BUCHER
automation

User manual





60888574_00

JX4-AI4I / JX4-AI8I / JX4-AI4V / JX4-AI8V / JX4-AI4ID / JX4-AI8ID / JX4-AI4VD / JX4-AI8VD / JX4-AO4I / JX4-AO8I / JX4-AO4V / JX4-AO8V

Analog I/O expansion modules

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	9/25/2025

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 7
2.3 Warnings used in this document 8
3 Product description 9
3.1 System overview 9
3.2 Design 10
3.3 Product features 10
3.4 Status indication 10
3.4.1 Lighting patterns of the LEDs 11
3.4.2 LED status indicators 11
3.5 Nameplate 12
3.6 Scope of delivery 12
4 Technical specifications 14
4.1 Dimensions 14
4.2 Mechanical specifications 15
4.3 Electrical properties 16
4.4 Environmental conditions 18
4.5 EMC Values 19
5 Mechanical installation 20
5.1 Order and arrangement 20
5.2 Installing the device on the DIN rail 20
5.3 Assembling the expansion module 22
5.4 Installing the end cover and retainers 23
5.5 Removing the device from the DIN rail 24
6 Electrical connection 27
6.1 Improving EMC Noise Immunity 27
6.2 Wiring 28
6.3 Block diagrams 28
6.3.1 JX4-AI8I 28
6.3.2 JX4-AI8ID 29

6.3.3 JX4-AI8V ... 29
6.3.4 JX4-AI8VD ... 30
6.3.5 JX4-AO8I ... 30
6.3.6 JX4-AO8V ... 31
6.3.7 JX4-AI4I ... 31
6.3.8 JX4-AI4ID ... 32
6.3.9 JX4-AI4V ... 32
6.3.10 JX4-AI4VD ... 33
6.3.11 JX4-AO4I ... 33
6.3.12 JX4-AO4V ... 34

7 Identification and configuration ... 35
7.1 Incorporating an EtherCAT® device as 3rd-party ... 35
7.2 Adding expansion modules ... 35

8 Programming ... 37
8.1 Analog voltage parameters ... 37
8.2 Analog current parameters ... 41
8.3 Adding support files for JX4 modules ... 43
8.4 Incorporating the files in the project ... 45
8.5 Configuring the objects and modules ... 45
8.5.1 Analog input filter ... 45
8.5.2 Analog output Clear/Hold function ... 45
8.5.3 Analog power failure protection ... 46
8.6 Declaring inputs and outputs ... 47

9 Maintenance ... 49
9.1 Repairs ... 49
9.2 Storage and Shipment ... 49
9.3 Return and Disposal ... 50

10 Service ... 51
10.1 Technical Support ... 51

11 Spare parts and accessories ... 52

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 analogJX4 I/O modules are designed to be used as an extension for existing machine control systems.

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

Analog I/O expansion modules

Product name	Specification	Description
JX4-AI4I	Input expansion module	Connection of analog sensors with current interface
JX4-AI8I	Input expansion module	Connection of analog sensors with current interface
JX4-AI4V	Input expansion module	Connection of analog sensors with voltage interface
JX4-AI8V	Input expansion module	Connection of analog sensors with voltage interface
JX4-AI4ID	Input expansion module	Connection of analog sensors with current interface, differential signal transmission
JX4-AI8ID	Input expansion module	Connection of analog sensors with current interface, differential signal transmission
JX4-AI4VD	Input expansion module	Connection of analog sensors with voltage interface, differential signal transmission
JX4-AI8VD	Input expansion module	Connection of analog sensors with voltage interface, differential signal transmission
JX4-AO4I	Output expansion module	Connection of analog actuators with current interface
JX4-AO8I	Output expansion module	Connection of analog actuators with current interface

Product name	Specification	Description
JX4-AO4V	Output expansion module	Connection of analog actuators with voltage interface
JX4-AO8V	Output expansion module	Connection of analog actuators with voltage interface

Tab. 1: Analog I/O expansion 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

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 input and output expansion modules of the JX4 family are used to connect analog sensors and actuators.

3.1 System overview



Fig. 1: System overview

3.2 Design

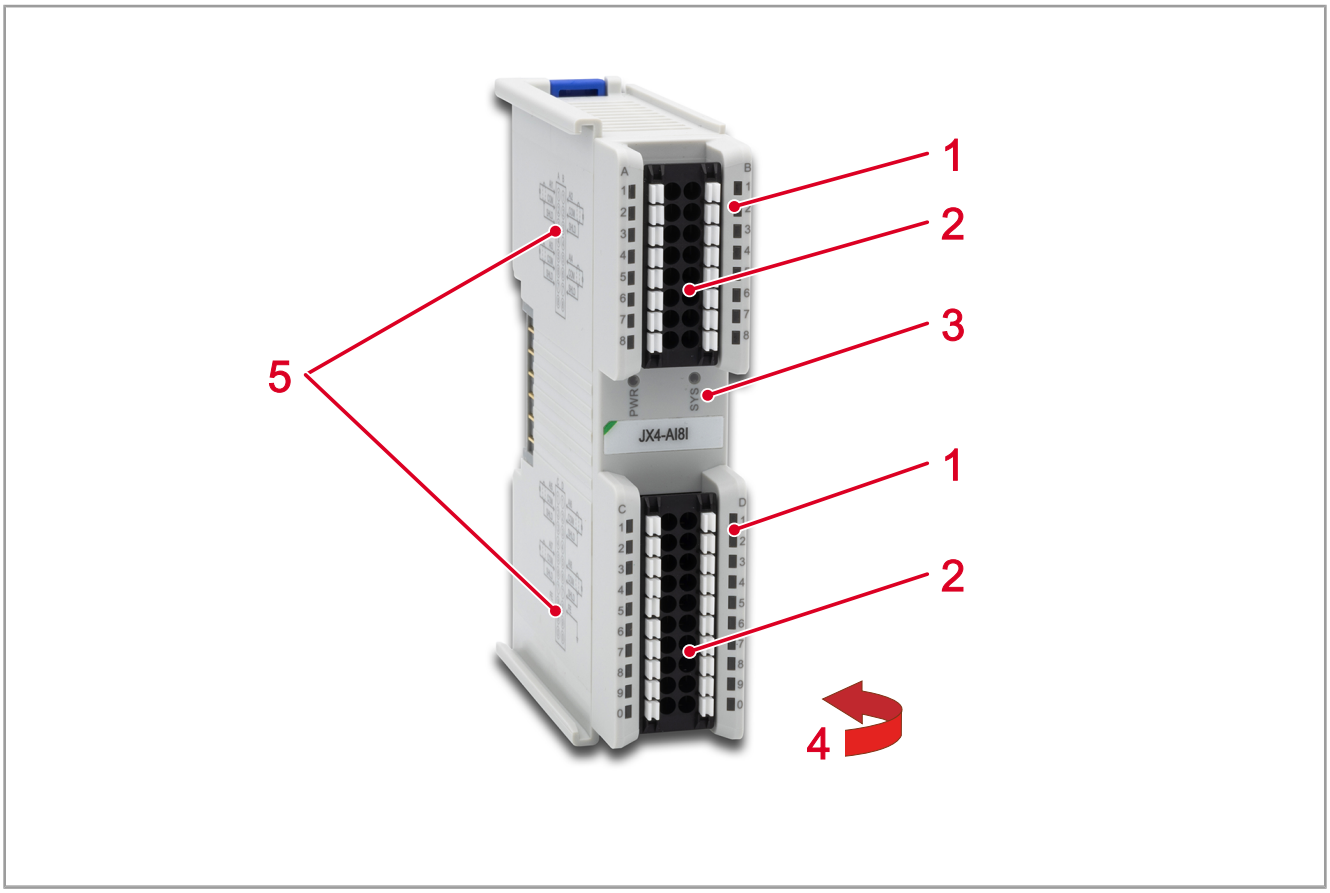


Fig. 2: Design

1	Channel display
2	Inputs and outputs
3	System display
4	Nameplate (on the right-hand side of the housing)
5	Pinout

3.3 Product features

- Up to 8 analog inputs or outputs
- 16-bit resolution
- Single-ended or differential inputs
- Push-in terminals
- Electrical isolation
- LEDs for monitoring supply voltage and communication

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. 2: Lighting patterns of the LEDs

3.4.2 LED status indicators

LED	Description	Color	Status	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
SYS	Operating status indicator	Green	ON	System works normally
			Flashing	Not connected or waiting for connection
			Flickering	Firmware upgrade
			OFF	System does not work
1 and 5	Input channel display	Yellow	ON	Input signal detected
			OFF	No input signal detected
1 and 5	Output channel display	Yellow	ON	Output signal is not equal to 0
			OFF	Output signal is 0

Tab. 3: Diagnostic capabilities by means of status indicators

3.5 Nameplate

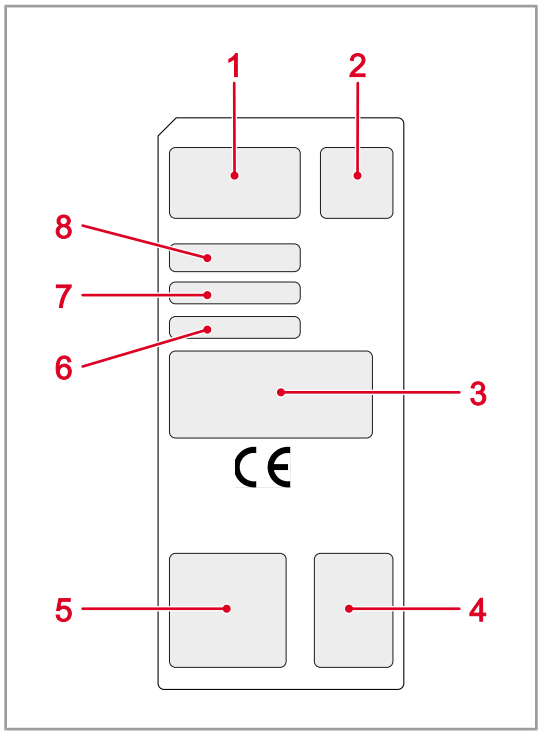


Fig. 3: Nameplate

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

Scope of delivery	Item number	Quantity
JX4-AI4I	10002720	1
or		
JX4-AI8I	10002721	1
or		
JX4-AI4V	10002722	1
or		
JX4-AI8V	10002723	1
or		
JX4-AI4ID	10002724	1
or		

Scope of delivery	Item number	Quantity
JX4-AI8ID	10002725	1
or		
JX4-AI4VD	10002726	1
or		
JX4-AI8VD	10002727	1
or		
JX4-AO4I	10002728	1
or		
JX4-AO8I	10002729	1
or		
JX4-AO4V	10002730	1
or		
JX4-AO8V	10002731	1

4 Technical specifications

This chapter contains the electrical and mechanical data as well as the operating data for the analog JX4-IO modules.

4.1 Dimensions

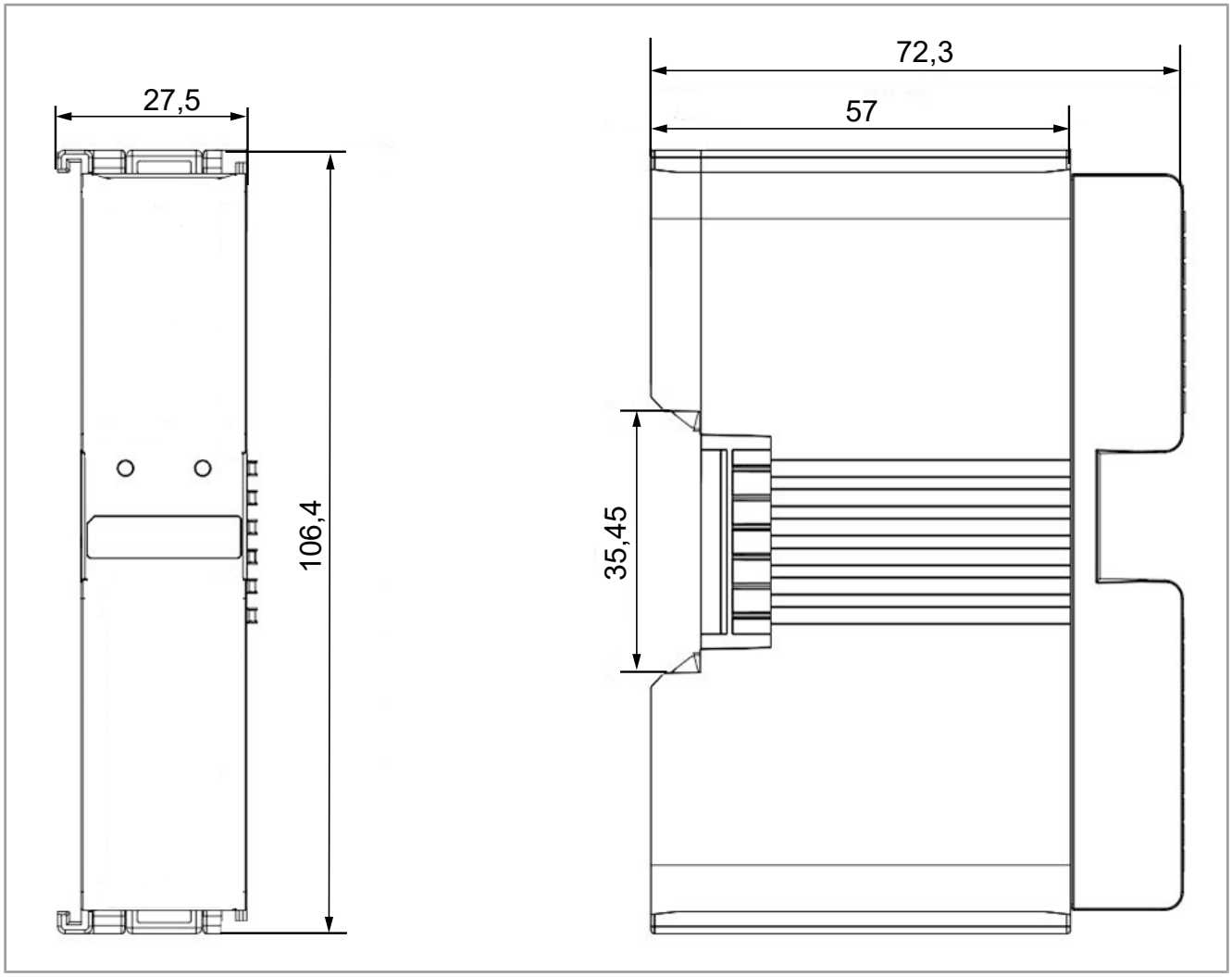


Fig. 4: Dimension in mm

4.2 Mechanical specifications

Parameter		Description	Standards
Mounting orientation		Vertically mounted on DIN rail	
Weight	Expansion modules featuring 4 channels	105 g	
	Expansion modules featuring 8 channels	125 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 specifications of analog expansion modules

4.3 Electrical properties

Analog input modules

Parameter	JX4-AI4I	JX4-AI8I	JX4-AI4V	JX4-AI8V
Analog channels	4	8	4	8
Input type	Current		Voltage	
Input signal	– Disabled – 0 ... 20 mA (factory setting) – 4 ... 20 mA		– Disabled – -10 V ... +10 V (factory setting) – 0 V ... 10 V – -5 V ... +5 V – 0 V ... 5 V – 1 V ... 5 V	
Input signal type	Single-ended signal			
Conversion time	600 µs	770 µs	700 µs	770 µs
Resolution	16 bits			
Sampling rate	≤1 ksps			
Measuring error	±0.1% at 25°C ±0.3% over the entire temperature range			
Input filters	1 … 200 measured values (factory setting 10 measured values)			
Input impedance (current)	≤300 Ω		-	-
Input impedance (voltage)	-	-	≥400 kΩ	
Overvoltage resistance	-	-	±30 V	
max. permissible input current	30 mA		-	
Galvanic isolation	No isolation between channels, isolation between channels and backplane bus			
Isolation resistor	500 V			
Logic voltage	DC 5 V			
Current consumption logic voltage	100 mA	110 mA	180 mA	260 mA
Power consumption/ wattage	0.5 W	0.55 W	0.9 W	1.3 W

Tab. 5: Electrical properties of analog input modules

Analog differential input modules

Parameter	JX4-AI4ID	JX4-AI8ID	JX4-AI4VD	JX4-AI8VD
Analog channels	4	8	4	8
Input type	Current		Voltage	
Input signal	– Disabled – 0 ... 20 mA (factory setting) – 4 ... 20 mA – -20 … +20 mA		– Disabled – -10 V ... +10 V (factory setting) – 0 V ... 10 V – -5 V ... +5 V – 0 V ... 5 V – 1 V ... 5 V	
Input signal type	Differential signal			
Conversion time	600 µs	770 µs	600 µs	850 µs
Resolution	16 bits			
Sampling rate	≤1 ksps			
Measuring error	±0.1% at 25°C ±0.3% over the entire temperature range			
Input filters	1 … 200 measured values (factory setting 10 measured values)			
Input impedance (current)	≤250 Ω		-	-
Input impedance (voltage)	-	-	≥1 MΩ	
Overvoltage resistance	-	-	±30 V	
max. permissible input current	30 mA		-	
Galvanic isolation	No isolation between channels, isolation between channels and backplane bus			
Isolation resistor	500 V			
Logic voltage	DC 5 V			
Current consumption logic voltage	150 mA	210 mA	150 mA	210 mA
Power consumption/ wattage	0.75 W	1.05 W	0.75 W	1.05 W

Tab. 6: Electrical properties of analog differential input modules

Analog output modules

Parameter	JX4-AO4I	JX4-AO8I	JX4-AO4V	JX4-AO8V
Analog channels	4	8	4	8
Output type	Current	Current	Voltage	Voltage
Output signal	– Disabled – 0 ... 20 mA (factory setting) – 4 ... 20 mA		– Disabled – -10 V ... +10 V (factory setting) – 0 V ... 10 V – -5 V … +5 V – 0 V ... 5 V – 1 V ... 5 V	
Conversion time	200 µs	400 µs	200 µs	400 µs
Resolution	16 bits			
Measuring error	±0.1% at 25°C ±0.3% over the entire temperature range			
Load impedance	≤500 Ω	≤500 Ω	≥2 kΩ	≥2 kΩ
Output protection	Overload protection, idle protection, short-circuit protection (all automatic recovery mechanisms)			
Galvanic isolation	No isolation between channels, isolation between channels and backplane bus, isolation between channels and power supply			
Isolation resistor	500 V			
Logic voltage	DC 5 V			
Current consumption of logic voltage	80 mA	100 mA	80 mA	100 mA
Power consumption/ wattage	0.4 W	0.5 W	0.4 W	0.5 W

Tab. 7: Electrical properties of analog output modules

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
Limit value	50 dB (µV/m) at 3 m distance	DIN EN 61131-2
Frequency band	**230 MHz … 1,000 MHz**	DIN EN 55011
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
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
	AM 80 % with 1 kHz	DIN EN 61000-4-3
	Criterion A	
ESD		
Discharge through air Test peak voltage	8 kV	DIN EN 61131-2 DIN EN 61000-6-2
Contact discharge Test peak voltage	4 kV Criterion A	DIN EN 61000-4-2

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 – JX4-PS – I/O module – 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.

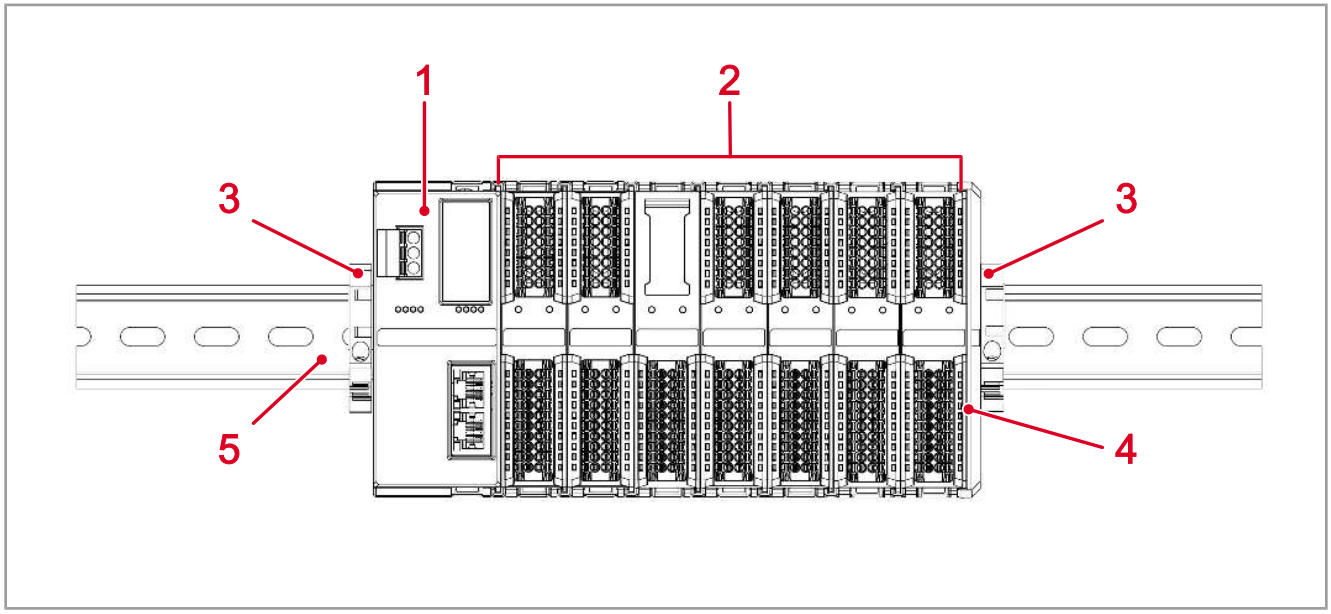
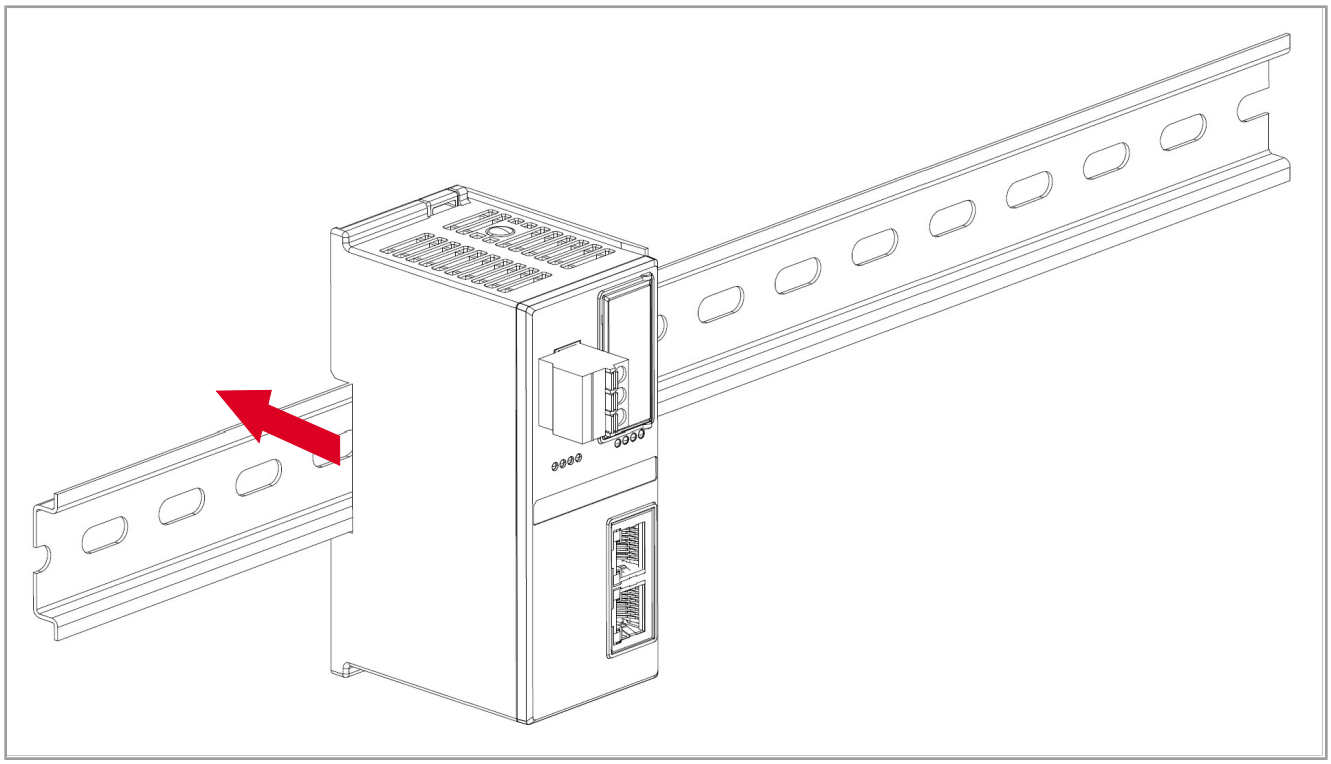


Fig. 5: System overview

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

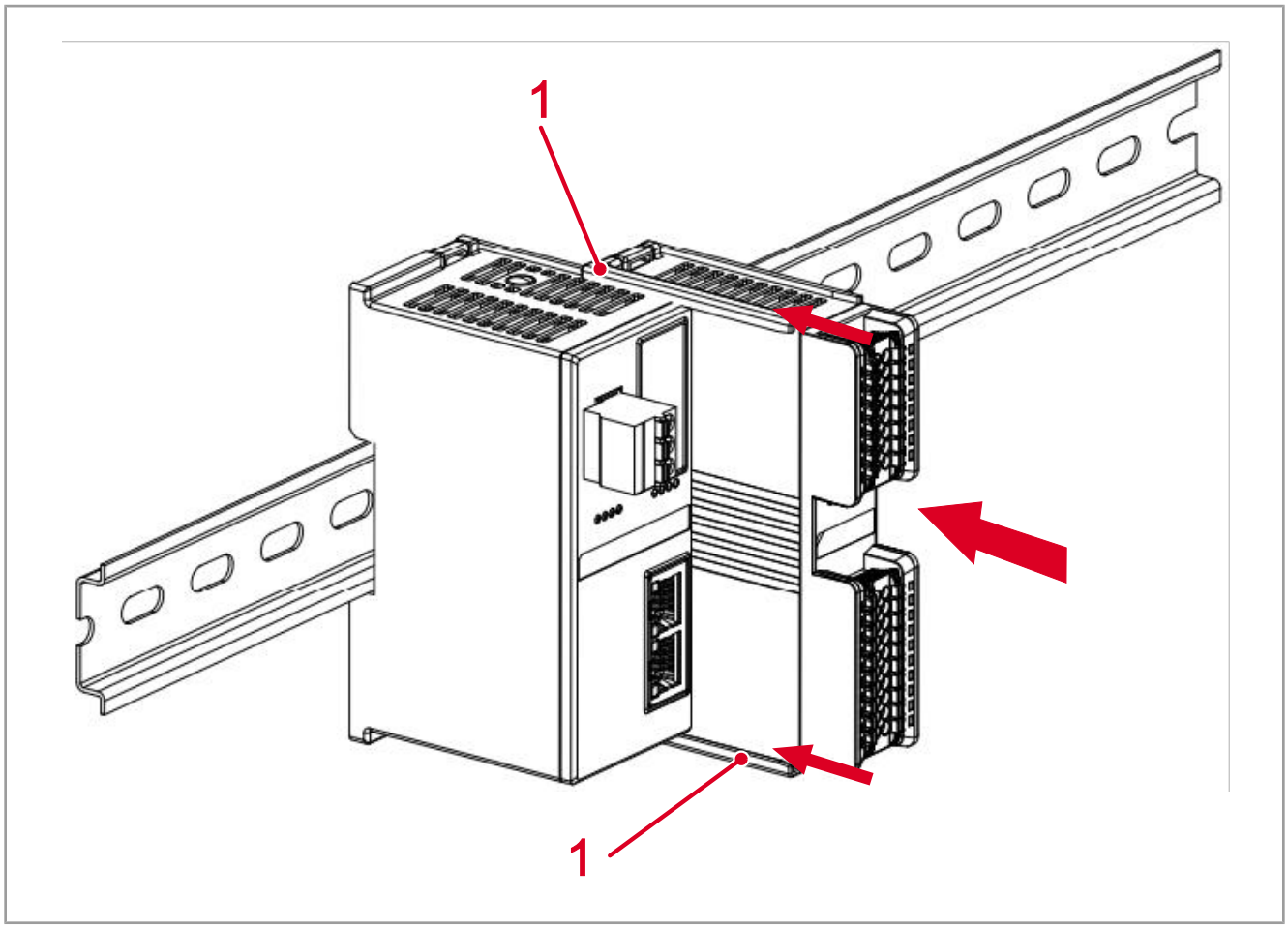


Fig. 6: Assembling the expansion module

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

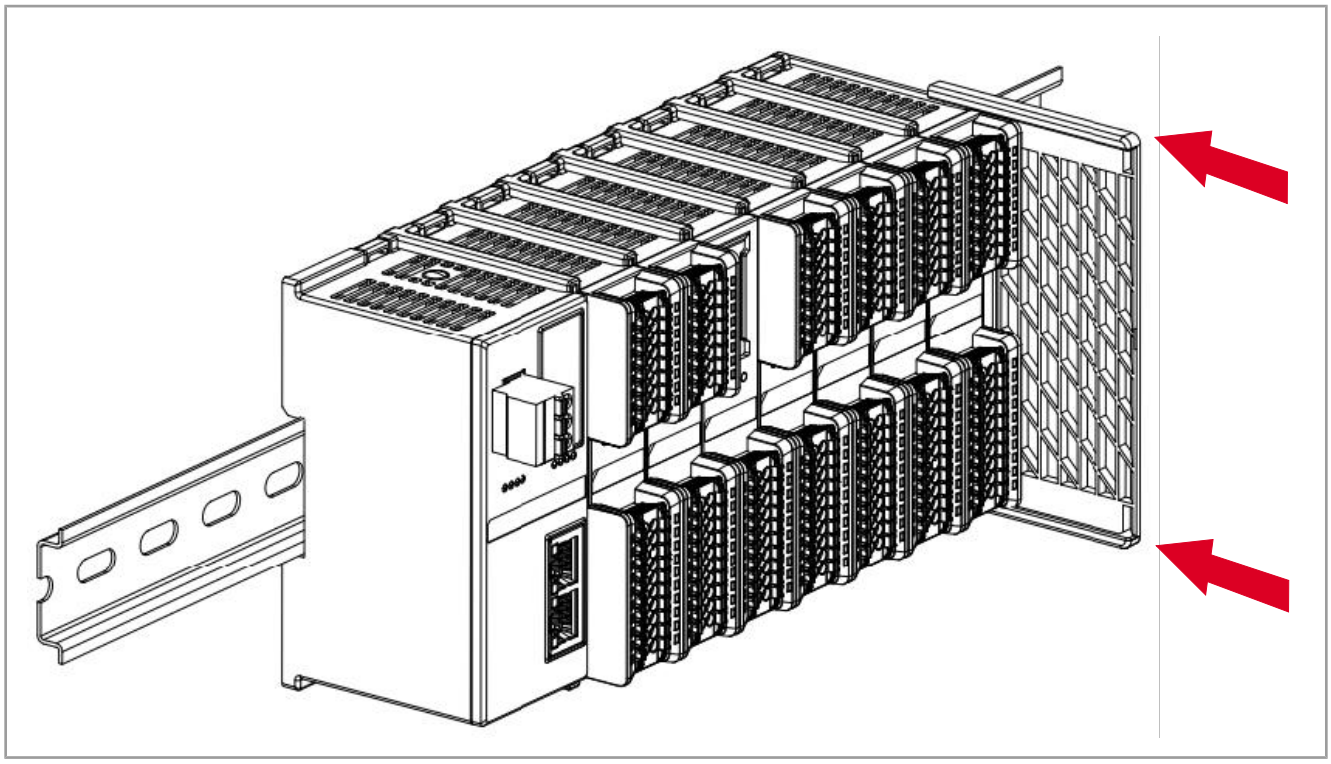


Fig. 7: Installing the end cover

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

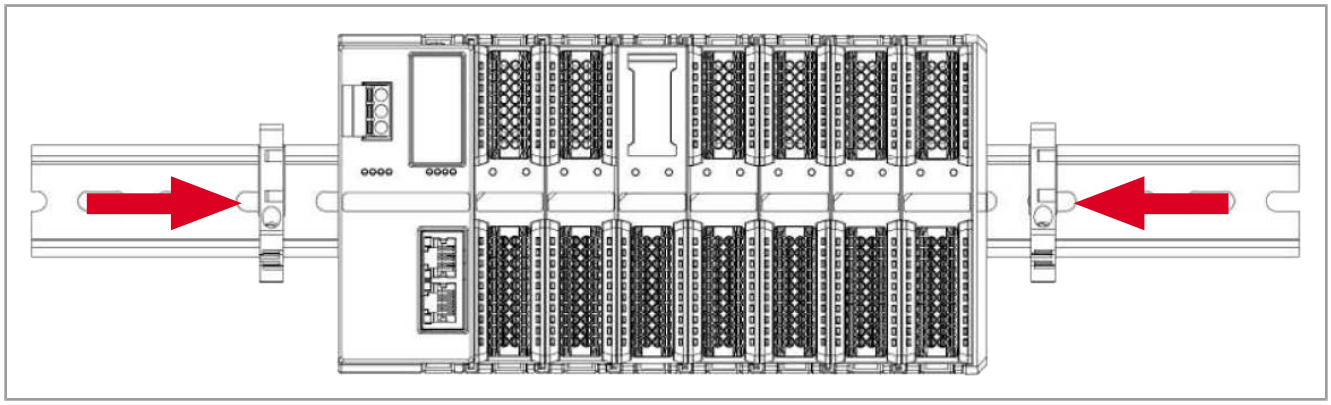


Fig. 8: Installing the retainers

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

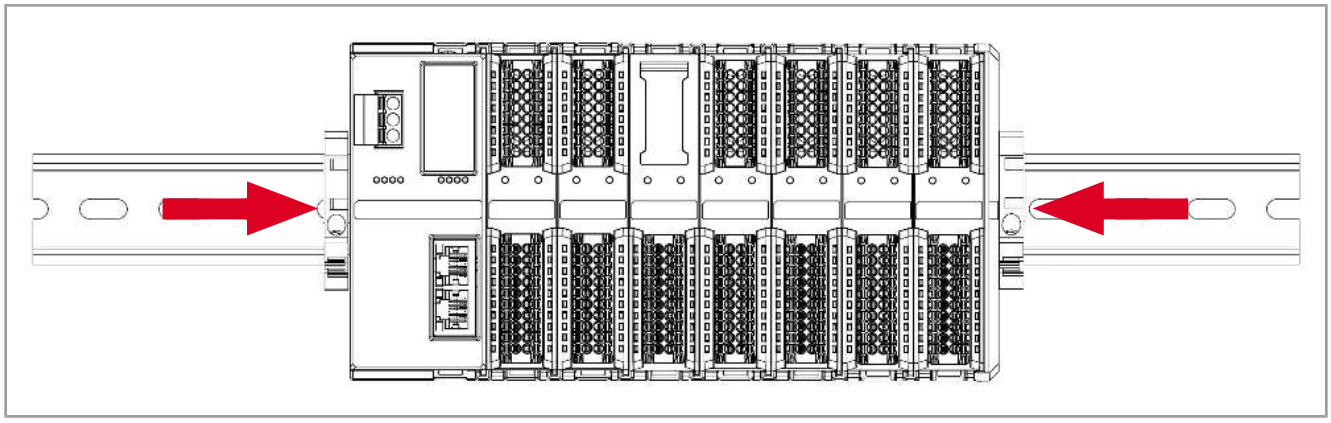


Fig. 9: Retainers firmly in place

3. Lock both retainers with a screwdriver.

5.5 Removing the device from the DIN rail

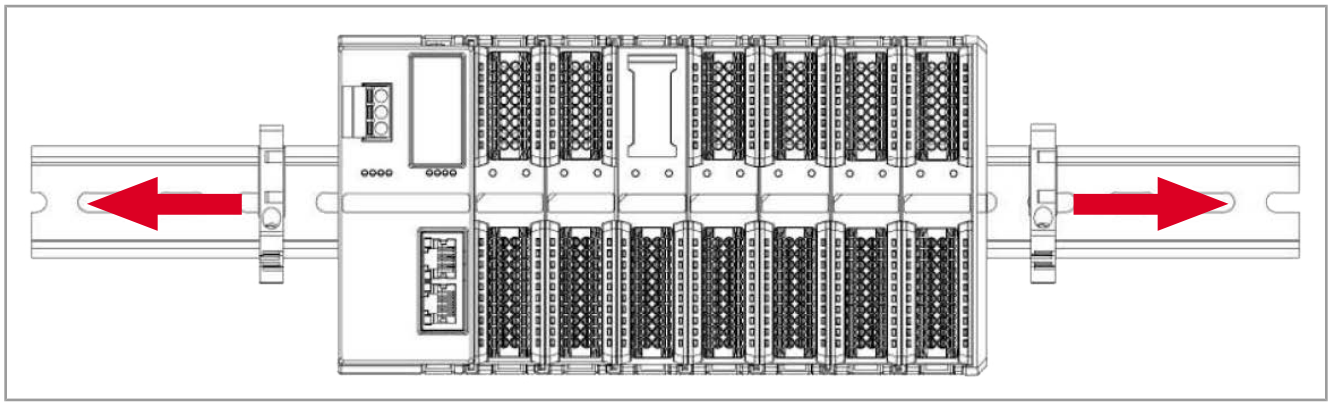


Fig. 10: Removing the retainers

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

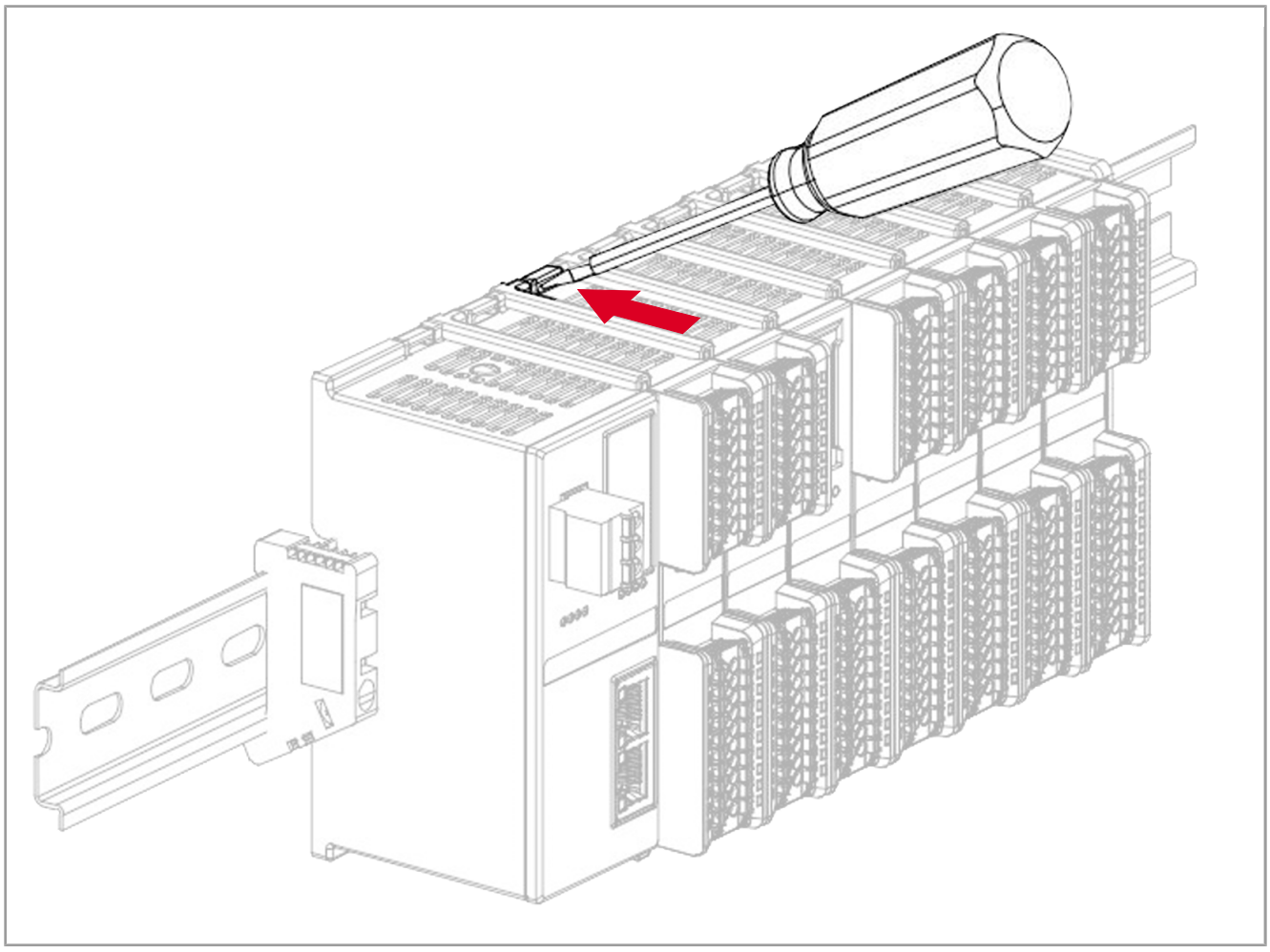


Fig. 11: Place a screwdriver on the latch.

3. Push the screwdriver into the latch.

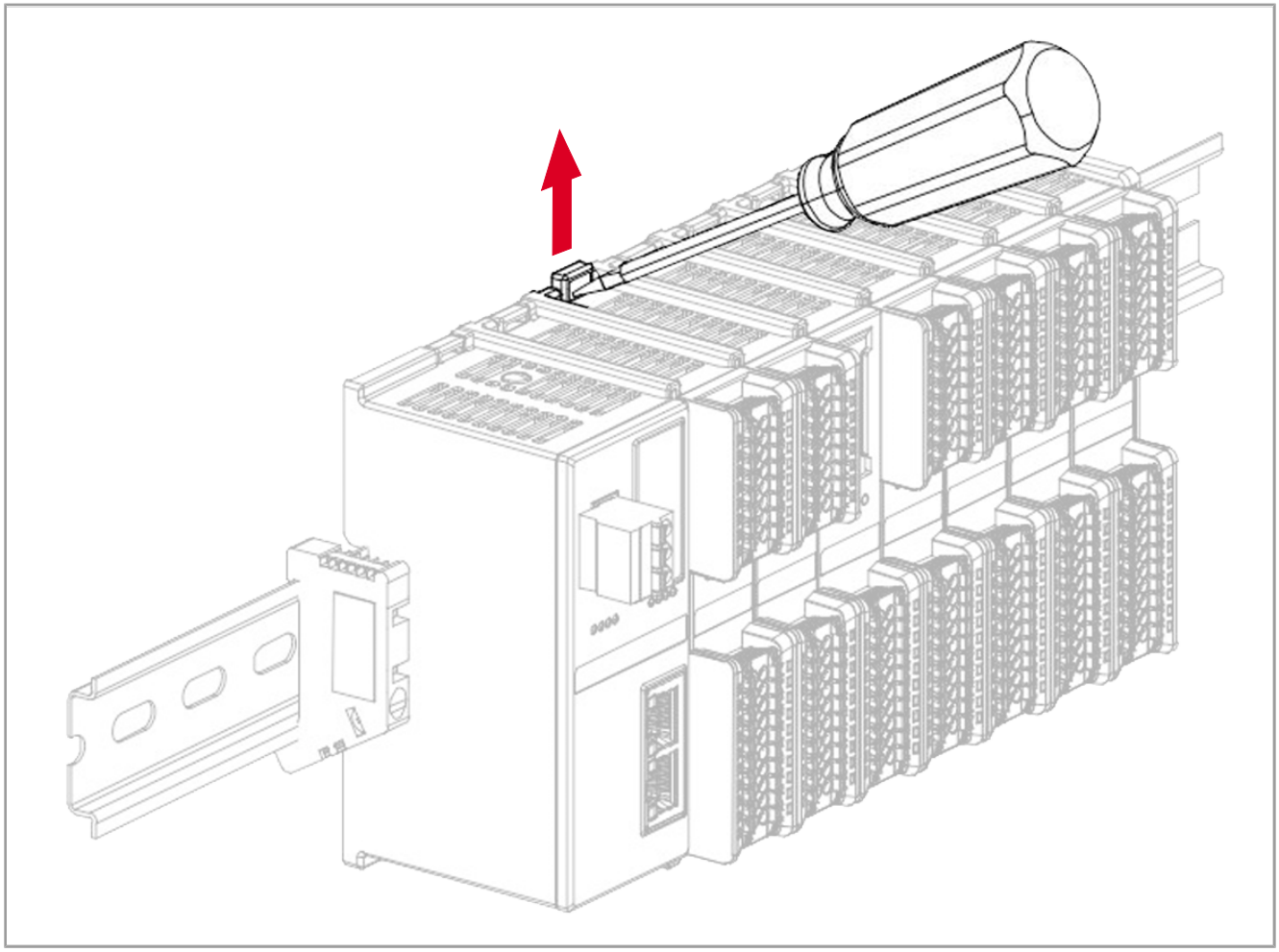


Fig. 12: Loosening the latch

4. Loose the latch.

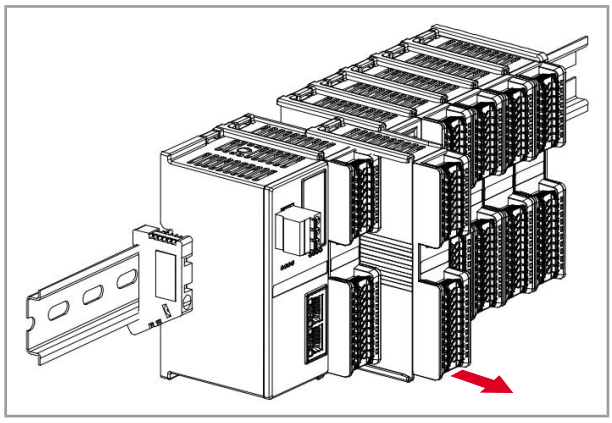


Fig. 13: Removing the module

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

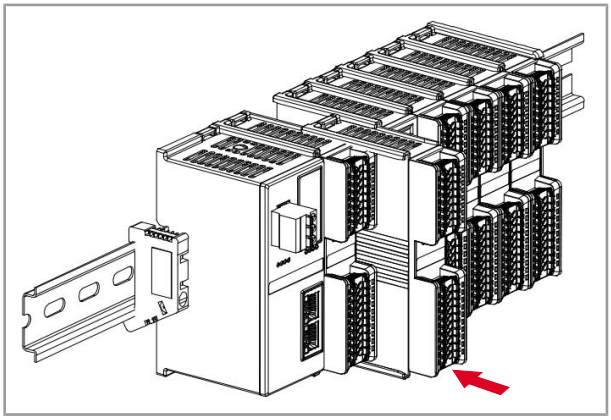
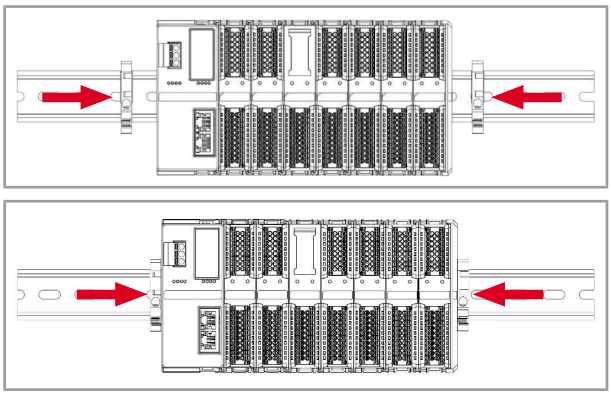


Fig. 14: Inserting the module

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 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 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. 11: Specification of connection terminals

6.3 Block diagrams

6.3.1 JX4-AI8I

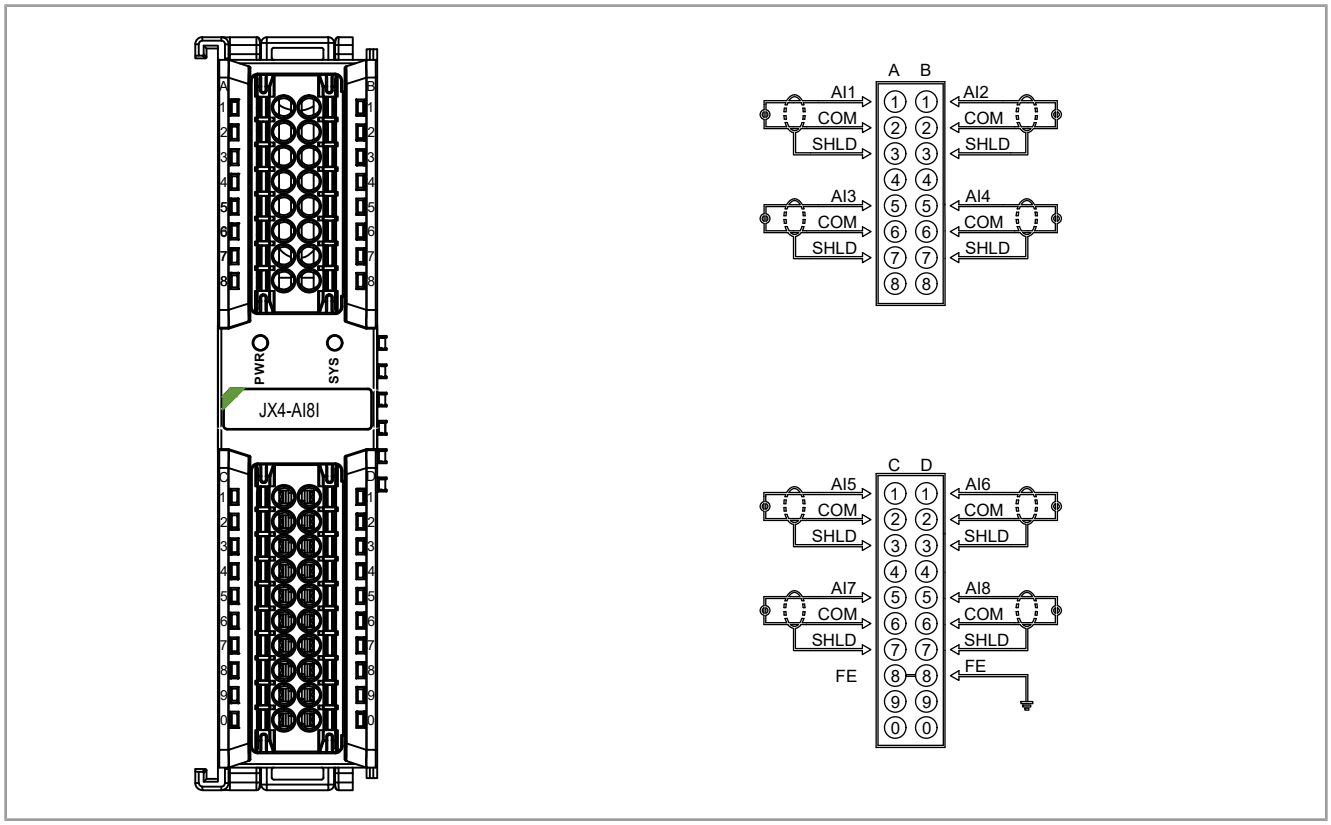


Fig. 15: JX4-AI8I block diagram

6.3.2 JX4-AI8ID

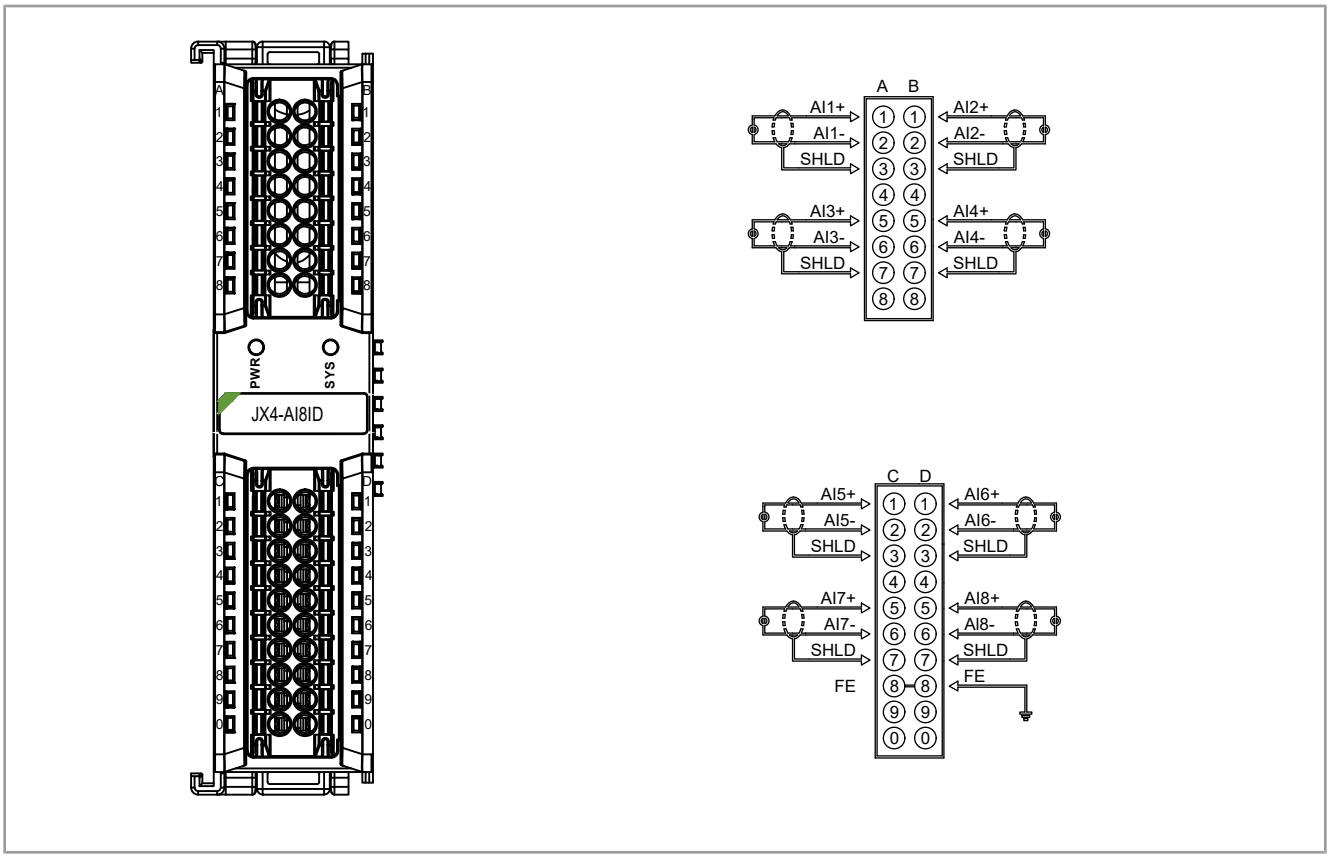


Fig. 16: JX4-AI8ID block diagram

6.3.3 JX4-AI8V

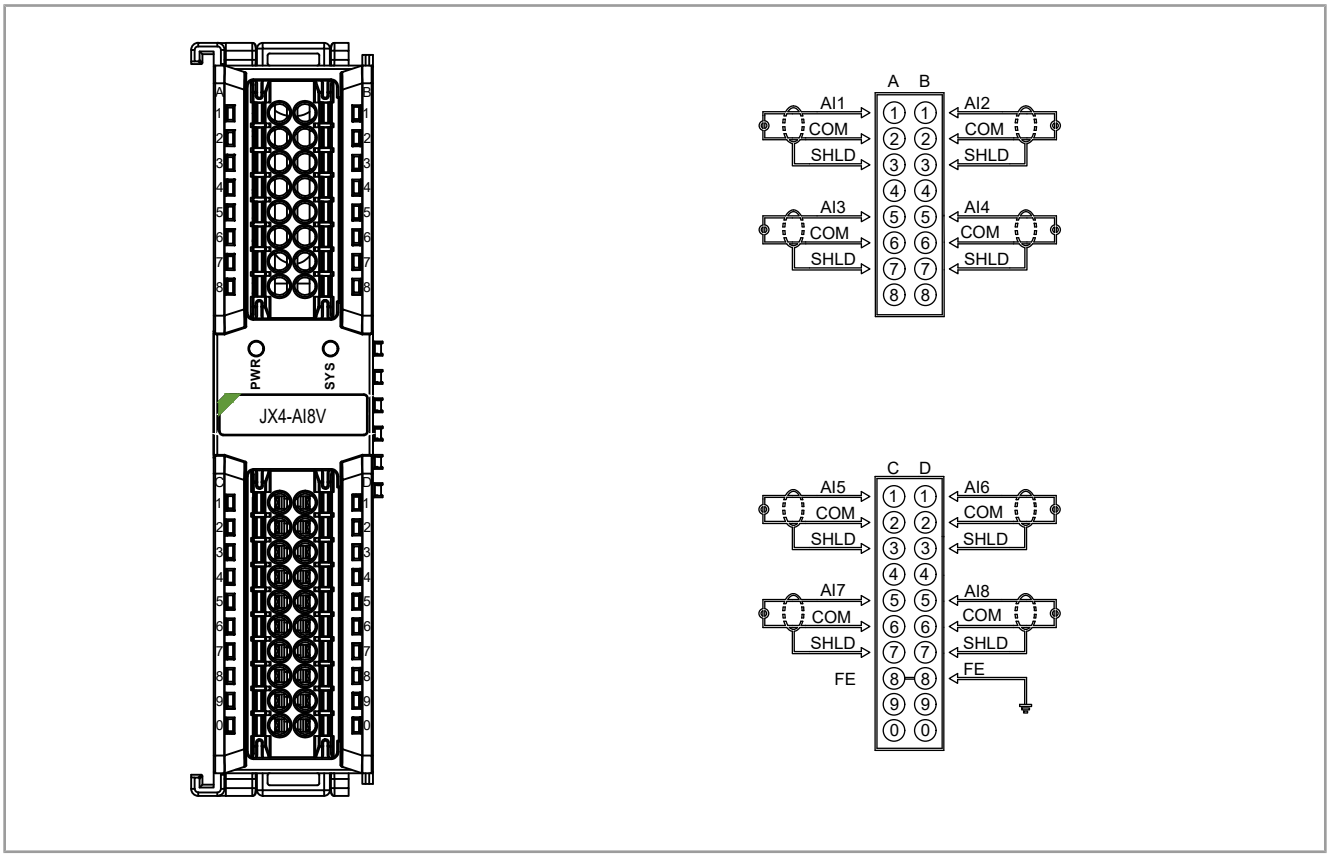


Fig. 17: JX4-AI8V block diagram

6.3.4 JX4-AI8VD

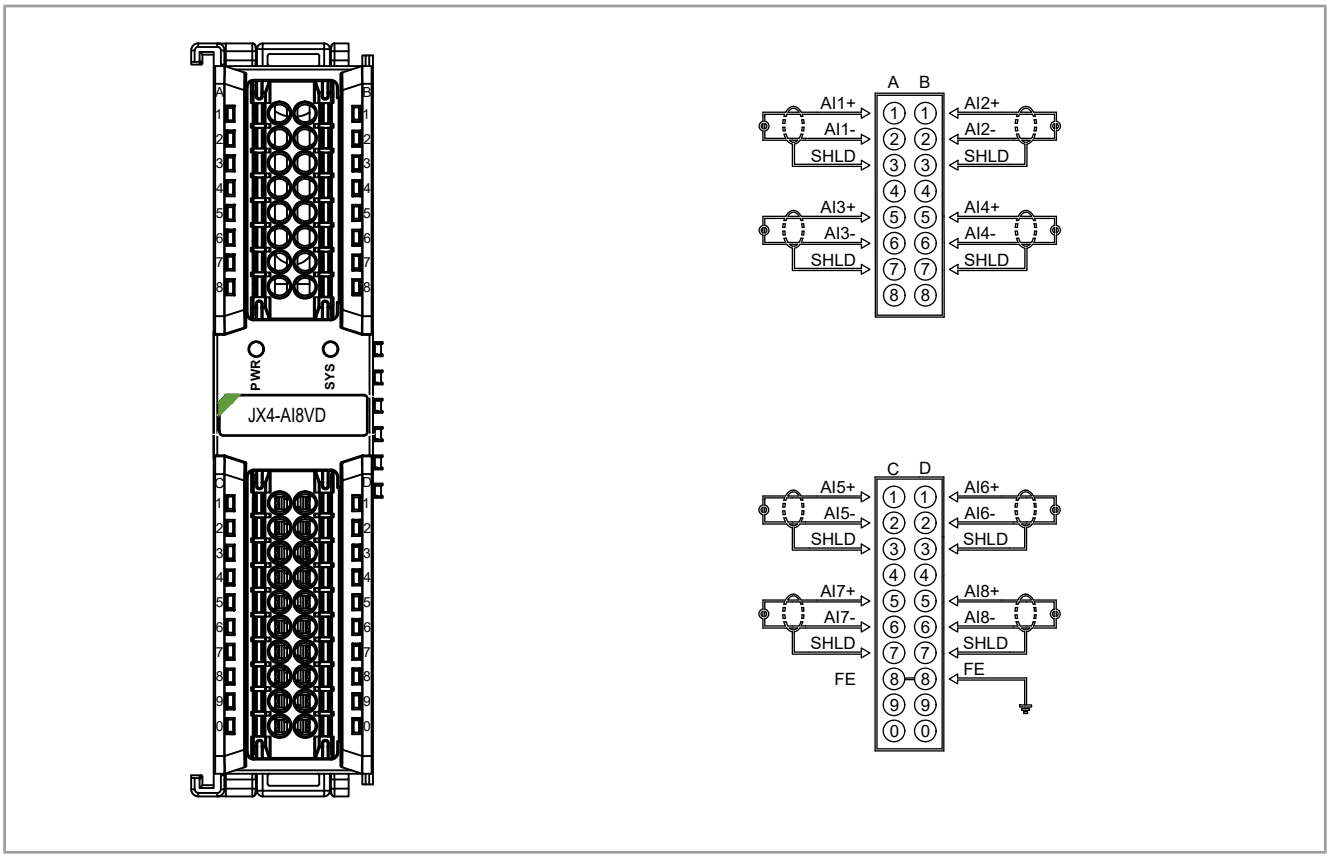


Fig. 18: JX4-AI8VD block diagram

6.3.5 JX4-AO8I

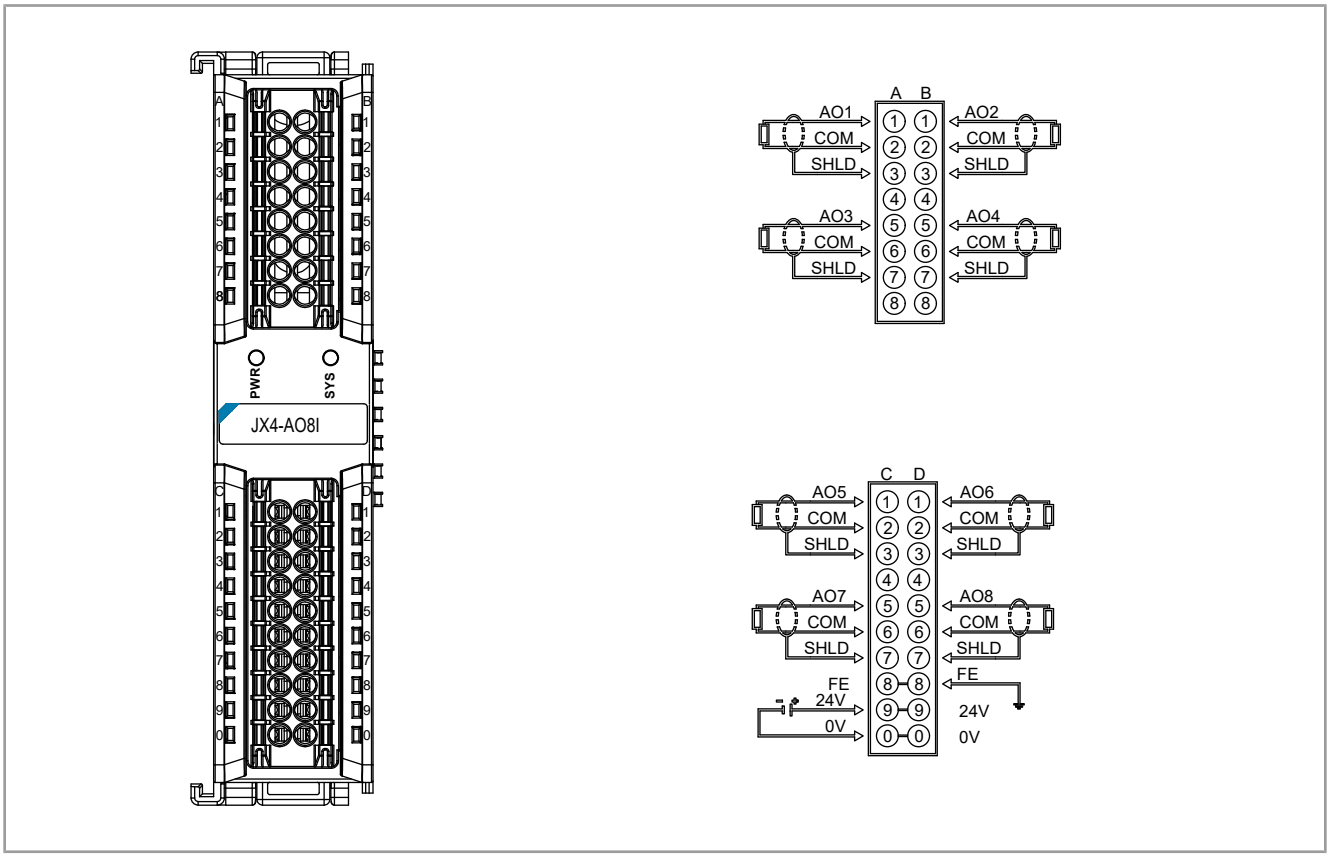


Fig. 19: JX4-AO8I block diagram

6.3.6 JX4-AO8V

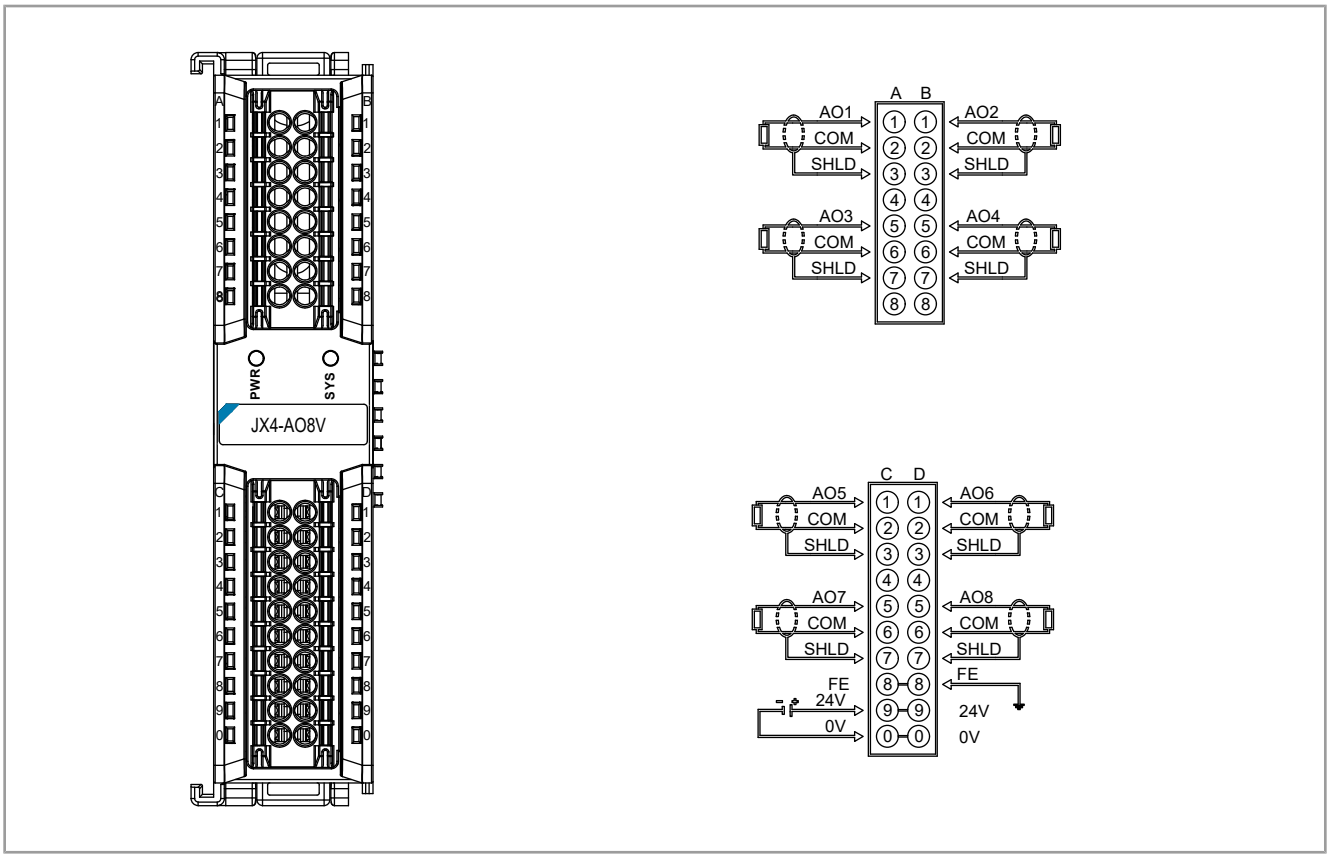


Fig. 20: JX4-AO8V block diagram

6.3.7 JX4-AI4I

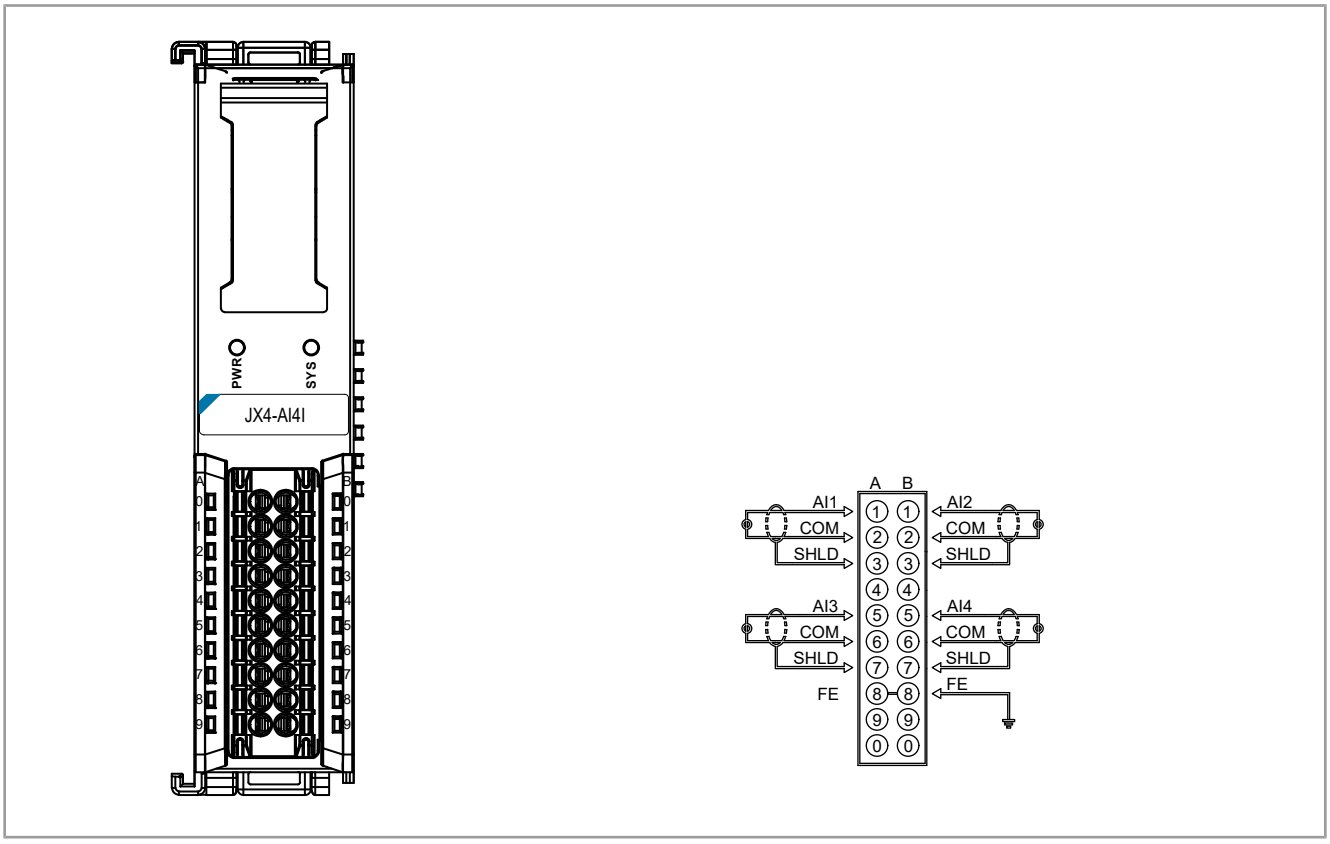


Fig. 21: JX4-AI4I block diagram

6.3.8 JX4-AI4ID

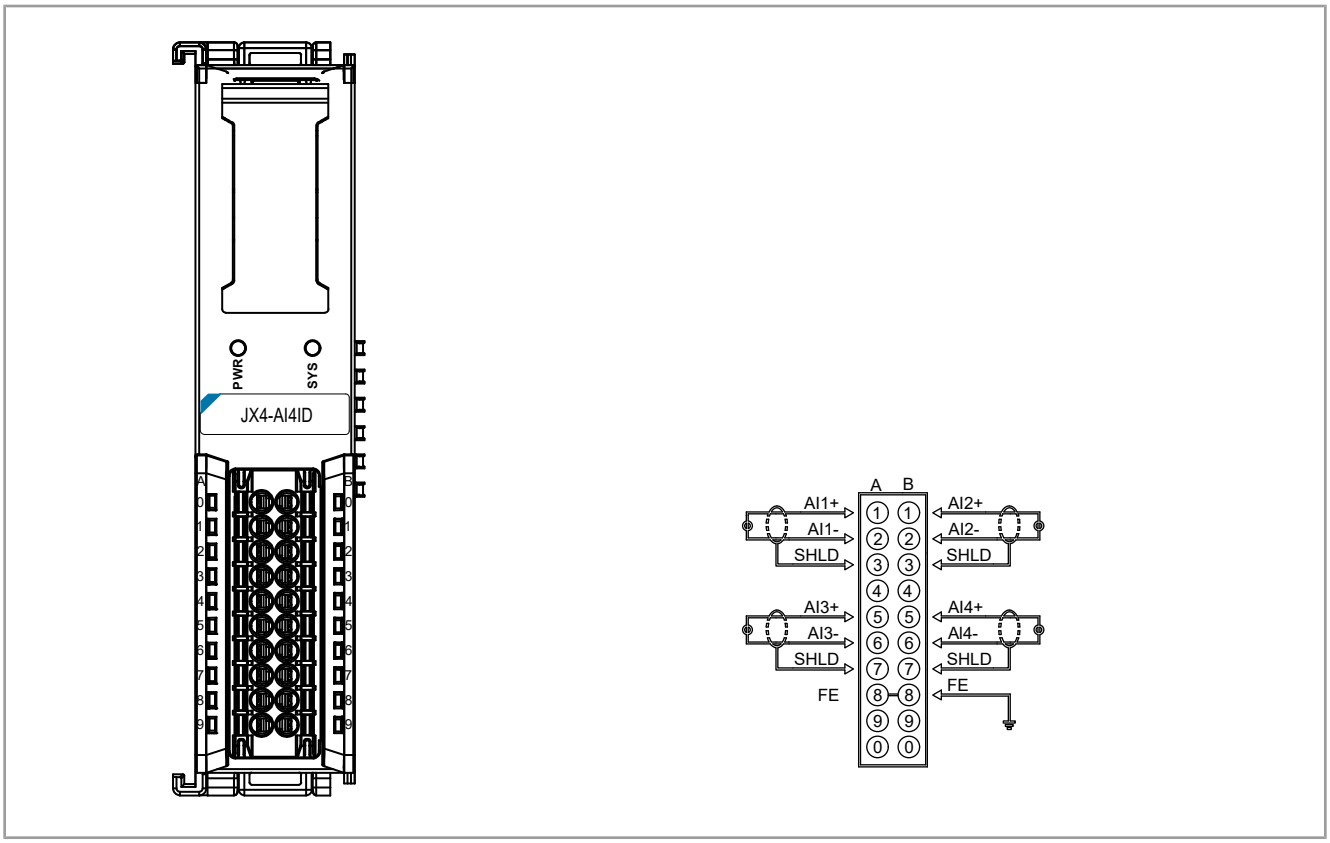


Fig. 22: JX4-AI4ID block diagram

6.3.9 JX4-AI4V

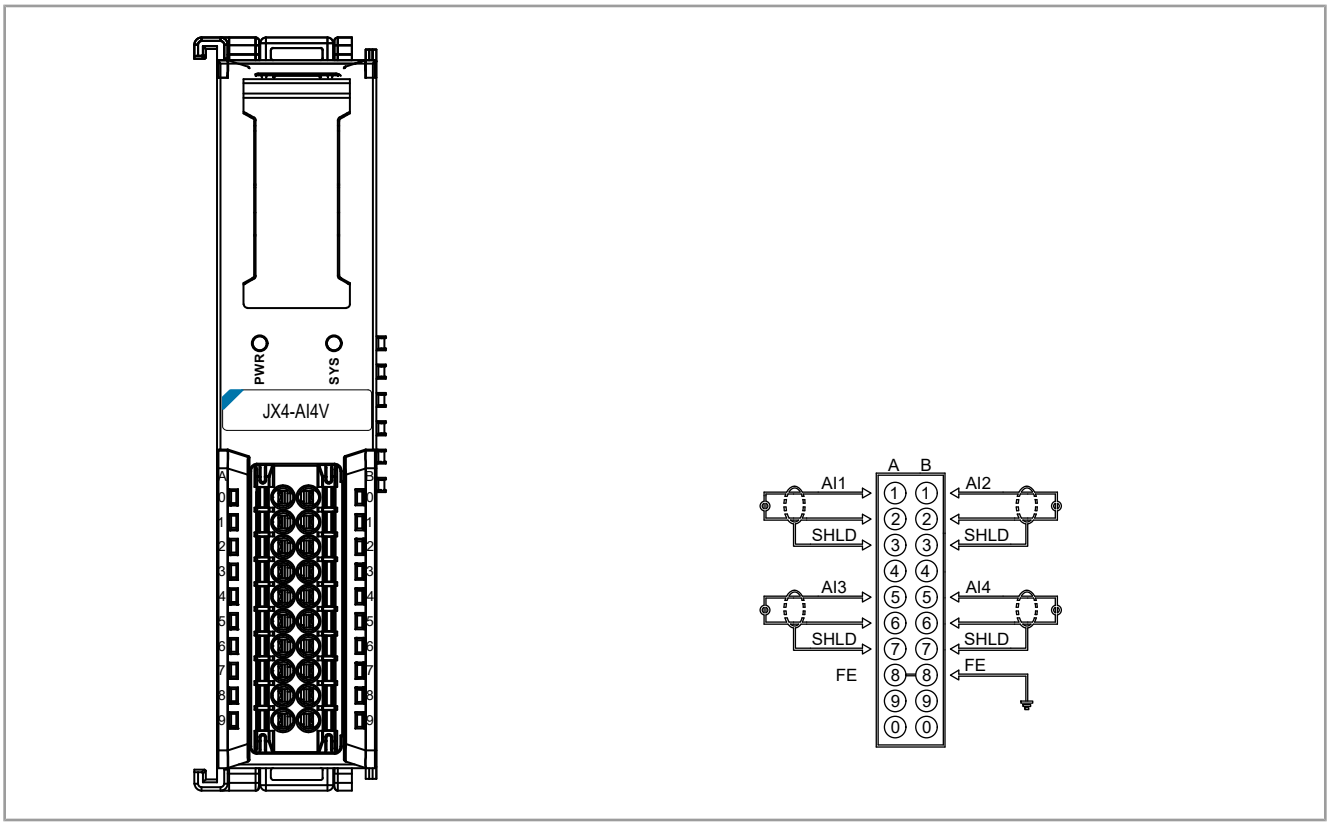


Fig. 23: JX4-AI4V block diagram

6.3.10 JX4-AI4VD

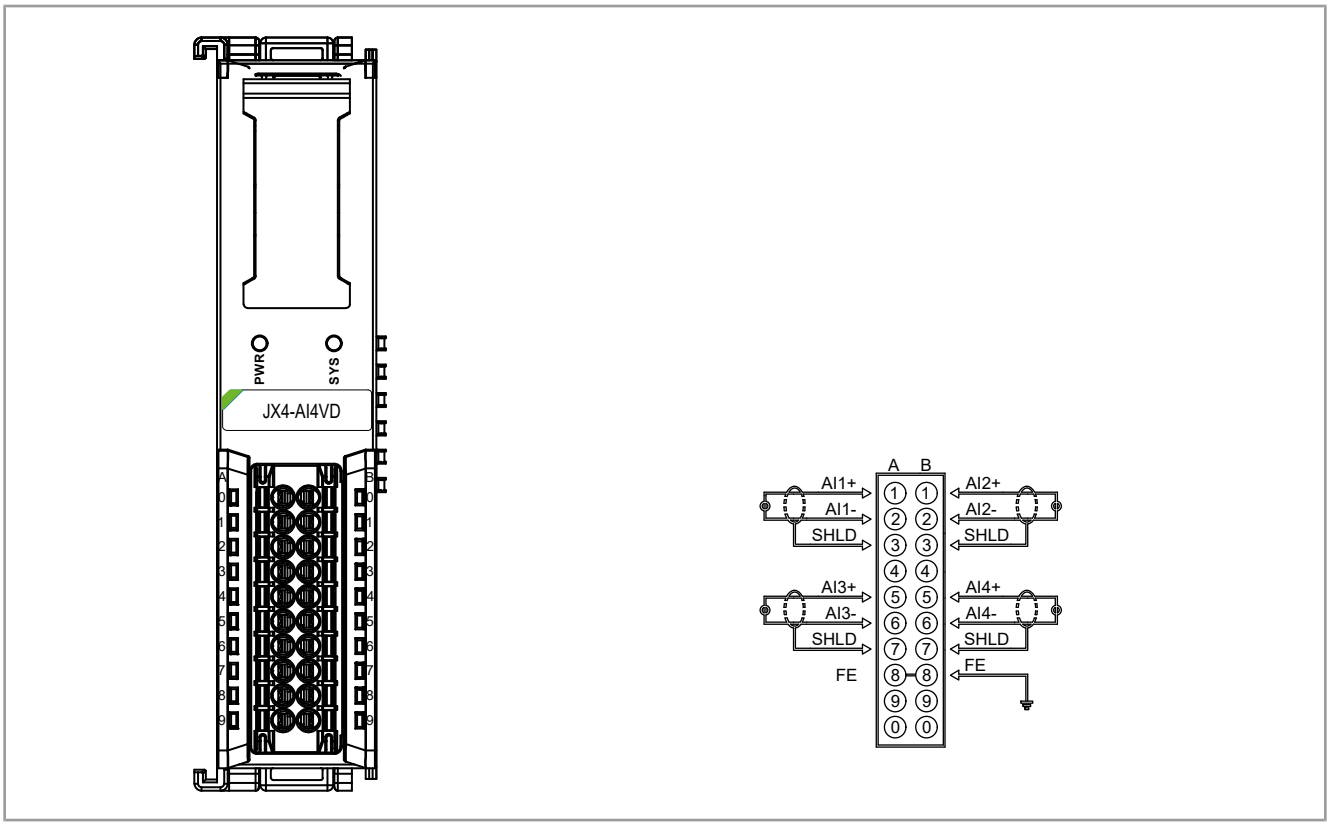


Fig. 24: JX4-AI4VD block diagram

6.3.11 JX4-AO4I

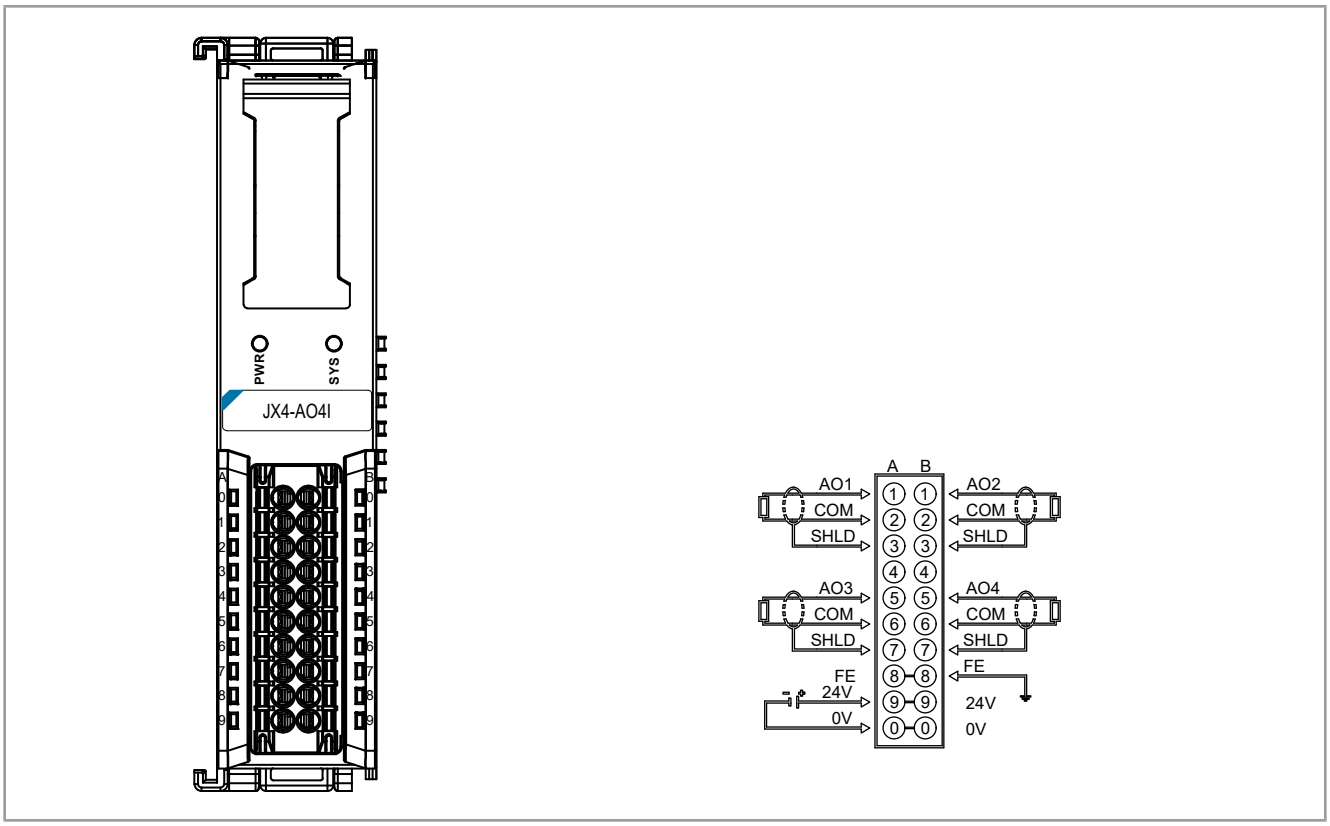


Fig. 25: JX4-AO4I block diagram

6.3.12 JX4-AO4V

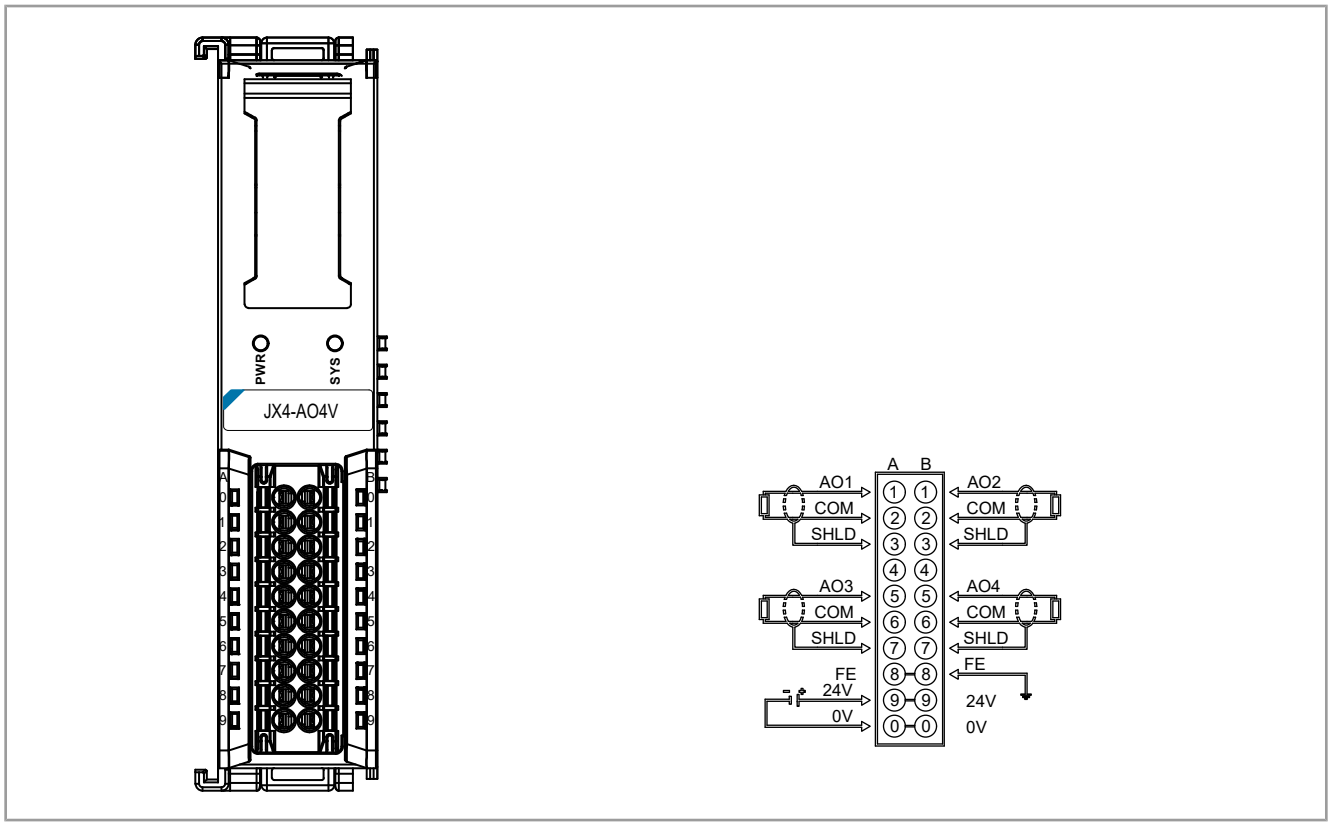


Fig. 26: JX4-AO4V block diagram

7 Identification and configuration

Requirements

– The JetSym software version 6.0 or higher has been installed.

ⓘ Info

Files and software

The files and software packages required for the project are available for download on the homepage. Go to www.bucherautomation.com and open *Products* > *Expansion modules* > *JX4 modules*.

ⓘ Info

Further information

For more information, refer to the JetSym online help.

7.1 Incorporating an EtherCAT® device as 3rd-party

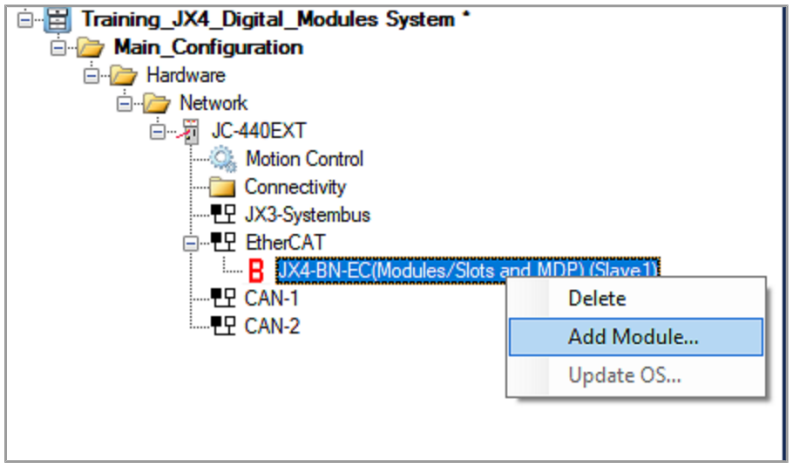
ⓘ Info

Order of device configuration

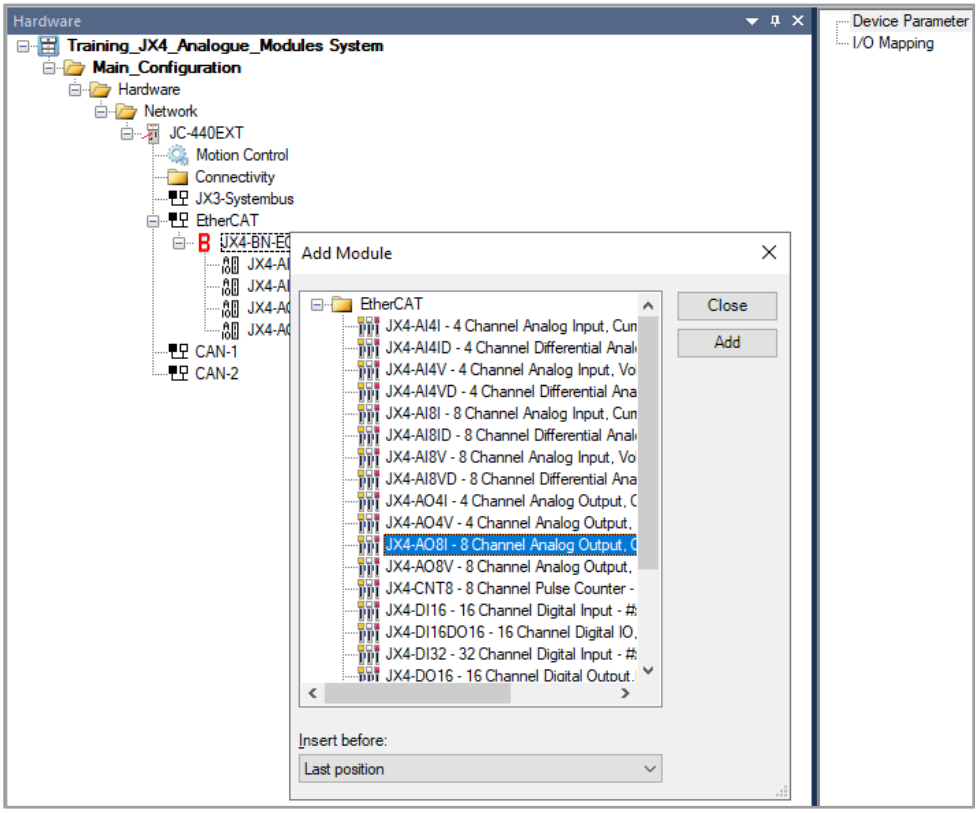
It is mandatory that the bus node be added prior to adding any expansion modules.

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*.

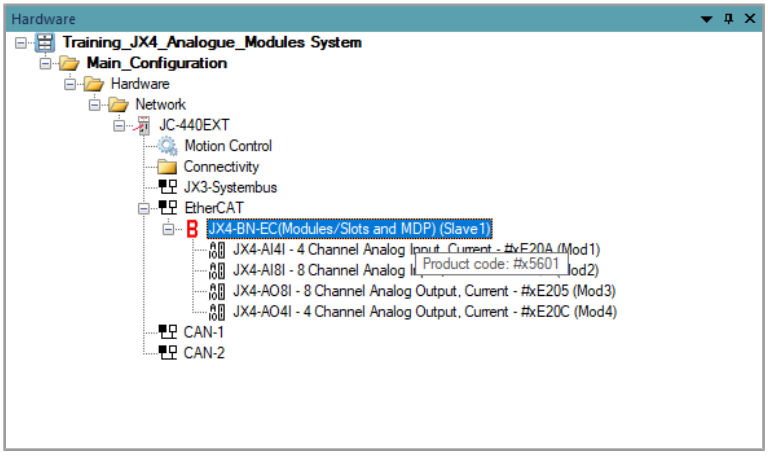
7.2 Adding expansion modules



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



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



⇨ The chosen modules are shown in the list.

8 Programming

8.1 Analog voltage parameters

Range selection	Measuring range	Value range	Formula for calculating of the voltage
0	Channel is disabled		
1 (factory setting)	-10 V … 10 V	-32768 … 32767	U=(D×20):65535
2	0 V … 10 V	0 … 32767	U=(D×10):32767
3	-10 V … 10 V	-27648 … 27648	U=(D×20):55296
4	0 V … 10 V	0 … 27648	U=(D×10):27648
5	-5 V … 5 V	-27648 … 27648	U=(D×10):55296
6	0 V … 5 V	0 … 27648	U=(D×5):27648
7	1 V … 5 V	0 … 27648	U=(D+6912)×4:27648

Tab. 12: Selection of voltage and value range

ⓘ Info

Selection of the voltage range

D stands for the digital value, U for the voltage. The factory setting for the analog voltage input module and voltage output module is 1: -10 V … +10 V (-32768 … 32767).

```
7  //*****************************************************************************
8  //* Enumeration with the different modes of the analog voltage output channels
9  //*****************************************************************************
10 type
11     JX4_AO_VOLTAGE_RANGE : enum(Disable = 0, Bipolar_10V_highres = 1, Unipolar_10V_highres = 2, Bipolar_10V_lowres = 3, Unipolar_10V_lowres = 4,
12                                 Bipolar_5V = 5, Unipolar_5V = 6, Unipolar_1_5V = 7)
13 end_type
14
```

Fig. 27: Support file voltage

All setting options for the voltage range are stored in the support file.

► Enter the code in the configuration settings.

	Range				
	Measuring range	-10 V … +10 V	0 V … 10 V	-10 V … +10 V	0 V … 10 V
	Value range	-32768 … 32767	0 … 32767	-27648 … 27648	0 … 27648
Voltage					
-10.13				-27980	-
-10		-32768	-	-27648	-
-1		-3277	-	-2765	-
-0.13		-426	-384	-359	-332
-0.06		-197	-197	-166	-156
0		0	0	0	0

1		3277	3277	2765	2765
10		32767	32767	27648	27648
10.12		-	-	27980	27980
Digital value formula		D=(65535:20)×U	D=(32767:10)×U	D=(55296:20)×U	D=(27648/10)×U

Tab. 13: Voltage input rating table

Voltage input module range selection

1. Range: -10 V … +10 V (-32768 … 32767)

– Supports overflow (up/down)
– At input > 10 V: All channels show 32767
– At input< -10 V: All channels show -32768

2. Range: 0 V … 10 V (0 … 32767)

– Supports underflow and overflow (up/down)
– Normal values: -0.13 V … +10 V
– At input > 10 V: Maximum value 32767 and alarm
– At input< -0.13 V: Minimum value -384 and alarm

3. Range: -10 V … +10 V (-27648 … 27648)

– Supports overshooting and overflow (up/down)
– Normal values: -10.13 V … +10.12 V
– At input > 10.12 V: Maximum value 27980 and alarm
– At input< -10.13 V: Minimum value -27980 and alarm

4. Range: 0 V … 10 V (0 … 27648)

– Supports overshooting and overflow (up/down)
– Normal values: -0.13 V … +10.12 V
– At input > 10.12 V: Maximum value 27980 and alarm
– At input< -0.13 V: Minimum value -332 and alarm

Important functions

Overflow

If the input is beyond the defined range, a warning is issued.

Overshoot

Occurs when the input voltage exceeds the range; the current digital value is displayed as long as the voltage remains within the tolerated limits.

These modules are designed to support different voltage ranges and ensure that appropriate warnings are issued in the event of over- or undershoots.

	Range			
	Measuring range	-5 V … +5 V	0 V … 5 V	1 V … 5 V
	Value range	-27648 … 27648	0 … 27648	0 … 27648
Voltage				
-5.07		-27980	-	-
-5		-27648	-	-
-1		-5530	-	-
-0.07		-332	-332	-
0		0	0	-
0.94		5198	5198	-345
1		5530	5530	0
5		27648	27648	27648
5.06		27980	27980	27933
Digital value formula		D=(55296:10)×U	D=(27648:5)×U	D=(27648:4)×U-6912

Tab. 14: Voltage input rating table

Overview of voltage input module functions

1. Module range -5 V ... +5 V:

– Normal range: -5.07 V ... +5.06 V (display of the calculated value)
– Exceeding: Above 5.06 V or below -5.07 V
– > 5.06 V: Display of the maximum exceedance value (27980) and alarm
– < -5.07 V: Display of the minimum exceedance value (-27980) and alarm

2. Module range 0 V ... +5 V:

– Normal range: -0.07 V ... +5.06 V (display of the calculated value)
– Exceeding: Above 5.06 V or below -0.07 V
– > 5.06 V: Display of the maximum exceedance value (27980) and alarm
– < -0.07 V: Display of the minimum exceedance value (-332) and alarm

3. Module range 1 V ... +5 V:

– Normal range: 0.94 V ... +5.06 V (display of the calculated value)
– Exceeding: Above 5.06 V or below 0.94 V
– > 5.06 V: Display of the maximum exceedance value (27933) and alarm
– < 0.94 V: Display of the minimum exceedance value (-345) and alarm

All modules support functions for overrun, overflow and alarm messages.

	Range				
	Output range	-10 V … +10 V	0 V … 10 V	-10 V … +10 V	0 V … 10 V
	Value range	-32768 … 32767	0 … 32767	-27648 … 27648	0 … 27648
Voltage					
-10		-32768	-	-27648	-
-1		-3277	-	-2765	-
0		0	0	0	0
1		3277	3277	2765	2765
10		32767	32767	27648	27648
Digital value formula		D=(65535:20)×U	D=(32767:10)×U	D=(55296:20)×U	D=(27648:10)×U

Tab. 15: Voltage output rating table

Voltage output module

The voltage output module supports an overflow function. If the voltage range is set to -10 V to +10 V or 0 V to 10 V, the following conditions apply:

– If a digital value is greater than the maximum value for the selected range, the channels output 10 V.

– If the digital value is less than the minimum value for the range (for -10 V ... +10 V), all channels output -10 V.

– If the digital value is less than the minimum value for the range (0 V ... 10 V), all channels output 0 V.

These functions enable flexible handling of over- and under-values in the voltage range.

	Range			
	Output range	-5 V … +5 V	0 V … 5 V	1 V … 5 V
	Value range	-27648 … 27648	0 … 27648	0 … 27648
Voltage				
-5		-27648	-	-
-1		-5530		-
0		0	0	-
1		5530	5530	0
5		27648	27648	27648
Digital value formula		D=(55296:10)×U	D=(27648:5)×U	D=(27648:4)×U-6912

Tab. 16: Voltage input rating table

Voltage output module

The voltage output module supports an overflow function. The following rules apply to the voltage ranges -5 V ... +5 V, 0 V ... 5 V, and 1 V ... 5 V:

– If the digital value is greater than the maximum value of the selected range, all channels output 5 V.
– If the digital value is less than the minimum value for the range -5 V ... +5 V, all channels output -5 V.
– If the digital value is less than the minimum value for the range 0 V ... 5 V, all channels output 0 V.
– If the digital value is less than the minimum value for the range 1 V ... 5 V, all channels output 1 V.

These functions enable flexible handling of over- and under-values in the various voltage ranges.

8.2 Analog current parameters

Table for selecting the current range

Range selection	Measuring range	Value range	Formula for calculating the current
0	Channel is disabled		
1	4 mA … 20 mA	0 … 65535	I=(D+16384)×16:65535
2 (default)	0 mA … 20 mA	0 … 65535	I=(D×20):65535
3	4 mA … 20 mA	0 … 27648	I=((D+6912)×16):27648
4	0 mA … 20 mA	0 … 27648	I=(D×20):27648
5[1)]	-20 mA … +20 mA	0 … 65535	I=(D×40):65535-20

Tab. 17: Selection of the current range and value range

ⓘ Info

Selection of the current range

D stands for the digital value and I for the current. The analog current input of the module has a standard range of 0 mA ... 20 mA (corresponding to 0 ... 65535).

[1)]The range -20 mA ... +20 mA (also 0 ... 65535) is specific to differential signal modules of the current input.

```
7  //****************************************************************************
8  //* Enumeration with the different modes of the analog current output channels
9  //****************************************************************************
10 type
11     JX4_AO_CURRENT_RANGE : enum(Disable = 0, Range_4_20mA_highres = 1, Range_0_20mA_highres = 2, Range_4_20mA_lowres = 3, Range_0_20mA_lowres = 4)
12 end_type
13
```

Fig. 28: Support file current

All setting options for the current range are stored in the support file.

► Enter the code in the configuration settings.

	Range					
	Measuring range	4 mA … 20 mA	0 mA … 20 mA	4 mA … 20 mA	0 mA … 20 mA	-20 mA … +20 mA
	Value range	0 … 65535	0 … 65535	0 … 27648	0 … 27648	0 … 65535
Current						
-20		-	-	-	-	0
-1		-	-	-	-	31129
0		-	0	-	0	32768
1		-	3277	-	1382	34406
4		0	13107	0	5530	39321
20		65535	65535	27648	27648	65535
20.19		-	-	28034	27917	
20.24		-	-	28085	27986	
Digital value formula		D=(65535:16) ×I-16384	D=(65535:20) ×I	D=(27648:16) ×I-6912	D=(27648:20) ×I	D=(65535:40) ×(I+20)

Tab. 18: Current input rating table

Current input rating table

1. Current input – range 4 mA … 20 mA (0 … 65535):

– Supports the overflow function. If the input is above 20 mA, the maximum digital value of 65535 is displayed; if it is below 4 mA, the minimum digital value of 0 is displayed.

2. Current input – range 0 mA … 20 mA (0 … 65535):

– Supports also the overflow function: Above 20 mA, the maximum digital value is 65535; below 0 mA, the minimum digital value is 0.

3. Current input – range 4 mA … 20 mA (0 … 27648):

– Supports overflow, overflow alarm and overshoot. At 4 mA ... 20.24 mA, the normal digital value is displayed. Above 20.24 mA, the digital value 28085 is displayed and an alarm is triggered at the same time. Below 4 mA, the value 0 is displayed.

4. Current input – range 0 mA … 20 mA (0 … 27648):

– Supports overflow, overflow alarm, and overshoot. The normal digital value is displayed within the range 0 mA ... 20.24 mA. Above 20.24 mA, the digital value 27986 is displayed and an alarm is triggered. Below 0 mA, the value 0 is displayed.

5. Current input – range -20 mA … +20 mA (0 … 65535):

– The range -20 mA ... +20 mA (0 ... 65535) is specifically for differential signal modules of the current input.

– Supports the overflow function. Above 20 mA, the maximum digital value 65535 is displayed; below -20 mA, the minimum digital value 0 is displayed.

These functions enable precise monitoring and display of currents in various ranges.

	Range				
	Measuring range	4 mA … 20 mA	0 mA … 20 mA	4 mA … 20 mA	0 mA … 20 mA
	Value range	0 … 65535	0 … 65535	0 … 27648	0 … 27648
Current					
0		-	0	-	0
4		0	13107	0	5530
20		65535	65535	27648	27648
22.81		-	-	32511	31538
23.52		-	-	-	32511
Digital value formula		D=(65535:16)×I-16384	D=(65535:20)×I	D=(27648:16)×I-6912	D=(27648:20)×I

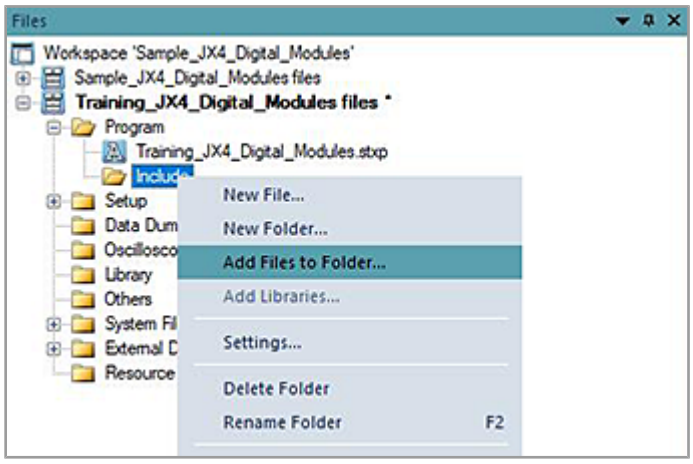
Tab. 19: Current output rating table

ⓘ Info

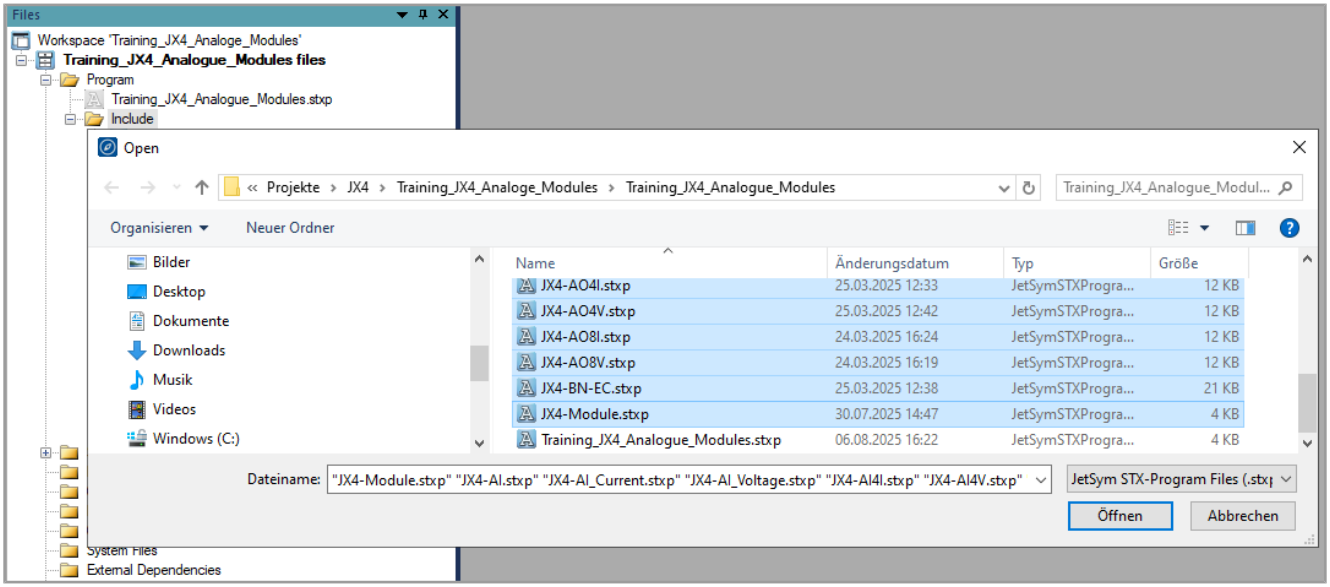
Selection of the current range

- The current output module supports the overflow and underflow functions for selections of 4 mA ... 20 mA (0 ... 27648) and 0 mA ... 20 mA (0 ... 27648).
- If the range of the current output module is set to 4 mA … 20 mA and the digital value is greater than 32511, all channels output a current of 22.81 mA.
- At a setting of 0 mA ... 20 mA and a digital value above 32511, the channels output a current of 23.52 mA.

8.3 Adding support files for JX4 modules

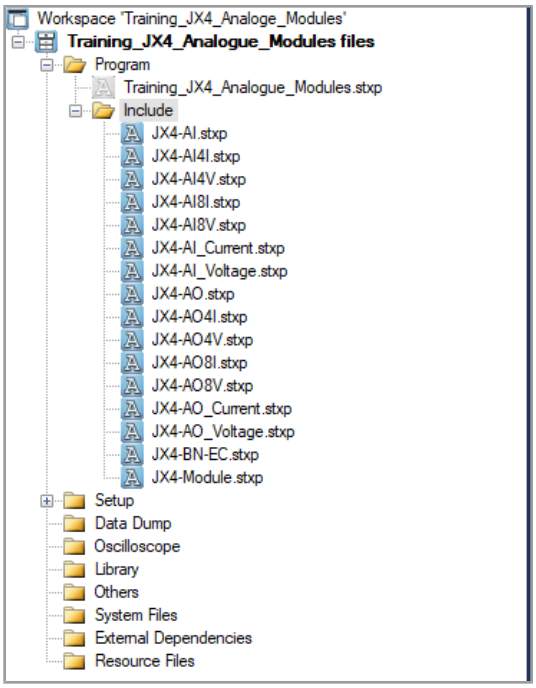


1. Open the Program folder.
2. Right-click the Include folder to open the context menu.
3. Select Add files to folder.



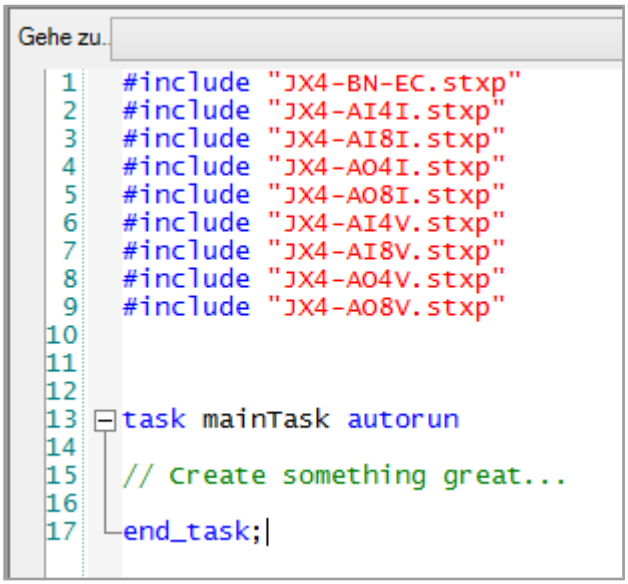
⇨ The Explorer opens.

4. Select the file with support function for the corresponding analog I/O module.
5. Click Open.



⇨ The chosen files are shown in the list.

8.4 Incorporating the files in the project



1. Double-click the Training_JX4_Analogue_Modules.stxp file to open it.
2. Use `#include` to incorporate the support files in the project.
3. Create objects for the modules.

8.5 Configuring the objects and modules

The I/O modules are configurable.

The corresponding support files have been downloaded, as described in Adding support files for JX4 modules [▶ 43].

8.5.1 Analog input filter

The filter function is used to internally average the data from the A/D converter in order to reduce fluctuations in the input signal caused by interference. The analog inputs are processed as a moving average over a specified number of A/D conversions.

Each channel can be configured individually. The adjustment range is between 1 and 200 (default: 10 conversions).

8.5.2 Analog output Clear/Hold function

The Clear/Hold function is intended for modules with output channels and determines how the output channels behave when the module is not in any operating mode, for example when operation is stopped or the network connection to the bus node is disconnected.

The function for deleting or holding the analog outputs supports both a setting for the entire module (template mode) and an individual setting for individual channels (single-channel mode). Single-channel mode takes precedence over template mode. The default configuration is for the module to clear all outputs.

Parameter	Value	Description
Template mode	**0 (default)**	– Delete all channels
	1	– Hold all channels
	2	– Output preset values for all channels
Single-channel mode	**0 (default)**	– Template mode
	1	– Reset Output
	2	– Hold output
	3	– Set output to preset value
Preset Value	**Code value range (default value 0)**	– Current current/voltage value corresponding to the output code – Preset value for the respective individual channel

Tab. 20: Clear/hold parameters of a digital output module

ⓘ Info

If the template mode is set to 2, the preset value is based on the preset code of channel 0 in the single-channel preset value for all outputs in template mode.

8.5.3 Analog power failure protection

Analog modules support the storage of all configuration parameters in the event of an unexpected shutdown or communication interruption.

The shutdown storage function is preset at the default settings.

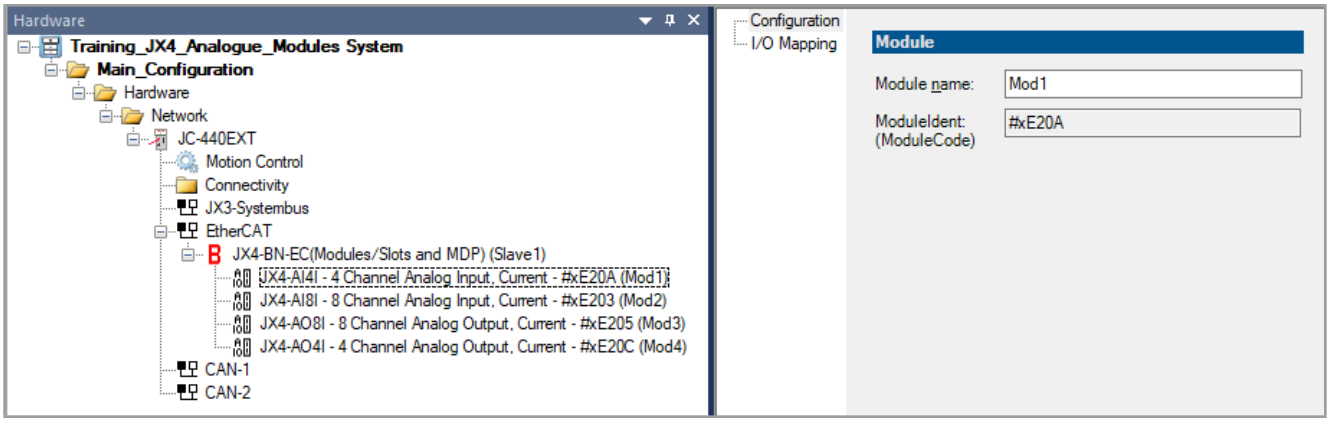
8.6 Declaring inputs and outputs

The address data of each input and output mus be declared.

Address syntax

1. Name of the JX4-BN-EC (slave1)
2. Name of the module (in this example JX4-AI4I Mod1)
3. Name of the PDO (in the example of the JX4-AI4I input)
4. Name of the PDO entry, for an output 'AO 01' ... 'AO 08', or 'AI 01' ... 'AI 08' for an input

Procedure



1. Open the control folder under Hardware>Network.
2. Open the EtherCAT submenu.
3. Double-click the desired module. In this example JX4-AI4I.

   ⇨ The submenu Configuration>I/O mapping opens.

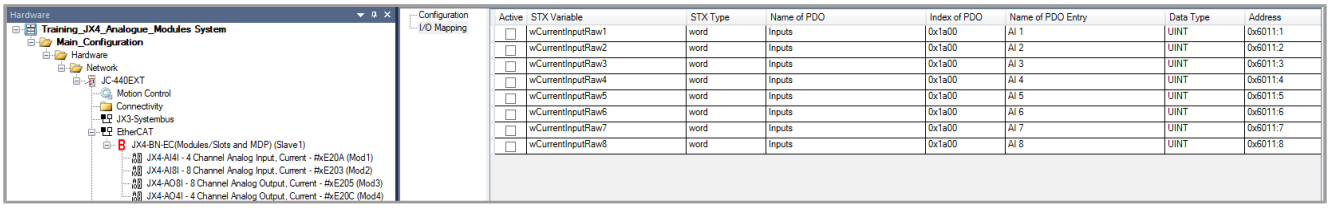


Fig. 29: Complete list of channel addresses

```
#define JX4_BN_EC_DeviceId SPDOAddr_Slave1


var
    // create object for JX4-BN-EC
    Slave1 : JX4_BN_EC_BusNode(JX4_BN_EC_DeviceId);
    // create objects for all JX4 modules at the busnode
    Mod1 : JX4_AI4I_ModuleOfBusNode(Slave1, 1);
    Mod2 : JX4_AI8I_ModuleOfBusNode(Slave1, 2);
    Mod3 : JX4_AO8I_ModuleOfBusNode(Slave1, 3);
    Mod4 : JX4_AO4I_ModuleOfBusNode(Slave1, 4);

    // create current intput channel objects from the first module
    oCurrentInput1 : JX4_AI4I_Input(Mod1, 1);
    oCurrentInput2 : JX4_AI4I_Input(Mod1, 2);
    oCurrentInput3 : JX4_AI4I_Input(Mod1, 3);
    oCurrentInput4 : JX4_AI4I_Input(Mod1, 4);

    // or just the raw value from the PDO of the second module
    wCurrentInputRaw1 : word at Slave1.Mod2.Inputs.'AI 1';
    wCurrentInputRaw2 : word at Slave1.Mod2.Inputs.'AI 2';
    wCurrentInputRaw3 : word at Slave1.Mod2.Inputs.'AI 3';
    wCurrentInputRaw4 : word at Slave1.Mod2.Inputs.'AI 4';
    wCurrentInputRaw5 : word at Slave1.Mod2.Inputs.'AI 5';
    wCurrentInputRaw6 : word at Slave1.Mod2.Inputs.'AI 6';
    wCurrentInputRaw7 : word at Slave1.Mod2.Inputs.'AI 7';
    wCurrentInputRaw8 : word at Slave1.Mod2.Inputs.'AI 8';
    // and the raw value from the PDO of the third module
    wCurrentOutputRaw1 : word at Slave1.Mod3.Outputs.'AO 1';
    wCurrentOutputRaw2 : word at Slave1.Mod3.Outputs.'AO 2';
    wCurrentOutputRaw3 : word at Slave1.Mod3.Outputs.'AO 3';
    wCurrentOutputRaw4 : word at Slave1.Mod3.Outputs.'AO 4';
    wCurrentOutputRaw5 : word at Slave1.Mod3.Outputs.'AO 5';
    wCurrentOutputRaw6 : word at Slave1.Mod3.Outputs.'AO 6';
    wCurrentOutputRaw7 : word at Slave1.Mod3.Outputs.'AO 7';
    wCurrentOutputRaw8 : word at Slave1.Mod3.Outputs.'AO 8';

    // create current output channel objects from the fourth module
    oCurrentOutput1 : JX4_AO4I_Output(Mod4, 1);
    oCurrentOutput2 : JX4_AO4I_Output(Mod4, 2);
    oCurrentOutput3 : JX4_AO4I_Output(Mod4, 3);
    oCurrentOutput4 : JX4_AO4I_Output(Mod4, 4);

end_var
```

4. For each channel, enter the corresponding code as described above.
5. Double-click again on the module you just configured.

   ⇨ The Configuration>I/O mapping submenu lists the addresses of all channels. (See above figure *Complete list of channel addresses*)

```
task mainTask autorun

    // configuration of current outputs
    oCurrentOutput1.ConfigRangeWrite(JX4_AO_CURRENT_RANGE.Range_0_20mA_highres);
    oCurrentOutput1.UserRangeWrite(20.0/JX4_AO_CURRENT_MaxValues[JX4_AO_CURRENT_RANGE.Range_0_20mA_highres], 0.0);
    oCurrentOutput2.ConfigRangeWrite(JX4_AO_CURRENT_RANGE.Range_4_20mA_highres);
    oCurrentOutput2.UserRangeWrite((20.0 - 4.0)/JX4_AO_CURRENT_MaxValues[JX4_AO_CURRENT_RANGE.Range_4_20mA_highres], 4.0);

    // configuration of current inputs
    oCurrentInput1.ConfigRangeWrite(JX4_AI_CURRENT_RANGE.Range_0_20mA_highres);
    oCurrentInput1.UserRangeWrite(20.0/JX4_AI_CURRENT_MaxValues[JX4_AI_CURRENT_RANGE.Range_0_20mA_highres], 0.0);
    oCurrentInput1.ConfigFilterWrite(20);
    oCurrentInput2.ConfigRangeWrite(JX4_AI_CURRENT_RANGE.Range_4_20mA_highres);
    oCurrentInput2.UserRangeWrite((20.0 - 4.0)/JX4_AI_CURRENT_MaxValues[JX4_AI_CURRENT_RANGE.Range_4_20mA_highres], 4.0);

    oCurrentOutput1.UserValue := 4.5; // set out put to 4.5 mA

end_task;
```

⇨ The inputs are ready to be used as usual.

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. 30: 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 ... 9
Fig. 2 Design ... 10
Fig. 3 Nameplate ... 12
Fig. 4 Dimension in mm ... 14
Fig. 5 System overview ... 21
Fig. 6 Assembling the expansion module ... 22
Fig. 7 Installing the end cover ... 23
Fig. 8 Installing the retainers ... 23
Fig. 9 Retainers firmly in place ... 23
Fig. 10 Removing the retainers ... 24
Fig. 11 Place a screwdriver on the latch ... 24
Fig. 12 Loosening the latch ... 25
Fig. 13 Removing the module ... 25
Fig. 14 Inserting the module ... 26
Fig. 15 JX4-AI8I block diagram ... 28
Fig. 16 JX4-AI8ID block diagram ... 29
Fig. 17 JX4-AI8V block diagram ... 29
Fig. 18 JX4-AI8VD block diagram ... 30
Fig. 19 JX4-AO8I block diagram ... 30
Fig. 20 JX4-AO8V block diagram ... 31
Fig. 21 JX4-AI4I block diagram ... 31
Fig. 22 JX4-AI4ID block diagram ... 32
Fig. 23 JX4-AI4V block diagram ... 32
Fig. 24 JX4-AI4VD block diagram ... 33
Fig. 25 JX4-AO4I block diagram ... 33
Fig. 26 JX4-AO4V block diagram ... 34
Fig. 27 Support file voltage ... 37
Fig. 28 Support file current ... 41
Fig. 29 Complete list of channel addresses ... 47
Fig. 30 WEEE icon – crossed out wheeled bin ... 50

List of tables

Tab. 1 Analog I/O expansion modules 6
Tab. 2 Lighting patterns of the LEDs 11
Tab. 3 Diagnostic capabilities by means of status indicators 11
Tab. 4 Mechanical specifications of analog expansion modules 15
Tab. 5 Electrical properties of analog input modules 16
Tab. 6 Electrical properties of analog differential input modules 17
Tab. 7 Electrical properties of analog output modules 18
Tab. 8 Environmental conditions 18
Tab. 9 Emitted interference 19
Tab. 10 Immunity to interference 19
Tab. 11 Specification of connection terminals 28
Tab. 12 Selection of voltage and value range 37
Tab. 13 Voltage input rating table 37
Tab. 14 Voltage input rating table 39
Tab. 15 Voltage output rating table 40
Tab. 16 Voltage input rating table 40
Tab. 17 Selection of the current range and value range 41
Tab. 18 Current input rating table 42
Tab. 19 Current output rating table 43
Tab. 20 Clear/hold parameters of a digital output module 46

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

www.bucherautomation.com