

X20(c)IF2181-2

Data sheet
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Version history

B&R makes every effort to keep documents as current as possible. The most current versions are available for download on the B&R website (www.br-automation.com).

1 General information

1.1 Other applicable documents

For additional and supplementary information, see the following documents.

Other applicable documents

Document name	Title
MAX20	X20 System user's manual

Additional documentation

Document name	Title
MAREDSYS	Redundancy for control systems

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 Order data

Order number	Short description	Figure
	X20 interface module communication	
X20IF2181-2	X20 interface module, 1x link selector for POWERLINK cable redundancy, POWERLINK functions: - Managing node - Controlled node for iCN operation - Redundant managing node for controller redundancy - Ring redundancy - 2-port hub - Multi ASend - PRC function, 2x RJ45	
X20cIF2181-2	X20 interface module, coated, 1x link selector for POWERLINK cable redundancy, POWERLINK functions: - Managing node - Controlled node for iCN operation - Redundant managing node for controller redundancy - Ring redundancy - 2-port hub - Multi ASend - PRC function, 2x RJ45	

Table 1: X20IF2181-2, X20cIF2181-2 - Order data

Optional accessories

Model number	Short description
X20CA0E61.xxxxx	POWERLINK/Ethernet connection cable, RJ45 to RJ45, 0.2 to 20 m
X20CA0E61.xxxx	POWERLINK/Ethernet connection cable, RJ45 to RJ45, 20 m and longer

1.4 Module description

The interface module is used for application-specific expansion of the X20 controllers. It is equipped with a POWERLINK interface.

The interface has two RJ45 sockets. Both connections lead to an integrated hub. This makes it easy to create daisy-chain connections using POWERLINK.

Functions:

- [POWERLINK](#)
- [Configurable cable and ring redundancy](#)

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 Technical description

2.1 Technical data

Order number	X20IF2181-2	X20cIF2181-2
Short description		
Communication module	1x POWERLINK managing or controlled node	
General information		
B&R ID code	0xC3B3	0xE23A
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	
POWERLINK cable redundancy system	Configurable	
Controller redundancy	Configurable	
Power consumption	2 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) 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 (0 to 55°C) Humidity: B (up to 100%) Vibration: B (4 g) EMC: B (bridge and open deck)	
CCS	Yes	-
LR	ENV1	
KR	Yes	
ABS	Yes	
BV	EC33B Temperature: 5 - 55°C Vibration: 4 g EMC: Bridge and open deck	
KC	Yes	-
Interfaces		
Fieldbus	POWERLINK managing or controlled node	
Type	Type 5 ¹⁾	
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	
Controller	POWERLINK MAC	
Electrical properties		
Electrical isolation	PLC isolated from POWERLINK (X1 and X2)	
Operating conditions		
Mounting orientation		
Horizontal	Yes	
Vertical	Yes	
Installation elevation above sea level		
0 to 2000 m	No limitation	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
Degree of protection per EN 60529	IP20	

Table 2: X20IF2181-2, X20cIF2181-2 - Technical data

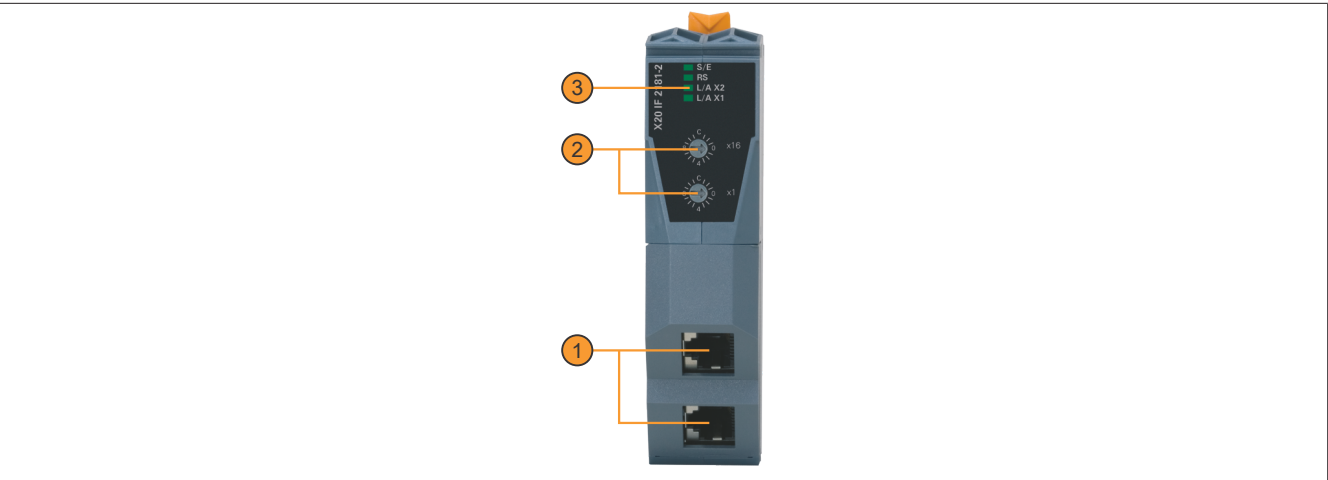
Technical description

Order number	X20IF2181-2		X20cIF2181-2
Ambient conditions			
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		
Mechanical properties			
Slot	In the X20 PLC		In the X20c PLC

Table 2: X20IF2181-2, X20cIF2181-2 - Technical data

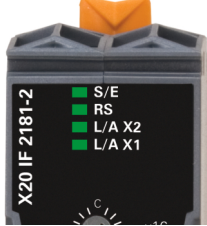
1) For additional information, see section "Communication / POWERLINK / General information / Hardware - IF/LS" in Automation Help.

2.2 Operating and connection elements



1	POWERLINK connection with 2x RJ45 for simple wiring	2	Node number switches
3	LED status indicators	4	-

2.2.1 LED status indicators

Figure	LED	Color	Status	Description
	S/E	Green/Red		Status/Error-LED. Die LED-Status sind im Abschnitt LED "S/E" beschrieben.
	RS	Green	On	Both cable connections are OK.
		Red	On	At least one cable connection is faulty.
	L/A X1/X2	Green	On	A link to the POWERLINK remote station has been established.
			Blinking	A link to the POWERLINK remote station has been established. Indicates Ethernet activity is taking place on the bus

LED "S/E"

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

Ethernet mode

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

Farbe grün - Status	Beschreibung
Ein	Die Schnittstelle wird als Ethernet-Schnittstelle betrieben.

POWERLINK mode

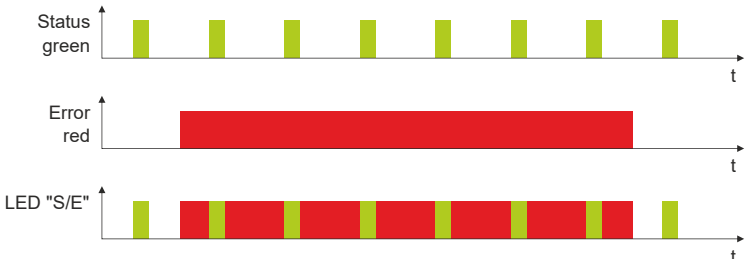
Red - Error	Description
On	The module is in an error mode (failed Ethernet frames, increased number of collisions on the network, etc.). If an error occurs in the following states, then the green LED blinks over the red LED: • PRE_OPERATIONAL_1 • PRE_OPERATIONAL_2 • READY_TO_OPERATE  Note: The LED blinks red several times immediately after startup. This is not an error, however.

Table 3: Status/Error LED as Error LED

Farbe grün - Status	Beschreibung
Aus	Modus Das Modul befindet sich im Modus NOT_ACTIVE oder es ist: • ausgeschaltet • im Hochlauf • in Automation Studio nicht richtig konfiguriert • defekt Managing Node (MN) Der Bus wird auf POWERLINK-Frames überwacht. Wird in dem eingestellten Zeitfenster (Timeout) kein entsprechender Frame empfangen, geht das Modul direkt in den Modus PRE_OPERATIONAL_1 über. Wenn jedoch vor Ablauf der Zeit eine POWERLINK-Kommunikation erkannt wird, wird der MN nicht gestartet. Controlled Node (CN) Der Bus wird auf POWERLINK-Frames überwacht. Wird in dem eingestellten Zeitfenster (Timeout) kein entsprechender Frame empfangen, geht das Modul direkt in den Modus BASIC_ETHERNET über. Wenn jedoch vor Ablauf der Zeit eine POWERLINK-Kommunikation erkannt wird, geht das Modul direkt in den Modus PRE_OPERATIONAL_1 über.
Grün flackernd (ca. 10 Hz)	Modus Das Modul befindet sich im Modus BASIC_ETHERNET. Die Schnittstelle wird als Ethernet-TCP/IP-Schnittstelle betrieben. Managing Node (MN) Dieser Zustand kann nur durch einen Reset des Moduls verlassen werden. Controlled Node (CN) Wird während dieses Zustandes eine POWERLINK-Kommunikation erkannt, geht das Modul in den Zustand PRE_OPERATIONAL_1 über.
Single Flash (ca. 1 Hz)	Modus Das Modul befindet sich im Modus PRE_OPERATIONAL_1. Managing Node (MN) Der MN startet den Betrieb des "reduced cycles". Es findet noch keine zyklische Kommunikation statt. Controlled Node (CN) In diesem Zustand kann das Modul vom MN konfiguriert werden. Der CN wartet auf den Empfang eines SoC Frames und wechselt dann in den Zustand PRE_OPERATIONAL_2. Wenn in diesem Zustand die rote LED leuchtet, heißt das, dass der MN ausgefallen ist.
Single Flash (ca. 1 Hz) Invertiert	Modus Das Modul befindet sich im Modus STANDBY. Dieser Zustand ist nur im Controller-Redundanz Mode möglich. Der POWERLINK Manager wird gerade als Standby Managing Node (SMN) betrieben.

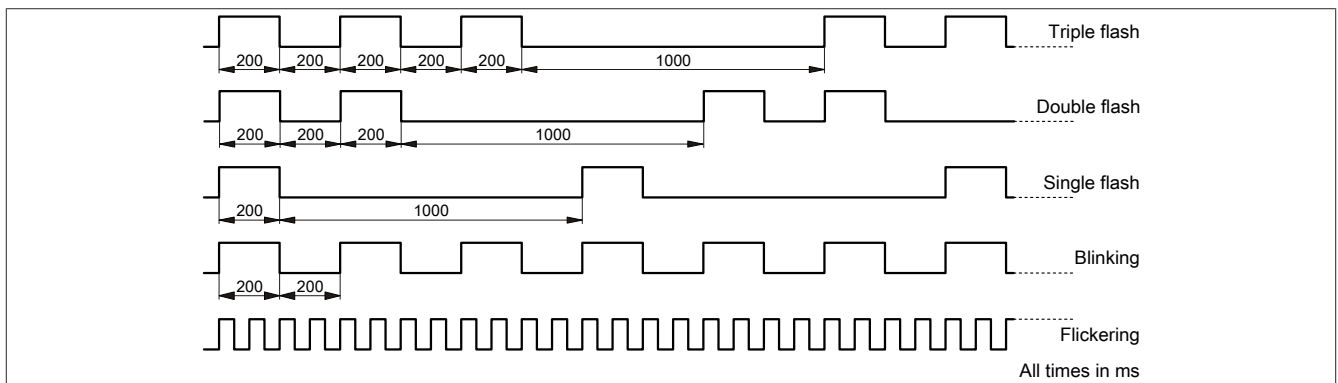
Table 4: Status/Error-LED als Status-LED - Betriebsmodus POWERLINK

Technical description

Farbe grün - Status	Beschreibung
Double Flash (ca. 1 Hz)	Modus Das Modul befindet sich im Modus PRE_OPERATIONAL_2. Managing Node (MN) Der MN beginnt mit der zyklischen Kommunikation (zyklische Eingangsdaten werden noch nicht ausgewertet). In diesem Zustand werden die CNs konfiguriert. Controlled Node (CN) In diesem Zustand kann das Modul vom MN konfiguriert werden. Danach wird per Kommando in den Zustand READY_TO_OPERATE weitergeschaltet. Wenn in diesem Modus die rote LED leuchtet, heißt das, dass der MN ausgefallen ist.
Triple Flash (ca. 1 Hz)	Modus Das Modul befindet sich im Zustand READY_TO_OPERATE. Managing Node (MN) Zyklische und asynchrone Kommunikation. Die empfangenen PDO-Daten werden ignoriert. Controlled Node (CN) Die Konfiguration des Moduls ist abgeschlossen. Normale zyklische und asynchrone Kommunikation. Die gesendeten PDO Daten entsprechen dem PDO-Mapping. Zyklische Daten werden jedoch noch nicht ausgewertet. Wenn in diesem Modus die rote LED leuchtet, heißt das, dass der MN ausgefallen ist.
Ein	Modus Das Modul befindet sich im Modus OPERATIONAL. PDO-Mapping ist aktiv und zyklische Daten werden ausgewertet.
Blinkend (ca. 2,5 Hz)	Modus Das Modul befindet sich im Modus STOPPED. Managing Node (MN) Dieser Zustand ist im MN nicht möglich. Controlled Node (CN) Ausgangsdaten werden nicht ausgegeben und es werden keine Eingangsdaten geliefert. Dieser Modus kann nur durch ein entsprechendes Kommando vom MN erreicht und wieder verlassen werden.

Table 4: Status/Error-LED als Status-LED - Betriebsmodus POWERLINK

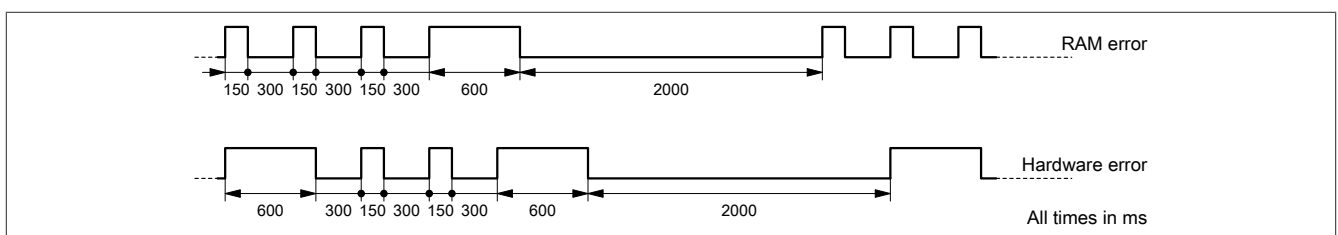
LED status indicators - Blinking patterns



2.2.1.1 System stop error codes

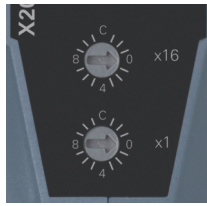
A system stop error can occur due to incorrect configuration or defective hardware.

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



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

2.2.2 POWERLINK node number



The node number for the POWERLINK station is set using the two number switches. The node number can also be directly configured using Automation Studio.

2.2.2.1 POWERLINK V2

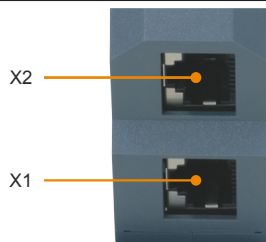
Switch position	Description
0x00	Reserved, switch position not permitted.
0x01 - 0xEF	Node number of POWERLINK station. Operation as controlled node.
0xF0	Operation as managing node.
0xF1 - 0xF7	Reserved, switch position not permitted.
0xF8	Controller redundancy: Function as primary controller
0xF9	Controller redundancy: Function as secondary controller
0xFA - 0xFF	Reserved, switch position not permitted.

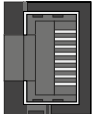
2.2.2.2 Ethernet mode

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

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
	2	RXD\
	3	TXD
	4	Termination
	5	Termination
	6	TXD\
	7	Termination
	8	Termination

3 Function description

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.

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.

When using POWERLINK ring redundancy, multiple nodes are connected within a ring. The ring manager must be inside the ring. In normal operation, the ring manager checks the continuity of the ring. However, it does not forward packets and thus prevents them from circulating endlessly in the ring. If a node or line fails, then the test packets sent from one of the ring manager's connections are not received on its other connection. The ring manager transmits the packets in both directions from now on.



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.

4 Commissioning

4.1 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).