BUCHER automation

User manual



60889237_00

JX4-ENC2

Encoder Module

This document has been compiled by Bucher Automation AG with due diligence based on the state of the art as known to them. Any revisions and technical advancements of our products are not automatically made available in a revised document.
The Bucher Automation AG shall not be liable for any errors either in form or content, or for any missing updates, as well as for any damage or detriment resulting from such failure.

Bucher Automation AG
Thomas-Alva-Edison-Ring 10
71672 Marbach/Neckar, Germany
T +49 7141 2550-0
info@bucherautomation.com

Technical support
T +49 7141 2550-444
support@bucherautomation.com

Sales
T +49 7141 2550-663
sales@bucherautomation.com

www.bucherautomation.com

Translation of the german original User Manual

Revision	1.00
Date of issue	6/8/2026

Table of Contents

1 Introduction 5
1.1 Document Information 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 Improper use 6
2.2.3 Warnings Used 7
3 Product description 8
3.1 System overview 8
3.2 Structure 9
3.3 Features 9
3.4 Status indication 10
3.4.1 Lighting patterns of the LEDs 10
3.4.2 LED status indicators 10
3.5 Nameplate 11
3.6 Scope of delivery 11
4 Technical Specifications 12
4.1 Dimensions 12
4.2 Mechanical specifications 13
4.3 Electrical Properties 13
4.4 Environmental conditions 14
4.5 EMC Values 15
5 Assembly 16
5.1 Order and arrangement 16
5.2 Installing the device on the DIN rail 16
5.3 Assembling the expansion module 18
5.4 Installing the end cover and retainers 19
5.5 Removing the device from the DIN rail 20
6 Electrical connection 23
6.1 Improving EMC Noise Immunity 23
6.2 Wiring 24
6.3 Block diagrams 24
6.3.1 JX4-ENC2 24
6.3.2 Encoder Pin Assignment 25

7 Identification and configuration 26
7.1 Incorporating an EtherCAT® device as 3rd-party 26
7.2 Adding expansion modules 26
8 Programming 28
8.1 Incorporating the files in the project 28
8.2 Configuring the objects and modules 28
8.2.1 Definition of configuration parameters 28
8.2.2 Configuring Pulse Mode 28
8.2.3 Configuring the filter stage 29
8.2.4 Configuring the counting ratio 29
8.2.5 Configuring the Counting Range 29
8.2.6 Configuring the counting direction 30
8.2.7 Configuring Latch Mode (Probe Function) 30
8.2.8 Configuring the Trigger Edge Function 31
8.2.9 Output with comparison function 31
8.2.10 Battery backup in case of a power outage 32
8.3 Process data 33
8.3.1 Input data 33
8.3.2 Input data 34
8.4 Declare inputs and outputs 38
9 Maintenance 41
9.1 Repairs 41
9.2 Storage and Shipment 41
9.3 Return and Disposal 41
10 Service 43
10.1 Technical Support 43
11 Spare parts and accessories 44

1 Introduction

1.1 Document Information

This document is part of the product and must be read and understood before using the device. It contains important and safety-related information to ensure that the product is used properly and in accordance with its intended purpose.

Target audiences

This document is intended for qualified personnel.
The device must only be put into operation by qualified and trained personnel.
Safe use of the device must be ensured throughout every stage of its life cycle. A lack of or insufficient technical and documentation knowledge will result in the loss of any liability claims.

Availability of information

Ensure that this information is readily available near the product throughout its entire service life.
Please check the Downloads section of our website for updates and the latest version of the document. This document is not subject to automatic version control.

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 your device's operating system

ⓘ Info

Further information

For more information on system immunity to interference, please refer to Application Note 016 *EMC-Compliant Control Cabinet Installation* at 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

At the time of its release, the product reflects the current state of science and technology.
In addition to the operating instructions, the laws, regulations, and guidelines of the country of use or the EU apply to the operation of the product. The operator is responsible for complying with the relevant accident prevention regulations and generally accepted safety standards.

2.2 Purpose

2.2.1 Intended use

The JX4 system works with a combination of bus nodes and I/O modules.

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

Due to its low operating voltage, the device falls under the Safety Extra Low Voltage category and is therefore not subject to the EU Low Voltage Directive. The device must be powered only from a SELV source.

2.2.2 Improper use

Do not use the device in technical systems that require a high level of reliability.

Machinery Directive

This device is not a safety component as defined by the Machinery Directive 2006/42/EC and is not suitable for use in safety-related applications.

2.2.3 Warnings Used

⚠ 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-ENC2 module from the JX4family is a 2-channel incremental encoder module.

3.1 System overview



Fig. 1: System Overview

3.2 Structure

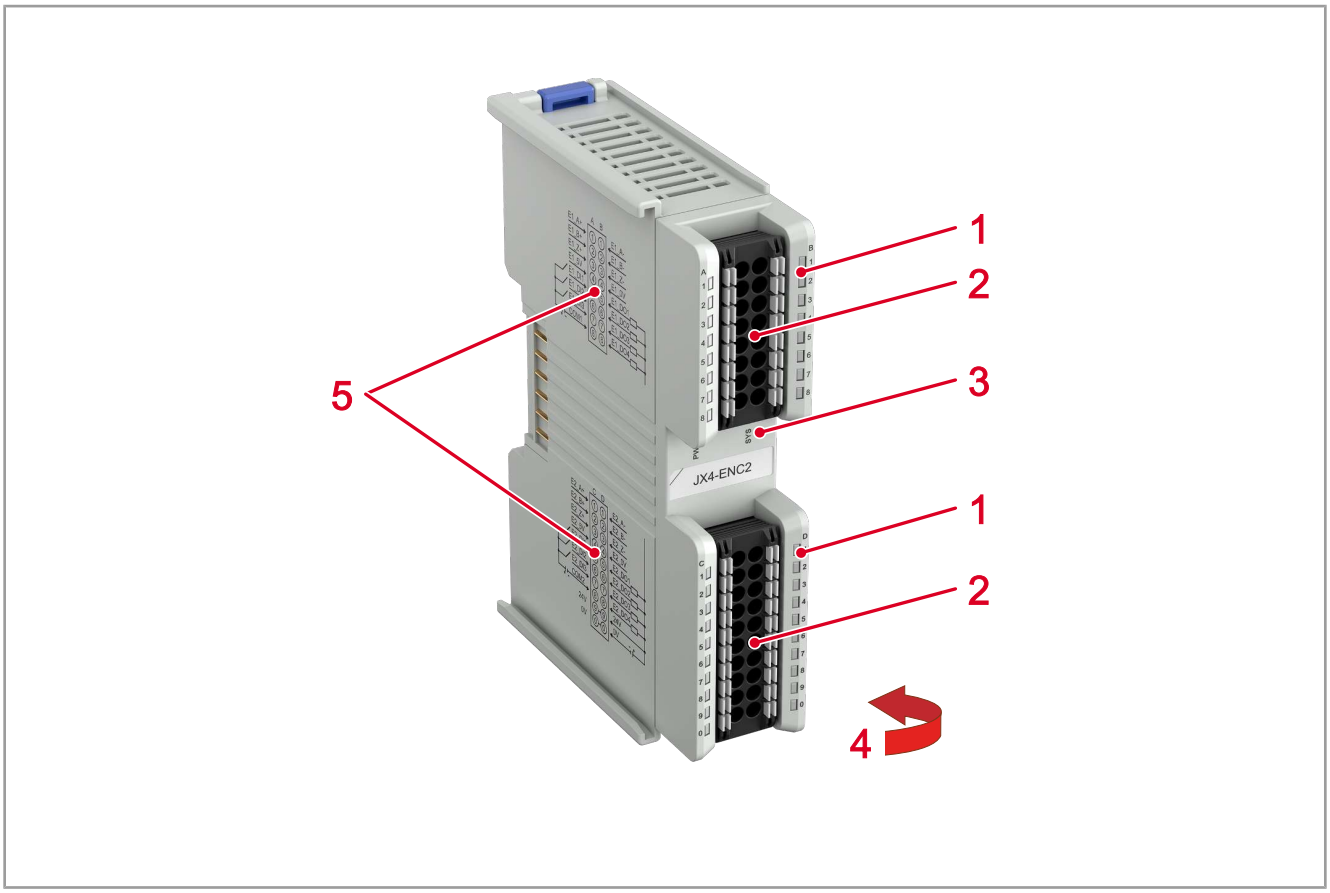


Fig. 2: Structure

1	Channel display
2	Inputs and outputs
3	System Display
4	Rating plate (on the right side of the housing)
5	Pin assignment

3.3 Features

- 2 encoder channels
- 3 pulse modes: AB Quadrature (ABZ), Pulse and Direction (Pulse/Dir), and Two-Pulse (CW/CCW)
- AB quadrature with 1-channel, 2-channel, or 4-channel output
- 2 ring measurement ranges: 0… 2^{32}-1 or 0 … encoder pulse count × revolutions × output -1
- Speed measurement
- Resetting the meter reading using the zero pulse Z
- Meter comparison with pulse output
- Save meter readings via digital inputs

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
Flickering	10 Hz	Fast and continuous blinking

Tab. 1: Lighting patterns of the LEDs

3.4.2 LED status indicators

LED	Description	Color	Status	Status description
PWR	Power indicator	Green	ON	The module's power supply is working properly
			OFF	Module is not turned on or has an irregular power supply
SYS	Power indicator	Green	ON	The system is working normally
			Blinking	No connection or waiting for connection
			Flickering	Firmware Update
			OFF	The system isn't working
1 and 2	Encoder Input AB Phase Indicator	Yellow	ON	Encoder enabled
			OFF	Encoder not enabled
3	Encoder Input Phase Indicator	Yellow	ON	Encoder Z-phase clear function enabled
			OFF	Encoder Z-phase clear function not enabled
5 … 7 (left side)	Input Channel Display	Yellow	ON	The channel has a signal input
			OFF	The channel has no signal input
5 … 8 (right side)	Output Channel Display	Yellow	ON	The channel has a signal output
			OFF	The channel has no signal output

Tab. 2: Diagnostic options via the status display

3.5 Nameplate

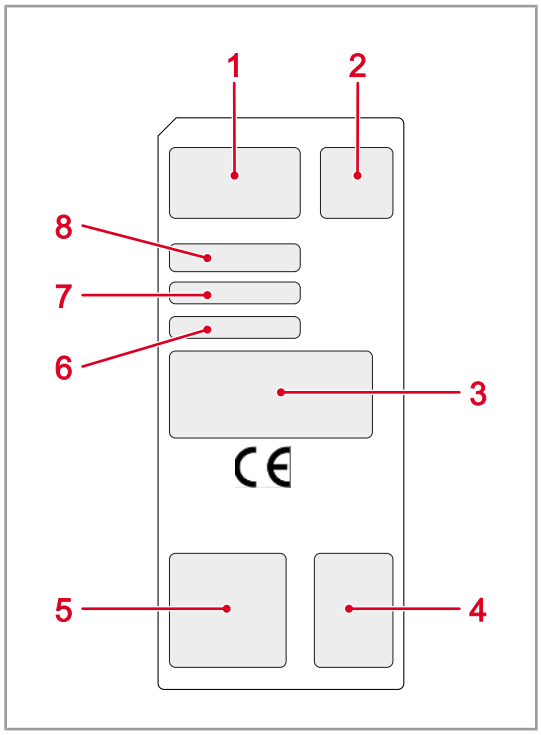


Fig. 3: Nameplate

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

What's Included	Item number	Quantity
JX4-ENC2	10002734	1

4 Technical Specifications

4.1 Dimensions

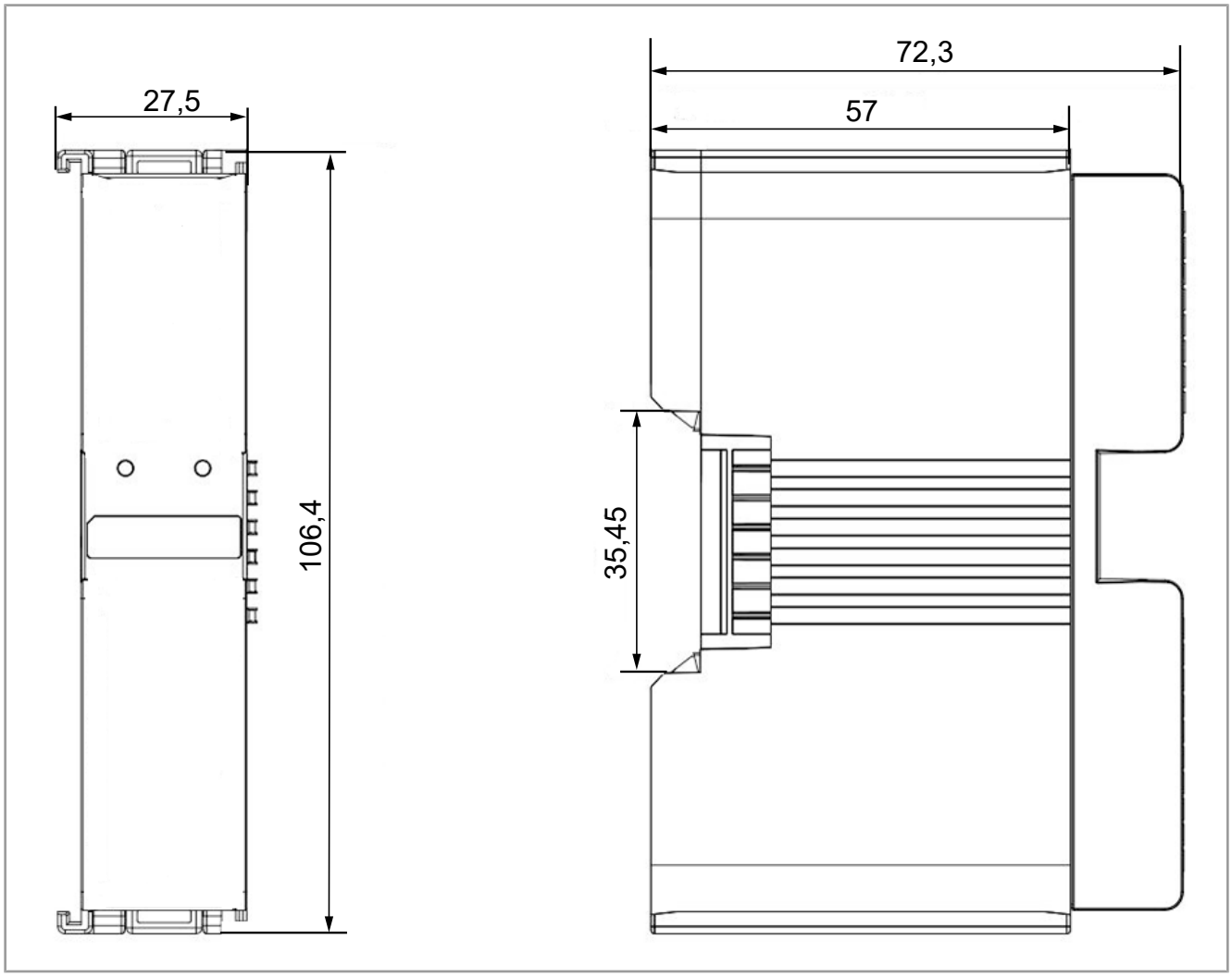


Fig. 4: Dimension in mm

4.2 Mechanical specifications

Parameters	Description	Standards
Installation orientation	Mounted vertically on a DIN rail	
Weight	110 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 per 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 passes for all 3 spatial axes	
Impact 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 both directions along the 3 spatial axes	
Protection class		
Protection class	IP20	DIN EN 60529

Tab. 3: Mechanical Properties of the Encoder Module

4.3 Electrical Properties

Parameters	Description
Channels	2
Type	Incremental encoder input, 5 V differential, with 3 digital inputs (including 2 test inputs) and 4 digital outputs (including 2 with comparison function)
Rated voltage of the digital inputs and power supply	24 V DC (20.4 V … 28.8 V)
Pulse input frequency range	max. 1 MHz
Pulse input count range	0 …^{232}-1 or 0 … number of scale divisions × revolutions × evaluation -1
Resolution setting for encoder ring counting	1 … 65,535
Setting the initial count value	0 …^{232}-1
Sample input frequency	1 MHz
Response time of the pulse output with counter comparison	<10 µs

Parameters	Description
System bus logic voltage	5 V DC (-15% … +10%)
Rated current consumption	130 mA
Power consumption	0.65 W

Tab. 4: Electrical Characteristics of the Encoder Module

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. 5: 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. 6: 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. 7: Immunity to interference

5 Assembly

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.

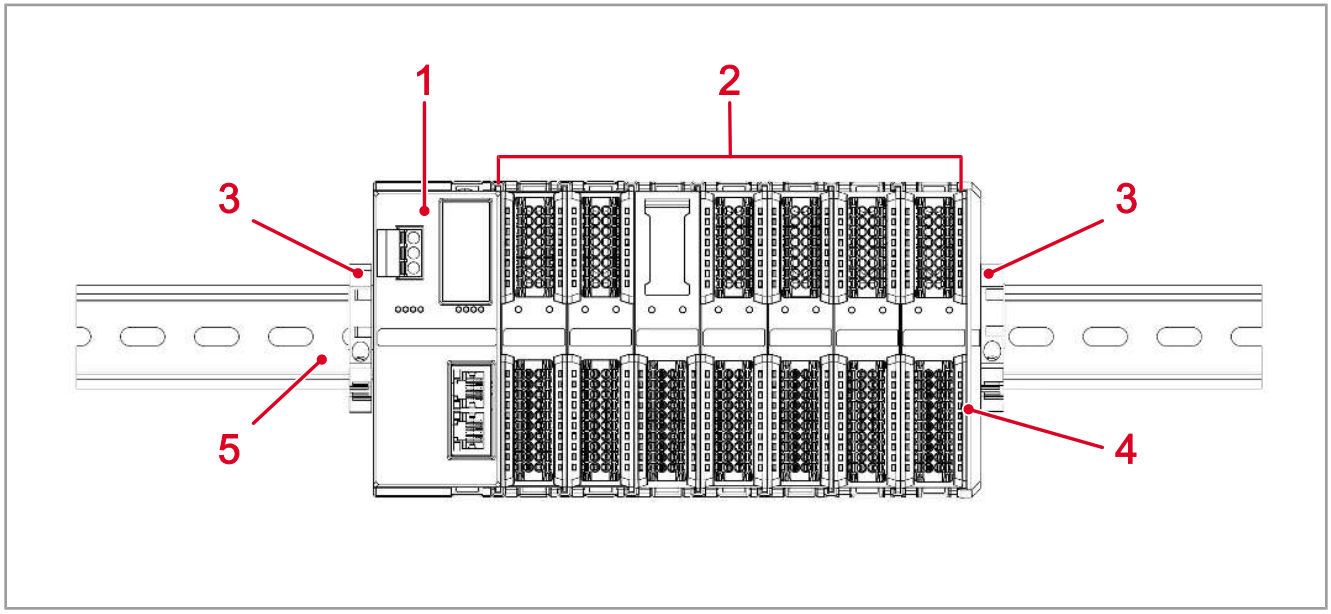
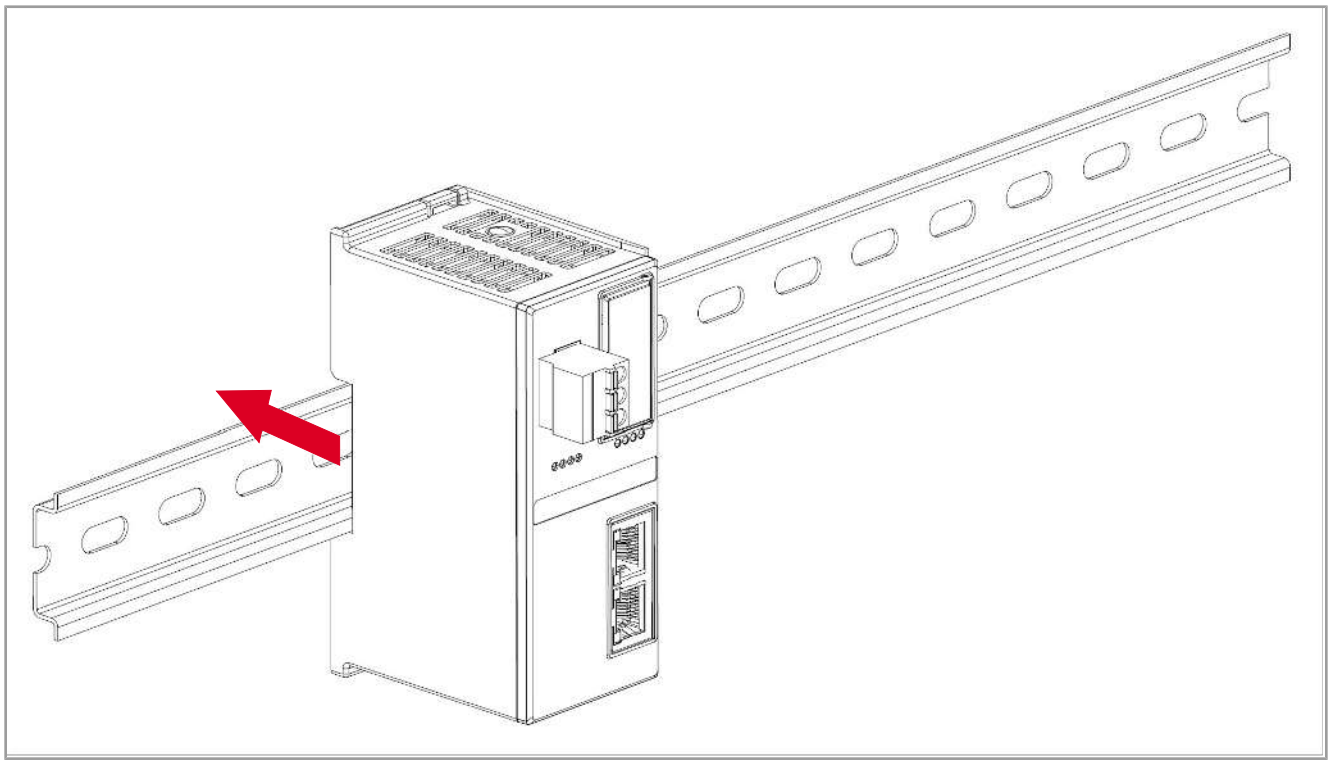


Fig. 5: System overview

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

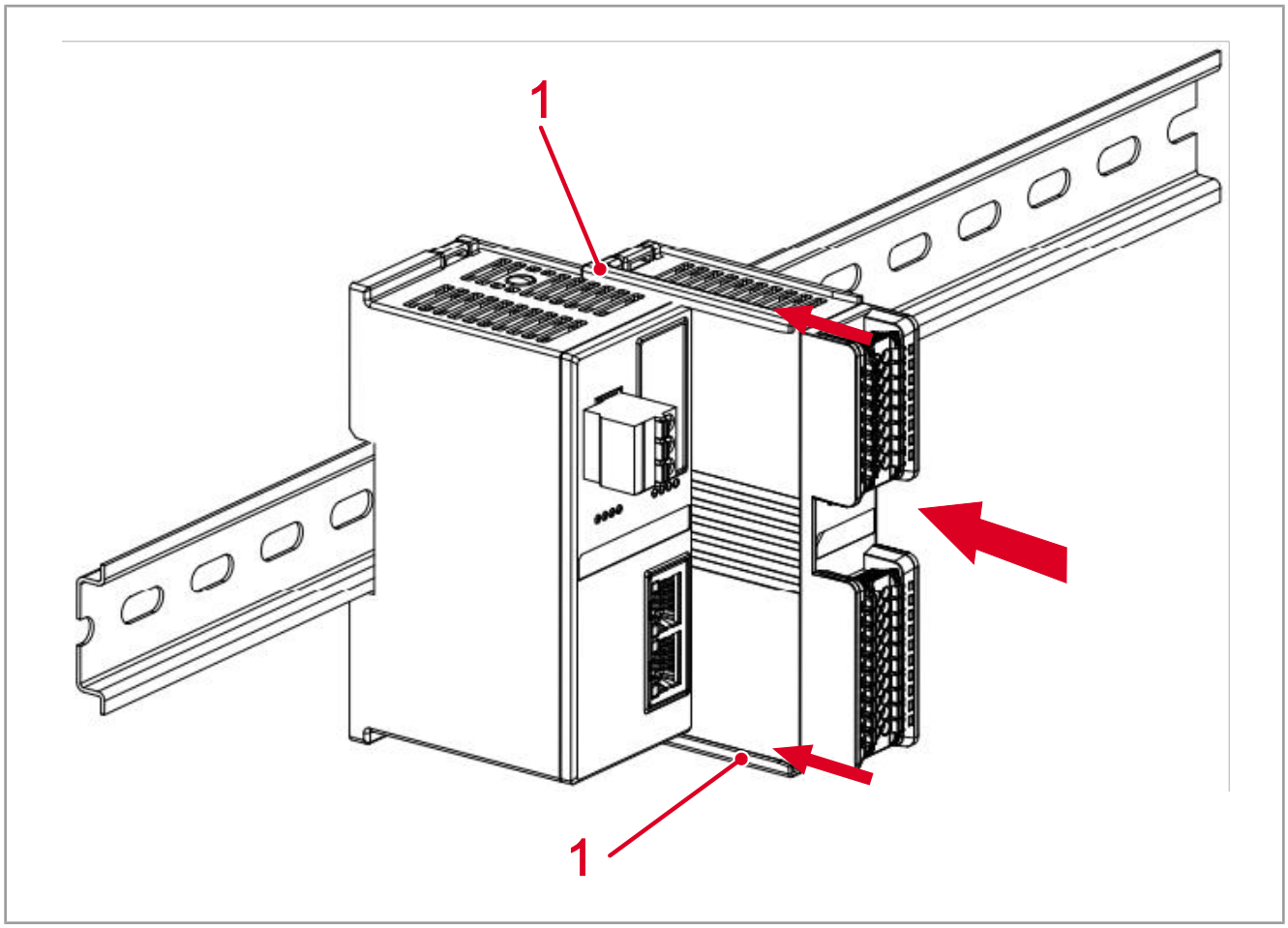


Fig. 6: Assembling the expansion module

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

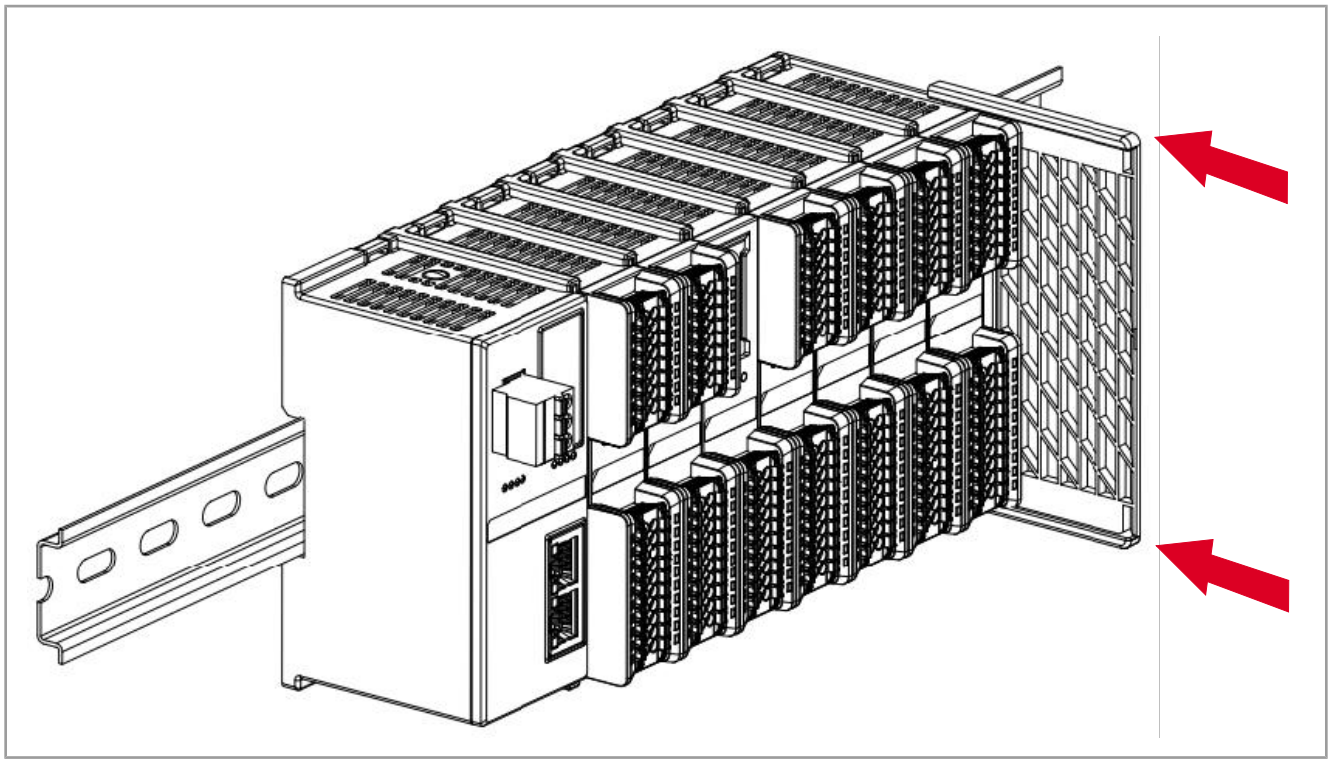


Fig. 7: Installing the end cover

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

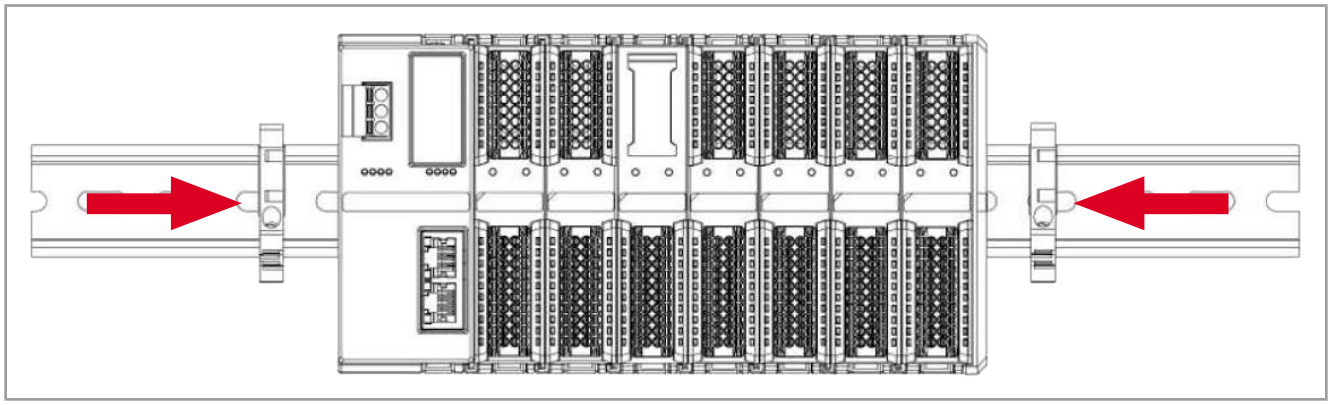


Fig. 8: Installing the retainers

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

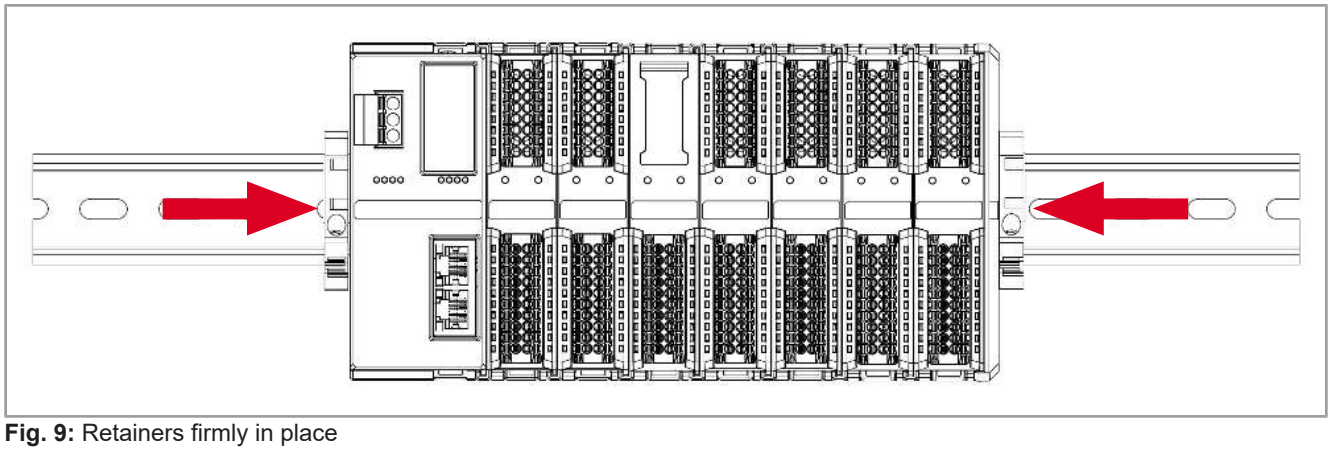


Fig. 9: Retainers firmly in place

3. Lock both retainers with a screwdriver.

5.5 Removing the device from the DIN rail

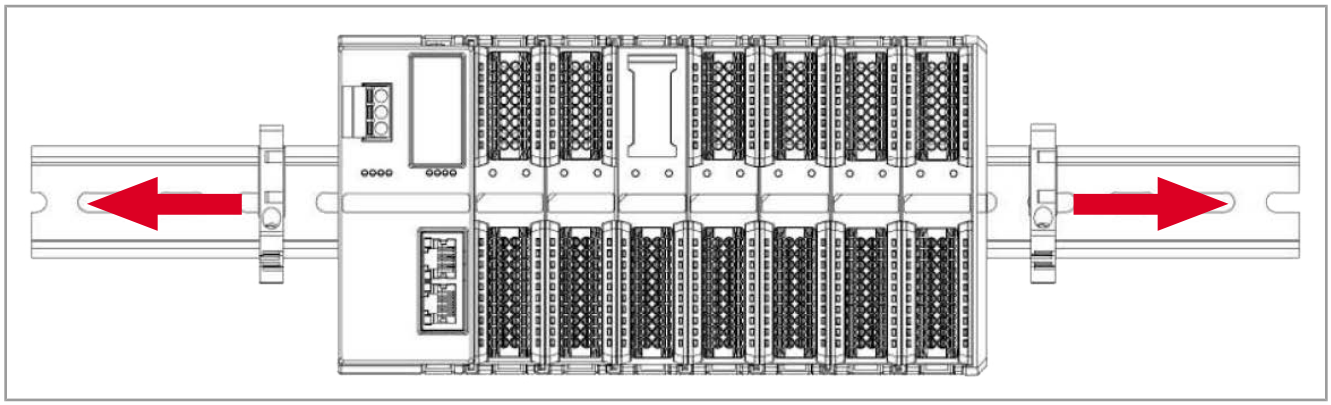


Fig. 10: Removing the retainers

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

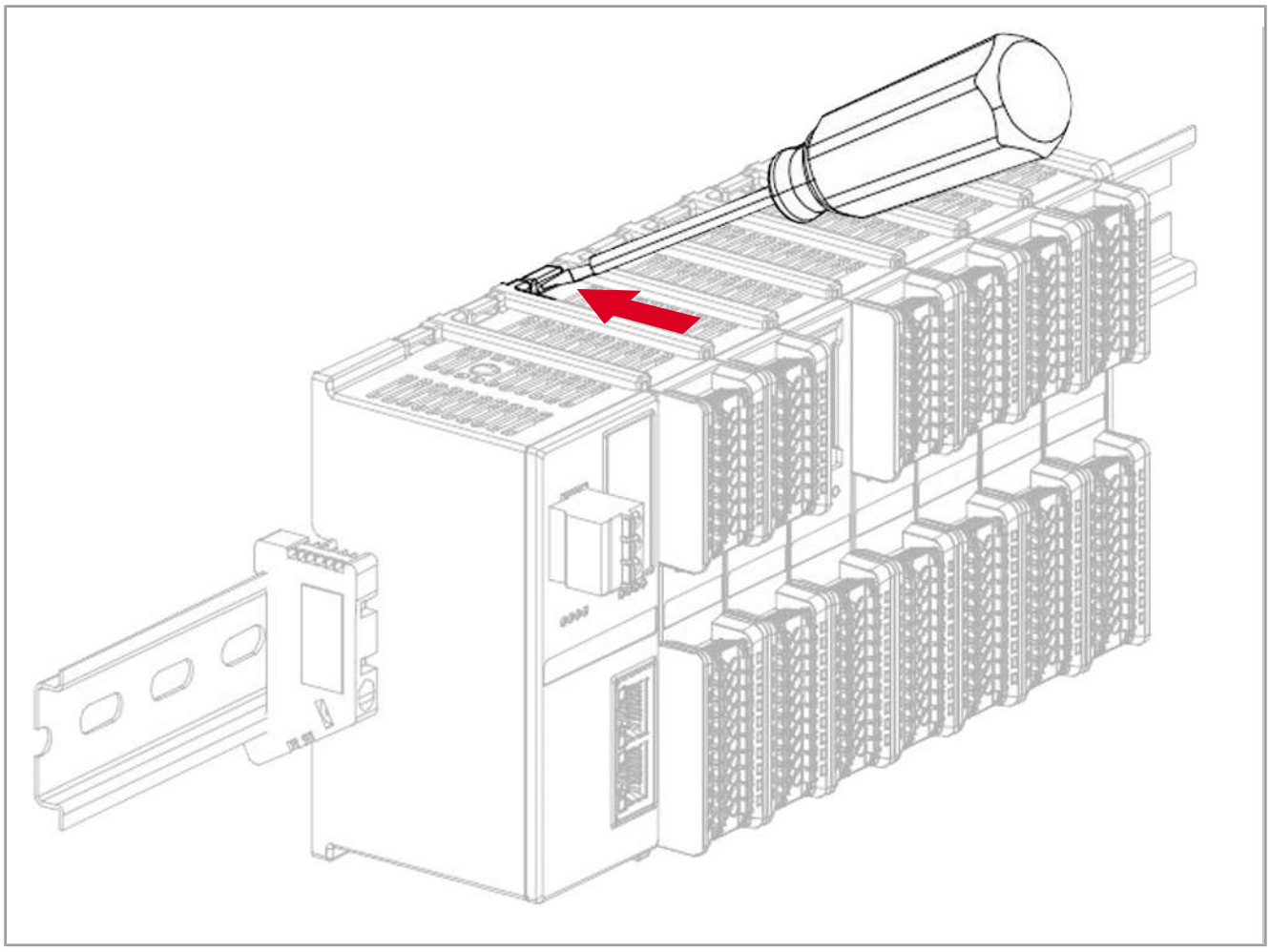


Fig. 11: Place a screwdriver on the latch.

3. Push the screwdriver into the latch.

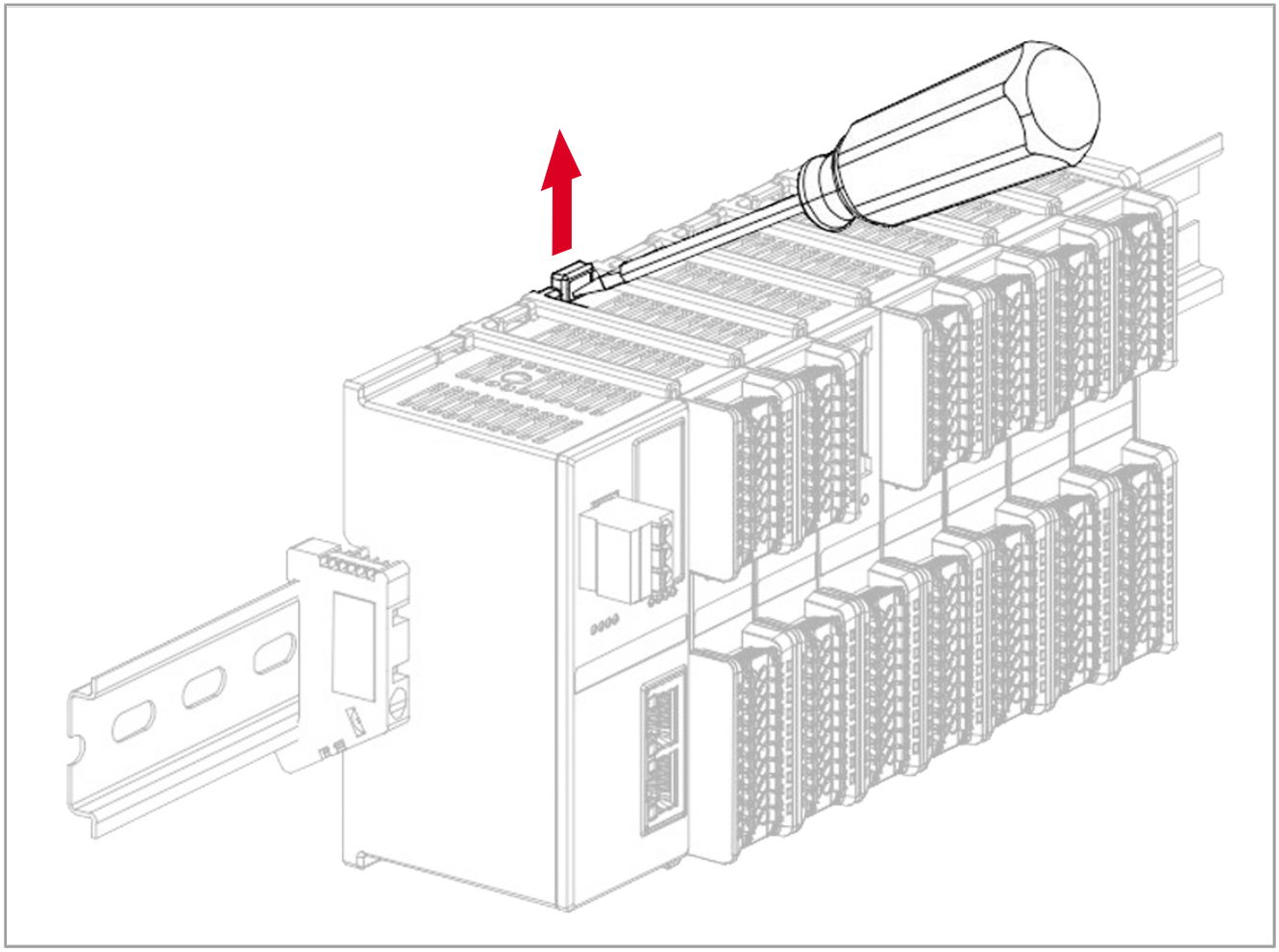


Fig. 12: Loosening the latch

4. Loose the latch.

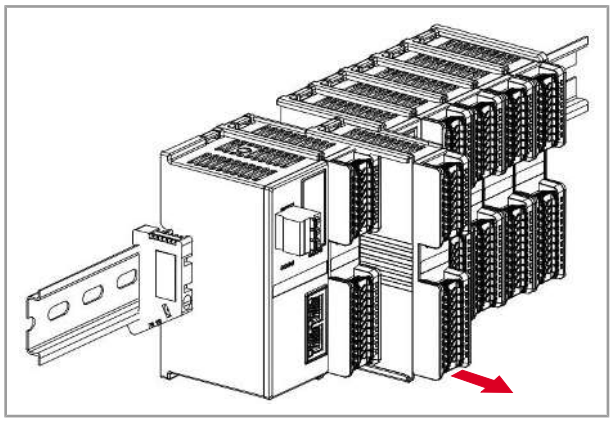


Fig. 13: Removing the module

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

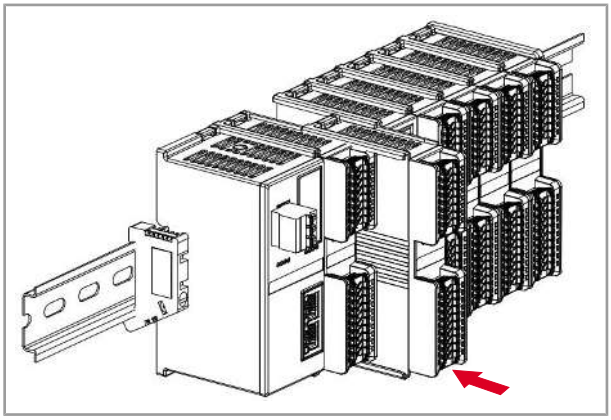
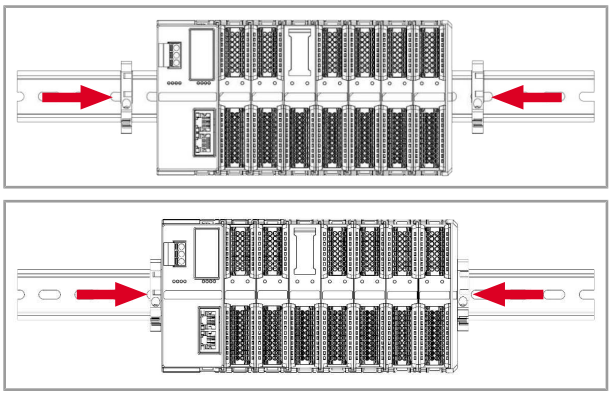


Fig. 14: Inserting the module

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 more information on system immunity to interference, please refer to Application Note 016 *EMC-Compliant Control Cabinet Installation* at www.bucherautomation.com.

DIN rail

– Mount the 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 Wiring

Parameter	Signal cable terminals (input and output terminals)
Voltage rating	200 V
Rated current	9.5 A
Number of pins	16P + 20P
AWG	22 … 17
Terminal range	0.3 … 1.0 mm^2
Stripping length	10 mm

Tab. 8: Specification of connection terminals

6.3 Block diagrams

6.3.1 JX4-ENC2

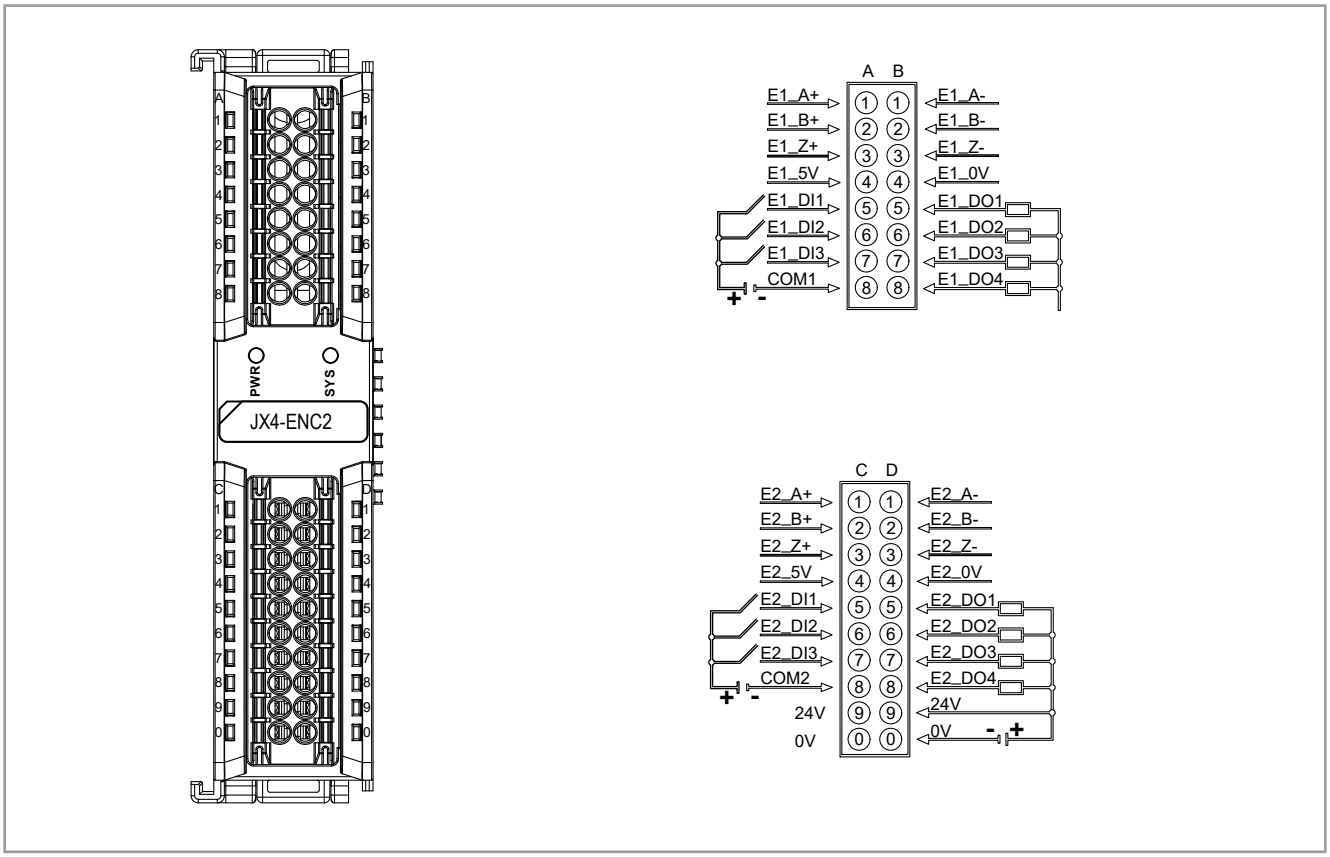


Fig. 15: Schematic Diagram JX4-ENC2

6.3.2 Encoder Pin Assignment

A			B		
Pin	**Connection**	**Description**	**Pin**	**Connection**	**Description**
1	E1_A+	Encoder 1 A+	1	E1_A-	Encoder 1 A-
2	E1_B+	Encoder 1 B+	2	E1_B-	Encoder 1 B-
3	E1_Z+	Encoder 1 Z+	3	E1_Z-	Encoder 1 Z-
4	E1_5V	Encoder 1 5V power supply	4	E1_0V	Encoder 1 0V power supply
5	E1_DI1	Encoder 1 Digital Input 1 (Test Function)	5	E1_DO1	Encoder 1 digital output 1 (comparison function)
6	E1_DI2	Encoder 1 digital input 2 (test function)	6	E1_DO2	Encoder 1 digital output 2 (comparison function)
7	E1_DI3	Encoder 1 Digital Input 3	7	E1_DO3	Encoder 1 Digital Output 3
8	COM1	Reference potential of the digital inputs of Encoder 1	8	E1_DO4	Encoder 1 Digital Output 4

Tab. 9: Pin Assignment for Encoder 1

A			B		
Pin	**Connection**	**Description**	**Pin**	**Connection**	**Description**
1	E2_A+	Encoder 2 A+	1	E2_A-	Encoder 2 A-
2	E2_B+	Encoder 2 B+	2	E2_B-	Encoder 2 B-
3	E2_Z+	Encoder 2 Z+	3	E2_Z-	Encoder 2 Z-
4	E2_5V	Encoder 2 5V power supply	4	E2_0V	Encoder 2 0V power supply
5	E2_DI1	Encoder 2 DI1 (Test Function)	5	E2_DO1	Encoder 2 DO1 (comparison function)
6	E2_DI2	Encoder 2 DI2 (Test Function)	6	E2_DO2	Encoder 2 DO2 (comparison function)
7	E2_DI3	Encoder 2 DI3	7	E2_DO3	Encoder 2 DO3
8	COM2	Reference potential of the digital inputs of Encoder 2	8	E2_DO4	Encoder 2 DO4
9	24 V	24 V field-side power supply	9	24 V	24 V field-side power supply
0	0 V	0 V field-side power supply	0	0 V	0 V field-side power supply

Tab. 10: Pin Assignment for Encoder 2

7 Identification and configuration

Prerequisites

– JetSym software version 6.1 or later is installed.

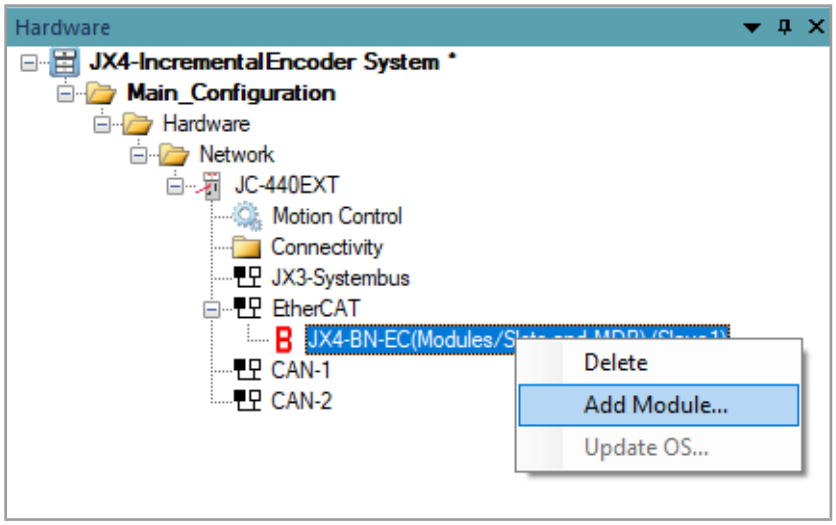
> **Info**
>
> **Further information**
>
> For more information, refer to the JetSym online help.

7.1 Incorporating an EtherCAT® device as 3rd-party

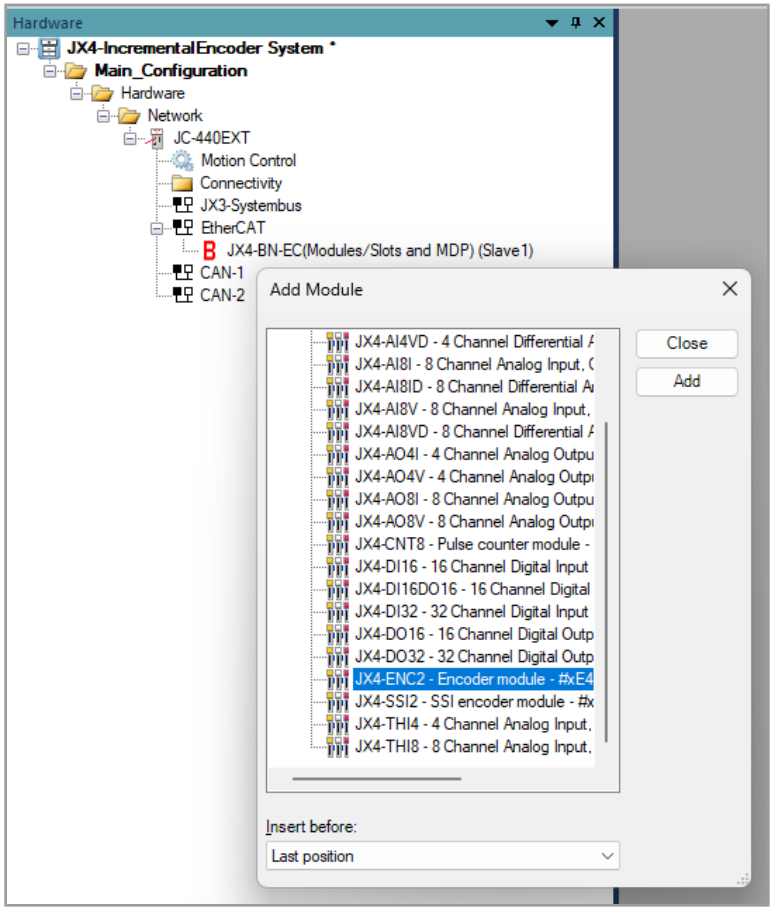
Prerequisites

> **Info**
>
> **Order of device configuration**
>
> It is mandatory that the bus node be added prior to adding any expansion modules.
>
> For further information refer to the JX4-BN-EC user manual available for download on the homepage. Go to www.bucherautomation.com and open *Products* > *Expansion modules* > *JX4 modules*.

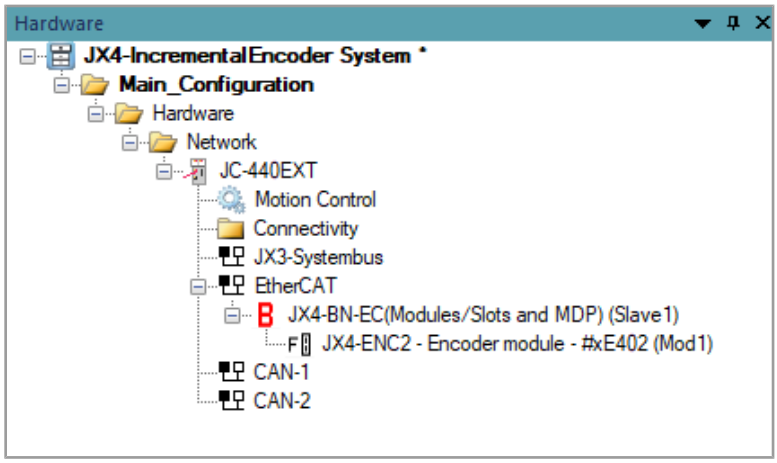
7.2 Adding expansion modules



1. Under Hardware > Network, open the controller folder.
2. Open the EtherCATsubfolder.
3. Right-clicking on JX4-BN-EC opens a context menu.
4. Select Add Module.



5. Select each desired module individually and click Add for each one.

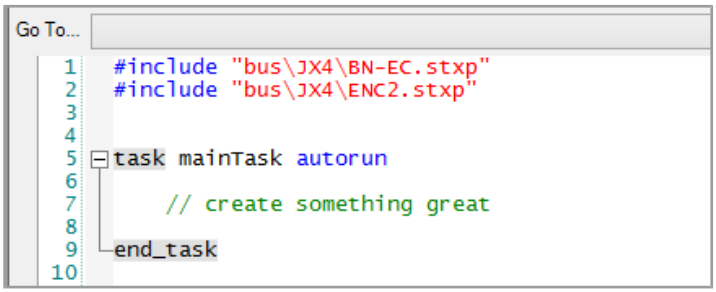


⇨ The selected modules appear in the list.

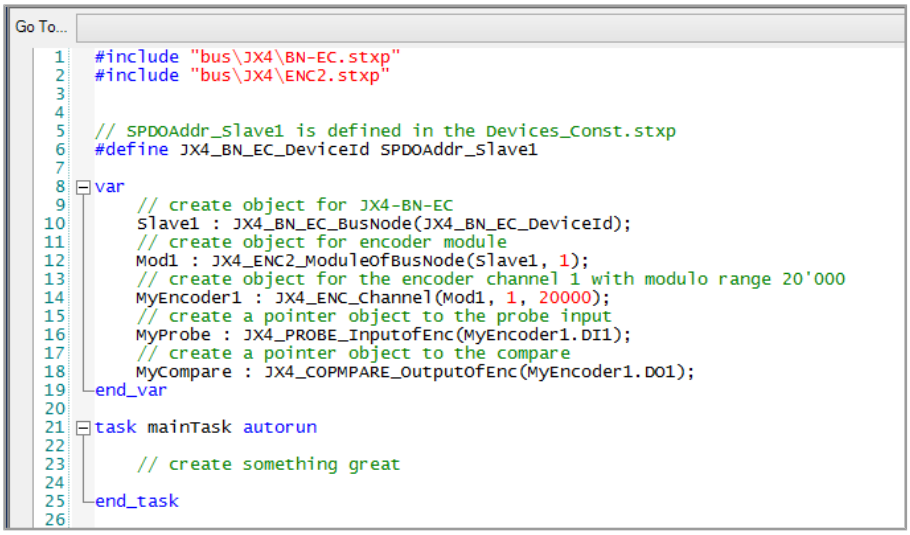
8 Programming

8.1 Incorporating the files in the project

1. Double-click the file IncrementalEncoder System*to open it



2. Include support files in the project using `#include` .



3. Create objects for the modules.

8.2 Configuring the objects and modules

The I/O modules are configurable.

8.2.1 Definition of configuration parameters

The module configuration includes a total of 23 parameters. Eleven of the configuration parameters for the two encoders are identical and are configured independently of one another; one parameter is shared by both encoders.

NOTICE! All configuration parameters will take effect the next time the encoder is activated.

8.2.2 Configuring Pulse Mode

The encoder counter supports 3 pulse modes:

– AB Quadrature Mode
– Directional mode
– Dual Mode

Support File: Pulse Mode Configuration

```
//*****************************************************************************
//* Enumeration with the different pulse modes of the encoder module channels
//*****************************************************************************
type
    JX4_ENC_PULSE_MODE : enum(AB_Quadrature = 0, Direction_Pulse = 1, Dual_Pulse = 3)
end_type
```

The support file contains all the settings for pulse mode.

► Enter the code for the desired pulse mode in the configuration.

8.2.3 Configuring the filter stage

– The filter is effective in all three pulse modes and has 16 filter levels (0–15)

– Level 0 means no filtering, and Level 15 means maximum filtering

– The filter setting is set to level 7 by default

Support File: Filter Stage Configuration

```
//*****************************************************************************
//* Enumeration with the different filter levels of the encoder module channels
//*****************************************************************************
type
    JX4_ENC_FILTER : enum(Level_0 = 0, Level_1 = 1, Level_2 = 2, Level_3 = 3, Level_4 = 4, Level_5 = 5, Level_6 = 6, Level_7 = 7,
                          Level_8 = 8, Level_9 = 9, Level_10 = 10, Level_11 = 11, Level_12 = 12, Level_13 = 13, Level_14 = 14, Level_15 =15)
end_type
```

The support file contains all the settings for configuring the filter stage.

► Enter the code for the desired filter level in the configuration.

8.2.4 Configuring the counting ratio

The multiplier of 1, 2, or 4 for the count is effective only in AB quadrature mode.

Support File: Configuring the Count Ratio

```
//*****************************************************************************
//* Enumeration with the different ratio values of the encoder module channels
//*****************************************************************************
type
    JX4_ENC_RATIO : enum(Ratio_1 = 1, Ratio_2 = 2, Ratio_4 = 4)
end_type
```

The support file contains all the settings for configuring the counting ratio.

► Enter the code for the desired factor in the configuration.

8.2.5 Configuring the Counting Range

– The counting range can be set to 0 to 2^{32}-1 (32-bit range) or to 0 to the number of encoder pulses × revolutions × resolution -1 (user range).

– The former is suitable for most cases, while the latter is suitable for situations in which the encoder does not have a Z-phase signal but must still be used for single-revolution counting.

32-bit range

The full range of a 32-bit counter is used.

User Range

You can set when the counter should reset to 0. To do this, the number of pulses from the encoder is multiplied by the number of revolutions.

Example:
The encoder has 500 marks per revolution. After 5 revolutions, the counter should reset to 0. Then the 500 strokes must be multiplied by 5. The result 2,500 is written to the counter resolution parameter.

```
// Set the count range to the user range
MyEncoder1.ConfigCountRangeWrite(JX4_ENC_RANGE.Range_User);
// Set the circular count resolution to 2,500 (500 lines * 5 turns = 2,500)
// As a result, the counter counts with quadruple evaluation in the range of
0 to 9,999 (500 lines * 5 turns * 4 = 10,000 counts)
MyEncoder1.ConfigCircularCountResolutionWrite(2500);
```

Support File: Configuring the Counting Range

```
//*****************************************************************************
//* Enumeration with count range of the encoder module channels
//*****************************************************************************
type
    JX4_ENC_RANGE : enum(Range_32Bits = 0, Range_User = 1)
end_type
```

The support file contains all the settings for configuring the counting range.

► Enter the code for the desired section in the configuration.

8.2.6 Configuring the counting direction

– The counting direction is set to 0 by default, which corresponds to forward counting.
– If it is set to 1, the encoder counts in the reverse direction after being reactivated.

Support file: Configuring the counting direction

```
//*****************************************************************************
//* Enumeration with the count direction of the encoder module channels
//*****************************************************************************
type
    JX4_ENC_DIR : enum(Dir_Forward = 0, Dir_Backward = 1)
end_type
```

The support file contains all the settings for configuring the counting direction.

► Enter the code for the desired counting direction in the configuration.

8.2.7 Configuring Latch Mode (Probe Function)

– The "Latch Mode" parameter allows each probe function channel to be configured for single-shot or continuous operation.
– If the probe function channel is configured in single mode, the count value can be frozen once after the probe function is activated if the channel receives a signal that meets the specified conditions. If a signal that meets the
specified conditions is subsequently received again, the count value will no longer be frozen unless the probe function channel is activated again.
– If the test function channel is configured for continuous operation, the count value can be saved once or multiple times each time the channel receives a signal after the test function is activated.

Support File: Configuring Latch Mode

```
//*****************************************************************************
//* Enumeration with the latch mode of the encoder module channels
//*****************************************************************************
type
    JX4_ENC_LATCH_MODE : enum(Single_Single = 0, Repeat_Single = 1, Single_Repeat = 2, Repeat_Repeat = 3)
end_type
```

The support file contains all the settings for configuring latch mode.

► Enter the code for the desired latch mode in the configuration.

8.2.8 Configuring the Trigger Edge Function

– The Trigger Edge function allows you to configure each encoder probe channel to trigger on a rising or falling edge.

– The latch trigger signals for the two test function channels of each encoder can be configured independently, and the stored values can be displayed separately.

– The test input channel is compatible with both PNP and NPN signals via the COM port.

– If the COM terminal is connected to 0 V, the input signal is of the PNP type, and a 24-V high-level input signal is valid, while a 0-V low-level input signal is invalid.

– If the COM terminal is connected to 24 V, the input signal is of the NPN type, and a 0 V low-level input signal is valid, while a 24 V high-level input signal is invalid.

– Rising-edge triggering means that the probe input channel is triggered by a transition from an invalid signal to a valid signal.

– "Falling edge trigger" means that the probe input channel is triggered by a transition from a valid signal to an invalid signal.

Support file for the Trigger Edge function

```
//*****************************************************************************
//* Enumeration with the trigger edge of the encoder module channels
//*****************************************************************************
type
    JX4_ENC_TRIGGER_EDGE : enum(Rising_Rising = 0, Falling_Rising = 1, Rising_Falling = 2, Falling_Falling = 3)
end_type
```

The support file contains all the settings for configuring the Trigger Edge function.

► Enter the code for the desired Trigger Edge function in the configuration.

8.2.9 Output with comparison function

– By configuring the enable setting for the comparison function, the comparison setpoint, the comparison direction, the single/repeat trigger mode, and the pulse duration of the output channel, the corresponding output channel emits a pulse of adjustable duration as soon as the encoder count value reaches the setpoint and the comparison direction is met.

– The adjustable duration is the pulse duration of the output. The comparator function has a pulse output response time of up to 10 µs.

– The configuration parameters for the comparison function include the pulse duration of the encoder output channel; the configurable range is between 1 and 65,535 ms.

– Each encoder is equipped with two output channels with a comparison function.

– The enable status of the comparison function, the comparison setpoint, the comparison direction, and the single/repeat trigger mode can all be configured in the process data.

– If the comparison function is not enabled, the output channel can be used as the default digital output.

8.2.10 Battery backup in case of a power outage

– If the "Save on Power-Off" parameter is enabled, the encoder count can be saved when the system is powered off.
– The default value is 1; the power-off memory function is enabled.
– If the value is 0, the memory function is disabled when the device is turned off.
– If the memory function is enabled while the device is turned off, the initial value of the encoder count is invalid, and the initial value of the encoder count is 0.

8.3 Process data

E[n]

E[n] represents the two variants E1 and E2 for encoders 1 and 2, respectively.

8.3.1 Input data

Parameters	Description	Value range	Data type	Length
E[n] DI1	Encoder Probe Channel Input 1 – If the latch function of the probe channel is not enabled, it can be used as a standard digital input channel.	0: no signal input 1: Signal input available	bool	1 bit Bit 0
E[n] DI2	Encoder Probe Channel Input 1 – If the latch function of the probe channel is not enabled, it can be used as a standard digital input channel.	0: no signal input 1: Signal input available	bool	1 bit Bit 1
E[n] DI3	Encoder input channel Input 3 Each encoder is equipped with a standard digital input channel that indicates the presence or absence of the corresponding DI channel input signal.	0: no signal input 1: Signal input available	bool	1 bit Bit 2
E[n] DI1 Latched Flag	Flag indicating that data has been saved to sample channel input 1	0: 1 → 0: save once, toggle once 1: 0 → 1: save once, toggle once	bool	1 bit Bit 4
E[n] DI2 Latched Flag	Flag indicating that data has been saved to test channel input 2	0: 1 → 0: save once, toggle once 1: 0 → 1: save once, toggle once	bool	1 bit Bit 5

Parameters	Description	Value range	Data type	Length
E[n] Count Value	Encoder count value The encoder count value corresponds to the encoder's current count value.	0 … 2^{32}-1	unsigned-32	4 bytes
E[n] DI1 Latched Value	Stored counter value of the encoder probe channel, input 1	0 … 2^{32}-1	unsigned-32	4 bytes
E[n] DI2 Latched Value	Stored counter value of the encoder probe channel, input 2	0 … 2^{32}-1	unsigned-32	4 bytes
E[n] Speed	Encoder speed The encoder speed is the pulse rate of the encoder input channel.	-2^{31} … 2^{31}-1	signed32	4 bytes

Tab. 11: Input data

8.3.2 Input data

Parameters	Description	Value range	Data type	Length
E[n] Enable	Enable counting	0: disabled 1: enabled	bool	1 bit Bit 0
E[n] Z Phase Clear Enable	Enable for deletion via the Z-phase signal – Once Z-phase reset is enabled, the current count value is reset by detecting the encoder's Z-phase signal. – Each time the encoder rotates, a Z-phase pulse is generated and the count value is reset.	0: disabled 1: enabled	bool	1 bit Bit 1
E[n] Count Clear	Reset counter – Edge control: If it is detected that this bit has been set from 0 to 1, the corresponding encoder count value is reset to 0. – If the initial value of the encoder counter is set, the count value is also set to 0.	0: disabled 1: enabled	bool	1 bit Bit 2

Parameters	Description	Value range	Data type	Length
E[n] DO1 Compare Enable	Enabling the comparison function for output 1 – If the comparison function is not enabled, the channel can be used as the default digital output channel. **NOTICE! Before you enable the reference output, you must ensure that the reference output channel is not producing any output. Otherwise, enabling the comparison output in the output status results in a constant output.**	0: disabled 1: enabled	bool	1 bit Bit 3
E[n] DO2 Compare Enable	Enabling the comparison function for output 2 – If the comparison function is not enabled, the channel can be used as the default digital output channel. **NOTICE! Before you enable the reference output, you must ensure that the reference output channel is not producing any output. Otherwise, enabling the comparison output in the output status results in a constant output.**	0: disabled 1: enabled	bool	1 bit Bit 4
E[n] DO1 Compare Direction	Direction of the reference function for output 1 – If the direction of the comparison function is set to 0, the comparison is descending, meaning that the count value ranges from large to small. – If it is set to 1, this is an ascending comparison, meaning the values are sorted from smallest to largest.	0: descending order 1: ascending comparison	bool	1 bit Bit 5
E[n] DO2 Compare Direction	Direction of the reference function for output 2 – If the direction of the comparison output channel is set to 0, the comparison is descending, meaning that the count value decreases from large to small. – If it is set to 1, this is an ascending comparison, meaning the values are sorted from smallest to largest.	0: descending order 1: ascending comparison	bool	1 bit Bit 6

Parameters	Description	Value range	Data type	Length
E[n] DO1 Compare Mode	Trigger mode of the comparator function for output 1 – When single trigger is enabled, a pulse output is triggered as soon as the count value meets the conditions, and no further comparisons are performed thereafter. To trigger the pulse output again, the comparison function must be reactivated. – When the repeat trigger is enabled, a pulse output is triggered as soon as the count value meets the conditions, and the next comparison begins immediately. However, the pulse output is not restarted during the pulse duration.	0: Single trigger 1: Repeat trigger	bool	1 bit Bit 7
E[n] DO2 Compare Mode	Trigger mode of the comparator function for output 2 – When single trigger is enabled, a pulse output is triggered as soon as the count value meets the conditions, and no further comparisons are performed thereafter. To trigger the pulse output again, the comparison function must be reactivated. – When the repeat trigger is enabled, a pulse output is triggered as soon as the count value meets the conditions, and the next comparison begins immediately. However, the pulse output is not restarted during the pulse duration.	0: Single trigger 1: Repeat trigger	bool	1 bit Bit 0
E[n] DO1	Output with comparison function Output 1 – If the comparator function is not enabled, it can be used as a standard digital output channel (NPN). – When the invert function is enabled, the level of this pin is inverted. Therefore, you can set the level for the pulse output by first setting this bit and then enabling the comparison function.	0: open (NPN) 1: shorted to 0 V (NPN)	bool	1 bit Bit 1
E[n] DO2	Output with comparison function Output 2 – If the comparator function is not enabled, it can be used as a standard digital output channel (NPN). – When the invert function is enabled, the level of this pin is inverted. Therefore, you can set the level for the pulse output by first setting this bit and then enabling the comparison function.	0: open (NPN) 1: shorted to 0 V (NPN)	bool	1 bit Bit 2

Parameters	Description	Value range	Data type	Length
E[n] DO3	Standard output: Output 3	0: open (NPN) 1: shorted to 0 V (NPN)	bool	1 bit Bit 3
E[n] DO4	Standard output: Output 4	0: open (NPN) 1: shorted to 0 V (NPN)	bool	1 bit Bit 4
E[n] DI1 Latch Enable	Enable Test Channel DI1	0: disabled 1: enabled	bool	1 bit Bit 5
E[n] DI2 Latch Enable	Enable Test Channel DI2	0: disabled 1: enabled	bool	1 bit Bit 6
E[n] DO1 Compare Value	Reference value for the reference function of output 1 The module compares the current reading with the set value. If the reference value and the reference direction match the measured value, the output generates a pulse of adjustable duration.	0 … 2^{32}-1	unsigned-32	4 bytes
E[n] DO2 Compare Value	Reference value for the reference function of output 2 The module compares the current reading with the set value. If the reference value and the reference direction match the measured value, the output generates a pulse of adjustable duration.	0 … 2^{32}-1	unsigned-32	4 bytes

Tab. 12: Input data

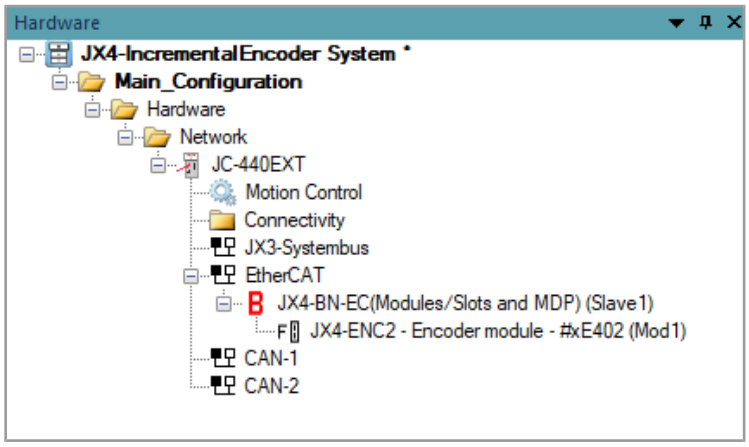
8.4 Declare inputs and outputs

The address data must be declared for each input and output channel.

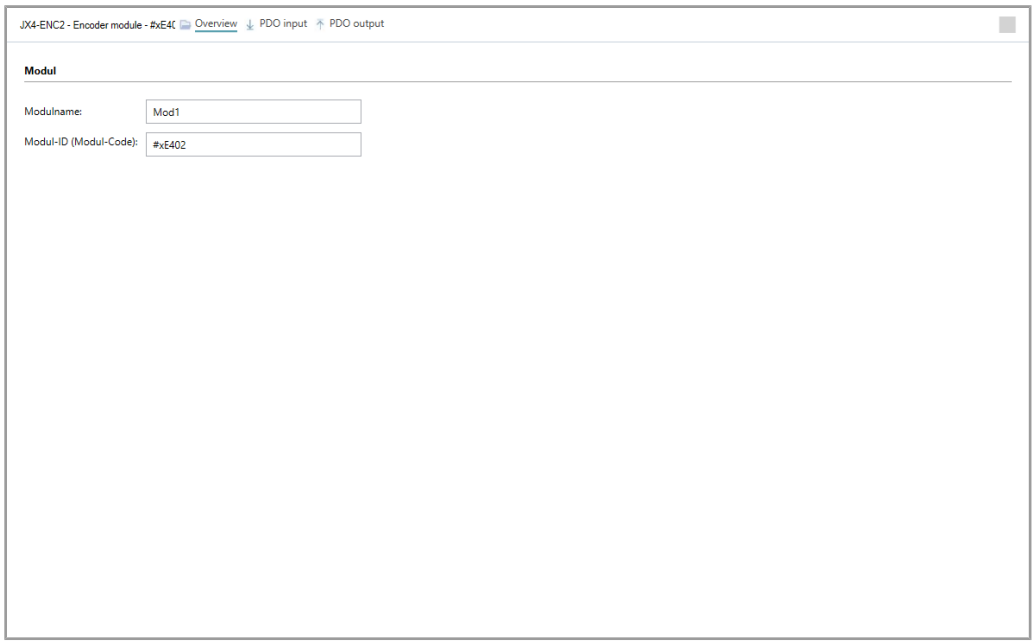
Address structure

1. Name of the JX4-BN-EC (Slave1)
2. Module Name (JX4-ENC2 Mod1)
3. Name of the PDO (either output or input)
4. Name of the PDO entry for E1 and E2 on input and for E1 and E2 on output.

Procedure

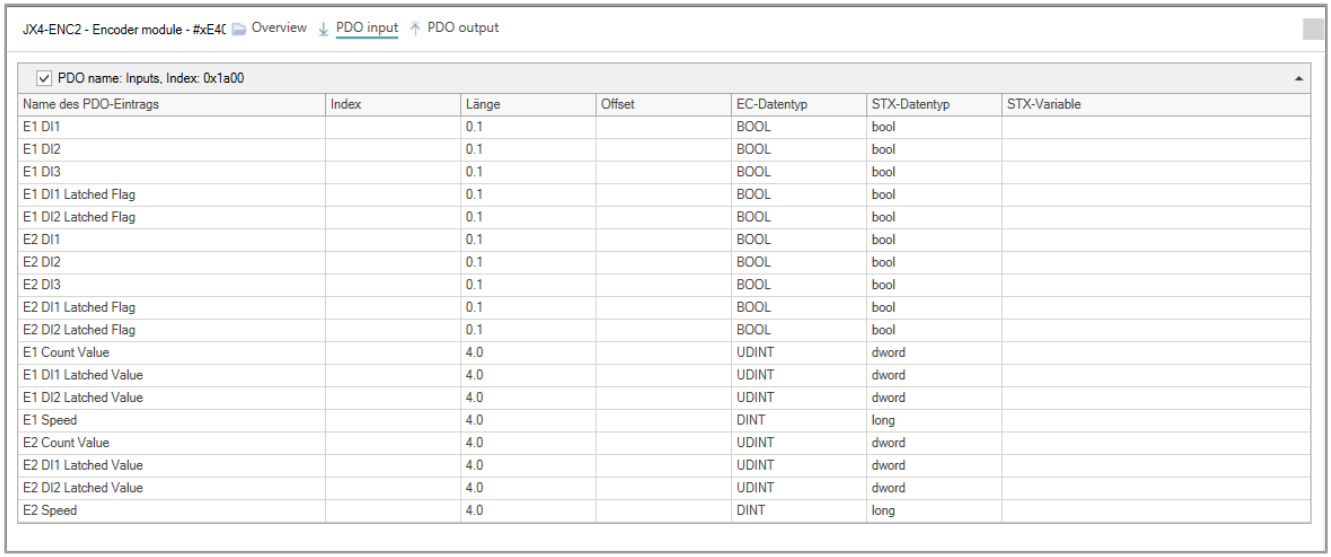


1. Under Hardware > Network, open the controller folder.
2. Open the EtherCAT subfolder.
3. Double-click the desired JX4-ENC2 module.



⇨ The overview page for Configuration > I/O Mapping opens.

4. Click on PDO input.



JX4-ENC2 - Encoder module - #xE4(Overview PDO input PDO output

PDO name: Inputs, Index: 0x1a00

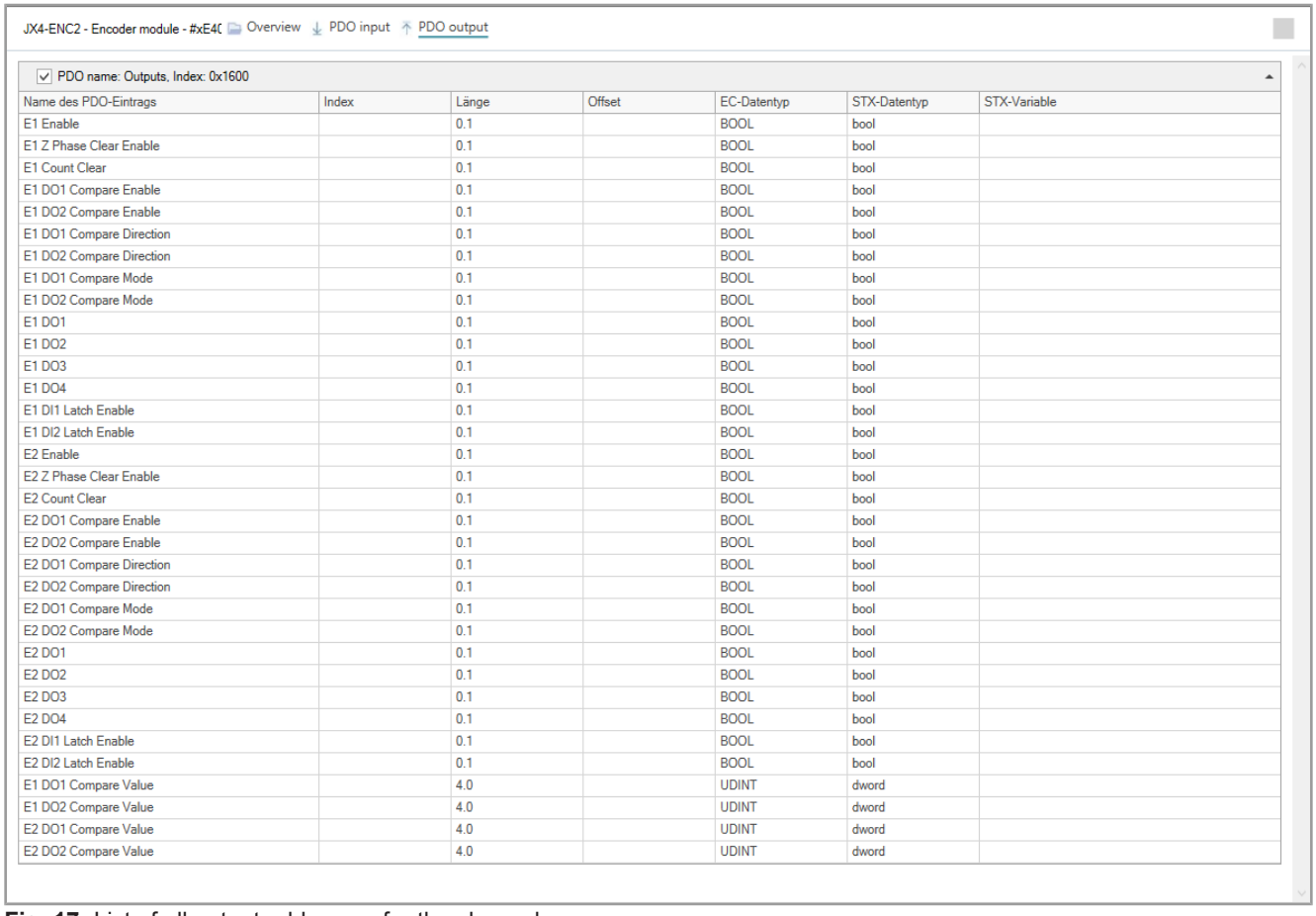
Name des PDO-Eintrags	Index	Länge	Offset	EC-Datentyp	STX-Datentyp	STX-Variable
E1 DI1		0.1		BOOL	bool	
E1 DI2		0.1		BOOL	bool	
E1 DI3		0.1		BOOL	bool	
E1 DI1 Latched Flag		0.1		BOOL	bool	
E1 DI2 Latched Flag		0.1		BOOL	bool	
E2 DI1		0.1		BOOL	bool	
E2 DI2		0.1		BOOL	bool	
E2 DI3		0.1		BOOL	bool	
E2 DI1 Latched Flag		0.1		BOOL	bool	
E2 DI2 Latched Flag		0.1		BOOL	bool	
E1 Count Value		4.0		UDINT	dword	
E1 DI1 Latched Value		4.0		UDINT	dword	
E1 DI2 Latched Value		4.0		UDINT	dword	
E1 Speed		4.0		DINT	long	
E2 Count Value		4.0		UDINT	dword	
E2 DI1 Latched Value		4.0		UDINT	dword	
E2 DI2 Latched Value		4.0		UDINT	dword	
E2 Speed		4.0		DINT	long	

Fig. 16: List of all channel input addresses

⇨ A list of all the channels' input addresses will open.

```
var
    // alternative declaration of input DI 1 value
    MyProbeInput : bool at Slave1.Mod1.Inputs.'E1 DI1';
    // alternative declaration of input DI 1 latched flag
    MyProbeLatchedFlag : bool at Slave1.Mod1.Inputs.'E1 DI1 Latched Flag';
    // alternative declaration of latched value for probe DI 1
    MyProbeLatchedValue : dword at Slave1.Mod1.Inputs.'E1 DI1 Latched Value';
    // alternative declaration of count value
    MyProbeCountValue : dword at Slave1.Mod1.Inputs.'E1 Count Value';
end_var
```

5. Enter the appropriate code for each channel, as described above.
6. Click on "PDO output."



JX4-ENC2 - Encoder module - #xE4(Overview PDO input PDO output

PDO name: Outputs, Index: 0x1600

Name des PDO-Eintrags	Index	Länge	Offset	EC-Datentyp	STX-Datentyp	STX-Variable
E1 Enable		0.1		BOOL	bool	
E1 Z Phase Clear Enable		0.1		BOOL	bool	
E1 Count Clear		0.1		BOOL	bool	
E1 DO1 Compare Enable		0.1		BOOL	bool	
E1 DO2 Compare Enable		0.1		BOOL	bool	
E1 DO1 Compare Direction		0.1		BOOL	bool	
E1 DO2 Compare Direction		0.1		BOOL	bool	
E1 DO1 Compare Mode		0.1		BOOL	bool	
E1 DO2 Compare Mode		0.1		BOOL	bool	
E1 DO1		0.1		BOOL	bool	
E1 DO2		0.1		BOOL	bool	
E1 DO3		0.1		BOOL	bool	
E1 DO4		0.1		BOOL	bool	
E1 DI1 Latch Enable		0.1		BOOL	bool	
E1 DI2 Latch Enable		0.1		BOOL	bool	
E2 Enable		0.1		BOOL	bool	
E2 Z Phase Clear Enable		0.1		BOOL	bool	
E2 Count Clear		0.1		BOOL	bool	
E2 DO1 Compare Enable		0.1		BOOL	bool	
E2 DO2 Compare Enable		0.1		BOOL	bool	
E2 DO1 Compare Direction		0.1		BOOL	bool	
E2 DO2 Compare Direction		0.1		BOOL	bool	
E2 DO1 Compare Mode		0.1		BOOL	bool	
E2 DO2 Compare Mode		0.1		BOOL	bool	
E2 DO1		0.1		BOOL	bool	
E2 DO2		0.1		BOOL	bool	
E2 DO3		0.1		BOOL	bool	
E2 DO4		0.1		BOOL	bool	
E2 DI1 Latch Enable		0.1		BOOL	bool	
E2 DI2 Latch Enable		0.1		BOOL	bool	
E1 DO1 Compare Value		4.0		UDINT	dword	
E1 DO2 Compare Value		4.0		UDINT	dword	
E2 DO1 Compare Value		4.0		UDINT	dword	
E2 DO2 Compare Value		4.0		UDINT	dword	

Fig. 17: List of all output addresses for the channels

⇨ A list of all the channels' output addresses will open.

```
var
    // alternative declaration of output MyEncoder1.Enable
    MyEncoder1Enable : bool at Slave1.Mod1.Outputs.'E1 Enable';
    // alternative declaration of output MyEncoder1.ZphaseClearEnable
    MyEncoder1ZphaseClearEnable : bool at Slave1.Mod1.Outputs.'E1 Z Phase Clear Enable';
    // alternative declaration of compare mode
    MyCompareEnable : bool at Slave1.Mod1.Outputs.'E1 DO1 Compare Enable';
    // alternative declaration of compare mode
    MyCompareDir : bool at Slave1.Mod1.Outputs.'E1 DO1 Compare Direction';
    // alternative declaration of compare mode
    MyCompareMode : bool at Slave1.Mod1.Outputs.'E1 DO1 Compare Mode';
    // alternative declaration of compare mode
    MyCompareDO : bool at Slave1.Mod1.Outputs.'E1 DO1';
    // alternative declaration of input DI latch enable
    MyProbeLatchEnable : bool at Slave1.Mod1.Outputs.'E1 DI1 Latch Enable';
    // alternative declaration of compare mode
    MyCompareValue : dword at Slave1.Mod1.Outputs.'E1 DO1 Compare Value';
end_var
```

7. Enter the appropriate code for each channel, as described above.

⇨ The inputs and outputs can be used as usual.

```
var
    // save the last latched flag
    MyProbeLatchedFlagSaved : bool;
    // save latched value
    LatchedValue : int;
    // user revolution
    myRevolution : int;
end_var

task mainTask autorun

    // reset enable signals
    MyEncoder1.Enable := false;
    MyEncoder1.ZphaseClearEnable := false;
    MyProbe.Probe.LatchEnable := false;
    MyCompare.CmpOut.CompareEnable := false;

    // set pulse mode to AB quadrature
    MyEncoder1.ConfigPulseModeWrite(JX4_ENC_PULSE_MODE.AB_Quadrature);
    // set count ration to 4 (500 lines * 4 = 2'000 counts)
    MyEncoder1.ConfigCountRatioWrite(JX4_ENC_RATIO.Ratio_4);
    // use full counter range of 32 bit
    MyEncoder1.ConfigCountRangeWrite(JX4_ENC_RANGE.Range_32Bits);
    // set count direction to forward
    MyEncoder1.ConfigCountDirectionWrite(JX4_ENC_DIR.Dir_Forward);
    // set filter level to off
    MyEncoder1.ConfigFilterLevelWrite(JX4_ENC_FILTER.Level_0);
    // set latch mode
    MyEncoder1.ConfigLatchModeWrite(JX4_ENC_LATCH_MODE.Repeat_Repeat);
    // set trigger edge
    MyEncoder1.ConfigTriggerEdgeWrite(JX4_ENC_TRIGGER_EDGE.Rising_Rising);
    // write compare value for the compare output
    // revolution to 0 and modulo value 1'000
    MyRevolution := 0;
    MyCompare.CmpOut.ModuloCompareValueWrite(MyRevolution, 1000);
    // write pulse time 1 second
    MyCompare.CmpOut.PulseTimeWrite(1000);
    // set compare direction in positive direction
    MyCompare.CmpOut.CompareDir := true;
    // set compare mode to repeated
    MyCompare.Cmpout.CompareModeRepeated := true;
    // enable compare mode
    MyCompare.CmpOut.CompareEnable := true;
    // enable counter
    MyEncoder1.Enable := true;
    // save current status of latched flag
    MyProbeLatchedFlagSaved := MyProbe.Probe.LatchedFlag;
    // enable latching by probe signal
    MyProbe.Probe.LatchEnable := true;
loop
    // wait till count value is latched
    when MyProbe.Probe.LatchedFlag != MyProbeLatchedFlagSaved continue;
    // save latched counter value
    LatchedValue := MyEncoder1.DI1.LatchedValue;
    // save current status of latched flag
    MyProbeLatchedFlagSaved := MyProbe.Probe.LatchedFlag;
    // write new compare value
    //MyCompare.CmpOut.CompareValue := MyCompare.CmpOut.CompareValue + 10000;
    MyRevolution -= 1;
    MyCompare.CmpOut.ModuloCompareValueWrite(MyRevolution, 1000);

end_loop

end_task;
```

Fig. 18: Sample Configuration

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. 19: 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

If you have any questions, suggestions, or issues, our technical support team is here to assist you with their expertise. You can reach them by phone or through the contact form on our website:

Technical Support | www.bucherautomation.com

Or send us an email:

support@bucherautomation.com

Technical Support needs the following information:

– Hardware Revision and Serial Number
  You can find the serial number and hardware revision of your product on the nameplate.

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 Structure 9
Fig. 3 Nameplate 11
Fig. 4 Dimension in mm 12
Fig. 5 System overview 17
Fig. 6 Assembling the expansion module 18
Fig. 7 Installing the end cover 19
Fig. 8 Installing the retainers 19
Fig. 9 Retainers firmly in place 19
Fig. 10 Removing the retainers 20
Fig. 11 Place a screwdriver on the latch 20
Fig. 12 Loosening the latch 21
Fig. 13 Removing the module 21
Fig. 14 Inserting the module 22
Fig. 15 Schematic Diagram JX4-ENC2 24
Fig. 16 List of all channel input addresses 39
Fig. 17 List of all output addresses for the channels 39
Fig. 18 Sample Configuration 40
Fig. 19 WEEE icon – crossed out wheeled bin 41

List of Tables

Tab. 1 Lighting patterns of the LEDs 10
Tab. 2 Diagnostic options via the status display 10
Tab. 3 Mechanical Properties of the Encoder Module 13
Tab. 4 Electrical Characteristics of the Encoder Module 13
Tab. 5 Environmental conditions 14
Tab. 6 Emitted interference 15
Tab. 7 Immunity to interference 15
Tab. 8 Specification of connection terminals 24
Tab. 9 Pin Assignment for Encoder 1 25
Tab. 10 Pin Assignment for Encoder 2 25
Tab. 11 Input data 33
Tab. 12 Input data 34

Bucher Automation AG
Thomas-Alva-Edison-Ring 10
71672 Marbach/Neckar, Germany
T +49 7141 2550-0
info@bucherautomation.com

www.bucherautomation.com