X20DO8232

Data sheet
2.20 (September 2024)

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	
X20DO8232	X20 digital output module, 8 outputs, 12 VDC, 2 A, source, supply directly on module, 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	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 1: X20DO8232 - Order data

1.3 Module description

This module is equipped with 8 outputs for 1-wire connections. The outputs are designed for a source circuit. The nominal output current is 2 A.

The output supply is fed directly to the module. An additional supply module is not needed. There is no connection between the module and the I/O supply potential on the bus module.

Functions:

- Digital outputs
- Delayed switching of outputs
- Monitoring the operating limits

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.

Delayed switching of outputs

The digital outputs can be switched with a delay using a timer.

Monitoring operating limits

The voltage of the I/O power supply is monitored for voltage overshoot or undershoot.

2 Technical description

2.1 Technical data

Order number	X20DO8232
Short description	
I/O module	8 digital outputs 12 VDC for 1-wire connections
General information	
B&R ID code	0xA4AD
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)
Supply voltage monitoring	Yes, using software
Power consumption	
Bus	0.22 W
Internal I/O	-
External I/O	0.82 W
Additional power dissipation caused by actuators (resistive) [W] [1]	+4.48
Certifications	
CE	Yes
UKCA	Yes
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÚ 09 ATEX 0083X
UL	cULus E115267 Industrial control equipment
HazLoc	cCSAus 244665 Process control equipment for hazardous locations Class I, Division 2, Groups ABCD, T5
DNV	Temperature: **B** (0 to 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)
CCS	Yes
LR	ENV1
KR	Yes
ABS	Yes
BV	**EC33B** Temperature: 5 - 55°C Vibration: 4 g EMC: Bridge and open deck
KC	Yes
Digital outputs	
Variant	Current-sourcing FET
Nominal voltage	12 VDC
Switching voltage	12 VDC (-15% / +20%)
Nominal output current	2 A
Total nominal current	8 A
Connection type	1-wire connections
Output circuit	Source
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") Reverse polarity protection of supply voltage
Actuator power supply	
Supply	External
Fuse	Required line fuse: Max. 10 A, slow-blow
Diagnostic status	Output monitoring with 10 ms delay
Leakage current when the output is switched off	5 µA
$R_{DS(on)}$	140 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 [2]	
0 → 1	<300 µs
1 → 0	<300 µs

Table 2: X20DO8232 - Technical data

Order number	X20DO8232
Switching frequency	
Resistive load [2]	Max. 500 Hz, 600 Hz at max. 250 mA load
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}
Additional functions	Outputs can be connected in parallel to increase the output current.
Electrical properties	
Electrical isolation	Channel isolated from bus 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
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 X20TB12 separately. Order 1x bus module X20BM11 separately.
Pitch	12.5$^{+0.2}$ mm

Table 2: X20DO8232 - Technical data

1) Number of outputs x $R_{DS(on)}$ x Nominal output current[2]. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.
2) At loads ≤ 1 kΩ

2.2 Status LEDs

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
	r	Green	Off	Module supply not connected
			Single flash	RESET mode
			Blinking	PREOPERATIONAL mode
			On	RUN mode
	e	Red	Off	Module supply not connected or everything OK
			Single flash	Warning/Error on an I/O channel. Level monitoring for digital outputs has been triggered.
			Double flash	External I/O power supply is outside the valid range: 12 VDC (-15% / +20%).
	e + r	Red on / Green single flash		Invalid firmware
	1 - 8	Orange		Output status of the corresponding digital output

2.3 Pinout
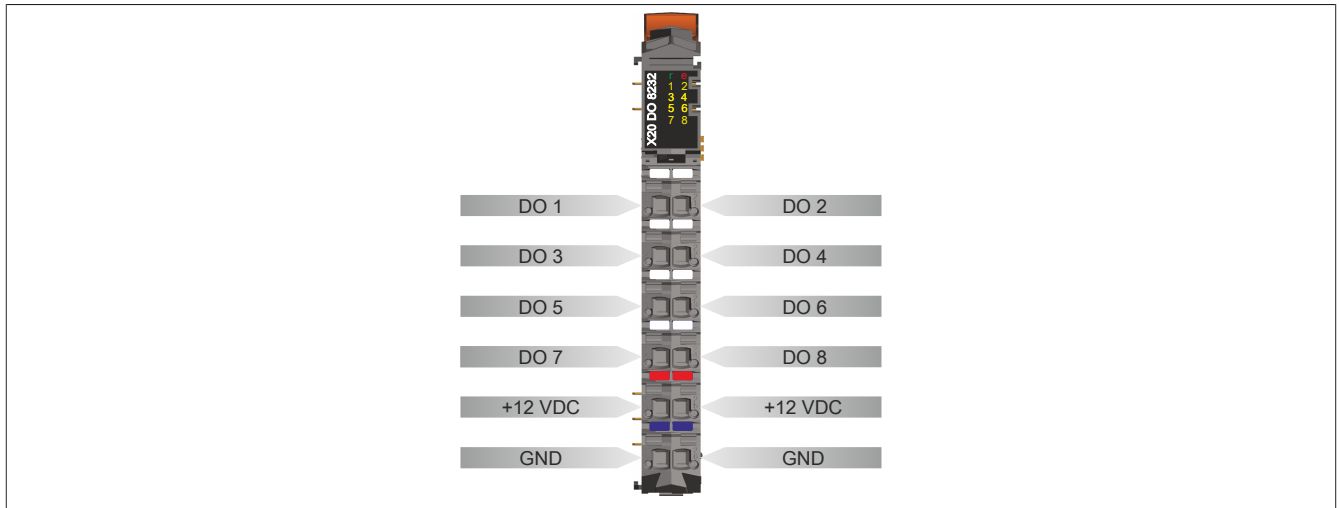
2.4 Connection example
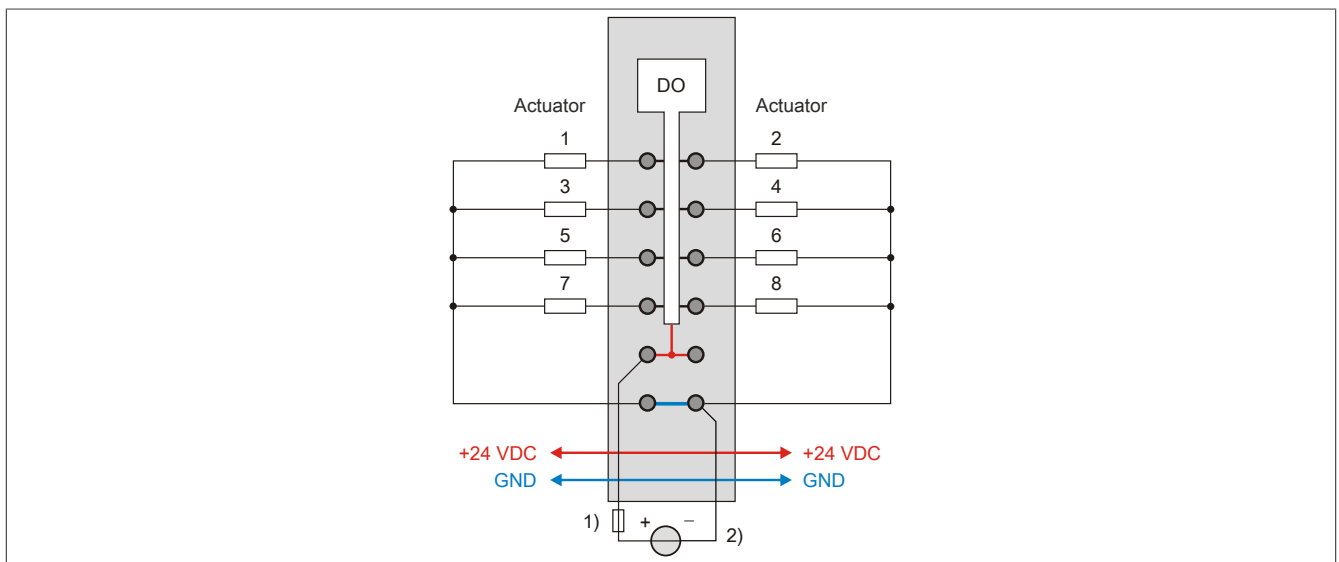
1) Fuse, 10 A slow-blow
2) External power supply 12 VDC

![Caution symbol] **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
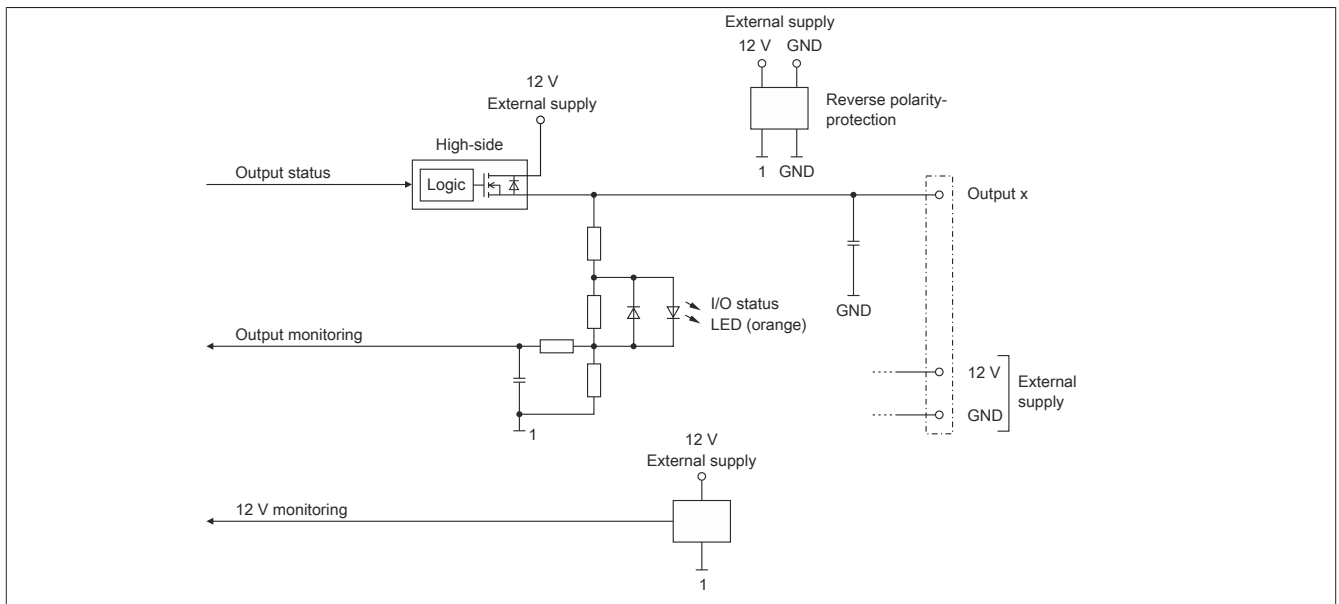
2.6 Switching inductive loads

Ambient temperature: 35°C, 4 outputs (1, 3, 5, 7 or 2, 4, 6, 8) equally loaded.
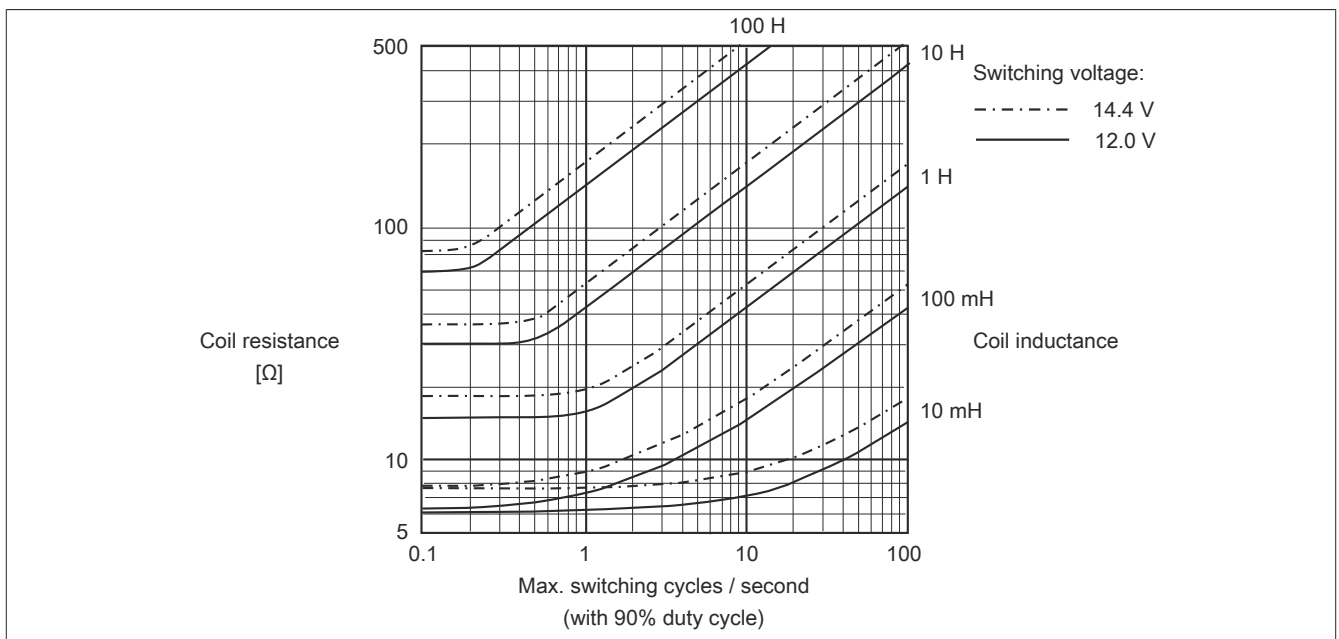
Technical description

Environmental temperature: 60°C, 4 outputs (1,3,5,7 or 2,4,6,8) with the same load.
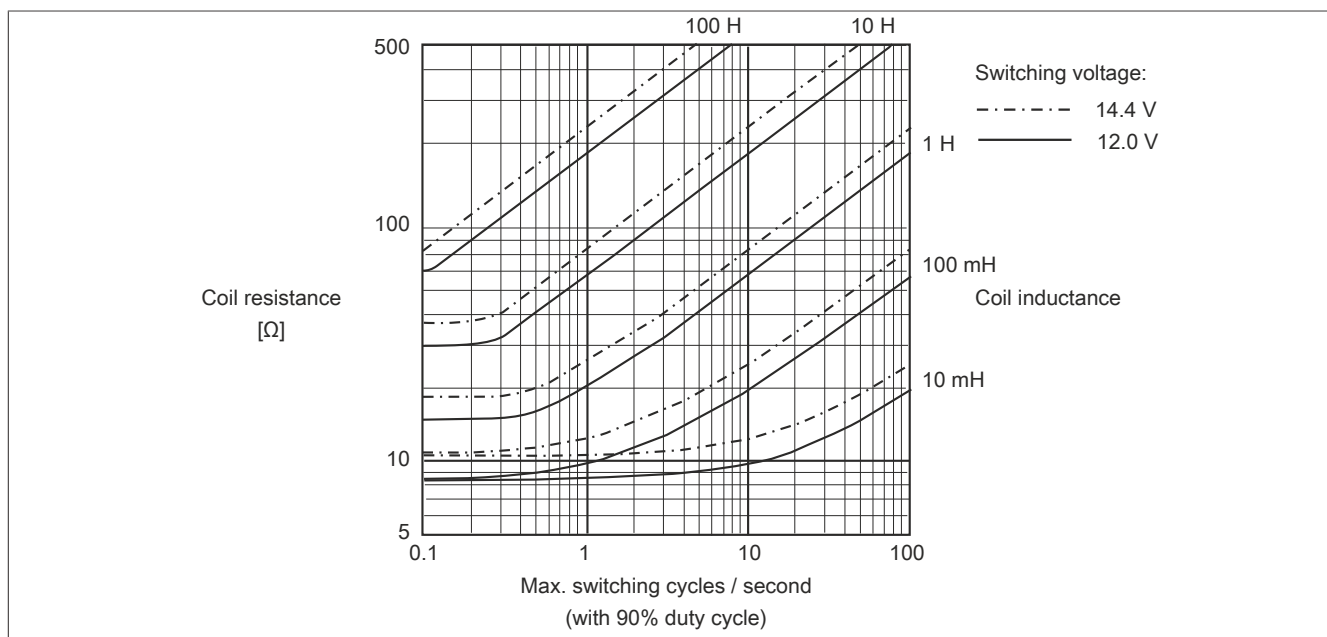
Environmental temperature: 60°C, all outputs with the same load.
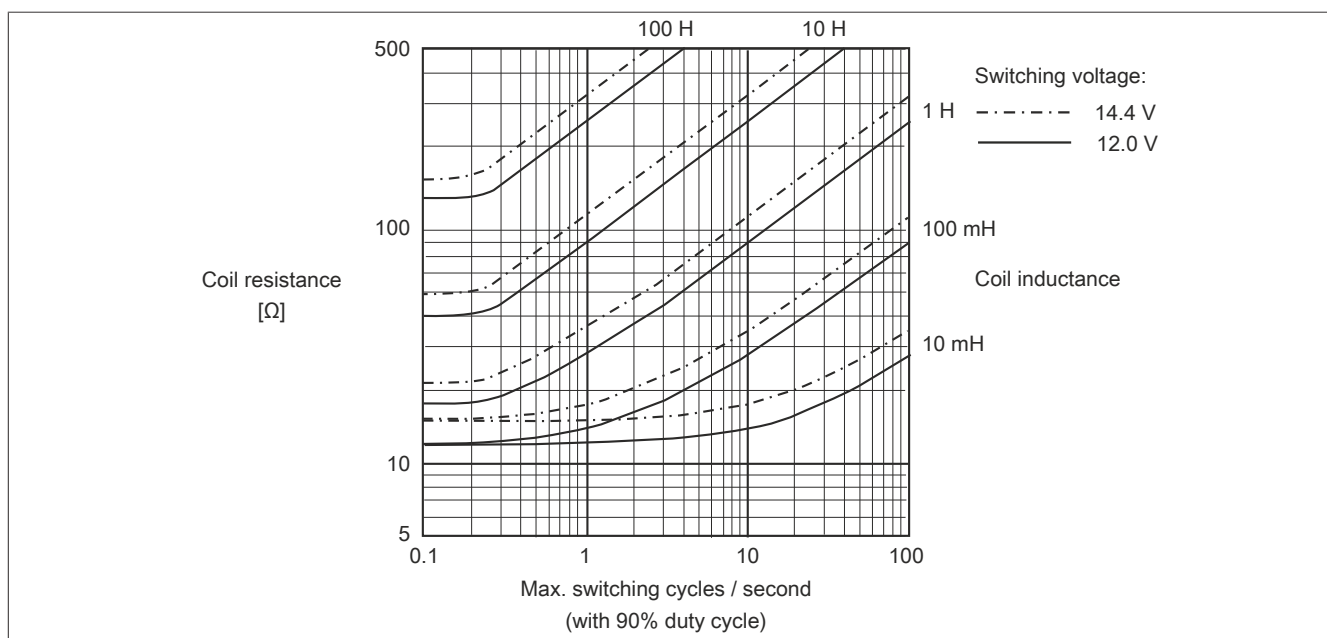
> ⓘ **Information:**
>
> **If the maximum number of operating cycles per second is exceeded, an external inverse diode must be used.**
>
> **Operating conditions outside of the area in the diagram are not permitted!**

2.7 Derating

The outputs of the module can be loaded with up to 2 A. With a summation current of 8 A, no more than 4 channels are operable at full load. To make the best use of the module, it is important to pay attention to the channel division and possible derating.

The correct channel division is important since the 8 outputs are divided between 2 output drivers. The channels operated at 2 A must therefore be divided equally between the two output drivers.

Output driver 1:   Channels 1 to 4
Output driver 2:   Channels 5 to 8

The following table provides an overview of the number of fully loaded channels, the resulting best division and possible derating.

Number of channels loaded with 2 A	Division	Derating
1	Any	No
2	1st channel with 2 A ... Channel no. 1 to 4 2nd channel with 2 A ... Channel no. 5 to 8	No
3	Assign only odd or even channel numbers. Examples: 1, 3, 5 2, 4, 6 3, 5, 7 4, 6, 8	 Channels 1 and 3 Channels 2 and 4 Channels 5 and 7 Channels 6 and 8
4	Assign only odd or even channel numbers. Possible divisions: 1, 3, 5, 7 2, 4, 6, 8	 For each channel For each channel

Derating when 3 or 4 channels are operated with 2 A:
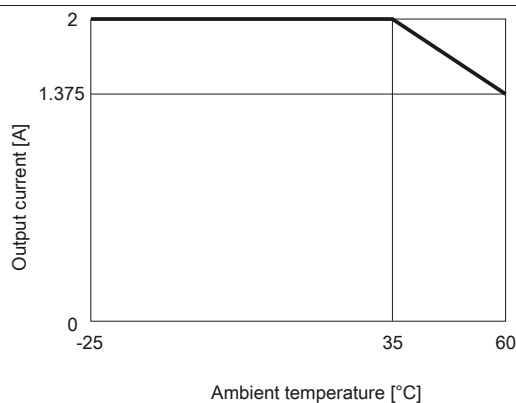
Information:

Only modules with a maximum power dissipation of 1 W are permitted to be operated next to the module.

For an example of calculating the power dissipation of I/O modules, see section "Mechanical and electrical configuration - Power dissipation of I/O modules" in the X20 user's manual.

3 Function description

3.1 Digital outputs

The module is equipped with 8 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 USINT data point (e.g. "DigitalOutput").

> **Information:**
>
> The register is described in **"Switching state of digital outputs 1 to 8" on page 14**.

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: • 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 8" on page 15**.

3.2 Delayed switching of outputs

In "Function model 1 - Switching outputs", it is possible to activate the digital outputs with a delay.

The OutputDelay mask can be used to activate the delay for each channel individually. The module is controlled here using a 100 µs-based timer and the Output or OutputDelayed register.

Behavior of function model 1 - Output switching

With a timer delay of 0:

      Output: DigitalOutput0x bits

When the delay is changed:

The bit string for DigitalOutput0x bits is output. The timer restarts.

      Output: DigitalOutput0x bits

After delay time has expired:

The channels whose bits are set in the mask for OutputDelay are adapted to the corresponding OutputDelayed bits.

      Output: DigitalOutput0x bits (if Enable bit = FALSE)
                              OutputDelayed bits (if Enable bit = TRUE)

> **Information:**
>
> **Adjusting the output and restarting the timer take place immediately after transferring the new delay, even if the previous time has not yet passed.**

> **Information:**
>
> **The registers are described in "Additional function - Delayed switching of digital outputs with switchover mask" on page 16.**

3.3 Monitoring the operating limits

Bit	Description
0	No error
1	

The status of the I/O supply voltage can be read out.

Bit	Description
0	I/O power supply above the warning limits of (10.2 V)
1	I/O power supply below the warning limits (10.2 V)

> **Information:**
>
> **The register is described in "Status of the supply voltage" on page 15.**

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 1 digital logical slot 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	USINT			●	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput08	Bit 7				
30	1	StatusInput01	USINT	●			
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput08	Bit 7				
8192	-	asy_ModulID	UINT		●		
8196	-	asy_SupplyStatus	USINT		●		
		PowerSupply01	Bit 2	●			

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 1 - Output switching

Register	Fixed offset	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				
4	1	Switching state of delayed digital outputs 1 to 8	USINT			●	
		DigitalOutput01Delayed	Bit 0				
		...	...				
		DigitalOutput08Delayed	Bit 7				
6	2	Switching mask after the delay time has expired	USINT			●	
		DigitalOutput01DelayEnable	Bit 0				
		...	...				
		DigitalOutput08DelayEnable	Bit 7				
8	3	Setting the delay (OutputDelayTime)	USINT			●	
30	1	Status of digital outputs 1 to 8	USINT		●		
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput08	Bit 7				
8192	-	asy_ModulID	UINT		●		
8196	-	Status of the supply voltage	USINT		●		
		PowerSupply01	Bit 2	●			

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.

5.4 Function model 254 - Bus Controller

Register	Offset[1]	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	-	Switching state of digital outputs 1 to 8	USINT			•	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput08	Bit 7				
30	-	Status of digital outputs 1 to 8	USINT		•		
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput08	Bit 7				
8192	-	asy_ModulID	UINT		•		
8196	-	Status of the supply voltage	USINT		•		
		PowerSupply01	Bit 2		•		

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

5.5 Digital outputs

5.5.1 Switching state of digital outputs 1 to 8

Name:
DigitalOutput
DigitalOutput01 to DigitalOutput08

The switching state of digital outputs 1 to 8 are stored in this register.

Data type	Values	Information[1]
USINT	0 to 255	Packed outputs = On Data point: "DigitalOutput"
	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard. Data points: "DigitalOutput01" to "DigitalOutput08"

1) See "Digital outputs" on page 10.

Bit structure:

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

5.6 Reading out the module ID

Name:
asy_ModulID

This register offers the possibility to read the module ID.

Data type	Values
UINT	Module ID

5.7 Monitoring status of the digital outputs

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

5.7.1 Status of digital outputs 1 to 8

Name:
StatusInput01
StatusDigitalOutput01 to StatusDigitalOutput08

This register is used to indicate the status of digital outputs 1 to 8.

Data type	Values	Information[1]
USINT	0 to 255	Packed outputs = On Data point: "StatusInput01"
	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard. Data points: "StatusDigitalOutput01" to "StatusDigitalOutput0x"

1)   See "Digital outputs" on page 10.

Bit structure:

Bit	Name	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 to channel
...		...	
8	StatusDigitalOutput08	0	Channel 08: No error
		1	Channel 08: For an error description, see channel 01.

5.8 Operating limit monitoring

The module's output supply is monitored. An I/O supply voltage of <10.2 V is displayed as a warning.

5.8.1 Status of the supply voltage

Name:
asy_SupplyStatus

The status of the I/O supply voltage is mapped in this register.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Name	Value	Information
0 - 1	Reserved	0	0
2	PowerSupply01	0	I/O supply above the warning level of 10.2 V
		1	I/O supply below the warning level of 10.2 V
3 - 7	Reserved	0	0

5.9 Additional function - Delayed switching of digital outputs with switchover mask

5.9.1 Switching state of delayed digital outputs 1 to 8

Name:
DigitalOutput01Delayed to DigitalOutput08Delayed

According to the corresponding bit in the OutputDelay mask, the switching state of all digital outputs 1 to 8 are stored in the OutputDelayed bits after the delay time has expired.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Name	Value	Information
0	DigitalOutput01Delayed	0	Digital output 01 reset
		1	Digital output 01 set
...		...	
7	DigitalOutput08Delayed	0	Digital output 08 reset
		1	Digital output 08 set

> **Information:**
>
> **After the delay time has elapsed, only the channels whose bit is set in the OutputDelay mask are adapted to the OutputDelayed bits.**

5.9.2 Switching mask after the delay time has expired

Name:
DigitalOutput01DelayEnable to DigitalOutput08DelayEnable

These registers form the mask for OutputDelay. They specify which outputs are switched to the bit pattern of register OutputDelayed after the delay time has elapsed.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Name	Value	Information
0	DigitalOutput01DelayEnable	0	Digital output 01 remains unchanged
		1	Digital output 01 being switched
...		...	
7	DigitalOutput08DelayEnable	0	Digital output 08 remains unchanged
		1	Digital output 08 being switched

5.9.3 Setting the delay

Name:
OutputDelayTime

This register can be used to set the delay in 100 µs steps.

After the delay time has expired, the digital outputs are adjusted according to the switching mask (register 6) and the delayed output pattern (register 4).

Data type	Value
USINT	0 to 255 (in 100 µs steps)[1]

1) The value 0 disables processing

5.10 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	
Standard function model	100 µs
Bus controller function model	150 µs

5.11 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	
Function model 0	Equal to the minimum cycle time
Function model 1	Equal to the minimum cycle time