

# **POWERLINK**

## **User's manual**

Version: **2.55 (March 2019)**  
Model no.: **MAPLK-ENG**

### **Translation of the original documentation**

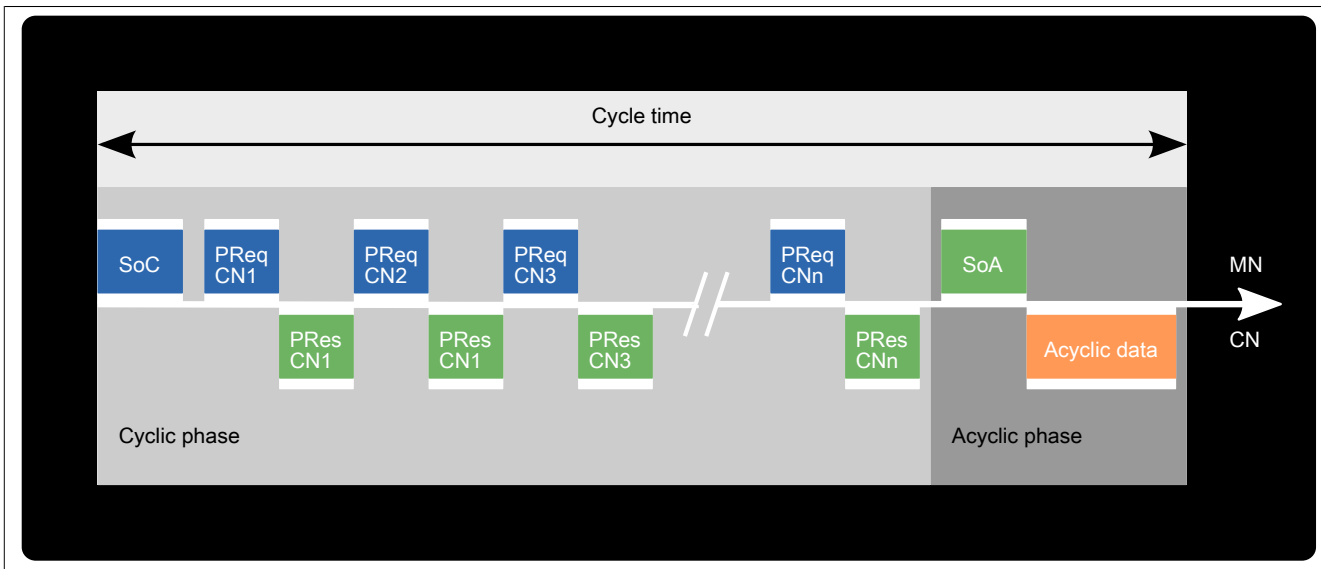
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<b>1 General information.....</b>	<b>4</b>
<b>2 Bus controllers.....</b>	<b>5</b>
2.1 X20 - Order data.....	5
2.2 X67 - Order data.....	6
2.3 X20 - Technical data.....	7
2.4 X67 - Technical data.....	9
2.5 LED status indicators.....	14
2.6 Operating and connection elements.....	15
2.7 POWERLINK node number.....	15
2.8 Dynamic node allocation (DNA).....	16
2.9 Behavior in the event of module failure.....	16
<b>3 Object directory.....</b>	<b>17</b>
3.1 General information.....	17
3.2 Object dictionary areas.....	17
3.3 Communication objects.....	18
3.3.1 Communication objects 0x1000 to 0x1403.....	18
3.3.2 Communication objects 0x1600 to 0x1C0C.....	19
3.3.3 Communication objects 0x1C0D to 0x1F0E.....	20
3.4 Device profile.....	21
3.4.1 Application objects.....	21
3.5 Device profile for B&R bus controllers.....	22
3.5.1 Application objects 0x2000 to 0x2011.....	22
3.5.2 Application objects 0x20A0 to 0x20FF.....	23
3.5.3 Application objects 0x21xx to 0x27xx.....	24
<b>4 Description of B&amp;R device objects.....</b>	<b>25</b>
4.1 X2X_CycleConfig_REC.....	25
4.2 X2X_OutputConfig_REC.....	28
4.3 EEC_Config_REC.....	30
4.4 X2X_IoDataBasic_REC.....	31
4.5 DIA_StatisticErrorCount_REC.....	32
4.6 MOD_CfgCount_U8.....	36
4.7 MOD_SlotCount_U8.....	36
4.8 MOD_ActCount_U8.....	36
4.9 NMT_ChildIdentData_ADOM.....	36
4.10 PDL_DownloadChildProgData_ADOM.....	37
4.11 MOD_NetworkStatus_AU64.....	38
4.12 IO_MultiScan_DOM.....	38
4.13 BC_Internal_REC.....	38
4.14 DUMMY_MapObjects_AU8.....	45
4.15 DUMMY_ProtocolTest_REC.....	45
4.16 MOD_Config_xhx_REC.....	46
<b>5 Configuration examples.....</b>	<b>54</b>
5.1 Resetting the bus controller.....	54
5.2 Saving the configuration.....	54
5.3 Configuring the bus controller in accordance with DS401.....	54
5.4 Configuring the bus controller in accordance with the B&R device profile.....	55

# 1 General information

POWERLINK is a real-time capable Ethernet-based fieldbus. Originally developed by B&R, the POWERLINK specification is now being further developed by the Ethernet POWERLINK Standardization Group (EPSCG). The protocol specification is open source and accessible to all<sup>1)</sup>. In addition to expanding the IEEE 802.3 Ethernet standard by adding a deterministic access method, POWERLINK also defines a fieldbus interface compatible with CANopen. Like CANopen, POWERLINK differentiates between process and service data. Process data objects (PDOs) are exchanged cyclically in the cyclic phase, while service data objects (SDOs) are transferred acyclically. Service data objects are transmitted in the acyclic phases of POWERLINK with the help of a connection-oriented protocol (see figure). The cyclic transfer of data in PDOs is enabled by what is known as mapping.



<sup>1)</sup> Ethernet POWERLINK Standardization Group: Ethernet POWERLINK Communication Profile Specification DS301 V1.1.0, 2009 [www.ethernet-powerlink.org](http://www.ethernet-powerlink.org).

## 2 Bus controllers

B&R bus controllers for POWERLINK make it possible to connect X2X Link I/O nodes to a POWERLINK network.

### 2.1 X20 - Order data

Model number	Short description	Figure
	<b>Bus controllers</b>	
X20BC0083	X20 bus controller, 1 POWERLINK interface, integrated 2-port hub, 2x RJ45, bus base, order power supply module and terminal block separately!	
	<b>Expandable bus controllers</b>	
X20BC1083	X20 bus controller, 1 POWERLINK interface, integrated 2-port hub, supports X20 interface module expansions, 2 RJ45, order bus base, power supply module and terminal block separately	
X20BC8083	X20 bus controller, 1 POWERLINK interface, integrated 2-port hub, supports expansion with X20 hub modules, 2 RJ45, order bus base, power supply module and terminal block separately.	
X20BC8084	X20 bus controller, 1 POWERLINK interface, 1x link selector for POWERLINK cable redundancy, supports expansion with active X20 hub modules, 2 RJ45, order bus base, power supply module and terminal block separately.	
	<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 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	
X20PS9402	X20 power supply module, for bus controller and internal I/O power supply, X2X Link power supply, supply not electrically isolated	
	<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 an X20 add-on module (IF, HB, etc.), X20 locking 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 locking 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>System modules for X20 redundancy systems</b>	
X20HB2885	X20 hub expansion module, integrated active 2-port hub, 2x RJ45	
X20HB2886	X20 hub expansion module, integrated active 2-port hub, 2 fiber optic interfaces	
	<b>System modules for expandable bus controllers</b>	
X20IF1091-1	X20 interface module, for expandable bus controller, 1 X2X Link master interface, electrically isolated, order 1x TB704 terminal block separately	
	<b>System modules for the X20 hub system</b>	
X20HB1881	X20 hub expansion module, integrated 1-port hub, for multimode fiber optic cable	
X20HB1882	X20 hub expansion module, integrated 1-port hub, for monomode fiber optic cable	
X20HB2880	X20 hub expansion module, integrated 2-port hub, 2x RJ45	
X20HB2881	X20 hub expansion module, integrated 2-port hub, for fiber optic cable	
	<b>X20 interface module communication</b>	
X20IF1041-1	X20 interface module, for DTM configuration, 1 CANopen master interface, electrically isolated, order 1x TB2105 terminal block separately	
X20IF1043-1	X20 interface module, for DTM configuration, 1 CANopen slave interface, electrically isolated, order 1x TB2105 terminal block separately	
X20IF1051-1	X20 interface module, for DTM configuration, 1 DeviceNet scanner (master) interface, electrically isolated, order 1x terminal block TB2105 separately!	

Table 1: X20BC0083, X20BC1083, X20BC8083, X20BC8084 - Order data

## Bus controllers

Model number	Short description	Figure
X20IF1053-1	X20 interface module, for DTM configuration, 1 DeviceNet adapter (slave) interface, electrically isolated, order 1x terminal block TB2105 separately!	
X20IF1061-1	X20 interface module for DTM configuration, 1 PROFIBUS DP V0/V1 master interface, electrically isolated	
X20IF1063-1	X20 interface module, for DTM configuration, 1 PROFIBUS DP V1 slave interface, electrically isolated	
X20IF1083-1	X20 interface - POWERLINK controlled node (slave)	
X20IF10A1-1	X20 interface module, for DTM configuration, 1 ASi master interface, electrically isolated, order 1x TB704 terminal block separately	
X20IF10D1-1	X20 interface module, for DTM configuration, 1 EtherNet/IP scanner (master) interface, electrically isolated	
X20IF10D3-1	X20 interface module, for DTM configuration, 1 EtherNet/IP adapter (slave) interface, electrically isolated	
X20IF10E1-1	X20 interface module for DTM configuration, 1 PROFINET RT controller (master) interface, electrically isolated	
X20IF10E3-1	X20 interface module, for DTM configuration, 1 PROFINET RT device (slave) interface, electrically isolated	
X20IF10G3-1	X20 interface module for DTM configuration, 1 EtherCAT slave interface, electrically isolated	
X20IF10H3-1	X20 interface module for DTM configuration, 1 Sercos III slave interface, electrically isolated	

Table 1: X20BC0083, X20BC1083, X20BC8083, X20BC8084 - Order data

## 2.2 X67 - Order data


Model number	Short description	Figure
	<b>Bus controller modules</b>	
X67BC8331	X67 bus controller, 1 POWERLINK interface, X2X Link power supply 3 W, 8 digital channels configurable as inputs or outputs, 24 VDC, 2 A, configurable input filter	
X67BC8321-1	X67 bus controller, 1 POWERLINK interface, X2X Link power supply 3 W, 8 digital channels configurable as inputs or outputs, 24 VDC, 0.5 A, configurable input filter, 2 event counters 50 kHz	
X67BC8321.L12	X67 bus controller, 1 POWERLINK interface, X2X Link power supply 15 W, 16 digital channels configurable as inputs or outputs, 24 VDC, 0.5 A, configurable input filter, 2 event counters 50 kHz, M12 connectors, high-density module	
X67BC8513.L12	X67 bus controller, 1 POWERLINK interface, X2X Link power supply 15 W, 12 digital channels configurable as inputs or outputs, 24 VDC, 0.5 A, configurable input filter, 1 event counters 50 kHz, 1 analog input 0 to 20 mA, 12-bit, M12 connectors, high-density module	
X67BC81RT.L12	X67 bus controller, 2 POWERLINK interfaces, X2X Link power supply 15 W, reACTION Technology module, 2 digital inputs, 24 VDC, <1 μs, 3 digital channels, 5 VDC, <1 μs, configurable as inputs or outputs, 2 digital channels, 24 VDC, 0.4 A, <1 μs, configurable as inputs or outputs, 2 analog inputs ±10 V, 5 μs 200 kHz sampling frequency, 13-bit converter resolution (including sign), configurable input filter, 1 analog output ±10 V, 2.5 μs, 13-bit converter resolution (including sign), M12 connectors, high-density module	

Table 2: X67BC8331, X67BC8321-1, X67BC8321.L12, X67BC8513.L12, X67BC81RT.L12 - Order data

## 2.3 X20 - Technical data

Product ID	X20BC0083	X20BC1083	X20BC8083	X20BC8084
<b>Short description</b>				
Bus controller	POWERLINK (V1/V2) controlled node	POWERLINK (V1/V2) controlled node with up to 2 slots for interface modules	POWERLINK (V1/V2) controlled node with up to 2 slots for hub expansion modules	POWERLINK (V1/V2) controlled node with compact link selector
<b>General information</b>				
B&R ID code	0x1F1E	0x2268	0x2673	0x2674
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				
Bus	2 W			
Additional power dissipation caused by actuators (resistive) [W]	-			
Certifications				
CE	Yes			
KC	Yes			
EAC	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 (see X20 user's manual) FTZÜ 09 ATEX 0083X			
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			
<b>Interfaces</b>				
Fieldbus	POWERLINK (V1/V2) controlled node			
Type	Type 2 <sup>1)</sup>			
Variant	2x shielded RJ45 (hub)			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			
Min. cycle time <sup>2)</sup>				
Fieldbus	200 µs			
X2X Link	200 µs			
Synchronization between bus systems possible	Yes			
Cyclic data				
Input data	-	Max. 1488 bytes	-	-
Output data	-	Max. 1488 bytes	-	-
<b>Electrical properties</b>				
Electrical isolation	POWERLINK isolated from bus and I/O			
<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			

Table 3: X20BC0083, X20BC1083, X20BC8083, X20BC8084 - Technical data

## Bus controllers

Product ID	X20BC0083	X20BC1083	X20BC8083	X20BC8084
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 terminal block 1x X20TB12 separately Order 1x power supply module X20PS9400 or X20PS9402 separately Order 1x bus base X20BB80 separately	Order 1x X20TB12 terminal block separately Order 1x X20PS9400 or X20PS9402 power supply module separately Order 1x X20BB81 or X20BB82 bus base separately	Order 1x X20TB12 terminal block separately Order 1x X20PS9400 or X20PS9402 power supply module separately Order 1x X20BB8x bus base separately	Order 1x X20TB12 terminal block separately Order 1x X20PS9400 or X20PS9402 power supply module separately Order 1x X20BB80 or X20BB82 bus base separately
Spacing <sup>3)</sup>	37.5 <sup>+0.2</sup> mm	-		
Spacing <sup>4)</sup>	-		37.5 <sup>+0.2</sup> mm	
X20BB80	-	62.5 <sup>+0.2</sup> mm		-
X20BB81	-	62.5 <sup>+0.2</sup> mm		-
X20BB82	-	87.5 <sup>+0.2</sup> mm		

Table 3: X20BC0083, X20BC1083, X20BC8083, X20BC8084 - Technical data

- 1) See Automation Help under "Communication / POWERLINK / General information / Hardware - CN" for more information.
- 2) The minimum cycle time defines how far the bus cycle can be reduced without communication errors occurring.
- 3) Spacing is based on the width of bus base X20BB80. In addition, power supply module X20PS9400 or X20PS9402 is always required for the bus controller.
- 4) Spacing is based on the width of the X20BB81 or X20BB82 bus base. Up to 2 interfaces modules and 1 X20PS9400 or X20PS9402 supply module are also always required for the bus controller.



## 2.4 X67 - Technical data

Product ID	X67BC8331	X67BC8321-1	X67BC8321.L12	X67BC8513.L12	X67BC81RT.L12
<b>Short description</b>					
Bus controller	POWERLINK (V1/V2) controlled node				
<b>General information</b>					
Inputs/Outputs	8 digital channels, configurable as inputs or outputs using software, inputs with additional functions	16 digital channels, configurable as inputs or outputs using software, inputs with additional functions	12 digital channels (configurable as inputs or outputs using software, inputs with additional functions), 1 analog channel	4 digital inputs, 2 digital channels, configurable as inputs or outputs using software, 2 analog inputs, 1 analog output, 1 ABR input, also usable as 5 V differential inputs/outputs, inputs with special function	
Isolation voltage between channel and bus	500 V <sub>Eff</sub>				
Nominal voltage	24 VDC				
<b>B&amp;R ID code</b>					
Bus controller	0xA7A5	0x1E37	0xA90E	0xB3AC	0xE2DC
Internal I/O module	0x1311		0x1A1D	0xB3CD	0xE2DF
Sensor/Actuator power supply	0.5 A summation current				-
Status indicators	I/O function for each channel, supply voltage, bus function				
<b>Diagnostics</b>					
Outputs	Yes, using status LED and software				
I/O power supply	Yes, using status LED and software				
reACTION-capable I/O channels	-				Yes
<b>Connection type</b>					
Fieldbus	M12 D-keyed				M12, D-keyed
X2X Link	M12, B-keyed				
Inputs/Outputs	8x M8, 3-pin	8x M12, A-keyed			M12, 5-pin, A-keyed
Encoder	-				M12, 12-pin, A-keyed
I/O power supply	M8, 4-pin				
Power output	3 W X2X Link power supply for I/O modules		15 W X2X Link supply for I/O modules		
<b>Power consumption</b>					
Fieldbus	3.5 W		4.2 W	2.5 W	4.6 W
Internal I/O	3.8 W	2.5 W		0.6 W	6 W
X2X Link power supply	4.2 W at maximum power output for connected I/O modules		24.3 W at maximum power output for connected I/O modules	17.25 W at maximum power output for connected I/O modules	19.6 W at maximum power output for connected I/O modules
<b>Application memory</b>					
Type	-				16 Mbit flash memory
Data retention	-				20 years at 55°C
Guaranteed erase/write cycles	-				100,000
<b>Certifications</b>					
CE	Yes				
KC	Yes				-
EAC	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 IIA T5 Gc IP67, Ta = 0 - Max. 60°C TÜV 05 ATEX 7201X				
<b>Interfaces</b>					
Fieldbus	POWERLINK (V1/V2) controlled node				
Type	Type 2 <sup>1)</sup>				-
Variant	M12 interface (female connector on module)	2x M12 interface (hub), 2x female connector on module			2x M12 circular connector (hub), 2x female connector on module
Line length	Max. 100 m between 2 stations (segment length)				
Transfer rate	100 Mbit/s				
<b>Transfer</b>					
Physical layer	100BASE-TX				
Half-duplex	Yes				
Full-duplex	No				
Autonegotiation	Yes				
Auto-MDI / MDIX	Yes				
Hub propagation delay	-		0.96 to 1 µs		

Table 4: X67BC8331, X67BC8321-1, X67BC8321.L12, X67BC8513.L12, X67BC81RT.L12 - Technical data

## Bus controllers

Product ID	X67BC8331	X67BC8321-1	X67BC8321.L12	X67BC8513.L12	X67BC81RT.L12
Min. cycle time <sup>2)</sup>					
Fieldbus			200 µs		
X2X Link			200 µs		
Synchronization between bus systems possible			Yes		
<b>Encoder power supply connector 8</b>					
5 VDC		-			Module-internal, max. 0.3 A summation current
24 VDC		-			Module-internal, max. 0.5 A summation current
<b>I/O power supply</b>					
Nominal voltage			24 VDC		
Voltage range			18 to 30 VDC		
Integrated protection			Reverse polarity protection		
Power consumption					
Sensor/Actuator power supply			Max. 12 W <sup>3)</sup>		
<b>Sensor/Actuator power supply</b>					
Voltage			I/O power supply minus voltage drop for short circuit protection		
Voltage drop for short-circuit protection at 0.5 A			Max. 2 VDC		
Summation current			Max. 0.5 A		
Short-circuit proof			Yes		
<b>Digital inputs</b>					
Input voltage			18 to 30 VDC		-
Input current at 24 VDC			Typ. 4 mA		-
Input characteristics per EN 61131-2			Type 1		-
Input filter					
Hardware		≤10 µs (channels 1 to 4) / ≤70 µs (channels 5 to 8)	≤10 µs (channels 1 to 4) / ≤70 µs (channels 5 to 16)	≤10 µs (channels 1 to 4) / ≤70 µs (channels 5 to 12)	-
Software		Default 0 ms, configurable between 0 and 25 ms in 0.2 ms intervals			-
Input circuit			Sink		-
Additional functions	-		50 kHz event counting, gate measurement		-
Input resistance			Typ. 6 kΩ		-
Switching threshold					
Low			<5 VDC		-
High			>15 VDC		-
<b>ABR incremental encoder</b>					
Quantity			-		1
Encoder inputs			-		DI 5 to DI 7, 5 V, symmetrical DI 1 to DI 4 and DI 8 to DI 9, 24 V, asymmetrical
Counter size			-		32-bit
Input frequency			-		DI 1 to DI 7: 250 kHz DI 8 and DI 9: 100 kHz
Evaluation			-		4x
Encoder power supply			-		5 V: Module-internal, max. 0.3 A 24 V: Module-internal, max. 0.5 A
Overload characteristics of encoder power supply			-		Short circuit protection, overload protection
<b>Digital inputs 5 VDC</b>					
Nominal voltage			-		5 VDC
Input circuit			-		Differential
Isolation voltage between encoder and bus			-		500 V <sub>eff</sub>
Input filter					
Hardware			-		No input filter
Software			-		Default 200 ns, configurable between 200 ns and 5 ms in 20 ns intervals
<b>Digital inputs 24 VDC</b>					
Nominal voltage			-		24 VDC
Input characteristics per EN 61131-2			-		Type 1 <sup>4)</sup>
Input circuit			-		Sink
Input voltage			-		24 VDC -15/+20%

Table 4: X67BC8331, X67BC8321-1, X67BC8321.L12, X67BC8513.L12, X67BC81RT.L12 - Technical data

Product ID	X67BC8331	X67BC8321-1	X67BC8321.L12	X67BC8513.L12	X67BC81RT.L12
Input current at 24 VDC					
Channel 1 and 2		-			Typ. 9 mA
Channel 3 and 4		-			Typ. 3 mA
Channel 8 and 9		-			Typ. 1 mA
Input resistance					
Channel 1 and 2		-			Typ. 3 k $\Omega$
Channel 3 and 4		-			Typ. 8 k $\Omega$
Channel 8 and 9		-			Typ. 40 k $\Omega$
Sensor power supply		-			0.5 A summation current
Isolation voltage between channel and bus		-			500 V <sub>eff</sub>
Input filter					
Hardware		-			≤50 ns
Software		-			Default 200 ns, configurable between 200 ns and 5 ms in 20 ns intervals
Switching threshold					
Low		-			<5 VDC
High		-			<15 VDC
<b>Event counter</b>					
Quantity	-	2	1	-	-
Signal form	-	Square wave pulse		-	-
Evaluation	-	Each falling edge, cyclic counter		-	-
Input frequency	-	Max. 50 kHz		-	-
Counter 1	-	Input 1		-	-
Counter 2	-	Input 3		-	-
Counter frequency	-	Max. 50 kHz		-	-
Counter size	-	16-bit		-	-
<b>Gate measurement</b>					
Quantity	-	1		-	-
Signal form	-	Square wave pulse		-	-
Evaluation	-	Rising edge - Falling edge		-	-
Counter frequency					
Internal	-	48 MHz, 3 MHz, 187.5 kHz		-	-
Counter size	-	16-bit		-	-
Length of pause between pulses	-	≥100 $\mu$ s		-	-
Pulse length	-	≥20 $\mu$ s		-	-
Supported inputs	-	Input 2 or input 4		Input 2	-
<b>Analog inputs</b>					
Input	-			0 to 20 mA	±10 V
Input type	-			Differential input	Single-ended
Digital converter resolution	-			12-bit	
Conversion time	-			200 $\mu$ s	5 $\mu$ s for both inputs
Output format	-			INT	
Output format					
Current	-			0x0000 - 0x7FFF / 1 LSB = 0x0008 = 4.883 $\mu$ A	-
Load	-			<300 $\Omega$	-
Input protection	-			Protection against wiring with supply voltage	
Open-circuit detection	-			Yes, using software	
Reverse polarity protection	-			Yes	
Permissible input signal	-			Max. ±30 mA	±30 V
Output of digital value during overload					
Undershoot	-			0x0000	0x8001
Overshoot	-			0x7FFF	
Conversion procedure	-			Successive approximation	
Max. error at 25°C					
Gain	-			0.1% <sup>(5)</sup>	0.1% <sup>(6)</sup>
Offset	-			0.05% <sup>(7)</sup>	0.05% <sup>(8)</sup>
Max. drift at 25°C					
Gain	-			0.01 %/°C <sup>(6)</sup>	
Offset	-			0.0075% / °C <sup>(8)</sup>	
Max. gain drift	-			0.013 %/°C <sup>(5)</sup>	
Max. offset drift	-			0.02%/°C <sup>(7)</sup>	
Common-mode rejection					
DC	-			>50 dB	-
50 Hz	-			>50 dB	-
Common-mode range	-			±2 V	-
Crosstalk between channels	-			>70 dB	-70 dB
Nonlinearity	-			<0.1% <sup>(7)</sup>	<0.0062% <sup>(8)</sup>

Table 4: X67BC8331, X67BC8321-1, X67BC8321.L12, X67BC8513.L12, X67BC81RT.L12 - Technical data

## Bus controllers

Product ID	X67BC8331	X67BC8321-1	X67BC8321.L12	X67BC8513.L12	X67BC81RT.L12
Isolation voltage between channel and bus	-				500 V <sub>eff</sub> , 1 min
Isolation voltage between input and bus	-			500 V <sub>Eff</sub>	-
Voltage drop at 20 mA	-			Typ. 4.5 V	-
Input filter					
Cutoff frequency	-			1 kHz	-
Slope	-			40 dB	-
<b>Digital outputs</b>					
Variant	FET positive switching				-
Switching voltage	I/O power supply minus residual voltage				-
Nominal output current	2 A	0.5 A			-
Total nominal current	8 A	4 A	8 A		-
Output circuit	Source				-
Output protection	Thermal cutoff for overcurrent and short circuit, integrated protection for switching inductances, reverse polarity protection for output power supply				-
Diagnostic status	Output monitoring with 10 ms delay				-
Leakage current when switched off	5 µA				-
Switching on after overload shutdown	Approx. 10 ms (depends on the module temperature)				-
R <sub>DS(on)</sub>	-			150 mΩ	-
Residual voltage	<0.5 V at 2 A nominal current	<0.3 V at 0.5 A rated current			-
Peak short-circuit current	<21 A	<12 A			-
Switching delay					
0 → 1	<250 µs	<400 µs			-
1 → 0	<270 µs	<400 µs			-
Switching frequency					
Resistive load	Max. 100 Hz				-
Inductive load	See section "Switching inductive loads"				-
Braking voltage when switching off inductive loads	50 VDC				-
<b>Digital outputs 5 VDC</b>					
Output protection	-				Short circuit protection
Variant	-				Differential
Nominal voltage	-				5 VDC
Output current	-				Max. 65 mA <sup>9)</sup>
Diagnostic status	-				Output monitoring
Switching frequency	-				Max. 500 kHz
<b>Digital outputs 24 VDC</b>					
Nominal voltage	-				24 VDC
Nominal output current	-				0.4 A
Variant	-				Push/Pull
Output protection	-				Thermal cutoff if overcurrent or short circuit occurs
Braking voltage when switching off inductive loads	-				50 VDC
Diagnostic status	-				Overload monitoring
Switch-on in the event of overload shutdown or short-circuit shutdown	-				Approx. 25 ms
Peak short-circuit current	-				<1 A
Switching voltage	-				24 VDC (-15/+20%)
Switching frequency					
Resistive load	-				Max. 100 kHz
Inductive load	-				Max. 100 kHz
Switching delay					
0 → 1	-				<1 µs
1 → 0	-				<1 µs
Isolation voltage between channel and bus	-				500 V <sub>eff</sub>
<b>Analog outputs</b>					
Output	-				±10 V
Digital converter resolution	-				12-bit
Conversion time	-				2 µs
Settling time for output changes over entire range	-				2.5 µs
Switch on/off behavior	-				Internal enable relay for startup
Max. error at 25°C					
Gain	-				0.15% <sup>6)</sup>
Offset	-				0.05% <sup>8)</sup>
Output protection	-				Short circuit protection
Output format	-				Example: INT 0x8001 - 0x7FFF / 1 LSB = 0x0010 = 4.882 mV



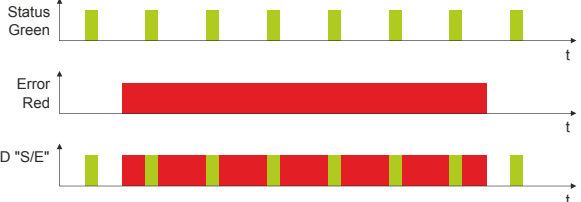
Table 4: X67BC8331, X67BC8321-1, X67BC8321.L12, X67BC8513.L12, X67BC81RT.L12 - Technical data

Product ID	X67BC8331	X67BC8321-1	X67BC8321.L12	X67BC8513.L12	X67BC81RT.L12
Load per channel			-		Max. $\pm 10$ mA, load $\geq 1$ k $\Omega$
Output filter			-		1st-order low pass / cutoff frequency 2.5 kHz
Max. gain drift			-		0.012%/°C <sup>6)</sup>
Max. offset drift			-		0.001 %/°C <sup>8)</sup>
Error caused by load change			-		Max. 0.01%, from 10 M $\Omega$ -> 1 k $\Omega$ , resistive
Nonlinearity			-		<0.15% <sup>8)</sup>
Isolation voltage between channel and bus			-		500 V <sub>eff</sub> , 1 min
Output response when power supply is switched on/off			-		An enable relay is switched on at a defined value $\neq 0$ , default setting = 10 k $\Omega$ to GND
Short-circuit proof					
Current limiting			-		$\pm 40$ mA
To actuator or I/O power supply			-		Yes
To GND			-		Yes
Max. error at 25°C and 10 k $\Omega$ load					
Gain			-		0.15%
Offset			-		0.05%
<b>Electrical properties</b>					
Electrical isolation	Bus isolated from POWERLINK and channel Channel not isolated from channel				
<b>Operating conditions</b>					
Mounting orientation					
Any	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	IP67				
<b>Ambient conditions</b>					
Temperature					
Operation	-25 to 60°C				
Derating	See section "Derating"				-
Storage	-40 to 85°C				
Transport	-40 to 85°C				
<b>Mechanical properties</b>					
Dimensions					
Width	53 mm				
Height	85 mm			155 mm	
Depth	42 mm				
Weight	200 g	195 g	350 g	360 g	320 g
Torque for connections					
M8	Max. 0.4 Nm				
M12	Max. 0.6 Nm				

Table 4: X67BC8331, X67BC8321-1, X67BC8321.L12, X67BC8513.L12, X67BC81RT.L12 - Technical data

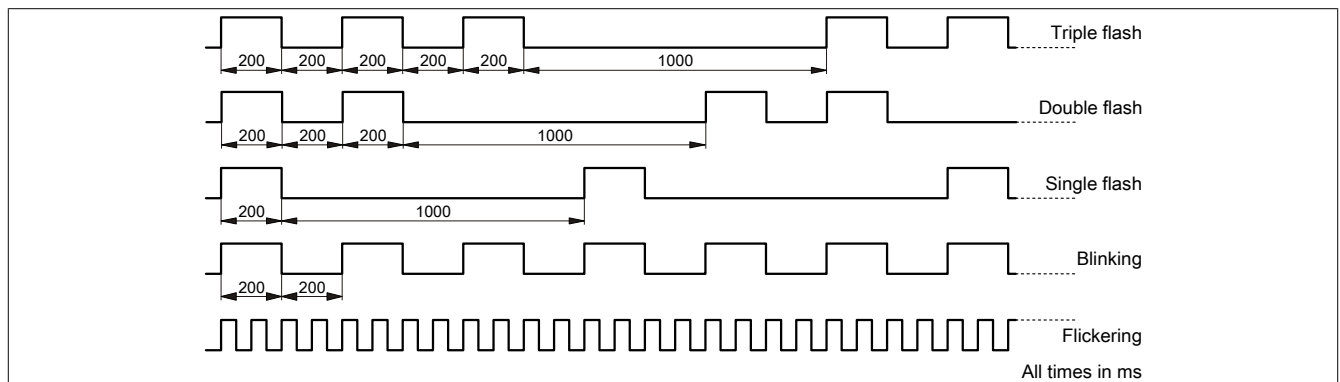
- 1) See Automation Help under "Communication / POWERLINK / General information / Hardware - CN" for more information.
- 2) The minimum cycle time defines how far the bus cycle can be reduced without communication errors occurring.
- 3) The power consumption of the sensors and actuators connected to the module is not permitted to exceed 12 W.
- 4) Only channels 1 to 4
- 5) Based on the current measured value.
- 6) Based on the current output value.
- 7) Based on the entire measurement range.
- 8) Based on the total output value.
- 9) For differential output voltage depending on the output current, see section "Differential output"

## 2.5 LED status indicators

Figure	LED	Color	Status	Description
 <p><b>X20</b></p> <p>S/E L/A IF1 L/A IF2</p>  <p><b>X67</b></p> <p>Status indicator 1: Left: Green, Right: Red</p> <p>Status indicator 2: Left: Green, Right: Red</p>	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 seconds after a restart. Communication is not possible with the CN. If no POWERLINK communication is detected during these 5 seconds, the CN enters state BASIC_ETHERNET (flickering). If POWERLINK communication is detected before this time expires, however, the CN immediately enters 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, etc.) If communication POWERLINK is detected in this state, the CN switches to PRE_OPERATIONAL_1.
			Single flash	Mode PRE_OPERATIONAL_1. When operating on a POWERLINK V1 manager, the CN switches directly to PRE_OPERATIONAL_2. When operated on a POWERLINK V2 manager, the CN waits until an SoC frame is received and then switches to the PRE_OPERATIONAL_2 state.
			Double flash	Mode PRE_OPERATIONAL_2. The CN is normally configured by the manager in this state. It is then switched to state READY_TO_OPERATE by command (POWERLINK V2) or by setting the "data valid" flag in the output data (POWERLINK V1).
			Triple flash	Mode READY_TO_OPERATE. In network POWERLINK V1, the CN switches automatically to OPERATIONAL as soon as input data is present. In a POWERLINK V2 network, the manager switches to the OPERATIONAL state by issuing a command.
			On	Mode OPERATIONAL. The 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.
			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, then the green LED blinks over the red 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 is lit red for CNs with configured physical node number 0 but that have not yet been assigned a node number via dynamic node allocation (DNA).</li> </ul>
			L/A IFx	Green
		Blinking	A link to the remote station has been established and there is activity on bus.	

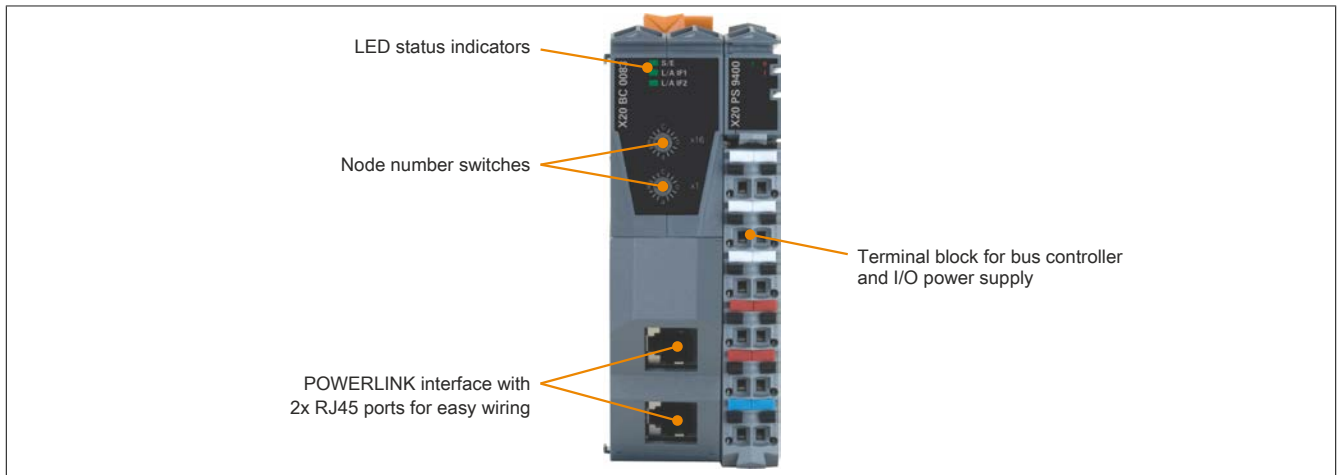
1) The Status/Error LED "S/E" is a green/red dual LED.

### LED status indicators - Blink times

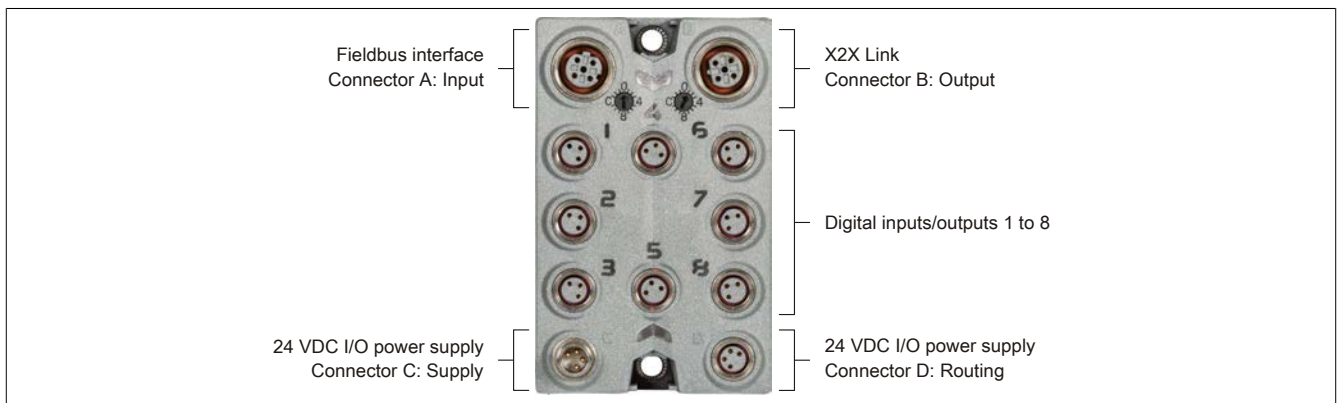


## 2.6 Operating and connection elements

### X20



### X67

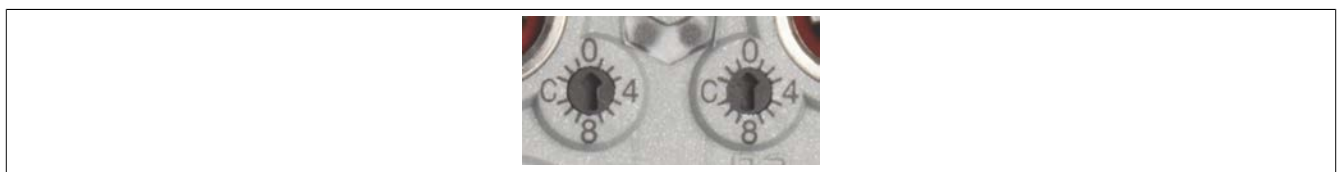


## 2.7 POWERLINK node number

### X20



### X67



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.
0xF0 - 0xFF	Reserved, switch position not permitted.

## 2.8 Dynamic node allocation (DNA)

Most POWERLINK bus controllers have the ability to dynamically assign node numbers. This has the following advantages:

- No setting of the node number switch
- Easier installation
- Reduced error sources

For information regarding configuration as well as an example, see Automation Help → Communication → POWERLINK → General information → Dynamic node allocation (DNA)

### Information:

Interface IF1 must always be used as the input from the preceding node.

## 2.9 Behavior in the event of module failure

If an I/O module connected to the bus controller fails, the following states occur:

- **Module data:** The data of the I/O module is frozen to the last valid value. It is updated again as soon as the module is available again.
- **StaleData:** Set to "1" as soon as no data has been transmitted from the module for at least one cycle. Switches back to "0" as soon as new data is available from the module.
- **ModuleOK:** Only set to "0" if the bus controller has reset the module internally. This can be delayed up to a few milliseconds.

For high-speed evaluation of the I/O module state, bit StaleData and bit ModuleOK must both be observed.



## 3 Object directory

---

### 3.1 General information

POWERLINK specifies a CANopen-compatible object dictionary that can be used to access all communication and application objects. An object is identified by a 16-bit index and 8-bit subindex in the object dictionary.

Each object has an object type that specifies whether the object is a variable, array or structure. Individual elements of an array or structure are mapped using up to 254 subobjects, which are only permitted to contain variables. In addition, attributes such as name, access rights, cyclic communication (PDO mapping) and value can be assigned to objects and subobjects.

### 3.2 Object dictionary areas

The POWERLINK specification divides the address space into different areas. These areas are listed in the following table.

Index	Area
0x0000	Unused
0x0001 - 0x001F	Static data types
0x0020 - 0x003F	Complex data types
0x0040 - 0x005F	Vendor-specific complex data types
0x0060 - 0x007F	Device profile-specific static data types
0x0080 - 0x009F	Device profile-specific complex data types
0x00A0 - 0x03FF	Reserved
0x0400 - 0x041F	POWERLINK-specific static data types
0x0420 - 0x04FF	POWERLINK-specific complex data types
0x0500 - 0x0FFF	Reserved
0x1000 - 0x1FFF	Area for the POWERLINK communication profile
0x2000 - 0x5FFF	Area for vendor-specific profiles
0x6000 - 0x9FFF	Area for standardized device profiles
0xA000 - 0xBFFF	Area for standardized interface profiles
0xC000 - 0xFFFF	Reserved

### 3.3 Communication objects

Objects responsible for configuring the POWERLINK network are referred to as communication objects. They are defined in the "Ethernet POWERLINK communication profile specification (DS301)"<sup>1)</sup> from the EPSG and located in the 0x1000 to 0x1FFF area of the object dictionary.

The following tables list the communication objects supported by B&R POWERLINK bus controllers. The DS301 specification contains a description of the objects themselves.

#### 3.3.1 Communication objects 0x1000 to 0x1403

Index	Name	Access	Default value	Comment	
	<b>Subindex</b>				
<b>0x1000</b>	NMT_DeviceType_U32	Constant	0x000F0191	DS401 device profile with digital and analog inputs/outputs	
<b>0x1001</b>	ERR_ErrorRegister_U8	Read only	0		
<b>0x1003</b>	ERR_History_ADOM				
	0x00	NumberOfEntries	Read/Write	0	
	0x01 - 0xFE	ErrorEntry_DOM	Read only		
<b>0x1006</b>	NMT_CycleLen_U32	Read/Write	1000		
<b>0x1008</b>	NMT_ManufactDevName_VS	Constant		Product name (e.g. X20BC0083)	
<b>0x1009</b>	NMT_ManufactHwVers_VS	Constant		e.g. V01.00	
<b>0x100A</b>	NMT_ManufactSwVers_VS	Constant		e.g. V01.00	
<b>0x1010</b>	NMT_StoreParam_REC				
	0x00	NumberOfEntries	Constant	3	
	0x01	AllParam_U32	Read/Write	0x00000001	Saves by writing "save"
	0x02	CommunicationParam_U32	Read/Write	0x00000001	Saves by writing "save"
	0x03	ApplicationParam_U32	Read/Write	0x00000000	Not supported
<b>0x1011</b>	NMT_RestoreDefParam_REC				
	0x00	NumberOfEntries	Constant	3	
	0x01	AllParam_U32	Read/Write	0x00000001	Resets by writing "load"
	0x02	CommunicationParam_U32	Read/Write	0x00000001	Resets by writing "load"
	0x03	ApplicationParam_U32	Read/Write	0x00000000	Not supported
<b>0x1018</b>	NMT_IdentityObject_REC				
	0x00	NumberOfEntries	Constant	4	
	0x01	VendorId_U32	Constant	0x1000006C	CANopen vendor ID for B&R
	0x02	ProductCode_U32	Constant		Hardware ID of the product (e.g. 0x1F1E)
	0x03	RevisionNo_U32	Constant		
	0x04	SerialNo_U32	Constant		
<b>0x1020</b>	CFM_VerifyConfiguration_REC				
	0x00	NumberOfEntries	Constant	2	
	0x01	ConfDate_U32	Read/Write	0	
	0x02	ConfTime_U32	Read/Write	0	
<b>0x1030</b>	NMT_InterfaceGroup_0h_REC				
	0x00	NumberOfEntries	Constant	9	
	0x01	InterfaceIndex_U16	Read only	0	
	0x02	InterfaceDescription_VSTR	Constant		e.g. BR_X20BC0083_1
	0x03	InterfaceType_U8	Constant	6	6 → Ethernet CSMA/CD
	0x04	InterfaceMtu_U16	Constant	1500	
	0x05	InterfacePhysAddress_OSTR	Constant		MAC address: "xx:xx:xx:xx:xx:xx"
	0x06	InterfaceName_VSTR	Read only	"IF1"	
	0x07	InterfaceOperStatus_U8	Read only	1	0 = Down, 1 = Up
	0x08	InterfaceAdminState_U8	Read/Write	1	0 = Down, 1 = Up
	0x09	Valid_BOOL	Read/Write	TRUE	
<b>0x1050</b>	NMT_RelativeLatencyDiff_AU32				
	0x00	NumberOfEntries	Read only	254	
	0x01 - 0xFE	RelativeLatencyDiff	Read only	0	
<b>0x1101</b>	DIA_NMTTelegrCount_REC				
	0x00	NumberOfEntries	Constant	8	
	0x01	IsochrCyc_U32	Read only	0	
	0x02	IsochrRx_U32	Read only	0	
	0x03	IsochrTx_U32	Read only	0	
	0x04	AsyncRx_U32	Read only	0	
	0x05	AsyncTx_U32	Read only	0	
	0x06	SdoRx_U32	Read only	0	
	0x07	SdoTx_U32	Read only	0	
	0x08	Status_U32	Read only	0	
<b>0x1102</b>	DIA_ERRStatistics_REC				
	0x00	NumberOfEntries	Constant	7	
	0x01	HistoryEntryWrite_U32	Read only	0	
	0x02	EmergencyQueueWrite_U32	Read only	0	
	0x03	EmergencyQueueOverflow_U32	Read only	0	
	0x04	StatusEntryChanged_U32	Read only	0	

<sup>1)</sup> Ethernet POWERLINK Standardization Group: Ethernet POWERLINK communication profile specification DS301 V1.1.0, 2009 [www.ethernet-powerlink.org](http://www.ethernet-powerlink.org)

Index	Name	Access	Default value	Comment
	<b>Subindex</b>			
	0x05	StaticErrorBitFieldChanged_U32	Read only	0
	0x06	ExceptionResetEdgePos_U32	Read only	0
	0x07	ExceptionNewEdge_U32	Read only	0
<b>0x1400 - 0x1403</b>	PDO_RxCommParam_xxxh_REC			
	0x00	NumberOfEntries	Constant	2
	0x01	NodeID_U8	Read/Write	0
	0x02	MappingVersion_U8	Read/Write	0

### 3.3.2 Communication objects 0x1600 to 0x1C0C

Index	Name	Access	Default value	Comment
	<b>Subindex</b>			
<b>0x1600</b>	PDO_RxMappParam_00h_AU64			Default Rx mapping (DS401)
	0x00	NumberOfEntries	Read/Write	20
	0x01	ObjectMapping	Read/Write	0x0008000000016200 Offset 0x0000: 8-bit → 0x6200 / 0x01
	0x02	ObjectMapping	Read/Write	0x0008000800026200 Offset 0x0008: 8-bit → 0x6200 / 0x02
	0x03	ObjectMapping	Read/Write	0x0008001000036200 Offset 0x0010: 8-bit → 0x6200 / 0x03
	0x04	ObjectMapping	Read/Write	0x0008001800046200 Offset 0x0018: 8-bit → 0x6200 / 0x04
	0x05	ObjectMapping	Read/Write	0x0008002000056200 Offset 0x0020: 8-bit → 0x6200 / 0x05
	0x06	ObjectMapping	Read/Write	0x0008002800066200 Offset 0x0028: 8-bit → 0x6200 / 0x06
	0x07	ObjectMapping	Read/Write	0x0008003000076200 Offset 0x0030: 8-bit → 0x6200 / 0x07
	0x08	ObjectMapping	Read/Write	0x0008003800086200 Offset 0x0038: 8-bit → 0x6200 / 0x08
	0x09	ObjectMapping	Read/Write	0x0010004000016411 Offset 0x0040: 16-bit → 0x6411 / 0x01
	0x0A	ObjectMapping	Read/Write	0x0010005000026411 Offset 0x0050: 16-bit → 0x6411 / 0x02
	0x0B	ObjectMapping	Read/Write	0x0010006000036411 Offset 0x0060: 16-bit → 0x6411 / 0x03
	0x0C	ObjectMapping	Read/Write	0x0010007000046411 Offset 0x0070: 16-bit → 0x6411 / 0x04
	0x0D	ObjectMapping	Read/Write	0x0010008000056411 Offset 0x0080: 16-bit → 0x6411 / 0x05
	0x0E	ObjectMapping	Read/Write	0x0010009000066411 Offset 0x0090: 16-bit → 0x6411 / 0x06
	0x0F	ObjectMapping	Read/Write	0x001000A000076411 Offset 0x00A0: 16-bit → 0x6411 / 0x07
	0x10	ObjectMapping	Read/Write	0x001000B000086411 Offset 0x00B0: 16-bit → 0x6411 / 0x08
	0x11	ObjectMapping	Read/Write	0x001000C000096411 Offset 0x00C0: 16-bit → 0x6411 / 0x09
	0x12	ObjectMapping	Read/Write	0x001000D0000A6411 Offset 0x00D0: 16-bit → 0x6411 / 0x0A
	0x13	ObjectMapping	Read/Write	0x001000E0000B6411 Offset 0x00E0: 16-bit → 0x6411 / 0x0B
	0x14	ObjectMapping	Read/Write	0x001000F0000C6411 Offset 0x00F0: 16-bit → 0x6411 / 0x0C
	0x15 - 0xFE	ObjectMapping	Read/Write	0 No mapping defined
<b>0x1601 - 0x1603</b>	PDO_RxMappParam_xxxh_AU64			
	0x00	NumberOfEntries	Read/Write	0
	0x01 - 0xFE	ObjectMapping	Read/Write	0 No mapping defined
<b>0x1800</b>				
	0x00	NumberOfEntries	Constant	2
	0x01	NodeID_U8	Read/Write	0
	0x02	MappingVersion_U8	Read/Write	0
<b>0x1A00</b>	PDO_TxMappParam_00h_AU64			Default Tx mapping (DS401)
	0x00	NumberOfEntries	Read/Write	0
	0x01	ObjectMapping	Read/Write	0x0008000000016000 0x6000 / 0x01: 8-bit → Offset 0x0000
	0x02	ObjectMapping	Read/Write	0x0008000800026000 0x6000 / 0x02: 8-bit → Offset 0x0008
	0x03	ObjectMapping	Read/Write	0x0008001000036000 0x6000 / 0x03: 8-bit → Offset 0x0010
	0x04	ObjectMapping	Read/Write	0x0008001800046000 0x6000 / 0x04: 8-bit → Offset 0x0018
	0x05	ObjectMapping	Read/Write	0x0008002000056000 0x6000 / 0x05: 8-bit → Offset 0x0020
	0x06	ObjectMapping	Read/Write	0x0008002800066000 0x6000 / 0x06: 8-bit → Offset 0x0028
	0x07	ObjectMapping	Read/Write	0x0008003000076000 0x6000 / 0x07: 8-bit → Offset 0x0030
	0x08	ObjectMapping	Read/Write	0x0008003800086000 0x6000 / 0x08: 8-bit → Offset 0x0038
	0x09	ObjectMapping	Read/Write	0x0010004000016401 0x6401 / 0x01: 16-bit → Offset 0x0040
	0x0A	ObjectMapping	Read/Write	0x0010005000026401 0x6401 / 0x02: 16-bit → Offset 0x0050
	0x0B	ObjectMapping	Read/Write	0x0010006000036401 0x6401 / 0x03: 16-bit → Offset 0x0060
	0x0C	ObjectMapping	Read/Write	0x0010007000046401 0x6401 / 0x04: 16-bit → Offset 0x0070
	0x0D	ObjectMapping	Read/Write	0x0010008000056401 0x6401 / 0x05: 16-bit → Offset 0x0080
	0x0E	ObjectMapping	Read/Write	0x0010009000066401 0x6401 / 0x06: 16-bit → Offset 0x0090
	0x0F	ObjectMapping	Read/Write	0x001000A000076401 0x6401 / 0x07: 16-bit → Offset 0x00A0
	0x10	ObjectMapping	Read/Write	0x001000B000086401 0x6401 / 0x08: 16-bit → Offset 0x00B0
	0x11	ObjectMapping	Read/Write	0x001000C000096401 0x6401 / 0x09: 16-bit → Offset 0x00C0
	0x12	ObjectMapping	Read/Write	0x001000D0000A6401 0x6401 / 0x0A: 16-bit → Offset 0x00D0
	0x13	ObjectMapping	Read/Write	0x001000E0000B6401 0x6401 / 0x0B: 16-bit → Offset 0x00E0
	0x14	ObjectMapping	Read/Write	0x001000F0000C6401 0x6401 / 0x0C: 16-bit → Offset 0x00F0
	0x15 - 0xFE	ObjectMapping	Read/Write	0 No mapping defined
<b>0x1C0A</b>	DLL_CNCCollision_REC			
	0x00	NumberOfEntries	Constant	3
	0x01	CumulativeCnt_U32	Read/Write	0
	0x02	ThresholdCnt_U32	Read only	0
	0x03	Threshold_U32	Read/Write	15
<b>0x1C0B</b>	DLL_CNLossSoC_REC			
	0x00	NumberOfEntries	Constant	3
	0x01	CumulativeCnt_U32	Read/Write	0

## Object directory

Index	Name	Access	Default value	Comment
	<b>Subindex</b>			
	0x02	ThresholdCnt_U32	Read only	0
	0x03	Threshold_U32	Read/Write	15
<b>0x1C0C</b>	DLL_CNLossSoA_REC			
	0x00	NumberOfEntries	Constant	3
	0x01	CumulativeCnt_U32	Read/Write	0
	0x02	ThresholdCnt_U32	Read only	0
	0x03	Threshold_U32	Read/Write	15

### 3.3.3 Communication objects 0x1C0D to 0x1F0E

Index	Name	Access	Default value	Comment	
	<b>Subindex</b>				
<b>0x1C0D</b>	DLL_CNLossPReq_REC				
	0x00	NumberOfEntries	Constant	3	
	0x01	CumulativeCnt_U32	Read/Write	0	
	0x02	ThresholdCnt_U32	Read only	0	
	0x03	Threshold_U32	Read/Write	15	
<b>0x1C0F</b>	DLL_CNCRCErrror_REC				
	0x00	NumberOfEntries	Constant	3	
	0x01	CumulativeCnt_U32	Read/Write	0	
	0x02	ThresholdCnt_U32	Read only	0	
	0x03	Threshold_U32	Read/Write	15	
<b>0x1C10</b>	DLL_CNLossOfLinkCum_U32	Read/Write	0		
<b>0x1C14</b>	DLL_LossOfSocTolerance_U32	Read/Write	100000		
<b>0x1E40</b>	NWL_IpAddrTable_0h_REC				
	0x00	NumberOfEntries	Constant	5	
	0x01	IfIndex_U16	Read/Write	0	
	0x02	Addr_IPAD	Read/Write	192.168.100.x	x = Node number
	0x03	NetMask_IPAD	Read/Write	255.255.255.0	
	0x04	ReasmMaxSize_U16	Read only	0	Not supported
	0x05	DefaultGateway_IPAD	Read/Write	192168100254	
<b>0x1E4A</b>	NWL_IpGroup_REC				
	0x00	NumberOfEntries	Constant	3	
	0x01	Forwarding_BOOL	Read/Write	FALSE	Not supported
	0x02	DefaultTTL_U16	Read/Write	64	Not supported
	0x03	ForwardDatagrams_U32	Read only	0	
<b>0x1F50</b>	PDL_DownloadProgData_ADOM				
	0x00	NumberOfEntries	Constant	1	
	01	Program	Read/Write		Bus controller firmware
<b>0x1F51</b>	PDL_ProgCtrl_AU8				
	0x00	NumberOfEntries	Constant	1	
	0x01	ProgCtrl	Read/Write	1	Value must always be 1
<b>0x1F52</b>	PDL_LocVerApplSw_REC				
	0x00	NumberOfEntries	Constant	2	
	0x01	ApplSwDate_U32	Read/Write	0	
	0x02	ApplSwTime_U32	Read/Write	0	
<b>0x1F81</b>	NMT_NodeAssignment_AU32				
	0x00	NumberOfEntries	Read/Write	254	
	0x01 - 0xFE	NodeAssignment	Read/Write	0	
<b>0x1F82</b>	NMT_FeatureFlags_U32	Constant	0x00048247	Supported: Isochronous, SDO/UDP, SDO / ASnd, dynamic mapping, multiplexed, SDO multiple read/write, PRes chaining	
<b>0x1F83</b>	NMT_EPLVersion_U8	Constant	0x20	POWERLINK V2.0	
<b>0x1F8C</b>	NMT_CurrNMTState_U8	Read/Write	0001 1100 (binary)	NMT_CS_NOT_ACTIVE	
<b>0x1F8D</b>	NMT_PResPayloadLimitList_AU16				
	0x00	NumberOfEntriesNumberOfEntries	Constant	254	
	0x01 - 0xFE	NumberOfEntries	Read/Write	0	
<b>0x1F93</b>	NMT_EPLNodeID_REC				
	0x00	NumberOfEntries	Constant	2	
	0x01	NodeID_U8	Read only	1 to 239	Corresponds to the node number switch
	0x02	NodeIDByHW_BOOL	Read only	TRUE	
<b>0x1F98</b>	NMT_CycleTiming_REC				
	0x00	NumberOfEntries	Constant	8	
	0x01	IsochrTxMaxPayload_U16	Read only	1490	
	0x02	IsochrRxMaxPayload_U16	Read only	1490	
	0x03	PResMaxLatency_U32	Constant	2000	
	0x04	PReqActPayload_U16	Read/Write	256	
	0x05	PReqActPayload_U16	Read/Write	256	
	0x06	ASndMaxLatency_U32	Constant	2000	
	0x07	MultiplCycleCnt_U8	Read/Write	0	
	0x08	AsyncMTUSize_U16	Read/Write	1500	
<b>0x1F99</b>	NMT_CNBasicEthernetTimeout_U32	Read/Write	5000000		

Index	Name	Access	Default value	Comment
<b>0x1F9A</b>	NMT_HostName_VSTR	Read/Write		e.g. "EPL_102" (node number 102)
<b>0x1F9B</b>	NMT_MultiplCycleAssign_AU8			
	0x00 NumberOfEntries	Constant	254	
	0x01 - 0xFE CycleNo	Read/Write	0	
<b>0x1F9E</b>	NMT_ResetCmd_U8	Read/Write	0xFF	

### 3.4 Device profile

B&R POWERLINK bus controllers support the CANopen device profile for generic I/O modules (DS401). According to the POWERLINK specification, range 0x6000 to 0x9FFF area is reserved for standardized device profiles in the object dictionary.

The following table lists the application objects supported by B&R POWERLINK bus controllers in accordance with DS401. The DS401 specification from CiA (CAN in Automation)<sup>1)</sup> contains a description of the objects themselves.

#### 3.4.1 Application objects

Index	Name	Access	Default value	Comment
<b>0x6000</b>	IO_DigitalInput_AU8			Digital inputs
	0x00 NumberOfEntries	Read only	254	
	0x01 - 0xFE DigitalInput	Read only		
<b>0x6200</b>	IO_DigitalOutput_AU8			Digital outputs
	0x00 NumberOfEntries	Read only	254	
	0x01 - 0xFE DigitalOutput	Read/Write		SDO access reads/writes force values
<b>0x6400</b>	IO_AnalogueInput_AI8			Analog inputs (8-bit)
	0x00 NumberOfEntries	Read only	254	
	0x01 - 0xFE AnalogueInput	Read only		For channels with more than 8 bits, only the 8 high-order bits are displayed here.
<b>0x6401</b>	IO_AnalogueInput_AI16			Analog inputs (16-bit)
	0x00 NumberOfEntries	Read only	254	
	0x01 - 0xFE AnalogueInput	Read only		For channels with more than 16 bits, only the 16 high-order bits are displayed here.
<b>0x6402</b>	IO_AnalogueInput_AI32			Analog inputs (32-bit)
	0x00 NumberOfEntries	Read only	254	
	0x01 - 0xFE AnalogueInput	Read only		
<b>0x6410</b>	IO_AnalogueOutput_AI8			Analog outputs (8-bit)
	0x00 NumberOfEntries	Read only	254	
	0x01 - 0xFE AnalogueOutput	Read/Write		For channels with more than 8 bits, only the 8 high-order bits are displayed here. SDO access reads/writes force values
<b>0x6411</b>	IO_AnalogueOutput_AI16			Analog outputs (16-bit)
	0x00 NumberOfEntries	Read only	254	
	0x01 - 0xFE AnalogueOutput	Read/Write		For channels with more than 16 bits, only the 16 high-order bits are displayed here. SDO access reads/writes force values
<b>0x6412</b>	IO_AnalogueOutput_AI32			Analog outputs (32-bit)
	0x00 NumberOfEntries	Read only	254	
	0x01 - 0xFE AnalogueOutput	Read/Write		SDO access reads/writes force values
<b>0x6423</b>	IO_AnalogueInputIrqEnable_BOOL	Read/Write	TRUE	No function, only included for compatibility

<sup>1)</sup> CAN in Automation: DS401 V3.0 CANopen device profile for generic I/O modules, [www.can-cia.org](http://www.can-cia.org)

### 3.5 Device profile for B&R bus controllers

In addition to the device profile for generic I/O modules (DS401) included in the previous section, a vendor-specific profile has been defined for bus controllers that is better adapted to the needs of a modular I/O system and offers extended configuration options. The range 0x2000 to 0x5FFF is reserved in the object dictionary for vendor-specific profiles.

The following tables list the vendor-specific application objects supported by B&R POWERLINK bus controllers.

#### 3.5.1 Application objects 0x2000 to 0x2011

Index	Name	Access	Default value	Comment
<b>0x2000</b>	"X2X_CycleConfig_REC"			
0x00	"NumberOfEntries"	Constant	14	
0x01	"X2X_CycleMode_U8"	Read/Write	1	Uses X2X_CycleTimeUs_U32
0x02	"X2X_CycleFactor_S8"	Read/Write	1	
0x03	"X2X_CycleTimeUs_U32"	Read/Write	1000	X2X Link cycle time in µs
0x04	"X2X_SyncMode_U8"	Read/Write	0	Synchronizes X2X to the SoC frame
0x05	"X2X_SyncShiftUs_S32"	Read/Write	0	X2X runs without offset to POWERLINK
0x06	"X2X_SyncOutSize_U16"	Read/Write	400	
0x07	"X2X_SyncInSize_U16"	Read/Write	400	
0x08	"X2X_AsyncSize_U16"	Read/Write	100	
0x09	"X2X_PhysicalSlots_U8"	Read/Write	253	
0x0A	"X2X_StartupDelayUs_U32"	Read/Write	1500000	
0x0B	"X2X_CfgModeUploadDisable_BOOL"	Read/Write	FALSE	
0x0C	"X2X_ResponseMinUs_U16"	Read/Write	0xFFFF	
0x0D	"X2X_ResponseMaxUs_U16"	Read/Write	0	
0x0E	"X2X_ResponseAverageUs_U16"	Read/Write	0	
<b>0x2001</b>	"X2X_OutputConfig_REC"			
0x00	"NumberOfEntries"	Constant	9	
0x01	"X2X_OutputControl_U8"	Read/Write	0	
0x02	"X2X_OutputOffDelayUs_U32"	Read/Write	0	
0x03	"X2X_OutputForceTimeUs_U32"	Read/Write	0	
0x04	"X2X_ModuleErrorReaction_U8"	Read/Write	0	
0x05	"X2X_PollReady0_Limit_U8"	Read/Write	10	
0x06	"X2X_PollReady0_InhibitTimeMs_U16"	Read/Write	1000	
0x07	"X2X_LocalNetTime_BOOL"	Read/Write	0	
0x08	"X2X_StreamControl_U32"	Read/Write	0	
0x09	"X2X_StreamData_DOM"	Write only		
<b>0x2002</b>	"EEC_Config_REC"			
0x00	"NumberOfEntries"	Constant	1	
0x01	"EEC_AutoNegIFx_U16"	Read/Write	0xFFFF	Enables AutoNeg on all interfaces
<b>0x2005</b>	"X2X_IoDataBasic_REC"			
0x00	"NumberOfEntries"	Constant	4	
0x01	"X2X_InputBasic_DOM"	Read only		
0x02	"X2X_OutputBasic_DOM"	Write only		
0x03	"X2X_OutputBasicWatchdogMs_U16"	Read/Write	500	
0x04	"X2X_OutputBasicLocked_BOOL"	Read/Write	FALSE	
<b>0x2011</b>	"DIA_StatisticErrorCount_REC"			
0x00	"NumberOfEntries"	Read/Write	0	
0x01	"DIA_Total_U32"	Read/Write	0	
0x02	"DIA_EthRxLost_U32"	Read/Write	0	
0x03	"DIA_EthRxOversize_U32"	Read/Write	0	
0x04	"DIA_EthRxCrcError_U32"	Read/Write	0	
0x05	"DIA_EthRxOverflow_U32"	Read/Write	0	
0x06	"DIA_EthTxCollision_U32"	Read/Write	0	
0x07	Reserved			
0x08 - 0x0F	"DIA_PhysLinkLoss_U32"	Read/Write	0	
0x10	"DIA_XlkCycleCount_U32"	Read/Write	0	
0x11	"DIA_XlkBreakCount_U32"	Read/Write	0	
0x12	"DIA_XlkSyncErrorCount_U32"	Read/Write	0	
0x13	"DIA_XlkSyncBusyErrorCount_U32"	Read/Write	0	
0x14	"DIA_XlkSyncNoRxErrorCount_U32"	Read/Write	0	
0x15	"DIA_XlkSyncFormatErrorCount_U32"	Read/Write	0	
0x16	"DIA_XlkSyncPendingErrorCount_U32"	Read/Write	0	
0x17	"DIA_XlkAsyncErrorCount_U32"	Read/Write	0	
0x18	"DIA_XlkAsyncBusyErrorCount_U32"	Read/Write	0	
0x19	"DIA_XlkAsyncNoRxErrorCount_U32"	Read/Write	0	
0x1A	"DIA_XlkAsyncFormatErrorCount_U32"	Read/Write	0	
0x1B	"DIA_XlkAsyncPendingErrorCount_U32"	Read/Write	0	

Index	Name	Access	Default value	Comment
<b>Subindex</b>				
0x1C	"DIA_XlkModuleLostWhileOperational_U32"	Read/Write	0	
0x1D	"DIA_XlkModuleNewWhileOperational_U32"	Read/Write	0	
0x1E - 0x1F	Reserved			
0x20	"DIA_RamAccessViolation_U32"	Read/Write	0	

### 3.5.2 Application objects 0x20A0 to 0x20FF

Index	Name	Access	Default value	Comment
<b>Subindex</b>				
<b>0x20A0</b>	"MOD_CfgCount_U8"	Read/Write	253	
<b>0x20A1</b>	"MOD_SlotCount_U8"	Read only		
<b>0x20A2</b>	"MOD_ActCount_U8"	Read only		
<b>0x20A8</b>	NMT_ChildIdentData_ADOM			
0x00	NumberOfEntries	Read only	1	
0x01 - 0xFE	NMT_ChildIdentData_ADOM	Read only		
<b>0x20A9</b>	PDL_DownloadChildProgData_ADOM			
0x00	NumberOfEntries	Read only	1	
0x01 - 0xFE	PDL_DownloadChildProgData_ADOM	Write only		
<b>0x20B0</b>	"MOD_NetworkStatus_AU64"			
0x00	"NumberOfEntries"	Constant	32	
0x01 - 0x20	"NetworkStatus"	Read only		The status of the first module in the group is located in the low-order byte.
<b>0x20B1</b>	"IO_MultiScan_DOM"	Read only		
<b>0x20F0</b>	"BC_Internal_REC"			
0x00	"NumberOfEntries"	Constant	29	
0x01	"BC_BootFpgaVersion_U16"	Read only		
0x02	"BC_BootFirmwareVersion_U16"	Read only		
0x03	"BC_UpgradeFpgaVersion_U16"	Read only		
0x04	"BC_UpgradeFirmwareVersion_U16"	Read only		
0x05	"BC_UpgradeActive_U8"	Read/Write		
0x06	"BC_NodeNumber_U8"	Read only		
0x07	"BC_MemFree_U32"	Read only		
0x08	Reserved			
0x09	"BC_LedTest_U8"	Write only	0	
0x0A	"BC_CntNvmStore_U16"	Read only		
0x0B	"BC_CntNvmInconsistent_U16"	Read only		
0x0C	"BC_CntNvmVersionChange_U16"	Read only		
0x0D	"BC_CntNvmReload_U16"	Read only		
0x0E	"BC_IoCycleCount_U8"	Read only		
0x0F	"BC_MsTime_U32"	Read only		
0x10	"BC_SyncPresetUs_U16"	Read/Write	35	
0x11	"BC_PhysicalPorts_U8"	Read only		
0x12	"BC_PhysicalLink_U8"	Read only		
0x13	"BC_SupportedSdoProtocols_U8"	Read/Write	0	
0x14	"BC_LineSpeed_U16"	Read only		
0x15	"BC_UserDataWriteEnable_U32"	Read/Write		
0x16	"BC_UserData_DOM"	Read/Write		
0x17	"BC_UserDataCountdown_U16"	Read only	0	
0x18	"BC_RedundancyNetworkFlags_U8"	Read only		Only on bus controllers with cable redundancy
0x19	"BC_RedundancyNetworkIndex_U8"	Read/Write		Only on bus controllers with cable redundancy
0x1A	"BC_RedundancyTxMode_U8"	Read/Write		Only on bus controllers with cable redundancy
0x1B	Reserved			
0x1C	"BC_PhyExist_U32"	Read only		
0x1D	"BC_PhyLinked_U32"	Read only		
<b>0x20F8</b>	"DUMMY_MapObjects_AU8"			
0x00	"NumberOfEntries"	Constant	8	
0x01 - 0x08	"MapObjects"	Read/Write	0	
<b>0x20FF</b>	"DUMMY_ProtocolTest_REC"			
0x00	"NumberOfEntries"	Constant	4	
0x01	"DUMMY_DomainUploadLen_U32"	Read/Write	1000	
0x02	"DUMMY_Upload_DOM"	Read only		
0x03	"DUMMY_DomainDownloadLen_U32"	Read only		
0x04	"DUMMY_Download_DOM"	Write only		

## 3.5.3 Application objects 0x21xx to 0x27xx

Index	Name	Access	Default value	Comment
<b>0x21xx</b>	"MOD_Config_xxx_REC"			
0x00	"NumberOfEntries"	Constant	254	
0x01	"MOD_ChildCfgIndex_U16"	Read/Write	0	
0x02	"MOD_ChildCfgCount_U8"	Read/Write	0	
0x03	"MOD_ChildActCount_U8"	Read only	0	
0x04	"MOD_CfgMode_U8"	Read/Write	0	Loads configuration from the I/O module
0x05	"MOD_RequestedHardwareId_U16"	Read/Write	0	Hardware ID verification disabled
0x06	"MOD_RequestedVendorId_U16"	Read/Write	0	Vendor ID verification disabled
0x07	"MOD_HardwareId_U16"	Read only		
0x08	"MOD_VendorId_U16"	Read only		
0x09	Reserved			
0x0A	"MOD_Status_U16"	Read/Write		
0x0B	"MOD_NetworkStatus_U8"	Read only		
0x0C	"MOD_BlockMask_U8"	Read only		
0x0D	"MOD_BootCount_U8"	Read/Write		
0x0E	"MOD_LastError_U8"	Read/Write		
0x0F - 0x10	Reserved			
0x11	"MOD_FirmwareVersion_U16"	Read only		
0x12	"MOD_HardwareVariant_U16"	Read only		
0x13	"MOD_SerialNo_U32"	Read only		
0x14	"MOD_PhysicalSlotNumber_U8"	Read only		
0x15	"MOD_NodeSwitch_U8"	Read only		
0x16	"MOD_RequestedSerialNo_U32"	Read/Write		
0x17	"MOD_ModuleErrorReaction_U8"	Read/Write		
0x18 - 0x1D	Reserved			
0x1E	"MOD_InputImage1_DOM"	Read only		
0x1F	"MOD_InputImage2_DOM"	Read only		
0x20	"MOD_OutputImage_DOM"	Write only		
0x21	"MOD_AsyncRead_U64"	Read/Write		
0x22	"MOD_AsyncWrite_U64"	Write only		
0x23	"MOD_Firmware_DOM"	Write only		
0x24 - 0x31	Reserved			
0x32	"MOD_FirmwareChannel_U16"	Write only	2	
0x33 - 0x59	Reserved			
0x5A	"MOD_CfgFunctionMode_U8"	Read/Write	0	Function model of the I/O module
0x5B	"MOD_CfgEntryCount_U8"	Read/Write	0	Number of configuration registers being used
0x5C - 0x63	Reserved			
0x64 - 0xC7	"MOD_CfgEntry_xx_U64"	Read/Write	0	Configuration registers 00 to 99
<b>0x22xx</b>	MOD_DataIn_xxx_AU8			
0x00	NumberOfEntries	Constant	254	Byte access to input register
0x01 - 0xFE	DataIn			
<b>0x23xx</b>	MOD_DataIn_xxx_AU16			
0x00	NumberOfEntries	Constant	254	Word access to input register
0x01 - 0xFE	DataIn			
<b>0x24xx</b>	MOD_DataIn_xxx_AU32			
0x00	NumberOfEntries	Constant	254	DWord access to input register
0x01 - 0xFE	DataIn			
<b>0x25xx</b>	MOD_DataOut_xxx_AU8			
0x00	NumberOfEntries	Constant	254	Byte access to output register
0x01 - 0xFE	DataOut			
<b>0x26xx</b>	MOD_DataOut_xxx_AU16			
0x00	NumberOfEntries	Constant	254	Word access to output register
0x01 - 0xFE	DataOut			
<b>0x27xx</b>	MOD_DataOut_xxx_AU32			
0x00	NumberOfEntries	Constant	254	DWord access to output register
0x01 - 0xFE	DataOut			



## 4 Description of B&R device objects

### 4.1 X2X\_CycleConfig\_REC

#### Object 0x2000

This object specifies the parameters for the X2X Link cycle configuration.

<b>Index</b>	<b>0x2000</b>
<b>Name</b>	X2X_CycleConfig_REC
<b>Data type</b>	X2X_CycleConfig_TYPE
<b>Object type</b>	RECORD

#### NumberOfEntries

<b>Subindex</b>	<b>0x00</b>
<b>Name</b>	NumberOfEntries
<b>Range of values</b>	14
<b>Data type</b>	-
<b>Default value</b>	14
<b>Access rights</b>	Constant
<b>PDO mapping</b>	No

#### X2X\_CycleMode\_U8

<b>Subindex</b>	<b>0x01</b>
<b>Name</b>	X2X_CycleMode_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 1
<b>Default value</b>	1
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

X2X\_CycleMode\_U8 defines whether the X2X cycle should be defined or automatically adjusted to the POWERLINK cycle.

Value	Description
0	The X2X cycle length is derived from the POWERLINK cycle NMT_CycleLen_U32 (0x1006, see section " <a href="#">Communication objects 0x1000 to 0x1403</a> " on page 18) and the factor X2X_CycleFactor_S8.
1	The X2X cycle length is defined in X2X_CycleTimeUs_U32.

#### X2X\_CycleFactor\_S8

<b>Subindex</b>	<b>0x02</b>
<b>Name</b>	X2X_CycleFactor_S8
<b>Data type</b>	SIGNED8
<b>Range of values</b>	-128 to -1 or 1 to 127
<b>Default value</b>	1
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

If X2X\_CycleMode\_U8 has the value 0, this subobject specifies the factor used to calculate the X2X cycle length from the POWERLINK cycle length (NMT\_CycleLen\_U32) (0x1006, see section "[Communication objects 0x1000 to 0x1403](#)" on page 18).

Value	Description
-n	n POWERLINK cycles result in 1 X2X cycle (X2X Link running slower than POWERLINK).
+n	1 POWERLINK cycle results in n X2X cycles (X2X Link running faster than POWERLINK)

#### X2X\_CycleTimeUs\_U32

<b>Subindex</b>	<b>0x03</b>
<b>Name</b>	X2X_CycleTimeUs_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 32000
<b>Default value</b>	1000
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

If X2X\_CycleMode\_U8 has the value 1, this subobject specifies the X2X cycle length in microseconds.

**X2X\_SyncMode\_U8**

Subindex	0x04
Name	X2X_SyncMode_U8
Data type	UNSIGNED8
Range of values	0 to 1
Default value	0
Access rights	Read/Write
PDO mapping	No

X2X\_SyncMode\_U8 defines the moment when X2X Link is synchronized with POWERLINK.

Value	Description
0	X2X Link is synchronized to the POWERLINK network's "Start of Cyclic" frame.
1	X2X Link is synchronized to the POWERLINK network's "Poll request".

Synchronizing X2X Link to the poll request achieves a faster reaction for inputs and outputs.

X2X Link networks behind different bus controllers are no longer synchronous with one another, however. Since the moment the poll request is made is not clearly defined, adding/removing stations can shift the moment of synchronization.

**X2X\_SyncShiftUs\_S32**

Subindex	0x05
Name	X2X_SyncShiftUs_S32
Data type	SIGNED32
Range of values	-2,147,483,648 to 2147483647
Default value	0
Access rights	Read/Write
PDO mapping	No

X2X\_SyncShiftUs\_S32 defines the phase shift between POWERLINK and X2X Link in microseconds. The value 0 means that the synchronous X2X output frame is transmitted at the same time as the POWERLINK SoC frame.

**X2X\_SyncOutSize\_U16**

Subindex	0x06
Name	X2X_SyncOutSize_U16
Data type	UNSIGNED16
Range of values	10 to 1490
Default value	400
Access rights	Read/Write
PDO mapping	No

X2X\_SyncOutSize\_U16 defines the length of the synchronous X2X output frame.

**Information:**

**X2X\_SyncInSize\_U16** and **X2X\_SyncOutSize\_U16** must have the same value!

**X2X\_SyncInSize\_U16**

Subindex	0x07
Name	X2X_SyncInSize_U16
Data type	UNSIGNED16
Range of values	10 to 1490
Default value	400
Access rights	Read/Write
PDO mapping	No

X2X\_SyncInSize\_U16 defines the length of the synchronous X2X input frame.

**Information:**

**X2X\_SyncInSize\_U16** and **X2X\_SyncOutSize\_U16** must have the same value!

**X2X\_AsyncSize\_U16**

Subindex	0x08
Name	X2X_AsyncSize_U16
Data type	UNSIGNED16
Range of values	20 to 800
Default value	100
Access rights	Read/Write
PDO mapping	No

X2X\_AsyncSize\_U16 defines the length of the asynchronous X2X frame.

**X2X\_PhysicalSlots\_U8**

Subindex	0x09
Name	X2X_PhysicalSlots_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	253
Access rights	Read/Write
PDO mapping	No

X2X\_PhysicalSlots\_U8 defines how many physical slots are started by the X2X master.

**X2X\_StartupDelayUs\_U32**

Subindex	0x0A
Name	X2X_StartupDelayUs_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	1500000
Access rights	Read/Write
PDO mapping	No

The bus controller can only be switched to the OPERATIONAL state when the X2X Link network has completely finished booting. Booting the X2X Link network is considered completely finished when no new I/O modules are registered during the period X2X\_StartupDelayUs\_U32.

**Example**

Increasing this value:

10 I/O modules are connected to a bus controller. The power supply for the last 2 modules is always switched on 5 seconds after the power supply for the other modules has been switched on. By default, the bus controller would wait an additional 1.5 seconds after the eighth module is initialized. During this time, the ninth and tenth modules are still not powered, however. In order for the bus controller to also wait for the last 2 modules, the value of X2X\_StartupDelayUs\_U32 must be set to at least 5 seconds.

**X2X\_CfgModeUploadDisable\_BOOL**

Subindex	0x0B
Name	X2X_CfgModeUploadDisable_BOOL
Data type	BOOLEAN
Range of values	TRUE, FALSE
Default value	FALSE
Access rights	Read/Write
PDO mapping	No

The automatic startup of X2X modules can be disabled for the entire X2X Link network using X2X\_CfgModeUploadDisable\_BOOL. If the value is set to FALSE, then modules where MOD\_CfgMode\_U8 = 0 are started automatically.

**X2X\_ResponseMinUs\_U16**

Subindex	0x0C
Name	X2X_ResponseMinUs_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	65535
Access rights	Read/Write
PDO mapping	No

The minimum response time in microseconds on the X2X Link network can be read using X2X\_ResponseMinUs\_U16. A write operation resets this value back to 65,535.

**X2X\_ResponseMaxUs\_U16**

Subindex	0x0D
Name	X2X_ResponseMaxUs_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	0
Access rights	Read/Write
PDO mapping	No

The maximum response time in microseconds on the X2X Link network can be read using X2X\_ResponseMaxUs\_U16. A write operation resets this value back to 0.

**X2X\_ResponseAverageUs\_U16**

Subindex	0x0E
Name	X2X_ResponseAverageUs_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	0
Access rights	Read/Write
PDO mapping	No

The average response time in microseconds on the X2X Link network can be read using X2X\_ResponseAverageUs\_U16. The last 8 cycles are taken into account. A write operation resets [X2X\\_ResponseMinUs\\_U16](#) and [X2X\\_ResponseMaxUs\\_U16](#).

**4.2 X2X\_OutputConfig\_REC****Object 0x2001**

This object specifies the X2X Link output parameters.

Index	0x2001
Name	X2X_OutputConfig_REC
Data type	X2X_OutputConfig_TYPE
Object type	RECORD

**NumberOfEntries**

Subindex	0x00
Name	NumberOfEntries
Data type	
Range of values	9
Default value	9
Access rights	Constant
PDO mapping	No

**X2X\_OutputControl\_U8**

Subindex	0x01
Name	X2X_OutputControl_U8
Data type	UNSIGNED8
Range of values	0 to 1
Default value	0
Access rights	Read/Write
PDO mapping	No

X2X\_OutputControl\_U8 defines which values are output on the X2X Link network if the bus controller on the POWERLINK network is not in the NMT\_CS\_OPERATIONAL state.

Value	Description
0	Resets the outputs to 0
1	Sets the outputs to preconfigured default values

**X2X\_OutputOffDelayUs\_U32**

Subindex	0x02
Name	X2X_OutputOffDelayUs_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

After the connection to the POWERLINK MN is lost, the outputs on the X2X Link network are reset to their default values. X2X\_OutputOffDelayUs\_U32 defines the time span (in microseconds) after which this reset takes place.

**X2X\_OutputForceTimeUs\_U32**

Subindex	0x03
Name	X2X_OutputForceTimeUs_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

Setting X2X\_OutputForceTimeUs\_U32 to a value greater than 0 forces permanent values on the outputs on the X2X Link network. The bus controller decrements this parameter down to 0.

**X2X\_ModuleErrorReaction\_U8**

<b>Subindex</b>	<b>0x04</b>
<b>Name</b>	X2X_ModuleErrorReaction_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

X2X\_ModuleErrorReaction\_U8 defines the behavior of the bus controller if there is a faulty module configuration on the X2X Link network.

Bit	Description
0	If set, does not switch to READY_TO_OPERATE mode if a configured module on the X2X Link network is missing.
1	If set, does not switch to READY_TO_OPERATE mode if a configured module on the X2X Link network does not correspond to the one that is actually connected.
2	If set, switches back from OPERATIONAL to PRE_OPERATIONAL_1 mode in the event of a module error.

**X2X\_PollReady0\_Limit\_U8**

<b>Subindex</b>	<b>0x05</b>
<b>Name</b>	X2X_PollReady0_Limit_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	10
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

The outputs are reset to default values after receiving more than the number of PReq frames whose ReadyFlag is not set than is configured in X2X\_PollReady0\_Limit\_U8. This applies at least for the time span set in [X2X\\_PollReady0\\_InhibitTimeMs\\_U16](#). Setting this to 0 disables the check for PReq ReadyFlags.

**X2X\_PollReady0\_InhibitTimeMs\_U16**

<b>Subindex</b>	<b>0x06</b>
<b>Name</b>	X2X_PollReady0_InhibitTimeMs_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	1000
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

X2X\_PollReady0\_InhibitTimeMs\_U16 specifies the time span (in milliseconds) in which PReq frames with an enabled ReadyFlag must be received by the bus controller until the transferred values are switched through to the outputs.

**X2X\_LocalNetTime\_BOOL**

<b>Subindex</b>	<b>0x07</b>
<b>Name</b>	X2X_LocalNetTime_BOOL
<b>Data type</b>	BOOLEAN
<b>Range of values</b>	TRUE, FALSE
<b>Default value</b>	FALSE
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

X2X\_LocalNetTime\_BOOL defines whether the bus controller should locally generate the NetTime for X2X Net-Time synchronization. This can be used, for example, to operate NetTime-dependent modules (e.g. X20DS1319) in basic Ethernet mode or behind a POWERLINK master that doesn't support RelativeTime in the SoC frame.

**X2X\_StreamControl\_U32**

Subindex	0x08
Name	X2X_StreamControl_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	-
Access rights	Read/Write
PDO mapping	No

X2X\_StreamControl\_U32 is used to configure the X2X\_StreamData\_DOM stream object.

**Information:**

This object is reserved for B&R.

Bit	Description
0 - 15	Client index
16 - 23	Client subindex
24 - 31	Client node ID

The node ID / index / subindex specify the destination to which the received data is sent back to the client via SDO/UDP. If all bits are set to 0, streaming is disabled.

**X2X\_StreamData\_DOM**

Subindex	0x09
Name	X2X_StreamData_DOM
Data type	DOMAIN
Range of values	-
Default value	-
Access rights	Read only
PDO mapping	No

The streaming data object (transmitted data) is written to X2X\_StreamData\_DOM.

**Information:**

This object is reserved for B&R.

**4.3 EEC\_Config\_REC****Object 0x2002**

This object specifies the extended Ethernet configuration.

Index	0x2002
Name	EEC_Config_REC
Data type	EEC_Config_TYPE
Object type	RECORD

**NumberOfEntries**

Subindex	0x00
Name	NumberOfEntries
Data type	
Range of values	1
Default value	1
Access rights	Constant
PDO mapping	No

**EEC\_AutoNegIFx\_U16**

Subindex	0x01
Name	EEC_AutoNegIFx_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	65535
Access rights	Read/Write
PDO mapping	No

Autonegotiation and Auto MDI/MDI-X can be enabled for the respective Ethernet interface using the individual bits in EEC\_AutoNegIFx\_U16 (i.e. bit 0 defines autonegotiation for IF0).

## 4.4 X2X\_IoDataBasic\_REC

### Object 0x2005

This object is used to access I/O data in basic Ethernet mode.

<b>Index</b>	<b>0x2005</b>
<b>Name</b>	X2X_IoDataBasic_REC
<b>Data type</b>	X2X_IoDataBasic_TYPE
<b>Object type</b>	RECORD

#### NumberOfEntries

<b>Subindex</b>	<b>0x00</b>
<b>Name</b>	NumberOfEntries
<b>Data type</b>	
<b>Range of values</b>	4
<b>Default value</b>	4
<b>Access rights</b>	Constant
<b>PDO mapping</b>	No

#### X2X\_InputBasic\_DOM

<b>Subindex</b>	<b>0x01</b>
<b>Name</b>	X2X_InputBasic_DOM
<b>Data type</b>	DOMAIN
<b>Range of values</b>	-
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

A complete input data frame is read using X2X\_InputBasic\_DOM. The data in this object corresponds to the payload data of a PRes frame from the bus controller.

#### Information:

This function is only available in basic Ethernet mode.

#### X2X\_OutputBasic\_DOM

<b>Subindex</b>	<b>0x02</b>
<b>Name</b>	X2X_OutputBasic_DOM
<b>Data type</b>	DOMAIN
<b>Range of values</b>	-
<b>Default value</b>	-
<b>Access rights</b>	Write only
<b>PDO mapping</b>	No

A complete output data frame is written using X2X\_OutputBasic\_DOM. The data in this object corresponds to the payload data of a PReq frame for the bus controller.

#### Information:

This function is only available in basic Ethernet mode.

#### X2X\_OutputBasicWatchdogMs\_U16

<b>Subindex</b>	<b>0x03</b>
<b>Name</b>	X2X_OutputBasicWatchdogMs_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	500
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

X2X\_OutputBasicWatchdogMs\_U16 defines the time span (in milliseconds) after which the outputs the outputs are reset to default values in basic Ethernet mode. The watchdog is reset to the value configured here by writing to [X2X\\_OutputBasic\\_DOM](#).

**X2X\_OutputBasicLocked\_BOOL**

Subindex	0x04
Name	X2X_OutputBasicLocked_BOOL
Data type	BOOLEAN
Range of values	TRUE, FALSE
Default value	FALSE
Access rights	Read/Write
PDO mapping	No

This flag is set to TRUE if the watchdog configured in [X2X\\_OutputBasicWatchdogMs\\_U16](#) expires. The outputs are then fixed to default values and have to be unlocked by writing 0 to this subobject.

**4.5 DIA\_StatisticErrorCount\_REC****Object 0x2011**

This object is used to read statistical error values.

Index	0x2011
Name	DIA_StatisticErrorCount_REC
Data type	DIA_StatisticErrorCount_TYPE
Object type	RECORD

**NumberOfEntries**

Subindex	0x00
Name	NumberOfEntries
Data type	
Range of values	32
Default value	32
Access rights	Constant
PDO mapping	No

**DIA\_Total\_U32**

Subindex	0x01
Name	DIA_Total_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

DIA\_Total\_U32 contains the total of all counters listed here (without [DIA\\_XlkCycleCount\\_U32](#)). Writing the value 0 to this object resets all counters to 0.

**DIA\_EthRxLost\_U32**

Subindex	0x02
Name	DIA_EthRxLost_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

DIA\_EthRxLost\_U32 specifies the number of received frames lost due to performance problems on the bus controller.

**DIA\_EthRxOversize\_U32**

Subindex	0x03
Name	DIA_EthRxOversize_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

DIA\_EthRxOversize\_U32 specifies the number of oversized frames received (jumbo frames >1500 bytes).



**DIA\_EthRxCrcError\_U32**

<b>Subindex</b>	<b>0x04</b>
<b>Name</b>	DIA_EthRxCrcError_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_EthRxCrcError\_U32 specifies the number of frames received with a fault checksum (CRC).

**DIA\_EthRxOverflow\_U32**

<b>Subindex</b>	<b>0x05</b>
<b>Name</b>	DIA_EthRxOverflow_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_EthRxOverflow\_U32 specifies the number of received frames lost due to performance problems on the bus controller.

**DIA\_EthTxCollision\_U32**

<b>Subindex</b>	<b>0x06</b>
<b>Name</b>	DIA_EthTxCollision_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_EthTxCollision\_U32 specifies the number of collisions that occurred during transmission.

**DIA\_PhyXLinkLoss\_U32**

<b>Subindex</b>	<b>0x08 - 0x0F</b>
<b>Name</b>	DIA_PhyXLinkLoss_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_PhyXLinkLoss\_U32 specifies how often the link to an Ethernet interface was lost. The assignment of PhyX to the subindexes is listed in the following table.

<b>Subindex</b>	<b>Physical interface</b>
0x08	Phy7
0x09	Phy8
0x0A - 0x0F	Phy1 to Phy6

**DIA\_XlkCycleCount\_U32**

<b>Subindex</b>	<b>0x10</b>
<b>Name</b>	DIA_XlkCycleCount_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_XlkCycleCount\_U32 specifies the number of X2X Link cycles carried out.

**DIA\_XlkBreakCount\_U32**

<b>Subindex</b>	<b>0x11</b>
<b>Name</b>	DIA_XlkBreakCount_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_XlkCycleCount\_U32 specifies the number of X2X Link cycles with a set break flag.

**DIA\_XlkSyncErrorCount\_U32**

<b>Subindex</b>	<b>0x12</b>
<b>Name</b>	DIA_XlkSyncErrorCount_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_XlkSyncErrorCount\_U32 specifies the number of sync errors on the X2X Link network.

**DIA\_XlkSyncBusyErrorCount\_U32**

<b>Subindex</b>	<b>0x13</b>
<b>Name</b>	DIA_XlkSyncBusyErrorCount_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_XlkSyncBusyErrorCount\_U32 specifies the number of bus timing errors from sync frames on the X2X Link network.

**DIA\_XlkSyncNoRxErrorCount\_U32**

<b>Subindex</b>	<b>0x14</b>
<b>Name</b>	DIA_XlkSyncNoRxErrorCount_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_XlkSyncNoRxErrorCount\_U32 specifies the number of frame timing errors from sync frames on the X2X Link network.

**DIA\_XlkSyncFormatErrorCount\_U32**

<b>Subindex</b>	<b>0x15</b>
<b>Name</b>	DIA_XlkSyncFormatErrorCount_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_XlkSyncFormatErrorCount\_U32 specifies the number of CRC errors from sync frames on the X2X Link network.

**DIA\_XlkSyncPendingErrorCount\_U32**

<b>Subindex</b>	<b>0x16</b>
<b>Name</b>	DIA_XlkSyncPendingErrorCount_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_XlkSyncPendingErrorCount\_U32 specifies the number of cases in which a sync frame could not be sent on the X2X Link network because another frame was being received.

**DIA\_XlkAsyncErrorCount\_U32**

<b>Subindex</b>	<b>0x17</b>
<b>Name</b>	DIA_XlkAsyncErrorCount_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DIA\_XlkAsyncErrorCount\_U32 specifies the number of errors from async frames on the X2X Link network.

**DIA\_XIkAsyncBusyErrorCount\_U32**

Subindex	0x18
Name	DIA_XIkAsyncBusyErrorCount_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

DIA\_XIkAsyncBusyErrorCount\_U32 specifies the number of bus timing errors from async frames on the X2X Link network.

**DIA\_XIkAsyncNoRxErrorCount\_U32**

Subindex	0x19
Name	DIA_XIkAsyncNoRxErrorCount_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

DIA\_XIkAsyncNoRxErrorCount\_U32 specifies the number of frame timing errors from async frames on the X2X Link network.

**DIA\_XIkAsyncFormatErrorCount\_U32**

Subindex	0x1A
Name	DIA_XIkAsyncFormatErrorCount_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

DIA\_XIkAsyncFormatErrorCount\_U32 specifies the number of CRC errors from async frames on the X2X Link network.

**DIA\_XIkAsyncPendingErrorCount\_U32**

Subindex	0x1B
Name	DIA_XIkAsyncPendingErrorCount_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

DIA\_XIkAsyncPendingErrorCount\_U32 specifies the number of cases in which an async frame could not be sent on the X2X Link network because another frame was being received.

**DIA\_XIkModuleLostWhileOperational\_U32**

Subindex	0x1C
Name	DIA_XIkModuleLostWhileOperational_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

The DIA\_XIkModuleLostWhileOperational\_U32 counter specifies how often a module was removed from the bus during operation.

**DIA\_XIkModuleNewWhileOperational\_U32**

Subindex	0x1D
Name	DIA_XIkModuleNewWhileOperational_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

The DIA\_XIkModuleNewWhileOperational\_U32 counter specifies how often a new module was detected on the bus during operation.

## DIA\_RamAccessViolation\_U32

Subindex	0x20
Name	DIA_RamAccessViolation_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	0
Access rights	Read/Write
PDO mapping	No

DIA\_RamAccessViolation\_U32 specifies the number of internal RAM access errors (e.g. null pointer access).

## 4.6 MOD\_CfgCount\_U8

### Object 0x20A0

Subindex	0x20A0
Name	MOD_CfgCount_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	253
Object type	VAR
Access rights	Read/Write
PDO mapping	No

MOD\_CfgCount\_U8 specifies the number of configured I/O modules. The X2X Link master starts up to the number of modules specified here.

## 4.7 MOD\_SlotCount\_U8

### Object 0x20A1

Subindex	0x20A1
Name	MOD_SlotCount_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Object type	VAR
Access rights	Read only
PDO mapping	No

MOD\_SlotCount\_U8 specifies the number of physical slots found. Empty X2X slots are also counted.

## 4.8 MOD\_ActCount\_U8

### Object 0x20A2

Subindex	0x20A2
Name	MOD_ActCount_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Object type	VAR
Access rights	Read only
PDO mapping	No

MOD\_ActCount\_U8 specifies the number of active modules on the X2X Link network.

## 4.9 NMT\_ChildIdentData\_ADOM

### Object 0x20A8

This object returns the identification data of the connected I/O modules according to the definition in EPSG DSP 311.

Index	0x20A0
Name	NMT_ChildIdentData_ADOM
Data type	DOMAIN
Object type	ARRAY

**NumberOfEntries**

Subindex	0x00
Name	NumberOfEntries
Data type	-
Range of values	1 to 253
Default value	1
Access rights	Read only
PDO mapping	No

**NMT\_ChildIdentData\_ADOM**

Subindex	0x01 to 0xFE
Name	NMT_ChildIdentData_ADOM
Data type	-
Range of values	DOMAIN
Default value	-
Access rights	Read only
PDO mapping	No

The subindexes refer to the respective I/O module (e.g. subindex 1 = first I/O module).

Each subindex contains 6 UINT32 entries.

- VendorID: Vendor ID, corresponds to 0x0100006C
- ProductCode: Corresponds to the module's hardware ID
- RevisionNo: Corresponds to the hardware variant of the module
- SerialNo: Corresponds to the module's serial number
- ApplSwdata: "0" - Value not supported by module
- ApplSwTime: Module's firmware version

Empty slots return "0" for all element entries.

**4.10 PDL\_DownloadChildProgData\_ADOM****Object 0x20A9**

This object corresponds to the firmware object according to the definition in EPSG DSP 311.

Index	0x20A9
Name	PDL_DownloadChildProgData_ADOM
Data type	DOMAIN
Object type	ARRAY

**NumberOfEntries**

Subindex	0x00
Name	NumberOfEntries
Data type	-
Range of values	1 to 253
Default value	1
Access rights	Read only
PDO mapping	No

**PDL\_DownloadChildProgData\_ADOM**

Subindex	0x01 to 0xFE
Name	PDL_DownloadChildProgData_ADOM
Data type	-
Range of values	DOMAIN
Default value	-
Access rights	Write only
PDO mapping	No

PDL\_DownloadChildProgData\_ADOM can be used for updating the firmware on I/O modules. The subindexes refer to the respective I/O module (e.g. subindex 1 = first I/O module).

## 4.11 MOD\_NetworkStatus\_AU64

### Object 0x20B0

This object can be used to read the network status bytes in groups of 8 modules.

<b>Index</b>	<b>0x20B0</b>
<b>Name</b>	MOD_NetworkStatus_AU64
<b>Data type</b>	UNSIGNED64
<b>Object type</b>	ARRAY

### NumberOfEntries

<b>Subindex</b>	<b>0x00</b>
<b>Name</b>	NumberOfEntries
<b>Data type</b>	
<b>Range of values</b>	32
<b>Default value</b>	32
<b>Access rights</b>	Constant
<b>PDO mapping</b>	No

### NetworkStatus

<b>Subindex</b>	<b>0x01 - 0x20</b>
<b>Name</b>	NetworkStatus
<b>Data type</b>	UNSIGNED64
<b>Range of values</b>	0 to 255 per module
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	TPDO

Each subindex encodes the network status of up to 8 X2X Link modules. The first module in the group of eight is located at the least significant byte.

## 4.12 IO\_MultiScan\_DOM

### Object 0x20B1

<b>Subindex</b>	<b>0x20B1</b>
<b>Name</b>	IO_MultiScan_DOM
<b>Data type</b>	DOMAIN
<b>Range of values</b>	-
<b>Default value</b>	-
<b>Object type</b>	VAR
<b>Access rights</b>	Read only
<b>PDO mapping</b>	TPDO

IO\_MultiScan\_DOM can be used to map multiple X2X Link cycles into one PRes frame. If a transmit mapping of 20 bytes is created, for example, and IO\_MultiScan\_DOM also mapped with 20 bytes, then 2 X2X Link cycles will be transferred in each PRes frame. If the IO\_MultiScan\_DOM object is mapped twice with 20 bytes each, then a total of 3 X2X Link cycles is transferred.

This function is used if X2X Link is working with a lower (faster) cycle time than POWERLINK and all I/O data should still be transferred to the PLC. If X2X Link is running at 1 ms and POWERLINK at 5 ms, for example, all 5 X2X Link cycles would be transferred in each POWERLINK PRes frame.

## 4.13 BC\_Internal\_REC

### Object 0x20F0

Internal bus controller information.

<b>Index</b>	<b>0x20F0</b>
<b>Name</b>	BC_Internal_REC
<b>Data type</b>	BC_Internal_TYPE
<b>Object type</b>	RECORD

### NumberOfEntries

<b>Subindex</b>	<b>0x00</b>
<b>Name</b>	NumberOfEntries
<b>Data type</b>	
<b>Range of values</b>	29
<b>Default value</b>	29
<b>Access rights</b>	Constant
<b>PDO mapping</b>	No

**BC\_BootFpgaVersion\_U16**

<b>Subindex</b>	<b>0x01</b>
<b>Name</b>	BC_BootFpgaVersion_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_BootFpgaVersion\_U16 is used to read the FPGA version of bootable flash memory.

**BC\_BootFirmwareVersion\_U16**

<b>Subindex</b>	<b>0x02</b>
<b>Name</b>	BC_BootFirmwareVersion_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_BootFirmwareVersion\_U16 is used to read the firmware version of bootable flash memory.

**BC\_UpgradeFpgaVersion\_U16**

<b>Subindex</b>	<b>0x03</b>
<b>Name</b>	BC_UpgradeFpgaVersion_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_UpgradeFpgaVersion\_U16 is used to read the FPGA version of upgrade flash memory.

**BC\_UpgradeFirmwareVersion\_U16**

<b>Subindex</b>	<b>0x04</b>
<b>Name</b>	BC_UpgradeFirmwareVersion_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_UpgradeFirmwareVersion\_U16 is used to read the firmware version of upgrade flash memory.

**BC\_UpgradeActive\_U8**

<b>Subindex</b>	<b>0x05</b>
<b>Name</b>	BC_UpgradeActive_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

BC\_UpgradeActive\_U8 can be used to determine the active flash memory range. A different firmware version can be enabled by a write operation.

Reading from BC\_UpgradeActive\_U8:

Value	Description
0	Firmware of bootable flash memory active
1	Firmware of upgrade flash memory active

Writing to BC\_UpgradeActive\_U8:

Value	Description
0	Loads the default firmware
1	Loads the upgrade firmware

**BC\_NodeNumber\_U8**

<b>Subindex</b>	<b>0x06</b>
<b>Name</b>	BC_NodeNumber_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_NodeNumber\_U8 shows the current setting of the node number switch.

**BC\_MemFree\_U32**

<b>Subindex</b>	<b>0x07</b>
<b>Name</b>	BC_MemFree_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_MemFree\_U32 contains the free memory after firmware initialization.

**BC\_LedTest\_U8**

<b>Subindex</b>	<b>0x09</b>
<b>Name</b>	BC_LedTest_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Write only
<b>PDO mapping</b>	No

BC\_LedTest\_U8 can be used to control the individual LEDs on the bus controller for testing purposes.

<b>Value</b>	<b>Description</b>
0	LED testing disabled (LEDs behave according to the POWERLINK state)
1	Status LED permanently lit green
2	Status LED permanently lit red
3	Reserved
4	All LEDs off
5	Link LED "L/A IF1" permanently lit
6	Link LED "L/A IF2" permanently lit

**BC\_CntNvmStore\_U16**

<b>Subindex</b>	<b>0x0A</b>
<b>Name</b>	BC_CntNvmStore_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_CntNvmStore\_U16 contains the number of save commands for the object dictionary.

**BC\_CntNvmInconsistent\_U16**

<b>Subindex</b>	<b>0x0B</b>
<b>Name</b>	BC_CntNvmInconsistent_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_CntNvmInconsistent\_U16 contains the number of inconsistencies in nonvolatile memory. These can occur when the power supply is interrupted while writing to the object dictionary, for example.



**BC\_CntNvmVersionChange\_U16**

Subindex	0x0C
Name	BC_CntNvmVersionChange_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	-
Access rights	Read only
PDO mapping	No

BC\_CntNvmVersionChange\_U16 contains the number of delete operations in nonvolatile memory caused by firmware update.

**BC\_CntNvmReload\_U16**

Subindex	0x0D
Name	BC_CntNvmReload_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	-
Access rights	Read only
PDO mapping	No

BC\_CntNvmReload\_U16 contains the number of reloaded cycles in nonvolatile memory.

**BC\_IoCycleCount\_U8**

Subindex	0x0E
Name	BC_IoCycleCount_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Access rights	Read only
PDO mapping	TPDO

BC\_IoCycleCount\_U8 contains the last cycle counter received on the X2X Link network.

**BC\_MsTime\_U32**

Subindex	0x0F
Name	BC_MsTime_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	-
Access rights	Read only
PDO mapping	No

BC\_MsTime\_U32 contains the number of milliseconds since the last bus controller startup.

**BC\_SyncPresetUs\_U16**

Subindex	0x10
Name	BC_SyncPresetUs_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	35
Access rights	Read/Write
PDO mapping	No

BC\_SyncPresetUs\_U16 defines how many microseconds before the sync event occurs the I/O data is prepared.

**BC\_PhysicalPorts\_U8**

Subindex	0x11
Name	BC_PhysicalPorts_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Access rights	Read only
PDO mapping	No

BC\_PhysicalPorts\_U8 indicates which physical Ethernet interfaces exist on the device. Bit 0 stands for IF1, bit 1 for IF2, etc.

**BC\_PhysicalLink\_U8**

<b>Subindex</b>	<b>0x12</b>
<b>Name</b>	BC_PhysicalLink_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_PhysicalLink\_U8 indicates the link status of the physical Ethernet interfaces. Bit 0 stands for IF1, bit 1 for IF2, etc.

**BC\_SupportedSdoProtocols\_U8**

<b>Subindex</b>	<b>0x13</b>
<b>Name</b>	BC_SupportedSdoProtocols_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

BC\_SupportedSdoProtocols\_U8 defines which PDO protocols should be supported by the bus controller. This setting is also indicated in NMT\_FeatureFlags\_U32 (see section "[Communication objects 0x1C0D to 0x1F0E](#)" on page 20).

<b>Value</b>	<b>Description</b>
0	SDO/UDP + SDO/ASnd
1	SDO/UDP only

**BC\_LineSpeed\_U16**

<b>Subindex</b>	<b>0x14</b>
<b>Name</b>	BC_LineSpeed_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

BC\_LineSpeed\_U16 indicates the current link speed (10/100/1000 Mbit/s).

**BC\_UserDataWriteEnable\_U32**

<b>Subindex</b>	<b>0x15</b>
<b>Name</b>	BC_UserDataWriteEnable_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	-
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

BC\_UserDataWriteEnable\_U32 enables write access to BC\_UserData\_DOM. The value 0x65766173 must be written for this. This value is reset to 0 after writing to BC\_UserData\_DOM.

**BC\_UserData\_DOM**

Subindex	0x16
Name	BC_UserData_DOM
Data type	DOMAIN
Range of values	-
Default value	-
Access rights	Read/Write
PDO mapping	No

User-specific data up to 1024 bytes can be written to BC\_UserData\_DOM.

Please note the following when writing user-specific data:

- Write 0x65766173 to [BC\\_UserDataWriteEnable\\_U32](#) to enable (an abort code will be returned otherwise).
- Data is stored directly in flash memory; old data is deleted.
- It can take up to 2 seconds until the write operation is confirmed (SDO command layer ACK).
- Data is only deleted explicitly; this data remains even during firmware updates.
- Reading is permitted anytime.
- All data is set to 0 if the power supply is interrupted during the write phase.
- After the data is written, this object is locked for 0.5 s per byte. After writing 50 bytes to an object, for example, the object cannot be written to for 25 s (this protects the flash memory from excessive write operations).

The following abort codes can be returned after a read operation:

Value	Description
0x08000021	No memory buffer for reading available or write operation currently active
0x08000000	No data available or data invalid

The following abort codes can be returned after a write operation:

Value	Description
0x08000021	Object locked due to earlier write operation (flash locking)
0x08000000	Write operation disabled (see " <a href="#">BC_UserDataWriteEnable_U32</a> " on page 42)

**BC\_UserDataCountdown\_U16**

Subindex	0x17
Name	BC_UserDataCountdown_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	-
Access rights	Read only
PDO mapping	No

BC\_UserDataCountdown\_U16 counts the number of seconds until new user-specific data is permitted to be written.

**BC\_RedundancyNetworkFlags\_U8**

Subindex	0x18
Name	BC_RedundancyNetworkFlags_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Access rights	Read only
PDO mapping	No

BC\_RedundancyNetworkFlags\_U8 indicates the available networks.

Bit	Description
0	First network determined
1	Second network determined

**Information:**

This object is only used on POWERLINK bus controllers with a cable redundancy system (X20BC8084).

**BC\_RedundancyNetworkIndex\_U8**

Subindex	0x19
Name	BC_RedundancyNetworkIndex_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Access rights	Read/Write
PDO mapping	No

BC\_RedundancyNetworkIndex\_U8 indicates the network to which the bus controller is currently connected. A write operation can be carried out to force a certain network to be used. This only works if valid network traffic is determined on the selected interface.

**Information:**

This object is only used on POWERLINK bus controllers with a cable redundancy system (X20BC8084).

**BC\_RedundancyTxMode\_U8**

Subindex	0x1A
Name	BC_RedundancyTxMode_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Access rights	Read/Write
PDO mapping	No

BC\_RedundancyTxMode\_U8 specifies whether transmission should take place only on the selected interface (value 0) or both interfaces simultaneously (value 1).

**Information:**

This object is only used on POWERLINK bus controllers with a cable redundancy system (X20BC8084).

**BC\_PhyExist\_U32**

Subindex	0x1C
Name	BC_PhyExist_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	-
Access rights	Read only
PDO mapping	No

BC\_PhyExist\_U32 uses bits to specify whether a certain physical interface exists. Bit 0 corresponds to interface 0, bit 1 to interface 1, etc.

**BC\_PhyLinked\_U32**

Subindex	0x1D
Name	BC_PhyLinked_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	-
Access rights	Read only
PDO mapping	No

BC\_PhyLinked\_U32 uses bits to specify whether a link to a physical interface exists. Bit 0 corresponds to interface 0, bit 1 to interface 1, etc.

## 4.14 DUMMY\_MapObjects\_AU8

### Object 0x20F8

The elements of this object can be mapped for testing purposes.

<b>Index</b>	<b>0x20F8</b>
<b>Name</b>	DUMMY_MapObjects_AU8
<b>Data type</b>	UNSIGNED8
<b>Object type</b>	ARRAY

### NumberOfEntries

<b>Subindex</b>	<b>0x00</b>
<b>Name</b>	NumberOfEntries
<b>Data type</b>	
<b>Range of values</b>	8
<b>Default value</b>	8
<b>Access rights</b>	Constant
<b>PDO mapping</b>	No

### MapObjects

<b>Subindex</b>	<b>0x01 to 0x08</b>
<b>Name</b>	MapObjects
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	Optional

## 4.15 DUMMY\_ProtocolTest\_REC

### Object 0x20FF

Various protocol tests.

<b>Index</b>	<b>0x20FF</b>
<b>Name</b>	DUMMY_ProtocolTest_REC
<b>Data type</b>	DUMMY_ProtocolTest_TYPE
<b>Object type</b>	RECORD

### NumberOfEntries

<b>Subindex</b>	<b>0x00</b>
<b>Name</b>	NumberOfEntries
<b>Data type</b>	
<b>Range of values</b>	4
<b>Default value</b>	4
<b>Access rights</b>	Constant
<b>PDO mapping</b>	No

### DUMMY\_DomainUploadLen\_U32

<b>Subindex</b>	<b>0x01</b>
<b>Name</b>	DUMMY_DomainUploadLen_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	1 to 516096
<b>Default value</b>	1000
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

DUMMY\_DomainUploadLen\_U32 defines the length of the DOMAIN that can be read using DUMMY\_Upload\_DOM.

### DUMMY\_Upload\_DOM

<b>Subindex</b>	<b>0x02</b>
<b>Name</b>	DUMMY_Upload_DOM
<b>Data type</b>	DOMAIN
<b>Range of values</b>	-
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

DUMMY\_Upload\_DOM defines a DOMAIN object that can be read for testing purposes.

**DUMMY\_DomainDownloadLen\_U32**

Subindex	0x03
Name	DUMMY_DomainDownloadLen_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	-
Access rights	Read only
PDO mapping	No

DUMMY\_DomainDownloadLen\_U32 specifies the length of the last DOMAIN object written to DUMMY\_Download\_DOM.

**DUMMY\_Download\_DOM**

Subindex	0x04
Name	DUMMY_Download_DOM
Data type	DOMAIN
Range of values	-
Default value	-
Access rights	Write only
PDO mapping	No

DUMMY\_Download\_DOM defines a DOMAIN object that can be written for testing purposes.

**4.16 MOD\_Config\_xxx\_REC****Object 21xx**

These objects can be used to configure the individual modules on the X2X Link network. Object 0x2100 represents the power supply module (e.g. X20PS9400), object 0x2101 the first I/O module in the X2X Link network, object 0x2102 the second I/O module, etc.

Index	0x2100 - 0x21FE
Name	MOD_Config_xxx_REC
Data type	MOD_Config_xxx_TYPE
Object type	RECORD

**NumberOfEntries**

Subindex	0x00
Name	NumberOfEntries
Data type	
Range of values	254
Default value	254
Access rights	Constant
PDO mapping	No

**MOD\_ChildCfgIndex\_U16**

Subindex	0x01
Name	MOD_ChildCfgIndex_U16
Data type	UNSIGNED16
Range of values	0 or 0x2101 to 0x21FE
Default value	0
Access rights	Read/Write
PDO mapping	No

This subindex is reserved for future expansions.

MOD\_ChildCfgIndex\_U16 specifies the index for the first submodule. The value 0 specifies that no submodules exist for this module.

**MOD\_ChildCfgCount\_U8**

Subindex	0x02
Name	MOD_ChildCfgCount_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	0
Access rights	Read/Write
PDO mapping	No

This subindex is reserved for future expansions.

MOD\_ChildCfgCount\_U8 specifies the number of configured submodules.

**MOD\_ChildActCount\_U8**

<b>Subindex</b>	<b>0x03</b>
<b>Name</b>	MOD_ChildActCount_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	0
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

This subindex is reserved for future expansions.

MOD\_ChildActCount\_U8 specifies the number of active submodules.

**MOD\_CfgMode\_U8**

<b>Subindex</b>	<b>0x04</b>
<b>Name</b>	MOD_CfgMode_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_CfgMode\_U8 can be used to determine how the X2X Link modules are configured.

Value	Description:
0	Loads the register information from the I/O modules and configures all cyclic registers (except if <a href="#">X2X_CfgModeUploadDisable_BOOL</a> is set to TRUE)
1	Takes the register configuration from the managing node (via <a href="#">MOD_CfgEntry_xx_U64</a> )
2	Disables the I/O module
3	Combination of 0 and 1: Loads the register information and then adds configuration parameters from <a href="#">MOD_CfgEntry_xx_U64</a> .

**MOD\_RequestedHardwareId\_U16**

<b>Subindex</b>	<b>0x05</b>
<b>Name</b>	MOD_RequestedHardwareId_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_RequestedHardwareId\_U16 specifies the hardware ID of the module expected in this slot. If the connected modules does not have the specified ID, it will not be enabled.

Value	Description
0	Disables ID verification for the module
1 - 65534	Expected hardware ID
65535	Dummy module

**MOD\_RequestedVendorId\_U16**

<b>Subindex</b>	<b>0x06</b>
<b>Name</b>	MOD_RequestedVendorId_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_RequestedVendorId\_U16 specifies the vendor ID of the module expected in this slot. If the connected modules does not have the specified ID, it will not be enabled.

Value	Description
0	Disables ID verification for the module
1 - 65,535	Expected vendor ID

**MOD\_HardwareId\_U16**

<b>Subindex</b>	<b>0x07</b>
<b>Name</b>	MOD_HardwareId_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

MOD\_HardwareId\_U16 specifies the hardware ID of the I/O module. 0 is output here if no module is connected.

**MOD\_VendorId\_U16**

<b>Subindex</b>	<b>0x08</b>
<b>Name</b>	MOD_VendorId_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

MOD\_VendorId\_U16 specifies the vendor ID of the I/O module. 0 is output here if no module is connected.

**MOD\_Status\_U16**

<b>Subindex</b>	<b>0x0A</b>
<b>Name</b>	MOD_Status_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	-
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_Status\_U16 describes the current status of the I/O module. The following values can be read:

Value	Status
0	Module not connected
0x42 ("B")	OS loader test
0x43 ("C")	Configuration
0x44 ("D")	Firmware download active
0x4E ("N")	Slot found but boot procedure could not be started due to missing I/O power supply or unconnected module
0x50 ("P")	PRE_OPERATIONAL mode
0x52 ("R")	RUN mode: Module active
0x53 ("S")	Synchronization
0x55 ("U")	IDs uploading
0xE0	Firmware update required (no valid firmware on module)
0xE1	Firmware update required (invalid file loaded for this module)
0xE2	GO command failed, incorrect function mode configured
0xE3	Faulty register configuration, configured register doesn't exist
0xE4	Error reading configuration flash memory on ASIC-only modules
0xE5	X2X frame too small
0xE6	Module with incorrect ID ( <a href="#">MOD_HardwareId_U16</a> <> <a href="#">MOD_RequestedHardwareId_U16</a> )

The following values can be written:

Value	Status
0x44 ("D")	Puts the module into the firmware download status (for manual firmware download via streaming channel)
0x63 ("c")	Closes the firmware download channel
0x64 ("d")	Returns abort code 0x08000021 (for compatibility reasons)
0x72 ("r")	Resets the I/O module

The controlled node is permitted to refuse a command with abort code 0x08000021 if it is not allowed in the current state.

**MOD\_NetworkStatus\_U8**

<b>Subindex</b>	<b>0x0B</b>
<b>Name</b>	MOD_NetworkStatus_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	TPDO

MOD\_NetworkStatus\_U8 specifies the module's current status.

Bit	Status
0	X2X supply voltage OK
1	Reserved
2	X2X network OK
3	Data valid (0 = OK, 1 = Data not refreshed since module was removed from bus, for example)



**MOD\_BlockMask\_U8**

Subindex	0x0C
Name	MOD_BlockMask_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Access rights	Read only
PDO mapping	No

MOD\_BlockMask\_U8 contains information about the module's firmware blocks (e.g. "Valid block mask" for PSOC modules).

**MOD\_BootCount\_U8**

Subindex	0x0D
Name	MOD_BootCount_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Access rights	Read/Write
PDO mapping	No

MOD\_BootCount\_U8 counts the module's boot cycles. The counter is incremented after successful startup and when the connection to the module is lost. An even number means that the module is inactive; an odd number means that the module is active and a hardware ID exists.

**MOD\_LastError\_U8**

Subindex	0x0E
Name	MOD_LastError_U8
Data type	UNSIGNED8
Range of values	0 to 255
Default value	-
Access rights	Read/Write
PDO mapping	No

MOD\_LastError\_U8 can be used to read an error code that specifies the reason for the module's last restart.

**MOD\_FirmwareVersion\_U16**

Subindex	0x11
Name	MOD_FirmwareVersion_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	-
Access rights	Read only
PDO mapping	No

MOD\_FirmwareVersion\_U16 specifies the version of the module's firmware.

**MOD\_HardwareVariant\_U16**

Subindex	0x12
Name	MOD_HardwareVariant_U16
Data type	UNSIGNED16
Range of values	0 to 65535
Default value	-
Access rights	Read only
PDO mapping	No

MOD\_HardwareVariant\_U16 specifies the X2X Link module's hardware variant.

**MOD\_SerialNo\_U32**

Subindex	0x13
Name	MOD_SerialNo_U32
Data type	UNSIGNED32
Range of values	0 to 4294967295
Default value	-
Access rights	Read only
PDO mapping	No

MOD\_SerialNo\_U32 specifies the last 7 digits of the X2X Link module's serial number.

**MOD\_PhysicalSlotNumber\_U8**

<b>Subindex</b>	<b>0x14</b>
<b>Name</b>	MOD_PhysicalSlotNumber_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

MOD\_PhysicalSlotNumber\_U8 specifies the X2X Link module's physical slot number. If X2X modules with node number switches are being used, then it is possible for the physical node number to be different from the logical node number.

**MOD\_NodeSwitch\_U8**

<b>Subindex</b>	<b>0x15</b>
<b>Name</b>	MOD_NodeSwitch_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	No

MOD\_NodeSwitch\_U8 contains the setting for the node number switch (0 if the module does not have node number switches).

**MOD\_RequestedSerialNo\_U32**

<b>Subindex</b>	<b>0x16</b>
<b>Name</b>	MOD_RequestedSerialNo_U32
<b>Data type</b>	UNSIGNED32
<b>Range of values</b>	0 to 4294967295
<b>Default value</b>	-
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_RequestedSerialNo\_U32 specifies the module's expected serial number. A module with a different serial number will not be enabled. Value 0 means that verification of the serial number is disabled.

**MOD\_ModuleErrorReaction\_U8**

<b>Subindex</b>	<b>0x17</b>
<b>Name</b>	MOD_ModuleErrorReaction_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	-
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_ModuleErrorReaction\_U8 can be used to determine the behavior of the bus controller when there is an error on the X2X Link module.

<b>Bit</b>	<b>Status</b>
0	Does not switch to READY_TO_OPERATE mode if this module is missing
1	Does not switch to READY_TO_OPERATE mode if this module is not the expected module
2	Switches to PRE_OPERATIONAL_1 mode if an error occurs on this module and the bus controller was in OPERATIONAL mode beforehand.

**MOD\_InputImage1\_DOM**

<b>Subindex</b>	<b>0x1E</b>
<b>Name</b>	MOD_InputImage1_DOM
<b>Data type</b>	DOMAIN
<b>Range of values</b>	-
<b>Default value</b>	-
<b>Access rights</b>	Read only
<b>PDO mapping</b>	TPDO

All cyclic input data including the connected X2X Link modules' network status bytes is transferred in MOD\_InputImage1\_DOM. This object is usually mapped to TPDO.

**MOD\_InputImage2\_DOM**

Subindex	0x1F
Name	MOD_InputImage2_DOM
Data type	DOMAIN
Range of values	-
Default value	-
Access rights	Read only
PDO mapping	TPDO

All cyclic input data without the connected X2X Link modules' network status bytes is transferred in MOD\_InputImage2\_DOM. This object is usually mapped to TPDO.

**MOD\_OutputImage\_DOM**

Subindex	0x20
Name	MOD_OutputImage_DOM
Data type	DOMAIN
Range of values	-
Default value	-
Access rights	Write only
PDO mapping	RPDO

All connected X2X Link modules' cyclic output data can be written to MOD\_OutputImage\_DOM. This object is usually mapped to RPDO.

**Information:**

**SDO access to this object is not supported!**

**MOD\_AsyncRead\_U64**

Subindex	0x21
Name	MOD_AsyncRead_U64
Data type	UNSIGNED64
Range of values	See format of configuration entries in "MOD_CfgEntry_xx_U64" in section "MOD_Config_xxxh_REC".
Default value	-
Access rights	Read/Write
PDO mapping	No

MOD\_AsyncRead\_U64 can be used to asynchronously read a register on the X2X Link module. The request is written to the object for this. The requested value can then be read by the object.

**MOD\_AsyncWrite\_U64**

Subindex	0x22
Name	MOD_AsyncWrite_U64
Data type	UNSIGNED64
Range of values	See format of configuration entries in "MOD_CfgEntry_xx_U64" in section "MOD_Config_xxxh_REC".
Default value	-
Access rights	Write only
PDO mapping	No

MOD\_AsyncWrite\_U64 can be used to asynchronously write to a register on the X2X Link module.

**MOD\_Firmware\_DOM**

Subindex	0x23
Name	MOD_Firmware_DOM
Data type	DOMAIN
Range of values	-
Default value	-
Access rights	Write only
PDO mapping	No

MOD\_Firmware\_DOM can be used to write the firmware to an X2X Link module.

**MOD\_FirmwareChannel\_U16**

<b>Subindex</b>	<b>0x32</b>
<b>Name</b>	MOD_FirmwareChannel_U16
<b>Data type</b>	UNSIGNED16
<b>Range of values</b>	0 to 65535
<b>Default value</b>	2
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

Downloads to MOD\_Firmware\_DOM are transferred via the X2X Link module's channel specified in MOD\_FirmwareChannel\_U16.

The least significant byte specifies the channel; the most significant byte defines whether the module should first switch to PRE\_OPERATIONAL mode (value 0) or remain in the current module mode (value 1).

**MOD\_CfgFunctionMode\_U8**

<b>Subindex</b>	<b>0x5A</b>
<b>Name</b>	MOD_CfgFunctionMode_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 255
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_CfgFunctionMode\_U8 defines the function model.

**MOD\_CfgEntryCount\_U8**

<b>Subindex</b>	<b>0x5B</b>
<b>Name</b>	MOD_CfgEntryCount_U8
<b>Data type</b>	UNSIGNED8
<b>Range of values</b>	0 to 100
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_CfgEntryCount\_U8 defines the number of configuration entries in MOD\_CfgEntry\_xx\_U64.

**MOD\_CfgEntry\_xx\_U64**

<b>Subindex</b>	0x64 - 0xC7
<b>Name</b>	MOD_CfgEntry_xx_U64
<b>Data type</b>	UNSIGNED64
<b>Range of values</b>	See format of the configuration entries
<b>Default value</b>	0
<b>Access rights</b>	Read/Write
<b>PDO mapping</b>	No

MOD\_CfgEntry\_xx\_U64 contains the register configuration for the X2X Link module. Up to 100 configuration entries are possible.

**Format of configuration entries**

Bit	Description
0 - 15	Register or parameter number (the upper 8 bits contain the register bank)
16 - 23	Size in bytes (0: Register not being used)
24 - 27	Type: <ul style="list-style-type: none"> <li>• 0: Dynamic cyclic input register</li> <li>• 1: Dynamic cyclic output register</li> <li>• 2: Static cyclic input register</li> <li>• 3: Static cyclic output register</li> <li>• 5: Acyclic output register</li> <li>• 6: Reserved</li> <li>• 7: Set parameters</li> </ul>
28 - 29	Element size
30 - 31	Flags: Reserved
32 - 63	Value: <ul style="list-style-type: none"> <li>• Type = 1: Default value for output if no valid data is available</li> <li>• Type = 3: Default value for output if no valid data is available</li> <li>• Type = 5: Writes the initialization value before the module is enabled</li> <li>• Type = 7: Parameter value that should be set before starting the module</li> </ul>

**Maximum number of configuration entries**

The bus controller automatically creates a list of configuration entries for each connected I/O module. This includes the following for each module:

- All cyclic registers of the I/O module
- All additional registers used internally by the function model for the I/O module configuration

This can cause an internal configuration memory overflow when using several computationally intensive I/O modules (e.g. X20DC4395).

**Information:**

**The total number of all configuration entries on the bus controller is not permitted to exceed 2024.**

## 5 Configuration examples

This chapter includes typical examples for configuring and using a B&R POWERLINK bus controller.

The following hardware combination is used:

Bus controller	X20BC0083
Power supply module	X20PS9402
12-channel digital input module	X20DI9371
12-channel digital output module	X20DO9322

### 5.1 Resetting the bus controller

The NMT\_Restore\_DefParam\_REC object is used to reset a POWERLINK bus controller to its default values (0x1011, see "[Communication objects 0x1000 to 0x1403](#)" on page 18). A write operation to subindex 0x01 (AllParam\_U32) deletes the entire bus controller configuration.

Step	Command	Object	Value	Description
1	SDOWrite	0x1011 / 0x01	0x64616F6C	Write "load" to NMT_RestoreDefParam_REC / AllParam_U32
2	NMTResetNode			Restart station

### 5.2 Saving the configuration

To save the current bus controller configuration, an unambiguous configuration timestamp should first be set in the CFM\_VerifyConfiguration\_REC object. This timestamp can be used when restarting the station by the managing node to determine whether the current configuration already exists or whether it needs to be written first.

The save procedure itself is triggered by a write operation to NMT\_StoreParam\_REC (see "[Communication objects 0x1000 to 0x1403](#)" on page 18).

Step	Command	Object	Value	Description
1	SDOWrite	0x1020 / 0x01	ConfDate	Number of days since 1984-01-01
2	SDOWrite	0x1020 / 0x02	ConfTime	Number of milliseconds since midnight
3	SDOWrite	0x1010 / 0x01	0x65766173	Write "save" to NMT_StoreParam_REC / AllParam_U32

### 5.3 Configuring the bus controller in accordance with DS401

If a B&R POWERLINK bus controller should be operated in accordance with the DS401 profile, then it should be reset first as described in section 4.1. At a minimum, the cycle time and mapping must then be defined.

In order to carry out PDO mapping, the number of mapping parameters is first set to 0. The objects specified in DS401 are then entered in the mapping table. Finally, the mapping is enabled by setting the actual number of mapping parameters.

Step	Command	Object	Value	Description
1	SDOWrite	0x1006h	Cycle time in $\mu$ s	Set cycle time using NMT_CycleLen_U32
Rx mapping				
2	SDOWrite	0x1600 / 0x00	0x00	Sets number of mapping parameters to 0
3	SDOWrite	0x1600 / 0x01	0x0008000000016200	Map first digital output register
4	SDOWrite	0x1600 / 0x00	0x01	Enables mapping with one entry
Tx mapping				
5	SDOWrite	0x1A00 / 0x00	0x00	Sets number of mapping parameters to 0
6	SDOWrite	0x1A00 / 0x01	0x0008000000016000	Map first digital input register
7	SDOWrite	0x1A00 / 0x00	0x01	Enables mapping with one entry
Starts station				
8	NMTResetConfiguration			Enables configuration
9	NMTEnableReadyToOperate			Prepares station for startup
10	NMTStartNode			Starts station

## 5.4 Configuring the bus controller in accordance with the B&R device profile

Compared to the DS401 profile, the B&R bus controller device profile offers extended configuration options. It makes sense to put together the device configuration for the bus controller and the X2X Link modules using Automation Studio V4.4 or later.

Automation Studio can be downloaded at no cost from the B&R website [www.br-automation.com](http://www.br-automation.com). The evaluation license is permitted to be used to create complete configurations for fieldbus bus controllers at no cost.

The objects in the vendor-specific range (0x2000 to 0x5FFF) of the generated XDC file<sup>1)</sup> are particularly interesting.

Step	Command	Object	Value	Description
1	SDOWrite	0x1006	Cycle time in µs	Set cycle time using <code>NMT_CycleLen_U32</code>
<b>X2X Link configuration</b>				
2	SDOWrite	0x2000 / 0x01	1	Sets the X2X Link cycle time explicitly
3	SDOWrite	0x2000 / 0x03	X2X cycle time in µs	X2X Link cycle time value
4	SDOWrite	0x2000 / 0x04	0	Synchronize X2X with POWERLINK to the SoC frame
5	SDOWrite	0x2000 / 0x06	94	X2X output sync frame length
6	SDOWrite	0x2000 / 0x07	94	X2X input sync frame length
7	SDOWrite	0x2000 / 0x08	159	X2X async frame length
8	SDOWrite	0x2000 / 0x09	33	Maximum number of physical slots
9	SDOWrite	0x2000 / 0x0B	1	Disables automatic register configuration
10	SDOWrite	0x20A0	3	Number of actual X2X Link modules
<b>X20PS9402 configuration</b>				
11	SDOWrite	0x2100 / 0x04	1	Enables manual register configuration
12	SDOWrite	0x2100 / 0x05	0xA389	ID code of the expected hardware (X20PS9402)
13	SDOWrite	0x2100 / 0x5A	0	Sets the function model
14	SDOWrite	0x2100 / 0x5B	1	Number of registers to be configured
15	SDOWrite	0x2100 / 0x64	0x0000000002010001	Registerkonfiguration2
<b>X20DI9371 configuration</b>				
16	SDOWrite	0x2101 / 0x04	1	Enables manual register configuration
17	SDOWrite	0x2101 / 0x05	0x1B95	ID code of the expected hardware (X20DI9371)
18	SDOWrite	0x2101 / 0x5A	0	Sets the function model
19	SDOWrite	0x2101 / 0x5B	3	Number of registers to be configured
20	SDOWrite	0x2101 / 0x64	0x0000000002010001	Register configuration
21	SDOWrite	0x2101 / 0x65	0x0000000002010002	Register configuration
22	SDOWrite	0x2101 / 0x66	0x0000000A05010012	Register configuration
<b>X20DO9322 configuration</b>				
23	SDOWrite	0x2102 / 0x04	1	Enables manual register configuration
24	SDOWrite	0x2102 / 0x05	0x1B9A	ID code of the expected hardware (X20DO9322)
25	SDOWrite	0x2102 / 0x5A	0	Sets the function model
26	SDOWrite	0x2102 / 0x5B	4	Number of registers to be configured
27	SDOWrite	0x2102 / 0x65	0x0000000003010000	Register configuration
27	SDOWrite	0x2102 / 0x66	0x0000000003010001	Register configuration
27	SDOWrite	0x2102 / 0x67	0x0000000002010001	Register configuration
27	SDOWrite	0x2102 / 0x68	0x0000000002010002	Register configuration
<b>Rx mapping</b>				
28	SDOWrite	0x1600 / 0x00	0x00	Sets number of mapping parameters to 0
29	SDOWrite	0x1600 / 0x01	0x0010000000202102	Maps output image of DO module
30	SDOWrite	0x1600 / 0x00	0x01	Enables mapping with one entry
<b>Tx mapping</b>				
31	SDOWrite	0x1A00 / 0x00	0x00	Sets number of mapping parameters to 0
32	SDOWrite	0x1A00 / 0x01	0x00100000001E2100	Maps input image of PS module
33	SDOWrite	0x1A00 / 0x02	0x00180010001E2101	Maps input image of DI module
34	SDOWrite	0x1A00 / 0x03	0x00180028001E2102	Maps input image of DO module
35	SDOWrite	0x1A00 / 0x00	0x03	Enables mapping with three entries
<b>Starts station</b>				
36	NMTResetConfiguration			Enables configuration
37	NMTEnableReadyToOperate			Prepares station for startup
38	NMTStartNode			Starts station

<sup>1)</sup> Ethernet POWERLINK Standardization Group: Ethernet POWERLINK XML Device Description DS311 V1.0.0, 2009, [www.ethernet-powerlink.org](http://www.ethernet-powerlink.org)