BUCHER automation

User Manual



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JX3-CNT

Counter Module

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1 Introduction

1.1 Information on this Document

This document forms an integral part of the product and must be read and understood prior to using it. 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.

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For further information, refer to the following information products:

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

ⓘ 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 Information

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 JX3-CNT is a JX3 I/O module designed for use in machines and is intended for connection to an already existing controller.

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 Usage Other Than Intended

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. This device is NOT intended for the purpose of personal safety and must, therefore, not be used to protect persons.

2.2.3 Warnings used in this document

⚠ DANGER



High risk

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

⚠ WARNING



Medium risk

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

⚠ CAUTION



Low risk

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

NOTICE



Material damage

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

3 Product Description

The JX3-CNT module is a digital counter module.

3.1 Design

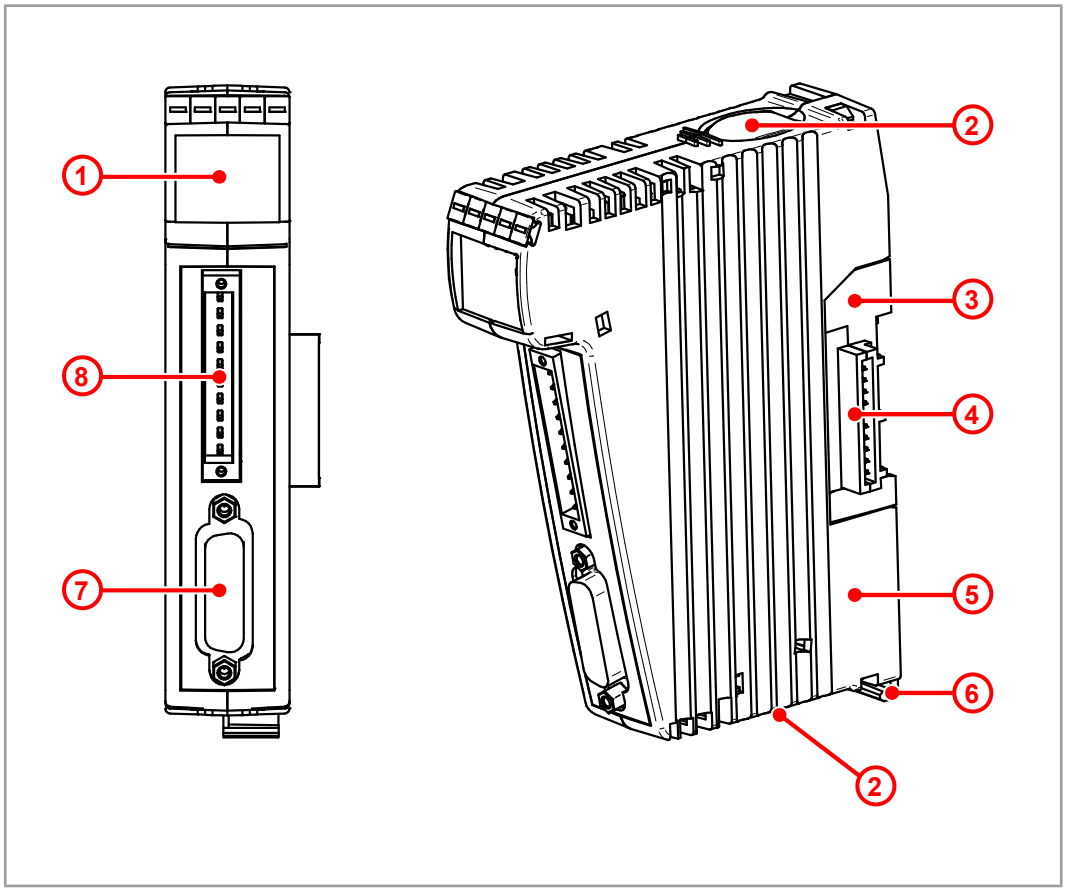


Fig. 1: Design

1	Status indication
2	DIN rail latch
3	Backplane module
4	Connector X119: Connection for JX3 I/O modules
5	Enclosure
6	DIN rail release latch
7	Female Sub-D connector X62: Connection for 5 V dual-channel counter or SSI encoder
8	Terminal X61: For connecting digital inputs/outputs

3.2 Product Features

- 24 V single-channel counter
- 24 V dual-channel counter
- 5 V dual-channel counter
- SSI (**S**ynchronous **S**erial **I**nterface)
- 4 multi-purpose I/Os

Additional Functions

- Application-specific scaling
- Monitoring of limit values
- Trailing indicator
- Forcing of count values
- Frequency measurement
- Period measurement
- Gating measurement
- 16-fold multi-strobe function
- Oscilloscope function
- Gate function
- Counter-controlled digital outputs

3.3 Status Indication

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

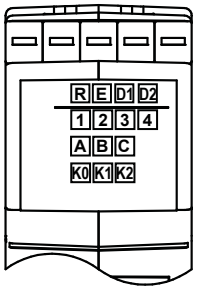


Fig. 2: Status indication

LED	Description
R	Run LED
E	Error LED
D1	Diagnostic function 1
D2	Diagnostic function 2
1	Status LED for multi-purpose I/O 1
2	Status LED for multi-purpose I/O 2
3	Status LED for multi-purpose I/O 3
4	Status LED for multi-purpose I/O 4
A	Status LED for counter A
B	Status LED for counter B
C	Status LED for counter C
K0	Status LED for dual-channel counter
K1	Status LED for dual-channel counter
K2	Status LED for dual-channel counter

3.3.1 Diagnostics Capabilities by Means of Status Indication

Color and status of the LEDs are an excellent source of information for analyzing various states. In the JetSym programming tool, diagnostics can be performed in the Hardware Manager or via the Setup pane by entering the corresponding register number.

LED	Status	Color	Description
R	OFF	---	Defect or no power supply
	ON	Green	Normal operating condition
E	OFF	---	No error
	ON	Red	Communication to bus head disabled
D1	OFF	---	Normal operating condition
	Blinking at 2 Hz	Red	Operating system update enabled
	ON	Red	Hardware error
D2	Blinking at 1 Hz	Red	Invalid operating system
	Blinking at 2 Hz	Red	Operating system update enabled

The yellow LEDs of the module indicate the digital level of the connected hardware. This lets you easily check, e.g., whether the connected counter is sending counting pulses.

Yellow Status LEDs for X61

The yellow LEDs are assigned to the following inputs on X61:

– I/O1 ... I/O4

– A ... C

If ...	... then ...
the voltage level is < +11 V,	the yellow LED is not lit.
the voltage level is > + 11 V,	the yellow LED is lit.

In case of multi-purpose I/Os, it does not make any difference regarding the LED status whether the terminal functions as an input, an output or a counter.

Yellow Status LEDs for X62

The yellow LEDs are assigned to the following inputs of X62:

– K0 ... K2

– SSI clock

– SSI data

If ...	... then ...
the **differential** voltage level is < 1.3 V,	the yellow LED is lit.
the **differential** voltage level is > 1.3 V,	the yellow LED is not lit.

LED	Status	Color	Description
1	OFF	---	Multi-purpose I/O 1 has low level

LED	Status	Color	Description
	ON	Yellow	Multi-purpose I/O 1 has high level
2	OFF	---	Multi-purpose I/O 2 has low level
	ON	Yellow	Multi-purpose I/O 2 has high level
3	OFF	---	Multi-purpose I/O 3 has low level
	ON	Yellow	Multi-purpose I/O 3 has high level
4	OFF	---	Multi-purpose I/O 4 has low level
	ON	Yellow	Multi-purpose I/O 4 has high level
A	OFF	---	Counter input A has low level
	ON	Yellow	Counter input A has high level
B	OFF	---	Counter input B has low level
	ON	Yellow	Counter input B has high level
C	OFF	---	Counter input C has low level
	ON	Yellow	Counter input C has high level
K0	OFF	---	Counter K0 - differential level is low
	ON	Yellow	Counter K0 - differential level is high
K1	OFF	---	Counter K1 - differential level is low
	ON	Yellow	Counter K1 - differential level is high
K2	OFF	---	Counter K2 - differential level is low
	ON	Yellow	Counter K2 - differential level is high

3.4 Nameplate

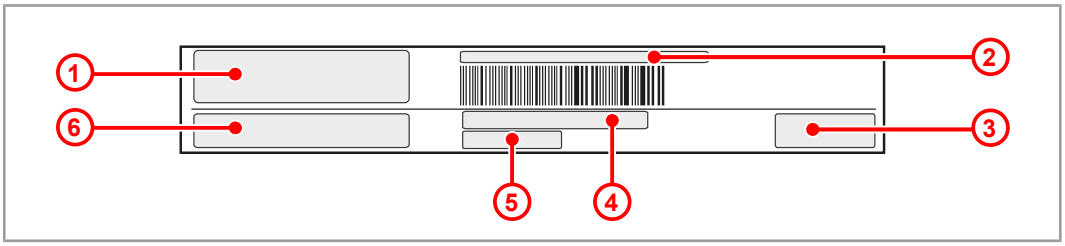


Fig. 3: Example of a nameplate

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

3.5 Scope of Delivery

Scope of delivery	Item number	Quantity
JX3-CNT	10000686	1
Male connector in spring-cage technology, 10-pin	60869252	1
OR		
JX3-CNT_PI	10001486	1
Male connector with PUSH-IN connection, 10-pin	60869254	1
AND		
Terminal labels	60870411	10
Keying pins	60870410	1
Installation manual	60872882	1

4 Technical Specifications

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

4.1 Dimensions

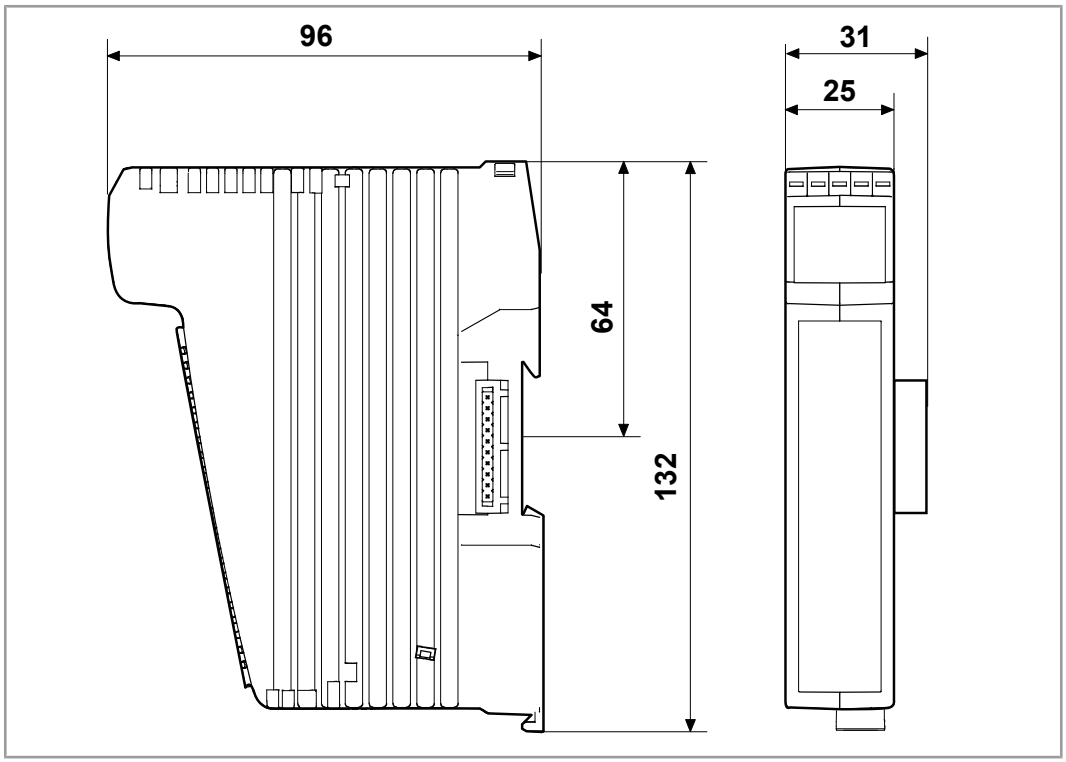


Fig. 4: Dimensions in mm

ⓘ Info

CAD data

CAD data of the device can be found in the download area of our homepage.

4.2 Mechanical Specifications

Parameter	Description	Standards
Mounting orientation	Vertically mounted on DIN rail	
Weight	150 g	
Enclosure specifications		
Material	Plastic	
Maximum height of fall		
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 ≤ 9 Hz
Constant acceleration	1 g	9 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. 1: Mechanical specifications

4.3 Electrical Properties

Parameter	Description	
4 single-channel counters 24 V I/O 1 ... I/O 4	Max. 1 kHz	Value range 32 bits
3 single-channel counters 24 V A, B, C	Max. 100 kHz	Value range 32 bits
1 dual-channel counter 24 V	Max. 500 kHz	Value range 32 bits
1 dual-channel counter 5 V	Max. 2 kHz	Value range 32 bits
SSI	Single-turn, multi-turn or linear absolute encoders	100 kHz, 200 kHz, 1 MHz
5 V operating point	Log. high, if level > 1.3 V	Differential
24 V operating point for multi-purpose I/O X61.I/O1 ... X61.I/O4	Log. low level: -30 V … +5 V	IEC 61131-2 Type 3 (input) IEC 61131-2 (output)
	Log. high level: +11 V ... +30 V	

Parameter	Description	
24 V operating point for counter inputs X61.A ... X61.C	Voltage range 0 V ... 30 V	Schmitt-Trigger inputs
	low level: < 2.2 V	
	high level: > 12 V	
Short-circuit capability	Yes	24 V encoder: max. 0.5 A; 5 V encoder: max. 0.2 A
Electrical isolation	None	
Certifications	CE	

Tab. 2: Electrical properties

Electrical Safety

Parameter	Description	Standards
Class of protection	III	DIN EN 61131-2
Dielectric test voltage	Functional ground is connected inside the device with the device ground.	
Protective connection	0	
Overvoltage category	II	

Tab. 3: Electrical safety

4.4 Environmental Conditions

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

Tab. 4: Environmental conditions

4.5 EMC Values

4.5.1 Enclosure

Emitted Interference

Parameter	Values	Standards
Frequency band	**30 MHz … 230 MHz**	DIN EN 61000-6-3 DIN EN 61131-2 DIN EN 55011
Limit value	30 dB (µV/m) at 10 m distance	
Frequency band	**230 MHz … 1,000 MHz**	
Limit value	37 dB (µV/m) at 10 m distance	
	Class B	

Tab. 5: 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
Discharge through air Test peak voltage	4 kV	
	Criterion A	

Tab. 6: Immunity to interference

4.5.2 DC Power Supply Inputs and Outputs

Emitted Interference

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

Tab. 7: Emitted interference of the DC power supply inputs and outputs

Immunity to Interference

Parameter	Values	Standards
RF field, asymmetric, amplitude-modulated		

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

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

4.5.3 Shielded Data and I/O Lines

Immunity to Interference

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

Tab. 9: Immunity of shielded data and I/O lines

Interference Immunity of Functional Earth Connection

Parameter	Values	Standards
RF field, asymmetric, amplitude-modulated		
Frequency band	0.15 MHz … 80 MHz	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-6
Test voltage	3 V	
	AM 80 % with 1 kHz	
Source impedance	150 Ω	
	Criterion A	
Bursts		
Test voltage	1 kV	DIN EN 61000-6-2 DIN EN 61000-6-2 DIN EN 61000-4-4
	tr/tn 5/50 ns	
Repetition frequency	5 kHz	
	Criterion A	

Tab. 10: Interference Immunity of Functional Earth Connection

5 Mechanical Installation

This chapter describes how to install and remove the JX3-CNT.

NOTICE

Damaged devices

Damaged devices may cause considerable physical damage.

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

5.1 Installing Device on DIN Rail

NOTICE

Functional impairment caused by unfavorable installation

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

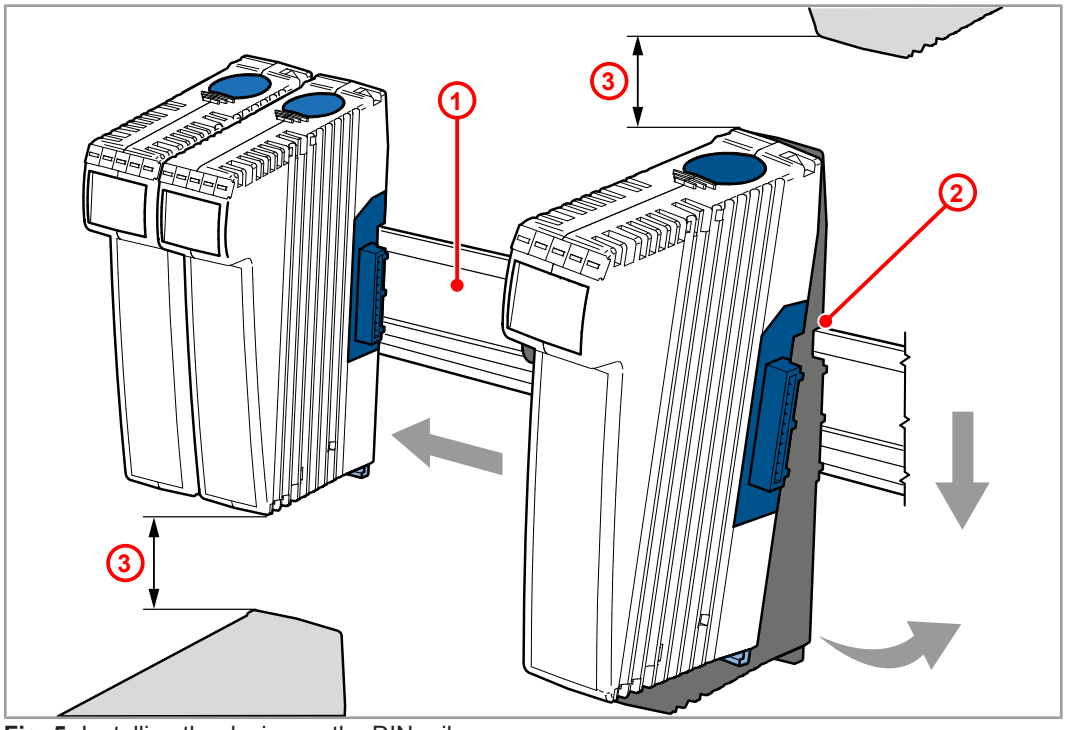


Fig. 5: Installing the device on the DIN rail

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

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

5.2 Removing Device from DIN Rail

The release latch lets you remove the device from the DIN rail.

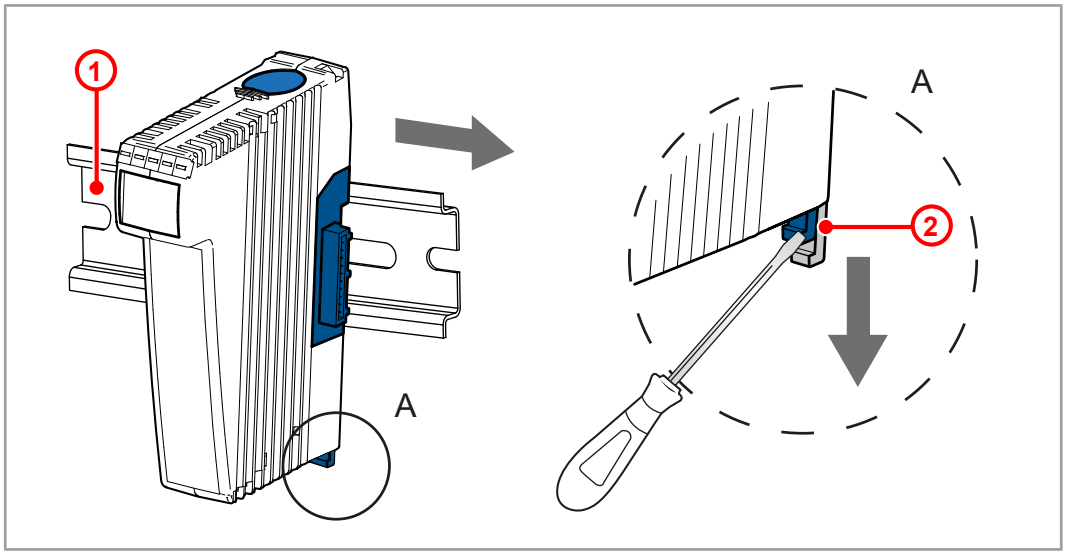


Fig. 6: Removing the device from the DIN rail

1	DIN rail
2	DIN rail release latch
3	Detail view

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

5.3 Dismounting Enclosure from Backplane Module

The upper and the lower backplane latch on the module let you pull off the enclosure from the backplane module.

NOTICE

Mechanical damage and reduced EMC noise immunity

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

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

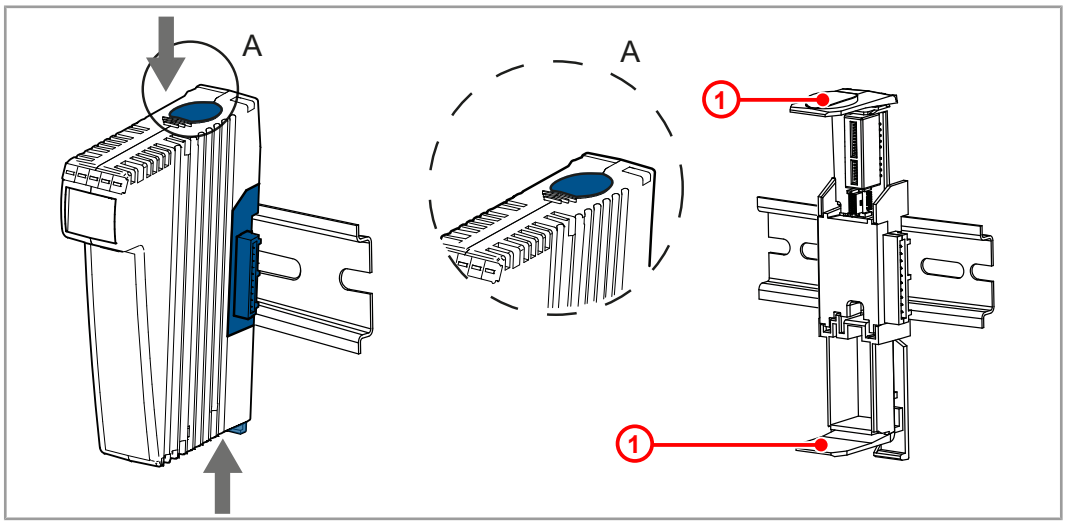


Fig. 7: Dismounting the enclosure from the backplane module

1	DIN rail latch
A	Detail view

1. Disconnect the system from the power supply.
2. Press the upper and lower latches (1) on the device simultaneously.
3. Keep the latches pressed and pull off the enclosure from the front.

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

The noise immunity of a system 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 our website.

DIN Rail

- Attach the JX3-CNT device to a DIN rail to EN 60715 with the dimensions 35 x 7.5 mm.
- The DIN rail must be electrically conducting and grounded by either of the following two ways:
  - Directly:
  - Via rear panel of the electric cabinet

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.
- Draw the entire shield, **in its entire perimeter**, behind the isolation. For **wide-area grounding**, clamp it down tightly with an extensively earthed strain relief.

Use of Connectors

– Clamp the shield down **entirely** using the shielding clamp of the metalized connector enclosure (impedance shielding), or the EMC-compliant gland bushing. For **wide-area** grounding, clamp it down tightly using a strain relief.

– Only use metalized connectors, e.g. Sub-D with metalized enclosure. Make sure that the strain relief is directly connected with the enclosure.

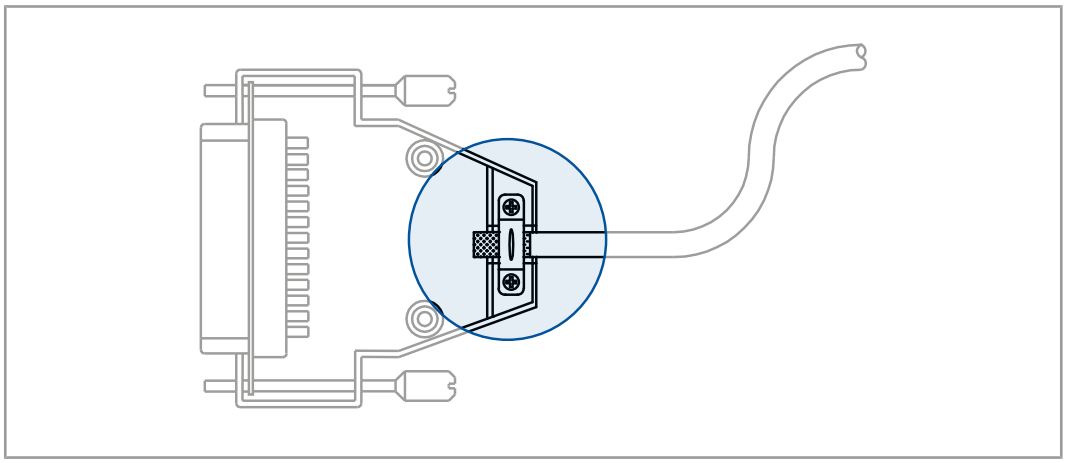


Fig. 8: Strain relief on the Sub-D enclosure

Use of Clamps

To ensure the highest level of noise immunity, use extensive shielding measures.

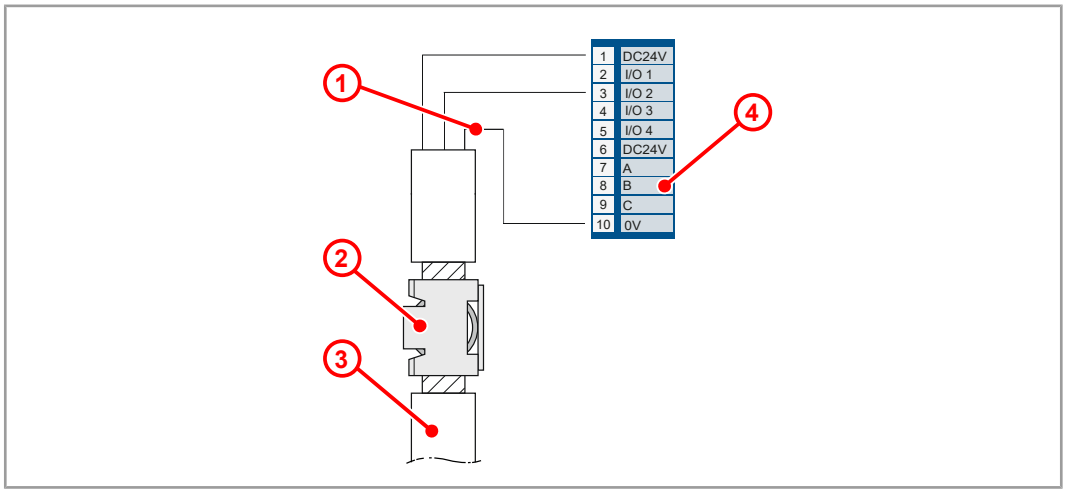


Fig. 9: Shielding measures

1	Line to the digital sensor/actuator
2	Shield clamp
3	Drain wire (copper)
4	JX3-CNT

Cables for Counting Pulses

– Use twisted cables for differential counting pulses.

– For differential pulses, use cables with separately shielded twisted pairs.

6.2 Interfaces

6.2.1 Overview of Features and Interfaces

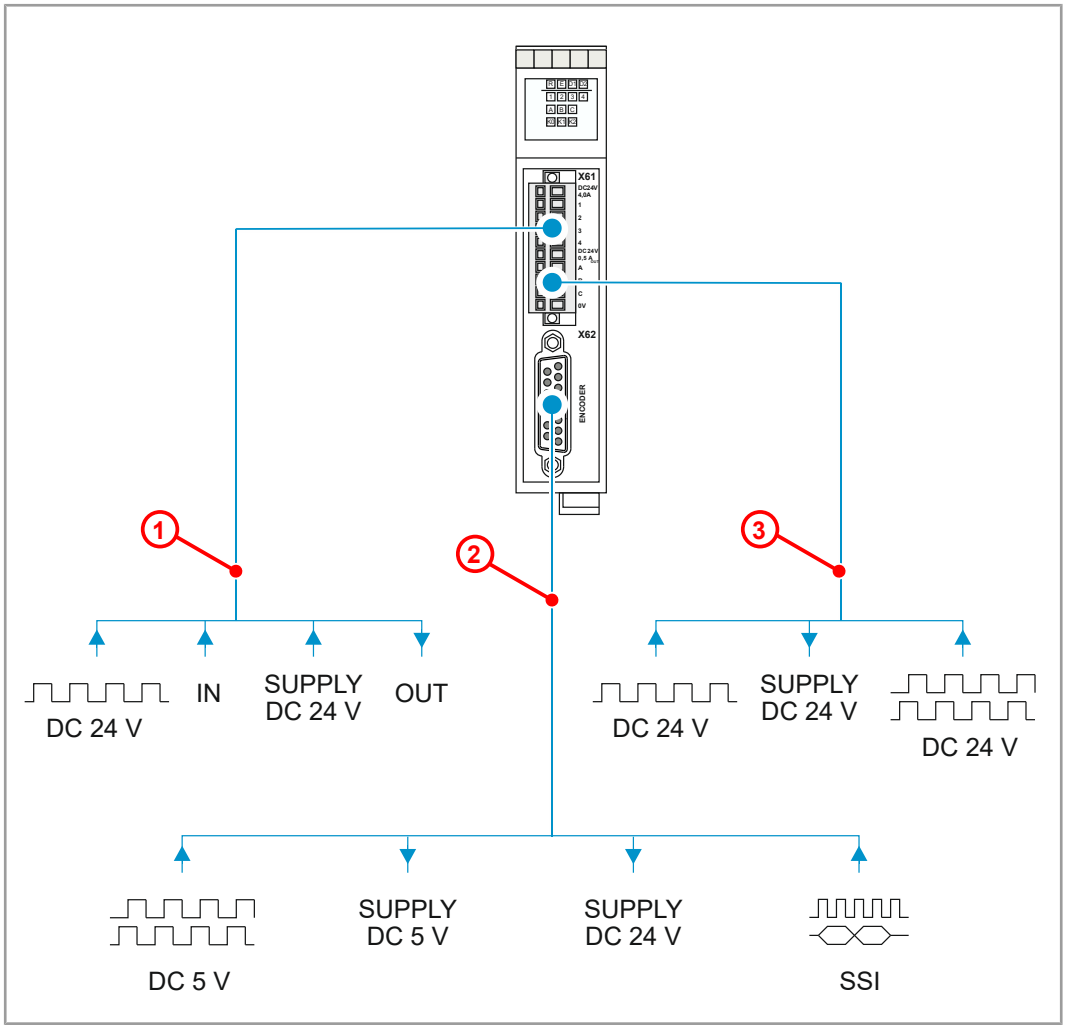


Fig. 10: Overview of features and interfaces

Number	Part	Feature
1	Terminal X61, upper part	– Single-channel counter, 24 V – Multi-purpose I/Os – 24 V control signals: Reference, gate, strobe – Counter-controlled digital outputs, 24 V
2	Female Sub-D connector X62	– 5 V dual-channel counter – Connection for SSI encoder – 24 V power supply for encoders – 5 V power supply for encoders
3	Terminal X61, lower part	– 24 V dual-channel counter – 24 V power supply for encoders

6.2.2 Simultaneous Utilization of Interfaces

Several interfaces on the JX3-CNT module use the same terminal points. During engineering, take into account which function is to be used on which interface. There are some restrictions that apply to their simultaneous utilization.

Simultaneous Utilization of Counters

The table below shows that certain combinations are allowed but make no sense, such as combining SSI and 5 V dual-channel counter.

	24 V single-channel	24 V incr.	5 V incr.	SSI
24 V single-channel	x	x	x	x
24 V incr.	x	x	x	x
5 V incr.	x	x	x	-
SSI	x	x	-	x

Simultaneous Utilization of X61.1 ... X61.4

The following functions can be connected to terminal points X61.1 ... X61.4:

– 24 V single-channel counter
– 24 V control signals from gate, strobe and reference input
– Counter-controlled digital 24 V outputs
– Multi-purpose I/Os

Any terminal point can perform any function, but only one function at a time.

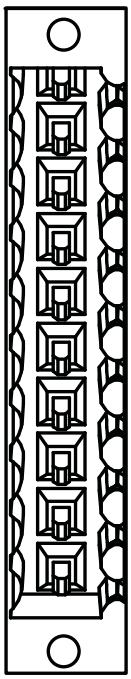
6.2.3 Terminal X61

Interfaces

X61 lets you connect the following:

– Digital 24 V levels as inputs or outputs
– Strobe, gate and reference input as additional function
– Switching counter-controlled outputs
– 24 V single-channel counter
– 24 V dual-channel counter

Pinning



Terminal	Terminal point	Description
X61	DC24 V 4.0 A	Power supply for outputs and SSI driver on the module
	I/O 1	Multi-purpose I/O: Can be used as a single-channel counter, gate, strobe or reference input or as a digital output
	I/O 2	Multi-purpose I/O: Can be used as a single-channel counter, gate, strobe or reference input or as a digital output
	I/O 3	Multi-purpose I/O: Can be used as a single-channel counter, gate, strobe or reference input or as a digital output
	I/O 4	Multi-purpose I/O: Can be used as a single-channel counter, gate, strobe or reference input or as a digital output
	DC24 V 0.5 A OUT	24 V encoder supply
	A	24 V single-channel counter; K0 24 V dual-channel counter
	B	24 V single-channel counter; K1 24 V dual-channel counter
	C	24 V single-channel counter; K2 24 V dual-channel counter
	0 V	Reference potential

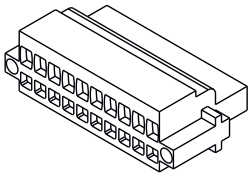
ⓘ Info

Utilization of Encoder Supply

If terminal X61 or Sub-D connector X62 are to be used to supply encoders with power, connect the 24 V power supply voltage to terminal X61.DC24 V4.0A.

A power supply voltage connected to X61.DC24 V4.0A supplies the following terminals with power:

– X61.DC24V0.5A OUT
– X62.10: DC +5 V 0.2 A encoder supply
– X62.12: DC +24 V 0.5 A encoder supply

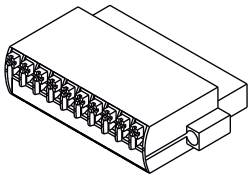


10-pin connector, spring-cage technology

Parameter	Description	Standards
Connector		
Designation	BU_10_E_BLZF_GE_RM3.5	
Item number	60869252	
Connector technology	Spring-cage connection	
Type	10-pin, 3.5 mm pattern	
Connectible conductors		
Outer diameter of the isolation	Max. 2.90 mm	
AWG	16 … 28	
Terminal range	0.13 … 1.5 mm²	
Stripping length	10 mm	
Specification without wire end ferrules		
Solid conductor	H05(07) V-U	
	0.2 … 1.5 mm²	
Flexible conductor	H05(07) V-K	
	0.2 … 1.5 mm²	
Specification with wire end ferrules		
Wire end ferrule without sleeve	0.2 … 1.5 mm²	DIN 46228/1
Wire end ferrule with sleeve	0.2 … 1.5 mm²	DIN 46228/4
Crimping tool	PZ 4, PZ 6 ROTO, PZ 6/5	DIN 46228

Tab. 11: Connector specification, 10-pin connector, spring-cage technology

10-pin male connector with PUSH-IN connection



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

Tab. 12: Connector specification, 10-pin, PUSH-IN connection

Terminal X61 block diagram

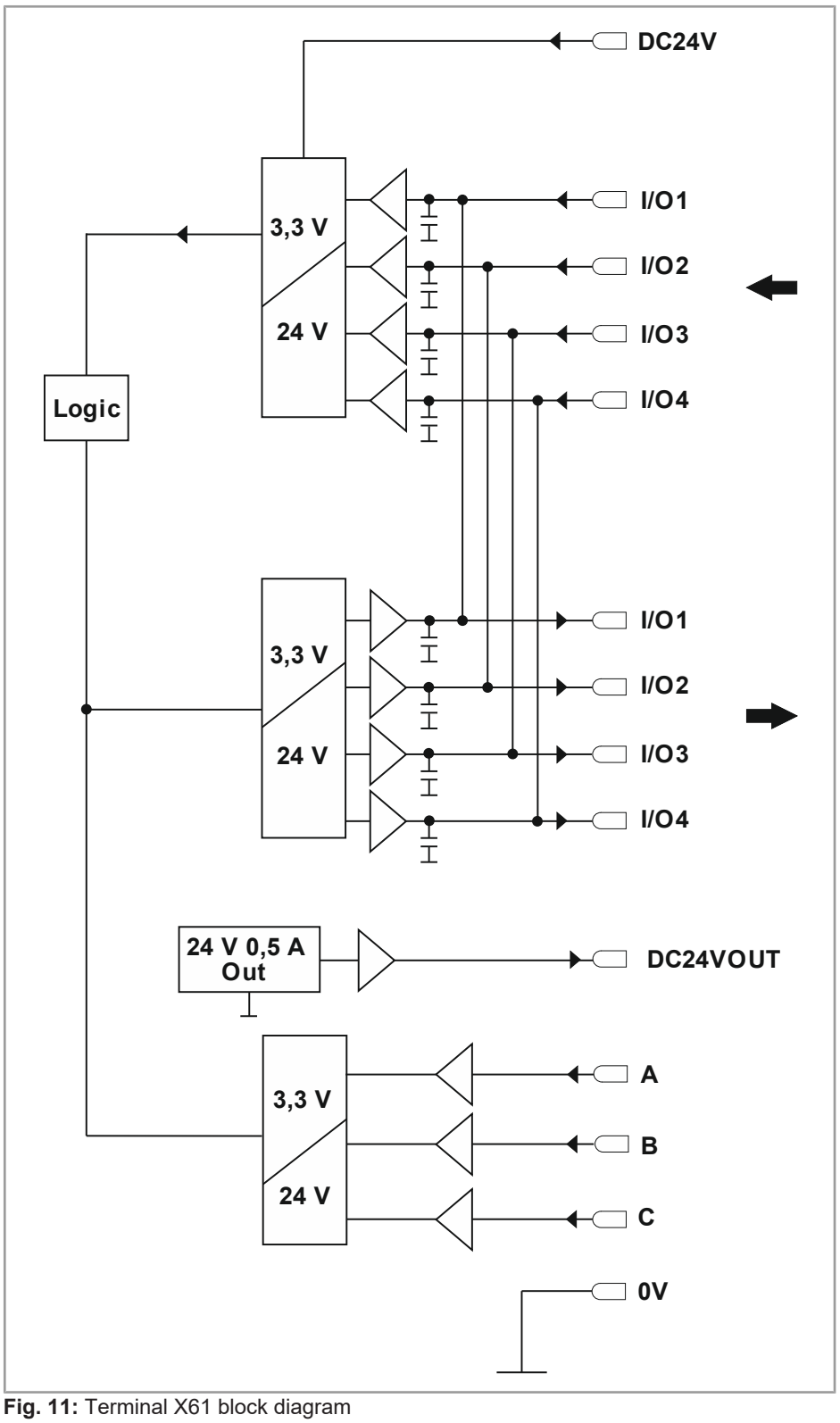


Fig. 11: Terminal X61 block diagram

Part	Description
Logic circuit	Digital evaluation
24 V/5 V	Level converter

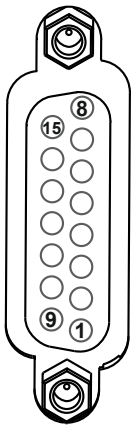
6.2.4 Female Sub-D Connector X62 – SSI Encoder and 5 V Dual-Channel Counter

Interfaces

Connect the following to female Sub-D connector X62:

– SSI encoder
– 5 V dual-channel counter, differential

Pinning



Pin	Description
1	Reference potential
2	5 V dual-channel counter: K0+ or SSI encoder: Clock+
3	5 V dual-channel counter: K0- or SSI encoder: Clock-
4	5 V dual-channel counter: K1+ or SSI encoder: Data+
5	5 V dual-channel counter: K1- or SSI encoder: Data-
6	5 V dual-channel counter: K2+
7	5 V dual-channel counter: K2-
8	5 V dual-channel counter: K0- or SSI encoder: Clock-
9	5 V dual-channel counter: K0+ or SSI encoder: Clock+
10	DC +5 V 0.2 A encoder supply
11	n. c.*
12	DC +24 V 0.5 A encoder supply
13	24 V single-channel counter; K0 24 V dual-channel counter
14	24 V single-channel counter; K1 24 V dual-channel counter
15	24 V single-channel counter; K2 24 V dual-channel counter
*n. c. = not connected (= without function)	

ⓘ Info

Utilization of Encoder Supply

If terminal X61 or Sub-D connector X62 are to be used to supply encoders with power, connect the 24 V power supply voltage to terminal X61.DC24 V4.0A.

A power supply voltage connected to X61.DC24 V4.0A supplies the following terminals with power:

– X61.DC24V0.5A OUT
– X62.10: DC +5 V 0.2 A encoder supply
– X62.12: DC +24 V 0.5 A encoder supply

Male Sub-D connector

Category	Description	
Connector technology	Soldering technology	
Type	Sub-D, 15-pin	male
Design	Free wiring	

Tab. 13: Connector specification, male Sub-D connector

Female Sub-D connector X62 block diagram

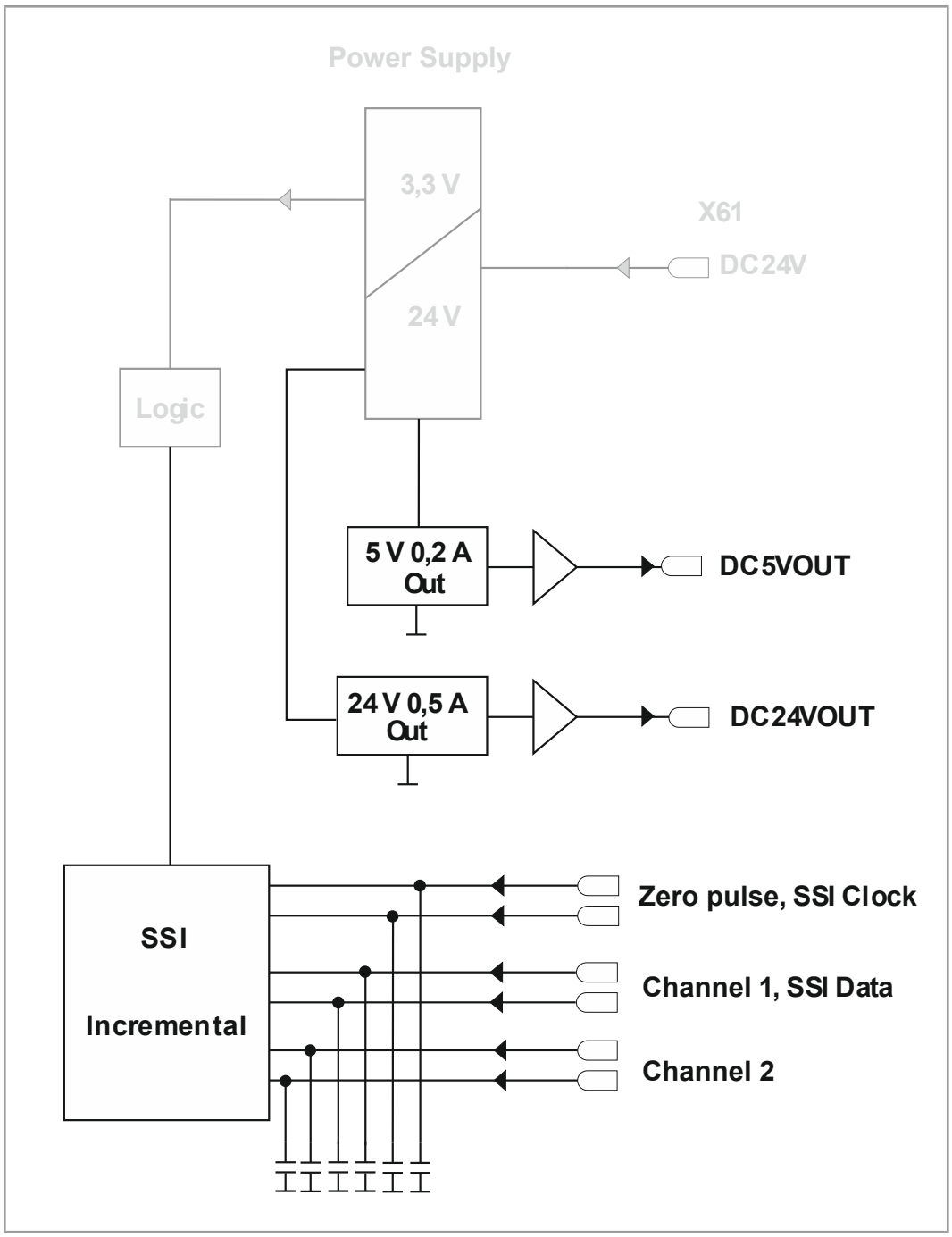


Fig. 12: Female Sub-D connector X62 block diagram

Part	Description
Logic circuit	Digital evaluation
24 V/5 V	Power supply
SSI incremental encoder	Counter inputs shown as a block
Zero pulse, SSI clock	Input for differential zero pulse, or SSI clock output
Channel # 1, SSI data	Input for differential counting pulses - channel # 1, or input for SSI data
Channel # 2	Input for differential counting pulses - channel # 2

6.3 Connecting Digital Sensors

Design of Cable

The design of the cable for connecting sensors must meet the following requirements:

– Shielded cable with 85 % coverage

– Drain wire, tin-coated copper

Separation of Load and Logic Voltage

If the load and logic voltages are supplied separately, all actuators are de-energized when the load voltage is switched off. At the same time, communication with the JX3 station and the sensors is maintained.

For separation of load and logic voltage, the following groups have to be supplied separately:

– Power supply of the JX3 station

– Power supply of the digital sensors or actuators on the JX3 station

Connecting Digital Sensors

If you use the multi-purpose I/Os or the encoder supply at X61/X62, you must connect DC +24 V to X61.DC24 V4.0A.

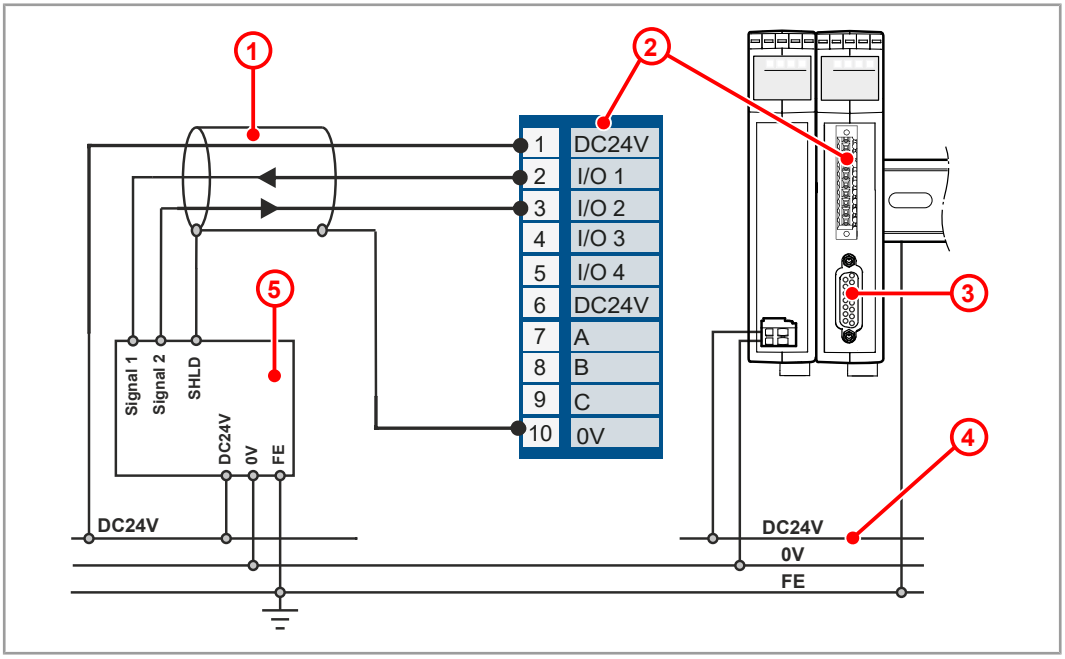


Fig. 13: Connecting digital sensors

1	Line to the digital sensor/actuator
2	X61
3	X62
4	Power supply for the JX3 station
5	Digital sensor or actuator

6.4 Connecting a 24 V Single-Channel Counter

Design of Cable

The design of the cable must meet the following requirements:

– Shielded cable with 85 % coverage

– Drain wire, tin-coated copper

– Cable cross-section 0.14 mm^2

Connecting a 24 V Single-Channel Counter

Single-channel counters are connected to all four multi-purpose I/Os and to inputs X61.A ... X61.C in the same way. The following illustration shows a single-channel counter connected to multi-purpose input X61.I/O1.

Please note that the maximum frequency supported by inputs X61.I/O1 ... X61.I/O4 is 1 kHz.

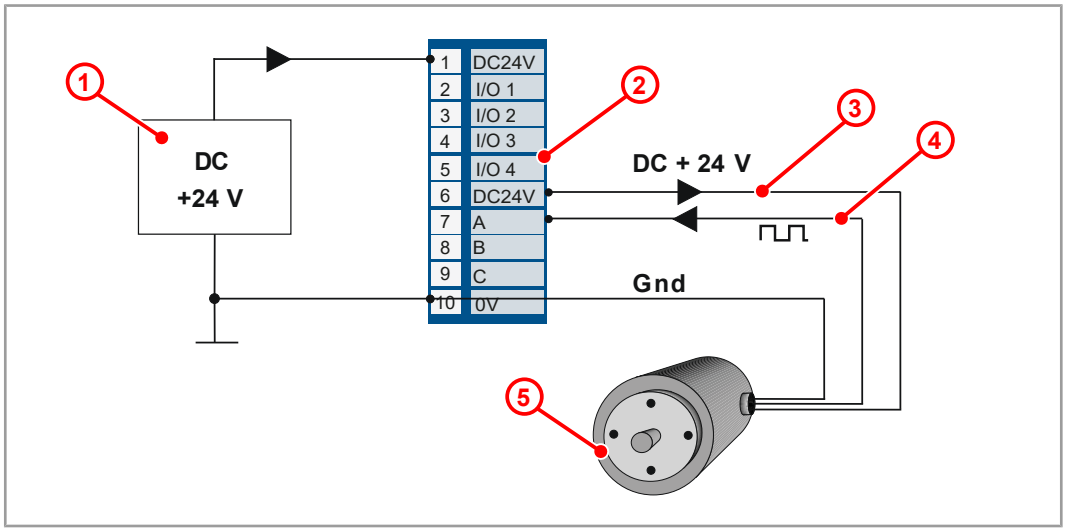


Fig. 14: Single-channel counter at terminal X61

1	External power supply unit, 24 V
2	Terminal X61
3	Encoder supply, 24 V, 0.5 A
4	Counting pulses, 24 V
5	Counter with pulse output

Input Terminals for 24 V Single-Channel Counter

This module lets you connect a 24 V single-channel counter to the following terminals:

Terminal point	Feature
X61.I/O1	Multi-purpose I/O (24 V) as input 1
X61.I/O2	Multi-purpose I/O (24 V) as input 2
X61.I/O3	Multi-purpose I/O (24 V) as input 3
X61.I/O4	Multi-purpose I/O (24 V) as input 4
X61.A	Input A (24 V)
X61.B	Input B (24 V)
X61.C	Input C (24 V)

Tab. 14: Input terminals for 24 V single-channel counter

ⓘ Info

Improving EMC noise immunity

For improving EMC noise immunity, follow the rules listed below:

– Connect the copper drain wire directly to terminal X61.0V.

– Use a shield clamp to provide additional grounding of the shield.

6.5 Connecting a 24 V Dual-Channel Counter

Design of Cable

The design of the cable must meet the following requirements:

– Shielded cable with 85 % coverage
– Drain wire, tin-coated copper
– Cable cross-section 0.14 mm²

Connecting a 24 V Dual-Channel Counter

Connect the dual-channel counter to inputs X61.A ... X61.C. If you wish to connect a dual-channel counter without zero pulse signal, do not use X61.A, but connect it only to counter inputs X61.B and X61.C.

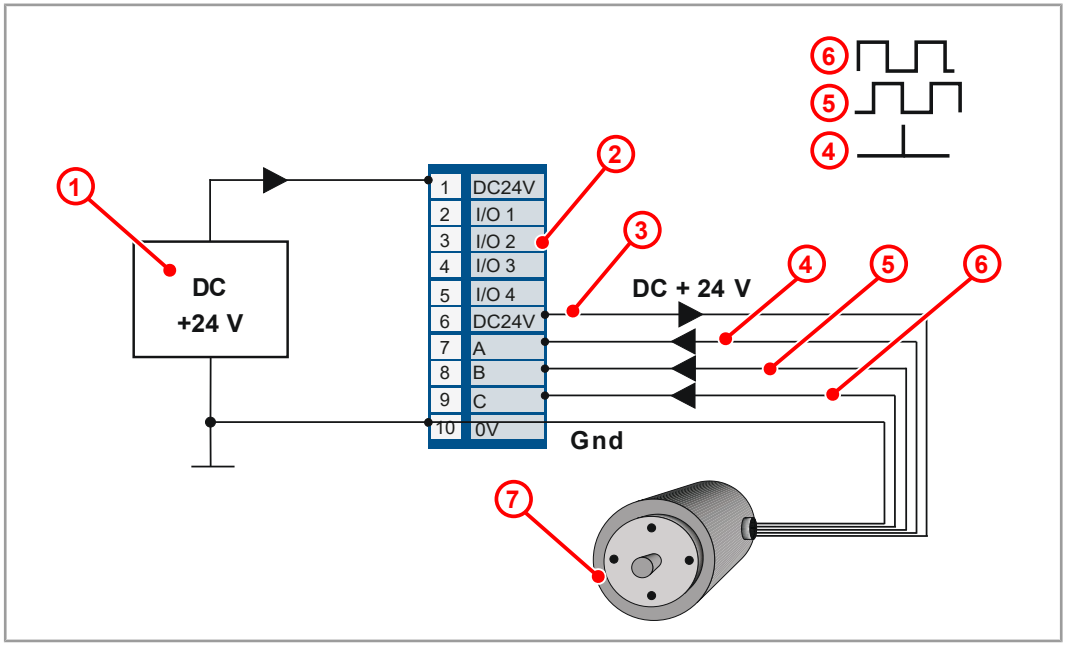


Fig. 15: Connection of dual-channel counter to X61

1	External power supply unit, 24 V
2	Terminal X61
3	Encoder supply, 24 V, 0.5 A
4	Zero pulse at X61.A
5	Counting pulse at X61.B
6	Counting pulse at X61.C
7	Counter

Connecting a 24 V Incremental Encoder

The marking of incremental encoder pinout often differs.

If the connections of the incremental encoder have got pinouts marked with A, B and Z, connect it as listed below:

Pinout marking on incremental encoder	Feature	Terminal point X61
A	Counting pulse	X61.B
B	Counting pulse	X61.C
Z	Reset pulse	X61.A

Tab. 15: Connections of the incremental encoder A, B and Z

If the connections of the incremental encoder have got pinouts marked with K0, K1 and K2, connect it as listed below:

Pinout marking on incremental encoder	Feature	Terminal point X61
K0	Reset pulse	X61.A
K1	Counting pulse	X61.B
K2	Counting pulse	X61.C

Tab. 16: Connections of the incremental encoder K0, K1 and K2

If the zero pulse signal is not required, do not use X61.A, but connect the incremental encoder pins only to counter inputs X61.B and X61.C.

ⓘ Info

Improving EMC noise immunity

For improving EMC noise immunity, follow the rules listed below:

– Connect the copper drain wire directly to terminal X61.0V.

– Use a shield clamp to provide additional grounding of the shield.

6.6 Connecting an SSI Encoder

Design of Cable

The design of the cable for connecting SSI encoders must meet the following requirements:

– Shielded cable with 85 % coverage
– Drain wire, tin-coated copper

Shielding for SSI encoder

Custom-made SSI encoder cables must meet the following requirements:

– Twisted pair conductors for SSI clock
– Twisted pair conductors for SSI data
– Option: separately shielded twisted pair conductors
– Connect low-resistant shielding to the connector
– Use a metal connector enclosure

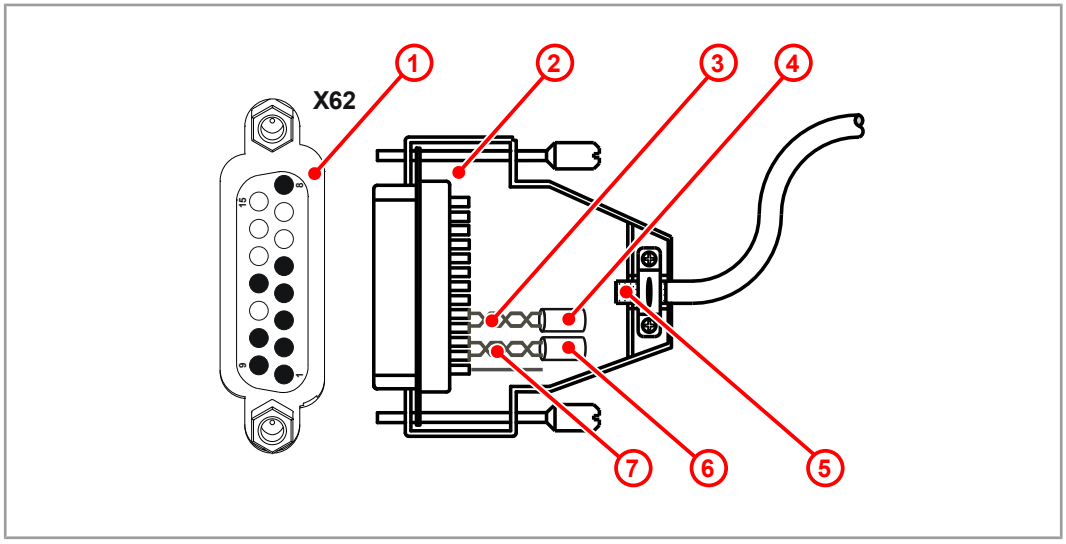


Fig. 16: Shielding for SSI encoder

1	15-pin female Sub-D connector: X62
2	15-pin male SUB-D connector for connection to X62
3	Twisted pair conductors for SSI data
4	Shield for twisted pair conductors
5	Shield
6	Shield for twisted pair conductors
7	Twisted pair conductors for SSI clock

Connecting an SSI Encoder

To connect an SSI encoder, proceed as follows:

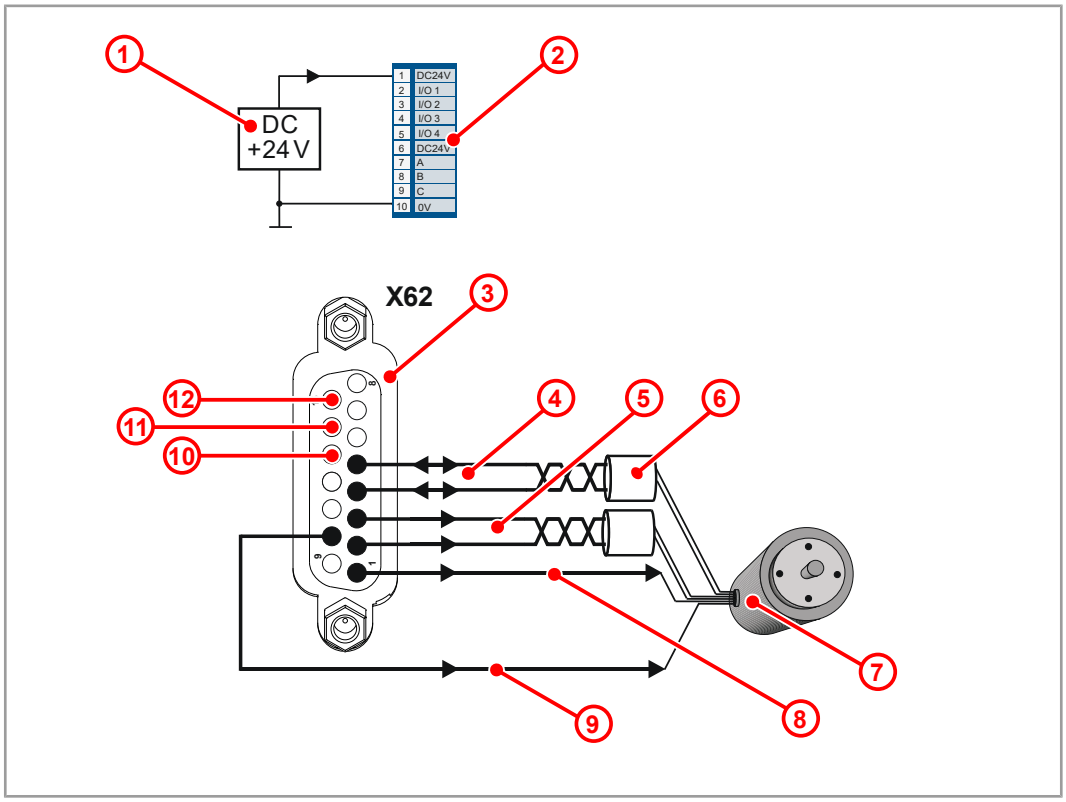


Fig. 17: Connecting an SSI encoder to X62

1	External power supply unit, DC +24 V
2	Terminal X61
3	15-pin female Sub-D connector: X62
4	SSI data
5	SSI clock
6	Shielding for SSI data
7	SSI encoder
8	Reference potential (GND)
9	Encoder supply, DC +5 V
10	Connection A (see X61.4)
11	Connection B (see X61.5)
12	Connection C (see X61.6)

ⓘ Info

Utilization of Encoder Supply

If terminal X61 or Sub-D connector X62 are to be used to supply encoders with power, connect the 24 V power supply voltage to terminal X61.DC24 V4.0A.

A power supply voltage connected to X61.DC24 V4.0A supplies the following terminals with power:

– X61.DC24V0.5A OUT
– X62.10: DC +5 V 0.2 A encoder supply
– X62.12: DC +24 V 0.5 A encoder supply

6.7 Connecting a 5 V Incremental Encoder

Design of Cable

The design of the cable for connecting counting pulses must meet the following requirements:

– Shielded cable with 85 % coverage
– Drain wire, tin-coated copper

Shielding for incremental encoders

Custom-made incremental encoder cables must meet the following requirements:

– Twisted pair conductors - K0
– Twisted pair conductors - K1
– Twisted pair conductors - K2
– Option: separately shielded twisted pair conductors
– Connect low-resistant shielding to the connector
– Use a metal connector enclosure

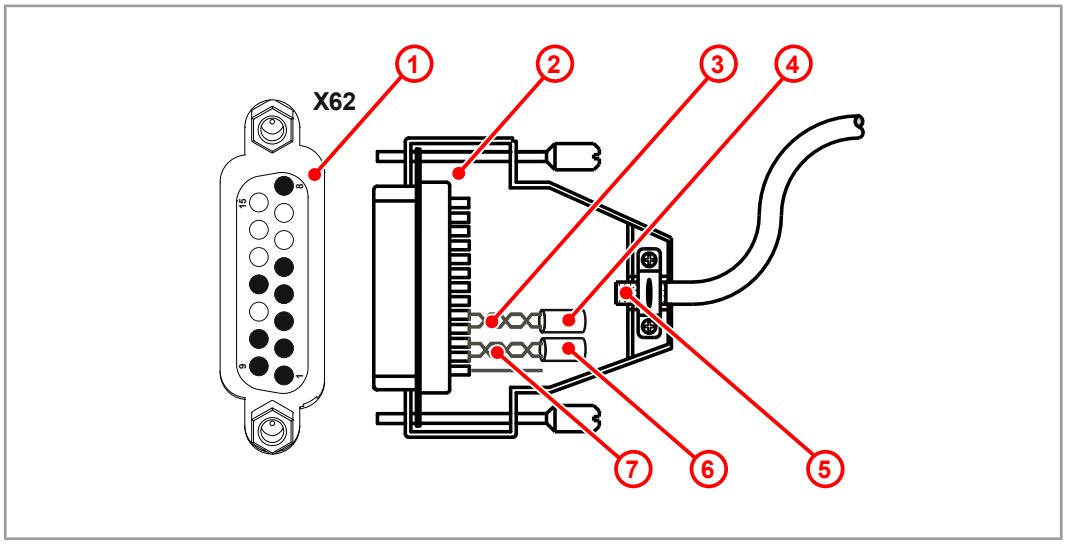


Fig. 18: Shielding for incremental encoders

1	15-pin female Sub-D connector: X62
2	15-pin male SUB-D connector for connection to X62
3	Twisted pair conductors - K0 (example)
4	Shield for twisted pair conductors
5	Shield
6	Shield for twisted pair conductors
7	Twisted pair conductors - K1 (example)

Connecting an Incremental Encoder

When using the encoder supply, connect an external power supply unit (DC +24 V) to X61.DC24 V4.0A.

You can connect the supply of a +5 V encoder to X62.10 or connect the supply of a +24 V encoder to X62.12.

To connect an incremental encoder, proceed as follows:

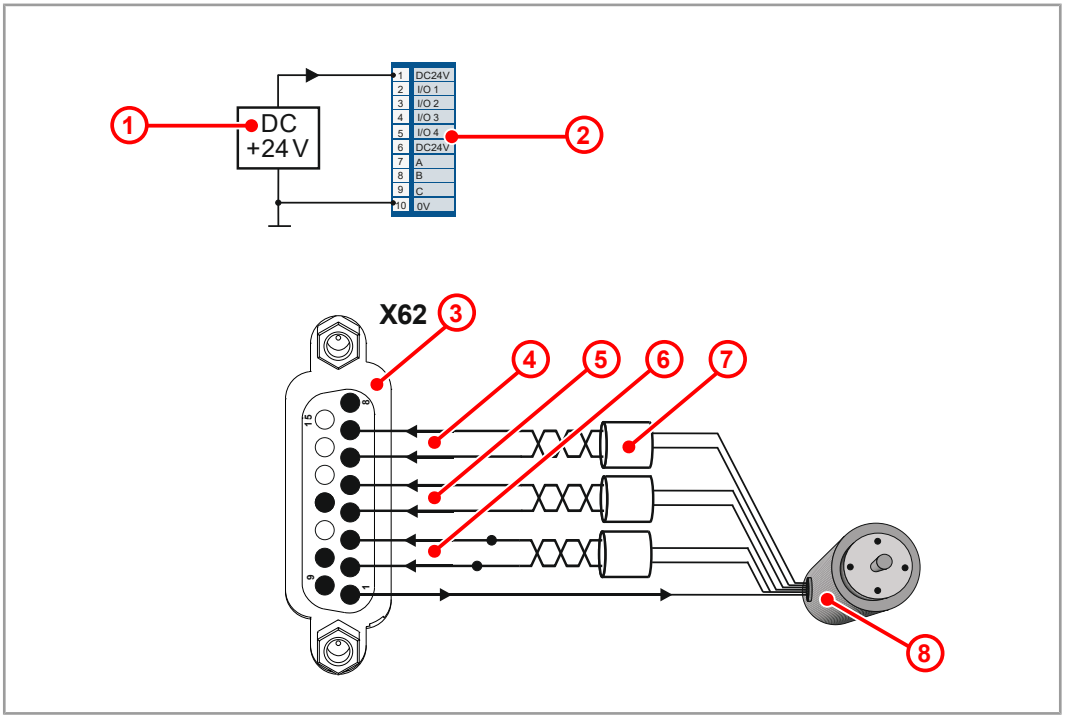


Fig. 19: Connection of incremental encoder to X62, simplified

1	External power supply unit, DC +24 V
2	Terminal X61
3	15-pin female Sub-D connector: X62
4	Differential input K2
5	Differential input K1
6	Differential input K0, zero pulse
7	Option: separately shielded twisted pair conductors
8	Incremental encoder

Complete Wiring Diagram

Due to compatibility reasons, some signals are assigned to two pins of the Sub-D connector.

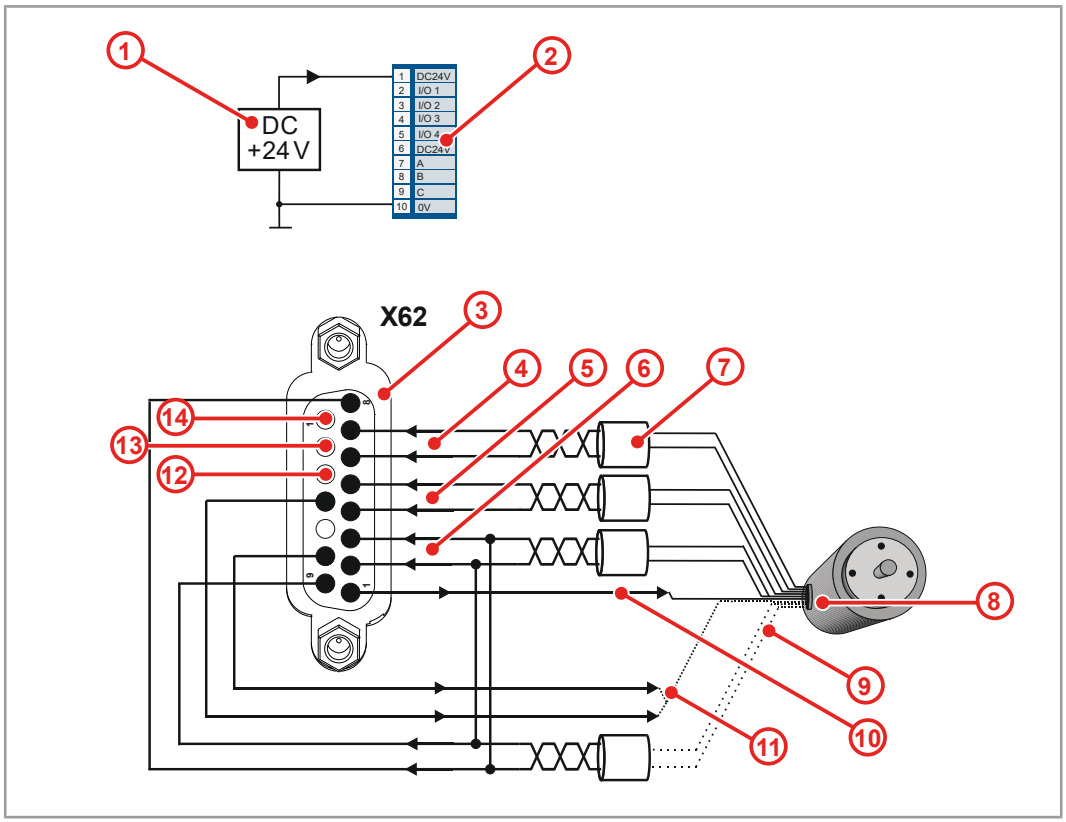


Fig. 20: Complete wiring diagram of incremental encoder to X62

1	External power supply unit, DC +24 V
2	Terminal X61
3	15-pin female Sub-D connector: X62
4	Differential input K2
5	Differential input K1
6	Differential input K0, zero pulse
7	Option: separately shielded twisted pair conductors
8	Incremental encoder
9	Differential input K0, zero pulse
10	Reference potential (GND)
11	Encoder supply +24 V (at X62.12) or +5 V (at X62.10)
12	Connection A (see X61.4)
13	Connection B (see X61.5)
14	Connection C (see X61.6)

Marking of Incremental Encoder Pinout

The marking of incremental encoder pinout often differs.

If the incremental encoder has got a pinout marked with A, B and Z, connect it as listed below:

Pinout marking on incremental encoder	Feature	Connection X62
A	Counting pulse, positive	X62.4
/A	Counting pulse, negative	X62.5
B	Counting pulse, positive	X62.6
/B	Counting pulse, negative	X62.7
Z	Zero pulse, positive	X62.2
/Z	Zero pulse, negative	X62.3

Tab. 17: Pinout markings of the incremental encoder A, B and Z

If the incremental encoder has got a pinout marked with K0, K1 and K2, connect it as listed below:

Pinout marking on incremental encoder	Feature	Pinning at connection X62
K0	Reset pulse	X62.2 and X62.3
K1	Counting pulse	X62.4 and X62.5
K2	Counting pulse	X62.6 and X62.7

Tab. 18: Pinout markings of the incremental encoder K0, K1 and K2

ⓘ Info

Improving EMC noise immunity

For improving EMC noise immunity, follow the rules listed below:

– Connect the copper drain wire directly to GND.

– Use a shield clamp to provide additional grounding of the shield.

7 Identification

This chapter describes the identification of the JX3-CNT:

– Determining the versions of the module

– Retrieving Electronic Data Sheet (EDS) information. The EDS holds numerous non-volatile production-relevant data.

Requirements

To be able to identify the module, the following requirements must be fulfilled:

– The module has been connected to a JC controller.

– The controller must be connected to a PC.

– The JetSym programming software has been installed on the PC.

– The minimum requirements regarding modules, controllers and software are fulfilled.

7.1 Electronic Data Sheet EDS

Each device in a JX3 system features an Electronic Data Sheet EDS. Numerous production-relevant data are permanently stored in the EDS. The EDS data can be read out via files in the file system of the controller or via special registers.

7.1.1 EDS Registers

Use the EDS registers to retrieve Electronic Data Sheet (EDS) information. These registers contain the exact same information as the EDS file. They are read only (ro).

Register Numbers

The basic register number is dependent on the controller. The register number is calculated by adding the number of the module register (MR) to the number of the basic register.

Device	Basic register number	Register numbers
JX3 bus master (e.g. JC-4xx)	100000	100500 ... 100827

Tab. 19: EDS register numbers

Register Overview

The following table gives an overview of the EDS registers. By means of this register array, you can have the EDS of the controller or of a JX3 module displayed. For this, you must select the controller or the desired JX3 module via module registers 500 and 501. Data of the selected EDS can be retrieved from MR 600 onwards.

Register	Section in eds.ini	Name in eds.ini	Description
MR 500	-	-	Functional group 0: CPU 1: JX3 modules
MR 501	-	-	Module number (if MR 500 > 0)
MR 600	IDENTIFICATION	Version	Version of this section
MR 601		Code	Module code
MR 602 … MR 612		Name	Module name or controller name
MR 613		PcbRev	PCB revision
MR 614		PcbOpt	PCB option
MR 700	PRODUCTION	Version	Version of this section
MR 701 … MR 707		SerNum	Serial number
MR 708		Day	Production date: Day
MR 709		Month	Production date: Month
MR 710		Year	Production date: Year
MR 711		TestNum	Internal usage
MR 712		TestRev	Internal usage

Tab. 20: EDS register summary

7.2 Version Registers

Each JX3 module features software with a unique revision number which can be read out via module registers. You will need these revision data if you have to contact the hotline of Bucher Automation AG in case of a problem.

Format of Software Version Numbers

The software version numbers of JX3-CNT are represented by four numbers.

1 . 2 . 3 . 4

Fig. 21: Software version numbers

Digits	Description
1	Major or main version number
2	Minor or secondary version number
3	Branch or intermediate version number
4	Build version number

Tab. 21: Format of software version numbers

Released Version A released version is identified by both the branch and build values being 0.

Register Overview The versions can be read out from the following registers:

Register	Description
MR 0009	OS version
MR 0032	FPGA version
MR 0769	Bootloader version

Tab. 22: Register overview

8 Programming

8.1 Abbreviations, Module Register Properties and Formats

Abbreviations

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

Abbreviation	Description
R 100	Register 100
MR 150	Module register 150

Tab. 23: Abbreviations

Module Registers Marked with y

Character y is assigned to module registers which have the same function for all counters. Y is a placeholder for the counter number.

Module register:

1yzz

y = Counter number

zz = Consecutive number

Module Register Properties

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

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

Tab. 24: Module register properties

Numerical formats

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

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

Tab. 25: Numerical formats

8.2 Addressing I/O Expansion Modules

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

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

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

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

- Controller model
- Type of connection between controller and expansion module
  - Local direct connection
  - Remote connection via Ethernet
  - Remote connection via EtherCAT®
- Position and number of expansion modules in the system
  The number of expansion modules that can be connected to a controller depends on the model of the expansion module. After max. 8 expansion modules, a power supply module must be inserted.

Example System Overview

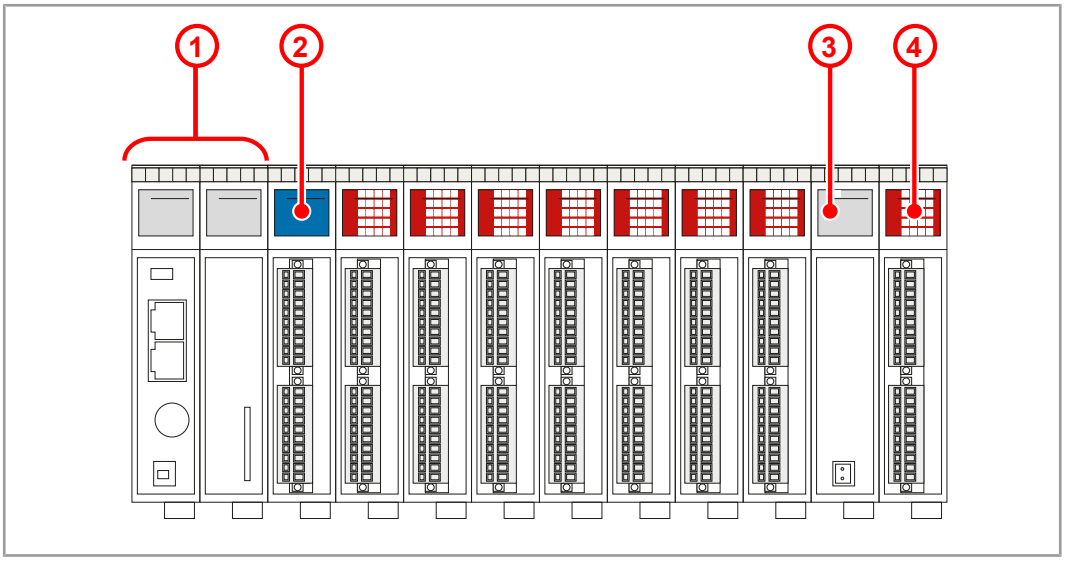


Fig. 22: Example: System overview of a controller together with various expansion modules

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

ⓘ Info

Number of connectible expansion modules

You can calculate the exact amount of connectible expansion modules by means of the
system bus configurator, JX3-sysbus_configurator_xxx_e, which is available for download on our website.

ⓘ Info

Further Information

For further information, please refer to the JX3 *System* application-oriented manual in the download area of our website.

8.2.1 Numbering Registers and I/Os

Module Registers – Definition

Module registers are the data interface of the JX3 module. Use module registers to read process, configuration and diagnostics data from the JX3 module, or write such data to the JX3 module.

– The module register number within a module is unique.
– This unique register number lets you access a specific module register within the system.

Registers - Definition

There are several ways to access registers directly:

– From an application program
– From the Setup pane of JetSym
– From a visualization application

The register number within the system is unique.

ⓘ Info

Further Information

For further information, please refer to the JX3 *System* application-oriented manual in the download area of our website.

Expansion modules connected with a controller

Our products offer a host of features accessible to the user via registers. Each register is addressed by a unique number – the register number. Each digital input and output has a unique I/O number.

Register numbering system

Register numbers consist of a prefix, the module position in the system and the module register number. If the expansion modules are connected with the controller via JX3 system bus, the prefix is 100. In this case, the module register number is always a four-digit number.

100XXZZZZ

Fig. 23: Example: Register numbers

Digits	Description	Value range
100	Prefix	
XX	Position of the module in the system	02 … 17
ZZZZ	Module register number	0000 … 9999

I/O numbering system

I/O numbers provide direct access to the inputs or outputs of the module. These I/O numbers consist of a five-digit prefix, the module position in the system and the I/O number of the module. The I/O numbers always start with the constant prefix **10000**.

10000XXZZ

Fig. 24: Example: I/O numbers

Digits	Description	Value range
10000	Prefix	
XX	Position of the module in the system	02 … 17
ZZ	Module-specific I/O number	01 … 16

Expansion modules connected to an Ethernet bus node

The Ethernet bus node and the controller communicate via Ethernet system bus. When addressing expansion modules via Ethernet bus node, the Global Node Number (GNN) becomes part of the register number.

System Overview

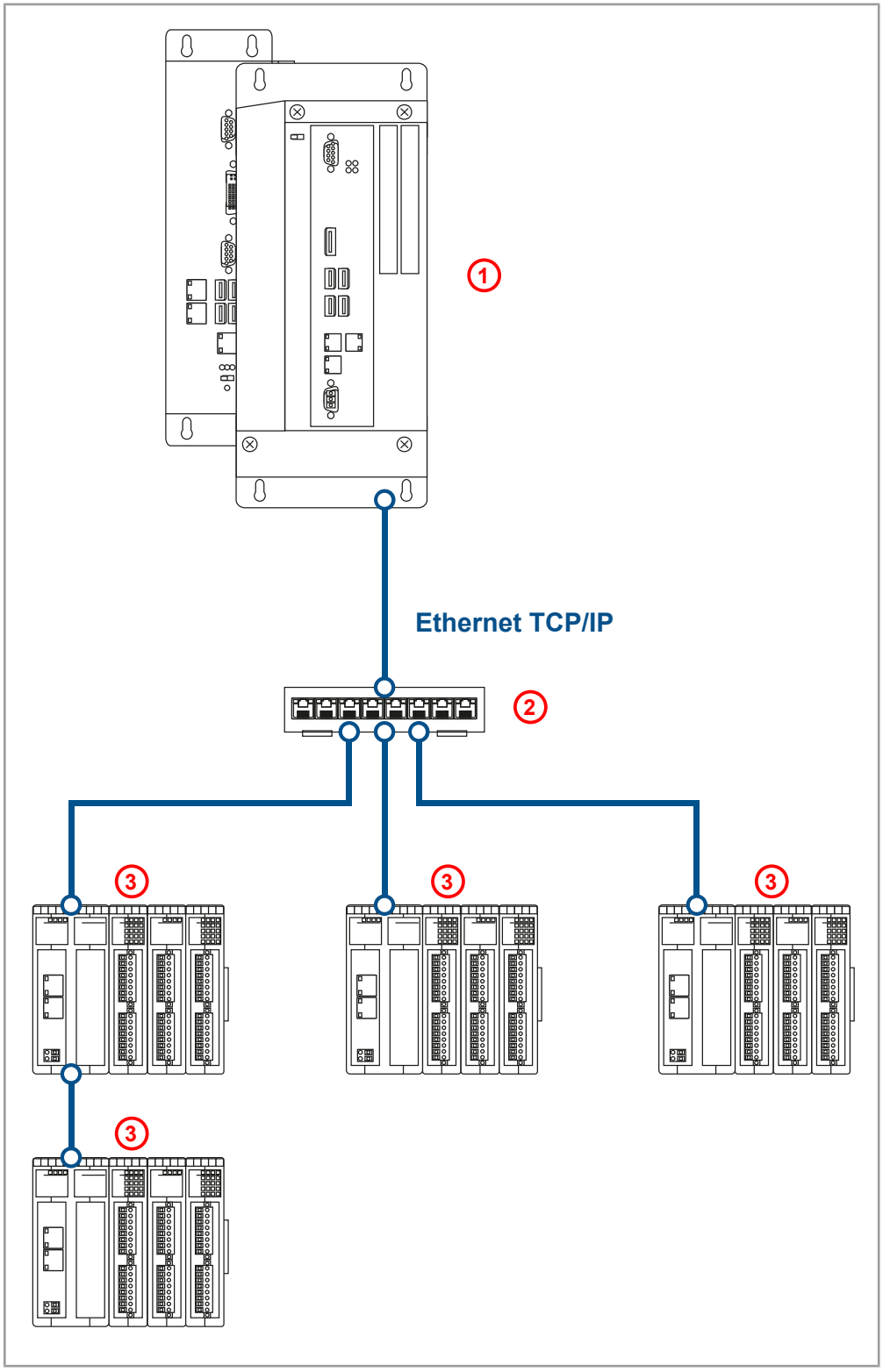


Fig. 25: System overview

1	Controller
2	Ethernet switch
3	Up to 199 Ethernet bus nodes per controller Up to 16 JX3 I/O modules per Ethernet bus node

Definition – Global Node Number

The Global Node Number (GNN) is used to identify Bucher Automation devices (e.g. controllers, bus nodes) within an Ethernet network:

– Within one network, each Bucher Automation device must have a unique GNN.
– The JetSym Hardware Manager automatically assigns the GNN during configuration.
– The value range of the GNN within a project is 000 ... 199.
– The GNN of the controller is always 000.

Register numbering system

Register numbers consist of a prefix, the GNN, the module position within the system and the module-specific register number.

1NNNXXZZZZ

Fig. 26: Example register number

Digits	Description	Value range
1	Prefix	
NNN	Bus node ID, GNN	001 … 199
XX	Position of the module within the station	02 … 17
ZZZZ	Module register number	0000 … 9999

I/O numbering system

I/O numbers provide direct access to the inputs or outputs of the module. The I/O numbers consist of prefix 1, the GNN, prefix 2, the module position in the system and the module-specific I/O number.

1NNN01XXZZ

Fig. 27: Example I/O number

Digits	Description	Value range
1	Prefix 1	
NNN	Bus node ID, GNN	001 … 199
01	Prefix 2	
XX	Position of the module within the station	02 … 17
ZZ	Module-specific I/O number	01 … 16

ⓘ Info

Further Information

For further information, please refer to the *Jetter Ethernet System Bus* application-oriented manual in the download area of our website.

Expansion modules connected to an EtherCAT® bus node

EtherCAT® bus node and controller communicate via EtherCAT® system bus. When addressing the expansion modules via EtherCAT® bus node, the EtherCAT® Node Number (ENN) becomes part of the register number. The ENN is used to identify controllers and EtherCAT® bus nodes within an EtherCAT® network. The ENN is automatically assigned by JetSym.

System Overview

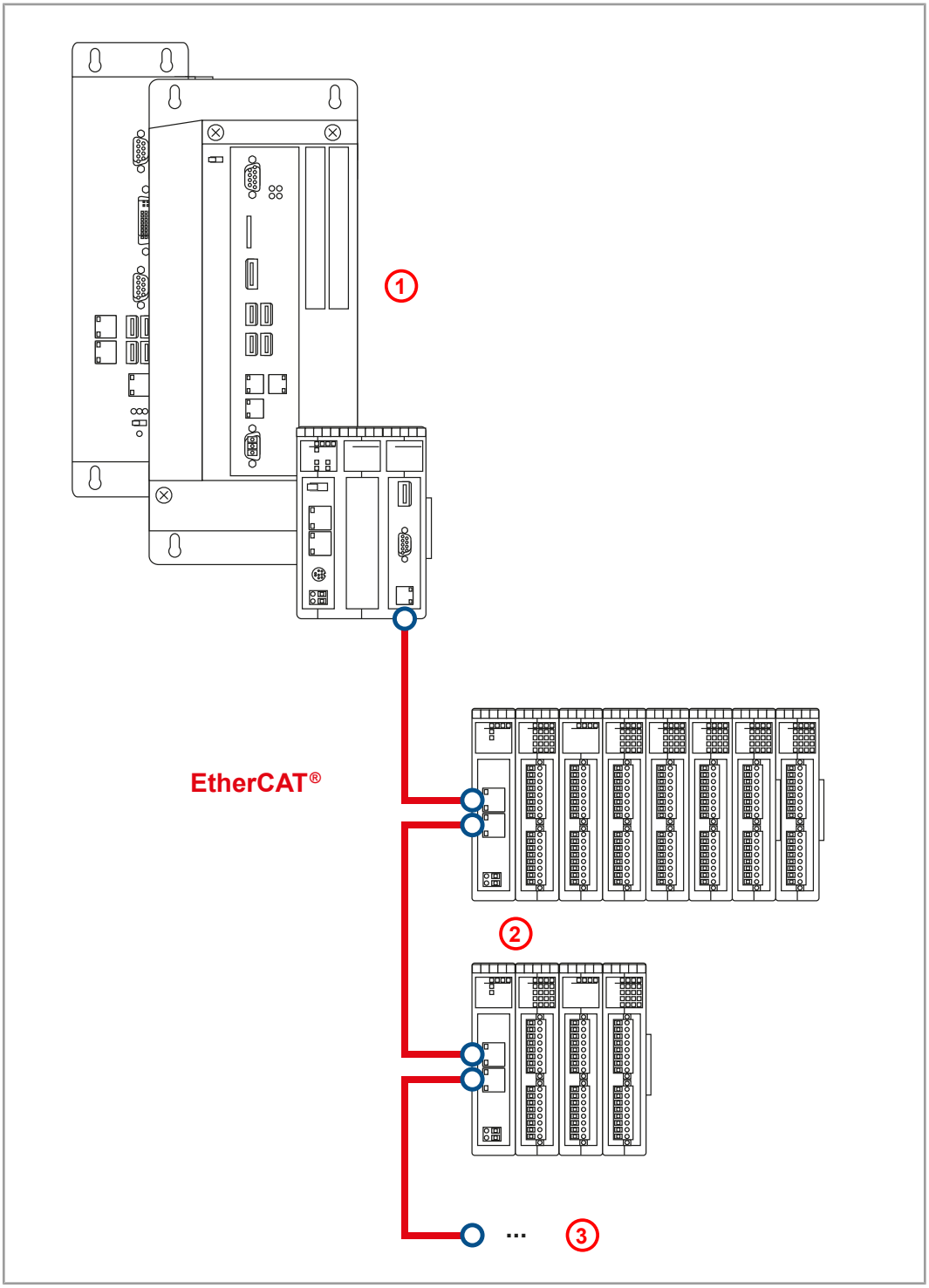


Fig. 28: System overview

1	EtherCAT® master
2	EtherCAT® bus node with up to 16 JX3 I/O modules
3	Up to 99 JX3-BN-EC

Register numbering system

The register numbers consist of a prefix, the ENN, the module position within the system and the module-specific register number.

12NNXXZZZZ

Fig. 29: Example: Register numbers

Digits	Description	Value range
12	Prefix	
NN	Bus node ID, ENN	01 … 99
XX	Position of the module within the station	02 … 33
ZZZZ	Module register number	0000 … 9999

I/O numbering system

I/O numbers provide direct access to the inputs or outputs of the module. The I/O numbers consist of prefix 1, the ENN, prefix 2, the module position in the system and the module-specific I/O number.

12NN00XXZZ

Fig. 30: Example: I/O numbers

Digits	Description	Value range
12	Prefix 1	
NN	Bus node ID, ENN	01 … 99
00	Prefix 2	
XX	Position of the module within the station	02 … 33
ZZ	Module-specific I/O number	01 … 16

8.3 Module State

The module register 0000 *Module state* allows you to diagnose and manage the JX3-CNT module.

The JX3-CNT module regularly checks the hardware for various errors. When an error is detected, the module switches to the error state. The cause of the error is entered into the module register 0000 *Module state*.

MR 0000

Module state

The module register 0000 displays status and error messages of the module.

Property	Description	
Type of access	Read	
Value range	32 bits, bit-coded	
Value after reset	Depending on state and error messages of the module	
Meaning of the bits		
Bit 17	**Short circuit 24 V**	
Bit 18	**Short circuit 5 V**	
Bit 19	**Collective bit: Value below lower limit**	
	1 =	At least one counter input has fallen below the lower limit value configured in MR 1y08.
Bit 20	**Collective bit: Value exceeds upper limit**	
	1 =	The upper limit value configured in MR 1y09 of at least one counter input has been exceeded.
Bit 21	**24 V encoder supply (X61.DC24V0.5A) is enabled**	
	0 =	Encoder supply is disabled

Property	Description	
	1 =	Encoder supply is enabled
Bit 22	**5 V encoder supply (X62.10) is enabled**	
	0 =	Encoder supply is disabled
	1 =	Encoder supply is enabled
Bit 23	**24 V encoder supply (X62.12) is enabled**	
	0 =	Encoder supply is disabled
	1 =	Encoder supply is enabled
Bit 30	**Synchronous data exchange**	
	1 =	Between the JX3-CNT module and the bus head or the controller, there is synchronous data exchange.

Tab. 26: Module state

8.4 Module Commands

Commands let you enable or disable various functions of the module.

MR 0001

Module-specific command registers

MR 0001 lets you configure functions provided by the module.

Property	Description
Type of access	Read/write
Value range	32 bits
Value after reset	0
Command	
1	Reset of status register 0000
2	Disable 24 V encoder supply (X61.DC24V0.5A)
3	Enable 24 V encoder supply (X61.DC24V0.5A)
4	Disable 5 V encoder supply (X62.10)
5	Enable 5 V encoder supply (X62.10)
6	Disable 24 V encoder supply (X62.12)
7	Enable 24 V encoder supply (X62.12)

Tab. 27: Command register Analog Input

8.5 Address Ranges of Counters

Each counter and some of the additional functions have got an address range of their own. The address ranges of the different counters are structured in a way that the same functions of different counters have the same register number ending (last two places).

Meaning of the Variable "y" in this User Manual

To explain identical functions that apply to different counters, the variable "y" has been introduced. The variable "y" as the second digit of the register number (e.g. 1y00) identifies the counter used.

Register range	y	Description
MR 1**1**00 ... 1**1**99	y = 1	Single-channel counter (24 V) # 1 at X61.I/O1
MR 1**2**00 ... 1**2**99	y = 2	Single-channel counter (24 V) # 1 at X61.I/O2
MR 1**3**00 ... 1**3**99	y = 3	Single-channel counter (24 V) # 1 at X61.I/O3
MR 1**4**00 ... 1**4**99	y = 4	Single-channel counter (24 V) # 1 at X61.I/O4
MR 1**5**00 ... 1**5**99	y = 5	Single-channel counter (24 V) at X61.A
MR 1**6**00 ... 1**6**99	y = 6	Single-channel counter (24 V) at X61.B
MR 1**7**00 ... 1**7**99	y = 7	Single-channel counter (24 V) at X61.C
MR 1**8**00 ... 1**8**99	y = 8	Dual-channel counter (24 V) at X61.A ... X61.C
MR 1**9**00 ... 1**9**99	y = 9	Dual-channel counter at X62
MR 2000 ... 2099		SSI at X62

Tab. 28: Meaning of the variable "y" in this user manual

Examples of Module Registers

– The status register for all counters is 1y00.
– The command register for all counters is 1y01.
– etc.

8.6 Monitoring the State by Means of Collective Bits

The JX3-CNT module signals the state of individual analog inputs by means of collective bits in MR 0000 *Module state*. This approach lets you collect the state of all counter inputs by just polling MR 0000 from within the application program.

States Indicated by Collective Bits

The collective bits indicate the following states:

– At least one counter has fallen below the lower limit
– At least one counter has exceeded the upper limit
– Short circuit 24 V
– Short circuit 5 V
– Power supply for X61.DC24V0.5AOUT enabled
– Power supply for X62.10 enabled
– Power supply for X62.12 enabled
– Synchronous data exchange is taking place

Collective Bits - Signalization

A collective bit in MR 0000 *Module state* is set if at least one corresponding status bit in MR 1y00 *State of counter input y* is set.

Signaling by collective bits occurs as follows:

Step	Description	
1	The JX3-CNT module signals the state of counter input y in MR 1y00 *State of counter input y*.	
	If...	**... then...**
	the value has fallen below the lower limit,	bit 19 in MR 1y00 is set.
	the value has exceeded the upper limit	bit 20 in MR 1y00 is set.
	Depending on how the counter is used, the other bits may differ.	
2	The JX3-CNT module signals the state of counters in MR 0000 *Module state*.	
	If...	**... then...**
	a short circuit 24 V exists,	in MR 0000 bit 17 is set.
	a short circuit 5 V exists,	in MR 0000 bit 18 is set.
	the value has fallen below the lower limit,	in MR 0000 bit 19 is set.
	the value has exceeded the upper limit	in MR 0000 bit 20 is set.
	the power supply for X61.DC24V/ 0.5A has been enabled,	in MR 0000 bit 21 is set.
	the power supply for X62.10 has been enabled,	in MR 0000 bit 22 is set.
	or in the module synchronous data exchange with the controller takes place,	in MR 0000 bit 30 is set.

Acknowledging Collective Bits in the Application Program

In the application program, collective bits are acknowledged as follows:

– The application program deletes collective bits in MR 0000 *Module state* by entering command 1 in MR 0001 *Command*.

8.7 Multi-Purpose I/Os - Additional Functions

This module lets you configure additional functions for each counter.

The following additional functions **cannot** be applied to inputs X61.I/O1 ... X61.I/O4 if they are used as counters:

– Gate function
– Strobe function
– Multi-strobe function
– Reference function

The following additional functions can be used in connection with multi-purpose inputs X61.I/O1 ... X61.I/O4:

– Gate function
– Strobe function
– Multi-strobe function
– Reference function

8.7.1 Gate Function

Gate Function - Applicability

The function can be used for the following counters:

Register range	Description
MR 1500 ... 1599	Single-channel counter (24 V) at X61.A
MR 1600 ... 1699	Single-channel counter (24 V) at X61.B
MR 1700 ... 1799	Single-channel counter (24 V) at X61.C
MR 1800 ... 1899	Dual-channel counter (24 V) at X61.A ... X61.C
MR 1900 ... 1999	Dual-channel counter (5 V) at X62

Tab. 29: Function - Applicability

Gate Function - Basic Principle

The gate function is a hardware enable. The gate function can also be negated.

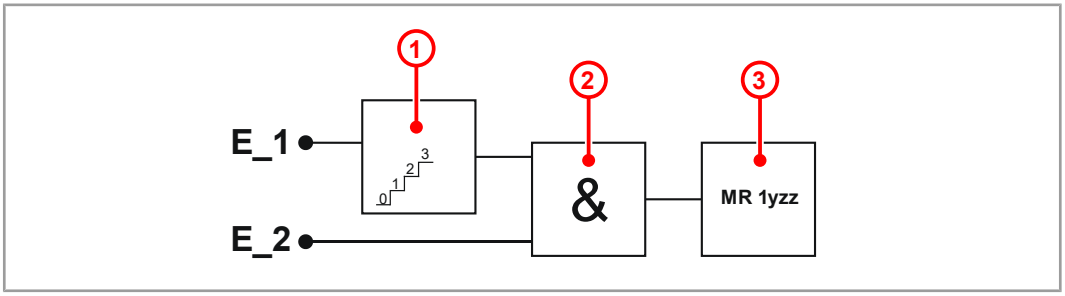


Fig. 31: Gate Function - Basic Principle

1	Actual counter
2	Gate function: The counter reading is copied into MR 1yzz only if the logic level at input E_2 is "1". Or if it is "0" in the case of a negation.
3	MR 1y03: Module register of count value
E_1	A selected counter input
E_2	A control input X61.I/O1 ... X61.I/O4 selected by software. Input E_2 can also be negated.

The counting value is incremented/decremented only if multi-purpose input X61.I/O1 ... X61.I/O4 enables it. This module lets you use several inputs as gate.

Gate Function - Commissioning

✓ An external counter providing counting pulses has been connected.

✓ A gate signal has been connected to one of the multi-purpose I/Os.

1. Define a multi-purpose input as gate input using the gate mask in MR 1y26.
2. Define the polarity of the gate signal in MR 1y27.
3. Activate the gate function with command 34 in MR 1y01.

⇨ The gate function is now ready.

Gate Function - Execution

The counter reading in MR 1y03 changes if the following conditions are met:

If …	… and …	… then …
the correct hardware signal is present at the gate input	counting pulses are present at the hardware input of the counter	the counter counts the hardware pulses and enters the readings into MR 1y03

8.7.2 Strobe Function

Strobe Function - Applicability

The function can be used for the following counters:

Register range	Description
MR 1500 ... 1599	Single-channel counter (24 V) at X61.A
MR 1600 ... 1699	Single-channel counter (24 V) at X61.B
MR 1700 ... 1799	Single-channel counter (24 V) at X61.C
MR 1800 ... 1899	Dual-channel counter (24 V) at X61.A ... X61.C
MR 1900 ... 1999	Dual-channel counter (5 V) at X62

Tab. 30: Function - Applicability

Strobe Function - Basic Principle

The strobe function lets you save a count value at a defined point in time triggered by a hardware pulse. Use the strobe function to quickly save a value and to be able to read it out afterwards. This approach is faster than single access to the module register.

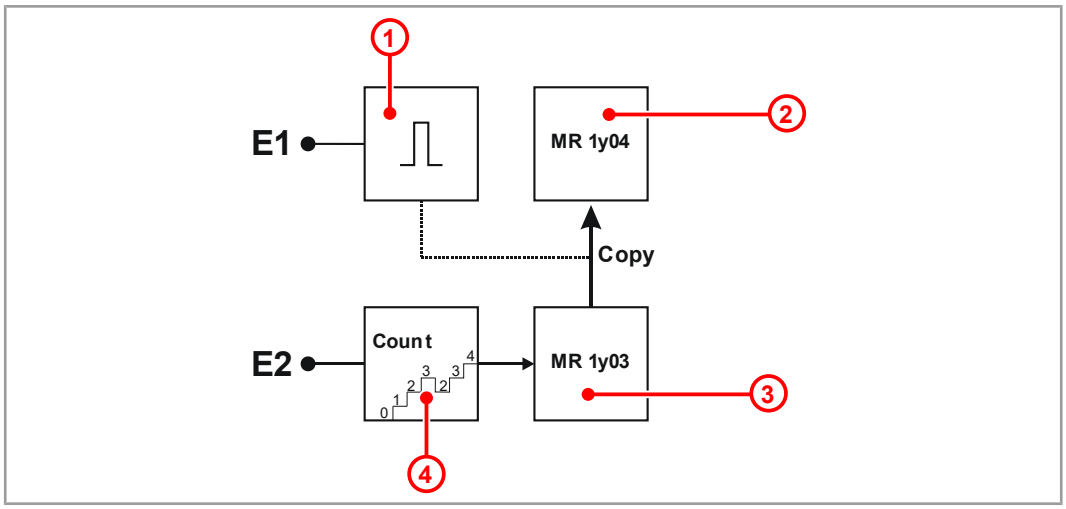


Fig. 32: Strobe Function - Basic Principle

1	A strobing signal at a control input (X61.I/O1 ... X61.I/O4), here marked as E1.
2	Module register 1y04 where the copy of the counter reading is stored in strobe mode.
3	Counter register 1y03
4	The counting pulses at a counter input, here marked as E2.

Strobe Function - Diagram

The multi-purpose I/Os let you to store counter values in a module register triggered by hardware pulses in strobe mode.

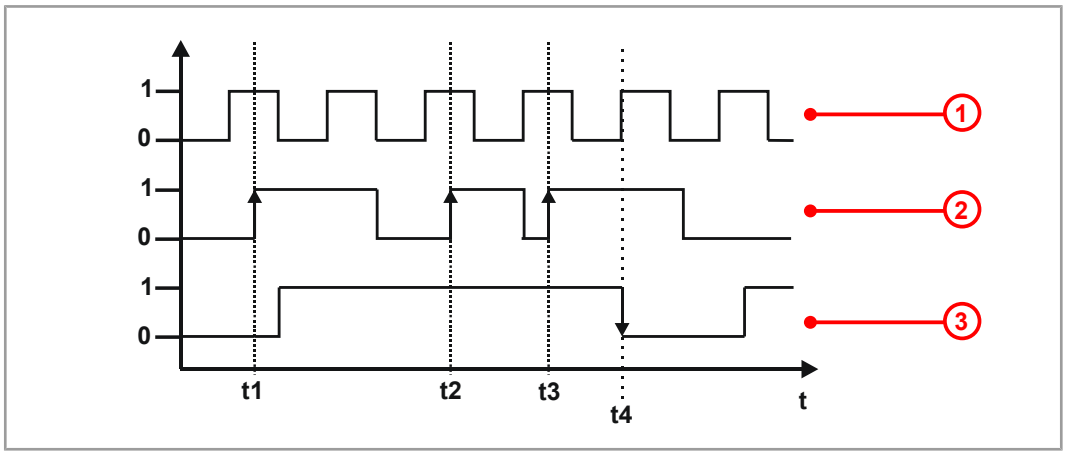


Fig. 33: Strobe function - diagram

1	Counting pulses at the counter input
2	Strobe input, set to positive edge
3	Strobe input, set to negative edge

Point in time	Description
t1	The count value of MR 1y03 is stored in MR 1y04 by a rising edge at the strobe input.
t2	Each read access to MR 1y04 causes bit 24 in MR 1y00 to be reset if the counter is in mode "Automatic Reset". If you do not read out an incoming value from MR 1y04, a strobe overflow occurs. In the example above, read access is made at t1, but not at t2. Thus, at t3, a strobe overflow occurs.
t3	A strobe overflow has occurred. Bit 28 in the status register MR 1y00 is set.
t4	t4 shows that you may also use a falling edge to trigger the strobe value to be saved.

Tab. 31: Points in time strobe function

Enabling Strobe Function

✓ An external counter providing counting pulses has been connected.

✓ A strobing signal has been connected to one of the multi-purpose I/Os.

✓ The edge of the strobe input has been defined.

1. Assign the strobe function to one of the inputs X61.I/O1 ... I/O4.
   You are also allowed to use several inputs.
2. If you want to evaluate a rising edge, write in MR 1y28 bit-coded which input is connected.
   If you want to evaluate a falling edge, write in MR 1y29 bit-coded which input is connected.
3. To enable the strobe function, enter command 36 in MR 1y01.

⇨ Strobe function is enabled. Bit 9 in MR 1y00 gets set.

Evaluating Strobe Function

1. Read out MR 1y00.
2. Decide whether the strobe bit 24 in MR 1y00 is to be deleted manually or automatically.
3. If you want to read out strobe bit 24 in MR 1y00 manually, write command 41 into MR 1y01.
   If you want to have strobe bit 24 in MR 1y00 reset automatically after each read operation, write command 40 into MR 1y01.
4. Read out the strobe value from MR 1y04.

8.7.3 Multi-Strobe Function

Multi-Strobe Function - Applicability

The function can be used for the following counters:

Register range	Description
MR 1500 ... 1599	Single-channel counter (24 V) at X61.A
MR 1600 ... 1699	Single-channel counter (24 V) at X61.B
MR 1700 ... 1799	Single-channel counter (24 V) at X61.C
MR 1800 ... 1899	Dual-channel counter (24 V) at X61.A ... X61.C
MR 1900 ... 1999	Dual-channel counter (5 V) at X62

Tab. 32: Function - Applicability

The following register range has been assigned to the multi-strobe function:

Register range	Description
MR 0900 ...0 949	Multi-strobe function

Tab. 33: Multi-strobe function - Register range

Multi-Strobe Function - Purpose

The multi-strobe function is an enhanced strobe function.

Sometimes it is useful to quickly save several values for later read access.

This function lets you save up to 16 measured values for later read access.

The multi-strobe function can be enabled for

– Single-channel counter at X61.A ... X61.C
– Dual-channel counter at X61.A ... X61.C, and X62
– SSI

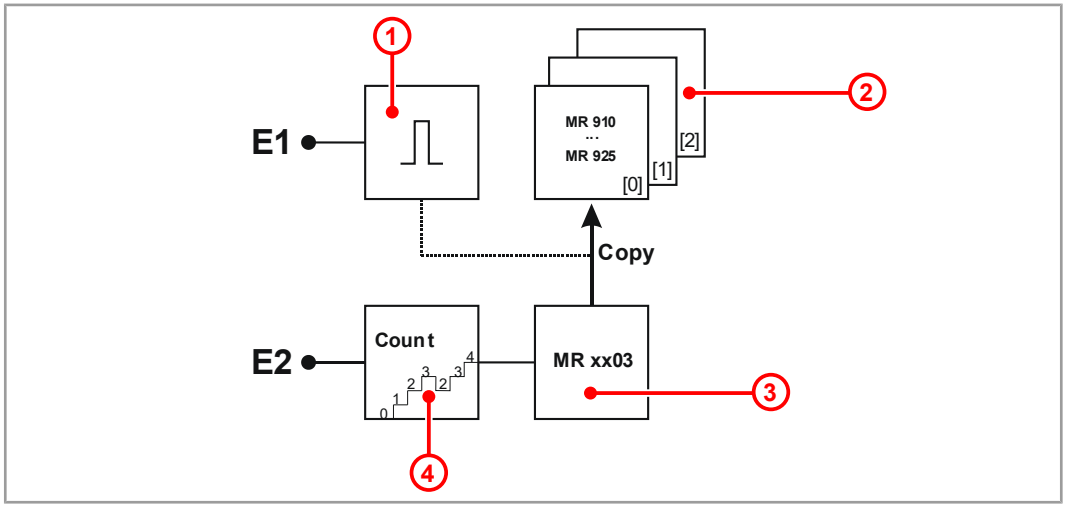


Fig. 34: Multi-strobe function

1	A strobing signal at a multi-purpose input X61.I/O1 ... X61.I/O4. Here marked as E1.
2	Module registers 910 ... 925 where the copy of the counter reading is stored at the given strobe pulse.
3	Counter register 1y03
4	The count value to be incremented/decremented depending on the state of input E2. This input has been defined in the application program.
E1	Multi-purpose input X61.I/O1 ... X61.I/O4
E2	Counting pulses at the counter input

Assigning Multi-Strobe to a Counter

The multi-strobe function can be used with all counters X61.A ... X61. C, as well as with dual-channel counters. The multi-strobe function can be assigned only to one counter at a time.

Number	Description
0	No counter assigned
5	Single-channel counter A at X61.A
6	Single-channel counter B at X61.B
7	Single-channel counter C at X61.C
8	Incremental encoder (24 V) at X61.A ... X61.C
9	Incremental encoder (5 V) at X62

Tab. 34: Assigning multi-strobe to a counter

Enabling Multi-Strobe Function in the Application Program

✓ A counter is connected to X61.A ... X61.C, or a dual-channel counter is connected.

✓ A strobing signal has been connected to one of the multi-purpose I/Os.

✓ The strobe function has been activated for the corresponding counter.

1. Assign a strobe input to the counter.
   MR 1828 lets you define which inputs are to respond to the rising edge of a strobe pulse.
   MR 1829 lets you define which inputs are to respond to the falling edge of a strobe pulse.
2. To enable the multi-strobe function, enter command 36 into MR 1801.

3. To assign the multi-strobe function to the connected 24 V dual-channel counters, enter the value 8 into MR 0902.
4. To reset all data concerning the multi-strobe function, enter command 4 into MR 0901.
5. To enable the multi-strobe function, enter command 2 into MR 0901.

⇨ The multi-strobe function is enabled.

Executing Multi-Strobe Function by Means of Hardware

Once the multi-strobe function has been enabled in the application program, it is further processed by means of hardware. If a strobing pulse arrives at a counter for which the multi-strobe function has been enabled, the following process starts:

– The strobing pulse causes the count value in MR 1y03 to be stored automatically. In detail: The hardware stores a copy of the count value contained in MR 1y03 to MR 1y04. Finally, it is stored in MR 0910 ... MR 0925.
– Once the value has been copied, the strobe count in MR 0903 is automatically incremented by 1.
– Then, MR 0903 is checked. Only if its value is less than 16, values are stored and the strobe count is incremented.

If ...	... and ...	... then ...
MR 0903 < 16	a strobing pulse arrives	– the current strobe value is copied from MR 1y04 to MR 0910 ... MR 0925. – the value of MR 0903 is incremented by 1.

Reading Out Stored Values

Once strobe values have been stored, you are able to read them out in two different ways:

– Using index and data registers (strobe index in MR 0904 and strobe data in MR 0905)
– Via direct access to MR 0910 ... MR 0925

Register Description

Address Range of Multi-Strobe Function

Register range	Description
MR 0900 ... MR 0949	Multi-strobe function

Tab. 35: Address range of multi-strobe function

MR 0900 **Status Register - Multi-Strobe**

In MR 0900, the module signals status messages on multi-strobe. To reset the status register, issue command 4.

Property	Description	
Type of access	Read only	
Meaning of the bits		
Bit 1	**Multi-strobe memory is full**	
	1 =	Strobe count = 15. Read out data or reset the multi-strobe function by issuing command 4.
Bit 2	**Multi-strobe is enabled**	
	1 =	The multi-strobe function is enabled.
Bit 4	**Multi-strobe overflow**	
	1 =	Strobe count > 15. Strobing signals have arrived whose corresponding count values could not be stored.

Tab. 36: Status register - Multi-strobe

MR 0901 **Command register - Multi-strobe**

MR 0901 lets you control the multi-strobe function.

Property	Description
Type of access	Read/write
Command	
2	Enable multi-strobe
3	Disable multi-strobe
4	Reset multi-strobe

Tab. 37: Command register - Multi-strobe

MR 0902 **Counter assignment - Multi-strobe**

MR 0902 lets you assign the multi-strobe function to a counter.

Property	Description
Type of access	Read/write
Value	
0	No counter assigned
5	X61.A
6	X61.B
7	X61.C
8	24 V dual-channel counter
9	5 V dual-channel counter

Tab. 38: Counter assignment - Multi-strobe

MR 0903 **Multi-strobe count**

The multi-strobe count in MR 0903 is used to count the number of incoming strobing pulses. Each strobing pulse arriving at the configured hardware input increments the counter by one.

To reset the counter register, issue command 4.

Property	Description
Values	0 ... 16
Type of access	Read only

Tab. 39: Multi-strobe count

MR 0904

Multi-strobe index

The multi-strobe index in MR 0904 lets you read out stored strobe data from MR 0905.

Property	Description
Values	0 ... 15

Tab. 40: Multi-strobe index

MR 0905

Multi-strobe data

The index register MR 0904 (multi-strobe index) lets you read out stored strobe data from MR 0905.

Property	Description	
Values	0 ... 15	
Type of access	Read/write	

Tab. 41: Multi-strobe data

MR 0910 ... MR 0925 **Multi-strobe data**

All multi-strobe data are consecutively stored in the array MR 0910 ... MR 0925.

Property	Description	
Type of access	Read only	
Module register properties		
0910	Multi-strobe data [0]	
0911	Multi-strobe data [1]	
0912	Multi-strobe data [2]	
0913	Multi-strobe data [3]	
0914	Multi-strobe data [4]	
0915	Multi-strobe data [5]	
0916	Multi-strobe data [6]	
0917	Multi-strobe data [7]	
0918	Multi-strobe data [8]	
0919	Multi-strobe data [9]	
0920	Multi-strobe data [10]	
0921	Multi-strobe data [11]	
0922	Multi-strobe data [12]	
0923	Multi-strobe data [13]	
0924	Multi-strobe data [14]	
0925	Multi-strobe data [15]	

Tab. 42: Multi-strobe data

8.7.4 Reference Function

This chapter describes the reference function of the JX3 I/O modules JX3-CNT.

The device lets you reference the following counters:

– Single-channel counters

– Dual-channel counters

Differences in Referencing Different Counter Types

There are differences in referencing single-channel and dual-channel counters:

– For referencing a single-channel counter, a positive or negative **edge** of the signal at X61.I/O1 ... X61.I/O4 is used.

– Dual-channel counters are enabled by a **level** at X61.I/O1 ... X61.I/O4. For referencing a dual-channel counter, the zero pulse signal is used.

Applicability of the Reference Function - Single-Channel Counters

The reference function can be used for the following single-counters:

Register	Description
MR 1500 ... 1599	Single-channel counter (24 V) at X61.A
MR 1600 ... 1699	Single-channel counter (24 V) at X61.B
MR 1700 ... 1799	Single-channel counter (24 V) at X61.C

Applicability of the Reference Function - Dual-Channel Counters

Register	Description
MR 1800 ... 1899	Dual-channel counter (24 V) at X61.A ... X61.C
MR 1900 ... 1999	Dual-channel counter (5 V) at X62

Reference Function for Single-Channel Counters

Example

On single-channel counters, reference positions can be set using the positive or negative signal **edge**.

In this example, the counter is reset to zero at the point in time t2 by a negative edge at input X61.I/O1. At the point in time t1, the counter is reset to zero by a positive edge at input X61.I/O2.

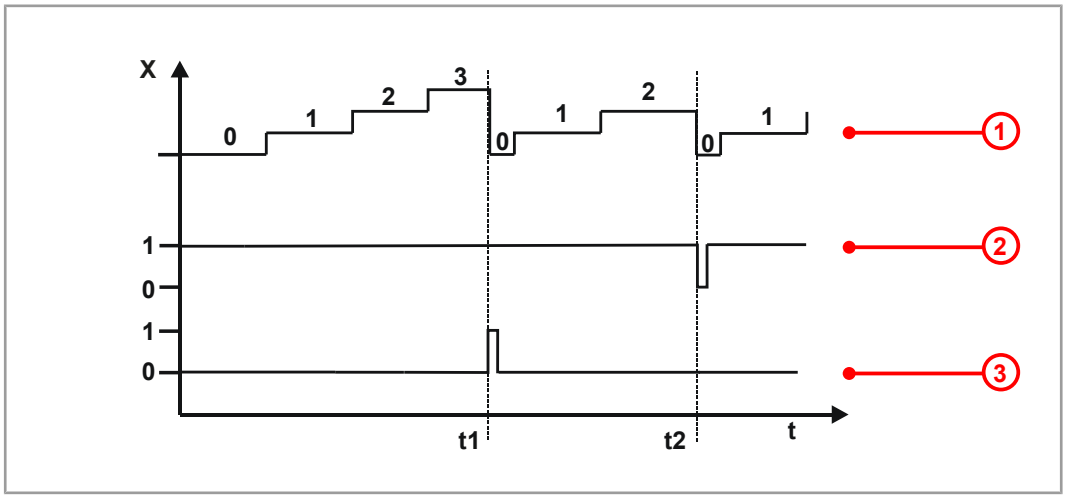


Fig. 35: Single-channel counter - reference function, X = value

1	Count value
2	Negative edge of reference signal at input X61.I/O1 at point in time t2
3	Positive edge of reference signal at input X61.I/O2 at point in time t1

Referencing Single-Channel Counters

The counter is referenced as follows (y = 5, 6 or 7):

1. Use MR1y32 to define a multi-purpose input X61.I/O1 ... X61.I/O4 as a reference input for rising edges.
2. Use MR1y33 to define a multi-purpose input X61.I/O1 ... X61.I/O4 as a reference input for falling edges.
3. Activate the referencing function with command 38 in MR 1y01.

⇨ The counter is now ready for the referencing function.

Conditions for the Referencing Function

The counter is reset to the value set in MR 1y05 if the following two conditions are met (y = 5, 6 or 7):

If ...	... and ...	... then ...
a rising edge of the signal is detected at reference input X61.I/O1 ... X61.I/O4	the referencing function has been enabled by command 38	the counter is reset to the value set in MR 1y05.
a falling edge of the signal is detected at reference input X61.I/O1 ... X61.I/O4	the referencing function has been enabled by command 38	the counter is reset to the value set in MR 1y05.

Reference Function for Dual-Channel Counters

Dual-Channel Counter - Example: Setting the Reference Position

Prerequisite

A reference signal has been connected to one of the inputs X61.I/O1 ... X61.I/O4. An incremental encoder with zero pulse signal has been connected to X61.A ... X61.C or X62.

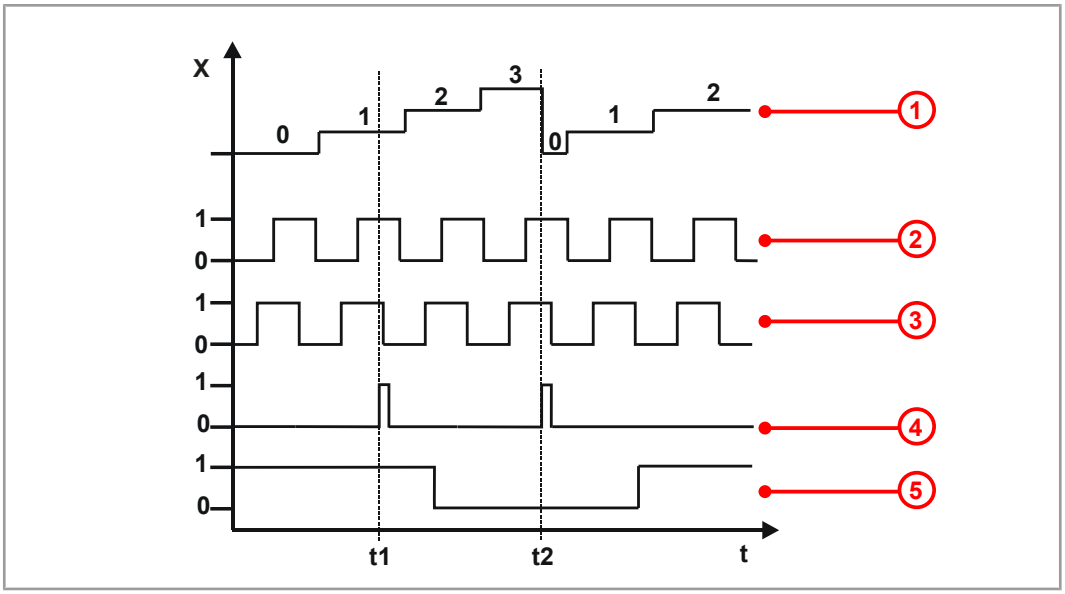


Fig. 36: Dual-channel counter - reference function, X = value

1	Count value
2	Incremental encoder - signal K1
3	Incremental encoder - signal K2
4	Zero pulse K0
5	Control signal REF at X61.I/O1, low active

At point in time t1 the count value is **not changed**. The control signal REF did not yet enable a reset.

At point in time t2, the counter is set to the new count value.

Level of the REF Signal at the Hardware Input

MR 1y31 can be used to specify whether the REF signal should be low-active or high-active.

To do so, enter the corresponding level bit-coded into MR 1y31.

y = 8 or 9

Referencing Dual-Channel Counters

✓ A dual-channel counter with zero pulse signal has been connected.

✓ A reference signal has been connected to a multi-purpose I/O.

1. Define a multi-purpose input as reference input in the referencing mask MR 1y30.
2. Define the polarity of the reference signal in MR 1y31.
3. Activate the referencing function with command 38 in MR 1y01.

⇨ The counter is now ready for the referencing function.

Conditions for the Referencing Function

The counter is reset to the value set in MR 1y05 if the following two conditions are met (y = 8 or 9):

If ...	... and ...	... then ...
the correct signal is present at the reference input	the first zero pulse signal of the dual-channel counter has been received	the counter is reset to the value set in MR 1y05

8.8 Programming 24 V Single-Channel Counters

8.8.1 Single-Channel Counter I/O1 ... I/O4

Terminals X61.I/O1 ... X61.I/O4 let you connect 24 V single-channel counters.

Properties of 24 V Single-Channel Counters

- Single-channel counter for 24 V counting pulses
- Maximum counting rate of 1 kHz
- Positive counting direction only
- 24 V single-channel counters are not affected by multi-purpose I/Os (gate, strobe, reference)

Configuring 24 V Single-Channel Counters

No separate configuration required for 24 V single-channel counters. To enable evaluation of incoming counting pulses, start the counter in the application program.

Count Value after Power-Up

Following power-up, all single-channel counters are set to 0.

Starting and Stopping Counters

A 24 V single-channel counter is started and stopped in JetSym.

Register Description

Address Range - Counter 1 ... Counter 4

Register range	y	Description
MR 1100 ... 1199	y = 1	Counter 1 (X61.I/O1)
MR 1200 ... 1299	y = 2	Counter 2 (X61.I/O2)
MR 1300 ... 1399	y = 3	Counter 3 (X61.I/O3)
MR 1400 ... 1499	y = 4	Counter 4 (X61.I/O4)

Tab. 43: Address range - counter 1 … 4

MR 1y00

Status of Counter Channel Connected to X61.I/O1 ... X61.I/O4

The status register lets you read out whether the counter has been started or stopped by the application program.

Property	Description	
Type of access	Read only	
Meaning of the bits		
Bit 26	0 =	Counter stopped
	1 =	Counter started

Tab. 44: Status of counter channel connected to X61.I/O1 ... X61.I/O4

MR 1y01 **Command register of counter channel**

The command register lets you start or stop the counter.

Register	Description
Type of access	Read/write
Command	
30	Enable counter
31	Disable counter

Tab. 45: Command register of counter channel

MR 1y03 **Read and write access to the count value**

Write access lets you enter a new value for the counter. Incoming counting pulses will increment this value.

Property	Description
Values	0 ... +4.294.967.295
Value after reset	0
Read	Reads the current count value
Write access	Sets the count value to a new value
Count value	The counter counts only in positive direction.

Tab. 46: Count value

8.8.2 Single-Channel Counter (Counter A, B, C at X61)

Terminals X61.A ... X61.C let you connect 24 V single-channel counters.

Properties of 24 V Single-Channel Counters

- Single-channel counter for 24 V counting pulses
- Positive and negative counting direction
- For connecting up to three 24 V single-channel counters
- Gate, strobe and reference function can be used
- Supports modulo function
- Period length and pulse width can be measured
- Supports user-defined scaling
- Supports trailing indicator
- Digital filter can be set

Configuring 24 V Single-Channel Counters

No separate configuration required for 24 V single-channel counters. To enable evaluation of incoming counting pulses, start the counter in the application program.

Count Value after Power-Up

Following power-up, all single-channel counters are set to 0.

Starting and Stopping Counters

A 24 V single-channel counter is started and stopped in JetSym or through the gate function provided by the hardware.

Measuring the Period Length of a 24 V Single-Channel Counter

The period length (in ms) is measured starting from the last signal (exactly: when the level of the last increment changed from high to low). The result is stored to the module register. This register allows only read access.

Measuring the Pulse Width of a 24 V Single-Channel Counter

The pulse width (in ms) is measured starting from the last signal (exactly: when the level of the last increment changed from high to high). The result is stored to the module register.

Monitoring of Limits, Reading Out the Trailing Indicator

The 24 V single-channel counters X61.A ... X61.C support the following special functions:

– Lower limit
– Upper limit
– Trailing indicator

The trailing indicator follows the current count value. MR 1y20 lets you directly read out or write the minimum value of the trailing indicator. MR 1y21 lets you directly read out or write the maximum value of the trailing indicator.

Module registers 1y08 and 1y09 let you specify the lower and upper limit. The status register of the single-channel counter indicates whether the limits have been exceeded or fallen below.

Enabling Digital Filter for 24 V Single-Channel Counter

Activate the digital filter to eliminate noise (e.g. spikes) from the input signal.

Register Description

Address Range of Counter A … C

Register range	y	Description
MR 1500 ... MR 1599	y = 5	Counter A (X61.A)
MR 1600 ... MR 1699	y = 6	Counter B (X61.B)
MR 1700 ... MR 1799	y = 7	Counter C (X61.C)

Tab. 47: Address Range of Counter A … C

MR 1y00

Status register - Counter module

The module indicates status messages of counter y in MR 1y00.

Property	Description	
Type of access	Read/write	
Meaning of the bits		
Bit 8	**Gate function enabled?**	
	1 =	enabled
Bit 9	**Strobe function enabled?**	
	1 =	enabled
Bit 10	**Search for reference enabled?**	
	1 =	enabled
Bit 14	**Modulo function enabled?**	
	1 =	enabled

Property	Description	
Bit 15	**Modulo error?**	
	1 =	In modulo mode, an error has occurred.
Bit 16	**Measurement enabled?**	
	1 =	Measurement of period length and pulse width is enabled.
Bit 19	**Value below lower limit?**	
	1 =	The lower limit contained in MR 1y08 has been fallen below. You can reset this bit by entering a value into status register 1y00.
Bit 20	**Value exceeds upper limit?**	
	1 =	The upper limit contained in MR 1y09 has been exceeded. You can reset this bit by entering a value into status register 1y00.
Bit 24	**Strobe value received?**	
	1 =	MR 1y04 contains a new strobe value.
Bit 25	**Counter blocked by gate function?**	
	1 =	There is no input signal enabling the counter.
Bit 26	**Counter enabled?**	
	1 =	The counter has been started; enabled by the application program.
Bit 27	**Reference set?**	
	0 =	This bit is 0 if the counter has not yet been referenced. No edge detected at X61.I/O1 ... X61.I/O4.
	1 =	This bit is 1 if an edge is detected at input X61.I/O1 ... X61.I/O4 configured as reference input.
Bit 28	**Strobe overflow?**	
	1 =	If a new strobing signal is present at the input and the value stored to MR 1y04 has not been read out yet, bit 28 "Strobe overflow" warns that a value has been lost.
Bit 29	**Reversal of counting direction enabled?**	
	0 =	Command 32 issued (positive counting direction)
	1 =	Command 33 issued (negative counting direction)

Tab. 48: Status register - Counter module

MR 1y01 **Command register of counter channel**

MR 1y01 lets you configure functions provided by the module.

Property	Description
Type of access	Read/write
Command	
30	Enable counter
31	Disable counter
32	Positive counting direction
33	Negative counting direction
34	Enable gate function
35	Disable gate function
36	Enable strobe function
37	Disable strobe function
38	Enable reference function
39	Disable reference function
50	Enable period and pulse width measurements
51	Disable period and pulse width measurements
60	Enable modulo function
61	Disable modulo function
70	Reset trailing indicator for minimum value
71	Reset trailing indicator for maximum value
72	Reset trailing indicator for minimum and maximum value

Tab. 49: Command register of counter channel

MR 1y03 **Unscaled count value**

The unscaled count value is entered into MR 1y03. To change the initial value, enter a new value into this module register.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647

Tab. 50: Unscaled count value

MR 1y04 **Strobe register**

If a hardware pulse is present at the correct multi-purpose I/O, the current count value is copied from MR 1y03 to MR 1y04.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Type of access	Read only

Tab. 51: Strobe register

MR 1y05 **Reference Offset**

MR 1y05 contains an offset value which is copied into MR 1y03 when a referencing pulse is applied to X61.I/O1 ... X61.I/O4.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647

Tab. 52: Reference offset

MR 1y06 **Period**

MR 1y06 contains the duration of a period. This is the interval in µs between two level changes (from high to high) of the last increment.

Property	Description
Values	0 ... +4.294.967.296
Unit	Microseconds
Type of access	Read only

Tab. 53: Period

MR 1y07 **Pulse width**

MR 1y07 contains the pulse width. This is the interval in µs between a level change (from high to low) of the last increment.

Property	Description
Values	0 ... +4.294.967.296
Unit	Microseconds
Type of access	Read only

Tab. 54: Pulse width

MR 1y23 **Digital filter**

The digital filter, that can be activated if required, allows to filter out interferences from the input signal. Depending on the setting, spikes can be filtered out from the input signal.

Property	Description
Values	0 ... +65.535
Access	Read and write access
Value after reset	0 (default: OFF)

Tab. 55: Digital filter

Operating principle

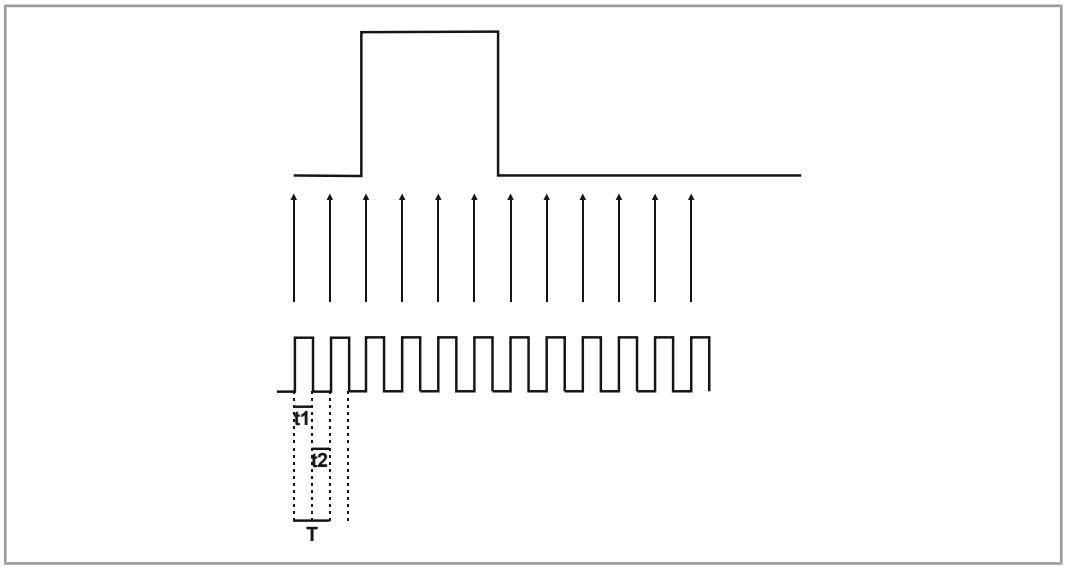


Fig. 37: Operating principle of the digital filter

This filter lets you define a different sampling time. As a result, the digital filter acts like a low-pass filter. The value is accepted only if the input signal is present for a period longer than time T.

Calculation

$$T = \frac{t_{1,2}}{2} = \frac{MR1y23}{48\,MHz}$$

where $T = t_1 + t_2$

MR 1y26

Gate mask

The gate mask lets you assign the gate function to one of the inputs.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 56: Gate mask

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

Example

To enable the gate function for the counter at X61.I/O2, enter the value 0b0010 into MR 1y26.

Enter command 34 into MR 1y01 to enable the gate function.

MR 1y27

Gate function – Low-active or high-active

MR 1y27 lets you enable the gate function for the respective input. Evaluation can be low-active or high-active.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15
0	Gate is low-active
1	Gate is high-active

Tab. 57: Gate function – High-active

MR 1y28

Strobe – Rising edge

The input mask "Strobe - Rising edge" lets you define which inputs X61.I/O1 ... X61.I/O4 are to respond to the rising edge of a strobe.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 58: Strobe **–** Rising edge

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

MR 1y29

Strobe – Falling edge

The input mask "Strobe - Falling edge" lets you define which inputs X61.I/O1 ... X61.I/O4 are to respond to the falling edge of a strobe.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 59: Strobe **–** Falling edge

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

MR 1y32

Reference - Rising edge

The input mask "Reference - Rising edge" lets you define which inputs X61.I/O1 ... X61.I/O4 are to respond to the rising edge of the reference signal.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 60: Reference **–** Rising edge

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

MR 1y33 **Reference - Falling edge**

The input mask "Reference - Rising edge" lets you define which inputs X61.I/O1 ... X61.I/O4 are to respond to the rising edge of the reference signal.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 61: Reference **–** Rising edge

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

MR 1y40 **Modulo - Lower limit**

MR 1y40 lets you define a lower limit for the modulo function. It is not mandatory that the count value starts at 0.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	3600

Tab. 62: Modulo - Lower limit

MR 1y41 **Modulo - Upper limit**

MR 1y41 lets you define an upper limit for the modulo function.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	3600

Tab. 63: Modulo - Upper limit

MR 1y42

Modulo count (revolutions)

MR 1y42 lets you read out how many times the limit has been exceeded. Thus, this module register shows the number of revolutions.

Property	Description
Values	0 ... +4.294.967.296

Tab. 64: Modulo count (revolutions)

Example

The lower modulo limit is 0, and the upper limit is 360. MR 1y42 displays 123, so the number of revolutions for a full circle is 123.

8.9 Programming - Dual-Channel Counters

8.9.1 24 V Dual-Channel Counter (X61.A ... X61.C)

This module lets you connect a 24 V dual-channel counter to terminals X61.A ... X61.C.

Properties of the 24 V Dual-Channel Counter

- Dual-channel counter for 24 V pulses with zero pulse signal
- Max. 1 counter can be connected
- Gate, strobe and reference function can be used
- Supports modulo function
- Period length and pulse width can be measured
- Trailing indicator (minimum and maximum values) can be read
- Digital filter can be set
- Up to four digital outputs (DC 24 V) can be switched depending on the count value

Count Value after Power-Up

Following power-up, all dual-channel counters are set to 0.

Starting and Stopping Counters

A dual-channel counter is started and stopped in JetSym.

8.9.2 5 V Dual-Channel Counter

This module lets you connect 5 V dual-channel counters to the female Sub-D connector X62.

Properties of 5 V Dual-Channel Counters

- Dual-channel counter for 5 V pulses with zero pulse signal
- Max. 1 counter can be connected
- Gate, strobe and reference input are assigned to 5 V dual-channel counter
- Supports modulo function
- Period length and pulse width can be measured
- Trailing indicator (minimum and maximum values) can be read
- Digital filter can be parameterized
- Up to four digital outputs (DC 24 V) can be switched depending on the count value.

Count Value after Power-Up

Following power-up, all dual-channel counters are set to 0.

Starting and Stopping Counters

A dual-channel counter is started and stopped in JetSym.

8.9.3 Register Description

Address Range - Dual-Channel Counter at X61.A ... X61.C

Register range	y	Description
MR 1800 ... 1899	y = 8	24 V dual-channel counter

Tab. 65: Address range - Dual-channel counter at X61.A ... X61.C

Address Range - Dual-Channel Counter at X62

Register range	y	Description
MR 1900 ... 1999	y = 9	5 V dual-channel counter

Tab. 66: Address range - Dual-channel counter at X62

MR 1y00

Status register - Counter module

The module indicates status messages of the dual-channel counter in MR 1y00.

Property	Description	
Type of access	Read/write	
Meaning of the bits		
Bit 8	**Gate function enabled?**	
	1 =	enabled
Bit 9	**Strobe function enabled?**	
	1 =	enabled
Bit 10	**Search for reference enabled?**	
	1 =	enabled
Bit 14	**Modulo function enabled?**	
	1 =	enabled
Bit 15	**Modulo error?**	
	1 =	In modulo mode, an error has occurred.
Bit 16	**Measurement enabled?**	
	1 =	Measurement of period length and pulse width is enabled.
Bit 19	**Value below lower limit?**	
	1 =	The lower limit contained in MR 1y08 has been fallen below. You can reset this bit by entering a value into status register 1y00.
Bit 20	**Value exceeds upper limit?**	
	1 =	The upper limit contained in MR 1y09 has been exceeded. You can reset this bit by entering a value into status register 1y00.
Bit 24	**Strobe value received?**	
	1 =	MR 1y04 contains a new strobe value.
Bit 25	**Counter blocked by gate function?**	
	1 =	There is no input signal enabling the counter.
Bit 26	**Counter enabled?**	
	1 =	The counter has been started; enabled by the application program.
Bit 27	**Reference set?**	
	0 =	This bit is 0 if the counter has not yet been referenced.

Property	Description	
		No edge detected at X61.I/O1 ... X61.I/O4.
	1 =	This bit is 1 if an edge is detected at input X61.I/O1 ... X61.I/O4 configured as reference input.
Bit 28	**Strobe overflow?**	
	1 =	If a new strobing signal is present at the input and the value stored in MR 1y04 has not been read out yet, bit 28 "Strobe overflow" warns that a value has been lost.

Tab. 67: Status register - Counter module

MR 1y01 **Command register of counter channel**

MR 1y01 lets you configure functions provided by the module.

Property	Description
Type of access	Read/write
Command	
30	Enable counter
31	Disable counter
34	Enable gate function
35	Disable gate function
36	Enable strobe function
37	Disable strobe function
38	Enable reference function
39	Disable reference function
60	Enable modulo function
61	Disable modulo function
70	Reset trailing indicator for minimum value
71	Reset trailing indicator for maximum value
72	Reset trailing indicator for minimum and maximum value

Tab. 68: Command register of counter channel

MR 1y03 **Unscaled count value**

The unscaled count value is entered into MR 1y03. To change the initial value, enter a new value into this module register.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647

Tab. 69: Unscaled count value

MR 1y04 **Strobe register**

If a hardware pulse is present at the correct multi-purpose I/O, the current count value is copied from MR 1y03 to MR 1y04.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Type of access	Read only

Tab. 70: Strobe register

MR 1y05 **Reference Offset**

MR 1y05 contains an offset value which is copied into MR 1y03 when a referencing pulse is applied to X61.I/O1 ... X61.I/O4.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647

Tab. 71: Reference offset

MR 1y06 **Period**

MR 1y06 contains the duration of a period. This is the interval in µs between two level changes (from high to high) of the last increment.

Property	Description
Values	0 ... +4.294.967.296
Unit	Microseconds
Type of access	Read only

Tab. 72: Period

MR 1y23 **Digital filter**

The digital filter, that can be activated if required, allows to filter out interferences from the input signal. Depending on the setting, spikes can be filtered out from the input signal.

Property	Description
Values	0 ... +65.535
Access	Read and write access
Value after reset	0 (default: OFF)

Tab. 73: Digital filter

Operating principle

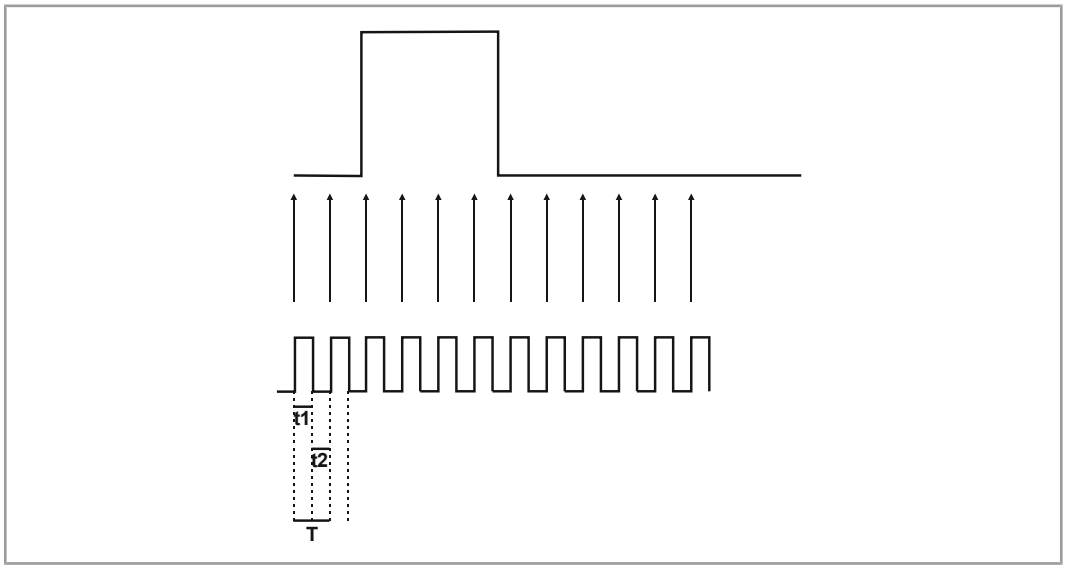


Fig. 38: Operating principle of the digital filter

This filter lets you define a different sampling time. As a result, the digital filter acts like a low-pass filter. The value is accepted only if the input signal is present for a period longer than time T.

Calculation

$$T = \frac{t_{1,2}}{2} = \frac{MR1y23}{48\,MHz}$$

where $T = t_1 + t_2$

MR 1y26

Gate mask

The gate mask lets you assign the gate function to one of the inputs.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 74: Gate mask

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

Example

To enable the gate function for the counter at X61.I/O2, enter the value 0b0010 into MR 1y26.

Enter command 34 into MR 1y01 to enable the gate function.

MR 1y27 **Gate function – Low-active or high-active**

MR 1y27 lets you enable the gate function for the respective input. Evaluation can be low-active or high-active.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15
0	Gate is low-active
1	Gate is high-active

Tab. 75: Gate function – High-active

MR 1y28 **Strobe – Rising edge**

The input mask "Strobe - Rising edge" lets you define which inputs X61.I/O1 ... X61.I/O4 are to respond to the rising edge of a strobe.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 76: Strobe **–** Rising edge

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

MR 1y29

Strobe – Falling edge

The input mask "Strobe - Falling edge" lets you define which inputs X61.I/O1 ... X61.I/O4 are to respond to the falling edge of a strobe.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 77: Strobe **–** Falling edge

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

MR 1y30

Reference mask

The reference mask lets you assign the reference function to one of the inputs.

This register is bit-coded (value range 0 ... 15).

Property	Description
Values	0 ... 15

Tab. 78: Reference mask

The values of the module register can be found in the following table:

Bit	Value	Description
0b0000	0	All inputs are disabled
0b0001	1	X61.I/O 1 is enabled
0b0010	2	X61.I/O 2 is enabled
0b0100	4	X61.I/O 3 is enabled
0b1000	8	X61.I/O 4 is enabled
...		
0b1010	10	X61.I/O 2 and X61.I/O 4 are enabled
...		
0b1111	15	All inputs are enabled

Example

To enable the reference function for the counter at X61.I/O2, enter the value 0b0010 into MR 1y30.

Enter command 34 into MR 1y01 to enable the reference function.

MR 1y31 **Reference function – Low-active**

MR 1y31 lets you set the referencing function for the respective input. Evaluation can be low-active or high-active.

This register is bit-coded (values 0 ... 15).

Property	Description
Values	0 ... 15
0	Reference is high-active
1	Reference is low-active

Tab. 79: Reference function – Low-active

MR 1y40 **Modulo - Lower limit**

MR 1y40 lets you define a lower limit for the modulo function. It is not mandatory that the count value starts at 0.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	3600

Tab. 80: Modulo - Lower limit

MR 1y41 **Modulo - Upper limit**

MR 1y41 lets you define an upper limit for the modulo function.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	3600

Tab. 81: Modulo - Upper limit

MR 1y42 **Modulo count (revolutions)**

MR 1y42 lets you read out how many times the limit has been exceeded. Thus, this module register shows the number of revolutions.

Property	Description
Values	0 ... +4.294.967.296

Tab. 82: Modulo count (revolutions)

Example

The lower modulo limit is 0, and the upper limit is 360. MR 1y42 displays 123, so the number of revolutions for a full circle is 123.

8.10 Setting a Counter to Zero

Introduction

The JX3-CNT module lets you set any counter to a specific value. This can be done before or while using the counter.

Comparison: Setting a Counter Reading - HW vs. SW

Method	Property	Description
Zeroing by means of software while the counter is running	Speed: Slower than by means of hardware	Due to incoming hardware pulses, the count value may change while the new value is entered. Consequence: There is a risk that counting pulses will be lost.
Zeroing by means of software while the counter is stopped	Speed: Slower than by means of hardware	The new count value will be taken over correctly.
Zeroing by means of hardware referencing	Speed: Fast Pulses will not be lost.	The hardware pulse copies the value contained in MR 1y05 "Reference offset" as new count value.

Tab. 83: Setting a Counter Reading - HW vs. SW

8.10.1 Setting a Counter to Zero by Means of Software

Setting counter to zero

To set a counter to zero in JetSym, proceed as follows:

1. Stop the counter.
   This prevents accidental count values. Poll the status register to see whether the counter is actually stopped:
   ```
   When (Status.26 == 0) Continue;
   ```
2. Enter "0" into count value register 1y03.

⇨ The counter is set to "0".

8.10.2 Setting a Counter to Zero by Means of Hardware

Introduction

Setting a counter to zero by means of a hardware pulse from the reference function [▶ 66] is always better than by means of software.

The hardware pulse method requires a multi-purpose I/O.

Reference Function - Applicability

The reference function can be used for the following counters:

Register range	Description
MR 1500 ... 1599	Single-channel counter (24 V) at X61.A
MR 1600 ... 1699	Single-channel counter (24 V) at X61.B
MR 1700 ... 1799	Single-channel counter (24 V) at X61.C
MR 1800 ... 1899	Dual-channel counter (24 V) at X61.A ... X61.C
MR 1900 ... 1999	Dual-channel counter (5 V) at X62

Tab. 84: Reference function - Applicability

8.11 SSI

SSI is short for **S**ynchronous **S**erial **I**nterface. Connect an SSI encoder to the female Sub-D connector X62.

Address Range - SSI Encoder at X62

Register range	Description	
2000 ... 2099	SSI	

Tab. 85: Address range - SSI encoder at X62

Data Formats

The JX3-CNT can be used to read in various data formats from SSI absolute encoders with a resolution of 10 to 24 bits.

Properties of SSI Evaluation

– Gray code decoding
– Binary code decoding
– Parity check

Parameterizing SSI Encoders

To parameterize an SSI encoder, proceed as follows:

1. To reset the JX3-CNT, write the value 1 into MR 2001.
2. To set the readout frequency, write a value 0 ... 5 into MR 2034.
3. To set the resolution, write a value 2 ... 24 (full resolution) into MR 2036.
4. To set the format for data exchange, write the bit-coded value into MR 2035.

⇨ The SSI encoder has been parameterized. When the SSI encoder turns, you can observe in the Setup pane of JetSym how the counter reading changes.

8.11.1 Register Description

MR 2000

Status register - SSI

In MR 2000, the JX3-CNT module signals SSI status messages.

Property	Description	
Type of access	Read only	
Meaning of the bits		
Bit 0	**Receiving register 1**	
	1 =	New value in receiving register 1
Bit 2	**Parity check**	
	1 =	Parity check error: Value in receiving register is invalid
Bit 8	**Receiving register 2**	
	1 =	New value in receiving register 2
Bit 19	**Value below lower limit**	
	1 =	The value has fallen below the lower limit defined in MR 2008.
Bit 20	**Value exceeds upper limit**	
	1 =	The value has exceeded the upper limit defined in MR 2009.

Tab. 86: Status register - SSI

MR 2001 **Command register - SSI**

Command register MR 2001 lets you configure the SSI functions of the JX3-CNT module.

Property	Description
Type of access	Read/write
Command	
1	Enable counter, reset
8	Software strobe
10	Enable continuous update
11	Disable continuous update
12	Enable continuous strobe
13	Disable continuous strobe
20	Enable forcing function
21	Disable forcing function
70	Reset trailing indicator for minimum value
71	Reset trailing indicator for maximum value
72	Reset trailing indicator for minimum and maximum value

Tab. 87: Command register - SSI

MR 2003 **SSI count value**

MR 2003 contains the SSI count value.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Access	Read only

Tab. 88: SSI count value

MR 2005 **SSI offset**

MR 2005 contains the SSI offset. SSI offset directly affects MR 2003.

Property	Description
Value range	-2.147.483.648 ... +2.147.483.647

Tab. 89: SSI offset

MR 2008 **SSI: Lower limit**

MR 2008 lets you define the lower limit of the SSI count value. If the counter falls below this value, bit 19 in status register 2000 is set.

Property	Description
Value range	-2.147.483.648 ... +2.147.483.647
Value after reset	-2.147.483.648

Tab. 90: SSI: Lower limit

MR 2009 **SSI: Upper limit**

MR 2009 lets you define the upper limit of the SSI count value. If the counter exceeds this value, bit 20 in status register 2000 is set.

Property	Description
Value range	-2.147.483.648 ... +2.147.483.647
Value after reset	+2.147.483.647

Tab. 91: SSI: Upper limit

MR 2020 **SSI: Trailing indicator for minimum value**

A trailing indicator follows the current count value. The minimum value of the trailing indicator represents the smallest measured value that MR 2003 has already counted and displayed. MR 2020 lets you read out the smallest counter value.

Property	Description
Value range	-2.147.483.648 ... +2.147.483.647
Value after reset	-2.147.483.648

Tab. 92: SSI: Trailing indicator for minimum value

MR 2021 **SSI: Trailing indicator for maximum value**

A trailing indicator follows the current count value. The maximum value of the trailing indicator represents the greatest measured value that MR 2003 has already counted. MR 2021 lets you read out the greatest counter value.

Property	Description
Value range	-2.147.483.648 ... +2.147.483.647
Value after reset	+2.147.483.647

Tab. 93: SSI: Trailing indicator for maximum value

MR 2034 **SSI clock frequency**

MR 2034 lets you set the frequency of the SSI clock. Enter, for example, the value 2 into MR 2034 to set the clock frequency to 200 kHz.

Property	Description	
Values	0	100 kHz
	1	200 kHz
	2	1 MHz

Tab. 94: SSI clock frequency

MR 2035 **SSI configuration**

To configure the SSI function, enter the following parameters into MR 2035:

Property	Description	
Value range	0 ... 7, bit-coded	
Value after reset	0b01101100	
Meaning of the bits		
Bit 7 ... 3	**Bit-coded resolution for single-turn mode**	
	0b00001	1-bit resolution
	0b11111	31-bit resolution
Bit 2	**Type of code**	
	0 =	Binary code
	1 =	Gray code
Bit 1	**Alignment of date**	
	0 =	Left aligned evaluation of date
	1=	Right aligned evaluation of date
Bit 0	**Parity check**	
	1 =	Parity check enabled

Tab. 95: SSI configuration

MR 2036 **Resolution**

MR 2036 lets you define the resolution of the SSI encoder.

Property	Description
Value range	1 ... 25

Tab. 96: Resolution

MR 2043 **Force value**

MR 2043 lets you define a force value. To enter this value into MR 2003, issue the corresponding command.

8.12 Additional Functions

This module lets you configure additional functions for each counter.

Applications

Additional functions let you implement the following applications:

- Configuration of terminals X61.I/O1 ... X61.I/O4 as digital I/Os.
- A counter measures a physical length. The module converts the values so that the output is proportional to micrometers.
- Checking whether a counter reading has exceeded a limit.
- Recording values from several module registers by means of the oscilloscope function.
- etc.

8.12.1 Digital I/Os

The multi-purpose inputs and outputs X61.I/O1 ... X61.I/O4 can be used as 24 V inputs/outputs.

Reading Back Outputs

The multi-purpose I/Os let you read back the physical state of a digital output through its associated digital input.

Sample configuration

This example is based on the following configuration:

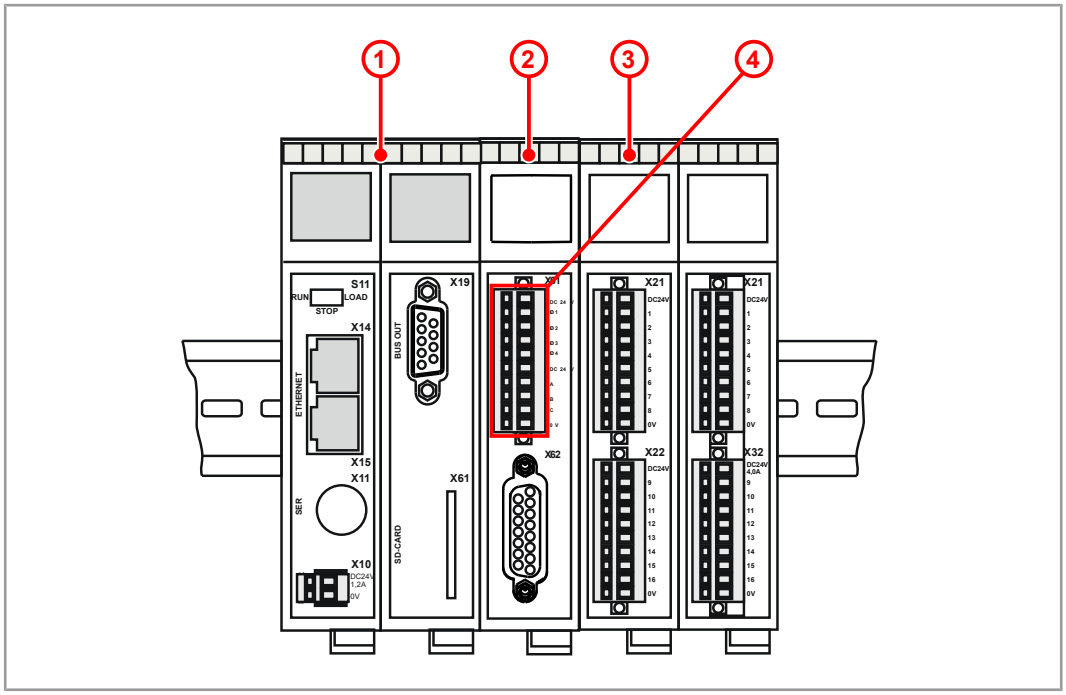


Fig. 39: Example configuration of digital I/Os

1	JC-3xx: Controller
2	JX3-CNT: Counter module, module number 2
3	JX3 modules: Further JX3 modules of the JX3 station
4	X61: Terminals for connecting digital I/Os

I/O Numbers

The I/O numbers are determined according to the pattern described in chapter Addressing I/O Expansion Modules [▶ 47].

Property	Number	Value
Module number	xx	02 … 17
Module-specific I/O number	zz	01 … 04
I/O numbers for module # 02	10000xxzz	100000201 … 100000204

Tab. 97: Example of I/O numbers for module # 02

Software Versions

The sample program has been tested on the following software versions:

– JetSym in version 4.4.3.
– The JC-350 controller in OS version 1.14.0.00.
– The JX3-CNT module in OS version 1.02.0.00.

> **Info** For current example programs, please refer to the online help of JetSym.

STX Program

```
Var
    JX3_CNT_Out1 : BOOL At %QX 100000201;
End_Var;

Task t_Main Autorun
    // A small blinker at port X61.I/O1
    Loop
        JX3_CNT_Out1 :=True;
        Delay(t#300ms);
        JX3_CNT_Out1 :=False;
        Delay(t#300ms);
    End_Loop;
End_Task;
```

8.12.2 Counter-Controlled Digital Outputs

The JX3-CNT module lets you define up to 16 values (switching values) which are then used to switch digital outputs ON or OFF as a function of the actual counter reading. This function can be compared to a cam-operated switchgroup or a timing drum.

Usable Counters

Number	Description
1	Counter 1
2	Counter 2
3	Counter 3
4	Counter 4
5	Counter A
6	Counter B
7	Counter C
8	24 V dual-channel counter
9	5 V dual-channel counter
10	SSI

Tab. 98: Usable Counters

ⓘ Info

Limitations

The following limitations apply to counter-controlled digital outputs:

– A maximum of 16 switching values (ON/OFF) can be defined per counter. The counter values must be entered in ascending order.
– Errors can be reset only by command 0.
– Counter control can be enabled only if no error has occurred.
– If you use a counter-controlled digital output, it is set and reset as a result of the counter reading. Do not use such a digital output as multi-purpose I/O.

Behavior of Counter Control

In managing counter readings for switching outputs, the counter control behaves as follows:

– You can enter ON/OFF values for each counter separately. The index for the corresponding output is automatically incremented by 1.
– Exit condition: If the last count value for switching OFF is smaller than the first count value.
– Four indices let you later edit the switching values for each output.
– In the case of errors, the module for evaluating the counter readings must be reset: To this end, enter value 0 into MR 951.
– The last counter reading that switched OFF an output affects the first count value for switching ON: As it is a closed system (comparable to a loop), the last count value which de-energized the output is of relevance to the next value even beyond the modulo limit.
– This function lets you read out the status of counter control at any time.

Enabling Counter Control

To enable counter-controlled outputs for a counter, proceed as follows:

1. Reset the counter control by issuing command 0.
2. Enter into MR 952 the counter which is to be used for counter control. The JX3-CNT module supports only one counter for counter control.
3. Assign switching values (ON/OFF) to the respective outputs. Note: Assign these values in ascending order!
4. Enter the following exit condition: The last value that switched an output OFF is smaller than the first value that switched that output.
5. Issue command 30 to enable counter control.

⇨ Counter control is enabled

Register description

Address Range - Counter-Controlled Digital Outputs

Register range	Description
MR 0950 ... 0999	24 V dual-channel counter

Tab. 99: Address Range - Counter-Controlled Digital Outputs

MR 0950

Status register

In MR 0950, the module reports the status of counter-controlled outputs.

Property	Description	
Type of access	Read	
Meaning of the bits		
Bit 0	**Validity - Output 1**	
	1 =	Counter control for output 1 is valid
Bit 1	**Validity - Output 2**	
	1 =	Counter control for output 2 is valid
Bit 2	**Validity - Output 3**	
	1 =	Counter control for output 3 is valid
Bit 3	**Validity - Output 4**	
	1 =	Counter control for output 4 is valid
Bit 6	**Counter control enabled**	
	1 =	Counter control is enabled
Bit 7	**Error state**	
	1 =	An error has occurred

Tab. 100: Status register

MR 0951

Command register of counter control

MR 0951 lets you configure the JX3-CNT module functions for counter control.

Command	Description
Type of access	Read/write
Command	
0	Initialize counter control (reset)
30	Enable counter control
31	Disable counter control

Tab. 101: Command register of counter control

MR 0952

Assigning counter control to counters

MR 0952 lets you assign counter control to a specific counter.

Property	Description
1	Counter 1
2	Counter 2
3	Counter 3
4	Counter 4
5	Counter A
6	Counter B

Property	Description
7	Counter C
8	24 V dual-channel counter
9	5 V dual-channel counter
10	SSI

Tab. 102: Assigning counter control to counters

MR 0959

Counter control version

MR 0959 lets you read out the software version of counter control.

Property	Description
Value	32 bits; the version can be displayed as IP address
Access	Read access

Tab. 103: Counter control version

MR 0960

Counter control index register for output 1

MR 0960 lets you access data in MR0961 and MR0962 using an index. This index register is assigned to output 1.

Property	Description
Values	0 ... 16
Range	Applies to MR 0961 and MR 0962

Tab. 104: Counter control index register for output 1

MR 0961

Count values for resetting output 1

MR 0961 lets you define the value which triggers output 1 to be set.

Property	Description
Count value	Output X61.I/O1 is set once the current count value of the selected counter corresponds to the value that has been entered into MR 0961.
Access	Indirect: The index in MR 0960 lets you manage up to 16 count values for setting output 1.
Please note:	The new count value in MR 0961 for setting output 1 must be greater than the last value in MR 0962 for resetting output 1.

Tab. 105: Count values for resetting output 1

MR 0962

Count values for resetting output 1

MR 0962 lets you define the value which triggers output 1 to be reset.

Property	Description
Count value	If the current count value of the selected counter corresponds to the value set in MR 0962, output X61.I/O1 is reset.
Access	Indirect: The index in MR 0960 lets you manage up to 16 count values for resetting output 1.
Please note:	The new count value in MR 0962 for resetting output 1 must be greater than the last value in MR 0961 for setting output 1.
Completion	The JX3-CNT module exits the list containing the count values for resetting outputs if one of the following conditions is met: – The index is set to the value 16 and the counter value for resetting is written. – The last programmed count value for resetting output 1 is smaller than the first count value for setting output 1.

Tab. 106: Count values for resetting output 1

MR 0963

Counter control index register for output 2

MR 0963 lets you access data in MR0964 and MR0965 using an index. This index register is assigned to output 2.

Property	Description
Value	0 ... 16
Range	Applies to MR 0964 and MR 0965

Tab. 107: Counter control index register for output 2

MR 0964

Count values for resetting output 2

MR 0964 lets you define the count value which triggers output 2 to be set.

Property	Description
Count value	Output X61.I/O2 is set once the current count value of the selected counter corresponds to the value that has been entered into MR 0964.
Access	Indirect: The index in MR 0963 lets you manage up to 16 count values for setting output 2.
Please note:	The new count value in MR 0964 for setting output 2 must be greater than the last value in MR 0965 for resetting output 2.

Tab. 108: Count values for resetting output 2

MR 0965

Count values for resetting output 2

MR 0965 lets you define the count value which triggers output 2 to be reset.

Property	Description
Count value	Output X61.I/O2 is reset once the current count value of the selected counter corresponds to the value that has been entered into MR 0965.
Access	Indirect: The index in MR 0963 lets you manage up to 16 count values for resetting output 2.
Please note:	The new count value in MR 0965 for resetting output 2 must be greater than the last value in MR 0964 for setting output 2.
Completion	The JX3-CNT module exits the list containing the count values for resetting outputs if one of the following conditions is met: – The index is set to the value 16 and the counter value for resetting is written. – The last programmed count value for resetting output 2 is smaller than the first count value for setting output 2.

Tab. 109: Count values for resetting output 2

MR 0966

Counter control index register for output 3

MR 0966 lets you access data in MR0967 and MR0968 using an index. This index register is assigned to output 3.

Property	Description
Value	0 ... 16
Range	Applies to MR 0967 and MR 0968

Tab. 110: Counter control index register for output 3

MR 0967

Count values for resetting output 3

MR 0967 lets you define the count value which triggers output 3 to be set.

Property	Description
Count value	Output X61.I/O3 is set once the current count value of the selected counter corresponds to the value that has been entered into MR 0967.
Access	Indirect: The index in MR 0966 lets you manage up to 16 count values for setting output 3.
Please note:	The new count value in MR 0967 for setting output 3 must be greater than the last value in MR 0968 for resetting output 3.

Tab. 111: Count values for resetting output 3

MR 0968

Count values for resetting output 3

MR 0968 lets you define the count value which triggers output 3 to be reset.

Property	Description
Count value	Output X61.I/O3 is reset once the current count value of the selected counter corresponds to the value that has been entered into MR 0968.
Access	Indirect: The index in MR 0966 lets you manage up to 16 count values for resetting output 3.
Please note:	The new count value in MR 0968 for resetting output 3 must be greater than the last value in MR 0967 for setting output 3.
Completion	The JX3-CNT module exits the list containing the count values for resetting outputs if one of the following conditions is met: – The index is set to the value 16 and the counter value for resetting is written. – The last programmed count value for resetting output 3 is smaller than the first count value for setting output 3.

Tab. 112: Count values for resetting output 3

MR 0969

Counter control index register for output 4

MR 0969 lets you access data in MR0970 and MR0971 using an index. This index register is assigned to output 4.

Property	Description
Value	0 ... 16
Range	Applies to MR 0970 and MR 0971

Tab. 113: Counter control index register for output 3

MR 0970

Count values for resetting output 4

MR 0970 lets you define the count value which triggers output 4 to be set.

Property	Description
Count value	Output X61.I/O4 is set once the current count value of the selected counter corresponds to the value that has been entered into MR 0970.
Access	Indirect: The index in MR 0969 lets you manage up to 16 count values for setting output 4.
Please note:	The new count value in MR 0970 for setting output 4 must be greater than the last value in MR 0971 for resetting output 4.

Tab. 114: Count values for resetting output 4

MR 0971

Count values for resetting output 4

MR 0971 lets you define the count value which triggers output 4 to be reset.

Property	Description
Count value	Output X61.I/O4 is reset once the current count value of the selected counter corresponds to the value that has been entered into MR 0971.
Access	Indirect: The index in MR 0969 lets you manage up to 16 count values for resetting output 4.
Please note:	The new count value in MR 0971 for resetting output 4 must be greater than the last value in MR 0970 for setting output 4.
Completion	The JX3-CNT module exits the list containing the count values for resetting outputs if one of the following conditions is met: – The index is set to the value 16 and the counter value for resetting is written. – The last programmed count value for resetting output 4 is smaller than the first count value for setting output 4.

Tab. 115: Count values for resetting output 4

8.12.3 Monitoring of Limit Values

The user can assign a separate value range to each counter input. The JX3-CNT module checks whether the count value is within the limits of this range.

Graphic Representation

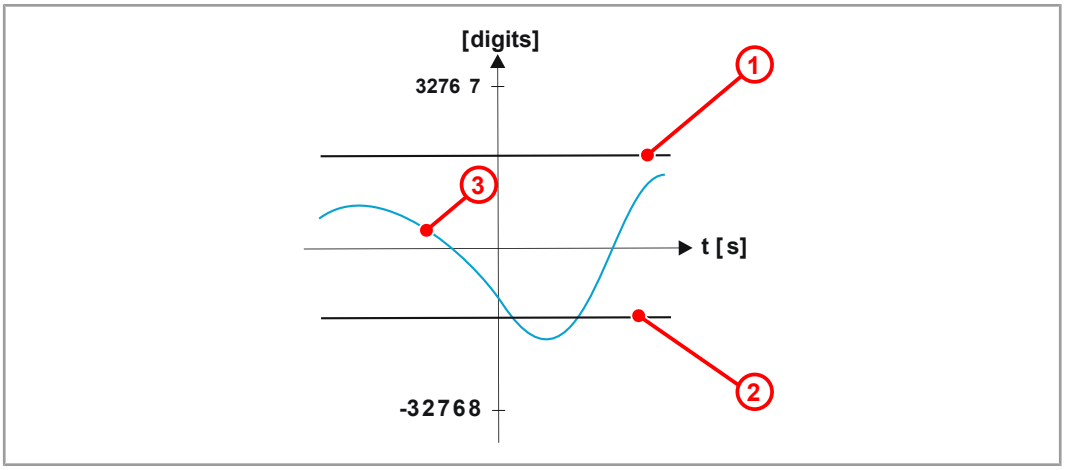


Fig. 40: Monitoring of limit values

1	Upper limit
2	Lower limit
3	Count value (in steps) of the corresponding counter input

Operating Principle

The JX3-CNT module checks the limit values as follows:

Step	Description	
1	The module receives a new value in MR 1y03.	
2	The module compares the value in MR 1y03 to the limit values in MR1y08 and 1y09.	
	If the count value in MR1y03 ...	**... then ...**
	is < MR 1y08,	bit 19 = 1 in MR 0000 and bit 19 = 1 MR 1y00 are set.
	is > MR 1y09,	bit 20 = 1 in MR 0000 and bit 20 = 1 MR 1y00 are set.

Configuration

To configure limit value monitoring, proceed as follows:

1. Enter the lower limit value for the count value into MR 1y08.
2. Enter the upper limit for the count value into MR 1y09.

⇨ Now, the JX3-CNT module checks at regular intervals whether the digital value of the counter input is within the limits.

Acknowledging Values Exceeding the Limits

To acknowledge values exceeding the limits, proceed as follows:

1. Delete bit 19 or bit 20 in MR 1y00 *Counter state.*
2. Delete bit 19 or bit 20 in MR 0000 *Module state*.

Register description

MR 1y08

Lower limit

MR 1y08 lets you define the lower limit for the counter. If the counter falls below this limit value, bit 19 in status register 1y00 is set.

Property	Description
Type of access	Read/write
Value range	-2.147.483.648 ... +2.147.483.647
Value after reset	-2.147.483.648

Tab. 116: Lower limit

MR 1y09

Upper limit

MR 1y09 lets you define the upper limit for the counter. If the counter exceeds this limit value, bit 20 in status register 1y00 is set.

Property	Description
Type of access	Read/write
Value range	-2.147.483.648 ... +2.147.483.647
Value after reset	+2.147.483.647

Tab. 117: Upper limit

8.12.4 Process Data Pointers

Process data pointers are directly available to the controller and need not be polled by the module from a register. This makes the application program much faster.

Application Range of the Process Data Pointers

With the two process data pointers in MR 800 and MR 801, two counter readings can be copied as a selection from all counters of the module into the module registers MR 2 and MR 3 with direct register access.

Number	Counter
1	Counter 1 at X61.I/O1
2	Counter 2 at X61.I/O2
3	Counter 3 at X61.I/O3
4	Counter 4 at X61.I/O4
5	Counter A at X61.A
6	Counter B at X61.B
7	Counter C at X61.C
8	Dual-channel counter (24 V) at X61.A ... X61.C
9	Dual-channel counter (5 V) at X62
10	SSI encoder at X62

Tab. 118: Application range of the process data pointers

Example

MR 2 is to indicate the counter reading of the 24 V dual-channel counter and MR 3 the counter reading of counter B.

Sample configuration

This example is based on the following configuration:

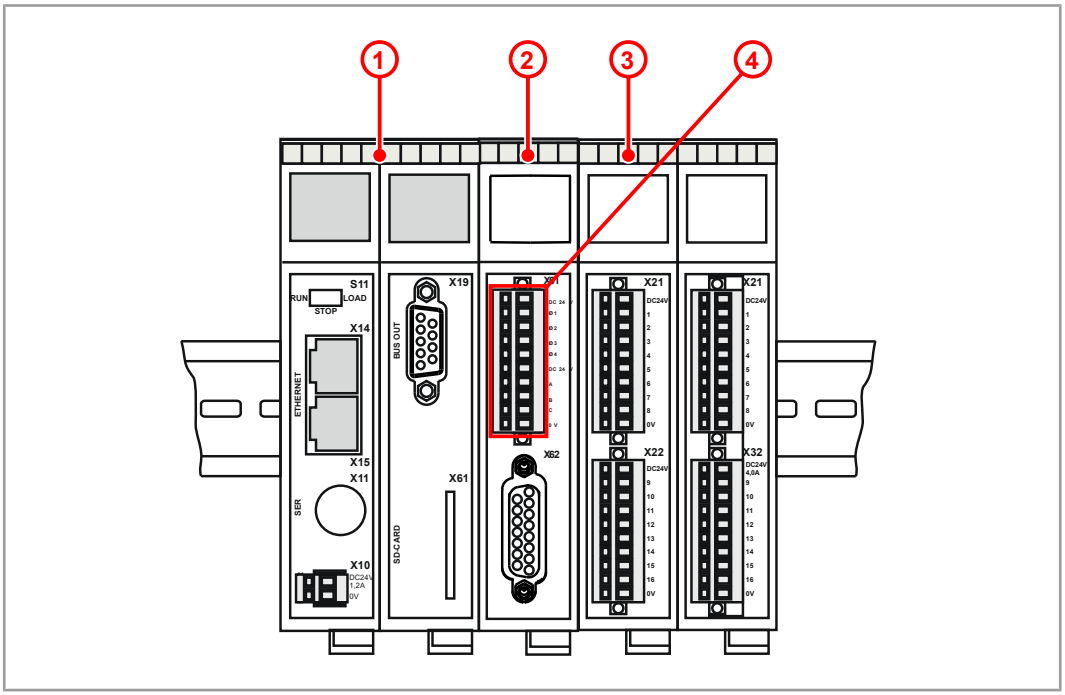


Fig. 41: Example configuration of digital I/Os

1	JC-3xx: Controller
2	JX3-CNT: Counter module, module number 2

3	JX3 modules: Further JX3 modules of the JX3 station
4	X61: Terminals for connecting digital I/Os

Software Versions

The sample program has been tested on the following software versions:

– JetSym in version 4.4.3.
– The JC-350 controller in OS version 1.14.0.00.
– The JX3-CNT module in OS version 1.02.0.00.

JetSym STX Program

```
Var
    JX3_CNT_DualCnt24 V_Cmd: Int At %VL 100021801;
    JX3_CNT_CounterB: Int At %VL 100021601;
    JX3_CNT_ProcPtr_1: Int At %VL 100020800;
    JX3_CNT_ProcPtr_2: Int At %VL 100020801;
End_Var;

Task Main Autorun
    // Initialization of the two counters
    JX3_CNT_DualCnt24 V_Cmd := 30;
    JX3_CNT_CounterB := 30;
    //Mapping:
    JX3_CNT_ProcPtr_1 := 8;
    JX3_CNT_ProcPtr_2 := 6;
    // the counter reading from the 24 V dual-channel counter is
now visible in MR 2
    // and the counter reading of counter B in MR 3.
End_Task;
```

Register description

MR 0800

Process data pointer 1

In MR 0800, the value 1 ... 10 is written to select a counter. The count value is directly copied into MR 0002 and is available to the controller without requiring additional steps.

Property	Description
Values	1 ... 10
Access	Read/write
Value after reset	8
Assignment - Process data pointers	
1	Counter 1 at X61.I/O1
2	Counter 2 at X61.I/O2
3	Counter 3 at X61.I/O3
4	Counter 4 at X61.I/O4
5	Counter A at X61.A
6	Counter B at X61.B
7	Counter C at X61.C
8	Dual-channel counter (24 V) at X61.A ... X61.C
9	Dual-channel counter (5 V) at X62
10	SSI encoder at X62

Tab. 119: Process data pointer 1

MR 0801

Process data pointer 2

In MR 0801, the value 1 ... 10 is written to select a counter. The count value is directly copied into MR 0003.

Property	Description
Values	1 ... 10
Access	Read/write
Value after reset	9
Assignment - Process data pointers	
1	Counter 1 at X61.I/O1
2	Counter 2 at X61.I/O2
3	Counter 3 at X61.I/O3
4	Counter 4 at X61.I/O4
5	Counter A at X61.A
6	Counter B at X61.B
7	Counter C at X61.C
8	Dual-channel counter (24 V) at X61.A ... X61.C

Property	Description
9	Dual-channel counter (5 V) at X62
10	SSI encoder at X62

Tab. 120: Process data pointer 2

8.12.5 Trailing Indicator

The JX3-CNT module checks each value in count value register 1y03. The trailing indicators show the lowest and highest measured values. The trailing indicator contents are lost when the module is switched off.

Initialization

After power-up, the JX3-CNT module automatically initializes the trailing indicators for minimum and maximum value.

Graphic Representation

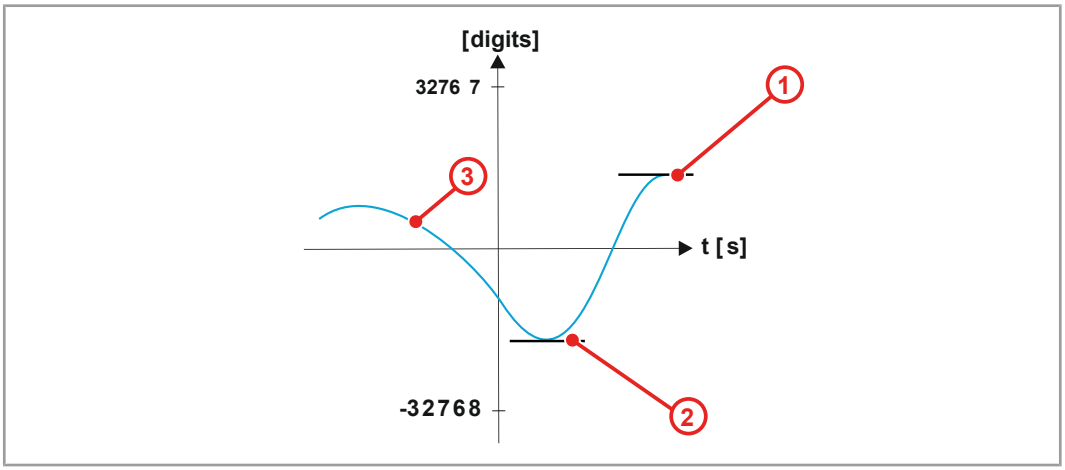


Fig. 42: Trailing indicator

1	Trailing indicator for maximum value, MR 1y21
2	Trailing indicator for minimum value, MR 1y20
3	Count value of counter input (in steps)

Operating Principle

The JX3-CNT module checks the trailing indicators as follows:

Step	Description	
1	The module receives a new value in MR 1y03.	
2	**If the count value in MR1y03 ...**	**... then ...**
	is < MR 1y20,	MR 1y20 = digital value of counter input y.
	Is > MR 1y21,	MR 1y21 = digital value of counter input y.

Resetting Trailing Indicators

Use commands 70, 71, 72 in MR 1y01 to reset the trailing indicators. The existing count value will be applied.

Register description

MR 1y20

Trailing indicator for minimum value

A trailing indicator follows the current count value. The lower limit of the trailing indicator represents the smallest measured value that MR 1y03 has already counted and displayed. MR 1y20 lets you read out the smallest counter value.

Property	Description
Type of access	Read/write
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	-2.147.483.648

Tab. 121: Trailing indicator for minimum value

MR 1y21

Trailing indicator for maximum value

A trailing indicator follows the current count value. The upper limit of the trailing indicator represents the greatest measured value that MR 1y03 has already counted. MR 1y21 lets you read out the greatest counter value.

Property	Description
Type of access	Read/write
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	+2.147.483.647

Tab. 122: Trailing indicator for maximum value

8.12.6 Forcing Function (Only SSI Encoder)

The JX3-CNT module additionally features a forcing function for SSI encoders. If an SSI encoder is connected, the module does not allow count values to be directly entered into count value register MR 1y03. When using the forcing function (SSI encoder counter input), the module outputs a value that can be configured in MR 2043 in the read-only MR 2003. This preset value does not depend on the actual value in MR 2003. The forcing function is intended, for instance, for test runs during commissioning.

MR 2003 contains the actual count value, or alternatively, any value defined in MR 2043. The offset entered into MR 2005 also applies to the force value.

Enabling Forcing Function

To enable the forcing function, proceed as follows:

1. Write the desired force value for the counter input into MR 2043 *Force value*.
2. Write command 20 *Enable forcing function* into MR 2001 *Command register SSI*.

⇨ MR 2003 contains the value that has been set in MR 2043. The offset entered into MR 2005 also applies to the force value in MR 2043.

Disabling Forcing Function

To disable the forcing function, proceed as follows:

► Write command 21 *Disable forcing function* into MR 2001 *Command register SSI*.

⇨ As a result, MR 2003 contains the actual count value of the SSI encoder.

8.12.7 Application-Specific Scaling

Application-specific scaling lets you convert count values into corresponding units. The conversion of the physical quantity into the appropriate calculated value is carried out by the JX3-CNT module. Application-specific scaling can be configured separately for each counter input.

Applicability of Application-Specific Scaling

Application-specific scaling can be enabled for the following counters:

Register range	Description
MR 1500 ... 1599	Single-channel counter (24 V) at X61.A
MR 1600 ... 1699	Single-channel counter (24 V) at X61.B
MR 1700 ... 1799	Single-channel counter (24 V) at X61.C
MR 1800 ... 1899	Dual-channel counter (24 V) at X61.A ... X61.C
MR 1900 ... 1999	Dual-channel counter at X62

Applications

Application-specific scaling can be used for the following applications:

– An incremental encoder counts from 0 to 360°. The output can be adapted so that the JX3-CNT module outputs numbers 0 to 360.

– A counter measures a physical length. The JX3-CNT module converts the values so that the output is proportional to micrometers.

– etc.

ⓘ Info

Differentiation

The scaling function provided by the JX3-CNT module differs from the one of other modules of the JX3 series.

The module requires a separate calculation of the equation of the straight line which can then be used as multiplier, divisor and offset for calculating the physical unit.

Calculation

A voltage to be output at the analog output is calculated according to the following formula:

$$y_n = x \cdot \frac{\mathrm{MUL}}{\mathrm{DIV}} + \mathrm{OFFSET}$$

Element	Description
x	Digital value of the count value from MR 1y03
MUL	Multiplier from MR 1y13 The internal intermediate result of the multiplication is a 32-bit value.
DIV	Divisor from MR 1y14
OFFSET	Offset from MR 1y15
y_n	Result of the calculation. This value is transferred to the controller in MR 1y18.

When calculating the scaling, multiplication takes place first. The intermediate result is a 32-bit value, which is then divided by the divisor. The OFFSET is only added in the last step.

Activation

After power-up, application-specific scaling is enabled. As the result is stored in a dedicated register, the calculated value can be displayed immediately and permanently. After power-up, the multiplier and divisor values are 1, offset is 0. Therefore, the value resulting from scaling is proportional to the original value.

Graphic Representation

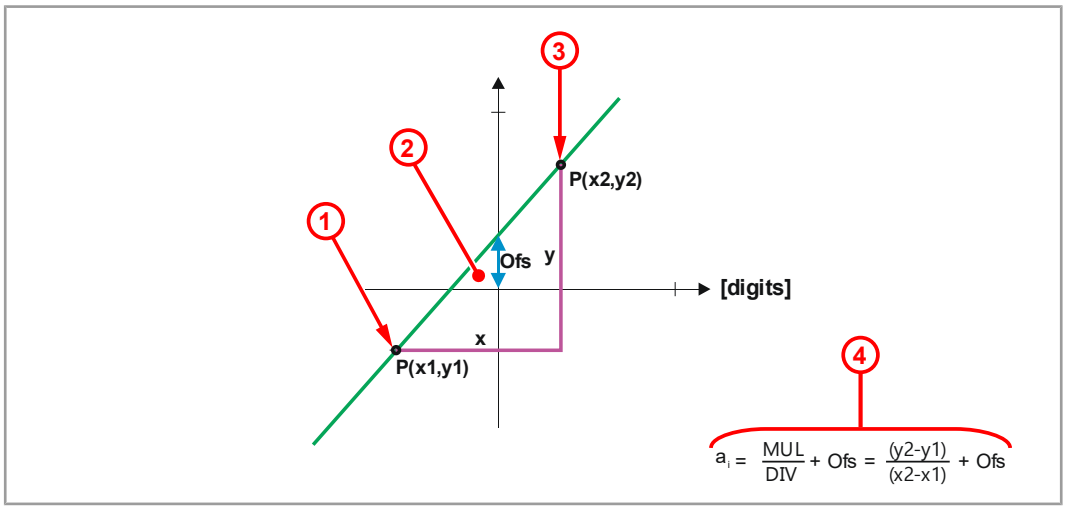


Fig. 43: Point pairs of application-specific scaling

1	First point P1 (x1, y1)
2	Offset of the straight line
3	Second point P2 (x2, y2)
4	Equation: Gradient of the straight line

To configure application-specific scaling, specify the gradient of the straight line and the offset.

Configuration

To configure application-specific scaling, proceed as follows:

1. Calculate gradient and offset of the straight line on the basis of the point pairs P1 (x1, y1) and P2 (x2, y2).

$$MUL = y2 - y1$$
$$DIV = x2 - x1$$

$$y_n = \frac{y2 - y1}{x2 - x1} = \frac{MUL}{DIV}$$

$$OFS = y1 - \frac{x1(y2 - y1)}{x2 - x1} = y2 - \frac{x2(y2 - y1)}{x2 - x1}$$

2. Enter the calculated multiplier value as integer into MR 1y13.
3. Enter the calculated divisor value as integer into MR 1y14.
4. Enter the calculated offset value as integer into MR 1y15.

⇨ MR 1y18 now contains the scaled count value.

Register description

MR 1y13

Multiplier for scaling function

MR 1y13 lets you define a multiplier. The count value contained in MR 1y03 is multiplied by the value of MR 1y13. The result is stored in MR 1y18.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	1

Tab. 123: Multiplier for scaling function

MR 1y14

Divisor for scaling function

MR 1y14 lets you define a divisor. The count value contained in MR 1y03 is divided by the value of MR 1y14. The result is stored in MR 1y18.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	1

Tab. 124: Divisor for scaling function

MR 1y15

Offset for scaling function

MR 1y15 lets you define an offset. An offset is added to the count value in MR 1y03, multiplication and division factors. The result is stored in MR 1y18.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Value after reset	0

Tab. 125: Offset for scaling function

MR 1y18

Scaled count value

The scaled or calculated count value is contained in MR 1y18.

Property	Description
Values	-2.147.483.648 ... +2.147.483.647
Type of access	Read only

Tab. 126: Scaled count value

8.13 Oscilloscope Function

The JX3-CNT module features an integrated oscilloscope function. The oscilloscope function lets you record values from several module registers.

JetSym

The JetSym programming tool lets you operate the oscilloscope function and have the recorded values displayed as diagrams in a very convenient way.

Technical Specifications

Parameter	Description
Recording interval	1 ms ... 65.535 ms
Number of channels	2 max.
Number of readings per channel	300 max.
Recordable module registers	MR 0002: Digital value input 1 MR 0003: Digital value input 2
Module registers to which a trigger condition can be assigned	MR 0002: Digital value input 1 MR 0003: Digital value input 2

Tab. 127: Oscilloscope - Technical specifications

Applications

The following applications are possible:

– Evaluation of output values as diagrams for documentation purposes

– etc.

8.13.1 Start/Stop Recording

During start/stop recording, the JX3-CNT module records measured values until the maximum number of measured values per channel has been recorded. Start/stop recording is started via command 1.

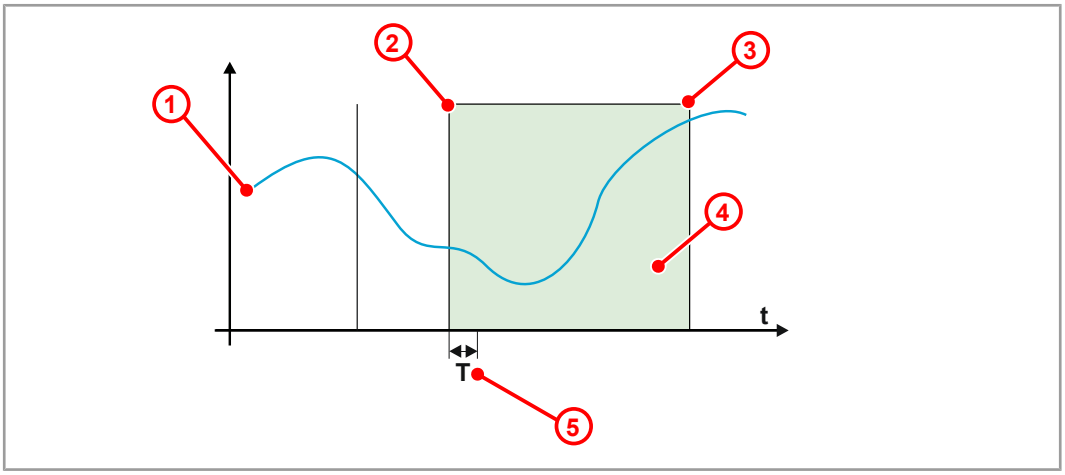


Fig. 44: Start/Stop Recording

1	Values of the module register to be recorded from.
2	Start time of recording
3	End of recording
4	Recorded values
5	Recording interval

Configuration

Start/stop recording is configured as follows:

1. Configure the module registers to be recorded.
   MR 9741 := 11 ... 14;
   MR 9742 := module register number;
2. Configure the recording interval.
   MR 9741 := 10;
   MR 9742 := recording interval;
3. Write value 1 into MR 9740 *Command oscilloscope*.

   ⇨ The JX3-CNT module starts recording.

⇨ The JX3-CNT module continues to record values until the number of measured values per channel has been recorded.

4. Check bit 0 of parameter *Status*.
   MR 9741 := 0;
   If bit 0 = 0 in MR 9742, the module has finished recording.

8.13.2 Continuous Recording

During continuous recording, the JX3-CNT module constantly records measured values. If you issue command 2 Stop, the JX3-CNT module continues recording until the post-buffer is filled with values. To start continuous recording, enter command 4.

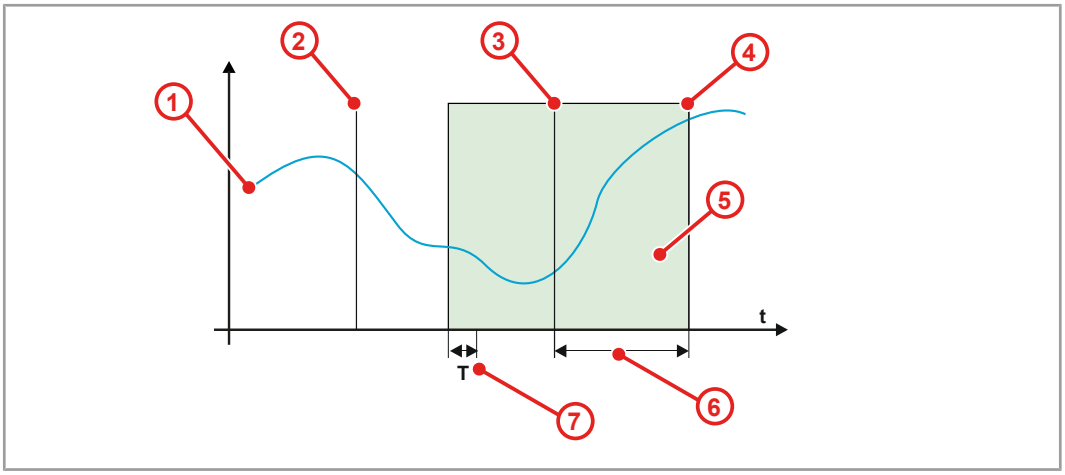


Fig. 45: Continuous Recording

1	Values of the module register to be recorded from
2	Start time of continuous recording
3	Time of stop command
4	End of recording; post-buffer is filled with values
5	Recorded values
6	Size of the post-buffer
7	Recording interval

Configuration

Continuous recording is configured as follows:

1. Configure the module registers to be recorded.
   MR 9741 := 11 ... 14;
   MR 9742 := module register number;
2. Configure the recording interval.
   MR 9741 := 10;
   MR 9742 := recording interval;
3. Configure the size of the post-buffer.
   MR 9741 := 30;
   MR 9742 := percentage of the maximum number of measured values per channel;
4. Write value 4 into MR 9740 *Command oscilloscope*.

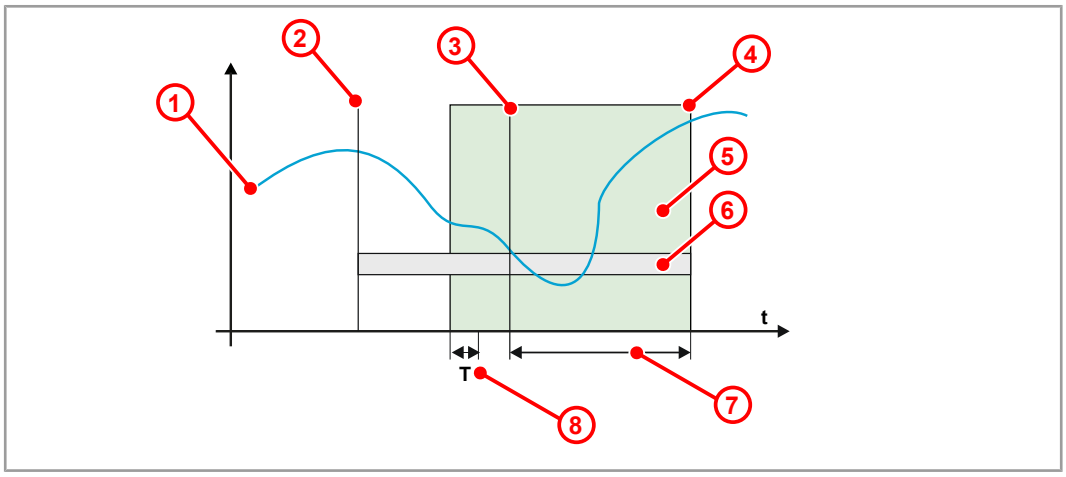
   ⇨ The JX3-CNT module starts recording.
5. Stop the recording by writing value 2 into MR 9740 *Command oscilloscope*.

6. The JX3-CNT module continues to record values until the post-buffer is filled.

7. Check bit 0 of parameter *Status*.
   MR 9741 := 0;
   If bit 0 = 0 in MR 9742, the module has finished recording.

8.13.3 Recording with Trigger Condition

When recording with trigger condition, the JX3-CNT module constantly records measured values. As soon as the trigger condition is met, recording continues until the post-buffer is filled with values. Recording with trigger condition is started via command 3.



Trigger Condition

The JX3-CNT module checks the trigger condition using the following rules:

– The value in the module register for trigger # 1 must be greater than a configured value.

– The value in the module register for trigger # 2 must be smaller than a configured value.

– The module register numbers for trigger # 1 and 2 can be different.

MR [Trigger # 1] > VAL [Trigger # 1]

AND

MR [Trigger # 2] < VAL [Trigger # 2]

Element	Description
MR [Trigger # 1]	Value in module register for trigger # 1
VAL [Trigger # 1]	Value for trigger # 1
MR [Trigger # 2]	Value in module register for trigger # 2
VAL [Trigger # 2]	Value for trigger # 2

Configuration

Recording with trigger condition is configured as follows:

1. Configure the module registers to be recorded:
   MR 9741 := 11 ... 14;
   MR 9742 := module register number;
2. Configure the recording interval:
   MR 9741 := 10;
   MR 9742 := recording interval;
3. Configure the size of the post-buffer:
   MR 9741 := 30;
   MR 9742 := percentage of the maximum number of measured values per channel;
4. Configure trigger # 1:
   MR 9741 := 20;
   MR 9742 := module register number for trigger # 1;
   MR 9741 := 21;
   MR 9742 := value for trigger # 1;
5. Configure trigger # 2:
   MR 9741 := 22;
   MR 9742 := module register number for trigger # 2;
   MR 9741 := 23;
   MR 9742 := value for trigger # 2;
6. Write value 3 into MR 9740 *Command oscilloscope*.
   ⇨ The JX3-CNT module starts recording.
   ⇨ The JX3-CNT module constantly checks the trigger condition.
   If the trigger condition is met, the JX3-CNT module continues to record values until the post-buffer is filled.
7. Check bit 0 of parameter *Index*.
   MR 9741 := 0;
   If bit 0 = 0 in MR 9742, the module has finished recording.

8.13.4 Reading Out Recorded Values

The JX3-CNT module stores recorded values in a volatile memory area. The recorded data are lost when the module is switched off. Also, if a new recording cycle is started, these values are overwritten.

Reading Out the Recorded Values

To read out the recorded values, proceed as follows:

1. Check bit 0 of parameter *Status*.
   MR 9741 := 0;
   If bit 0 = 0 in MR 9742, the module has finished recording.
2. Enter the value 0 into MR 9743 *Index of recorded values*.
   MR 9743 := 0;
3. Each read access to MR 9744 *Recorded values* reads out the next recorded value. If you have read out MR 9744 300 times, then all recorded values from channel 1 have been read.
4. Enter the value 300 into MR 9743 *Index of recorded values*.
   MR 9743 := 300;

5. Each read access to MR 9744 *Recorded values* reads out the next recorded value. If you have read out MR 9744 300 times, then all recorded values from channel 2 have been read.
6. Enter the value 300 into MR 9743 *Index of recorded values*.
   MR 9743 := 600;

8.13.5 Register description

MR 9740 **Command register Oscilloscope function**

MR 9740 lets you configure the functionalities of the oscilloscope functions.

Property	Description
Type of access	Read/write
Value range	0 … 4
Value after reset	0
Command	
1	**Starting a recording session**
	The module starts recording the previously configured values. Once the internal memory is stored with readings, the module stops recording.
2	**Stopping a recording session**
	The command *Stop* lets you pause a recording that has been started.
3	**Starting a recording session once a trigger condition is fulfilled**
	The module starts monitoring the trigger condition. Once the trigger condition is fulfilled, the module starts recording the values. Recording stops once the memory for the measured values is full.
4	**Starting continuous recording**
	The module starts recording immediately. Recording is not stopped before issuing command *Stopping a recording session*.

Tab. 128: Command register Oscilloscope function

MR 9741 **Parameter index**

MR 9741 contains the parameter index. The parameter index is used for selecting the parameters for the oscilloscope function. The parameter value can then be directly read out from MR 9742, or entered into MR 9742.

Property	Description
Type of access	Read/write
Value range	0 … 23

Tab. 129: Parameter index

MR 9742

Parameter

MR 9742 contains the parameter. The parameter is selected via the parameter index (MR 9741).

Index	Description	
Type of access	Read/write	
Value range	32 bits	
Value after reset	0	
Parameter		
0	**Status (read-only)**	
	Bit 0 = 1	Recording
	Bit 1 = 1	Trigger enabled
10	**Sampling interval**	
	The sampling interval defines the intervals at which readings are recorded. The interval between two recordings (in milliseconds) results from the product of minimum sampling interval and sampling interval.	
	Value range	1 ... 65535
11 ... 12	**Module register number for channel # 1 ... 2**	
	Parameters 11 to 12 are used to configure the module registers that the module is to record.	
20	**Module register number for trigger # 1**	
	Number of the module register for trigger condition # 1.	
21	**Value for trigger # 1**	
	Value in module register for trigger condition # 1.	
22	**Module register number for trigger # 2**	
	Number of the module register for trigger condition # 2.	
23	**Value for trigger # 2**	
	Value in module register for trigger condition # 2.	
30	**Size of the post-buffer**	
	Value range	0 % ... 100 %

Tab. 130: Parameter

MR 9743

Index of the recorded values

The recorded values are selected via the index.

MR 9744

Recorded values

The recorded values are read via the module register.

9 Register overview

This register overview describes the registers of the JX3-CNT device in operating system version 1.02.0.00 in a highly summarized form.

Module code

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

– Module code JX3-CNT: 308

General overview – registers

Register range	Description
0000	Module-specific status register
0001	Module-specific command registers
0002 … 0003	Process data
0007	Index
0008	Value
0009, 0032, 0769, 9600	Version registers
0800 ... 0801	Pointer to process data
0900 ... 0949	Multi-strobe
0950 ... 0999	Counter-controlled outputs (SimpleCAM)
1100 ... 1199	Counter 1 (X61.I/O1)
1200 ... 1299	Counter 2 (X61.I/O2)
1300 ... 1399	Counter 3 (X61.I/O3)
1400 ... 1499	Counter 4 (X61.I/O4)
1500 ... 1599	Counter A (X61.A)
1600 ... 1699	Counter B (X61.B)
1700 ... 1799	Counter C (X61.C)
1800 ... 1899	24 V dual-channel counter (X61.A .... X61.C)
1900 ... 1999	5 V dual-channel counter (X62)
2000 ... 2099	SSI (X62)
9740 ... 9744	Oscilloscope function

Module state

Register	Description
0000	**Module-specific status register**
Bit 17 = 1	Short circuit 24 V
Bit 18 = 1	Short circuit 5 V
Bit 19 = 1	Collective bit "Lower limit"
Bit 20 = 1	Collective bit "Upper limit"
Bit 21 = 1	24 V encoder supply (X61.DC24V0.5A) is enabled
Bit 22 = 1	5 V encoder supply (X62.10) is enabled
Bit 23 = 1	24 V encoder supply (X62.12) is enabled
Bit 30 = 1	Synchronous data exchange

Module commands

Register	Description
0001	**Module-specific command registers**
1	Status register reset 0
2	Disable 24 V encoder supply (X61.DC24V0.5A)
3	Enable 24 V encoder supply (X61.DC24V0.5A)
4	Disable 5 V encoder supply (X62.10)
5	Enable 5 V encoder supply (X62.10)
6	Disable 24 V encoder supply (X62.12)

Pointer to process data

Register range	Description
0800	Pointer to process data in MR 2
0801	Pointer to process data in MR 3
Value	
1 ... 4	Counter 1 ... 4
5 ... 7	Counter A ... C
8	24 V dual-channel counter
9	5 V dual-channel counter
10	SSI encoder

Multi-strobe function

Register	Description
0900	**Status**
Bit 1 = 1	Multi-strobe memory is full
Bit 2 = 1	Multi-strobe enabled
Bit 4 = 1	Multi-strobe overflow
0901	**Command**
2	Enable multi-strobe
3	Disable multi-strobe
4	Reset data
0902	**Assignment**
5 ... 7	Counter A ... C
8	24 V dual-channel counter
9	5 V dual-channel counter
0903	Strobe count
0904	Strobe index
0905	Strobe data
0910 ... 0925	Strobe-DirectData[0] ... Strobe-DirectData[15]

Counter-controlled outputs (Simple-CAM)

Register	Description
0950	**Status**
Bit 0 = 1	Output 1: no error
Bit 1 = 1	Output 2: no error
Bit 2 = 1	Output 3: no error
Bit 3 = 1	Output 4: no error
Bit 6 = 1	Counter control enabled
Bit 7 = 1	An error has occurred
0951	**Command**
0	Initialize counter control
30	Enable counter control
31	Disable counter control
0952	Assign counter 1 ... 10 for Simple-CAM
0959	Software version of counter control
0960	Index register for output 1
0961	Output 1 start point (to index 960)
0962	Output 1 end point (to index 960)
0963	Index register for output 2
0964	Output 2 start point (to index 963)
0965	Output 2 end point (to index 963)
0966	Index register for output 3
0967	Output 3 start point (to index 966)
0968	Output 3 end point (to index 966)
0969	Index register for output 4
0970	Output 4 start point (to index 969)
0971	Output 4 end point (to index 969)

Counter 1 ... 4 at X61

Register	Description
1y00	**Counter state**
Bit 26 = 1	Counter enabled
1y01	**Command**
30	Enable counter
31	Disable counter
1y03	Count value
where y = 1 represents counter 1	
where y = 2 represents counter 2	
where y = 3 represents counter 3	
where y = 4 represents counter 4	

Counter A ... C at X61

Register	Description
1y00	**Counter state**
Bit 8 = 1	Gate function is enabled
Bit 9 = 1	Strobe function is enabled
Bit 10 = 1	Search for reference is enabled
Bit 14 = 1	Modulo function is enabled
Bit 15 = 1	Modulo error
Bit 16 = 1	Measurement is enabled
Bit 19 = 1	Value below lower limit
Bit 20 = 1	Value exceeds upper limit
Bit 24 = 1	Strobe value is received
Bit 25 = 1	Counter is blocked by gate function
Bit 26 = 1	Counter enabled
Bit 27 = 1	Reference is set
Bit 28 = 1	Strobe overflow
Bit 29 = 1	Reversal of counting direction is enabled
1y01	**Command**
30	Enable counter
31	Disable counter
32	Positive counting direction
33	Negative counting direction
34	Enable gate function
35	Disable gate function
36	Enable strobe function
37	Disable strobe function
38	Enable reference function
39	Disable reference function
40	Clear strobe bit on reading
41	Clear strobe bit manually
50	Activate measurement
51	Disable measurement
60	Enable modulo function
61	Disable modulo function
70	Reset trailing indicator for minimum value
71	Reset trailing indicator for maximum value
72	Reset trailing indicator for minimum and maximum value
1y03	Count value
1y04	Strobe
1y05	Reference offset
1y06	Period
1y07	Pulse width
1y08	Lower limit
1y09	Upper limit
1y13	Multiplication factor
1y14	Division factor
1y15	Offset
1y18	Count value after scaling
1y20	Trailing indicator for minimum value
1y21	Trailing indicator for maximum value
1y23	Digital filter
1y26	Gate mask
1y27	Gate active high
1y28	Strobe - rising edge
1y29	Strobe - falling edge
1y32	Reference - rising edge
1y33	Reference - falling edge
1y40	Modulo - lower limit
1y41	Modulo - upper limit
1y42	Modulo revolutions
where y = 5 represents channel A	
where y = 6 represents channel B	
where y = 7 represents channel C	

Dual-channel counter

Register	Description
1y00	**Counter state**
Bit 8 = 1	Gate function is enabled
Bit 9 = 1	Strobe function is enabled
Bit 10 = 1	Search for reference is enabled

Register	Description
Bit 14 = 1	Modulo function is enabled
Bit 15 = 1	Modulo error
Bit 19 = 1	Value below lower limit
Bit 20 = 1	Value exceeds upper limit
Bit 24 = 1	Strobe value is received
Bit 25 = 1	Counter is blocked by gate function
Bit 26 = 1	Counter enabled
Bit 27 = 1	Reference is set
Bit 28 = 1	Strobe overflow
Bit 29 = 1	Reversal of counting direction is enabled
1y01	**Command**
30	Enable counter
31	Disable counter
32	Positive counting direction
33	Negative counting direction
34	Enable gate function
35	Disable gate function
36	Enable strobe function
37	Disable strobe function
38	Enable reference function
39	Disable reference function
40	Clear strobe bit on reading
41	Clear strobe bit manually
60	Enable modulo function
61	Disable modulo function
70	Reset trailing indicator for minimum value
71	Reset trailing indicator for maximum value
72	Reset trailing indicator for minimum and maximum value
1y03	Count value
1y04	Strobe
1y05	Reference offset
1y06	Period
1y08	Lower limit
1y09	Upper limit
1y13	Multiplication factor
1y14	Division factor
1y15	Offset
1y18	Count value after scaling
1y20	Trailing indicator for minimum value
1y21	Trailing indicator for maximum value
1y23	Digital filter
1y26	Gate mask
1y27	Gate active high
1y28	Strobe - Rising edge
1y29	Strobe - Falling edge
1y30	Reference mask
1y31	Reference active low
1y40	Modulo - lower limit
1y41	Modulo - upper limit
1y42	Modulo revolutions
where y = 8 represents 24 V dual-channel counter (X61.A to X61.C)	
where y = 9 represents 5 V dual-channel counter (X62)	

SSI at X62

Register	Description
2000	**Status**
Bit 0 = 1	New value has been received
Bit 2 = 1	Parity check failed
Bit 18 = 1	Forcing function is enabled
2001	**Command**
1	Reset
8	Software strobe
10	Enable continuous update
11	Disable continuous update
12	Enable continuous strobe
13	Disable continuous strobe
20	Enable forcing function
21	Disable forcing function

Register	Description
70	Reset trailing indicator for minimum value
71	Reset trailing indicator for maximum value
72	Reset trailing indicator for minimum and maximum value
2003	Count value
2005	Offset
2008	Lower limit
2009	Upper limit
2020	Trailing indicator for minimum value
2021	Trailing indicator for maximum value
2034	**SSI clock frequency**
0	100 kHz
1	200 kHz
2	1 MHz
2035	Configuration
2036	Resolution
2043	Force value

Oscilloscope function

Register	Description
9740	Command
9741	Parameter index
9742	Parameter
9743	Data index
9744	Data

Revisions

Register	Description
0009	OS version
0032	FPGA version
0769	Bootloader version
9600	FPGA version - counter features

Electronic Data Sheet (EDS)

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

Register range	Description
100500 … 100501	**EDS data selection**
100500	Interface: 1= Position of the expansion modules in the system
100501	Module number within the system
100600 … 100614	**Data of the EDS page 0 (identification)**
100600	Revision of EDS page 0
100601	Module code
100602 … 100612	Module name
100613	Hardware revision
100614	Hardware option
100700 … 100710	**Data of the EDS page 1 (production)**
100700	Revision of EDS page 1
100701 … 100707	Serial number of the module
100708	Production date: Day
100709	Production date: Month
100710	Production date: Year

10 Maintenance

This device is maintenance free.
Therefore, for the operation of the device, no inspection or maintenance is required.

10.1 Repairs

Defective components could cause dangerous malfunctions and could compromise safety.
Only the manufacturer is allowed to repair the device.
It is forbidden to open the device.

Modifications to the device

Modifications and alterations to the device and its functions are not allowed. In the case of modifications to the device, any liability is excluded.

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

Any liability for any damages resulting from the use of non-original parts and equipment is excluded.

10.2 Storage and Shipment

Storage

When storing the device observe the environmental conditions given in chapter “Technical specifications”.

Shipment and packaging

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

To protect the device from impact or shock, it must be shipped in its original packaging, or in an appropriate protective ESD packaging.
In case of damaged packaging inspect the device for any visible damage, and inform your freight forwarder and the Bucher Automation AG of the damage caused during shipment. If the device is damaged or has been dropped, it is strictly forbidden to use it.

10.3 Return and Disposal

Disposal Options

Return your Bucher Automation AG product to us for proper disposal. Visit our website for detailed information and to download the required Returns form.

Meaning of WEEE Icon



Fig. 46: WEEE icon – crossed out trash can

The product is waste electronic equipment and must be disposed of by a certified waste management facility. Do not dispose of the product with normal household waste. Applicable local environmental directives and regulations must be complied with.

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 customers to delete any personal data stored on waste electric and electronic equipment prior to disposal.

11 Service

11.1 Customer service

Should you have any questions, suggestions, or problems, please don't hesitate to contact our service representatives. To contact them, please call our technical hotline or use the contact form on our homepage:

Technical hotline | Bucher Automation - We automate your success.

You are also welcome to send an e-mail to our technical hotline:

hotline@bucherautomation.com

Please supply the following information when contacting our technical hotline:

– Hardware revision and serial number
  For the hardware revision and serial number of your product, please refer to the nameplate.
– OS version
  To determine the operating system version, use the functions of the development environment.

12 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.

12.1 Spare Parts

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

Tab. 131: Spare parts

12.2 Accessories

ⓘ Info

Ordering Accessories

The accessories are not part of the scope of delivery.

Suitable accessories can be obtained from Bucher Automation AG.

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

Tab. 132: Accessories

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