

X20(c)AO4632

1 General information

The module is equipped with four outputs with 16-bit (including sign) digital converter resolution. It is possible to select between the current and voltage signal using different connection terminal points.

- 4 analog outputs
- Either current or voltage signal possible
- 16-bit digital converter resolution

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
	Analog outputs	
X20AO4632	X20 analog output module, 4 outputs, ± 10 V or 0 to 20 mA, 16-bit converter resolution	
X20cAO4632	X20 analog output module, coated, 4 outputs, ± 10 V or 0 to 20 mA, 16-bit converter resolution	
	Required accessories	
	Bus modules	
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	
	Terminal blocks	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 1: X20AO4632, X20cAO4632 - Order data

4 Technical data

Product ID	X20AO4632	X20cAO4632
Short description		
I/O module	4 analog outputs, ± 10 V or 0 to 20 mA	
General information		
B&R ID code	0x1BA5	0xD575
Status indicators	I/O function per channel, operating state, module status	
Diagnostics		
Module run/error	Yes, using status LED and software	
Channel type	Yes, using software	
Power consumption		
Bus	0.01 W	
Internal I/O	1.8 W (Rev. \geq J0); 2.2 W (Rev. $<$ J0)	1.8 W
Additional power dissipation caused by the actuators (resistive) [W]	-	
Electrical isolation		
Channel - Bus	Yes	
Channel - Channel	No	
Certification		
CE	Yes	
cULus	Yes	
cCSAus HazLoc Class 1 Division 2	Yes	-
ATEX Zone 2 ¹⁾		
KC	Yes	-
GL		Yes
GOST-R		Yes
Analog outputs		
Output	± 10 V or 0 to 20 mA, via different connection terminal points	
Digital converter resolution		
Voltage	± 15 -bit	
Current	15-bit	
Conversion time	50 μ s for all outputs	
Settling time for output changes over entire range	500 μ s	
Power on/off behavior	Internal enable relay for booting	
Max. error at 25°C		
Voltage		
Gain	0.040% ²⁾	
Offset	0.022% ³⁾	
Current		
Gain	0.090% ²⁾	
Offset	0.045% ³⁾	
Output protection	Short circuit protection	
Output format		
Voltage	INT 0x8001 - 0x7FFF / 1 LSB = 0x0001 = 305.176 μ V	
Current	INT 0x0000 - 0x7FFF / 1 LSB = 0x0001 = 610.352 nA	
Load per channel		
Voltage	Max. ± 10 mA, load ≥ 1 k Ω	
Current	Load max. 600 Ω (Rev. \geq J0); 500 Ω (Rev. $<$ J0)	Max. load is 600 Ω
Short circuit protection	Current limiting ± 40 mA	
Output filter	1st-order low pass / cutoff frequency 10 kHz	
Max. gain drift		
Voltage	0.010 %/°C ²⁾	
Current	0.020 %/°C ²⁾	
Max. offset drift		
Voltage	0.012 %/°C ³⁾	
Current	0.012 %/°C ³⁾	
Error caused by load change		
Voltage	Max. 0.11%, from 10 M Ω \rightarrow 1 k Ω , resistive	
Current	Max. 0.50%, from 1 Ω \rightarrow 600 Ω , resistive	
Nonlinearity	$< 0.005\%$ ⁴⁾	
Isolation voltage between channel and bus	500 V _{eff}	
Operating conditions		
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: X20AO4632, X20cAO4632 - Technical data


Product ID	X20AO4632	X20cAO4632
Environmental conditions		
Temperature		
Operation		
Horizontal installation	-25 to 60°C (Rev. ≥ J0); 0 to 55°C (Rev. < J0)	-25 to 60°C
Vertical installation	-25 to 50°C (Rev. ≥ J0); 0 to 50°C (Rev. < J0)	-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	Up to 100%, condensing
Storage	5 to 95%, non-condensing	
Transport	5 to 95%, non-condensing	
Mechanical characteristics		
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
Spacing	12.5 ^{+0.2} mm	

Table 2: X20AO4632, X20cAO4632 - Technical data

- 1) Ta min.: 0°C
Ta max.: See environmental conditions
- 2) Based on the current output value.
- 3) Based on the entire output range.
- 4) Based on the output range.

5 LED status indicators

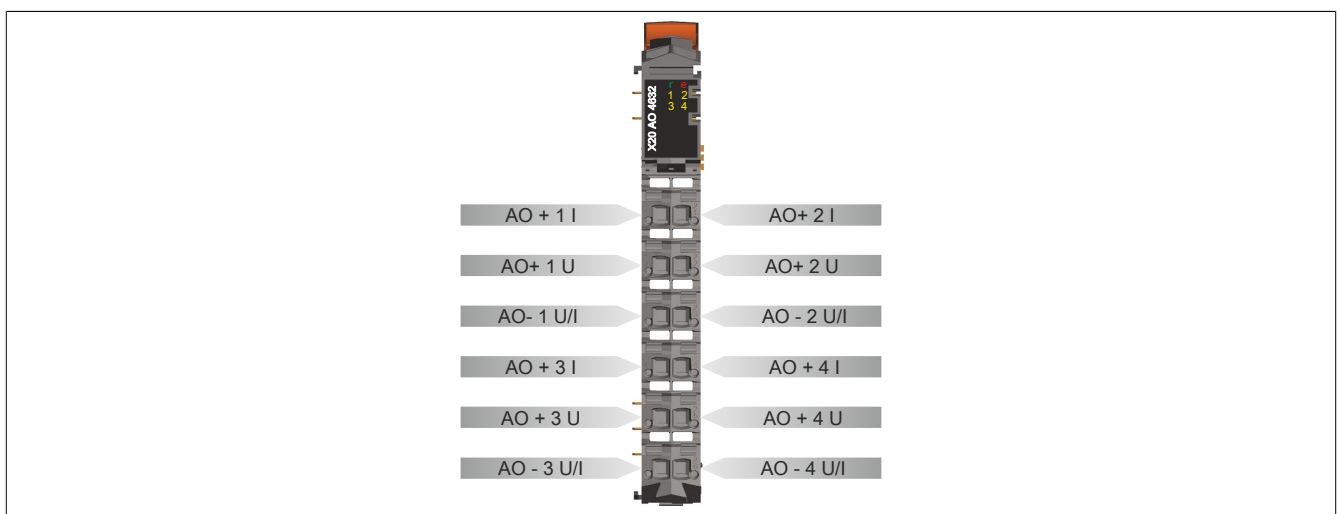
For a description of the various operating modes, see the section "re LEDs" in chapter 2 "System characteristics" of the X20 system user's manual.

Figure	LED	Color	Status	Description
	r	Green	Off	No power to module
			Single flash	RESET mode
			Double flash	BOOT mode (during firmware update) ¹⁾
			Blinking	PREOPERATIONAL mode
	e	Red	On	RUN mode
			Off	No power to module or everything OK
	1 - 4	Orange	On	Error or reset status
			Off	Value = 0
			On	Value ≠ 0

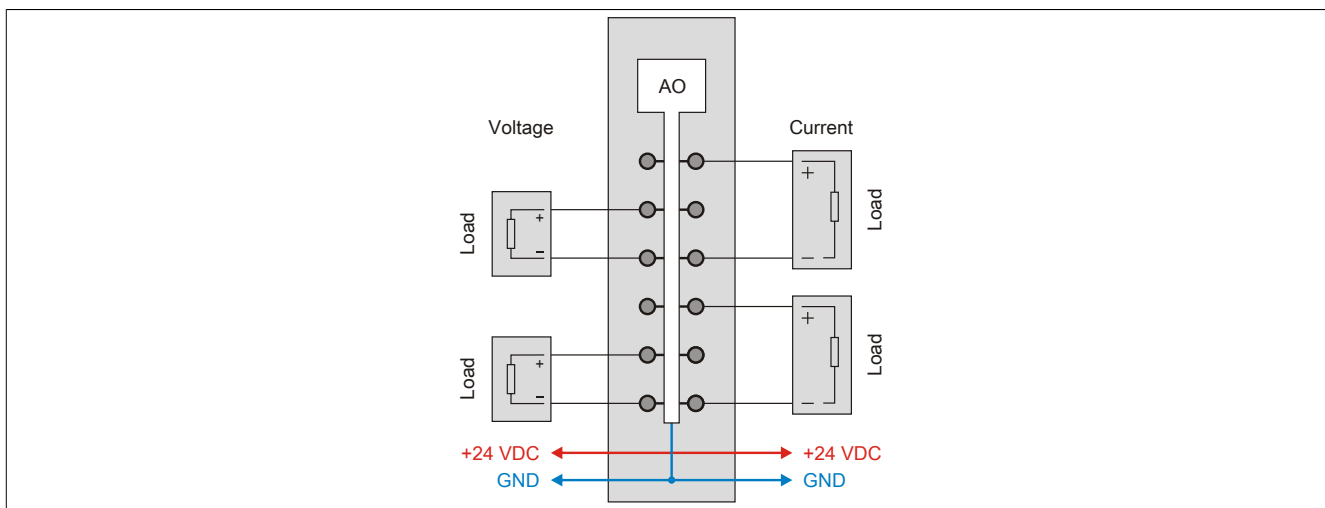
- 1) Depending on the configuration, a firmware update can take up to several minutes.

6 Pinout

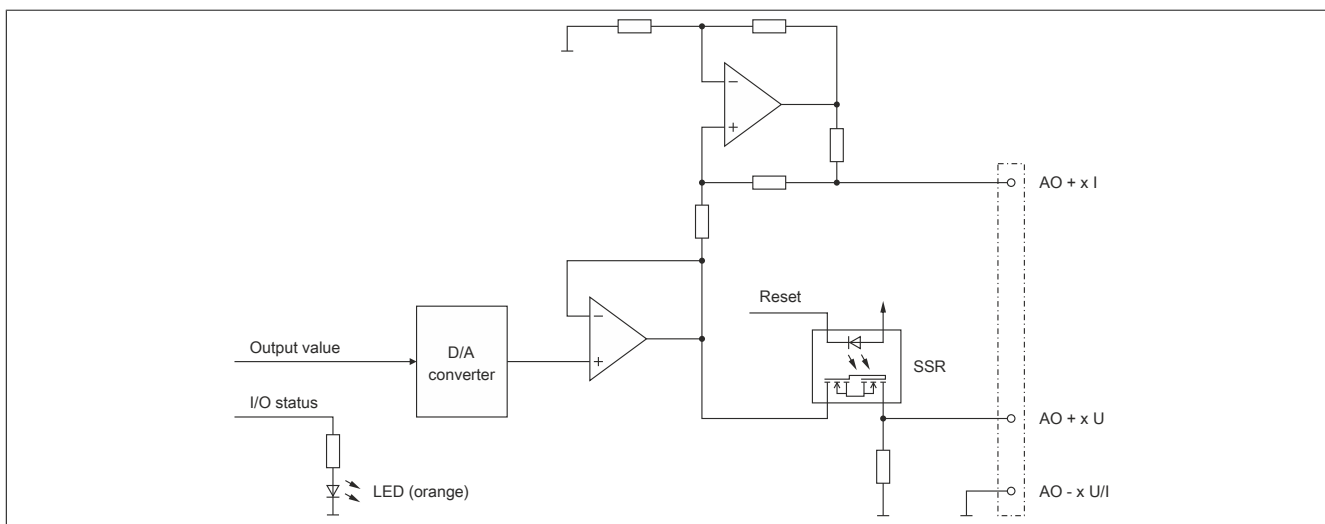
Each channel can be configured for either current or voltage signals. The type of signal is also determined by the connection terminals used.



7 Connection example



8 Output circuit diagram

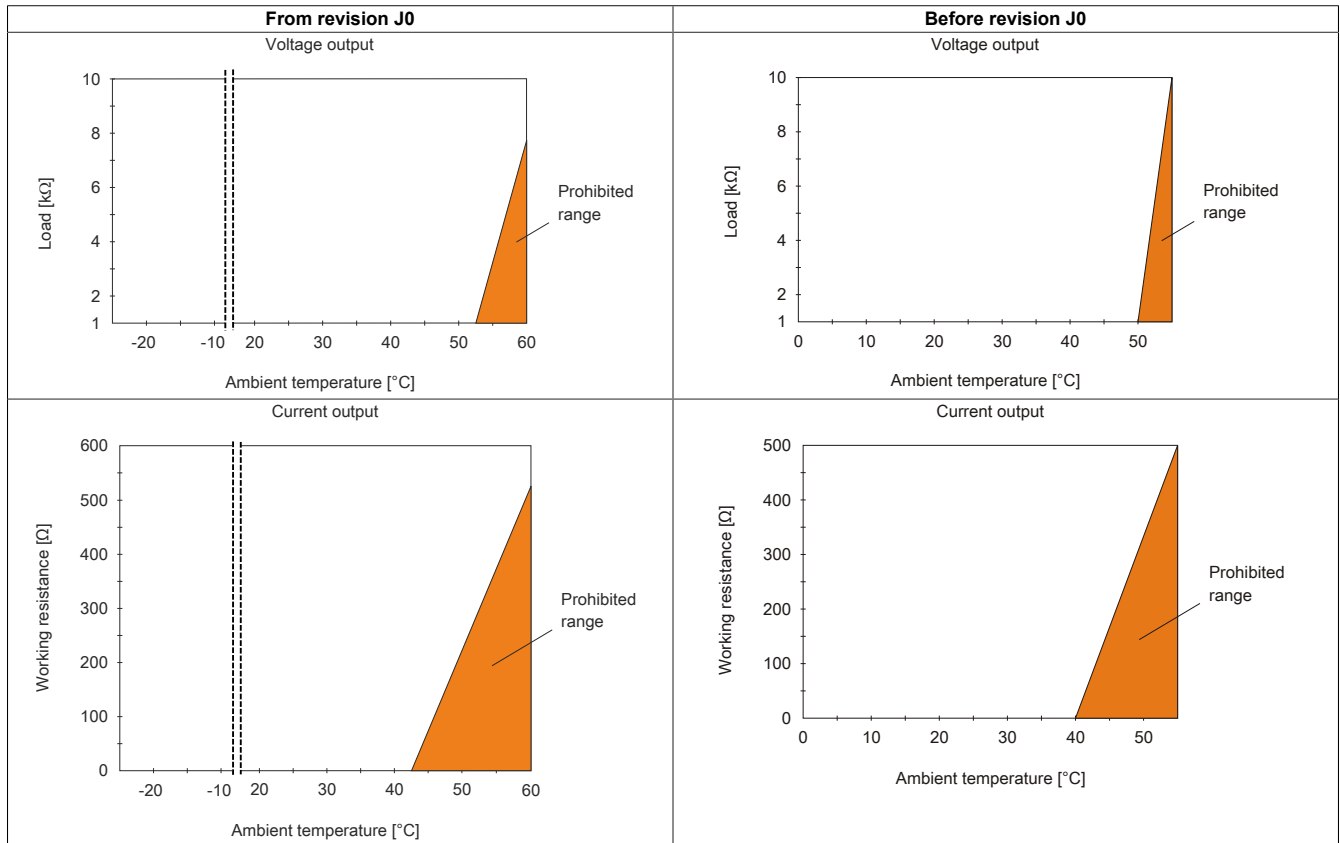


9 Derating

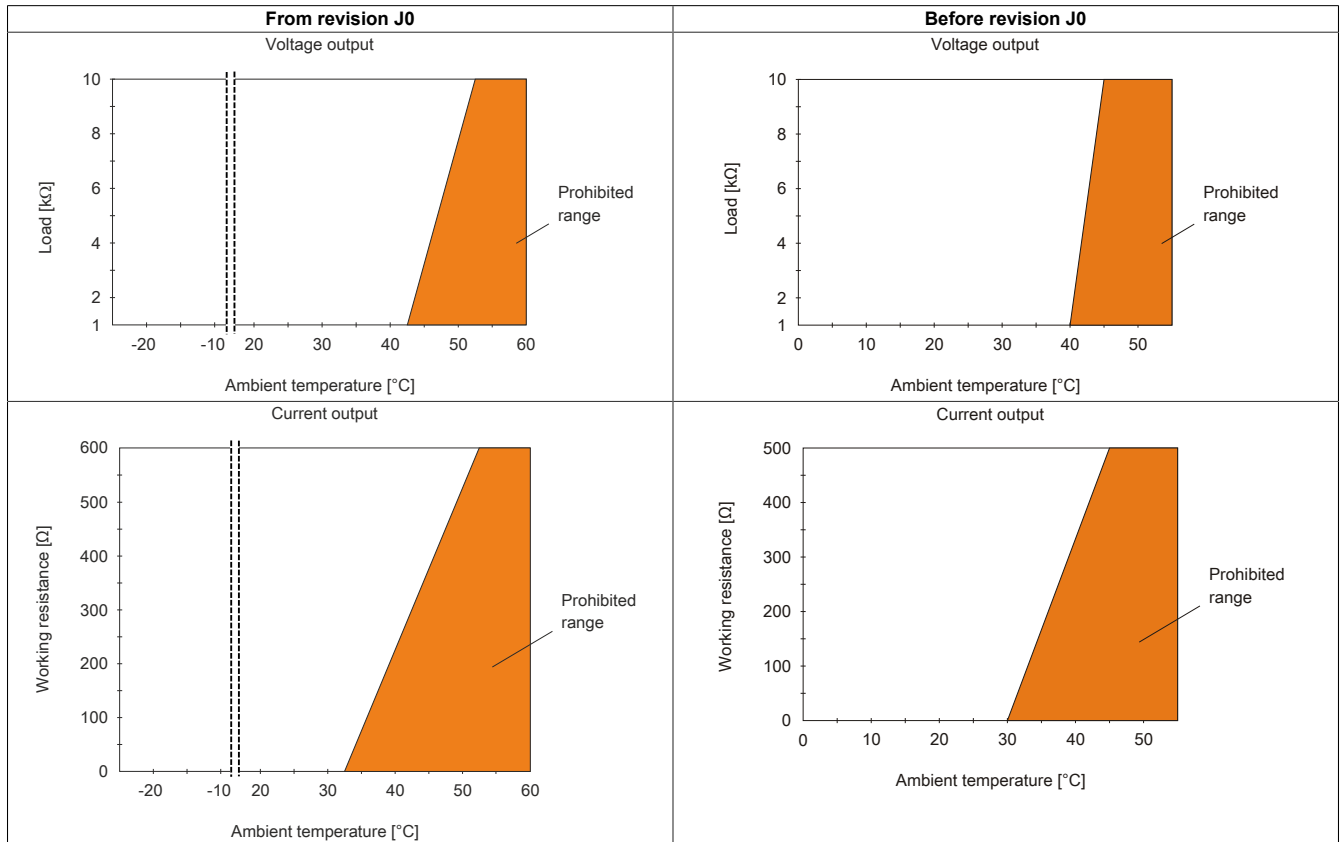
To ensure proper operation, the following items must be taken into consideration:

- The following derating listings must be taken into consideration
- For mixed operation with one current output, the average of both derating curves should be used
- For mixed operation with two or three current outputs, the derating for the current outputs should be used

Horizontal installation



Vertical installation



10 Register description

10.1 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 the "General data points" section of chapter 4 "X20 system modules" in the X20 system user's manual.

10.2 Function model 0 - Standard

Register	Name	Data type	Read		Write	
			Cyclic	Non-cyclic	Cyclic	Non-cyclic
Analog signal - Configuration						
0	ConfigOutput01	UINT				•
Analog signal - Communication						
Index * 2	AnalogOutput0N (Index N = 1 to 4)	INT			•	
10 + Index * 4	AnalogOutputDelayed0N (Index N = 0 to 3)	INT			•	
12	OutputDelayConfig00	UINT			•	
18	OutputDelayConfig01	UINT			•	
14	AnalogOutputLatchTime00	UINT	•			
22	AnalogOutputLatchTime01	UINT	•			
20	Error	UINT	•			

10.3 Function model 254 - Bus controller

Register	Offset ¹⁾	Name	Data type	Read		Write	
				Cyclic	Non-cyclic	Cyclic	Non-cyclic
Analog signal - Configuration							
0	-	ConfigOutput01	UINT				•
Analog signal - Communication							
10 + Index * 4	Index * 2 - 2	AnalogOutput0N (Index N = 1 to 4)	INT			•	

1) The offset specifies the position of the register within the CAN object.

10.4 Analog output - Configuration

10.4.1 Setting the channel type

Name:

ConfigOutput01

This register can be used to set the channel type of the outputs.

Each channel is capable of handling either current or voltage signals. The type of signal is determined by the connection terminals used. Since current and voltage require different adjustment values, it is also necessary to configure the desired type of output signal. The following output signals can be set:

- ± 10 V voltage signal (default)
- 0 to 20 mA current signal

Data type	Value
USINT	See bit structure.

Bit structure:

Bit	Description	Value	Information
0 - 7	Reserved	0	
8	Channel 1	0	Voltage signal
		1	Current signal
...		...	
11	Channel 4	0	Voltage signal
		1	Current signal
12 - 15	Reserved	0	

10.5 Analog output - Configuration

10.5.1 Output values of the analog outputs

Name:

AnalogOutput01 to AnalogOutput04

These registers provide the standardized output values. Once a permitted value is received, the module outputs the respective current or voltage.

Information:

The value "0" disables the channel status LED.

Data type	Value	
INT	-32767 to 32767	Voltage; Bus controller default setting: 0
	0 to 32767	Current

10.5.2 Value for delayed output

Name:

AnalogOutputDelayed00 to AnalogOutputDelayed03

These registers contain the values with which the analog outputs are overwritten after the delay configured with OutputDelayConfig0x has expired.

Data type	Value	Output Signal
INT	-32768 to 32767	Voltage signal -10 VDC to 10 VDC
	0 to 32767	Current signal 0 mA to 20 mA

10.5.3 Configuration of the output delay

Name:

OutputDelayConfig00 to OutputDelayConfig01

Two configurations independent from each other can be created using these registers.

The delay time after which AnalogOutputDelay0x should overwrite the channel can be configured using bits 0 to 13. Using bits 14 and 15, the channel is determined for which the configuration is valid.

Each channel can only be overwritten once. No additional channel can be overwritten while the respective time is running.

Data type	Value
UINT	See bit structure.

Bit structure:

Bit	Description	Value	Information
0 - 13	Delay time for the selected channel	x	Time in μ s
14 - 15	Channel	00	Analog output 01
		01	Analog output 02
		10	Analog output 03
		11	Analog output 04

10.5.4 Delay time for the output value

Name:

AnalogOutputLatchTime00 to AnalogOutputLatchTime01

These registers can be used to read when the respective overwrite value was actually written on the output.

Data type	Value
UINT	Actual delay time

10.5.5 Error register for counter

Name:

Error

There are some limitations because two timers are used. This register is available to the user for reporting these potential errors.

The error bits are deleted as soon as a valid state is reset.

Data type	Value
UINT	See bit structure.

Bit structure:

Bit	Description	Value	Information
0	Analog output 01	0	OK
		1	Has already been overwritten
...		...	
3	Analog output 04	0	OK
		1	Has already been overwritten
4	Timer 01	0	OK
		1	Already in use
5	Timer 02	0	OK
		1	Already in use
6	Timer 01 and 02	0	OK
		1	Both timers refer to the same channel number
7 - 15	Reserved		

10.6 Minimum cycle time

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

Minimum cycle time
200 μ s

10.7 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
200 μ s