X20(c)DI4375

Data sheet

2.30 (08.2024)

Disclaimer

Version history

B&R makes every effort to keep documents as current as possible. The most current versions are available for download on the B&R website (www.br-automation.com).

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
MAEMV	Installations / EMV 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

1.2.1 Starting temperature

The starting temperature describes the minimum permissible ambient temperature in a voltage-free state 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 the closed control cabinet, e.g. due to the use of a fan or ventilation slots.**

1.3 Order data

Order number	Short description	Figure
	Digital inputs	
X20DI4375	X20 digital input module, 4 inputs, 24 VDC, sink, configurable input filter, open-circuit and short-circuit detection, 3-wire connections	
X20cDI4375	X20 digital input module, coated, 4 inputs, 24 VDC, sink, configurable input filter, open-circuit and short-circuit detection, 3-wire connections	
	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: X20DI4375, X20cDI4375 - Order data

1.4 Module description

The module is equipped with 4 inputs for 3-wire connections. It has open circuit and short circuit detection. This detection can be switched off individually for each channel.

- 24 VDC and GND for the sensor power supply

Functions:

- Digital inputs
- Monitoring the input channels
- Timestamp

Digital inputs

The digital inputs are equipped with an input filter with a configurable input delay.

Monitoring the input channels

Each input channel is monitored for short circuit, open circuit, sensor power supply and other channel errors.

Timestamp

Each converted value is provided with a timestamp.

2 Technical description

2.1 Technical data

Order number	X20DI4375	X20cDI4375
Short description		
I/O module	4 digital inputs 24 VDC for 3-wire connections, open-circuit and short-circuit detection, possible to switch off detection for each channel	
General information		
B&R ID code	0xA911	0xE220
Status indicators	I/O function per channel, operating state, module status, sensor line, sensor power supply	
Diagnostics		
Module run/error	Yes, using LED status indicator and software	
Open circuit	Yes, using LED status indicator and software	
Short circuit	Yes, using LED status indicator and software	
Sensor power supply	Yes, using LED status indicator and software	
Other channel errors	Yes, using LED status indicator and software	
Power consumption		
Bus	0.01 W	
Internal I/O	1.1 W	
Additional power dissipation caused by actuators (resistive) [W]	-	
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	-
Digital inputs		
Nominal voltage	24 VDC	
Input voltage	24 VDC -15% / +20%	
Input current at 24 VDC	Typ. 4.8 mA (standard wiring)	
Input circuit	Sink	
Input filter		
Hardware	0.8 ms	
Software	Default 1 ms, configurable between 0 and 25 ms in 0.2 ms increments	
Connection type	3-wire connections	
Sensor power supply	4x 50 mA	
Open-circuit and short-circuit detection	Yes, possible to switch off for each channel	
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 limitation	
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m	
Degree of protection per EN 60529	IP20	

Table 2: X20DI4375, X20cDI4375 - Technical data

Technical description

Order number	X20DI4375	X20cDI4375
Ambient conditions		
Temperature		
Operation		
Horizontal mounting orientation	-25 to 60°C	
Vertical mounting orientation	-25 to 50°C	
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 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: X20DI4375, X20cDI4375 - Technical data

2.2 Status LEDs

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

Image	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	Module supply not connected or everything OK
			Single flash	Summary status for channel error → Check the red channel LEDs 1 - 4
			Double flash	Module supply below lower limit
			Triple flash	Converter error (or transition between single and double flash)
	1 - 4	Green		Input status of the corresponding digital input
	1 - 4	Red	Off	No error detected
			Single flash	Short circuit of respective digital input with +24 VDC
			Blinking	Open circuit or the measured value is below the lower switch off threshold
			Single flash, inverse	Other channel error
	S1 - S4	Red	Off	Sensor supply OK
			On	Sensor supply monitor has detected something

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

2.3 Pinout

Shielded cables should be used for all connections.
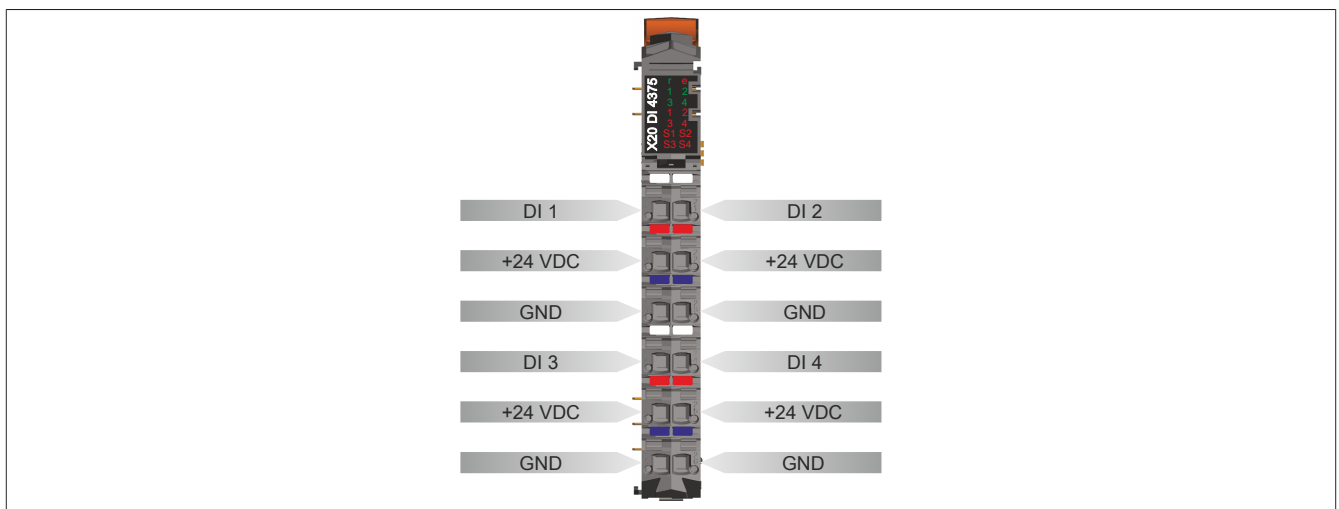
2.4 Connection example

2.5 Input circuit diagram

3 Function description

3.1 Digital inputs

The module is equipped with 4 digital input channels.

3.1.1 Recording the input state

Unfiltered

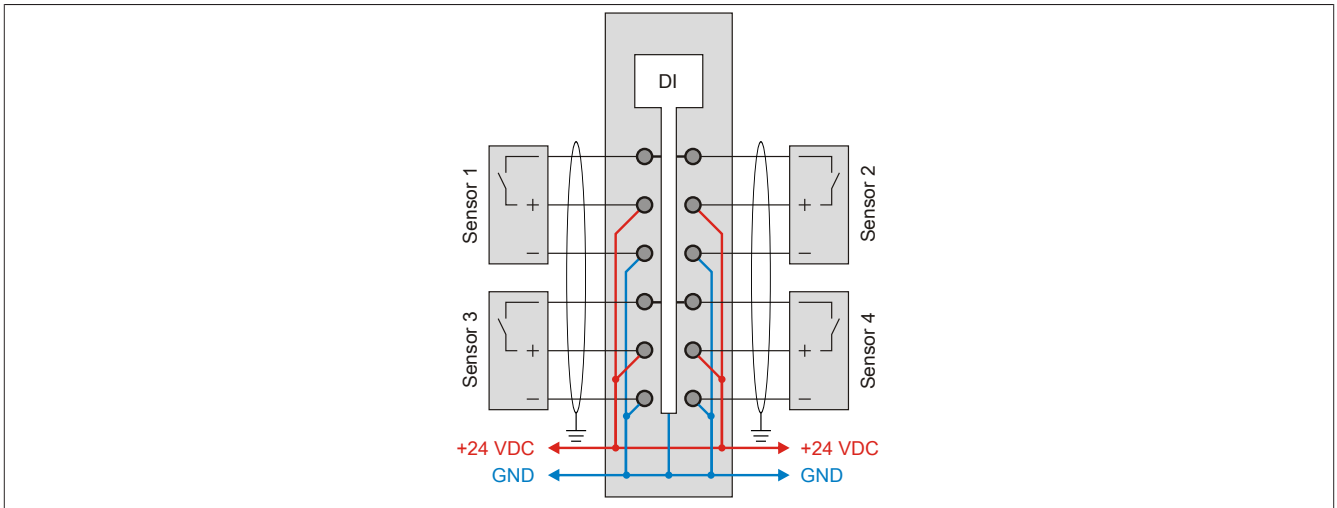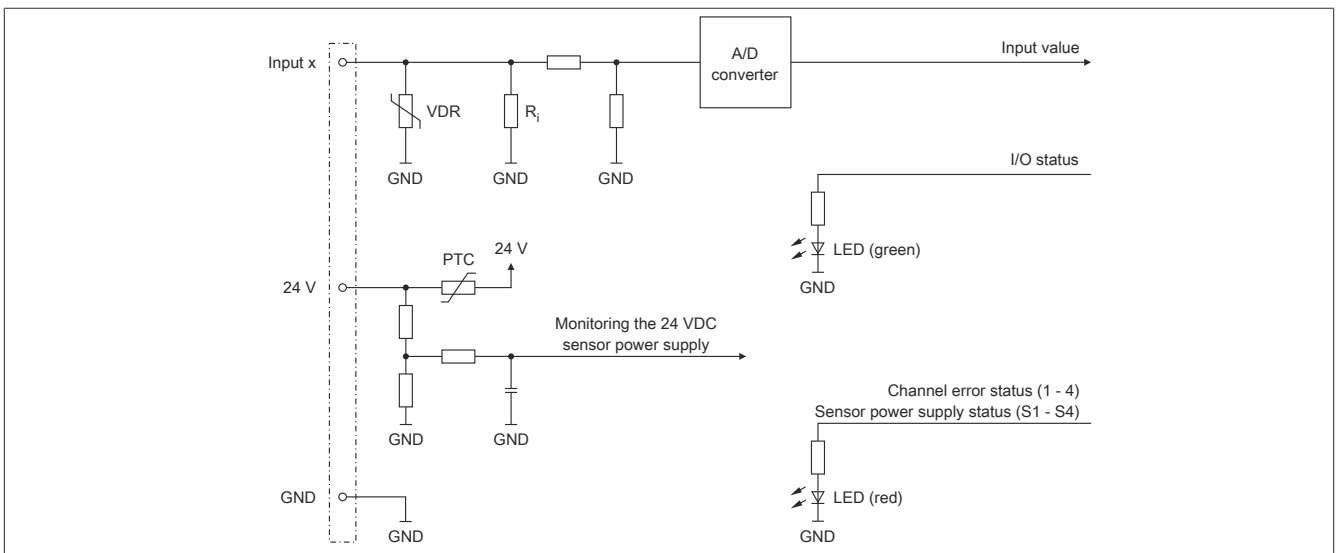The input state is collected with a fixed offset to the network cycle and transferred in the same cycle.

Filtered

The filtered state 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.

Packed outputs (only function model 0 - Standard)

Setting "Packed inputs" in the Automation Studio I/O configuration can be used to determine whether all bits of the register should be applied as individual data points in the Automation Studio I/O mapping (e.g. "DigitalInput01 to DigitalInputxx") or whether the register should be displayed as a single USINT data point (e.g. "DigitalInput").

Information:

The register is described in **"Input status of digital inputs 1 to 4" on page 14**.

3.1.2 Input filter

An input filter is available for each input. Disturbance pulses that are shorter than the input delay are suppressed by the input filter.
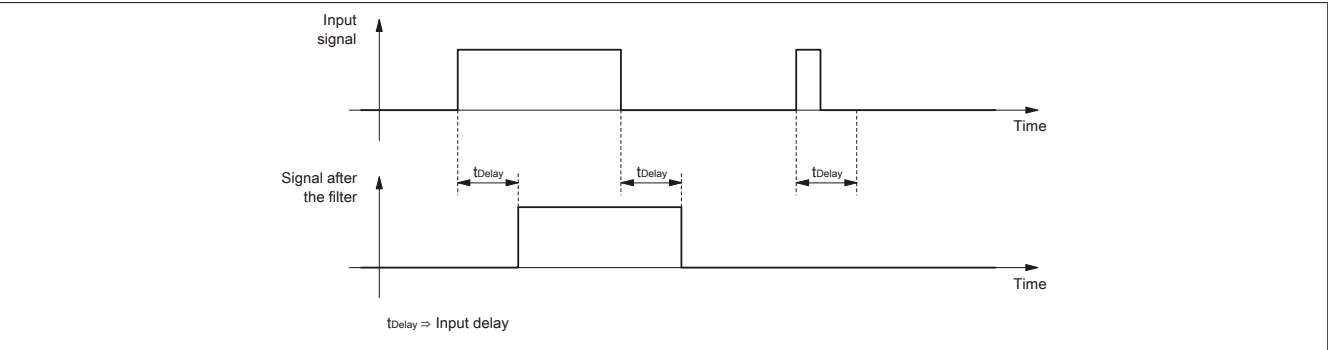
The input delay can be set in steps of 100 µs. It makes sense, however, to enter values in steps of 2 since the input signals are sampled in an interval of 200 µs.

Values	Filter
0	No software filter
2	0.2 ms
…	…
250	25 ms - Higher values are limited to this value.

Information:

The register is described in **"Digital input filter" on page 14**.

3.2 Monitoring the input channels

The digital input channels of the module are monitored for the following states. Each channel can be evaluated separately:

- Short circuit of the sensor line
- Open circuit of the sensor line
- Sensor supply
- Other channel error

> **Information:**
>
> **The registers are described in "Error monitoring" on page 15.**
>
> **The collected error status is described in "Input status of digital inputs 1 to 4" on page 14.**

3.2.1 Open circuit and short circuit detection

For open-circuit and short-circuit detection, the sensor must be connected accordingly with resistors.

The resistances are connected to the sensor parallel or in series. The following values are defined for the resistances:

Resistance	Range
Serial	1 - 2 kΩ (10%)
Parallel	10 - 20 kΩ (10%)

Connection options

The +24 VDC sensor power supply of the module must be used to ensure error-free functionality of open-circuit and short-circuit detection.

Value	Configuration	Schema	Information
0	**Standard**		Short-circuit detection and open-circuit monitoring are not possible when using this configuration.
1	**Serial/Parallel**		Short-circuit detection and open-circuit monitoring is possible with this configuration.
2	**Parallel/Serial**		Short-circuit detection and open-circuit monitoring is possible with this configuration.
3	**Parallel**		Using this configuration enables open-circuit monitoring. Short-circuit detection is not possible when using this configuration.
4	**Serial**		Using this configuration enables short-circuit detection. Open-circuit monitoring is not possible when using this configuration.

3.3 Timestamp

Each converted value is given a timestamp. The time of the last conversion can be read.

> **Information:**
>
> **The register is described in "Timestamp of last conversion" on page 14.**

4 Commissioning

4.1 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).

4.1.1 CAN I/O bus controller

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

5 Register description

5.1 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.

5.2 Function model 0 - Standard

Register	Name	Data type	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Configuration						
2050	ConfigOutput01 (power monitoring)	UINT				●
2053	ConfigOutput02 (input filter)	USINT				●
Communication						
2305	DigitalInput	USINT	●			
	DigitalInput01	Bit 0				
	...	...				
	DigitalInput04	Bit 3				
	StateDigitalInput01	Bit 4				
	...	...				
	StateDigitalInput04	Bit 7				
2307	StatusInput01	USINT	●			
	SC_DigitalInput01	Bit 0				
	...	...				
	SC_DigitalInput04	Bit 3				
2309	StatusInput02	USINT	●			
	WB_DigitalInput01	Bit 0				
	...	...				
	WB_DigitalInput04	Bit 3				
2311	StatusInput03	USINT	●			
	SM_DigitalInput01	Bit 0				
	...	...				
	SM_DigitalInput04	Bit 3				
2313	StatusInput04		●			
	IE_DigitalInput01	Bit 0				
	...	...				
	IE_DigitalInput01	Bit 3				
2324	SampleTimeStamp	UDINT	●			

5.3 Function model 254 - Bus controller

Register	Offset[1]	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
2050	-	ConfigOutput01 (power monitoring)	UINT				•
2053	-	ConfigOutput02 (input filter)	USINT				•
Communication							
2305	0	Input status of digital inputs 1 to 4	USINT	•			
		DigitalInput01	Bit 0				
		...	...				
		DigitalInput04	Bit 3				
		StateDigitalInput01	Bit 4				
		...	...				
		StateDigitalInput04	Bit 7				
2307	-	Short circuit monitoring of channels 1 to 4	USINT		•		
		SC_DigitalInput01	Bit 0				
		...	...				
		SC_DigitalInput04	Bit 3				
2309	-	Open line monitoring on channels 1 to 4	USINT		•		
		WB_DigitalInput01	Bit 0				
		...	...				
		WB_DigitalInput04	Bit 3				
2311	-	Voltage monitoring on channels 1 to 4	USINT		•		
		SM_DigitalInput01	Bit 0				
		...	...				
		SM_DigitalInput04	Bit 3				
2313	-	Error monitoring on channels 1 to 4			•		
		IE_DigitalInput01	Bit 0				
		...	...				
		IE_DigitalInput01	Bit 3				
2324	-	SampleTimeStamp	UDINT		•		

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

5.4 Digital inputs

5.4.1 Digital input filter

Name:
ConfigOutput02

The filter value for all digital inputs can be configured in this register.

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

Data type	Values	Filter
USINT	0	No software filter (bus controller default setting)
	2	0.2 ms
	...	...
	250	25 ms - Higher values are limited to this value.

5.4.2 Input status of digital inputs 1 to 4

Name:
DigitalInput or
DigitalInput01 to DigitalInput04
StateDigitalInput01 to StateDigitalInput04

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

Data type	Values	Information[1]
USINT	0 to 255	Packed inputs = On Data point: "DigitalInput"
	See the bit structure.	Packed inputs = Off or function model ≠ 0 - Standard Data points: "DigitalInput01" to "DigitalInput04" and "StateDigitalInput01" to "StateDigitalInput04"

[1]   See "Digital inputs - Record input status" on page 8.

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	StateDigitalInput01	0	No error
		1	Short-circuit, open line, sensor monitoring error or other channel error
...		...	
7	StateDigitalInput04	0	No error
		1	Short-circuit, open line, sensor monitoring error or other channel error

5.4.3 Timestamp of last conversion

Name:
SampleTimeStamp

This register shows the timestamp of the last conversion in µs.

Data type	Value
UDINT	Timestamp of the last conversion in µs

5.5 Error monitoring

5.5.1 Configuration of line status monitoring

Name:
ConfigOutput01

This register is used to configure short circuit monitoring and line status monitoring on the inputs.

Data type	Value	Bus controller default setting
UINT	See bit structure	0

Bit structure:

Bit	Name	Value	Information
0 - 3	Channel configuration - Channel 1	0	Default (bus controller default setting)
		1	Serial/Parallel: R-1k[1] in series with (R-10k parallel to the switch)
		2	Parallel/Serial: R-10k[2] parallel to (R-1k in series with switch)
		3	Parallel: R-10k[2] parallel to switch
		4	Serial: R-1k[1] in series with switch
		5 to 15	Inactive
4 - 7	Channel configuration - Channel 2	0 to 15	See Channel configuration - Channel 1
8 - 11	Channel configuration - Channel 3	0 to 15	See Channel configuration - Channel 1
12 - 15	Channel configuration - Channel 4	0 to 15	See Channel configuration - Channel 1

1) Resistance in the permissible range of 1 to 2 kΩ with an accuracy of 10%.
2) Resistance in the permissible range of 10 to 20 kΩ with an accuracy of 10%.

> **Information:**
>
> **Inputs that are not being used should be set to the type "Standard" or "Serial" to prevent mistakes.**

5.5.2 Short circuit monitoring of channels 1 to 4

Name:
StatusInput01 or
SC_DigitalInput01 to SC_DigitalInput04

This register indicates whether a short circuit has occurred on the individual channels.

Data type	Value	Information[1]
USINT	0 to 15	Packed inputs = On Data point: "StatusInput01"
	See the bit structure.	Packed inputs = Off or function model ≠ 0 - Standard Data points: "SC_DigitalInput01" to "SC_DigitalInput04"

1) See "Digital inputs - Record input status" on page 8.

Bit structure:

Bit	Name	Value	Information
0	SC_DigitalInput01	0	No error
		1	Short circuit on channel 1
...		...	
3	SC_DigitalInput04	0	No error
		1	Short circuit on channel 4
4 - 7	Reserved	-	

5.5.3 Open line monitoring on channels 1 to 4

Name:
StatusInput02 or
WB_DigitalInput01 to WB_DigitalInput04

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

Data type	Value	Information
USINT	0 to 15	Packed inputs = On Data point: "StatusInput02"
	See the bit structure.	Packed inputs = Off or function model ≠ 0 - Standard Data points: "WB_DigitalInput0" to "WB_DigitalInput04"

1)   See "Digital inputs - Record input status" on page 8.

Bit structure:

Bit	Name	Value	Information
0	WB_DigitalInput01	0	No error
		1	Open line on channel 1
...		...	
3	WB_DigitalInput04	0	No error.
		1	Open line on channel 4
4 - 7	Reserved	-	

5.5.4 Voltage monitoring on channels 1 to 4

Name:
StatusInput03 or
SM_DigitalInput01 to SM_DigitalInput04

This register monitors the voltage supply on the individual channels.

Data type	Value	Information
USINT	0 to 15	Packed inputs = On Data point: "StatusInput03"
	See the bit structure.	Packed inputs = Off or function model ≠ 0 - Standard Data points: "SM_DigitalInput01" to "SM_DigitalInput04"

1)   See "Digital inputs - Record input status" on page 8.

Bit structure:

Bit	Name	Value	Information
0	SM_DigitalInput01	0	No error
		1	Sensor supply error on channel 1
...		...	
3	SM_DigitalInput04	0	No error
		1	Sensor supply error on channel 4
4 - 7	Reserved	-	

5.5.5 Error monitoring on channels 1 to 4

Name:
StatusInput04 or
IE_DigitalInput01 to IE_DigitalInput04

This register indicates whether any other errors have occurred on the individual channels.

Data type	Value	Information[1]
USINT	0 to 15	Packed inputs = On Data point: "StatusInput04"
	See the bit structure.	Packed inputs = Off or function model ≠ 0 - Standard Data points: "IE_DigitalInput01" to "IE_DigitalInput04"

1)   See "Digital inputs - Record input status" on page 8.

Bit structure:

Bit	Name	Value	Information
0	IE_DigitalInput01	0	No error
		1	Other error on channel 1
...		...	
3	IE_DigitalInput04	0	No error
		1	Other error on channel 4
4 - 7	Reserved	-	

5.6 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	
All channels	150 µs

5.7 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	
All channels	150 µs