X20(c)AO4622

1 General information

The module is equipped with four outputs with 13-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
- 13-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	
X20AO4622	X20 analog output module, 4 outputs, ±10 V or 0 to 20 mA / 4 to 20 mA, 13-bit converter resolution	
X20cAO4622	X20 analog output module, coated, 4 outputs, ±10 V or 0 to 20 mA / 4 to 20 mA, 13-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: X20AO4622, X20cAO4622 - Order data

4 Technical data

Product ID	X20AO4622	X20cAO4622
Short description		
I/O module	4 analog outputs ±10 V or 0 to 20 mA / 4 to 20 mA [1]	4 analog outputs ±10 V or 0 to 20 mA / 4 to 20 mA
General information		
B&R ID code	0x1BA3	0xE212
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. ≥ 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 [2]	Yes	
KC	Yes	-
GL	Yes	
GOST-R	Yes	
Analog outputs		
Output	±10 V or 0 to 20 mA / 4 to 20 mA, via different terminal connections [1]	±10 V or 0 to 20 mA / 4 to 20 mA, via different terminal connections
Max. output current	10 mA at voltages >5 V 15 mA at voltages <5 V	
Digital converter resolution		
Voltage	±12-bit	
Current	12 Bit	
Conversion time	300 µs for all outputs	
Settling time for output changes over entire range	500 µs	
Power on/off behavior	Internal enable relay for booting	
Max. error at 25°C		
Voltage		
Gain	0.08% [3]	
Offset	0.05% [4]	
Current		
Gain	0.09% [3]	
Offset	0.05% [4]	
Output protection	Short circuit protection	
Output format		
Voltage	INT 0x8001 - 0x7FFF / 1 LSB = 0x0010 = 4.882 mV	
Current	INT 0x8001 - 0x7FFF / 1 LSB = 0x0010 = 9.766 µA	
Load per channel		
Voltage	Max. ±10 mA, load ≥1 kΩ	
Current	Load max. 600 Ω (Rev. ≥ 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	0.015 %/°C [3]	
Current	0.02 %/°C [3]	
Max. offset drift		
Voltage	0.032 %/°C [4]	
Current	0.032 %/°C [4]	
Error caused by load change		
Voltage	Max. 0.11%, from 10 MΩ → 1 kΩ, resistive	
Current	Max. 0.5%, from 1 Ω → 600 Ω, resistive	
Nonlinearity	<0.005% [5]	
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: X20AO4622, X20cAO4622 - Technical data

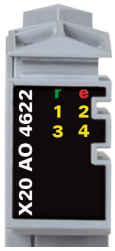
Product ID	X20AO4622	X20cAO4622
Environmental conditions		
Temperature		
Operation		
Horizontal installation	-25 to 60°C (Rev. ≥ J0); 0 to 55°C (Rev. < J0)	-25 to 60°C
Vertical installation	-25 to 50°C (Rev. ≥ J0); 0 to 50°C (Rev. < J0)	-25 to 50°C
Derating	See section "Derating"	
Storage	-40 to 85°C	
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: X20AO4622, X20cAO4622 - Technical data

1) 4 to 20 mA: From upgrade version 1.0.2.0 or hardware revision "I0"
2) Ta min.: 0°C
   Ta max.: See environmental conditions
3) Based on the current output value.
4) Based on the entire output range.
5) Based on the output range.

5 LED status indicators

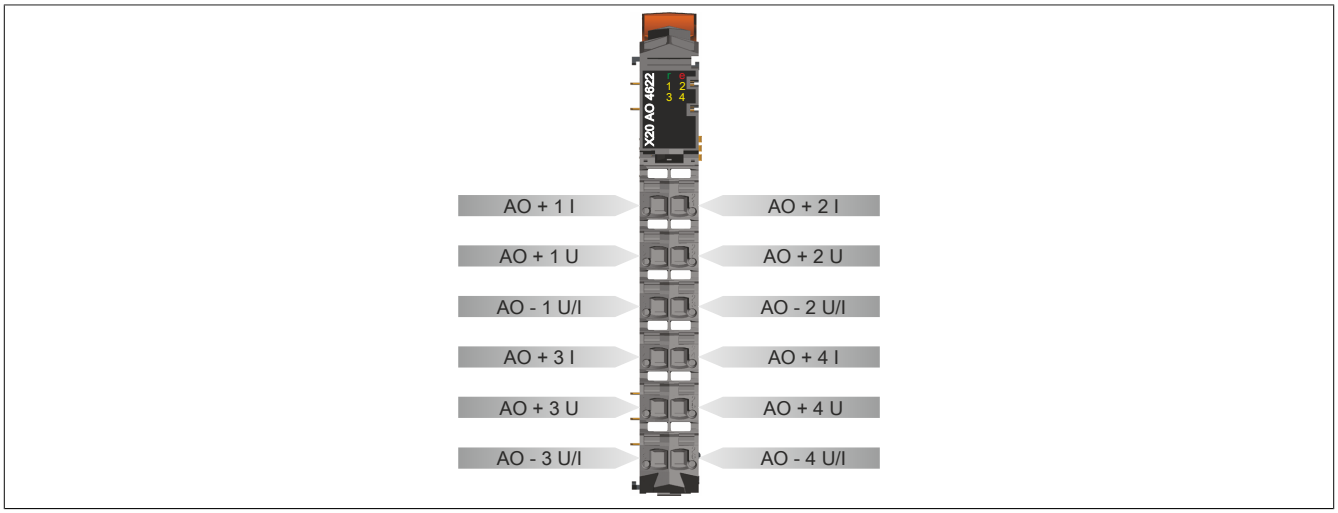
For a description of the various operating modes, see the section "re LEDs" in chapter 2 "System characteristics" of the X20 system user's manual.

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
			On	RUN mode
	e	Red	Off	No power to module or everything OK
			On	Error or reset status
	e + r	Red on / Green single flash		Invalid firmware
	1 - 4	Orange	Off	Value = 0
			On	Value ≠ 0

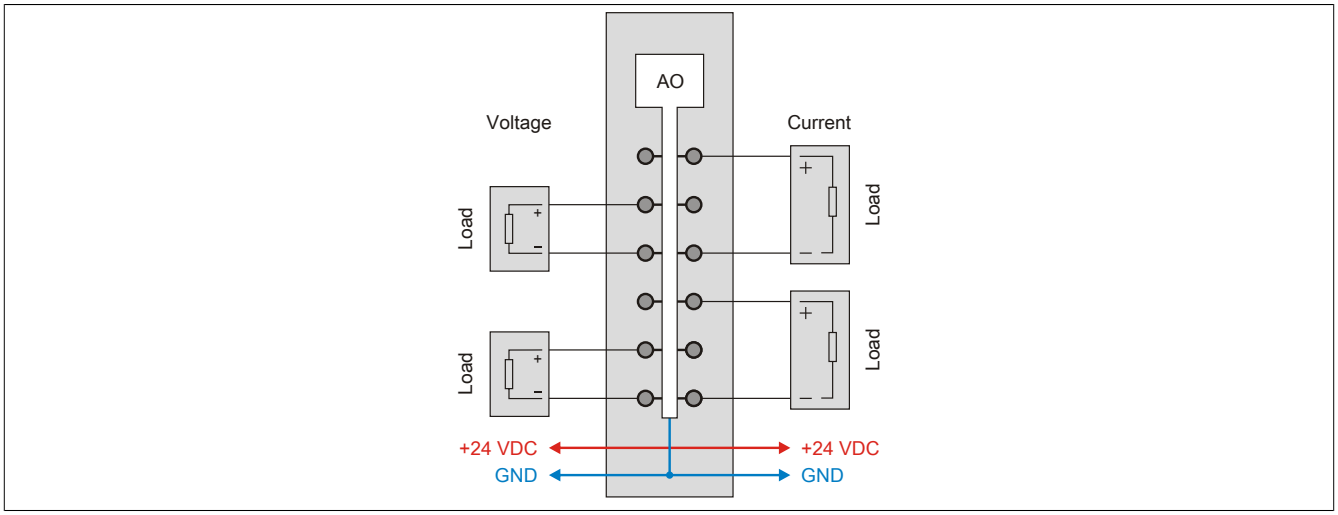
1) Depending on the configuration, a firmware update can take up to several minutes.

6 Pinout

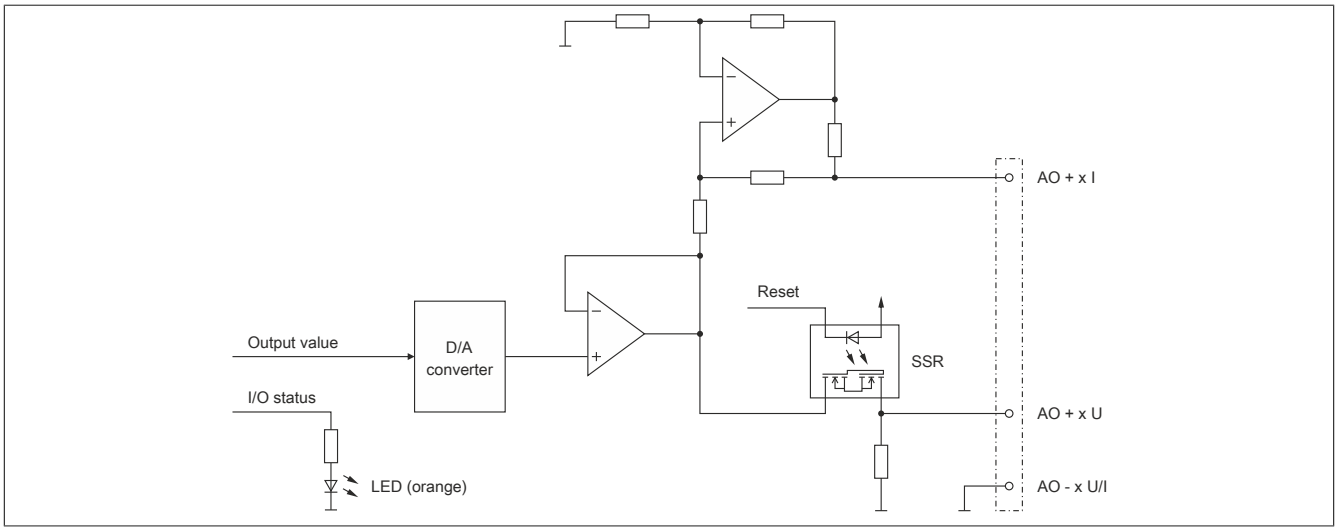
Each channel can be configured for either current or voltage signals. The type of signal is also determined by the connection terminals used.



7 Connection example



8 Output circuit diagram



9 Derating

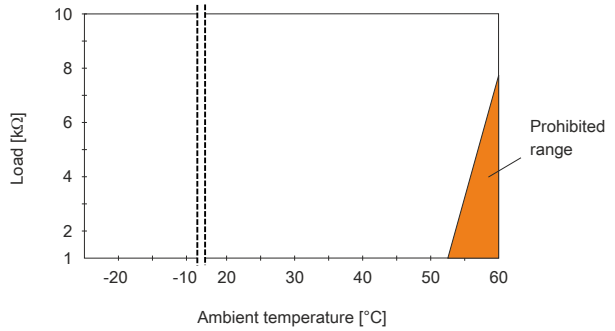
To ensure proper operation, the following items must be taken into consideration:

- 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

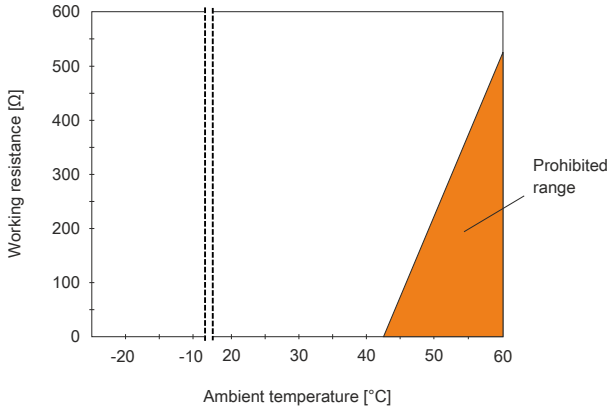
Horizontal installation

From revision J0

Voltage output

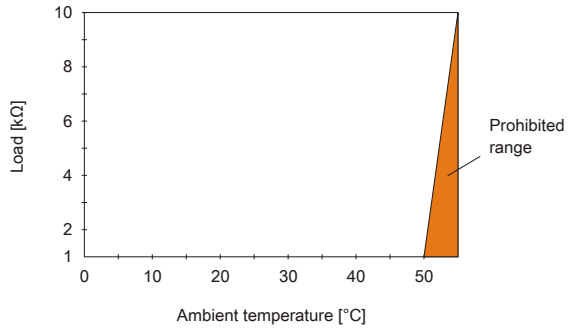


Current output

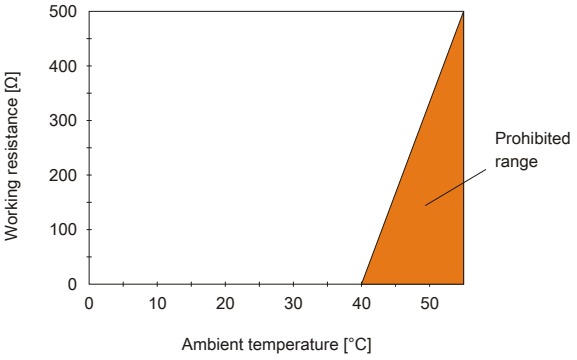


Before revision J0

Voltage output



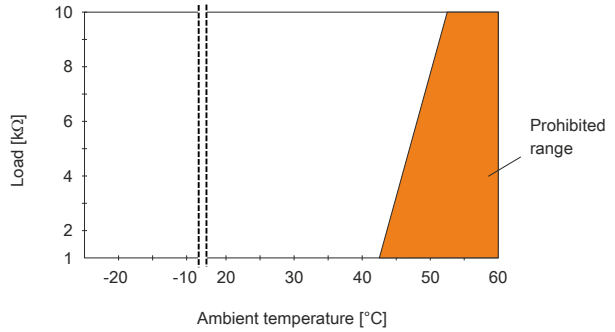
Current output



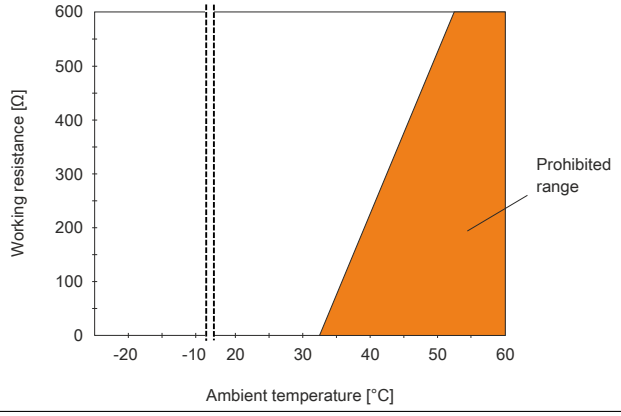
Vertical installation

From revision J0

Voltage output

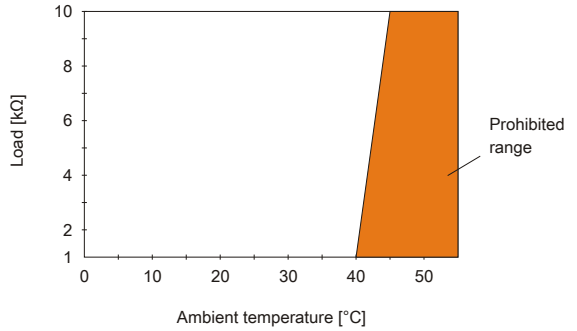


Current output

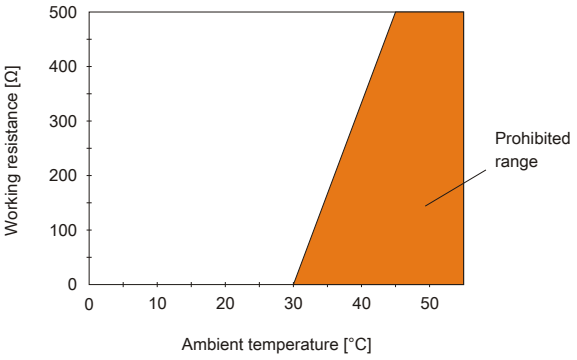


Before revision J0

Voltage output



Current output



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 and function model 1 - I/O with fast reaction

Register	Name	Data type	Read		Write	
			Cyclic	Non-cyclic	Cyclic	Non-cyclic
Analog signal - Configuration						
18	ConfigOutput01	USINT				•
Analog signal - Communication						
0	AnalogOutput01	INT			•	
2	AnalogOutput02	INT			•	
4	AnalogOutput03	INT			•	
6	AnalogOutput04	INT			•	

10.3 Function model 254 - Bus controller

Register	Offset[1)]	Name	Data type	Read		Write	
				Cyclic	Non-cyclic	Cyclic	Non-cyclic
Analog signal - Configuration							
18	-	ConfigOutput01	USINT				•
Analog signal - Communication							
0	0	AnalogOutput01	INT			•	
2	2	AnalogOutput02	INT			•	
4	4	AnalogOutput03	INT			•	
6	6	AnalogOutput04	INT			•	

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

10.3.1 CAN I/O bus controller

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

10.4 Function model comparison

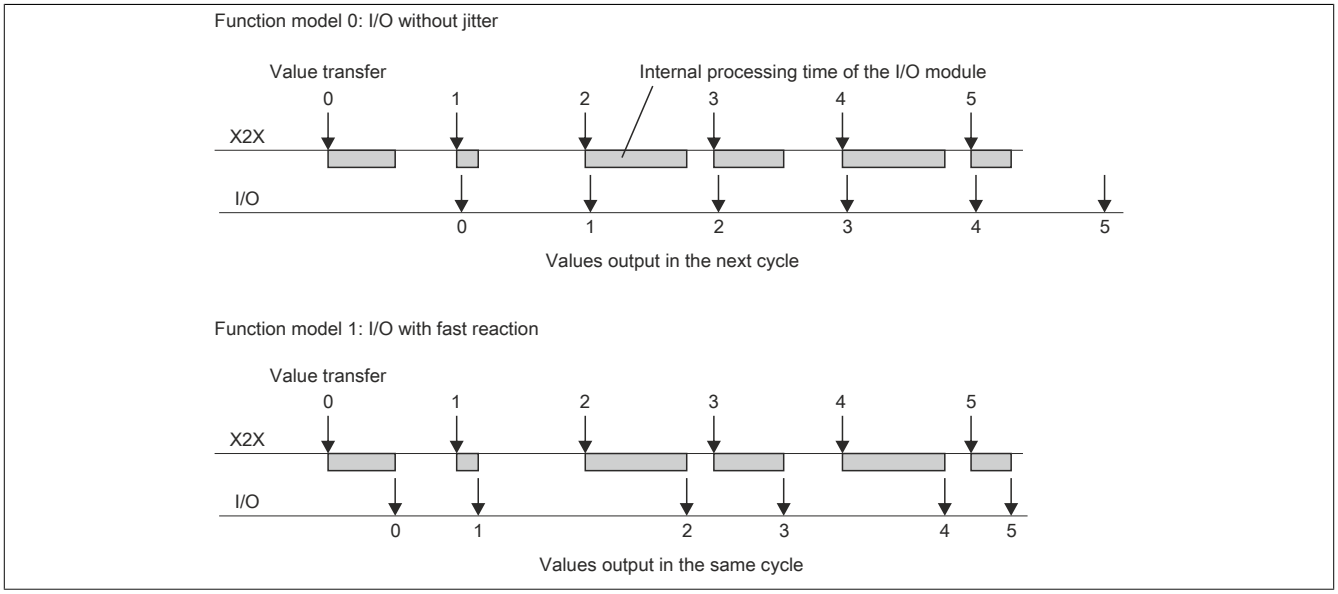
Function model 0: I/O without jitter (standard)

Corrected values are output in the next cycle if the minimum cycle is ≥400 µs in order to reduce jitter to a minimum.

Function model 1: I/O with fast reaction

Corrected values are output in the same cycle if the minimum cycle is ≥400 µs (optimized reactions).

Comparison of the two function models



10.5 Analog outputs

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

10.5.1 Output values of the analog output

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.

Data type	Value	Information
INT	-32768 to 32767	Voltage signal -10 to 10 VDC
	0 to 32767	Current signal 0 to 20 mA
	0 to 32767	Current signal 4 to 20 mA[1)]

1) From upgrade version 1.0.2.0 or hardware revision "I0"

10.5.2 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
- 4 to 20 mA current signal

Data type	Value
USINT	See bit structure.

Bit structure:

Bit	Description	Value	Information
0	Channel 1	0	Voltage signal
		1	Current signal, measurement range corresponding to bit 4
...		...	
3	Channel 4	0	Voltage signal
		1	Current signal, measurement range corresponding to bit 7
4	Channel 1: Current measurement range	0	0 to 20 mA current signal
		1	4 to 20 mA current signal
...		...	
7	Channel 4: Current measurement range	0	0 to 20 mA current signal
		1	4 to 20 mA current signal

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
250 µs

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
400 µs