X20(c)CP041x, X20CP0420 and X20CP048x

1 General information

The CPUs in the X20 Compact-S family are available in different variants. This way, customers get the product that best meets the requirements of the machine – technically and economically.

The processor performance of the compact CPUs ranges from 166 MHz (compatible) to 667 MHz. The most economical variant is equipped with 128 MB RAM, 8 kB nonvolatile RAM and a 256 MB flash drive. The most powerful variant of the Compact-S CPUs achieves cycle times up to 400 µs. It is equipped with 512 MB RAM, 64 kB nonvolatile RAM and a 2 GB internal flash drive.

With POWERLINK, Ethernet, USB and RS232, the CPUs offer a wide range of communication options. An optional CAN interface is also available. If the application requires additional interfaces, the CPU can be modularly expanded by one or two X20 interface slots. This allows the entire product range of X20 fieldbus interfaces to be used.

The fanless, battery-free design of Compact-S CPUs means they are completely maintenance-free.

- ARM Cortex-A9 processor with 166 MHz (compatible) to 667 MHz and integrated I/O processor
- Depending on the variant: POWERLINK with poll-response chaining
- 2x onboard USB
- Up to 2 slots for modular interface expansions
- 128 to 512 MB DDR3 SDRAM
- 256 MB to 2 GB onboard flash drive
- Fanless
- No battery
- Extremely compact

2 Coated modules

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

> **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

3 Order data

X20CP0410, X20CP0411

X20CP0420, X20CP0482,
X20CP0483, X20CP0484, X20CP0484-1

Model number	Short description
	Compact-S CPUs
X20CP0410	X20 Compact-S CPU, ARM Cortex-A9-166 (compatible), 128 MB DDR3 RAM, 8 kB FRAM, 256 MB onboard flash drive, 2 USB interfaces, 1 RS232 interface, 1 Ethernet interface 10/100BASE-T. Order bus base, power supply module and terminal block separately!
X20cCP0410	X20c Compact-S CPU, coated, ARM Cortex-A9-166 (compatible), 128 MB DDR3 RAM, 8 kB FRAM, 256 MB onboard flash drive, 2 USB interfaces, 1 RS232 interface, 1 Ethernet interface 10/100BASE-T. Order bus base, power supply module and terminal block separately!
X20CP0411	X20 Compact-S CPU, ARM Cortex-A9-240, 128 MB DDR3 RAM, 16 kB FRAM, 512 MB onboard flash drive, 2 USB interfaces, 1 RS232 interface, 1 Ethernet interface 10/100BASE-T. Order bus base, power supply module and terminal block separately!
X20CP0420	X20 Compact-S CPU, ARM Cortex-A9-166 (compatible), 128 MB DDR3 RAM, 8 kB FRAM, 256 MB onboard flash drive, 2 USB interfaces, 1 RS232 interface, 1 Ethernet interface 10/100BASE-T (2-port switch). Order bus base, power supply module and terminal block separately!
X20CP0482	X20 Compact-S CPU, ARM Cortex-A9-300, 128 MB DDR3 RAM, 16 kB FRAM, 1 GB onboard flash drive, 2 USB interfaces, 1 RS232 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T, can be expanded with X20 interface slot. Order bus base, power supply module and terminal block separately!
X20CP0483	X20 Compact-S CPU, ARM Cortex-A9-500, 256 MB DDR3 RAM, 32 kB FRAM, 1 GB onboard flash drive, 2 USB interfaces, 1 RS232 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T, can be expanded with X20 interface slot. Order bus base, power supply module and terminal block separately!
X20CP0484	X20 Compact-S CPU, ARM Cortex-A9-667, 256 MB DDR3 RAM, 64 kB FRAM, 2 GB onboard flash drive, 2 USB interfaces, 1 RS232 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T, can be expanded with X20 interface slot. Order bus base, power supply module and terminal block separately!
X20CP0484-1	X20 Compact-S CPU, ARM Cortex-A9-667, 512 MB DDR3 RAM, 64 kB FRAM, 2 GB onboard flash drive, 2 USB interfaces, 1 RS232 interface, 1 POWERLINK interface, 1 Ethernet interface 10/100BASE-T, can be expanded with X20 interface slot. Order bus base, power supply module and terminal block separately!
	Required accessories
	System modules for Compact-S CPUs
X20BB52	X20 Compact-S bus base, for Compact-S CPU and Compact-S CPU power supply module, base for integrated RS232 interface, X20 connection, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included
X20BB57	X20 Compact-S bus base, for Compact-S CPU and Compact-S CPU power supply module, base for integrated RS232 and CAN bus interface, X20 connection, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included
X20BB62	X20 Compact-S bus base, for Compact-S CPU and Compact-S CPU power supply module, base for integrated RS232 interface, slots for X20 interface module, X20 connection, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included
X20BB67	X20 Compact-S bus base, for Compact-S CPU and Compact-S CPU power supply module, base for integrated RS232 and CAN bus interface, slot for X20 interface module, X20 connection, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included
X20BB72	X20 Compact-S bus base, for Compact-S CPU and Compact-S CPU power supply module, base for integrated RS232 interface, 2 slots for X20 interface modules, X20 connection, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included
X20BB77	X20 Compact-S bus base, for Compact-S CPU and Compact-S CPU power supply module, base for integrated RS232 and CAN bus interface, 2 slots for X20 interface modules, X20 connection, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included
X20PS9600	X20 power supply module, for Compact-S CPU and internal I/O power supply, X2X Link power supply
X20PS9602	X20 power supply module, for Compact-S CPU and internal I/O power supply, X2X Link power supply, power supply not electrically isolated

Table 1: X20(c)CP041x, X20CP0420 and X20CP048x - Order data

X20cBB52	X20c Compact-S bus base, coated, for Compact-S CPU and Compact-S CPU power supply module, base for integrated RS232 interface, X20 connection, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included
X20cBB57	X20c Compact-S bus base, coated, for Compact-S CPU and Compact-S CPU power supply module, base for integrated RS232 and CAN bus interface, X20 connection, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included
X20cPS9600	X20 power supply module, coated, for Compact-S CPU and internal I/O power supply, X2X Link power supply
Terminal blocks	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed

Table 1: X20(c)CP041x, X20CP0420 and X20CP048x - Order data

Included in delivery

X20 end cover plates are included with the delivery of the Compact-S CPU bus base.

Order number	Short description
X20AC0SL1	X20 end cover plate, left
X20AC0SR1	X20 end cover plate, right

4 X20(c)CP041x and X20CP0420 - Technical data

Model number	X20CP0410	X20cCP0410	X20CP0411	X20CP0420
Short description				
Interfaces	1x Ethernet, 2x USB, 1x X2X Link			1x Ethernet (2-port switch), 2x USB, 1x X2X Link
System module	CPU			
General information				
B&R ID code	0xE94F	0xFC36	0xE950	0xF4D3
Cooling	Fanless			
Status indicators	CPU function, Ethernet			
Diagnostics				
CPU function	Yes, using LED status indicator			
Ethernet	Yes, using LED status indicator			
Temperature	Yes, using software register			
Power consumption	2.2 W [1]			2.5 W [1]
Support				
Controller redundancy possible	No			
ACOPOS support	Yes			
Visual Components support	Yes			
Additional power dissipation caused by actuators (resistive) [W]	-			
Certifications				
CE	Yes			
UL	cULus E115267 Industrial control equipment	-	cULus E115267 Industrial control equipment	-
DNV GL	Temperature: **B** (0 - 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)			-
EAC	Yes	-	Yes	
Controller				
Real-time clock	Retention for at least 300 hours, typ. 1000 hours at 25°C, 1 s resolution, -18 to 28 ppm accuracy at 25°C			
FPU	Yes			
Processor				
Type	ARM Cortex-A9			
Clock frequency	166 MHz (compatible)		240 MHz	166 MHz (compatible)
L1 cache				
Data code	32 kB			
Program code	32 kB			
L2 cache	512 kB			
Integrated I/O processor	Processes I/O data points in the background			
Remanent variables	8 kB FRAM, retention >10 years [2]		16 kB FRAM, retention >10 years [2]	8 kB FRAM, retention >10 years [2]
Shortest task class cycle time	4 ms		2 ms	4 ms
Typical instruction cycle time	0.0446 µs		0.0309 µs	0.0446 µs
Standard memory				
RAM	128 MB DDR3 SDRAM			

Table 2: X20(c)CP041x and X20CP0420 - Technical data

Model number	X20CP0410	X20cCP0410	X20CP0411	X20CP0420
Application memory				
Type	256 MB eMMC flash memory		512 MB eMMC flash memory	256 MB eMMC flash memory
Data retention	10 years			
Writable data amount				
Guaranteed	40 TB			
Results for 5 years	21.9 GB/day			
Guaranteed erase/write cycles	20,000			
Error-correcting code (ECC)	Yes			
Interfaces				
Interface IF2				
Signal	Ethernet			
Variant	1x RJ45 shielded			2x shielded RJ45 (switch)
Cable length	Max. 100 m between 2 stations (segment length)			
Transfer rate	10/100 Mbit/s			
Transfer				
Physical layer	10BASE-T/100BASE-TX			
Half-duplex	Yes			
Full-duplex	Yes			
Autonegotiation	Yes			
Auto-MDI/MDIX	Yes			
Interface IF4				
Type	USB 1.1/2.0			
Variant	Type A			
Max. output current	0.2 A			
Interface IF5				
Type	USB 1.1/2.0			
Variant	Type A			
Max. output current	0.2 A			
Interface IF6				
Fieldbus	X2X Link master			
On base module				
X20BB52, X20BB62 and X20BB72	Compact-S CPU base module with integrated RS232 interface			
X20BB57, X20BB67 and X20BB77	Compact-S CPU base module with integrated RS232 and CAN bus interface			
Electrical properties				
Electrical isolation	Ethernet (IF2) isolated from other interfaces and PLC X2X (IF6) isolated from other interfaces and PLC: Yes, with X20PS9600 / No, with X20PS9602 USB (IF4, IF5) not isolated from each other and PLC			
Operating conditions				
Mounting orientation				
Horizontal	Yes			
Vertical	Yes			
Installation elevation above sea level				
0 to 2000 m	No limitation			
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m			
Degree of protection per EN 60529	IP20			
Ambient conditions				
Temperature				
Operation				
Horizontal mounting orientation	-25 to 60°C			
Vertical mounting orientation	-25 to 50°C			
Derating	See section "Derating" in the X20PS960x data sheet.			
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 terminal block X20TB12 separately. Order 1x power supply module X20PS9600 or X20PS9602 separately. Order 1x Compact-S CPU base X20BB5x separately.	Order 1x terminal block X20TB12 separately. Order 1x power supply module X20cPS9600 separately. Order 1x Compact-S CPU base X20cBB5x separately.	Order 1x terminal block X20TB12 separately. Order 1x power supply module X20PS9600 or X20PS9602 separately. Order 1x Compact-S CPU base X20BB5x separately.	
Pitch [3]				
X20BB5x	37.5$^{+0.2}$ mm			

Table 2: X20(c)CP041x and X20CP0420 - Technical data

1) Without USB interface.
2) The memory size for remanent variables is configurable in Automation Studio.
3) The pitch is based on the width of the Compact-S CPU base.

5 X20CP048x - Technical data

Model number	X20CP0482	X20CP0483	X20CP0484	X20CP0484-1
Short description				
Interfaces	1x Ethernet, 1x POWERLINK V2, 2x USB, 1x X2X Link			
System module	CPU			
General information				
B&R ID code	0xE951	0xE952	0xE953	0xFA24
Cooling	Fanless			
Status indicators	CPU function, Ethernet, POWERLINK			
Diagnostics				
CPU function	Yes, using LED status indicator			
Ethernet	Yes, using LED status indicator			
POWERLINK	Yes, using LED status indicator			
Temperature	Yes, using software register			
Power consumption	2.7 W [1]	2.9 W [1]	2.95 W [1]	2.97 W [1]
Support				
Controller redundancy possible	No			
ACOPOS support	Yes			
Visual Components support	Yes			
Additional power dissipation caused by actuators (resistive) [W]	-			
Certifications				
CE	Yes			
UL	cULus E115267 Industrial control equipment			-
DNV GL	Temperature: **B** (0 - 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)			-
LR	ENV1			-
KR	Yes			-
ABS	Yes			-
EAC	Yes			-
Controller				
Real-time clock	Retention for at least 300 hours, typ. 1000 hours at 25°C, 1 s resolution, -18 to 28 ppm accuracy at 25°C			
FPU	Yes			
Processor				
Type	ARM Cortex-A9			
Clock frequency	300 MHz	500 MHz	667 MHz	
L1 cache				
Data code	32 kB			
Program code	32 kB			
L2 cache	512 kB			
Integrated I/O processor	Processes I/O data points in the background			
Remanent variables	16 kB FRAM, retention >10 years [2]	32 kB FRAM, retention >10 years [2]	64 kB FRAM, retention >10 years [2]	
Shortest task class cycle time	1 ms	0.8 ms	0.4 ms	
Typical instruction cycle time	0.0247 µs	0.0145 µs	0.0106 µs	
Standard memory				
RAM	128 MB DDR3 SDRAM	256 MB DDR3 SDRAM		512 MB DDR3 SDRAM
Application memory				
Type	1 GB eMMC flash memory		2 GB eMMC flash memory	
Data retention	10 years			
Writable data amount				
Guaranteed	40 TB			
Results for 5 years	21.9 GB/day			
Guaranteed erase/write cycles	20,000			
Error-correcting code (ECC)	Yes			
Slots for interface modules				
X20BB5x	0			
X20BB6x	1			
X20BB7x	2			

Table 3: X20CP048x - Technical data

| Model number	X20CP0482	X20CP0483	X20CP0484	X20CP0484-1
Interfaces				
Interface IF2				
Signal		Ethernet		
Variant		1x RJ45 shielded		
Cable length		Max. 100 m between 2 stations (segment length)		
Transfer rate		10/100 Mbit/s		
Transfer				
Physical layer		10BASE-T/100BASE-TX		
Half-duplex		Yes		
Full-duplex		Yes		
Autonegotiation		Yes		
Auto-MDI/MDIX		Yes		
Interface IF3				
Fieldbus		POWERLINK V2 managing or controlled node		
Type		Type 4 [3]		
Variant		1x RJ45 shielded		
Cable length		Max. 100 m between 2 stations (segment length)		
Transfer rate		100 Mbit/s		
Transfer				
Physical layer		100BASE-TX		
Half-duplex		Yes		
Full-duplex		POWERLINK mode: No / Ethernet mode: Yes		
Autonegotiation		Yes		
Auto-MDI/MDIX		Yes		
Interface IF4				
Type		USB 1.1/2.0		
Variant		Type A		
Max. output current		0.2 A		
Interface IF5				
Type		USB 1.1/2.0		
Variant		Type A		
Max. output current		0.2 A		
Interface IF6				
Fieldbus		X2X Link master		
On base module				
X20BB52, X20BB62 and X20BB72		Compact-S CPU base module with integrated RS232 interface		
X20BB57, X20BB67 and X20BB77		Compact-S CPU base module with integrated RS232 and CAN bus interface		
Electrical properties				
Electrical isolation		Ethernet (IF2) and POWERLINK (IF3) isolated from each other, from other interfaces and from PLC X2X (IF6) isolated from other interfaces and PLC: Yes, with X20PS9600 / No, with X20PS9602 USB (IF4, IF5) not isolated from each other and PLC		
Operating conditions				
Mounting orientation				
Horizontal		Yes		
Vertical		Yes		
Installation elevation above sea level				
0 to 2000 m		No limitation		
>2000 m		Reduction of ambient temperature by 0.5°C per 100 m		
Degree of protection per EN 60529		IP20		
Ambient conditions				
Temperature				
Operation				
Horizontal mounting orientation		-25 to 60°C		
Vertical mounting orientation		-25 to 50°C		
Derating		See section "Derating" in the X20PS960x data sheet.		
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 terminal block X20TB12 separately. Order 1x power supply module X20PS9600 or X20PS9602 separately. Order 1x Compact-S CPU base X20BB5x, X20BB6x or X20BB7x separately.		
Pitch [4]				
X20BB5x		37.5$^{+0.2}$ mm		
X20BB6x		62.5$^{+0.2}$ mm [5]		
X20BB7x		87.5$^{+0.2}$ mm [6]		

Table 3: X20CP048x - Technical data

1)   Without USB interface.
2)   The memory size for remanent variables is configurable in Automation Studio.
3)   For additional information, see section "Communication / POWERLINK / General information / Hardware - IF/LS" in Automation Help.

4) The pitch is based on the width of the Compact-S CPU base.
5) X20CP048x CPUs can be used to operate 1 interface module.
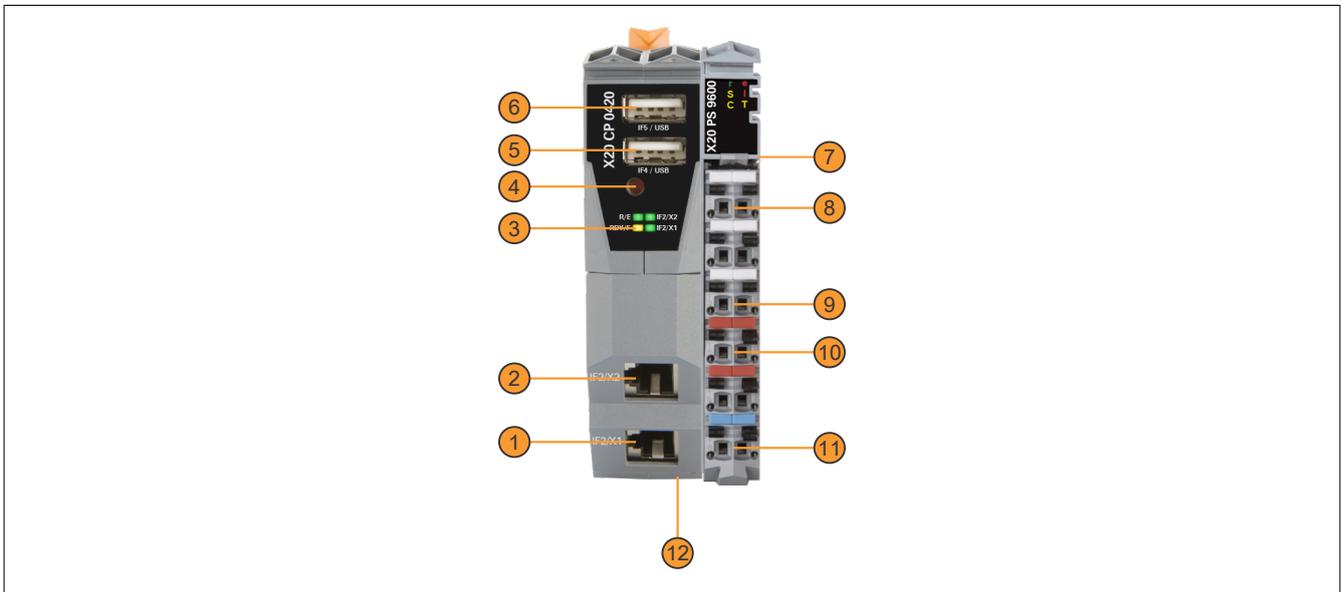6) X20CP048x CPUs can be used to operate 2 interface modules.

# 6 Operating and connection elements

X20CP0410 and X20CP0411
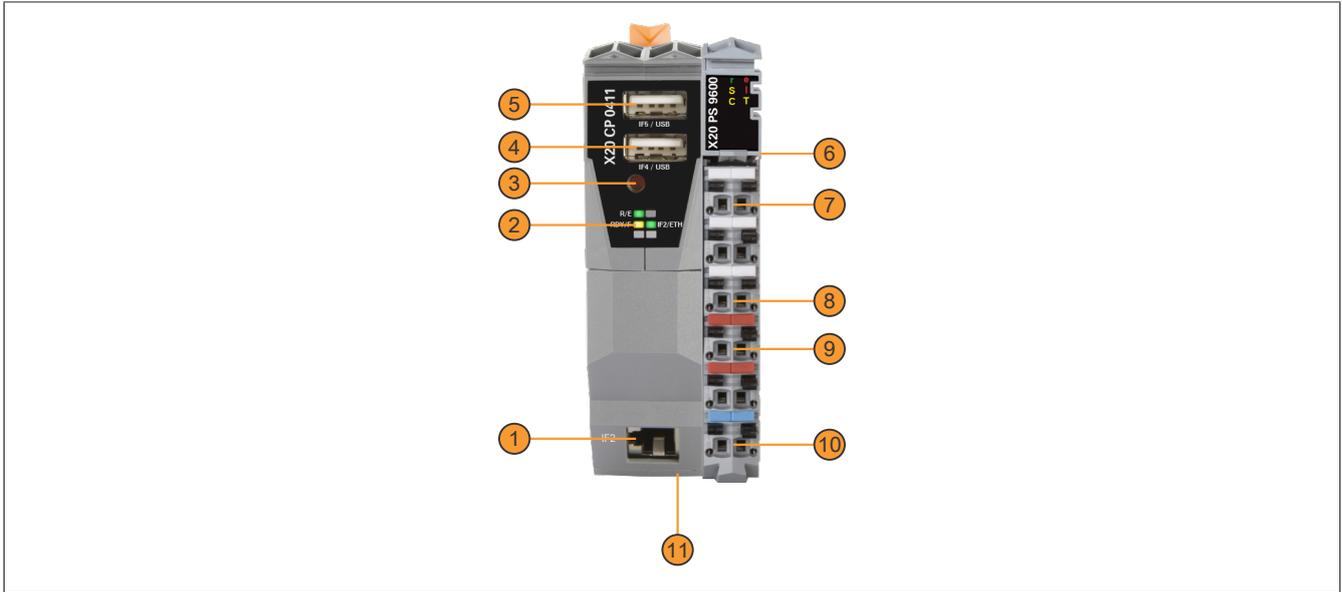
1	IF2 - Ethernet	2	LED status indicators
3	Reset button	4	IF4 - USB
5	IF5 - USB	6	IF6 - X2X Link
7	IF1 - RS232	8	IF7 - CAN bus (with X20BB57)
9	+24 V I/O	10	GND
11	Switch for CAN bus terminating resistor (on X20BB57)	-	-

X20CP0420

1	IF2/X1 - Ethernet	2	IF2/X2 - Ethernet
3	LED status indicators	4	Reset button
5	IF4 - USB	6	IF5 - USB
7	IF6 - X2X Link	8	IF1 - RS232
9	IF7 - CAN bus (with X20BB57)	10	+24 V I/O
11	GND	12	Switch for CAN bus terminating resistor (on X20BB57)

X20CP0482, X20CP0483, X20CP0484 and X20CP0484-1
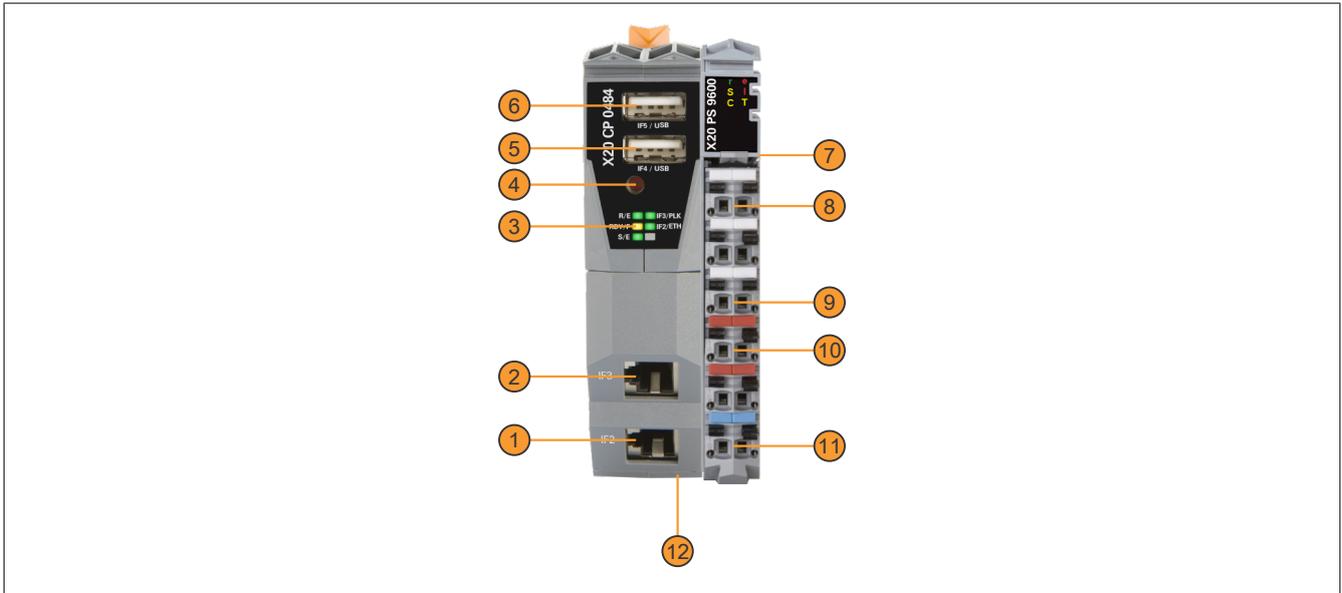
1	IF2 - Ethernet	2	IF3 - POWERLINK
3	LED status indicators	4	Reset button
5	IF4 - USB	6	IF5 - USB
7	IF6 - X2X Link	8	IF1 - RS232
9	IF7 - CAN bus (with X20BB57/67/77)	10	+24 V I/O
11	GND	12	Switch for CAN bus terminating resistor (on X20BB57/67/77)

6.1 LED status indicators

X20CP0410 and X20CP0411

Figure	LED	Color	Status	Description
	R/E	Green	On	Application running
			Blinking	System startup: The CPU is initializing the application, all bus systems and I/O modules.[1]
			Double flash	System startup during firmware update[1]
		Red	On	Mode SERVICE[2]
			Blinking	If LED "R/E" blinks red and LED "RDY/F" blinks yellow, a license violation has occurred.
	RDY/F	Yellow	On	Mode SERVICE[2] or BOOT[2]
			Blinking	If LED "RDY/F" blinks yellow and LED "R/E" blinks red, a license violation has occurred.
	IF2/ETH	Green	On	The link to the Ethernet remote station is established.
			Blinking	The link to the Ethernet remote station is established. The LED blinks if Ethernet activity is taking place on the bus.

1)   This process can take several minutes depending on the configuration.
2)   The operating states are described in Automation Help under "Real-time operating system - Method of operation - Operating states".

X20CP0420

Figure	LED	Color	Status	Description
	R/E	Green	On	Application running
			Blinking	System startup: The CPU is initializing the application, all bus systems and I/O modules.[1]
			Double flash	System startup during firmware update[1]
		Red	On	Mode SERVICE[2]
			Blinking	If LED "R/E" blinks red and LED "RDY/F" blinks yellow, a license violation has occurred.
	RDY/F	Yellow	On	Mode SERVICE[2] or BOOT[2]
			Blinking	If LED "RDY/F" blinks yellow and LED "R/E" blinks red, a license violation has occurred.
	IF2 X1/X2	Green	On	The link to the Ethernet remote station is established.
			Blinking	The link to the Ethernet remote station is established. The LED blinks if Ethernet activity is taking place on the bus.

1)   This process can take several minutes depending on the configuration.
2)   The operating states are described in Automation Help under "Real-time operating system - Method of operation - Operating states".

X20CP0482, X20CP0483, X20CP0484 and X20CP0484-1

Figure	LED	Color	Status	Description
R/E IF3/PLK RDY/F IF2/ETH S/E	R/E	Green	On	Application running
			Blinking	System startup: The CPU is initializing the application, all bus systems and I/O modules.[1]
			Double flash	System startup during firmware update[1]
		Red	On	Mode SERVICE[2]
			Blinking	If LED "R/E" blinks red and LED "RDY/F" blinks yellow, a license violation has occurred.
	RDY/F	Yellow	On	Mode SERVICE[2] or BOOT[2]
			Blinking	If LED "RDY/F" blinks yellow and LED "R/E" blinks red, a license violation has occurred.
	S/E	Green/Red		Status/Error LED. LED states are described in section "LED "S/E" (LED "Status/Error")" on page 9.
	IF3/PLK	Green	On	The link to the POWERLINK remote station is established.
			Blinking	The link to the POWERLINK remote station is established. The LED blinks if Ethernet activity is taking place on the bus.
	IF2/ETH	Green	On	The link to the Ethernet remote station is established.
			Blinking	The link to the Ethernet remote station is established. The LED blinks if Ethernet activity is taking place on the bus.

1)   This process can take several minutes depending on the configuration.
2)   The operating states are described in Automation Help under "Real-time operating system - Method of operation - Operating states".

6.1.1 LED "S/E" (LED "Status/Error")

This LED is a green/red dual LED and indicates the state of the POWERLINK interface. The LED states have a different meaning depending on the operating mode of the POWERLINK interface.

6.1.1.1 Ethernet mode

In this mode, the interface is operated as an Ethernet interface.

LED "S/E"		
Green	Red	Description
On	Off	The interface is operated as an Ethernet interface.

Table: LED "S/E": Interface in Ethernet mode

#### 6.1.1.2 POWERLINK V2 mode

Error message

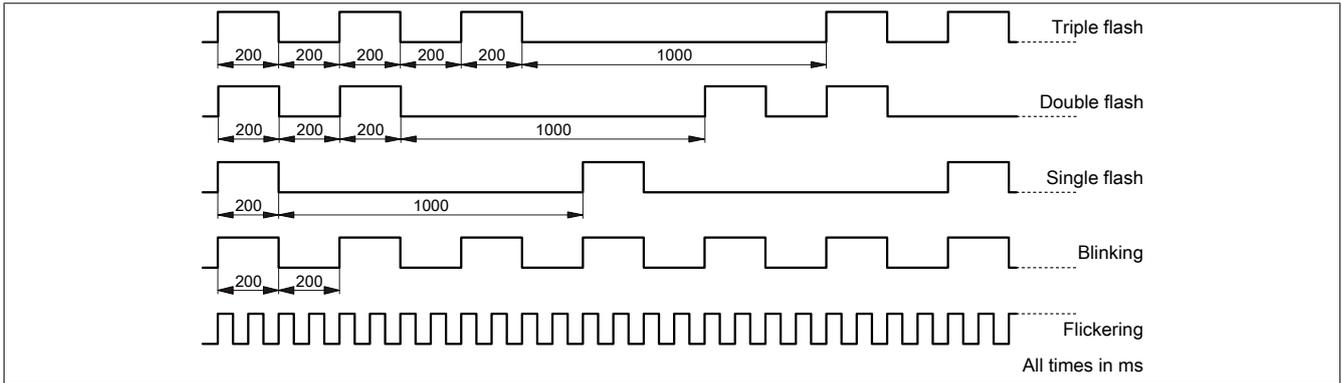| LED "S/E"		
Green	Red	Description
Off	On	The interface is in error mode (failed Ethernet frames, increased number of collisions on the network, etc.). Note: Several red blinking signals are displayed immediately after the device is switched on. These are not errors, however.
Blinking	On	If an error occurs in the following modes, then the green LED blinks over the red LED: • PRE_OPERATIONAL_1 • PRE_OPERATIONAL_2 • READY_TO_OPERATE Status green Error red LED "S/E"
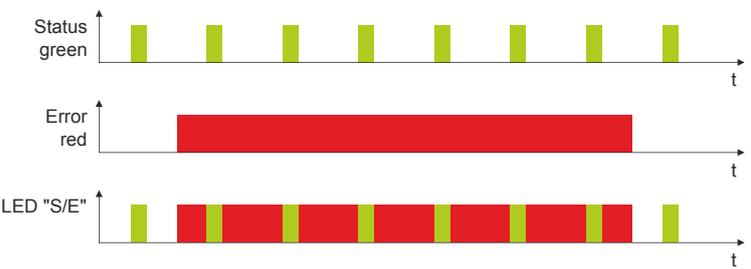
Table: LED "S/E" - Error message (interface in POWERLINK mode)

Interface status

LED "S/E"		
Green	**Red**	**Description**
Off	Off	**Mode:** NOT_ACTIVE The interface is either in mode NOT_ACTIVE or one of the following modes or errors is present: • The device is switched off. • The device is in the startup phase. • The interface or device is not configured correctly in Automation Studio. • The interface or device is defective. **Managing node (MN)** The network is monitored for POWERLINK frames. If a frame is not received within the configured time window (timeout), the interface immediately enters mode PRE_OPERATIONAL_1. If POWERLINK communication is detected before the time has elapsed, however, the MN is not started. **Controlled node (CN)** The network is monitored for POWERLINK frames. If a frame is not received within the configured time window (timeout), the interface immediately enters mode BASIC_ETHERNET. If POWERLINK communication is detected before this time expires, however, the interface immediately enters mode PRE_OPERATIONAL_1.
Flickering (approx. 10 Hz)	Off	**Mode:** BASIC_ETHERNET The interface is in mode BASIC_ETHERNET. The interface is operated in Ethernet mode. **Managing node (MN)** This mode can only be exited by resetting the controller. **Controlled node (CN)** If POWERLINK communication is detected during this mode, the interface enters mode PRE_OPERATIONAL_1.
Single flash (approx. 1 Hz)	Off	**Mode:** PRE_OPERATIONAL_1 The interface is in mode PRE_OPERATIONAL_1. **Managing node (MN)** The MN is in "reduced cycle" mode. The CNs are configured in this mode. Cyclic communication is not yet taking place. **Controlled node (CN)** The CN can be configured by the MN in this mode. The CN waits until it receives an SoC frame and then switches to mode PRE_OPERATIONAL_2.
	On	**Controlled node (CN)** If the red LED lights up in this mode, this means that the MN has failed.
Double flash (approx. 1 Hz)	Off	**Mode:** PRE_OPERATIONAL_2 The interface is in mode PRE_OPERATIONAL_2. **Managing node (MN)** The MN starts cyclic communication (cyclic input data is not yet evaluated). The CNs are configured in this mode. **Controlled node (CN)** The CN can be configured by the MN in this mode. A command then switches the mode to READY_TO_OPERATE.
	On	**Controlled node (CN)** If the red LED lights up in this mode, this means that the MN has failed.
Triple flash (approx. 1 Hz)	Off	**Mode:** READY_TO_OPERATE The interface is in mode READY_TO_OPERATE. **Managing node (MN)** Cyclic and asynchronous communication. Received PDO data is ignored. **Controlled node (CN)** The configuration of the CN is completed. Normal cyclic and asynchronous communication. The transmitted PDO data corresponds to the PDO mapping. However, cyclic data is not yet evaluated.
	On	**Controlled node (CN)** If the red LED lights up in this mode, this means that the MN has failed.
On	Off	**Mode:** OPERATIONAL The interface is in mode OPERATIONAL. PDO mapping is active and cyclic data is evaluated.
Blinking (approx. 2.5 Hz)	Off	**Mode:** STOPPED The interface is in mode STOPPED. **Managing node (MN)** This mode does not occur for the MN. **Controlled node (CN)** Output data is not being output, and no input data is being provided. This mode can only be reached and exited by a corresponding command from the MN.

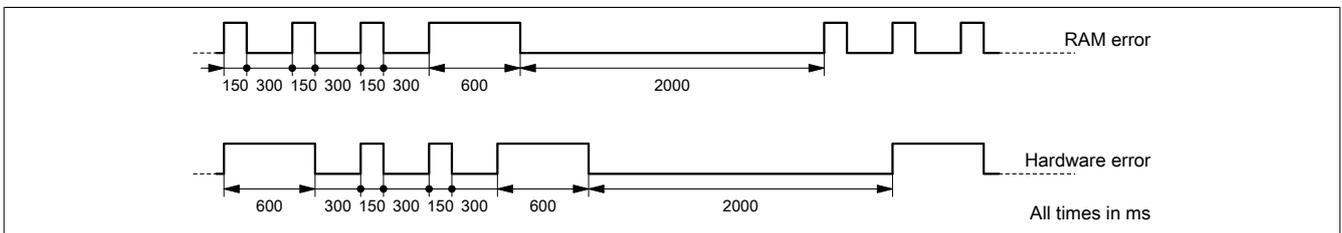Table: LED "S/E" - Interface state (interface in POWERLINK mode)

Blink times

Triple flash
Double flash
Single flash
Blinking
Flickering

All times in ms

6.1.2 System stop error codes

A system stop error can occur due to incorrect configuration or defective hardware.

The error code is indicated by LED "S/E" blinking red. The blinking signal of the error code consists of 4 switch-on phases with short (150 ms) or long (600 ms) duration. The error code is repeated every 2 seconds.

RAM error

150 300 150 300 150 300   600   2000

Hardware error

600   300 150 300 150 300   600   2000

All times in ms

Error	Error description
RAM error	The device is defective and must be replaced.
Hardware error	The device or a system component is defective and must be replaced.

6.2 Button for reset and operating mode

6.2.1 Reset

The button must be pressed for less than 2 seconds to trigger a reset. This triggers a hardware reset on the CPU, which means that:

- All application programs are stopped.
- All outputs are set to zero.

The controller then boots into service mode by default. The startup mode after pressing the reset button can be set in Automation Studio:

- Service mode (default)
- Warm restart
- Cold restart
- Diagnostic mode

6.2.2 Operating mode

3 operating modes can be set using different button sequences:

Operating mode	Button sequence	Description
BOOT[1]	Boot mode is enabled by the following button sequence: • Press the button for less than 2 s. As soon as LED "Error" lights **RED**, the button can be released. • Then press the button within 2 s for longer than 2 s. As soon as LED "Error" goes dark, the button can be released.	Boot AR is started, and the runtime system can be installed via the online interface (Automation Studio). User flash memory is erased only when the download begins.
SERVICE/RUN[1]	Press the button for less than 2 s. As soon as LED "Error" lights **RED**, the button can be released.	Mode SERVICE/RUN: Triggering and startup behavior correspond to triggering a hardware reset (see "Reset" on page 12).
DIAGNOSE[1]	Press the button for more than 2 s. LED "Error" lights **RED** and then goes dark. As soon as LED "Error" goes dark, the button can be released.	The CPU is starting up in diagnostic mode. Program sections in User RAM and User FlashPROM are not initialized. After diagnostic mode, the CPU always boots with a warm restart.

1)   The operating states are described in "Real-time operating system - Method of operation - Operating states" in Automation Help.

6.3 Flash drive

This application memory is implemented as an integrated flash drive.

6.4 Project installation

Project installation is described in "Project management - Project installation" in Automation Help.

6.5 RS232 interface (IF1)

The non-galvanically isolated RS232 interface is designed as an online interface for communication with the programming device. The terminal connections for the signals are located on the power supply module.
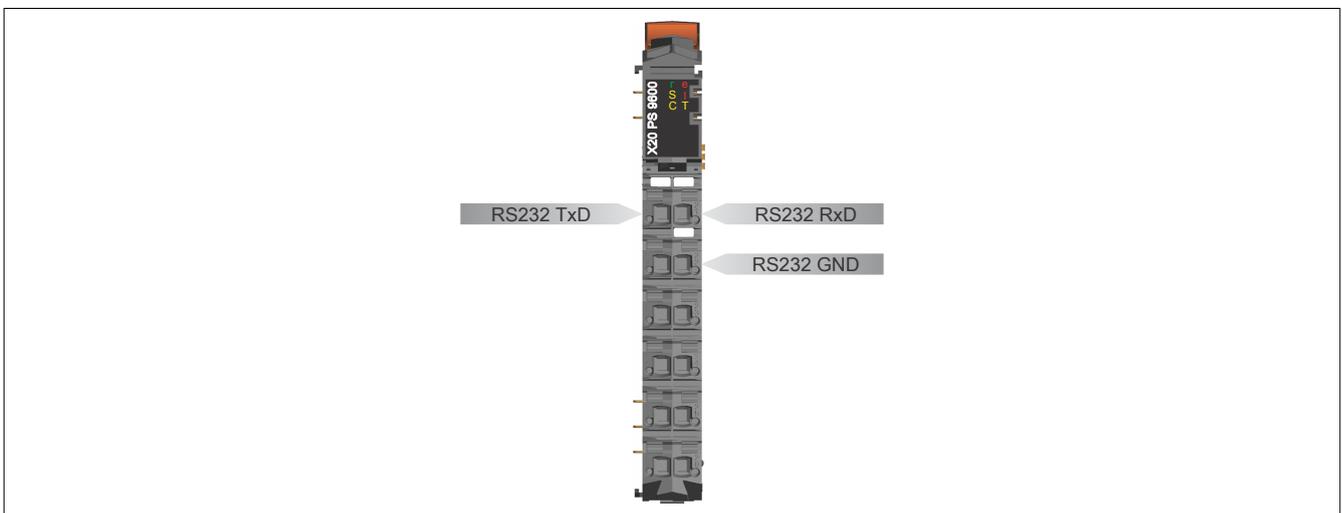
6.6 Ethernet interface (IF2)

General information

IF2 is a 10BASE-T/100BASE-TX Ethernet interface.

The INA2000 station number is set using the B&R Automation Studio software.

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.

> # Information:
>
> **The Ethernet interface is not suitable for POWERLINK.**
>
> **When using the POWERLINK interface, the Ethernet interface is not permitted to be operated with an IP address from the POWERLINK address range.**
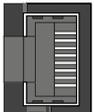> **POWERLINK address range: 192.168.100.x**

X20CP0420

The interface is equipped with 2 female RJ45 connections. Both connections result in an integrated switch. This makes daisy-chain wiring easy.

The X20CP0420 supports half-duplex and full-duplex communication. Mixed operation is not possible. Both connections must be operated in either half-duplex or full-duplex communication mode.

Pinout

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

6.7 POWERLINK interface (IF3)

X20CP048x Compact-S CPUs are equipped with a POWERLINK V2 interface.

POWERLINK

By default, the POWERLINK interface is operated as a managing node (MN). In the managing node, the node number is set to a fixed value of 240.
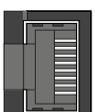
If the POWERLINK node is operated as a controlled node (CN), a node number from 1 to 239 can be set in the POWERLINK configuration in Automation Studio.

Ethernet mode

In this mode, the interface is operated as an Ethernet interface. The INA2000 station number is set using the B&R Automation Studio software.

Pinout

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.

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

6.8 USB interfaces (IF4 and IF5)

IF4 and IF5 are non-galvanically isolated USB interfaces. The abbreviation USB stands for "Universal Serial Bus". Both USB interfaces support the USB 1.1 and 2.0 standards.

Information:

USB peripheral devices can be connected to the USB interfaces. Due to the variety of USB devices available on the market, B&R cannot guarantee their functionality. The functionality of USB devices available from B&R is ensured.

Information:

- **The USB interfaces cannot be used as online communication interfaces.**
- **Only devices isolated from GND are permitted to be connected to the USB interfaces.**
- **Current-carrying capacity is listed in the technical data.**

6.9 CAN bus interface (IF7)

When used with bus base X20BB57, X20BB67 or X20BB77, the CPUs have access to a CAN bus interface. The terminal connections for the signals are located on the power supply module.

6.10 Slot for interface modules

Up to 2 interface modules can be connected to the left side of X20CP048x Compact-S CPUs. Different bus or network systems can be flexibly integrated into the X20 system by selecting the appropriate interface module.

CPU base	Slots for interface modules
X20BB62, X20BB67	1
X20BB72, X20BB77	2

6.10.1 Information regarding operation of interface modules on the X20CP048x

Some X20 interface modules must have a certain minimum firmware version or minimum upgrade version for operation with an X20CP048x, but these are not included in the Automation Studio 4.3.3 release. A hardware upgrade may be necessary. This can be installed from Automation Studio by selecting **Tools / Upgrades** from the menu.

The following table contains a corresponding overview of affected interface modules. No special requirements apply to all other interface modules:

Order number	Minimum upgrade version
X20IF1082-2	1.5.0.0
X20IF1082	1.5.0.0
X20IF1086-2	1.5.0.0
X20IF2181-2	1.3.0.0
X20cIF1082-2	1.5.0.0
X20cIF2181-2	1.3.0.0
X20IF1091	1.1.0.0
X20IF2792	1.1.0.0

6.11 Data and real-time clock retention

The CPUs do not use a battery. This makes them completely maintenance-free. Eliminating the backup battery was made possible by the following measures:

Data and real-time clock retention	Backup type	Note
Remanent variables	FRAM	This FRAM stores its contents ferroelectrically. Unlike normal SRAM, this does not require a battery.
Real-time clock	Gold foil capacitor	The real-time clock is backed up for approx. 1000 hours by a gold foil capacitor. The gold foil capacitor is completely charged after 3 continuous hours of operation.

7 Overtemperature shutdown

To prevent damage, the CPU is shut down / reset at the following board temperature:

- X20CP041x and X20CP0420: 95°C
- X20CP048x: 105°C

The following errors are entered in the logbook in the event of shutdown:

Error number	Short error text
9204	PLC restart triggered by the PLC CPU's temperature monitoring.
9210	Warning: Halt/Service after watchdog or manual reset.

8 System requirements

CPU	System requirements

X20CP041x, X20CP048x	The following minimum versions are recommended to generally be able to use all functions:
	
	• Automation Studio 4.3.3
	• Automation Runtime 4.34
	• For error-free support by Automation Studio, **all** Compact-S hardware upgrades must be installed separately via the Automation Studio **Tools / Upgrades** menu:
	   ° X20CP04xx
	   ° X20BB5x/6x/7x
	   ° X20PS960x
	• Starting with Automation Studio 4.4, all Compact-S components are included in the installation package.

X20cCP0410	The following minimum versions are recommended in order to be able to generally use all functions of coated CPU X20cCP0410: • Automation Studio 4.8.1 • Automation Runtime E4.81
X20CP0420	The following minimum versions are recommended to generally be able to use all functions: • Automation Studio 4.7.1 • Automation Runtime 4.73
X20CP0484-1	The following minimum versions are recommended to generally be able to use all functions: • Automation Studio 4.5 • Automation Runtime 4.5

9 General data points

This CPU is equipped with general data points. These are not CPU-specific; instead, they contain general information such as system time and heat sink temperature.

General data points are described in section "Additional information - General data points" in the X20 system user's manual.