# X20(c)DI4371

## 1 General Information

The module is equipped with four inputs for 3-wire connections.

- 4 digital inputs
- Sink connection
- 3-wire connections
- 4 counter inputs with 1 kHz counter frequency
- 24 VDC and GND for sensor supply
- Software input filter can be configured for entire module

## 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 |
|---|---|---|
| | **Digital inputs** | |
| X20DI4371 | X20 digital input module, 4 inputs, 24 VDC, sink, configurable input filter, 3-wire connections | |
| X20cDI4371 | X20 digital input module, coated, 4 inputs, 24 VDC, sink, configurable input filter, 3-wire connections | |
| | **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: X20DI4371, X20cDI4371 - Order data

# 4 Technical data

| Model number | X20DI4371 | X20cDI4371 |
|---|---|---|
| **Short description** | | |
| I/O module | 4 digital inputs 24 VDC for 3-wire connections | |
| **General information** | | |
| B&R ID code | 0x1B92 | 0xE21F |
| Status indicators | I/O function per channel, operating state, module status | |
| Diagnostics | | |
| Module run/error | Yes, using status LED and software | |
| Power consumption | | |
| Bus | 0.14 W | |
| Internal I/O | 0.59 W | |
| Additional power dissipation caused by the actuators (resistive) [W] | - | |
| Electrical isolation | | |
| Channel - Bus | Yes | |
| Channel - Channel | No | |
| Certification | | |
| CE | Yes | |
| KC | Yes | - |
| UL | cULus E115267<br>Industrial Control Equipment | |
| HazLoc | cCSAus 244665<br>Process Control Equipment<br>for Hazardous Locations<br>Class I, Division 2, Groups ABCD, T5 | - |
| ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta = 0 - max. 60°C<br>FTZÚ 09 ATEX 0083X | |
| DNV GL | Temperature: **B** (0 - 55°C)<br>Humidity: **B** (up to 100%)<br>Vibration: **B** (4g)<br>EMC: **B** (Bridge and open deck) | |
| LR | ENV1 | |
| GOST-R | Yes | |
| **Digital inputs** | | |
| Nominal voltage | 24 VDC | |
| Input voltage | 24 VDC -15 % / +20 % | |
| Input current at 24 VDC | Typ. 3.75 mA | |
| Input filter | | |
| Hardware | ≤100 µs | |
| Software | Default 1 ms, configurable between 0 and 25 ms in 0.2 ms intervals | |
| Connection type | 3-wire connections | |
| Input circuit | Sink | |
| Input resistance | Typ. 6.4 kΩ | |
| Switching threshold | | |
| Low | <5 VDC | |
| High | >15 VDC | |
| Isolation voltage between channel and bus | 500 V$_{eff}$ | |
| **Event counter** | | |
| Quantity | 4 | |
| Signal form | Square wave pulse | |
| Evaluation | Configurable edge event, cyclic counter | |
| Input frequency | Max. 1 kHz | |
| Counter 1 | Input 1 | |
| Counter 2 | Input 2 | |
| Counter 3 | Input 3 | |
| Counter 4 | Input 4 | |
| Counter frequency | Max. 1 kHz (when input filter switched off) | |
| Counter size | 16-bit | |
| **Sensor supply** | | |
| Power consumption | Max. 12 W [1] | |
| Voltage | Module supply minus voltage drop for short circuit protection | |
| Voltage drop for short circuit protection at 500 mA | Max. 2 VDC | |
| Summation current | 0.5 A | |
| Short circuit protection | Yes | |
| **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 | |

Table 2: X20DI4371, X20cDI4371 - Technical data

| Model number | X20DI4371 | X20cDI4371 |
|---|---|---|
| EN 60529 protection | IP20 | |
| **Environmental conditions** | | |
| Temperature | | |
| Operation | | |
| Horizontal installation | -25 to 60°C | |
| Vertical installation | -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 characteristics** | | |
| Note | Order 1x X20TB12 terminal block separately<br>Order 1x X20BM11 bus module separately | Order 1x X20TB12 terminal block separately<br>Order 1x X20cBM11 bus module separately |
| Spacing | 12.5$^{+0.2}$ mm | |

Table 2: X20DI4371, X20cDI4371 - Technical data

1)    The power consumption of the sensors connected to the module is not permitted to exceed 12 W.

# 5 Status LEDs

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

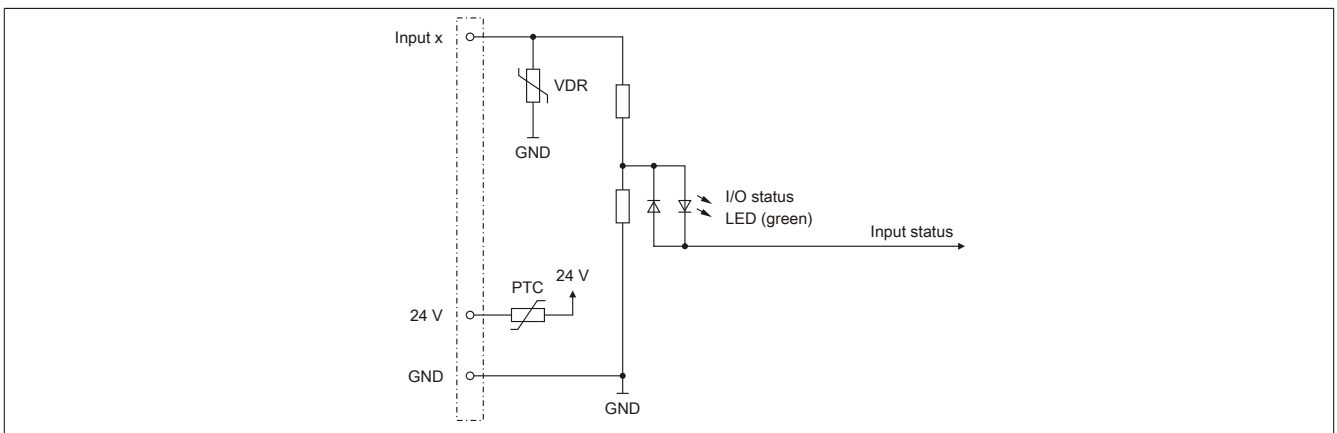| Image | LED | Color | Status | Description |
|---|---|---|---|---|
|  | r | Green | Off | No power to module |
| | | | Single flash | RESET mode |
| | | | Blinking | PREOPERATIONAL mode |
| | | | On | RUN mode |
| | e | Red | Off | Module supply not connected or everything OK |
| | e + r | Red on / Green single flash | | Invalid firmware |
| | 1 - 4 | Green | | Input status of the corresponding digital input |

# 6 Pinout
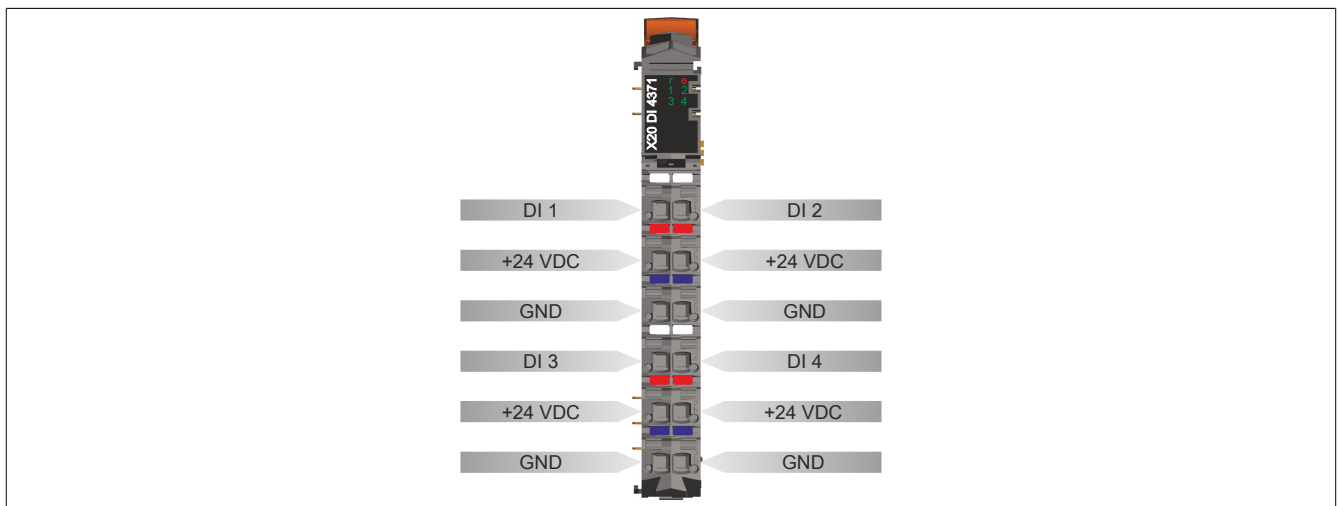
# 7 Connection example
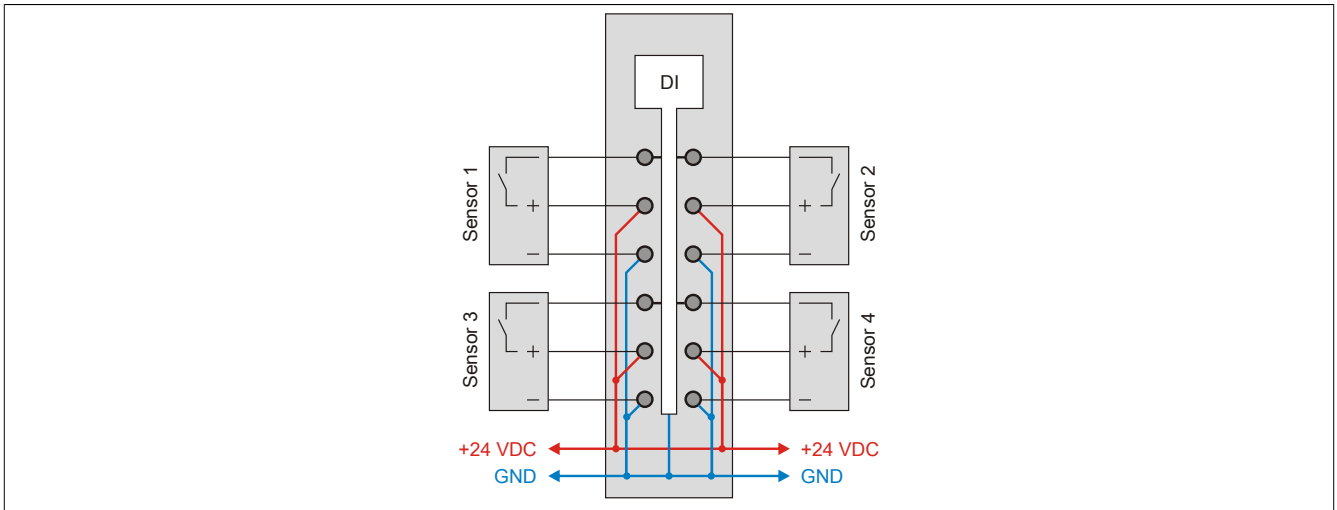


# 8 Input circuit diagram



# 9 Input filter

An input filter is available for each input. The input delay can be set using register "ConfigOutput01" on page 6. Disturbance pulses which are shorter than the input delay are suppressed by the input filter.



$t_{Delay} \Rightarrow$ Input delay
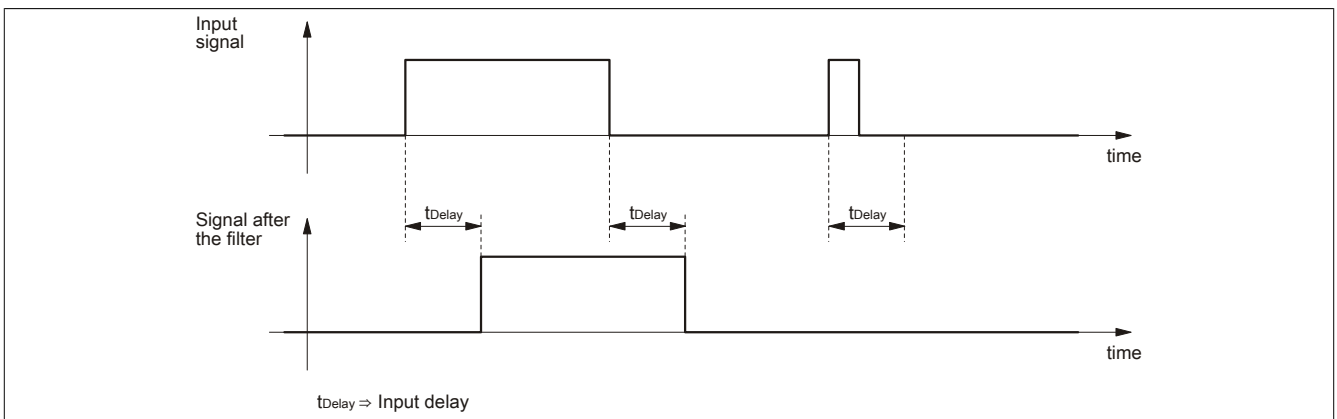
# 10 Register description

## 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 section "Additional information - General data points" of the X20 system user's manual.

## 10.2 Function model 0 - Standard

| Register | Fixed offset | Name | Data type | Read | | Write | |
|---|---|---|---|---|---|---|---|
| | | | | Cyclic | Acyclic | Cyclic | Acyclic |
| 0 | 1 | DigitalInput | USINT | ● | | | |
| | | DigitalInput01 | Bit 0 | | | | |
| | | ... | ... | | | | |
| | | DigitalInput04 | Bit 3 | | | | |
| 18 | - | ConfigOutput01 | USINT | | | | ● |

Fixed modules require their data points to be in a specific order in the X2X frame. Cyclic access occurs according to a predefined offset, not based on the register address.

Acyclic access continues to be based on the register numbers.

## 10.3 Function model 1 - Event counter

| Register | Fixed offset | Name | Data type | Read | | Write | |
|---|---|---|---|---|---|---|---|
| | | | | Cyclic | Acyclic | Cyclic | Acyclic |
| 0 | 1 | Input status of digital inputs 1 to 4 | USINT | ● | | | |
| | | DigitalInput01 | Bit 0 | | | | |
| | | ... | ... | | | | |
| | | DigitalInput04 | Bit 3 | | | | |
| 4 | 2 | Counter01 | UINT | ● | | | |
| 6 | 4 | Counter02 | UINT | ● | | | |
| 8 | 6 | Counter03 | UINT | ● | | | |
| 10 | 8 | Counter04 | UINT | ● | | | |
| 12 | 0 | Resets the counter registers | USINT | | | ● | |
| | | ResetCounter01 | Bit 0 | | | | |
| | | ... | ... | | | | |
| | | ResetCounter04 | Bit 3 | | | | |
| 18 | - | ConfigOutput01 | USINT | | | | ● |
| 14 | - | ConfigOutput02 | USINT | | | | ● |

Fixed modules require their data points to be in a specific order in the X2X frame. Cyclic access occurs according to a predefined offset, not based on the register address.

Acyclic access continues to be based on the register numbers.

## 10.4 Function model 254 - Bus Controller

| Register | Offset[1] | Name | Data type | Read | | Write | |
|---|---|---|---|---|---|---|---|
| | | | | Cyclic | Acyclic | Cyclic | Acyclic |
| 0 | 0 | Input status of digital inputs 1 to 4 | USINT | ● | | | |
| | | DigitalInput01 | Bit 0 | | | | |
| | | ... | ... | | | | |
| | | DigitalInput04 | Bit 3 | | | | |
| 18 | - | ConfigOutput01 | USINT | | | | ● |

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

### 10.4.1 CAN I/O bus controller

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

## 10.5 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.

### 10.5.1 Digital input filter

Name:
ConfigOutput01

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 |
| | 2 | 0.2 ms |
| | ... | ... |
| | 250 | 25 ms - Higher values are limited to this value |

### 10.5.2 Input status of digital inputs 1 to 4

Name:
DigitalInput or
DigitalInput01 to DigitalInput04

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

Function model 0 - Standard only:

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 "DigitalInput04") 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 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 status - Digital input 4 |

## 10.6 The event counter function model

Starting with hardware variant F0 and firmware version 801, the module has four software counters for signal edges. Each counter register can be configured individually for falling, rising or both edges.

### 10.6.1 Counter register

Name:
Counter01 to Counter04

These registers provide the current counter value for the configured events.

| Data type | Value |
|-----------|-------|
| UINT | 0 to 65535 |

### 10.6.2 Resets the counter registers

Name:
ResetCounter01 to ResetCounter04

Using these data points, the corresponding counter registers can be reset to 0.

| Data type | Value |
|---|---|
| USINT | See bit structure. |

Bit structure:

| Bit | Name | Value | Information |
|---|---|---|---|
| 0 | ResetCounter01 | 0 | No change |
| | | 1 | Counter register 1 is reset |
| ... | | ... | |
| 3 | ResetCounter04 | 0 | No change |
| | | 1 | Counter register 4 is reset |

> # Information:
>
> **A counter is only reset if a positive edge is detected on the reset bit.**
>
> **A continually set reset bit does not prevent counting in the counter register.**

### 10.6.3 Configuration of the edges

Name:
ConfigOutput02

This register is used to configure which event will be assessed on the channel input for the respective counter.

| Data type | Value |
|---|---|
| USINT | See bit structure. |

Bit structure:

| Bit | Name | Value | Information |
|---|---|---|---|
| 0 | Rising edge on input 1 | 0 | Event is not counted |
| | | 1 | Event increments Counter01 |
| ... | | ... | |
| 3 | Rising edge on input 4 | 0 | Event is not counted |
| | | 1 | Event increments Counter04 |
| 4 | Falling edge on input 1 | 0 | Event is not counted |
| | | 1 | Event increments Counter01 |
| ... | | ... | |
| 7 | Falling edge on input 4 | 0 | Event is not counted |
| | | 1 | Event increments Counter04 |

## 10.7 Minimum cycle time

The minimum cycle time defines how far the bus cycle can be reduced without communication errors occurring. Note that very fast cycles decrease the idle time available for handling monitoring, diagnostics and acyclic commands.

| Minimum cycle time | |
|---|---|
| Without filtering | 100 µs |
| With filtering | 150 µs |

## 10.8 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 | |
|---|---|
| Without filtering | 100 µs |
| With filtering | 200 µs |