

User Manual



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JX3-DI16
Digital input module

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Translation of the german original User Manual

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1 Introduction

1.1 Information on this document

This document forms an integral part of the product and must be read and understood prior to using the device. It contains important and safety-related information for the proper use of the product as intended.

Target Groups

This document is intended for specialists with appropriate qualifications.

Only competent and trained personnel are allowed to put this device into operation.

During the whole product life cycle, safe handling and operation of the device must be ensured. In the case of missing or inadequate technical knowledge or knowledge of this document any liability is excluded.

Availability of Information

Make sure this document is kept at the ready in the vicinity of the product throughout its service life.

For information on new revisions of this document, visit the download area on our website. This document is not subject to any updating service.

[Start | www.bucherautomation.com](http://www.bucherautomation.com)

For further information refer to the following information products:

- User manuals
Information on commissioning Bucher Automation products
- Online help for the JetSym software
Functions of software products with application examples
- Application-oriented manuals
Product-independent documentation
- Version updates
Information about changes to the software products and operating system of your device

Info

Further information

For further information on the noise immunity of a system, please refer to the Application Note 016 *EMC-Compatible Installation of the Electric Cabinet* available for download on www.bucherautomation.com.

1.2 Typographical conventions

This manual uses different typographical effects to support you in finding and classifying information. Below, there is an example of a step-by-step instruction:

- ✓ This symbol indicates requirements which have to be met before executing the following action.
- ▶ This sign or a numbering at the beginning of a paragraph marks an action instruction that must be executed by the user. Execute the instructions one after the other.
- ⇒ The target after a list of instructions indicates reactions to, or results of these actions.

Info

Further information and practical tips

In the info box you will find helpful information and practical tips about your product.

2 Safety

2.1 General

The product corresponds to the current state of science and technology when placed on the market. In addition to this user manual, the laws, regulations and directives of the country of operation or the EU apply to the operation of the product. The operator is responsible for compliance with the relevant accident prevention regulations and generally recognized safety rules.

2.2 Purpose

2.2.1 Intended use

This expansion module is for adding digital inputs to controllers.

Operate the device only in accordance with the intended conditions of use and within the limits set forth in the technical specifications.

Intended use of the product includes its operation in accordance with this manual.

SELV

The operating voltage of this device is classified as Safety Extra Low Voltage and is, therefore, not subject to the EU Low Voltage Directive. The device may only be operated from a SELV source.

2.2.2 Non-intended use

Do not use the device in technical systems for which a high level of failure safety is specified.

Machinery Directive

This device is not a safety-related part as per Machinery Directive 2006/42/EC and must, therefore, not be used for safety-relevant applications.

2.3 Warnings used in this document

DANGER



High risk

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING



Medium risk

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION



Low risk

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE



Material damage

Indicates a situation which, if not avoided, could result in malfunctions or material damage.

3 Product description

The JX3-DI16 is an expansion module for the connection of digital sensors. The module is equipped with 16 digital inputs.

3.1 Design

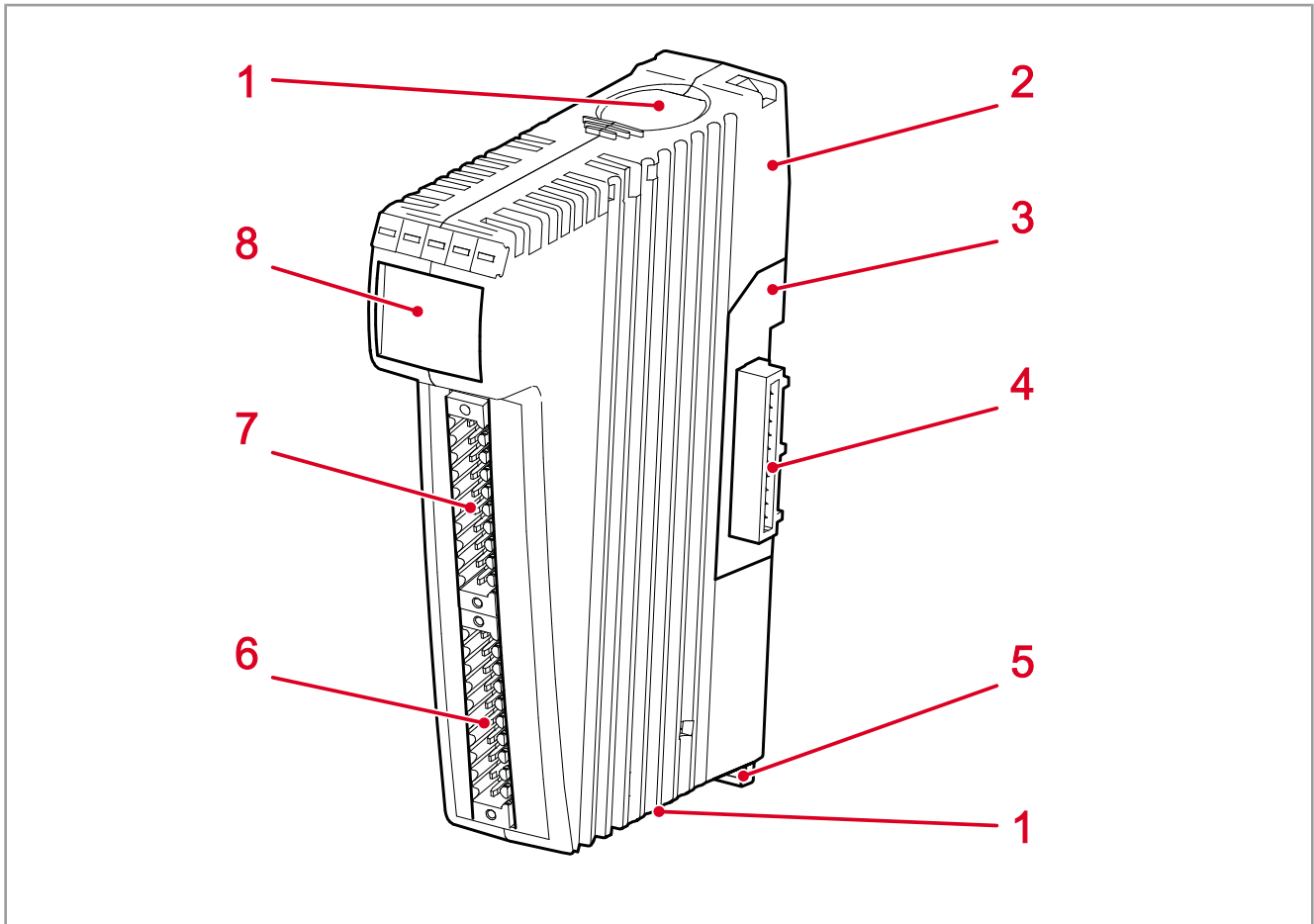


Fig. 1: Design

1	Latch
2	Housing
3	Backplane module
4	Connector for expansion modules
5	DIN rail release latch
6	Digital inputs 1 ... 8
7	Digital inputs 9 ... 16
8	Status indication

3.2 Product features

- Pulse stretching - 8 digital inputs can be configured
- Digital input filters for the inputs
- Sensor voltage recognition

3.3 Status indication

LEDs indicate the communication status of the module as well as the status of the power supply.

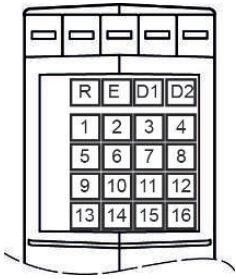


Fig. 2: Status indication

LED	Description
R	Logic circuit supply
E	Communication with controller or bus node
D1	No function
D2	No function
1 ... 16	Digital level

Tab. 1: Description of the LEDs

3.3.1 Diagnostic choices using status lights

The expansion module is equipped with 20 LEDs which indicate states. The LED colors indicate different states for simple diagnostics. The amber LEDs indicate the digital level of the connected hardware.

The amber LEDs 1 through 16 refer to digital inputs IN 1 through IN 16.

Diagnostics capabilities are also offered in the Setup window of the JetSym software.

LED	Lighting pattern	Color	Description
R	OFF	---	No logic circuit supply
	ON	Green	Logic voltage supply is OK
E	OFF	---	Communication with controller or bus node is active
	ON	Red	Communication with controller or bus node is Inactive
D1/D2	---	---	No function
1 ... 16	OFF		State of input 1 ... 16 = OFF. Input 1 ... 16 has low level, voltage level of the terminal < +11 V
	ON	Yellow	State of input 1 ... 16 = ON. Input 1 ... 16 has high level, voltage level of the terminal > +11 V

3.4 Nameplate

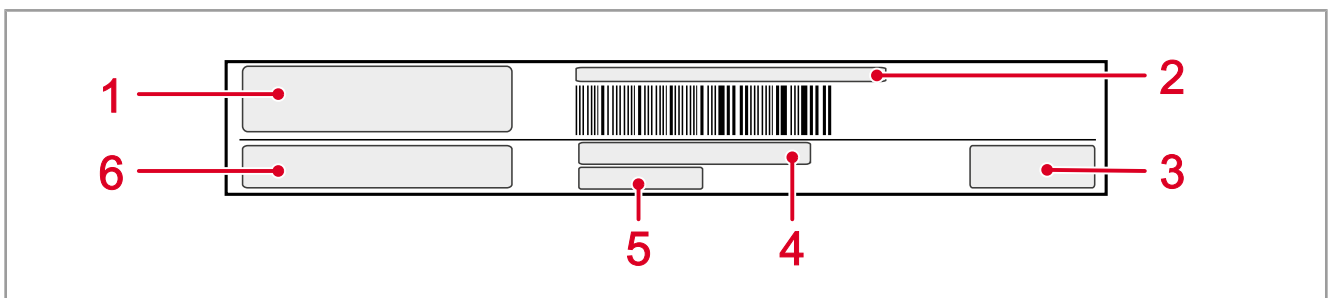


Fig. 3: Sample nameplate

1	Company logo
2	Serial number
3	Certification mark
4	Item number
5	Hardware revision
6	Item name

3.5 Scope of delivery

Scope of delivery	Item number	Quantity
JX3-DI16	10000516	1
OR		
JX3-DI16_PI	10001479	1
Male connector with PUSH-IN connection, 10-pin	60869254	2
AND		
Terminal labels	60870411	10
Keying pins	60870410	1
Product Documentation Note	60888123	1

4 Technical specifications

This chapter contains information on both electrical and mechanical data as well as on operating data of the JX3-DI16 device.

4.1 Dimensions

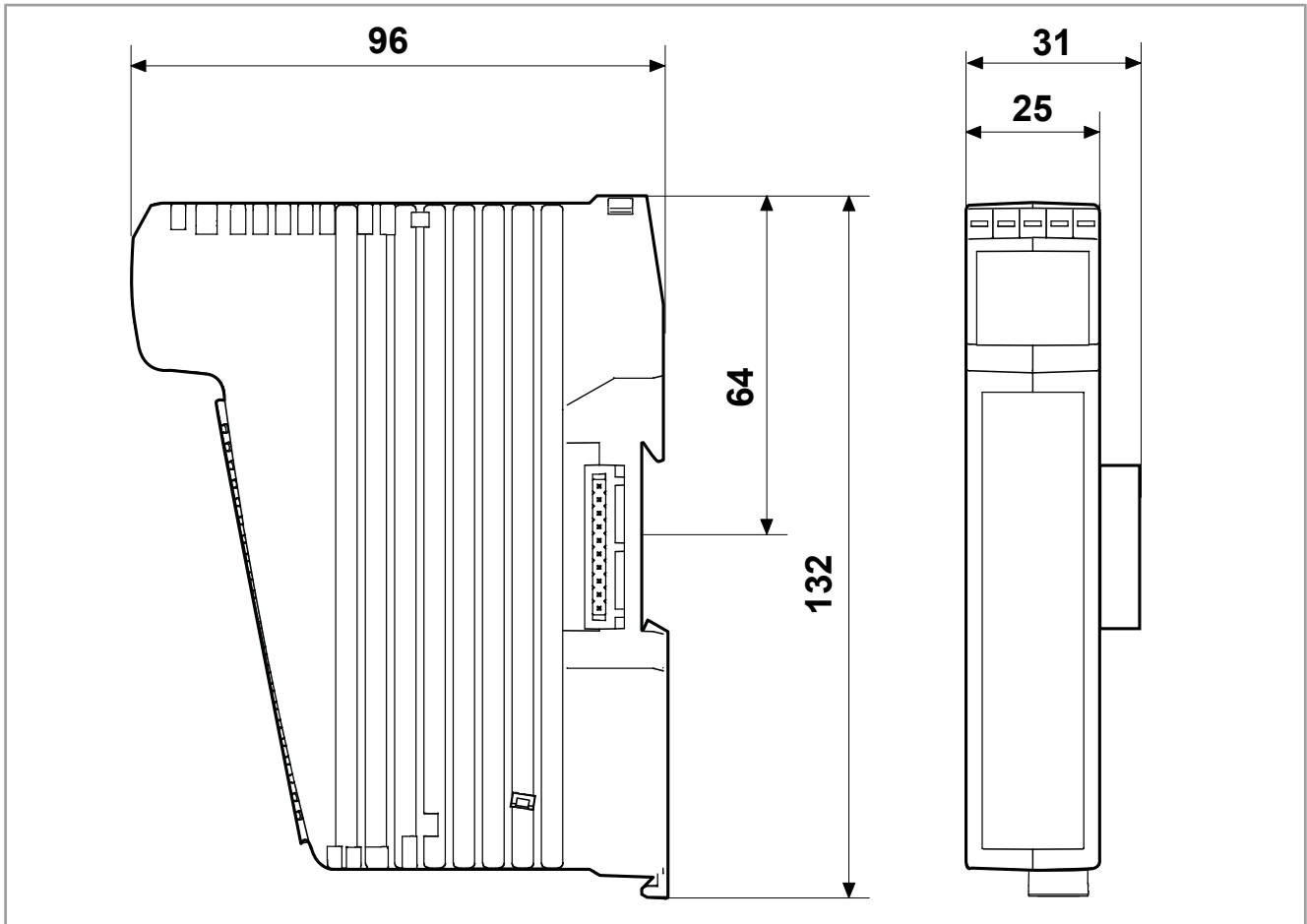


Fig. 4: Dimensions in mm

4.2 Mechanical specifications

Parameter	Description	Standards
Mounting orientation	Vertically mounted on DIN rail	
Weight	160 g	
Housing specifications		
Material	Plastic	
Maximum drop height		
with shipping packaging	1 m	DIN EN 61131-2
with product packaging	0.3 m	DIN EN 60068-2-31
Vibration resistance		

Parameter	Description	Standards
Frequency sweeps	1 octave/minute, sinusoidal	DIN EN 61131-2 DIN EN 60068-2-6
Constant amplitude	3.5 mm	$5 \text{ Hz} \leq f \leq 9 \text{ Hz}$
Constant acceleration	1 g	$9 \text{ Hz} \leq f \leq 150 \text{ Hz}$
Number and direction	10 sweeps for all 3 spatial axes	
Shock resistance		
Type of shock	Half-sine wave	DIN EN 61131-2 DIN EN 60068-2-27
Intensity and duration	15 g for 11 ms	
Number and direction	3 shocks in the directions of all 3 spatial axes	
Degree of protection		
Degree of protection	IP20	DIN EN 60529

Tab. 2: Mechanical specifications

4.3 Electrical properties

Digital inputs

Category	Description	
Rated input current range	2.8 mA ... 4.3 mA	
Surge withstand capability	DC -30 V ... +30 V	
Input delay time	< 200 μ s	
Type	3, pnp	IEC 61131-2
Input frequency	2.5 kHz (50 % duty cycle)	
Electrical isolation	None	
Max. operating point OFF	5 V (input current, 1.5 mA max.)	
Min. operating point ON	11 V (input current, 2.0 mA min.)	
Load current per input	< 1 mA	

Tab. 3: Digital inputs

System bus

Category	Description	
Type	JX3 system bus	
Logic voltage of the system bus	DC +5 V	(-15 % ... +10 %)
Current consumption	Logic voltage	55 mA
	Additional voltage	12 mA
Additional voltage	DC +24 V	(+15 % ... +20 %)
Nominal power consumption	563 mW	

Tab. 4: System bus

4.4 Environmental Conditions

Parameter	Description	Standards
Operating temperature	0 °C ... +50 °C	DIN EN 61131-2
Storage temperature	-40 °C ... +70 °C	DIN EN 60068-2-1
Humidity	10 % ... 95 %, non-condensing	DIN EN 60068-2-2
Max. operating altitude	2,000 m above sea level	DIN EN 61131-2
Corrosion immunity and chemical resistance	No special protection against corrosion. Ambient air must be free from higher concentrations of acids, alkaline solutions, corrosive agents, salts, metal vapors and other corrosive or electroconductive contaminants.	
Degree of pollution – Electronics	Level 2	DIN EN 61131-2
	Usually, the pollution is non-conductive. However, temporary conductivity due to condensation may occur.	

Tab. 5: Environmental conditions

4.5 EMC Values

4.5.1 Housing

Emitted interference

Parameter	Values	Standards
Frequency band	30 MHz ... 230 MHz	DIN EN 61000-6-3
Limit value	30 dB ($\mu\text{V}/\text{m}$) at 10 m distance	DIN EN 61131-2 DIN EN 55011
Frequency band	230 MHz ... 1,000 MHz	
Limit value	37 dB ($\mu\text{V}/\text{m}$) at 10 m distance	
	Class B	

Tab. 6: Emitted interference

Immunity to interference

Parameter	Values	Standards
Magnetic field with mains frequency		
Frequency	50 Hz	DIN EN 61131-2
Magnetic field	30 A/m	DIN EN 61000-6-2 DIN EN 61000-4-8
RF field, amplitude-modulated		
Frequency band	80 MHz ... 2 GHz	DIN EN 61131-2
Test field strength	10 V/m	DIN EN 61000-6-2 DIN EN 61000-4-3
	AM 80 % with 1 kHz	
	Criterion A	

Parameter	Values	Standards
ESD		
Discharge through air Test peak voltage	8 kV	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-2
Discharge through air Test peak voltage	4 kV Criterion A	

Tab. 7: Immunity to interference

4.5.2 DC Power Supply Inputs and Outputs

Emitted interference

Parameter	Values	Standards
Signal and control line connections, DC voltage supply inputs and outputs		
Frequency band	0.15 ... 0.5 MHz	DIN EN 61000-6-3
Limit value	40 to 30 dB	
Frequency band	0.5 ... 30 MHz	
Limit value	30 dB Class B	

Tab. 8: Emitted interference of the DC power supply inputs and outputs

Immunity to interference

Parameter	Values	Standards
RF field, asymmetric, amplitude-modulated		
Frequency band	0.15 ... 80 MHz	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-6
Test voltage	3 V AM 80 % with 1 kHz	
Source impedance	150 Ω Criterion A	
Bursts		
Test voltage	2 kV tr/tn 5/50 ns	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-4
Repetition frequency	5 kHz Criterion A	
Surge voltages, symmetric, line-to-line		
Differential-mode coupling	tr/th 1.2/50 μ s 0.5 kV	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-5
Surge voltages, asymmetric, line-to-ground		
Common-mode coupling	tr/th 1.2/50 μ s 1 kV	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-5

Tab. 9: Immunity to interference of the DC power supply inputs and outputs

4.5.3 Shielded Data and I/O Lines

Immunity to interference

Parameter	Values	Standards
RF field, asymmetric, amplitude-modulated		
Frequency band	0.15 MHz ... 80 MHz	DIN EN 61131-2
Test voltage	3 V	DIN EN 61000-6-2
	AM 80 % with 1 kHz	DIN EN 61000-4-6
Source impedance	150 Ω	
Criterion	A	
Bursts		
Test voltage	1 kV	DIN EN 61000-6-2
	tr/tn 5/50 ns	DIN EN 61000-6-2 DIN EN 61000-4-4
Repetition frequency	5 kHz	
Criterion	A	
Surge voltages, asymmetric, line-to-ground		
Common-mode coupling	tr/th 1.2/50 μ s	DIN EN 61131-2
	1 kV	DIN EN 61000-6-2 DIN EN 61000-4-5

Tab. 10: Immunity of shielded data lines and I/O lines

5 Mechanical installation

This chapter describes how to install and replace the device.

NOTICE



Damaged devices

Damaged devices may cause considerable physical damage.

- ▶ Check the device for external damage and faulty connections.
- ▶ Ensure to install only fully functional devices.

5.1 Installing the device on the DIN rail

NOTICE



Functional impairment caused by unfavorable installation

- ▶ Install the device only in vertical position on the DIN rail (DIN EN 60715).
- ▶ Keep a minimum distance of 30 mm to surrounding parts.

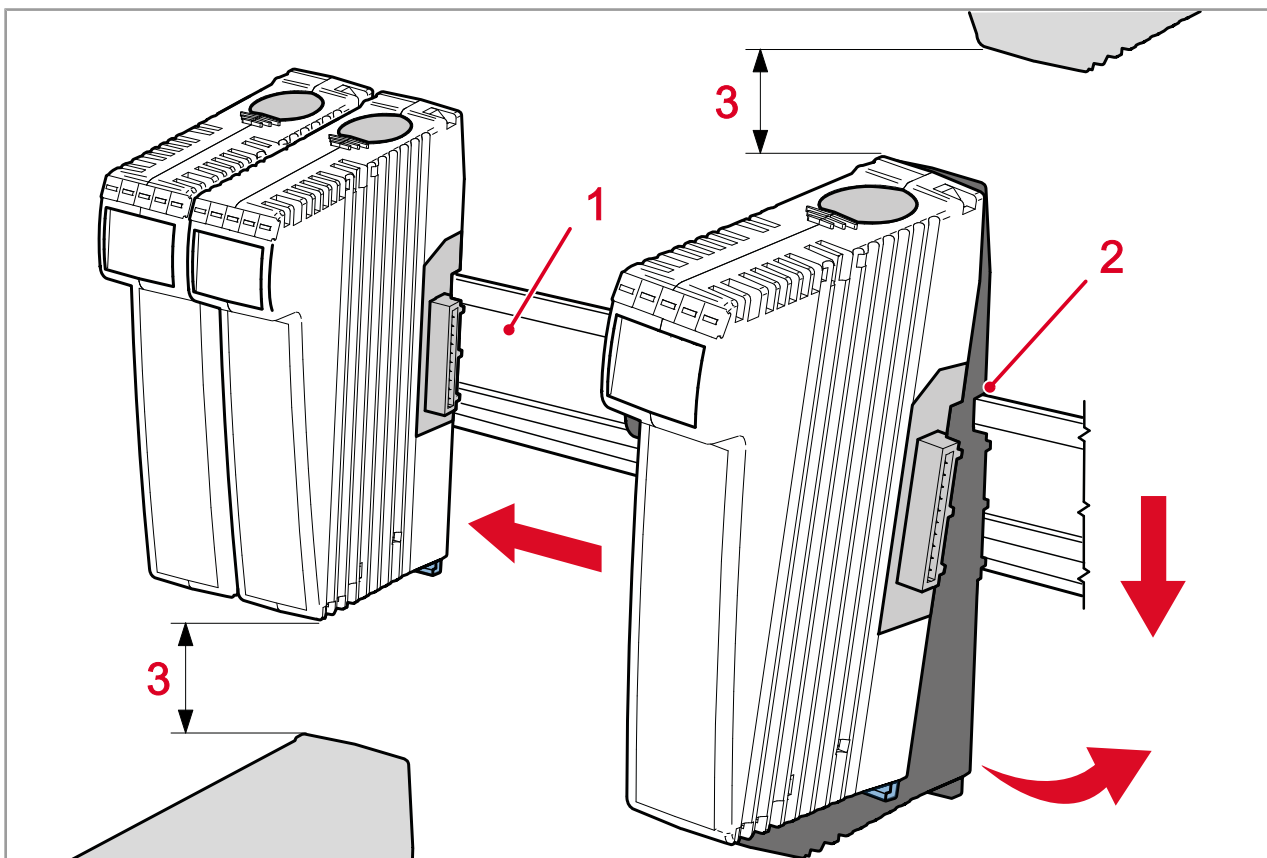


Fig. 5: Installing the device on the DIN rail

1	DIN rail
2	Upper latch
3	Minimum distance to surrounding parts (30 mm min.)

1. De-energize the system.
2. Place the upper latch (2) in an angled position on the DIN rail (1).
3. Snap the lower latch of the device onto the DIN rail.
4. Slide the device on the DIN rail to its intended position.

5.2 Removing Device from DIN Rail

Applying force to the release latch disengages the device from the DIN rail.

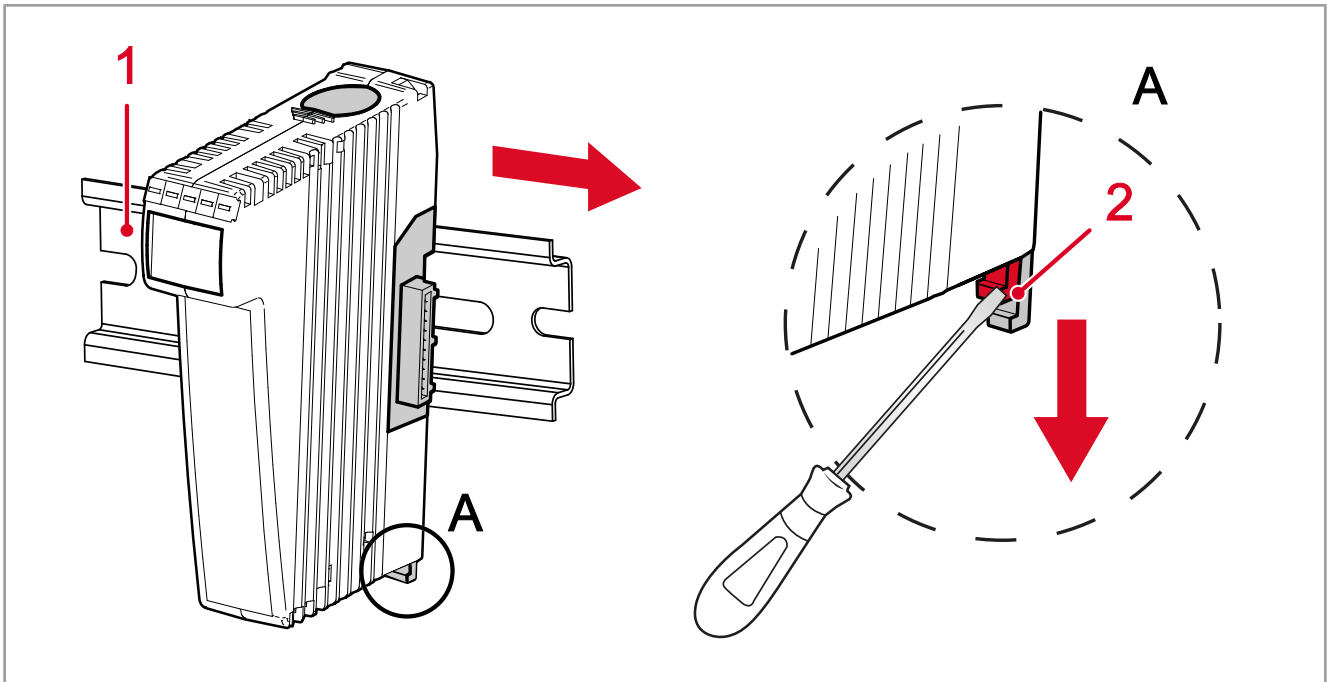


Fig. 6: Removing the device from the DIN rail

1	DIN rail
2	DIN rail release latch
A	Detail view

1. Disconnect the system from the power supply.
2. Pull the device off the overall assembly.
3. Pry the release latch (2) downwards and pull the device off the DIN rail (1).

5.3 Removing the enclosure from the backplane module

Pressing down on the upper and the lower backplane latches of the device allows you to remove the enclosure from the backplane module.

NOTICE



Mechanical damage and reduced EMC noise immunity

If devices are replaced, degree of protection IP20 is not ensured. Touching the EMC clip may lead to mechanical damage to the device and reduced EMC noise immunity.

- ▶ Do not touch any electronic components once the enclosure has been removed from the backplane module.

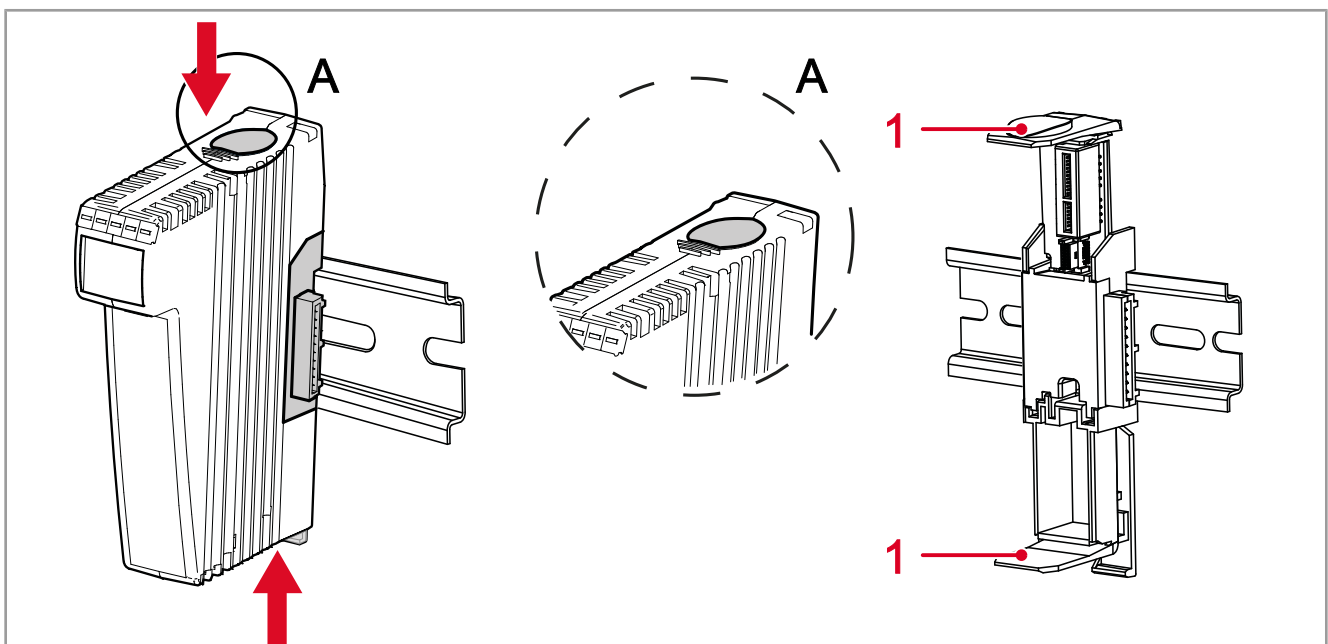


Fig. 7: Removing the enclosure from the backplane module

A	Detail view
1	Latch

1. De-energize the system.
2. Simultaneously, press and hold the upper and lower latches (1) of the device.
3. Keep the latches pressed and pull off the enclosure.

6 Electrical Connection

NOTICE



Damages to material or functional impairment

Improper implementation of the wiring harness may cause mechanical stress.

- ▶ Protect the cables from bending, twisting or chafing.
- ▶ Install strain reliefs for the connecting cables.

6.1 Block diagram

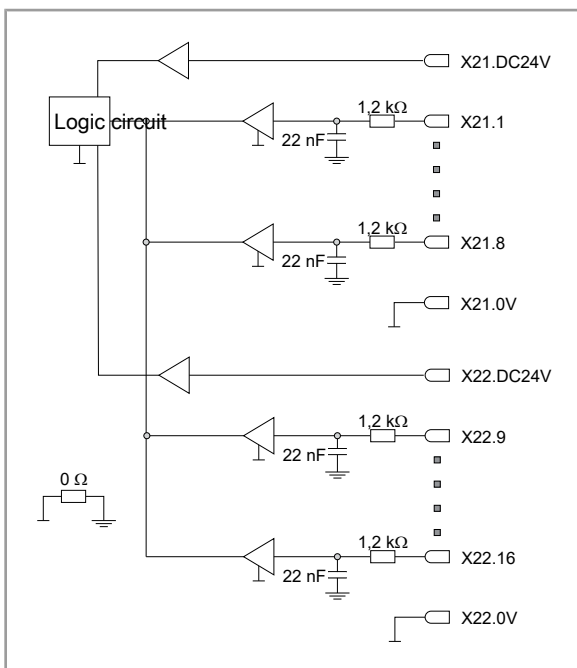
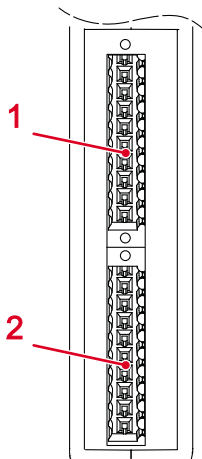


Fig. 8: Block diagram

Part	Description
Logic circuit	Communication with the internal interface
22 nF	Capacitance at the digital input
X21. DC24V	Power supply of the digital inputs IN 1 ... 8
X22. DC24V	Power supply of the digital inputs IN 9 ... 16

Tab. 11: Legend Block diagram

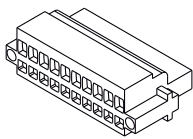
6.2 Digital inputs X21, X22



	Position 1		Position 2	
Pin	X21		Pin	X22
DC24V	Power supply of digital inputs IN 1 ... 8		DC24V	Power supply of digital inputs IN 9 ... 16
1	Digital input IN 1		9	Digital input IN 9
2	Digital input IN 2		10	Digital input IN 10
3	Digital input IN 3		11	Digital input IN 11
4	Digital input IN 4		12	Digital input IN 12
5	Digital input IN 5		13	Digital input IN 13
6	Digital input IN 6		14	Digital input IN 14
7	Digital input IN 7		15	Digital input IN 15
8	Digital input IN 8		16	Digital input IN 16
0 V	Reference potential		0 V	Reference potential

6.3 Connector specification

6.3.1 10-pin connector, spring-cage technology

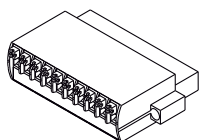


Parameter	Description	Standards
Connector		
Designation	BU_10_E_BLZF_GE_RM3.5	
Item number	60869252	
Connector technology	Spring-cage connection	
Type	10-pin, 3.5 mm pitch	
Connectible conductors		
Outer diameter of the isolation	2.90 mm max	
AWG	16 ... 28	
Terminal range	0.13 ... 1.5 mm ²	
Stripping length	10 mm	
Specification without wire end ferrules		
Solid conductor	H05(07) V-U	
	0.2 ... 1.5 mm ²	
Flexible conductor	H05(07) V-K	
	0.2 ... 1.5 mm ²	
Specification with wire end ferrules		
Wire end ferrule without sleeve	0.2 ... 1.5 mm ²	DIN 46228/1

Parameter	Description	Standards
Wire end ferrule with sleeve	0.2 ... 1.5 mm ²	DIN 46228/4
Crimping tool	PZ 4, PZ 6 ROTO, PZ 6/5	DIN 46228

Tab. 12: Connector specification, 10-pin connector, spring-cage technology

6.3.2 10-pin male connector with PUSH-IN connection



Parameter	Description	Standards
Connector		
Designation	BU_10_E_BL-I/O_GE_RM3.5	
Item number	60869254	
Connector technology	Spring connection, push-in	
Type	10-pin, 3.5 mm pitch	
Connectible conductors		
Outer diameter of the isolation	2.90 mm max	
AWG	16 ... 24	
Terminal range	0.2 mm ² ... 1.5 mm ²	
Stripping length	10 mm	
Specification without wire end ferrules		
Solid conductor	H05(07) V-U	
	0.2 mm ² ... 1.5 mm ²	
Flexible conductor	H05(07) V-K	
	0.2 mm ² ... 1.5 mm ²	
Specification with wire end ferrules		
Wire end ferrule without sleeve	0.25 mm ² ... 1.0 mm ²	DIN 46228/1
Wire end ferrule with sleeve	0.25 mm ² ... 0.75 mm ²	DIN 46228/4
Crimping tool	PZ 4, PZ 6 ROTO, PZ 6/5	DIN 46228

Tab. 13: Connector specification, 10-pin, PUSH-IN connection

6.4 Connecting digital sensors

The way of connecting digital sensors is identical for all 16 inputs. Usage of a shielded cable is optional. Separating load and logic voltage is not required.

1. Ensure that the cross section of the conductor is apt for conducting maximum current to the sensor.
2. Connect the sensors to the inputs and to the power supply unit. The following example shows the connection of a digital sensor to input IN 1.

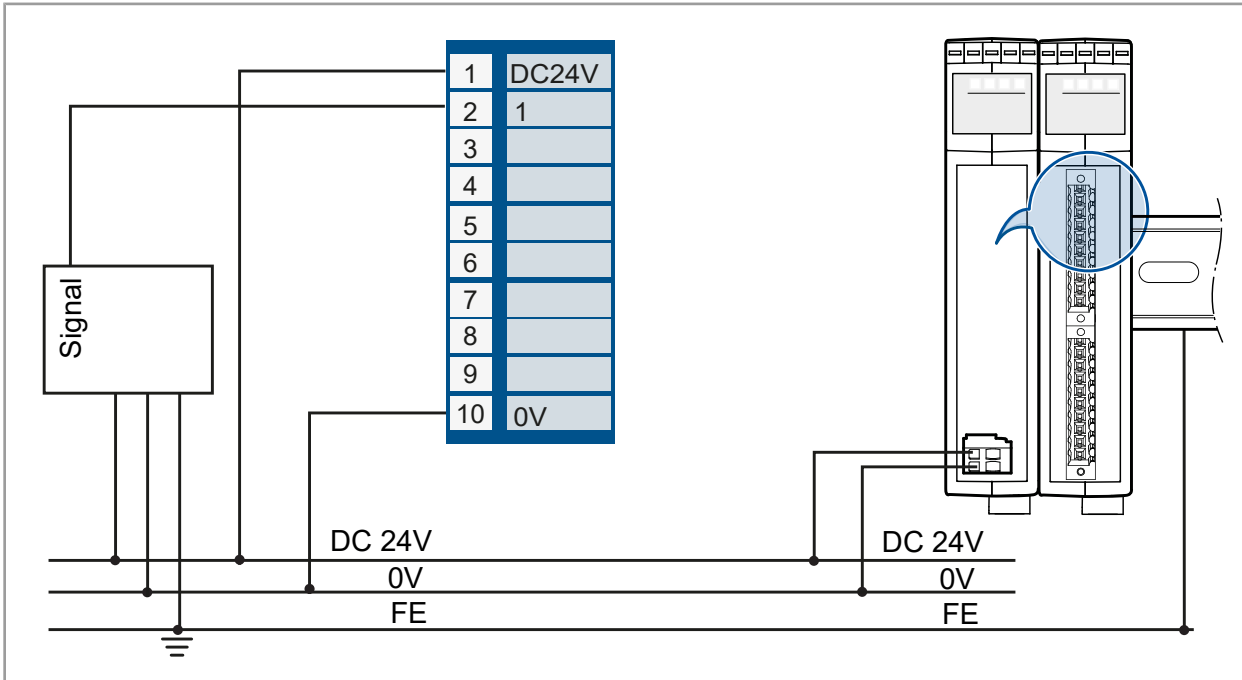


Fig. 9: Sample connection: Digital sensor

6.5 Connecting digital sensors for the counter function

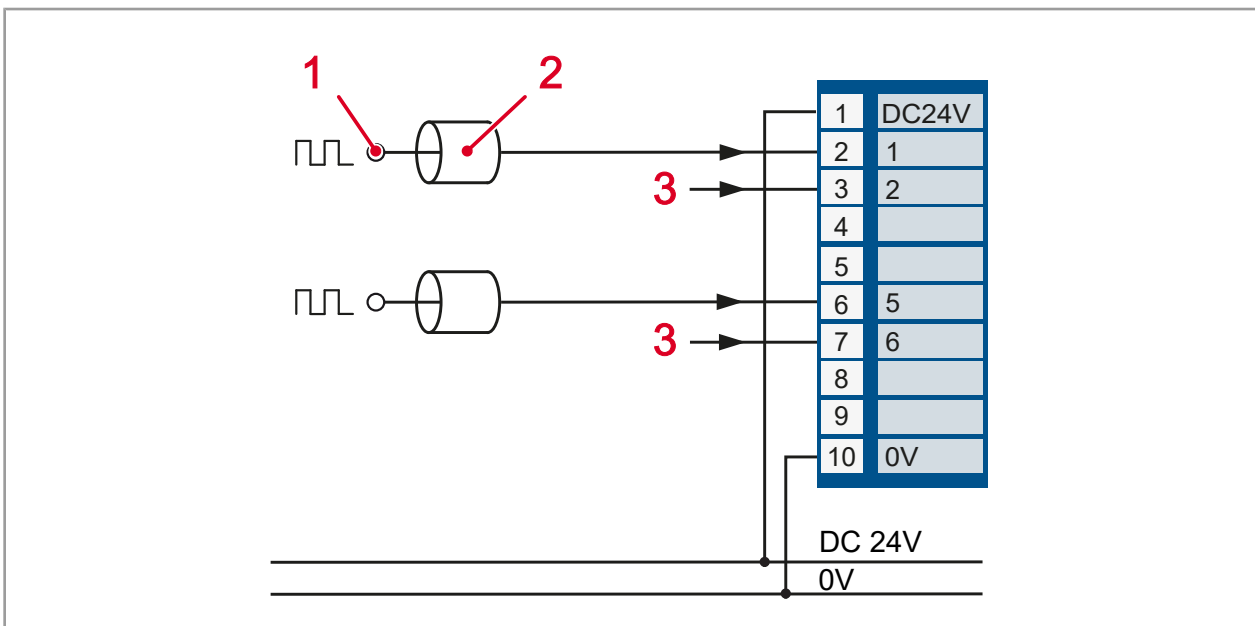


Fig. 10: Connection example: Counting function with digital sensors

1	Digital pulses of a sensor
2	Shielded line leading to the sensor
3	Gate inputs for locking and unlocking the counter function

Digital sensors for the counter function can be connected to inputs X21.1 and X21.5. The connection of digital sensors is identical for both counting inputs.

The two gate inputs (3) are for locking and unlocking the counter function.

1. Use a shielded line (2) leading to the sensor.
2. Separate load and logic voltage: Connect the load voltage of the digital inputs and the logic voltage to separate power supply units. This way, communication with the expansion module is still possible, even if the load voltage supply is switched off.

6.6 Functional test

For reading digital inputs the module needs not be configured after it has been powered up. Immediately after power up, all 16 inputs can show their input state.

- ✓ The digital sensors have been connected.
- ✓ The expansion module has been connected to a JX3 node.
 - ▶ Power up the JX3 node.
- ⇒ Following correct commissioning, LED R is lit green.

7 Programming

7.1 Abbreviations, Module Register Properties and Formats

Abbreviations

The abbreviations used in this document are listed in the table below:

Abbreviation	Meaning
R 100	Register 100
MR 150	Module register 150

Tab. 14: Abbreviations

Module register properties

Each module register is characterized by certain properties. Most properties are identical for many module registers. In the following description, module register properties are mentioned only if a property deviates from the default properties listed below.

Property	Default
Access	Read/write
Value after reset	0 or undefined (e.g. revision/version number)
Takes effect	Immediately
Write access	Always
Data type	Integer

Tab. 15: Module register properties

Numerical formats

The numerical formats used in this document are listed in the table below:

Notation	Format of numerical values
100	Decimal
0x100	Hexadecimal
0b100	Binary

Tab. 16: Numerical formats

7.2 Addressing I/O Expansion Modules

The JX3 I/O module connects to sensors and actuators. The data are either sent directly to the controller via the JX3 system bus or, if the JX3 modules are located remotely, via Ethernet bus nodes or EtherCAT® bus nodes.

Each JX3 I/O module provides 10,000 module registers.

These module registers are mapped to registers in the controller. The only way of writing and reading process, configuration and diagnostic data to and from an expansion module is via controller registers. Controller registers can be accessed in the application program of the controller, in a setup pane of JetSym or via a visualization application.

The number of a controller register or I/O being mapped to a module register depends on the following parameters:

- Controller model
- Type of connection between controller and expansion module
 - Local direct connection
 - Remote connection via Ethernet
 - Remote connection via EtherCAT®

- Position and number of expansion modules in the system

The number of expansion modules that can be connected to a controller depends on the model of the expansion module. After max. 8 expansion modules, a power supply module must be inserted.

Example system overview

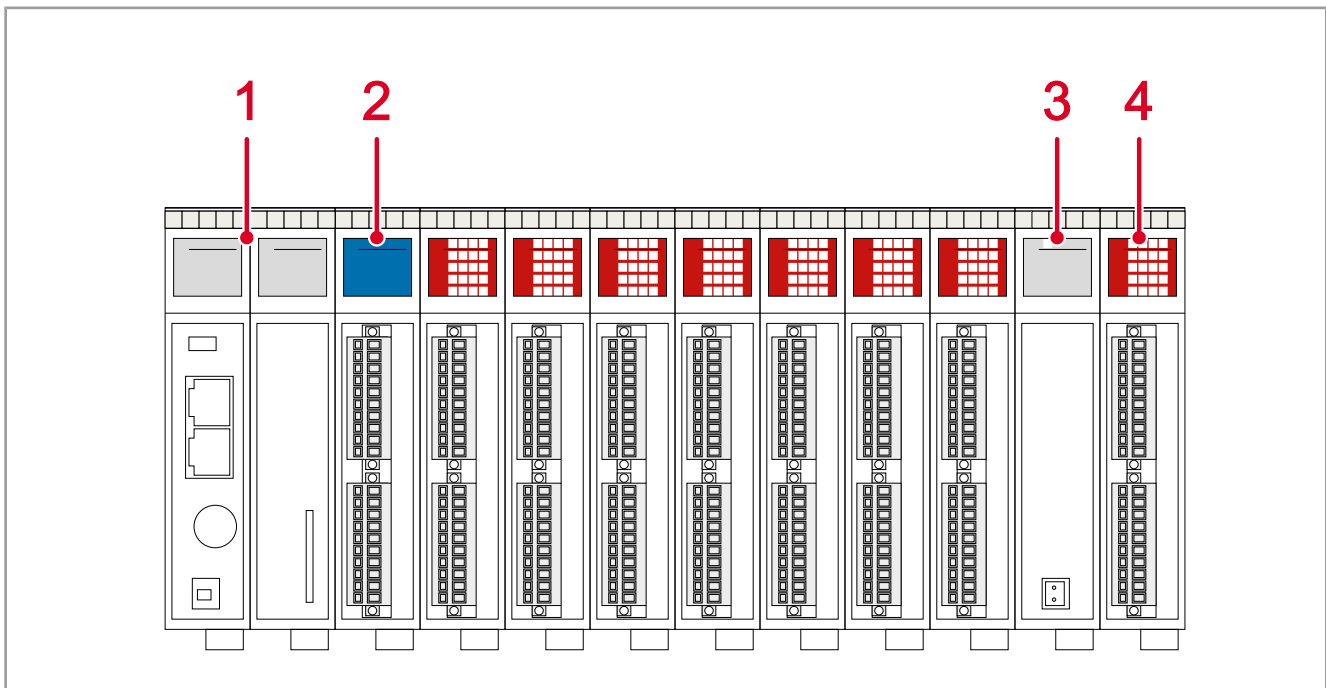


Fig. 11: Example: System overview of a controller together with various expansion modules

1	Controller
2	First expansion module
3	Power supply module
4	Further expansion modules

i Info

Number of connectible expansion modules

You can calculate the exact amount of connectible expansion modules by means of the system bus configurator, JX3-sysbus_configurator_xxx_e. The configurator is available for download. Go to www.bucherautomation.com and navigate to the JX3Modules product page > Downloads.

 **Info**
Further information

For in-depth information, see the *JX3 System* application-oriented manual.

For application-oriented manuals open www.bucherautomation.com and go to *product page JX3-DI16 > Product-independent documentation*.

7.3 Diagnostics of error messages

The expansion module signals error messages. If an error is detected, the expansion module sets the respective error bit in the module register. The controller and the bus node, if any, respond to the error.

The application program detects in certain registers on the controller that the expansion module signals an error. The application program responds to this error. Once the root cause has been eliminated by the user, the expansion module sets error bit 0 in the module register. The application program acknowledges the error message in the controller and bus node, if any.

7.3.1 Module register

Module register	0000
Description	Module state Signaling error messages
Value range	2 bits, bit-coded
Bit values	Description
Bit 1	Voltage at X21.DC24V
1 =	Voltage at X21.DC24V < 16.3 V
Bit 2	Voltage at X22.DC24V
1 =	Voltage at X22.DC24V < 16.3 V

7.4 How to identify the module

Module register	0009
Description	Displaying the OS version JetSym lets you transfer another operating system to the expansion module.
Values	Released OS version: IP#1.0.0.0 ... IP#254.255.0.0 Bootloader version: IP#255.1.0.0 ... IP#255.255.0.0
Access	Read access
Value after reset	OS version
Module register	0032
Description	Displaying the FPGA revision The FPGA version number cannot be changed by the user.
Values	IP#1.0.0.0 ... IP#255.255.0.0
Access	Read access
Value after reset	OS version

7.5 Reading all inputs

The module register lets you read in all inputs of the expansion module in one reading cycle.

Module register	0256
Description	Reading the inputs
Value range	16 bits, bit-coded
Inputs	IN 1 ... IN 16

7.6 Digital input filters

All digital inputs are provided with an input delay feature. The expansion module does not recognize the input signal before the delay time has elapsed.

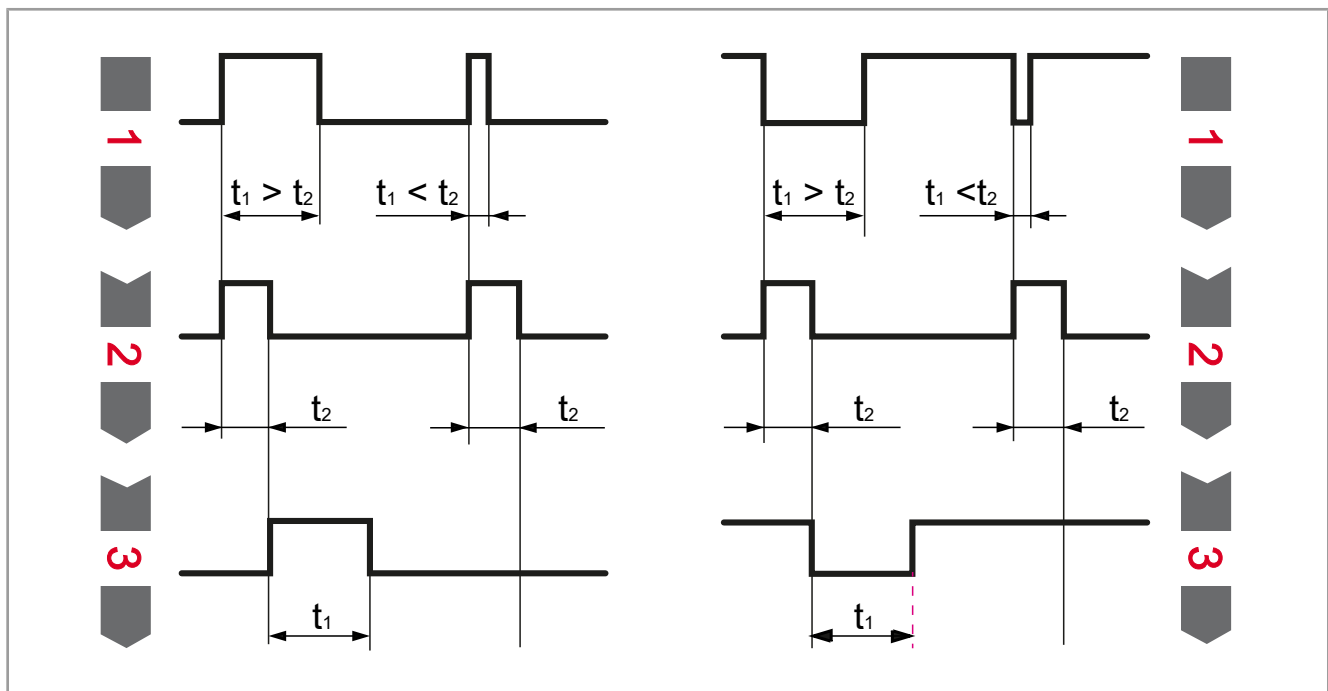


Fig. 12: The functioning principle of the input filter

1	Input pulse at IN 1 ... IN 16
2	Time t_2 of the input filter
3	Recognized input pulse at IN 1... IN 16

The illustration to the left shows filtering to the high edge. The illustration to the right shows filtering to the low edge.

Module register	0262	
Description	Activating the input filters	
	Configuring the inputs IN 1 ... IN 16. One bit in the module register is assigned to each input.	
Value range	16 bits, bit-coded	
Value after reset	0x0000FFFF	
Bit value = 1	Input filtering is enabled.	
Assigning inputs IN 1 ... 16 to the bits:		
IN 1 = BIT 0	IN 6 = BIT 5	IN 11 = BIT 10

Module register		0262	
IN 2 = BIT 1	IN 7 = BIT 6	IN 12 = BIT 11	
IN 3 = BIT 2	IN 8 = BIT 7	IN 13 = BIT 12	
IN 4 = BIT 3	IN 9 = BIT 8	IN 14 = BIT 13	
IN 5 = BIT 4	IN 10 = BIT 9	IN 15 = BIT 14	
Module register	Inputs		
Configuring the input filter time for groups of four inputs			
0263	IN 1 ... IN 4		
0264	IN 5 ... IN 8		
0265	IN 9 ... IN 12		
0266	IN 13 ... IN 16		
Value range	0 ... 7		
Value after reset	4		
Assigning values 0 ... 7 to the pulse stretching times			
0 = none	3 = 1.0 ms	6 = 8.0 ms	
1 = 0.25 ms	4 = 2.0 ms (default value)	7 = 16.0 ms	
2 = 0.5 ms	5 = 4.0 ms		

Tab. 17: Digital input filters register overview

7.7 Pulse stretching

This function lets you stretch in time incoming pulses at the digital inputs of the module. This way, you can more effectively process very short pulses in your application program. You can configure for each input an individual pulse stretching via module registers 0257, 0758, and 0259.

Module register		0257	
Description	Enabling of pulse stretching		
	Configuring the inputs IN 1 ... IN 8. Each input is assigned a bit in the module register.		
Value range	8 bits, bit-coded		
Bit value = 1	Pulse stretching is enabled		

Assigning inputs IN 1 ... 8 to the bits:		
IN 1 = BIT 0	IN 4 = BIT 3	IN 7 = BIT 6
IN 2 = BIT 1	IN 5 = BIT 4	IN 8 = BIT 7
IN 3 = BIT 2	IN 6 = BIT 5	

Module register		0258, 0259	
0258	Pulse stretching for inputs IN 1 ... IN 4		
0259	Pulse stretching for inputs IN 5 ... IN 8		
Description	Lets you define the pulse stretching time.		
Value range	0 ... 15		
Value after reset	0		

Assigning values 0 ... 15 to the pulse stretching times		
0 = none (default value)	6 = 3.0 ms	12 = 6.0 ms
1 = 0.5 ms	7 = 3.5 ms	13 = 6.5 ms
2 = 1.0 ms	8 = 4.0 ms	14 = 7.0 ms
3 = 1.5 ms	9 = 4.5 ms	15 = 7.5 ms
4 = 2.0 ms	10 = 5.0 ms	
5 = 2.5 ms	11 = 5.5 ms	

7.8 Counter function

7.8.1 Description

- The expansion module lets you use two counters at inputs IN 1 and IN 5.
- The following module registers let you configure the counter function of counter A and counter B.
- Regarding the counter function, input IN 1 does not influence input IN 5 and vice versa.
- The inputs are independent of each other.

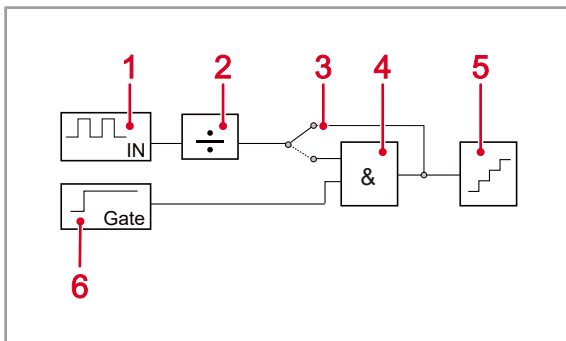


Fig. 13: Block diagram: Counter

1	Hardware input X21.1 for counter A or X21.5 for counter B
2	Pre-divider of pulses at the hardware input
3	Gate function (hardware enable) ON or
4	Gate Function
5	Counter
6	Hardware input X21.2 for counter A and X21.6 for counter B as counter enable

- Counter inputs IN 1 and IN 5 can be set in the edge. They can react to both the rising or to the falling edge.
- The counters are started and stopped by an enabling signal at the gate input or through the application program. Gate inputs IN 2 and IN 6 can be set in the edge. They can react to both high or to low level.
- One upper counting level can be set. If this is exceeded, a bit is set and the counter starts counting from value zero again.

7.8.2 Configuration

Commissioning counter A

- ✓ At hardware input X21.1, a signal with valid pulses has been connected.
1. Deactivate the hardware input filter by writing value 0 to module register 0262.

2. To activate counter A, write value 0x82 to module register 0322.
 3. To configure the counter, write to command register 0321 of the counter.
 4. Write a value 1 ... 255 (pre-divider) to module register 0324.
- ⇒ The counting pulses applied to input X21.1 are counted.

Commissioning counter B

- ✓ At hardware input X21.5, a signal with valid pulses has been connected.
1. Deactivate the hardware input filter by writing value 0 to module register 0262.
 2. To activate counter A, write value 0x82 to module register 0337.
 3. To configure the counter, write to command register 0337 of the counter.
 4. Write a value 1 ... 255 (pre-divider) to module register 0340.
- ⇒ The counting pulses applied to input X21.5 are counted.

Resetting the counters

After power-up, both counters have got value 0.

To reset a counter during operation, proceed as follows:

1. Stop the single-channel counter by writing value 0x02 to module register 0322 for counter A or to module register 0338 for counter B.
 2. Write value 0x01 for counter 1 to module register 0321.
 3. Write value 0x01 for counter 2 to module register 0337.
- ⇒ The respective counter is set to 0.

7.8.3 Module register

Module register	0320
Description	Status register of counter A Displaying the status of the upper counting limit.
Value range	1 bits, bit-coded
Access	Read access
Resetting MR 0320	This bit can only be cleared via MR 0321.
Bit 1	Controlling the upper counting limit
	1 = The upper counting limit has been exceeded.
	0 = The upper counting limit has not been exceeded.

Module register	0321
Description	Command registers of counter A Setting various counter functions.
Value range	7 bits, bit-coded

Bit values		Description
Bit 1	Bit 0	Resetting counter A / Activating counter A

Bit values		Description
0 =	0 =	Resetting counter A to value 0.
0 =	1 =	Resetting counter A to value 0.
1 =	0 =	If an edge at input X21.1 is recognized, the count value is incremented by 1. Bit 4 determines the edge type (falling or rising).
1 =	1 =	Reset counter A to value 0.
Bit 2		Activating and deactivating the gate function
	0 =	Deactivate the gate function for input X21.2.
	1 =	Activate the gate function for input X21.2.
Bit 4		Edge type
	0 =	The counter responds to the falling edge.
	1 =	The counter responds to the rising edge.
Bit 5		Level at the gate input
	0 =	Gate input X21.2 responds to low level.
	1 =	Gate input X21.2 responds to high level.
Bit 6		Mode
	0 =	Consecutive counter
	1 =	After exceeding the set upper limit, the counter is reset to value 0.
Bit 7		Resetting status register 0320
	1 =	The status register (upper counting limit) is reset.

Command	Description
0x01	Reset count value to 0.
0x02	Count falling edges.
0x12	Count rising edges.
0x06	Count falling edges at X21.1. The gate function at X21.2 responds to low level.
0x26	Count falling edges at X21.1. The gate function at X21.2 responds to high level.
0x16	Count rising edges at X21.1. The gate function at X21.2 responds to low level.
0x36	Count rising edges at X21.1. The gate function at X21.2 responds to high level.
0x42	Count falling edges. The adjustable upper limit in MR 325 of counter A is activated.
0x52	Count rising edges. The adjustable upper limit in MR 325 of counter A is activated.
0x80	Reset the status in MR 0320 to value 0.

Module register	0324
Description	Pre-divider of counter A
	Decelerating the count value by a pre-divider.
Value range	0 ... 255

Value	Description
0	Counter A is stopped. Count pulses may be present at input X21.1. Counting pulses are not taken into account.
1	At each pulse, counter A is incremented by one.
2	At each second pulse, counter A is incremented by one.
...	...
255	After registration of 255 pulses at input X21.1 of counter A, the count value is incremented by one.

Module register	0325
Description	Upper counting limit of counter A
	Defining an upper counting limit. If the counting limit has been exceeded, bit 1 is set MR 0320. The counter is reset to value 0. Command register 0321 lets you activate and deactivate the function.
Value range	32 bits, 0 ... 4,294,967,295

Module register	0326
Description	Count value of counter A
	Displaying the current count value of counter A.
Value range	32 bits, 0 ... 4,294,967,295
Access	Read

Module register	0336
Description	Status register of counter B
	Displaying the status of the upper counting limit.
Access	Read
Resetting MR 0336	The bit can only be cleared via MR 0337.
Bit 1	Controlling the upper counting limit MR 0341
1 =	The upper counting limit has been exceeded.
0 =	The upper counting limit has not been exceeded.

Module register	0337
Description	Command registers of counter B
	Setting various counter functions.
Value range	7 bits, bit-coded

Bit values		Description
Bit 1	Bit 0	Resetting counter B / Activating counter B
0 =	0 =	Reset counter B to value 0.

Bit values		Description
0 =	1 =	Reset counter B to value 0.
1 =	0 =	If an edge at input X2.5 is recognized, the count value is incremented by 1.
1 =	1 =	Reset counter B to 0.
Bit 2		Activating and deactivating the gate function
	0 =	Deactivate the gate function for input X21.6.
	1 =	Activate the gate function for input X21.6.
Bit 4		Edge type
	0 =	The counter responds to the falling edge.
	1 =	The counter responds to the rising edge.
Bit 5		Level at the gate input
	0 =	Gate input X21.6 responds to low level.
	1 =	Gate input X21.6 responds to high level.
Bit 6		Mode
	0 =	Consecutive counter
	1 =	After exceeding the set upper limit, the counter is reset to value 0.
Bit 7		Resetting status register 0336
	1 =	The status register (upper counting limit) is reset.

Command	Description
0x01	Reset count value to 0.
0x02	Count falling edges.
0x12	Count rising edges.
0x06	Count falling edges at X21.5. The gate function at X21.6 responds to low level.
0x26	Count falling edges at X21.5. The gate function at X21.6 responds to high level.
0x16	Count rising edges at X21.5. The gate function at X21.6 responds to low level.
0x36	Count rising edges at X21.5. The gate function at X21.6 responds to high level.
0x42	Count falling edges. The adjustable upper limit in MR 0341 of counter B is activated.
0x52	Count rising edges. The adjustable upper limit in MR 0341 of counter B is activated.
0x80	Reset the status in MR 0336 to value 0.

Module register	0340
Description	Pre-divider of counter B
	Decelerating the count value by a pre-divider.
Value range	0 ... 255

Value	Description
0	Counter B is stopped. Count pulses may be present at input X21.5. Counting pulses are not taken into account.
1	At each pulse, counter B is incremented by one.
2	At each second pulse, counter B is incremented by one.
...	...
255	After registration of 255 pulses at input X21.5 of counter B, the count value is incremented by one.

Module register	0341
Description	Upper counting limit of counter B
	Defining an upper counting limit. If the counting limit has been exceeded, bit 1 is set MR 0336. The counter is reset to value 0. Command register 0337 lets you activate and deactivate the function.
Value range	32 bits, 0 ... 4,294,967,295

Module register	0342
Description	Count value of counter B
	Displaying the current count value of counter B.
Value range	32 bits, 0 ... 4,294,967,295
Access	Read

8 Register overview

This register overview describes the registers of the JX3-DI16 device in operating system version 2.35.0.00 in a highly summarized form.

Module code

Each module has a unique module code for identification purposes (see module register 100601 *Module code*).

- Module code JX3-DI16: 300

General overview – registers

Register range	Description
0000	Module-specific status register
0002	Process data input
0009, 0032, 0257	Version registers
0256	All inputs IN 1 ... IN 16
0257 ... 0259	Pulse stretching with digital inputs
0262 ... 0266	Digital input filters
320 ... 342	Counters A and B

Module state

Registers	Description
0000	Module-specific status register
Bit 1 = 1	Voltage at X21.DC24V < 16.3 V
Bit 2 = 1	Voltage at X22.DC24V < 16.3 V

Revisions

Registers	Description
0009	OS version
0032	FPGA version
0257	Bootloader version

Pulse stretching

Register range	Description
0257	Enabling of pulse stretching
Bit 0 = 1	Activating pulse stretching for IN 1
Bit 1 = 1	Activating pulse stretching for IN 2
etc.	
Bit 7 = 1	Activating pulse stretching for IN 8
0258	Duration pulse stretching IN 1 ... IN 4 configurable in 0.5 ms steps, max. 7.5 ms
0259	Duration pulse stretching IN 5 ... IN 8 configurable in 0.5 ms steps, max. 7.5 ms

Digital input filters

Register range	Description
0262	Activation of digital input filters
Bit 0 = 1	Activating the digital filter for IN 1
Bit 1 = 1	Activating the digital filter for IN 2
etc.	
Bit 15 = 1	Activating the digital filter for IN 16
0263	Delay of digital filters for IN 1 ... IN 4
0264	Delay of digital filters for IN 5 ... IN 8
0265	Delay of digital filters for IN 9 ... IN 12
0266	Delay of digital filters for IN 13 ... IN 16

Counter function

Register range	Description
0320	State of counter A
0321	Command registers of counter A
0324	Pre-divider A
0325	Upper counting limit (0 ... 4,294,967,295)
0326	Count value A (0 ... 4,294,967,295)
0336	State of counter B
0337	Command registers of counter B

Register range	Description
0340	Pre-divider B
0341	Upper counting limit (0 ... 4,294,967,295)
0342	Count value B (0 ... 4,294,967,295)

Electronic Data Sheet (EDS)

This register range is located in the JX3 bus master (e.g. controller) and not on the JX3 I/O module.

Register range	Description
100500 ... 100501	EDS data selection
100500	Interface: 1= Position of the expansion modules in the system
100501	Module number within the system

Register range	Description
100600 ... 100614	Data of the EDS page 0 (identification)
100600	Revision of EDS page 0
100601	Module code
100602 ... 100612	Module name
100613	Hardware revision
100614	Hardware option
100700 ... 100710	Data of the EDS page 1 (production)
100700	Revision of EDS page 1
100701 ... 100707	Serial number of the module
100708	Production date: Day
100709	Production date: Month
100710	Production date: Year

9 Maintenance

This product is maintenance-free. The operation of the product does not require inspection or maintenance efforts.

9.1 Repairs

Defective components can cause dangerous malfunctions and compromise safety. Only the manufacturer is authorized to perform repair work. It is forbidden to open the product.

Product modifications

Modifications and alterations to the product and its functions are not allowed. The manufacturer exempts from liability for any modifications made to the product.

The original parts are specifically designed for the product. Parts and equipment from other manufacturers must not be used.

The manufacturer exempts from liability for any damage resulting from the use of non-original parts and equipment is excluded.

9.2 Storage and Shipment

Storage

When storing the product, observe the environmental conditions given in chapter "Technical specifications".

Shipment and packaging

The product contains electrostatically sensitive components which can be damaged if not handled properly. Damages to the product can impair its reliability.

To protect the product from impact or shock, it must be shipped in its original packaging, or in an appropriate protective ESD packaging.

If the packaging is damaged, inspect the device for any visible damage, and immediately inform your freight forwarder and Bucher Automation AG of the damage caused during shipment. It is strictly forbidden to use a product that has been damaged or dropped.

9.3 Return and Disposal

The WEEE icon (crossed-out wheeled bin) says that end users must not dispose of waste electrical and electronic equipment together with household waste, but separately in an appropriate way. Applicable local environmental directives and regulations must be complied with.

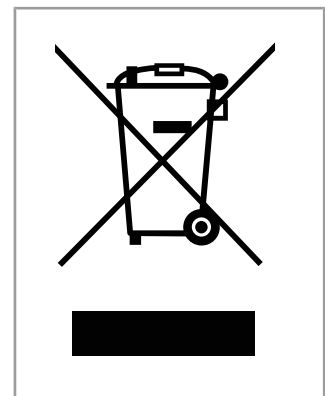


Fig. 14: WEEE icon – crossed out wheeled bin

Disposal options

To do so, you may either resort to professional disposal service providers or return waste electronics to Bucher Automation AG.

Find detailed information along with the required Return Delivery Form on our [website](#).

Batteries

Prior to disposing of waste electronics, remove any batteries where this is possible in a safe and non-destructive way. Dispose of batteries properly.

Personal data

It is the responsibility of the end user to delete any personal data stored on waste electric and electronic equipment prior to disposal.

Packaging material

The product's packaging materials must not be disposed of together with household waste. Find detailed information on how to return packaging material to Bucher Automation AG on our [website](#).

10 Service

10.1 Technical Support

In case of questions, suggestions, or issues, please contact our experts from Technical Support. You may reach out by phone or through the contact form on our homepage:

[Technical Support | www.bucherautomation.com](http://www.bucherautomation.com)

Or email us:

support@bucherautomation.com

Please supply the following information when contacting Technical Support:

- Hardware revision and serial number
The hardware revision and serial number is printed on the nameplate of the product.
- OS version
To determine the operating system version, use the functions of the development environment.

11 Spare parts and accessories

NOTICE



Inadequate accessories might cause damage to the product

Parts and equipment from other manufacturers might impede the function of the device and cause damage to the product.

- ▶ Only use accessories recommended by Bucher Automation AG.

11.1 Spare parts

Component	Item number
Terminal labels	60870411
Key	60870410
Male connector in spring-cage technology, 10-pin	60869252
Male connector with PUSH-IN connection, 10-pin	60869254

Tab. 18: Spare parts

11.2 Accessories

Info

Ordering Accessories

The accessories are not part of the scope of delivery.

Suitable accessories can be obtained from Bucher Automation AG.

Component	Item number
Screwdriver	60871712
End clamp for DIN rail	60863970
Strain relief	60870963

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