X20(c)DO8332

1 General information

The module is equipped with 8 outputs for 1-wire connections. The rated 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.

- 8 digital outputs with 2 A
- Source connection
- 1-wire connections
- Power feed integrated in the 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

2.1 Starting temperature

The starting temperature describes the minimum permissible ambient temperature when the power is switched off at the time the coated module is switched on. This is permitted to be as low as -40°C. During operation, the conditions as specified in the technical data continue to apply.

Information:

It is important to absolutely ensure that there is no forced cooling by air currents in the closed control cabinet, e.g. due to the use of a fan or ventilation slots.

3 Order data

Model number	Short description	Figure
	Digital outputs	
X20DO8332	X20 digital output module, 8 outputs, 24 VDC, 2 A, source, supply directly on module, 1-wire connections	
X20cDO8332	X20 digital output module, coated, 8 outputs, 24 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 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: X20DO8332, X20cDO8332 - Order data

4 Technical data

Model number	X20DO8332	X20cDO8332
Short description		
I/O module	8 digital outputs 24 VDC for 1-wire connections	
General information		
B&R ID code	0x1B9D	0xE22C
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)	
Supply voltage monitoring	Yes, using software	
Power consumption		
Bus	0.22 W	
Internal I/O	-	
External I/O	0.92 W	
Additional power dissipation caused by actuators (resistive) [W] [1)]	+2.24	
Certifications		
CE	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 GL	Temperature: **B** (0 - 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)	
LR	ENV1	
KR	Yes	
ABS	Yes	
EAC	Yes	
KC	Yes	-
Digital outputs		
Variant	FET positive switching	
Number of output groups	2	
Nominal voltage	24 VDC	
Switching voltage	24 VDC -15 % / +20 %	
Nominal output current	2 A	
Total nominal current		
Per group	4 A	
Per module	8 A [2)]	
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") Reverse polarity protection for supply voltage	

Table 2: X20DO8332, X20cDO8332 - Technical data

Model number	X20DO8332	X20cDO8332
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		
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	
Insulation voltage between channel and bus	500 V_{eff}	
Additional functions	To increase the output current, outputs can be switched in parallel	
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 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	See section "Derating"	
Starting temperature	-	Yes, -40°C
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
Pitch	12.5$^{+0.2}$ mm	

Table 2: X20DO8332, X20cDO8332 - Technical data

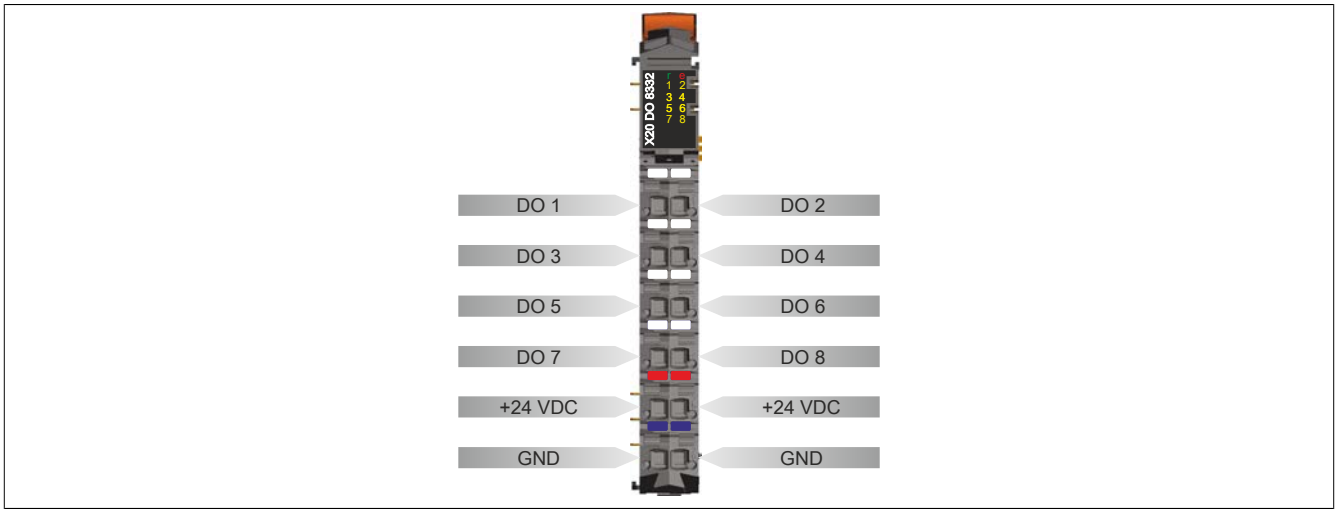
1) Number of outputs x $R_{DS(on)}$ x Nominal output current^2. For a calculation example, see section "Mechanical and electrical configuration" of the X20 system user's manual.
2) Derating may be necessary with more than 6 A summation current.

5 Status LEDs

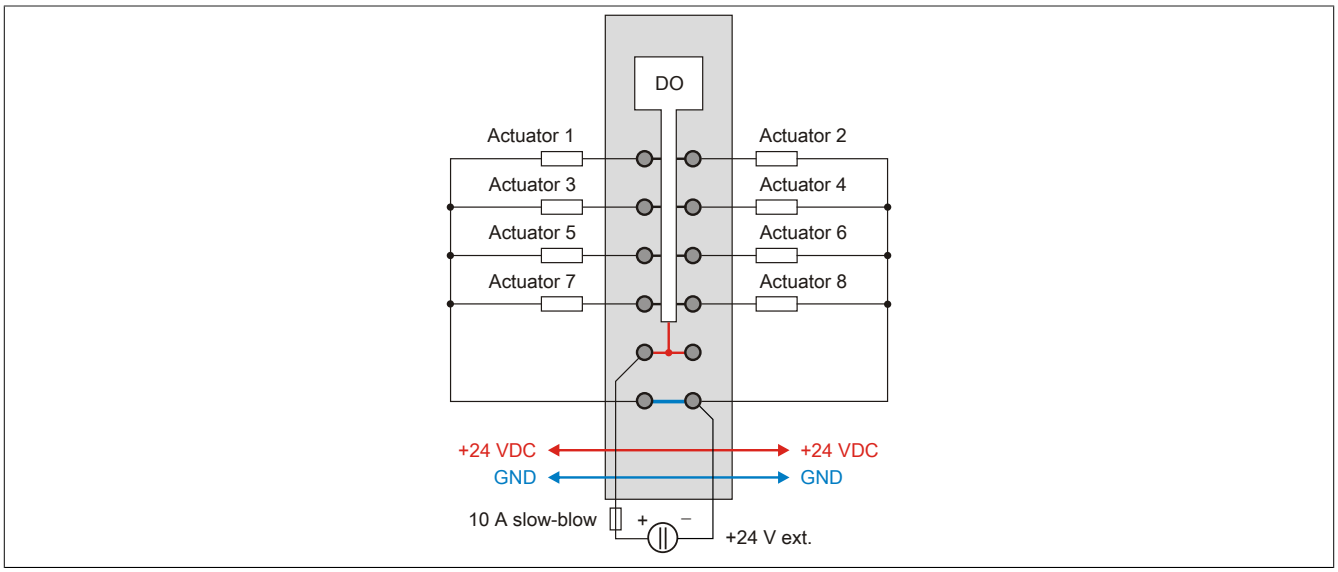
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" of the X20 system user's manual.

Figure	LED	Color	Status	Description
	r	Green	Off	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	I/O supply too low
	e + r	Red on / Green single flash		Invalid firmware
	1 - 8	Orange		Output status of the corresponding digital output

6 Pinout



7 Connection example

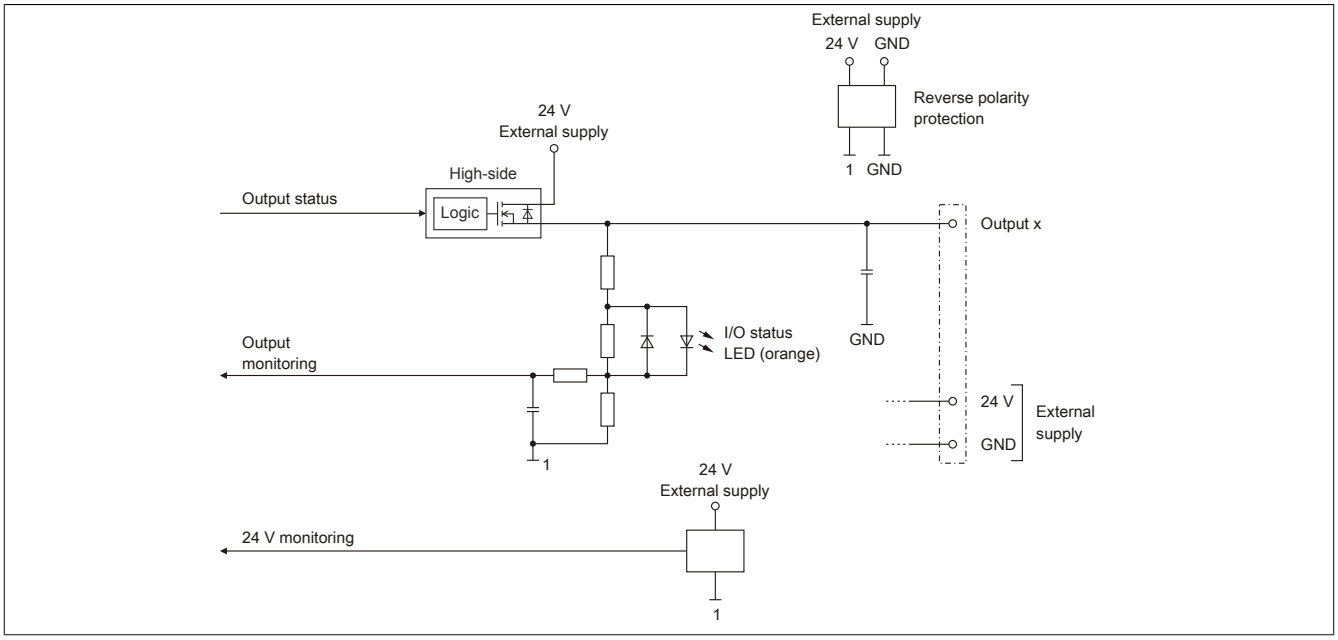


Caution!

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.

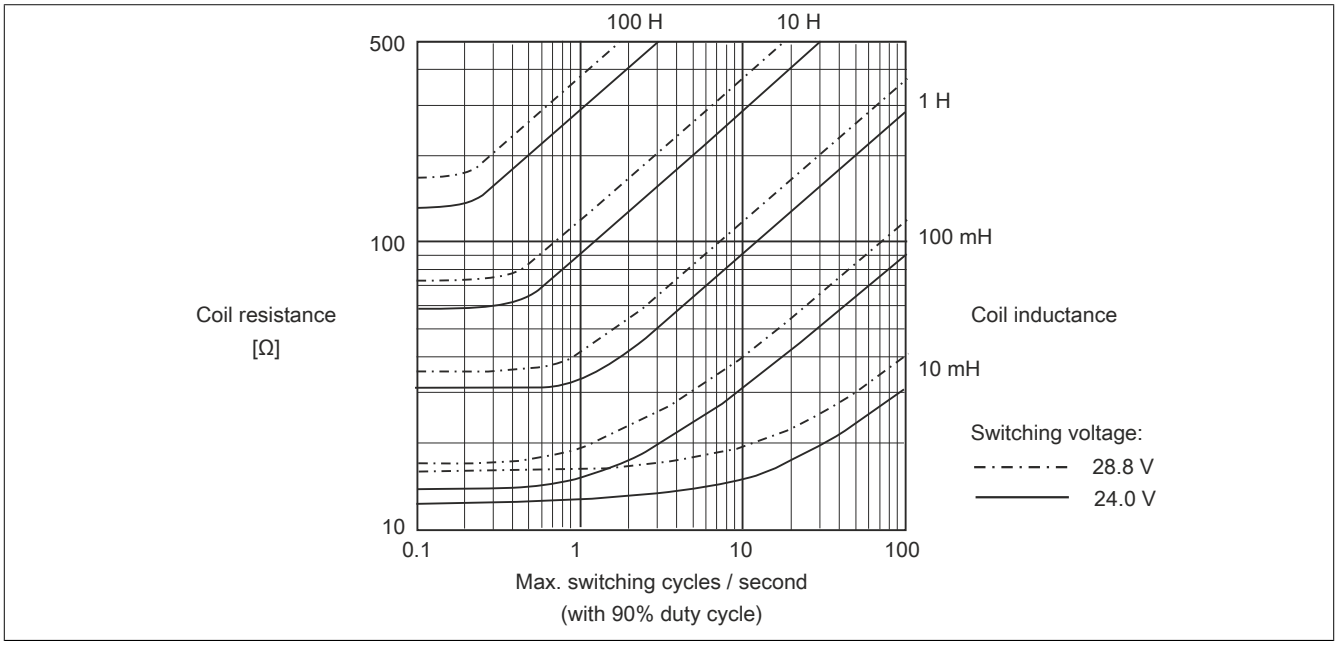
Appropriate cable cross-sections or external safety measures must therefore be provided.

8 Output circuit diagram

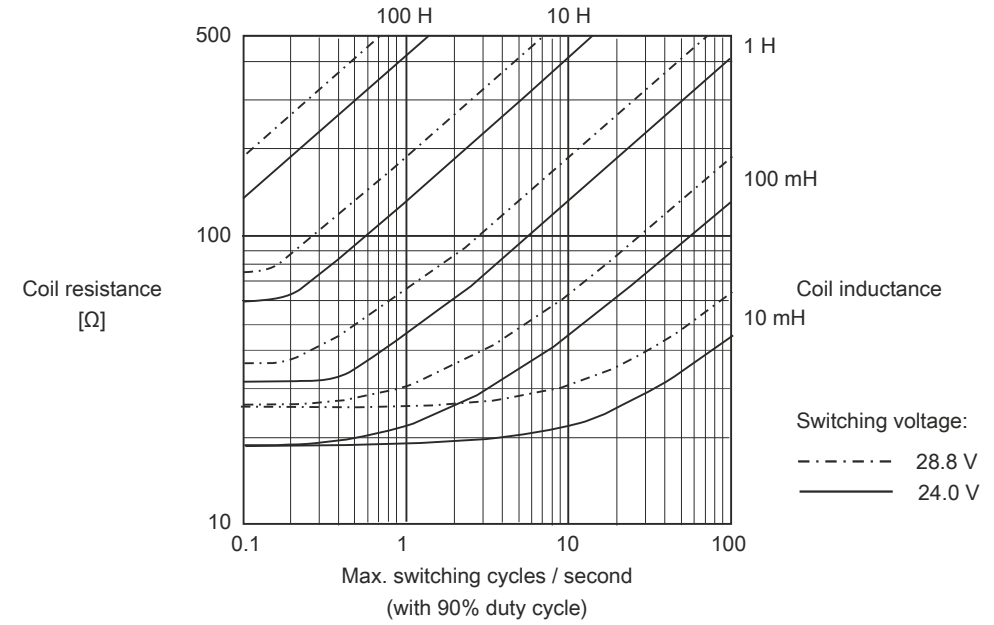


9 Switching inductive loads

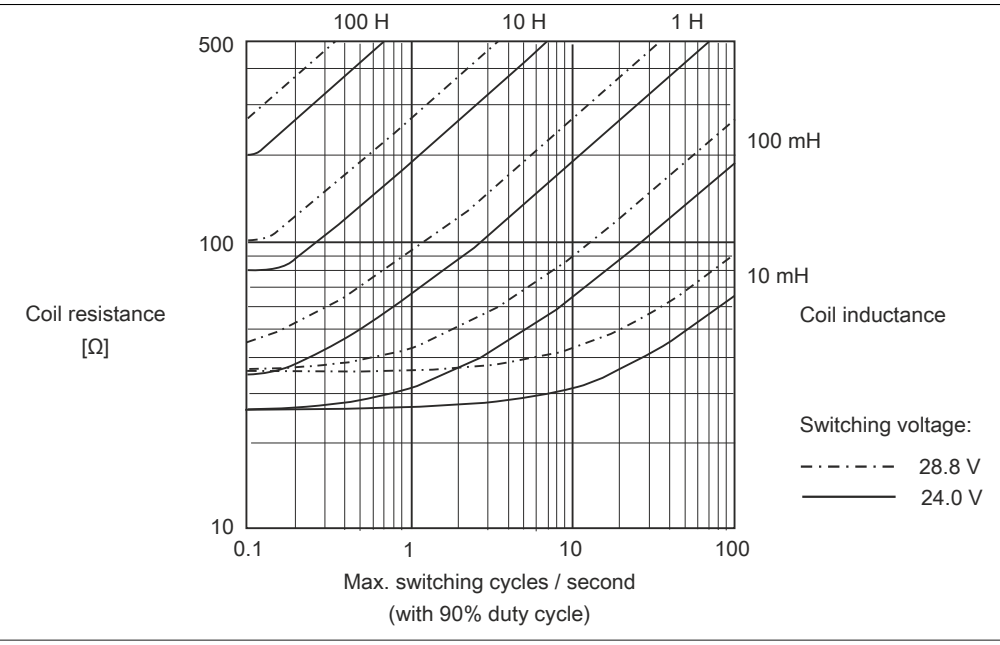
Environmental temperature: 35°C, 4 outputs (1,3,5,7 or 2,4,6,8) with the same load.



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!

10 Derating

The outputs of the module can handle up to 2 A. With a summation current of 8 A, no more than 4 channels are operable at full load. To ensure optimal use of the module, it is important to assign the channels properly, and to keep in mind a potential derating.

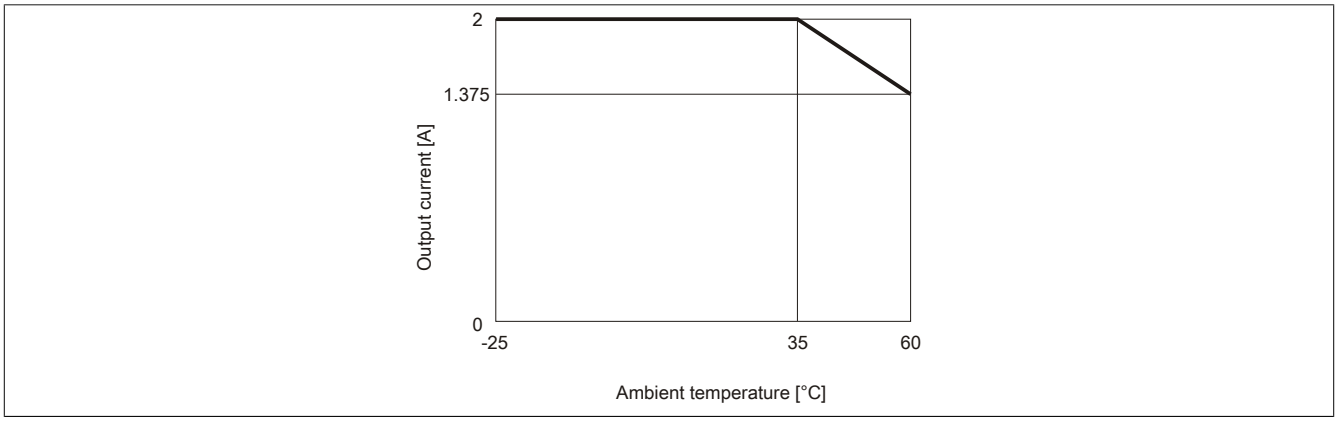
Correct channel assignment is important, since the 8 outputs are divided between 2 output drivers. The channels operated with 2 A must therefore be evenly divided between both output drivers.

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 used channels, the resulting best distribution, and a potential derating.

Number of channels using 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 all even or all odd 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 all even or all odd channel numbers. Possible divisions: 1, 3, 5, 7 2, 4, 6, 8	 On each channel On each channel

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



Information:

Modules next to this module can have a maximum power dissipation of 1.5 W.

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.

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
2	0	DigitalOutput	USINT			•	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput08	Bit 7				
30	1	StatusInput01	USINT		•		
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput08	Bit 7				
8192	-	Reading the module ID	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.

11.3 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	-	Reading the module ID	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.

11.4 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				
30	-	Status of digital outputs 1 to 8	USINT		•		
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput08	Bit 7				
8192	-	Reading the module ID	UINT		•		
8196	-	Status of the supply voltage	USINT		•		
		Power Supply01	Bit 2		•		

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

11.4.1 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" of the X20 user's manual (version 3.50 or later).

11.4.2 CAN I/O bus controller

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

11.5 Digital outputs

The output state 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 8

Name:
DigitalOutput
DigitalOutput01 to DigitalOutput08

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

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

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

11.6 Reading the module ID

Name:
asy_ModulID

This register offers the possibility to read the module ID.

Data type	Values
UINT	Module ID

11.7 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 is actively transmitted as an error message.

11.7.1 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.

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

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

11.8 Operating limit monitoring

The output supply of the module is monitored. I/O supply voltage <20.4 V is displayed as a warning.

11.8.1 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	
2	PowerSupply01	0	I/O supply above the warning level of 20.4 V
		1	I/O supply below the warning level of 20.4 V
3 - 7	Reserved	0	

11.9 Additional function - switch digital outputs w/ delay using switching mask

In function model 1 - Output switching, it is possible to control 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.

11.9.1 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 expired, only the channels with a bit set in the OutputDelay mask are adjusted to the OutputDelayed bits.

11.9.2 Switching mask after the delay time has expired

Name:
DigitalOutput01DelayEnable to DigitalOutput08DelayEnable

These registers create the mask for OutputDelay. They define which outputs are switched to the bit string for the OutputDelayed register after the delay time has expired.

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 is toggled
...		...	
7	DigitalOutput08DelayEnable	0	Digital output 08 remains unchanged
		1	Digital output 08 is toggled

11.9.3 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

11.10 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	
Standard function model	100 µs
Bus controller function model	150 µs

11.11 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