X20(c)DM9324

1 General information

This module is equipped with 8 inputs and 4 outputs for 1-wire connections. The inputs are designed for sink connections, the outputs for source connections.

- 8 digital inputs, sink connections
- 4 digital outputs, source connections
- 1-wire connections
- Configurable software input filter for entire module
- Integrated output protection

2 Coated modules

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

> **For simplification purposes, only images and module IDs of uncoated modules are used in this data sheet.**

The coating has been certified according to the following standards:

- Condensation: BMW GS 95011-4, 2x 1 cycle
- Corrosive gas: EN 60068-2-60, method 4, exposure 21 days

3 Order data

Model number	Short description	Figure
	Digital inputs/outputs	
X20DM9324	X20 digital mixed module, 8 inputs, 24 VDC, sink, configurable input filter, 4 outputs, 24 VDC, 0.5 A, source 1-wire connections	
X20cDM9324	X20 digital mixed module, coated, 8 inputs, 24 VDC, sink, configurable input filter, 4 outputs, 24 VDC, 0.5 A, source, 1-wire connections	
	Required accessories	
	Bus modules	
X20BM11	X20 bus module, 24 VDC keyed, internal I/O supply continuous	
X20BM15	X20 bus module, with node number switch, 24 VDC keyed, internal I/O supply continuous	
X20cBM11	X20 bus module, coated, 24 VDC keyed, internal I/O supply continuous	
	Terminal blocks	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 1: X20DM9324, X20cDM9324 - Order data

4 Technical data

Model number	X20DM9324	X20cDM9324
Short description		
I/O module	8 digital inputs 24 VDC for 1-wire connections, 4 digital outputs 24 VDC for 1-wire connections	
General information		
Nominal voltage	24 VDC	
B&R ID code	0x20B9	0xE225
Status indicators	I/O function per channel, operating state, module status	
Diagnostics		
Module run/error	Yes, using status LED and software	
Outputs	Yes, using status LED and software (output error status)	
Power consumption		
Bus	0.21 W	
Internal I/O	0.5 W	
External I/O	1.17 W	
Additional power dissipation caused by actuators (resistive) [W] [1]	+0.21	
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) FTZÚ 09 ATEX 0083X	
Digital inputs		
Input characteristics per EN 61131-2	Type 1	
Input voltage	24 VDC -15 % / +20 %	
Input current at 24 VDC	Typ. 3.75 mA	
Input circuit	Sink	
Input filter		
Hardware	≤100 µs	
Software	Default 1 ms, configurable between 0 and 25 ms in 0.2 ms intervals	
Connection type	1-wire connections	
Input resistance	Typ. 6.4 kΩ	
Switching threshold		
Low	<5 VDC	
High	>15 VDC	
Isolation voltage between channel and bus	500 V_{eff}	
Digital outputs		
Variant	FET positive switching	
Switching voltage	24 VDC -15 % / +20 %	
Nominal output current	0.5 A	
Total nominal current	2 A	
Connection type	1-wire connections	
Output circuit	Source	
Output protection	Thermal cutoff if overcurrent or short circuit occurs (see value "Peak short circuit current") Internal inverse diode for switching inductive loads (see section "Switching inductive loads")	
Diagnostic status	Output monitoring with 10 ms delay	
Leakage current when switched off	5 µA	
$R_{DS(on)}$	210 mΩ	
Peak short-circuit current	<12 A	
Switch-on in the event of overload shutdown or short-circuit shutdown	Approx. 10 ms (depends on the module temperature)	
Switching delay		
0 → 1	<300 µs	
1 → 0	<300 µs	
Switching frequency		
Resistive load	Max. 500 Hz	
Inductive load	See section "Switching inductive loads"	
Braking voltage when switching off inductive loads	Typ. 50 VDC	
Isolation voltage between channel and bus	500 V_{eff}	
Electrical properties		
Electrical isolation	Channel isolated from bus Channel not isolated from channel	

Table 2: X20DM9324, X20cDM9324 - Technical data

| Model number	X20DM9324	X20cDM9324
Operating conditions		
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	
Ambient conditions		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C	
Vertical mounting orientation	-25 to 50°C	
Derating	-	
Storage	-40 to 85°C	
Transport	-40 to 85°C	
Relative humidity		
Operation	5 to 95%, non-condensing	Up to 100%, condensing
Storage	5 to 95%, non-condensing	
Transport	5 to 95%, non-condensing	
Mechanical properties		
Note	Order 1x X20TB12 terminal block separately Order 1x X20BM11 bus module separately	Order 1x X20TB12 terminal block separately Order 1x X20cBM11 bus module separately
Spacing	12.5$^{+0.2}$ mm	

Table 2: X20DM9324, X20cDM9324 - Technical data

1)   Number of outputs x $R_{DS(on)}$ x nominal output current[2]

5 Status LEDs

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

| Figure	LED	Color	Status	Description
	r	Green	Off	No power to module
			Single flash	RESET mode
			Blinking	PREOPERATIONAL mode
			On	RUN mode
	e	Red	Off	No power to module or everything OK
			Single flash	Warning/Error on an I/O channel. Level monitoring for digital outputs has been triggered.
	e + r	Red on / Green single flash		Invalid firmware
	1 - 8	Green		Input status of the corresponding digital input
	1 - 4	Orange		Output status of the corresponding digital output

6 Pinout
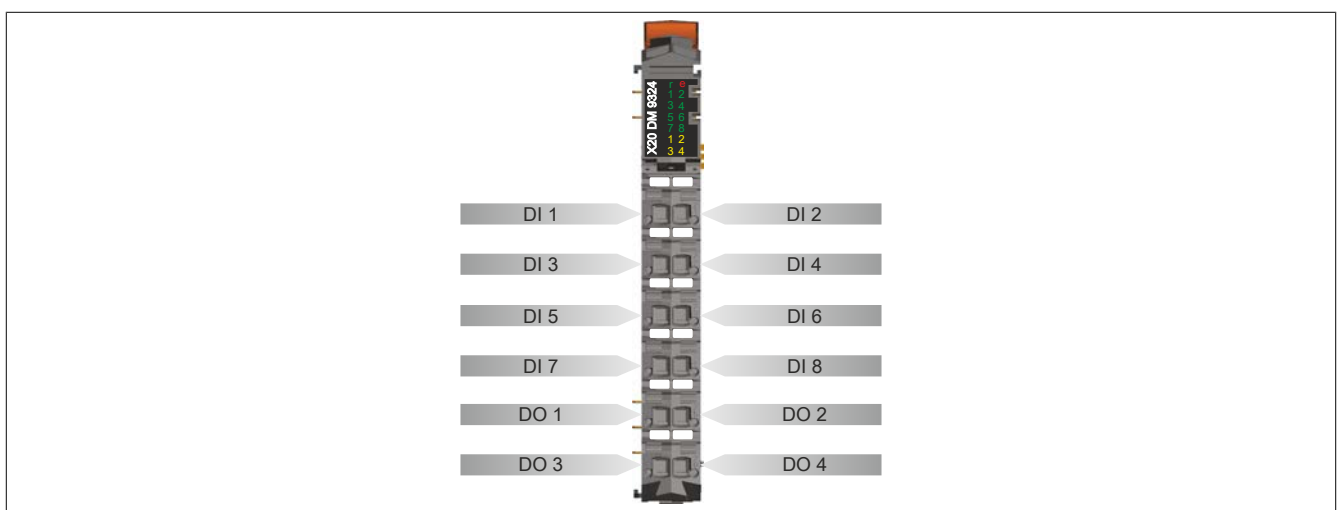
7 Connection example
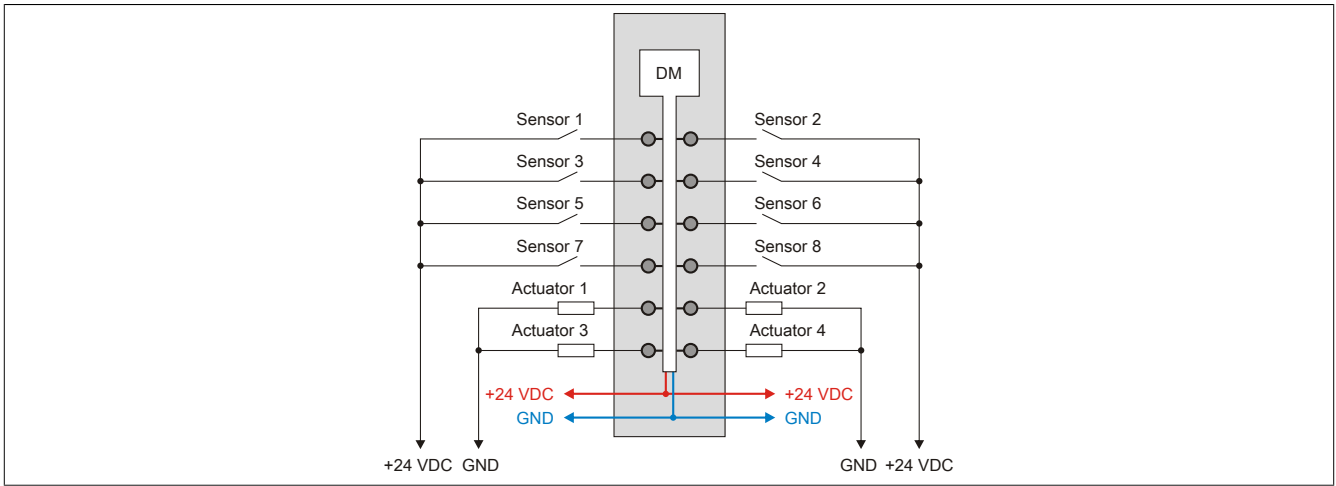
8 Input circuit diagram
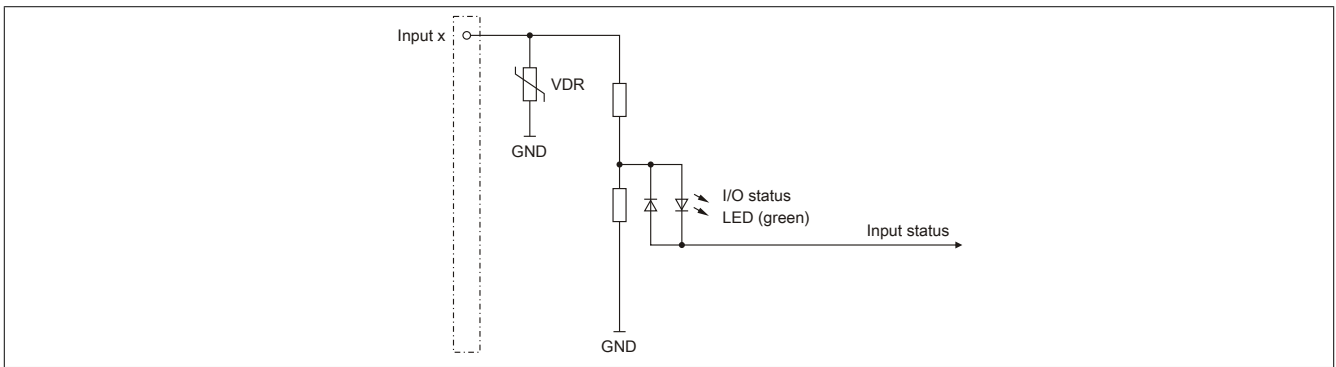
9 Output circuit diagram
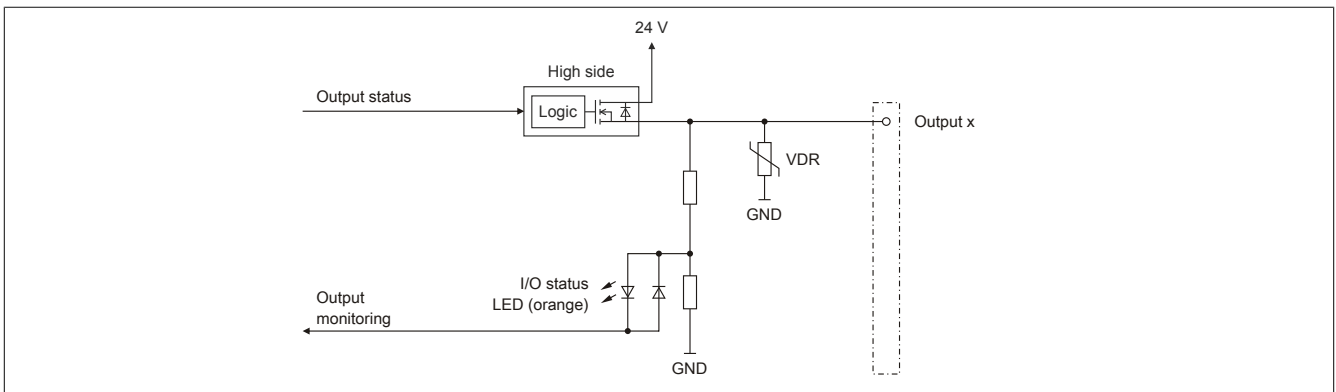
10 Switching inductive loads
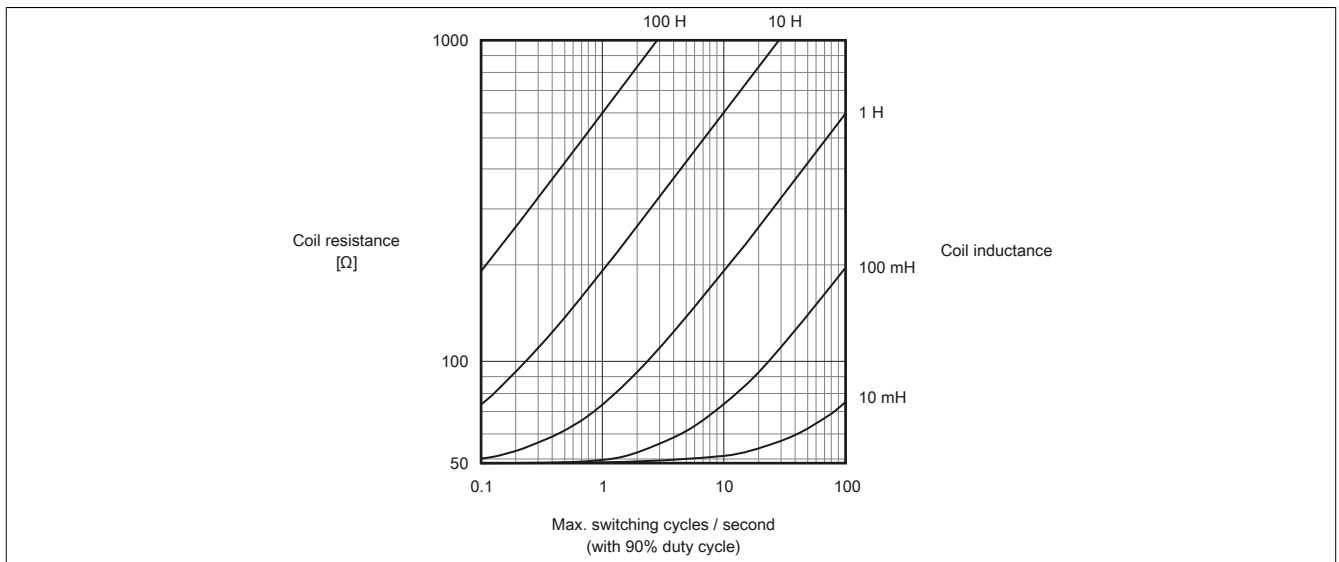
11 Register description

11.1 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" of the X20 system user's manual.

11.2 Function model 0 - Standard

Register	Fixed offset	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
18	-	ConfigOutput01 (input filter)	USINT				●
Communication							
0	1	DigitalInput	USINT	●			
		DigitalInput01	Bit 0				
		...	...				
		DigitalInput08	Bit 7				
2	0	DigitalOutput				●	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput04	Bit 3				
30	2	StatusInput01	USINT	●			
		StatusDigitalOutput01	Bit 0				
			...				
		StatusDigitalOutput04	Bit 3				

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.

11.3 Function model 254 - Bus controller

Register	Offset[1]	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
18	-	ConfigOutput01 (input filter)	USINT				●
Communication							
0	0	Input state of digital inputs 1 to 8	USINT	●			
		DigitalInput01	Bit 0				
		...	...				
		DigitalInput08	Bit 7				
2	0	Switching state of digital outputs 1 to 4				●	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput04	Bit 3				
30	-	Status of digital outputs 1 to 4	USINT		●		
		StatusDigitalOutput01	Bit 0				
			...				
		StatusDigitalOutput04	Bit 3				

1) The offset specifies where the register is within the CAN object.

11.3.1 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 additional registers and functions depending on the fieldbus used.

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

11.3.2 CAN I/O bus controller

The module occupies 1 digital logical slot on CAN I/O.

11.4 Digital inputs

Unfiltered

The input state is collected with a fixed offset to the network cycle and transferred in the same cycle.

Filtered

The filtered status is collected with a fixed offset to the network cycle and transferred in the same cycle. Filtering takes place asynchronously to the network in multiples of 200 µs with a network-related jitter of up to 50 µs.

11.4.1 Input state of digital inputs 1 to 8

Name:
DigitalInput or
DigitalInput01 to DigitalInput08

This register is used to indicate the input state of digital inputs 1 to 8.

Only function model 0 - Standard:

The "Packed inputs" setting in the Automation Studio I/O configuration is used to determine whether all of this register's bits should be set up individually as data points in the Automation Studio I/O mapping ("DigitalInput01" through "DigitalInput08") or whether this register should be displayed as an individual USINT data point ("DigitalInput").

Data type	Value	Information
USINT	0 to 255	Packed inputs = On
	See the bit structure.	Packed inputs = Off or function model ≠ 0 - Standard

Bit structure:

Bit	Name	Value	Information
0	DigitalInput01	0 or 1	Input state - Digital input 1
...		...	
7	DigitalInput08	0 or 1	Input state - Digital input 8

11.4.2 Digital input filter

Name:
ConfigOutput01

This register can be used to specify the filter value for all digital inputs.

The filter value can be configured in steps of 100 µs. It makes sense to enter values in steps of 2, however, since the input signals are sampled every 200 µs.

Data type	Value	Filter
USINT	0	No software filter (bus controller default setting)
	2	0.2 ms
	...	...
	250	25 ms - Higher values are limited to this value

11.5 Digital outputs

The output status is transferred to the output channels with a fixed offset (<60 µs) based on the network cycle (SyncOut).

11.5.1 Switching state of digital outputs 1 to 4

Name:
DigitalOutput
DigitalOutput01 to DigitalOutput04

This register is used to store the switching state of digital outputs 1 to 4.

Only function model 0 - Standard:

Setting "Packed outputs" in the Automation Studio I/O configuration determines whether all bits of this register should be applied individually as data points in the Automation Studio I/O assignment ("DigitalOutput01" to "DigitalOutput0x") or whether this register should be displayed as a single USINT data point ("DigitalOutput").

Data type	Values	Information
USINT	0 to 15	Packed outputs = On
	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard.

Bit structure:

Bit	Description	Value	Information
0	DigitalOutput01	0	Digital output 01 reset
		1	Digital output 01 set
...		...	
3	DigitalOutput04	0	Digital output 04 reset
		1	Digital output 04 set

11.6 Monitoring status of the digital 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. A change in the monitoring status generates an error message.

11.6.1 Status of digital outputs 1 to 4

Name:
StatusInput01
StatusDigitalOutput01 to StatusDigitalOutput04

This register contains the state of digital outputs 1 to 4.

Only function model 0 - Standard:

Setting "Packed outputs" in the Automation Studio I/O configuration determines whether all bits of this register should be applied individually as data points in the Automation Studio I/O assignment ("StatusDigitalOutput01" to "StatusDigitalOutput0x") or whether this register should be displayed as a single USINT data point ("StatusInput01").

Data type	Values	Information
USINT	0 to 15	Packed outputs = On
	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard.

Bit structure:

Bit		Value	Information
0	StatusDigitalOutput01	0	Channel 01: No error
		1	Channel 01: • Short circuit or overload • Channel switched on and missing I/O power supply • Channel switched off and external voltage applied on channel
...		...	
3	StatusDigitalOutput04	0	Channel 04: No error
		1	Channel 04: For an error description, see channel 01.

11.7 Minimum cycle time

The minimum cycle time specifies the time up to which 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	
Without filtering	100 µs
With filtering	150 µs

11.8 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	
Without filtering	100 µs
With filtering	200 µs