X20(c)AO4622

1 General information

The module is equipped with 4 outputs with 13-bit (including sign) digital converter resolution. It is possible to select between the current and voltage signal using different terminals.

- 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

2.1 Starting temperature

The starting temperature describes the minimum permissible ambient temperature when the power is switched off at the time the coated module is switched on. This is permitted to be as low as -40°C. During operation, the conditions as specified in the technical data continue to apply.

Information:

It is important to absolutely ensure that there is no forced cooling by air currents in a closed control cabinet, for example using a fan or ventilation slots.

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	
X20BM15	X20 bus module, with node number switch, 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

Model number	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 actuators (resistive) [W]	-	
Certifications		
CE	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	
DNV GL	Temperature: **B** (0 - 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)	
LR	ENV1	
KR	Yes	
EAC	Yes	
KC	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 on output change over entire range	500 µs	
Switch on/off behavior	Internal enable relay for booting	
Max. error		
Voltage		
Gain	0.08% [2]	
Offset	0.05% [3]	
Current		
Gain	0.09% [2]	
Offset	0.05% [3]	
Output protection	Short circuit protection	
Output format		
Voltage	INT 0x8001 - 0x7FFF / 1 LSB = 0x0008 = 2.441 mV	
Current	INT 0x0000 - 0x7FFF / 1 LSB = 0x0008 = 4.883 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 proof	Current limiting ±40 mA	
Output filter	1st-order low pass / cutoff frequency 10 kHz	
Max. gain drift		
Voltage	0.015 %/°C [2]	
Current	0.02 %/°C [2]	
Max. offset drift		
Voltage	0.032 %/°C [3]	
Current	0.032 %/°C [3]	
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% [4]	
Isolation voltage between channel and bus	500 V_{eff}	

Table 2: X20AO4622, X20cAO4622 - Technical data

Model number	X20AO4622	X20cAO4622
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 limitations	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
Degree of protection per EN 60529	IP20	
Ambient conditions		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C (Rev. ≥ J0); 0 to 55°C (Rev. < J0)	-25 to 60°C
Vertical mounting orientation	-25 to 50°C (Rev. ≥ J0); 0 to 50°C (Rev. < J0)	-25 to 50°C
Derating	See section "Derating"	
Starting temperature	-	Yes, -40°C
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 properties		
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
Pitch	12.5$^{+0.2}$ mm	

Table 2: X20AO4622, X20cAO4622 - Technical data

1)   4 to 20 mA: From upgrade version 1.0.2.0 and hardware revision "I0"
2)   Based on the current output value.
3)   Based on the entire output range.
4)   Based on the output range.
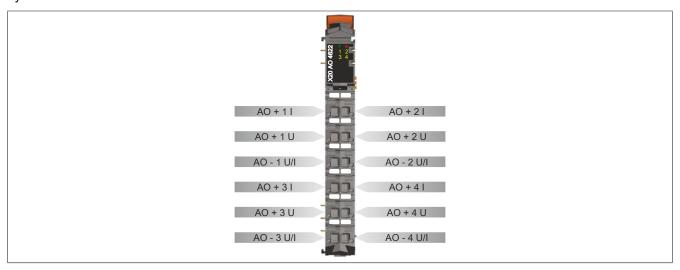
5 LED status indicators

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

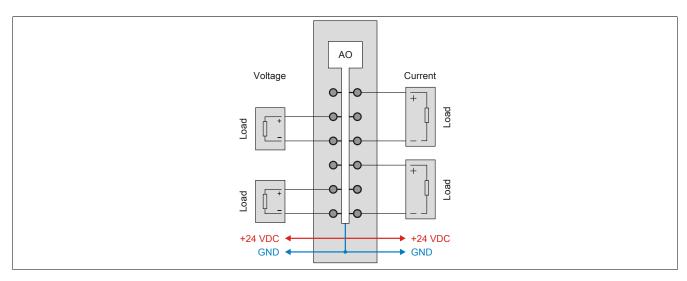| Figure	LED	Color	Status	Description
	r	Green	Off	No power to module
			Single flash	RESET mode
			Double flash	BOOT mode (during firmware update)[1]
			Blinking	PREOPERATIONAL mode
			On	RUN mode
	e	Red	Off	No power to module or everything OK
			On	Error or reset status
	e + r	Red on / Green single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

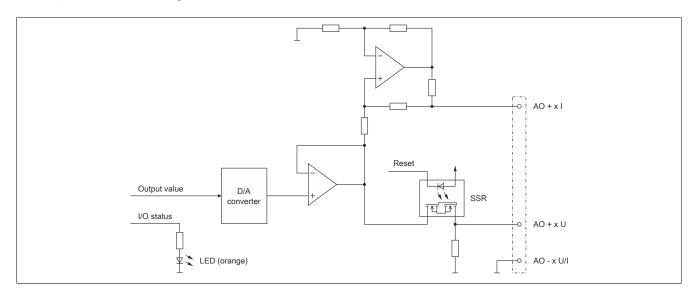1)   Depending on the configuration, a firmware update can take up to several minutes.

6 Pinout

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

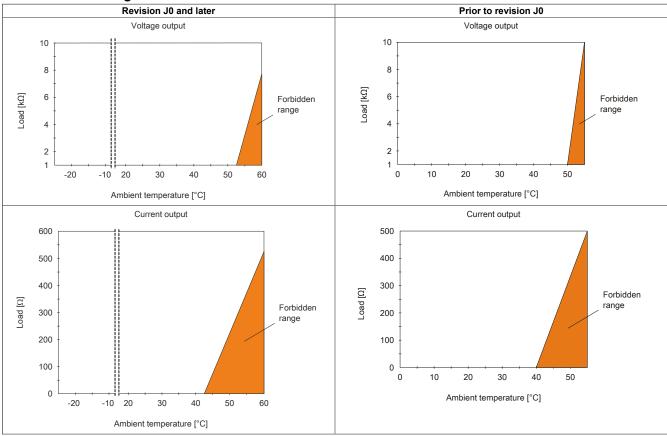|	
AO + 1 I	AO + 2 I
AO + 1 U	AO + 2 U
AO - 1 U/I	AO - 2 U/I
AO + 3 I	AO + 4 I
AO + 3 U	AO + 4 U
AO - 3 U/I	AO - 4 U/I

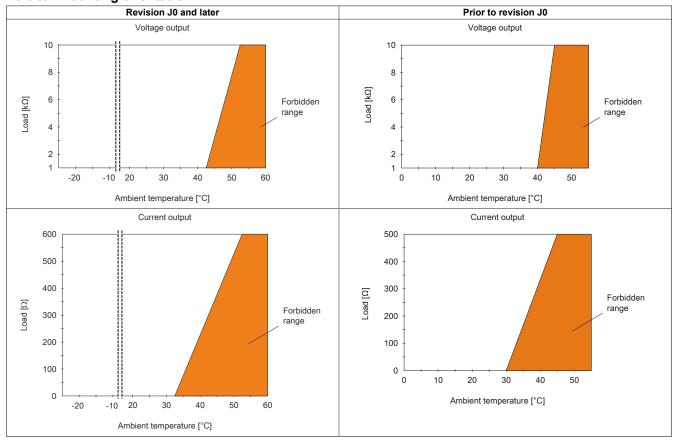# 7 Connection example

8 Output circuit diagram

9 Derating

To ensure proper operation, the following points must be taken into account:

- The derating values listed below must be taken into account.
- In mixed operation with one current output, the mean value of both derating curves must be applied.
- In mixed operation with 2 or 3 current outputs, the derating of the current outputs must be applied.

Horizontal mounting orientation

Revision J0 and later	Prior to revision J0

Vertical mounting orientation

Revision J0 and later	Prior to revision J0

Voltage output

Forbidden range

Voltage output

Forbidden range

Current output

Forbidden range

Current output

Forbidden range

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
and function model 1 - I/O with fast response

Register	Name	Data type	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Analog signal - Configuration						
18	ConfigOutput01 (channel type)	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	Acyclic	Cyclic	Acyclic
Analog signal - Configuration							
18	-	ConfigOutput01 (channel type)	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 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" 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.
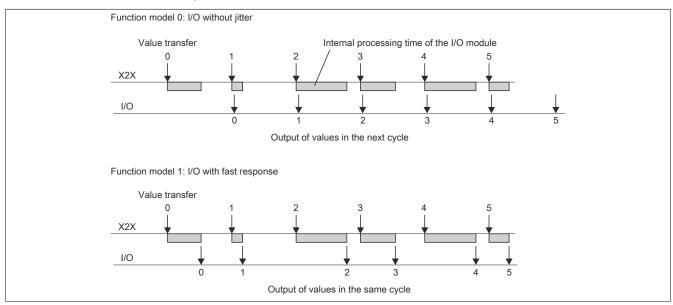
10.4 Function model comparison

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

With a minimum cycle of ≥400 μs, the corrected values are output in the next cycle. This reduces jitter to a minimum.

Function model 1: I/O with fast response

With a minimum cycle of ≥400 μs, the corrected values are output in the same cycle (optimized response).

The two function models compared

10.5 Analog outputs

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

10.5.1 Output values of the analog output

Name:
AnalogOutput01 to AnalogOutput04

The normalized output values are specified via these registers. After a permissible value is transferred, the module outputs the corresponding current or voltage.

Data type	Values	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) Starting with upgrade version 1.0.2.0 and hardware revision "I0"

10.5.2 Setting the channel type

Name:
ConfigOutput01

The channel type of the outputs can be defined in this register.

The individual channels are designed for current and voltage signals. The differentiation is made by different terminal connections; because of different adjustment values for current and voltage, the output signal must also be selected. The following output signals can be set:

- ±10 V voltage signal
- 0 to 20 mA current signal
- 4 to 20 mA current signal

Data type	Values	Bus controller default setting
USINT	See the bit structure.	0

Bit structure:

Bit	Description	Value	Information
0	Channel 1	0	Voltage signal (bus controller default setting)
		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 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
250 µs

10.7 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
400 µs