

X20DOF321

Data sheet
1.12 (September 2024)



Publishing information

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Version history

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

1 General information

1.1 Other applicable documents

For additional and supplementary information, see the following documents.

Other applicable documents

Document name	Title
MAX20	X20 System user's manual
MAEMV	Installations / EMV guide

1.2 Order data


Order number	Short description	Figure
	Digital outputs	
X20DOF321	X20 digital output module, 16 outputs, 24 VDC, 0.5 A, sink, 1-wire connections	
	Required accessories	
	Bus modules	
X20BM11	X20 bus module, 24 VDC keyed, internal I/O power supply connected through	
X20BM15	X20 bus module, with node number switch, 24 VDC keyed, internal I/O power supply connected through	
	Terminal blocks	
X20TB1F	X20 terminal block, 16-pin, 24 VDC keyed	

Table 1: X20DOF321 - Order data

1.3 Module description

The module is equipped with 16 outputs for 1-wire connections. The module is designed for a sink output circuit.

Functions:

- [Digital outputs](#)

Monitoring status of the digital outputs

The output signal of the digital outputs is monitored for short circuit or overload, as is the state of the power supply.

2 Technical description

2.1 Technical data

Order number	X20DOF321
Short description	
I/O module	16 digital outputs 24 VDC for 1-wire connections
General information	
B&R ID code	0x292A
Status indicators	I/O function per channel, operating state, module status
Diagnostics	
Module run/error	Yes, using LED status indicator and software
Outputs	Yes, using LED status indicator and software (output error status)
Power consumption	
Bus	0.25 W
Internal I/O	0.4 W ¹⁾
Additional power dissipation caused by actuators (resistive) [W] ²⁾	+0.48
Certifications	
CE	Yes
UKCA	Yes
Digital outputs	
Variant	FET current-sinking
Nominal voltage	24 VDC
Switching voltage	24 VDC -15% / +20%
Nominal output current	0.5 A
Total nominal current	8 A
Connection type	1-wire connections
Output circuit	Sink
Output protection	Thermal shutdown in the event of overcurrent or short circuit (see value "Short-circuit peak current") Internal freewheeling diode for switching inductive loads (see section "Switching inductive loads")
Diagnostic status	Output monitoring with 10 ms delay
Leakage current when the output is switched off	75 µA
R _{DS(on)}	120 mΩ
Peak short-circuit current	<7 A
Switch-on in the event of overload shutdown or short-circuit shutdown	Approx. 10 ms (depends on the module temperature)
Switching delay ³⁾	
0 → 1	<300 µs
1 → 0	<300 µs
Switching frequency	
Resistive load ³⁾	Max. 500 Hz
Inductive load	See section "Switching inductive loads".
Braking voltage when switching off inductive loads	Typ. 50 VDC
Insulation voltage between channel and bus	500 V _{eff}
Electrical properties	
Electrical isolation	Channel isolated from bus Channel not isolated from channel and I/O power supply
Operating conditions	
Mounting orientation	
Horizontal	Yes
Vertical	Yes
Installation elevation above sea level	
0 to 2000 m	No limitation
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m
Degree of protection per EN 60529	IP20
Ambient conditions	
Temperature	
Operation	
Horizontal mounting orientation	-25 to 60°C
Vertical mounting orientation	-25 to 50°C
Derating	See section "Derating".
Storage	-40 to 85°C
Transport	-40 to 85°C

Table 2: X20DOF321 - Technical data


Order number	X20DOF321
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
Mechanical properties	
Note	Order 1x terminal block X20TB1F separately. Order 1x bus module X20BM11 separately.
Pitch	12.5 ^{+0.2} mm

Table 2: X20DOF321 - Technical data

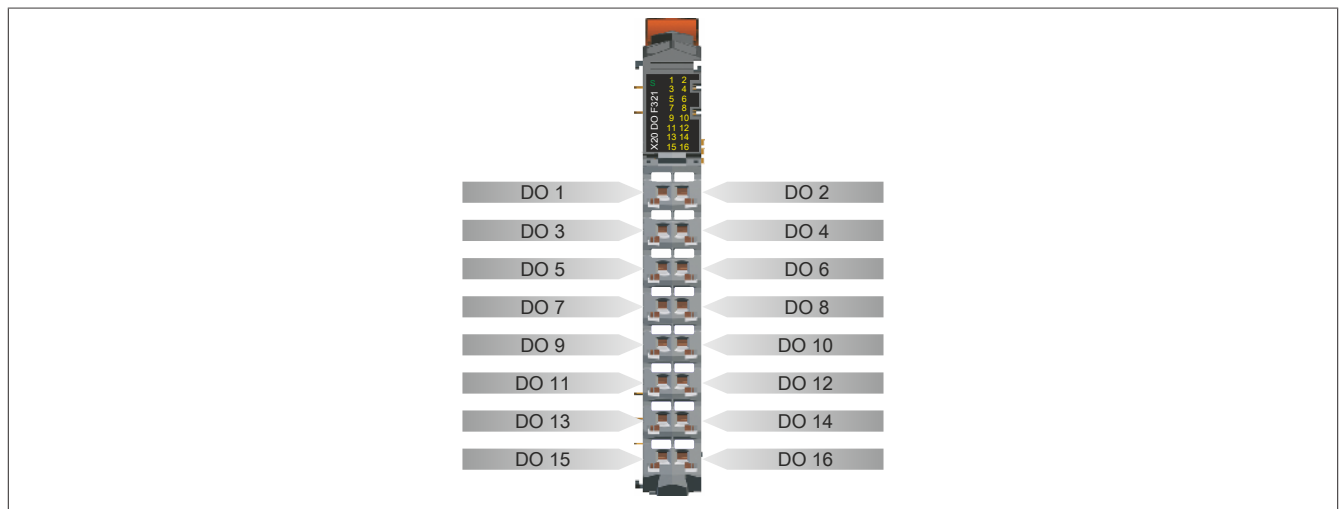
- 1) The power consumed externally for operating the module discharges via the GND contact of the power supply module and must therefore be taken into account in the power balance of the power supply module.
- 2) Number of outputs $\times R_{DS(on)} \times \text{Nominal output current}^2$. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
- 3) At loads $\leq 1 \text{ k}\Omega$

2.2 LED status indicators

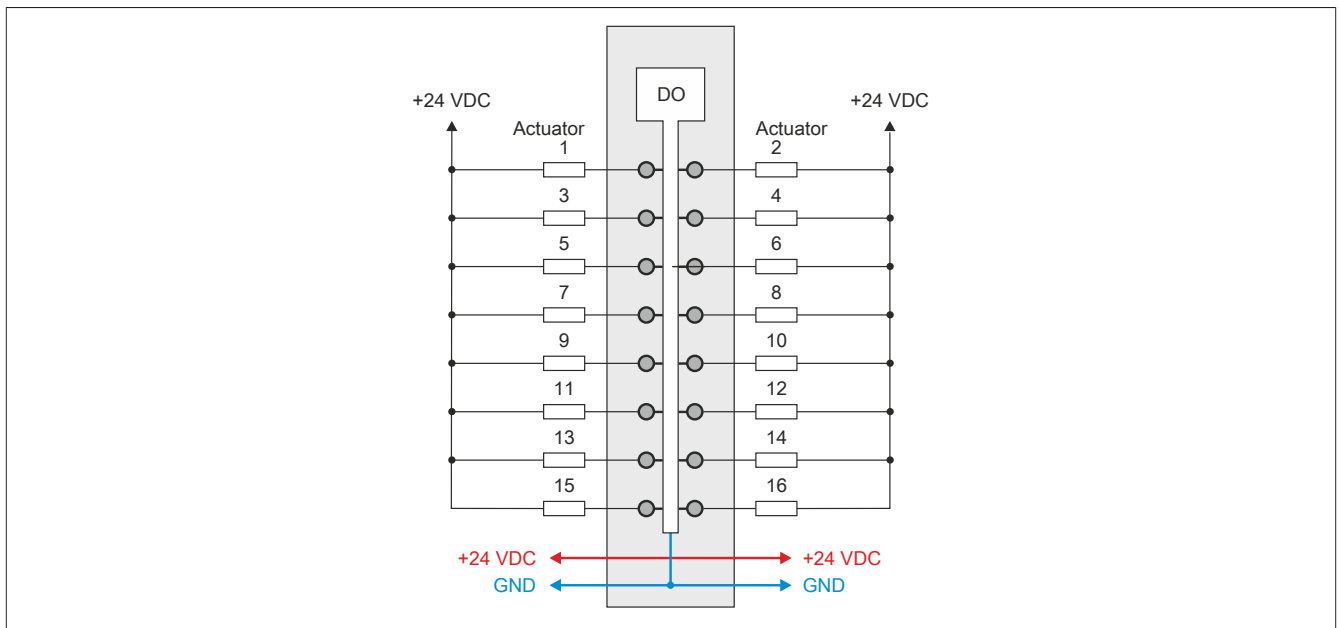
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" in the X20 System user's manual.

Figure	LED	Color	Status	Description
	S	Green	Off	No power to module
			Single flash	Mode RESET
			Blinking	Mode PREOPERATIONAL
			On	Mode RUN
		Red	Off	Module not supplied with power or everything OK
			Single flash	Warning/Error on an I/O channel. Level monitoring for digital outputs has been triggered.
		Solid red / Single green flash		Invalid firmware
	1 - 16	Orange		Output state of the corresponding digital output

2.3 Pinout



2.4 Connection example

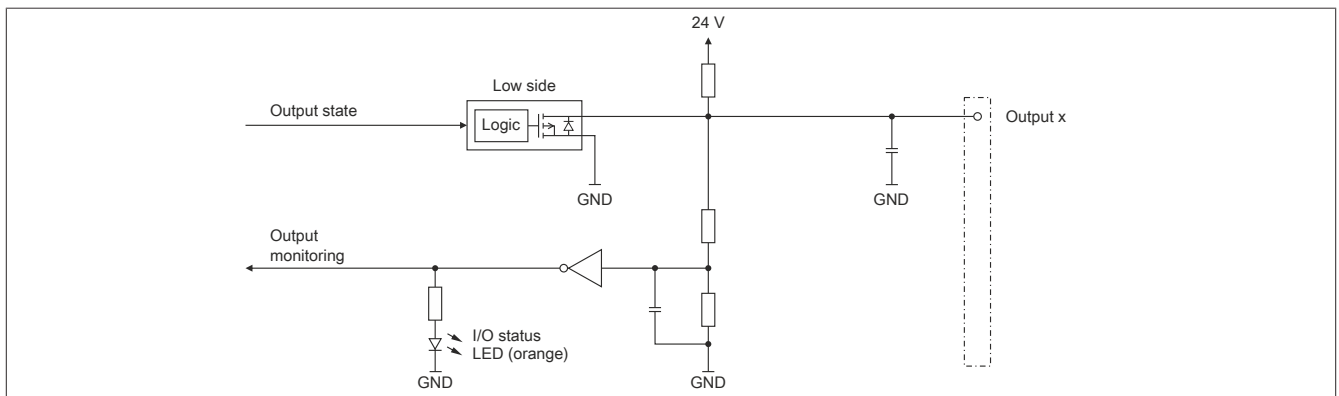


Caution!

If the module is operated outside specifications, the output current may rise above the maximum permissible nominal current. This applies both to individual channels and to the summation current of the module.

Appropriate cable cross-sections or external safety measures must therefore be provided.

2.5 Output circuit diagram



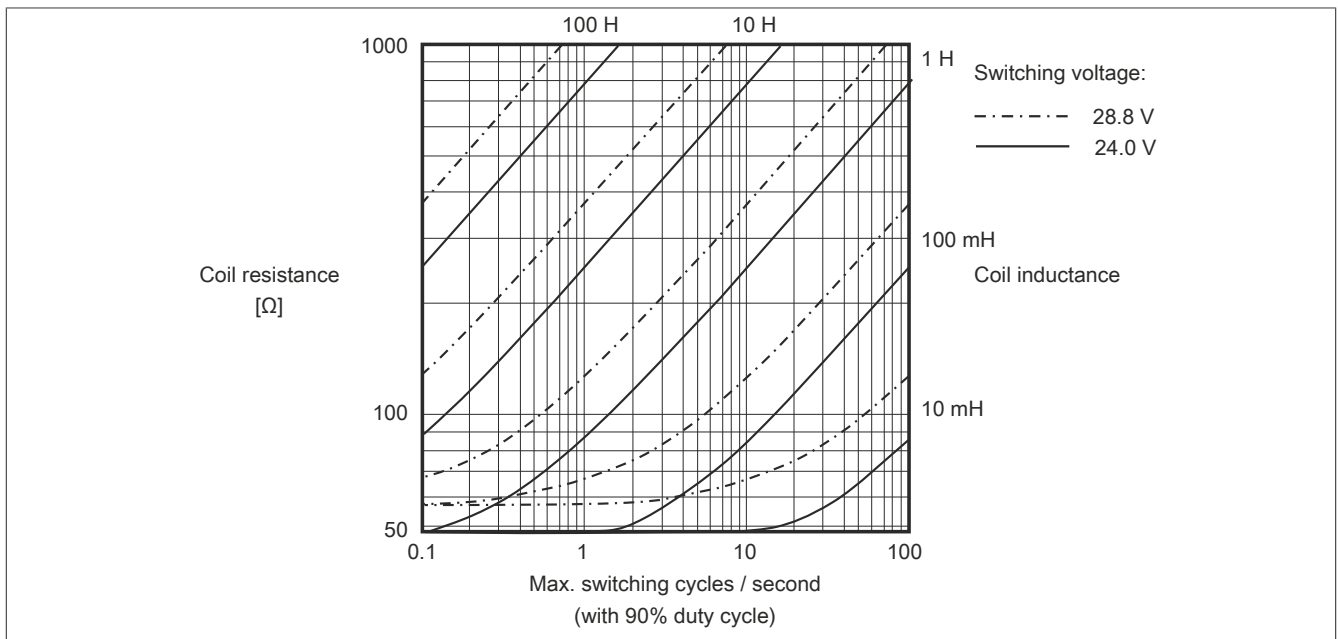
2.6 Derating

There is no derating when operated below 55°C.

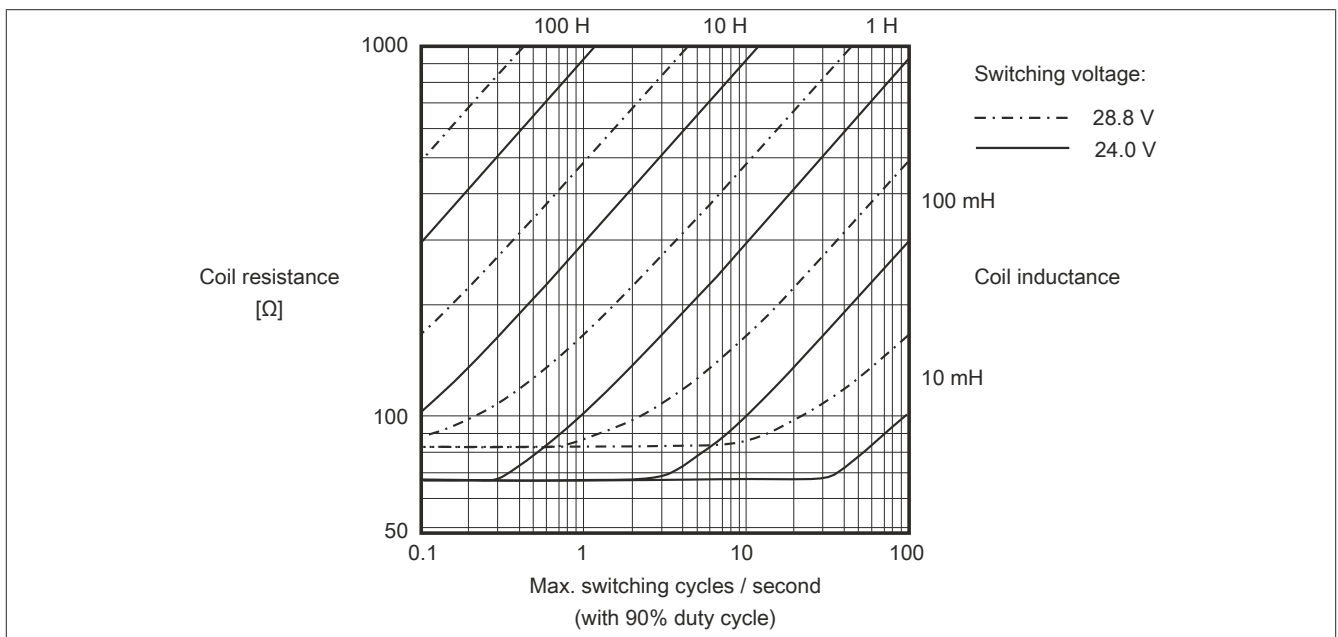
The maximum current per channel is reduced to 0.35 A when operated above 55°C!

2.7 Switching inductive loads

Ambient temperature: 55°C, all outputs with the same load



Ambient temperature: 60°C, all outputs with the same load



Information:

If the maximum number of operating cycles per second is exceeded, an external inverse diode must be used.

Operating conditions outside of the area in the diagram are not permitted!

3 Function description

3.1 Digital outputs

The module is equipped with 16 digital outputs.

The output state is transferred to the output channels with a fixed offset (<60 µs) in relation to the network cycle (SyncOut).

Packed outputs (only function model 0 - Standard)

Setting "Packed outputs" in the Automation Studio I/O configuration can be used to determine whether all bits of the register should be applied as individual data points in the Automation Studio I/O mapping (e.g. "DigitalOutput01 to DigitalOutputxx") or whether the register should be displayed as a single UINT data point (e.g. "DigitalOutput").



Information:

The register is described in ["Switching state of digital outputs 1 to 16" on page 11.](#)

3.1.1 Monitoring status of the outputs

On the module, the output states of the outputs are compared to the target states. The control of the output driver is used for the target state.

A change in the output state resets monitoring for that output. The status of each individual channel can be read out. A change in the monitoring status is actively transmitted as an error message.

Supervision status	Description
0	Digital output channel: No error
1	Digital output channel: <ul style="list-style-type: none"> • Short circuit or overload • Channel switched on and missing I/O power supply • Channel switched off and external voltage applied to channel



Information:

The register is described in ["Status of digital outputs 1 to 16" on page 12.](#)

4 Commissioning

4.1 Using the module on the bus controller

Function model 254 "Bus controller" is used by default only by non-configurable bus controllers. All other bus controllers can use other registers and functions depending on the fieldbus used.

For detailed information, see section "Additional information - Using I/O modules on the bus controller" in the X20 user's manual (version 3.50 or later).

4.1.1 CAN I/O bus controller

The module occupies 2 digital logical slots on CAN I/O.

5 Register description

5.1 General data points

In addition to the registers described in the register description, the module has additional general data points. These are not module-specific but contain general information such as serial number and hardware variant.

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

5.2 Function model 0 - Standard

Register	Fixed offset	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	0	DigitalOutput	UINT			•	
		Switching state of digital outputs 1 to 8	USINT				
		DigitalOutput01	Bit 0				
					
3	1	DigitalOutput08	Bit 7				
		Switching state of digital outputs 9 to 16	USINT				
		DigitalOutput09	Bit 0				
					
30	1	DigitalOutput16	Bit 7		•		
		StatusDigitalOutput	UINT				
		Status of digital outputs 1 to 8	USINT				
		StatusDigitalOutput01	Bit 0				
31	2				
		StatusDigitalOutput08	Bit 7				
		Status of digital outputs 9 to 16	USINT				
		StatusDigitalOutput09	Bit 0				
					
		StatusDigitalOutput16	Bit 7				

Fixed modules require their data points to be in a specific order in the X2X frame. Cyclic access occurs according to a predefined offset, not based on the register address.

Acyclic access continues to be based on the register numbers.

5.3 Function model 254 - Bus controller

Register	Offset ¹⁾	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	0	Switching state of digital outputs 1 to 8	USINT			•	
		DigitalOutput01	Bit 0				
					
		DigitalOutput08	Bit 7				
3	1	Switching state of digital outputs 9 to 16	USINT				
		DigitalOutput09	Bit 0				
					
		DigitalOutput16	Bit 7				
30	-	Status of digital outputs 1 to 8	USINT		•		
		StatusDigitalOutput01	Bit 0				
					
		StatusDigitalOutput08	Bit 7				
31	-	Status of digital outputs 9 to 16	USINT				
		StatusDigitalOutput09	Bit 0				
					
		StatusDigitalOutput16	Bit 7				

1) The offset specifies the position of the register within the CAN object.

5.4 Digital outputs

5.4.1 Switching state of digital outputs 1 to 16

Name:

DigitalOutput

DigitalOutput01 to DigitalOutput16

This register stores the switching state of digital outputs 1 to 16.

Data type	Values	Information ¹⁾
UINT	0 to 65535	Packed outputs = On Data point: "DigitalOutput"
USINT	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard. Data points: "DigitalOutput01" to "DigitalOutput16"

1) See ["Digital outputs" on page 8](#).

Bit structure:

Register 2, offset 0:

Bit	Name	Value	Information
0	DigitalOutput01	0	Digital output 01 reset
		1	Digital output 01 set
...		...	
7	DigitalOutput08	0	Digital output 08 reset
		1	Digital output 08 set

Register 3, offset 1:

Bit	Name	Value	Information
0	DigitalOutput09	0	Digital output 09 reset
		1	Digital output 09 set
...		...	
7	DigitalOutput16	0	Digital output 16 reset
		1	Digital output 16 set

5.5 Monitoring status of the digital outputs

On the module, the output states of the outputs are compared to the target states.

5.5.1 Status of digital outputs 1 to 16

Name:

StatusDigitalOutput

StatusDigitalOutput01 to StatusDigitalOutput16

This register contains the state of digital outputs 1 to 16.

Data type	Values	Information ¹⁾
UINT	0 to 65535	Packed outputs = On Data point: "StatusDigitalOutput"
USINT	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard. Data points: "StatusDigitalOutput01" to "StatusDigitalOutput16"

1) See "Digital outputs" on page 8.

Bit structure:

Register 30, offset 1:

Bit	Name	Value	Description
0	StatusDigitalOutput01	0	Channel 01: No error
		1	Channel 01: <ul style="list-style-type: none"> Short circuit or overload Channel switched on and missing I/O power supply Channel switched off and external voltage applied to channel
...
7	StatusDigitalOutput08	0	Channel 08: No error
		1	Channel 08: For an error description, see channel 01.

Register 31, offset 2:

Bit	Name	Value	Information
0	StatusDigitalOutput09	0	Channel 09: No error
		1	Channel 09: <ul style="list-style-type: none"> Short circuit or overload Channel switched on and missing I/O power supply Channel switched off and external voltage applied to channel
...
7	StatusDigitalOutput16	0	Channel 16: No error
		1	Channel 16: For an error description, see channel 09.

5.6 Minimum cycle time

The minimum cycle time specifies how far the bus cycle can be reduced without communication errors occurring. It is important to note that very fast cycles reduce the idle time available for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
100 µs

5.7 Minimum I/O update time

The minimum I/O update time specifies how far the bus cycle can be reduced so that an I/O update is performed in each cycle.

Minimum I/O update time
Equal to the minimum cycle time