# X20DI0471

## 1 General information

The module is equipped with 10 inputs for 1-wire connections. It is designed for a nominal voltage of 5 to 48 VDC.

- 10 digital inputs
- Sink circuit
- 1-wire connections
- Configurable software input filter for entire module

## 2 Order data

| Model number | Short description | Figure |
|---|---|---|
| | **Digital inputs** | |
| X20DI0471 | X20 digital input module, 10 inputs, 5-48 VDC, sink, configurable input filter, 1-wire connections | |
| | **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 | |
| | **Terminal blocks** | |
| X20TB12 | X20 terminal block, 12-pin, 24 VDC keyed | |

Table 1: X20DI0471 - Order data

# 3 Technical data

| Model number | X20DI0471 |
|---|---|
| **Short description** | |
| I/O module | 10 digital inputs 5 to 48 VDC for 1-wire connections |
| **General information** | |
| B&R ID code | 0xE7CE |
| Status indicators | I/O function per channel, operating state, module status |
| Diagnostics | |
|    Module run/error | Yes, using status LED and software |
| Power consumption | |
|    Bus | 0.3 W |
|    Internal I/O | 0.6 W |
|    External I/O | 0.94 W |
| Additional power dissipation caused by actuators (resistive) [W] | - |
| Certifications | |
|    CE | Yes |
|    EAC | Yes |
|    UL | cULus E115267<br>Industrial control equipment |
|    ATEX | Zone 2, II 3G Ex nA nC IIA T5 Gc<br>IP20, Ta (see X20 user's manual)<br>FTZÚ 09 ATEX 0083X |
| **Digital inputs** | |
| Nominal voltage | 5 to 48 VDC |
| Input voltage | 4.75 to 60 VDC |
| Input current at 48 VDC | Typ. 0.96 mA |
| Reference voltage | 4.75 to 60 VDC |
| Input circuit | Sink |
| Input filter | |
|    Hardware | ≤100 μs |
|    Software | Default 1 ms, configurable between 0 and 25 ms in 0.2 ms intervals |
| Connection type | 1-wire connections |
| Reference voltage input resistance | 20 kΩ |
| Switching threshold | |
|    Low | ≤0.2 x $U_{ref}$ |
|    High | ≥0.6 x $U_{ref}$ |
| Reference voltage monitoring | Yes |
| Isolation voltage between channel and bus | 500 $V_{eff}$ |
| **Electrical properties** | |
| Electrical isolation | Channel isolated from bus<br>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 |
|       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 |
|    Storage | 5 to 95%, non-condensing |
|    Transport | 5 to 95%, non-condensing |
| **Mechanical properties** | |
| Note | Order 1x X20TB12 terminal block separately<br>Order 1x X20BM11 bus module separately |
| Spacing | 12.5$^{+0.2}$ mm |

Table 2: X20DI0471 - Technical data

# 4 LED status indicators

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

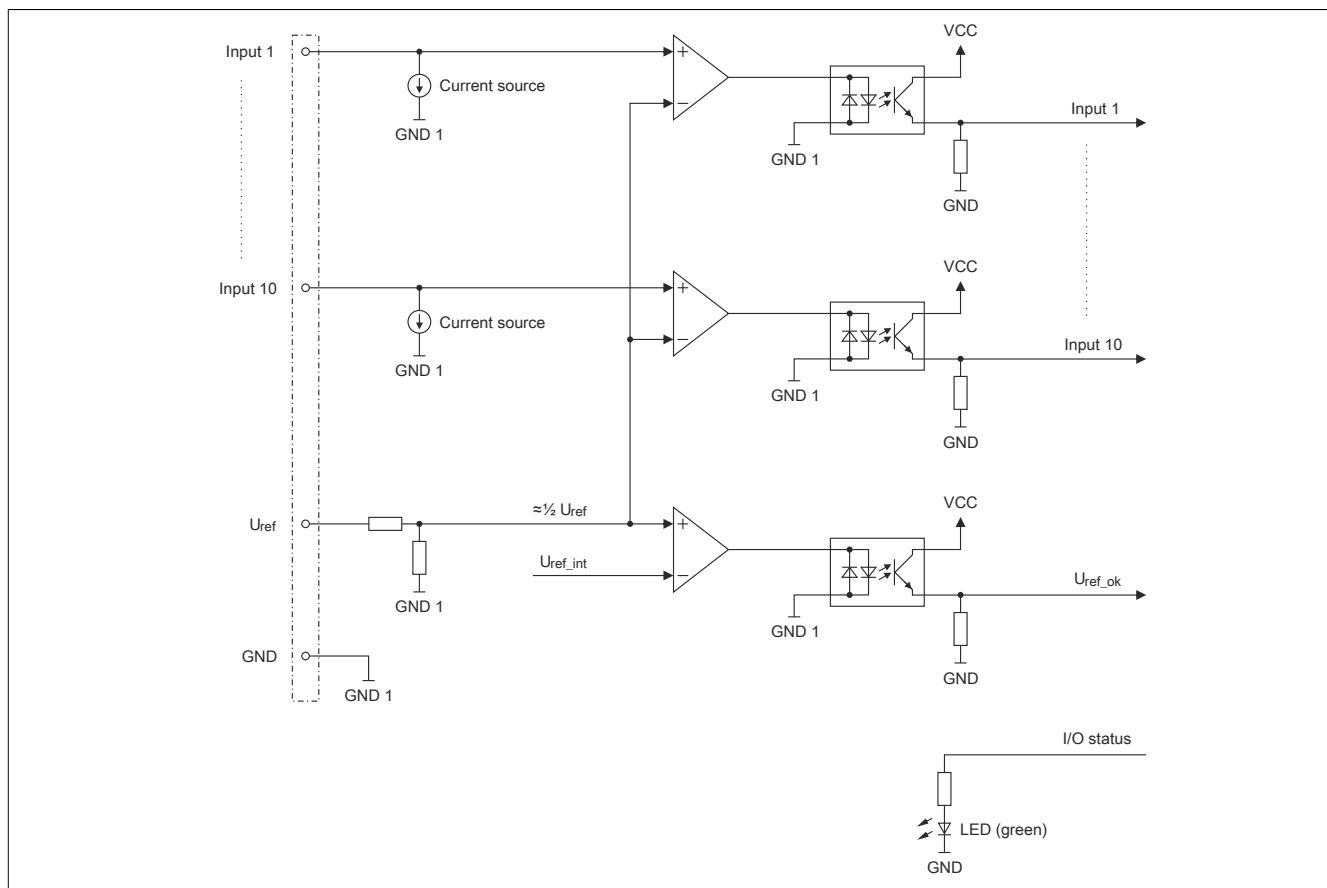| Figure | LED | Color | Status | Description |
|---|---|---|---|---|
| | r | Green | Off | No power to module |
| | | | Single flash | RESET mode |
| | | | Blinking | PREOPERATIONAL mode |
| | | | On | RUN mode |
| | e | Red | Off | No power to module or everything OK |
| | | | On | Error or reset status |
| | e + r | Red on / Green single flash | | Invalid firmware |
| | 1 - 10 | Green | | Input state of the corresponding digital input |

# 5 Pinout
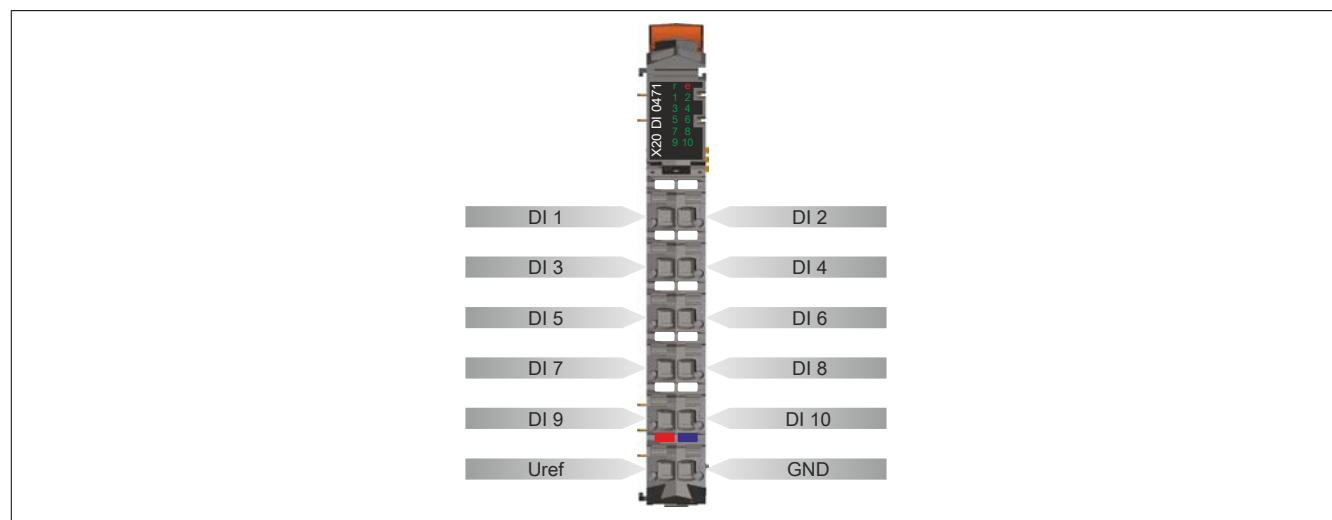


# 6 Connection example
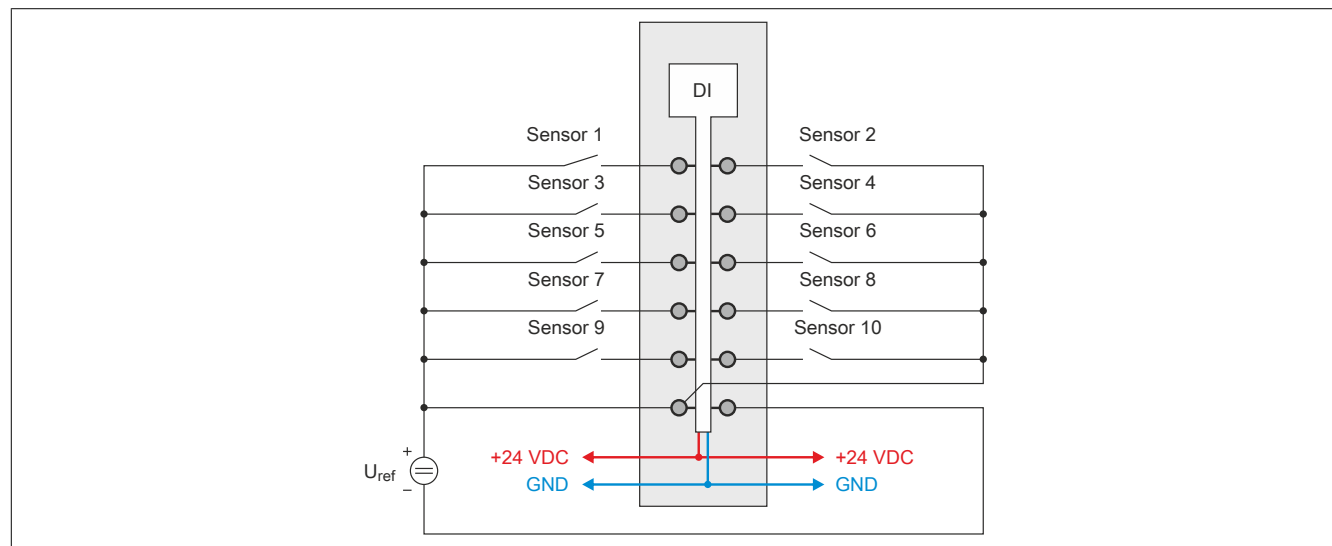
# 7 Input circuit diagram



# 8 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.
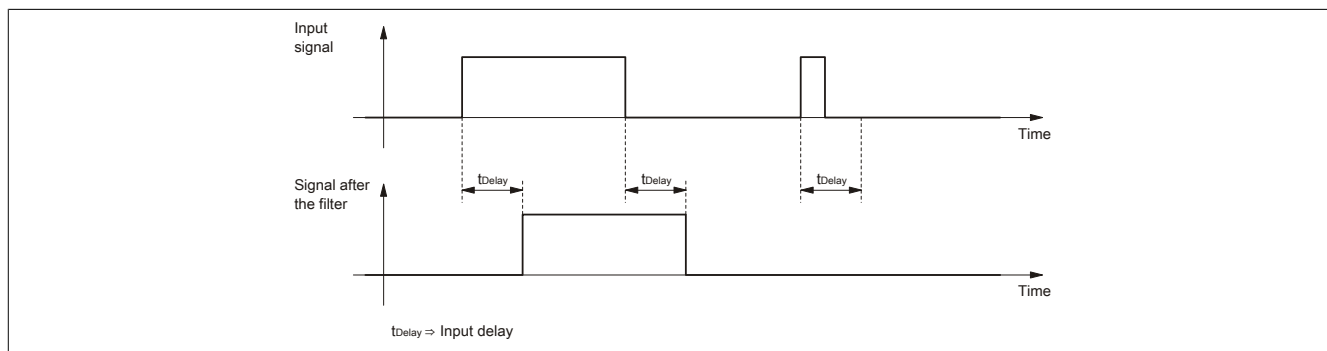
# 9 Register description

## 9.1 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.

## 9.2 Function model 0 - default

| Register | Fixed offset | Register name | Data type | Read | | Write | |
|---|---|---|---|---|---|---|---|
| | | | | Cyclic | Acyclic | Cyclic | Acyclic |
| **Configuration** | | | | | | | |
| 18 | - | ConfigOutput01 (input filter) | USINT | | | | ● |
| **Communication** | | | | | | | |
| - | 1 | DigitalInput | UINT | ● | | | |
| 0 | 1 | Input state of digital inputs 1 to 8 | USINT | ● | | | |
| | | DigitalInput01 | Bit 0 | | | | |
| | | ... | ... | | | | |
| | | DigitalInput08 | Bit 7 | | | | |
| 1 | 2 | Input state of digital inputs 9 to 10 | USINT | ● | | | |
| | | DigitalInput09 | Bit 0 | | | | |
| | | DigitalInput10 | Bit 1 | | | | |
| | | ReferenceStatus | Bit 7 | | | | |

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.

## 9.3 Function model 254 - Bus controller

| Register | Offset[1] | Register name | Data type | Read | | Write | |
|---|---|---|---|---|---|---|---|
| | | | | Cyclic | Acyclic | Cyclic | Acyclic |
| **Configuration** | | | | | | | |
| 18 | - | ConfigOutput01 (input filter) | USINT | | | | ● |
| **Communication** | | | | | | | |
| 0 | 0 | Input state of digital inputs 1 to 8 | USINT | ● | | | |
| | | DigitalInput01 | Bit 0 | | | | |
| | | ... | ... | | | | |
| | | DigitalInput08 | Bit 7 | | | | |
| 1 | 1 | Input state of digital inputs 9 to 10 | USINT | ● | | | |
| | | DigitalInput09 | Bit 0 | | | | |
| | | DigitalInput10 | Bit 1 | | | | |
| | | ReferenceStatus | Bit 7 | | | | |

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

### 9.3.1 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 additional 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).

### 9.3.2 CAN I/O bus controller

The module occupies 2 digital logical slots on CAN I/O.

## 9.4 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.

## 9.5 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 (bus controller default setting) |
| | 2 | 0.2 ms |
| | ... | ... |
| | 250 | 25 ms - Higher values are limited to this value |

### 9.5.1 Details related to use

The table shows how the register must be defined in relation to the function model and which parameter is available for this in the Automation Studio configuration.

| Function model | Value or path for the configuration parameter |
|---|---|
| All | General / Input filter [0.1 ms] |

## 9.6 Input state of digital inputs 1 to 10

Register name:
DigitalInput or
DigitalInput01 to DigitalInput10

This register indicates the input state of digital inputs 1 to 10 and the status of the reference voltage.

The reference voltage is monitored. The status is output in bit 7.

| Reference voltage | Status of the digital inputs in relation to the input voltage | |
|---|---|---|
| $U_{ref} < 4.75$ V | All digital inputs are in a low state regardless of the voltage on the inputs. | |
| $U_{ref} \geq 4.75$ V | $U_{In} \leq 0.2 * U_{ref}$ | The digital input is low |
| | $U_{In} \geq 0.6 * U_{ref}$ | The digital input is high |
| | $0.2 * U_{ref} < U_{In} < 0.6 * U_{ref}$ | This area is inconclusive. The digital input is either low or high. |

**Example**

The reference voltage $U_{ref}$ = 48 VDC

Calculation of the switching threshold:

Switching threshold low = 48 * 0.2 = 9.6 VDC

Switching threshold high = 48 * 0.6 = 28.8 VDC

Status of the digital inputs in relation to the input voltage:

| Input voltage | State of the digital input |
|---|---|
| $U_{In} \leq 9.6$ VDC | The digital input is low |
| 9.6 VDC $< U_{In} <$ 28.8 VDC | The digital input is either low or high (inconclusive). |
| $U_{In} \geq 28.8$ VDC | The digital input is high |

**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 this register should be set up individually as data points in the Automation Studio I/O mapping ("DigitalInput01" to "DigitalInput10") or whether this register should be displayed as an individual UINT data point ("DigitalInput").

| Data type | Value | Information | |
|---|---|---|---|
| UINT | 0x0000 to 0x83FF | Packed inputs = On | |
| | | 0xy000 to 0xy3FF | Status of digital inputs 1 to 10 |
| | | 0x0yyy | Reference voltage $U_{ref}$ < 4.75 V |
| | | 0x8yyy | Reference voltage $U_{ref}$ ≥ 4.75 V |
| USINT | See bit structure. | Packed inputs = Off or Function model <> 0 - Standard | |

Bit structure:

**Register 0**

| Bit | Name | Value | Information |
|---|---|---|---|
| 0 | DigitalInput01 | 0 or 1 | Input state - Digital input 1 |
| ... | | ... | |
| 7 | DigitalInput08 | 0 or 1 | Input state - Digital input 8 |

**Register 1**

| Bit | Name | Value | Information |
|---|---|---|---|
| 0 | DigitalInput09 | 0 or 1 | Input state - Digital input 9 |
| 1 | DigitalInput10 | 0 or 1 | Input state - Digital input 10 |
| 2 - 6 | Reserved | | |
| 7 | ReferenceStatus | 0 | Reference voltage $U_{ref}$ < 4.75 V |
| | | 1 | Reference voltage $U_{ref}$ ≥ 4.75 V |

## 9.7 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 |

## 9.8 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 | |
|---|---|
| Without filtering | 100 µs |
| With filtering | 200 µs |