X20 System Register Descriptions

User's Manual

Version: **1.00 (March 2007)**

Model number: **MAX20REGISTER-ENG**

Chapter 7: Analog input modules

Chapter 8: Analog output modules

Chapter 9: Temperature modules

Chapter 10: Motor modules

Chapter 11: Other modules

Chapter 12: Counter modules

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Chapter 1 • General information

1. Manual history

Version	Date	Comment
1.00	March 2007	First version.

Table 1: Manual history

2. Introduction

This manual describes the registers used to configure the X20 System modules. It also contains the following information:

- Variable assignment in Automation Studio (X2X master, CANIO, etc.)
- Data points with respect to the type of fieldbus used (CANopen, DeviceNet, etc.)
- Descriptions of module functions
- B&R ID code

Chapter 2 • Bus receivers / transmitters

1. Overview

Module	Description
X20BR9300	X20 bus receiver (X2X Link) with feed for internal I/O supply, and X2X Link bus supply
X20BT9100	X20 bus transmitter (X2X Link)

Table 2: Overview of bus receivers and bus transmitters

2. X20BR9300

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 3: Register overview - BR9300

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyCurrent	USINT	1	●			
SupplyVoltage	USINT	1	●			

Table 4: Variable assignment in Automation Studio (X2X master) - BR9300

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyCurrent	UINT	1	●			
SupplyVoltage	UINT	1	●			

Table 5: Variable assignment in Automation Studio (CANIO) - BR9300

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 6: CANopen data points - BR9300

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 7: DeviceNet data points - BR9300

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 8: Modbus/TCP data points - BR9300

2.7 Module status

The following module states are monitored:

- Bus supply current
- Bus supply voltage
- 24 VDC I/O supply voltage

Bus supply current

A bus supply current of >2.3 A is displayed as a warning.

Bus supply voltage

A bus supply voltage of <4.7 V is displayed as a warning.

24 VDC I/O supply voltage

An I/O supply voltage of <20.4 V is displayed as a warning.

2.8 Register: ModuleStatus

Bit	Description
0	0 ... No error 1 ... Bus supply warning - overcurrent (>2.3 A) or undercurrent (<4.7 V)
1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V
3 - x	0

2.9 Register: StatusInput01

BOOL	Description
x	0 ... No error 1 ... Bus supply warning - overcurrent (>2.3 A) or undercurrent (<4.7 V)

2.10 Register: StatusInput02

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V

2.11 Register: BusSupplyCurrent, SupplyCurrent

The bus supply current is measured with a resolution of 0.1 A.

2.12 Register: BusSupplyVoltage, SupplyVoltage

The bus supply voltage is measured with a resolution of 0.1 V.

2.13 B&R ID code

Code for module identification ($1BC1).

2.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 9: Minimum cycle time - BR9300

2.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
2 ms

Table 10: Minimum I/O update time - BR9300

3. X20BT9100

3.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 11: Register overview - BT9100

3.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyVoltage	USINT	1	●			

Table 12: Variable assignment in Automation Studio (X2X master) - BT9100

3.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyVoltage	UINT	1	●			

Table 13: Variable assignment in Automation Studio (CANIO) - BT9100

3.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 14: CANopen data points - BT9100

3.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 15: DeviceNet data points - BT9100

3.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 16: Modbus/TCP data points - BT9100

3.7 Module status

The following module states are monitored:

- Bus supply voltage
- 24 VDC I/O supply voltage

Bus supply voltage

A bus supply voltage of <4.7 V is displayed as a warning.

24 VDC I/O supply voltage

An I/O supply voltage of <20.4 V is displayed as a warning.

3.8 Register: ModuleStatus

Bit	Description
0	0 ... No error 1 ... Bus supply warning - undervoltage (<4.7 V)
1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V
3 - x	0

3.9 Register: StatusInput01

BOOL	Description
x	0 ... No error 1 ... Bus supply warning - undervoltage (<4.7 V)

3.10 Register: StatusInput02

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V

3.11 Register: BusSupplyVoltage, SupplyVoltage

The bus supply voltage is measured with a resolution of 0.1 V.

3.12 B&R ID code

Code for module identification ($1BC2).

3.13 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 17: Minimum cycle time - BT9100

3.14 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
2 ms

Table 18: Minimum I/O update time - BT9100

Chapter 3 • Supply modules

1. Overview

Supply modules	Description
X20PS2100	X20 supply module for internal I/O supply
X20PS2110	X20 supply module for internal I/O supply, integrated microfuse
X20PS3300	X20 supply module for internal I/O supply, X2X link supply
X20PS3310	X20 supply module for internal I/O supply, X2X Link bus supply, integrated microfuse
X20PS9400	X20 supply module for bus controller and internal I/O supply, X2X link bus supply

Table 19: Overview of supply modules

2. X20PS2100

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 20: Register overview - PS2100

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyVoltage	USINT	1	●			

Table 21: Variable assignment in Automation Studio (X2X master) - PS2100

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyVoltage	UINT	1	●			

Table 22: Variable assignment in Automation Studio (CANIO) - PS2100

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 23: CANopen data points - PS2100

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 24: DeviceNet data points - PS2100

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 25: Modbus/TCP data points - PS2100

2.7 Module status

The following module states are monitored:

- Bus supply voltage
- 24 VDC I/O supply voltage

Bus supply voltage

A bus supply voltage of <4.7 V is displayed as a warning.

24 VDC I/O supply voltage

An I/O supply voltage of <20.4 V is displayed as a warning.

2.8 Register: ModuleStatus

Bit	Description
0	0 ... No error 1 ... Bus supply warning - undervoltage (<4.7 V)
1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V
3 - x	0

2.9 Register: StatusInput01

BOOL	Description
x	0 ... No error 1 ... Bus supply warning - undervoltage (<4.7 V)

2.10 Register: StatusInput02

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V

2.11 Register: BusSupplyVoltage, SupplyVoltage

The bus supply voltage is measured with a resolution of 0.1 V.

2.12 B&R ID code

Code for module identification ($1BBF).

2.13 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 26: Minimum cycle time - PS2100

2.14 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
2 ms

Table 27: Minimum I/O update time - PS2100

3. X20PS2110

3.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 28: Register overview - PS2110

3.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyVoltage	USINT	1	●			

Table 29: Variable assignment in Automation Studio (X2X master) - PS2110

3.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyVoltage	UINT	1	●			

Table 30: Variable assignment in Automation Studio (CANIO) - PS2110

3.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 31: CANopen data points - PS2110

3.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 32: DeviceNet data points - PS2110

3.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 33: Modbus/TCP data points - PS2110

3.7 Module status

The following module states are monitored:

- Bus supply voltage
- 24 VDC I/O supply voltage

Bus supply voltage

A bus supply voltage of <4.7 V is displayed as a warning.

24 VDC I/O supply voltage

An I/O supply voltage of <20.4 V is displayed as a warning.

3.8 Register: ModuleStatus

Bit	Description
0	0 ... No error 1 ... Bus supply warning - undervoltage (<4.7 V)
1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V or faulty fuse
3 - x	0

3.9 Register: StatusInput01

BOOL	Description
x	0 ... No error 1 ... Bus supply warning - undervoltage (<4.7 V)

3.10 Register: StatusInput02

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V or faulty fuse

3.11 Register: BusSupplyVoltage, SupplyVoltage

The bus supply voltage is measured with a resolution of 0.1 V.

3.12 B&R ID code

Code for module identification ($2016).

3.13 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 34: Minimum cycle time - PS2110

3.14 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
2 ms

Table 35: Minimum I/O update time - PS2110

4. X20PS3300

4.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 36: Register overview - PS3300

4.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyCurrent	USINT	1	●			
SupplyVoltage	USINT	1	●			

Table 37: Variable assignment in Automation Studio (X2X master) - PS3300

4.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyCurrent	UINT	1	●			
SupplyVoltage	UINT	1	●			

Table 38: Variable assignment in Automation Studio (CANIO) - PS3300

4.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 39: CANopen data points - PS3300

4.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 40: DeviceNet data points - PS3300

4.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 41: Modbus/TCP data points - PS3300

4.7 Module status

The following module states are monitored:

- Bus supply current
- Bus supply voltage
- 24 VDC I/O supply voltage

Bus supply current

A bus supply current of >2.3 A is displayed as a warning.

Bus supply voltage

A bus supply voltage of <4.7 V is displayed as a warning.

24 VDC I/O supply voltage

An I/O supply voltage of <20.4 V is displayed as a warning.

4.8 Register: ModuleStatus

Bit	Description
0	0 ... No error 1 ... Bus supply warning - overcurrent (>2.3 A) or undercurrent (<4.7 V)
1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V
3 - x	0

4.9 Register: StatusInput01

BOOL	Description
x	0 ... No error 1 ... Bus supply warning - overcurrent (>2.3 A) or undercurrent (<4.7 V)

4.10 Register: StatusInput02

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V

4.11 Register: BusSupplyCurrent, SupplyCurrent

The bus supply current is measured with a resolution of 0.1 A.

4.12 Register: BusSupplyVoltage, SupplyVoltage

The bus supply voltage is measured with a resolution of 0.1 V.

4.13 B&R ID code

Code for module identification ($1BC0).

4.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 42: Minimum cycle time - PS3300

4.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
2 ms

Table 43: Minimum I/O update time - PS3300

5. X20PS3310

5.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 44: Register overview - PS3310

5.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyCurrent	USINT	1	●			
SupplyVoltage	USINT	1	●			

Table 45: Variable assignment in Automation Studio (X2X master) - PS3310

5.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyCurrent	UINT	1	●			
SupplyVoltage	UINT	1	●			

Table 46: Variable assignment in Automation Studio (CANIO) - PS3310

5.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 47: CANopen data points - PS3310

5.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 48: DeviceNet data points - PS3310

5.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 49: Modbus/TCP data points - PS3310

5.7 Module status

The following module states are monitored:

- Bus supply current
- Bus supply voltage
- 24 VDC I/O supply voltage

Bus supply current

A bus supply current of >2.3 A is displayed as a warning.

Bus supply voltage

A bus supply voltage of <4.7 V is displayed as a warning.

24 VDC I/O supply voltage

An I/O supply voltage of <20.4 V is displayed as a warning.

5.8 Register: ModuleStatus

Bit	Description
0	0 ... No error 1 ... Bus supply warning - overcurrent (>2.3 A) or undercurrent (<4.7 V)
1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V
3 - x	0

5.9 Register: StatusInput01

BOOL	Description
x	0 ... No error 1 ... Bus supply warning - overcurrent (>2.3 A) or undercurrent (<4.7 V)

5.10 Register: StatusInput02

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V

5.11 Register: BusSupplyCurrent, SupplyCurrent

The bus supply current is measured with a resolution of 0.1 A.

5.12 Register: BusSupplyVoltage, SupplyVoltage

The bus supply voltage is measured with a resolution of 0.1 V.

5.13 B&R ID code

Code for module identification ($2017).

5.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 50: Minimum cycle time - PS3310

5.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
2 ms

Table 51: Minimum I/O update time - PS3310

6. X20PS9400

6.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 52: Register overview - PS9400

6.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyCurrent	USINT	1	●			
SupplyVoltage	USINT	1	●			

Table 53: Variable assignment in Automation Studio (X2X master) - PS9400

6.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
SupplyCurrent	UINT	1	●			
SupplyVoltage	UINT	1	●			

Table 54: Variable assignment in Automation Studio (CANIO) - PS9400

6.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	ModuleStatus	UINT	1	●	●		
2	BusSupplyCurrent	UINT	1	●	●		
4	BusSupplyVoltage	UINT	1	●	●		

Table 55: CANopen data points - PS9400

6.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 56: DeviceNet data points - PS9400

6.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	ModuleStatus	USINT	1	●	●		
2	BusSupplyCurrent	USINT	1	●	●		
4	BusSupplyVoltage	USINT	1	●	●		

Table 57: Modbus/TCP data points - PS9400

6.7 Module status

The following module states are monitored:

- Bus supply current
- Bus supply voltage
- 24 VDC I/O supply voltage

Bus supply current

A bus supply current of >2.3 A is displayed as a warning.

Bus supply voltage

A bus supply voltage of <4.7 V is displayed as a warning.

24 VDC I/O supply voltage

An I/O supply voltage of <20.4 V is displayed as a warning.

6.8 Register: ModuleStatus

Bit	Description
0	0 ... No error 1 ... Bus supply warning - overcurrent (>2.3 A) or undercurrent (<4.7 V)
1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V
3 - x	0

6.9 Register: StatusInput01

BOOL	Description
x	0 ... No error 1 ... Bus supply warning - overcurrent (>2.3 A) or undercurrent (<4.7 V)

6.10 Register: StatusInput02

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V

6.11 Register: BusSupplyCurrent, SupplyCurrent

The bus supply current is measured with a resolution of 0.1 A.

6.12 Register: BusSupplyVoltage, SupplyVoltage

The bus supply voltage is measured with a resolution of 0.1 V.

6.13 B&R ID code

Code for module identification ($1F8C).

6.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 58: Minimum cycle time - PS9400

6.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
2 ms

Table 59: Minimum I/O update time - PS9400

Chapter 4 • Digital input modules

1. Overview

Digital input modules	Description
X20DI2371	X20 digital input module, 2 inputs, 24 VDC, sink, configurable input filters, 3-wire connections
X20DI2372	X20 digital input module, 2 inputs, 24 VDC, source, configurable input filters, 3-wire connections
X20DI2377	X20 digital input module, 2 inputs, 24 VDC, sink, configurable input filters, 2 event counters 50 kHz
X20DI4371	X20 digital input module, 4 inputs, 24 VDC, sink, configurable input filters, 3-wire connections
X20DI4372	X20 digital input module, 4 inputs, 24 VDC, source, configurable input filters, 3-wire connections
X20DI4760	X20 digital input module, 4 NAMUR inputs, 8.05 VDC
X20DI6371	X20 digital input module, 6 inputs, 24 VDC, sink, configurable input filters, 2-wire connections
X20DI6372	X20 digital input module, 6 inputs, 24 VDC, source, configurable input filters, 2-wire connections
X20DI9371	X20 digital input module, 12 inputs, 24 VDC, sink, configurable input filters, 1-wire connections
X20DI9372	X20 digital input module, 12 inputs, 24 VDC, source, configurable input filters, 1-wire connections

Table 60: Overview of digital input modules

2. X20DI2371

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 61: Register overview - DI2371

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			

Table 62: Variable assignment in Automation Studio (X2X master) - DI2371

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			

Table 63: Variable assignment in Automation Studio (CANIO) - DI2371

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 2	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 64: CANopen data points - DI2371

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 65: DeviceNet data points - DI2371

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 66: Modbus/TCP data points - DI2371

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 μs grid with a network-related jitter of up to 50 μs.

2.7 Register: DigitalInput 1 - 2

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2

2.8 Register: DigitalInput01 - DigitalInput02

BOOL	Description
x	0/1 ... Input status - digital input

2.9 Register: InputFilter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 67: Input filters - DI2371

2.10 B&R ID code

Code for module identification ($1B8D).

2.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering [1]	≥100 µs

Table 68: Minimum cycle time - DI2371

1) At cycle times of <150 µs, filtering is deactivated

2.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 µs
With filtering	≥200 µs

Table 69: Minimum I/O update time - DI2371

3. X20DI2372

3.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 70: Register overview - DI2372

3.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			

Table 71: Variable assignment in Automation Studio (X2X master) - DI2372

3.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			

Table 72: Variable assignment in Automation Studio (CANIO) - DI2371

3.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 2	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 73: CANopen data points - DI2372

3.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 74: DeviceNet data points - DI2372

3.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 75: Modbus/TCP data points - DI2372

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 μs grid with a network-related jitter of up to 50 μs.

3.7 Register: DigitalInput 1 - 2

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2

3.8 Register: DigitalInput01 - DigitalInput02

BOOL	Description
x	0/1 ... Input status - digital input

3.9 Register: InputFilter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 76: Input filters - DI2372

3.10 B&R ID code

Code for module identification ($22A7).

3.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering [1]	≥100 μs

Table 77: Minimum cycle time - DI2372

1) At cycle times of <150 μs, filtering is deactivated

3.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 μs
With filtering	≥200 μs

Table 78: Minimum I/O update time - DI2372

4. X20DI2377

4.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
4	Counter01	UINT	2	●	●		
6	Counter02	UINT	2	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●
20	ConfigurationCounter01	USINT	1		●	●	●
22	ConfigurationCounter02	USINT	1		●	●	●
26	PositiveEdgeInputLatch 1)	USINT	1	●	●		
28	AcknowledgeInputLatch1)	USINT	1		●	●	●

Table 79: Register overview - DI2377

1) Only with function model 1

4.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
Counter01	UINT	2	●			
Counter02	UINT	2	●			
ResetCounter01	BOOL	1			●	
ResetCounter02	BOOL	1			●	
DigitalInput01Latch1)	BOOL	1	●			
DigitalInput02Latch1)	BOOL	1	●			
DigitalInput01LatchAck1)	BOOL	1			●	
DigitalInput02LatchAck1)	BOOL	1			●	

Table 80: Variable assignment in Automation Studio (X2X master) - DI2377

1) Only with function model 1

4.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Counter01	UINT	2	●			
Counter02	UINT	2	●			
ResetCounter01	BOOL	1				●
ResetCounter02	BOOL	1				●

Table 81: Variable assignment in Automation Studio (CANIO) - DI2377

4.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 2	USINT	1		●		
4	Counter01	UINT	2	●	●		
6	Counter02	UINT	2	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●
20	ConfigurationCounter01	USINT	1		●		●
22	ConfigurationCounter02	USINT	1		●		●
26	PositiveEdgeInputLatch	USINT	1		●		
28	AcknowledgeInputLatch	USINT	1		●		●

Table 82: CANopen data points - DI2377

4.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1		●		
4	Counter01	UINT	2	●	●		
6	Counter02	UINT	2	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●
20	ConfigurationCounter01	USINT	1		●		●
22	ConfigurationCounter02	USINT	1		●		●
26	PositiveEdgeInputLatch	USINT	1		●		
28	AcknowledgeInputLatch	USINT	1		●		●

Table 83: DeviceNet data points - DI2377

4.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1		●		
4	Counter01	UINT	2	●	●		
6	Counter02	UINT	2	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●
20	ConfigurationCounter01	USINT	1		●		●
22	ConfigurationCounter02	USINT	1		●		●
26	PositiveEdgeInputLatch	USINT	1		●		
28	AcknowledgeInputLatch	USINT	1		●		●

Table 84: Modbus/TCP data points - DI2377

4.7 Digital inputs

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 µs grid with a network-related jitter of up to 50 µs.

4.8 Register: DigitalInput 1 - 2

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2

4.9 Register: DigitalInput01 - DigitalInput02

BOOL	Description
x	0/1 ... Input status - digital input

4.10 Register: Counter01 - Counter02

Event counter or gate measurement (16-bit counter value) depending on operating mode.

4.11 Register: ResetCounter01 - ResetCounter02

BOOL	Description
x	0 ... No influence on the counter 1 ... Delete counter

4.12 Input filter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 85: Input filters - DI2377

4.13 Counter operation

The following operation modes can be selected:

- Event counter operation
- Gate measurement

Event counter operation

The falling edges are registered on the counter input.

The counter status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Gate measurement

Information:

Only one of the counter channels at a time can be used for gate measurement.

The time of rising to falling edges for the gate input is registered using an internal frequency. The result is checked for overflow ($FFFF) and corrected with the adjustable prescaler.

The recovery time between measurements must be >100 µs.

The measurement result is transferred with the falling edge to the result memory.

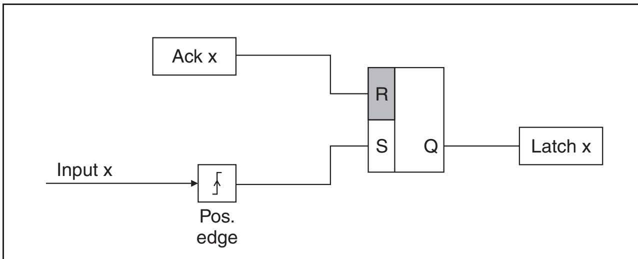
4.14 Register: ConfigurationCounter01 - ConfigurationCounter02

Bit	Description
0 - 3	0000 ... Counter frequency= 48 MHz (only with gate measurement) 0001 ... Counter frequency= 3 MHz (only with gate measurement) 0010 ... Counter frequency= 187.5 kHz (only with gate measurement) 0011 ... Counter frequency= 24 MHz (only with gate measurement) 0100 ... Counter frequency= 12 MHz (only with gate measurement) 0101 ... Counter frequency= 6 MHz (only with gate measurement) 0110 ... Counter frequency= 1.5 MHz (only with gate measurement) 0111 ... Counter frequency= 750 kHz (only with gate measurement) 1000 ... Counter frequency= 375 kHz (only with gate measurement)
4	0
5	0 ... No influence on the counter 1 ... Delete counter
6 - 7	00 ... Event counter measurement 01 ... Gate measurement

4.15 Positive edge input latch

Using this function, the positive edges of the input signal can be latched with a resolution of 200 µs. With the "Acknowledge input latch" function, the input latch is either reset or prevented from latching.

It works in the same way as a dominant reset RS flip-flop.



R	S	Q	Status
0	0	x	Do not change
0	1	1	Set
1	0	0	Reset
1	1	0	Reset

Table 86: Functioning principle of positive edge input latch - DI2377

4.16 Register: InputLatchPositiveEdge

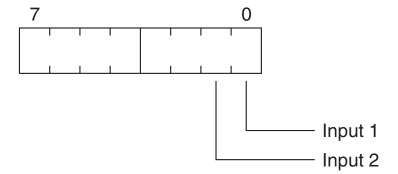


Figure 1: InputLatchPositiveEdge register - DI2377

4.17 Register: DigitalInput01Latch - DigitalInput02Latch

BOOL	Description
x	0/1 ... Latch status - digital input

4.18 Input latch acknowledgement

This function is used to reset the input latches channel by channel.

4.19 Register: AcknowledgeInputLatch

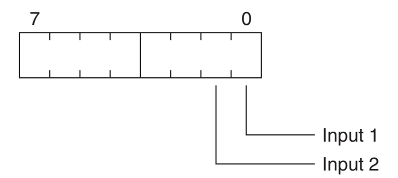


Figure 2: AcknowledgeInputLatch register - DI2377

4.20 Register: DigitalInput01LatchAck - DigitalInput02LatchAck

BOOL	Description
x	0 ... No influence on the latch status 1 ... Resets the latch status

4.21 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

Function model 0: counter module (default)

Function model 0							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
4	Counter01	UINT	2	●	●		
6	Counter02	UINT	2	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●
20	ConfigurationCounter01	USINT	1		●	●	●
22	ConfigurationCounter02	USINT	1		●	●	●

Table 87: Function model 0: counter module (default) - DI2377

Function model 1: counter module with input latch

Function model 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 2	USINT	1	●	●		
4	Counter01	UINT	2	●	●		
6	Counter02	UINT	2	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●
20	ConfigurationCounter01	USINT	1		●	●	●
22	ConfigurationCounter02	USINT	1		●	●	●
26	PositiveEdgeInputLatch	USINT	1	●	●		
28	AcknowledgeInputLatch	USINT	1		●	●	●

Table 88: Function model 1: counter module with input latch - DI2377

4.22 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: counter module (default)	●	●	●	●	●
Function model 1: counter module with input latch	●			●	

Table 89: Function models - DI2377

4.23 B&R ID code

Code for module identification ($1B8E).

4.24 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering 1)	≥100 μs

Table 90: Minimum cycle time - DI2377

1) At cycle times of <150 μs, filtering is deactivated

4.25 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 μs
With filtering	≥200 μs

Table 91: Minimum I/O update time - DI2377

5. X20DI4371

5.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 92: Register overview - DI4371

5.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			

Table 93: Variable assignment in Automation Studio (X2X master) - DI4371

5.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			

Table 94: Variable assignment in Automation Studio (CANIO) - DI4371

5.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 4	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 95: CANopen data points - DI4371

5.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 96: DeviceNet data points - DI4371

5.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 97: Modbus/TCP data points - DI4371

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 μs grid with a network-related jitter of up to 50 μs.

5.7 Register: DigitalInput 1 - 4

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2
2	Input status - digital input 3
3	Input status - digital input 4

5.8 Register: DigitalInput01 - DigitalInput04

BOOL	Description
x	0/1 ... Input status - digital input

5.9 Register: InputFilter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 98: Input filters - DI4371

5.10 B&R ID code

Code for module identification ($1B92).

5.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering 1)	≥100 µs

Table 99: Minimum cycle time - DI4371

1) At cycle times of <150 µs, filtering is deactivated

5.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 µs
With filtering	≥200 µs

Table 100: Minimum I/O update time - DI4371

6. X20DI4372

6.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 101: Register overview - DI4372

6.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			

Table 102: Variable assignment in Automation Studio (X2X master) - DI4372

6.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			

Table 103: Variable assignment in Automation Studio (CANIO) - DI4372

6.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 4	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 104: CANopen data points - DI4372

6.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 105: DeviceNet data points - DI4372

6.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 106: Modbus/TCP data points - DI4372

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 μs grid with a network-related jitter of up to 50 μs.

6.7 Register: DigitalInput 1 - 4

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2
2	Input status - digital input 3
3	Input status - digital input 4

6.8 Register: DigitalInput01 - DigitalInput04

BOOL	Description
x	0/1 ... Input status - digital input

6.9 Register: InputFilter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 107: Input filters - DI4372

6.10 B&R ID code

Code for module identification ($22A8).

6.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering [1]	≥100 µs

Table 108: Minimum cycle time - DI4372

1) At cycle times of <150 µs, filtering is deactivated

6.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 µs
With filtering	≥200 µs

Table 109: Minimum I/O update time - DI4372

7. X20DI4760

7.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
4	Pos. edge counter DigitalInput 1	USINT	1	●	●		
6	Pos. edge counter DigitalInput 2	USINT	1	●	●		
8	Pos. edge counter DigitalInput 3	USINT	1	●	●		
10	Pos. edge counter DigitalInput 4	USINT	1	●	●		
12	Current - channel 1	SINT	1		●		
13	Current - channel 2	SINT	1		●		
14	Current - channel 3	SINT	1		●		
15	Current - channel 4	SINT	1		●		
30	Channel status 1 - 4	USINT	1	●	●		

Table 110: Register overview - DI4760

7.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			

Table 111: Variable assignment in Automation Studio (X2X master) - DI4760

7.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			

Table 112: Variable assignment in Automation Studio (CANIO) - DI4760

7.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 4	USINT	1	●	●		
4	Pos. edge counter DigitalInput 1	USINT	1		●		
6	Pos. edge counter DigitalInput 2	USINT	1		●		
8	Pos. edge counter DigitalInput 3	USINT	1		●		
10	Pos. edge counter DigitalInput 4	USINT	1		●		
12	Current - channel 1	SINT	1		●		
13	Current - channel 2	SINT	1		●		
14	Current - channel 3	SINT	1		●		
15	Current - channel 4	SINT	1		●		
30	Channel status 1 - 4	USINT	1		●		

Table 113: CANopen data points - DI4760

7.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
4	Pos. edge counter DigitalInput 1	USINT	1		●		
6	Pos. edge counter DigitalInput 2	USINT	1		●		
8	Pos. edge counter DigitalInput 3	USINT	1		●		
10	Pos. edge counter DigitalInput 4	USINT	1		●		
12	Current - channel 1	SINT	1		●		
13	Current - channel 2	SINT	1		●		
14	Current - channel 3	SINT	1		●		
15	Current - channel 4	SINT	1		●		
30	Channel status 1 - 4	USINT	1		●		

Table 114: DeviceNet data points - DI4760

7.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 4	USINT	1	●	●		
4	Pos. edge counter DigitalInput 1	USINT	1		●		
6	Pos. edge counter DigitalInput 2	USINT	1		●		
8	Pos. edge counter DigitalInput 3	USINT	1		●		
10	Pos. edge counter DigitalInput 4	USINT	1		●		
12	Current - channel 1	SINT	1		●		
13	Current - channel 2	SINT	1		●		
14	Current - channel 3	SINT	1		●		
15	Current - channel 4	SINT	1		●		
30	Channel status 1 - 4	USINT	1		●		

Table 115: Modbus/TCP data points - DI4760

7.7 Register: DigitalInput 1 - 4

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2
2	Input status - digital input 3
3	Input status - digital input 4

7.8 Register: DigitalInput01 - DigitalInput04

BOOL	Description
x	0/1 ... Input status - digital input

7.9 Register: ChannelStatus 1 - 4

Bit	Description
0	Channel 1 overload
1	Channel 2 overload
2	Channel 3 overload
3	Channel 4 overload
4	Channel 1 wire break
5	Channel 2 wire break
6	Channel 3 wire break
7	Channel 4 wire break

7.10 B&R ID code

Code for module identification ($2105).

7.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Any type of operation	≥100 µs

Table 116: Minimum cycle time - DI4760

7.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Any type of operation	≥500 µs

Table 117: Minimum I/O update time - DI4760

8. X20DI6371

8.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 6	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 118: Register overview - DI6371

8.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			
DigitalInput05	BOOL	1	●			
DigitalInput06	BOOL	1	●			

Table 119: Variable assignment in Automation Studio (X2X master) - DI6371

8.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			
DigitalInput05	BOOL	1	●			
DigitalInput06	BOOL	1	●			

Table 120: Variable assignment in Automation Studio (CANIO) - DI6371

8.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 6	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 121: CANopen data points - DI6371

8.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 6	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 122: DeviceNet data points - DI6371

8.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 6	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 123: Modbus/TCP data points - DI6371

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 μs grid with a network-related jitter of up to 50 μs.

8.7 Register: DigitalInput 1 - 6

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2
2	Input status - digital input 3
3	Input status - digital input 4
4	Input status - digital input 5
5	Input status - digital input 6

8.8 Register: DigitalInput01 - DigitalInput06

BOOL	Description
x	0/1 ... Input status - digital input

8.9 Register: InputFilter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 124: Input filters - DI6371

8.10 B&R ID code

Code for module identification ($1B93).

8.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering [1)]	≥100 µs

Table 125: Minimum cycle time - DI6371

1) At cycle times of <150 µs, filtering is deactivated

8.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 μs
With filtering	≥200 μs

Table 126: Minimum I/O update time - DI6371

9. X20DI6372

9.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 6	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 127: Register overview - DI6372

9.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			
DigitalInput05	BOOL	1	●			
DigitalInput06	BOOL	1	●			

Table 128: Variable assignment in Automation Studio (X2X master) - DI6372

9.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			
DigitalInput05	BOOL	1	●			
DigitalInput06	BOOL	1	●			

Table 129: Variable assignment in Automation Studio (CANIO) - DI6372

9.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 6	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 130: CANopen data points - DI6372

9.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 6	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 131: DeviceNet data points - DI6372

9.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 6	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 132: Modbus/TCP data points - DI6372

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 µs grid with a network-related jitter of up to 50 µs.

9.7 Register: DigitalInput 1 - 6

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2
2	Input status - digital input 3
3	Input status - digital input 4
4	Input status - digital input 5
5	Input status - digital input 6

9.8 Register: DigitalInput01 - DigitalInput06

BOOL	Description
x	0/1 ... Input status - digital input

9.9 Register: InputFilter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 133: Input filters - DI6372

9.10 B&R ID code

Code for module identification ($1B94).

9.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering [1]	≥100 µs

Table 134: Minimum cycle time - DI6372

1) At cycle times of <150 µs, filtering is deactivated

9.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 µs
With filtering	≥200 µs

Table 135: Minimum I/O update time - DI6372

10. X20DI9371

10.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 8	USINT	1	●	●		
1	DigitalInput 9 - 12	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 136: Register overview - DI9371

10.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			
DigitalInput05	BOOL	1	●			
DigitalInput06	BOOL	1	●			
DigitalInput07	BOOL	1	●			
DigitalInput08	BOOL	1	●			
DigitalInput09	BOOL	1	●			
DigitalInput10	BOOL	1	●			
DigitalInput11	BOOL	1	●			
DigitalInput12	BOOL	1	●			

Table 137: Variable assignment in Automation Studio (X2X master) - DI9371

10.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			
DigitalInput05	BOOL	1	●			
DigitalInput06	BOOL	1	●			
DigitalInput07	BOOL	1	●			
DigitalInput08	BOOL	1	●			
DigitalInput09	BOOL	1	●			
DigitalInput10	BOOL	1	●			
DigitalInput11	BOOL	1	●			
DigitalInput12	BOOL	1	●			

Table 138: Variable assignment in Automation Studio (CANIO) - DI9371

10.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 8	USINT	1	●	●		
1	DigitalInput 9 - 12	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 139: CANopen data points - DI9371

10.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 8	USINT	1	●	●		
1	DigitalInput 9 - 12	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 140: DeviceNet data points - DI9371

10.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 8	USINT	1	●	●		
1	DigitalInput 9 - 12	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 141: Modbus/TCP data points - DI9371

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 µs grid with a network-related jitter of up to 50 µs.

10.7 Register: DigitalInput 1 - 8

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2
2	Input status - digital input 3
3	Input status - digital input 4
4	Input status - digital input 5
5	Input status - digital input 6
6	Input status - digital input 7
7	Input status - digital input 8

10.8 Register: DigitalInput 9 - 12

Bit	Description
0	Input status - digital input 9
1	Input status - digital input 10
2	Input status - digital input 11
3	Input status - digital input 12

10.9 Register: DigitalInput01 - DigitalInput12

BOOL	Description
x	0/1 ... Input status - digital input

10.10 Register: InputFilter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 142: Input filters - DI9371

10.11 B&R ID code

Code for module identification ($1B95).

10.12 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering 1)	≥100 µs

Table 143: Minimum cycle time - DI9371

1) At cycle times of <150 µs, filtering is deactivated

10.13 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 µs
With filtering	≥200 µs

Table 144: Minimum I/O update time - DI9371

11. X20DI9372

11.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 8	USINT	1	●	●		
1	DigitalInput 9 - 12	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 145: Register overview - DI9372

11.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			
DigitalInput05	BOOL	1	●			
DigitalInput06	BOOL	1	●			
DigitalInput07	BOOL	1	●			
DigitalInput08	BOOL	1	●			
DigitalInput09	BOOL	1	●			
DigitalInput10	BOOL	1	●			
DigitalInput11	BOOL	1	●			
DigitalInput12	BOOL	1	●			

Table 146: Variable assignment in Automation Studio (X2X master) - DI9372

11.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
DigitalInput03	BOOL	1	●			
DigitalInput04	BOOL	1	●			
DigitalInput05	BOOL	1	●			
DigitalInput06	BOOL	1	●			
DigitalInput07	BOOL	1	●			
DigitalInput08	BOOL	1	●			
DigitalInput09	BOOL	1	●			
DigitalInput10	BOOL	1	●			
DigitalInput11	BOOL	1	●			
DigitalInput12	BOOL	1	●			

Table 147: Variable assignment in Automation Studio (CANIO) - DI9372

11.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	DigitalInput 1 - 8	USINT	1	●	●		
1	DigitalInput 9 - 12	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 148: CANopen data points - DI9372

11.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 8	USINT	1	●	●		
1	DigitalInput 9 - 12	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 149: DeviceNet data points - DI9372

11.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	DigitalInput 1 - 8	USINT	1	●	●		
1	DigitalInput 9 - 12	USINT	1	●	●		
18	InputFilter [0.2 ms]	USINT	1		●		●

Table 150: Modbus/TCP data points - DI9372

Unfiltered

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

Filtered

The filtered status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle. Filtering takes place asynchronous to the network in a 200 µs grid with a network-related jitter of up to 50 µs.

11.7 Register: DigitalInput 1 - 8

Bit	Description
0	Input status - digital input 1
1	Input status - digital input 2
2	Input status - digital input 3
3	Input status - digital input 4
4	Input status - digital input 5
5	Input status - digital input 6
6	Input status - digital input 7
7	Input status - digital input 8

11.8 Register: DigitalInput 9 - 12

Bit	Description
0	Input status - digital input 9
1	Input status - digital input 10
2	Input status - digital input 11
3	Input status - digital input 12

11.9 Register: DigitalInput01 - DigitalInput12

BOOL	Description
x	0/1 ... Input status - digital input

11.10 Register: InputFilter

The filter value can be configured for all digital inputs.

Value	Filter
0	No SW filter
2	0.2 ms
4	0.4 ms
:	:
250	25 ms - higher values are limited to this value

Table 151: Input filters - DI9372

11.11 B&R ID code

Code for module identification ($1D28).

11.12 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering [1)]	≥100 µs

Table 152: Minimum cycle time - DI9372

1) At cycle times of <150 µs, filtering is deactivated

11.13 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Without filtering	≥100 µs
With filtering	≥200 µs

Table 153: Minimum I/O update time - DI9372

Chapter 5 • Digital output modules

1. Overview

Digital output modules	Description
X20DO2321	X20 digital output module, 2 outputs, 24 VDC, 0.5 A, sink, 3-line connections
X20DO2322	X20 digital output module, 2 outputs, 24 VDC, 0.5 A, source, 3-line connections
X20DO2649	X20 digital output module, 2 relays, change-over contacts, 230 VAC / 5 A, 30 VDC / 5 A
X20DO4321	X20 digital output module, 4 outputs, 24 VDC, 0.5 A, sink, 3-line connections
X20DO4322	X20 digital output module, 4 outputs, 24 VDC, 0.5 A, source, 3-line connections
X20DO4331	X20 digital output module, 4 outputs, 24 VDC, 2.0 A, sink, 3-line connections
X20DO4332	X20 digital output module, 4 outputs, 24 VDC, 2.0 A, source, 3-line connections
X20DO4529	X20 digital output module, 4 relays, change-over contacts, 115 VAC / 0.5 A, 30 VDC / 1 A
X20DO6321	X20 digital output module, 6 outputs, 24 VDC, 0.5 A, sink, 2-line connections
X20DO6322	X20 digital output module, 6 outputs, 24 VDC, 0.5 A, source, 2-line connections
X20DO6529	X20 digital output module, 6 relays, N.O. contacts, 115 VAC / 0.5 A, 30 VDC / 1 A
X20DO8331	X20 digital output module, 8 outputs, 24 VDC, 2.0 A, sink, feed directly on module, 1-wire connections
X20DO8332	X20 digital output module, 8 outputs, 24 VDC, 2.0 A, source, feed directly on module, 1-wire connections
X20DO9321	X20 digital output module, 12 outputs, 24 VDC, 0.5 A, sink, 1-line connections
X20DO9322	X20 digital output module, 12 outputs, 24 VDC, 0.5 A, source, 1-line connections

Table 154: Overview of digital output modules

2. X20DO2321

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●
30	StatusDigitalOutput 1 - 2	USINT	1	●	●		

Table 155: Register overview - DO2321

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			

Table 156: Variable assignment in Automation Studio (X2X master) - DO2321

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		

Table 157: Variable assignment in Automation Studio (CANIO) - DO2321

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 2	USINT	1			●	●
30	StatusDigitalOutput 1 - 2	USINT	1		●		

Table 158: CANopen data points - DO2321

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●
30	StatusDigitalOutput 1 - 2	USINT	1	●	●		

Table 159: DeviceNet data points - DO2321

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●
30	StatusDigitalOutput 1 - 2	USINT	1		●		

Table 160: Modbus/TCP data points - DO2321

2.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

2.8 Register: DigitalOutput 1 - 2

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set

2.9 Register: DigitalOutput01 - DigitalOutput02

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

2.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 161: Monitoring status - DO2321

2.11 Register: StatusDigitalOutput 1 - 2

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload

2.12 Register: StatusDigitalOutput01 - StatusDigitalOutput02

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

2.13 B&R ID code

Code for module identification ($22B3).

2.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 162: Minimum cycle time - DO2321

2.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 163: Minimum I/O update time - DO2321

3. X20DO2322

3.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●
30	StatusDigitalOutput 1 - 2	USINT	1	●	●		

Table 164: Register overview - DO2322

3.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			

Table 165: Variable assignment in Automation Studio (X2X master) - DO2322

3.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		

Table 166: Variable assignment in Automation Studio (CANIO) - DO2322

3.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 2	USINT	1			●	●
30	StatusDigitalOutput 1 - 2	USINT	1		●		

Table 167: CANopen data points - DO2322

3.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●
30	StatusDigitalOutput 1 - 2	USINT	1	●	●		

Table 168: DeviceNet data points - DO2322

3.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●
30	StatusDigitalOutput 1 - 2	USINT	1		●		

Table 169: Modbus/TCP data points - DO2322

3.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

3.8 Register: DigitalOutput 1 - 2

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set

3.9 Register: DigitalOutput01 - DigitalOutput02

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

3.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 170: Monitoring status - DO2322

3.11 Register: StatusDigitalOutput 1 - 2

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload

3.12 Register: StatusDigitalOutput01 - StatusDigitalOutput02

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

3.13 B&R ID code

Code for module identification ($1B96).

3.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 171: Minimum cycle time - DO2322

3.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 172: Minimum I/O update time - DO2322

4. X20DO2649

4.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●

Table 173: Register overview - DO2649

4.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	

Table 174: Variable assignment in Automation Studio (X2X master) - DO2649

4.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	

Table 175: Variable assignment in Automation Studio (CANIO) - DO2649

4.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 2	USINT	1			●	●

Table 176: CANopen data points - DO2649

4.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●

Table 177: DeviceNet data points - DO2649

4.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 2	USINT	1			●	●

Table 178: Modbus/TCP data points - DO2649

4.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

4.8 Register: DigitalOutput 1 - 2

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set

4.9 Register: DigitalOutput01 - DigitalOutput02

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

4.10 B&R ID code

Code for module identification ($20DA).

4.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 179: Minimum cycle time - DO2649

4.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 180: Minimum I/O update time - DO2649

5. X20DO4321

5.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1	●	●		

Table 181: Register overview - DO4321

5.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			

Table 182: Variable assignment in Automation Studio (X2X master) - DO4321

5.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		

Table 183: Variable assignment in Automation Studio (CANIO) - DO4321

5.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1		●		

Table 184: CANopen data points - DO4321

5.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1	●	●		

Table 185: DeviceNet data points - DO4321

5.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1		●		

Table 186: Modbus/TCP data points - DO4321

5.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

5.8 Register: DigitalOutput 1 - 4

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set

5.9 Register: DigitalOutput01 - DigitalOutput04

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

5.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 187: Monitoring status - DO4321

5.11 Register: StatusDigitalOutput 1 - 4

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload

5.12 Register: StatusDigitalOutput01 - StatusDigitalOutput04

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

5.13 B&R ID code

Code for module identification ($22B4).

5.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 188: Minimum cycle time - DO4321

5.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 189: Minimum I/O update time - DO4321

6. X20DO4322

6.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1	●	●		

Table 190: Register overview - DO4322

6.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			

Table 191: Variable assignment in Automation Studio (X2X master) - DO4322

6.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		

Table 192: Variable assignment in Automation Studio (CANIO) - DO4322

6.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1		●		

Table 193: CANopen data points - DO4322

6.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1	●	●		

Table 194: DeviceNet data points - DO4322

6.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1		●		

Table 195: Modbus/TCP data points - DO4322

6.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

6.8 Register: DigitalOutput 1 - 4

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set

6.9 Register: DigitalOutput01 - DigitalOutput04

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

6.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 196: Monitoring status - DO4322

6.11 Register: StatusDigitalOutput 1 - 4

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload

6.12 Register: StatusDigitalOutput01 - StatusDigitalOutput04

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

6.13 B&R ID code

Code for module identification ($1B97).

6.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 197: Minimum cycle time - DO4322

6.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 198: Minimum I/O update time - DO4322

7. X20DO4331

7.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1	●	●		

Table 199: Register overview - DO4331

7.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			

Table 200: Variable assignment in Automation Studio (X2X master) - DO4331

7.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		

Table 201: Variable assignment in Automation Studio (CANIO) - DO4331

7.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1		●		

Table 202: CANopen data points - DO4331

7.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1	●	●		

Table 203: DeviceNet data points - DO4331

7.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1		●		

Table 204: Modbus/TCP data points - DO4331

7.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

7.8 Register: DigitalOutput 1 - 4

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set

7.9 Register: DigitalOutput01 - DigitalOutput04

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

7.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 205: Monitoring status - DO4331

7.11 Register: StatusDigitalOutput 1 - 4

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload

7.12 Register: StatusDigitalOutput01 - StatusDigitalOutput04

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

7.13 B&R ID code

Code for module identification ($22B5).

7.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 206: Minimum cycle time - DO4331

7.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 207: Minimum I/O update time - DO4331

8. X20DO4332

8.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1	●	●		

Table 208: Register overview - DO4332

8.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			

Table 209: Variable assignment in Automation Studio (X2X master) - DO4332

8.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		

Table 210: Variable assignment in Automation Studio (CANIO) - DO4332

8.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1		●		

Table 211: CANopen data points - DO4332

8.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1	●	●		

Table 212: DeviceNet data points - DO4332

8.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●
30	StatusDigitalOutput 1 - 4	USINT	1		●		

Table 213: Modbus/TCP data points - DO4332

8.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

8.8 Register: DigitalOutput 1 - 4

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set

8.9 Register: DigitalOutput01 - DigitalOutput04

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

8.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 214: Monitoring status - DO4332

8.11 Register: StatusDigitalOutput 1 - 4

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload

8.12 Register: StatusDigitalOutput01 - StatusDigitalOutput04

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

8.13 B&R ID code

Code for module identification ($1B9C).

8.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 215: Minimum cycle time - DO4332

8.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 216: Minimum I/O update time - DO4332

9. X20DO4529

9.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●

Table 217: Register overview - DO4529

9.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	

Table 218: Variable assignment in Automation Studio (X2X master) - DO4529

9.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	

Table 219: Variable assignment in Automation Studio (CANIO) - DO4529

9.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 4	USINT	1			●	●

Table 220: CANopen data points - DO4529

9.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●

Table 221: DeviceNet data points - DO4529

9.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 4	USINT	1			●	●

Table 222: Modbus/TCP data points - DO4529

9.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

9.8 Register: DigitalOutput 1 - 4

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set

9.9 Register: DigitalOutput01 - DigitalOutput04

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

9.10 B&R ID code

Code for module identification ($20D9).

9.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 µs

Table 223: Minimum cycle time - DO4529

9.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 224: Minimum I/O update time - DO4529

10. X20DO6321

10.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●
30	StatusDigitalOutput 1 - 6	USINT	1	●	●		

Table 225: Register overview - DO6321

10.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			
StatusDigitalOutput05	BOOL	1	●			
StatusDigitalOutput06	BOOL	1	●			

Table 226: Variable assignment in Automation Studio (X2X master) - DO6321

10.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		
StatusDigitalOutput05	BOOL	1		●		
StatusDigitalOutput06	BOOL	1		●		

Table 227: Variable assignment in Automation Studio (CANIO) - DO6321

10.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 6	USINT	1			●	●
30	StatusDigitalOutput 1 - 6	USINT	1		●		

Table 228: CANopen data points - DO6321

10.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●
30	StatusDigitalOutput 1 - 6	USINT	1	●	●		

Table 229: DeviceNet data points - DO6321

10.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●
30	StatusDigitalOutput 1 - 6	USINT	1		●		

Table 230: Modbus/TCP data points - DO6321

10.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

10.8 Register: DigitalOutput 1 - 6

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set

10.9 Register: DigitalOutput01 - DigitalOutput06

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

10.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 231: Monitoring status - DO6321

10.11 Register: StatusDigitalOutput 1 - 6

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload
4	0 ... Channel 5: No error 1 ... Channel 5: Short circuit or overload
5	0 ... Channel 6: No error 1 ... Channel 6: Short circuit or overload

10.12 Register: StatusDigitalOutput01 - StatusDigitalOutput06

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

10.13 B&R ID code

Code for module identification ($1B99).

10.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 232: Minimum cycle time - DO6321

10.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 233: Minimum I/O update time - DO6321

11. X20DO6322

11.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●
30	StatusDigitalOutput 1 - 6	USINT	1	●	●		

Table 234: Register overview - DO6322

11.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			
StatusDigitalOutput05	BOOL	1	●			
StatusDigitalOutput06	BOOL	1	●			

Table 235: Variable assignment in Automation Studio (X2X master) - DO6322

11.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		
StatusDigitalOutput05	BOOL	1		●		
StatusDigitalOutput06	BOOL	1		●		

Table 236: Variable assignment in Automation Studio (CANIO) - DO6322

11.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 6	USINT	1			●	●
30	StatusDigitalOutput 1 - 6	USINT	1		●		

Table 237: CANopen data points - DO6322

11.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●
30	StatusDigitalOutput 1 - 6	USINT	1	●	●		

Table 238: DeviceNet data points - DO6322

11.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●
30	StatusDigitalOutput 1 - 6	USINT	1		●		

Table 239: Modbus/TCP data points - DO6322

11.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

11.8 Register: DigitalOutput 1 - 6

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set

11.9 Register: DigitalOutput01 - DigitalOutput06

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

11.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 240: Monitoring status - DO6322

11.11 Register: StatusDigitalOutput 1 - 6

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload
4	0 ... Channel 5: No error 1 ... Channel 5: Short circuit or overload
5	0 ... Channel 6: No error 1 ... Channel 6: Short circuit or overload

11.12 Register: StatusDigitalOutput01 - StatusDigitalOutput06

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

11.13 B&R ID code

Code for module identification ($1B98).

11.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 241: Minimum cycle time - DO6322

11.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 242: Minimum I/O update time - DO6322

12. X20DO6529

12.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●

Table 243: Register overview - DO6529

12.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	

Table 244: Variable assignment in Automation Studio (X2X master) - DO6529

12.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	

Table 245: Variable assignment in Automation Studio (CANIO) - DO6529

12.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 6	USINT	1			●	●

Table 246: CANopen data points - DO6529

12.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●

Table 247: DeviceNet data points - DO6529

12.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 6	USINT	1			●	●

Table 248: Modbus/TCP data points - DO6529

12.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

12.8 Register: DigitalOutput 1 - 6

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set

12.9 Register: DigitalOutput01 - DigitalOutput06

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

12.10 B&R ID code

Code for module identification ($2019).

12.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 249: Minimum cycle time - DO6529

12.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 250: Minimum I/O update time - DO6529

13. X20DO8331

13.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
4	DigitalOutputDelayed 1 - 8[1)]	USINT	1			●	●
6	DigitalOutputSwitchingMask 1 - 8[1)]	USINT	1			●	●
8	DelayTime[1)]	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
8196	OperatingLimitStatus	USINT	1	●			

Table 251: Register overview - DO8331

1) Only with function model 1

13.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
DigitalOutput07	BOOL	1			●	
DigitalOutput08	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			
StatusDigitalOutput05	BOOL	1	●			
StatusDigitalOutput06	BOOL	1	●			
StatusDigitalOutput07	BOOL	1	●			
StatusDigitalOutput08	BOOL	1	●			
PowerSupply01	BOOL	1	●			
OutputDelayTime[1)]	USINT	1			●	
DigitalOutput01DelayEnable[1)]	BOOL	1			●	
DigitalOutput02DelayEnable[1)]	BOOL	1			●	
DigitalOutput03DelayEnable[1)]	BOOL	1			●	
DigitalOutput04DelayEnable[1)]	BOOL	1			●	
DigitalOutput05DelayEnable[1)]	BOOL	1			●	
DigitalOutput06DelayEnable[1)]	BOOL	1			●	
DigitalOutput07DelayEnable[1)]	BOOL	1			●	
DigitalOutput08DelayEnable[1)]	BOOL	1			●	
DigitalOutput01Delayed[1)]	BOOL	1			●	
DigitalOutput02Delayed[1)]	BOOL	1			●	
DigitalOutput03Delayed[1)]	BOOL	1			●	
DigitalOutput04Delayed[1)]	BOOL	1			●	

Table 252: Variable assignment in Automation Studio (X2X master) - DO8331

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput05Delayed[1)]	BOOL	1			●	
DigitalOutput06Delayed[1)]	BOOL	1			●	
DigitalOutput07Delayed[1)]	BOOL	1			●	
DigitalOutput08Delayed[1)]	BOOL	1			●	

Table 252: Variable assignment in Automation Studio (X2X master) - DO8331

1) Only with function model 1

13.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
DigitalOutput07	BOOL	1			●	
DigitalOutput08	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		
StatusDigitalOutput05	BOOL	1		●		
StatusDigitalOutput06	BOOL	1		●		
StatusDigitalOutput07	BOOL	1		●		
StatusDigitalOutput08	BOOL	1		●		
PowerSupply01	BOOL	1		●		

Table 253: Variable assignment in Automation Studio (CANIO) - DO8331

13.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 8	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1		●		

Table 254: CANopen data points - DO8331

13.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		

Table 255: DeviceNet data points - DO8331

13.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1		●		

Table 256: Modbus/TCP data points - DO8331

13.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

13.8 Register: DigitalOutput 1 - 8

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set
6	0 ... Digital output 7 reset 1 ... Digital output 7 set
7	0 ... Digital output 8 reset 1 ... Digital output 8 set

13.9 Register: DigitalOutput01 - DigitalOutput08

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

13.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 257: Monitoring status - DO8331

13.11 Register: StatusDigitalOutput 1 - 8

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload
4	0 ... Channel 5: No error 1 ... Channel 5: Short circuit or overload
5	0 ... Channel 6: No error 1 ... Channel 6: Short circuit or overload
6	0 ... Channel 7: No error 1 ... Channel 7: Short circuit or overload
7	0 ... Channel 8: No error 1 ... Channel 8: Short circuit or overload

13.12 Register: StatusDigitalOutput01 - StatusDigitalOutput08

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

13.13 Operating limit monitoring

The module's output supply is monitored. An I/O supply voltage of <20.4 V is displayed as a warning.

13.14 Register: OperatingLimitStatus

Bit	Description
0 - 1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V
3 - 7	0

13.15 Register: PowerSupply01

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V

13.16 Additional function - switch digital outputs w/ delay using switching mask

In function model 1 the digital outputs can be operated with a timer on a 100 μs basis and with your choice of switching mask. After the delay time has expired, the digital outputs are adjusted according to the switching mask and the delayed output pattern.

Procedure:

The delay time is changed or set to 0:
Output status = status is taken from register 2

After delay time has expired:
Output status = (register 2 AND INV(register 6)) OR (register 4 AND register 6)

Register 2 = Register: DigitalOutput 1 - 8 or Register: DigitalOutput01 - DigitalOutput08

Register 4 = Register: DigitalOutputDelayed 1 - 8 or
Register: DigitalOutput01Delayed - DigitalOutput08Delayed

Register 6 = Register: DigitalOutputSwitchingMask 1 - 8 or
Register: DigitalOutput01DelayEnable - DigitalOutput08DelayEnable

13.17 Register: DigitalOutputDelayed 1 - 8

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set
6	0 ... Digital output 7 reset 1 ... Digital output 7 set
7	0 ... Digital output 8 reset 1 ... Digital output 8 set

13.18 Register: DigitalOutput01Delayed - DigitalOutput08Delayed

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

13.19 Register: DigitalOutputSwitchingMask 1 - 8

Bit	Description
0	0 ... Digital output 1 remains unchanged 1 ... Digital output 1 is toggled
1	0 ... Digital output 2 remains unchanged 1 ... Digital output 2 is toggled
2	0 ... Digital output 3 remains unchanged 1 ... Digital output 3 is toggled
3	0 ... Digital output 4 remains unchanged 1 ... Digital output 4 is toggled
4	0 ... Digital output 5 remains unchanged 1 ... Digital output 5 is toggled
5	0 ... Digital output 6 remains unchanged 1 ... Digital output 6 is toggled
6	0 ... Digital output 7 remains unchanged 1 ... Digital output 7 is toggled
7	0 ... Digital output 8 remains unchanged 1 ... Digital output 8 is toggled

13.20 Register: DigitalOutput01DelayEnable - DigitalOutput08DelayEnable

BOOL	Description
x	0 ... Digital output remains unchanged 1 ... Digital output is toggled

13.21 Register: DelayTime, OutputDelayTime

After the delay time has expired (100 µs base), the digital outputs are adjusted according to the switching mask (register 6) and the delayed output pattern (register 4).

Register 6 = Register: DigitalOutputSwitchingMask 1 - 8 or
Register: DigitalOutput01DelayEnable - DigitalOutput08DelayEnable

Register 4 = Register: DigitalOutputDelayed 1 - 8 or
Register: DigitalOutput01Delayed - DigitalOutput08Delayed

Value	Delay time
0	Delay activated
1	0.1 ms
2	0.2 ms
:	:
250	25 ms

13.22 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

13.22.1 Function model 0: digital outputs (default)

Function model 0							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
8196	OperatingLimitStatus	USINT	1	●			

Table 258: Function model 0: digital outputs (default) - DO8331

13.22.2 Function model 1: digital outputs with toggle function

Function model 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
4	DigitalOutputDelayed 1 - 8	USINT	1			●	●
6	DigitalOutputSwitchingMask 1 - 8	USINT	1			●	●
8	DelayTime	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
8196	OperatingLimitStatus	USINT	1	●			

Table 259: Function model 1: digital outputs with toggle function - DO8331

13.23 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: digital output module (default)	●	●	●	●	●
Function model 1: digital output module with toggle function	●			●	

Table 260: Function models - DO8331

13.24 B&R ID code

Code for module identification ($22EB).

13.25 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Function model 0	≥100 μs
Function model 1	≥150 μs

Table 261: Minimum cycle time - DO8331

13.25.1 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Function model 0	Equal to the minimum cycle time
Function model 1	Equal to the minimum cycle time

Table 262: Minimum I/O update time - DO8331

14. X20DO8332

14.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
4	DigitalOutputDelayed 1 - 8[1)]	USINT	1			●	●
6	DigitalOutputSwitchingMask 1 - 8[1)]	USINT	1			●	●
8	DelayTime[1)]	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
8196	OperatingLimitStatus	USINT	1	●			

Table 263: Register overview - DO8332

1) Only with function model 1

14.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
DigitalOutput07	BOOL	1			●	
DigitalOutput08	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			
StatusDigitalOutput05	BOOL	1	●			
StatusDigitalOutput06	BOOL	1	●			
StatusDigitalOutput07	BOOL	1	●			
StatusDigitalOutput08	BOOL	1	●			
PowerSupply01	BOOL	1	●			
OutputDelayTime1)	USINT	1			●	
DigitalOutput01DelayEnable1)	BOOL	1			●	
DigitalOutput02DelayEnable1)	BOOL	1			●	
DigitalOutput03DelayEnable1)	BOOL	1			●	
DigitalOutput04DelayEnable1)	BOOL	1			●	
DigitalOutput05DelayEnable1)	BOOL	1			●	
DigitalOutput06DelayEnable1)	BOOL	1			●	
DigitalOutput07DelayEnable1)	BOOL	1			●	
DigitalOutput08DelayEnable1)	BOOL	1			●	
DigitalOutput01Delayed1)	BOOL	1			●	
DigitalOutput02Delayed1)	BOOL	1			●	
DigitalOutput03Delayed1)	BOOL	1			●	
DigitalOutput04Delayed1)	BOOL	1			●	
DigitalOutput05Delayed1)	BOOL	1			●	
DigitalOutput06Delayed1)	BOOL	1			●	
DigitalOutput07Delayed1)	BOOL	1			●	
DigitalOutput08Delayed1)	BOOL	1			●	

Table 264: Variable assignment in Automation Studio (X2X master) - DO8332

1) Only with function model 1

14.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
DigitalOutput07	BOOL	1			●	
DigitalOutput08	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		
StatusDigitalOutput05	BOOL	1		●		
StatusDigitalOutput06	BOOL	1		●		
StatusDigitalOutput07	BOOL	1		●		
StatusDigitalOutput08	BOOL	1		●		
PowerSupply01	BOOL	1		●		

Table 265: Variable assignment in Automation Studio (CANIO) - DO8332

14.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 8	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1		●		

Table 266: CANopen data points - DO8332

14.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		

Table 267: DeviceNet data points - DO8332

14.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1		●		

Table 268: Modbus/TCP data points - DO8331

14.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

14.8 Register: DigitalOutput 1 - 8

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set
6	0 ... Digital output 7 reset 1 ... Digital output 7 set
7	0 ... Digital output 8 reset 1 ... Digital output 8 set

14.9 Register: DigitalOutput01 - DigitalOutput08

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

14.10 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 269: Monitoring status - DO8332

14.11 Register: StatusDigitalOutput 1 - 8

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload
4	0 ... Channel 5: No error 1 ... Channel 5: Short circuit or overload
5	0 ... Channel 6: No error 1 ... Channel 6: Short circuit or overload
6	0 ... Channel 7: No error 1 ... Channel 7: Short circuit or overload
7	0 ... Channel 8: No error 1 ... Channel 8: Short circuit or overload

14.12 Register: StatusDigitalOutput01 - StatusDigitalOutput08

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

14.13 Operating limit monitoring

The module's output supply is monitored. An I/O supply voltage of <20.4 V is displayed as a warning.

14.14 Register: OperatingLimitStatus

Bit	Description
0 - 1	0
2	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V
3 - 7	0

14.15 Register: PowerSupply01

BOOL	Description
x	0 ... I/O supply above the warning level of 20.4 V 1 ... I/O supply below the warning level of 20.4 V

14.16 Additional function - switch digital outputs with delay using switching mask

In function model 1 the digital outputs can be operated with a timer on a 100 μs basis and with your choice of switching mask. After the delay time has expired, the digital outputs are adjusted according to the switching mask and the delayed output pattern.

Procedure:

The delay time is changed or set to 0:
Output status = status is taken from register 2

After delay time has expired:
Output status = (register 2 AND INV(register 6)) OR (register 4 AND register 6)

Register 2 = Register: DigitalOutput 1 - 8 or
Register: DigitalOutput01 - DigitalOutput08

Register 4 = Register: DigitalOutputDelayed 1 - 8 or
Register: DigitalOutput01Delayed - DigitalOutput08Delayed

Register 6 = Register: DigitalOutputSwitchingMask 1 - 8 or
Register: DigitalOutput01DelayEnable - DigitalOutput08DelayEnable

14.17 Register: DigitalOutputDelayed 1 - 8

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set
6	0 ... Digital output 7 reset 1 ... Digital output 7 set
7	0 ... Digital output 8 reset 1 ... Digital output 8 set

14.18 Register: DigitalOutput01Delayed - DigitalOutput08Delayed

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

14.19 Register: DigitalOutputSwitchingMask 1 - 8

Bit	Description
0	0 ... Digital output 1 remains unchanged 1 ... Digital output 1 is toggled
1	0 ... Digital output 2 remains unchanged 1 ... Digital output 2 is toggled
2	0 ... Digital output 3 remains unchanged 1 ... Digital output 3 is toggled
3	0 ... Digital output 4 remains unchanged 1 ... Digital output 4 is toggled
4	0 ... Digital output 5 remains unchanged 1 ... Digital output 5 is toggled
5	0 ... Digital output 6 remains unchanged 1 ... Digital output 6 is toggled
6	0 ... Digital output 7 remains unchanged 1 ... Digital output 7 is toggled
7	0 ... Digital output 8 remains unchanged 1 ... Digital output 8 is toggled

14.20 Register: DigitalOutput01DelayEnable - DigitalOutput08DelayEnable

BOOL	Description
x	0 ... Digital output remains unchanged 1 ... Digital output is toggled

14.21 Register: DelayTime, OutputDelayTime

After the delay time has expired (100 µs base), the digital outputs are adjusted according to the switching mask (register 6) and the delayed output pattern (register 4).

Register 6 = Register: DigitalOutputSwitchingMask 1 - 8 or
Register: DigitalOutput01DelayEnable - DigitalOutput08DelayEnable

Register 4 = Register: DigitalOutputDelayed 1 - 8 or
Register: DigitalOutput01Delayed - DigitalOutput08Delayed

Value	Delay time
0	Delay activated
1	0.1 ms
2	0.2 ms
:	:
250	25 ms

14.22 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

14.22.1 Function model 0: digital outputs (default)

Function model 0							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
8196	OperatingLimitStatus	USINT	1	●			

Table 270: Function model 0: digital outputs (default) - DO8332

14.22.2 Function model 1: digital outputs with toggle function

Function model 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
4	DigitalOutputDelayed 1 - 8	USINT	1			●	●
6	DigitalOutputSwitchingMask 1 - 8	USINT	1			●	●
8	DelayTime	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
8196	OperatingLimitStatus	USINT	1	●			

Table 271: Function model 1: digital outputs with toggle function - DO8332

14.23 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: digital output module (default)	●	●	●	●	●
Function model 1: digital output module with toggle function	●			●	

Table 272: Function models - DO8332

14.24 B&R ID code

Code for module identification ($1B9D).

14.25 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Function model 0	≥100 µs
Function model 1	≥150 µs

Table 273: Minimum cycle time - DO8332

14.26 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Function model 0	Equal to the minimum cycle time
Function model 1	Equal to the minimum cycle time

Table 274: Minimum I/O update time - DO8332

15. X20DO9321

15.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
3	DigitalOutput 9 - 12	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
31	StatusDigitalOutput 9 - 12	USINT	1	●	●		

Table 275: Register overview - DO9321

15.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
DigitalOutput07	BOOL	1			●	
DigitalOutput08	BOOL	1			●	
DigitalOutput09	BOOL	1			●	
DigitalOutput10	BOOL	1			●	
DigitalOutput11	BOOL	1			●	
DigitalOutput12	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			
StatusDigitalOutput05	BOOL	1	●			
StatusDigitalOutput06	BOOL	1	●			
StatusDigitalOutput07	BOOL	1	●			
StatusDigitalOutput08	BOOL	1	●			
StatusDigitalOutput09	BOOL	1	●			
StatusDigitalOutput10	BOOL	1	●			
StatusDigitalOutput11	BOOL	1	●			
StatusDigitalOutput12	BOOL	1	●			

Table 276: Variable assignment in Automation Studio (X2X master) - DO9321

15.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
DigitalOutput07	BOOL	1			●	
DigitalOutput08	BOOL	1			●	
DigitalOutput09	BOOL	1			●	
DigitalOutput10	BOOL	1			●	
DigitalOutput11	BOOL	1			●	
DigitalOutput12	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		
StatusDigitalOutput05	BOOL	1		●		
StatusDigitalOutput06	BOOL	1		●		
StatusDigitalOutput07	BOOL	1		●		
StatusDigitalOutput08	BOOL	1		●		
StatusDigitalOutput09	BOOL	1		●		
StatusDigitalOutput10	BOOL	1		●		
StatusDigitalOutput11	BOOL	1		●		
StatusDigitalOutput12	BOOL	1		●		

Table 277: Variable assignment in Automation Studio (CANIO) - DO9321

15.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 8	USINT	1			●	●
3	DigitalOutput 9 - 12	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1		●		
31	StatusDigitalOutput 9 - 12	USINT	1		●		

Table 278: CANopen data points - DO9321

15.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
3	DigitalOutput 9 - 12	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
31	StatusDigitalOutput 9 - 12	USINT	1	●	●		

Table 279: DeviceNet data points - DO9321

15.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
3	DigitalOutput 9 - 12	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1		●		
31	StatusDigitalOutput 9 - 12	USINT	1		●		

Table 280: Modbus/TCP data points - DO9321

15.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

15.8 Register: DigitalOutput 1 - 8

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set
6	0 ... Digital output 7 reset 1 ... Digital output 7 set
7	0 ... Digital output 8 reset 1 ... Digital output 8 set

15.9 Register: DigitalOutput 9 - 12

Bit	Description
0	0 ... Digital output 9 reset 1 ... Digital output 9 set
1	0 ... Digital output 10 reset 1 ... Digital output 10 set
2	0 ... Digital output 11 reset 1 ... Digital output 11 set
3	0 ... Digital output 12 reset 1 ... Digital output 12 set

15.10 Register: DigitalOutput01 - DigitalOutput12

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

15.11 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 281: Monitoring status - DO9321

15.12 Register: StatusDigitalOutput 1 - 8

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload
4	0 ... Channel 5: No error 1 ... Channel 5: Short circuit or overload
5	0 ... Channel 6: No error 1 ... Channel 6: Short circuit or overload
6	0 ... Channel 7: No error 1 ... Channel 7: Short circuit or overload
7	0 ... Channel 8: No error 1 ... Channel 8: Short circuit or overload

15.13 Register: StatusDigitalOutput 9 - 12

Bit	Description
0	0 ... Channel 9: No error 1 ... Channel 9: Short circuit or overload
1	0 ... Channel 10: No error 1 ... Channel 10: Short circuit or overload
2	0 ... Channel 11: No error 1 ... Channel 11: Short circuit or overload
3	0 ... Channel 12: No error 1 ... Channel 12: Short circuit or overload

15.14 Register: StatusDigitalOutput01 - StatusDigitalOutput12

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

15.15 B&R ID code

Code for module identification ($1B9B).

15.16 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 282: Minimum cycle time - DO9321

15.17 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 283: Minimum I/O update time - DO9321

16. X20DO9322

16.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
3	DigitalOutput 9 - 12	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
31	StatusDigitalOutput 9 - 12	USINT	1	●	●		

Table 284: Register overview - DO9322

16.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
DigitalOutput07	BOOL	1			●	
DigitalOutput08	BOOL	1			●	
DigitalOutput09	BOOL	1			●	
DigitalOutput10	BOOL	1			●	
DigitalOutput11	BOOL	1			●	
DigitalOutput12	BOOL	1			●	
StatusDigitalOutput01	BOOL	1	●			
StatusDigitalOutput02	BOOL	1	●			
StatusDigitalOutput03	BOOL	1	●			
StatusDigitalOutput04	BOOL	1	●			
StatusDigitalOutput05	BOOL	1	●			
StatusDigitalOutput06	BOOL	1	●			
StatusDigitalOutput07	BOOL	1	●			
StatusDigitalOutput08	BOOL	1	●			
StatusDigitalOutput09	BOOL	1	●			
StatusDigitalOutput10	BOOL	1	●			
StatusDigitalOutput11	BOOL	1	●			
StatusDigitalOutput12	BOOL	1	●			

Table 285: Variable assignment in Automation Studio (X2X master) - DO9322

16.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
DigitalOutput01	BOOL	1			●	
DigitalOutput02	BOOL	1			●	
DigitalOutput03	BOOL	1			●	
DigitalOutput04	BOOL	1			●	
DigitalOutput05	BOOL	1			●	
DigitalOutput06	BOOL	1			●	
DigitalOutput07	BOOL	1			●	
DigitalOutput08	BOOL	1			●	
DigitalOutput09	BOOL	1			●	
DigitalOutput10	BOOL	1			●	
DigitalOutput11	BOOL	1			●	
DigitalOutput12	BOOL	1			●	
StatusDigitalOutput01	BOOL	1		●		
StatusDigitalOutput02	BOOL	1		●		
StatusDigitalOutput03	BOOL	1		●		
StatusDigitalOutput04	BOOL	1		●		
StatusDigitalOutput05	BOOL	1		●		
StatusDigitalOutput06	BOOL	1		●		
StatusDigitalOutput07	BOOL	1		●		
StatusDigitalOutput08	BOOL	1		●		
StatusDigitalOutput09	BOOL	1		●		
StatusDigitalOutput10	BOOL	1		●		
StatusDigitalOutput11	BOOL	1		●		
StatusDigitalOutput12	BOOL	1		●		

Table 286: Variable assignment in Automation Studio (CANIO) - DO9322

16.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	DigitalOutput 1 - 8	USINT	1			●	●
3	DigitalOutput 9 - 12	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1		●		
31	StatusDigitalOutput 9 - 12	USINT	1		●		

Table 287: CANopen data points - DO9322

16.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
3	DigitalOutput 9 - 12	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1	●	●		
31	StatusDigitalOutput 9 - 12	USINT	1	●	●		

Table 288: DeviceNet data points - DO9322

16.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	DigitalOutput 1 - 8	USINT	1			●	●
3	DigitalOutput 9 - 12	USINT	1			●	●
30	StatusDigitalOutput 1 - 8	USINT	1		●		
31	StatusDigitalOutput 9 - 12	USINT	1		●		

Table 289: Modbus/TCP data points - DO9322

16.7 Digital outputs

The output status is transferred to the output channels using a fixed offset to the network cycle.

16.8 Register: DigitalOutput 1 - 8

Bit	Description
0	0 ... Digital output 1 reset 1 ... Digital output 1 set
1	0 ... Digital output 2 reset 1 ... Digital output 2 set
2	0 ... Digital output 3 reset 1 ... Digital output 3 set
3	0 ... Digital output 4 reset 1 ... Digital output 4 set
4	0 ... Digital output 5 reset 1 ... Digital output 5 set
5	0 ... Digital output 6 reset 1 ... Digital output 6 set
6	0 ... Digital output 7 reset 1 ... Digital output 7 set
7	0 ... Digital output 8 reset 1 ... Digital output 8 set

16.9 Register: DigitalOutput 9 - 12

Bit	Description
0	0 ... Digital output 9 reset 1 ... Digital output 9 set
1	0 ... Digital output 10 reset 1 ... Digital output 10 set
2	0 ... Digital output 11 reset 1 ... Digital output 11 set
3	0 ... Digital output 12 reset 1 ... Digital output 12 set

16.10 Register: DigitalOutput01 - DigitalOutput12

BOOL	Description
x	0 ... Digital output channel reset 1 ... Digital output channel set

16.11 Output monitoring status

The output states for the outputs are compared to the set values on the module. The control for the output driver is used for the set states.

A change in the output status resets the monitoring for this output. The status of each individual channel can be read. A change in monitoring status triggers an error message.

Monitoring status	Description
0	Digital output channel: No error
1	Digital output channel: Short circuit or overload

Table 290: Monitoring status - DO9322

16.12 Register: StatusDigitalOutput 1 - 8

Bit	Description
0	0 ... Channel 1: No error 1 ... Channel 1: Short circuit or overload
1	0 ... Channel 2: No error 1 ... Channel 2: Short circuit or overload
2	0 ... Channel 3: No error 1 ... Channel 3: Short circuit or overload
3	0 ... Channel 4: No error 1 ... Channel 4: Short circuit or overload
4	0 ... Channel 5: No error 1 ... Channel 5: Short circuit or overload
5	0 ... Channel 6: No error 1 ... Channel 6: Short circuit or overload
6	0 ... Channel 7: No error 1 ... Channel 7: Short circuit or overload
7	0 ... Channel 8: No error 1 ... Channel 8: Short circuit or overload

16.13 Register: StatusDigitalOutput 9 - 12

Bit	Description
0	0 ... Channel 9: No error 1 ... Channel 9: Short circuit or overload
1	0 ... Channel 10: No error 1 ... Channel 10: Short circuit or overload
2	0 ... Channel 11: No error 1 ... Channel 11: Short circuit or overload
3	0 ... Channel 12: No error 1 ... Channel 12: Short circuit or overload

16.14 Register: StatusDigitalOutput01 - StatusDigitalOutput12

BOOL	Description
x	0 ... Digital output channel: No error 1 ... Digital output channel: Short circuit or overload

16.15 B&R ID code

Code for module identification ($1B9A).

16.16 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥100 μs

Table 291: Minimum cycle time - DO9322

16.17 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
Equal to the minimum cycle time

Table 292: Minimum I/O update time - DO9322

Chapter 7 • Analog input modules

1. Overview

Analog input modules	Description
X20AI2622	X20 analog input module, 2 inputs, ±10 V / 0 to 20 mA, 12-bit resolution, configurable input filters
X20AI4622	X20 analog input module, 4 inputs, ±10 V / 0 to 20 mA, 12-bit resolution, configurable input filters

Table 293: Overview of analog input modules

2. X20AI2622

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogInput01	INT	2	●	●		
2	AnalogInput02	INT	2	●	●		
16	InputFilter	USINT	1		●	●	●
18	ChannelType	USINT	1		●	●	●
30	StatusInput01	USINT	1	●	●		

Table 294: Register overview - AI2622

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogInput01	INT	2	●			
AnalogInput02	INT	2	●			
StatusInput01	USINT	1	●			

Table 295: Variable assignment in Automation Studio (X2X master) - AI2622

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogInput01	INT	2	●			
AnalogInput02	INT	2	●			
StatusInput01	USINT	1		●		

Table 296: Variable assignment in Automation Studio (CANIO) - AI2622

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	AnalogInput01	INT	2	●	●		
2	AnalogInput02	INT	2	●	●		
16	InputFilter	USINT	1		●		●
18	ChannelType	USINT	1		●		●
30	StatusInput01	USINT	1		●		

Table 297: CANopen data points - AI2622

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogInput01	INT	2	●	●		
2	AnalogInput02	INT	2	●	●		
16	InputFilter	USINT	1		●		●
18	ChannelType	USINT	1		●		●
30	StatusInput01	USINT	1	●	●		

Table 298: DeviceNet data points - AI2622

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogInput01	INT	2	●	●		
2	AnalogInput02	INT	2	●	●		
16	InputFilter	USINT	1		●		●
18	ChannelType	USINT	1		●		●
30	StatusInput01	USINT	1	●	●		

Table 299: Modbus/TCP data points - AI2622

2.7 Analog inputs

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

2.8 Register: AnalogInput01 - AnalogInput02

Analog input value with respect to operating mode:

Input signal	Digital value
Voltage signal -10 VDC to +10 VDC	-32768 to +32767
Current signal 0 mA to 20 mA	0 to +32767

2.9 Input filter

The module is equipped with a configurable input filter. The minimum cycle time must be >500 µs. Filtering is deactivated for shorter cycle times.

If the input filter is active, then the channels are scanned in ms cycles. The time offset between the channels is 200 µs. The conversion takes place asynchronously to the network cycle.

2.9.1 Input ramp limitation

Input ramp limitation can only take place when a filter is used. Input ramp limitation is executed before filtering takes place.

The amount of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value ± the limit value.

Adjustable limit values:

Code	Limit value
0	The input value is used without limitation.
1	$3FFF = 16383
2	$1FFF = 8191
3	$0FFF = 4095
4	$07FF = 2047
5	$03FF = 1023
6	$01FF = 511
7	$00FF = 255

Table 300: Input ramp limit values - AI2622

The input ramp limitation is well suited for suppressing disturbances (spikes). The following examples show the function of the input ramp limitation based on an input jump and a disturbance.

Example 1: The input value makes a jump from 8,000 to 17,000. The diagram displays the adjusted input value for the following settings:

Input ramp limitation = 4 = $07FF = 2047

Filter level = 2

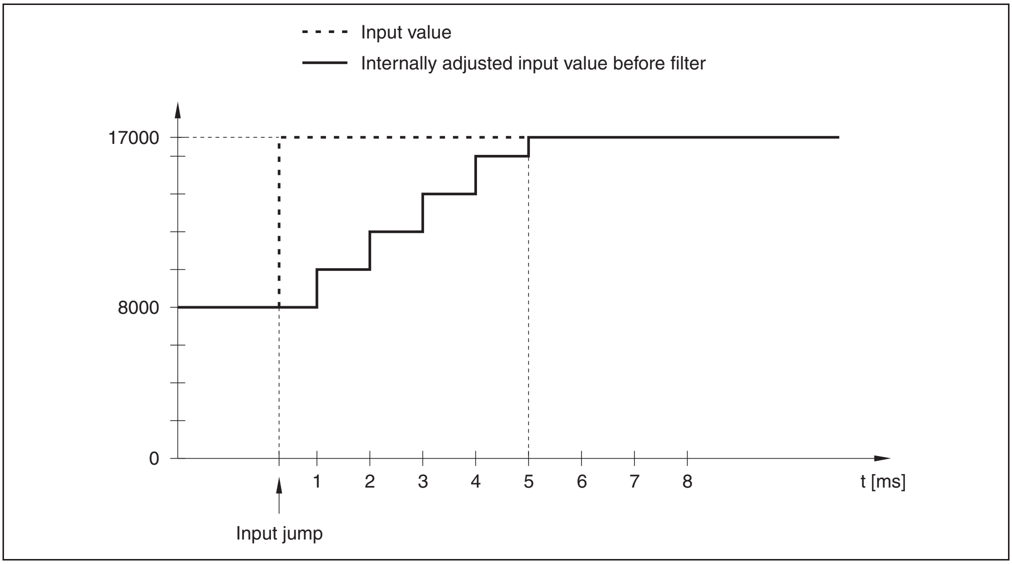


Figure 3: Input value adjusted for input jump - AI2622

Example 2: A disturbance is imposed on the input value. The diagram shows the adjusted input value with the following settings:

Input ramp limitation = 4 = $07FF = 2047

Filter level = 2

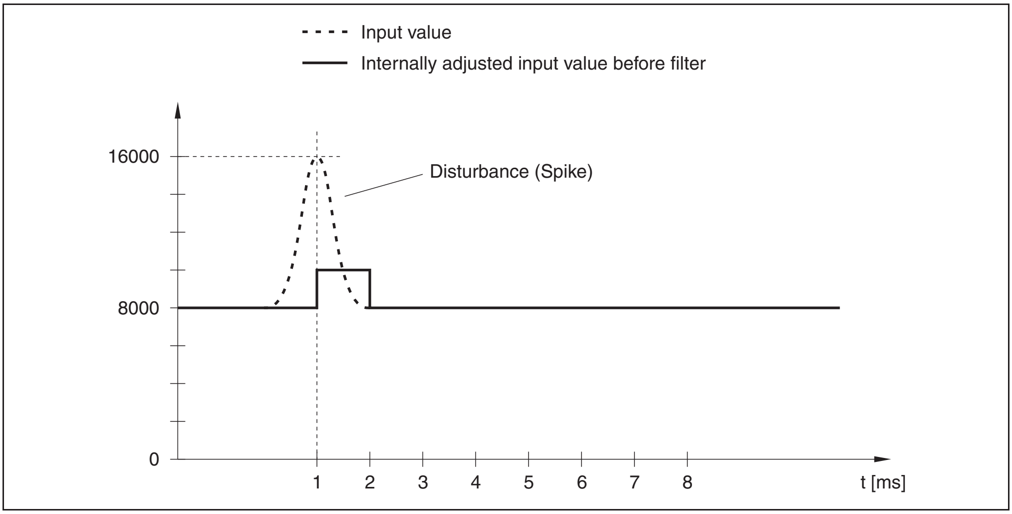


Figure 4: Input value adjusted for disturbance - AI2622

2.9.2 Filter level

The input value is evaluated according to the filter level. An input ramp limitation can then be applied using this evaluation.

Formula for the evaluation of the input value:

$$\mathrm{Value_{new}} = \mathrm{Value_{old}} - \frac{\mathrm{Value_{new}}}{\mathrm{FilterLevel}} + \frac{\mathrm{InputValue}}{\mathrm{FilterLevel}}$$

Adjustable filter levels:

Code	Filter level
0	Filter switched off
1	Filter level 2
2	Filter level 4
3	Filter level 8
4	Filter level 16
5	Filter level 32
6	Filter level 64
7	Filter level 128

Table 301: Adjustable filter levels - AI2622

The following examples show the function of the input ramp limitation based on an input jump and a disturbance.

Example 1: The input value makes a jump from 8,000 to 16,000. The diagram displays the evaluated value with the following settings:

Input ramp limitation = 0

Filter level = 2 or 4

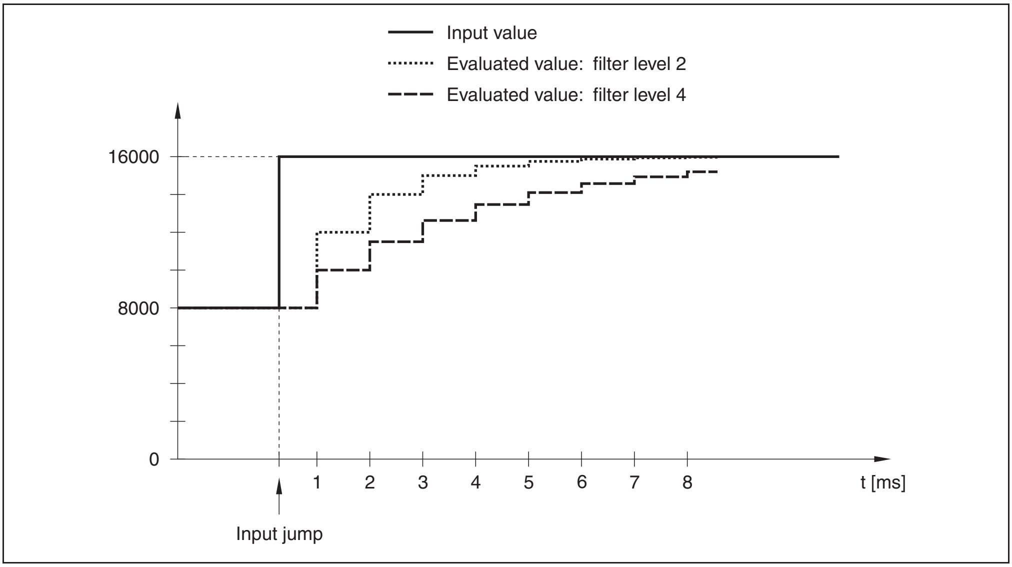


Figure 5: Evaluated value during input jump - AI2622

Example 2: A disturbance is imposed on the input value. The diagram shows the evaluated value with the following settings:

Input ramp limitation = 0

Filter level = 2 or 4

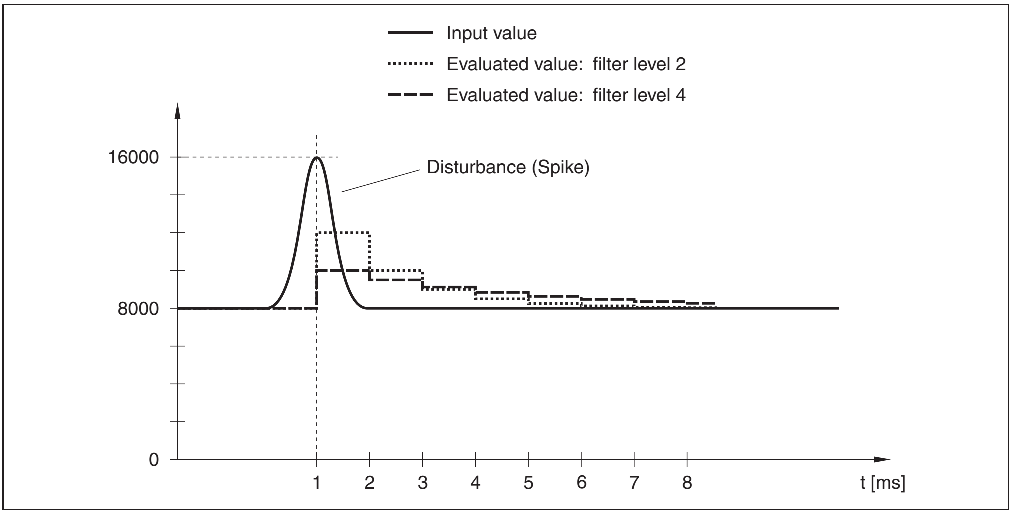


Figure 6: Evaluated value during disturbance - AI2622

2.10 Register: InputFilter

Bit	Description
0 - 2	The filter level is defined using these bits. 000 ... Filter switched off 001 ... Filter level 2 010 ... Filter level 4 011 ... Filter level 8 100 ... Filter level 16 101 ... Filter level 32 110 ... Filter level 64 111 ... Filter level 128
3	0
4 - 6	The input ramp limit is defined using these bits. 000 ... The input value is used without limitation 001 ... Limit value = $3FFF = 16383 010 ... Limit value = $1FFF = 8191 011 ... Limit value = $0FFF = 4095 100 ... Limit value = $07FF = 2047 101 ... Limit value = $03FF = 1023 110 ... Limit value = $01FF = 511 111 ... Limit value = $00FF = 255
7	0

2.11 Channel type

Each channel is capable of either current or voltage signals.

The type of signal is determined by the connection terminals used. Since current and voltage require different adjustment values, it is also necessary to configure the desired type of input signal.

Code	Input signal
0	Voltage signal (default)
1	Current signal

Table 302: Channel type - AI2622

2.12 Register: ChannelType

Bit	Description
0	0 ... Channel 1: Voltage signal 1 ... Channel 1: Current signal
1	0 ... Channel 2: Voltage signal 1 ... Channel 2: Current signal
2 - 7	0

2.13 Input status

The module's inputs are monitored. A change in monitoring status triggers an error message.

Code	Voltage signal	Current signal
0	No error	No error
1	Below lower limit value	The input value has a lower limit of $0000. Underflow monitoring is therefore not necessary.
2	Above upper limit value	Above upper limit value
3	Wire break	-

Table 303: Input status - AI2622

2.14 Register: StatusInput01

Bit	Voltage signal description	Current signal description
0 - 1	Channel 1: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break	Channel 1: 00 ... No error 10 ... Above upper limit value
2 - 3	Channel 2: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break	Channel 2: 00 ... No error 10 ... Above upper limit value
4 - 7	0	0

In addition to the status info, the error type also sets the analog value as follows:

Error type	Digital value for error
Wire break	+32767 (0x7FFF)
Above upper limit value	+32767 (0x7FFF)
Below lower limit value	-32767 (0x8001)
Invalid value	-32768 (0x8000)

2.15 B&R ID code

Code for module identification ($1B9E).

2.16 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Inputs without filtering	≥100 µs
Inputs with filtering	>500 µs

Table 304: Minimum cycle time - AI2622

2.17 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Inputs without filtering	300 µs for all inputs
Inputs with filtering	≥1 ms

Table 305: Minimum I/O update time - AI2622

3. X20AI4622

3.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogInput01	INT	2	●	●		
2	AnalogInput02	INT	2	●	●		
4	AnalogInput03	INT	2	●	●		
6	AnalogInput04	INT	2	●	●		
16	InputFilter	USINT	1		●	●	●
18	ChannelType	USINT	1		●	●	●
30	StatusInput01	USINT	1	●	●		

Table 306: Register overview - AI4622

3.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogInput01	INT	2	●			
AnalogInput02	INT	2	●			
AnalogInput03	INT	2	●			
AnalogInput04	INT	2	●			
StatusInput01	USINT	1	●			

Table 307: Variable assignment in Automation Studio (X2X master) - AI4622

3.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogInput01	INT	2	●			
AnalogInput02	INT	2	●			
AnalogInput03	INT	2	●			
AnalogInput04	INT	2	●			
StatusInput01	USINT	1		●		

Table 308: Variable assignment in Automation Studio (CANIO) - AI4622

3.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	AnalogInput01	INT	2	●	●		
2	AnalogInput02	INT	2	●	●		
4	AnalogInput03	INT	2	●	●		
6	AnalogInput04	INT	2	●	●		
16	InputFilter	USINT	1		●		●
18	ChannelType	USINT	1		●		●
30	StatusInput01	USINT	1		●		

Table 309: CANopen data points - AI4622

3.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogInput01	INT	2	●	●		
2	AnalogInput02	INT	2	●	●		
4	AnalogInput03	INT	2	●	●		
6	AnalogInput04	INT	2	●	●		
16	InputFilter	USINT	1		●		●
18	ChannelType	USINT	1		●		●
30	StatusInput01	USINT	1	●	●		

Table 310: DeviceNet data points - AI4622

3.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogInput01	INT	2	●	●		
2	AnalogInput02	INT	2	●	●		
4	AnalogInput03	INT	2	●	●		
6	AnalogInput04	INT	2	●	●		
16	InputFilter	USINT	1		●		●
18	ChannelType	USINT	1		●		●
30	StatusInput01	USINT	1	●	●		

Table 311: Modbus/TCP data points - AI4622

3.7 Analog inputs

The input status is registered with a fixed offset with respect to the network cycle and is transferred in the same cycle.

3.8 Register: AnalogInput01 - AnalogInput04

Analog input value with respect to operating mode:

Input signal	Digital value
Voltage signal -10 VDC to +10 VDC	-32768 to +32767
Current signal 0 mA to 20 mA	0 to +32767

3.9 Input filter

The module is equipped with a configurable input filter. The minimum cycle time must be >500 µs. Filtering is deactivated for shorter cycle times.

If the input filter is active, then the channels are scanned in ms cycles. The time offset between the channels is 200 µs. The conversion takes place asynchronously to the network cycle.

3.9.1 Input ramp limitation

Input ramp limitation can only take place when a filter is used. Input ramp limitation is executed before filtering takes place.

The difference of the change in the input value is checked to make sure the specified limits are not exceeded. If the values are exceeded, the adjusted input value is equal to the old value ± the limit value.

Adjustable limit values:

Code	Limit value
0	The input value is used without limitation.
1	$3FFF = 16383
2	$1FFF = 8191
3	$0FFF = 4095
4	$07FF = 2047
5	$03FF = 1023
6	$01FF = 511
7	$00FF = 255

Table 312: Input ramp limit values - AI4622

The input ramp limitation is well suited for suppressing disturbances (spikes). The following examples show the function of the input ramp limitation based on an input jump and a disturbance.

Example 1: The input value makes a jump from 8,000 to 17,000. The diagram displays the adjusted input value for the following settings:

Input ramp limitation = 4 = $07FF = 2047

Filter level = 2

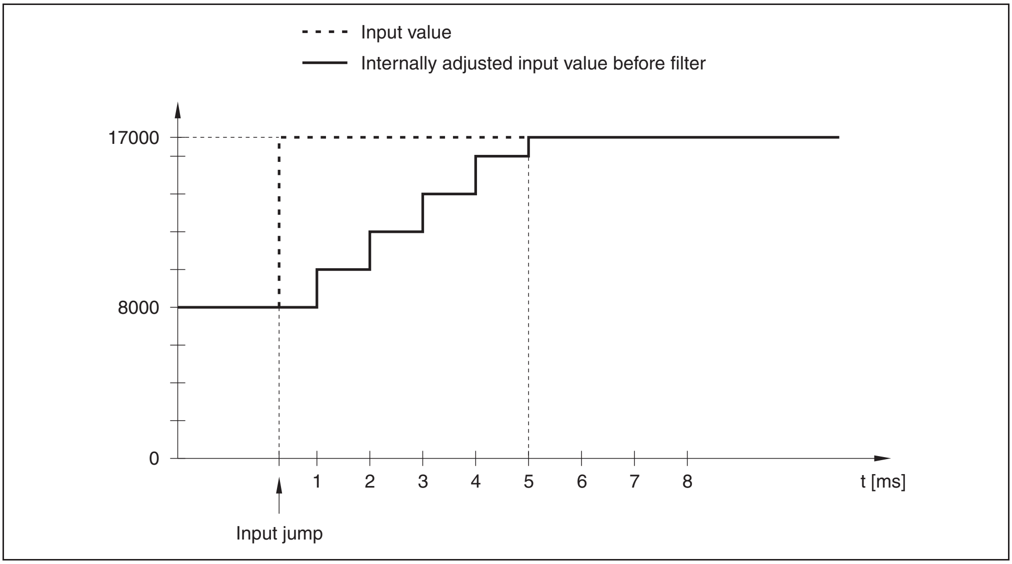


Figure 7: Input value adjusted for input jump - AI4622

Example 2: A disturbance is imposed on the input value. The diagram shows the adjusted input value with the following settings:

Input ramp limitation = 4 = $07FF = 2047

Filter level = 2

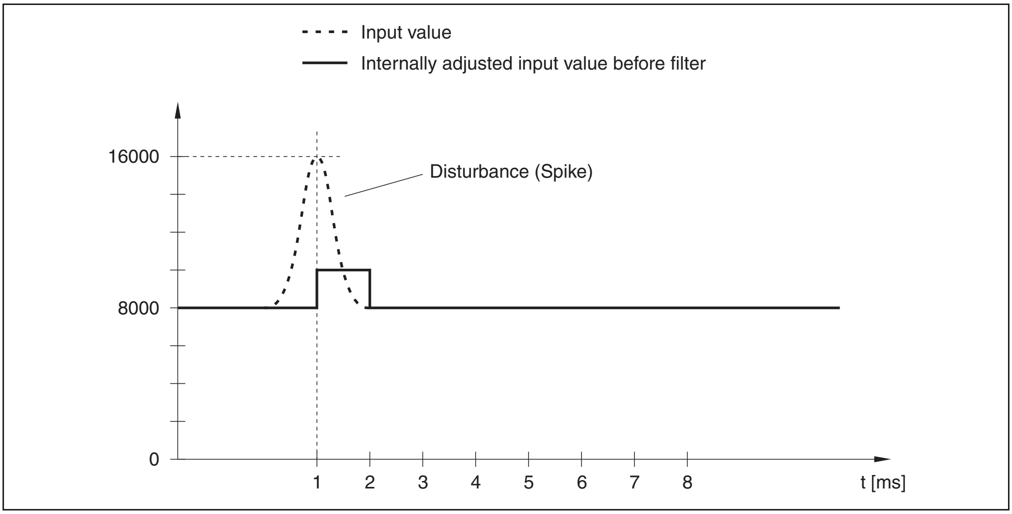


Figure 8: Input value adjusted for disturbance - AI4622

3.9.2 Filter level

Depending on the filter level, the input value is more strongly or less strongly evaluated. The evaluation is then made for a possible input ramp limitation.

Formula for the evaluation of the input value:

$$Value_{new} = Value_{old} - \frac{Value_{old}}{FilterLevel} + \frac{InputValue}{FilterLevel}$$

Adjustable filter levels:

Code	Filter level
0	Filter switched off
1	Filter level 2
2	Filter level 4
3	Filter level 8
4	Filter level 16
5	Filter level 32
6	Filter level 64
7	Filter level 128

Table 313: Adjustable filter levels - AI4622

The following examples show the function of the input ramp limitation based on an input jump and a disturbance.

Example 1: The input value makes a jump from 8,000 to 16,000. The diagram displays the evaluated value with the following settings:

Input ramp limitation = 0

Filter level = 2 or 4

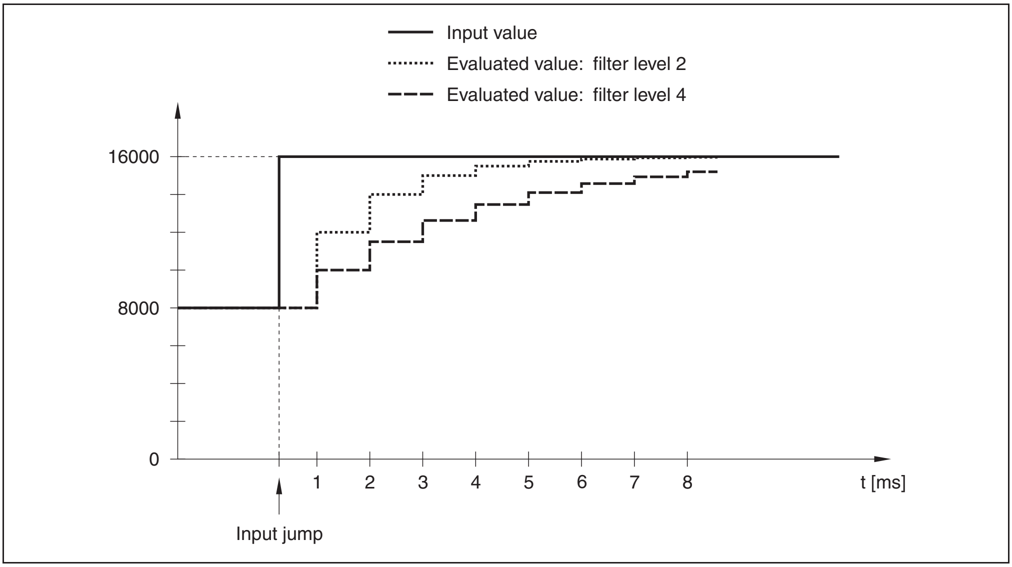


Figure 9: Evaluated value during input jump - AI4622

Example 2: A disturbance is imposed on the input value. The diagram shows the evaluated value with the following settings:

Input ramp limitation = 0

Filter level = 2 or 4

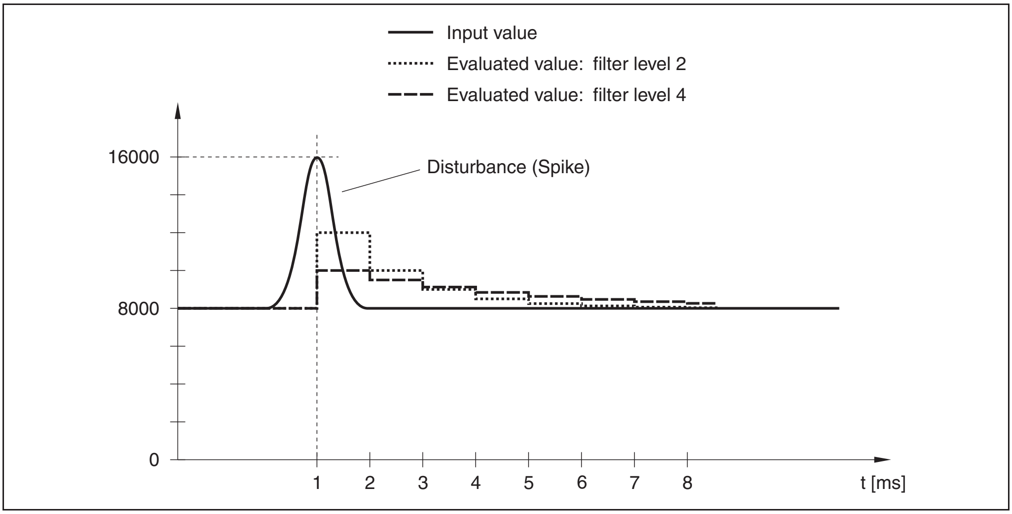


Figure 10: Evaluated value during disturbance - AI4622

3.10 Register: InputFilter

Bit	Description
0 - 2	The filter level is defined using these bits. 000 ... Filter switched off 001 ... Filter level 2 010 ... Filter level 4 011 ... Filter level 8 100 ... Filter level 16 101 ... Filter level 32 110 ... Filter level 64 111 ... Filter level 128
3	0
4 - 6	The input ramp limit is defined using these bits. 000 ... The input value is used without limitation 001 ... Limit value = $3FFF = 16383 010 ... Limit value = $1FFF = 8191 011 ... Limit value = $0FFF = 4095 100 ... Limit value = $07FF = 2047 101 ... Limit value = $03FF = 1023 110 ... Limit value = $01FF = 511 111 ... Limit value = $00FF = 255
7	0

3.11 Channel type

Each channel is capable of either current or voltage signals.

The type of signal is determined by the connection terminals used. Since current and voltage require different adjustment values, it is also necessary to configure the desired type of input signal.

Code	Input signal
0	Voltage signal (default)
1	Current signal

Table 314: Channel type - AI4622

3.12 Register: ChannelType

Bit	Description
0	0 ... Channel 1: Voltage signal 1 ... Channel 1: Current signal
1	0 ... Channel 2: Voltage signal 1 ... Channel 2: Current signal
2	0 ... Channel 3: Voltage signal 1 ... Channel 3: Current signal
3	0 ... Channel 4: Voltage signal 1 ... Channel 4: Current signal
4 - 7	0

3.13 Input status

The module's inputs are monitored. A change in monitoring status triggers an error message.

Code	Voltage signal	Current signal
0	No error	No error
1	Below lower limit value	The input value has a lower limit of $0000. Underflow monitoring is therefore not necessary.
2	Above upper limit value	Above upper limit value
3	Wire break	-

Table 315: Input status - AI4622

3.14 Register: StatusInput01

Bit	Voltage signal description	Current signal description
0 - 1	Channel 1: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break	Channel 1: 00 ... No error 10 ... Above upper limit value
2 - 3	Channel 2: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break	Channel 2: 00 ... No error 10 ... Above upper limit value
4 - 5	Channel 3: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break	Channel 3: 00 ... No error 10 ... Above upper limit value
6 - 7	Channel 4: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break	Channel 4: 00 ... No error 10 ... Above upper limit value

In addition to the status info, the error type also sets the analog value as follows:

Error type	Digital value for error
Wire break	+32767 (0x7FFF)
Above upper limit value	+32767 (0x7FFF)
Below lower limit value	-32767 (0x8001)
Invalid value	-32768 (0x8000)

3.15 B&R ID code

Code for module identification ($1BAA).

3.16 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Inputs without filtering	≥100 µs
Inputs with filtering	>500 µs

Table 316: Minimum cycle time - AI4622

3.17 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Inputs without filtering	300 µs for all inputs
Inputs with filtering	≥1 ms

Table 317: Minimum I/O update time - AI4622

Chapter 8 • Analog output modules

1. Overview

Analog output modules	Description
X20AO2622	X20 analog output module, 2 outputs, ±10 V / 0 to 20 mA, 12-bit resolution
X20AO2632	X20 analog output module, 2 outputs, ±10 V / 0 to 20 mA, 16-bit resolution
X20AO4622	X20 analog output module, 4 outputs, ±10 V / 0 to 20 mA, 12-bit resolution
X20AO4632	X20 analog output module, 4 outputs, ±10 V / 0 to 20 mA, 16-bit resolution

Table 318: Overview of analog output modules

2. X20AO2622

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
18	ChannelType	USINT	1		●	●	●

Table 319: Register overview - AO2622

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogOutput01	INT	2			●	
AnalogOutput02	INT	2			●	

Table 320: Variable assignment in Automation Studio (X2X master) - AO2622

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogOutput01	INT	2			●	
AnalogOutput02	INT	2			●	

Table 321: Variable assignment in Automation Studio (CANIO) - AO2622

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
18	ChannelType	USINT	1		●		●

Table 322: CANopen data points - AO2622

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
18	ChannelType	USINT	1		●		●

Table 323: DeviceNet data points - AO2622

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
18	ChannelType	USINT	1		●		●

Table 324: Modbus/TCP data points - AO2622

2.7 Analog outputs

Each channel can be configured for either current or voltage signals. The type of signal is also determined by the connection terminals used.

2.8 Register: AnalogOutput01 - AnalogOutput02

Analog output value with respect to operating mode:

Digital value	Output signal
-32768 to +32767	Voltage signal -10 VDC to +10 VDC
0 to +32767	Current signal 0 mA to 20 mA

2.9 Channel type

Each channel is capable of either current or voltage signals.

The type of signal is determined by the connection terminals used. Since current and voltage require different adjustment values, it is also necessary to configure the desired type of output signal.

Code	Output signal
0	Voltage signal (default)
1	Current signal

Table 325: Channel type - AO2622

2.10 Register: ChannelType

Bit	Description
0	0 ... Channel 1: Voltage signal 1 ... Channel 1: Current signal
1	0 ... Channel 2: Voltage signal 1 ... Channel 2: Current signal
2 - 7	0

2.11 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

Function model 0: Jitter-free I/O (default)

The output of corrected values occurs in the next cycle with a minimum cycle of ≥300 μs. This minimizes jitter.

Function model 1: Fast reaction I/O

The output of corrected values occurs in the same cycle with a minimum cycle of ≥300 μs.

Comparison of the two function models

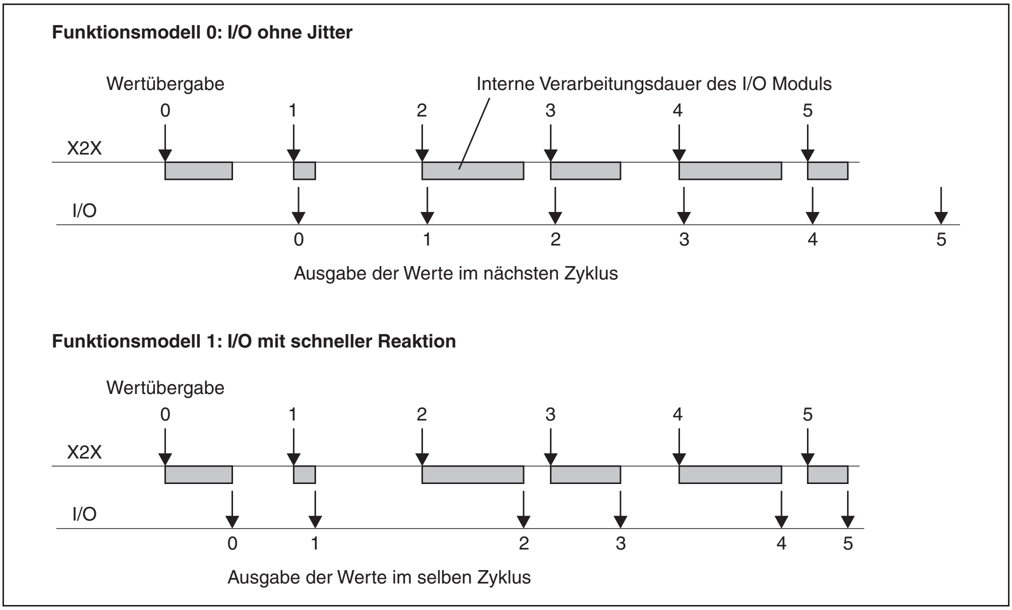


Figure 11: Function model comparison - AO2622

The registers used are identical for all function models:

Function models 0 and 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
18	ChannelType	USINT	1		●	●	●

Table 326: Function models 0 and 1 - AO2622

2.12 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: Jitter-free I/O (default)	●	●	●	●	●
Function model 1: I/O with fast reaction	●			●	

Table 327: Function models - AO2622

2.13 B&R ID code

Code for module identification ($1BA2).

2.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Minimum cycle time	≥250 μs

Table 328: Minimum cycle time - AO2622

2.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
For all outputs	<300 μs

Table 329: Minimum I/O update time - AO2622

3. X20AO2632

3.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	AnalogOutput01	INT	2			●	●
4	AnalogOutput02	INT	2			●	●
0	ChannelType	UINT	2				●

Table 330: Register overview - AO2632

3.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogOutput01	INT	2			●	
AnalogOutput02	INT	2			●	

Table 331: Variable assignment in Automation Studio (X2X master) - AO2632

3.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogOutput01	INT	2			●	
AnalogOutput02	INT	2			●	

Table 332: Variable assignment in Automation Studio (CANIO) - AO2632

3.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	AnalogOutput01	INT	2			●	●
4	AnalogOutput02	INT	2			●	●
0	ChannelType	UINT	2				●

Table 333: CANopen data points - AO2632

3.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	AnalogOutput01	INT	2			●	●
4	AnalogOutput02	INT	2			●	●
0	ChannelType	UINT	2				●

Table 334: DeviceNet data points - AO2632

3.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	AnalogOutput01	INT	2			●	●
4	AnalogOutput02	INT	2			●	●
0	ChannelType	UINT	2				●

Table 335: Modbus/TCP data points - AO2632

3.7 Analog outputs

Each channel can be configured for either current or voltage signals. The type of signal is also determined by the connection terminals used.

3.8 Register: AnalogOutput01 - AnalogOutput02

Analog output value with respect to operating mode:

Digital value	Output signal
-32768 to +32767	Voltage signal -10 VDC to +10 VDC
0 to +32767	Current signal 0 mA to 20 mA

3.9 Channel type

Each channel is capable of either current or voltage signals.

The type of signal is determined by the connection terminals used. Since current and voltage require different adjustment values, it is also necessary to configure the desired type of output signal.

Code	Output signal
0	Voltage signal (default)
1	Current signal

Table 336: Channel type - AO2632

3.10 Register: ChannelType

Bit	Description
0 - 7	0
8	0 ... Channel 1: Voltage signal 1 ... Channel 1: Current signal
9	0 ... Channel 2: Voltage signal 1 ... Channel 2: Current signal
10 - 15	0

3.11 B&R ID code

Code for module identification ($1BA4).

3.12 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Minimum cycle time	≥200 µs

Table 337: Minimum cycle time - AO2632

3.13 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
For all outputs	≥200 µs

Table 338: Minimum I/O update time - AO2632

4. X20AO4622

4.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
4	AnalogOutput03	INT	2			●	●
6	AnalogOutput04	INT	2			●	●
18	ChannelType	USINT	1		●	●	●

Table 339: Register overview - AO4622

4.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogOutput01	INT	2			●	
AnalogOutput02	INT	2			●	
AnalogOutput03	INT	2			●	
AnalogOutput04	INT	2			●	

Table 340: Variable assignment in Automation Studio (X2X master) - AO4622

4.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogOutput01	INT	2			●	
AnalogOutput02	INT	2			●	
AnalogOutput03	INT	2			●	
AnalogOutput04	INT	2			●	

Table 341: Variable assignment in Automation Studio (CANIO) - AO4622

4.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
4	AnalogOutput03	INT	2			●	●
6	AnalogOutput04	INT	2			●	●
18	ChannelType	USINT	1		●		●

Table 342: CANopen data points - AO4622

4.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
4	AnalogOutput03	INT	2			●	●
6	AnalogOutput04	INT	2			●	●
18	ChannelType	USINT	1		●		●

Table 343: DeviceNet data points - AO4622

4.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
4	AnalogOutput03	INT	2			●	●
6	AnalogOutput04	INT	2			●	●
18	ChannelType	USINT	1		●		●

Table 344: Modbus/TCP data points - AO4622

4.7 Analog outputs

Each channel can be configured for either current or voltage signals. The type of signal is also determined by the connection terminals used.

4.8 Register: AnalogOutput01 - AnalogOutput04

Analog output value with respect to operating mode:

Digital value	Output signal
-32768 to +32767	Voltage signal -10 VDC to +10 VDC
0 to +32767	Current signal 0 mA to 20 mA

4.9 Channel type

Each channel is capable of either current or voltage signals.

The type of signal is determined by the connection terminals used. Since current and voltage require different adjustment values, it is also necessary to configure the desired type of output signal.

Code	Output signal
0	Voltage signal (default)
1	Current signal

Table 345: Channel type - AO4622

4.10 Register: ChannelType

Bit	Description
0	0 ... Channel 1: Voltage signal 1 ... Channel 1: Current signal
1	0 ... Channel 2: Voltage signal 1 ... Channel 2: Current signal
2	0 ... Channel 3: Voltage signal 1 ... Channel 3: Current signal
3	0 ... Channel 4: Voltage signal 1 ... Channel 4: Current signal
4 - 7	0

4.11 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

Function model 0: Jitter-free I/O (default)

The output of corrected values occurs in the next cycle with a minimum cycle of $\geq$400 µs. This minimizes jitter.

Function model 1: Fast reaction I/O

The output of corrected values occurs in the same cycle with a minimum cycle of ≥400 μs.

Comparison of the two function models

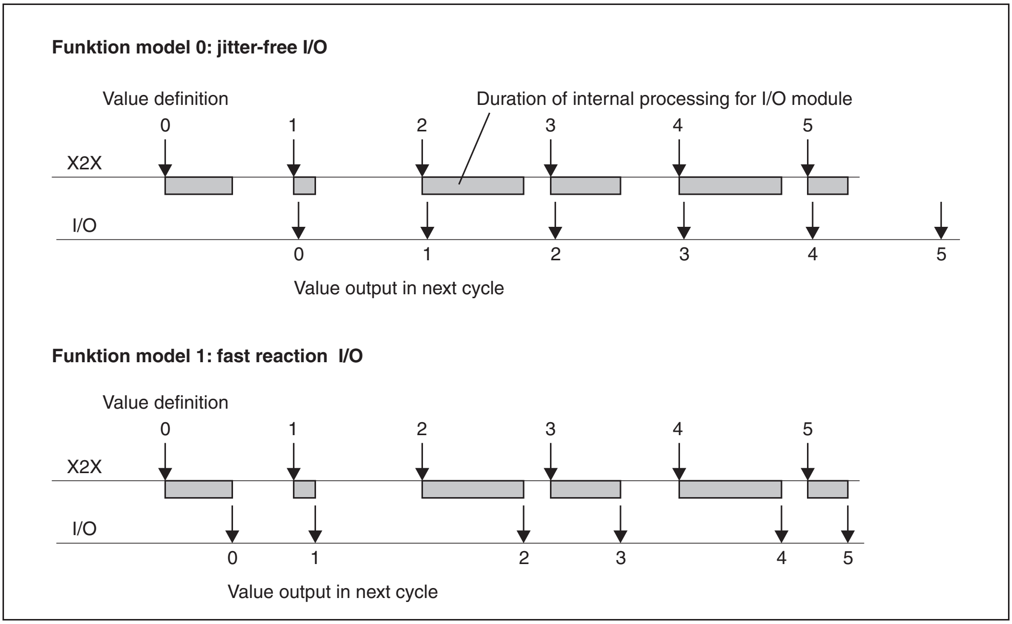


Figure 12: Function model comparison - AO4622

The registers used are identical for all function models:

Function models 0 and 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	AnalogOutput01	INT	2			●	●
2	AnalogOutput02	INT	2			●	●
4	AnalogOutput03	INT	2			●	●
6	AnalogOutput04	INT	2			●	●
18	ChannelType	USINT	1		●	●	●

Table 346: Function models 0 and 1 - AO4622

4.12 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: Jitter-free I/O (default)	●	●	●	●	●
Function model 1: I/O with fast reaction	●			●	

Table 347: Function models - AO4622

4.13 B&R ID code

Code for module identification ($1BA3).

4.14 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Minimum cycle time	≥250 µs

Table 348: Minimum cycle time - AO4622

4.15 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
For all outputs	<400 μs

Table 349: Minimum I/O update time - AO4622

5. X20AO4632

5.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	AnalogOutput01	INT	2			●	●
4	AnalogOutput02	INT	2			●	●
6	AnalogOutput03	INT	2			●	●
8	AnalogOutput04	INT	2			●	●
0	ChannelType	UINT	2				●

Table 350: Register overview - AO4632

5.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogOutput01	INT	2			●	
AnalogOutput02	INT	2			●	
AnalogOutput03	INT	2			●	
AnalogOutput04	INT	2			●	

Table 351: Variable assignment in Automation Studio (X2X master) - AO4632

5.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
AnalogOutput01	INT	2			●	
AnalogOutput02	INT	2			●	
AnalogOutput03	INT	2			●	
AnalogOutput04	INT	2			●	

Table 352: Variable assignment in Automation Studio (CANIO) - AO4632

5.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2	AnalogOutput01	INT	2			●	●
4	AnalogOutput02	INT	2			●	●
6	AnalogOutput03	INT	2			●	●
8	AnalogOutput04	INT	2			●	●
0	ChannelType	UINT	2				●

Table 353: CANopen data points - AO4632

5.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	AnalogOutput01	INT	2			●	●
4	AnalogOutput02	INT	2			●	●
6	AnalogOutput03	INT	2			●	●
8	AnalogOutput04	INT	2			●	●
0	ChannelType	UINT	2				●

Table 354: DeviceNet data points - AO4632

5.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2	AnalogOutput01	INT	2			●	●
4	AnalogOutput02	INT	2			●	●
6	AnalogOutput03	INT	2			●	●
8	AnalogOutput04	INT	2			●	●
0	ChannelType	UINT	2				●

Table 355: Modbus/TCP data points - AO4632

5.7 Analog outputs

Each channel can be configured for either current or voltage signals. The type of signal is also determined by the connection terminals used.

5.8 Register: AnalogOutput01 - AnalogOutput04

Analog output value with respect to operating mode:

Digital value	Output signal
-32768 to +32767	Voltage signal -10 VDC to +10 VDC
0 to +32767	Current signal 0 mA to 20 mA

5.9 Channel type

Each channel is capable of either current or voltage signals.

The type of signal is determined by the connection terminals used. Since current and voltage require different adjustment values, it is also necessary to configure the desired type of output signal.

Code	Output signal
0	Voltage signal (default)
1	Current signal

Table 356: Channel type - AO4632

5.10 Register: ChannelType

Bit	Description
0 - 7	0
8	0 ... Channel 1: Voltage signal 1 ... Channel 1: Current signal
9	0 ... Channel 2: Voltage signal 1 ... Channel 2: Current signal
10	0 ... Channel 3: Voltage signal 1 ... Channel 3: Current signal
11	0 ... Channel 4: Voltage signal 1 ... Channel 4: Current signal
12 - 15	0

5.11 B&R ID code

Code for module identification ($1BA5).

5.12 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Minimum cycle time	≥200 µs

Table 357: Minimum cycle time - AO4632

5.13 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
For all outputs	≥200 µs

Table 358: Minimum I/O update time - AO4632

Chapter 9 • Temperature modules

1. Overview

Temperature modules	Description
X20AT2222	X20 temperature input module, 2 inputs for resistance measurement, PT100, PT1000, resolution 0.1 K, 3-line connections
X20AT2402	X20 temperature input module, 2 thermocouple inputs, type J,K,N,S, resolution 0.1 K
X20AT4222	X20 temperature input module, 4 inputs for resistance measurement, PT100, PT1000, resolution 0.1 K, 3-line connections
X20AT6402	X20 temperature input module, 6 thermocouple inputs, type J,K,N,S, resolution 0.1 K

Table 359: Overview of temperature modules

2. X20AT2222

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●	●	●
18	SensorType	USINT	1		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		

Table 360: Register overview - AT2222

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Temperature01 / Resistor01	INT/UINT	2	●			
Temperature02 / Resistor02	INT/UINT	2	●			
IOCyclicCounter	USINT	1	●			
StatusInput01	USINT	1	●			

Table 361: Variable assignment in Automation Studio (X2X master) - AT2222

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Temperature01 / Resistor01	INT/UINT	2	●			
Temperature02 / Resistor02	INT/UINT	2	●			
IOCyclicCounter	USINT	1		●		
StatusInput01	USINT	1		●		

Table 362: Variable assignment in Automation Studio (CANIO) - AT2222

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●		●
18	SensorType	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1		●		

Table 363: CANopen data points - AT2222

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●		●
18	SensorType	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1	●	●		

Table 364: DeviceNet data points - AT2222

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●		●
18	SensorType	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1		●		

Table 365: Modbus/TCP data points - AT2222

2.7 Analog inputs

The converted analog values are output by the module in the registers. Different resistance or temperature measurements will result in different value ranges and data types.

2.8 Register: Temperature01 - Temperature02, Resistor01 - Resistor02

Analog input value with respect to operating mode:

Input signal	Digital value
Sensor type PT100	-2000 to +8500 (for -200.0°C to +850.0°C)
Sensor type PT1000	-2000 to +8500 (for -200.0°C to +850.0°C)
Resistance measurement 0.1 Ω to 4500 Ω	1 to 45000 (resolution 0.1 Ω)
Resistance measurement 0.05 Ω to 2250 Ω	1 to 45000 (resolution 0.05 Ω)

The following should be taken into consideration to ensure that the user always has a defined output value:

- Up to the first conversion, $8000 is output.
- After switching the sensor type, $8000 is output until the first conversion.
- If the input is not switched on, $8000 is output.

2.9 Timing setting

The timing setting for data acquisition is made using the converter hardware. All switched on inputs are converted during each conversion cycle.

2.10 Conversion time

The conversion time for the channels depends on their use. For the formulas listed in the table, 'n' corresponds to the number of channels that are switched on.

Channel uses	Conversion time
1 channel	$1 \cdot \mathrm{FilterTime}$
n channels with the same sensor type	$n \cdot (20\mathrm{ms} + \mathrm{FilterTime})$
n channels with different sensor types	$n \cdot (20\mathrm{ms} + 2 \cdot \mathrm{FilterTime})$

Table 366: Conversion time calculation - AT2222

2.11 Reduced refresh time

If an input is not necessary, it can be switched off, thereby reducing the refresh time. Inputs can also be only temporarily switched off.

The time saved is equal to:

$$\text{TimeSavings} = 2 \cdot 20\text{ms} + \text{FilterTime}$$

The filter time is the conversion time for the remaining channels.

Examples

The inputs are filtered using a 60 Hz filter.

	Example 1	Example 2
Switched on inputs	1	1 - 2
Conversion time	16.7 ms	73.4 ms

Table 367: Example conversion time calculations - AT2222

2.12 Input filter

The filter time for all analog inputs is defined using the input filter parameter.

Value	Filter	Filter time	Digital converter resolution
0	15 Hz	66.7 ms	16-bit
1	25 Hz	40 ms	16-bit
2	30 Hz	33.3 ms	16-bit
3	50 Hz	20 ms	16-bit
4	60 Hz	16.7 ms	16-bit
5	100 Hz	10 ms	16-bit
6	500 Hz	2 ms	16-bit
7	1000 Hz	1 ms	16-bit

Table 368: Input filters - AT2222

2.13 Register: InputFilter

Value	Description
0 - 7	Filter time

2.14 Sensor type and channel deactivation

The module is designed for temperature and resistance measurement. The sensor type must be specified because of the different adjustment values for temperature and resistance.

The default setting for all channels is ON. To save time, individual channels can be switched off (see section "Reduced refresh time" on page 227).

Code	Input signal
0	Reserved
1	Reserved
2	Sensor type PT100
3	Sensor type PT1000
4	Reserved
5	Resistance measurement 0.1 Ω to 4500 Ω
6	Resistance measurement 0.05 Ω to 2250 Ω
7	Channel turned off

Table 369: Setting the sensor type and channel deactivation - AT2222

2.15 Register: SensorType

Bit	Description
0 - 3	Channel 1: 0000 ... Reserved 0001 ... Reserved 0010 ... Sensor type PT100 0011 ... Sensor type PT1000 0100 ... Reserved 0101 ... Resistance measurement 0.1 Ω to 4500 Ω 0110 ... Resistance measurement 0.05 Ω to 2250 Ω 0111 ... Channel turned off
4 - 7	Channel 2: 0000 ... Reserved 0001 ... Reserved 0010 ... Sensor type PT100 0011 ... Sensor type PT1000 0100 ... Reserved 0101 ... Resistance measurement 0.1 Ω to 4500 Ω 0110 ... Resistance measurement 0.05 Ω to 2250 Ω 0111 ... Channel turned off

2.16 Input status

The module's inputs are monitored. A change in monitoring status triggers an error message.

Code	Channel x
0	No error
1	Below lower limit value
2	Above upper limit value
3	Wire break

Table 370: Input status - AT2222

2.17 Register: StatusInput01

Bit	Description
0 - 1	Channel 1: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
2 - 3	Channel 2: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
4 - 7	0

In addition to the status info, the error type also sets the analog value as follows:

Error type	Temperature measurement Digital value for error	Resistance measurement Digital value for error
Wire break	+32767 (0x7FFF)	65535 (0xFFFF)
Above upper limit value	+32767 (0x7FFF)	65535 (0xFFFF)
Below lower limit value	-32767 (0x8001)	0 (0x0000)
Invalid value	-32768 (0x8000)	65535 (0xFFFF)

2.18 IOCyclicCounter

The cyclic counter increases after all input data have been updated.

2.19 Register: IOCyclicCounter

Value	Description
0 - 255	Repeating counter

2.20 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

Selection of connection type

For this module, the connection type is selected using function models 0 and 1.

Function model	Connection type
0	3-line connection (default)
1	2-line connection

Table 371: Selection of connection type using function models - AT2222

The registers used are identical for all function models:

Function models 0 and 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●	●	●
18	SensorType	USINT	1		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		

Table 372: Function models 0 and 1 - AT2222

2.21 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: 3-line connection (default)	●	●	●	●	●
Function model 1: 2-line connection	●			●	

Table 373: Function models - AT2222

2.22 B&R ID code

Code for module identification ($1BA6).

2.23 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
In each operating mode	≥100 µs

Table 374: Minimum cycle time - AT2222

2.24 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
1 input	Corresponds to the filter time
2 inputs	$2 \cdot (20\mathrm{ms} + \mathrm{FilterTime})$

Table 375: Minimum I/O update time - AT4222

3. X20AT2402

3.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
12	TerminalTemperature01 1)	INT	2		●		
	ExternalCompensationTemperature 2)					●	●
14	TerminalTemperature02	INT	2		●		
24	InputFilter	USINT	1		●	●	●
26	SensorType	USINT	1		●	●	●
27	ChannelDeactivation	USINT	1		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		

Table 376: Register overview - AT2402

1) Only with function model 0: TerminalTemperature01
2) Only with function model 1: ExternalCompensationTemperature

3.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Temperature01	INT	2	●			
Temperature02	INT	2	●			
ExternalCompensationTemperature 1)	INT	2			●	
IOCyclicCounter	USINT	1	●			
StatusInput01	USINT	1	●			
CompensationTemperature 2)	INT	2		●		

Table 377: Variable assignment in Automation Studio (X2X master) - AT2402

1) Only with function model 1: ExternalCompensationTemperature
2) Data point can only be read using the library

3.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Temperature01	INT	2	●			
Temperature02	INT	2	●			
IOCyclicCounter	USINT	1		●		
StatusInput01	USINT	1		●		

Table 378: Variable assignment in Automation Studio (CANIO) - AT2402

3.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
12	TerminalTemperature01	INT	2		●		
14	TerminalTemperature02	INT	2		●		
24	InputFilter	USINT	1		●		●
26	SensorType	USINT	1		●		●
27	ChannelDeactivation	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1		●		

Table 379: CANopen data points - AT2402

3.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
12	TerminalTemperature01	INT	2		●		
14	TerminalTemperature02	INT	2		●		
24	InputFilter	USINT	1		●		●
26	SensorType	USINT	1		●		●
27	ChannelDeactivation	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1	●	●		

Table 380: DeviceNet data points - AT2402

3.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
12	TerminalTemperature01	INT	2		●		
14	TerminalTemperature02	INT	2		●		
24	InputFilter	USINT	1		●		●
26	SensorType	USINT	1		●		●
27	ChannelDeactivation	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1		●		

Table 381: Modbus/TCP data points - AT2402

3.7 Analog inputs

The converted analog values are output by the module in the registers. The sensor type configured will affect the value ranges.

3.8 Register: Temperature01 - Temperature02

Analog input value with respect to sensor type:

Input signal	Digital value
Type J (FeCuNi)	-2100 to +12000 (for -210.0°C to +1200.0°C)
Type K (NiCrNi)	-2700 to +13720 (for -270.0°C to +1372.0°C)
Type N (NiCrSi)	-2700 to +13000 (for -270.0°C to +1300.0°C)
Type S (PtRhPt)	-500 to +17680 (for -50.0°C to +1768.0°C)
Raw value without linearization and terminal temperature compensation Resolution 1.0625 µV for a measurement range of ±35 mV	-32768 to +32767
Raw value without linearization and terminal temperature compensation Resolution 2.125 µV for a measurement range of ±70 mV	-32768 to +32767

The following should be taken into consideration to ensure that the user always has a defined output value:

- Up to the first conversion, $8000 is output.
- After switching the sensor type, $8000 is output until the first conversion.
- If the input is not switched on, $8000 is output.

3.9 Raw value measurement

If a sensor type other than J, K, N or S is used, the terminal temperature must be measured on at least one input. Based on this value, the user must perform a terminal temperature compensation.

3.10 Timing setting

The timing setting for data acquisition is made using the converter hardware. All switched on inputs are converted during each conversion cycle. A terminal temperature measurement also takes place (not in function model 1).

If an input is not necessary, it can be switched off, thereby reducing the refresh time. Inputs can also be only temporarily switched off. The measurement of the terminal temperature is switched off in function model 1.

3.11 Conversion time

The conversion time depends on the number of channels and on the function model. For the formulas listed in the table, 'n' corresponds to the number of channels that are switched on.

Function model	Conversion time
Model 0 - n channels	$(n + 1) \cdot (2 \cdot \mathrm{FilterTime} + 200\mu s)$
Model 1 - n channels	$n \cdot (2 \cdot \mathrm{FilterTime} + 200\mu s)$
Model 1 - 1 channel	Corresponds to the filter time

Table 382: Conversion time calculation - AT2402

Examples

The inputs are filtered using a 50 Hz filter.

	Example 1		Example 2	
	Function model 0	Function model 1	Function model 0	Function model 1
Switched on inputs	1	1	1 - 2	1 - 2
Conversion time	40.2 ms	20 ms	80.4 ms	80.4 ms
Conversion time for the terminal temperature	40.2 ms	-	40.2 ms	-
Total conversion time	80.4 ms	20 ms	120.6 ms	80.4 ms

Table 383: Example conversion time calculations - AT2402

3.12 Compensation temperature

The module's compensation temperatures can be read.

3.13 Register: TerminalTemperature01 - TerminalTemperature02, CompensationTemperature

Analog input value:

Input signal	Digital value
Compensation temperature (PT1000)	-250 to +850 (for -25.0°C to +85.0°C)

3.14 Setting the external compensation temperature

For each module you can set the compensation temperature used for measurement correction.

3.15 Register: ExternalCompensationTemperature

Output value:

Description	Digital value
ExternalCompensationTemperature	-250 to +850 (for -25.0°C to +85.0°C)

3.16 Input filter

The filter time for all analog inputs is defined using the input filter parameter.

Value	Filter	Filter time	Digital converter resolution
0	15 Hz	66.7 ms	16-bit
1	25 Hz	40 ms	16-bit
2	30 Hz	33.3 ms	16-bit
3	50 Hz	20 ms	16-bit
4	60 Hz	16.7 ms	16-bit
5	100 Hz	10 ms	16-bit
6	500 Hz	2 ms	16-bit
7	1000 Hz	1 ms	16-bit

Table 384: Input filter - AT2402

3.17 Register: InputFilter

Value	Description
0 - 7	Filter time

3.18 Sensor type

The module is designed for various sensor types. The sensor type must be specified because of the different adjustment values.

Code	Input signal
0	Conversion switched off
1	Sensor type J
2	Sensor type K
3	Sensor type S
4	Sensor type N
5	Conversion switched off
6	Raw value without linearization and terminal temperature compensation Resolution 1.0625 µV for a measurement range of ±35 mV
7	Raw value without linearization and terminal temperature compensation Resolution 2.125 µV for a measurement range of ±70 mV

Table 385: Setting the sensor type - AT2402

3.19 Register: SensorType

Bit	Description
0 - 2	Defines sensor: 000 ... Sensor switched off 001 ... Sensor type J 010 ... Sensor type K 011 ... Sensor type S 100 ... Sensor type N 101 ... Sensor switched off 110 ... Raw value without linearization and terminal temperature compensation Resolution 1.0625 µV for a measurement range of ±35 mV 111 ... Raw value without linearization and terminal temperature compensation Resolution 2.125 µV for a measurement range of ±70 mV
3 - 7	0

3.20 Channel deactivation

The default setting for all channels is ON. To save time, individual channels can be switched off (see section "Conversion time" on page 235).

Code	Description
0	Channel x: Switched off
1	Channel x: Switched on

Table 386: Channel deactivation - AT2402

3.21 Register: ChannelDeactivation

Bit	Description
0	Channel 1: 0 ... Off 1 ... On
1	Channel 2: 0 ... Off 1 ... On
2 - 7	0

3.22 Input status

The module's inputs are monitored. A change in monitoring status triggers an error message.

Code	Channel x
0	No error
1	Below lower limit value
2	Above upper limit value
3	Wire break

Table 387: Input status - AT2402

3.23 Register: StatusInput01

Bit	Description
0 - 1	Channel 1: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
2 - 3	Channel 2: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
4 - 7	0

In addition to the status info, the error type also sets the analog value as follows:

Error type	Digital value for error
Wire break	+32767 (0x7FFF)
Above upper limit value	+32767 (0x7FFF)
Below lower limit value	-32767 (0x8001)
Invalid value	-32768 (0x8000)

3.24 IOCyclicCounter

The cyclic counter increases after all input data have been updated.

3.24.1 Register: IOCyclicCounter

Value	Description
0 - 255	Repeating counter

3.25 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

3.25.1 Selection of terminal temperature compensation

For this module, the terminal temperature compensation is selected using function models 0 and 1.

Function model	Terminal temperature compensation
0	Internal compensation temperature (default)
1	ExternalCompensationTemperature

Table 388: Selection of compensation type using function models - AT2402

3.25.2 Function models - Internal compensation temperature (default)

Function model 0							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
24	InputFilter	USINT	1		●	●	●
26	SensorType	USINT	1		●	●	●
27	ChannelDeactivation	USINT	1		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		

Table 389: Function model 0: Internal compensation temperature (default) - AT2402

3.25.3 Function models - External compensation temperature

Function model 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
12	ExternalCompensationTemperature	INT	2			●	●
24	InputFilter	USINT	1		●	●	●
26	SensorType	USINT	1		●	●	●
27	ChannelDeactivation	USINT	1		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		

Table 390: Function model 0: External compensation temperature - AT2402

3.26 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: Internal compensation temperature (default)	●	●	●	●	●
Function model 1: External compensation temperature	●			●	

Table 391: Function models - AT2402

3.27 B&R ID code

Code for module identification ($1BA8).

3.28 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
In each operating mode and function model	≥150 µs

Table 392: Minimum cycle time - AT2402

3.29 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

For the formulas listed in the table, 'n' corresponds to the number of channels that are switched on.

Minimum I/O update time - function model 0	
n inputs	$(n+1) \cdot (FilterTime + 200\mu s)$

Table 393: Minimum I/O update time (function model 0) - AT2402

Minimum I/O update time - function model 1	
1 input	Corresponds to the filter time
n inputs	$n \cdot (FilterTime + 200\mu s)$

Table 394: Minimum I/O update time (function model 1) - AT2402

4. X20AT4222

4.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
4	Temperature03 / Resistor03	INT/UINT	2	●	●		
6	Temperature04 / Resistor04	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●	●	●
18	SensorType	UINT	2		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		

Table 395: Register overview - AT4222

4.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Temperature01 / Resistor01	INT/UINT	2	●			
Temperature02 / Resistor02	INT/UINT	2	●			
Temperature03 / Resistor03	INT/UINT	2	●			
Temperature04 / Resistor04	INT/UINT	2	●			
IOCyclicCounter	USINT	1	●			
StatusInput01	USINT	1	●			

Table 396: Variable assignment in Automation Studio (X2X master) - AT4222

4.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Temperature01 / Resistor01	INT/UINT	2	●			
Temperature02 / Resistor02	INT/UINT	2	●			
Temperature03 / Resistor03	INT/UINT	2	●			
Temperature04 / Resistor04	INT/UINT	2	●			
IOCyclicCounter	USINT	1		●		
StatusInput01	USINT	1		●		

Table 397: Variable assignment in Automation Studio (CANIO) - AT4222

4.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
4	Temperature03 / Resistor03	INT/UINT	2	●	●		
6	Temperature04 / Resistor04	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●		●
18	SensorType	UINT	2		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1		●		

Table 398: CANopen data points - AT4222

4.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
4	Temperature03 / Resistor03	INT/UINT	2	●	●		
6	Temperature04 / Resistor04	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●		●
18	SensorType	UINT	2		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1	●	●		

Table 399: DeviceNet data points - AT4222

4.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
4	Temperature03 / Resistor03	INT/UINT	2	●	●		
6	Temperature04 / Resistor04	INT/UINT	2	●	●		
16	InputFilter	USINT	1		●	●	●
18	SensorType	UINT	2		●	●	●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1		●		

Table 400: Modbus/TCP data points - AT4222

4.7 Analog inputs

The converted analog values are output by the module in the registers. Different resistance or temperature measurements will result in different value ranges and data types.

4.8 Register: Temperature01 - Temperature04, Resistor01 - Resistor04

Analog input value with respect to operating mode:

Input signal	Digital value
Sensor type PT100	-2000 to +8500 (for -200.0°C to +850.0°C)
Sensor type PT1000	-2000 to +8500 (for -200.0°C to +850.0°C)
Resistance measurement 0.1 Ω to 4500 Ω	1 to 45000 (resolution 0.1 Ω)
Resistance measurement 0.05 Ω to 2250 Ω	1 to 45000 (resolution 0.05 Ω)

The following should be taken into consideration to ensure that the user always has a defined output value:

- Up to the first conversion, $8000 is output.
- After switching the sensor type, $8000 is output until the first conversion.
- If the input is not switched on, $8000 is output.

4.9 Timing setting

The timing setting for data acquisition is made using the converter hardware. All switched on inputs are converted during each conversion cycle.

4.10 Conversion time

The conversion time for the channels depends on their use. For the formulas listed in the table, 'n' corresponds to the number of channels that are switched on.

Channel uses	Conversion time
1 channel	$1 \cdot \mathrm{FilterTime}$
n channels with the same sensor type	$n \cdot (20\mathrm{ms} + \mathrm{FilterTime})$
n channels with different sensor types	$n \cdot (20\mathrm{ms} + 2 \cdot \mathrm{FilterTime})$

Table 401: Conversion time calculation - AT4222

4.11 Reduced refresh time

If an input is not necessary, it can be switched off, thereby reducing the refresh time. Inputs can also be only temporarily switched off.

Calculating the time saved

The amount of time saved can be calculated with the following formula. And 'n' corresponds to the number of inputs that are switched off.

$$\mathrm{TimeSavings} = n \cdot (20\mathrm{ms} + \mathrm{FilterTime})$$

Examples

The inputs are filtered using a 60 Hz filter.

	Example 1	Example 2	Example 3
Switched on inputs	1	1, 3	1 - 4
Conversion time	16.7 ms	73.4 ms	146.8 ms

Table 402: Example conversion time calculations - AT4222

4.12 Input filter

The filter time for all analog inputs is defined using the input filter parameter.

Value	Filter	Filter time	Digital converter resolution
0	15 Hz	66.7 ms	16-bit
1	25 Hz	40 ms	16-bit
2	30 Hz	33.3 ms	16-bit
3	50 Hz	20 ms	16-bit
4	60 Hz	16.7 ms	16-bit
5	100 Hz	10 ms	16-bit
6	500 Hz	2 ms	16-bit
7	1000 Hz	1 ms	16-bit

Table 403: Input filters - AT4222

4.13 Register: InputFilter

Value	Description
0 - 7	Filter time

4.14 Sensor type and channel deactivation

The module is designed for temperature and resistance measurement. The sensor type must be specified because of the different adjustment values for temperature and resistance.

The default setting for all channels is ON. To save time, individual channels can be switched off (see section "Reduced refresh time" on page 245).

Code	Input signal
0	Reserved
1	Reserved
2	Sensor type PT100
3	Sensor type PT1000
4	Reserved
5	Resistance measurement 0.1 Ω to 4500 Ω
6	Resistance measurement 0.05 Ω to 2250 Ω
7	Channel turned off

Table 404: Setting the sensor type and channel deactivation - AT4222

4.15 Register: SensorType

Bit	Description
0 - 3	Channel 1: 0000 ... Reserved 0001 ... Reserved 0010 ... Sensor type PT100 0011 ... Sensor type PT1000 0100 ... Reserved 0101 ... Resistance measurement 0.1 Ω to 4500 Ω 0110 ... Resistance measurement 0.05 Ω to 2250 Ω 0111 ... Channel turned off
4 - 7	Channel 2: 0000 ... Reserved 0001 ... Reserved 0010 ... Sensor type PT100 0011 ... Sensor type PT1000 0100 ... Reserved 0101 ... Resistance measurement 0.1 Ω to 4500 Ω 0110 ... Resistance measurement 0.05 Ω to 2250 Ω 0111 ... Channel turned off
8 - 11	Channel 3: 0000 ... Reserved 0001 ... Reserved 0010 ... Sensor type PT100 0011 ... Sensor type PT1000 0100 ... Reserved 0101 ... Resistance measurement 0.1 Ω to 4500 Ω 0110 ... Resistance measurement 0.05 Ω to 2250 Ω 0111 ... Input switched off
12 - 15	Channel 4: 0000 ... Reserved 0001 ... Reserved 0010 ... Sensor type PT100 0011 ... Sensor type PT1000 0100 ... Reserved 0101 ... Resistance measurement 0.1 Ω to 4500 Ω 0110 ... Resistance measurement 0.05 Ω to 2250 Ω 0111 ... Input switched off

4.16 Input status

The module's inputs are monitored. A change in monitoring status triggers an error message.

Code	Channel x
0	No error
1	Below lower limit value
2	Above upper limit value
3	Wire break

Table 405: Input status - AT4222

4.17 Register: StatusInput01

Bit	Description
0 - 1	Channel 1: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
2 - 3	Channel 2: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
4 - 5	Channel 3: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
6 - 7	Channel 4: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break

In addition to the status info, the error type also sets the analog value as follows:

Error type	Temperature measurement Digital value for error	Resistance measurement Digital value for error
Wire break	+32767 (0x7FFF)	65535 (0xFFFF)
Above upper limit value	+32767 (0x7FFF)	65535 (0xFFFF)
Below lower limit value	-32767 (0x8001)	0 (0x0000)
Invalid value	-32768 (0x8000)	65535 (0xFFFF)

4.18 IOCyclicCounter

The cyclic counter increases after all input data have been updated.

4.19 Register: IOCyclicCounter

Value	Description
0 - 255	Repeating counter

4.20 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

4.20.1 Selection of connection type

For this module, the connection type is selected using function models 0 and 1.

Function model	Connection type
0	3-line connection (default)
1	2-line connection

Table 406: Selection of connection type using function models - AT4222

4.20.2 The registers used are identical for all function models:

Function models 0 and 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01 / Resistor01	INT/UINT	2	●	●		
2	Temperature02 / Resistor02	INT/UINT	2	●	●		
4	Temperature03 / Resistor03	INT/UINT	2	●	●		
6	Temperature04 / Resistor04	INT/UINT	2	●	●		
16	Input filter	USINT	1		●	●	●
18	SensorType	UINT	2		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		

Table 407: Function models 0 and 1 - AT4222

4.21 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: 3-line connection (default)	●	●	●	●	●
Function model 1: 2-line connection	●			●	

Table 408: Function models - AT4222

4.22 B&R ID code

Code for module identification ($1BA7).

4.23 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
In each operating mode	≥100 µs

Table 409: Minimum cycle time - AT4222

4.24 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
1 input	Corresponds to the filter time
n inputs	$n \cdot (20ms + FilterTime)$

Table 410: Minimum I/O update time - AT4222

5. X20AT6402

5.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
4	Temperature03	INT	2	●	●		
6	Temperature04	INT	2	●	●		
8	Temperature05	INT	2	●	●		
10	Temperature06	INT	2	●	●		
12	TerminalTemperature01 1)	INT	2		●		
	ExternalCompensationTemperature 2)					●	●
14	TerminalTemperature02	INT	2		●		
16	TerminalTemperature03	INT	2		●		
18	TerminalTemperature04	INT	2		●		
20	TerminalTemperature05	INT	2		●		
22	TerminalTemperature06	INT	2		●		
24	InputFilter	USINT	1		●	●	●
26	SensorType	USINT	1		●	●	●
27	ChannelDeactivation	USINT	1		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		
31	StatusInput02	USINT	1	●	●		

Table 411: Register overview - AT6402

1) Only with function model 0: TerminalTemperature01
2) Only with function model 1: ExternalCompensationTemperature

5.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Temperature01	INT	2	●			
Temperature02	INT	2	●			
Temperature03	INT	2	●			
Temperature04	INT	2	●			
Temperature05	INT	2	●			
Temperature06	INT	2	●			
ExternalCompensationTemperature 1)	INT	2			●	
IOCyclicCounter	USINT	1	●			
StatusInput01	USINT	1	●			
StatusInput02	USINT	1	●			
CompensationTemperature2)	INT	2		●		

Table 412: Variable assignment in Automation Studio (X2X master) - AT6402

1) Only with function model 1: ExternalCompensationTemperature
2) Data point can only be read using the library

5.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Temperature01	INT	2	●			
Temperature02	INT	2	●			
Temperature03	INT	2	●			
Temperature04	INT	2	●			
Temperature05	INT	2	●			
Temperature06	INT	2	●			
IOCyclicCounter	USINT	1		●		
StatusInput01	USINT	1		●		
StatusInput02	USINT	1		●		

Table 413: Variable assignment in Automation Studio (CANIO) - AT6402

5.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
4	Temperature03	INT	2	●	●		
6	Temperature04	INT	2	●	●		
8	Temperature05	INT	2	●	●		
10	Temperature06	INT	2	●	●		
12	TerminalTemperature01	INT	2		●		
14	TerminalTemperature02	INT	2		●		
16	TerminalTemperature03	INT	2		●		
18	TerminalTemperature04	INT	2		●		
20	TerminalTemperature05	INT	2		●		
22	TerminalTemperature06	INT	2		●		
24	InputFilter	USINT	1		●		●
26	SensorType	USINT	1		●		●
27	ChannelDeactivation	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1		●		
31	StatusInput02	USINT	1		●		

Table 414: CANopen data points - AT6402

5.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
4	Temperature03	INT	2	●	●		
6	Temperature04	INT	2	●	●		
8	Temperature05	INT	2	●	●		
10	Temperature06	INT	2	●	●		
12	TerminalTemperature01	INT	2		●		
14	TerminalTemperature02	INT	2		●		
16	TerminalTemperature03	INT	2		●		
18	TerminalTemperature04	INT	2		●		
20	TerminalTemperature05	INT	2		●		
22	TerminalTemperature06	INT	2		●		
24	InputFilter	USINT	1		●		●
26	SensorType	USINT	1		●		●
27	ChannelDeactivation	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1	●	●		
31	StatusInput02	USINT	1	●	●		

Table 415: DeviceNet data points - AT6402

5.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
4	Temperature03	INT	2	●	●		
6	Temperature04	INT	2	●	●		
8	Temperature05	INT	2	●	●		
10	Temperature06	INT	2	●	●		
12	TerminalTemperature01	INT	2		●		
14	TerminalTemperature02	INT	2		●		
16	TerminalTemperature03	INT	2		●		
18	TerminalTemperature04	INT	2		●		
20	TerminalTemperature05	INT	2		●		
22	TerminalTemperature06	INT	2		●		
24	InputFilter	USINT	1		●		●
26	SensorType	USINT	1		●		●
27	ChannelDeactivation	USINT	1		●		●
28	IOCyclicCounter	USINT	1		●		
30	StatusInput01	USINT	1		●		
31	StatusInput02	USINT	1		●		

Table 416: Modbus/TCP data points - AT6402

5.7 Analog inputs

The converted analog values are output by the module in the registers. The sensor type configured will affect the value ranges.

5.8 Register: Temperature01 - Temperature06

Analog input value with respect to sensor type:

Input signal	Digital value
Type J (FeCuNi)	-2100 to +12000 (for -210.0°C to +1200.0°C)
Type K (NiCrNi)	-2700 to +13720 (for -270.0°C to +1372.0°C)
Type N (NiCrSi)	-2700 to +13000 (for -270.0°C to +1300.0°C)
Type S (PtRhPt)	-500 to +17680 (for -50.0°C to +1768.0°C)
Raw value without linearization and terminal temperature compensation Resolution 1.0625 µV for a measurement range of ±35 mV	-32768 to +32767
Raw value without linearization and terminal temperature compensation Resolution 2.125 µV for a measurement range of ±70 mV	-32768 to +32767

The following should be taken into consideration to ensure that the user always has a defined output value:

- Up to the first conversion, $8000 is output.
- After switching the sensor type, $8000 is output until the first conversion.
- If the input is not switched on, $8000 is output.

5.9 Raw value measurement

If a sensor type other than J, K, N or S is used, the terminal temperature must be measured on at least one input. Based on this value, the user must perform a terminal temperature compensation.

5.10 Timing setting

The timing setting for data acquisition is made using the converter hardware. All switched on inputs are converted during each conversion cycle. A terminal temperature measurement also takes place (not in function model 1).

If an input is not necessary, it can be switched off, thereby reducing the refresh time. Inputs can also be only temporarily switched off. The measurement of the terminal temperature is switched off in function model 1.

5.11 Conversion time

The conversion time depends on the number of channels and on the function model. For the formulas listed in the table, 'n' corresponds to the number of channels that are switched on.

Function model	Conversion time
Model 0 - n channels	$(n+1) \cdot (2 \cdot \text{FilterTime} + 200\mu s)$
Model 1 - n channels	$n \cdot (2 \cdot \text{FilterTime} + 200\mu s)$
Model 1 - 1 channel	Corresponds to the filter time

Table 417: Conversion time calculation - AT6402

Examples

The inputs are filtered using a 50 Hz filter.

	Example 1		Example 2	
	Function model 0	Function model 1	Function model 0	Function model 1
Switched on inputs	1	1	1 - 6	1 - 6
Conversion time	40.2 ms	20 ms	241.2 ms	241.2 ms
Conversion time for the terminal temperature	40.2 ms	-	40.2 ms	-
Total conversion time	80.4 ms	20 ms	281.4 ms	241.2 ms

Table 418: Example conversion time calculations - AT6402

5.12 Compensation temperature

The module's compensation temperatures can be read.

5.13 Register: TerminalTemperature01 - TerminalTemperature06, CompensationTemperature

Analog input value:

Input signal	Digital value
Compensation temperature (PT1000)	-250 to +850 (for -25.0°C to +85.0°C)

5.14 Setting the external compensation temperature

For each module you can set the compensation temperature used for measurement correction.

5.15 Register: ExternalCompensationTemperature

Output value:

Description	Digital value
ExternalCompensationTemperature	-250 to +850 (for -25.0°C to +85.0°C)

5.16 Input filter

The filter time for all analog inputs is defined using the input filter parameter.

Value	Filter	Filter time	Digital converter resolution
0	15 Hz	66.7 ms	16-bit
1	25 Hz	40 ms	16-bit
2	30 Hz	33.3 ms	16-bit
3	50 Hz	20 ms	16-bit
4	60 Hz	16.7 ms	16-bit
5	100 Hz	10 ms	16-bit
6	500 Hz	2 ms	16-bit
7	1000 Hz	1 ms	16-bit

Table 419: Input filter - AT6402

5.17 Register: InputFilter

Value	Description
0 - 7	Filter time

5.18 Sensor type

The module is designed for various sensor types. The sensor type must be specified because of the different adjustment values.

Code	Input signal
0	Conversion switched off
1	Sensor type J
2	Sensor type K
3	Sensor type S
4	Sensor type N
5	Conversion switched off
6	Raw value without linearization and terminal temperature compensation Resolution 1.0625 µV for a measurement range of ±35 mV
7	Raw value without linearization and terminal temperature compensation Resolution 2.125 µV for a measurement range of ±70 mV

Table 420: Setting the sensor type - AT6402

5.19 Register: SensorType

Bit	Description
0 - 2	Defines sensor: 000 ... Sensor switched off 001 ... Sensor type J 010 ... Sensor type K 011 ... Sensor type S 100 ... Sensor type N 101 ... Sensor switched off 110 ... Raw value without linearization and terminal temperature compensation Resolution 1.0625 µV for a measurement range of ±35 mV 111 ... Raw value without linearization and terminal temperature compensation Resolution 2.125 µV for a measurement range of ±70 mV
3 - 7	0

5.20 Channel deactivation

The default setting for all channels is ON. To save time, individual channels can be switched off (see section "Conversion time" on page 257).

Code	Description
0	Channel x: Switched off
1	Channel x: Switched on

Table 421: Channel deactivation - AT6402

5.21 Register: ChannelDeactivation

Bit	Description
0	Channel 1: 0 ... Off 1 ... On
1	Channel 2: 0 ... Off 1 ... On
2	Channel 3: 0 ... Off 1 ... On
3	Channel 4: 0 ... Off 1 ... On
4	Channel 5: 0 ... Off 1 ... On
5	Channel 6: 0 ... Off 1 ... On
6 - 7	0

5.22 Input status

The module's inputs are monitored. A change in monitoring status triggers an error message.

Code	Channel x
0	No error
1	Below lower limit value
2	Above upper limit value
3	Wire break

Table 422: Input status - AT6402

5.23 Register: StatusInput01

Bit	Description
0 - 1	Channel 1: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
2 - 3	Channel 2: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
4 - 5	Channel 3: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
6 - 7	Channel 4: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break

5.24 Register: StatusInput02

Bit	Description
0 - 1	Channel 5: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
2 - 3	Channel 6: 00 ... No error 01 ... Below lower limit value 10 ... Above upper limit value 11 ... Wire break
4 - 7	0

In addition to the status info, the error type also sets the analog value as follows:

Error type	Digital value for error
Wire break	+32767 (0x7FFF)
Above upper limit value	+32767 (0x7FFF)
Below lower limit value	-32767 (0x8001)
Invalid value	-32768 (0x8000)

5.25 IOCyclicCounter

The cyclic counter increases after all input data have been updated.

5.26 Register: IOCyclicCounter

Value	Description
0 - 255	Repeating counter

5.27 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus. The cycle time can be minimized by selecting the correct function model.

5.27.1 Selection of terminal temperature compensation

For this module, the terminal temperature compensation is selected using function models 0 and 1.

Function model	Terminal temperature compensation
0	Internal compensation temperature (default)
1	ExternalCompensationTemperature

Table 423: Selection of compensation type using function models - AT6402

5.27.2 Function models - Internal compensation temperature (default)

Function model 0							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
4	Temperature03	INT	2	●	●		
6	Temperature04	INT	2	●	●		
8	Temperature05	INT	2	●	●		
10	Temperature06	INT	2	●	●		
24	InputFilter	USINT	1		●	●	●
26	SensorType	USINT	1		●	●	●
27	ChannelDeactivation	USINT	1		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		
31	StatusInput02	USINT	1	●	●		

Table 424: Function model 0: Internal compensation temperature (default) - AT6402

5.27.3 Function models - External compensation temperature

Function model 1							
Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	Temperature01	INT	2	●	●		
2	Temperature02	INT	2	●	●		
4	Temperature03	INT	2	●	●		
6	Temperature04	INT	2	●	●		
8	Temperature05	INT	2	●	●		
10	Temperature06	INT	2	●	●		
12	ExternalCompensationTemperature	INT	2			●	●
24	InputFilter	USINT	1		●	●	●
26	SensorType	USINT	1		●	●	●
27	ChannelDeactivation	USINT	1		●	●	●
28	IOCyclicCounter	USINT	1	●	●		
30	StatusInput01	USINT	1	●	●		
31	StatusInput02	USINT	1	●	●		

Table 425: Function model 0: External compensation temperature - AT6402

5.28 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0: Internal compensation temperature (default)	●	●	●	●	●
Function model 1: External compensation temperature	●			●	

Table 426: Function models - AT6402

5.29 B&R ID code

Code for module identification ($1BA9).

5.30 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
In each operating mode and function model	≥150 µs

Table 427: Minimum cycle time - AT6402

5.31 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

For the formulas listed in the table, 'n' corresponds to the number of channels that are switched on.

Minimum I/O update time - function model 0	
n inputs	$(n + 1) \cdot (FilterTime + 200\mu s)$

Table 428: Minimum I/O update time (function model 0) - AT6402

Minimum I/O update time - function model 1	
1 input	Corresponds to the filter time
n inputs	$n \cdot (FilterTime + 200\mu s)$

Table 429: Minimum I/O update time (function model 1) - AT6402

Chapter 11 • Other modules

1. Overview

Other modules	Description
X20PS4951	X20 supply module for potentiometers, 4 x ±10 V potentiometer supply

Table 430: Overview of other modules

2. X20PS4951

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	SupplyStatus 1 - 4	USINT	1	●	●		

Table 431: Register overview - PS4951

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
OpenLine01	BOOL	1	●			
OpenLine02	BOOL	1	●			
OpenLine03	BOOL	1	●			
OpenLine04	BOOL	1	●			
ShortCircuit01	BOOL	1	●			
ShortCircuit02	BOOL	1	●			
ShortCircuit03	BOOL	1	●			
ShortCircuit04	BOOL	1	●			

Table 432: Variable assignment in Automation Studio (X2X master) - PS4951

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
OpenLine01	BOOL	1	●			
OpenLine02	BOOL	1	●			
OpenLine03	BOOL	1	●			
OpenLine04	BOOL	1	●			
ShortCircuit01	BOOL	1	●			
ShortCircuit02	BOOL	1	●			
ShortCircuit03	BOOL	1	●			
ShortCircuit04	BOOL	1	●			

Table 433: Variable assignment in Automation Studio (CANIO) - PS4951

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
0	SupplyStatus 1 - 4	USINT	1	●	●		

Table 434: CANopen data points - PS4951

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	SupplyStatus 1 - 4	USINT	1	●	●		

Table 435: DeviceNet data points - PS4951

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
0	SupplyStatus 1 - 4	USINT	1	●	●		

Table 436: Modbus/TCP data points - PS4951

2.7 Register: SupplyStatus 1 - 4

Bit	Description
0	Channel 1 overload
1	Channel 2 overload
2	Channel 3 overload
3	Channel 4 overload
4	Channel 1 wire break
5	Channel 2 wire break
6	Channel 3 wire break
7	Channel 4 wire break

2.8 Register: OpenLine01 - OpenLine04

BOOL	Description
x	0 ... No open connection on channel 1 ... Open connection on channel

2.9 Register: ShortCircuit01 - ShortCircuit04

BOOL	Description
x	0 ... No short circuit on channel 1 ... Short circuit on channel

2.10 B&R ID code

Code for module identification ($1F43).

2.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Any type of operation	≥100 µs

Table 437: Minimum cycle time - PS4951

2.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time	
Any type of operation	≥1 ms

Table 438: Minimum I/O update time - PS4951

Chapter 12 • Counter modules

1. Overview

Counter modules	Description
X20DC1196	X20 digital counter module, 1 channel ABR, 5 V, 250 kHz input freq., 4x evaluation
X20DC1198	X20 digital counter module, 1 channel SSI, 5 V, 1 MBit/s, 32-bit
X20DC1396	X20 digital counter module, 1 channel ABR, 24 V, 100 kHz input freq., 4x evaluation
X20DC1398	X20 digital counter module, 1 channel SSI, 24 V, 125 MBit/s, 32-bit
X20DC2396	X20 digital counter module, 2 channel ABR, 24 V, 100 kHz input freq., 4x evaluation
X20DC2398	X20 digital counter module, 2 channel SSI, 24 V, 125 MBit/s, 32-bit

Table 439: Overview - counter modules

2. X20DC1196

2.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01[1)]	INT	2	●	●		
2080	Encoder01_32-bit[2)]	DINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1[1)]	INT	2			●	●
2064	Cf0_PresetABR01_1_32-bit[2)]	DINT	4			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●

Table 440: Register overview - DC1196

1) Only with function model 0
2) Only with function model 1

2.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01[1)]	INT	2	●			
Encoder01[2)]	DINT	4	●			
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
ReferenceModeEncoder01	BOOL	1			●	
StatusInput01	BOOL	1	●			
PowerSupply01	BOOL	1	●			
PowerSupply02	BOOL	1	●			

Table 441: Variable assignment in Automation Studio (X2X master) - DC1196

1) Only with function model 0
2) Only with function model 1

2.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	INT	2	●			
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
ReferenceModeEncoder01	BOOL	1			●	
StatusInput01	BOOL	1	●			
PowerSupply01	BOOL	1	●			
PowerSupply02	BOOL	1	●			

Table 442: Variable assignment in Automation Studio (CANIO) - DC1196

2.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2080	Encoder01	INT	2	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1				●
4106	Cfo_EdgeDetectRising	USINT	1				●
2064	Cf0_PresetABR01_1	INT	2				●
512	ConfigOutput24	UINT	2				●
522	ConfigOutput26	USINT	1				●
520	ConfigOutput27	USINT	1				●

Table 443: CANopen data points - DC1196

2.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01	INT	2	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1				●
4106	Cfo_EdgeDetectRising	USINT	1				●
2064	Cf0_PresetABR01_1	INT	2				●
512	ConfigOutput24	UINT	2				●
522	ConfigOutput26	USINT	1				●
520	ConfigOutput27	USINT	1				●

Table 444: DeviceNet data points - DC1196

2.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01 1)	INT	2	●	●		
2080	Encoder01_32-bit 2)	DINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			● 3)	●
4106	Cfo_EdgeDetectRising	USINT	1			● 3)	●
2064	Cf0_PresetABR01_1 1)	INT	2			● 3)	●
2064	Cf0_PresetABR01_1_32-bit 2)	DINT	4			● 3)	●
512	ConfigOutput24	UINT	2			● 3)	●
522	ConfigOutput26	USINT	1			● 3)	●
520	ConfigOutput27	USINT	1			● 3)	●

Table 445: Modbus/TCP data points - DC1196

1) Only with function model 0

2) Only with function model 1

3) With the default configuration, these registers are not located in the area for cyclic output data. However, using a special function (Modbus/TCP User's Manual) these registers can also be applied cyclically.

2.7 Cyclic encoder registers

2.7.1 Register: Encoder01

The encoder is represented by a 16-bit value.

Data type	Description	
INT[1)]	-32768 - 32767 ...	Encoder counter value

1) Only with function model 0

2.7.2 Register: Encoder01_32Bit

The encoder is represented by a 32-bit value.

Data type	Description	
DINT[1)]	-2147483648 - 2147483647 ...	Encoder counter value

1) Only with function model 1

2.7.3 Register: DigitalInput 1 - 2

Bit	Description
0	Input status - encoder signal A
1	Input status - encoder signal B
2	Input status - encoder reference impulse
4	Input status - digital input 1
5	Input status - digital input 2

2.7.4 Register: DigitalInput01 - DigitalInput02

BOOL	Description
x	0/1 ... Input status - digital input

2.7.5 Register: ReferenceModeEncoder01

This register determines the reference mode.

Bit	Description
0 - 1	00 ... Referencing OFF 01 ... One-time reference (single shot) 11 ... Continuous referencing
2 - 5	0000 ... Bits permanently set = 0
6 - 7	00 ... Referencing OFF 11 ... Bits permanently set = 1

Table 446: Reference mode - DC1196

This results in the following values:

%00000000 = $00 = Referencing OFF

%11000001 = $C1 = One-time reference (single shot)

When starting over after the referencing process is complete, the value $00 must be written. Then wait until the StatusInput01 also takes on the value $00
Only then can the value $C1 be written.

%11000011 = $C3 = Continuous referencing

Referencing occurs at every reference pulse.

It is important to know how the optional reference enable (see section 2.8.4 "Referencing with reference enable input" on page 277) is configured.

2.7.6 Register: StatusInput01

This register contains information regarding whether the referencing process is off, active, or complete.

Bit	Description
0 - 1	00 ... Always 0
2	0/1 ... Bit is always 1 after the first reference impulse
3	0/1 ... Toggle after each completed reference
4	0/1 ... Bit is always 1 after the first reference impulse
5 - 7	xxx ... Free-running counter, increased with each reference impulse

Table 447: Encoder status information - DC1196

Examples of possible values:

%00000000 = $00 = Referencing off or already in progress

%00111100 = $3C = first reference complete, reference value applied in register Encoder01

%xxx11100 = $xB = Bits 5 - 7 are changed sequentially with each reference impulse

%xxx1x100 = $xx = Bits changed continuously with the setting continuous referencing. With every reference impulse, the reference value is applied to register Encoder01

It is important to know how the optional reference enable (see section 2.8.4 "Referencing with reference enable input" on page 277) is configured.

2.7.7 Register: PowerSupply 1 - 2

This register shows the status of the integrated encoder supplies.

Bit	Description
0	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty
1	0 ... 5 VDC encoder supply voltage OK 1 ... 5 VDC encoder supply voltage faulty

2.7.8 Register: PowerSupply01

BOOL	Description
x	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

2.7.9 Register: PowerSupply02

BOOL	Description
x	0 ... 5 VDC encoder supply voltage OK 1 ... 5 VDC encoder supply voltage faulty

2.8 Encoder configuration register for cyclical operation

2.8.1 Reference pulse - positive edge

The following registers must be configured by setting the listed values one time using a non-cyclic write command so that the reference process is completed on the positive edge of the reference pulse.

Register: CfO_EdgeDetectFalling

USINT	Description
$00	$00 ... Configuration value

Register: CfO_EdgeDetectRising

USINT	Description
$04	$04 ... Configuration value

Register: ConfigOutput24

UINT	Description
$1012	$1012 ... Configuration value

2.8.2 Reference pulse - negative edge (default configuration)

The following registers must be configured by setting the listed values one time using a non-cyclic write command so that the reference process is completed on the negative edge of the reference pulse.

Register: CfO_EdgeDetectFalling

USINT	Description
$04	$04 ... Configuration value (default)

Register: CfO_EdgeDetectRising

USINT	Description
$00	$00 ... Configuration value (default)

Register: ConfigOutput24

UINT	Description
$1002	$1002 ... Configuration value (default)

2.8.3 Preset home position

This register allows you to apply a preset home position using a one-time non-cyclic write command (default = 0). The value set here is applied to the counter value upon completion of the referencing process.

Register: CfO_PresetABR01_1

Data type	Description	
INT[1)]	-32768 - 32767 ...	Home position

1) Only with function model 0

Register: CfO_PresetABR01_1_32Bit

Data type	Description	
DINT[1)]	-2147483648 - 2147483647 ...	Home position

1) Only with function model 1

2.8.4 Referencing with reference enable input

Regardless of the referencing mode, it is possible to prevent the home position from being taken over when the corresponding reference input voltage level occurs (DigitalInput01 / DigitalInput 1 - 2 bit 4). The desired setting can be configured using a one-time non-cyclic write command.

Register: ConfigOutput27

USINT	Description
$x0	$00 ... Reference enable input OFF (default) $10 ... Reference enable input activated

Register: ConfigOutput26

The voltage level to activate reference enable (DigitalInput01 / DigitalInput 1 - 2 bit 4) is configured with this register.

USINT	Description
$x0	$00 ... Reference enable is active at 0 VDC $10 ... Reference enable is active at 24 VDC

2.8.5 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus.

Function model 0 with 16-bit encoder counter value (default)

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01	INT	2	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1	INT	2			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●

Table 448: Function model 0 with 16-bit encoder - DC1196

Function model 1 with 32-bit encoder counter value

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01_32Bit	DINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1_32Bit	DINT	4			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●

Table 449: Function model 1 with 32-bit encoder - DC1196

2.8.6 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0 with 16-bit encoder data (default)	●	●	●	●	●
Function model 1 with 32-bit encoder data	●			●	

Table 450: Function models - DC1196

2.9 B&R ID code

Code for module identification ($1BAF).

2.10 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥128 μs

Table 451: Minimum cycle time - DC1196

2.11 Maximum cycle time

The maximum cycle time is the maximum time the bus cycle can take to start without internal counter overruns causing module errors.

Minimum cycle time
<16 ms

Table 452: Maximum cycle time - DC1196

2.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
≥128 μs

Table 453: Minimum I/O update time - DC1196

3. X20DC1198

3.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
7176	ConfigOutput14	UINT	2			●	●

Table 454: Register overview - DC1198

3.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	UDINT	4	●			
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
PowerSupply01	BOOL	1	●			
PowerSupply02	BOOL	1	●			

Table 455: Variable assignment in Automation Studio (X2X master) - DC1198

3.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	UDINT	4	●			
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
PowerSupply01	BOOL	1	●			
PowerSupply02	BOOL	1	●			

Table 456: Variable assignment in Automation Studio (CANIO) - DC1198

3.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
7184	Encoder01	UDINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
7176	ConfigOutput14	UINT	2				●

Table 457: CANopen data points - DC1198

3.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
7176	ConfigOutput14	UINT	2				●

Table 458: DeviceNet data points - DC1198

3.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
40	PowerSupply 1 - 2	USINT	1	●	●		
7176	ConfigOutput14	UINT	2			● 1)	●

Table 459: Modbus/TCP data points - DC1198

1) With the default configuration, these registers are not located in the area for cyclic output data. However, using a special function (Modbus/TCP User's Manual) these registers can also be applied cyclically.

3.7 SSI encoder cyclic register

3.7.1 Register: Encoder01

The SSI encoder value is displayed as a 32-bit position value. The SSI position value is generated synchronously with the X2X cycle.

Data type	Description
DINT	-2147483648 - 2147483647 ... SSI position

3.7.2 Register: DigitalInput 1 - 2

Bit	Description
4	Input status - digital input 1
5	Input status - digital input 2

3.7.3 Register: DigitalInput01 - DigitalInput02

BOOL	Description
x	0/1 ... Input status - digital input

3.7.4 Register: PowerSupply 1 - 2

This register shows the status of the integrated encoder supplies.

Bit	Description
0	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty
1	0 ... 5 VDC encoder supply voltage OK 1 ... 5 VDC encoder supply voltage faulty

3.7.5 Register: PowerSupply01

BOOL	Description
x	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

3.7.6 Register: PowerSupply02

BOOL	Description
x	0 ... 5 VDC encoder supply voltage OK 1 ... 5 VDC encoder supply voltage faulty

3.8 SSI encoder configuration register for cyclical operation

3.8.1 Register: ConfigOutput14

This configuration register is used to set the coding, the clock rate and the number of bits. Default = 0. This must be set once using a non-cyclic write command.

Bit	Description
0 - 5	Number of bits valid for SSI value
6 - 7	Clock rate: 00: 1 MHz 01: 500 kHz 10: 250 kHz 11: 125 kHz
8 - 13	Total number of bits in SSI, including leading zeros
14	0 ... Reserved
15	0 ... Binary coding 1 ... Gray coding

3.9 B&R ID code

Code for module identification ($1BB0)

3.10 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥128 μs

Table 460: Minimum cycle time - DC1198

3.11 Maximum cycle time

The maximum cycle time is the maximum time the bus cycle can take to start without internal counter overruns causing module errors.

Minimum cycle time
<16 ms

Table 461: Maximum cycle time - DC1198

3.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
≥128 μs

Table 462: Minimum I/O update time - DC1198

4. X20DC1396

4.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01 1)	INT	2	●	●		
2080	Encoder01_32Bit 2)	DINT	4	●	●		
264	DigitalInput 1	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1 1)	INT	2			●	●
2064	Cf0_PresetABR01_1_32Bit 2)	DINT	4			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●

Table 463: Register overview - DC1396

1) Only with function model 0
2) Only with function model 1

4.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01 1)	INT	2	●			
Encoder01 2)	DINT	4	●			
DigitalInput01	BOOL	1	●			
ReferenceModeEncoder01	BOOL	1			●	
StatusInput01	BOOL	1	●			
PowerSupply01	BOOL	1	●			

Table 464: Variable assignment in Automation Studio (X2X master) - DC1396

1) Only with function model 0
2) Only with function model 1

4.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	INT	2	●			
DigitalInput01	BOOL	1	●			
ReferenceModeEncoder01	BOOL	1			●	
StatusInput01	BOOL	1	●			
PowerSupply01	BOOL	1	●			

Table 465: Variable assignment in Automation Studio (CANIO) - DC1396

4.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2080	Encoder01	INT	2	●	●		
264	DigitalInput 1	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1				●
4106	Cfo_EdgeDetectRising	USINT	1				●
2064	Cf0_PresetABR01_1	INT	2				●
512	ConfigOutput24	UINT	2				●
522	ConfigOutput26	USINT	1				●
520	ConfigOutput27	USINT	1				●

Table 466: CANopen data points - DC1396

4.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01	INT	2	●	●		
264	DigitalInput 1	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1				●
4106	Cfo_EdgeDetectRising	USINT	1				●
2064	Cf0_PresetABR01_1	INT	2				●
512	ConfigOutput24	UINT	2				●
522	ConfigOutput26	USINT	1				●
520	ConfigOutput27	USINT	1				●

Table 467: DeviceNet data points - DC1396

4.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01 1)	INT	2	●	●		
2080	Encoder01_32Bit 2)	DINT	4	●	●		
264	DigitalInput 1	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			● 3)	●
4106	Cfo_EdgeDetectRising	USINT	1			● 3)	●
2064	Cf0_PresetABR01_1 1)	INT	2			● 3)	●
2064	Cf0_PresetABR01_1_32Bit 2)	DINT	4			● 3)	●
512	ConfigOutput24	UINT	2			● 3)	●
522	ConfigOutput26	USINT	1			● 3)	●
520	ConfigOutput27	USINT	1			● 3)	●

Table 468: Modbus/TCP data points - DC1396

1) Only with function model 0

2) Only with function model 1

3) With the default configuration, these registers are not located in the area for cyclic output data. However, using a special function (Modbus/TCP User's Manual) these registers can also be applied cyclically.

4.7 Cyclic encoder registers

4.7.1 Register: Encoder01

The encoder is represented by a 16-bit value.

Data type	Description	
INT[1)]	-32768 - 32767 ...	Encoder counter value

1) Only with function model 0

4.7.2 Register: Encoder01_32Bit

The encoder is represented by a 32-bit value.

Data type	Description	
DINT[1)]	-2147483648 - 2147483647 ...	Encoder counter value

1) Only with function model 1

4.7.3 Register: DigitalInput 1

Bit	Description
0	Input status - encoder signal A
1	Input status - encoder signal B
2	Input status - encoder reference impulse
3	Input status - digital input 1

4.7.4 Register: DigitalInput01

BOOL	Description
x	0/1 ... Input status - digital input

4.7.5 Register: ReferenceModeEncoder01

This register determines the reference mode.

Bit	Description
0 - 1	00 ... Referencing OFF 01 ... One-time reference (single shot) 11 ... Continuous referencing
2 - 5	0000 ... Bits permanently set = 0
6 - 7	00 ... Referencing OFF 11 ... Bits permanently set = 1

Table 469: Reference mode - DC1396

This results in the following values:

%00000000 = $00 = Referencing OFF

%11000001 = $C1 = One-time reference (single shot)

When starting over after the referencing process is complete, the value $00 must be written. Then wait until the StatusInput01 also takes on the value $00
Only then can the value $C1 be written.

%11000011 = $C3 = Continuous referencing

Referencing occurs at every reference pulse.

It is important to know how the optional reference enable (see section 4.8.4 "Referencing with reference enable input" on page 291) is configured.

4.7.6 Register: StatusInput01

This register contains information regarding whether the referencing process is off, active, or complete.

Bit	Description
0 - 1	00 ... Always 0
2	0/1 ... Bit is always 1 after the first reference impulse
3	0/1 ... Toggle after each completed reference
4	0/1 ... Bit is always 1 after the first reference impulse
5 - 7	xxx ... Free-running counter, increased with each reference impulse

Table 470: Encoder status information - DC1396

Examples of possible values:

%00000000 = $00 = Referencing off or already in progress

%00111100 = $3C = First reference complete, reference value applied in register Encoder01

%xxx11100 = $xB = Bits 5 - 7 are changed sequentially with each reference impulse

%xxx1x100 = $xx = Bits changed continuously with the setting continuous referencing. With every reference impulse, the reference value is applied to register Encoder01

It is important to know how the optional reference enable (see section 4.8.4 "Referencing with reference enable input" on page 291) is configured.

4.7.7 Register: PowerSupply 1

This register shows the status of the integrated encoder supplies.

Bit	Description
0	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

4.7.8 Register: PowerSupply01

BOOL	Description
x	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

4.8 Encoder configuration register for cyclical operation

4.8.1 Reference pulse - positive edge

The following registers must be configured by setting the listed values one time using a non-cyclic write command so that the reference process is completed on the positive edge of the reference pulse.

Register: CfO_EdgeDetectFalling

USINT	Description
$00	$00 ... Configuration value

Register: CfO_EdgeDetectRising

USINT	Description
$04	$04 ... Configuration value

Register: ConfigOutput24

UINT	Description
$1012	$1012 ... Configuration value

4.8.2 Reference pulse - negative edge (default configuration)

The following registers must be configured by setting the listed values one time using a non-cyclic write command so that the reference process is completed on the negative edge of the reference pulse.

Register: CfO_EdgeDetectFalling

USINT	Description
$04	$04 ... Configuration value (default)

Register: CfO_EdgeDetectRising

USINT	Description
$00	$00 ... Configuration value (default)

Register: ConfigOutput24

UINT	Description
$1002	$1002 ... Configuration value (default)

4.8.3 Preset home position

This register allows you to apply a preset home position using a one-time non-cyclic write command (default = 0). The value set here is applied to the counter value upon completion of the referencing process.

Register: CfO_PresetABR01_1

Data type	Description	
INT[1]	-32768 - 32767 ...	Home position

1) Only with function model 0

Register: CfO_PresetABR01_1_32Bit

Data type	Description	
DINT[1]	-2147483648 - 2147483647 ...	Home position

1) Only with function model 1

4.8.4 Referencing with reference enable input

Regardless of the referencing mode, it is possible to prevent the home position from being taken over when the corresponding reference input voltage level occurs (DigitalInput01 / DigitalInput 1 bit 3). The desired setting can be configured using a one-time non-cyclic write command.

Register: ConfigOutput27

USINT	Description
$0x	$00 ... Reference enable input OFF (default) $08 ... Reference enable input activated

Register: ConfigOutput26

The voltage level to activate reference enable (DigitalInput01 / DigitalInput 1 bit 3) is configured with this register.

USINT	Description
$0x	$00 ... Reference enable is active at 0 VDC $08 ... Reference enable is active at 24 VDC

4.8.5 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus.

Function model 0 with 16-bit encoder counter value (default)

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01	INT	2	●	●		
264	DigitalInput 1	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1	INT	2			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●

Table 471: Function model 0 with 16-bit encoder - DC1396

Function model 1 with 32-bit encoder counter value

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01_32Bit	DINT	4	●	●		
264	DigitalInput 1	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1_32Bit	DINT	4			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●

Table 472: Function model 1 with 32-bit encoder - DC1396

4.8.6 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0 with 16-bit encoder data (default)	●	●	●	●	●
Function model 1 with 32-bit encoder data	●			●	

Table 473: Function models - DC1396

4.9 B&R ID code

Code for module identification ($1BAC).

4.10 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥128 µs

Table 474: Minimum cycle time - DC1396

4.11 Maximum cycle time

The maximum cycle time is the maximum time the bus cycle can take to start without internal counter overruns causing module errors.

Minimum cycle time
<16 ms

Table 475: Maximum cycle time - DC1396

4.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
≥128 µs

Table 476: Minimum I/O update time - DC1396

5. X20DC1398

5.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
264	DigitalInput 1	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
7176	ConfigOutput14	UINT	2			●	●

Table 477: Register overview - DC1398

5.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	UDINT	4	●			
DigitalInput01	BOOL	1	●			
PowerSupply01	BOOL	1	●			

Table 478: Variable assignment in Automation Studio (X2X master) - DC1398

5.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	UDINT	4	●			
DigitalInput01	BOOL	1	●			
PowerSupply01	BOOL	1	●			

Table 479: Variable assignment in Automation Studio (CANIO) - DC1398

5.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
7184	Encoder01	UDINT	4	●	●		
264	DigitalInput 1	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
7176	ConfigOutput14	UINT	2				●

Table 480: CANopen data points - DC1398

5.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
264	DigitalInput 1	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
7176	ConfigOutput14	UINT	2				●

Table 481: DeviceNet data points - DC1398

5.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
264	DigitalInput 1	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
7176	ConfigOutput14	UINT	2			● 1)	●

Table 482: Modbus/TCP data points - DC1398

1) With the default configuration, these registers are not located in the area for cyclic output data. However, using a special function (Modbus/TCP User's Manual) these registers can also be applied cyclically.

5.7 SSI encoder cyclic register

5.7.1 Register: Encoder01

The SSI encoder value is displayed as a 32-bit position value. The SSI position value is generated synchronously with the X2X cycle.

Data type	Description
DINT	-2147483648 - 2147483647 ... SSI position

5.7.2 Register: DigitalInput 1

Bit	Description
3	Input status - digital input 1

5.7.3 Register: DigitalInput01

BOOL	Description
x	0/1 ... Input status - digital input

5.7.4 Register: PowerSupply 1

This register shows the status of the integrated encoder supplies.

Bit	Description
0	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

5.7.5 Register: PowerSupply01

BOOL	Description
x	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

5.8 SSI encoder configuration register for cyclical operation

5.8.1 Register: ConfigOutput14

This configuration register is used to set the coding, the clock rate and the number of bits. Default = 0. This must be set once using a non-cyclic write command.

Bit	Description
0 - 5	Number of bits valid for SSI value
6 - 7	Clock rate: 11: 125 kHz
8 - 13	Total number of bits in SSI, including leading zeros
14	0 ... Reserved
15	0 ... Binary coding 1 ... Gray coding

5.9 B&R ID code

Code for module identification ($1BAE).

5.10 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥128 μs

Table 483: Minimum cycle time - DC1398

5.11 Maximum cycle time

The maximum cycle time is the maximum time the bus cycle can take to start without internal counter overruns causing module errors.

Minimum cycle time
<16 ms

Table 484: Maximum cycle time - DC1398

5.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
≥128 µs

Table 485: Minimum I/O update time - DC1398

6. X20DC2396

6.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01 1)	INT	2	●	●		
2080	Encoder01_32Bit 2)	DINT	4	●	●		
2592	Encoder02 1)	INT	2	●	●		
2592	Encoder02_32Bit 2)	DINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2628	ReferenceModeEncoder02	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
2630	StatusInput02	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1 1)	INT	2			●	●
2064	Cf0_PresetABR01_1_32Bit 2)	DINT	4			●	●
2576	Cf0_PresetABR02_1 1)	INT	2			●	●
2576	Cf0_PresetABR02_1_32Bit 2)	DINT	4			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●
544	ConfigOutput32	UINT	2			●	●
554	ConfigOutput34	USINT	1			●	●
552	ConfigOutput35	USINT	1			●	●

Table 486: Register overview - DC2396

1) Only with function model 0
2) Only with function model 1

6.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01[1)]	INT	2	●			
Encoder01[2)]	DINT	4	●			
Encoder02 [1)]	INT	2	●			
Encoder02 [2)]	DINT	4	●			
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
ReferenceModeEncoder01	BOOL	1			●	
ReferenceModeEncoder02	BOOL	1			●	
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
PowerSupply01	BOOL	1	●			

Table 487: Variable assignment in Automation Studio (X2X master) - DC2396

1) Only with function model 0

2) Only with function model 1

6.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	INT	2	●			
Encoder02	INT	2	●			
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
ReferenceModeEncoder01	BOOL	1			●	
ReferenceModeEncoder02	BOOL	1			●	
StatusInput01	BOOL	1	●			
StatusInput02	BOOL	1	●			
PowerSupply01	BOOL	1	●			

Table 488: Variable assignment in Automation Studio (CANIO) - DC2396

6.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
2080	Encoder01	INT	2	●	●		
2592	Encoder02	INT	2	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2628	ReferenceModeEncoder02	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
2630	StatusInput02	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1				●
4106	Cfo_EdgeDetectRising	USINT	1				●
2064	Cf0_PresetABR01_1	INT	2				●
2576	Cf0_PresetABR02_1	INT	2				●
512	ConfigOutput24	UINT	2				●
522	ConfigOutput26	USINT	1				●
520	ConfigOutput27	USINT	1				●
544	ConfigOutput32	UINT	2			●	●
554	ConfigOutput34	USINT	1			●	●
552	ConfigOutput35	USINT	1			●	●

Table 489: CANopen data points - DC2396

6.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01	INT	2	●	●		
2592	Encoder02	INT	2	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2628	ReferenceModeEncoder02	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
2630	StatusInput02	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1				●
4106	Cfo_EdgeDetectRising	USINT	1				●
2064	Cf0_PresetABR01_1	INT	2				●

Table 490: DeviceNet data points - DC2396

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2576	Cf0_PresetABR02_1	INT	2				●
512	ConfigOutput24	UINT	2				●
522	ConfigOutput26	USINT	1				●
520	ConfigOutput27	USINT	1				●
544	ConfigOutput32	UINT	2			●	●
554	ConfigOutput34	USINT	1			●	●
552	ConfigOutput35	USINT	1			●	●

Table 490: DeviceNet data points - DC2396

6.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01[1)]	INT	2	●	●		
2080	Encoder01_32Bit[2)]	DINT	4	●	●		
2592	Encoder02 [1)]	INT	2	●	●		
2592	Encoder02_32Bit [2)]	DINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2628	ReferenceModeEncoder02	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
2630	StatusInput02	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			● [3)]	●
4106	Cfo_EdgeDetectRising	USINT	1			● [3)]	●
2064	Cf0_PresetABR01_1[1)]	INT	2			● [3)]	●
2064	Cf0_PresetABR01_1_32Bit[2)]	DINT	4			● [3)]	●
2576	Cf0_PresetABR02_1[1)]	INT	2			● [3)]	●
2576	Cf0_PresetABR02_1_32Bit[2)]	DINT	4			● [3)]	●
512	ConfigOutput24	UINT	2			● [3)]	●
522	ConfigOutput26	USINT	1			● [3)]	●

Table 491: Modbus/TCP data points - DC2396

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
520	ConfigOutput27	USINT	1			● 3)	●
544	ConfigOutput32	UINT	2			● 3)	●
554	ConfigOutput34	USINT	1			● 3)	●
552	ConfigOutput35	USINT	1			● 3)	●

Table 491: Modbus/TCP data points - DC2396

1) Only with function model 0

2) Only with function model 1

3) With the default configuration, these registers are not located in the area for cyclic output data. However, using a special function (Modbus/TCP User's Manual) these registers can also be applied cyclically.

6.7 Cyclic encoder registers

6.7.1 Register: Encoder01, Encoder02

The encoders are represented by 16-bit values.

Data type	Description	
INT1)	-32768 - 32767 ...	Encoder counter value

1) Only with function model 0

6.7.2 Register: Encoder01_32Bit, Encoder02_32Bit

The encoders are represented by 32-bit values.

Data type	Description	
DINT1)	-2147483648 - 2147483647 ...	Encoder counter value

1) Only with function model 1

6.7.3 Register: DigitalInput 1 - 2

Bit	Description
0	Input status - Encoder01 signal A
1	Input status - Encoder01 signal B
2	Input status - Encoder01 reference pulse
3	Input status - digital input 1
4	Input status - Encoder02 signal A
5	Input status - Encoder02 signal B
6	Input status - Encoder02 reference pulse
7	Input status - digital input 2

6.7.4 Register: DigitalInput01 - DigitalInput02

BOOL	Description
x	0/1 ... Input status - digital input

6.7.5 Register: ReferenceModeEncoder01, ReferenceModeEncoder02

ReferenceModeEncoder01:
This register determines the reference mode for Encoder01.

ReferenceModeEncoder02:
This register determines the reference mode for Encoder02.

Bit	Description
0 - 1	00 ... Referencing OFF 01 ... One-time reference (single shot) 11 ... Continuous referencing
2 - 5	0000 ... Bits permanently set = 0
6 - 7	00 ... Referencing OFF 11 ... Bits permanently set = 1

Table 492: Reference mode - DC2396

This results in the following values:

%00000000 = $00 = Referencing OFF

%11000001 = $C1 = One-time reference (single shot)

When starting over after the referencing process is complete, the value $00 must be written. Then wait until the StatusInput01 also takes on the value $00
Only then can the value $C1 be written.

%11000011 = $C3 = Continuous referencing

Referencing occurs at every reference pulse.

It is important to know how the optional reference enable (see section 6.9.4 "Referencing with reference enable input" on page 309) is configured.

6.7.6 Register: StatusInput01, StatusInput02

StatusInput01:
This register contains information regarding whether the referencing process is off, active, or complete for Encoder01.

StatusInput02:
This register contains information regarding whether the referencing process is off, active, or complete for Encoder02.

Bit	Description
0 - 1	00 ... Always 0
2	0/1 ... Bit is always 1 after the first reference impulse
3	0/1 ... Toggle after each completed reference
4	0/1 ... Bit is always 1 after the first reference impulse
5 - 7	xxx ... Free-running counter, increased with each reference impulse

Table 493: Encoder status information - DC2396

Examples of possible values:

%00000000 = $00 = Referencing off or already in progress

%00111100 = $3C = first reference complete, reference value applied in register Encoder01

%xxx11100 = $xB = Bits 5 - 7 are changed sequentially with each reference impulse

%xxx1x100 = $xx = Bits changed continuously with the setting continuous referencing. With every reference impulse, the reference value is applied to register Encoder01

It is important to know how the optional reference enable (see section 6.9.4 "Referencing with reference enable input" on page 309) is configured.

6.7.7 Register: PowerSupply 1

This register shows the status of the integrated encoder supplies.

Bit	Description
0	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

6.7.8 Register: PowerSupply01

BOOL	Description
x	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

6.8 Encoder01 configuration register for cyclical operation

6.8.1 Reference pulse - positive edge

The following registers must be configured by setting the listed values one time using a non-cyclic write command so that the reference process is completed on the positive edge of the reference pulse.

Register: CfO_EdgeDetectFalling

USINT	Description
$x0	$x0 ... Configuration value x defined by settings for Encoder02 Default: $00

Register: CfO_EdgeDetectRising

USINT	Description
$x4	$x4 ... Configuration value x defined by settings for Encoder02 Default: $44

Register: ConfigOutput24

UINT	Description
$1012	$1012 ... Configuration value

6.8.2 Reference pulse - negative edge (default configuration)

The following registers must be configured by setting the listed values one time using a non-cyclic write command so that the reference process is completed on the negative edge of the reference pulse.

Register: CfO_EdgeDetectFalling

USINT	Description
$x4	$x4 ... Configuration value x defined by settings for Encoder02 Default: $44

Register: CfO_EdgeDetectRising

USINT	Description
$x0	$x0 ... Configuration value x defined by settings for Encoder02 Default: $00

Register: ConfigOutput24

UINT	Description
$1002	$1002 ... Configuration value (default)

6.8.3 Preset home position

This register allows you to apply a preset home position using a one-time non-cyclic write command (default = 0). The value set here is applied to the counter value upon completion of the referencing process.

Register: CfO_PresetABR01_1

Data type	Description	
INT[1]	-32768 - 32767 ...	Home position

1) Only with function model 0

Register: CfO_PresetABR01_1_32Bit

Data type	Description	
DINT[1]	-2147483648 - 2147483647 ...	Home position

1) Only with function model 1

6.8.4 Referencing with reference enable input

Regardless of the referencing mode, it is possible to prevent the home position from being taken over when the corresponding reference input voltage level occurs (DigitalInput01 / DigitalInput 1 bit 3). The desired setting can be configured using a one-time non-cyclic write command.

Register: ConfigOutput27

USINT	Description	
$0x	$00 ...	Reference enable input OFF (default)
	$08 ...	Reference enable input activated

Register: ConfigOutput26

The voltage level to activate reference enable (DigitalInput01 / DigitalInput 1 bit 3) is configured with this register.

USINT	Description	
$0x	$00 ...	Reference enable is active at 0 VDC
	$08 ...	Reference enable is active at 24 VDC

6.9 Encoder02 configuration register for cyclical operation

6.9.1 Reference pulse - positive edge

The following registers must be configured by setting the listed values one time using a non-cyclic write command so that the reference process is completed on the positive edge of the reference pulse.

Register: CfO_EdgeDetectFalling

USINT	Description
$0x	$0x ... Configuration value x defined by settings for Encoder01 Default: $00

Register: CfO_EdgeDetectRising

USINT	Description
$4x	$4x ... Configuration value x defined by settings for Encoder01 Default: $44

Register: ConfigOutput32

UINT	Description
$1016	$1016 ... Configuration value

6.9.2 Reference pulse - negative edge

The following registers must be configured by setting the listed values one time using a non-cyclic write command so that the reference process is completed on the negative edge of the reference pulse.

Register: CfO_EdgeDetectFalling

USINT	Description
$4x	$4x ... Configuration value x defined by settings for Encoder01 Default: $44

Register: CfO_EdgeDetectRising

USINT	Description
$0x	$0x ... Configuration value x defined by settings for Encoder01 Default: $00

Register: ConfigOutput32

UINT	Description
$1006	$1006 ... Configuration value (default)

6.9.3 Preset home position

This register allows you to apply a preset home position using a one-time non-cyclic write command (default = 0). The value set here is applied to the counter value upon completion of the referencing process.

Register: CfO_PresetABR02_1

Data type	Description
INT1)	-32768 - 32767 ... Home position

1) Only with function model 0

Register: CfO_PresetABR02_1

Data type	Description
DINT1)	-2147483648 - 2147483647 ... Home position

1) Only with function model 1

6.9.4 Referencing with reference enable input

Regardless of the referencing mode, it is possible to prevent the home position from being taken over when the corresponding reference input voltage level occurs (DigitalInput02 / DigitalInput 1 bit 7). The desired setting can be configured using a one-time non-cyclic write command.

Register: ConfigOutput35

USINT	Description
$x0	$00 ... Reference enable input OFF (default) $80 ... Reference enable input activated

Register: ConfigOutput34

The voltage level to activate reference enable (DigitalInput02 / DigitalInput 1 bit 7) is configured with this register.

USINT	Description
$x0	$00 ... Reference enable is active at 0 VDC $80 ... Reference enable is active at 24 VDC

6.9.5 Function models

A function model describes the registers for the module (memory model) which are available for the application. Only these registers are processed on the module during each cycle and cyclically transferred using the bus.

Function model 0 with 16-bit encoder counter value (default)

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01	INT	2	●	●		
2592	Encoder02	INT	2	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2628	ReferenceModeEncoder02	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
2630	StatusInput02	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1	INT	2			●	●
2576	Cf0_PresetABR02_1	INT	2			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●
544	ConfigOutput32	UINT	2			●	●
554	ConfigOutput34	USINT	1			●	●
552	ConfigOutput35	USINT	1			●	●

Table 494: Function model 0 with 16-bit encoder - DC2396

Function model 1 with 32-bit encoder counter value

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
2080	Encoder01_32Bit	DINT	4	●	●		
2592	Encoder02_32Bit	DINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
2116	ReferenceModeEncoder01	USINT	1			●	●
2628	ReferenceModeEncoder02	USINT	1			●	●
2118	StatusInput01	USINT	1	●	●		
2630	StatusInput02	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
4104	Cf0_EdgeDetectFalling	USINT	1			●	●
4106	Cfo_EdgeDetectRising	USINT	1			●	●
2064	Cf0_PresetABR01_1_32Bit	DINT	4			●	●
2576	Cf0_PresetABR02_1_32Bit	DINT	4			●	●
512	ConfigOutput24	UINT	2			●	●
522	ConfigOutput26	USINT	1			●	●
520	ConfigOutput27	USINT	1			●	●
544	ConfigOutput32	UINT	2			●	●
554	ConfigOutput34	USINT	1			●	●
552	ConfigOutput35	USINT	1			●	●

Table 495: Function model 1 with 32-bit encoder - DC2396

6.9.6 Function models - used where?

Name	Automation Studio	CANopen	DeviceNet	Modbus/TCP	CAN I/O
Function model 0 with 16-bit encoder data (default)	●	●	●	●	●
Function model 1 with 32-bit encoder data	●			●	

Table 496: Function models - DC2396

6.10 B&R ID code

Code for module identification ($1BAB).

6.11 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥128 μs

Table 497: Minimum cycle time - DC2396

6.12 Maximum cycle time

The maximum cycle time is the maximum time the bus cycle can take to start without internal counter overruns causing module errors.

Minimum cycle time
<16 ms

Table 498: Maximum cycle time - DC2396

6.13 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
≥128 μs

Table 499: Minimum I/O update time - DC2396

7. X20DC2398

7.1 Register overview

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
7440	Encoder02	UDINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
7176	ConfigOutput15	UINT	2			●	●
7432	ConfigOutput16	UINT	2			●	●

Table 500: Register overview - DC2398

7.2 Variable assignment in Automation Studio (X2X master)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	UDINT	4	●			
Encoder02	UDINT	4	●			
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
PowerSupply01	BOOL	1	●			

Table 501: Variable assignment in Automation Studio (X2X master) - DC2398

7.3 Variable assignment in Automation Studio (CANIO)

Name	Data type	Length	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Encoder01	UDINT	4	●			
Encoder02	UDINT	4	●			
DigitalInput01	BOOL	1	●			
DigitalInput02	BOOL	1	●			
PowerSupply01	BOOL	1	●			

Table 502: Variable assignment in Automation Studio (CANIO) - DC2398

7.4 CANopen data points

Register	Name	Data type	Length	Read		Write	
				PDO	SDO	PDO	SDO
7184	Encoder01	UDINT	4	●	●		
7440	Encoder02	UDINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
7176	ConfigOutput15	UINT	2				●
7432	ConfigOutput16	UINT	2				●

Table 503: CANopen data points - DC2398

7.5 DeviceNet data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
7440	Encoder02	UDINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
7176	ConfigOutput15	UINT	2				●
7432	ConfigOutput16	UINT	2				●

Table 504: DeviceNet data points - DC2398

7.6 Modbus/TCP data points

Register	Name	Data type	Length	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
7184	Encoder01	UDINT	4	●	●		
7440	Encoder02	UDINT	4	●	●		
264	DigitalInput 1 - 2	USINT	1	●	●		
40	PowerSupply 1	USINT	1	●	●		
7176	ConfigOutput15	UINT	2			● 1)	●
7432	ConfigOutput16	UINT	2			● 1)	●

Table 505: Modbus/TCP data points - DC2398

1) With the default configuration, these registers are not located in the area for cyclic output data. However, using a special function (Modbus/TCP User's Manual) these registers can also be applied cyclically.

7.7 SSI encoder cyclic register

7.7.1 Register: Encoder01, Encoder02

The two SSI encoder values are displayed as 32-bit position values. The SSI position values are generated synchronously with the X2X cycle.

Data type	Description
DINT	-2147483648 - 2147483647 ... SSI positions

7.7.2 Register: DigitalInput 1 - 2

Bit	Description
3	Input status - digital input 1
7	Input status - digital input 2

7.7.3 Register: DigitalInput01 - DigitalInput02

BOOL	Description
x	0/1 ... Input status - digital input

7.7.4 Register: PowerSupply 1

This register shows the status of the integrated encoder supplies.

Bit	Description
0	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

7.7.5 Register: PowerSupply01

BOOL	Description
x	0 ... 24 VDC encoder supply voltage OK 1 ... 24 VDC encoder supply voltage faulty

7.8 SSI encoder configuration register for cyclical operation

7.8.1 Register: ConfigOutput15, ConfigOutput16

ConfigOutput15: Configuration register for SSI Encoder01
ConfigOutput16: Configuration register for SSI Encoder02

These configuration registers are used to set the coding, the clock rate and the number of bits. Default = 0. This must be set once using a non-cyclic write command.

Bit	Description
0 - 5	Number of bits valid for SSI value
6 - 7	Clock rate: 11: 125 kHz
8 - 13	Total number of bits in SSI, including leading zeros
14	0 ... Reserved
15	0 ... Binary coding 1 ... Gray coding

7.9 B&R ID code

Code for module identification ($1BAD).

7.10 Minimum cycle time

The minimum cycle time is the minimum time needed for the bus cycle to be shut down without a communication error occurring. It should be noted that very fast cycles have reduced the idle time needed for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
≥128 μs

Table 506: Minimum cycle time - DC2398

7.11 Maximum cycle time

The maximum cycle time is the maximum time the bus cycle can take to start without internal counter overruns causing module errors.

Minimum cycle time
<16 ms

Table 507: Maximum cycle time - DC2398

7.12 Minimum I/O update time

The minimum I/O update time refers to the minimum time it takes for the bus cycle to shut down, so that in each cycle an I/O update takes place.

Minimum I/O update time
≥128 μs

Table 508: Minimum I/O update time - DC2398