

X20(c)DI4760

1 General Information

The module is used to transfer digital signals from NAMUR encoders according to EN 60947-5-6. In addition to NAMUR encoders, normal switches can also be used.

- 4 digital inputs
- Input module for NAMUR encoders
- Open line and short circuit detection
- Each input can be used as a counter input

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
	Digital inputs	
X20DI4760	X20 digital input module, 4 NAMUR inputs, 8.05 V	
X20cDI4760	X20 digital input module, coated, 4 NAMUR inputs, 8.05 V	
	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: X20DI4760, X20cDI4760 - Order data

4 Technical data

Model number	X20DI4760	X20cDI4760
Short description		
I/O module	4 NAMUR inputs, special function	
General information		
B&R ID code	0x2105	0xE221
Status indicators	I/O function by channel, open line and short circuit detection by channel, operating status, module status	
Diagnostics		
Module run/error	Yes, using status LED and software	
Short circuit	Yes, using status LED and software	
Open circuit	Yes, using status LED and software	
Power consumption		
Bus	0.01 W	
Internal I/O	1.5 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) FTZÜ 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	-
Event counters		
Quantity	4	
Signal form	Symmetrical square wave pulse or corresponding minimum pulse duration ¹⁾	
Evaluation	Every rising edge, cyclic counter	
Counter size	8-bit	
Input frequency		
1 input active	Max. 1600 Hz	
2 inputs active	Max. 1100 Hz	
3 inputs active	Max. 870 Hz	
4 inputs active	Max. 680 Hz	
NAMUR inputs		
Open-circuit detection	<350 µA	
Input circuit	For NAMUR encoders in accordance with EN 60947-5-6	
Isolation voltage between channel and bus	500 V _{eff}	
Short-circuit detection	>7 mA	
Open-circuit voltage	8.05 V ±0.33%	
Switching amplifier internal resistance	1 kΩ ±1%	
Max. short-circuit current	8.2 mA	
Input delay		
1 input active	≤310 µs	
2 inputs active	≤450 µs	
3 inputs active	≤570 µs	
4 inputs active	≤735 µs	
Switching threshold		
Area	1.2 mA to 2.1 mA	
Switching hysteresis	Typ. 300 µA	
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	

Table 2: X20DI4760, X20cDI4760 - Technical data


Model number	X20DI4760		X20cDI4760	
Ambient conditions				
Temperature				
Operation				
Horizontal mounting orientation			-25 to 60°C	
Vertical mounting orientation			-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: X20DI4760, X20cDI4760 - Technical data

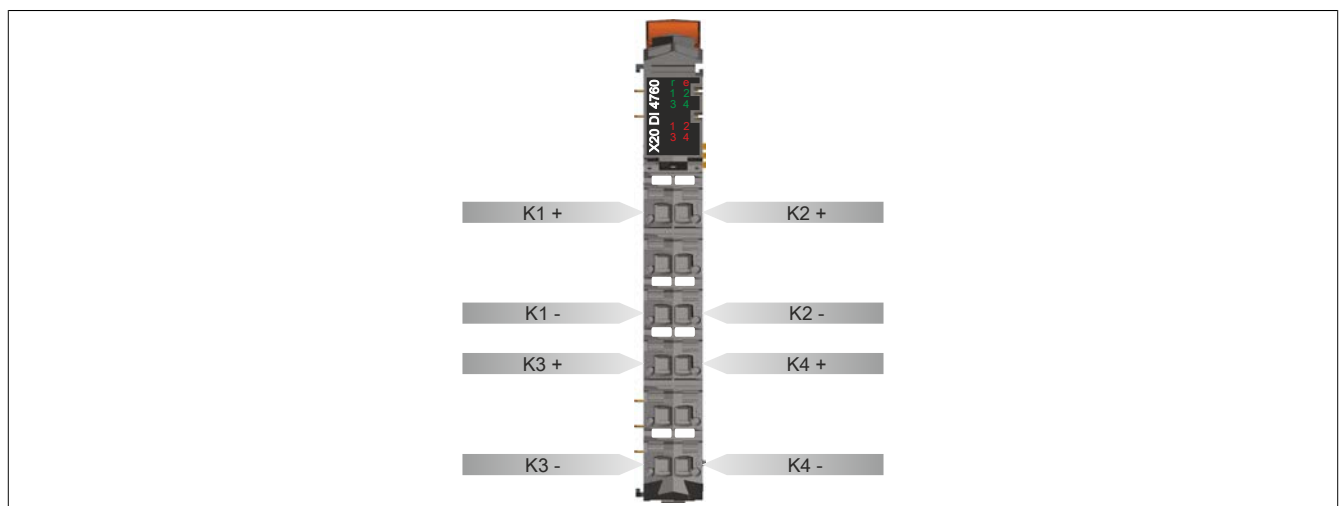
1) Minimum pulse duration: $t[s] \geq 1/(2 \times f_{max}[Hz])$

5 Status LEDs

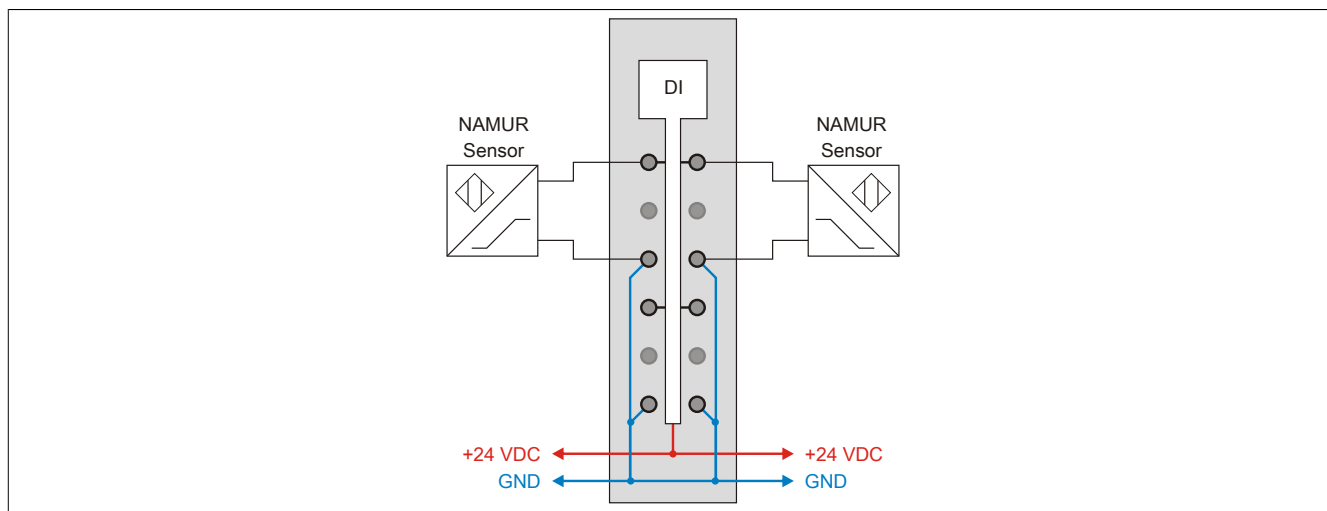
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" of the X20 system user's manual.

Image	LED	Color	Status	Description
	r	Green	Off	No power to module
			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	Error on at least one channel
	e + r	Red on / Green single flash		Invalid firmware
	1 - 4	Green	Off	Open line or input status log. 0
			On	Short circuit or input status log. 1
	1 - 4	Red	Off	The sensor is ready for operation
			Blinking 1Hz	Open line on corresponding channel
			On	Short circuit on corresponding channel

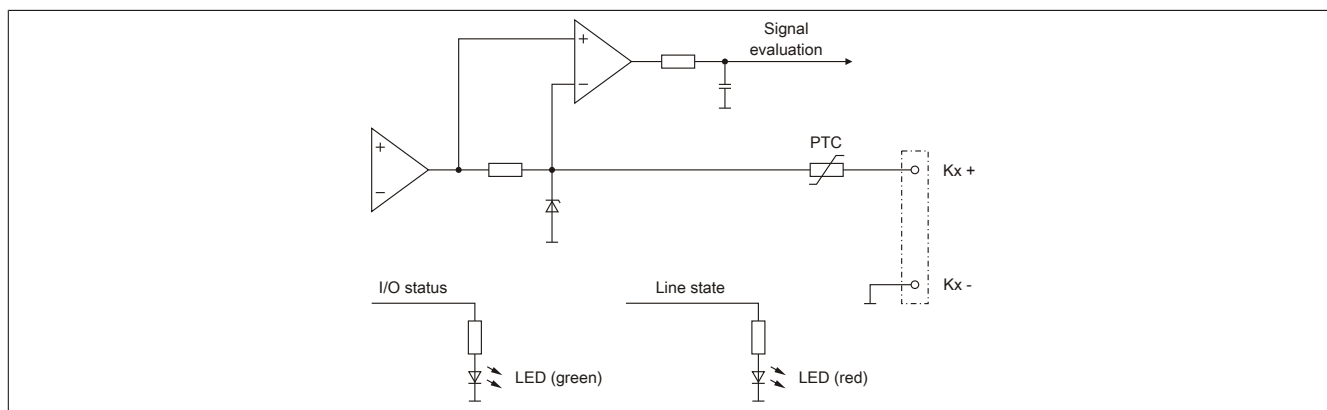
6 Pinout



7 Connection example

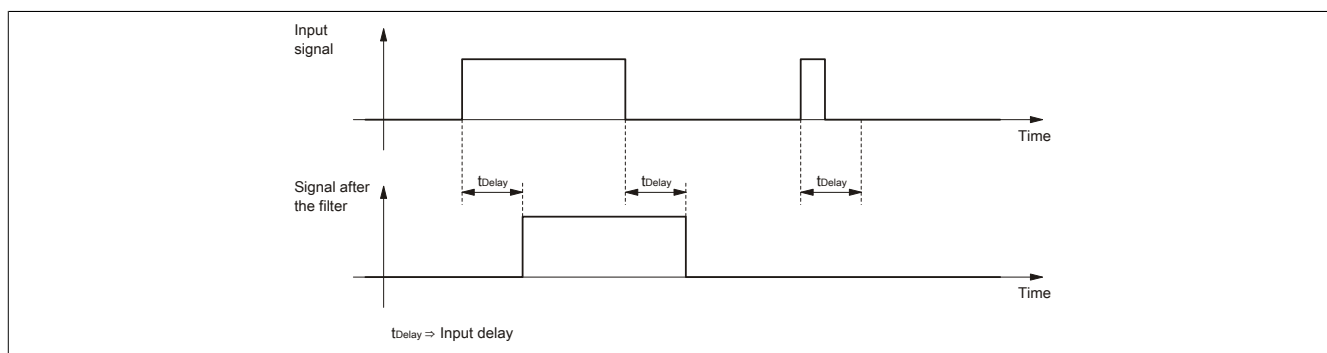


8 Input circuit diagram

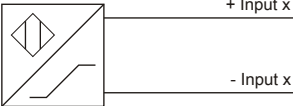
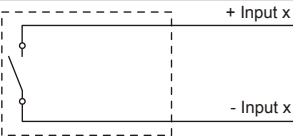
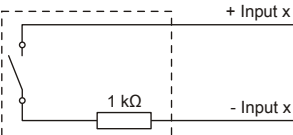
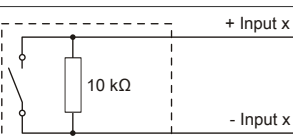
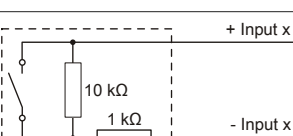


9 Input filter

An input filter is available for each input. The input delay can be set using register "ConfigOutput03" on page 7. Disturbance pulses which are shorter than the input delay are suppressed by the input filter.



10 Examples of possible signal generators

Proximity switch	
Switch in accordance with EN 60947-5-6 (NAMUR)	
Mechanical contacts (instead of NAMUR encoders)	
Without open line detection and without short circuit detection	
Without open line detection and with short circuit detection	
With open line detection and without short circuit detection	
With open line detection and with short circuit detection	

11 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.

.....	X20 module Power dissipation > 1.15 W	Neighboring X20 module Power dissipation ≤ 1.15 W	This module	Neighboring X20 module Power dissipation ≤ 1.15 W	X20 module Power dissipation > 1.15 W
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12 Register description

12.1 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.

12.2 Function model 0 - Standard

Register	Name	Data type	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Configuration						
16	ConfigOutput01 (channel/status configuration)	USINT				•
18	ConfigOutput02 (replacement values)	USINT				•
20	ConfigOutput03 (input filter)	USINT				•
Communication						
0	DigitalInput	USINT	•			
	DigitalInput01	Bit 0				
				
	DigitalInput04	Bit 3				
4	Counter01	USINT	•			
6	Counter02	USINT	•			
8	Counter03	USINT	•			
10	Counter04	USINT	•			
30	StatusInput	USINT	•			
	ShortCircuit01	Bit 0				
				
	ShortCircuit04	Bit 3				
	OpenLine01	Bit 4				
				
	OpenLine04	Bit 7				

12.3 Function model 254 - Bus Controller

Register	Offset ¹⁾	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
16	-	ConfigOutput01 (channel/status configuration)	USINT				•
18	-	ConfigOutput02 (replacement values)	USINT				•
20	-	ConfigOutput03 (input filter)	USINT				•
Communication							
0	0	Input status of digital inputs 1 to 4	USINT	•			
		DigitalInput01	Bit 0				
					
		DigitalInput04	Bit 3				
4	-	Counter01	USINT		•		
6	-	Counter02	USINT		•		
8	-	Counter03	USINT		•		
10	-	Counter04	USINT		•		
30	-	Status of channels 1 to 4	USINT		•		
		ShortCircuit01	Bit 0				
					
		ShortCircuit04	Bit 3				
		OpenLine01	Bit 4				
					
		OpenLine04	Bit 7				

1) The offset specifies where the register is within the CAN object.

12.3.1 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).

12.3.2 CAN I/O bus controller

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

12.4 Digital inputs

Unfiltered

The input state is collected with a fixed offset to the network cycle and transferred in the same cycle.

Filtered

The filtered status is collected with a fixed offset to the network cycle and transferred in the same cycle. Filtering takes place asynchronously to the network in multiples of 200 µs with a network-related jitter of up to 50 µs.

12.4.1 Digital input filter

Name:

ConfigOutput03

This register can be used to specify the filter value for all digital inputs.

The filter value can be configured in steps of 100 µs. It makes sense to enter values in steps of 2, however, since the input signals are sampled every 200 µs.

Data type	Value	Filter
USINT	0	No software filter (bus controller default setting)
	2	0.2 ms

	250	25 ms - Higher values are limited to this value

12.4.2 Input status of digital inputs 1 to 4

Name:

DigitalInput or

DigitalInput01 to DigitalInput04

PowerSupply

The input status of digital inputs 1 to 4 is mapped in this register.

Only function model 0 - Standard:

The "Packed inputs" setting in the Automation Studio I/O configuration is used to determine whether all of the bits from these registers should be set up individually as data points in the Automation Studio I/O mapping ("DigitalInput01" through "DigitalInput02" and "PowerSupply") or whether this register should be displayed as an individual USINT data point ("DigitalInput").

Data type	Value	Information
USINT	0 to 15	Packed inputs = On
	See the bit structure.	Packed inputs = Off or function model ≠ 0 - Standard

Bit structure:

Bit	Name	Value	Information
0	DigitalInput01	0 or 1	Input status - Digital input 1
...		...	
3	DigitalInput04	0 or 1	Input state - Digital input 4
4 - 6	Reserved	0	
7	PowerSupply	0	Supply voltage too low
		1	Supply voltage >80 VAC

12.5 Positive edge counter on digital inputs

Name:

Counter01 to Counter04

These registers cyclically count the positive edges on the individual channels.

Data type	Value
USINT	Positive edge counter on channel, cyclic

12.6 Status of channels 1 to 4

Name:

StatusInput01 and

ShortCircuit01 to ShortCircuit04

OpenLine01 to OpenLine04

This register indicates whether an open line or overflow has occurred on the individual channels.

Only function model 0 - Standard:

The "Packed inputs" setting in the Automation Studio I/O configuration is used to determine whether all of the bits from these registers should be set up individually as data points in the Automation Studio I/O mapping ("ShortCircuit01" to "ShortCircuit04" and "OpenLine01" to "OpenLine04") or whether this register should be displayed as an individual USINT data point ("StatusInput01").

Data type	Values	Information
USINT	0 to 255	Packed inputs = On
	See bit structure.	Packed inputs = Off or Function model <> 0 - Standard

Bit structure:

Bit	Name	Value	Information
0	ShortCircuit01	0	No error
		1	Overload on channel 1
...
3	ShortCircuit04	0	No error
		1	Overload on channel 4
4	OpenLine01	0	No error
		1	Open line on channel 1
...
7	OpenLine04	0	No error
		1	Open line on channel 4

12.7 Function expansion

Firmware version 802 is offered for hardware variant 7 or higher of the module. This and subsequent firmware versions provide the user with new configuration possibilities.

12.7.1 Disabling channels and status messages

Name:

ConfigOutput01

This register can be used to (de)activate individual channels or just their status responses.

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

Bit structure:

Bit	Name	Value	Information
0	Channel 1	0	Channel enabled (bus controller default setting)
		1	Channel disabled
...
3	Channel 4	0	Channel enabled (bus controller default setting)
		1	Channel disabled
4	Status message - Channel 1	0	Status message enabled (bus controller default setting)
		1	Status message deactivated
...
7	Status message - Channel 4	0	Status message enabled (bus controller default setting)
		1	Status message deactivated

12.7.2 Replacement values during overload

Name:

ConfigOutput02

This register can be used to specify defined replacement values for the individual channels according to the error situation.

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

Bit structure:

Bit	Name	Value	Information
0	Overload - Channel 1	0	Replacement value when overload is FALSE
		1	Replacement value if overload TRUE (bus controller default setting)
...		...	
3	Overload - Channel 4	0	Replacement value when overload is FALSE
		1	Replacement value if overload TRUE (bus controller default setting)
4	Open line - Channel 1	0	Replacement value when open line is FALSE
		1	Replacement value if open circuit TRUE (bus controller default setting)
...		...	
7	Open line - Channel 4	0	Replacement value when open line is FALSE
		1	Replacement value if open circuit TRUE (bus controller default setting)

12.8 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	
Without filtering	100 µs
With filtering	150 µs

12.9 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	
Without filtering	100 µs
With filtering	200 µs