BUCHER automation

User Manual



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JX4-BN-EC

EtherCAT® Bus Node

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Translation of the german original User Manual

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Table of contents

1 Introduction 5
1.1 Information on this document 5
1.2 Typographical conventions 5
2 Safety 6
2.1 General 6
2.2 Purpose 6
2.2.1 Intended use 6
2.2.2 Non-intended use 6
2.3 Warnings used in this document 7
3 Product description 8
3.1 System overview 8
3.2 Design 9
3.3 Features 10
3.4 Status indication 10
3.4.1 Lighting patterns of the LEDs 10
3.4.2 LED status indicators 11
3.5 Nameplate 12
3.6 Scope of delivery 12
4 Technical specifications 13
4.1 Dimensions 13
4.2 Mechanical specifications 14
4.3 Electrical properties 14
4.4 Environmental conditions 15
4.5 EMC Values 16
5 Mechanical installation 17
5.1 Order and arrangement 17
5.2 Installing the device on the DIN rail 17
5.3 Assembling the expansion module 19
5.4 Installing the end cover and retainers 20
5.5 Removing the device from the DIN rail 21
6 Electrical connection 24
6.1 Improving EMC Noise Immunity 24
6.2 Interfaces 25
6.2.1 Power supply 25
6.2.2 IN, OUT sockets – EtherCAT® 26

7 Identification and configuration 27
7.1 Incorporating an EtherCAT® device as 3rd-party 27
7.2 Integrate an EtherCAT® device into JetSym 30
7.3 Adding expansion modules 31
8 Programming 33
8.1 Include the support file for JX4-BN-EC 33
8.2 Loading the configuration on the controller. 34
9 Maintenance 36
9.1 Repairs 36
9.2 Storage and Shipment 36
9.3 Return and Disposal 37
10 Service 38
10.1 Technical support 38
11 Spare parts and accessories 39

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

For further information refer to the following information 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.

ⓘ Info

EtherCAT®

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

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

The JX4-BN-EC is a gateway module between an EtherCAT® main device and JX4 I/O modules. It is used to set up distributed I/O stations.

The JX4 system works with a combination of bus nodes and I/O modules. The bus node connects the scalable I/O modules with an industrial-scale real-time Ethernet system. The bus node ensures fieldbus communication thereby enabling real-time data exchange between the I/O modules and the bus node.

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.

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 JX4-BN-EC EtherCAT® bus node serves as a gateway between an EtherCAT® main device and the Bucher Automation JX4-IO modules. The JX4-BN-EC is used for the purpose of setting up distributed I/O stations. The module enables synchronous communication via EtherCAT® between the controller and remote JX4-I/O modules.

3.1 System overview

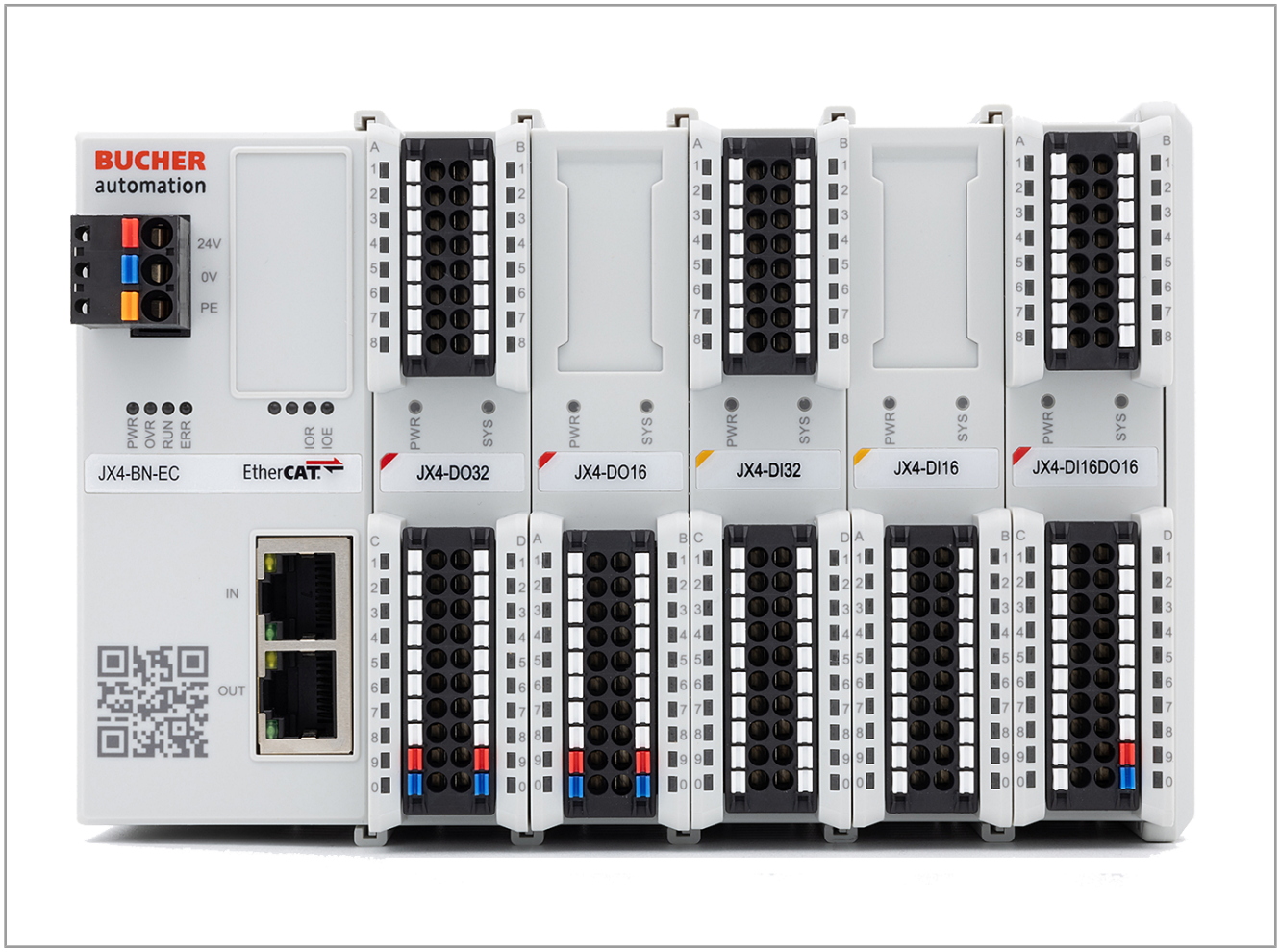


Fig. 1: System overview

3.2 Design

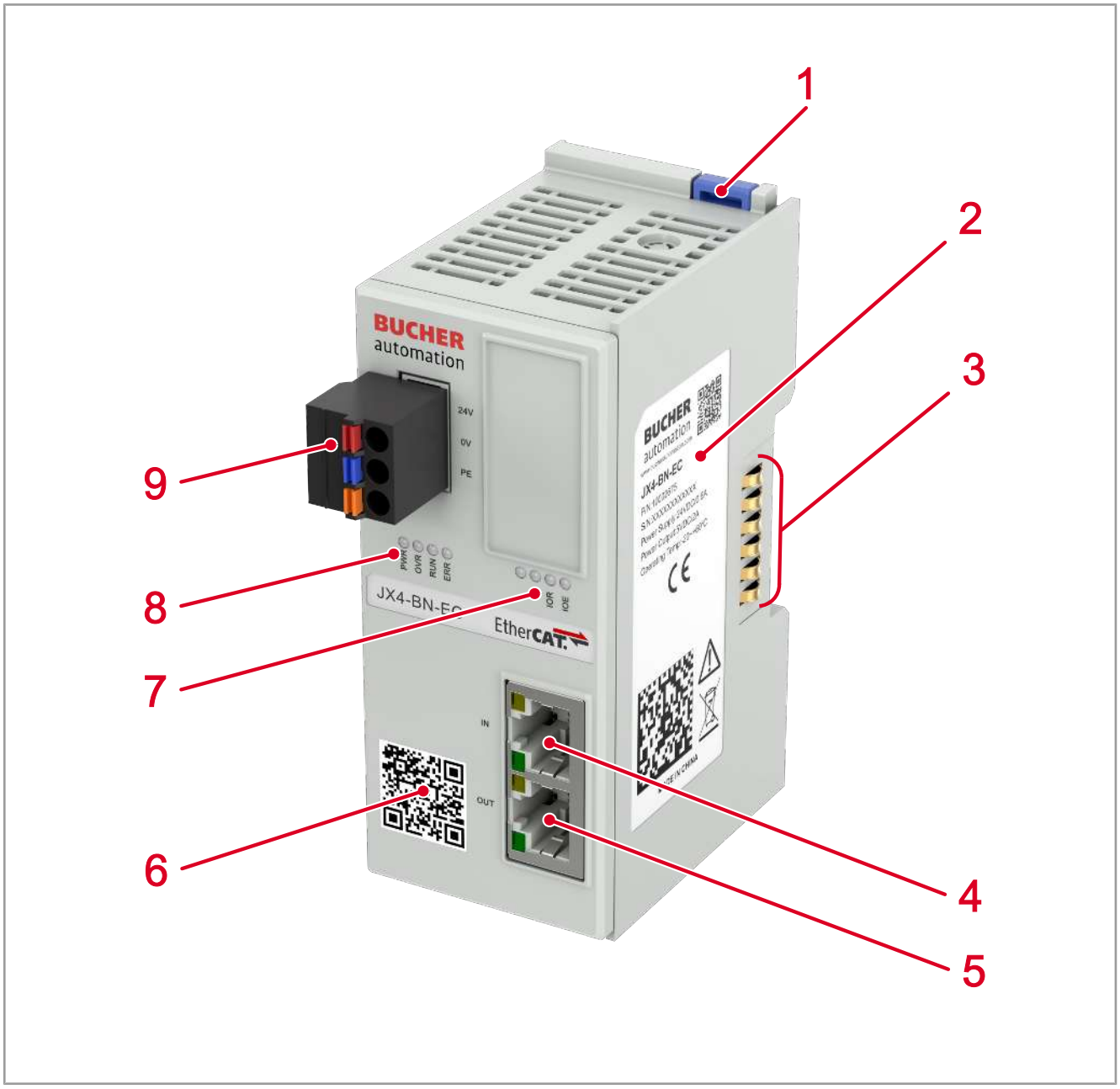


Fig. 2: Design

1	Latch
2	Nameplate
3	Contact pins of internal JX4 system bus
4	Socket X14: EtherCAT® IN
5	Socket X15: EtherCAT® OUT
6	Scan – link to Homepage
7	Status indicator of the system's operating state
8	Module indicator: shows the device status of the bus node and its operating status.
9	3-Pin push-in terminal: Power supply

3.3 Features

– Automatic addressing
– CoE protocol (CAN application protocol over EtherCAT®)
– Compliant with EtherCAT® Modular Device Profile (MDP)
– Synchronous communication via Distributed Clocks (DC Sync)
– Up to 32 expansion modules can be connected
– LEDs indicate the state of communication and power supply

3.4 Status indication

Status indication LEDs show the communication status of the device as well as the status of the power supply.

Color and status of the LEDs facilitate diagnosing various states.

3.4.1 Lighting patterns of the LEDs

Parameter	Lighting pattern	Description
OFF	-	LED turned off
ON	Continuously lit	LED turned on
Blinking	1 Hz	Slow and continuous blinking
	2.5 Hz	Faster continuous blinking
Flickering	10 Hz	Fast and continuous blinking
Flashing	ON 200 ms, OFF 1 s	Lighting up briefly
Double-flashing	OFF 200 ms, ON 200 ms, OFF 200 ms, ON 1000 ms	Flashing alternately briefly and long

Tab. 1: Lighting patterns of the LEDs

3.4.2 LED status indicators

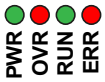


Fig. 3: JX4-BN-EC status indicator

LED	Function	Color	Status	Description
PWR	Operating status indicator	Green	ON	Power is supplied properly to the module
			OFF	Module is turned OFF or power supply is irregular
OVR	Overload indicator	Red	OFF	No overload
			ON	Load is 90 % (+/--5 %) or more
RUN	EtherCAT® operating status indicator	Green	ON	EtherCAT® Operational state
			Blinking at 2.5 Hz	EtherCAT® Pre-operational state
			Flashing	EtherCAT® safe-operational state
			Flickering	Bootstrap status
			OFF	EtherCAT® Init state
ERR	EtherCAT® Error indicator	Red	Double-flashing	EtherCAT® watchdog timeout
			Flashing	Local error on the module
			Blinking at 2.5 Hz	General configuration error
			OFF	No EtherCAT® communication error

Tab. 2: JX4-BN-EC LED status indicator



Fig. 4: System status indicator

LED	Function	Color	Status	Description
IOR	IO-RUN Communication indicator	Green	ON	IO process data have been generated
			Blinking at 1 Hz	No interaction
			Flickering	Busnode firmware upgrade
IOE	IO ERROR error indicator	Red	ON	Failure to connect to I/O modules
			Blinking at 1 Hz	I/O module alarm
			OFF	No communication errors

Tab. 3: System system LED indicator

3.5 Nameplate

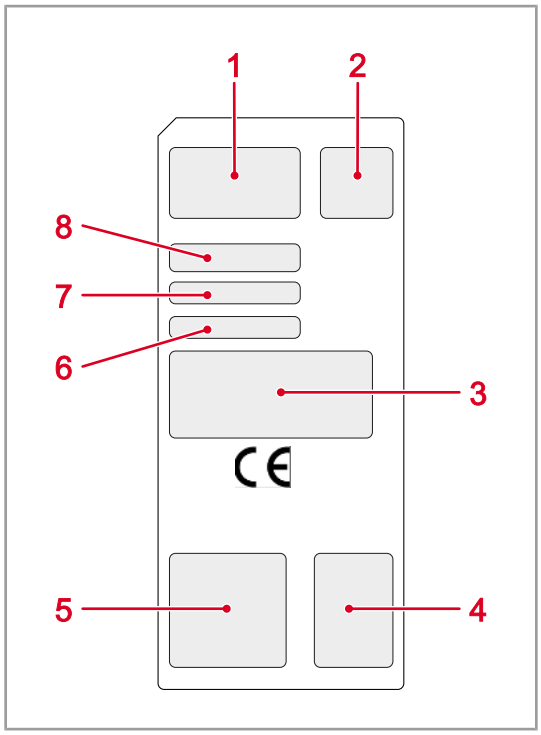


Fig. 5: Nameplate

1	Company logo
2	QR code pointing to Website
3	Power data
4	Warning and mandatory signs
5	Data Matrix Code with product information
6	Serial number
7	Item number
8	Item name

3.6 Scope of delivery

Scope of delivery	Item number	Quantity
JX4-BN-EC	10002675	1
End cover		1
Clamping part		2

4 Technical specifications

This chapter contains information on both electrical and mechanical data as well as on operating data of the JX4-BN-EC device.

4.1 Dimensions

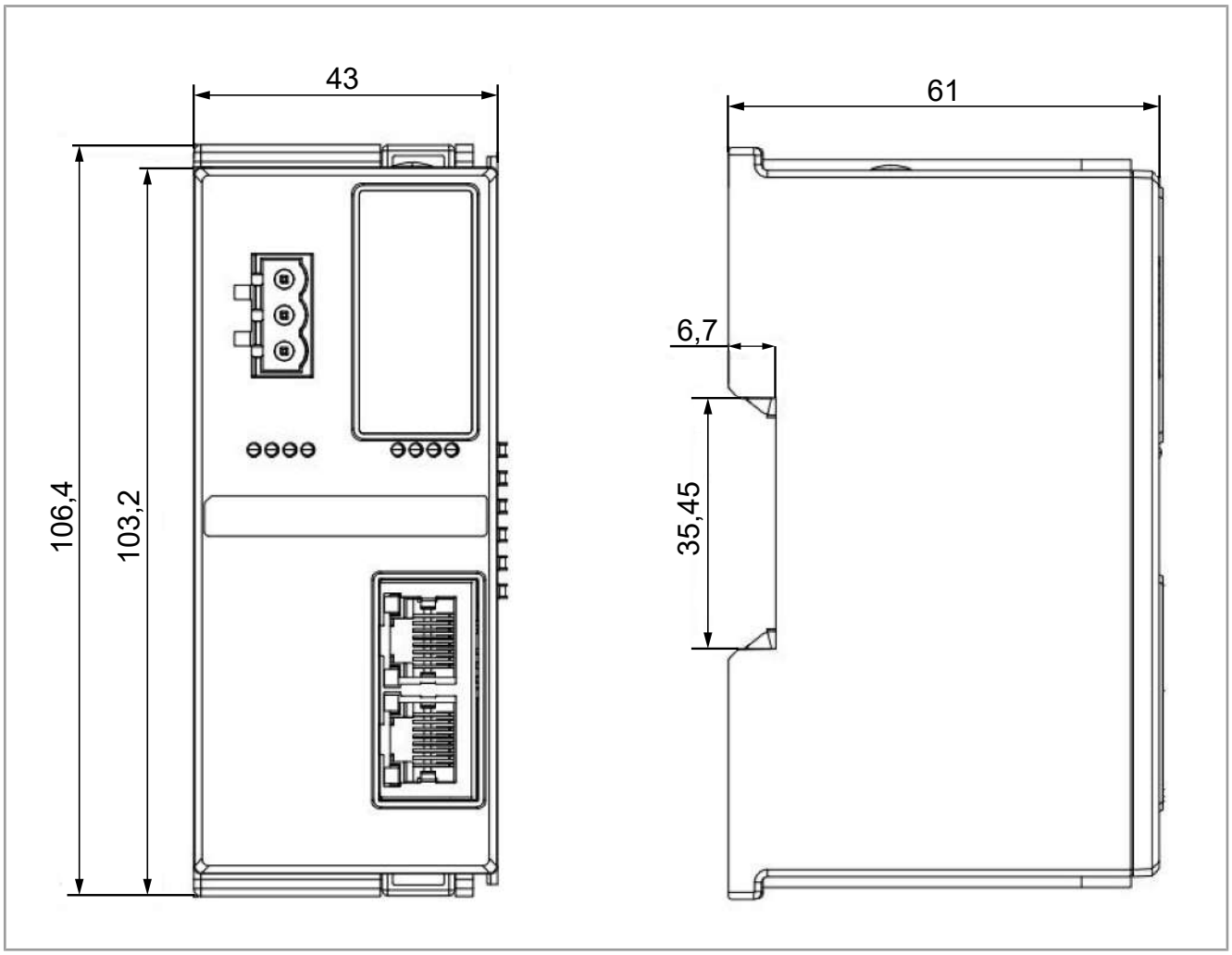


Fig. 6: Dimension in mm

4.2 Mechanical specifications

Parameter	Description	Standards
Mounting orientation	Vertically mounted on DIN rail	
Weight	155 g	
Housing specifications		
Material	Plastic	
Maximum drop height		
with shipping packaging	1 m	DIN EN 61131-2 DIN EN 60068-2-31
with product packaging	0.3 m	
Vibration resistance		
Frequency sweeps	1 octave/minute, sinusoidal	DIN EN 61131-2 DIN EN 60068-2-6
Constant amplitude	3.5 mm	5 Hz ≤ f ≤ 8.4 Hz
Constant acceleration	1 g	8.4 Hz ≤ f ≤ 150 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. 4: Mechanical properties – bus node

4.3 Electrical properties

Input power supply

Category	Description	
Rated voltage	DC 24 V	
Wire size range	0.3 … 1.0 mm^2	
Permissible voltage range	-15 % … + 20 %	
Input current(at rated voltage)	Max. 600 mA	Including connected modules
Backplane supply current	Max. 2 A	
Backplane supply voltage	DC 5 V	
Power consumption		
Bus node without connected modules	Max. 4.4 W	
Bus node incl. connected modules	Max. 14.4 W	

Tab. 5: Input power supply

EtherCAT® interface (ports IN/OUT)

Category	Description	
Type	RJ45 jack	
Number of ports	2	EtherCAT® IN and EtherCAT® OUT
Bit rate	100 Mbit/s	Cat 5e
transmission path	≤ 100 m	From station to station
Volume of input and output process data	1024 bytes	
Auto-crossover	Automatic crossover function	

Tab. 6: EtherCAT® interface (ports IN/OUT)

ⓘ Info

Volume

The total volume of upstream and downstream data must not exceed 1024 bytes.

Electrical safety

Parameter	Description	Standards
Class of protection	III	DIN EN 61131-2
Dielectric test voltage	Functional ground is internally connected to the device ground	
Protective connection	0	
Overvoltage category	I	

Tab. 7: Electrical safety

4.4 Environmental conditions

Parameter	Description	Standards
Operating temperature	-20 °C ... +60 °C	DIN EN 61131-2
Storage temperature	-40 °C ... +80 °C	DIN EN 60068-2-1
Humidity	10 % … 95 %, non-condensing	DIN EN 60068-2-2
Maximum operating altitude	2,000 m above sea level	DIN EN 61131-2
Corrosion immunity and chemical resistance	No special anti-corrosion precautions have been taken. The ambient air must not contain 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. 8: Environmental conditions

4.5 EMC Values

Emitted interference

Parameter	Values	Standards
Frequency band	**30 MHz … 230 MHz**	DIN EN 61000-6-4 DIN EN 61131-2 DIN EN 55011
Limit value	50 dB (µV/m) at 3 m distance	
Frequency band	**230 MHz … 1,000 MHz**	
Limit value	57 dB (µV/m) at 3 m distance	
	Class A	

Tab. 9: Emitted interference

Immunity to interference

Parameter	Values	Standards
Magnetic field with mains frequency		
Frequency	50 Hz	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-8
Magnetic field	30 A/m	
RF field, amplitude-modulated		
Frequency band	80 MHz … 2 GHz	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-3
Test field strength	10 V/m	
	AM 80 % with 1 kHz	
	Criterion A	
ESD		
Discharge through air Test peak voltage	8 kV	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-2
Contact discharge Test peak voltage	4 kV	
	Criterion A	

Tab. 10: Immunity to interference

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 Order and arrangement

The following guidelines apply for arranging and installing the devices:

– The devices can be mounted on the DIN rail side by side with no gaps between them.

– The devices must be installed in the following order from left to right: JX4-BN-EC – I/O modules – end cover.

5.2 Installing the device on the DIN rail

NOTICE



Functional impairment due to incorrect installation

- ► Install the device only in vertical position on the DIN rail (DIN EN 60715).
- ► To allow for sufficient venting, ensure a minimum distance of 50 mm above and below the module.

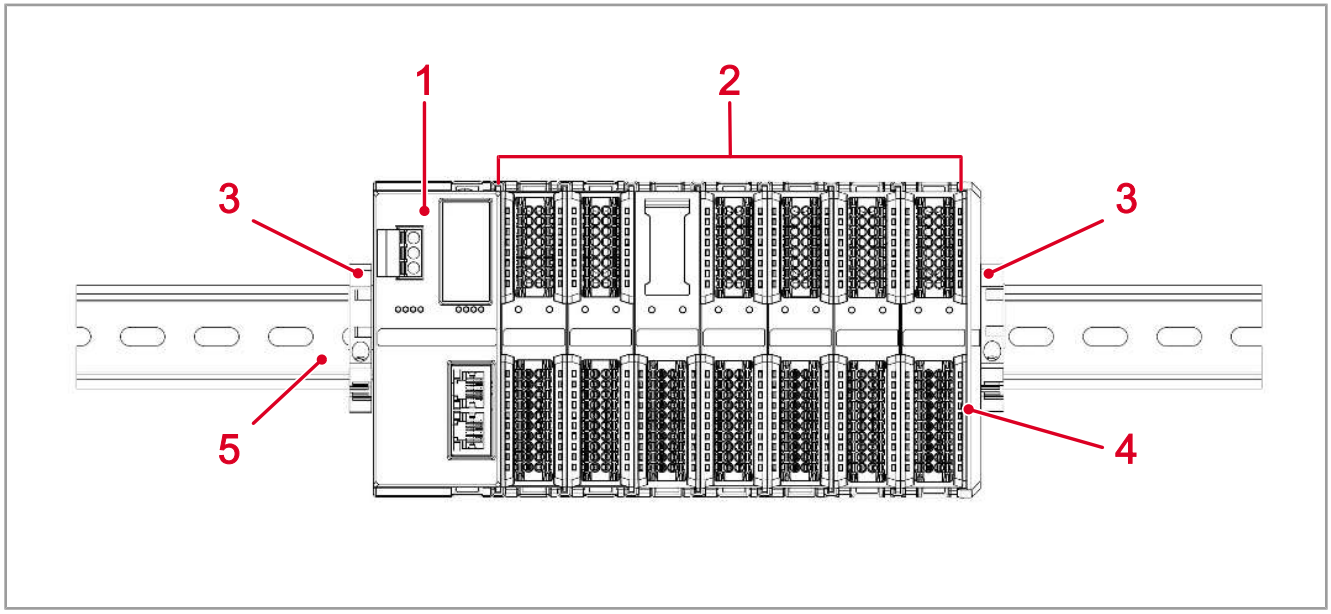
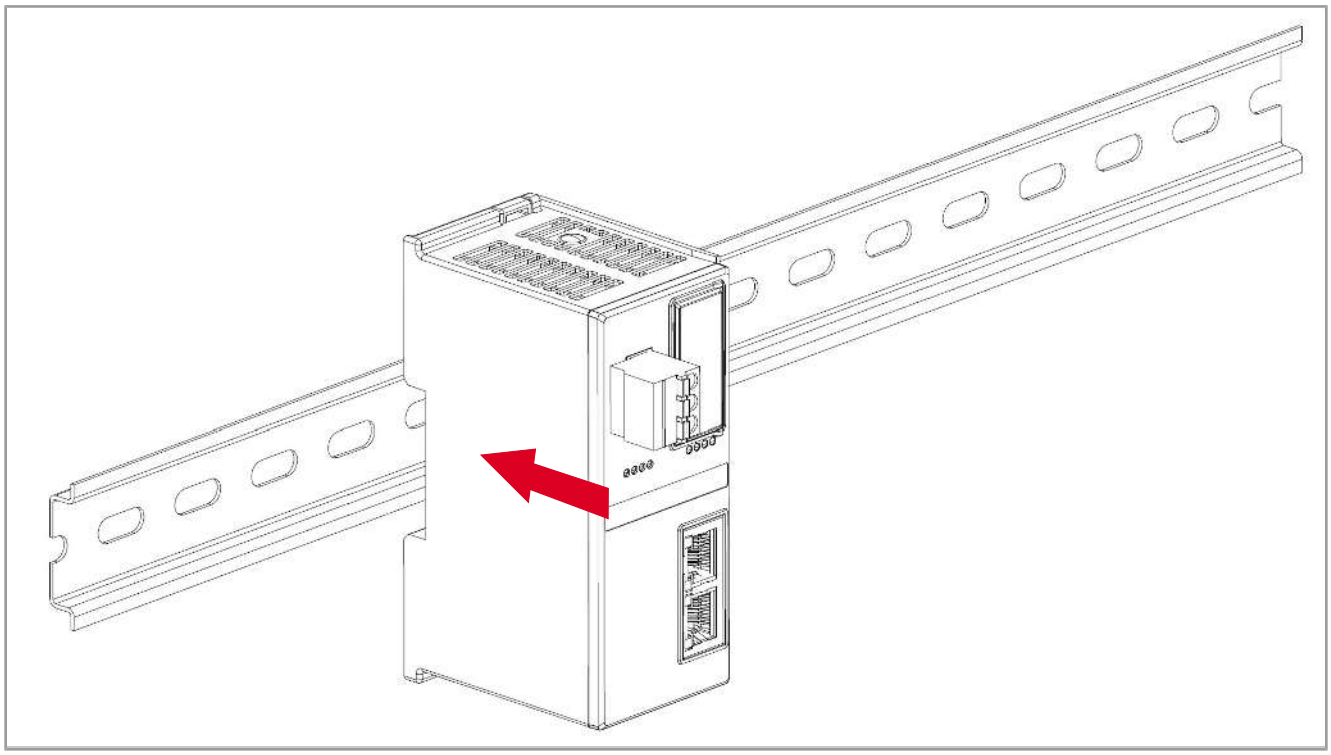
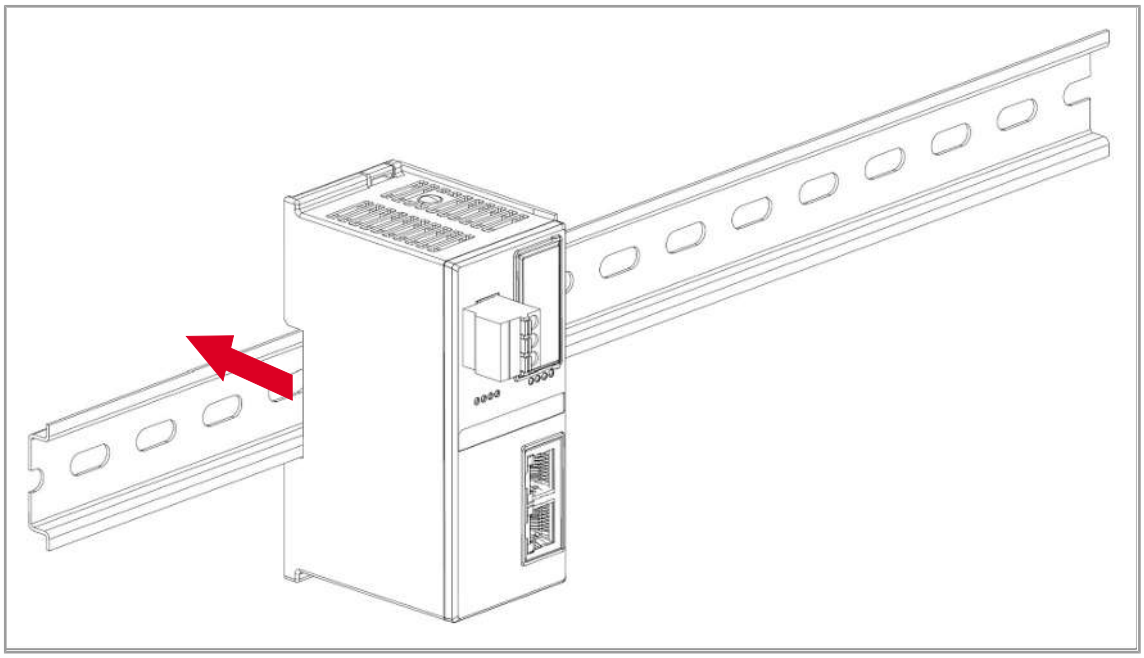


Fig. 7: System overview

1	Bus node
2	Expansion modules
3	Clamping parts
4	End cover
5	DIN rail



1. De-energize the system.
2. Align the device vertically on the DIN rail.



3. Press the device toward the DIN rail.
4. Listen for it to click into place.

5.3 Assembling the expansion module

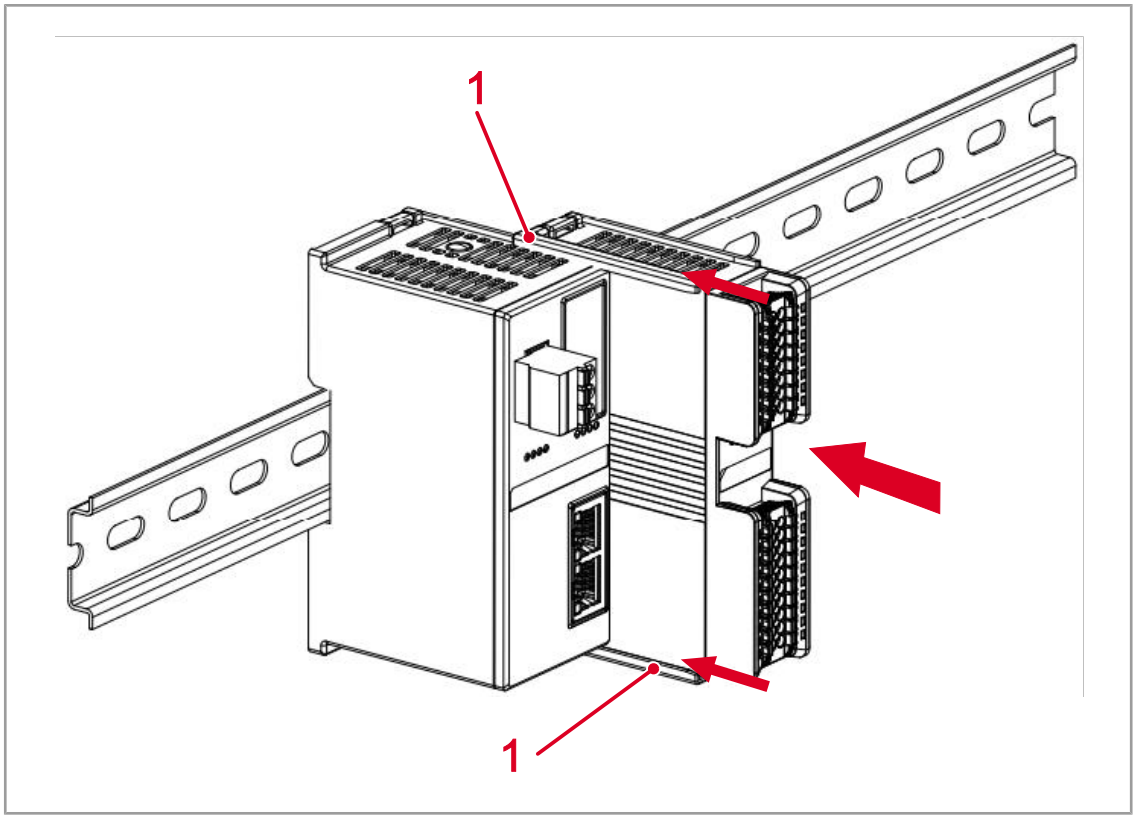


Fig. 8: Assembling the expansion module

1	Guide rail

1. Add expansion modules to complement the device.
2. Align the guide rails (1) and push the devices back until they click into place.

5.4 Installing the end cover and retainers

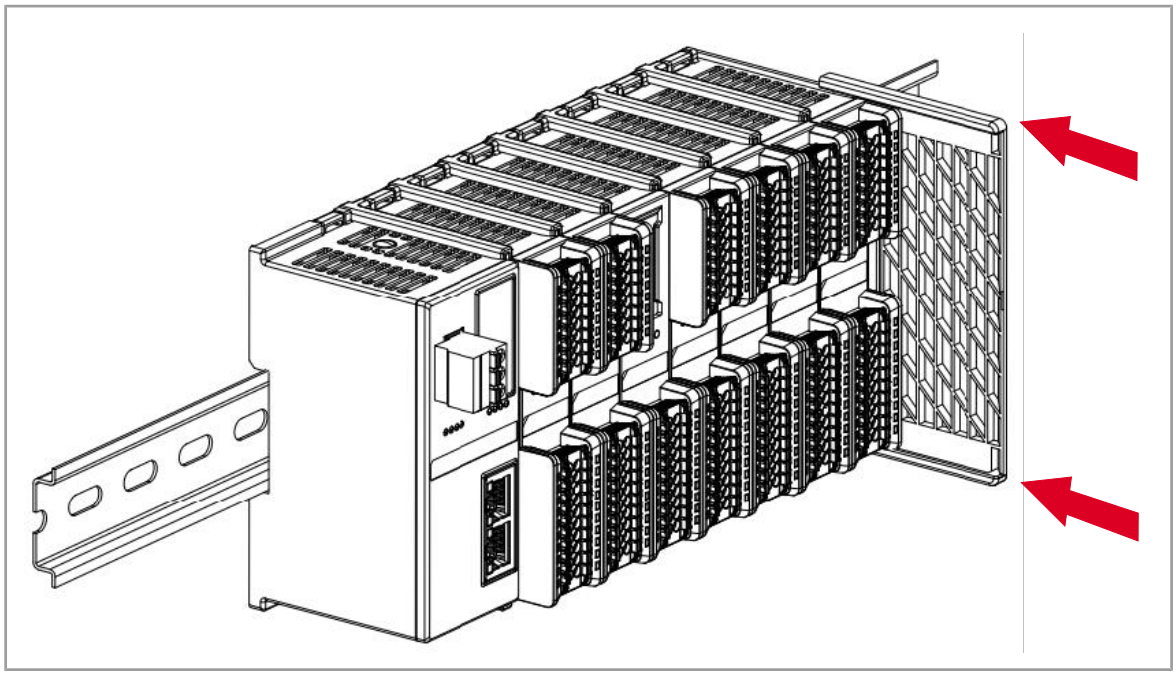


Fig. 9: Installing the end cover

1. Install the end cover on the right-hand side next to the last expansion module. The grooved surface faces toward the expansion module.

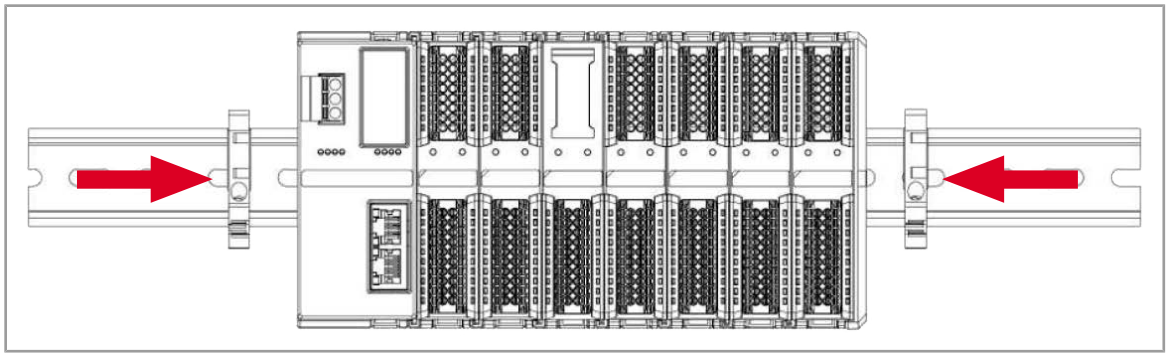


Fig. 10: Installing the retainers

2. Place the retainers on both sides of the assembly and push them firmly against the devices.

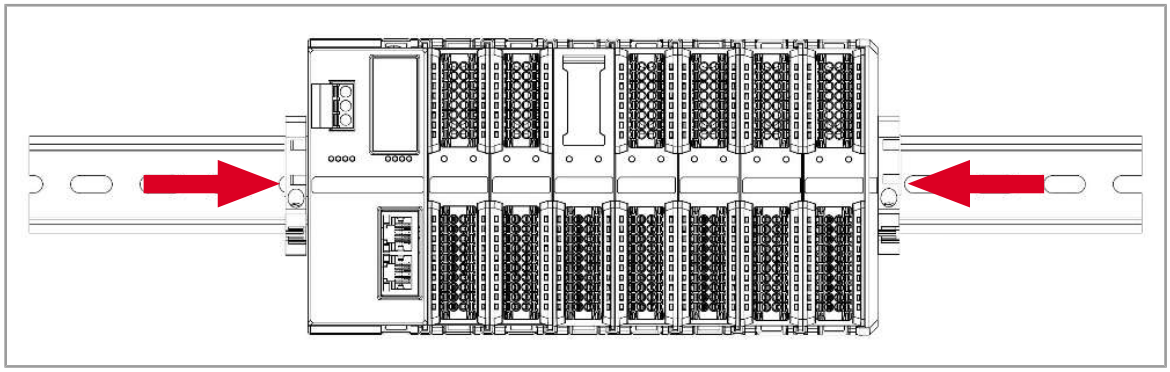


Fig. 11: Retainers firmly in place

3. Lock both retainers with a screwdriver.

5.5 Removing the device from the DIN rail

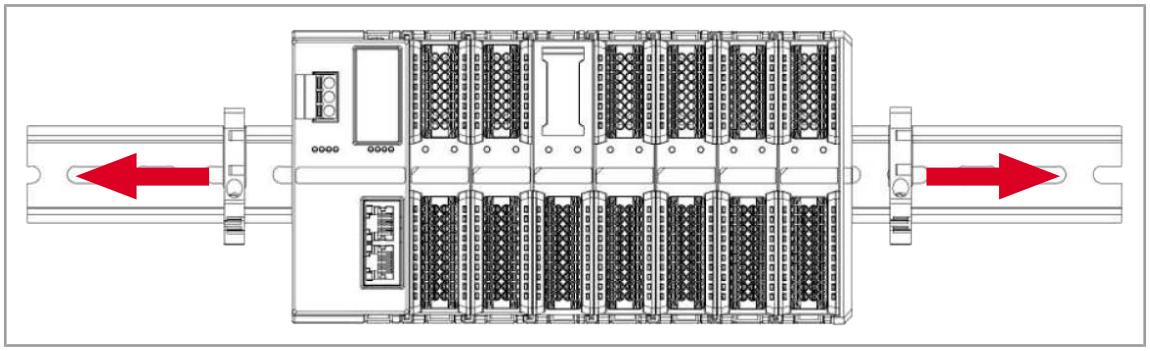


Fig. 12: Removing the retainers

1. De-energize the system.
2. Remove the retainers.

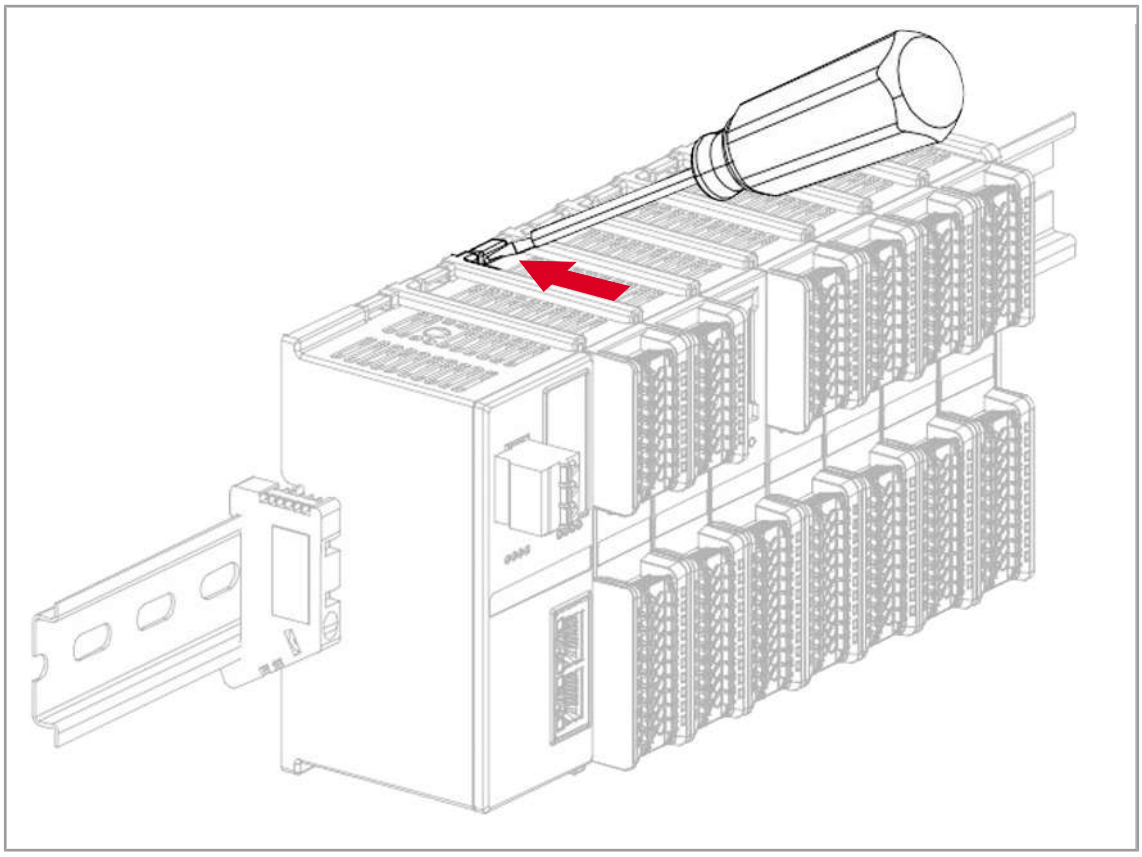


Fig. 13: Place a screwdriver on the latch.

3. Push the screwdriver into the latch.

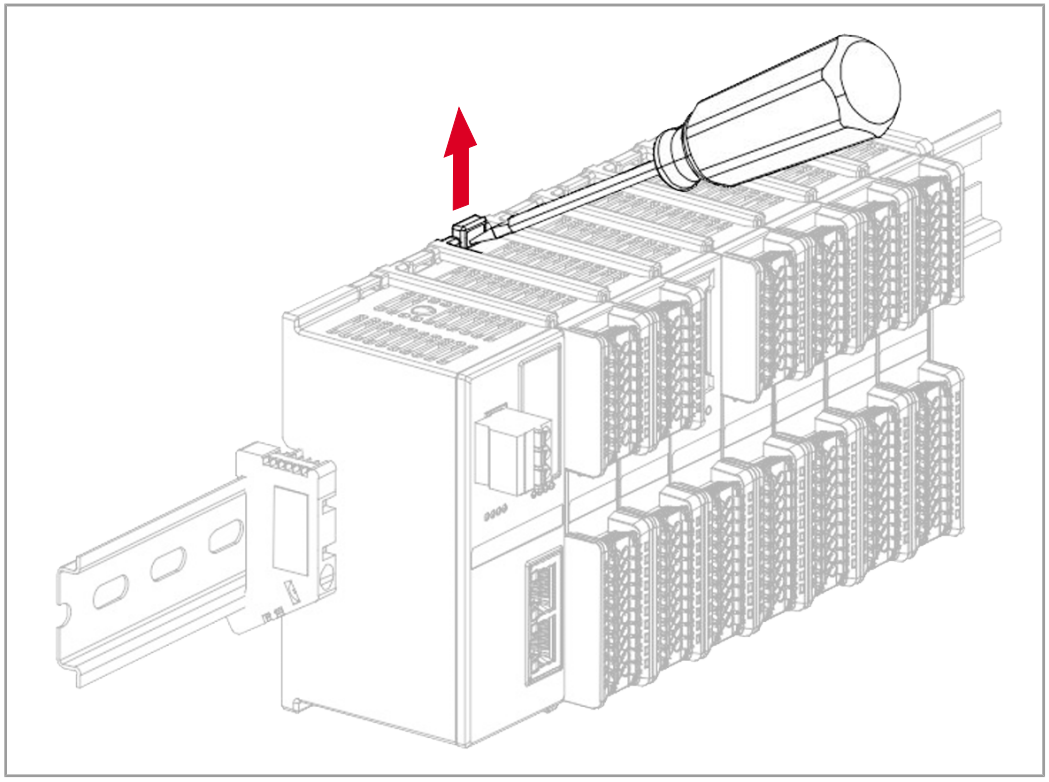


Fig. 14: Loosening the latch

4. Loose the latch.

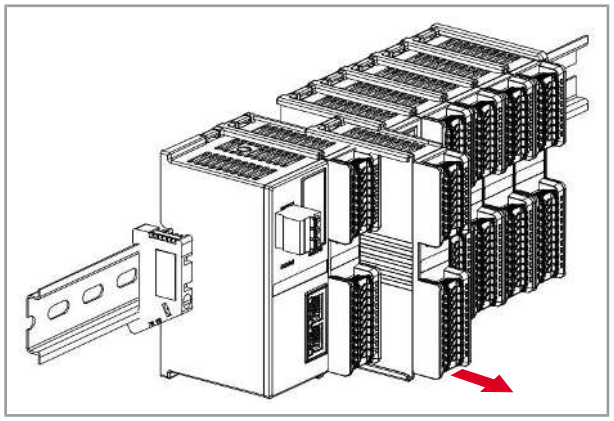


Fig. 15: Removing the module

5. Pull the device toward you and off the rail.

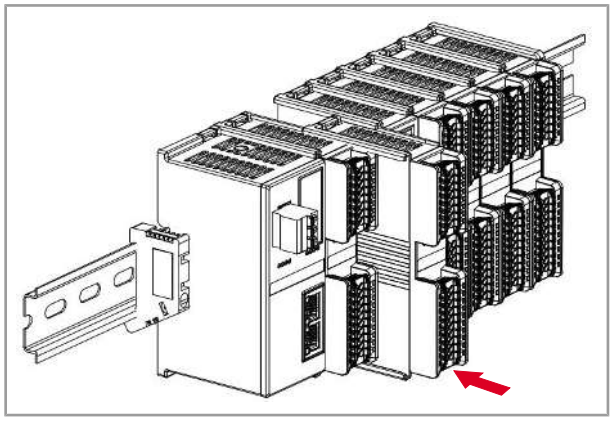
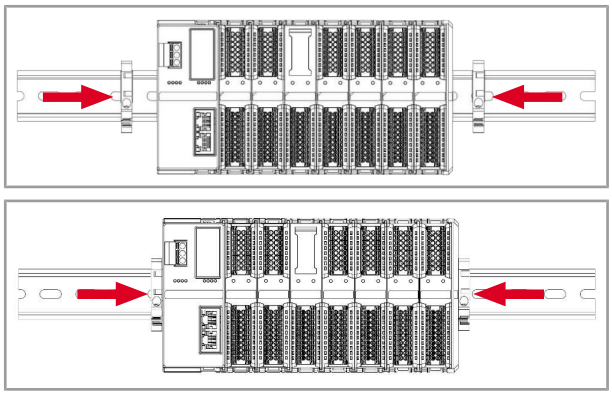


Fig. 16: Inserting the module

6. Insert a new device.



7. Install the retainers to secure the assembly.

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 Improving EMC Noise Immunity

A system's immunity to noise is determined by its weakest component. Key factors are correct connections, lines and proper shielding. Observe the measures set out in this chapter.

ⓘ 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.

DIN rail

– Mount the JX4-BN-EC device on a DIN rail sized 35 mm x 7.5 mm as per DIN EN 60715.

Application Note 016

Follow the instructions given in Application Note 016 *EMC-Compatible Installation of the Electric Cabinet*.

The following instructions are excerpts from Application Note 016:

– Keep signal and power lines **separated from each other** at all times. Bucher Automation AG recommends that there be a minimum distance of 20 cm. Cables and lines should cross each other at an angle of 90°.
– Shield the following cables and lines:
  – Analog lines
  – Data lines
  – Motor cables coming from inverter drives (servo output stage, frequency converter)
  – Lines between components and interference suppressor filter, where the suppressor filter is located not immediately adjacent to the component.
– Place the shield **on both sides**.
– Keep unshielded wire ends of shielded cables as short as possible.
– Span the shield **entirely** across the isolation. For **wide-area grounding**, clamp it down tightly with an extensively earthed strain relief.

6.2 Interfaces

6.2.1 Power supply

⚠ WARNING

Non-observance of safety instructions may result in injuries or physical damage

- ► Prior to assembling and installing the device, read and follow the safety precautions and restrictions of use as set out in the Safety chapter.
- ► Only authorized qualified personnel is allowed to perform any kind work on the device.

Connect the terminal as illustrated below:

– Voltage supply and earthing (PE) of the JX4-BN-EC bus node

– Power supply and earthing (PE) of the connected JX4 extension modules if they are not supplied by a separate JX4-PS power supply module.

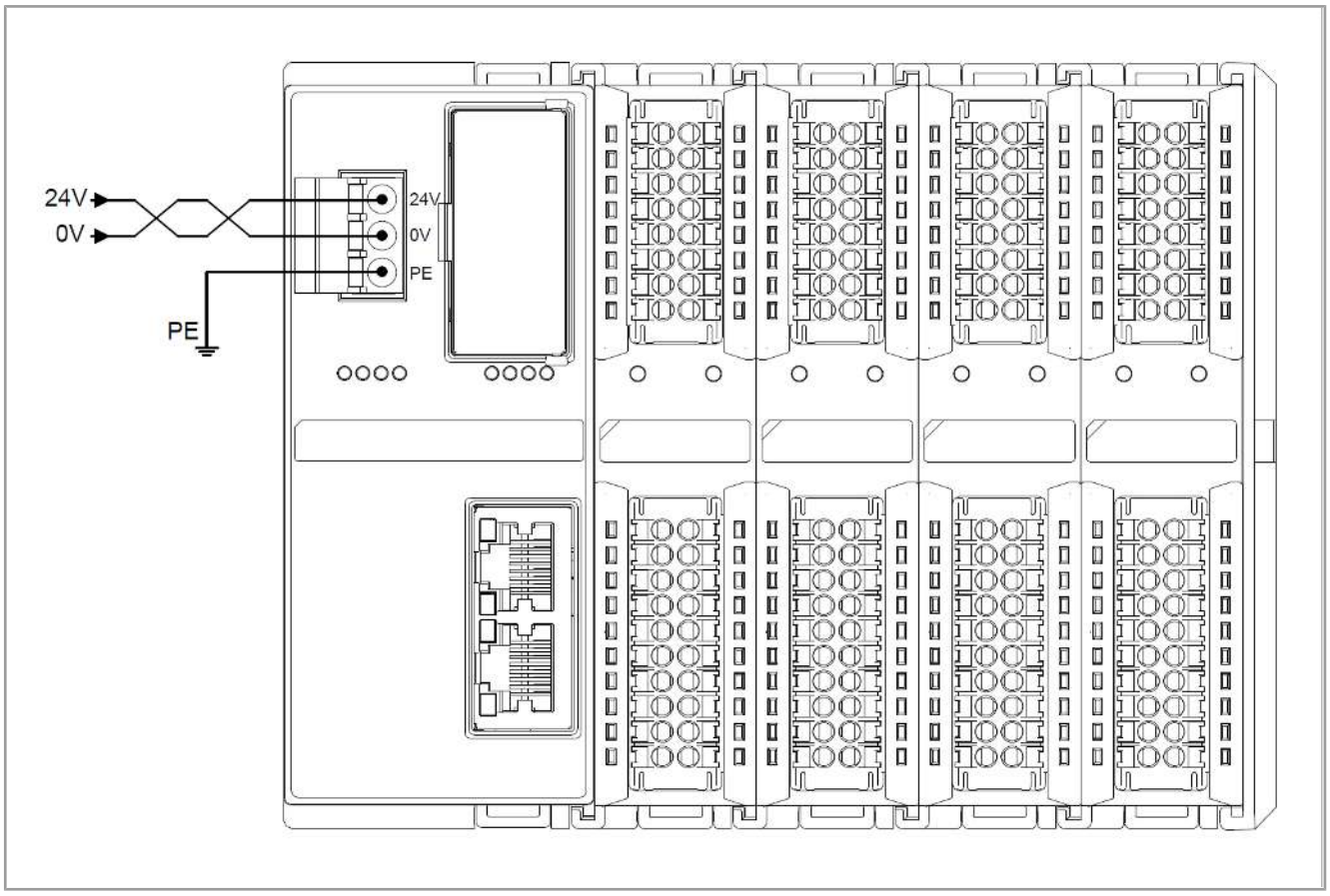
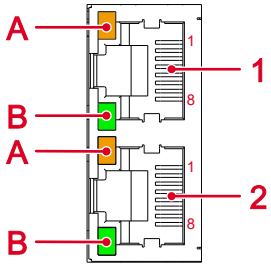


Fig. 17: Power supply terminal

6.2.2 IN, OUT sockets – EtherCAT®

The IN and OUT sockets connect to the following devices:

– EtherCAT® interface to any device



Pos.	Socket	LED	Color		Description
1	IN	A	Orange	Blinking	Activity connection with data transfer
				OFF	No data transfer
		B	Green	ON	Link network connection is active
				OFF	No network connection
2	OUT	A	Orange	Blinking	Activity connection with data transfer
				OFF	No data transfer
		B	Green	ON	Link network connection is active
				OFF	No network connection

7 Identification and configuration

Prerequisites

– JetSym software version 6.1 or later is installed.

> **ⓘ Info** **Further information**
>
> For more information, refer to the JetSym online help.

7.1 Incorporating an EtherCAT® device as 3rd-party

Prerequisites

– The JX4-BN-EC ESI file has been downloaded to the PC.

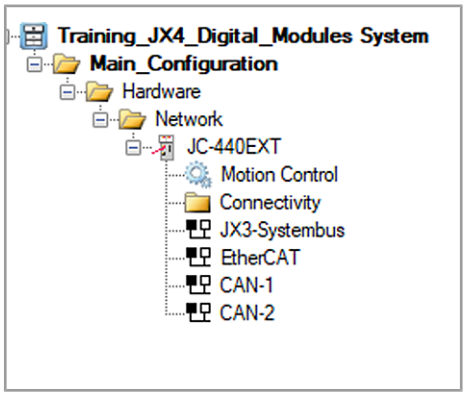
> **ⓘ Info** **Download the JX4-BN-EC ESI file to your PC**
>
> The ESI file for JX4-BN-EC only needs to be downloaded if modules are used that have not already been integrated into JetSym.

– The JX4-BN-EC is integrated into the network as a *“3rd Party EtherCat® Device”* when using modules that have not yet been integrated into JetSym.

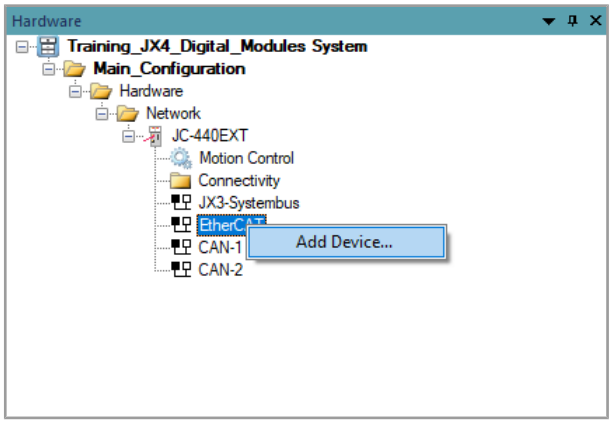
– The name assigned by the system can be changed by the user.

The following example illustrates the procedure when using a JC-440 EXT as a controller.

Creating a new project

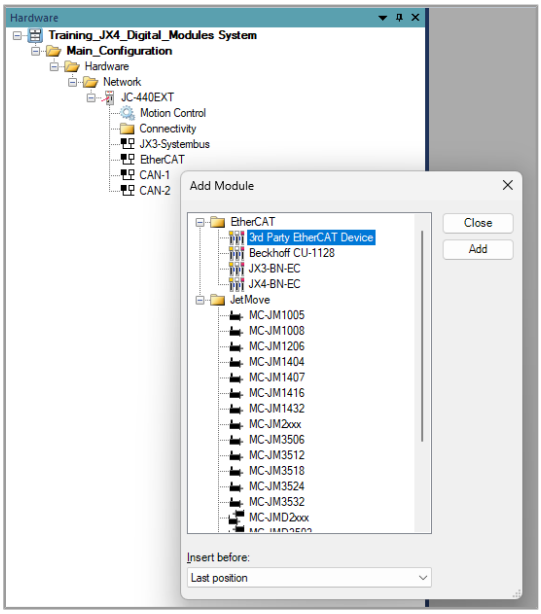


1. Go to Hardware>Network and open the folder of the respective controller.



2. Right-click the subfolder EtherCAT to open the context menu.

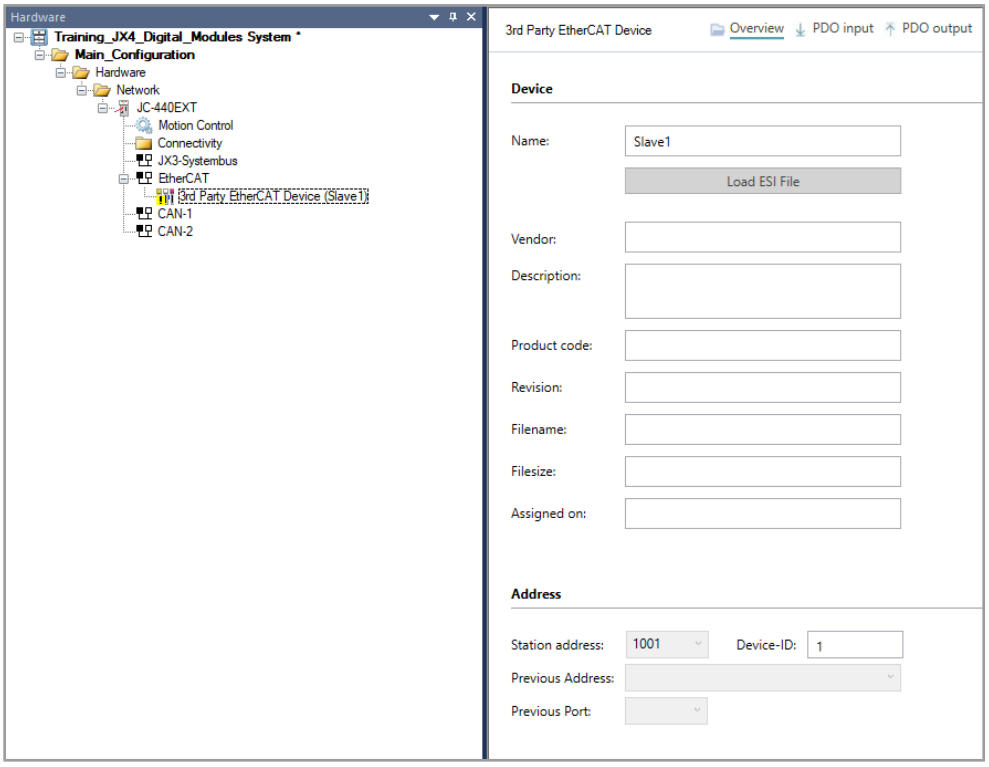
3. Select Add Device.



4. Select 3rd Party EtherCAT Device from the list.
5. Click on Add.

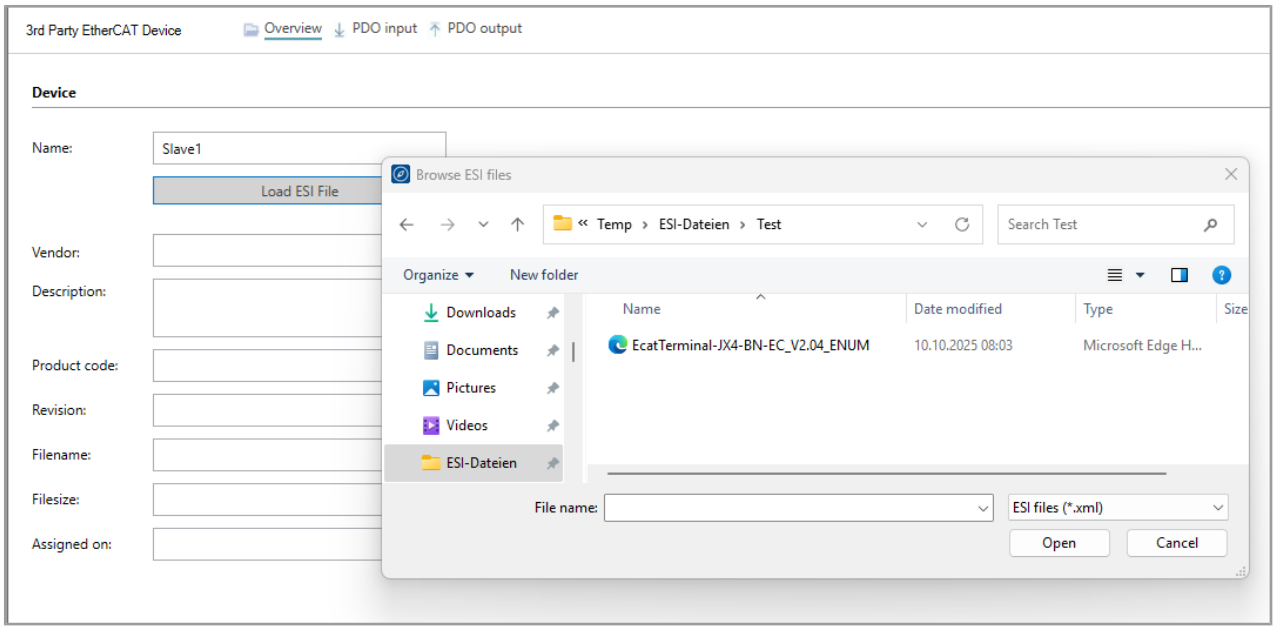
Load the ESI file for the EtherCAT device

✓ The required ESI files are available.



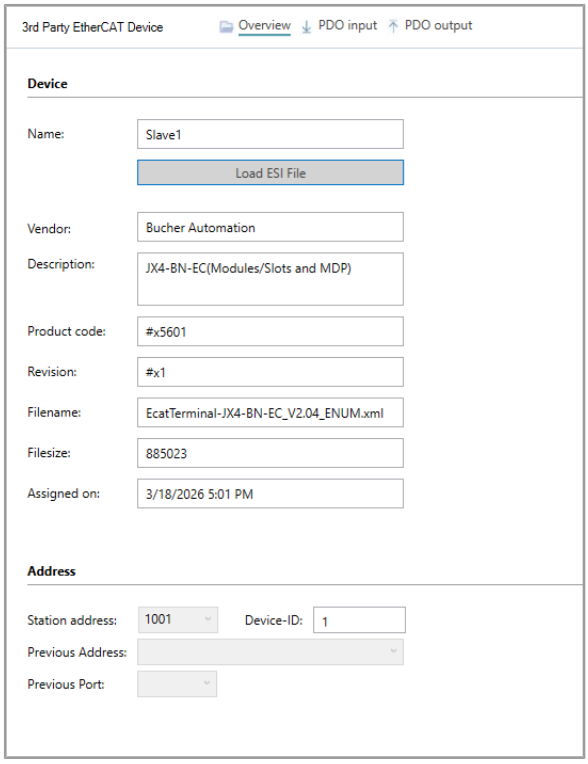
1. Double-click 3rd Party EtherCAT Device (Slave1).

   ⇨ The Device Parameters submenu opens.
2. Click Load ESI File.



⇨ The Explorer opens.

3. Select the file *EcatTerminal-JX4-BN-EC_V2.04_ENUM*.
4. Click Open.

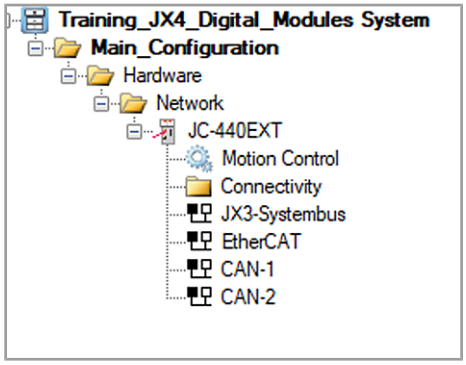


⇨ The device parameters have been entered, and the bus node appears in the list.

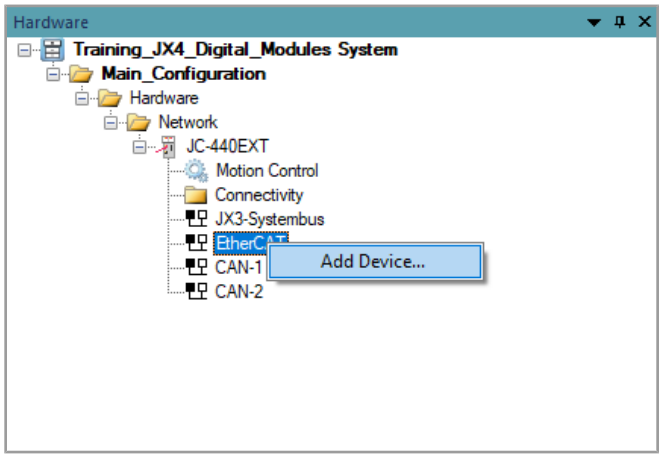
7.2 Integrate an EtherCAT® device into JetSym

The following example illustrates the procedure when using a JC-440 EXT as a controller.

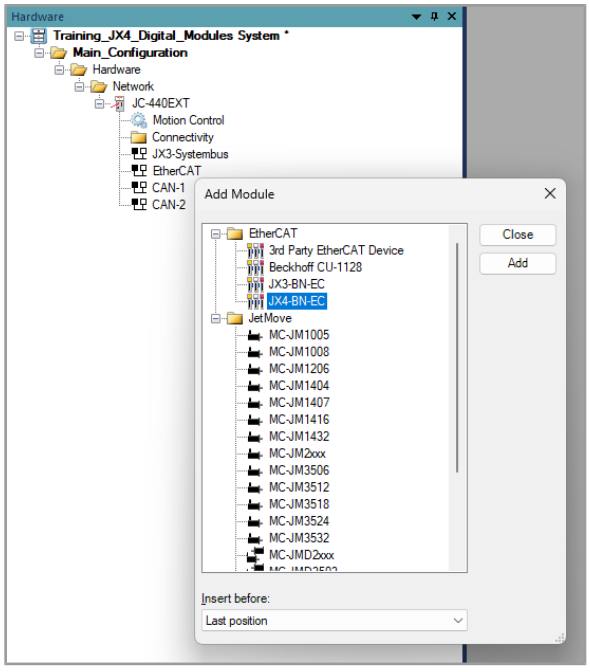
Creating a new project



1. Go to Hardware>Network and open the folder of the respective controller.

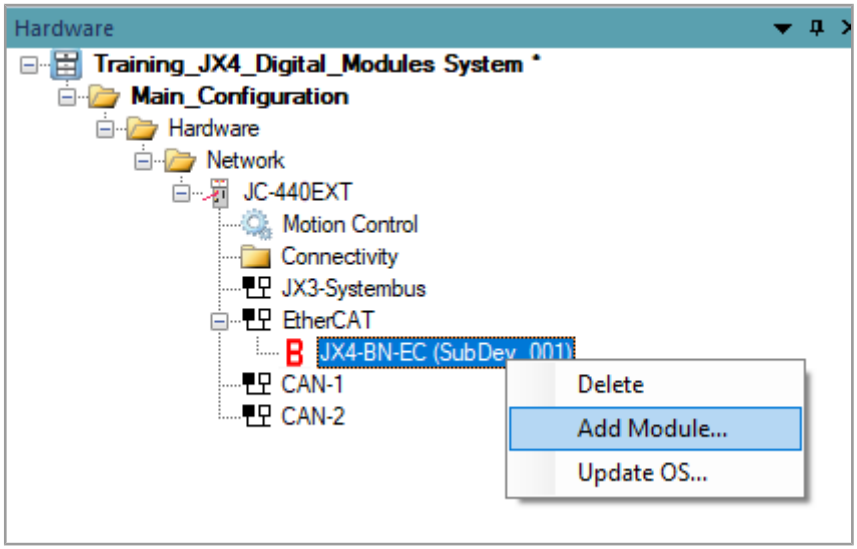


2. Right-click the subfolder EtherCAT to open the context menu.
3. Select Add Device.

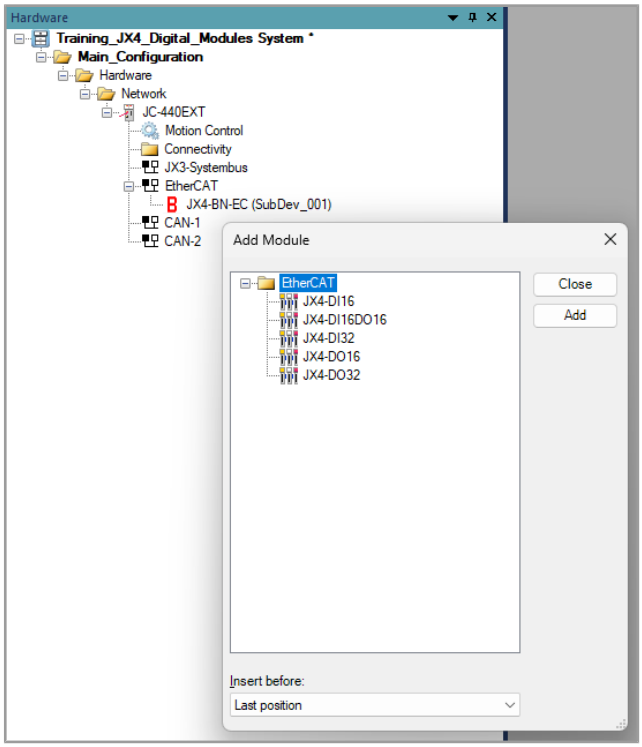


4. Select JX4-BN-EC from the list.
5. Click on Add.

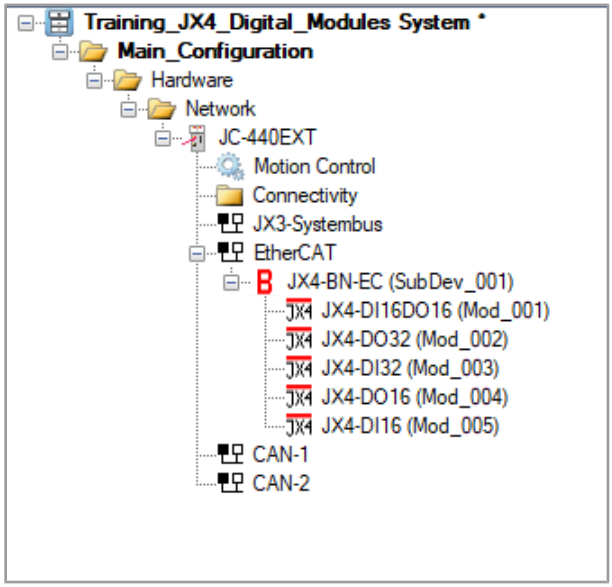
7.3 Adding expansion modules



1. Go to Hardware>Network and open the folder of the respective controller.
2. Open the subfolder EtherCAT.
3. Right-click JX4-BN-EC to open the context menu.
4. Select Add module.



5. One by one, select the desired modules and click Add.

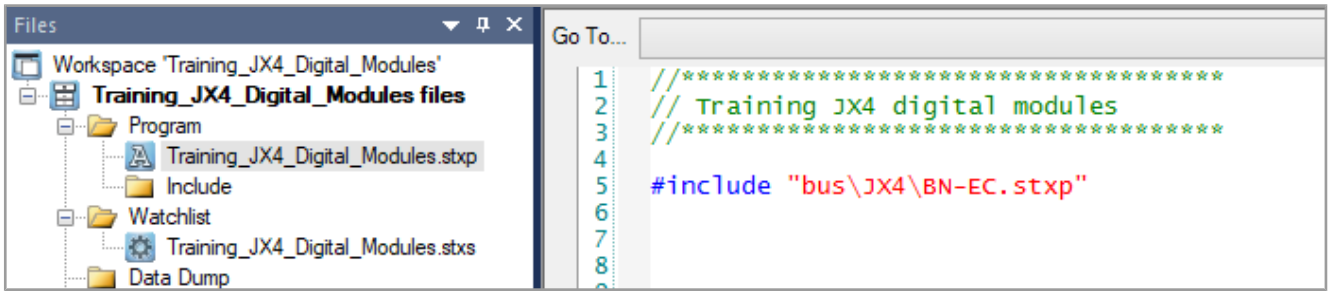


⇨ The selected modules are shown in the list.

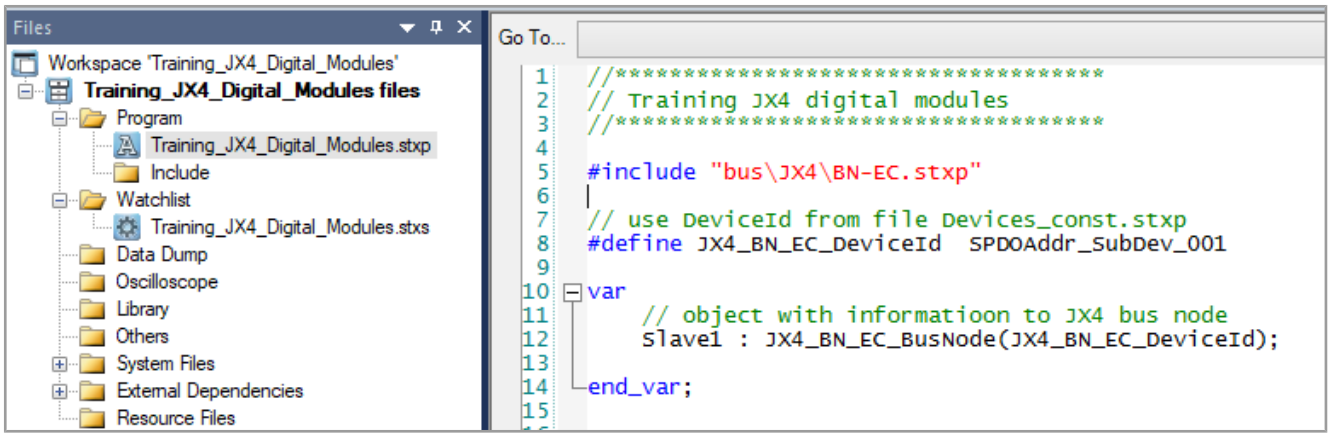
8 Programming

8.1 Include the support file for JX4-BN-EC

1. Double-click the Training_JX4_Digital_Modules.stxp file to open it.



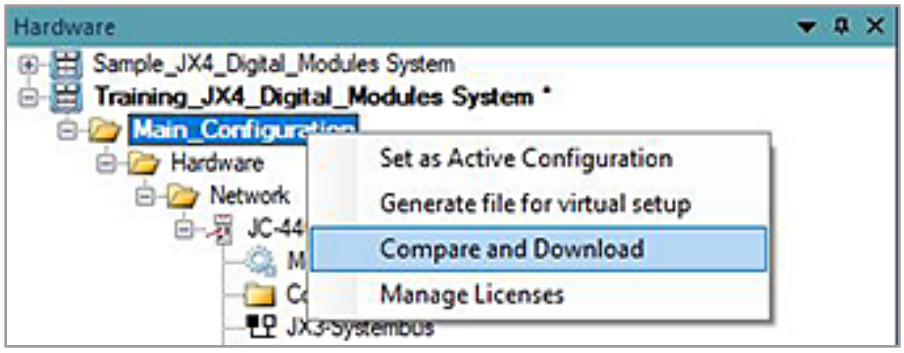
2. Use `#include` to include the support files in the project.



3. Define the bus node as an object.

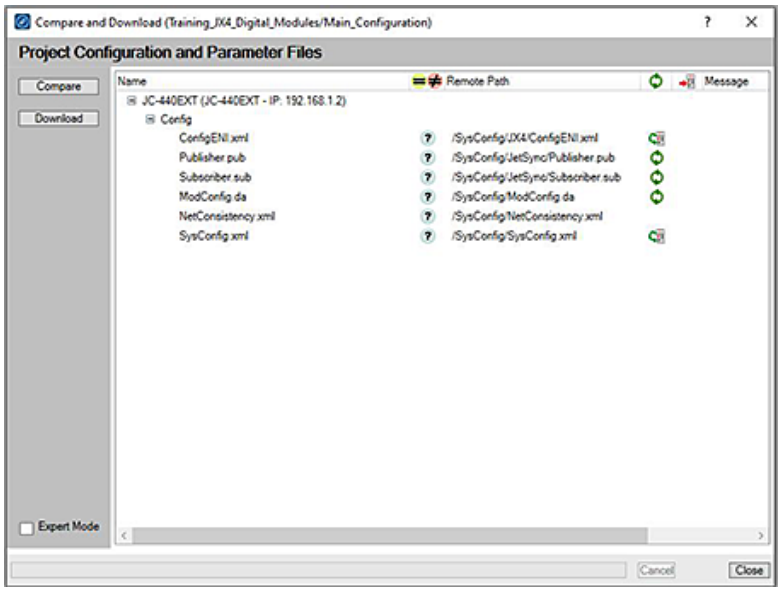
8.2 Loading the configuration on the controller.

✓ Before the configuration is downloaded to the controller, you can verify that the controller contains the correct configuration data.



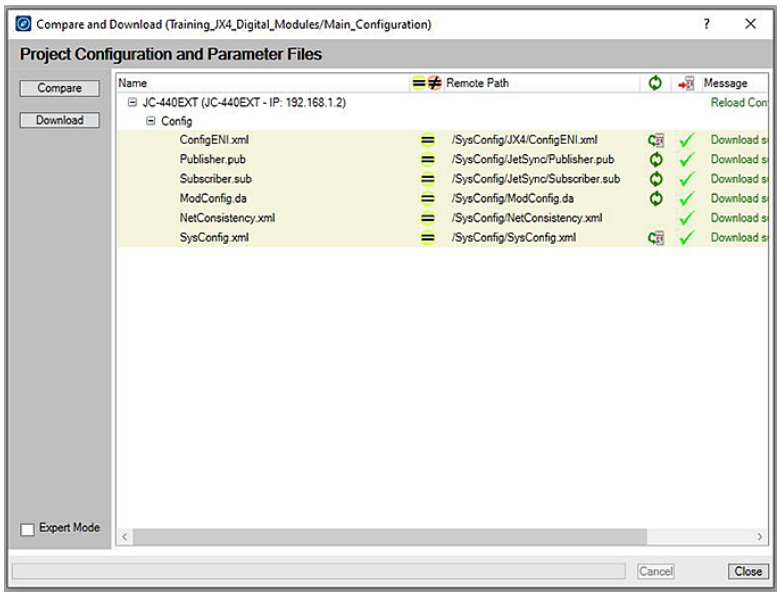
1. Right-click the folder Main_Configuration to open the context menu.
2. Select Compare and Download.

   ⇨ The following dialog box opens:



3. Click on Compare.

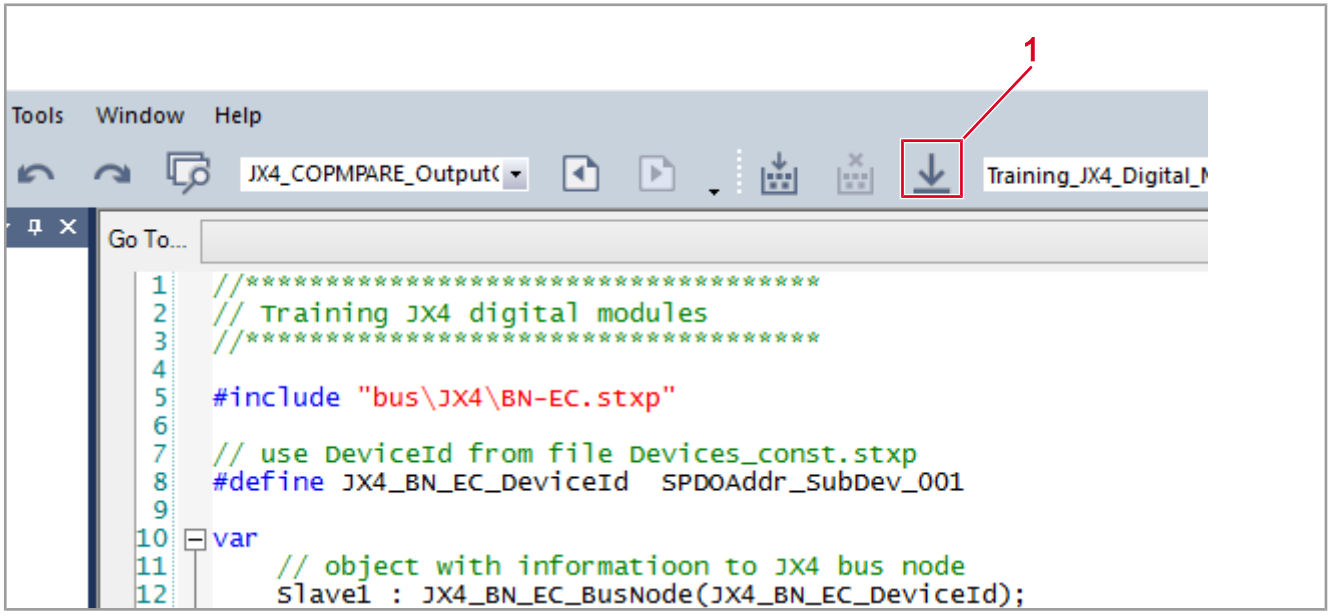
   ⇨ If the verification was successful, the following dialog box appears.



If the check reveals errors:

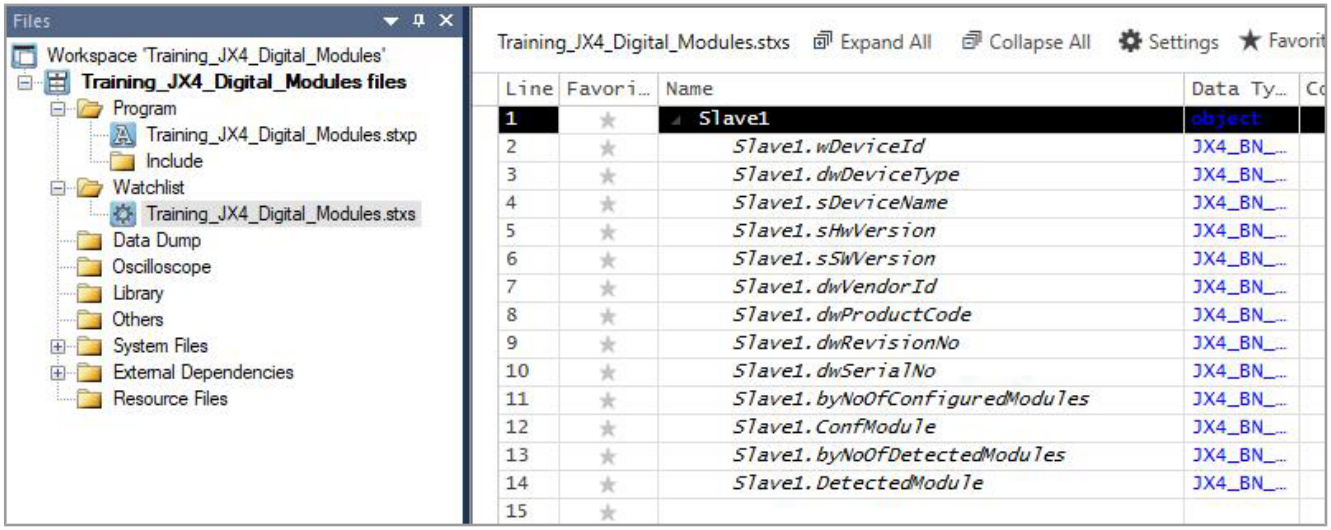
1. Click the button Download.

   ⇨ The right configuration is loaded to the controller.



2. Click the **download arrow (1)** in the menu bar or press **[Ctrl + F5]**.

   ⇨ The project is being downloaded.



3. Open the Setup folder.

⇨ The setup window lists all data for JX4-BN-EC .

9 Maintenance

This product is maintenance-free. The operation of the product does not required 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. 18: 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

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.

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.

List of figures

Fig. 1 System overview 8
Fig. 2 Design 9
Fig. 3 JX4-BN-EC status indicator 11
Fig. 4 System status indicator 11
Fig. 5 Nameplate 12
Fig. 6 Dimension in mm 13
Fig. 7 System overview 18
Fig. 8 Assembling the expansion module 19
Fig. 9 Installing the end cover 20
Fig. 10 Installing the retainers 20
Fig. 11 Retainers firmly in place 20
Fig. 12 Removing the retainers 21
Fig. 13 Place a screwdriver on the latch 21
Fig. 14 Loosening the latch 22
Fig. 15 Removing the module 22
Fig. 16 Inserting the module 22
Fig. 17 Power supply terminal 25
Fig. 18 WEEE icon – crossed out wheeled bin 37

List of tables

Tab. 1 Lighting patterns of the LEDs 10
Tab. 2 JX4-BN-EC LED status indicator 11
Tab. 3 System system LED indicator..... 11
Tab. 4 Mechanical properties – bus node..... 14
Tab. 5 Input power supply 14
Tab. 6 EtherCAT® interface (ports IN/OUT)..... 15
Tab. 7 Electrical safety 15
Tab. 8 Environmental conditions 15
Tab. 9 Emitted interference 16
Tab. 10 Immunity to interference..... 16

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