. 3 if parameter "Disable OSSD = Yes - Warning", Cat. 4 if parameter "Disable OSSD = No" ¹⁾	
PL	PL d if parameter "Disable OSSD = Yes - Warning", PL e if parameter "Disable OSSD = No" ¹⁾	
DC	>60% if parameter "Disable OSSD = Yes - Warning", >94% if parameter "Disable OSSD = No" ¹⁾	
IEC 61508:2010, IEC 61511:2004, EN 62061:2013		
SIL CL	SIL 2 if parameter "Disable OSSD = Yes - Warning", SIL 3 if parameter "Disable OSSD = No" ¹⁾	
SFF	>60% if parameter "Disable OSSD = Yes - Warning", >90% if parameter "Disable OSSD = No" ¹⁾	
I/O power supply		
Nominal voltage	24 VDC	
Voltage range	24 VDC -15% / +20%	
Integrated protection	Reverse polarity protection	
Safe digital inputs		
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	Max. 3.28 mA	
Input resistance	Min. 7.33 kΩ	
Error detection time	100 ms	
Isolation voltage between channel and bus	500 V _{eff}	
Switching threshold		
Low	<5 VDC	
High	>15 VDC	
Cable length between pulse output and input	Max. 60 m with unshielded line Max. 400 m with shielded line	
Safe digital outputs		
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	
Isolation voltage between channel and bus	500 V _{eff}	
Peak short-circuit current	See section "Inrush current behavior for output channels".	
Leakage current when the power is switched off	<500 µA	
Residual voltage	≤300 mVDC at nominal current	
Switching voltage	I/O power supply minus residual voltage	
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		
Variant	Push-Pull	
Nominal output current	20 mA	
Output protection	Shutdown of individual channels in the event of overload or short circuit ²⁾	
Peak short-circuit current	25 A for 15 µs	
Short-circuit current	100 mA _{eff}	
Leakage current when the power is switched off	0.1 mA	

Table 4: X20SC2212, X20cSC2212 - Technical data

Model number	X20SC2212	X20cSC2212
Residual voltage	3 VDC	
Switching voltage	I/O power supply minus residual voltage	
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	-40 to 60°C ³⁾
Vertical mounting orientation	0 to 50°C	-40 to 50°C ⁴⁾
Derating	See section "Derating".	
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. Order 1x safety-keyed bus module separately.	
Pitch	25 ^{+0.2} mm	

Table 4: X20SC2212, X20cSC2212 - Technical data

- 1) The related danger warnings in the technical data sheet must also be observed.
- 2) The protective function is provided for max. 30 minutes for a continuous short circuit.
- 3) Up to hardware revision < E0: -25 to 60°C
- 4) Up to hardware revision < E0: -25 to 50°C

Derating

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

Module	X20SC2212
Derating bonus	
At 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 5: Derating bonus

Inputs

The number of inputs that should be used at the same time depends on the operating temperature and the mounting orientation. The resulting amount can be looked up in the following table.

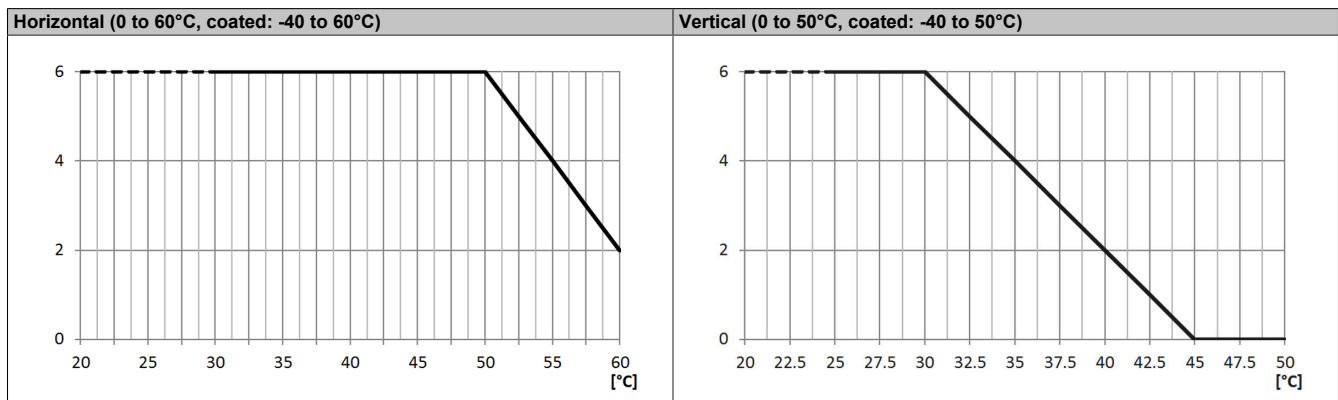


Table 6: Derating in relation to operating temperature and mounting orientation

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.

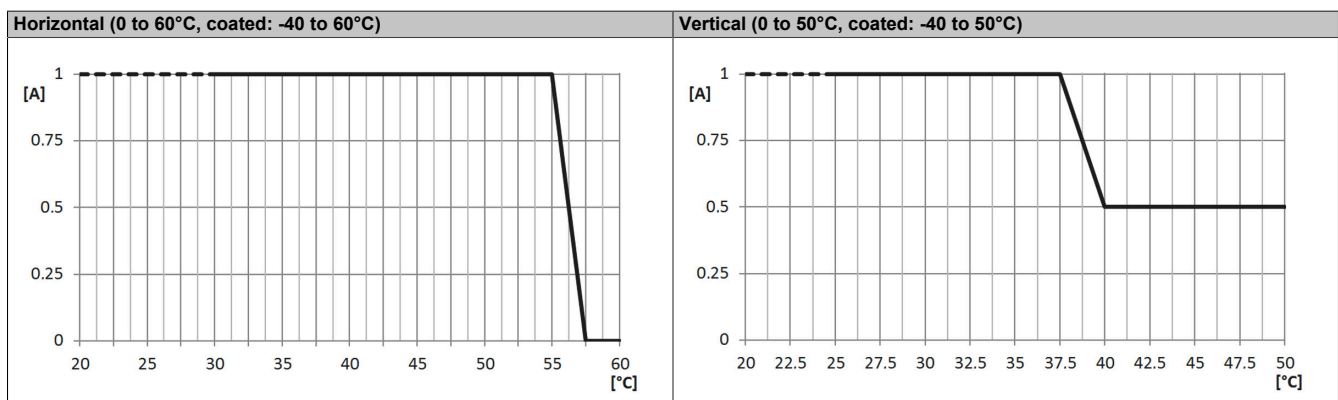


Table 7: Derating in relation to operating temperature and mounting orientation

Information:

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

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.

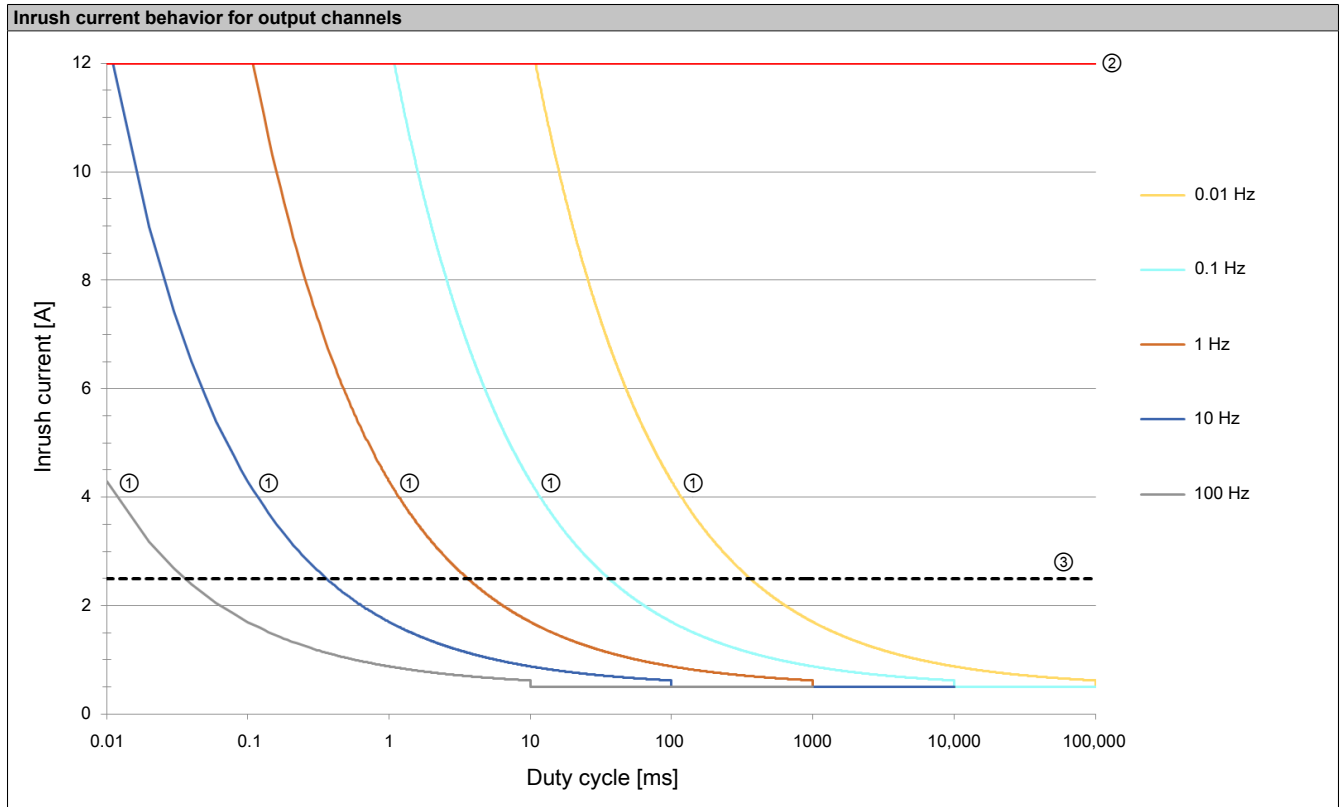


Table 8: Inrush current behavior for output channels

Legend:

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

Information:

The protective function is provided for max. 30 minutes for a continuous short circuit.

Danger!

Operation outside the technical data is not permitted and can result in dangerous states.

Information:

For detailed information about installation, see section "[Installation notes for X20 modules](#)" of Automation Help.

4 LED status indicators


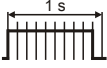



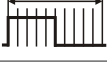
Figure	LED	Color	Status	Description	
	r	Green	Off	No power to module	
			Single flash	Mode "Reset"	
			Double flash	Updating firmware	
			Blinking	Mode PREOPERATIONAL	
			On	Mode RUN	
	e	Red	Off	Module not supplied with power or everything OK	
			Pulsating	Bootloader mode	
			Triple flash	Updating safety-related firmware	
			On	Error or I/O component not provided with voltage	
	e + r	Solid red / Single green flash		Invalid firmware	
	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 the 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 the SafeLOGIC controller not OK or startup not yet completed	
		Orange	On	Output set	
		SE	Red	Off	Mode RUN or I/O component not provided with voltage
				Boot phase, missing X2X Link or defective processor	
				Safety PREOPERATIONAL state Modules that are not used in the SafeDESIGNER application remain in state PREOPERATIONAL.	
				Safe communication channel not OK	
	The firmware for this module is a non-certified pilot customer version.				
	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 ("S" LED) and safety processor 2 ("E" LED).					

Table 9: Status indicators

Danger!

Constantly lit "SE" LEDs indicate a defective module that must be replaced immediately. 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!

5 Pinout

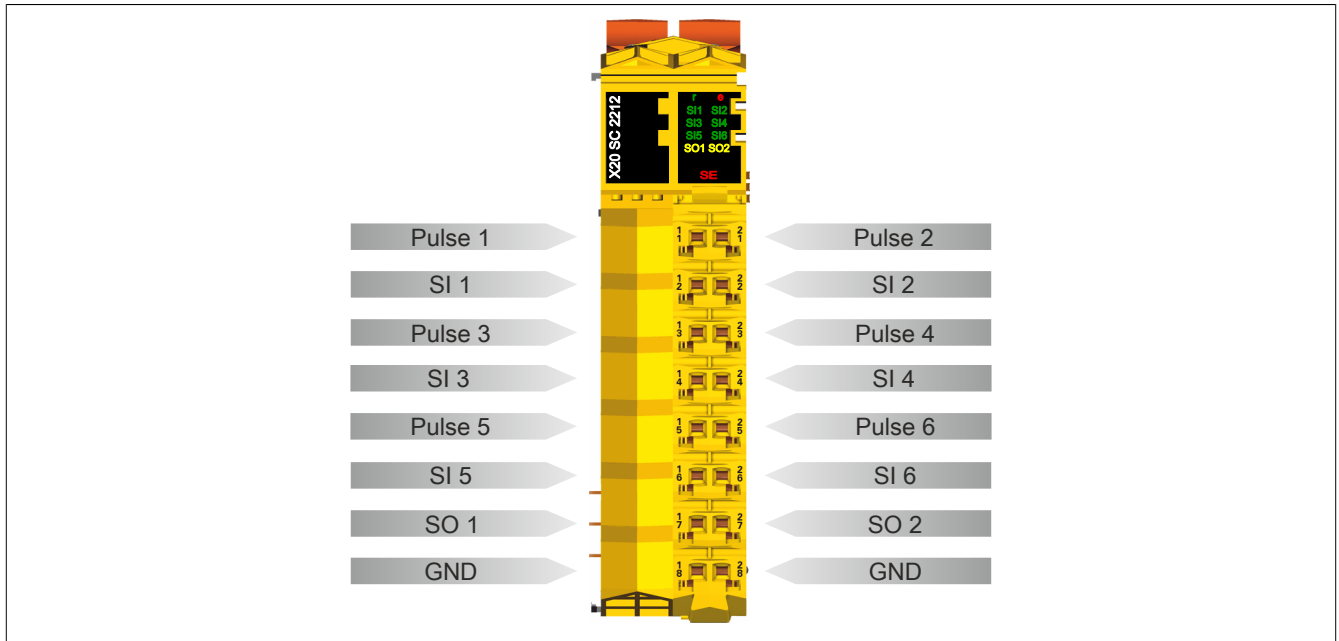


Figure 1: X20SC2212 - Pinout

6 Input circuit diagram

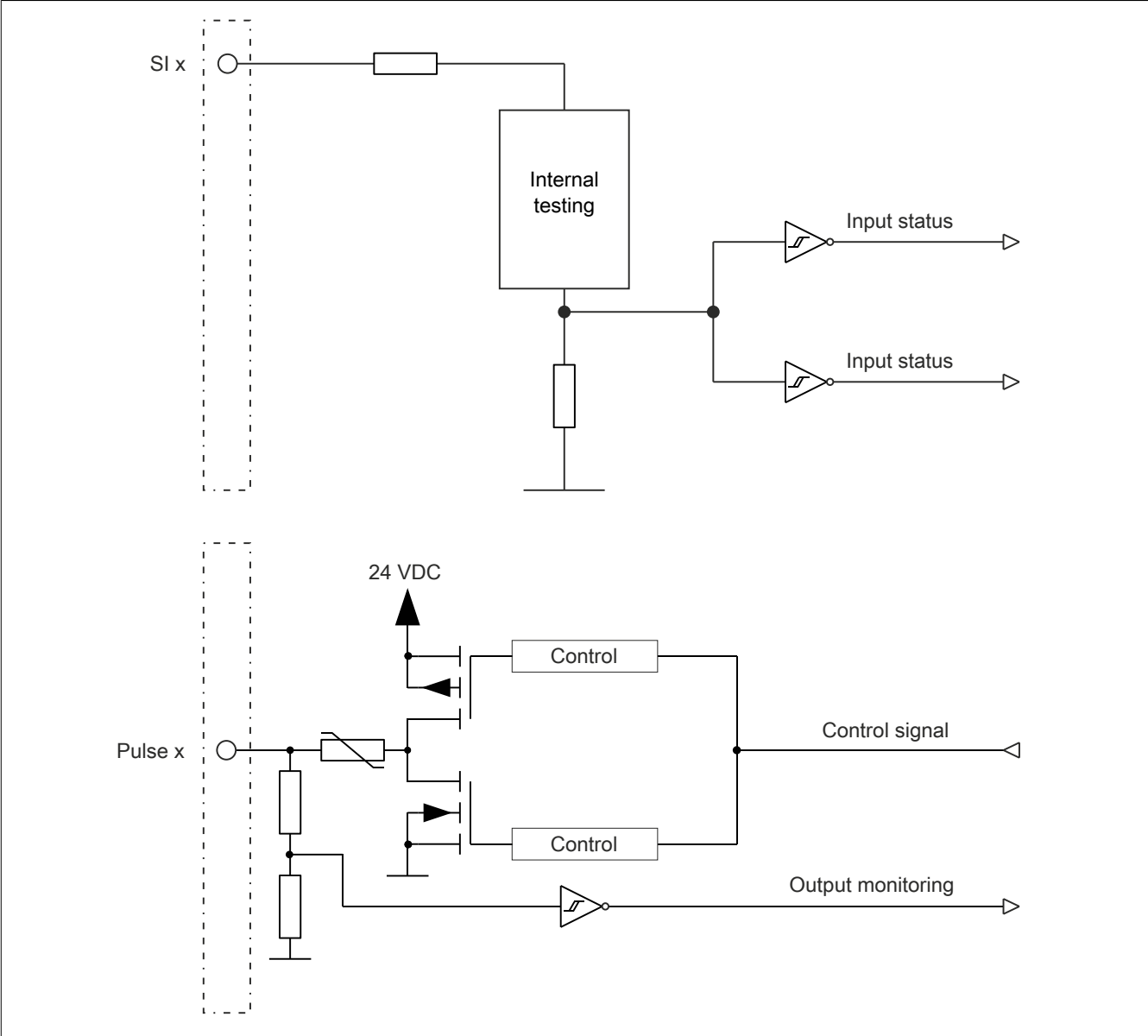


Figure 2: Input circuit diagram

7 Type B output circuit diagram

Type B digital output channels are designed for positive and positive switching inside the module.

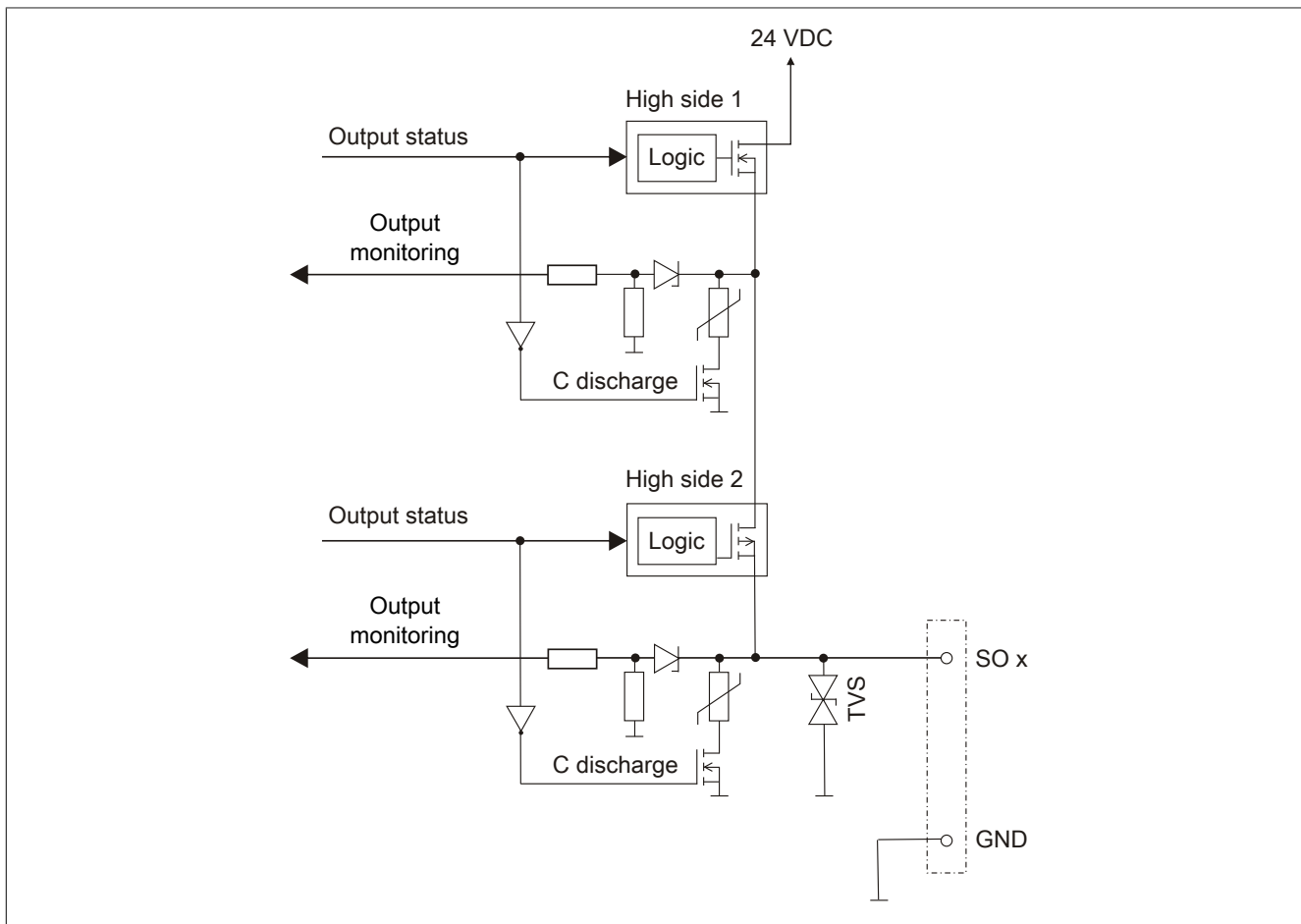


Figure 3: Type B output circuit diagram

8 Register description

8.1 Parameters in the I/O configuration

Group: Function model

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

Table 10: I/O configuration parameters: Function model

Group: General

Parameter	Description	Default value	Unit
Module supervised	System behavior when a module is missing	On	-
	Parameter value	Description	
	On	A missing module triggers service mode.	
	Off	A missing module is ignored.	
Blackout mode	This parameter enables blackout mode (see section Blackout mode in Automation Help under: Hardware → X20 system → Additional information → Blackout mode).	Off	-
	Parameter value	Description	
	On	Blackout mode is enabled.	
	Off	Blackout mode is disabled.	
Channel state information	This parameter enables/disables the 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.	Off	-
State number for start interlock on error	This parameter enables/disables the status information for the start interlock on error.	Off	-
SafeDOMAIN ID	In applications with multiple SafeLOGIC controllers, this parameter defines the module's association with a particular SafeLOGIC controller. <ul style="list-style-type: none"> Permissible values: 1 to 1000 	Assigned automatically	-
SafeNODE ID	Unique safety address of the module <ul style="list-style-type: none"> Permissible values: 2 to 1023 	Assigned automatically	-

Table 11: I/O configuration parameters: General

Group: Output signal path

Parameter	Description	Default value	Unit
Digital output xx	This parameter specifies the mode that can be used by the standard application to access the output channel.	Direct	-
	Parameter value	Description	
	Direct	The output channel can be accessed directly by the standard application. Signals "DigitalOutputxx" are available in the I/O mapping accordingly.	
	Via SafeLOGIC	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.	

Table 12: I/O configuration parameters: Output signal path

8.2 Parameters in SafeDESIGNER

Group: Basic

Parameter	Description	Default value	Unit
Min. required firmware revision	This parameter is reserved for future functional expansions.	Basic release	-
Availability	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.	Permanent	-
Parameter value	Description		
Permanent	<p>This module is mandatory for the application.</p> <p>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".</p> <p>After startup, module problems are indicated by a quickly blinking "MXCHG" LED on the SafeLOGIC controller. An entry is also made in the logbook.</p>		
Optional	<p>The module is not required for the application.</p> <p>The module is not taken into account during startup, which means the safety application is started regardless of whether the modules with "Availability = Optional" are in OPERATIONAL mode or if safe communication is properly established between these modules and the SafeLOGIC controller.</p> <p>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.</p>		
Startup	<p>This module is optional. The system determines how the module will proceed during startup.</p> <p>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.</p> <p>If it is determined that the module is not physically present during startup, then the module behaves as if "Availability = Optional" is set.</p>		
Never	<p>The module is not required for the application.</p> <p>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.</p> <p>Unlike when "Availability = Optional" is configured, the module is not started with "Availability = Never", which optimizes system startup behavior.</p> <p>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.</p>		

Table 13: SafeDESIGNER parameters: Basic

Group: Safety response time

Parameter	Description	Default value	Unit
Manual configuration	This parameter makes it possible to manually and individually configure the safety response time for the module. 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.	No	-
	Parameter value	Description	
	Yes	Data from the module's "Safety response time" group is used to calculate the safety response time for the module's signals.	
	No	The parameters for the safety response time are taken from the "Safety response time" group on the SafeLOGIC controller.	
Safe data duration	This parameter specifies the maximum permissible data transmission time between the SafeLOGIC controller and SafeIO module. For more information about the actual data transmission time, see Automation Help under Diagnostics and service -> Diagnostics tools -> Network analyzer -> Editor -> Calculation of safety runtime. The following formula can be used as the lower limit: "Value of the Network Analyzer" * 2 + SafeLOGIC cycle time * 2 The stability of the system cannot be ensured for smaller values. <ul style="list-style-type: none"> Permissible values: 2000 to 10,000,000 µs (corresponds to 2 ms to 10 s) 	20000	µs
Additional tolerated packet loss	This parameter specifies the number of additional tolerated lost packets during data transfer. <ul style="list-style-type: none"> Permissible values: 0 to 10 	1	Packets
Node guarding packets	This parameter specifies the maximum number of packets used for node guarding. <ul style="list-style-type: none"> Permissible values: 1 to 255 Note <ul style="list-style-type: none"> The larger the configured value, the greater the amount of asynchronous data traffic. This setting is not critical to safety functionality. The time for safely cutting off actuators is determined independently of this. 	5	Packets

Table 14: SafeDESIGNER parameters: Safety response time

Group: Module configuration

Parameter	Description	Default value	Unit
Disable OSSD	This parameter can be used to switch off automatic testing of the output driver for all of the module's channels.	No	-
	Parameter value	Description	
	Yes - Warning	Automatic testing of the output driver is switched off.	
	No	Automatic testing of the output driver is enabled.	

Table 15: SafeDESIGNER parameters: Module configuration

Danger!

With "Disable OSSD = Yes - Warning", the module has reduced error detection capabilities and no longer meets the requirements of SIL 3 per EN 62061:2013 or PL e per EN ISO 13849-1:2015.

In order to meet the requirements for applications up to SIL 2 per EN 62061:2013 or PL d per EN ISO 13849-1:2015, the user must check the safety function on a daily basis when using type B output channels.

For type B2 output channels, it is also important to ensure that all of the module's output channels are simultaneously in a switched-off state for at least 1 s during this test.

Group: SafeDigitalInputxx

Parameter	Description	Default value	Unit								
Pulse source	This parameter can be used to specify the pulse source for the input channel.	Pulse x	-								
	<table border="1"> <thead> <tr> <th>Parameter value</th> <th>Description</th> </tr> </thead> <tbody> <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> </tbody> </table>			Parameter value	Description	Pulse x	The input expects a test pulse from the pulse output (pulse x).	No pulse	The input does not expect a test pulse.	Other module	The input expects an external test pulse.
	Parameter value	Description									
	Pulse x	The input expects a test pulse from the pulse output (pulse x).									
No pulse	The input does not expect a test pulse.										
Other module	The input expects an external test pulse.										
Filter off	Switch-off filter for the channel to remove potentially disruptive signal low phases. <ul style="list-style-type: none"> Permissible values: 0 to 500,000 μs (corresponds to 0 to 0.5 s) 	0	μ s								
Filter on	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. <ul style="list-style-type: none"> Permissible values: 0 to 500,000 μs (corresponds to 0 to 0.5 s) 	200000	μ s								
Discrepancy time	Parameter only available for odd-numbered channels. This parameter specifies for function "dual-channel evaluation" 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. <ul style="list-style-type: none"> Permissible values: 0 to 10,000,000 μs (corresponds to 0 to 10 s) 	50000	μ s								
Dual-channel processing mode	Parameter only available for odd-numbered channels. This parameter specifies the type of dual-channel evaluation. Permissible values: <ul style="list-style-type: none"> Equivalent Antivalent 	Equivalent	-								

Table 16: SafeDESIGNER parameters: SafeDigitalInputxx

Danger!

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

Danger!

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.

Danger!

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.

Group: PulseOutput

Parameter	Description	Default value	Unit						
Pulse x mode	This parameter can be used to specify the pulse mode for the pulse output.	Internal	-						
	<table border="1"> <thead> <tr> <th>Parameter value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Internal</td> <td>The channel works exclusively with the pulse output that is configured for "Pulse source".</td> </tr> <tr> <td>External</td> <td>The channel works with any pulse output on a B&R input module as long as the pulse output is configured as "external".</td> </tr> </tbody> </table>			Parameter value	Description	Internal	The channel works exclusively with the pulse output that is configured for "Pulse source".	External	The channel works with any pulse output on a B&R input module as long as the pulse output is configured as "external".
	Parameter value	Description							
Internal	The channel works exclusively with the pulse output that is configured for "Pulse source".								
External	The channel works with any pulse output on a B&R input module as long as the pulse output is configured as "external".								

Table 17: SafeDESIGNER parameters: PulseOutput

8.3 Channel list

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																						
SerialNumber	Read	-	UDINT	Module serial number																						
ModuleID	Read	-	UINT	Module ID																						
HardwareVariant	Read	-	UINT	Hardware variant																						
FirmwareVersion	Read	-	UINT	Firmware version of the module																						
UDID_low	(Read) ¹⁾	-	UDINT	UDID, lower 4 bytes																						
UDID_high	(Read) ¹⁾	-	UINT	UDID, upper 2 bytes																						
SafetyFWversion1	(Read) ¹⁾	-	UINT	Firmware version - Safety processor 1																						
SafetyFWversion2	(Read) ¹⁾	-	UINT	Firmware version - Safety processor 2																						
SafetyFWcrc1	(Read) ¹⁾	-	UINT	CRC of firmware header on safety processor 1																						
SafetyFWcrc2	(Read) ¹⁾	-	UINT	CRC of firmware header on safety processor 2																						
Bootstate	(Read) ¹⁾	-	UINT	Startup state of the module. Notes: <ul style="list-style-type: none"> Some of the boot states do not occur during normal startup or are cycled through so quickly that they are not visible externally. The boot states usually cycle through in ascending order. There are cases, however, in which a previous value is captured. <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0x0003</td> <td>Startup communication processor OK, no communication with the safety processors (check 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 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 SafeDESIGNER application or no valid application exists, waiting on acknowledgments such as module exchange)</td> </tr> <tr> <td>0x1040</td> <td>Evaluating the configuration according to the SafeDESIGNER application</td> </tr> <tr> <td>0x3440</td> <td>Stabilizing cyclic openSAFETY data exchange. Note: If the boot state remains here, check SafeDESIGNER parameters "(Default) Safe data duration" and "(Default) Additional tolerated packet loss".</td> </tr> <tr> <td>0x4040</td> <td>RUN. Final state, startup completed.</td> </tr> </tbody> </table>	Value	Description	0x0003	Startup communication processor OK, no communication with the safety processors (check 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 safety processors	0x0040	Firmware of safety processors started	0x0440	Firmware of safety processors running	0x0840	Waiting for openSAFETY "Operational" (loading SafeDESIGNER application or no valid application exists, waiting on acknowledgments such as module exchange)	0x1040	Evaluating the configuration according to the SafeDESIGNER application	0x3440	Stabilizing cyclic openSAFETY data exchange. Note: If the boot state remains here, check SafeDESIGNER parameters "(Default) Safe data duration" and "(Default) Additional tolerated packet loss".	0x4040	RUN. Final state, startup completed.
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Diag1_Temp	(Read) ¹⁾	-	INT	Module temperature in °C																						
FBInputStatexxy	Read	-	USINT	State number of dual-channel evaluation (PLCopen function block "Equivalent" or "Antivalent")																						
InputErrorStates	(Read) ¹⁾	-	UDINT	Channel status, additional information for channel error <table border="1"> <thead> <tr> <th colspan="2">Type of error</th> </tr> <tr> <th colspan="2">Inputs</th> </tr> <tr> <th colspan="2">Input stuck at high</th> </tr> </thead> <tbody> <tr> <td colspan="2">Bit no. 0 to 5 = Channel 1 to 6</td> </tr> </tbody> </table> <p>If a bit is set, the corresponding error has been detected on the respective channel.</p>	Type of error		Inputs		Input stuck at high		Bit no. 0 to 5 = Channel 1 to 6															
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SafeModuleOK	Read	Read	SAFEBOOL	Indicates whether the safe communication channel is OK																						
SafeDigitalInputxx	Read	Read	SAFEBOOL	Physical channel SI xx																						
SafeTwoChannelInputxxyy	Read	Read	SAFEBOOL	Dual-channel evaluation of channel SI xx/yy																						
SafeInputOKxx	Read	Read	SAFEBOOL	Status of physical channel SI xx																						

Table 18: Channel list

Channel name	Access via Automation Studio	Access via SafeDESIGNER	Data type	Description				
SafeTwoChannelOKxxyy	Read	Read	SAFEBOOL	Status of dual-channel evaluation of channel SI xx/yy				
DigitalOutputxx	Write	-	BOOL	Enable signal - Channel SO xx				
SafeDigitalOutputxx	-	Write	SAFEBOOL	Safe channel SO xx				
SafeOutputOKxx	Read	Read	SAFEBOOL	Status of channel SO xx				
ReleaseOutput	-	Write	BOOL	Release signal for start interlock on error				
PhysicalStateOutputxx	Read	Read	BOOL	Read-back value of physical channel SO xx				
FBOutputStatexxyy	Read	-	USINT	State number of start interlock on error of channel x. See section ""Start interlock on error" state diagram" of Automation Help.				
				<table border="1"> <thead> <tr> <th>Bit 7 to 4</th> <th>Bit 3 to 0</th> </tr> </thead> <tbody> <tr> <td>Channel yy</td> <td>Channel xx</td> </tr> </tbody> </table>	Bit 7 to 4	Bit 3 to 0	Channel yy	Channel xx
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Channel yy	Channel xx							

Table 18: Channel list

1) This data is accessed in Automation Studio using the ASIOACC library.

9 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 μ s

10 I/O update time

The time needed by the module to generate a sample is specified by the I/O update time.

Minimum I/O update time
500 μ s
Maximum I/O update time for input channels
2150 μ s + filter time (see section "Filter" in Automation Help)
Maximum I/O update time for output channels
1800 μ s

11 Version history

Version	Date	Comment
2.05	February 2020	<ul style="list-style-type: none"> Chapter 3 "Technical data": Added section "Inrush current behavior for output channels" and updated technical data accordingly. Chapter 8.2 "Parameters in SafeDESIGNER": Group "Module configuration": Updated danger notice. Editorial changes.
2.04	November 2019	<ul style="list-style-type: none"> Chapter 3 "Technical data": Updated certifications. Editorial changes.
2.02	May 2019	First edition for mapp Safety

Table 19: Version history

12 EC declaration of conformity

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

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The place of jurisdiction, in accordance with article 17 of the European Convention on Courts of Jurisdiction and Enforcement, is A-4910

Ried im Innkreis, Austria, commercial register court: Ried im Innkreis, Austria

Commercial register number: FN 111651 v.

The place of fulfillment in accordance with article 5 of the European Convention on Courts of Jurisdiction and Enforcement is A-5142 Eggelsberg, Austria

VATIN: ATU62367156

The EC declarations of conformity for B&R products can be downloaded from the B&R website www.br-automation.com.