1 General information

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

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



1.3 Order data

Order number	Short description	Figure
	Counter functions	
X20DC2395	X20 digital counter module, 1 SSI absolute encoders, 24 V, 1 ABR incremental encoders, 24 V, 2 AB incremental encoders, 24 V, 4 event counters or 2 PWM, local time measurement functions	
X20cDC2395	X20 digital counter module, coated, 1 SSI absolute encoder, 24 V, 1 ABR incremental encoder, 24 V, 2 AB incremental encoders, 24 V, 4 event counters or 2 PWM, local time measurement functions	
	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: X20DC2395, X20cDC2395 - Order data

1.4 Module description

This module is a multifunctional counter module. It can be connected to one SSI encoder, one ABR encoder, two AB encoders or four event counters. Two outputs are available for pulse width modulation. The functions can also be mixed.

Functions:

- Digital inputs and outputs
- Counters and encoders
- SSI encoder interface
- PWM - Pulse width modulation
- Time measurement function
- Controlling the LED status indicators
- Monitoring the encoder power supply

Digital inputs and outputs

This module is equipped with 4 digital channels. All channels are used as inputs, 2 channels are also configurable as outputs. The inputs can be compared with predefined states and used to generate events. In addition to being controlled from the application, the setting or clearing of outputs can also be controlled by events.

Counters and encoders

The module provides counter functions for each channel. These can be configured for different counter or encoder functions depending on the channel. These include:

- AB encoder
- ABR encoders
- Up/Down counter
- Event counters

SSI absolute encoder

The module provides one SSI absolute encoders that is directly supported by the hardware.

PWM - Pulse width modulation

The module provides 2 PWM functions that are directly supported by the hardware.

Time measurement function

The module has a time measurement function for each I/O channel. It can be configured separately for rising and falling edges on each channel.

Controlling LED status indicators

The module LED status indicators can be controlled by the application. This allows blink signals to be output or the states of physical inputs and outputs to be displayed.

Monitoring the supply voltage

The encoder power supply voltage is monitored.

2 Technical description

2.1 Technical data

Order number	X20DC2395	X20cDC2395
Short description		
I/O module	1 SSI absolute encoders 24 V, 1 ABR incremental encoders 24 V, 2 AB incremental encoders 24 V, 4x event counter or 2x pulse width modulation, time measurement, relative timestamp	
General information		
Input voltage	24 VDC -15% / +20%	
B&R ID code	0x1CD4	0xE503
Status indicators	I/O function per channel, operating state, module status	
Diagnostics		
Module run/error	Yes, using LED status indicator and software	
Outputs	Yes, using LED status indicator and software (output state)	
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	
UKCA	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	Temperature: **B** (0 to 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)	
CCS	Yes	-
LR	ENV1	
KR	Yes	
ABS	Yes	
BV	**EC33B** Temperature: 5 - 55°C Vibration: 4 g EMC: Bridge and open deck	
KC	Yes	-
Incremental encoders		
Quantity	2	
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	
Overload characteristics of encoder power supply	Short-circuit proof, overload-proof	
SSI absolute encoder		
Quantity	1	
Encoder inputs	24 V, asymmetrical	
Counter size	32-bit	
Max. transfer rate	125 kbit/s	
Encoder power supply	Module-internal, max. 600 mA	
Coding	Gray/Binary	
CLK: Output current	Max. 100 mA	
Overload characteristics of encoder power supply	Short-circuit proof, overload-proof	
Event counters		
Quantity	4	
Nominal voltage	24 VDC	
Signal form	Square wave pulse	

Table 2: X20DC2395, X20cDC2395 - Technical data

Technical description

Order number	X20DC2395	X20cDC2395
Evaluation	Each edge, cyclic counter	
Input frequency	Max. 100 kHz	
Input current at 24 VDC	Approx. 1.3 mA	
Input resistance	18.4 kΩ	
Insulation voltage between channel and bus	500 V_{eff}	
Counter frequency	200 kHz	
Counter size	16/32-bit	
Input filter		
Hardware	≤2 µs	
Software	-	
Switching threshold		
Low	<5 VDC	
High	>15 VDC	
Edge detection / Time measurement		
Possible measurements	Gate time, period duration, edge offset for various channels	
Measurements per module	Up to 9	
Measurements per channel	Up to 2	
Signal form	Square wave pulse	
Counter size	16-bit	
Counter frequency		
Internal	8 MHz, 4 MHz, 2 MHz, 1 MHz, 500 kHz, 250 kHz, 125 kHz, 62.5 kHz	
Measurement type	Continuous or triggered	
Digital outputs		
Quantity	2	
Variant	Push / Pull / Push-Pull	
Nominal voltage	24 VDC	
Switching voltage	24 VDC -15% / +20%	
Nominal output current	0.1 A	
Total nominal current	0.2 A	
Output circuit	Sink or source	
Output protection	Thermal shutdown in the event of overcurrent or short circuit, integrated protection for switching inductive loads	
Pulse width modulation [1)]		
Period duration	41.6 µs to 1.36 s	
Factor for period duration	n/48000 s, n = 2 to 65535	
Pulse duration	0 to 100%	
Resolution for pulse duration	0.1%	
Actuator power supply	Module-internal, max. 600 mA	
Diagnostic status	Output monitoring	
Leakage current when the output is switched off	Max. 25 µA	
Residual voltage	<0.9 V at 0.1 A nominal current	
Peak short-circuit current	<10 A	
Switch-on in the event of overload shutdown or short-circuit shutdown	Approx. 10 ms (depends on the module temperature)	
Switching delay		
0 → 1	<2 µs	
1 → 0	<2 µs	
Switching frequency		
Resistive load	Max. 24 kHz	
Inductive load	See section "Switching inductive loads".	
Braking voltage when switching off inductive loads	Switching voltage + 0.6 VDC	
Insulation voltage between channel and bus	500 V_{eff}	
Electrical properties		
Electrical isolation	Bus isolated from encoder and output Output not isolated from output and encoder Encoder not isolated from encoder	
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	

Table 2: X20DC2395, X20cDC2395 - Technical data

Order number	X20DC2395	X20cDC2395
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: X20DC2395, X20cDC2395 - Technical data

1) Dead time when switching between push and pull: Max. 1.5 µs.

2.2 LED status indicators

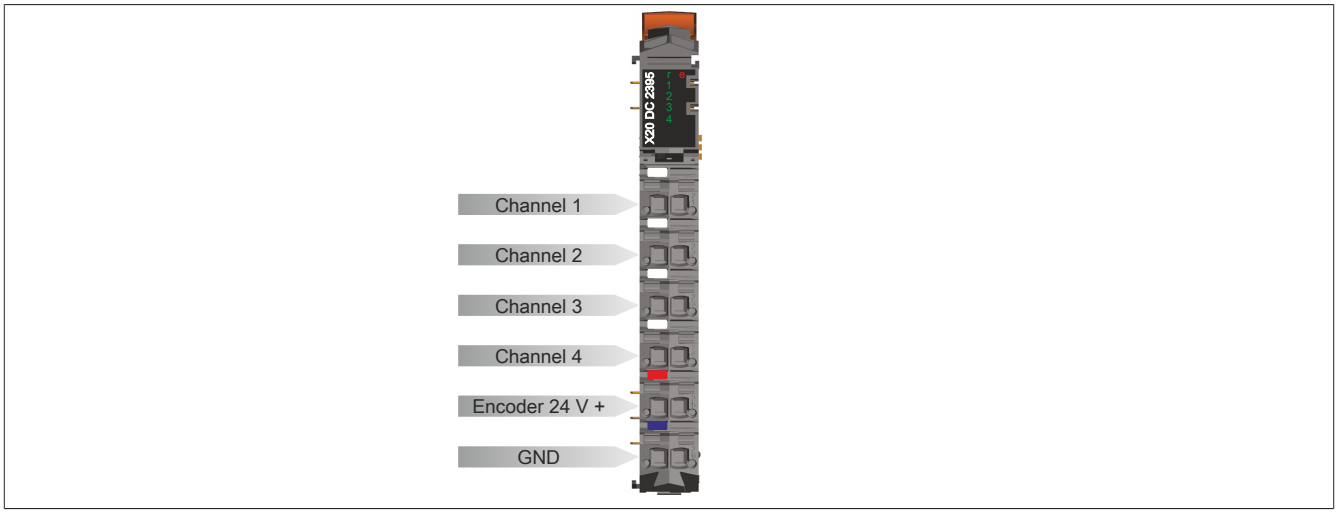
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" in the X20 System user's manual.

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
	1 - 4	Green		Status of the corresponding digital signal

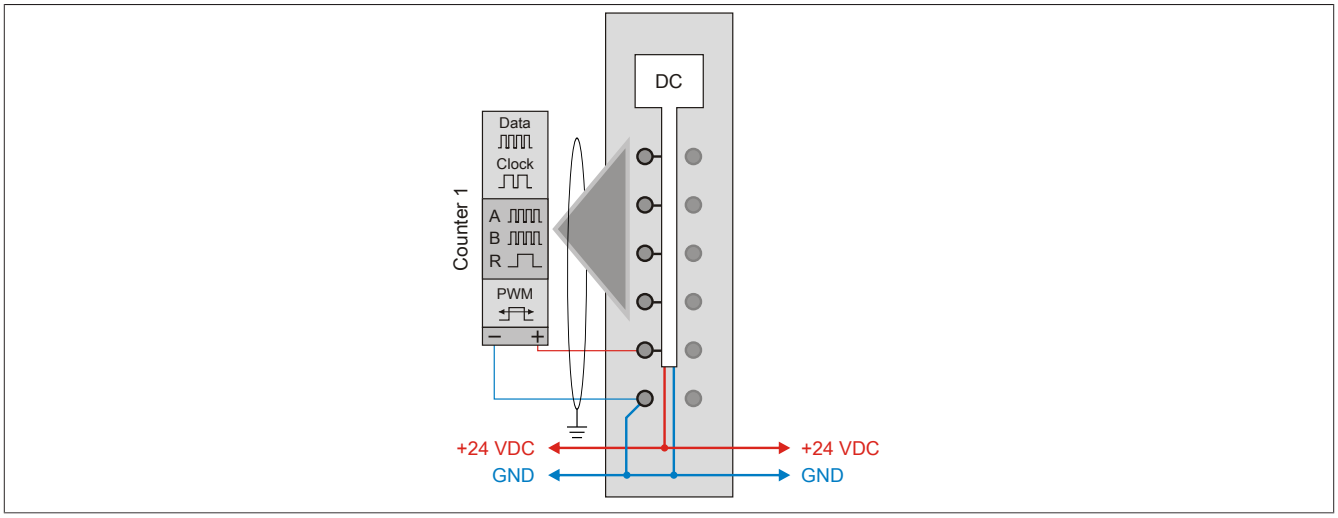
1) Depending on the configuration, a firmware update can take up to several minutes.

2.3 Pinout

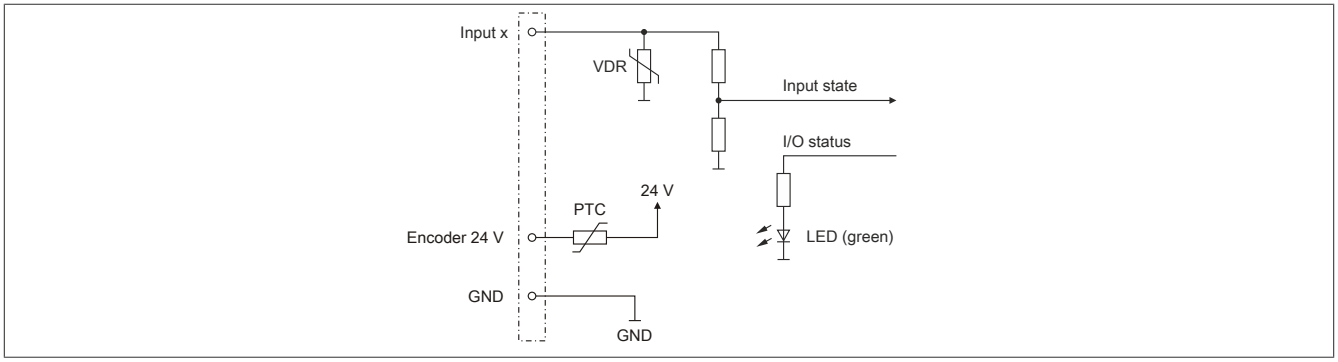
Shielded cables must be used for all signal lines.



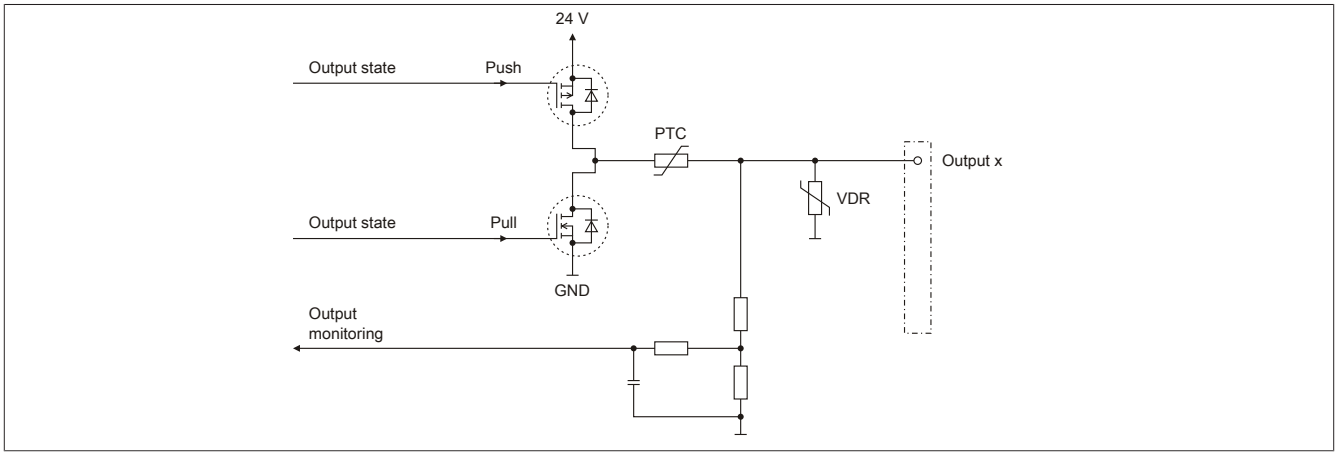
2.4 Connection example



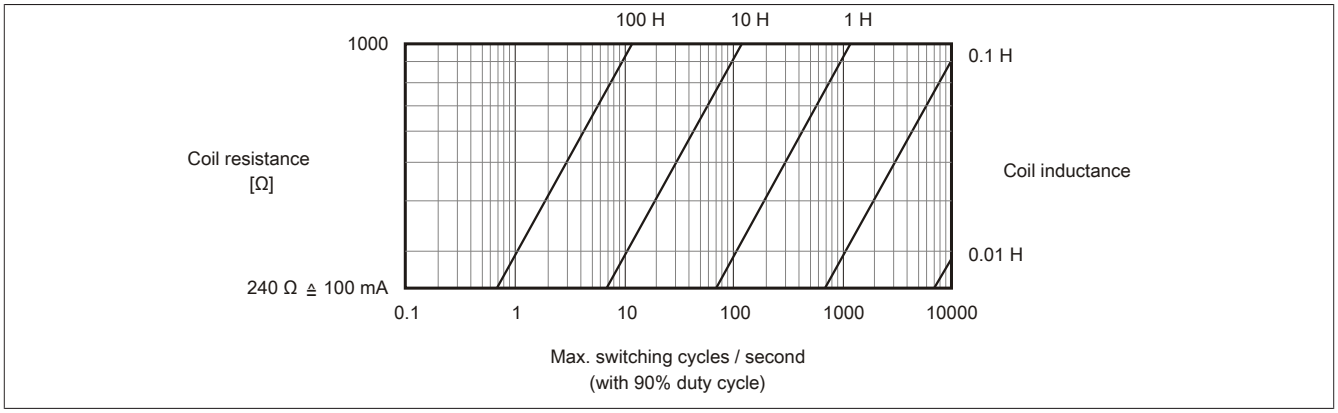
2.5 Input circuit diagram



2.6 Output circuit diagram



2.7 Switching inductive loads



3 Function description

3.1 Hardware channel functions

The following functions can be configured on the module. However, these cannot all be operated simultaneously due to the multiple use of the hardware channels and the cyclical data length limitation:

- 4 digital channels, 2 of which are configurable as outputs
- 4 event counters with adjustable counting direction and optional referencing via digital input
- 2 PWM outputs
- 2 up/down counters, each with optional latch inputs and comparator output
- 2 AB encoders, each with optional latch inputs and comparator output
- 1 ABR encoder with adjustable reference pulse edge and reference position, optional reference enable input, latch input and comparator output
- 1 SSI encoder, each with optional latch input and comparator output
- 1 Edge-triggered time measurement functions for each channel with selectable start edge regardless of the configuration setting



Information:

This module is a multifunctional module. Some bus controllers only support the default function model.

Default function model:

- **2x event counter (24 V)**
- **2x PWM output (24 V)**

3.1.1 Connecting options

Channels 1 to 4 can be connected as follows:

Channel	Function					
1	I	Event counter	A	A	SSI data	
2	I/O	Event counter	B	B	SSI cycle	PWM
3	I	Event counter	A	R		
4	I/O	Event counter	B	Enable reference		PWM

The functions can also be mixed. For example:

Example 1	
Channel	Function
1	SSI data
2	SSI cycle
3	Event counter
4	PWM

Example 2	
Channel	Function
1	SSI data
2	SSI cycle
3	A
4	B

Example 3	
Channel	Function
1	Event counter
2	PWM
3	Event counter
4	PWM

Example 4	
Channel	Function
1	A
2	B
3	R
4	Enable reference

Example 5	
Channel	Function
1	A
2	B
3	Event counter
4	PWM

Example 6	
Channel	Function
1	Event counter
2	Event counter
3	Event counter
4	PWM