X67DM9331.L12

1 General information

This module has 8 digital channels that can be configured as inputs or outputs. The inputs are designed for sink connections, the outputs for source connections. The outputs can handle up to 2 A. The summation current is 8 A.

The node number switch for setting the X2X Link address is a unique feature. When modular machine configurations change, it is necessary, for example, to define specific module groups at a fixed address that is independent of the preceding modules in the line. All subsequent standard modules refer to this offset and use it automatically for addressing purposes.

- ▪ 8 digital channels, configurable as inputs or outputs
- ▪ Outputs can handle up to 2 A
- ▪ Node number switches for setting the X2X Link address
- ▪ Replacement of passive distributors
- ▪ All outputs with single-channel diagnostics
- ▪ Extensive additional status information

2 Order data

Model number	Short description	Figure
	Digital mixed modules	
X67DM9331.L12	X67 digital mixed module, 8 channels configurable as inputs or outputs, 24 VDC, 2 A, configurable input filter, single-channel sensor/actuator supply monitoring, M12 connectors, X2X Link address switch, high-density module	

Table 1: X67DM9331.L12 - Order data

Required accessories
For a general overview, see section "Accessories - General overview" of the X67 system user's manual.

3 Technical data

Model number	X67DM9331.L12
Short description	
I/O module	8 digital channels, configurable as inputs or outputs using software
General information	
Isolation voltage between channel and bus	500 V$_{Eff}$
Nominal voltage	24 VDC
B&R ID code	0x1B15
Sensor/Actuator power supply	
Sensor/Actuator current	0.1 A
Summation current	0.5 A
Status indicators	I/O function for each channel, sensor/actuator power supply for each channel, supply voltage, bus function
Diagnostics	
Outputs	Yes, using status LED and software
I/O power supply	Yes, using status LED and software
Sensor/Actuator power supply	Yes, using status LED and software
Connection type	
X2X Link	M12, B-keyed
Inputs/Outputs	8x M12, A-keyed
I/O power supply	M8, 4-pin
Power consumption	
Internal I/O	1.7 W
X2X Link power supply	0.75 W
Certifications	
CE	Yes
KC	Yes
EAC	Yes
UL	cULus E115267 Industrial control equipment
HazLoc	cCSAus 244665 Process control equipment for hazardous locations Class I, Division 2, Groups ABCD, T5
ATEX	Zone 2, II 3G Ex nA IIA T5 Gc IP67, Ta = 0 - Max. 60°C TÜV 05 ATEX 7201X
I/O power supply	
Nominal voltage	24 VDC
Voltage range	18 to 30 VDC
Integrated protection	Reverse polarity protection
Power consumption	
Sensor/Actuator power supply	Max. 12 W [1]
Sensor/Actuator power supply	
Voltage	I/O power supply minus voltage drop for short circuit protection
Voltage drop for short-circuit protection at 0.5 A	Max. 2 VDC
Summation current	Max. 0.5 A
Short-circuit proof	Yes
Digital inputs	
Input voltage	18 to 30 VDC
Input current at 24 VDC	Typ. 4.4 mA
Input characteristics per EN 61131-2	Type 1
Input filter	
Hardware	≤70 µs
Software	Default 0 ms, configurable between 0 and 25 ms in 0.2 ms intervals
Input circuit	Sink
Input resistance	Typ. 5 kΩ
Switching threshold	
Low	<5 VDC
High	>15 VDC
Digital outputs	
Variant	FET positive switching
Switching voltage	I/O power supply minus residual voltage
Nominal output current	2 A
Total nominal current	8 A
Output circuit	Source
Output protection	Thermal cutoff for overcurrent and short circuit, integrated protection for switching inductances, reverse polarity protection for output power supply
Diagnostic status	Output monitoring with 10 ms delay
Leakage current when switched off	5 µA
Switching on after overload shutdown	Approx. 10 ms (depends on the module temperature)
Residual voltage	<0.5 V at 2 A nominal current
Peak short-circuit current	<21 A

Table 2: X67DM9331.L12 - Technical data

Model number	X67DM9331.L12
Switching delay	
0 → 1	<250 µs
1 → 0	<270 µs
Switching frequency	
Resistive load	Max. 100 Hz
Braking voltage when switching off inductive loads	50 VDC
Electrical properties	
Electrical isolation	Channel isolated from bus Channel not isolated from channel
Operating conditions	
Mounting orientation	
Any	Yes
Installation elevation above sea level	
0 to 2000 m	No limitations
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m
Degree of protection per EN 60529	IP67
Ambient conditions	
Temperature	
Operation	-25 to 60°C
Derating	-
Storage	-40 to 85°C
Transport	-40 to 85°C
Mechanical properties	
Dimensions	
Width	53 mm
Height	155 mm
Depth	42 mm
Weight	325 g
Torque for connections	
M8	Max. 0.4 Nm
M12	Max. 0.6 Nm

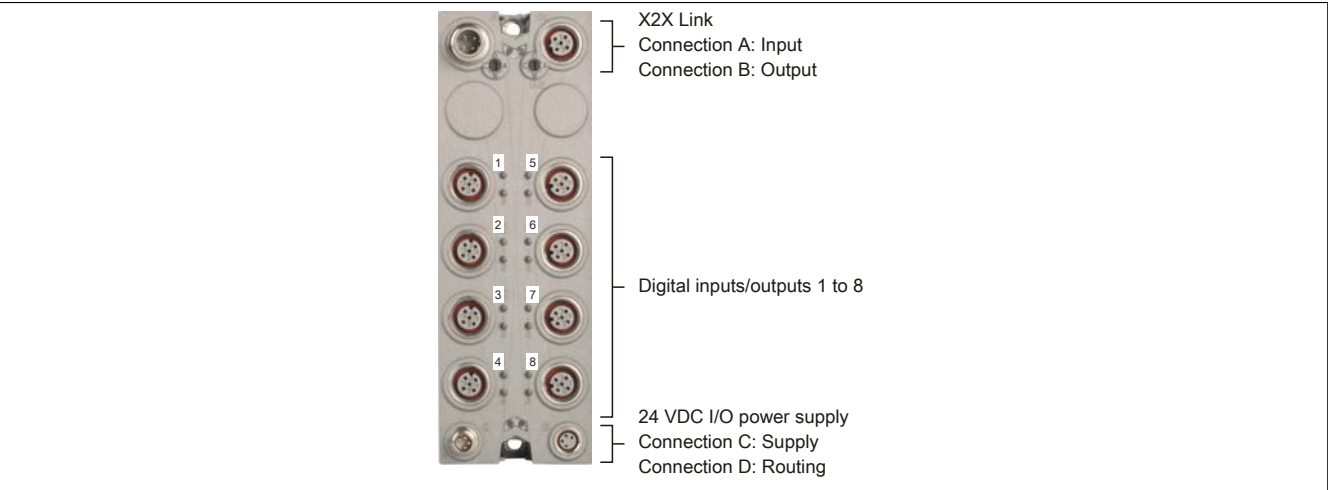Table 2: X67DM9331.L12 - Technical data

1)   The power consumption of the sensors and actuators connected to the module is not permitted to exceed 12 W.
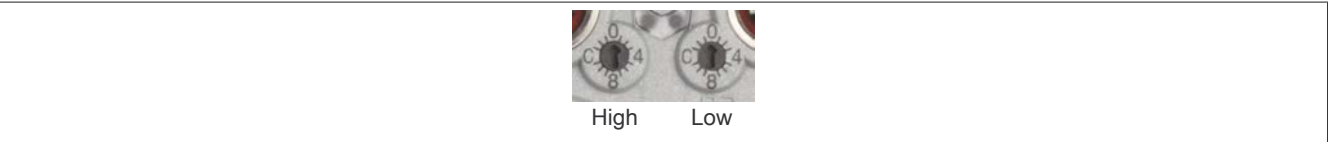
4 LED status indicators

Figure	LED	Color/Status		Description
 Status indicator 1: Left: green, Right: red Status indicator 2: Left: green, Right: red	**Status indicator 1**: Status indicator for X2X Link			
	LED	Green (left)	Red (right)	Description
		Off	Off	No power supply via X2X Link
		On	Off	X2X Link supplied, communication OK
		Off	On	X2X Link supplied but X2X Link communication not functioning
		On	On	PREOPERATIONAL: X2X Link supplied, module not initialized
	I/O LEDs			
	LED	Color	Status	Description
	x-1	Red	Off	Sensor/Actuator power supply within valid range
			On	Short circuit or overload
	x-2	Orange	-	Input/Output status of the corresponding digital input/output
	Status indicator 2: Status indicator for module function			
	LED	Color	Status	Description
	Left	Green	Off	No power to module
			Single flash	RESET mode
			Double flash	BOOT mode (during firmware update)1)
			Blinking	PREOPERATIONAL mode
			On	RUN mode
	Right	Red	Off	No power to module or everything OK
			On	Error or reset status
			Single flash	Warning/Error on an I/O channel. Level monitoring of digital outputs triggered or short circuit / overload of sensor/actuator power supply
			Double flash	Supply voltage not within valid range

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

5 Operating and connection elements

X2X Link
Connection A: Input
Connection B: Output

Digital inputs/outputs 1 to 8

24 VDC I/O power supply
Connection C: Supply
Connection D: Routing

6 Node number switches

High   Low

The decentralized X2X Link backplane, which connects individual X67 modules with one another, is set up to be self-addressing. Because of this, it is not necessary to set the node numbers. The module address is assigned according to its position in the X2X Link line.

In certain cases, e.g. when configurations of modular machines change, it is necessary to define specific module groups at a fixed address, regardless of the preceding modules in the line.

For this reason, the digital mixed module is equipped with node number switches that can be used to set the X2X Link address. All subsequent modules refer to this offset and use it automatically for addressing purposes.
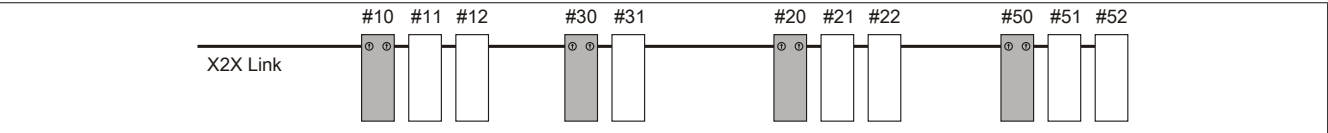

Figure 1: Sample configuration

If the node number on the module is set to 0x00, then the module address is assigned according to its position in the X2X Link line.

7 X2X Link

This module is connected to X2X Link using pre-assembled cables. The connection is made using M12 circular connectors.
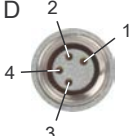
Connection	Pinout	
A	**Pin**	**Description**
	1	X2X+
	2	X2X
	3	X2X⊥
	4	X2X\
B	Shield connection made via threaded insert in the module. A → B-keyed (male), input B → B-keyed (female), output	

8 24 VDC I/O power supply

The I/O power supply is connected via M8 connectors C and D. The I/O power supply is connected via connector C (male). Connector D (female) is used to route the I/O power supply to other modules.

> **Information:**
>
> **The maximum permissible current for the I/O power supply is 8 A (4 A per connection pin)!**

Connection	Pinout	
	Pin	**Name**
	1	24 VDC[1]
	2	24 VDC[1]
	3	GND
	4	GND
	C → Connector (male) in module, feed for I/O power supply	
	D → Connector (female) in module, routing of I/O power supply	

1) Both supply pins must be supplied. Cutting off the outputs is only ensured if **both** pins are disconnected from the power supply.

> **Information:**
>
> **If the summation current of the outputs is >4 A, current must also be supplied via connector D, pin 2.**

9 Pinout
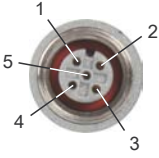
① X67CA0A41.xxxx: M12 sensor cable, straight
  X67CA0A51.xxxx: M12 sensor cable, angled

9.1 Connection X1 to X8

M12, 5-pin	Pinout	
Connection 1 to 4	**Pin**	**Name**
	1	24 VDC sensor/actuator power supply[1]
	2	Reserved
	3	GND
	4	Input/Output x
	5	NC
	Shield connection made via threaded insert in the module.	
	1) Sensors/Actuators are not permitted to be supplied externally.	
	X1 to X8 → A-keyed (female), input/output	
Connection 5 to 8		

10 Connection examples
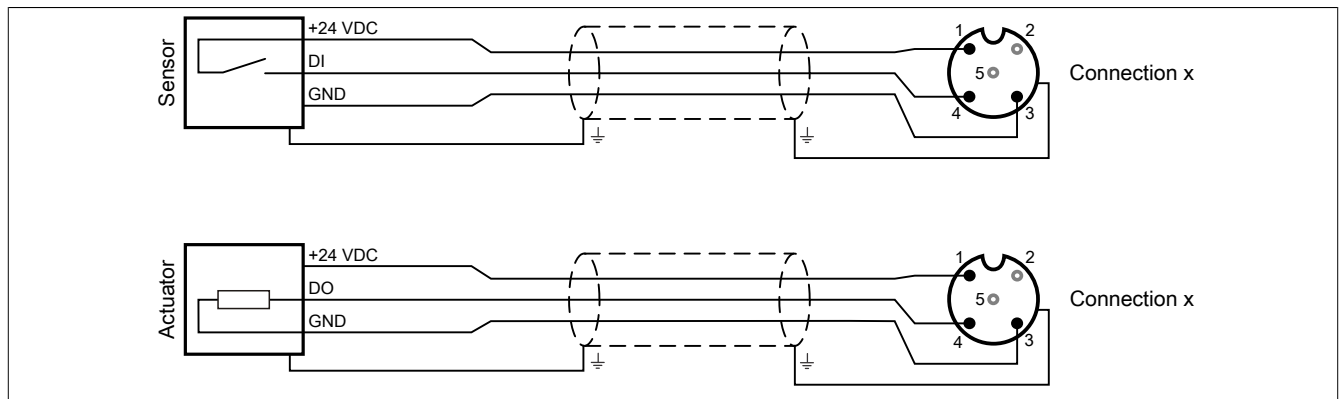
11 Input/Output circuit diagram
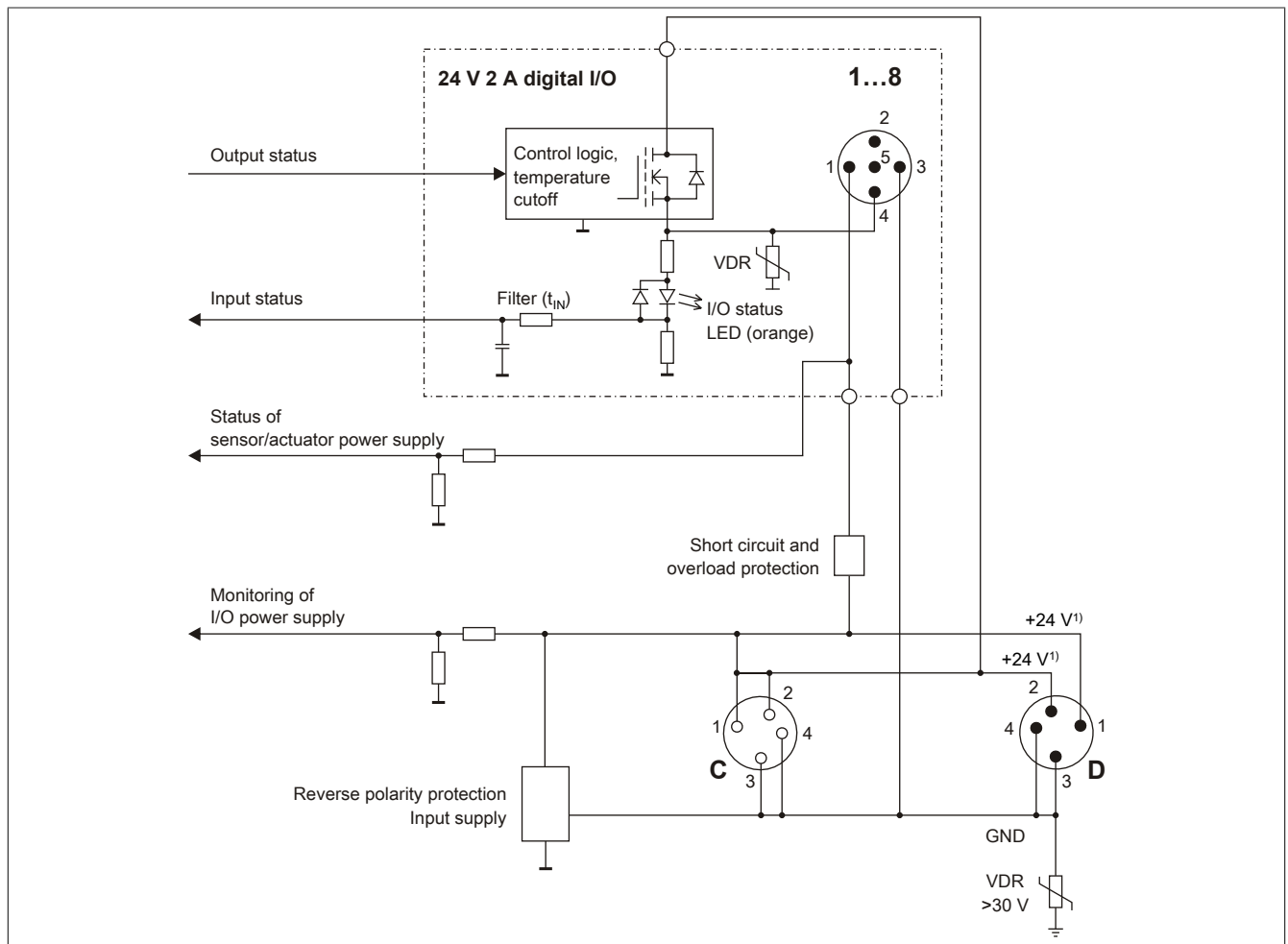
1) Cutting off the outputs is only ensured if **both** pins are disconnected from the power supply.

12 Switching inductive loads

13 Derating / Operation with 2 A

The outputs of the module can handle up to 2 A. With a summation current of 8 A, no more than 4 channels are operable at full load. To ensure optimal use of the module, it is important to assign the channels properly, and to keep in mind a potential derating.

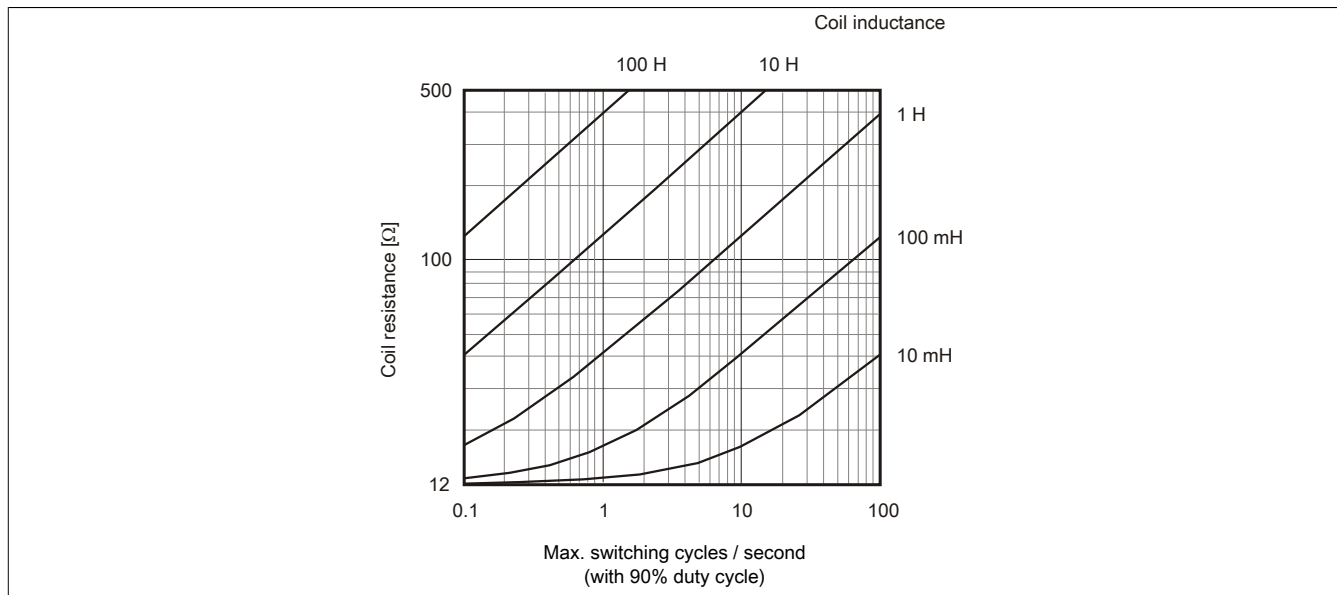Correct channel assignment is important, since the 8 outputs are divided between 2 output drivers. The channels operated with 2 A must therefore be evenly divided between both output drivers.

Output driver 1:   Channels 1 to 4
Output driver 2:   Channels 5 to 8

The following table provides an overview of the number of fully used channels, the resulting best distribution, and a potential derating.

Number of channels using 2 A	Division	Derating
1	Any	No
2	1st channel with 2 A ... channel no. 1 to 4 2nd channel with 2 A ... channel no. 5 to 8	No
3	Assign all even or all odd channel numbers. Examples: 1, 3, 5 2, 4, 6 3, 5, 7 4, 6, 8	Channels 1 and 3 Channels 2 and 4 Channels 5 and 7 Channels 6 and 8
4	Assign all even or all odd channel numbers. Possible divisions: 1, 3, 5, 7 2, 4, 6, 8	On each channel On each channel

Derating when 3 or 4 channels are operated with 2 A:
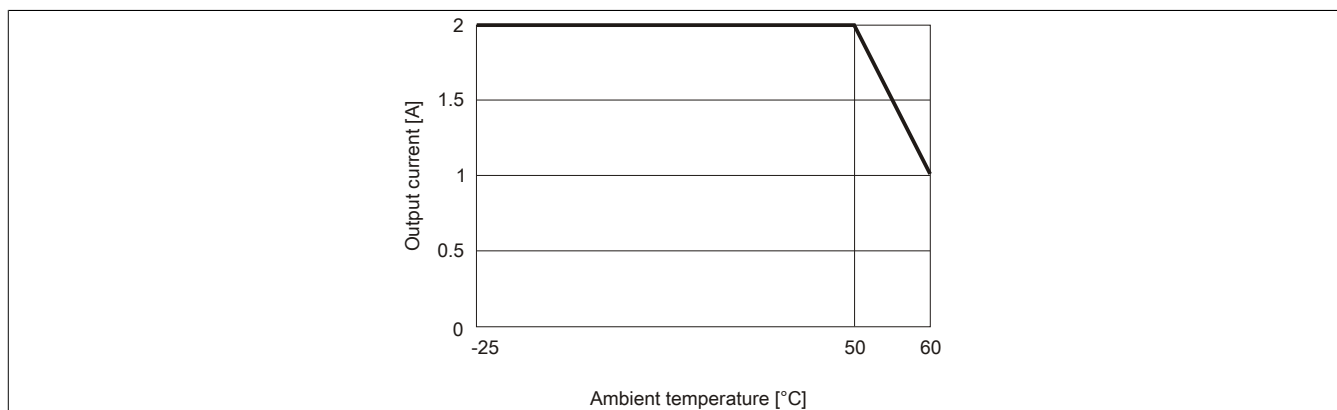
14 Register description

14.1 General data points

In addition to the registers listed in the register description, the module also has other more general data points. These registers are not specific to the module but contain general information such as serial number and hardware version.

These general data points are listed in section "Additional information - General data points" of the X67 system user's manual.

14.2 Function model 0 - Standard

Register	Name	Data type	Read		Write	
			Cyclic	Acyclic	Cyclic	Acyclic
Configuration						
16	ConfigIOMask01	USINT				●
18	ConfigOutput01 (input filter)	USINT				●
Communication						
0	Input state of digital inputs 1 to 8	USINT	●			
	DigitalInput01	Bit 0				
	...	...				
	DigitalInput08	Bit 7				
2	Switching state of digital outputs 1 to 8	USINT			●	
	DigitalOutput01	Bit 0				
	...	...				
	DigitalOutput08	Bit 7				
28	Status of the actuator/sensor power supply	USINT	●			
	StatusSensor01	Bit 0				
	...	...				
	StatusSensor08	Bit 7				
30	Status of digital outputs 1 to 8	USINT	●			
	StatusDigitalOutput01	Bit 0				
	...	...				
	StatusDigitalOutput08	Bit 7				
8192	asy_ModulID	UINT		●		
8196	asy_SupplyStatus	USINT		●		
8208	asy_SupplyInput	USINT		●		
8210	asy_SupplyOutput	USINT		●		

14.3 Function model 254 - Bus controller

Register	Offset[1]	Name	Data type	Read		Write	
				Cyclic	Acyclic	Cyclic	Acyclic
Configuration							
16	-	ConfigIOMask01	USINT				●
18	-	ConfigOutput01 (input filter)	USINT				●
Communication							
0	0	Input state of digital inputs 1 to 8	USINT	●			
		DigitalInput01	Bit 0				
		...	...				
		DigitalInput08	Bit 7				
2	0	Switching state of digital outputs 1 to 8	USINT			●	
		DigitalOutput01	Bit 0				
		...	...				
		DigitalOutput08	Bit 7				
28	-	Status of the actuator/sensor power supply	USINT	●			
		StatusSensor01	Bit 0				
		...	...				
		StatusSensor08	Bit 7				
30	-	Status of digital outputs 1 to 8	USINT	●			
		StatusDigitalOutput01	Bit 0				
		...	...				
		StatusDigitalOutput08	Bit 7				
8192	-	asy_ModulID	UINT		●		
8196	-	asy_SupplyStatus	USINT		●		
8208	-	asy_SupplyInput	USINT		●		
8210	-	asy_SupplyOutput	USINT		●		

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

14.3.1 Using the module on the bus controller

Function model 254 "Bus controller" is used by default only by non-configurable bus controllers. All other bus controllers can use additional registers and functions depending on the fieldbus used.

For detailed information, see section "Additional information - Using I/O modules on the bus controller" of the X67 user's manual (version 3.30 or later).

14.3.2 CAN I/O bus controller

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

14.4 Configuration

14.4.1 I/O mask 1 to 8

Name:
ConfigIOMask01

Channels are configured as inputs/outputs in this register. It also determines whether output monitoring or filtering is applied to the channels. Outputs are monitored but not filtered.

Data type	Values	Bus controller default setting
USINT	See bit structure.	0

Bit structure:

Bit	Description	Value	Information
0	Channel 1 configured as input/output	0	Configured as input (bus controller default setting)
		1	Configured as output
...		...	
7	Channel 8 configured as input/output	0	Configured as input (bus controller default setting)
		1	Configured as output

14.4.2 Input filter

An input filter is available for each input. The input delay can be set using register . Disturbance pulses which are shorter than the input delay are suppressed by the input filter.
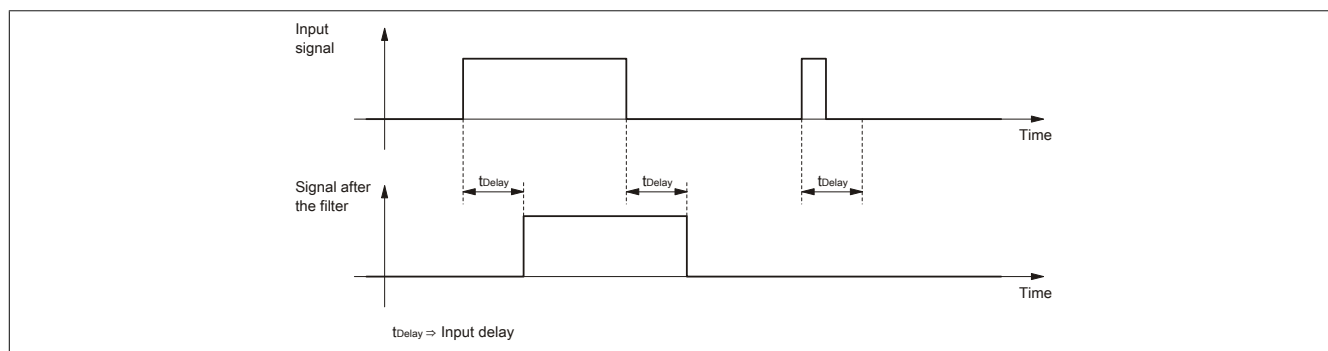
14.4.2.1 Digital input filter

Name:
ConfigOutput01

This register can be used to specify the filter value for all digital inputs.

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

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

14.5 Communication

14.5.1 Digital inputs

Unfiltered

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

Filtered

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

14.5.1.1 Input state of digital inputs 1 to 8

Name:
DigitalInput01 to DigitalInput08

This register indicates the input state of digital inputs 1 to 8.

Data type	Values
USINT	See the bit structure.

Bit structure:

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

14.5.2 Digital outputs

The output status is transferred to the output channels with a fixed offset in relation to the network cycle (SyncOut).

14.5.2.1 Switching state of digital outputs 1 to 8

Name:
DigitalOutput01 to DigitalOutput08

This register is used to store the switching state of digital outputs 1 to 8.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Name	Value	Information
0	DigitalOutput01	0	Digital output 01 reset
		1	Digital output 01 set
...		...	
7	DigitalOutput08	0	Digital output 08 reset
		1	Digital output 08 set

14.5.2.2 Status of the actuator/sensor power supply

Name:
StatusSensor01 to StatusSensor08

This register is used to indicate the status of digital actuator/sensor power supply 1 to 8.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Name	Value	Information
0	StatusSensor01	0	Channel 01: Actuator/Sensor power supply in valid range
		1	Channel 01: Short circuit or overload
...		...	
7	StatusSensor08	0	Channel 08: Actuator/Sensor power supply in valid range
		1	Channel 08: Short circuit or overload

14.5.3 Monitoring status of the digital outputs

On the module, the output states of the outputs are compared to the target states. The control of the output driver is used for the target state.

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

14.5.3.1 Status of digital outputs 1 to 8

Name:
StatusDigitalOutput01 to StatusDigitalOutput08

This register is used to indicate the status of digital outputs 1 to 8.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Name	Value	Information
0	StatusDigitalOutput01	0	Channel 01: No error
		1	Channel 01: Short circuit or overload
...		...	
7	StatusDigitalOutput08	0	Channel 08: No error
		1	Channel 08: Short circuit or overload

14.5.4 Reading the module ID

Name:
asy_ModulID

This register offers the possibility to read the module ID.

Data type	Values
UINT	Module ID

14.5.5 Operating limit status registers

Name:
asy_SupplyStatus

This register can be used to read the status of the operating limits.

Data type	Values
USINT	See bit structure.

Bit structure:

Bit	Description	Value	Information
0	I/O power supply within/outside warning limits	0	Within the warning limits (18 to 30 V)
		1	Outside of the warning limits (<18 V or >30 V)
1 - 7	Reserved	0	

14.5.6 I/O supply voltage

Name:
asy_SupplyInput

This register contains the I/O supply voltage measured by the module.

Data type	Values	Information
USINT	0 to 255	Resolution 1 V

14.5.7 Output supply voltage

Name:
asy_SupplyOutput

This register contains the output supply voltage measured by the module.

Data type	Values	Information
USINT	0 to 255	Resolution 1 V

14.6 Minimum I/O update time

The minimum I/O update time defines how far the bus cycle can be reduced while still allowing an I/O update to take place in each cycle.

Minimum I/O update time	
Without filtering	150 µs
With filtering	200 µs

14.7 Minimum cycle time

The minimum cycle time specifies the time up to which the bus cycle can be reduced without communication errors occurring. It is important to note that very fast cycles reduce the idle time available for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time	
Without filtering	150 µs
With filtering	200 µs