

X20(c)DC1396

1 General information

The module is equipped with 1 input for an ABR incremental encoder with 24 V encoder signal.

- 1 ABR incremental encoder 24 V
- 1 additional input e.g. for home enable switch
- 24 VDC and GND for encoder supply

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	Installation / EMC guide

1.2 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 Order data


Order number	Short description	Figure
	Counter functions	
X20DC1396	X20 digital counter module, 1 ABR incremental encoder, 24 V, 100 kHz input frequency, 4x evaluation	
X20cDC1396	X20 digital counter module, coated, 1 ABR incremental encoder, 24 V, 100 kHz input frequency, 4x evaluation	
	Required accessories	
	Bus modules	
X20BM11	X20 bus module, 24 VDC keyed, internal I/O power supply connected through	
X20BM15	X20 bus module, with node number switch, 24 VDC keyed, internal I/O power supply connected through	
X20cBM11	X20 bus module, coated, 24 VDC keyed, internal I/O power supply connected through	
	Terminal blocks	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 1: X20DC1396, X20cDC1396 - Order data

3 Technical description

3.1 Technical data

Order number	X20DC1396		X20cDC1396
Short description			
I/O module	1 ABR incremental encoder 24 V		
General information			
Input voltage	24 VDC -15% / +20%		
B&R ID code	0x1BAC	0xE502	
Status indicators	I/O function per channel, operating state, module status		
Diagnostics			
Module run/error	Yes, using LED status indicator and software		
Power consumption			
Bus	0.01 W		
Internal I/O	1.4 W		
Additional power dissipation caused by actuators (resistive) [W]	-		
Type of signal lines	Shielded lines must be used for all signal lines.		
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	Temperature: B (0 - 55°C) Humidity: B (up to 100%) Vibration: B (4 g) EMC: B (bridge and open deck)		
LR	ENV1		
KR	Yes		
ABS	Yes		
EAC	Yes		
KC	Yes	-	
Digital inputs			
Quantity	1		
Nominal voltage	24 VDC		
Input characteristics per EN 61131-2	Type 1		
Input current at 24 VDC	Approx. 3.3 mA		
Input circuit	Sink		
Input filter			
Hardware	≤2 µs		
Software	-		
Connection type	3-wire connections		
Input resistance	7.19 kΩ		
Additional functions	Home enable switch		
Switching threshold			
Low	<5 VDC		
High	>15 VDC		
Insulation voltage between channel and bus	500 V _{eff}		
ABR incremental encoder			
Encoder inputs	24 V, asymmetrical		
Counter size	16/32-bit		
Input frequency	Max. 100 kHz		
Evaluation	4x		
Encoder power supply	Module-internal, max. 600 mA		
Input filter			
Hardware	≤2 µs		
Software	-		
Input current at 24 VDC	Approx. 1.3 mA		
Input resistance	18.4 kΩ		
Switching threshold			
Low	<5 VDC		
High	>15 VDC		
Overload characteristics of encoder power supply	Short-circuit proof, overload-proof		
Insulation voltage between encoder and bus	500 V _{eff}		
Electrical properties			
Electrical isolation	Bus isolated from encoder and reference enable switch Encoder not isolated from reference enable switch		

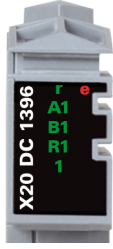
Table 2: X20DC1396, X20cDC1396 - Technical data

Order number	X20DC1396	X20cDC1396
Operating conditions		
Mounting orientation		
Horizontal		Yes
Vertical		Yes
Installation elevation above sea level		
0 to 2000 m		No limitation
>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
Vertical mounting orientation		-25 to 50°C
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 properties		
Note	Order 1x terminal block X20TB12 separately. Order 1x bus module X20BM11 separately.	Order 1x terminal block X20TB12 separately. Order 1x bus module X20cBM11 separately.
Pitch		12.5 ^{+0.2} mm

Table 2: X20DC1396, X20cDC1396 - Technical data

3.2 LED status indicators

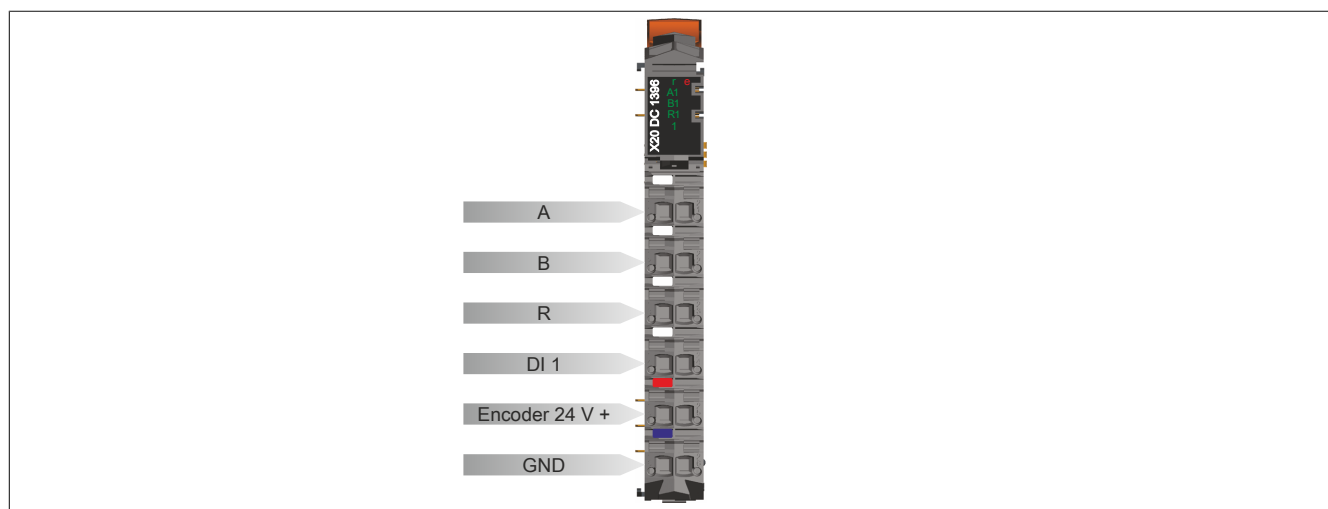
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" in the X20 system user's manual.

Figure	LED	Color	Status	Description
	r	Green	Off	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
	A1	Green		Input state of counter input A
	B1	Green		Input state of counter input B
	R1	Green		Input state of reference pulse R
	1	Green		Input state - Digital input

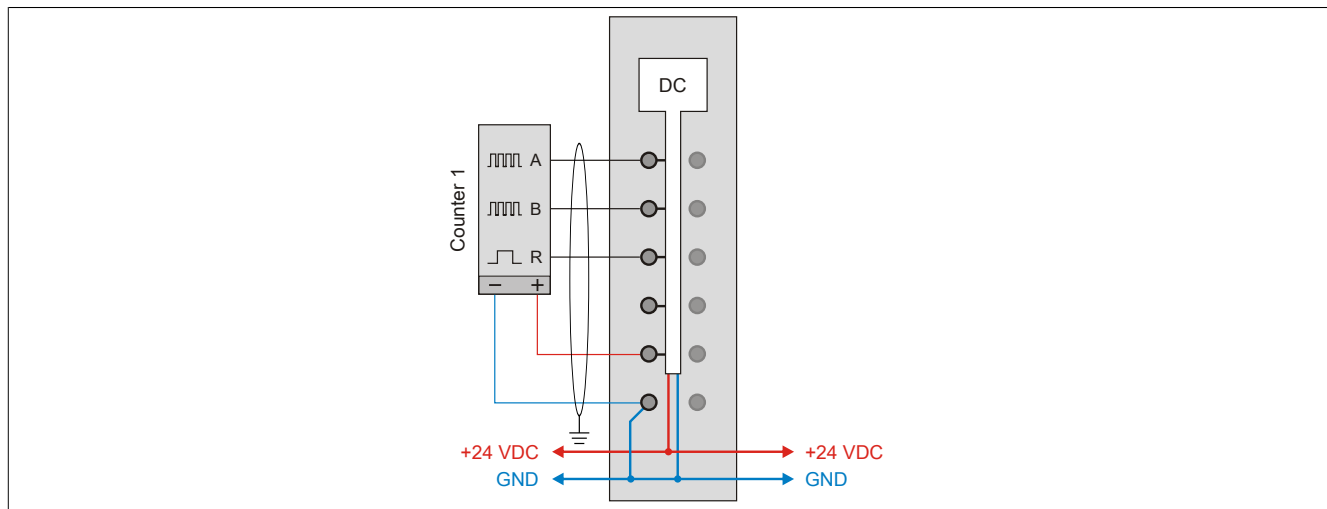
1) Depending on the configuration, a firmware update can take up to several minutes.

3.3 Pinout

Shielded cables must be used for all signal lines.

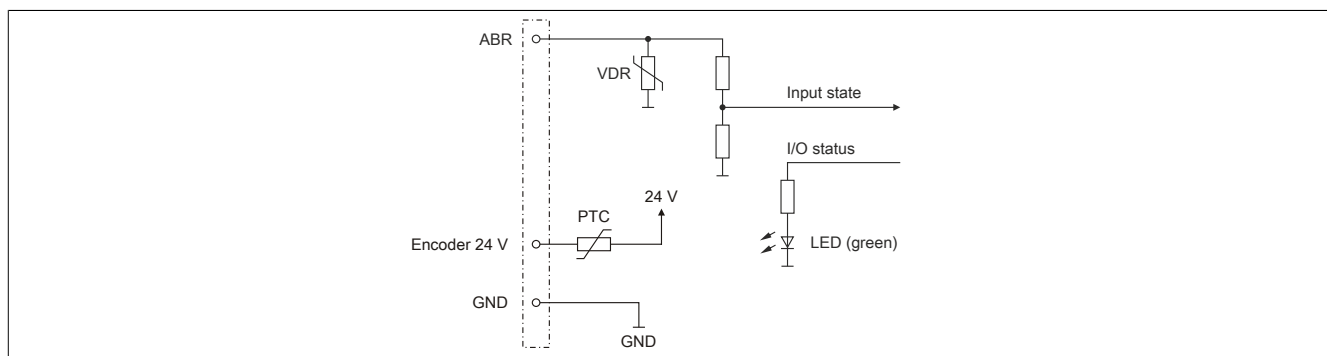


3.4 Connection example

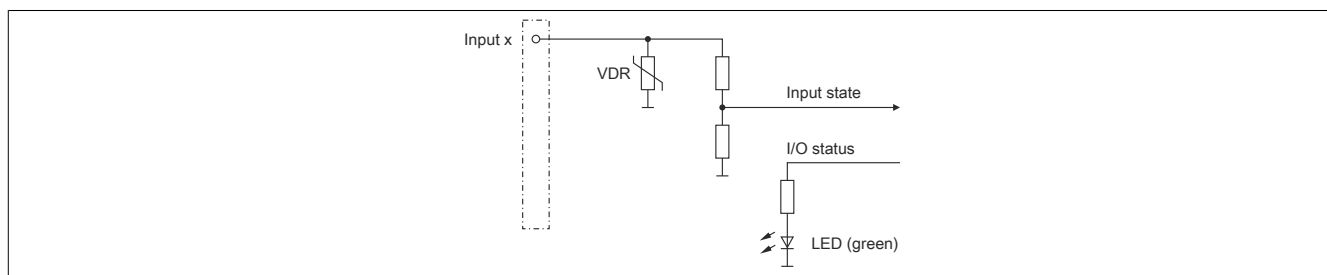


3.5 Input circuit diagram

Counter inputs



Standard input



4 Register description

4.1 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.

4.2 Function model 0 - Standard and Function model 1 - Standard with 32-bit encoder counter value

The difference between function model 0 and function model 1 is the size of the data type for some registers.

- Function model 0 uses data type INT
- Function model 1 uses data type DINT (specified in parentheses)

Register	Name	Data type	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Configuration						
4104	CfO_EdgeDetectFalling	USINT				•
4106	CfO_EdgeDetectRising	USINT				•
2064	CfO_PresetABR01_1(_32Bit)	(D)INT				•
2068	CfO_PresetABR01_2(_32Bit)	(D)INT				•
512	ConfigOutput24	UINT				•
522	ConfigOutput26	USINT				•
520	ConfigOutput27	USINT				•
Communication						
2116	ReferenceModeEncoder01	USINT			•	
2080	Encoder01	(D)INT	•			
264	Input state of the digital input	USINT	•			
	DigitalInput01	Bit 3				
2118	StatusInput01	USINT	•			
40	Status of encoder power supply	USINT	•			
	PowerSupply01	Bit 0				

4.3 Function model 254 - Bus controller

Register	Offset ¹⁾	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
4104	-	CfO_EdgeDetectFalling	USINT				•
4106	-	CfO_EdgeDetectRising	USINT				•
2064	-	CfO_PresetABR01_1	INT				•
2068	-	CfO_PresetABR01_2	INT				•
512	-	ConfigOutput24	UINT				•
522	-	ConfigOutput26	USINT				•
520	-	ConfigOutput27	USINT				•
Communication							
2116	0	ReferenceModeEncoder01	USINT			•	
2080	0	Encoder01	INT	•			
264	2	Input state of the digital input	USINT	•			
		DigitalInput01	Bit 3				
2118	4	StatusInput01	USINT	•			
40	3	Status of encoder power supply	USINT	•			
		PowerSupply01	Bit 0				

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

4.3.1 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" in the X20 user's manual (version 3.50 or later).

4.3.2 CAN I/O bus controller

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

4.4 ABR encoder - Configuration registers

4.4.1 Reference pulse

The following registers must be configured by a single acyclic write with the listed values so that the homing procedure is completed on the edge of the reference pulse.

The homing procedure can take place on:

- Rising edge
- Falling edge (default configuration)

4.4.1.1 Constant register "CfO_EdgeDetectFalling"

Name:

CfO_EdgeDetectFalling

Data type	Value	Information
USINT	0x00	Configuration value for rising edge
	0x04	Configuration value for falling edge (bus controller default setting)

4.4.1.2 Constant register "CfO_EdgeDetectRising"

Name:

CfO_EdgeDetectRising

Data type	Value	Information
USINT	0x04	Configuration value for rising edge
	0x00	Configuration value for falling edge (bus controller default setting)

4.4.1.3 Constant register "ConfigOutput24"

Name:

ConfigOutput24

This register contains the value for ABR encoder 1.

Data type	Value	Information
UINT	0x1012	Configuration value for rising edge
	0x1002	Configuration value for falling edge (bus controller default setting)

4.4.2 Setting the home position

Name:

CfO_PresetABR01_1 to CfO_PresetABR01_2

CfO_PresetABR01_1_32Bit to CfO_PresetABR01_2_32Bit (only in function model 1)

It is possible to specify 2 home positions with these registers through a one-off acyclic write, for example. The configured values are applied to the counter values after a completed homing procedure.

Data type	Value	Information
INT	-32,768 to 32,767	Bus controller default setting: 0
DINT ¹⁾	-2,147,483,648 to 2,147,483,647	

1) Only in function model 1

4.4.3 Homing with reference enable input

Regardless of the referencing mode, it is possible using this register to prevent the home position from being applied when the corresponding reference input voltage level occurs (see ["Input state of the digital input" on page 8](#): bit 3). The desired setting can be configured by a one-off acyclic write.

4.4.3.1 Voltage level for reference enable activation

Name:

ConfigOutput26

This register is used to configure the active voltage level of the digital input for the reference enable.

Data type	Value	Information
USINT	0x00	Reference enable is active at 0 VDC (bus controller default setting).
	0x08	Reference enable is active at 24 VDC

4.4.3.2 Reference enable of the input

Name:

ConfigOutput27

This register can be used to define whether the reference enable is activated.

Data type	Value	Information
USINT	0x00	Reference enable input disabled (bus controller default setting)
	0x08	Reference enable input activated

4.5 ABR encoder - Configuration registers

4.5.1 Counter state of the encoder

Name:

Encoder01

The encoder values are represented as 16-bit or 32-bit counter values in this register.

Data type	Value
INT	-32,768 to 32,767
DINT ¹⁾	-2,147,483,648 to 2,147,483,647

1) Only in function model 1

4.5.2 Input state of the digital input

Name:

DigitalInput01

This register displays the input status of the encoder and the digital input.

Data type	Value
USINT	See bit structure.

Bit	Name	Value	Information
0	Encoder A	0 or 1	Input state
1	Encoder B	0 or 1	Input state
2	Encoder A + B	0 or 1	Input state of reference pulse
3	DigitalInput01	0 or 1	Input state - Digital input 1
4 - 7	Reserved	-	

4.5.3 Reading the referencing mode

Name:

ReferenceModeEncoder01

This register determines the referencing mode.

Data type	Value
USINT	See bit structure.

Bit structure:

Bit	Name	Value	Information
0 - 1		00	Referencing OFF
		01	Single shot referencing
		11	Continuous referencing
2 - 5		0	Bits permanently set = 0
6 - 7		00	Referencing OFF
		11	Bits permanently set = 1

This results in the following values:

Binary	Hex	Function
00000000	0x00	Referencing OFF
11000001	0xC1	Single shot referencing
		For a new start after the completed homing procedure:
		<ul style="list-style-type: none"> Write value 0x00 Wait until bit 0 to bit 3 of the StatusInput01 register takes on the value 0. Counter bits 4 to 7 are not erased Switch homing procedure on again
11000011	0xC3	Continuous referencing
		Referencing occurs at every reference pulse.

It is important to know how the optional reference enable is configured. See ["Homing with reference enable input" on page 7](#)

4.5.4 Status of the homing procedure

Name:
StatusInput01

This register contains information about a switched-off, active or completed referencing process.

Data type	Value
USINT	See bit structure.

Bit structure:

Bit	Name	Value	Information
0	Reference pulse without homing ¹⁾	0	No reference impulse without homing has occurred yet
		1	At least a reference impulse without homing has occurred
1	State change	0 or 1	Changes with each reference pulse without homing
2	Reference pulse with homing ¹⁾	0	No homing has occurred yet
		1	At least one homing procedure has occurred
3	State change	0 or 1	Changes with each homing procedure that has taken place
4	Reference pulse	0	The last reference pulse didn't bring about a homing procedure
		1	The last reference pulse brought about a homing procedure
5 - 7	Counter	x	Free-running counter, increased with each reference pulse

1) Always 1 after the first reference pulse that has occurred

Examples of possible values:

Binary	Hex	Function
0x00000000	0x00	Referencing OFF or homing procedure already active
0x00111100	0x3CE	First homing procedure complete Reference value applied in the Encoder01 register
0xxxx11100	0xxB	Bits 5 to 7 are changed with each reference pulse
0xxxx1x100	0xxx	Continuously changing the bits with the "Continuous referencing" setting. The reference value is applied to the Encoder01 register on each reference pulse.

It is important to know how the optional reference enable (see ["Homing with reference enable input" on page 7](#)) is configured.

4.5.5 Status of encoder power supply

Name:
PowerSupply01

This register indicates the state of the integrated encoder power supply. A faulty encoder power supply is output as a warning.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Description	Value	Information
0	PowerSupply01	0	24 VDC encoder power supply OK
		1	24 VDC encoder power supply faulty
1 - 7	Reserved	-	

4.6 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
128 μ s

4.7 Maximum cycle time

The maximum cycle time specifies the time up to which the bus cycle can be increased without internal counter overflows causing module malfunctions.

Maximum cycle time
16 ms

4.8 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
128 μ s