

# X20(c)DO6322

## 1 General information

The module is equipped with 6 outputs for 1 or 2-wire connections. The X20 6-pin terminal block can be used for universal 1-line wiring. 2-line wiring can be implemented using the 12-pin terminal block. The module is designed for source output wiring.

- 6 digital outputs
- Source connection
- 2-wire connections
- GND for signal supply
- Integrated output protection
- 1-wire connection type with 6-pin terminal block
- OSP mode

## 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
	<b>Digital outputs</b>	
X20DO6322	X20 digital output module, 6 outputs, 24 VDC, 0.5 A, source, 2-wire connections	
X20cDO6322	X20 digital output module, coated, 6 outputs, 24 VDC, 0.5 A, source, 2-wire connections	
	<b>Required accessories</b>	
	<b>Bus modules</b>	
X20BM11	X20 bus module, 24 VDC keyed, internal I/O supply continuous	
X20cBM11	X20 bus module, coated, 24 VDC keyed, internal I/O supply continuous	
	<b>Terminal blocks</b>	
X20TB06	X20 terminal block, 6-pin, 24 VDC keyed	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 1: X20DO6322, X20cDO6322 - Order data

## 4 Technical data

Model number	X20DO6322	X20cDO6322
<b>Short description</b>		
I/O module	6 digital outputs 24 VDC for 1- or 2-wire connections	
<b>General information</b>		
B&R ID code	0x1B98	0xE229
Status indicators	I/O function per channel, operating state, module status	
Diagnosics		
Module run/error	Yes, using status LED and software	
Outputs	Yes, using status LED and software (output error status)	
Power consumption		
Bus	0.18 W	
Internal I/O	0.71 W	
Additional power dissipation caused by the actuators (resistive) [W] <sup>1)</sup>	+0.31	
Electrical isolation		
Channel - Bus	Yes	
Channel - Channel	No	
Certification		
CE	Yes	
KC	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 = 0 - Max. 60°C FTZÚ 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	
GOST-R	Yes	
<b>Digital outputs</b>		
Design	FET positive switching	
Nominal voltage	24 VDC	
Switching voltage	24 VDC -15 % / +20 %	
Nominal output current	0.5 A	
Total nominal current	3 A	
Connection type	1- or 2-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 <sub>DS(on)</sub>	210 mΩ	
Peak short circuit current	<12 A	
Switching on after overload or short circuit cutoff	Approx. 10 ms (depends on the module temperature)	
Switching delay <sup>2)</sup>		
0 -> 1	<300 µs	
1 -> 0	<300 µs	
Switching frequency		
Resistive load <sup>2)</sup>	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 <sub>eff</sub>	
<b>Operating conditions</b>		
Mounting orientation		
Horizontal	Yes	
Vertical	Yes	
Installation at elevations above sea level		
0 to 2000 m	No limitations	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
EN 60529 protection	IP20	

Table 2: X20DO6322, X20cDO6322 - Technical data


Model number	X20DO6322	X20cDO6322
<b>Environmental conditions</b>		
Temperature		
Operation		
Horizontal installation		-25 to 60°C
Vertical installation		-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	
<b>Mechanical characteristics</b>		
Note	Order 1x X20TB06 or X20T-B12 terminal block separately Order 1x X20BM11 bus module separately	Order 1x X20TB06 or X20T-B12 terminal block separately Order 1x X20cBM11 bus module separately
Spacing	12.5 <sup>+0.2</sup> mm	

Table 2: X20DO6322, X20cDO6322 - Technical data

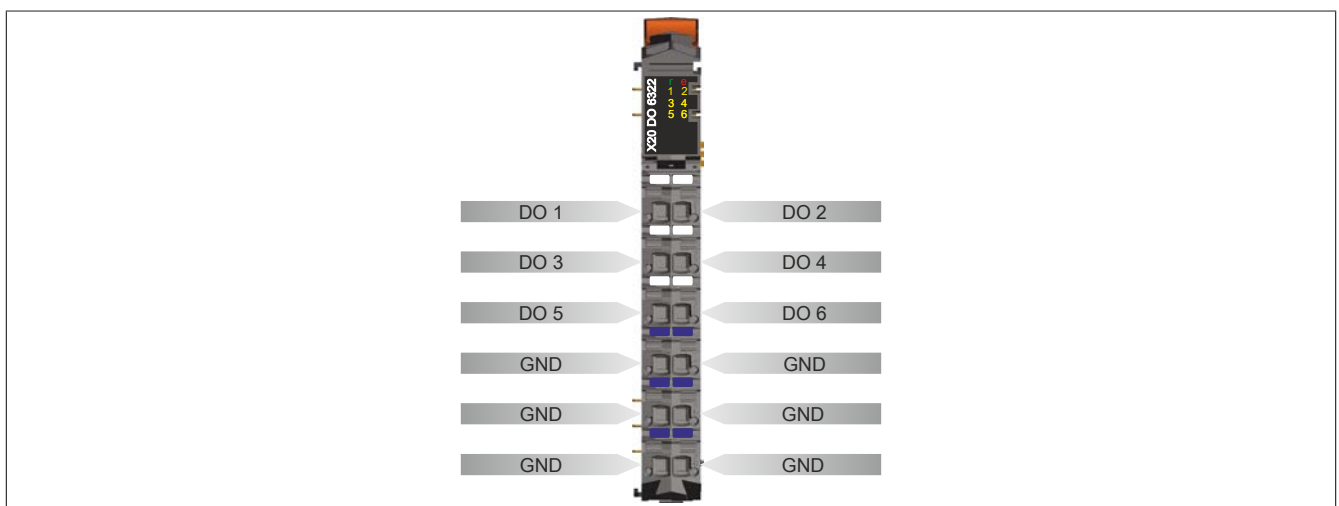
- 1) Number of outputs x  $R_{DS(on)}$  x Nominal output current<sup>2</sup> (A calculation example can be found on the B&R website in the download area for the module.)  
 2) At loads  $\leq 1$  k $\Omega$

## 5 Status LEDs

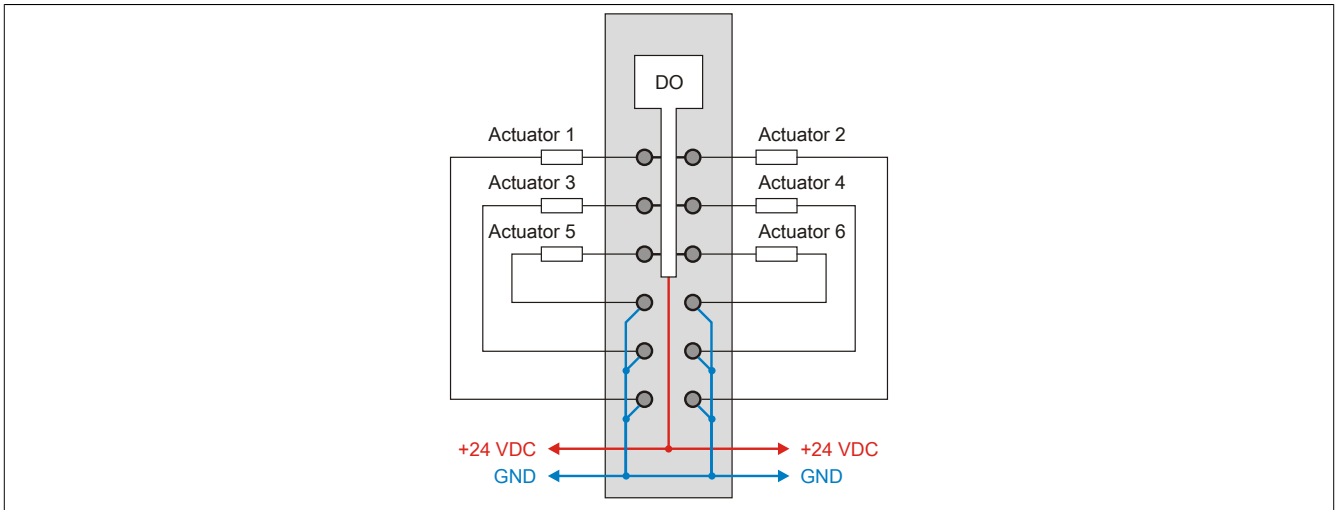
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" of the X20 system user's manual.

Figure	LED	Color	Status	Description
	r	Green	Off	Module supply not connected
			Single flash	RESET mode
			Blinking	PREOPERATIONAL mode
			On	RUN mode
			Flickering (approx. 10 Hz)	Module is in OSP state
	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.
	e + r	Red on / Green single flash	Invalid firmware	
	1 - 6	Orange		Output status of the corresponding digital output

## 6 Pinout



## 7 Connection example



### Caution!

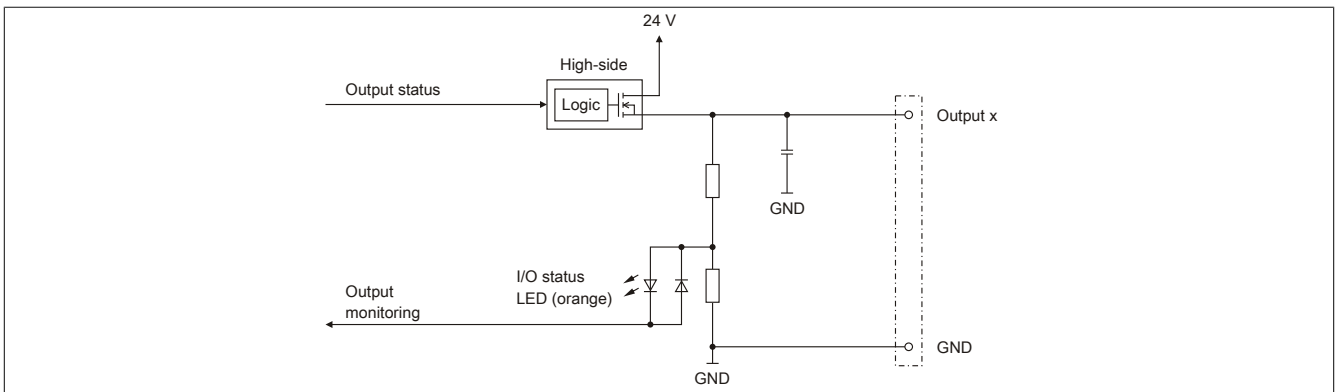
If the module is operated outside of specifications, the output current can increase above the maximum permissible nominal current. This applies to individual channels and also to the summation current for the module.

Therefore sufficient cable cross sections or external safety measures must be used.

## 8 OSP hardware requirements

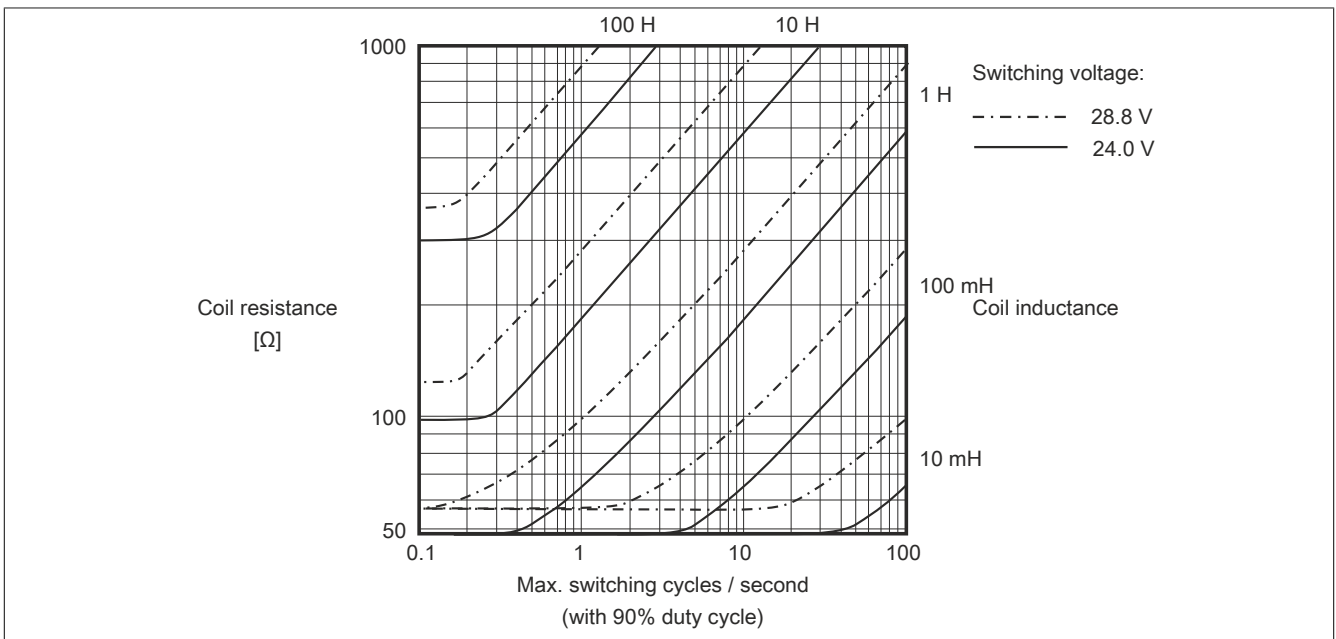
In order to best use OSP mode, make sure when creating the application that the output module and CPU have separate power supplies.

## 9 Output circuit diagram



## 10 Switching inductive loads

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!

## 11 Register description

### 11.1 General data points

In addition to the registers listed in the register description, the module also has other more general data points. These registers are not specific to the module but contain general information such as serial number and hardware version.

These general data points are listed 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				
		...	...				
		DigitalOutput06	Bit 5				
30	1	StatusInput01	USINT	•			
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput06	Bit 5				

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 - OSP

Register	Fixed offset	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	0	Switching state of digital outputs 1 to 6	USINT			•	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput06	Bit 5				
30	1	Status of digital outputs 1 to 6	USINT		•		
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput06	Bit 5				
34	1	Activating the OSP output in the module	USINT			•	
		OSPValid	Bit 0				
32	-	CfgOSPMODE	USINT				•
36	-	CfgOSPValue	USINT				•

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 <sup>1)</sup>	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	0	Switching state of digital outputs 1 to 6	USINT			•	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput06	Bit 5				
30	-	Status of digital outputs 1 to 6	USINT		•		
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput06	Bit 5				

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

#### 11.4.1 CAN I/O bus controller

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

## 11.5 Digital outputs

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

### 11.5.1 Switching state of digital outputs 1 to 6

Name:

DigitalOutput

DigitalOutput01 to DigitalOutput06

The switching state of digital outputs 1 to 6 are stored in this register.

Function model 0 - Standard only:

The "Packed outputs" setting in the Automation Studio I/O configuration is used to determine whether all of this registers' bits should be set up individually as data points in the Automation Studio I/O mapping ("DigitalOutput01" through "DigitalOutput0x") or whether this register should be displayed as an individual USINT data point ("DigitalOutput").

Data type	Value	Information
USINT	0 to 63	Packed outputs = on
	See 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
...	...	...	...
5	DigitalOutput06	0	Digital output 06 reset
		1	Digital output 06 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 6

Name:

StatusInput01

StatusDigitalOutput01 to StatusDigitalOutput06

The status of digital outputs 1 to 6 is mapped in this register.

Function model 0 - Standard only:

The "Packed outputs" setting in the Automation Studio I/O configuration is used to determine whether all of this registers' bits should be set up individually as data points in the Automation Studio I/O mapping ("StatusDigitalOutput01" through "StatusDigitalOutput0x") or whether this register should be displayed as an individual USINT data point ("StatusInput01").

Data type	Value	Information
USINT	0 to 63	Packed outputs = on
	See 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: <ul style="list-style-type: none"> <li>Short circuit or overload</li> <li>Channel switched on and missing I/O power supply</li> <li>Channel switched off and external voltage applied on channel</li> </ul>
...	...	...	...
5	StatusDigitalOutput06	0	Channel 06: No error
		1	Channel 06: For error description, see channel 01

## 11.7 "OSP" function model

In the "OSP" function model (Operator Set Predefined), the user defines an analog value or digital pattern. This OSP value is output as soon as communication between the module and master is interrupted.

### Functionality

The user can choose between 2 OSP modes:

- Retain last valid value
- Replace with static value

In the first case, the module retains the last value as validly recognized output state.

When selecting the mode, "Replace with static value" a plausible output value must be entered in the corresponding value register. If an OSP event occurs, this value will be output instead of the value currently requested by the task.

#### 11.7.1 Activating the OSP output in the module

Name:

OSPValid

This data point offers the possibility to start module output and request OSP operation during running operation.

Data type	Values
USINT	See bit structure.

Bit structure:

Bit	Name	Value	Information
0	OSPValid	0	Request OSP operation (after initial start or module in Standby)
		1	Request normal operation
1 - 7	Reserved	0	

There is one OSPValid bit on the module, which is managed by the user task. It must be set when the enabled channels are started. As long as the OSPValid bit remains set in the module, the module behaves the same as the "Standard" function model.

If an OSP event occurs (e.g. communication between the module and master CPU interrupted) then the OSPValid bit will be reset on the module. The module enters OSP mode and the output occurs in the register "[OSPMoDe](#)" on page 9 according to the configuration.

#### The following applies:

**The OSP replacement value remains even after the communication channel has recovered. OSP mode is only exited when a set OSPValid bit is transferred.**

**When the master CPU is restarted, the OSPValid bit is re-initialized on the master CPU. It must once more be set by the application and transferred via the bus.**

**When temporary communication errors occur between the module and master CPU (e.g. due to EMC), a few bus cycles will pass without refreshing the cyclic registers. The OSPValid bit is reset internally in the module - the bit in the CPU however remains set. Upon the next successful transfer, the OSPValid bit in the module is set again and the module returns to normal operation.**

The ModulOK bit can be evaluated if the task in the master CPU needs to know which output mode the module is currently in.

### Warning!

**If the OSPValid bit is reset to "0" on the module, then the output state no longer depends on the responsible task in the master CPU. However, output still occurs according to the configuration of the OSP replacement value.**



### 11.7.2 Setting the OSP mode

Name:  
CfgOSPMode

This register essentially controls a channel's behavior when OSP is being used.

Data type	Value	Description
USINT	0	Replace with static value
	1	Retain last valid value

### 11.7.3 Define the OSP digital output value

Name:  
CfgOSPValue

This register contains the digital output value, which is output in "Replace with static value" mode during OSP operation.

Data type	Values
USINT	See bit structure.

Bit structure:

Bit	Name	Value	Information
0		0 or 1	OSP output value for channel DigitalOutput00
...		...	
x		0 or 1	OSP output value for channel DigitalOutput0x

## Warning!

The "OSPValue" is not accepted by the module until the "OSPValid" bit has been set in the module.

### 11.8 Minimum cycle time

The minimum cycle time defines how far the bus cycle can be reduced without communication errors occurring. Note that very fast cycles decrease the idle time available for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
100 $\mu$ s

### 11.9 Minimum I/O update time

The minimum I/O update time defines how far the bus cycle can be reduced while still allowing an I/O update to take place in each cycle.

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