X20DO4623

Data sheet
3.30 (September 2024)

Translation of the original documentation

Publishing information

B&R Industrial Automation GmbH

B&R Strasse 1

5142 Eggelsberg

Austria

Telephone: +43 7748 6586-0

Fax: +43 7748 6586-26

office@br-automation.com

Disclaimer

All information in this document is current as of its creation. The contents of this document are subject to change without notice. B&R Industrial Automation GmbH assumes unlimited liability in particular for technical or editorial errors in this document only (i) in the event of gross negligence or (ii) for culpably inflicted personal injury. Beyond that, liability is excluded to the extent permitted by law. Liability in cases in which the law stipulates mandatory unlimited liability (such as product liability) remains unaffected. Liability for indirect damage, consequential damage, business interruption, loss of profit or loss of information and data is excluded, in particular for damage that is directly or indirectly attributable to the delivery, performance and use of this material.

B&R Industrial Automation GmbH notes that the software and hardware designations and brand names of the respective companies used in this document are subject to general trademark, brand or patent protection.

Hardware and software from third-party suppliers referenced in this document is subject exclusively to the respective terms of use of these third-party providers. B&R Industrial Automation GmbH assumes no liability in this regard. Any recommendations made by B&R Industrial Automation GmbH are not contractual content, but merely non-binding information for which no liability is assumed. When using hardware and software from third-party suppliers, the relevant user documentation of these third-party suppliers must additionally be consulted and, in particular, the safety guidelines and technical specifications contained therein must be observed. The compatibility of the products from B&R Industrial Automation GmbH described in this document with hardware and software from third-party suppliers is not contractual content unless this has been separately agreed in individual cases; in this respect, warranty for such compatibility is excluded in any case, and it is the sole responsibility of the customer to verify this compatibility in advance.

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	
X20DO4623	X20 digital output module, 4 outputs, 100 to 240 VAC, 0.5 A, source, 240 V keyed, 2-wire connections	
	Required accessories	
	Bus modules	
X20BM12	X20 bus module, 240 VAC keyed, internal I/O power supply connected through	
	Terminal blocks	
X20TB32	X20 terminal block, 12-pin, 240 VAC keyed	

Table 1: X20DO4623 - Order data

1.3 Module description

The module is a digital output module that is equipped with 4 SSR outputs with zero cross-over switches and uses 2-line connections. The module is also equipped with integrated full-wave control. The supply (L and N) is fed directly to the module.

Functions:

- Digital outputs
- Full-wave control

Integrated full-wave control

Full-wave control is used to control the power of loads operated with AC voltage.

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 Technical description

2.1 Technical data

Order number	X20DO4623
Short description	
I/O module	4 digital SSR outputs 100 to 240 VAC for 2-wire connections
General information	
B&R ID code	0x267C
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	0.52 W
Internal I/O	-
External I/O	0.38 W
Additional power dissipation caused by actuators (resistive) [W] [1)]	+3.2
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
KC	Yes
Digital outputs	
Variant	SSR
Circuit	L-switching
Nominal voltage	100 to 240 VAC
Max. voltage	264 VAC
Rated frequency	47 to 63 Hz
Nominal output current	0.5 A
Total nominal current	1 A
Surge current	7 A (20 ms), 2 A (1 s)
Connection type	2-wire connections
Zero-crossing switches	Yes
Leakage current	Max. 1.5 mA at 240 V
Residual voltage (on-state voltage)	1.6 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
Insulation voltage between channel and bus	Tested at 2500 VAC
Voltage monitoring L - N	No
Overvoltage protection between L and N	Yes
Output voltage	
Minimum	75 VAC
Protective circuit	
External	Generally varistor or fuse
Internal	Snubber circuit (RC element)
Electrical properties	
Electrical isolation	Channel isolated from bus and I/O power supply
Operating conditions	
Mounting orientation	
Horizontal	Yes
Vertical	Yes

Table 2: X20DO4623 - Technical data

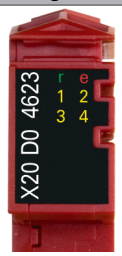
Order number	X20DO4623
Installation elevation above sea level	
0 to 2000 m	No limitation
>2000 m	Not permitted
Degree of protection per EN 60529	IP20
Ambient conditions	
Temperature	
Operation	
Horizontal mounting orientation	-25 to 60°C
Vertical mounting orientation	-25 to 50°C
Derating	See section "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 X20TB32 separately. Order 1x bus module X20BM12 separately.
Pitch	12.5$^{+0.2}$ mm

Table 2: X20DO4623 - Technical data

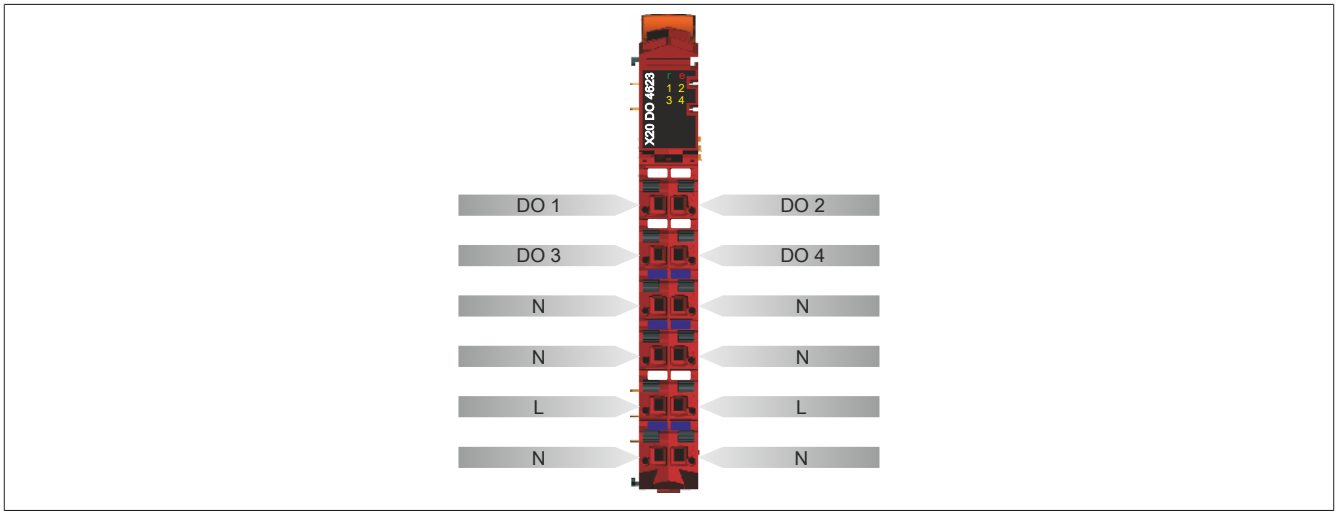
1) Number of outputs x Residual voltage (on-state voltage) x Nominal output current. For a calculation example, see section "Mechanical and electrical configuration" in the X20 system user's manual.

2.2 Status LEDs

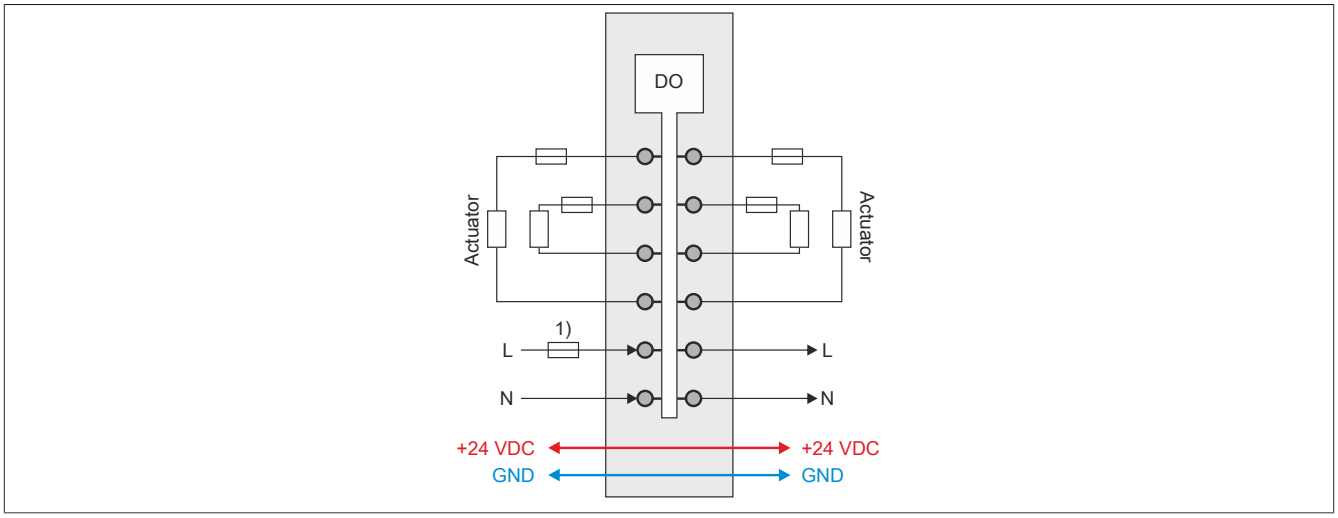
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" in the X20 System user's manual.

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
			On	Error or reset status
			Single flash	Zero cross-over signal has dropped out
	e + r	Red on / Green single flash		Invalid firmware
	1 - 4	Orange		Control status of the corresponding digital output

2.3 Pinout

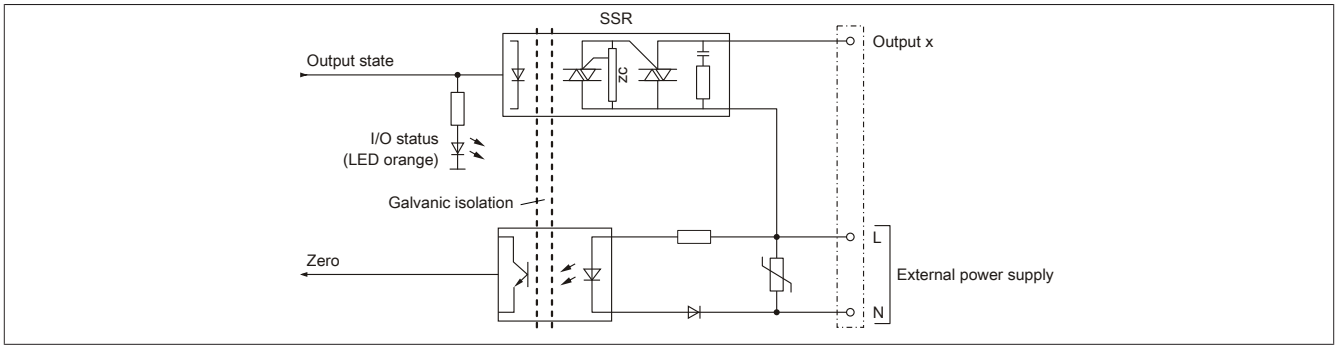


2.4 Connection example



1) Fuse, 10 A slow-blow

2.5 Output circuit diagram

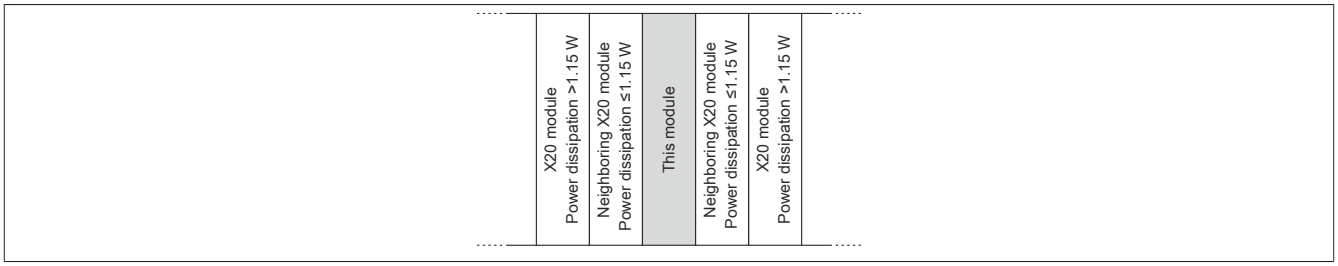


2.6 Derating

There is no derating when operated below 55°C.

When operated above 55°C, the modules to the left and right of this module are permitted to have a maximum power dissipation of 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.



3 Function description

3.1 Digital outputs

This module is equipped with 4 digital outputs.

The output state is transferred asynchronously to the connected network to the drive circuit; the actual switching procedure is carried out via the logic of the solid state relays. Switching on takes place during the voltage zero crossing and switched off during the current zero crossing.

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 4" on page 11.

3.2 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

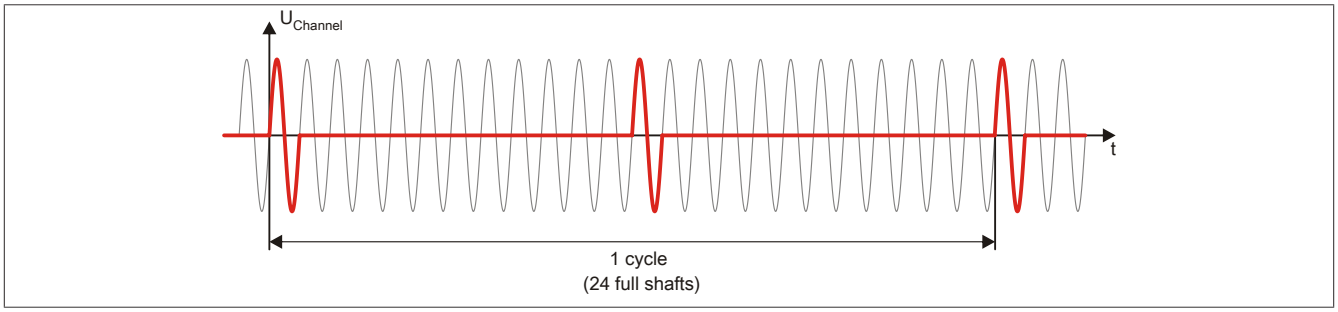
Unlike phase-angle control, the sine wave oscillation form of the mains voltage is not changed during full-wave control. This significantly reduces system perturbation.

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.

The output value is transferred to the drive circuit in synchronization with the connected mains according to the firing pattern table. The analog value is output with a resolution of ~4% over a period of 24 full waves. Values ≥96% result in full activation. Changes to the output value within an interval are applied after the next zero crossing.

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%):



Information:

The registers are described in "Full-wave control" on page 11.

3.2.1 Monitoring the zero crossing

Zero-crossing detection works with a fixed filter time of 1 ms and a sampling frequency of 10 kHz. When a missing or too short period is detected, control is deactivated until at least 2 periods are detected correctly, and the status flag is set accordingly. Activation takes place with a delay of 2 ms before the negative half-wave until correct detection of the next zero crossing or another error occurs. This is normally at least one complete wave.

After switching on, monitoring is not enabled until the first zero crossing is detected.

Information:

The register is described in "Zero crossing status" on page 12.

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 analog 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
Configuration							
28	-	ConfigOutput01 (output filter)	USINT				•
Communication							
2	0	DigitalOutput	USINT			•	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput04	Bit 3				
4	1	AnalogOutput01	USINT			•	
6	2	AnalogOutput02	USINT			•	
8	3	AnalogOutput03	USINT			•	
10	4	AnalogOutput04	USINT			•	
30	1	StatusInput01	USINT	•			
		ZeroCrossingInput	Bit 0				
		ZeroCrossingStatus	Bit 4				

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 254 - Bus Controller

Register	Offset[1)]	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
28	-	ConfigOutput01 (output filter)	USINT				•
Communication							
4	0	AnalogOutput01	USINT			•	
6	2	AnalogOutput02	USINT			•	
8	4	AnalogOutput03	USINT			•	
10	6	AnalogOutput04	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.

5.4 Digital outputs

The output state is transferred to the drive circuit asynchronously to the connected mains. Switching on takes place during the voltage zero crossing and switched off during the current zero crossing.

5.4.1 Switching state of digital outputs 1 to 4

Name:
DigitalOutput
DigitalOutput01 to DigitalOutput04

This register stores the switching state of digital outputs 1 to 4.

Data type	Values	Information[1)]
USINT	0 to 15	Packed outputs = On Data point: "DigitalOutput"
	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard. Data points: "DigitalOutput01" to "DigitalOutput04"

1) See "Digital outputs" on page 7.

Bit structure:

Bit	Name	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

Information:

The states are only applied if the configuration of the channels in "Setting the output configuration" on page 12 is set to DIGITAL accordingly.

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

5.5 Full-wave control

5.5.1 Setting the output value of the firing pattern table

Name:
AnalogOutput01 to AnalogOutput04

The output value of the firing pattern table is set in these registers (see section "Full-wave control" on page 7).

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 if the configuration of the channels in "Setting the output configuration" on page 12 is set to ANALOG accordingly.

5.5.2 Setting the output configuration

Name:
ConfigOutput01

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

Data type	Values	Bus controller default setting
USINT	See the bit structure.	15

Bit structure:

Bit	Name	Value	Description
0	Channel 1	0	Digital register is used
1		1	Analog register used (bus controller default setting)
...		...	
3	Channel 4	0	Digital register is used
		1	Analog register used (bus controller default setting)
4 - 7	Reserved	0	

5.5.3 Zero crossing status

Name:
ZeroCrossingInput
ZeroCrossingStatus
StatusInput01

Information about the zero crossing is indicated in this register. After switching on, monitoring is not enabled until the first zero crossing is detected. For details, see "Monitoring the zero crossing" on page 8.

Data type	Value	Information[1)]
USINT	0 to 17	Packed outputs = On Data point: "StatusInput01"
	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard. Data points: "ZeroCrossingInput" and "ZeroCrossingStatus"

1) See "Digital outputs" on page 7.

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)

5.6 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

5.7 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