X20DO2623

1 General information

The module is a digital output module that is equipped with 2 SSR outputs with zero cross-over switches and uses 3-line connections. The module is also equipped with integrated full-wave control. The supply (L and N) is fed directly to the module.

- 2 digital outputs
- Outputs with integrated snubber circuit
- Outputs with 100 to 240 VAC
- L switching
- 50 Hz or 60 Hz
- 3-wire connections
- Integrated full-wave control
- 240 V coding

Danger!

Risk of electric shock!

The terminal block is only permitted to conduct voltage when it is connected. It is not permitted to be disconnected or connected while voltage is applied or have voltage applied to it while it is removed under any circumstances.

This module is not permitted to be the last module connected on the X2X Link network. At least one subsequent X20ZF dummy module must provide protection against contact.

2 Order data

Model number	Short description	Figure
	Digital outputs	
X20DO2623	X20 digital output module, 2 outputs, 100 to 240 VAC, 1 A, source, 240 V keyed, 3-wire connections	
	Required accessories	
	Bus modules	
X20BM12	X20 bus module, 240 VDC keyed, internal I/O supply continuous	
	Terminal blocks	
X20TB32	X20 terminal block, 12-pin, 240 VAC keyed	

Table 1: X20DO2623 - Order data

3 Technical data

Model number	X20DO2623
Short description	
I/O module	2 digital SSR outputs 100 to 240 VAC for 3-wire connections
General information	
B&R ID code	0x267B
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
Power consumption	
Bus	0.35 W
Internal I/O	-
External I/O	0.38 W
Additional power dissipation caused by actuators (resistive) [W] [1)]	+3
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 outputs	
Variant	SSR
Wiring	L-switching
Nominal voltage	100 to 240 VAC
Max. voltage	264 VAC
Rated frequency	47 to 63 Hz
Nominal output current	1 A
Total nominal current	1 A
Surge current	40 A (20 ms), 10 A (1 s)
Connection type	3-wire connections
Zero-crossing switches	Yes
Leakage current	Max. 10 mA at 240 V
Residual voltage (on-state voltage)	1.5 V
Switching delay	
At 50 Hz	
0 → 1	≤11 ms
1 → 0	≤11 ms
At 60 Hz	
0 → 1	≤9.3 ms
1 → 0	≤9.3 ms
Isolation voltage between channel and bus	Tested at 2500 VAC
Voltage monitoring L - N	No
Overvoltage protection between L and N	Yes
Output voltage	
Minimum	80 VAC
Protective circuit	
External	Generally varistor or fuse
Internal	Snubber circuit (RC element)
Electrical properties	
Electrical isolation	Channel isolated from bus Channel not isolated from channel
Operating conditions	
Mounting orientation	
Horizontal	Yes
Vertical	Yes
Installation elevation above sea level	
0 to 2000 m	No limitation
>2000 m	Not permitted
Degree of protection per EN 60529	IP20

Table 2: X20DO2623 - Technical data

Model number	X20DO2623
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 X20TB32 separately. Order 1x bus module X20BM12 separately.
Spacing	12.5 $^{+0.2}$ mm

Table 2: X20DO2623 - Technical data

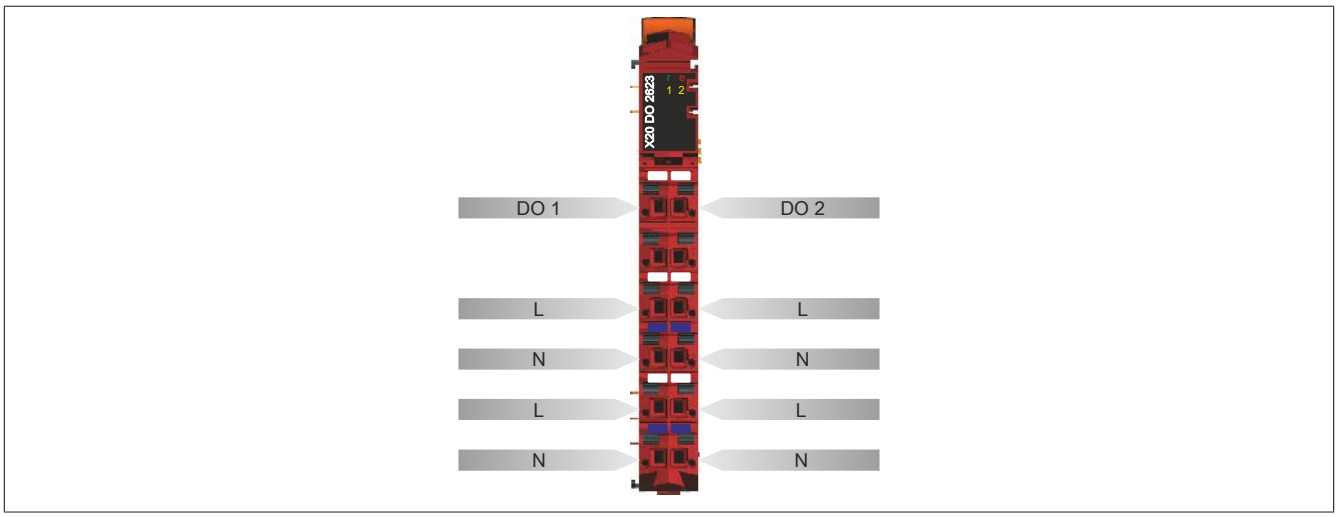
1) Number of outputs x Residual voltage (on-state voltage) x Nominal output current. For a calculation example, see section "Mechanical and electrical configuration" of the X20 system user's manual.

4 Status LEDs

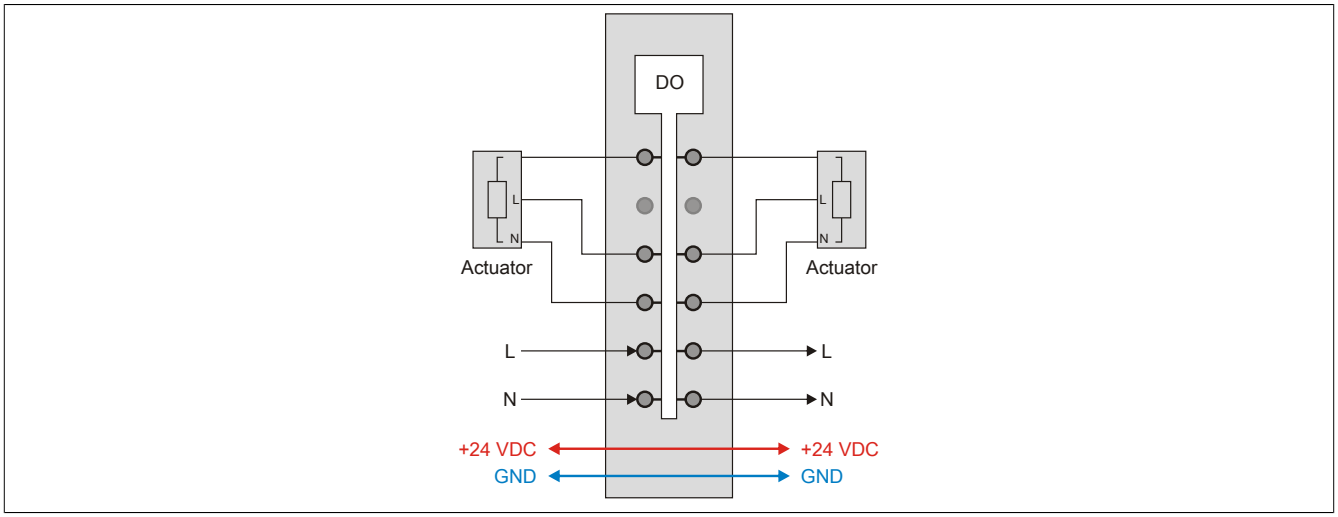
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" of the X20 system user's manual.

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
			On	Error or reset status
			Single flash	Zero cross-over signal has dropped out
	e + r	Red on / Green single flash		Invalid firmware
	1 - 2	Orange		Control status of the corresponding digital output

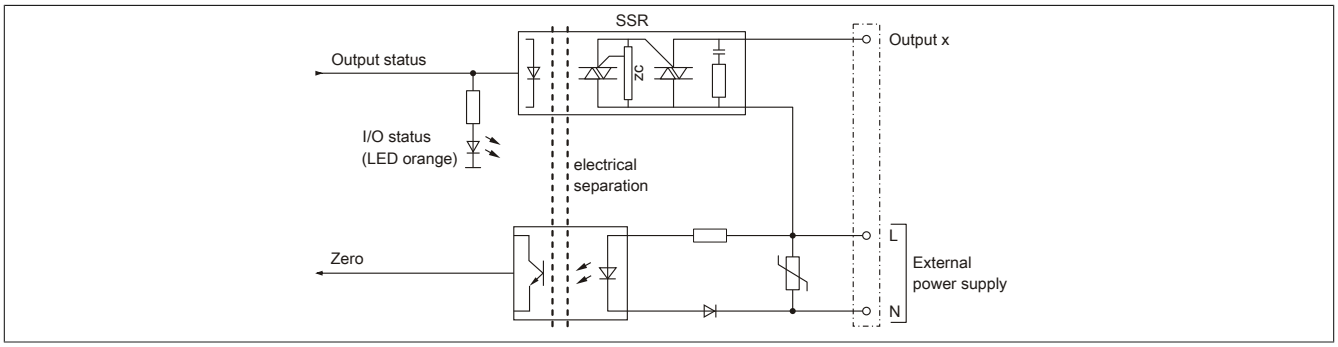
5 Pinout



6 Connection example



7 Output circuit diagram



8 Integrated full-wave control

Full-wave control is used to control power for electrical power consumers that are operated with AC voltage. Temperature control is a typical application

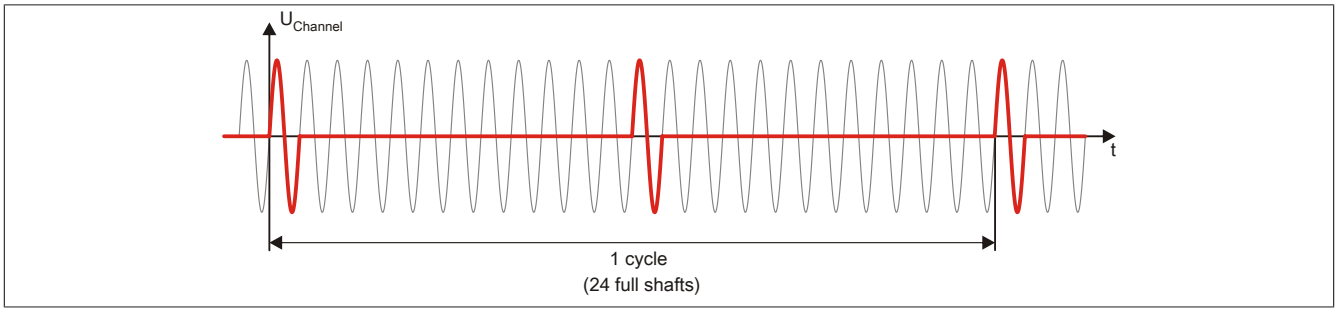
Unlike phase-angle control, the sine wave oscillation form of the mains voltage is not changed during full-wave control. This significantly reduces system perturbation.

The output voltage (channel) is switched on and off at a certain ratio. This switches the multi-cycle packets. A multi-cycle packet consists of a number of complete sine waves throughout a cycle. The relationship between the power-on duration and the cycle duration results in the desired effect of reduced power consumption by the connected power consumer.

With the full-wave control that is integrated in the module, a maximum of 24 full waves can be provided on the outputs per cycle. Control takes place in 4% steps.

Settings		Full waves																							
SW%	%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
0	0																								
4		•																							
8		•												•											
12		•								•								•							
16		•						•						•						•					
20		•					•					•					•					•			
24	25	•				•				•				•				•				•			
28		•				•			•				•			•				•			•		
32		•			•			•			•			•			•			•			•		
36		•			•			•		•			•			•		•			•			•	
40		•			•		•			•		•		•			•		•			•		•	
44		•			•		•		•		•		•			•		•		•		•		•	
48	50	•		•		•		•		•		•		•		•		•		•		•		•	
52			•	•		•		•		•		•		•	•		•		•		•		•		•
56			•	•		•		•	•		•		•		•	•		•		•	•		•		•
60			•	•		•	•		•		•	•		•	•		•		•	•		•	•		•
64			•	•		•	•		•	•		•	•		•	•		•	•		•	•		•	•
68			•	•	•		•	•		•	•	•		•	•		•	•	•		•	•		•	•
72	75		•	•	•		•	•	•		•	•	•		•	•	•		•	•	•		•	•	•	•
76			•	•	•	•		•	•	•	•		•	•	•	•		•	•	•	•		•	•	•	•
80			•	•	•	•	•		•	•	•	•	•		•	•	•	•	•		•	•	•	•	•	•
84			•	•	•	•	•	•	•		•	•	•	•	•	•	•		•	•	•	•	•	•	•	•
88			•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•
92			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
96	100	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Example of full-wave control (8%):

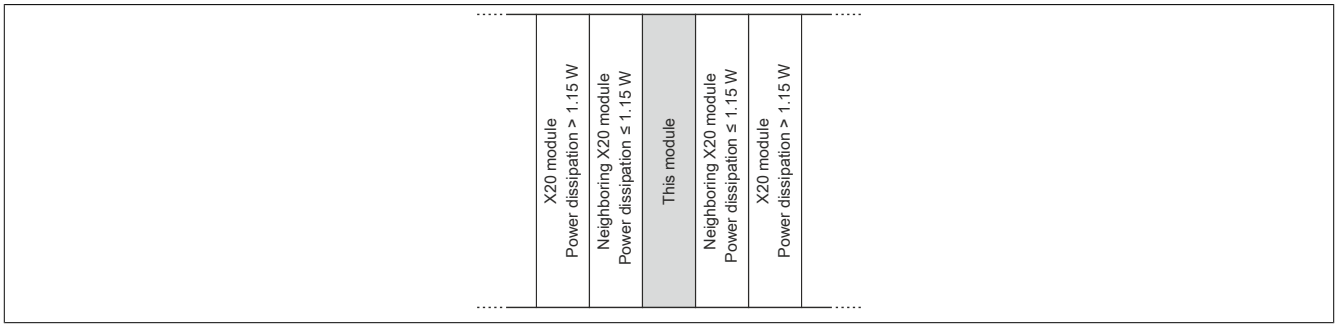


9 Derating

There is no derating when operated below 55°C.

During operation over 55°C, the power dissipation of the modules to the left and right of this module is not permitted to exceed 1.15 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.



10 Register description

10.1 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.

10.2 Function model 0 - Standard

Register	Fixed offset	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
12	3	ShiftOutput01[1)]	USINT			•	
14	4	ShiftOutput02[1)]	USINT			•	
28	-	ConfigOutput01	USINT				•
Communication							
2	0	DigitalOutput	USINT			•	
		DigitalOutput01	Bit 0				
		DigitalOutput02	Bit 1				
4	1	AnalogOutput01	USINT			•	
6	2	AnalogOutput02	USINT			•	
30	1	StatusInput01	USINT	•			
		ZeroCrossingInput	Bit 0				
		ZeroCrossingStatus	Bit 4				

1) Firmware version 816 and up.

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.

10.3 Function model 254 - Bus Controller

Register	Offset[1)]	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
12	-	ShiftOutput01[2)]	USINT				•
14	-	ShiftOutput02[2)]	USINT				•
28	-	ConfigOutput01 (output filter)	USINT				•
Communication							
4	0	AnalogOutput01	USINT			•	
6	2	AnalogOutput02	USINT			•	
30	0	Zero crossing status	USINT	•			
		ZeroCrossingInput	Bit 0				
		ZeroCrossingStatus	Bit 4				

1) The offset specifies where the register is within the CAN object.
2) Firmware version 816 and up.

10.3.1 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).

10.3.2 CAN I/O bus controller

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

10.4 Digital outputs

The output status is transferred to the control switch asynchronously to the connected network. The outputs switch on when the voltage crosses zero and switch off when the current crosses zero.

10.4.1 Switching state of digital outputs 1 to 2

Name:
DigitalOutput
DigitalOutput01 to DigitalOutput02

This register is used to store the switching state of digital outputs 1 to 2.

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 3	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
1	DigitalOutput02	0	Digital output 02 reset
		1	Digital output 02 set

Information:

The states in this register are only applied when the channels are set to DIGITAL in "Setting the output configuration" on page 9.

When using the setting "packed outputs" ALL channels must be set to DIGITAL. Mixed operation is not possible.

10.5 Analog outputs

The output value is transferred to the control circuit in sync with the connected power mains according to the firing pattern table (see "Integrated full-wave control" on page 5). The analog value is output with a resolution of ~4% over a duration of 24 complete waves. Values > 96% result in full control. Changes to the output value within an interval are applied after the next zero crossover.

10.5.1 Setting the output value from the firing pattern table

Name:
AnalogOutput01 to AnalogOutput02

These registers are used to set the output value from the firing pattern table.

Values between 0 and 100 correspond to the output value for the respective channel in percent. Values above 100 correspond to 100%.

Data type	Value
USINT	0 to 100

Information:

The states in these registers are only applied when the channels are set to ANALOG in "Setting the output configuration" on page 9.

10.5.2 Setting the output configuration

Name:
ConfigOutput01

Each channel can be configured for either "digital" or "analog" operation in this register. The corresponding DigitalOutput or AnalogOutput registers must be written depending on the setting.

Data type	Values	Bus controller default setting
USINT	See the bit structure.	3

Bit structure:

Bit	Name	Value	Information
0	Channel 1	0	Digital register is used
		1	Analog register used (bus controller default setting)
1	Channel 2	0	Digital register used
		1	Analog register used (bus controller default setting)
2 - 7	Reserved	0	

10.5.3 Shift switching pattern

Name:
ShiftOutput01 to ShiftOutput02

To prevent load peaks due to simultaneous switching of outputs, this register can be used to shift the switching pattern by a number of full waves. Due to the hardware used, it is not possible to shift by less than a full wave.

Values higher than 23 are limited to 23.

Data type	Value	Information
USINT	0	No shift (bus controller default setting)
	1 to 23	Size of the shift in number of full waves

Example

Set 0 on Channel 1 and 1 on Channel 2. With the same control value (see "Integrated full-wave control" on page 5) this delays the switching pattern of Channel 2 by one full wave.

10.6 Zero crossing status

Name:
ZeroCrossingInput
ZeroCrossingStatus
StatusInput01

Zero crossing detection uses a fixed filter time of 1 ms and a scanning frequency of 10 kHz. When a missing or too short period is detected, control is switched off until at least 2 periods are detected correctly, and the status flag is set accordingly. Control is offset by 2 ms from the negative half-wave until the next zero crossover is detected correctly or another error occurs. This is normally at least one complete wave.

Monitoring is activated at the first zero crossover after being switched on.

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 ("ZeroCrossingInput" to "ZeroCrossingStatus") or whether this register should be displayed as a single USINT data point ("StatusInput01").

Data type	Value	Information
USINT	0 to 17	Packed outputs = On
	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard.

Bit structure:

Bit	Description	Value	Information
0	ZeroCrossingInput[1)]	0	Signal during the negative half-wave
		1	Signal during the positive half-wave
1 - 3	Reserved	0	
4	ZeroCrossingStatus	0	No error
		1	Zero crossover failed
5 - 7	Reserved	0	

1) Value is valid if no error has occurred (ZeroCrossingStatus= 0)

10.7 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	
Digital mode	100 µs
Digital and analog mode	150 µs

10.8 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	
Digital mode	100 µs
Digital and analog mode	150 µs