

# **X20 hub and redundancy system**

## **Data sheets**

Version: **1.10 (March 2024)**

Order no.: **X20 hub and redundancy system**

**Translation of the original documentation**

## **Publishing information**

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# **X20 hub system**

## **Data sheets**

Version: **1.10 (March 2024)**  
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## 1.1 X20ET8819

### 1.1.1 General information

#### Analyzing POWERLINK

POWERLINK has proven itself in the field for years and rarely has problems during commissioning and production. Nonetheless, it is still possible for communication disturbances to occur due to damaged or poor quality cables. If an error occurs, localizing and correcting it is usually very easy thanks to the heterogeneous structure of this flat network type (all data is always visible throughout the network). What's problematic are errors that occur sporadically. This is where tools such as Omnippeek or Wireshark come in.

These tools (or more likely the standard PC technology being used) reach their limits, however, when dealing with machines that have short network cycles. Either not all frames can be recorded, or some telegrams are lost altogether. In these cases, what's needed is a special hardware tool that can work very quickly, record and save every bit of traffic and then pass it on to a laptop.

#### Ethernet analysis tool X20ET8819

This module provides different operating modes. For example, it can work passively on the network, in which case the real-time behavior remains unchanged. The device listens in and selectively takes in data when certain defined trigger conditions are met. It can read all of the data, mark it with a timestamp, store it temporarily and ultimately pass it on to a PC. The data is then analyzed in the familiar PC environment.

- NetTime time stamp has a resolution of 20 ns
- Recording and analysis of CRC and frame errors
- Triggers can also be activated using external digital signals
- Analysis of both half-duplex and full-duplex networks
- Able to record two networks simultaneously

## 1.1.2 Order data

Order number	Short description	Figure
	<b>X20 hub system</b>	
X20ET8819	X20 Ethernet analysis tool, can be expanded with active bus modules, 2x RJ45	
	<b>Required accessories</b>	
	<b>System modules for bus controllers</b>	
X20BB80	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20PS9400	X20 power supply module, for bus controller and internal I/O power supply X2X Link power supply	
	<b>System modules for expandable bus controllers</b>	
X20BB81	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with one expansion slot for X20 add-on module (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20BB82	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
	<b>Terminal blocks</b>	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	
	<b>Optional accessories</b>	
	<b>Bus modules</b>	
X20BM11	X20 bus module, 24 VDC keyed, internal I/O power supply connected through	
X20BM15	X20 bus module, with node number switch, 24 VDC keyed, internal I/O power supply connected through	
	<b>Digital inputs</b>	
X20DI9371	X20 digital input module, 12 inputs, 24 VDC, sink, configurable input filter, 1-wire connections	
	<b>Digital outputs</b>	
X20DO9322	X20 digital output module, 12 outputs, 24 VDC, 0.5 A, source, 1-wire connections	
	<b>System modules for the X20 hub system</b>	
X20HB2880	X20 hub expansion module, integrated 2-port hub, 2x RJ45	
X20HB2881	X20 hub expansion module, integrated 2-port hub, for fiber optic cables	

Table 1: X20ET8819 - Order data

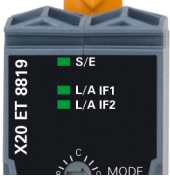
## 1.1.3 Technical data

<b>Order number</b>	<b>X20ET8819</b>
<b>Short description</b>	
Ethernet analysis tool	Ethernet analysis tool with up to 2 slots for hub expansion modules
<b>General information</b>	
Status indicators	Module status, bus function
Diagnostics	
Module status	Yes, using status LED and software
Bus function	Yes, using status LED and software
Power consumption	2 W
Certifications	
CE	Yes
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÚ 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
EAC	Yes
KC	Yes
<b>Interfaces</b>	
Type	Ethernet analysis tool
Variant	2x shielded RJ45
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	Yes
Autonegotiation	Yes
Auto-MDI/MDIX	Yes
<b>Electrical properties</b>	
Electrical isolation	POWERLINK (IF1, IF2) isolated from power supply
<b>Operating conditions</b>	
Mounting orientation	
Horizontal	Yes
Vertical	Yes
Installation elevation above sea level	
0 to 2000 m	No limitations
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m
Degree of protection per EN 60529	IP20
<b>Ambient conditions</b>	
Temperature	
Operation	
Horizontal mounting orientation	-25 to 60°C
Vertical mounting orientation	-25 to 50°C
Derating	-
Storage	-40 to 85°C
Transport	-40 to 85°C
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
<b>Mechanical properties</b>	
Note	Order 1x X20TB12 terminal block separately Order 1x X20PS9400 power supply module separately Order 1x X20BB8x bus base separately
Pitch <sup>1)</sup>	
X20BB80	37.5 <sup>+0.2</sup> mm
X20BB81	62.5 <sup>+0.2</sup> mm
X20BB82	87.5 <sup>+0.2</sup> mm

Table 2: X20ET8819 - Technical data

- 1) Spacing is based on the width of the X20BB80 bus base. Up to two X20HB2880 or X20HB2881 hub expansion modules and one X20PS9400 power supply module are also always required for the Ethernet analysis tool.

## 1.1.4 LED status indicators

Figure	LED	Color	Status	Description
	S/E <sup>1)</sup>	Green/red		Status/Error LED. The statuses of this LED are described in section "S/E LED" on page 7.
	L/A IF1	Green	On	A link to the remote station has been established.
			Blinking	A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus
	L/A IF2	Green	On	A link to the remote station has been established.
			Blinking	A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus

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

## 1.1.5 S/E LED

The Status/Error LED is a green and red dual LED.

Red - Error	Description
On	This error can occur only in Analysis mode. If packets are lost when in Analysis mode, the red Status LED lights up.  Remedy: Use the "MODE" switch to reduce the number of bytes in the received packets (see "Analysis mode" on page 13).  As soon as no packets are lost for longer than 1 s, it switches back to green.

Table 3: Status/error LED is red: LED indicates error

Green - Status	Description
Off	The Ethernet analysis tool is either booting or not receiving power.
Green flickering (approx. 10 Hz)	The analysis tool is in Service mode: Analysis tool disabled, go to website to update firmware (see "Firmware update" on page 12)
Single flash (approx. 1 Hz)	The external trigger is active. No data is currently being recorded. No data has been recorded since turned on.
Double flash (approx. 1 Hz)	The external trigger is active. No data is currently being recorded. However, the analysis tool has recorded data at least once. This means that the trigger has been triggered at least once.
On	The analysis tool is active, and is recording all received packets.

Table 4: Status/error LED is green: LED indicates operation

## System failure error codes

Incorrect node number or defective hardware can cause a system failure error. The error code is indicated by the red error LED using four switch-on phases. The switch-on phases have a duration of either 150 ms or 600 ms. Error code output is repeated cyclically after 2 seconds.

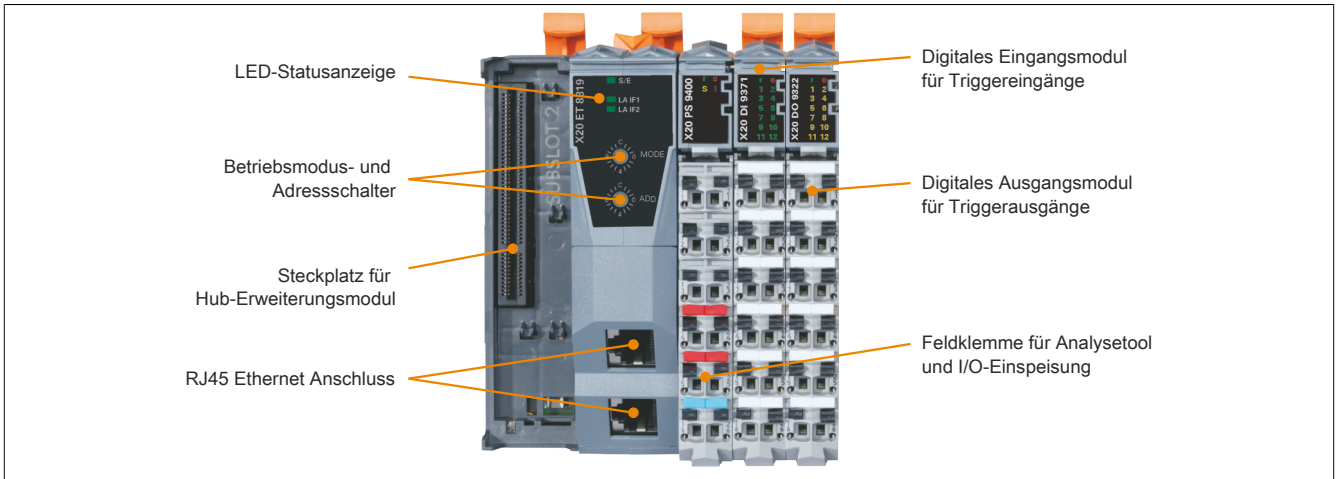
Key:

- ... 150 ms
- ... 600 ms
- Pause ... 2 sec. delay

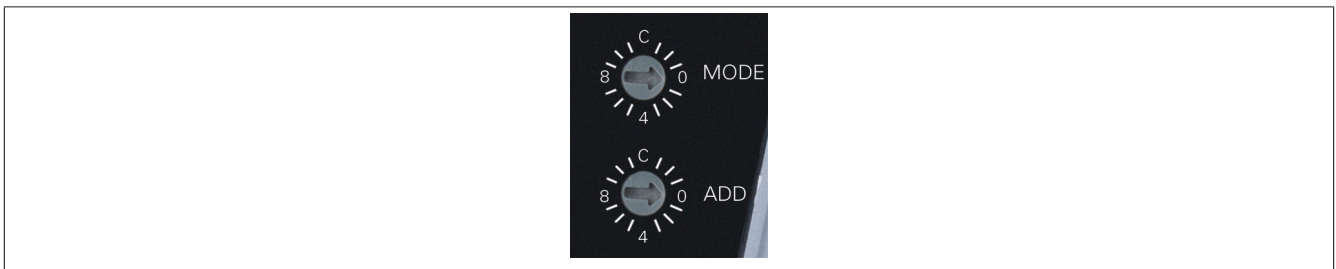
Error description	Error code indicated by red status LED									
RAM error: The module is defective and must be replaced.	•	•	•	–	Pause	•	•	•	–	Pause
Wrong node number	•	–	–	–	Pause	•	–	–	–	Pause
Hardware errors: The module or a system component is defective and must be replaced.	–	•	•	–	Pause	–	•	•	–	Pause

Table 5: Status/Error LED as Error LED - System failure error codes

### 1.1.6 Operating and connection elements



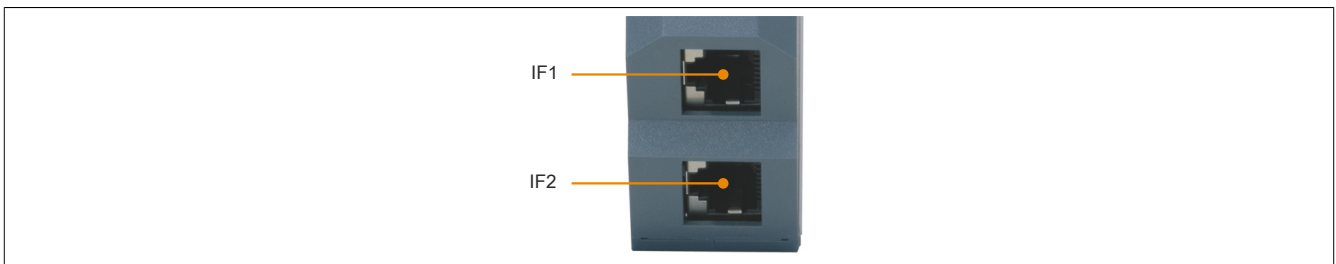
### 1.1.7 Operating mode and address switch

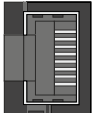


switches	Description
MODE	Specifies the mode in which the analysis tool is run (see "Analysis mode" on page 13)
ADD	The following addresses are derived from the position of the ADD switch: <ul style="list-style-type: none"> <li>• Own IP address (192.168.0.ADD)</li> <li>• Analysis mode: Destination MAC (01:00:5 e: 00:00: ADD)</li> <li>• Analysis mode: MulticastIP 239.0.0.ADD</li> </ul> Note: Position 0 is not permitted

### 1.1.8 Ethernet interface

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	

### 1.1.9 Hardware configuration 1

If the Ethernet analysis tool is run without additional hub expansion modules, then recording is only possible on port T0. The analysis tool must be connected to an available hub port in the system.

**Information:**

An X20HB288x module is not permitted in this hardware configuration.

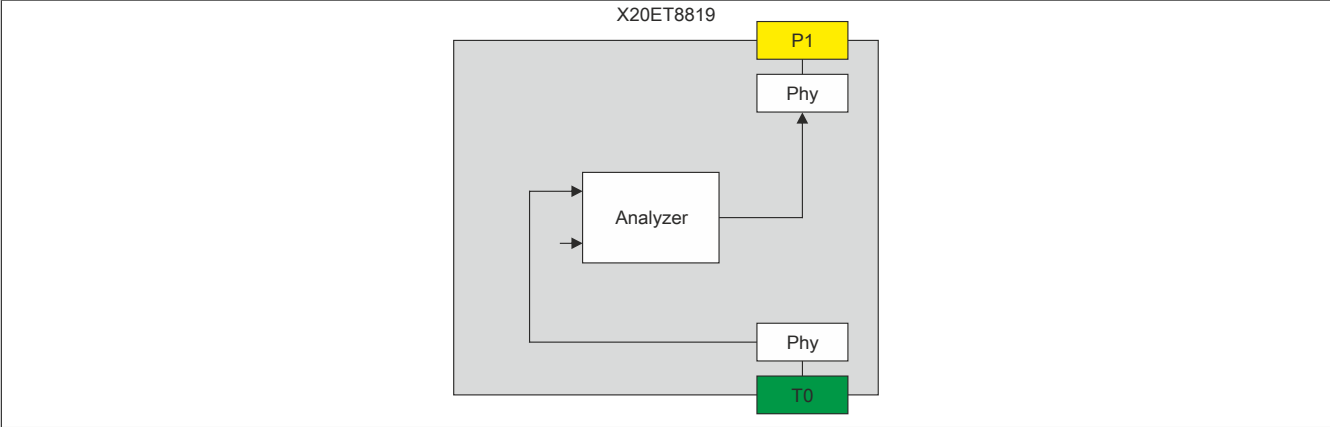


Figure 1: Diagram of hardware configuration 1

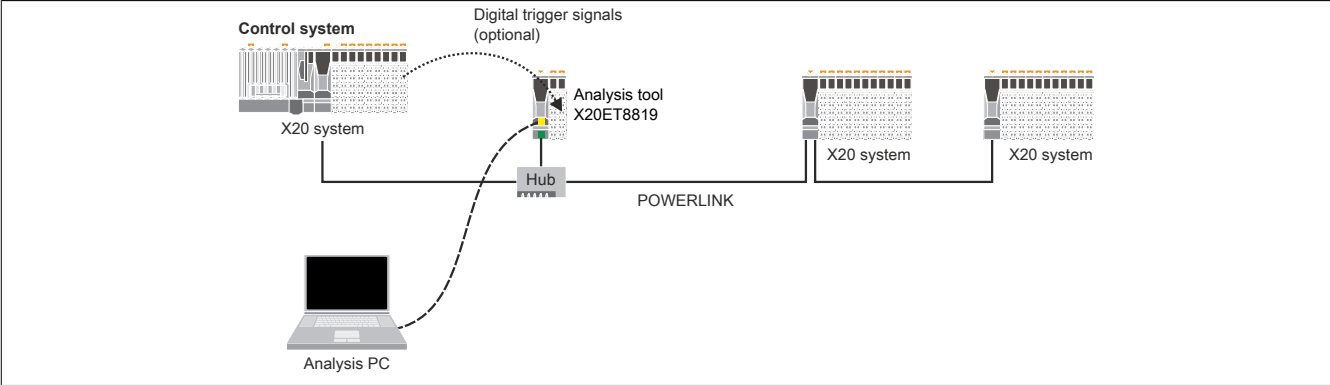


Figure 2: Example application of hardware configuration 1

### 1.1.10 Hardware configuration 2

Extending the Ethernet analysis tool with an X20HB2880 or X20HB2881 allows even full-duplex lines to be recorded as well. In this case ports T1 and T2 are analyzed.

**Information:**

Only the required X20HB288x module is permitted in this hardware configuration. A second X20HB288x module would produce different behavior (see Hardware configuration 3).

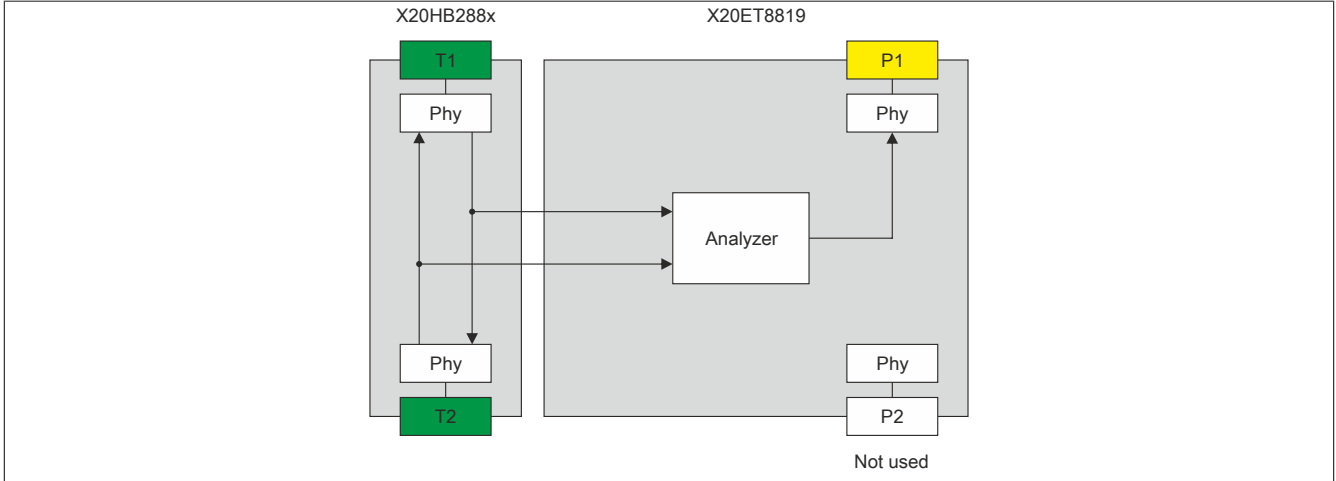


Figure 3: Diagram of hardware configuration 2

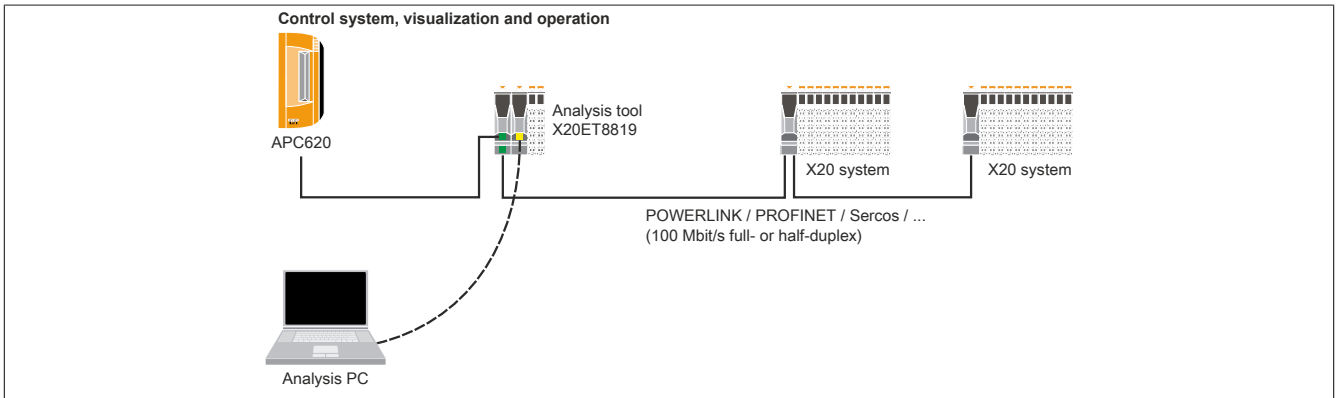


Figure 4: Example application of hardware configuration 2

1.1.11 Hardware configuration 3a

Simultaneous data recording at two locations in the network is possible by using two X20HB2880 or X20HB2881. Only data from T1 and T3 is analyzed.

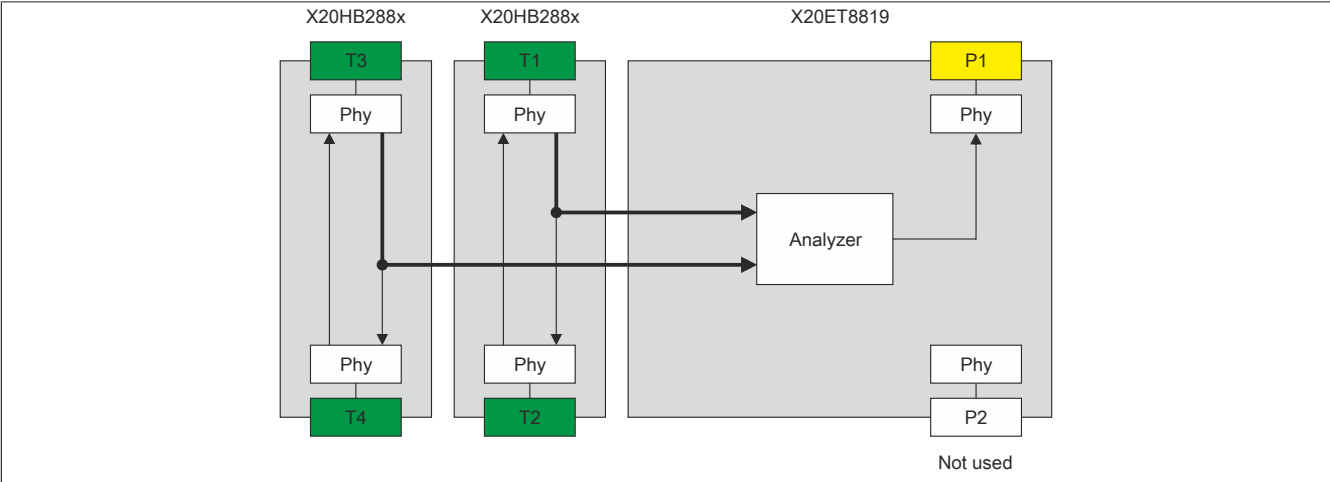


Figure 5: Diagram of hardware configuration 3a

Example application 1 shows data being recorded simultaneously from two hubs.

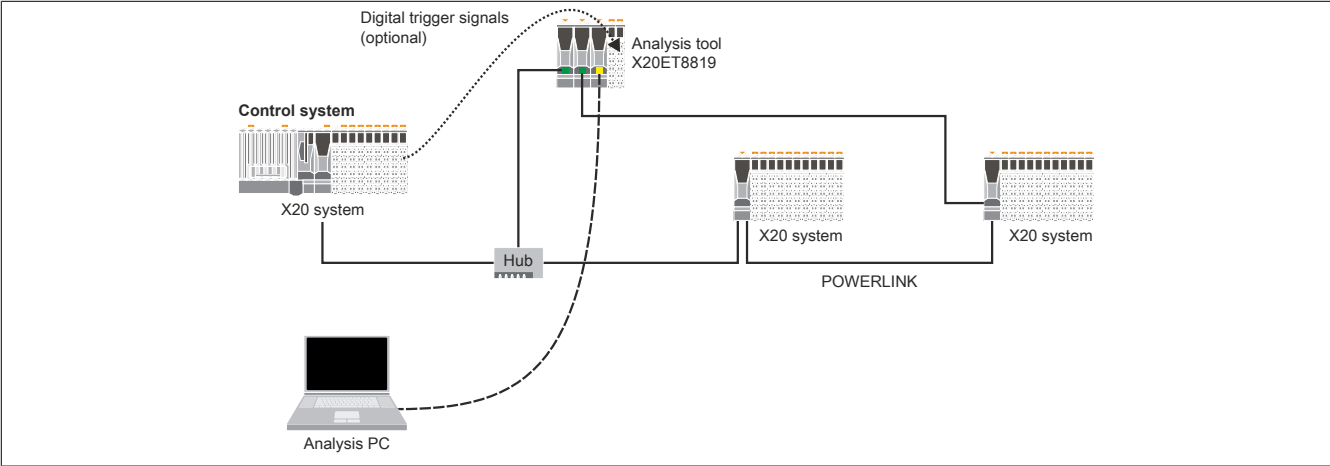


Figure 6: Example application 1 of hardware configuration 3, connection via hubs

The two hub expansion modules can also be inserted in series in the network. It should be noted that in this case data recording is only possible in one direction at a time.

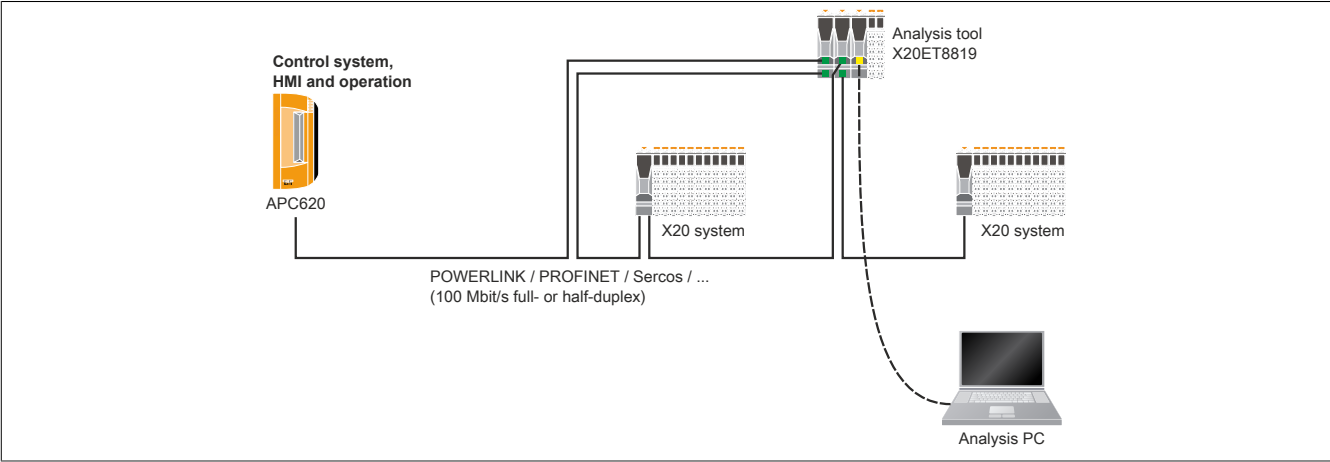


Figure 7: Example application 2 of hardware configuration 3, connection in line

### 1.1.12 Hardware configuration 3b

With firmware V 1.03 and higher, data traffic in half-duplex networks (e.g. POWERLINK) is recorded in both directions.

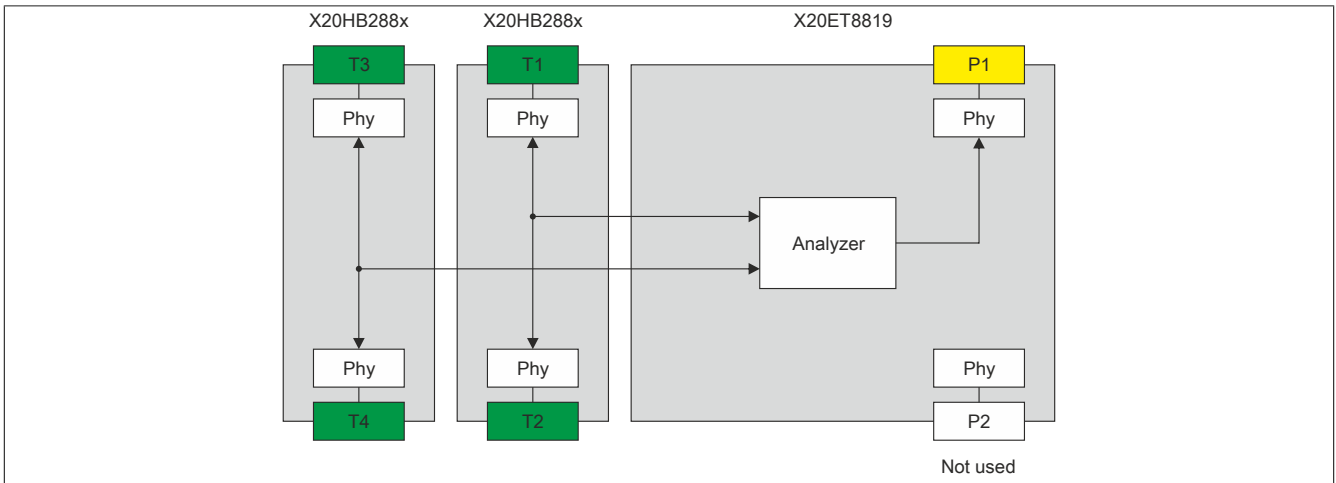


Figure 8: Diagram of hardware configuration 3b

### 1.1.13 Firmware update

To update the firmware, the webpage of the X20ET8819 module must be opened when in service mode. To do this, set the MODE switch to 0 and ADD to a value between 0x1 and 0xF. When the hardware is restarted now, the module will enter service mode. A connection can be established to the webpage using a web browser via the interface IF1 (P1) and the IP address 192.168.0.ADD. The update is started by selecting "Firmware Download".

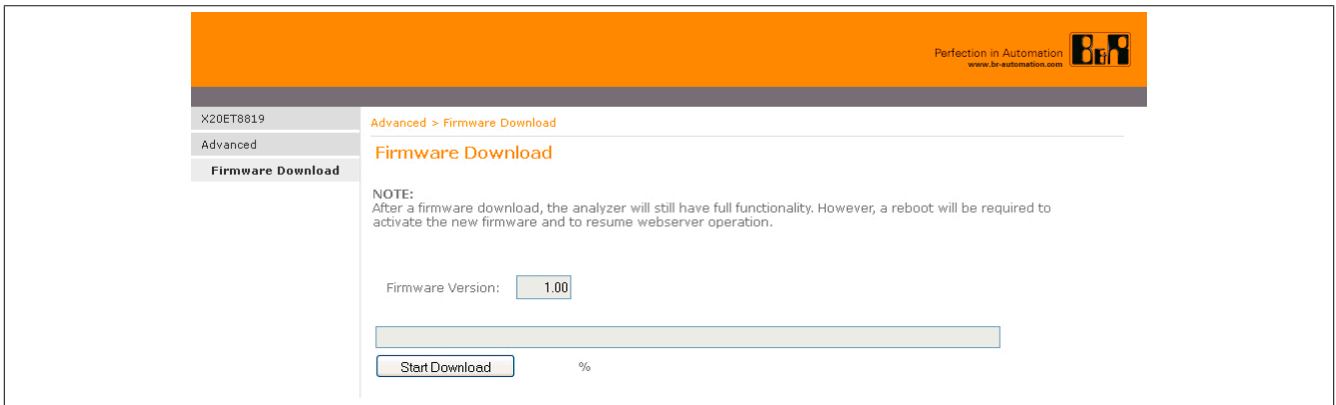
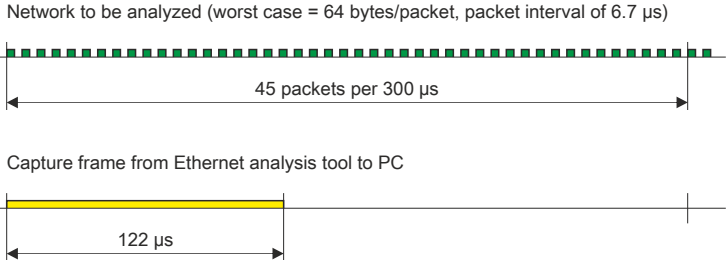
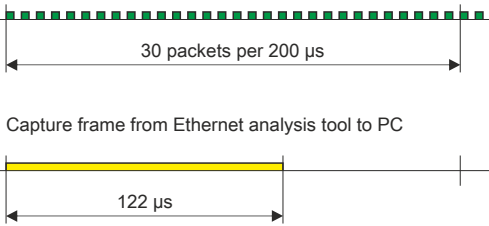
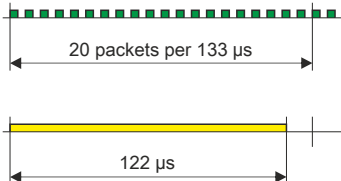


Figure 9: Start firmware update

### 1.1.14 Analysis mode

Each time an incoming packet is analyzed, (see hardware configurations 1 to 3), the analysis tool saves the reception timestamp, various flags and the first 'n' bytes of data from the received packet in capture frames. These frames are sent via IF 1 (P1).

The number of recorded data bytes, 'n', is set with the operating mode switch MODE. This defines the number of packets that are sent for each capture frame.

MODE	n	p/s	Description
0	-	-	Service mode
1	24	148800	<p>45 packets fit in a capture frame: <math>(1514-64) / (24+8) = 45</math> packets</p> 
2	40	148800	
3	64	148800	<p>This is the first setting at which complete packets fit in the capture frame (minimum packet with 60 byte payload). 20 packets can fit in one capture frame, however this setting could cause problems on the analysis PC because there is not much idle time between the capture frames.</p> 
4	80	128000	
5	120	88000	
6	196	56000	
7	280	40000	
8	716	16000	<p>2 packets fit in a capture frame: <math>(716+8)*2 + 64 = 1512</math> bytes A setting 'n' &gt; 716 has the disadvantage that a network with full capacity would not be able to be analyzed.</p>
9	24 to 1440	-	<p>The analysis tool selects the largest possible value for 'n' itself due to the packet volume of the last capture frame that was sent. This means that each capture frame can be assigned a different 'n' value. 'n' is always a multiple of 4 and can assume values between 24 and 1440.</p>
A	-	-	Up to a size of 1440 bytes every packet is recorded in its original size.
B - F	-	-	Reserved

#### Note:

- A change in the position of the MODE switch from 1 to A will be applied online during operation.
- If the "S/E" LED is red, then the number of bytes to be recorded should be reduced.

## 1.1.15 Using trigger inputs

The Ethernet analysis tool launches the first connected I/O module in the standard function model. The X2X link is configured with a fixed cycle of 1 ms. If this configuration contains digital input data (digital input module X20DI9371), the first 4 digital inputs will be included in the packet header.

### 1.1.15.1 Background

When looking for very complicated errors, it is usually not possible to find a trigger condition on the network. It is often difficult to discern whether the cause of the problem is even associated with the Ethernet communication or somewhere else. The fact that such errors are extremely rare makes finding them that much harder.

A permanent record of network frames through the module X20ET8819 would exceed storage capabilities of the recording software due to the large amount of data. The trigger inputs on the X20ET8819 offer an additional way to circumvent this problem. Analysis of the network can be started or stopped when a specific event occurs.

In most cases, the problem can be indicated using a digital signal. The CPU can detect errors or irregularities (e.g. failure of a network slave), for example, and then set a digital output on the local I/O bus. If this signal is connected to a digital input on the Ethernet analysis tool, then the module is able to evaluate this information and trigger a response such as pausing an active recording.

### 1.1.15.2 Evaluation of the inputs on the analysis tool X20ET8819

#### Input 1 - 4

The first 4 inputs will be inserted only in the packet header by the X20ET8819. The recording software from B&R (OmniPeek full version and plugin) can determine how the signals are interpreted.

#### Input 5 - 7

If the recording software is unable to evaluate the first 4 inputs (Wireshark, OmniPeek, various other capture tools), then inputs 5 - 7 are used to control the Ethernet analysis tool X20ET8819 directly.

Input	Name	Description
5	ExternActivate	Recording will not start automatically if this input is set to HIGH when the analysis tool is turned on. The module waits for a positive edge on input 6.
6	ExternStart	Recording begins when a positive edge occurs on this input. The value in 'captureId', offset 49 in the capture frame header is incremented to indicate to the receiving tool that a new recording has been started. When recording using the recording software from B&R, this information can be used to switch to a new ring buffer and to store the last one.
7	ExternStop	Recording stops when a negative edge occurs on this input.
8 - 12	-	Reserved

Table 6: Evaluation of inputs 5 - 7 on the analysis tool

#### Example 1

A drive is started one time each minute. After 10 to 30 hours, a problem arises on a network station shortly after starting the drive. To analyze the error, the Ethernet communication is recorded between when the start command is issued and when the error occurs.

Problems:

Due to the large amount of data it is not possible to record the entire 30 hours. Someone would have to stay on the analysis PC the whole time to stop recording when the error occurs.

Solution:

Input	Description
ExternActivate	Input permanently wired to 24 VDC = Activates the external trigger function
ExternStart / ExternStop	Connect both inputs to the same digital output that the master uses to notify the X20ET8819 when to start and stop recording. The master can, for example, always set the output before the drive start command and reset it as soon as the startup has been completed. When the master detects an error, it only has stop setting the output. This would mean that after 30 hours the recording is certain to contain the time period in which the error occurred and as well as a few prior recordings of proper startups for comparison.

Table 7: Function of the inputs in Example 1

## Example 2

A system containing multiple X20 I/O systems on the POWERLINK network is experiencing sporadic failures. An I/O slave suddenly fails for no apparent reason after running properly for a long time. To analyze whether the failure is network related, the time before the failure must be recorded.

Problems:

The master has no indication as to when and why the problem occurs. That means there is no start condition for the recording. Someone would have to stay on the analysis PC the whole time to stop recording when the error occurs.

Solution:

Input	Description
ExternActivate	Input permanently wired to 24 VDC = Activates the external trigger function
ExternStart	Input permanently wired to 24 VDC = Ensures that the recording starts immediately when the X20ET8819 is turned on
ExternStop	Connect input to a digital output on the affected I/O slave, which is permanently set to 1 by the program. As soon as the slave fails the first time and resets the digital outputs, recording is stopped by the negative edge on ExternStop and is not started again.

Table 8: Function of the inputs in Example 2

### 1.1.16 Using trigger outputs

Output	Name	Description
1	FrameError	As soon as a frame error (CRC, Oversize, Preamble, Noise or Alignment) occurs, this output is set for 10 ms.
2 - 12	-	Reserved

Table 9: Using trigger outputs in the event of an error

### 1.1.17 B&R recording software

The following tools for analysis can be downloaded in the Downloads section on the [B&R website \(https://www.br-automation.com\)](https://www.br-automation.com):

- Recording plug-in for Wireshark to decode the captured frames

## 1.2 X20(c)HB8880

### 1.2.1 General information

The X20 hub is a device that can be used universally in standard Ethernet networks or POWERLINK networks. It is suitable for 100 Mbit/s (Fast Ethernet) networks.

The bus modules expanded to the left allow connection of up to 2 hub expansion modules in addition to the hub base module. This means that a single base device provides up to 6 hub interfaces.

- 2x / 4x / 6x Fast Ethernet hub
- Modular construction
- Easily expandable

### 1.2.2 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



#### 1.2.2.1 -40°C starting temperature

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

#### Information:

**It is important to absolutely ensure that there is no forced cooling by air currents in a closed control cabinet, for example using a fan or ventilation slots.**

## 1.2.3 Order data


Order number	Short description	Figure
	<b>X20 hub system</b>	
X20HB8880	X20 base hub module, integrated 2-port hub, 2x RJ45	
X20cHB8880	X20 base hub module, coated, integrated 2-port hub, 2x RJ45	
	<b>Required accessories</b>	
	<b>System modules for bus controllers</b>	
X20BB80	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB80	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
	<b>System modules for expandable bus controllers</b>	
X20BB81	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with one expansion slot for X20 add-on module (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20BB82	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB81	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, with one expansion slot for X20 add-on module (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB82	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
	<b>System modules for the X20 hub system</b>	
X20PS8002	X20 power supply module, for standalone hub and compact link selector	
X20cPS8002	X20 power supply module, coated, for standalone hub and compact link selector	
	<b>Terminal blocks</b>	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	
	<b>Optional accessories</b>	
	<b>System modules for the X20 hub system</b>	
X20HB1881	X20 hub expansion module, integrated 1-port hub, for multimode fiber optic cables	
X20HB1882	X20 hub expansion module, integrated 1-port hub, for monomode fiber optic cables	
X20HB2880	X20 hub expansion module, integrated 2-port hub, 2x RJ45	
X20HB2881	X20 hub expansion module, integrated 2-port hub, for fiber optic cables	
X20cHB1881	X20 hub expansion module, coated, integrated 1-port hub for fiber optic cables	
X20cHB2880	X20 hub expansion module, coated, integrated 2-port hub, 2x RJ45	
X20cHB2881	X20 hub expansion module, coated, integrated 2-port hub for fiber optic cables	

Table 10: X20HB8880, X20cHB8880 - Order data

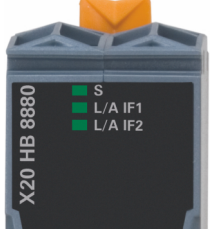
## 1.2.4 Technical data

Order number	X20HB8880	X20cHB8880
<b>Short description</b>		
Hub	Modular X20 hub with up to 2 slots for hub expansion modules:	
<b>General information</b>		
Status indicators	Module status, bus function	
Diagnostics		
Module status	Yes, using status LED	
Bus function	Yes, using status LED	
Power consumption	2 W	
Certifications		
CE	Yes	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÚ 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: <b>B</b> (0 - 55°C) Humidity: <b>B</b> (up to 100%) Vibration: <b>B</b> (4 g) EMC: <b>B</b> (bridge and open deck)	
LR	ENV1	
KR	Yes	
EAC	Yes	
KC	Yes	-
<b>Interfaces</b>		
Type	Hub base module	
Variant	2x shielded RJ45	
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	No	
Autonegotiation	Yes	
Auto-MDI/MDIX	Yes	
Hub propagation delay	0.96 to 1 µs	
<b>Electrical properties</b>		
Electrical isolation	Power supply isolated from Ethernet (IF1 and IF2)	
<b>Operating conditions</b>		
Mounting orientation		
Horizontal	Yes	
Vertical	Yes	
Installation elevation above sea level		
0 to 2000 m	No limitations	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
Degree of protection per EN 60529	IP20	
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C	
Vertical mounting orientation	-25 to 50°C	
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	
<b>Mechanical properties</b>		
Note	Order 1x X20TB12 terminal block separately Order 1x X20PS8002 power supply module separately Order 1x X20BB8x bus base separately	Order 1x X20TB12 terminal block separately Order 1x X20cPS8002 power supply module separately Order 1x X20cBB8x bus base separately
Pitch <sup>1)</sup>		
X20BB80	37.5 <sup>+0.2</sup> mm	
X20BB81	62.5 <sup>+0.2</sup> mm	62.5 <sup>+0.2</sup> mm
X20BB82	87.5 <sup>+0.2</sup> mm	

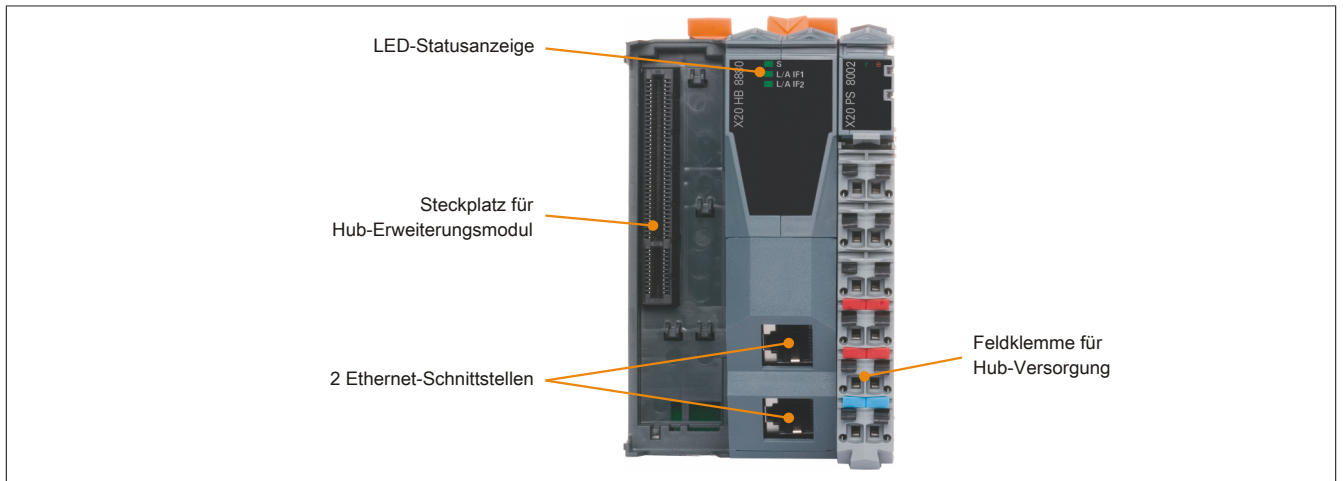
Table 11: X20HB8880, X20cHB8880 - Technical data

1) Spacing is based on the width of the X20BB80 bus base. Up to two X20HB2880 hub expansion modules and one X20PS8002 supply module are also always required for the hub.

### 1.2.5 LED status indicators

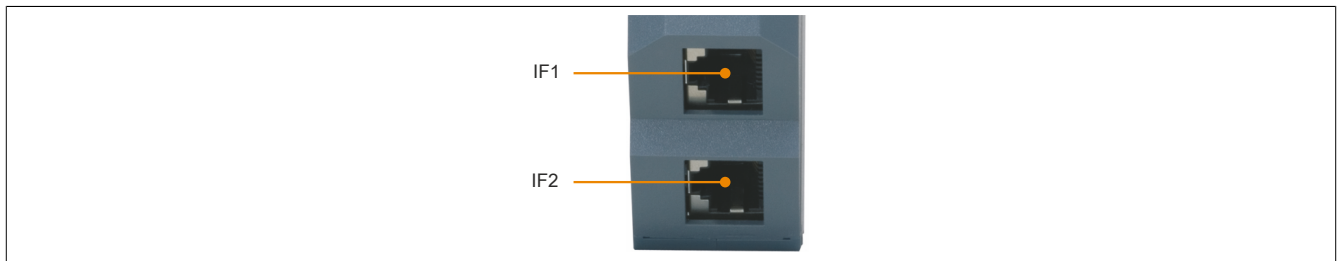
Figure	LED	Color	Status	Description
	S	Green	On	Hub is active
	L/A IFx	Green	On	A link to the remote station has been established.
			Blinking	A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus.

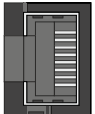
### 1.2.6 Operating and connection elements



### 1.2.7 Ethernet interface

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



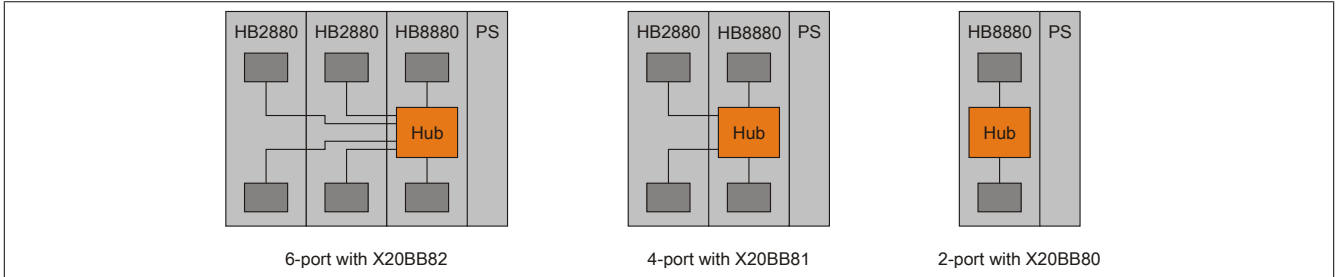
Interface	Pinout		
	Pin	Ethernet	
 Shielded RJ45	1	RXD	Receive data
	2	RXD\	Receive data\
	3	TXD	Transmit data
	4	Termination	
	5	Termination	
	6	TXD\	Transmit data\
	7	Termination	
	8	Termination	

### 1.2.8 Slot for hub expansion modules

Depending on the bus base, up to 2 hub expansion modules can be installed on the left side of the X20 hub:

Bus base	Slots for hub expansion modules
X20BB81	1
X20BB82	2

The hub expansion module is a 2x hub, which allows the hub base module to be expanded into a 6x hub.



### 1.2.9 Network size and collision detection

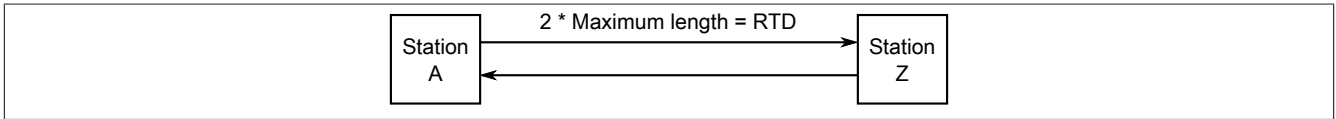
#### Information:

This section applies to the use of Ethernet networks, not POWERLINK networks.

According to Ethernet specification IEEE 802.3, the transmission duration of a frame of minimum length must always be greater than the round-trip delay time (RTD). RTD is the time needed by a data packet to travel from one end of the network to the other.

If this is not observed, collision detection can no longer be guaranteed.

Illustration of RTD



When using copper cables, the maximum distance is generally 100 m. Since there are often many different devices with different PHYs in a network, the propagation delay of the frames changes due to the different latency of each PHY. This also affects the network size, and collision detection can no longer be guaranteed at 100 m.

### Example for calculating network size

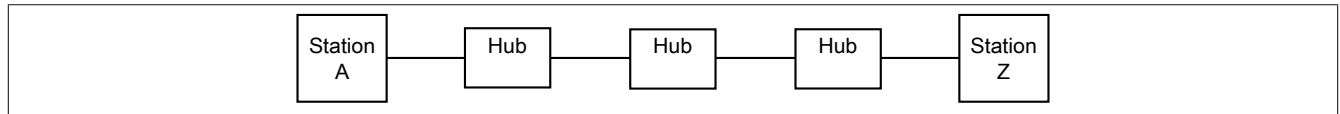
The following parameters are specified for a network:

- Transfer rate: 100 Mbit/s
- Cable length: 100 m
- Number of hubs: 2
- Hub propagation delay of a frame: 1  $\mu$ s
- Minimum frame size in the Ethernet network: 72 bytes

#### Calculation procedure

1. How long does 1 byte take at 100 Mbit/s? – 100 Mbit/s / 8 = 12.5 MB/s	$\frac{12,500,000}{1} = \frac{1}{x}$ $x = \frac{1s}{12,500,000} = 80ns$
2. Propagation delay of minimum Ethernet frame – Minimum frame in Ethernet network: 72 bytes	$72 * 80ns = 5.76\mu s$
3. Propagation delay in cable and hub – 100 m cable = 0.5 $\mu$ s – 2 hubs = 2 x 1 $\mu$ s	$2\mu s + 0.5\mu s = 2.5\mu s$
4. Calculation of total propagation delay – Outbound/Inbound propagation delay	$2.5\mu s * 2 = 5\mu s$
<b>Result</b> Collision detection is possible since the total time of 5 $\mu$ s is less than the minimum Ethernet propagation delay of 5.76 $\mu$ s.	

### Example for calculating the network reach with devices between 2 stations



Corresponding to the previous example, the following situation occurs in a network with 3 hubs and 100 m cables:

- The transmission duration of a frame of minimum length is 5.76  $\mu$ s.

#### Calculation procedure

1. Propagation delay in cable and hub – 100 m cable = 0.5 $\mu$ s – 3 hubs = 3 x 1 $\mu$ s	$3\mu s + 0.5\mu s = 3.5\mu s$
2. Calculation of total propagation delay – Outbound/Inbound propagation delay	$3.5\mu s * 2 = 7\mu s$
<b>Result</b> Collision detection is not possible since the total time of 7 $\mu$ s is greater than the minimum Ethernet propagation delay of 5.76 $\mu$ s. The $\approx 1.3$ $\mu$ s missing for collision detection can only be recovered by removing a hub.	

## 1.3 X20(c)HB8815

### 1.3.1 General information

#### 1.3.1.1 Other applicable documents

For additional and supplementary information, see the following documents.

#### Other applicable documents

Document name	Title
MAX20	<a href="#">X20 System user's manual</a>
MAEMV	<a href="#">Installation / EMC guide</a>

#### 1.3.1.2 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



##### 1.3.1.2.1 Starting temperature

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

#### Information:

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

### 1.3.1.3 Order data


Order number	Short description	Figure
	<b>X20 hub system</b>	
X20HB8815	X20 POWERLINK - TCP/IP gateway, can be expanded with active hub modules, 2x RJ45	
X20cHB8815	X20 POWERLINK - TCP/IP gateway, coated, can be expanded with active hub modules, 2x RJ45	
	<b>Required accessories</b>	
	<b>System modules for bus controllers</b>	
X20BB80	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB80	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
	<b>System modules for expandable bus controllers</b>	
X20BB81	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with one expansion slot for X20 add-on module (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20BB82	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB81	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, with one expansion slot for X20 add-on module (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB82	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
	<b>System modules for the X20 hub system</b>	
X20PS8002	X20 power supply module, for standalone hub and compact link selector	
X20cPS8002	X20 power supply module, coated, for standalone hub and compact link selector	
	<b>Terminal blocks</b>	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	
	<b>Optional accessories</b>	
	<b>System modules for the X20 hub system</b>	
X20HB1881	X20 hub expansion module, integrated 1-port hub, for multimode fiber optic cables	
X20HB1882	X20 hub expansion module, integrated 1-port hub, for monomode fiber optic cables	
X20HB2880	X20 hub expansion module, integrated 2-port hub, 2x RJ45	
X20HB2881	X20 hub expansion module, integrated 2-port hub, for fiber optic cables	
X20cHB1881	X20 hub expansion module, coated, integrated 1-port hub for fiber optic cables	
X20cHB2880	X20 hub expansion module, coated, integrated 2-port hub, 2x RJ45	
X20cHB2881	X20 hub expansion module, coated, integrated 2-port hub for fiber optic cables	

Table 12: X20HB8815, X20cHB8815 - Order data

### 1.3.1.4 Module description

This module is a POWERLINK - TCP/IP gateway for exchanging any application data between a POWERLINK network and e.g. a TCP/IP network.

Due to the bus modules extended to the left, up to 2 hub expansion modules can be connected in addition to the gateway. Up to 2 POWERLINK interfaces are therefore available with one device base.

#### Functions

- [POWERLINK](#)
- [POWERLINK - TCP/IP gateway](#)

#### POWERLINK

POWERLINK is a standard protocol for Fast Ethernet equipped with hard real-time characteristics.

#### POWERLINK - TCP/IP gateway

The POWERLINK - TCP/IP Gateway can be used to exchange any application data (HMI application, diagnostics, parameter data, etc.) between a POWERLINK network and e.g. TCP/IP network.

## 1.3.2 Technical description

### 1.3.2.1 Technical data

Order number	X20HB8815	X20cHB8815
<b>Short description</b>		
Gateway	POWERLINK controlled node with up to 2 slots for hub expansion modules	
<b>General information</b>		
Status indicators	Module status, bus function	
Diagnostics		
Module status	Yes, using LED status indicator and software	
Bus function	Yes, using LED status indicator and software	
Power consumption	2 W	
Certifications		
CE	Yes	
UKCA	Yes	
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	Temperature: <b>B</b> (0 to 55°C) Humidity: <b>B</b> (up to 100%) Vibration: <b>B</b> (4 g) EMC: <b>B</b> (bridge and open deck)	
LR	ENV1	
KR	Yes	
ABS	Yes	
BV	<b>EC33B</b> Temperature: 5 - 55°C Vibration: 4 g EMC: Bridge and open deck	
EAC	Yes	
KC	Yes	-
<b>Interfaces</b>		
Type	POWERLINK gateway	
Variant	2x shielded RJ45	
Line length	Max. 100 m between 2 stations (segment length)	
Transfer rate		
POWERLINK	100 Mbit/s	
TCP/IP	10/100 Mbit/s	
Transfer		
POWERLINK		
Physical layer	100BASE-TX	
Half-duplex	Yes	
Full-duplex	No	
Autonegotiation	Yes	
Auto-MDI/MDIX	Yes	
TCP/IP		
Physical layer	10BASE-T/100BASE-TX	
Half-duplex	Yes	
Full-duplex	Yes	
Autonegotiation	Yes	
Auto-MDI/MDIX	Yes	
Hub propagation delay	0.96 to 1 µs	
<b>Electrical properties</b>		
Electrical isolation	Power supply isolated from Ethernet (ETH1) and POWERLINK (PLK2)	
<b>Operating conditions</b>		
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	

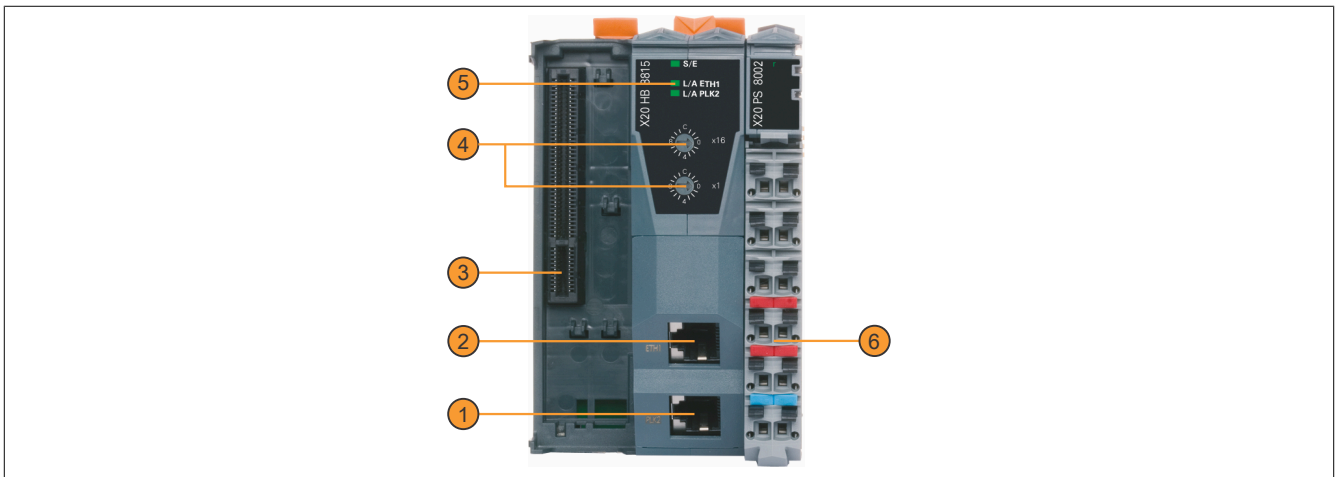
Table 13: X20HB8815, X20cHB8815 - Technical data

Order number	X20HB8815	X20cHB8815
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation		-25 to 60°C
Vertical mounting orientation		-25 to 50°C
Derating		-
Starting temperature	-	Yes, -40°C
Storage		-40 to 85°C
Transport		-40 to 85°C
Relative humidity		
Operation	5 to 95%, non-condensing	Up to 100%, condensing
Storage		5 to 95%, non-condensing
Transport		5 to 95%, non-condensing
<b>Mechanical properties</b>		
Note	Order 1x terminal block X20TB12 separately. Order 1x power supply module X20PS8002 separately. Order 1x bus base X20BB8x separately.	Order 1x terminal block X20TB12 separately. Order 1x power supply module X20cPS8002 separately. Order 1x bus base X20cBB8x separately.
Pitch <sup>1)</sup>		
X20BB80		37.5 <sup>+0.2</sup> mm
X20BB81		62.5 <sup>+0.2</sup> mm
X20BB82		87.5 <sup>+0.2</sup> mm

Table 13: X20HB8815, X20cHB8815 - Technical data


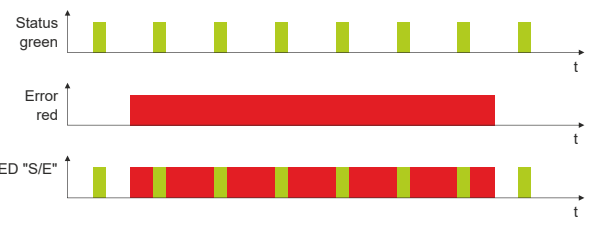
- 1) Pitch is based on the width of bus base X20BB8x. Up to 2 X20cHB2880 or X20cHB2881 hub expansion modules and 1 X20cPS8002 power supply module are also always required for the gateway.

### 1.3.2.2 Operating and connection elements



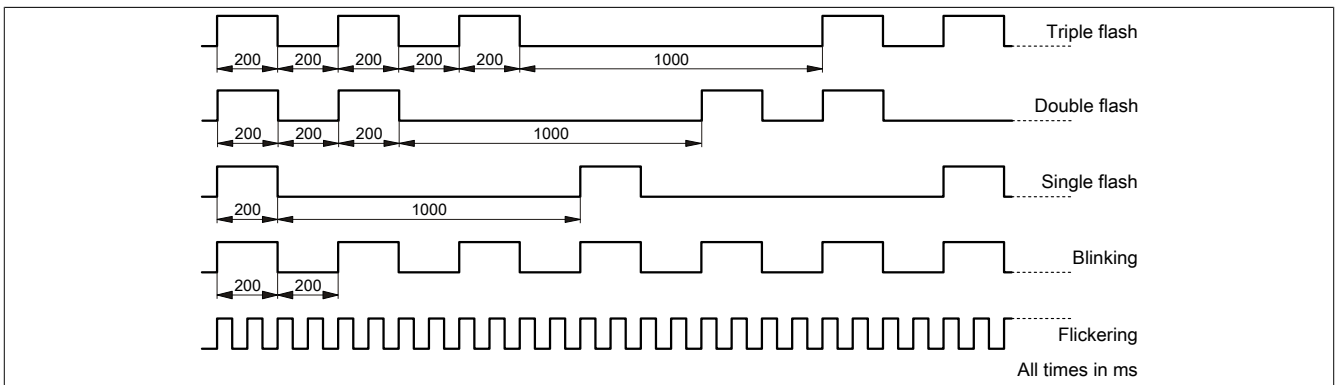
1	POWERLINK interface	2	Ethernet interface
3	Slot for hub expansion module	4	Node number switches
5	LED status indicators	6	Terminal block for POWERLINK TCP/IP gateway

1.3.2.2.1 LED status indicators

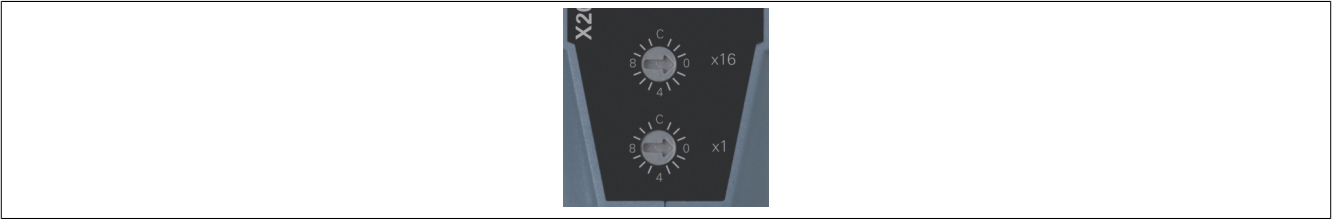
Figure	LED	Color	Status	Description	
	S/E <sup>1)</sup>	Green	Off	No power supply or mode NOT_ACTIVE. The controlled node (CN) is either not supplied with power or it is in state NOT_ACTIVE. The CN waits in this state for about 5 s after a restart. Communication is not possible with the CN. If no POWERLINK communication is detected during these 5 s, the CN changes to state BASIC_ETHERNET (flickering). If POWERLINK communication is detected before this time expires, however, the CN immediately changes to state PRE_OPERATIONAL_1.	
			Flickering	Mode BASIC_ETHERNET. The CN has not detected any POWERLINK communication. In this state, it is possible to communicate directly with the CN (e.g. with UDP, IP). If POWERLINK communication is detected in this state, the CN enters state PRE_OPERATIONAL_1.	
			Single flash	PRE_OPERATIONAL_1 mode. The CN waits until it receives an SoC frame and then switches to the PRE_OPERATIONAL_2 state.	
			Double flash	PRE_OPERATIONAL_2 mode. The CN is normally configured by the manager in this state. A command then switches the CN to the READY_TO_OPERATE state.	
			Triple flash	READY_TO_OPERATE mode. The manager switches the CN via command to the OPERATIONAL state.	
			On	Mode OPERATIONAL. PDO mapping is active and cyclic data is evaluated.	
			Blinking	Mode STOPPED. Output data is not being output, and no input data is being provided. It is only possible to switch to or leave this state after the manager has given the appropriate command.	
		Red	On	The controlled node (CN) is in an error state (failed Ethernet frames, increased number of collisions on the network, etc.). If an error occurs in the following states, the red LED is superimposed by the green flashing LED: <ul style="list-style-type: none"> <li>PRE_OPERATIONAL_1</li> <li>PRE_OPERATIONAL_2</li> <li>READY_TO_OPERATE</li> </ul>  <p>Note:</p> <ul style="list-style-type: none"> <li>Several red blinking signals are displayed immediately after the device is switched on. This is not an error, however.</li> <li>The LED lights up red for CNs with set physical node number 0 that have not yet been assigned a node number via dynamic node allocation (DNA).</li> </ul>	
		L/A ETH1	Green	On	A link to the peer station has been established (TCP/IP network).
				Blinking	A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus
	L/A PLK2	Green	On	A link to the peer station has been established (POWERLINK network).	
			Blinking	A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus	

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

Status LED - Blinking patterns



### 1.3.2.2 POWERLINK node number switches

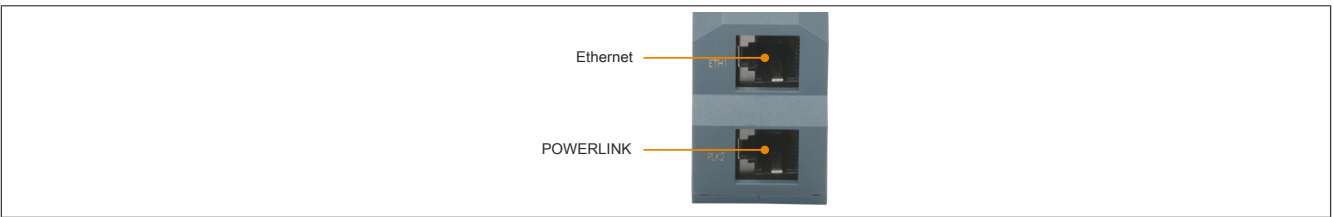


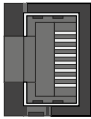
The node number for the POWERLINK node is set using the two number switches.

Switch position	Description
0x00	Only permitted when operating the POWERLINK node in DNA mode.
0x01 - 0xEF	Node number of the POWERLINK node. Operation as a controlled node (CN).
0xF0 - 0xFF	Reserved, switch position not permitted.

### 1.3.2.3 Ethernet interface

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	

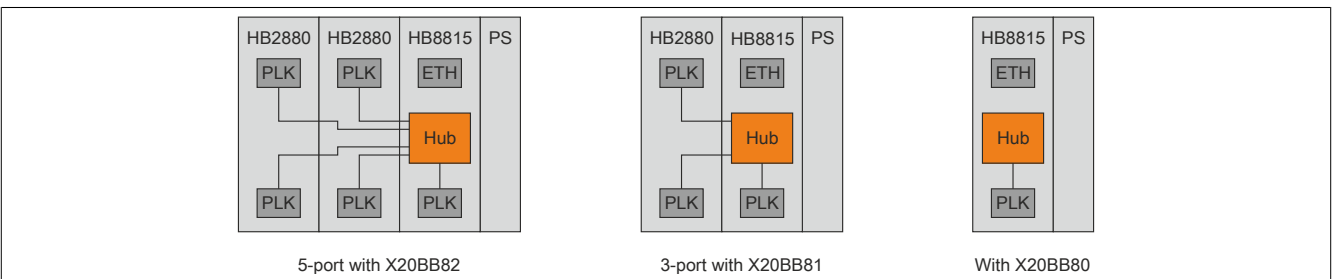
### 1.3.2.4 Slot for hub expansion modules

Depending on the bus base, up to 2 hub expansion modules can be installed on the left side of the module:

Bus base	Slots for hub expansion modules
X20BB81	1
X20BB82	2

Table 14: Slots for hub expansion modules for various bus bases

The hub expansion module for the gateway is a 2x hub, which allows the gateway to be expanded into a 5x POWERLINK hub.



### 1.3.3 Function description

#### 1.3.3.1 POWERLINK

POWERLINK is an Ethernet-based, real-time capable fieldbus. POWERLINK extends the IEEE 802.3 Ethernet standard by a deterministic access method and also defines a CANopen-compatible fieldbus interface. POWERLINK distinguishes between process and service data in the same way as CANopen. Process data (PDO) is exchanged cyclically in the cyclic phase, while service data (SDO) is transferred acyclically. Service data objects are transmitted in the acyclic phases of POWERLINK using a connection-oriented protocol. The cyclic transfer of data in PDOs is enabled by "mapping".

For additional information, see [POWERLINK bus controller user's manual](#) and [www.br-automation.com/en/technologies/powerlink](http://www.br-automation.com/en/technologies/powerlink).

#### 1.3.3.2 POWERLINK - TCP/IP gateway

The POWERLINK - TCP/IP gateway behaves like a layer 2 switch with the exception that cyclic POWERLINK packets are not forwarded to the "ETH" interface.

The gateway of the layer 2 switch uses the store-and-forward principle. The gateway functionality does not need to be configured specifically.

When the gateway receives a frame, it stores the MAC address of the transmitter and associated interface in the source address table (SAT). If the destination address is found in the SAT, the gateway forwards the frame to the corresponding interface. Frames with a broadcast or multicast address are always forwarded to all interfaces.

If IP packets larger than the MTU set on the POWERLINK network are received on the "ETH" interface, they are fragmented if permitted.

- Interface "ETH": Interface for TCP/IP network
- Interface "PLK": Interface for POWERLINK network

## 1.3.4 Commissioning

### 1.3.4.1 SG3

This module is not supported on SG3 target systems.

### 1.3.4.2 Firmware

The module comes with preinstalled firmware. The firmware is part of the Automation Studio project. The module is automatically brought up to this level.

A hardware upgrade must be performed to upgrade the firmware included in Automation Studio (see Help "Project management - Workspace - Upgrades" in Automation Help).

When using a 3rd-party device as a POWERLINK manager, the firmware update can be performed via the integrated Web server.

### 1.3.4.3 MTU size

Automatic MTU configuration is currently not supported. The MTU size is set to 300 (default value).

The MTU can be set manually under "Asynchronous Optimization" -> "Local ASnd MTU" in the I/O configuration of the module.

### 1.3.4.4 Asynchronous send priority

If needed, a higher asynchronous send priority can be assigned to the module. The setting for this is made in the I/O configuration of the module under "Asynchronous Optimization" -> "Asynchronous Send Priority".

#### **Information:**

**If the priority is set too high, it is possible in some circumstances that other POWERLINK stations cannot send their asynchronous data on time.**

### 1.3.4.5 Usage examples

#### Information:

No I/O modules can be operated with the X20HB8815!  
POWERLINK V1 is not supported.

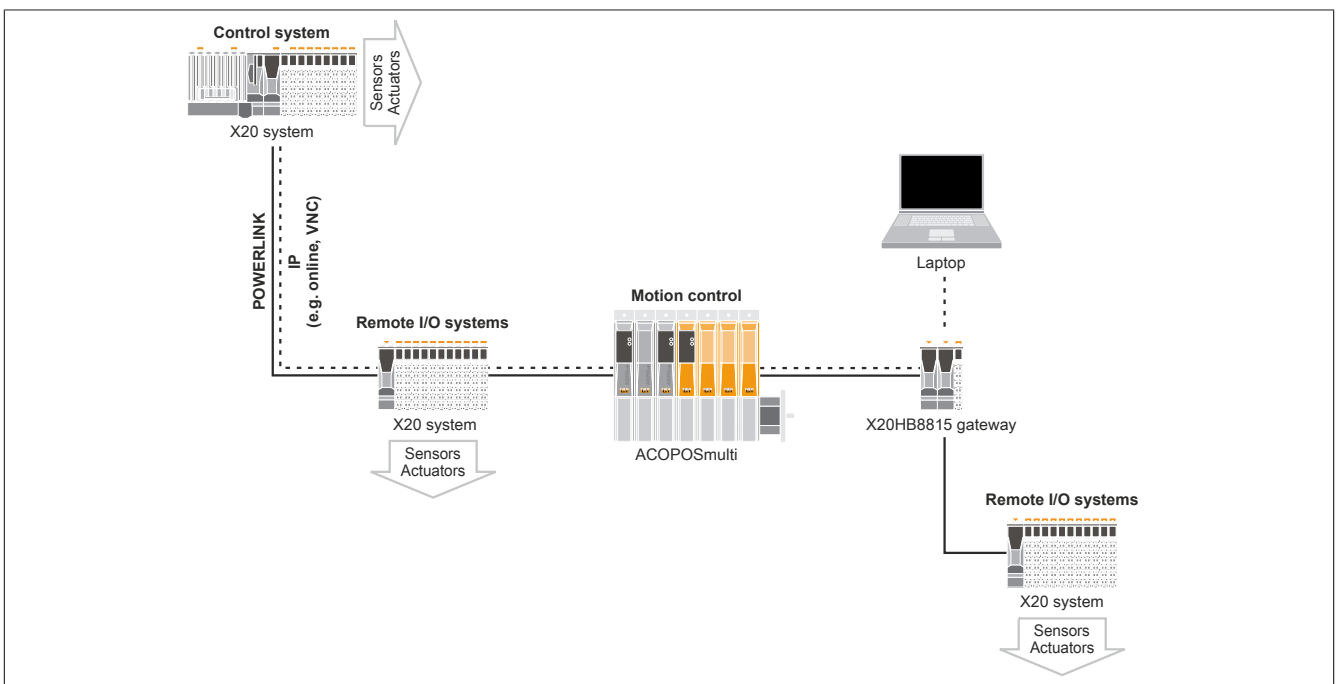
#### Information:

The X20HB8815 can also be operated as an async-only controlled node. It must only be ensured that the node number is between 1 and 239 and that it is not yet used or physically present in the POWERLINK network.

#### Information:

A direct connection via Ethernet (PC control system) is faster than a connection via the X20HB8815 since the available bandwidth must be shared with the POWERLINK protocol.

#### 1.3.4.5.1 Example 1: Online connection with Automation Studio or SDM via POWERLINK



1. The following settings must be made on the POWERLINK manager interface.

- The desired IP address and subnet mask must be entered under the Ethernet parameters. This IP address is not permitted to overlap the POWERLINK default subnet address 192.168.100.x and the configured POWERLINK NAT subnet.
- INA communication must be enabled.

Ethernet parameters	
Activate Ethernet communic...	on
Device name	<InterfaceAddress>.ETH
Redundant parameter	Single CPU Project
Mode	enter IP address manually
Host name	
IP address	10.0.8.10
Subnet Mask	255.255.255.0
INA parameters	
Activate online communicati...	on

If required, the web server and SDM must be enabled in Automation Studio.

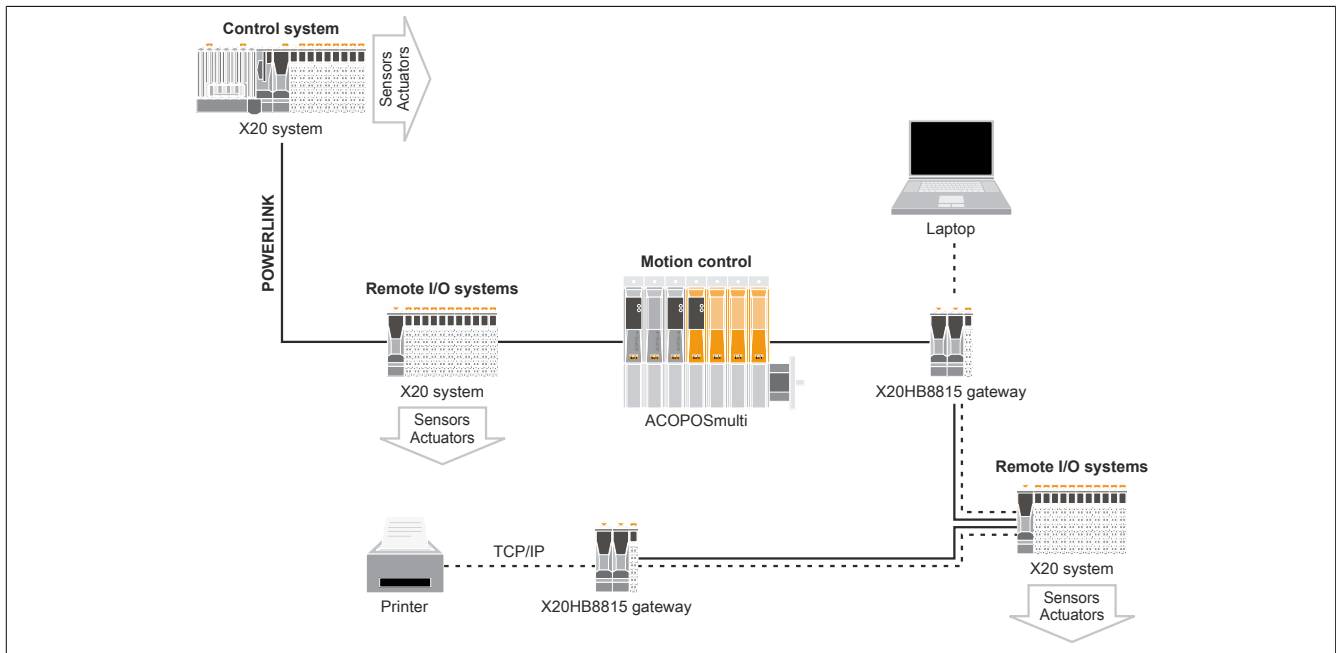
2. The following settings must be made on the PC:

- The IP address of the Ethernet interface must be located in the same subnet as the configured IP address (Ethernet parameters) of the POWERLINK interface. Otherwise, a route must be set manually.

### Information:

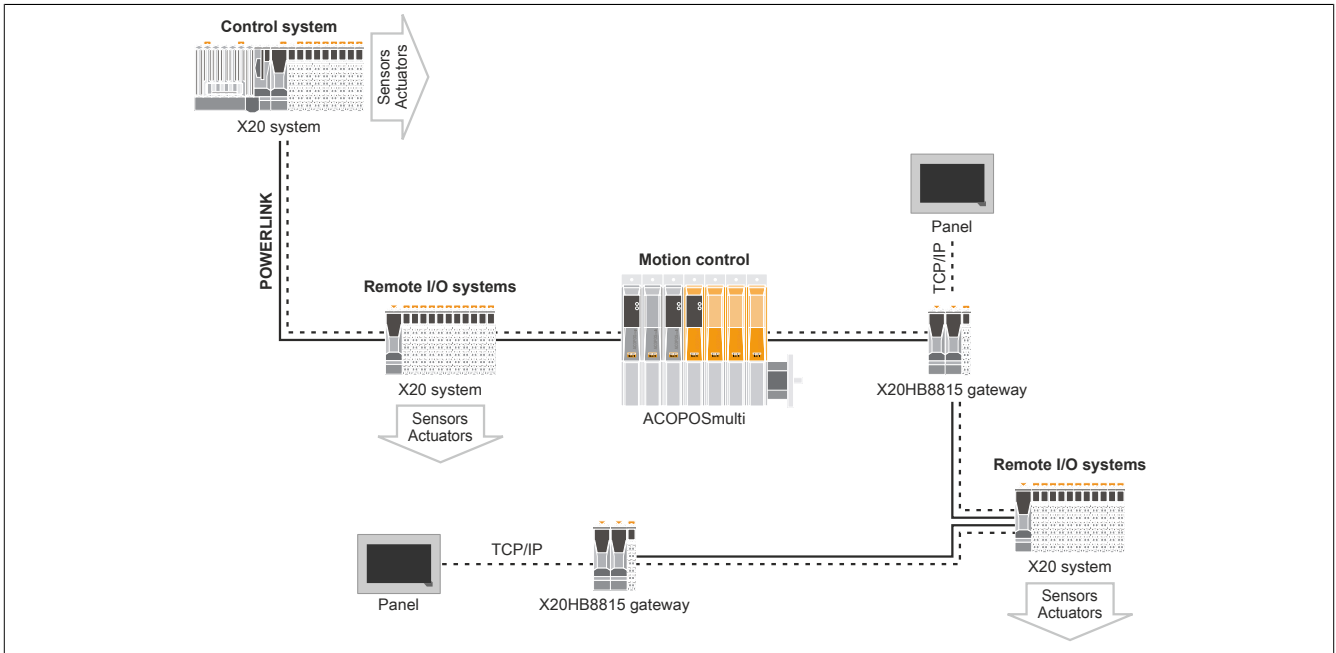
The search for destinations (SNMP) does not work via the X20HB8815.

#### 1.3.4.5.2 Example 2: Using a POWERLINK network for TCP/IP services



With the 2 devices connected via the X20HB8815, it is important to make sure that they are in the same IP subnet and that corresponding routes are set.

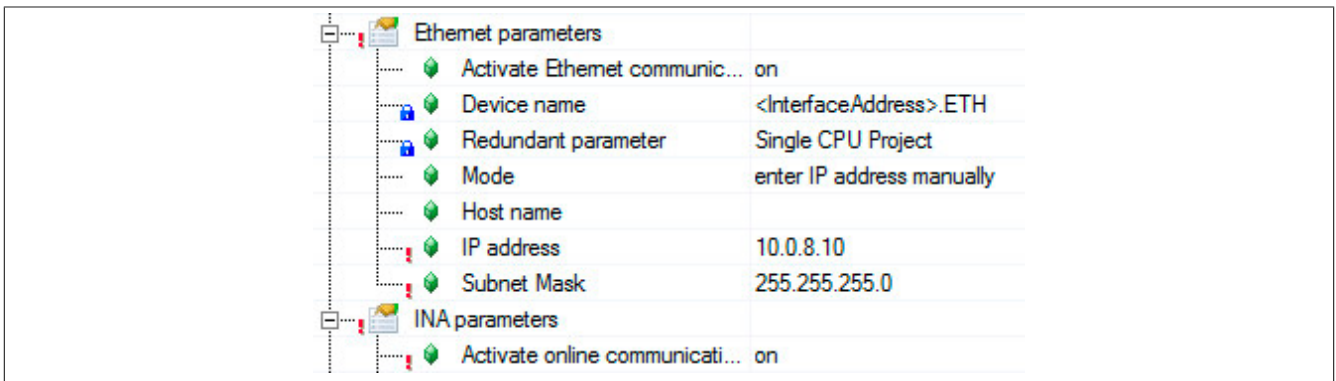
1.3.4.5.3 Example 3: Terminal panel via POWERLINK using X20HB8815



A terminal panel can be operated with POWERLINK using a X20HB8815 and VC3.95.6 or higher.

The following settings must be made on the POWERLINK manager interface.

- The desired IP address and subnet mask must be entered under the Ethernet parameters. This IP address is not permitted to overlap the POWERLINK default subnet address 192.168.100.x and the configured POWERLINK NAT subnet.
- INA communication must be enabled.



**Information:**

The terminal or T-Series panel must be attached to the ETH port in Automation Studio and have an IP configured that is located in the subnet of the POWERLINK Manager (under Ethernet parameters configured IP subnet).

T-Series Panel: Only works with this application over VNC. The configured IP address (Ethernet parameters) must be used as the terminal server IP address.

# **X20 redundancy system**

## **Data sheets**

Version: **1.10 (March 2024)**  
Order no.: **X20 redundancy system**

## 2.1 X20(c)HB8884

### 2.1.1 General information

#### 2.1.1.1 Other applicable documents

For additional and supplementary information, see the following documents.

#### Other applicable documents

Document name	Title
MAX20	<a href="#">X20 System user's manual</a>
MAEMV	<a href="#">Installation / EMC guide</a>

#### Additional documentation

Document name	Title
MAREDSYS	<a href="#">Redundancy for control systems</a>

#### 2.1.1.2 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



##### 2.1.1.2.1 Starting temperature

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

#### Information:

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

### 2.1.1.3 Order data

Order number	Short description	Figure
	<b>X20 redundancy systems</b>	
X20HB8884	X20 Compact link selector, 2x RJ45, order bus base, power supply module and terminal block separately!	
X20cHB8884	X20 Compact link selector, coated, 2x RJ45, order bus base, power supply module and terminal block separately!	
	<b>Required accessories</b>	
	<b>System modules for X20 redundancy systems</b>	
X20HB2885	X20 hub expansion module, integrated active 2-port hub, 2x RJ45	
X20cHB2885	X20 hub expansion module, coated, integrated active 2-port hub, 2x RJ45	
	<b>System modules for expandable bus controllers</b>	
X20BB81	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with one expansion slot for X20 add-on module (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20BB82	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB81	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, with one expansion slot for X20 add-on module (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB82	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
	<b>System modules for the X20 hub system</b>	
X20HB2880	X20 hub expansion module, integrated 2-port hub, 2x RJ45	
X20PS8002	X20 power supply module, for standalone hub and compact link selector	
X20cHB2880	X20 hub expansion module, coated, integrated 2-port hub, 2x RJ45	
X20cPS8002	X20 power supply module, coated, for standalone hub and compact link selector	
	<b>Terminal blocks</b>	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 15: X20HB8884, X20cHB8884 - Order data

### 2.1.1.4 Module description

With the compact link selector module, it is possible to connect any POWERLINK device to a redundant POWERLINK network.

Functions:

- [POWERLINK](#)
- [POWERLINK redundancy system](#)

#### POWERLINK

POWERLINK is a standard protocol for Fast Ethernet equipped with hard real-time characteristics.

#### Redundancy system

In cable redundancy systems, data is fed into 2 cable lines simultaneously via a corresponding mechanism.

In ring redundancy systems, multiple nodes are connected within a ring and data packets can be transmitted in both directions if needed.

## 2.1.2 Technical description

### 2.1.2.1 Technical data

Order number	X20HB8884	X20cHB8884
<b>Short description</b>		
POWERLINK compact link selector	Connects POWERLINK devices to a redundant POWERLINK network	
<b>General information</b>		
Status indicators	Module status, bus function	
Diagnosics		
Module status	Yes, using LED status indicator	
Bus function	Yes, using LED status indicator	
Power consumption	2 W	
Certifications		
CE	Yes	
UKCA	Yes	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÜ 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	Temperature: <b>B</b> (0 to 55°C) Humidity: <b>B</b> (up to 100%) Vibration: <b>B</b> (4 g) EMC: <b>B</b> (bridge and open deck)	
LR	ENV1	
KR	Yes	
ABS	Yes	
BV	<b>EC33B</b> Temperature: 5 - 55°C Vibration: 4 g EMC: Bridge and open deck	
EAC	Yes	
KC	Yes	-
<b>Interfaces</b>		
Type	POWERLINK compact link selector	
Variant	2x shielded RJ45	
Line length	Max. 100 m between 2 stations (segment length)	
Transfer rate	100 Mbit/s	
Transfer		
Physical layer	100BASE-TX	
Half-duplex	Yes	
Full-duplex	No	
Autonegotiation	Yes	
Auto-MDI/MDIX	Yes	
Hub propagation delay	0.96 to 1 µs	
<b>Electrical properties</b>		
Electrical isolation	Power supply isolated from POWERLINK (IF1 and IF2)	
<b>Operating conditions</b>		
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	
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C	
Vertical mounting orientation	-25 to 50°C	
Derating	-	
Starting temperature	-	Yes, -40°C
Storage	-40 to 85°C	
Transport	-40 to 85°C	
Relative humidity		
Operation	5 to 95%, non-condensing	Up to 100%, condensing
Storage	5 to 95%, non-condensing	
Transport	5 to 95%, non-condensing	

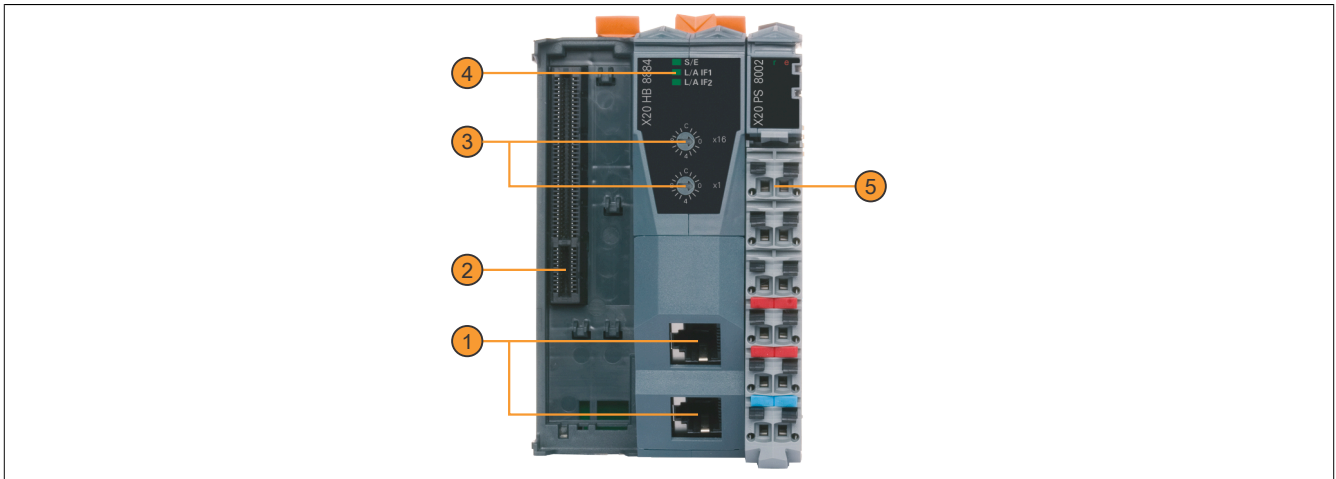
Table 16: X20HB8884, X20cHB8884 - Technical data

Order number	X20HB8884	X20cHB8884
<b>Mechanical properties</b>		
Note	Order 1x terminal block X20TB12 separately. Order 1x power supply module X20PS8002 separately. Order 1x hub expansion module X20HB2880 or 2x hub expansion module X20HB2885. Order 1x bus base X20BB81 or X20BB82 separately.	Order 1x terminal block X20TB12 separately. Order 1x power supply module X20cPS8002 separately. Order 1x hub expansion module X20cHB2880 or 2x hub expansion module X20cHB2885. Order 1x bus base X20cBB81 or X20cBB82 separately.
Pitch <sup>1)</sup>		
X20BB81		62.5 <sup>+0.2</sup> mm
X20BB82		87.5 <sup>+0.2</sup> mm

Table 16: X20HB8884, X20cHB8884 - Technical data

1) Pitch is based on the width of bus base X20BB81 or X20BB82. 1 X20HB2880 hub expansion module or 2 X20HB2885 hub expansion modules and 1 X20PS8002 power supply module are also always required for the compact link selector.

### 2.1.2.2 Operating and connection elements



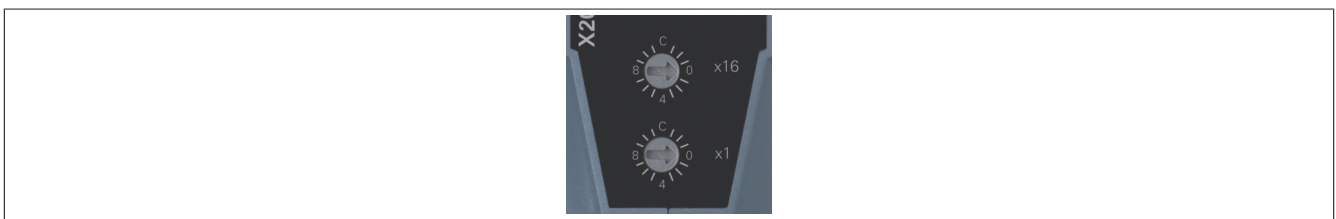
1	POWERLINK connection with 2x RJ45 for simple wiring	2	Slot for hub expansion module
3	POWERLINK node number	4	LED status indicators
5	Terminal block for compact link selector power supply	6	-

#### 2.1.2.2.1 LED status indicators

Figure	LED	Color	Status	Description
	S/E <sup>1)</sup>	Green	On	An active POWERLINK network was detected on both networks.
		Red	Single flash	Network 2 is active. Disturbances detected on network 1 or there is no POWERLINK network active.  Note: Several red blinking signals are displayed immediately after the device is switched on. This is not an error, however.
			Double flash	Network 1 is active. Disturbances detected on network 2 or there is no POWERLINK network active.  <b>Several red blinking signals are displayed immediately after the device is switched on. This is not an error, however.</b>
	On	Failure of both networks.		
	L/A IFx	Green	Blinking	A link to the peer station has been established. The LED blinks when Ethernet activity is taking place on the bus.
On		A link to the remote station has been established.		

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

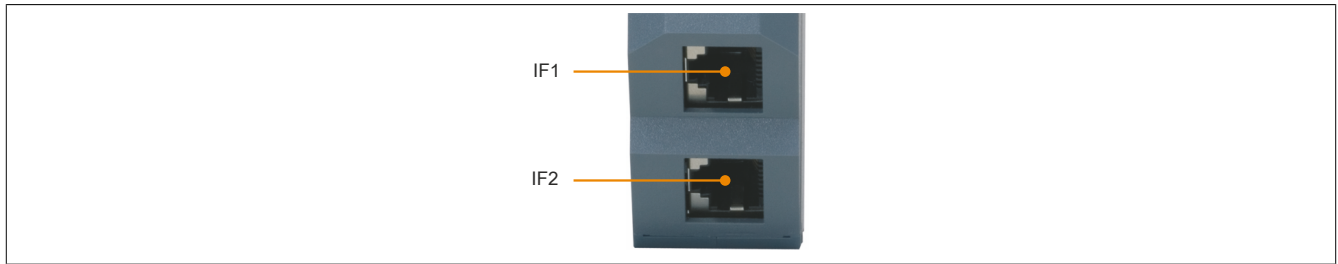
#### 2.1.2.2.2 POWERLINK node numbers

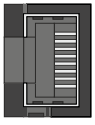


The number switches have no function during operation. They are only used for product testing.

### 2.1.2.2.3 Ethernet interface

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	

## 2.1.3 Function description

### 2.1.3.1 POWERLINK

POWERLINK is an Ethernet-based, real-time capable fieldbus. POWERLINK extends the IEEE 802.3 Ethernet standard by a deterministic access method and also defines a CANopen-compatible fieldbus interface. POWERLINK distinguishes between process and service data in the same way as CANopen. Process data (PDO) is exchanged cyclically in the cyclic phase, while service data (SDO) is transferred acyclically. Service data objects are transmitted in the acyclic phases of POWERLINK using a connection-oriented protocol. The cyclic transfer of data in PDOs is enabled by "mapping".

For additional information, see [POWERLINK bus controller user's manual](#) and [www.br-automation.com/en/technologies/powerlink](http://www.br-automation.com/en/technologies/powerlink).

### 2.1.3.2 POWERLINK redundancy system

It is often indispensable to have redundant network cabling, especially in systems that handle technical processes. The potential for danger, especially to the lines that run through the system, is disproportionately high in relation to the need to keep communication active in all operating situations. This risk is effectively reduced with double cabling that is routed separately.

The POWERLINK cable redundancy system is based on the principle of doubling transfer paths and their constant and simultaneous monitoring. This means that data is fed into 2 cable lines simultaneously via a corresponding mechanism. The same mechanisms are used to receive these telegrams again from the redundant network. In contrast to ring redundancy, cable redundancy eliminates the sometimes problematic cable return routing. The design of arbitrary tree structures is therefore possible.

#### **Information:**

**Details about the structure of a redundancy system can be found in the "Redundancy for control systems" user's manual. The user's manual is available in the Downloads section of the B&R website [www.br-automation.com](http://www.br-automation.com).**

#### 2.1.3.2.1 Link selector

POWERLINK can be used to implement systems with redundant cable routing. Data is always transferred via the best quality network line using the link selector function built into the device.

# **System modules of the X20 hub system**

## **Data sheets**

Version: **1.10 (March 2024)**

Order no.: **System modules of the X20 hub system**

## 3.1 X20(c)HB1881

### 3.1.1 General information

#### 3.1.1.1 Other applicable documents

For additional and supplementary information, see the following documents.

#### Other applicable documents

Document name	Title
MAX20	<a href="#">X20 System user's manual</a>
MAEMV	<a href="#">Installation / EMC guide</a>

#### Additional documentation

Document name	Title
MAREDSYS	<a href="#">Redundancy for control systems</a>

#### 3.1.1.2 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



#### 3.1.1.3 Order data

Order number	Short description	Figure
	<b>System modules for the X20 hub system</b>	
X20HB1881	X20 hub expansion module, integrated 1-port hub, for multimode fiber optic cables	
X20cHB1881	X20 hub expansion module, coated, integrated 1-port hub for fiber optic cables	

Table 17: X20HB1881, X20cHB1881 - Order data

#### 3.1.1.4 Module description

The POWERLINK bus controllers X20BC8083, X20BC8084 (revision D0 or higher) and the stand-alone hub X20HB8880 are equipped with a modular hub expansion. An additional 1 or 2 slots are available, depending on the bus base used. The X20HB1881 hub expansion module can be operated in these slots. Note that the hardware revision of the X20BC8083 and the X20HB8880 must be  $\geq F0$ .

The hub expansion module is a 1x hub. The Ethernet connection is made using 62.5/125  $\mu\text{m}$  or 50/125  $\mu\text{m}$  fiber optic multimode cable with a duplex LC connection. The module and network status is indicated using LEDs.

- Hub expansion module
- 1x hub 100 BASE-FX
- Fiber optic multimode cable
- Range up to 2 km
- Hot-swap-capable

### 3.1.2 Technical description

#### 3.1.2.1 Technical data

Order number	X20HB1881	X20cHB1881
<b>Short description</b>		
Hub	1 Fast Ethernet interface for fiber optic cables for hub expansion	
<b>General information</b>		
Status indicators	Module status, bus function	
Diagnostics		
Module status	Yes, using LED status indicator	
Bus function	Yes, using LED status indicator	
Power consumption	1.45 W (rev. <D0: 1.65 W)	1.45 W
Additional power dissipation caused by actuators (resistive) [W]	-	
<b>Certifications</b>		
CE	Yes	
UKCA	Yes	
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	Temperature: <b>B</b> (0 - 55°C) Humidity: <b>B</b> (up to 100%) Vibration: <b>B</b> (4 g) EMC: <b>B</b> (bridge and open deck)	
LR	ENV1	
ABS	Yes	
BV	<b>EC33B</b> Temperature: 5 - 55°C Vibration: 4 g EMC: Bridge and open deck	
EAC	Yes	
KC	Yes	-
<b>Interfaces</b>		
Type	Hub expansion module	
Variant	1x female duplex LC	
Transfer rate	100 Mbit/s	
Transfer		
Physical layer	100BASE-FX	
Half-duplex	Yes	
Full-duplex	No	
Autonegotiation	No	
Auto-MDI/MDIX	No	
Hub propagation delay	0.96 to 1 µs	
Wave length	Typ. 1300 nm Rx range: 1270 to 1380 nm Tx range: 1270 to 1380 nm	
Cable fiber type	Multimode fiber with 62.5/125 µm or 50/125 µm core diameter On both sides: Male duplex LC connector	
Optical power budget		
Glass fiber 62.5/125 µm, NA = 0.275	11 dB	
Glass fiber 50/125 µm, NA = 0.200	7.5 dB	
Line length		
Half-duplex	Max. 175 m between 2 stations (segment length)	
POWERLINK	Max. 2 km between 2 stations (segment length)	
<b>Electrical properties</b>		
Electrical isolation	Power supply isolated from Ethernet	
<b>Operating conditions</b>		
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	

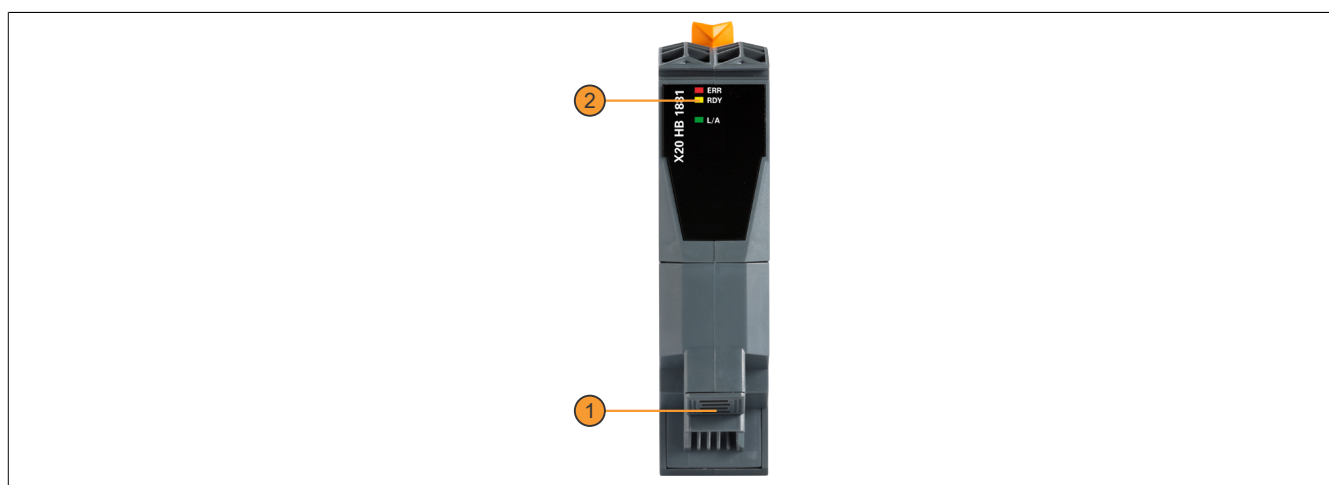
Table 18: X20HB1881, X20cHB1881 - Technical data

Order number	X20HB1881	X20cHB1881
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation		-25 to 60°C
Vertical mounting orientation		-25 to 50°C
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
<b>Mechanical properties</b>		
Slot	Hub expansion for X20BC8083, X20BC8084 and X20HB8880 <sup>1)</sup>	Hub expansion for X20cBC8084 and X20cHB8880 <sup>2)</sup>

Table 18: X20HB1881, X20cHB1881 - Technical data

- 1) The hardware revision of X20BC8083 and X20HB8880 must be F0 or later, and the hardware revision of X20BC8084 must be D0 or later.
- 2) The hardware revision of the X20cHB8880 must be F0 or later, and the hardware revision of the X20cBC8084 must be D0 or later.

### 3.1.2.2 Operating and connection elements



1	Ethernet interface	2	LED status indicators
---	--------------------	---	-----------------------

#### 3.1.2.2.1 LED status indicators

Figure	LED	Color	Status	Description
	ERR	Red	On	Slot not detected
	RDY	Orange	On	Slot detected, module active
	L/A	Green	On	The link to the remote station is established.
			Blinking	The link to the remote station is established. The LED blinks if Ethernet activity is taking place on the bus.

#### 3.1.2.2.2 Ethernet interface

Figure	Description
	100BASE-FX, female duplex LC

### 3.1.2.2.1 Wiring guidelines for X20 modules with fiber optic cable

The following wiring guidelines must be observed:

- Cable fiber type: Multimode fiber with 62.5/125  $\mu\text{m}$  or 50/125  $\mu\text{m}$  core diameter
- On both sides: Duplex LC male connector
- Observe minimum cable flex radius (see data sheet for the cable)

### 3.1.3 Commissioning

#### 3.1.3.1 Network size and collision detection

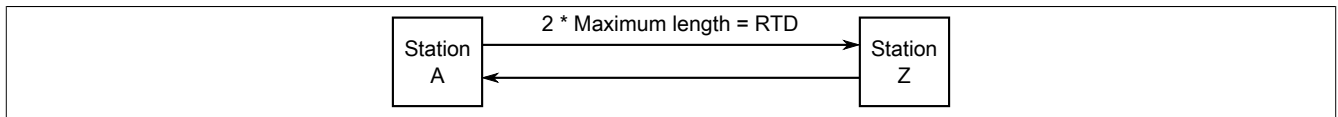
#### Information:

This section applies to the use of Ethernet networks, not POWERLINK networks.

According to Ethernet specification IEEE 802.3, the transmission duration of a frame of minimum length must always be greater than the round-trip delay time (RTD). RTD is the time needed by a data packet to travel from one end of the network to the other.

If this is not observed, collision detection can no longer be guaranteed.

Illustration of RTD



When using fiber optic cables, the default maximum size is 175 m. Since there are often different devices in a network using different PHYs, the propagation delay of the frames changes since each PHY has different latency. This also affects the network size, and collision detection can no longer be guaranteed at 175 m.

For this reason, it is necessary to re-check whether the transmission duration of a frame of minimum length is actually greater than the maximum RTD.

#### Example for calculating network size

- Transfer rate: 100 Mbit/s
- Length of the fiber optic cable: 175 m
- Number of hubs: 2
- Hub propagation delay of a frame: 1  $\mu\text{s}$
- Minimum frame size in the Ethernet network: 72 bytes

Calculation procedure

1. How long does 1 byte need at 100 Mbit/s – 100 Mbit/s / 8 = 12.5 MB/s	$\frac{12,500,000}{1} = \frac{1}{x}$ $x = \frac{1\text{s}}{12,500,000} = 80\text{ns}$
2. Propagation delay of minimum Ethernet frame – Minimum frame in Ethernet network: 72 bytes	$72 * 80\text{ns} = 5.76\mu\text{s}$
3. Propagation delay in cable and hub (100 m cable = 0.5 $\mu\text{s}$ ) – 175 m cable = 1.75 x 0.5 $\mu\text{s}$ – 2 hubs = 2 x 1 $\mu\text{s}$	$\frac{175}{100}\text{m} * 0.5\mu\text{s} + 2\mu\text{s} = 2.875\mu\text{s}$
4. Calculation of total propagation delay – Outbound/Inbound propagation delay	$2.875\mu\text{s} * 2 = 5.75\mu\text{s}$
<b>Result</b> Collision detection is possible since the total time of 5.75 $\mu\text{s}$ is less than the minimum Ethernet propagation delay of 5.76 $\mu\text{s}$ . With a longer cable or device with different latency, collision detection would no longer exist.	

## 3.2 X20HB1882

### 3.2.1 General information

POWERLINK bus controllers X20BC8083 and X20BC8084 (revision D0 and later) and standalone hub X20HB8880 are equipped with a modular hub expansion. An additional 1 or 2 slots are available depending on the bus base being used. Hub expansion module X20HB1882 can be operated in these slots. Note that the hardware revision of the X20BC8083 and X20HB8880 must be  $\geq$ F0.

The hub expansion module is designed as a 1-port hub. The Ethernet connection is made using 9/125  $\mu$ m single-mode glass fiber cables with a duplex LC connector. The module state and network status are indicated using LEDs.

- Hub expansion module
- 1-port hub, 100BASE-FX
- Single-mode glass fiber cables
- Range up to 50 km
- Hot-swappable

### Information:

This module is not suitable for POWERLINK ring redundancy applications.

### 3.2.2 Order data


Order number	Short description	Figure
	<b>System modules for the X20 hub system</b>	
X20HB1882	X20 hub expansion module, integrated 1-port hub, for monomode fiber optic cables	

Table 19: X20HB1882 - Order data

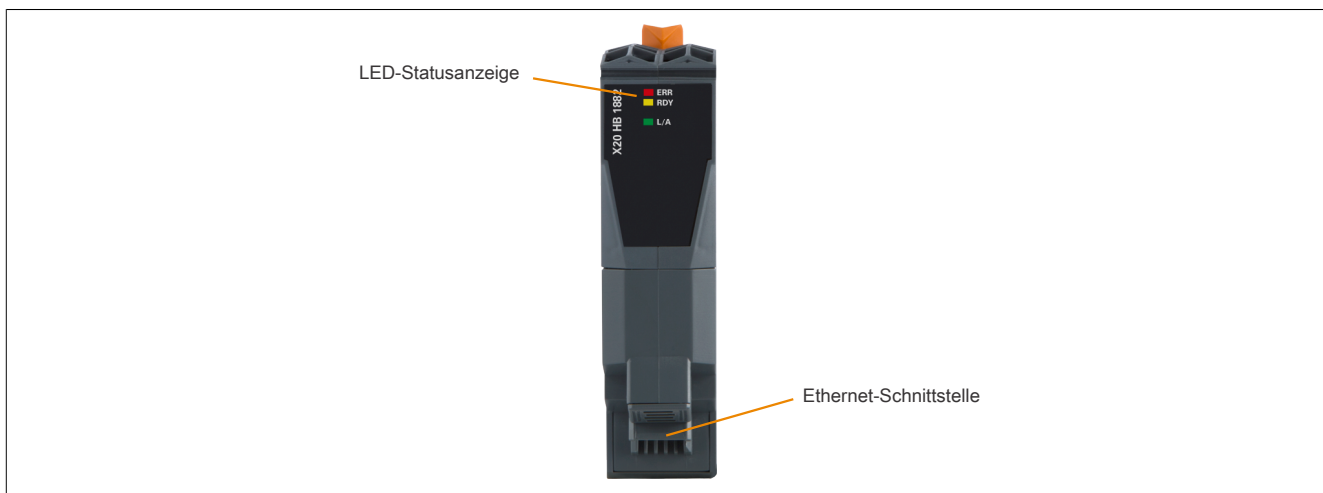
## 3.2.3 Technical data

Order number	X20HB1882
<b>Short description</b>	
Hub	1 Fast Ethernet interface for single-mode fiber optic cables for hub expansion
<b>General information</b>	
Status indicators	Module status, bus function
Diagnostics	
Module status	Yes, using LED status indicator
Bus function	Yes, using LED status indicator
Power consumption	1.65 W
Additional power dissipation caused by actuators (resistive) [W]	-
<b>Certifications</b>	
CE	Yes
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÜ 09 ATEX 0083X
UL	cULus E115267 Industrial control equipment
EAC	Yes
<b>Interfaces</b>	
Type	Hub expansion module
Variant	1x female duplex LC
Transfer rate	100 Mbit/s
Transfer	
Physical layer	100BASE-FX
Half-duplex	Yes
Full-duplex	No
Autonegotiation	No
Auto-MDI/MDIX	No
Hub propagation delay	0.96 to 1 µs
Wave length	Typ. 1300 nm Rx range: 1270 to 1380 nm Tx range: 1270 to 1380 nm
Cable fiber type	Single-mode fiber with 9/125 µm core diameter On both sides: Male duplex LC connector
Optical power budget	30 dB
Cable length	
Half-duplex	Max. 175 m between 2 stations (segment length)
POWERLINK	Max. 50 km between 2 stations (segment length)
<b>Electrical properties</b>	
Electrical isolation	Power supply isolated from Ethernet
<b>Operating conditions</b>	
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
<b>Ambient conditions</b>	
Temperature	
Operation	
Horizontal mounting orientation	-25 to 55°C
Vertical mounting orientation	-25 to 45°C
Derating	-
Storage	-40 to 85°C
Transport	-40 to 85°C
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
<b>Mechanical properties</b>	
Slot	Hub expansion for X20BC8083, X20BC8084 and X20HB8880 <sup>1)</sup>

Table 20: X20HB1882 - Technical data

1) The hardware revision of X20BC8083 and X20HB8880 must be ≥F0, and the hardware revision of X20BC8084 must be ≥D0.

### 3.2.4 Operating and connection elements



#### 3.2.4.1 LED status indicators

Figure	LED	Color	Status	Description
	ERR	Red	On	Slot not detected
	RDY	Orange	On	Slot detected, module active
	L/A	Green	On	Link to remote station established
			Blinking	Link to remote station established. The LED blinks if Ethernet activity is taking place on the bus.

#### 3.2.4.2 Ethernet interface

Figure	Description
<p>Duplex LC Tx Rx</p>	100BASE-FX, female duplex LC

##### 3.2.4.2.1 Cabling guidelines for X20 modules with fiber optic cables

The following cabling guidelines must be observed:

- Cable fiber type: Single-mode fiber with 9/125 µm core diameter
- On both sides: Male duplex LC connector
- Observe the minimum cable bend radius (see data sheet for the cable).

### 3.2.5 Network size and collision detection

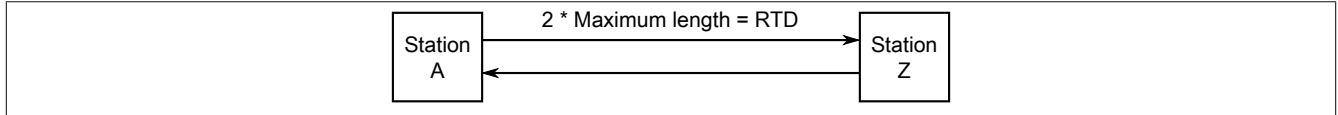
#### Information:

This section applies to the use of Ethernet networks, not POWERLINK networks.

According to Ethernet specification IEEE 802.3, the transmission duration of a frame of minimum length must always be greater than the round-trip delay time (RTD). RTD is the time needed by a data packet to travel from one end of the network to the other.

If this is not observed, collision detection can no longer be guaranteed.

#### Illustration of RTD



When using fiber optic cables, the default maximum size is 175 m. Since there are often different devices in a network using different PHYs, the propagation delay of the frames changes since each PHY has different latency. This also affects the network size, and collision detection can no longer be guaranteed at 175 m.

For this reason, it is necessary to re-check whether the transmission duration of a frame of minimum length is actually greater than the maximum RTD.

#### Example for calculating network size

- Transfer rate: 100 Mbit/s
- Length of the fiber optic cable: 175 m
- Number of hubs: 2
- Hub propagation delay of a frame: 1  $\mu$ s
- Minimum frame size in the Ethernet network: 72 bytes

#### Calculation procedure

1. How long does 1 byte need at 100 Mbit/s – 100 Mbit/s / 8 = 12.5 MB/s	$\frac{12,500,000}{1} = \frac{1}{x}$ $x = \frac{1s}{12,500,000} = 80ns$
2. Propagation delay of minimum Ethernet frame – Minimum frame in Ethernet network: 72 bytes	$72 * 80ns = 5.76\mu s$
3. Propagation delay in cable and hub (100 m cable = 0.5 $\mu$ s) – 175 m cable = 1.75 x 0.5 $\mu$ s – 2 hubs = 2 x 1 $\mu$ s	$\frac{175}{100}m * 0.5\mu s + 2\mu s = 2.875\mu s$
4. Calculation of total propagation delay – Outbound/Inbound propagation delay	$2.875\mu s * 2 = 5.75\mu s$

#### Result

Collision detection is possible since the total time of 5.75  $\mu$ s is less than the minimum Ethernet propagation delay of 5.76  $\mu$ s.

With a longer cable or device with different latency, collision detection would no longer exist.

### 3.3 X20(c)HB2880

#### 3.3.1 General information

The POWERLINK bus controller X20BC8083 and the stand-alone hubs X20HB8880 and X20HB8815 are equipped with a modular hub expansion. An additional 1 or 2 slots are available, depending on the bus base used. The X20HB2880 hub expansion module can be operated in these slots.

The status of the module and network are indicated by LEDs.

- Hub expansion module
- 2x hub 100 BASE-TX

#### 3.3.2 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



##### 3.3.2.1 -40°C starting temperature

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

#### Information:

**It is important to absolutely ensure that there is no forced cooling by air currents in a closed control cabinet, for example using a fan or ventilation slots.**

#### 3.3.3 Order data

Order number	Short description	Figure
	<b>System modules for the X20 hub system</b>	
X20HB2880	X20 hub expansion module, integrated 2-port hub, 2x RJ45	
X20cHB2880	X20 hub expansion module, coated, integrated 2-port hub, 2x RJ45	

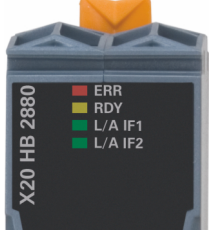
Table 21: X20HB2880, X20cHB2880 - Order data

## 3.3.4 Technical data

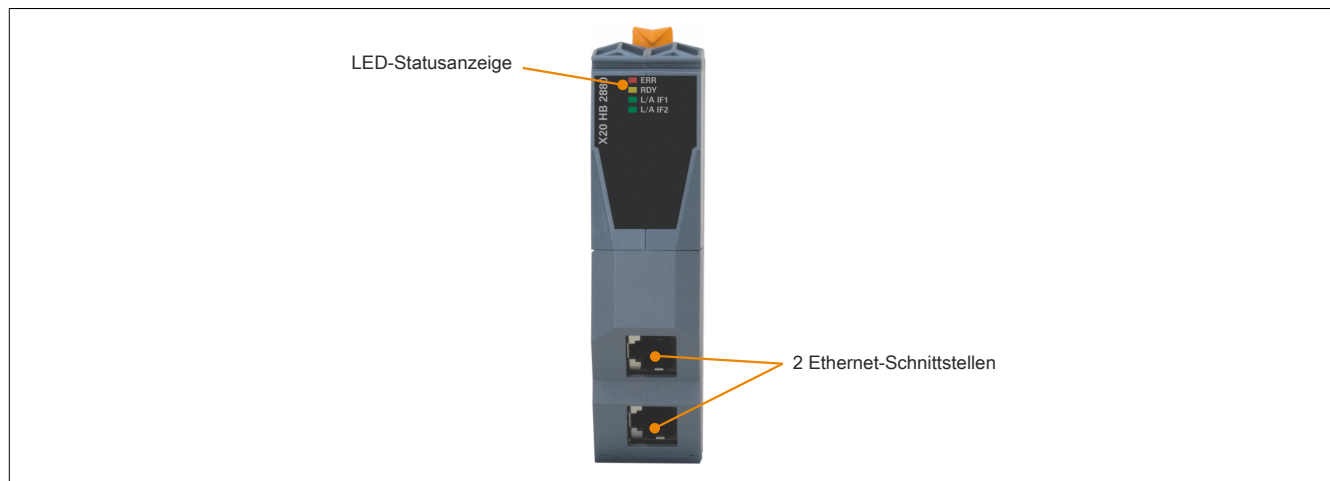
Order number	X20HB2880	X20cHB2880
<b>Short description</b>		
Hub	2 Fast Ethernet hubs for hub expansion	
<b>General information</b>		
Status indicators	Module status, bus function	
Diagnostics		
Module status	Yes, using status LED	
Bus function	Yes, using status LED	
Power consumption	1.17 W	
Additional power dissipation caused by actuators (resistive) [W]	-	
Certifications		
CE	Yes	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÚ 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: <b>B</b> (0 - 55°C) Humidity: <b>B</b> (up to 100%) Vibration: <b>B</b> (4 g) EMC: <b>B</b> (bridge and open deck)	
LR	ENV1	
KR	Yes	
EAC	Yes	
KC	Yes	-
<b>Interfaces</b>		
Type	Hub expansion module	
Variant	2x shielded RJ45	
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	No	
Autonegotiation	Yes	
Auto-MDI/MDIX	Yes	
Hub propagation delay	0.96 to 1 µs	
<b>Electrical properties</b>		
Electrical isolation	Power supply isolated from Ethernet (IF1 and IF2)	
<b>Operating conditions</b>		
Mounting orientation		
Horizontal	Yes	
Vertical	Yes	
Installation elevation above sea level		
0 to 2000 m	No limitations	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
Degree of protection per EN 60529	IP20	
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C	
Vertical mounting orientation	-25 to 50°C	
Derating		
Storage	-	
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	
<b>Mechanical properties</b>		
Slot	Hub expansion for X20BC8083 and X20HB8880	Hub expansion for X20cBC8083 and X20cHB8880

Table 22: X20HB2880, X20cHB2880 - Technical data

### 3.3.5 LED status indicators

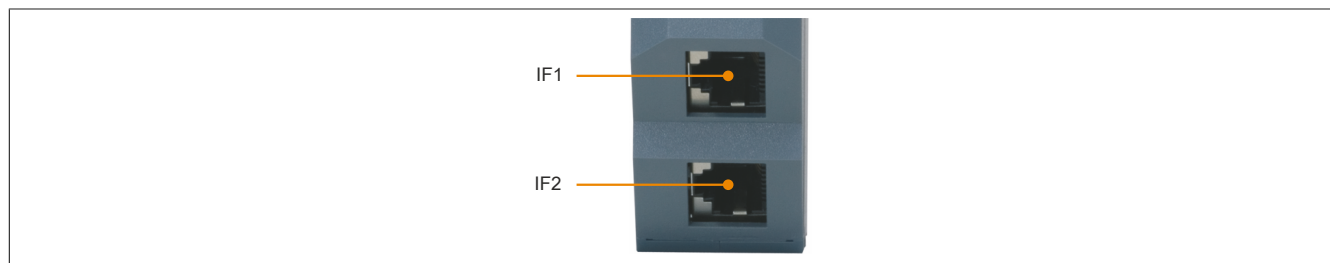
Figure	LED	Color	Status	Description
	ERR	Red	On	Slot not detected
	RDY	Orange	On	Slot detected, module is active
	L/A IFx	Green	On	A link to the remote station has been established.
			Blinking	A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus.

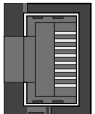
### 3.3.6 Operating and connection elements



### 3.3.7 Ethernet interface

For information about wiring X20 modules with an Ethernet interface, see section "Mechanical and electrical configuration - Wiring guidelines for X20 modules with Ethernet cables" of 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	

### 3.3.8 Network size and collision detection

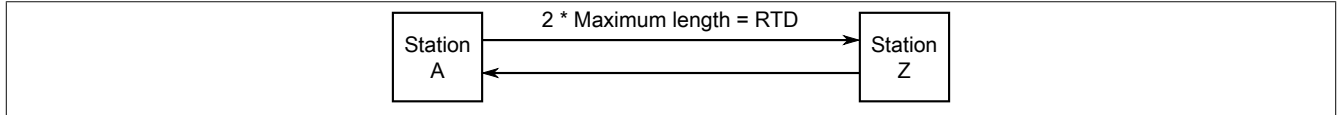
#### Information:

This section applies to the use of Ethernet networks, not POWERLINK networks.

According to Ethernet specification IEEE 802.3, the transmission duration of a frame of minimum length must always be greater than the round-trip delay time (RTD). RTD is the time needed by a data packet to travel from one end of the network to the other.

If this is not observed, collision detection can no longer be guaranteed.

#### Illustration of RTD



When using copper cables, the maximum distance is generally 100 m. Since there are often many different devices with different PHYs in a network, the propagation delay of the frames changes due to the different latency of each PHY. This also affects the network size, and collision detection can no longer be guaranteed at 100 m.

#### Example for calculating network size

The following parameters are specified for a network:

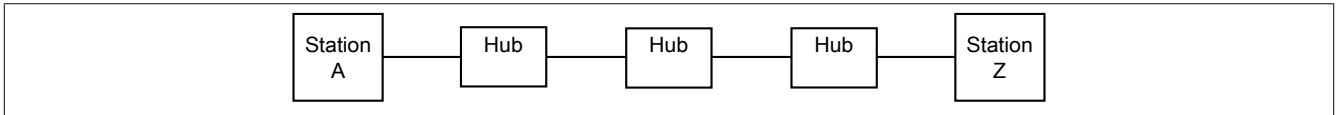
- Transfer rate: 100 Mbit/s
- Cable length: 100 m
- Number of hubs: 2
- Hub propagation delay of a frame: 1  $\mu$ s
- Minimum frame size in the Ethernet network: 72 bytes

#### Calculation procedure

1. How long does 1 byte take at 100 Mbit/s – 100 Mbit/s / 8 = 12.5 MB/s	$\frac{12,500,000}{1} = \frac{1}{x}$ $x = \frac{1\text{s}}{12,500,000} = 80\text{ns}$
2. Propagation delay of minimum Ethernet frame – Minimum frame in Ethernet network: 72 bytes	$72 * 80\text{ns} = 5.76\mu\text{s}$
3. Propagation delay in cable and hub – 100 m cable = 0.5 $\mu$ s – 2 hubs = 2 x 1 $\mu$ s	$2\mu\text{s} + 0.5\mu\text{s} = 2.5\mu\text{s}$
4. Calculation of total propagation delay – Outbound/Inbound propagation delay	$2.5\mu\text{s} * 2 = 5\mu\text{s}$

#### Result

Collision detection is possible since the total time of 5  $\mu$ s is less than the minimum Ethernet propagation delay of 5.76  $\mu$ s.

**Example for calculating the network reach with devices between 2 stations**

Corresponding to the previous example, the following situation occurs in a network with 3 hubs and 100 m cables:

- The transmission duration of a frame of minimum length is 5.76  $\mu\text{s}$ .

Calculation procedure

1. Propagation delay in cable and hub – 100 m cable = 0.5 $\mu\text{s}$ – 3 hubs = 3 x 1 $\mu\text{s}$	$3\mu\text{s} + 0.5\mu\text{s} = 3.5\mu\text{s}$
2. Calculation of total propagation delay – Outbound/Inbound propagation delay	$3.5\mu\text{s} * 2 = 7\mu\text{s}$

**Result**

Collision detection is not possible since the total time of 7  $\mu\text{s}$  is greater than the minimum Ethernet propagation delay of 5.76  $\mu\text{s}$ .

The  $\approx 1.3 \mu\text{s}$  missing for collision detection can only be recovered by removing a hub.

## 3.4 X20(c)HB2881

### 3.4.1 General information

#### 3.4.1.1 Other applicable documents

For additional and supplementary information, see the following documents.

#### Other applicable documents

Document name	Title
MAX20	<a href="#">X20 System user's manual</a>
MAEMV	<a href="#">Installation / EMC guide</a>

#### Additional documentation

Document name	Title
MAREDSYS	<a href="#">Redundancy for control systems</a>

#### 3.4.1.2 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



#### 3.4.1.3 Order data

Order number	Short description	Figure
	<b>System modules for the X20 hub system</b>	
X20HB2881	X20 hub expansion module, integrated 2-port hub, for fiber optic cables	
X20cHB2881	X20 hub expansion module, coated, integrated 2-port hub for fiber optic cables	

Table 23: X20HB2881, X20cHB2881 - Order data

#### 3.4.1.4 Module description

The POWERLINK bus controller X20BC8083 and the stand-alone hubs X20HB8880 and X20HB8815 are equipped with a modular hub expansion. An additional 1 or 2 slots are available, depending on the bus base used. The X20H-B2881 hub expansion module can be operated in these slots. Note that the hardware revision of the X20BC8083 and the X20HB8880 must be  $\geq F0$ .

The hub expansion module is a 2x hub. The Ethernet connection is made using 62.5/125  $\mu\text{m}$  or 50/125  $\mu\text{m}$  fiber optic multimode cable with a duplex LC connection. The status of the module and network are indicated by LEDs.

- Hub expansion module
- 2x Hub 100 BASE-FX

## 3.4.2 Technical description

### 3.4.2.1 Technical data

Order number	X20HB2881	X20cHB2881
<b>Short description</b>		
Hub	2 Fast Ethernet interfaces for fiber optic cables for hub expansion	
<b>General information</b>		
Status indicators	Module status, bus function	
Diagnostics		
Module status	Yes, using LED status indicator	
Bus function	Yes, using LED status indicator	
Power consumption	2.3 W (rev. <E0: 2.8 W)	2.3 W
Additional power dissipation caused by actuators (resistive) [W]	-	
Certifications		
CE	Yes	
UKCA	Yes	
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	Temperature: <b>B</b> (0 - 55°C) Humidity: <b>B</b> (up to 100%) Vibration: <b>B</b> (4 g) EMC: <b>B</b> (bridge and open deck)	
LR	ENV1	
ABS	Yes	
BV	<b>EC33B</b> Temperature: 5 - 55°C Vibration: 4 g EMC: Bridge and open deck	
EAC	Yes	
KC	Yes	-
<b>Interfaces</b>		
Type	Hub expansion module	
Variant	2x female duplex LC	
Transfer rate	100 Mbit/s	
Transfer		
Physical layer	100BASE-FX	
Half-duplex	Yes	
Full-duplex	No	
Autonegotiation	No	
Auto-MDI/MDIX	No	
Hub propagation delay	0.96 to 1 µs	
Wave length	Typ. 1300 nm Rx range: 1270 to 1380 nm Tx range: 1270 to 1380 nm	
Cable fiber type	Multimode fiber with 62.5/125 µm or 50/125 µm core diameter On both sides: Male duplex LC connector	
Optical power budget		
Glass fiber 62.5/125 µm, NA = 0.275	11 dB	
Glass fiber 50/125 µm, NA = 0.200	7.5 dB	
Line length		
Half-duplex	Max. 175 m between 2 stations (segment length)	
POWERLINK	Max. 2 km between 2 stations (segment length)	
<b>Electrical properties</b>		
Electrical isolation	Power supply isolated from Ethernet (IF1 and IF2)	
<b>Operating conditions</b>		
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	

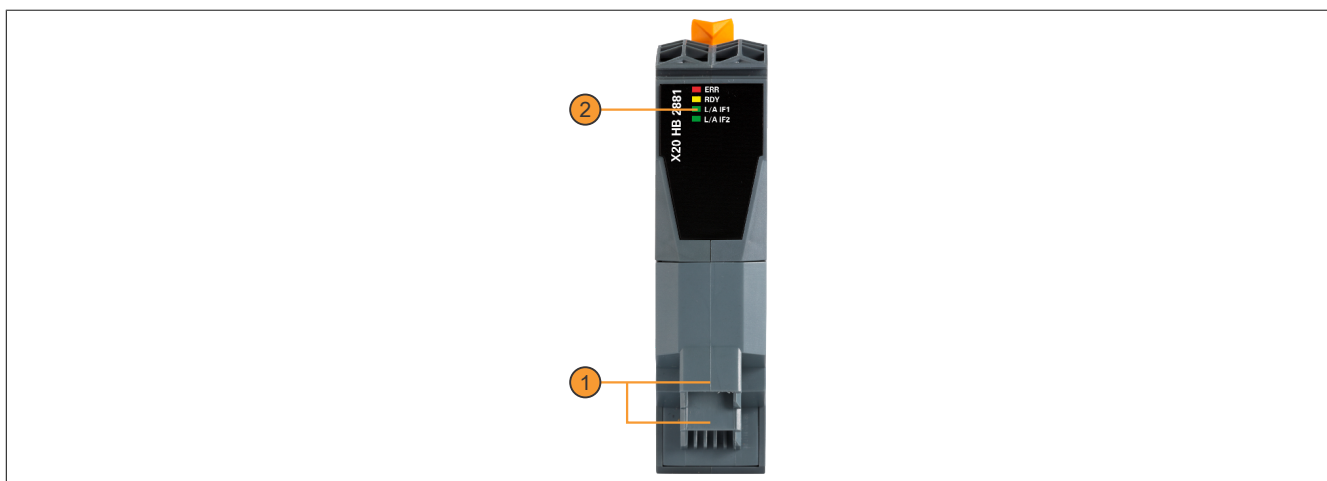
Table 24: X20HB2881, X20cHB2881 - Technical data

Order number	X20HB2881	X20cHB2881
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation (with 1 hub)	-25 to 55°C (Rev. <E0: 0 to 45°C)	-25 to 55°C
Horizontal mounting orientation (with ≥2 hubs)	-25 to 50°C (Rev. <E0: 0 to 40°C)	-25 to 50°C
Vertical mounting orientation (with 1 hub)	-25 to 40°C (Rev. <E0: 0 to 40°C)	-25 to 40°C
Vertical mounting orientation (with ≥2 hubs)	-25 to 35°C (Rev. <E0: 0 to 35°C)	-25 to 35°C
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	
<b>Mechanical properties</b>		
Slot	Hub expansion for X20BC8083 and X20HB8880 <sup>1)</sup>	Hub expansion for X20cBC8083 and X20cHB8880 <sup>2)</sup>

Table 24: X20HB2881, X20cHB2881 - Technical data

- 1) The hardware revision of the X20BC8083 and X20HB8880 must be F0 or later.
- 2) The hardware revision of the X20cBC8083 and X20cHB8880 must be F0 or later.

### 3.4.2.2 Operating and connection elements



1	2 Ethernet interfaces	2	LED status indicators
---	-----------------------	---	-----------------------

#### 3.4.2.2.1 LED status indicators

Figure	LED	Color	Status	Description
	ERR	Red	On	Slot not detected
	RDY	Orange	On	Slow detected, module is active
	L/A IFx	Green	On	A link to the remote station has been established.
			Blinking	A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus.

#### 3.4.2.2.2 Ethernet interfaces

Figure	Description
	100 BASE-FX, Duplex LC female

### 3.4.2.2.1 Wiring guidelines for X20 modules with fiber optic cable

The following wiring guidelines must be observed:

- Cable fiber type: Multimode fiber with 62.5/125  $\mu\text{m}$  or 50/125  $\mu\text{m}$  core diameter
- On both sides: Duplex LC male connector
- Observe minimum cable flex radius (see data sheet for the cable)

## 3.4.3 Commissioning

### 3.4.3.1 Network size and collision detection

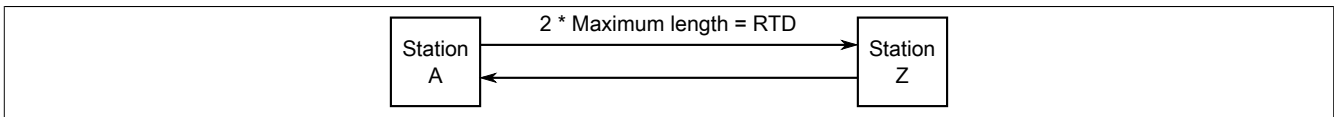
#### Information:

This section applies to the use of Ethernet networks, not POWERLINK networks.

According to Ethernet specification IEEE 802.3, the transmission duration of a frame of minimum length must always be greater than the round-trip delay time (RTD). RTD is the time needed by a data packet to travel from one end of the network to the other.

If this is not observed, collision detection can no longer be guaranteed.

Illustration of RTD



When using fiber optic cables, the default maximum size is 175 m. Since there are often different devices in a network using different PHYs, the propagation delay of the frames changes since each PHY has different latency. This also affects the network size, and collision detection can no longer be guaranteed at 175 m.

For this reason, it is necessary to re-check whether the transmission duration of a frame of minimum length is actually greater than the maximum RTD.

#### Example for calculating network size

- Transfer rate: 100 Mbit/s
- Length of the fiber optic cable: 175 m
- Number of hubs: 2
- Hub propagation delay of a frame: 1  $\mu\text{s}$
- Minimum frame size in the Ethernet network: 72 bytes

Calculation procedure

1. How long does 1 byte need at 100 Mbit/s – 100 Mbit/s / 8 = 12.5 MB/s	$\frac{12,500,000}{1} = \frac{1}{x}$ $x = \frac{1\text{s}}{12,500,000} = 80\text{ns}$
2. Propagation delay of minimum Ethernet frame – Minimum frame in Ethernet network: 72 bytes	$72 * 80\text{ns} = 5.76\mu\text{s}$
3. Propagation delay in cable and hub (100 m cable = 0.5 $\mu\text{s}$ ) – 175 m cable = 1.75 x 0.5 $\mu\text{s}$ – 2 hubs = 2 x 1 $\mu\text{s}$	$\frac{175}{100}\text{m} * 0.5\mu\text{s} + 2\mu\text{s} = 2.875\mu\text{s}$
4. Calculation of total propagation delay – Outbound/Inbound propagation delay	$2.875\mu\text{s} * 2 = 5.75\mu\text{s}$

#### Result

Collision detection is possible since the total time of 5.75  $\mu\text{s}$  is less than the minimum Ethernet propagation delay of 5.76  $\mu\text{s}$ .

With a longer cable or device with different latency, collision detection would no longer exist.

## 3.5 X20(c)PS8002

### 3.5.1 General information

The supply module is used to supply X20 stand-alone devices. These include e.g. the X20HB8884 POWERLINK compact link selector and the X20HB8880 stand alone hub.

- Supply for X20 stand-alone devices
- No electrical isolation between the I/O supply and the device power supply

#### 3.5.1.1 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



##### 3.5.1.1.1 Starting temperature

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

#### Information:

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

#### 3.5.1.2 Other applicable documents

For additional and supplementary information, see the following documents.

##### Other applicable documents

Document name	Title
MAX20	<a href="#">X20 System user's manual</a>
MAEMV	<a href="#">Installation / EMC guide</a>

##### Additional documentation

Document name	Title
MAREDSYS	<a href="#">Redundancy for control systems</a>

### 3.5.2 Order data


Order number	Short description	Figure	
<b>System modules for the X20 hub system</b>			
X20PS8002	X20 power supply module for standalone hub and compact link selector		
X20cPS8002	X20 power supply module, coated, for standalone hub and compact link selector		
<b>Required accessories</b>			
<b>Terminal blocks</b>			
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed		

Table 25: X20PS8002, X20cPS8002 - Order data

### 3.5.3 Technical description


#### 3.5.3.1 Technical data

Order number	X20PS8002	X20cPS8002
<b>Short description</b>		
Power supply module	24 VDC power supply module for X20 standalone devices	
<b>General information</b>		
Status indicators	Operating state, module status	
Diagnostics		
Module run/error	Yes, using LED status indicator	
Overload	Yes, using LED status indicator	
Power consumption <sup>1)</sup>	1.34 W	
Certifications		
CE	Yes	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÜ 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	Temperature: <b>B</b> (0 - 55°C) Humidity: <b>B</b> (up to 100%) Vibration: <b>B</b> (4 g) EMC: <b>B</b> (bridge and open deck)	
LR	ENV1	
KR	Yes	
ABS	Yes	
EAC	Yes	
KC	Yes	-
<b>Input power supply</b>		
Input voltage	24 VDC -15% / +20%	
Input current	Max. 0.7 A	
Fuse	Integrated, cannot be replaced	
Reverse polarity protection	Yes	
<b>Output power supply</b>		
Overload characteristics	Short-circuit proof, temporary overload	
Nominal output power		
Horizontal mounting orientation	7 W at 45°C and 5 W at 55°C	
Vertical mounting orientation	7 W at 40°C and 5 W at 50°C	
<b>Electrical properties</b>		
Electrical isolation	I/O power supply not isolated from device power supply	
<b>Operating conditions</b>		
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	
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C	
Vertical mounting orientation	-25 to 50°C	
Derating	See section "Derating".	
Starting temperature	-	Yes, -40°C
Storage	-40 to 85°C	
Transport	-40 to 85°C	
Relative humidity		
Operation	5 to 95%, non-condensing	Up to 100%, condensing
Storage	5 to 95%, non-condensing	
Transport	5 to 95%, non-condensing	
<b>Mechanical properties</b>		
Note	Order 1x terminal block X20TB12 separately.	
Pitch	12.5 <sup>+0.2</sup> mm	

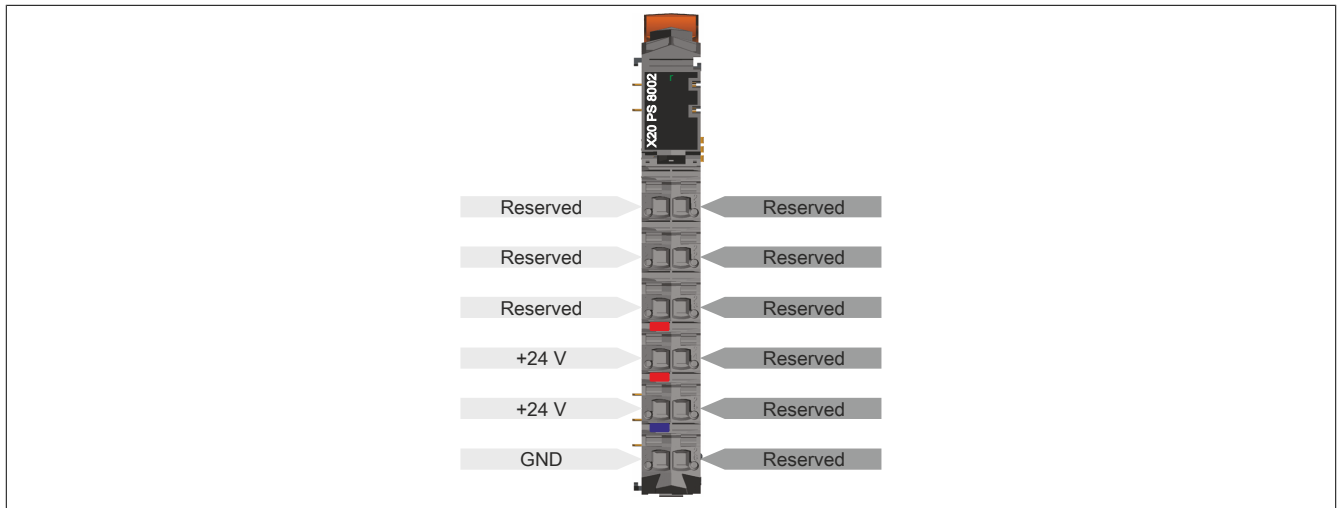
Table 26: X20PS8002, X20cPS8002 - Technical data

- 1) The specified values are maximum values. For examples of the exact calculation, see section "Mechanical and electrical configuration" in the X20 system user's manual.

### 3.5.3.2 LED status indicators

Figure	LED	Color	Status	Description
	r	Green	On	Input voltage > 19.2 V

### 3.5.3.3 Pinout



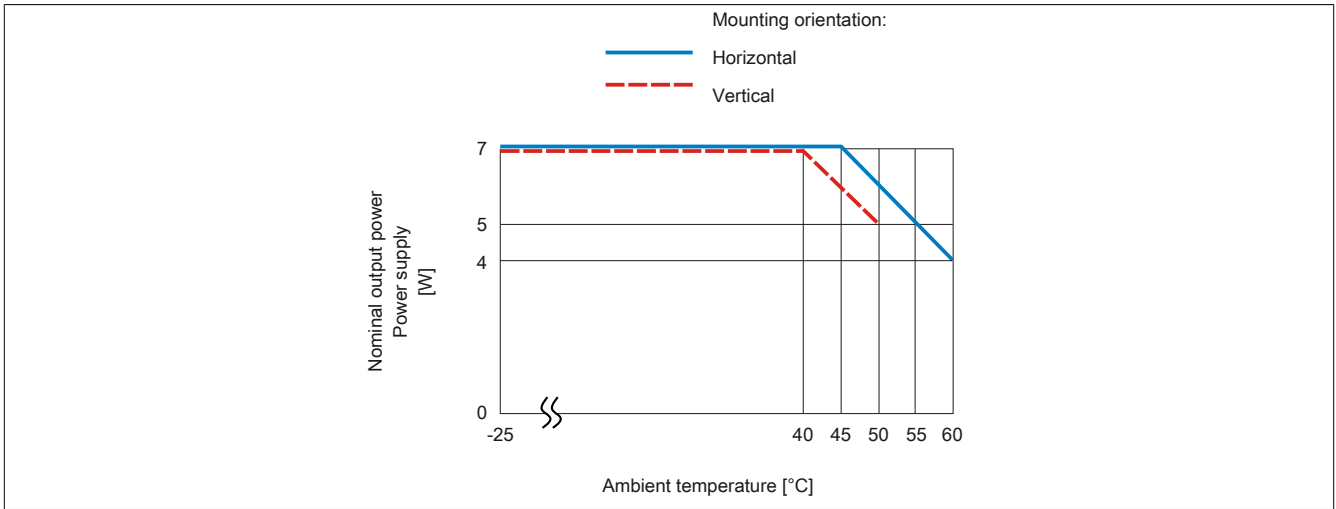
### 3.5.3.4 Connection example



1) 24 VDC supply

### 3.5.3.5 Derating

The rated output current for the supply is 7 W. Derating must be taken into consideration based on mounting orientation.



### 3.6 For reference only

#### **Information:**

The data sheets in this section are for reference only when the modules are already in use.

### 3.6.1 X20HB28G0

#### 3.6.1.1 General information

The X20BC80G3 expandable EtherCAT bus controller and the X20HB88G0 stand-alone EtherCAT junction base module are equipped with an additional slot. The X20HB28G0 EtherCAT junction module is operated in this slot.

The X20HB28G0 module is equipped with a 2x EtherCAT junction. The status of the module and network are indicated by LEDs.

- EtherCAT junction module
- 2x EtherCAT junction

#### 3.6.1.2 Order data


Order number	Short description	Figure
X20HB28G0	<p><b>System modules for the X20 hub system</b></p> <p>X20 EtherCAT junction module, integrated 2-port EtherCAT junction, 2x RJ45</p>	


Table 27: X20HB28G0 - Order data

## 3.6.1.3 Technical data

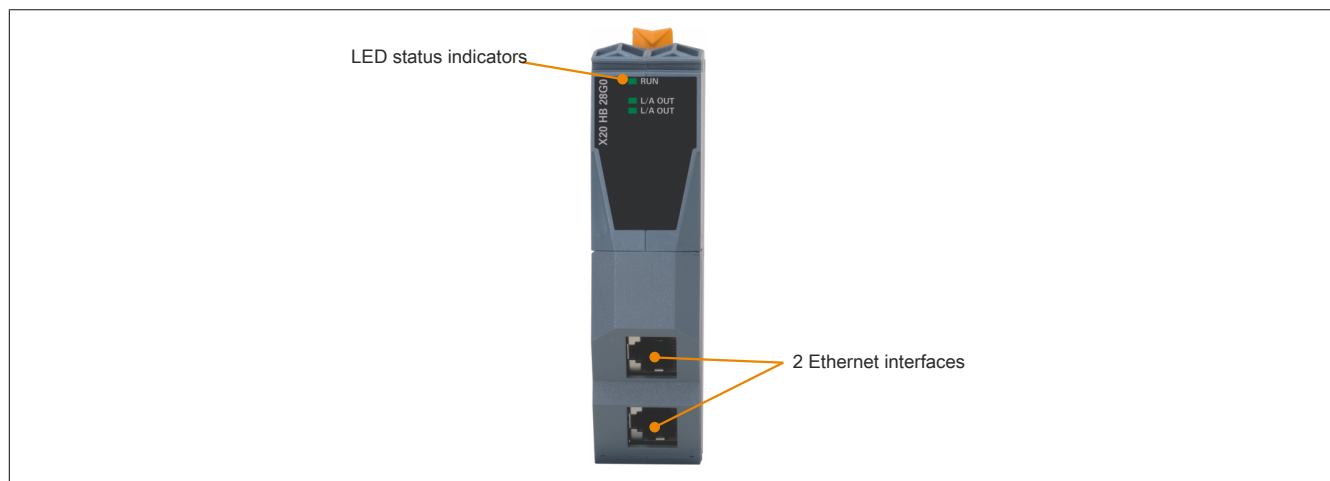
Order number	X20HB28G0
<b>Short description</b>	
Junction module	2x EtherCAT junction for expansion
<b>General information</b>	
Status indicators	Module status, bus function
Diagnostics	
Module status	Yes, using status LED
Bus function	Yes, using status LED
Power consumption	1.01 W
Additional power dissipation caused by actuators (resistive) [W]	-
Electrical isolation	
Fieldbus - Power supply	Yes
Certifications	
CE	Yes
KC	Yes
UL	cULus E115267 Industrial control equipment
HazLoc	cCSAus 244665 Process control equipment for hazardous locations Class I, Division 2, Groups ABCD, T5
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta = 0 - Max. 60°C FTZÜ 09 ATEX 0083X
GOST-R	Yes
<b>Interfaces</b>	
Type	EtherCAT junction expansion module
Variant	2x RJ45, shielded
Line length	Max. 100 m between 2 stations (segment length)
Transfer rate	100 Mbit/s
Transfer	
Physical layer	100 BASE-TX
Half-duplex	Yes
Full-duplex	Yes
Autonegotiation	Yes
Auto-MDI/MDIX	Yes
Hub propagation delay	See data sheet for X20BC80G3 and X20HB88G0
<b>Operating conditions</b>	
Mounting orientation	
Horizontal	Yes
Vertical	Yes
Installation elevation above sea level	
0 to 2000 m	No limitations
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m
Degree of protection per EN 60529	IP20
<b>Ambient conditions</b>	
Temperature	
Operation	
Horizontal mounting orientation	0 to 55°C
Vertical mounting orientation	0 to 50°C
Derating	-
Storage	-25 to 70°C
Transport	-25 to 70°C
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
<b>Mechanical properties</b>	
Slot	Hub expansion for X20BC80G3 and X20HB88G0

Table 28: X20HB28G0 - Technical data

### 3.6.1.4 LED status indicators

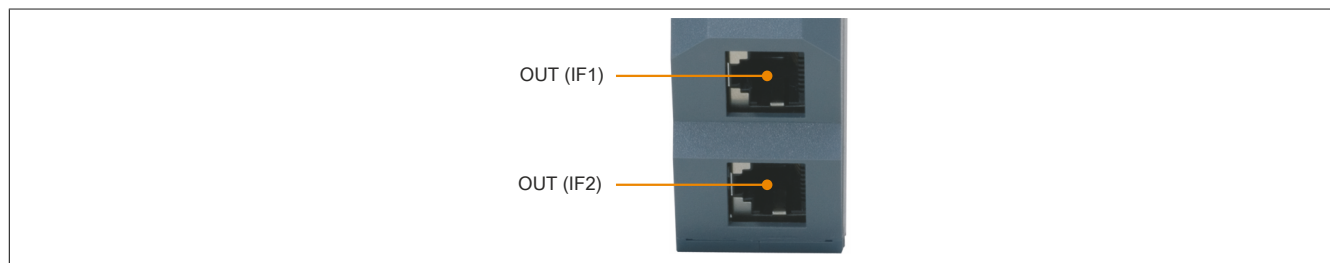
Figure	LED	Color	Status	Description
	RUN	Green	On	Module is active
	L/A OUT	Green	Blinking	The respective LED blinks when Ethernet activity is present (PORT OPEN) on the corresponding interface.
			On	Connection (link) established, however no communication (PORT OPEN).
			Off	No physical Ethernet connection exists (PORT CLOSED).

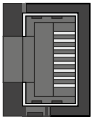
### 3.6.1.5 Operating and connection elements



### 3.6.1.6 Ethernet interface

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



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

# **System modules of the X20 redundancy system**

## **Data sheets**

Version: **1.10 (March 2024)**

Order no.: **System modules of the X20 redundancy  
system**

## 4.1 X20(c)HB2885

### 4.1.1 General information

The X20BC8084 POWERLINK bus controller and the X20HB8884 module are equipped with an integrated link selector function. An additional 1 or 2 slots are available, depending on the bus base used. The active X20HB2885 hub expansion module can be operated in these slots.

The active hub expansion module is equipped with one integrated 2x hub and allows redundant wiring. This means that the connection between the two ports remains intact if there is a failure in the bus controller or Compact Link Selector. The status of the module and network are indicated by LEDs.

- Active hub expansion module
- 2x Fast Ethernet hub for redundant wiring
- Hot-swap-capable

### 4.1.2 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



### 4.1.3 Order data

Order number	Short description	Figure
	<b>System modules for X20 redundancy system</b>	
X20HB2885	X20 hub expansion module, integrated active 2-port hub, 2x RJ45	
X20cHB2885	X20 hub expansion module, coated, integrated active 2-port hub, 2x RJ45	
	<b>Required accessories</b>	
	<b>Expandable bus controllers</b>	
X20BC8084	X20 bus controller, 1 POWERLINK interface, 1x link selector for POWERLINK cable redundancy, supports expansion with active X20 hub modules, 2x RJ45, order bus base, power supply module and terminal block separately!	
X20cBC8084	X20 bus controller, coated, 1 POWERLINK interface, 1x link selector for POWERLINK cable redundancy, supports expansion with active X20 hub modules, 2x RJ45, order bus base, power supply module and terminal block separately!	
	<b>System modules for expandable bus controllers</b>	
X20BB82	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB82	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
	<b>X20 redundancy systems</b>	
X20HB8884	X20 Compact link selector, 2x RJ45, order bus base, power supply module and terminal block separately!	
X20cHB8884	X20 Compact link selector, coated, 2x RJ45, order bus base, power supply module and terminal block separately!	


Table 29: X20HB2885, X20cHB2885 - Order data

## 4.1.4 Technical data

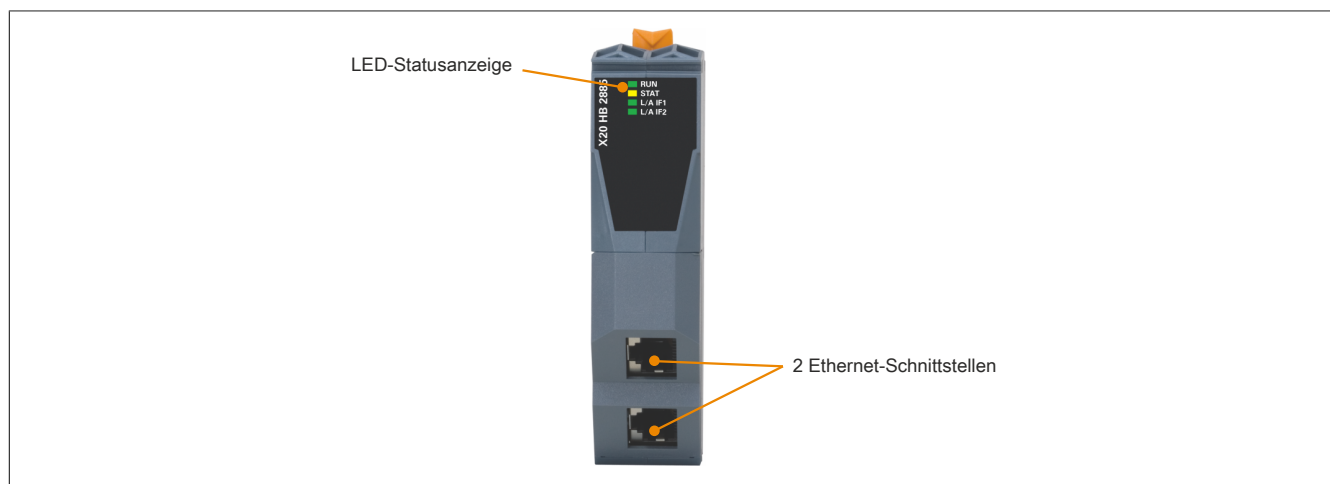
Order number	X20HB2885	X20cHB2885
<b>Short description</b>		
Hub	2 Fast Ethernet hubs for redundant wiring	
<b>General information</b>		
Status indicators	Module status, bus function	
Diagnostics		
Module status	Yes, using status LED	
Bus function	Yes, using status LED	
Power consumption	1.17 W	
Additional power dissipation caused by actuators (resistive) [W]	-	
Certifications		
CE	Yes	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÚ 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	
EAC	Yes	
KC	Yes	-
<b>Interfaces</b>		
Type	Active hub expansion module	
Variant	2x shielded RJ45	
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	No	
Autonegotiation	Yes	
Auto-MDI/MDIX	Yes	
Hub propagation delay	0.96 to 1 µs	
<b>Electrical properties</b>		
Electrical isolation	Power supply isolated from Ethernet (IF1 and IF2)	
<b>Operating conditions</b>		
Mounting orientation		
Horizontal	Yes	
Vertical	Yes	
Installation elevation above sea level		
0 to 2000 m	No limitations	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
Degree of protection per EN 60529	IP20	
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C	
Vertical mounting orientation	-25 to 50°C	
Derating		
Storage	-	
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	
<b>Mechanical properties</b>		
Slot	Hub expansion for X20BC8084 and X20HB8884	Hub expansion for X20cBC8084 and X20cHB8884

Table 30: X20HB2885, X20cHB2885 - Technical data

### 4.1.5 LED status indicators

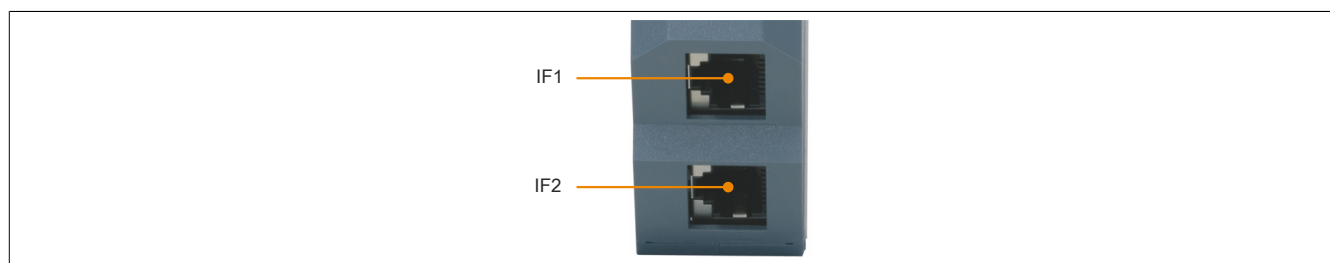
Figure	LED	Color	Status	Description	
	RUN	Red	On	Module inactive. Module is in the reset state.	
		Green	On	Module active	
	STAT	Orange	Off	Off	Normal operation
			Blinking	Off	No X20BC8084 or X20HB8884 found.
			On	On	Normal operation. However, the X20BC8084 or X20HB8884 was inserted after the system had booted.
	L/A IFx	Green	On	On	A link to the remote station has been established.
			Blinking	On	A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus.

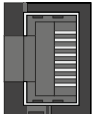
### 4.1.6 Operating and connection elements



### 4.1.7 Ethernet interface

For information about wiring X20 modules with an Ethernet interface, see section "Mechanical and electrical configuration - Wiring guidelines for X20 modules with Ethernet cables" of 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	

## 4.2 X20(c)HB2886

### 4.2.1 General information

The X20BC8084 POWERLINK bus controller and the X20HB8884 module are equipped with an integrated link selector function. An additional 1 or 2 slots are available, depending on the bus base used. The active X20HB2886 hub expansion module can be operated in these slots. Note that the hardware revision of the X20BC8084 and the X20HB8884 must be  $\geq$ E0.

The active hub expansion module is equipped with one integrated 2x hub and allows redundant wiring. This means that the connection between the two 100 Base-FX interfaces remains intact if there is a failure in the bus controller or Compact Link Selector. The Ethernet connection is made using 62.5/125  $\mu$ m or 50/125  $\mu$ m fiber optic multimode cable with a duplex LC connection. The status of the module and network are indicated by LEDs.

- Active hub expansion module
- 2x 100 BASE-FX hub for redundant wiring
- Hot-swap-capable

### 4.2.2 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



### 4.2.3 Order data

Order number	Short description	Figure
	<b>System modules for X20 redundancy system</b>	
X20HB2886	X20 hub expansion module, integrated active 2-port hub, 2 fiber optic interfaces	
X20cHB2886	X20 hub expansion module, coated, integrated active 2-port hub, 2 fiber optic interfaces	
	<b>Required accessories</b>	
	<b>Expandable bus controllers</b>	
X20BC8084	X20 bus controller, 1 POWERLINK interface, 1x link selector for POWERLINK cable redundancy, supports expansion with active X20 hub modules, 2x RJ45, order bus base, power supply module and terminal block separately!	
X20cBC8084	X20 bus controller, coated, 1 POWERLINK interface, 1x link selector for POWERLINK cable redundancy, supports expansion with active X20 hub modules, 2x RJ45, order bus base, power supply module and terminal block separately!	
	<b>System modules for expandable bus controllers</b>	
X20BB82	X20 bus base, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
X20cBB82	X20 bus base, coated, for X20 base module (BC, HB, etc.) and X20 power supply module, with 2 expansion slots for 2 X20 add-on modules (IF, HB, etc.), X20 end cover plates (left and right) X20AC0SL1/X20AC0SR1 included	
	<b>X20 redundancy systems</b>	
X20HB8884	X20 Compact link selector, 2x RJ45, order bus base, power supply module and terminal block separately!	
X20cHB8884	X20 Compact link selector, coated, 2x RJ45, order bus base, power supply module and terminal block separately!	

Table 31: X20HB2886, X20cHB2886 - Order data

## 4.2.4 Technical data

Order number	X20HB2886	X20cHB2886
<b>Short description</b>		
Hub	2 Fast Ethernet interfaces for fiber optic cable for redundant wiring	
<b>General information</b>		
Status indicators	Module status, bus function	
Diagnostics		
Module status	Yes, using status LED	
Bus function	Yes, using status LED	
Power consumption	2.3 W (Rev. <D0: 2.8 W)	
Additional power dissipation caused by actuators (resistive) [W]	-	
<b>Certifications</b>		
CE	Yes	
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÚ 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	
EAC	Yes	
KC	Yes	-
<b>Interfaces</b>		
Type	Active hub expansion module	
Variant	2x duplex LC female	
Transfer rate	100 Mbit/s	
Transfer		
Physical layer	100BASE-FX	
Half-duplex	Yes	
Full-duplex	No	
Autonegotiation	No	
Auto-MDI/MDIX	No	
Hub propagation delay	0.96 to 1 µs	
Wave length	Typ. 1300 nm Rx range: 1270 to 1380 nm Tx range: 1270 to 1380 nm	
Cable fiber type	Multimode fiber with 62.5/125 µm or 50/125 µm core diameter On both sides: Duplex LC male connector	
Optical power budget		
Glass fiber 62.5/125 µm, NA = 0.275	11 dB	
Glass fiber 50/125 µm, NA = 0.200	7.7 dB	
Cable length		
Half-duplex	Max. 400 m between 2 stations (segment length)	
POWERLINK	Max. 2 km between 2 stations (segment length)	
<b>Electrical properties</b>		
Electrical isolation	Power supply isolated from Ethernet (IF1 and IF2)	
<b>Operating conditions</b>		
Mounting orientation		
Horizontal	Yes	
Vertical	Yes	
Installation elevation above sea level		
0 to 2000 m	No limitations	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
Degree of protection per EN 60529	IP20	
<b>Ambient conditions</b>		
Temperature		
Operation		
Horizontal mounting orientation (with ≥2 hubs)	-25 to 50°C (Rev. <D0: 0 to 40°C)	
Vertical mounting orientation (with ≥2 hubs)	-25 to 35°C (Rev. <D0: 0 to 35°C)	
Derating	-	
Storage	-40 to 85°C	
Transport	-40 to 85°C	

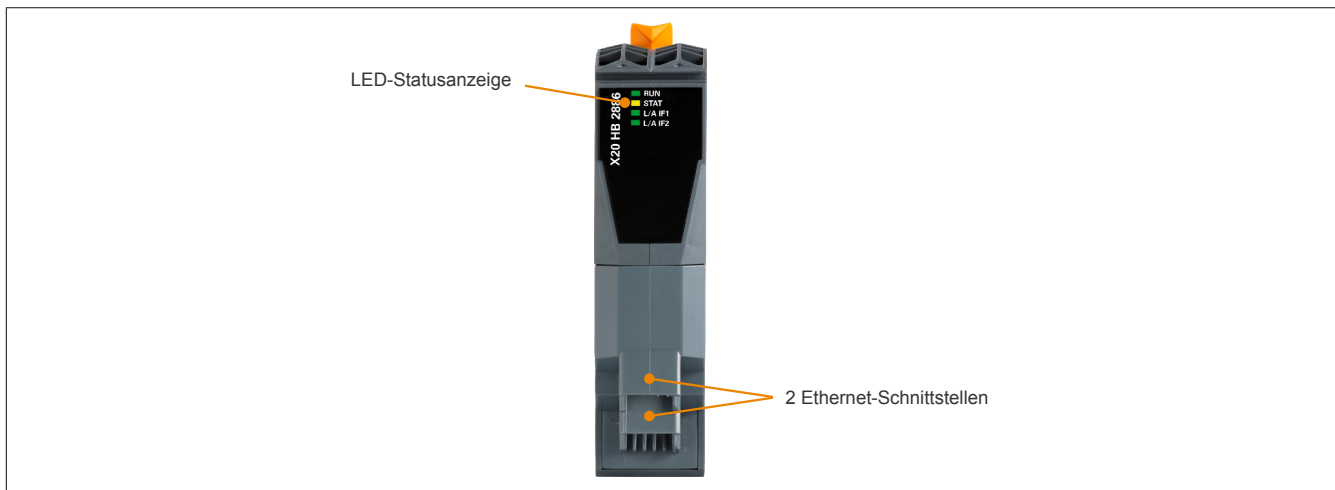
Table 32: X20HB2886, X20cHB2886 - Technical data

Order number	X20HB2886	X20cHB2886
Relative humidity		
Operation	5 to 95%, non-condensing	Up to 100%, condensing
Storage		5 to 95%, non-condensing
Transport		5 to 95%, non-condensing
<b>Mechanical properties</b>		
Slot	Hub expansion for X20BC8084 and X20HB8884 <sup>1)</sup>	Hub expansion for X20cBC8084 and X20cHB8884 <sup>2)</sup>

Table 32: X20HB2886, X20cHB2886 - Technical data

- 1) The hardware revision of X20BC8084 and X20HB8884 must be ≥E0.
- 2) The hardware revision of X20cBC8084 and X20cHB8884 must be ≥E0.

### 4.2.5 Operating and connection elements



#### 4.2.5.1 LED status indicators

Figure	LED	Color	Status	Description	
	RUN	Red	On	Module inactive. Module is in the reset state.	
		Green	On	Module active	
	STAT		Orange	Off	Normal operation
			Blinking		No X20BC8084 or X20HB8884 found.
			On		Normal operation. However, the X20BC8084 or X20HB8884 was inserted after the system had booted.
	L/A IFx	Green	On		A link to the remote station has been established.
			Blinking		A link to the remote station has been established. Indicates Ethernet activity is taking place on the bus.

#### 4.2.5.2 Ethernet interfaces

Figure	Description
	100 BASE-FX, Duplex LC female

##### 4.2.5.2.1 Wiring guidelines for X20 modules with fiber optic cable

The following wiring guidelines must be observed:

- Cable fiber type: Multimode fiber with 62.5/125 µm or 50/125 µm core diameter
- On both sides: Duplex LC male connector
- Observe minimum cable flex radius (see data sheet for the cable)