

X20(c)Slx1x0

Information:

B&R keeps data sheets as current as possible. From a safety standpoint, however, the current certified version of the data sheet must be used.

The currently valid certified data sheet – including a detailed version history – is available for download from the B&R website at www.br-automation.com.

Organization of safety notices

Safety notices in this manual are organized as follows:

Safety notice	Description
Danger!	Disregarding these safety guidelines and notices can result in severe injury, death or substantial damage to equipment.
Information:	This information is important for preventing errors.

Table 1: Organization of safety notices

1 General information

1.1 Function

Safe digital inputs

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 is 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 signal pairs (channels 1 and 2, 3 and 4, etc.) are monitored in the module for simultaneity. The maximum permitted discrepancy of inputs of a signal pair is configurable. Here, the signals of two-channel evaluation directly represent the safe signal of a 2-channel sensor, such as from an E-stop button or safety light curtain.

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).

openSAFETY

This module uses the protective mechanisms of openSAFETY when transferring data to the various bus systems. Because the data is securely encapsulated in the openSAFETY container, the components on the network that are involved in the transfer do not require any additional safety-related features. At this point, only the safety-related characteristic values specified for openSAFETY in the technical data are to be consulted. The data in the openSAFETY container undergoes safety-related processing only when received by the peer station; for this reason, only this component is involved from a safety point of view. Read access to the data in the openSAFETY container for applications without safety-related characteristics is permitted at any point in the network without affecting the safety-related characteristics of openSAFETY.

open 
SAFETY

1.2 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

Unlike X20 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 Overview

Module	X20SI2100	X20SI4100	X20SI8110	X20SI9100
Safe digital inputs				
Number of inputs	2	4	8	20
Nominal voltage	24 VDC			
Input filter	≤150 µs			
Hardware	Default 0 ms, configurable between 0 and 500 ms			
Software				
Input circuit	Sink			
Pulse outputs				
Design	Push-Pull			
Switching voltage	I/O power supply minus residual voltage			

Table 2: Digital input modules

3 Order data

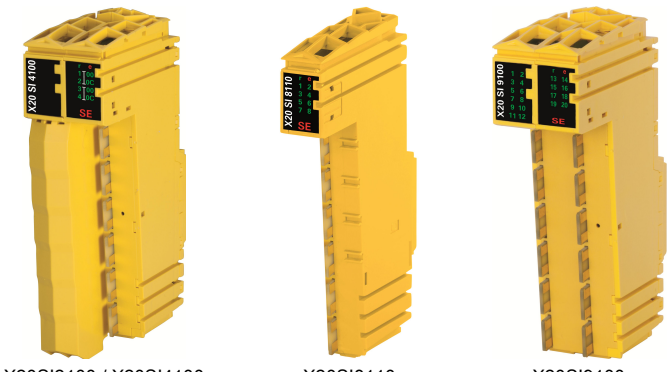
		
X20SI2100 / X20SI4100	X20SI8110	X20SI9100
Model number	Short description	
Digital input modules		
X20SI2100	X20 safe digital input module, 2 safe digital inputs, configurable input filter, 2 pulse outputs, 24 VDC	
X20SI4100	X20 safe digital input module, 4 safe digital inputs, configurable input filter, 4 pulse outputs, 24 VDC	
X20cSI4100	X20 safe digital input module, coated, 4 safe digital inputs, configurable input filter, 4 pulse outputs, 24 VDC	
X20SI8110	X20 safe digital input module, 8 safe digital inputs, configurable input filter, 4 pulse outputs, 24 VDC, single-width	
X20SI9100	X20 safe digital input module, 20 safe digital inputs, configurable input filter, 4 pulse outputs, 24 VDC	
X20cSI9100	X20 safe digital input module, coated, 20 safe 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 continuous, single-width	
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		
X20TB52	X20 terminal block, 12-pin, safety-keyed	

Table 3: X20SI2100, X20SI4100, X20cSI4100, X20SI8110, X20SI9100, X20cSI9100 - Order data

4 Technical data

Product ID	X20SI2100	X20SI4100	X20cSI4100	X20SI8110	X20SI9100	X20cSI9100
Short description						
I/O module	2 safe digital inputs, 2 pulse outputs, 24 VDC	4 safe digital inputs, 4 pulse outputs, 24 VDC		8 safe digital inputs, 4 pulse outputs, 24 VDC	20 safe digital inputs, 4 pulse outputs, 24 VDC	
General information						
B&R ID code	0x1F15	0x1DBD	0xDD5A	0xE742	0xAEC8	0xDD5B
System requirements	Automation Studio					
Automation Runtime	3.0.71 or higher	4.0.16 or higher		4.0 or higher	3.0.81.15 or higher	4.0.16 or higher
SafeDESIGNER	2.95 or higher	V3.08 or higher		4.0 or higher	3.00 or higher	V3.08 or higher
Safety Release	2.58 or higher	3.1.0 or higher		3.4.0 or higher	2.71 or higher	3.1.0 or higher
Safety Release	1.1 or higher	1.7 or higher			1.3 or higher	1.7 or higher
Status indicators	I/O function per channel, operating state, module status					
Diagnosics	Module run/error					
Inputs	Yes, using status LED and software					
Max. internal cycle time	800 µs			1 ms	1600 µs	
Power consumption	Bus					
Internal I/O	0.25 W	0.32 W		2.5 W	0.4 W	
Electrical isolation	Channel - Bus					
Channel - Channel	No					
Certification	CE					
cULus	Yes					
cCSAus HazLoc Class 1 Division 2	Yes	Yes		In preparation	Yes	
ATEX Zone 2 ¹⁾		Yes		In preparation	Yes	
KC	Yes				Yes	-
GL		Yes			In preparation	
LR		Yes			-	
EN IEC 61508:2010, EN IEC 62061:2010, EN ISO 13849-1:2008, EN IEC 61511:2004		Yes		In preparation	Yes	
ANSI UL 1998:2008, NFPA 79:2015, NFPA 85:2015, UL category FSPC, FSPC7		Yes		In preparation	Yes	
EN 50156-1:2004		Yes		In preparation	Yes	
GOST-R				Yes		
Safety characteristics						
EN ISO 13849-1:2008 category	CAT 3 when using individual input channels CAT 4 when using input channel pairs (e.g. SI1 & SI2) or more than 2 input channels ²⁾					
EN ISO 13849-1:2008 PL	PL e					
EN IEC 62061:2010 SIL CL	SIL 3					
EN IEC 61508:2010 SIL CL	SIL 3					
EN IEC 61511:2004 SIL CL	SIL 3					
Proof Test Interval (PT)	20 years					
Mission time	20 years					
PFH	Module					
openSAFETY wired	<1*10 ⁻¹⁰					
openSAFETY wireless	Negligible					
PFH	<1*10 ⁻¹⁴ * Number of openSAFETY packets per hour					
PT = 10 years	<1*10 ⁻⁵					
PT = 20 years	<2*10 ⁻⁵					
SFF	>90%					
DC	>94%					
MTTFd	2500 years					
I/O supply						
Nominal voltage	24 VDC					
Voltage range	24 VDC -15% / +20%					
Integrated protection	Reverse polarity protection					
Safe digital inputs						
Nominal voltage	24 VDC					
Input filter	Hardware					
Software	≤150 µs					
Input circuit	Configurable between 0 and 500 ms					
Input voltage	Sink					
Input current at 24 VDC	Typ. 3.45 mA, starting with hardware revision J0: Typ. 2.48 mA			Typ. 2.48 mA		
Input resistance	Typ. 7 kΩ, starting with hardware revision J0: Typ. 9.68 kΩ			Typ. 9.68 kΩ		
Error detection time	100 ms			200 ms		

Table 4: X20SI2100, X20SI4100, X20cSI4100, X20SI8110, X20SI9100, X20cSI9100 - Technical data

Product ID	X20SI2100	X20SI4100	X20cSI4100	X20SI8110	X20SI9100	X20cSI9100
Isolation voltage between channel and bus	500 V _{eff}					
Switching threshold						
Low	<5 VDC					
High	>15 VDC					
Cable length	Max. 50 m					
Pulse outputs						
Design	Push-Pull					
Nominal output current	100 mA, starting with hardware revision J0: 50 mA			50 mA		
Output protection	Thermal cutoff of all channels if overload or short circuit occurs, Starting with hardware revision J0: Cutoff of individual channels if overload or short circuit occurs ³⁾			Cutoff of individual channels if overload or short circuit occurs ³⁾		
Diagnostic status	Output monitoring					
Peak short circuit current	300 mA, starting with hardware revision J0: 100 mA		500 mA		Typ. 7 A for 1 ms, starting with hardware revision D0: 100 mA	
Leakage current when switched off	Max. 25 µA		<500 µA		Max. 25 µA	
Residual voltage	Max. 0.6 VDC at 100 mA, starting with hardware revision J0: 2 VDC		≤4 VDC		Typ. 0.2 VDC, starting with hardware revision D0: 2 VDC	
Switching voltage	I/O power supply minus residual voltage					
Total nominal current	200 mA, starting with hardware revision J0: 100 mA	400 mA, starting with hardware revision J0: 200 mA		200 mA		
Cable length	Max. 50 m					
Operating conditions						
Mounting orientation						
Horizontal	Yes					
Vertical	Yes					
Installation at elevations above sea level						
0 to 2000 m	No limitations					
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m					
EN 60529 protection	IP20					
Environmental conditions						
Temperature						
Operation						
Horizontal installation	0 to 60°C, see Derating	-25 to 60°C, see Derating	0 to 60°C, see Derating	-25 to 60°C, see Derating		
Derating bonus at 24 VDC	+2.5°C		+0°C		+5°C	
Derating bonus with dummy modules	Dummy module to the left: +0°C Dummy module to the right: +2.5°C Dummy module to the left and right: +5°C		Dummy module to the left: +0°C Dummy module to the right: +0°C Dummy module to the left and right: +0°C		Dummy module to the left: +0°C Dummy module to the right: +2.5°C Dummy module to the left and right: +5°C	
Vertical installation	0 to 50°C	-25 to 50°C	0 to 50°C, see Derating	-25 to 50°C, see Derating		
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 characteristics						
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	
Spacing	25 ^{+0.2} mm		12.5 ^{+0.2} mm		25 ^{+0.2} mm	

Table 4: X20SI2100, X20SI4100, X20cSI4100, X20SI8110, X20SI9100, X20cSI9100 - Technical data

- 1) Ta min.: 0°C
Ta max.: See environmental conditions
- 2) It is also important to take note of the danger warnings in the technical data sheet.
- 3) Protection is provided for max. 30 minutes for continuous short circuits.

Danger!

Operating outside of technical data specifications is not permitted and can result in dangerous situations.

X20SIx100 - Derating

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.

The derating curve refers to operation at 28.8 VDC. When operated at 24 VDC and mounted horizontally, the derating curve is shifted to the right by the derating bonus specified in the technical data.

If a dummy module is installed on the left, right or left and right next to the module, then the derating curve is shifted to the right by the derating bonus specified in the technical data (with horizontal mounting).

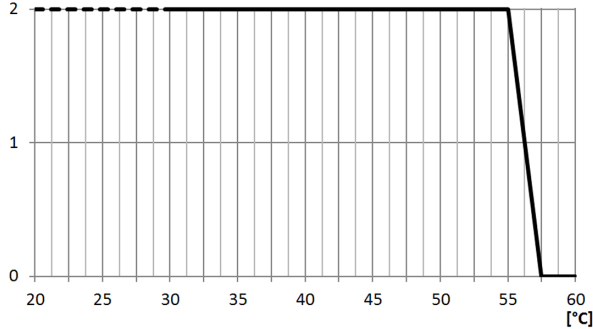
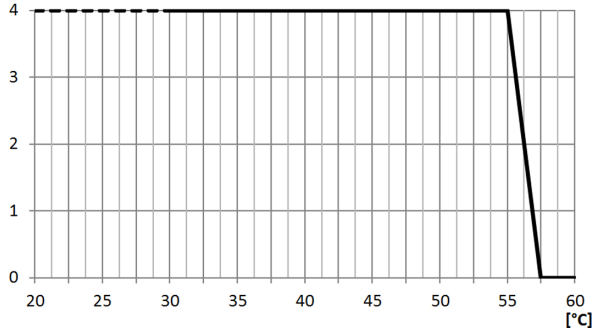
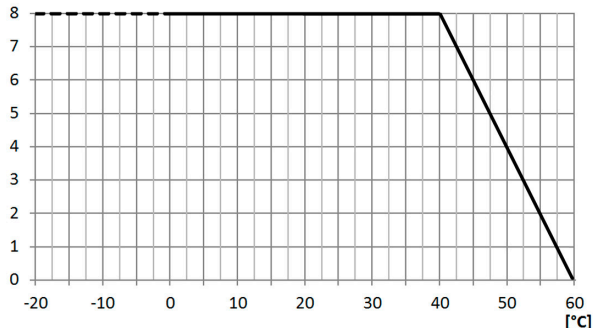
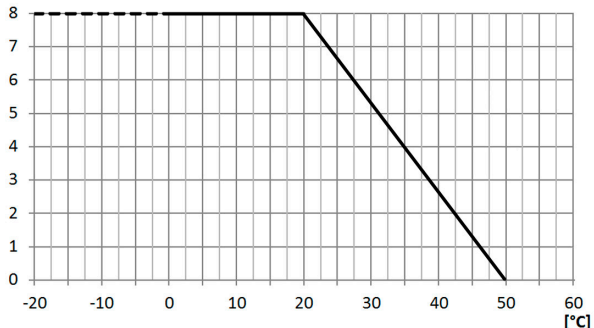
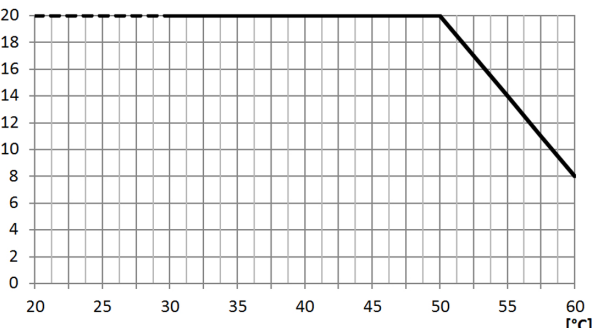
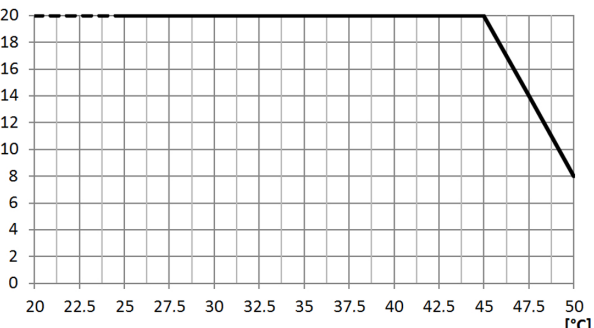
Horizontal (0 to 60°C, coated: -25 to 60°C)	Vertical (0 to 50°C, coated: -25 to 50°C)
<p>X20SI2100</p> 	<p>No derating</p>
<p>X20SI4100</p> 	<p>No derating</p>
<p>X20SI8110</p> 	
<p>X20SI9100</p> 	

Table 5: 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.

5 LED status indicators




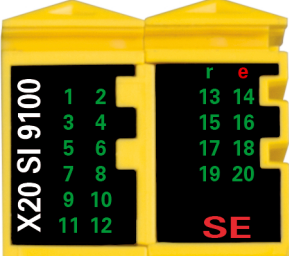
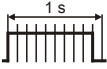
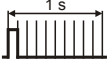


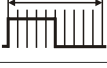
Figure	LED	Color	Status	Description	
 <p>X20SI2100</p>	r	Green	Off	No power to module	
			Single flash	Reset mode	
			Double flash	Updating firmware	
			Blinking	PREOPERATIONAL mode	
			On	RUN mode	
 <p>X20SI4100</p>	e	Red	Off	No power to module or everything OK	
			Pulsating	Boot loader mode	
			Triple flash	Updating safety-related firmware	
			On	Error or I/O component not provided with voltage	
			Red on / green single flash	Invalid firmware	
 <p>X20SI8110</p>	1 to 20	Input state of the corresponding digital input 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 (only for X20SI9100 and X20SI8110)	Error in two-channel evaluation (synchronous blinking of 2 affected channels)	
			All on	Error on all channels, connection to the SafeLOGIC controller not OK or booting not yet completed	
		Green	On	Input set	
		OO	These LEDs may not be available depending on the module type. Errors in two-channel evaluation are indicated by channel LEDs 1 to 20 in this case.		Open - Open: Two-channel evaluation on channels 1 and 2 using the "Equivalent" function block
			Red	On	Warning/Error on this evaluation channel
				All on	Error on all channels, connection to the SafeLOGIC controller not OK or booting not yet completed
		Green	On	Evaluation channel set	
		OC	These LEDs may not be available depending on the module type. Errors in two-channel evaluation are indicated by channel LEDs 1 to 20 in this case.		Open - Closed: Two-channel evaluation on channels 1 and 2 using the "Antivalent" function block
Red	On		Warning/Error on this evaluation channel		
	All on		Error on all channels, connection to the SafeLOGIC controller not OK or booting not yet completed		
Green	On	Evaluation channel set			
 <p>X20SI9100</p>	SE	Red	Off	RUN mode 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 the PREOPERATIONAL state.	
				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 (= "FailSafe" state)	
The "SE" LEDs separately indicate the status of safety processor 1 ("S" LED) and safety processor 2 ("E" LED).					

Table 6: Status display

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 dangerous situations!

6 Pinouts

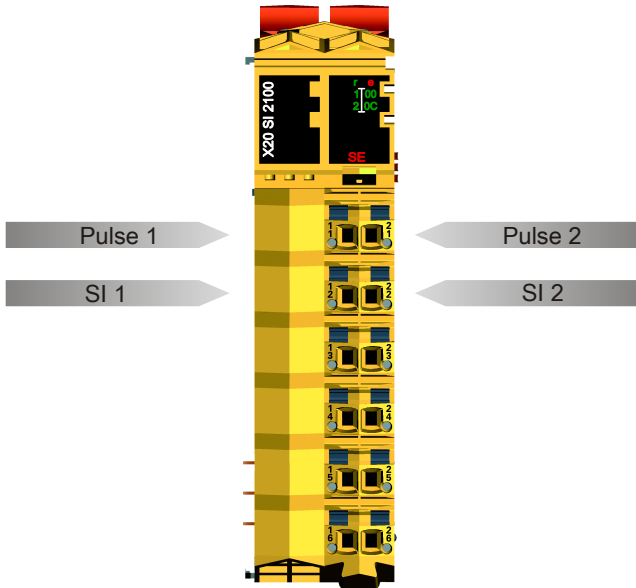


Figure 1: X20SI2100 - Pinout

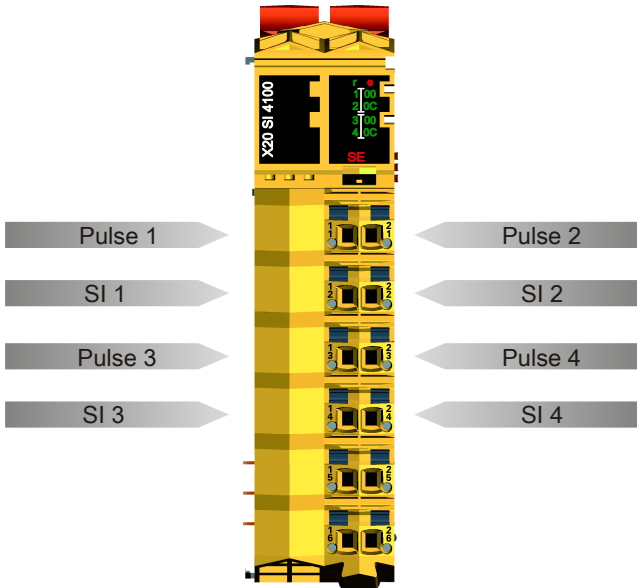


Figure 2: X20SI4100 - Pinout

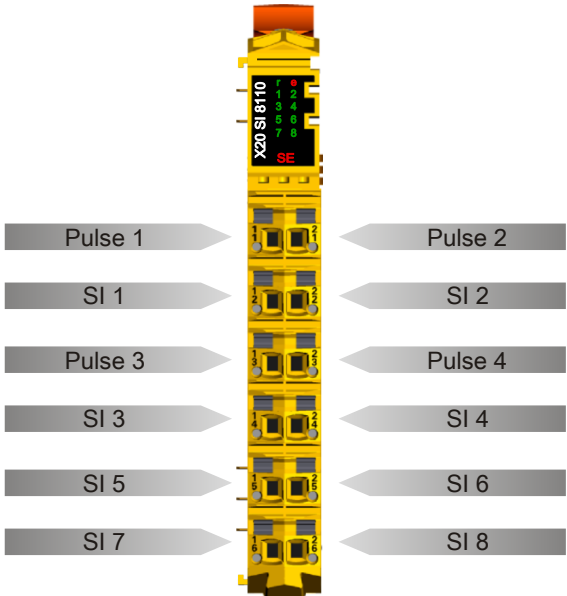


Figure 3: X20SI8110 - Pinout

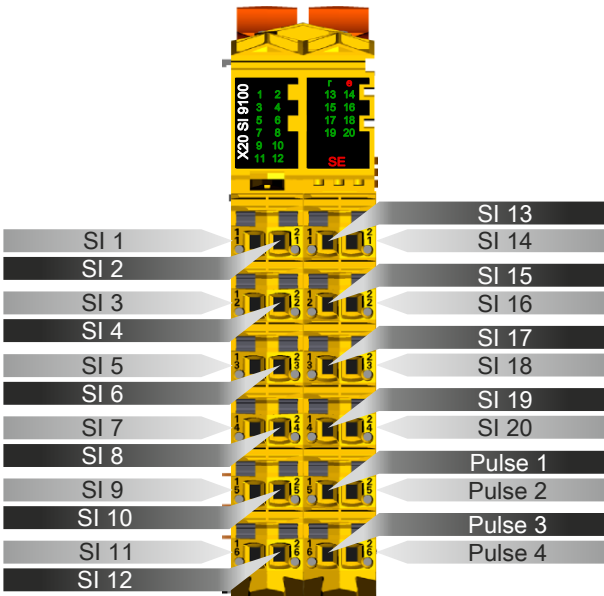


Figure 4: X20SI9100 - Pinout