JX2-IO16

Peripheral Module

JetWeb

User Manual

Jetter
Automation. Made easy.

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Revision 3.00.2

Jetter AG reserves the right to make alterations to its products in the interest of technical progress. These alterations need not be documented in every single case.

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This user manual is an integral part of the peripheral module JX2-IO16:

Type: _____

Serial #: _____

Year of construction: _____

Order #: _____

CE

To be entered by the customer:

Inventory #: _____

Place of operation: _____

Significance of this User Manual

This manual is an integral part of the JX2-IO16 module, and

- must be kept in a way that it is always at hand until the JX2-IO16 module will be disposed of.
- If the JX2-IO16 module is sold, alienated or loaned, this manual must be handed over.

In any case you encounter difficulties to clearly understand this user manual, please contact the manufacturer.
We would appreciate any suggestions and contributions on your part and would ask you to contact us. This will help us to produce manuals that are more user-friendly and to address your wishes and requirements.

This manual contains important information on how to transport, erect, install, operate, maintain and repair the JX2-IO16 module.
Therefore, the persons carrying out these jobs must carefully read, understand and observe this manual, and especially the safety instructions.

Missing or inadequate knowledge of the manual results in the loss of any claim of liability on part of Jetter AG. Therefore, the operating company is recommended to have the instruction of the persons concerned confirmed in writing.

History

Revision	Comment
1.0	Original issue
1.1	Various amendments
3.00.1	See „Recent Revisions“ in Appendix A of revision 3.00.1
3.00.2	See “Recent Revisions” on page 107.

Description of Symbols

Warning

This sign is to indicate a possible impending danger of serious physical damage or death.

Caution

This sign is to indicate a possible impending danger of light physical damage.
This sign is also to warn you of material damage.

Warning

This sign indicates hazard of life due to electric shock caused by a high operating voltage.

Warning

This sign is to indicate hazard of serious physical damage or death due to accidentally touching dangerous parts of the device.

Warning

You are asked to wear goggles. Failure to comply may lead to bodily injuries.

Important

This sign is to indicate a possible impending situation which might bring damage to the product or to its surroundings.
It also identifies requirements necessary to ensure faultless operation.

You will be informed of various possible applications and will receive further useful suggestions.
It also gives you words of advice on how to efficiently use hardware and software in order to avoid unnecessary efforts.

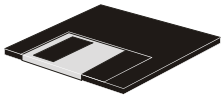
Note

· / - Enumerations are marked by full stops, strokes or scores.

Operating instructions are marked by this arrow.

Automatically running processes or results to be achieved are marked by this arrow.

PC and user interface keys.



Reference to a program or file.

This symbol informs you of additional references (data sheets, literature, etc.) associated with the given subject, product, etc. It also helps you to find your way around this manual.

Table of Contents

List of Appendices

1 Safety Instructions

1.1 Generally Valid Safety Instructions

The JX2-IO16 module complies with the safety regulations and standards in effect. Special emphasis was given to the safety of the users.

Of course, the user should adhere to the following rules and regulations:

- relevant accident prevention regulations;
- accepted safety rules;
- EC guidelines and other country-specific regulations.

1.1.1 Usage as Agreed Upon

Usage as agreed upon includes operation in accordance with the operating instructions.
The JX2-IO16 module is a peripheral module featuring 8 digital inputs and 8 digital outputs and can be connected to the Jetter system bus.

The supply voltage of the JX2-IO16 module is DC 24 V. This operating voltage is classified as SELV (Safety Extra Low Voltage). The JX2-IO16 module is therefore not subject to the EU Low Voltage Directive.

Up to three non-intelligent JX2-IO modules can be connected to a JX2-IO16 module not requiring a power supply of their own.
Sensors and connectors connected to a JX2-IO16 module are supplied with DC 24 V by the module.

The JX2-IO16 module may only be operated within the limits of the stated data (for more information refer to chapter 5 "Technical Data", page 29).

Do not apply a voltage to the JX2-IO16 module that is higher than the specified operating voltage.

The JX2-IO16 module is used to control machinery, such as conveyors, production machines, and handling machines.

1.1.2 Usage Other Than Agreed Upon

The JX2-IO16 module must not be used in technical systems which to a high degree have to be fail-safe, e.g. ropeways and aeroplanes.

If the JX2-IO16 module is to be run under ambient conditions, which differ from the conditions mentioned in chapter 4 "Operating Conditions", page 25, the manufacturer is to be contacted beforehand.

1.1.3 Who is Permitted to Operate the JX2-IO16 Module?

Only instructed, trained and authorised persons are permitted to operate the JX2-IO16 module.

Transport:	Only by personnel with knowledge in handling electrostatically sensitive components.
Installation:	Only by specialists with training in electrical engineering.
Commissioning:	Only by specialists with extensive knowledge of, and experience with, electrical engineering / drive technology.

1.1.4 Modifications and Alterations to the Module

For safety reasons, no modifications and changes to the JX2-IO16 module and its functions are permitted.
Any modifications to the JX2-IO16 module not expressly authorized by the manufacturer will result in a loss of any liability claims to Jetter AG.

The original parts are specially designed for the JX2-IO16 module. Parts and equipment of other manufacturers are not tested on our part, and are, therefore, not released by us.
The installation of such parts may impair the safety and the proper functioning of the JX2-IO16 module.

Any liability on the part of Jetter AG for any damages resulting from the use of non original parts and equipment is excluded.

1.1.5 Repairing and maintaining the JX2-IO16 Module

The JX2-IO16 module must not be repaired by the operator itself. The JX2-IO16 module does not contain any parts which can be repaired by the operator.
If the JX2-IO16 module needs repairing, please send it to Jetter AG.

The JX2-IO16 module is maintenance-free. Therefore, absolutely no inspection or maintenance works are required for the operation of the module.

1.1.6 Decommissioning and Disposal of the JX2-IO16 Module

Decommissioning and disposal of the JX2-IO16 module are subject to the environmental legislation of the respective country in effect for the operator's premises.

1.2 Ensure Your Own Safety

- Disconnect the JX2-IO16 module from the mains to carry out maintenance work. By doing so, you will prevent accidents resulting from electric voltage and moving parts.
- Safety and protective devices, e.g. the barrier and cover of the terminal box must never be shunted or by-passed.
- Dismantled protective equipment must be reattached prior to commissioning and checked for proper functioning.

1.2.1 Malfunctions

- Malfunctions or other damages are to be reported to an authorised person at once.
- Safeguard the JX2-IO16 module against misuse or accidental use.

1.2.2 Information Signs and Labels

- Writings, information signs, and labels always have to be observed and kept readable.
- Damaged or unreadable information signs and labels are to be exchanged.

1.3 Instructions on EMI

The noise immunity of a system corresponds to the weakest component of the system. For this reason, correct wiring and shielding of cables is of paramount importantance.

Important!

Measures for increasing immunity to interference:

- The JX2-IO16 module has to be attached to a DIN rail acc. to EN 50022-35 x 7.5.
- Follow the instructions given in Application Note 016 "EMC-Compatible Installation of the Electric Cabinet" published by Jetter AG.

The following instructions are excerpts from Application Note 016:

- On principle, **physical separation** should be maintained between signal and power lines. We recommend spacings greater than 20 cm. Cables and lines should cross each other at an angle of 90°.
- Shield cables **at both ends**.
- Unshielded wire ends of shielded cables should be as short as possible.
- The entire shield **must**, in its entire perimeter, be drawn behind the isolation, and then be clamped under an earthed strain relief **with the greatest possible surface area**.

When male connectors are used:

- The shield (impedance shielding) **must**, in its entire perimeter, be drawn behind the shielding clamp of the metallised connector housing, respectively of the EMC gland bushing, its greatest possible surface area being clamped under a strain relief (refer to Fig. 1).

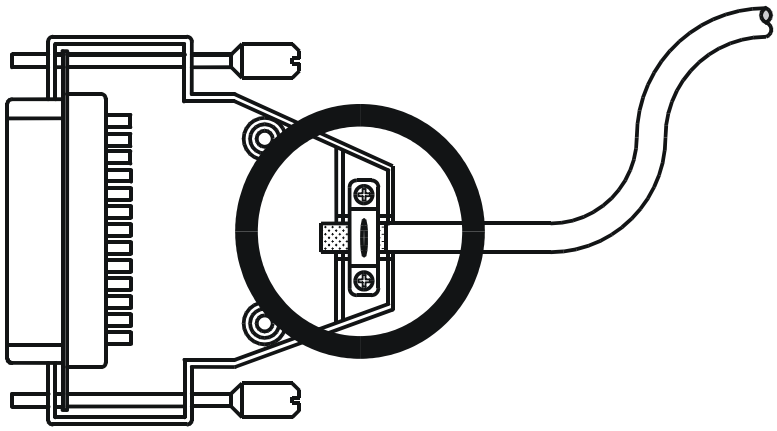


Fig. 1: Shielding of SUB-D connectors in conformity with EMC standards.

If the shield cannot be attached to the connector, for example, with a screw type terminal:

When connecting the single-channel and dual-channel counter, make sure that the sensor lines are properly shielded and that the shield is connected with the greatest possible surface area.
The shield is to be connected to a separate grounding bar in close vincinity to the input terminal (for more information refer to Fig. 2).

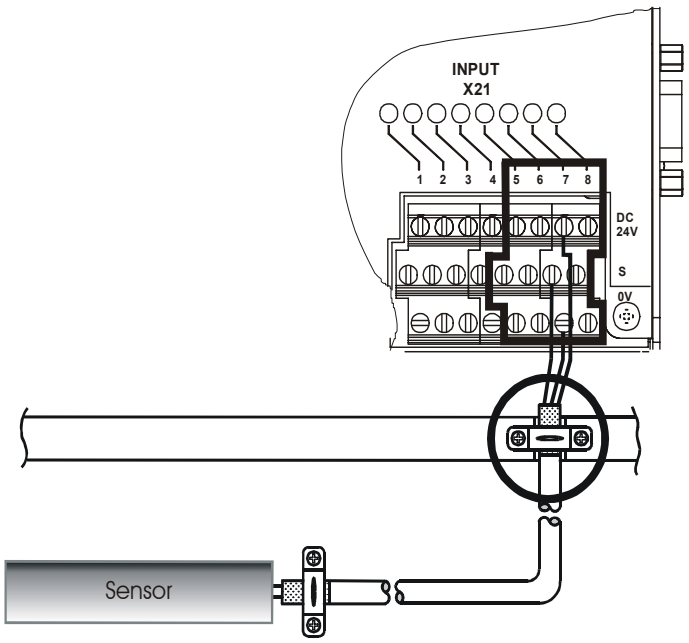


Fig. 2: Shielding of screw terminals in conformity with the EMC standards.

Important!

To avoid malfunctions the following must be ensured:

- Adhere to the measures for increasing immunity to interference.
  Compliance with these measures will also prevent malfunctions.

2 Introduction

This manual contains important information on how to erect, install, connect, operate, and maintain the peripheral module JX2-IO16 with firmware version 3.00 or higher.

Along with this manual, the User's Manual on the respective controller by Jetter AG and the User Information on the submodule JX6-SB have to be taken into account.

2.1 Document Overview

The following documents are available for download on the internet page of Jetter AG at http://www.jetter.de "Service Center".

Installation

jx2_io16_ia_10x_installationsanleitung.pdf
Overview of connections and their characteristics

jx2_io16_ba_300x_manual.pdf
This document

Programming

jx2_io16_kr_300x_quick_reference.pdf
Overview of registers and register array

jx2_io16_ba_300x_manual.pdf
This document

2.2 Product Description

The JX2-IO16 module provides a means for distributed control of digital inputs and outputs. The inputs can, furthermore, be used as single-channel or dual-channel counters. The module is connected to +24 VDC and can act as power supply for three more JX2-I/O modules directly connected to it.

2.3 Ordering Information

Designation	Description	Article #
JX2-IO16	JX2-IO16 module with the following system bus connection: - Sub-D, BUS-IN (X18), on the front panel pointing upwards - Sub-D, BUS-OUT (X19) on the side	10000164
JX2-IO16U	JX2-IO16 module with the following system bus connection: - Sub-D, BUS-IN (X18), on the front panel pointing upwards - Sub-D, BUS-OUT (X19), on the front panel pointing upwards	10000165
Jetter system bus cable	Cable assembly # 530 available in different lengths: 0.2 m; 0.5 m; 1.0 m; 1.5 m, 3 m, 4 m, 5 m (other lenghts available on request)	see table below

JETTER system bus connection cables:

Length 0.2 m:	Cable confection # 530 0.2 m	Article # 10309001
Length 0.5 m:	Cable confection # 530 0.5 m	Article # 10309002
Length 1.0 m	Cable confection # 530 1.0 m	Article # 10309003
Length 1.5 m	Cable confection # 530 1.5 m	Article # 10309004
Length 2.0 m	Cable confection # 530 2.0 m	Article # 10309006
Length 2.5 m	Cable confection # 530 2.5 m	Article # 10309016
Length 3.0 m	Cable confection # 530 3.0 m	Article # 10309015
Length 4.0 m	Cable confection # 530 4.0 m	Article # 10309007
Length 5.0 m	Cable confection # 530 5.0 m	Article # 10309008

2.4 Update Information

The operating system (OS) of the JX2-IO16 module cannot be updated through JetSym. An OS update can only be carried out by Jetter AG.

2.5 System Requirements

Software versions	
Module	**Starting from FW version**
JX2-IO16	3.00
Controller	**Minimum Software Version**
JC-241, JC-243, JC-246	3.20
NANO-B, NANO-C, NANO-D	3.53
JX6-SB(-I) (for JC-647(-MC), DELTA, JC-800)	2.12

3 Mounting Dimensions

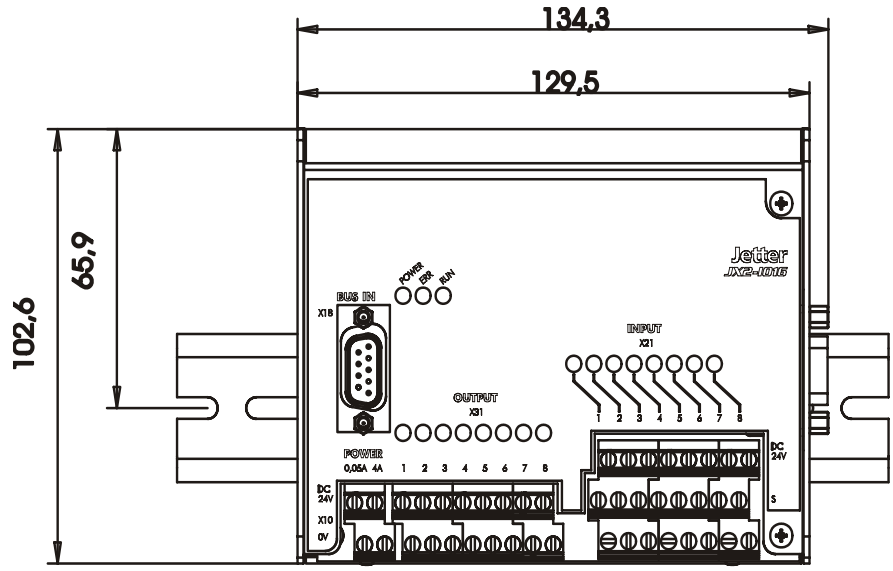


Fig. 3: Front View - JX2-IO16

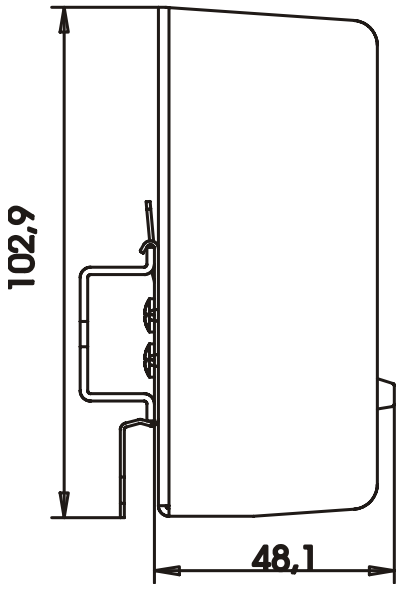


Fig. 4: Side View - JX2-IO16

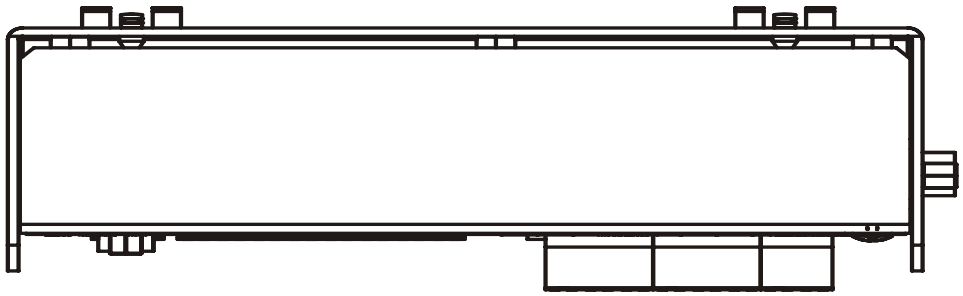


Fig. 5: Top View JX2-IO16

4 Operating Conditions

Operating Parameters: Power Rating		
Parameter	**Value**	**Reference**
Power Rating	DC 24 V (DC 20 V ... 30 V) Residual ripple: <= 5 % SELV power supply Power consumption: max. 5.775 A	
Voltage dips	Duration of voltage dips ≤ 10 ms Time interval between two voltage dips ≥ 1 s Severity level PS2	DIN EN 61131-2

Environmental Operating Parameters		
Parameter	**Value**	**Reference**
Operating Temperature Range	0 °C - +50 °C	-
Storage Temperature Range	-25 °C - +70 °C	DIN EN 61131-2 DIN EN 60068-2-1 DIN EN 60068-2-2
Air Humidity	10 % - 95 % (non-condensing)	DIN EN 61131-2
Pollution Degree	2	DIN EN 61131
Corrosion immunity/ chemical resistance	No special protection against corrosion. Ambient air must be free from higher concentrations of acids, alcaline solutions, corrosive agents, salts, metal vapours, or other corrosive or electroconductive contaminants	-
Atmospheric pressure	2,000 m	DIN EN 61131-2

Mechanical Operating Parameters

Parameter	Value	Reference
Free Falls Withstanding Test	Height of fall (units within packing): 1 m	DIN EN 61131-2 DIN EN 60068-2-32
Vibration Resistance	10 Hz - 57 Hz: with an amplitude of 0.0375 mm for continuous operation (peak amplitude of 0.075 mm) 57 Hz - 150 Hz: 0.5 g constant acceleration for continuous operation (1 g constant acceleration as peak value), 1 octave per minute, 10 frequency sweeps (sinusoidal), all spatial axes	DIN EN 61131-2 IEC 06.02.1968
Shock Resistance	15 g occasionally, 11 ms, sinusoidal half-wave, 2 shocks in all three spatial axes	DIN EN 61131-2 IEC 68-2-27
Class of Protection	IP20, rear: IP10	DIN EN 60529
Mounting Position	Any position, snapped on DIN rail	

Operating Parameters - Electrical Safety

Parameter	Value	Reference
Protection class	III	DIN EN 61131-2
Dielectric Test Voltage	Functional ground is connected to chassis ground internally.	DIN EN 61131-2
Overvoltage Category	II	DIN EN 61131-2

EMC - Emitted Interference Operating Parameters

Parameter	Value	Reference
Rack	Frequency 30 - 230 MHz, limit 30 dB (µV/m) at 10 m distance frequency band 230 - 1,000 MHz, limit 37 dB (µV/m) at 10 m distance (class B)	DIN EN 50081-1 DIN EN 55011 DIN EN 50081-2

Operating Parameters (EMC) - Immunity to Interference of Housing		
Parameter	**Value**	**Reference**
Magnetic Field with Mains Frequency	50 Hz, 60 Hz 30 A/m	DIN EN 61000-6-2 DIN EN 61000-4-8
RF Field, amplitude-modulated	Frequency band 27 - 1000 MHz Test field strength 10 V/m AM 80 % with 1 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-3
ESD	Discharge through air: Test peak voltage 15 kV (Humidity Rating RH-2 / ESD-4) Contact Discharge: Test peak voltage 4 kV (severity level 2) Criterion A	DIN EN 61000-6-2 DIN EN 61131-2 DIN EN 61000-4-2

EMC - Immunity to Interference Operating Parameters Signal Ports		
Parameter	**Value**	**Reference**
Asymmetric RF, amplitude-modulated	Frequency band 0.15 - 80 MHz Test voltage 10 V AM 80 % with 1 kHz Source impedance 150 Ohm Criterion A	DIN EN 61000-6-2 DIN EN 61000-4-6
Burst (fast transients)	Test voltage 1 kV tr/tn 5/50 ns Repetition rate 5 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-4

EMC - Immunity to Interference Operating Parameters DC Power Supply Inputs and Outputs

Parameter	Value	Reference
Asymmetric RF, amplitude-modulated	Frequency band 0.15 - 80 MHz Test voltage 10 V AM 80 % with 1 kHz Source impedance 150 Ohm Criterion A	DIN EN 61000-6-2 DIN EN 61000-4-6
Burst (fast transients)	Test voltage 2 kV tr/tn 5/50 ns Repetition rate 5 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-4

5 Technical Data

5.1 General Information

Technical Data - General	
Module Code	2
Rated voltage of logic circuit	DC 24 V, max. ripple 5%
Operating voltage range of logic circuit and sensor supply	DC 20 .. 30 V
No-load current of logic circuit at X10.0,05A.DC24V (without other JX2-IO modules)	≤ 40 mA
Heat loss of logic circuit	≤ 1.2 watt
Maximum current consumption at X10.0,0,05A.DC24V when supplying additional 3 JX2-I/O modules.	135 mA (45 mA per JX2-IO module)
Maximum total current consumption at X10.0,05A.DC24V for supplying sensors.	1.6 A (8 x 200 mA)
Maximum total current consumption of all outputs at X10.4A.DC24V	4 A (8 x 0.5 A)
Maximum total current consumption of the module	5.775 A
Maximum rated power loss (total)	140 Watt
Connection to the basic unit via system bus	System bus cable connected to SUB-D, 9 pins
Housing bottom	Aluminium, powder coated; Colour: Blue
Housing cover	Steel sheet metal coated with AlZn
Dimensions (H x W x D in mm)	103 x 130 x 48
Weight	350 g
Installation	DIN-rail EN 50022-35 x 7.5

5.2 Digital Inputs

Technical Data of Digital Inputs	
8 digital inputs	DC 24 V
Type	pnp
Input terminals	Three-level terminal blocks (screw plugs)
LEDs, inputs 1 - 8	DC 24 V are applied to the input. Pick-off method: Hardware-triggered signal
Signal Voltage	DC 0 .. 30 V
Maximum current carrying capacity of sensor supply per input	200 mA
Typical input current with signal voltage ON	Approx. 8 mA
Input resistance	3.0 kΩ
Input delay time of inputs 1 - 4	Fixed value of 2.8 ms (from 0 to 1, and from 1 to 0)
Input delay time of inputs 5 - 8 (fast inputs)	Fixed value of 180 ms (from 0 to 1, and from 1 to 0) with a resolution of 128 µs
Signal voltage ON	Minimum DC 16 V
Signal voltage OFF	Maximum DC 5 V
Signal processing	Dynamic
Electrical isolation	None
Pulse stretching	Yes (for all inputs) Each input can indiviually be parameterized
Single-channel counter	
Quantity	4 (via inputs 5 - 8, DC 24 V)
Minimum pulse length (high or low pulse)	250 µs
Maximum counting frequency at 50 % duty cycle	2 kHz
Dual-channel counter	
Quantity	1 (via inputs 5 - 6, DC 24 V)
Edge evaluation	Quadruple evaluation
Max. counting frequency	1 kHz

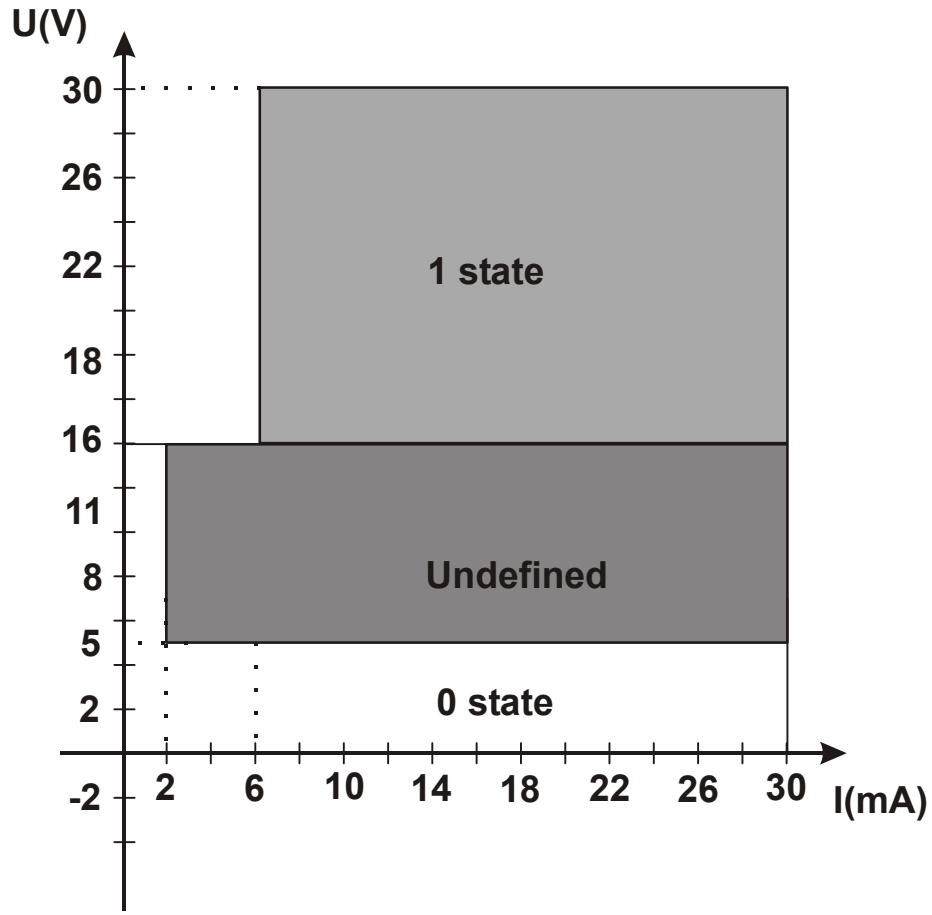


Fig. 6: Digital Inputs - Current voltage characteristic

5.3 Digital Outputs

Technical Data of Digital Outputs	
8 digital outputs	DC 24 V, 0.5 A
Type	Transistor, PNP
Output terminals	Two-level terminal blocks (screw plugs)
LEDs, outputs 1 - 8	Output is set on DC 24 V; pick-off method: Hardware-triggered signal
Supply Voltage (V_{Supply})	DC 20 .. 30 V
Signal voltage ON	Typ. V_{supply} - 1.5 V
Output Current	Max. 0.5 A per output
Total output power	96 W
Electrical isolation	None
Protective circuit	Short circuit, undervoltage, overtemperature
Protection against inductive loads	Yes
Principle of Operation	Non-latching

6 Installation Guide

6.1 Installation Steps

Important!

Make sure that the connection cables are **correctly wired** when installing the JX2-IO16 module.
Incorrect polarity of input lines for power supply, as well as digital input and output lines results in damages to the JX2-IO16 module.

- Please check the shipment for completeness.
- Choose the place of the DIN rail for mounting the JX2-IO16 module and, if necessary, other expansion modules, such as JX-SIO, and JX2-..., in your electric cabinet.
- Mount the module and any expansion modules to the DIN rail as described in the corresponding user manuals.
- Connect the module to the corresponding controller, such as JC-24x, NANO-A/B/C/D, etc., using a system bus cable. Connect any further expansion modules using the proper cable.
- Launch JetSym and set the communication parameters.
- Switch the controller on and download a JetSym program from your computer to your controller.
- Check the module for correct functioning.

6.2 Notes on Safety as regards the Installation

Danger resulting from electric shock!

Caution

If the JX2-IO16 module is not isolated from the mains, for example during installation, maintenance, and repair, you can get an electric shock.
Please observe the following precautions in order to avoid injuries such as muscle cramps, and damages to the module:

- Have works on the electric and electronic system performed by qualified personnel only. For information refer to chapter 1.1.3 "Who is Permitted to Operate the JX2-IO16 Module?", page 12.
- **Do not plug or unplug** plug-in connectors while they are energized. Also, **do not unscrew** screwed connections of energized components. Failure to comply with these rules may cause voltage peaks and, thus, electromagnetic interferences which may result in damages to the equipment, as well as in electrical hazards to persons.
  Therefore, switch off the operating voltage of the machine before carrying out any work on it.
- Before carrying out installation and maintenance jobs, isolate the module and all devices connected to it from the mains.
- Avoid damages caused by electrostatic discharge by touching grounded points before carrying out installation work.
  Damages caused by ESD do not always become immediately apparent!

6.3 Notes on Safety as regards Commissioning

Caution

Danger resulting from electric shock!

If the JX2-IO16 module is not isolated from the mains, for example during commissioning, you can get an electric shock.
Please observe the following precautions in order to avoid injuries such as muscle cramps, and damages to the module:

- Have works on the electric and electronic system performed by qualified personnel only. For information refer to chapter 1.1.3 "Who is Permitted to Operate the JX2-IO16 Module?", page 12.

Prior to commissioning, please do the following:

- Reattach dismantled protective equipment and check it for proper functioning.
  This way, protection from moving parts of the machine will be achieved.
- Connect only devices or electrical components to the signal lines of the JX2-IO16 module that have been sufficiently isolated from the connected electric circuits;
- Protect the JX2-IO16 module and the equipment connected to it against accidental contact with live parts and components;
- Always carry out each commissioning, even a short functional test, with correctly connected PE bus;
- Ensure a durable connection between controller, module and expansion modules connected to it.

6.4 General Information

Note

Please note that in the module array of the controller the JX2-IO16 module appears as 1 module, though it performs the functions of 2 modules. The JX2-IO16 module is to be regarded as one combined JX2-PS1, JX2-OD8, and JX2-ID8 module.

Note

All voltage signals relate to 0 V.

Within the module, the 0V signal is connected to ground internally via the enclosure.

6.5 Sample Circuitry

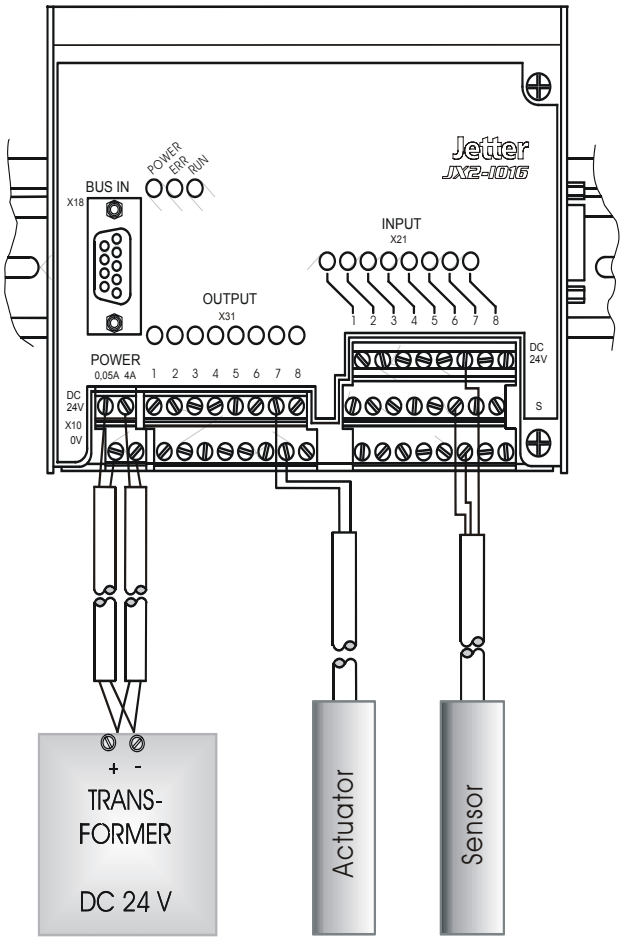


Fig. 7: JX2-IO16 Module: Sample circuitry

6.6 Power Supply

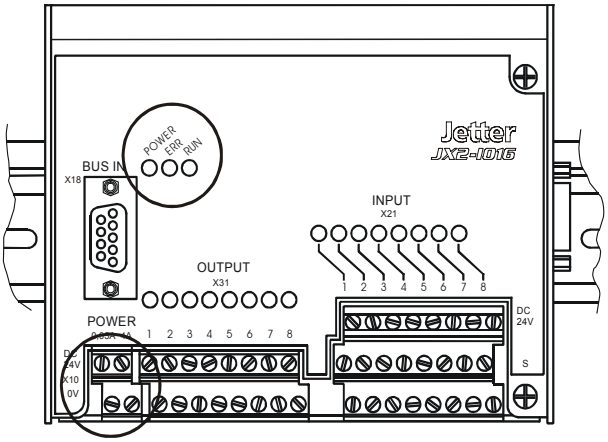


Fig. 8: Power Supply

6.6.1 Requirements

Power Supply Unit Requirements	
Voltage Range	DC 20 .. 30 V (SELV) Residual ripple<5 % filtered
Maximum Power Consumption	5.775 A, see chapter 5.1 "General Information", page 29.

Caution

Attention!

- The JX2-IO16 module is **NOT** protected against polarity reversal.
- The maximum supply voltage must not exceed DC 30 V since a higher supply voltage may cause damages to the JX2-IO16 module.
- A supply voltage less than DC 20 V (undervoltage) can cause malfunctions of the JX2-IO16 module.

6.6.2 Description of Connections

Terminal Specifications

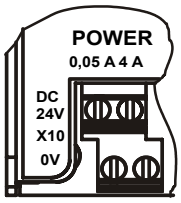
- Double-level terminal block COMBICON 5.08.
- Cable cross-sectional area: 0.25 - 2.5 mm^2
- Torque (for input plug screws): 0.5 .. 0.6 Nm
- The maximum stripping length for input lines is 7 mm
- The accepted VDE guidelines have to be observed
- Bladed screw-driver: 0.6 x 3.5 x 100 mm

Connecting Cable Specifications

- Not required

Cable Shielding

- Not required

Pin Assignment of 4-pin Double-Level Terminal Blocks			
View	**Pin**	**Signal**	**Comment**
X 10 	DC 24V / 0.05 A	DC 20 .. 30 V	Power supply for logic circuit
	DC 24V / 4 A	DC 20 .. 30 V	Power supply for digital outputs (V_{Supply})
	0 V / 0.05 V 0 V / 4 V	GND	Impedance grounding connected to the housing

6.6.3 Description of the LEDs

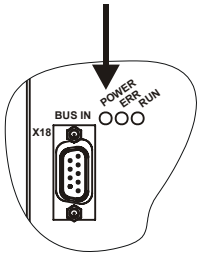


Fig. 9: Power LED

LEDs: Power Supply		
Designation	**Colour**	**Function**
POWER	green	**ON:** External voltage supply of the digital outputs is provided.

6.7 Digital Inputs

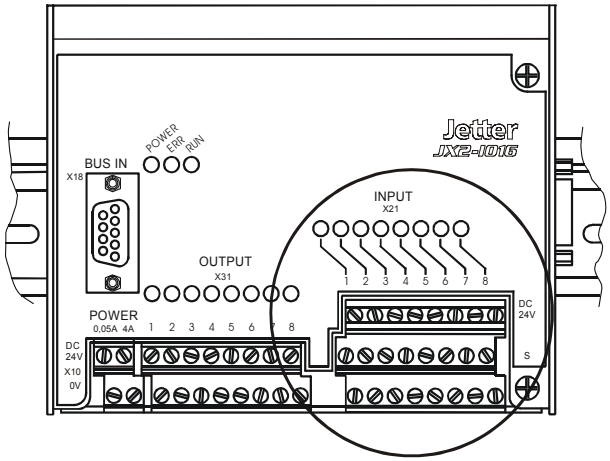


Fig. 10: Digital Inputs

6.7.1 Important information

Caution

Apply a maximum voltage of 28.8 volt to the digital inputs of the JX2-IO16 module. This will prevent the JX2-IO16 module and the sensor, e.g. an inductive limit switch, from being destroyed.

Caution

Make sure that digital input modules are disconnected from the power supply before inserting or removing them. When removing or inserting the module, the supply lines as well as the signal lines must be de-energised. Otherwise the JX2-IO16 module will be destroyed.

Caution

If a line with reverse polarity is connected to a digital input, the input will be destroyed.

Note

A digital output may directly (without additional load) be connected to a digital input.

6.7.2 Description of Connections

Terminal Specifications

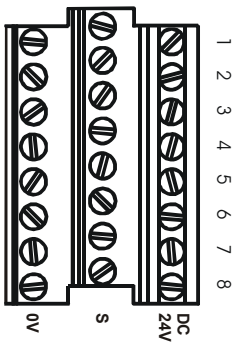
- Three-level terminal block COMBICON 5.08.
- Cable cross-sectional area: 0.25 - 2.5 mm^2
- Torque (for input plug screws): 0.5 .. 0.6 Nm
- The maximum stripping length for input lines is 7 mm
- The accepted VDE guidelines have to be observed
- Bladed screw-driver: 0.6 x 3.5 x 100 mm

Connecting Cable Specifications

- Not required

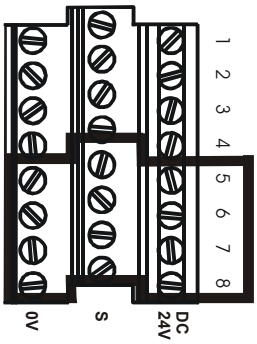
Cable Shielding

- If digital inputs are used as counter.

Pin assignment of 24-pin three-level terminal blocks		
View	**Pin**	**Signal**
X21 	1 - 8 / DC 24V	Sensor power supply DC 24 V
	1 / S	Digital input # 1
	2 / S	Digital input # 2
	3 / S	Digital input # 3
	4 / S	Digital input # 4
	5 / S	Digital input # 5
	6 / S	Digital input # 6
	7 / S	Digital input # 7
	8 / S	Digital input # 8
	1 - 8 / 0V	GND

6.7.3 Single-channel counter

The 4 single-channels are connected as follows:

Pin assignment of 24-pin three-level terminal blocks		
View	**Pin**	**Signal**
X21 	5 - 8 / DC 24V	Sensor power supply DC 24 V
	5 / S	Single-channel counter - Input # 5
	6 / S	Single-channel counter - Input # 6
	7 / S	Single-channel counter - Input # 7
	8 / S	Single-channel counter - Input # 8
	5 - 8 / 0V	GND

When connecting single-channel counters, make sure that the sensor lines are properly shielded and that the shield is connected with the greatest possible surface area. The shield is to be connected to a separate grounding bar in close vincinity to the input terminal. For more information refer to Fig. 11.

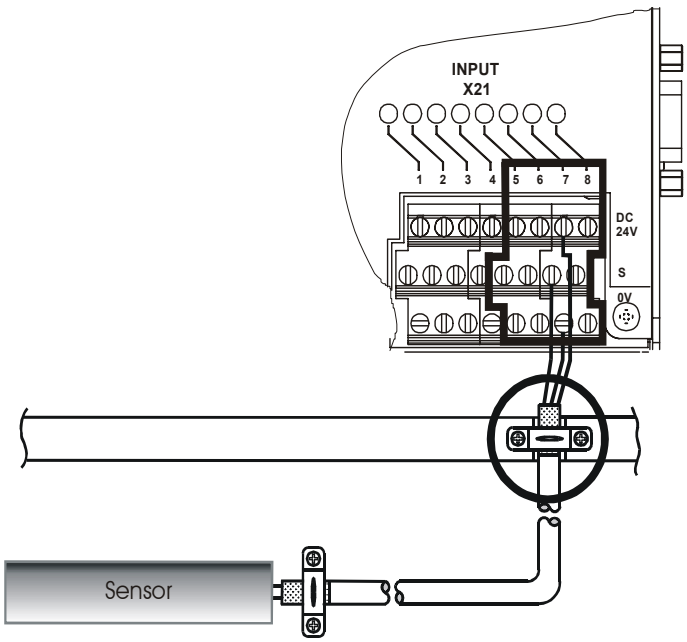
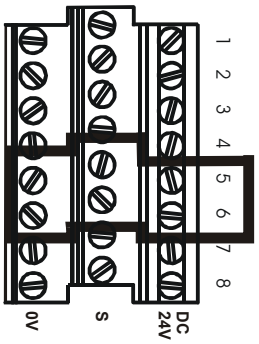


Fig. 11: Shielding the single-channel counter connection

6.7.4 Dual-channel counter

The dual-channel counter is connected as follows:

Pin assignment of 24-pin three-level terminal blocks		
View	**Pin**	**Signal**
X21 	5 - 6 / DC 24V	Sensor power supply DC 24 V
	5 / S	Dual-channel counter - K1 + / channel A
	6 / S	Dual-channel counter - K2 + / channel B
	5 - 6 / 0V	GND

When connecting the dual-channel counter, make sure that the sensor line are properly shielded and that the shield is connected with the greatest possible surface area. The shield is to be connected to a separate grounding bar in close vincinity to the input terminals. For more information refer to Fig. 12.

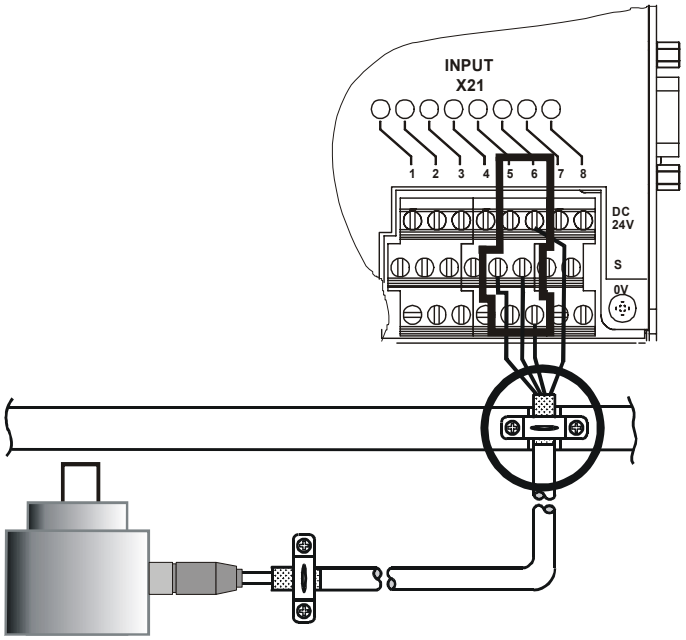


Fig. 12: Connecting an incremental encoder

6.7.5 Description of the LEDs

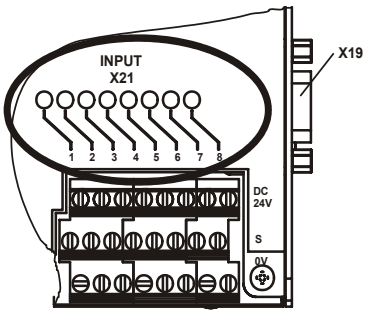


Fig. 13: LEDs of the Digital Inputs

LEDs of Digital Inputs		
Designation	**Colour**	**Function**
INPUT X21 1 ... 8	yellow	Digital input 1 through 8 **ON:** Signal voltage ON **OFF:** Signal voltage OFF

6.8 Digital Outputs

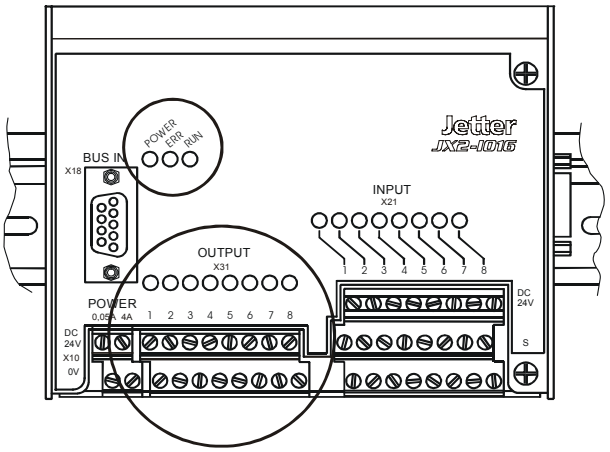


Fig. 14: Digital Outputs

6.8.1 Important information

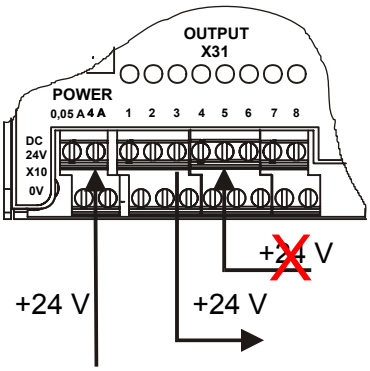
Caution

Make sure that digital output modules are disconnected from the power supply before inserting or removing them. When removing or inserting the module, the supply lines as well as the signal lines must be de-energised. Otherwise the JX2-IO16 module will be destroyed.

Note

A digital output may directly (without additional load) be connected to a digital input.

Caution



- Do not apply voltage to individual digital outputs.
- If application of voltage cannot be avoided (for example, for testing inputs/ outputs with the JX2-IO16 module wired in an electric cabinet), the voltage has to be applied to the output drivers of the module before-hand. Otherwise the output drivers will be destroyed.

6.8.2 Description of Connections

Terminal Specifications

- Double-level terminal block COMBICON 5.08.
- Cable cross-sectional area: 0.25 - 2.5 mm^2
- Torque (for input plug screws): 0.5 .. 0.6 Nm
- The maximum stripping length for input lines is 7 mm
- The accepted VDE guidelines have to be observed
- Bladed screw-driver: 0.6 x 3.5 x 100 mm

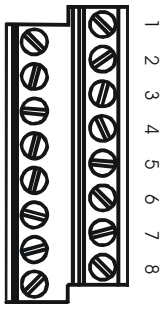
Connecting Cable Specifications

- Not required

Cable Shielding

- Not required

Pin Assignment of 16-pin Double-Level Terminal Blocks

View	Pin	Signal
X31 	1	Digital Output # 1
	2	Digital Output # 2
	3	Digital Output # 3
	4	Digital Output # 4
	5	Digital Output # 5
	6	Digital Output # 6
	7	Digital Output # 7
	8	Digital Output # 8

6.8.3 Emergency Stop Circuit of Outputs

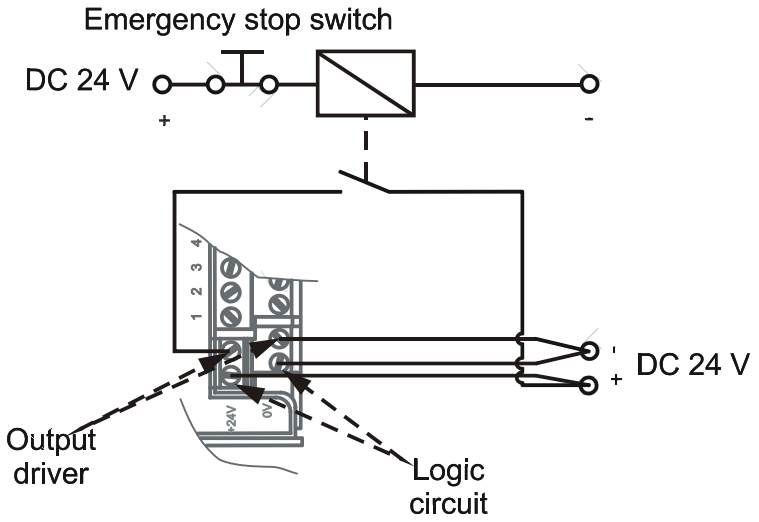


Fig. 15: Example: Emergency Stop Circuit of Outputs

Note!

Once the Emergency Stop button is pressed, all outputs are set to 0 V. However, the logic circuit remains active, e.g. for error scanning.

6.8.4 Description of the LEDs

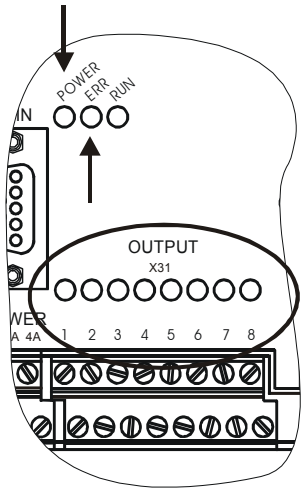


Fig. 16: LEDs of the Digital Outputs

LEDs of digital outputs		
Designation	**Colour**	**Function**
OUTPUT X31 1 ... 8	yellow	Digital output 1 through 8 **ON:** Signal voltage ON **OFF:** Signal voltage OFF
ERR Collective error message	red	**ON:** Overload, short circuit, overtemperature of one or more outputs. An error condition can be polled via controller.
POWER	green	**ON:** External voltage supply of the digital outputs is provided.

6.9 System Bus

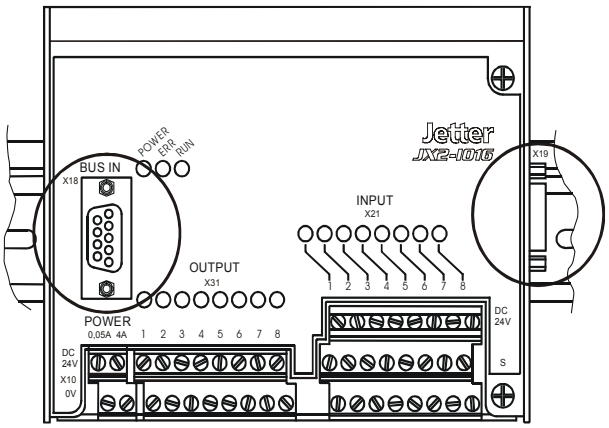


Fig. 17: System bus

6.9.1 Description of Connections

Specification of Connectors

On the controller side

- 9-pin male SUB-D connector in metallized housing (quality grade 3).
- Diameter of the cable apt for connecting: 0.25 - 0.60 mm^2

On the opposite side of the cable

- 9-pin female SUB-D connector in metallized housing (quality grade 3).
- Diameter of the cable apt for connecting: 0.25 - 0.60 mm^2

System Bus Cable Specification

The following minimum requirements apply to the manufacture of the system bus cable:

System Bus Cable - Technical Data	
Function	**Description**
Core cross-sectional area	1 MBaud: 0.25 - 0.34 mm^2 500 kBaud: 0.34 - 0.50 mm^2 250 kBaud: 0.34 - 0.60 mm^2 125 kBaud: 0.50 - 0.60 mm^2
Cable capacitance	maximum 60 pF/m
Resistivity	1 MBaud: maximum 70 Ω/km 500 kBaud: maximum 60 Ω/km 250 kBaud: maximum 60 Ω/km 125 kBaud: maximum 60 Ω/km
Number of cores	5
Shield	Complete shielding, no paired shielding
Twisting	Core pair CL and CH twisted.

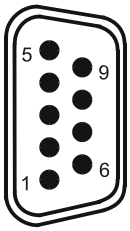
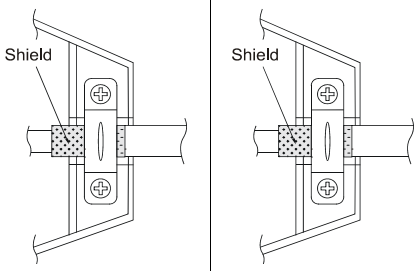
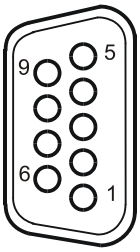
Allowed cable lengths			
Baud Rate	**Max. cable length**	**Max. tap line length**	**Max. overall tap line length**
1 MBaud	30 m	0.3 m	3 m
500 kBaud	100 m	1 m	39 m
250 kBaud	200 m	3 m	78 m
125 kBaud	200 m	-	-

Note!

- The maximum cable length depends on the baud rate used and the number of modules connected to the bus.
- When calculating the maximum line length, please take into account that each module connected to the bus reduces the cable length by approx. 1 m.

Note!

On the BUS OUT side of the system bus cable pins 3 and 5 have to be bridged. For information refer to the table below.

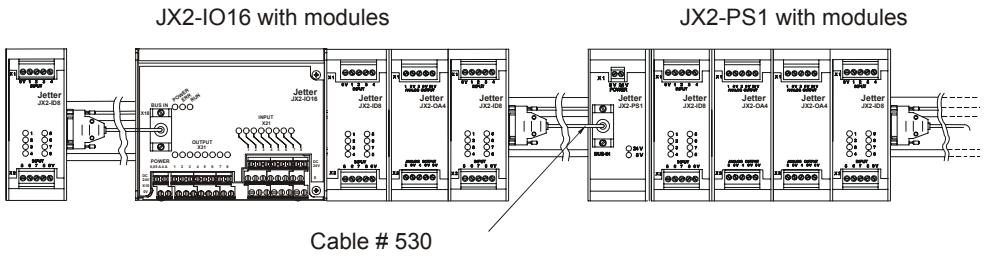
System bus cable of cable confection # 530		
	Shield	
		
BUS-OUT X19	Connect shield with the greatest possible surface area! Use metallized housing only!	**BUS-IN X18**
Pin	**Signal**	**Pin**
1	CMODE0	1
2	CL	2
3	GND	3
4	CMODE1	4
5	TERM (not connected)	5
6	Unassigned	6
7	CH	7
8	Unassigned	8
9	Do not connect	9

6.9.2 Ordering Information

The system bus cable can be purchased from Jetter AG in various lengths. For more information refer to chapter 2.3 "Ordering Information", page 20.

6.10 Connecting JX2-I/O Modules

Three more JX2-IO modules can directly be connected to the JX2-IO16 module. This configuration does not require a system bus cable or external power supply. For more than 3 JX2-IO modules a JX2-PS1 power supply module is required.



6.11 Status LEDs

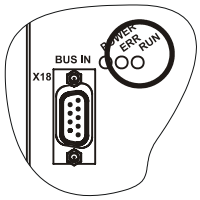


Fig. 18: Status LEDs

Status LEDs - General	
RUN (green)	The OS of the module is running and communication with the controller has been initialized. Refer also to the table "LED - Booting Sequence".
ERR (red)	Errors: For more information refer to chapter 12 "Diagnostic and Administrative Functions", page 93. Refer also to the table "LED - Booting Sequence".

Once the internal logic circuit has been energized, the booting sequence of the JX2-IO16 module is activated. The status of the booting sequence is displayed through the LEDs ERR and RUN. For more information on the status please refer to the following table:

Status LEDs - Booting Sequence		
Sequence status	**LED**	**Meaning**
1a	ERR (red) is lit RUN (green) is lit	ERROR: No system bus cable connected to the BUS IN (X18) interface, or no connection with the controller.
1b	ERR (red) is lit RUN (green) is off	Module has established connection with the controller and is waiting for communication start.
2	ERR (red) is off RUN (green) flashes	Establishing communication with the controller.
3	ERR (red) is off RUN (green) is lit	Module is ready for operation

7 Software Programming

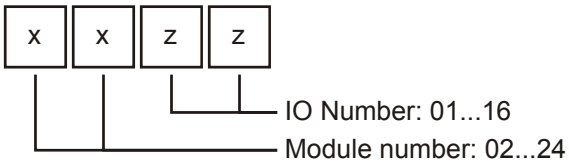
7.1 Addressing Digital Inputs and Outputs

The address is made up of the location of the module and the number of the respective input or output.

Addressing with JC-24x / NANO-A/B/C/D controllers:

IO Number: xxzz

Meaning:

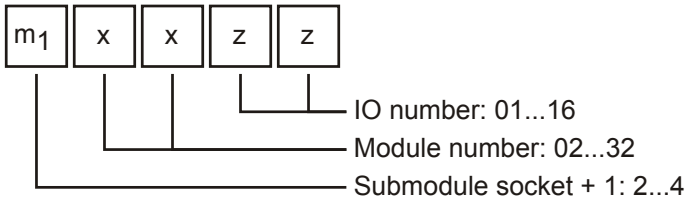


For more information, for example on register overlaying of IOs, refer to the User's Manual supplied with the corresponding controller.

Addressing with JC-647 controllers equipped with JX6-SB(-I), or DELTA controllers with JX6-SB(-I):

IO Number: $m_1$xxzz

Meaning:



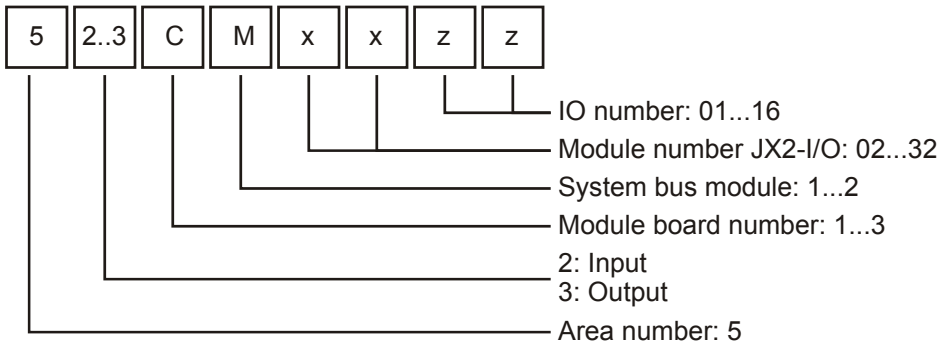
For more information, for example on register overlaying of IOs, refer to the User's Manual that comes with the JX6-SB(-I) module.

Addressing with JC-800 controllers equipped with JX6-SB(-I):

The IO address starts with the area number 5.

Input number:	52CM xxzz
Output number:	53CM xxzz

Meaning:



For more information, for example on register overlaying of IOs, refer to the User's Manual supplied with the JC-800 controller.

Note!

For determination of the module number, the digital input or output modules are being counted. Intelligent modules, such as JX2-SV1, JX2-SM2, JX2-PID1 modules, etc., located among the digital input and output modules, are not being taken into consideration.

Module no. 1 is assigned to the basic controller. Starting from there, the module numbers are being counted left to right.
Basically, the granularity is 16. That means, for example, that a JX2-IO16 module occupies 16 logical outputs, despite it provides only 8 physical ones.

Example1: Configuration consisting of digital input and output modules only

System consisting of a JC-24x, two JX2-IO16 and one JX2-OD8:

Basic controller JC-24x	I/O Module JX2-IO16	I/O Module JX2-IO16	Input module JX2-ID8
Module # 1	Module # 2	Module # 3	Module # 4
Input **101 ... 116** Outputs **101 .. 108**	Input **201 .. 208** Output **201 .. 208**	Input **301 .. 308** Output **301 .. 308**	Input **401 .. 408**

Example2: Configuration consisting of one JX2-SV1

System consisting of a JC-24x, one JX2-IO16 and one digital output module JX2-OD8:

Basic controller JC-24x	I/O Module JX2-IO16	Servo module JX2-SV1	Input module JX2-ID8
Module # 1	Module # 2	Module # 3	Module # 4
Input **101 ... 116** Outputs **101 .. 108**	Input **201 .. 208** Output **201 .. 208**	SV Module	**! ! !** Input **301 .. 308**

7.2 Register Interface

The register interface consists of 10 registers which allow direct read or write access. Key information is stored to these registers, and can be read out from here. In addition, a register array is available which is used to parameterize JX2-IO16 functions and to read out additional diagnostic information.

For more information refer to Appendix B: "Overview of Registers", page 108.

7.2.1 Register Addressing

The register address is made up of the module number and the respective register number.

Note!

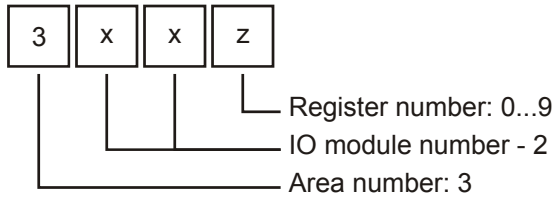
In this manual outside this subchapter the register numbers are specified only with their last 4 digits.

Addressing register numbers with JC-24x / NANO-B/C/D controllers:

The register address always starts with the area number 3.

Register number: 3xxz

Meaning:



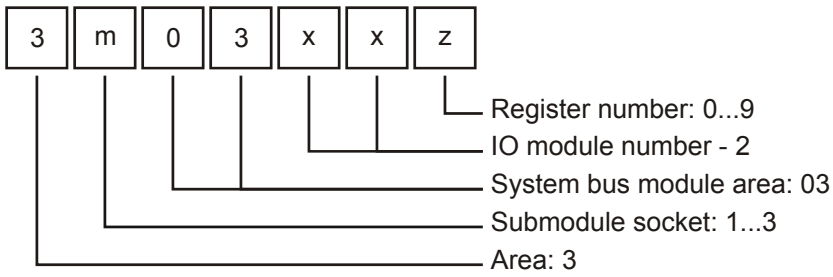
For more information refer to the manual on the corresponding controller.

Addressing register numbers with JC-647 and DELTA controllers:

The register address always consists of the area number 3 and the area number 03 for the system bus module.

Register number: 3m0 3xxz

Meaning:



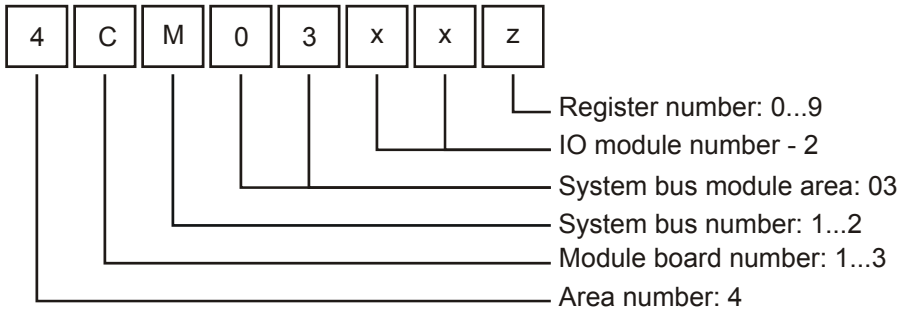
For more information refer to the User's Manual that comes with the JX6-SB(-I) module.

Addressing register numbers with JC-800 controllers

The register address always consists of the area number 4 and the area number 03 for the system bus module.

Register number: 4cm0 3xxz

Meaning:



For more information refer to the manual on the JC-800 controller.

IO module number 1 is dedicated to the controller or the system bus module JX6-SB(-I). Starting from there, the IO module numbers are being counted left to right. That is, module number 2 is assigned to the first IO module that follows the controller or the system bus module.

Note!

To determine the IO module number, only the non-intelligent modules will be counted, such as JX2-IO16, JX2-ID8, JX2-OD8, etc. Intelligent modules, such as JetMove 2xx, JetMove 6xx, JX2-SV1, JX2--SM2, JX2-PID1, etc., located among the digital input and output modules, are not being taken into consideration.

The last four digits are the same for all addresses. The following applies to these digits:

```
Register number = 3000 + (IO module number - 2) * 10 + local register
number
```

Example3: Determining Register Numbers

Determinig the register number of the third IO expansion module connected to a JetControl 246:

I/O module number = 4
Local register number = 9

Register number = 3000 + (4 - 2) * 10 + 9 = 3029

7.2.2 Addressing a Register Array

The register array is used to parameterize JX2-IO16 functions and to read out additional diagnostic information. For this purpose, the index of the register array element is entered into register 8 "Register Array: Index". Register 9 "Register Array: Value" is then used to read out or enter the value of the given element.

Example4: Addressing a Register Array

Excerpt from the program:

```
...
REGISTER_LOAD (3008, 2)                 // Index = 2 ->Information on
                                        // error
IF REG 3009 > 0 THEN                    // Evaluation of information
                                        // on error through register 9
     Error handling                     //
     . . . .
THEN
```

Register 3xx8: Register Array: Index	
Function	**Description**
Read	Present index
Write	New index
Value range	1 ... 51
Value after reset	1

Register 3xx9: Register Array: Value	
Function	**Description**
Read	Present value of the register array element
Write	New value of the register array element
Value range	Depending from register array element
Value after reset	Version number (Index 1)

8 Status and Control Functions

Register 3xx0 "Status / Controller" is available for status and control functions.

Register 3xx0: Status / Controller	
Function	**Description**
Read	Present module status
Write	Setting a new module mode, only bits 8 - 11
Value range	Bit-coded, 24 bits
Value after reset	0b 00000000 00000001 00000000

Only bits 8 - 11 can be used for setting the module mode. All other bits are status bits which can not be changed.

Status

Meaning of the individual bits:

Bit 0:	**Manual pulse stretching - Input # 1** Indicates whether manual pulse stretching for the given input is enabled (for more information refer to chapter 10 "Pulse stretching", page 69). 0 = Disabled 1 = Enabled Value following reset: 0
Bit 1:	**Manual pulse stretching - Input # 2**
Bit 2:	**Manual pulse stretching - Input # 3**
Bit 3:	**Manual pulse stretching - Input # 4**
Bit 4:	**Manual pulse stretching - Input # 5**
Bit 5:	**Manual pulse stretching - Input # 6**
Bit 6:	**Manual pulse stretching - Input # 7**
Bit 7:	**Manual pulse stretching - Input # 8**
Bits 8 - 11	**Control bit (see below)**
Bit 12:	**Reserved**
Bit 13:	**Reserved**
Bit 14:	**Reserved**

Meaning of the individual bits:

Bit 15: Error

Indicates whether an error has occurred (for more information refer to chapter 12 "Diagnostic and Administrative Functions", page 93).

0 = No error

1 = Error

Value following reset: 0

Bit 16: Pulse stretching - Input # 1

Indicates wheter pulse stretching (manual or automatic) for the given input is active (for more information refer to chapter 10 "Pulse stretching", page 69).

0 = Not active

1 = Active

Value following reset: 0

Bit 17: Pulse stretching - Input # 2

Bit 18: Pulse stretching - Input # 3

Bit 19: Pulse stretching - Input # 4

Bit 20: Pulse stretching - Input # 5

Bit 21: Pulse stretching - Input # 6

Bit 22: Pulse stretching - Input # 7

Bit 23: Pulse stretching - Input # 8

Controller

Meaning of the individual bits:

Bit 8:	**Time-out - Reaction (only for commissioning)**

This feature is for defining the reation to a time-out in system bus communication (becomes immediately effective). See chapter 12 "Diagnostic and Administrative Functions", page 93.

The module is to remain addressable
Once the communication error is eliminated, IOs and registers can be addressed as before.
This function makes sense only if the communication problem can be resolved without switching off the logic voltage for controller and module. If this function is used, it is not allowed to enter an error state, which is defined via register array elements 50 and 51, into one of the outputs.

Module is to assume stop state
In this mode, the module has to be re-initialized first before IOs and registers can be re-addressed. If this function is used, an error state, which is defined via register array elements 50 and 51, can be entered into one of the outputs.

0 = The module remains addressable **(only for commissioning purposes)**

1 = The module assumes stop state and has to be re-initialized

Value following reset: 1

Bit 9:	**Output initialization**

Initialization of digital outputs in case of a warm restart (re-initialization of the JX2-IO16 module via controller without de-energizing and re-energizing the JX2-IO16 module). This function immediately becomes effective. See also chapter 12 "Diagnostic and Administrative Functions", page 93.

This bit is automatically set when a time-out in system bus communication occurs. It remains set until it is reset by the user.

This bit can be used by the user irrespective of a time-out.

0 = With a warm restart, outputs are set to 0.

1 = With a warm restart, outputs maintain the last state.

Value following reset: 0

Meaning of the individual bits:

Bit 10: Counter configuration

Counter configuration for inputs 5 - 6 (becomes immediately effective).
See chapter 11 "Counter Function", page 83.

0 = Inputs 5 - 6 are used as single-channel counters

1 = Inputs 5 - 6 are used as dual-channel counters with quadruple evaluation

Value following reset: 0

Bit 11: Reserved

9 Fast inputs - Software filter

9.1 Fast Inputs

All digital inputs are provided with an input delay feature. The input signal is recognized by the JX2-IO16 module once the delay time has elapsed. The delay time for inputs 1 - 4 is preset (hardware filter); for more information refer to chapter "Technical Data of Digital Inputs", page 30. The delay time for inputs 5 - 8 is adjustable (software filter); for more information refer to chapter "Technical Data of Digital Inputs", page 30.

The delay time for inputs 5 - 8 can be set to a significantly shorter duration, than the delay time for inputs 1 - 4. Therefore, inputs 5 - 8 are called "fast inputs".

Using the shortest possible delay time, a fast input is able to reliably recognize a pulse length of 250 µs for high or low pulses.

The default value for adjustable delay time of fast inputs has been set in a way that it ensures compatibility with the other inputs.

9.2 Software filter

The fast inputs 5 - 8 are provided with a software filter. Read / write access to the delay time of the software filter is performed through register array elements 45 - 48.

Register 3xx8 = 45 - 48 Register 3xx9: Software filter - Delay time Inputs 5 - 8	
Function	**Description**
Read	Present delay time
Write	New delay time (immediately effective)
Value range	0 ... 255
Value after reset	21 (2.8 ms)

Except for the value 0, the filter time is a multiple of 128 µs and is calculated by the following formula:

Input delay time = (delay time + 1) x 128 µs.

0: Input delay time = max.180 µs

1: Input delay time = max. 256 µs

2: Input delay time = max. 384 µs

...

255: Input delay time = 32.64 ms

10 Pulse stretching

10.1 Overview of Registers

Register Name	Brief Description
General:	
3xx0 Status / Controller	Pulse stretching status, Page 63
3xx3 Present input state	Actual input state at the input terminal, Page 78
3xx8 29 3xx9 Edge evaluation - Polarity	Polarity (0 V / 24 V) of input signal, Page 79
3xx8 30 3xx9 Edge evaluation - Edge / State	Pulse stretching event with (rising / falling) edge or state (0 V / 24 V), Page 80
3xx8 45 - 48 3xx9 Software filter - Filtering interval	Software filter for inputs 5 ... 8, Page 67
Manual pulse stretching:	
3xx1 Manual pulse stretching - Setting	Manual pulse stretching - resetting and activating, Page 76
3xx2 Manual pulse stretching - Resetting	Manual pulse stretching - resetting and deactivating, Page 77
Automatic pulse stretching:	
3xx8 31 - 38 3xx9 Automatic pulse stretching - pulse stretching interval	Pulse stretching interval, Page 81

10.2 Operating principle

The pulse stretching feature means that the logic input state, which is read out by the controller from the module, is stretched in time. That is, even when the input signal is no longer applied, the logic input state of the module displays the input signal for a certain time through its I/O number in the application program. Thus, even very short input pulses can definitely be recognized in the application program.

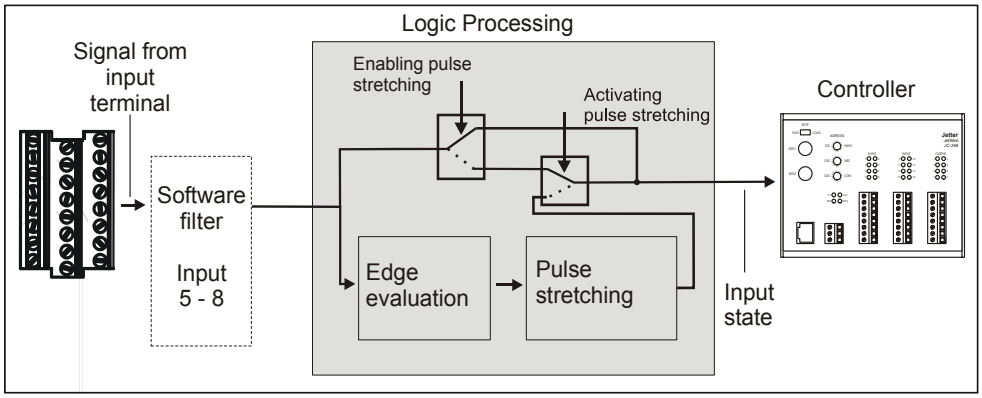


Fig. 19: Generating the pulse stretching

The pulse evaluation circuit checks for each input whether the pulse stretching condition is fulfilled. If the condition is fulfilled, the JX2-IO16 module activates the pulse stretching for each input separately. That is, the input signal is stretched, for example, starting from its rising edge. Edge evaluation can be parameterized using register array elements 29 "Edge evaluation - Polarity", and 30 "Edge evaluation - Edge / State".

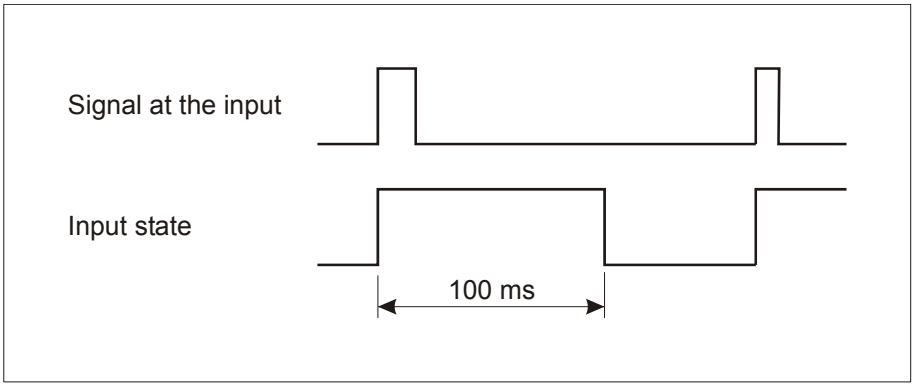


Fig. 20: Effect of pulse stretching of 100 ms with rising edge

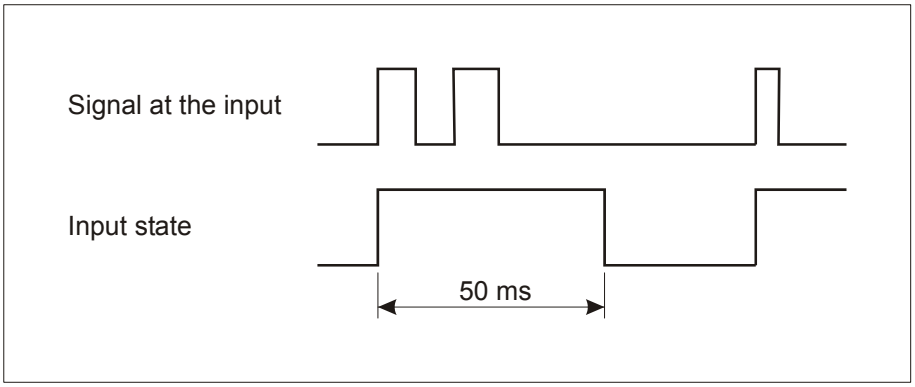


Fig. 21: Effect of pulse stretching with two short signals

With pulse stretching for an input signal in progress, additional edge changes of this input signal are ignored. Therefore, pulse stretching is, for example, used for debouncing an input signal.

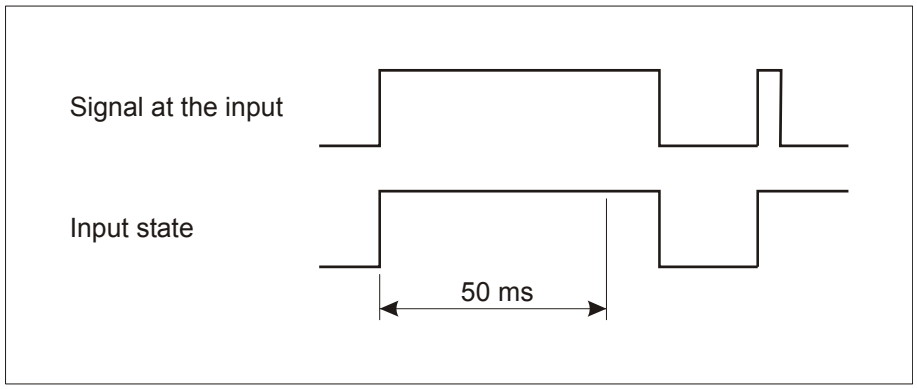


Fig. 22: Effect of pulse stretching with a signal of longer duration

If the duration of the input signal exceeds the pulse stretching interval, then, pulse stretching has no effect. In this case, the length of the actual input pulse determines the length of the stretched input pulse.

Once pulse stretching is deactivated, the actual input state is displayed.

The JX2-IO16 module provides two types of pulse stretching:

- Manual pulse stretching
- Automatic pulse stretching

Manual pulse stretching

With manual pulse stretching the input pulse is stretched until the application program resets pulse stretching.

Automatic pulse stretching

With automatic pulse stretching the input pulse is stretched until the set pulse stretching interval has elapsed.

Important

ATTENTION:

Do not enable both pulse stretching modes in parallel.

10.3 Manual pulse stretching

The pulse stretching condition is defined for each input separately using register array elements 29 "Edge evaluation - Polarity", and 30 "Edge evaluation - Edge / State".

Then, manual pulse stretching is activated for each input separately through register 3xx1. Bits 0 - 7 of register 3xx0 indicate which input has been enabled. If for an enabled input pulse stretching was already in progress, it is reset as a result of the activation process.

As long as the pulse stretching condition is not fulfilled, the actual input state, which is applied to the input terminal, is displayed. If the pulse stretching condition for an input is fulfilled, JX2-IO16 activates pulse stretching for this input until pulse stretching is reset by the application program.

Bits 16 - 23 in register 3xx0 display whether pulse stretching is active (see the following example).

If pulse stretching is not required at the moment, it can be disabled by resetting register 3xx1 or through register 3xx2.

Note

ATTENTION:

When disabling an active pulse stretching, the actual input state at the input terminal is displayed. However, it takes a certain cycle time until the controller updates the actual state in the input number registers or overlaid registers, containing input information. The cycle time depends on the controller type and the module number (location) of the JX2-IO16 module.

This has to be taken into account if pulse stretching is disabled through register 3xx1 and the pulse stretching state of the input is immediately polled. For more information refer to Example5: "Manual pulse stretching - Variant 1".

In order to always poll the actual input state at the input terminal of the JX2-IO16 module immediately after a reset, register 3xx3 "Present input state" has to be read out. Reading this register will **not** update the state being present at the respective input number or the input information of overlaid registers.

Examples

On the first JX2-IO16 module located after the controller, input signal of input 1 is to be stretched manually with rising edge.

Example5: Manual pulse stretching - Variant 1

Loop with input number polling

Excerpt from the program

```
...
REGISTER_LOAD (3008, 30)                // Selecting the register
                                        // array element 30 -> Edge/
                                        // State
BIT_CLEAR (3009, 0)                     // Selecting "Edge"
REGISTER_LOAD (3008, 29)                // Selecting register array
                                        // element 29 -> Polarity
BIT_SET (3009, 0)                       // Rising edge
...
LABEL l_Check_Input_1                   // Beginning of the loop
 REGISTER_LOAD (3001, 1)                // Enabling and resetting
                                        // the input for manual pulse
                                        // stretching
 WHEN -IN 201 THEN     <------ ATTENTION // Following the reset of an
                                        // active pulse stretching
                                        // (beginning from the 2nd
                                        // loop iteration), waiting
                                        // until IN 201 is also set
                                        // to zero.
                                        //
 WHEN IN 201 THEN                       // Waiting until the first
                                        // rising edge is detected -
                                        // > Pulse stretching
                                           activated.
 ...                                    // Doing anything
GOTO l_Check_Input_1                    // Going back to the
                                        // beginning of the loop.
...
```

Example6: Manual pulse stretching - Variant 2

Loop with polling an active pulse stretching

Excerpt from the program

```
...
REGISTER_LOAD (3008, 30)                // Selecting the register
                                        // array element 30 -> Edge/
                                        // State
BIT_CLEAR (3009, 0)                     // Selecting "Edge"
REGISTER_LOAD (3008, 29)                // Selecting register array
                                        // element 29 -> Polarity
BIT_SET (3009, 0)                       // Rising edge
...
LABEL l_Check_Input_1                   // Beginning of the loop
 REGISTER_LOAD (3001, 1)                // Enabling and resetting
                                        // the input for manual pulse
                                        // stretching
```

```
 WHEN BIT_SET (3000, 16) THEN          // Waiting until pulse
                                       // stretching of input 1
                                       // becomes active.
 ...                                   // Doing anything
GOTO l_Check_Input_1                   // Going back to the
                                       // beginning of the loop.
...
```

10.4 Automatic pulse stretching

The pulse stretching condition is defined for each input separately using register array elements 29 "Edge evaluation - Polarity", and 30 "Edge evaluation - Edge / State".

Through register array elements 31 - 38 the pulse stretching duration can be specified for each input separately, or the pulse stretching function can be disabled.

If the pulse stretching condition for an input is fulfilled, JX2-IO16 activates pulse stretching for this input until the pulse stretching duration has elapsed. Then, pulse stretching is automatically reset by the JX2-IO16 module. As long as the condition is not fulfilled again, the actual input state is displayed.

Bits 16 - 23 in register 3xx0 display whether pulse stretching is active.

Automatic pulse stretching remains enabled until the value 0 is entered into register array elements 31 - 38.

Examples

On the first JX2-IO16 module located after the controller, input signal of input 1 is to be stretched for 10 ms automatically when the edge is rising.

Example7: Automatic pulse stretching - Variant 1

Loop with input number polling

Excerpt from the program

```
...
REGISTER_LOAD (3008, 30)               // Selecting the register
                                       // array element 30 -> Edge/
                                       // State
BIT_CLEAR (3009, 0)                    // Selecting "Edge"
REGISTER_LOAD (3008, 29)               // Selecting register array
                                       // element 29 -> Polarity
                                       //
BIT_SET (3009, 0)                      // Rising edge
REGISTER_LOAD (3008, 31)               // Selecting register array
                                       // element 31 -> Pulse
                                       // stretching duration
REGISTER_LOAD (3009, 10)               // Pulse stretching duration
                                          of 10 ms
...
LABEL l_Check_Input_1                  // Beginning of loop
```

```
 WHEN IN 201 THEN                    // Waiting until first
                                     // rising edge is sensed
 ...                                 // Doing anything
 WHEN -IN 201 THEN                   // Waiting until pulse
                                     // stretching duration is
                                        reset
GOTO l_Check_Input_1                 // End of loop
...
```

Example8: Automatische Impulsverlängerung - Variante 2

Schleife mit Abfrage einer aktiven Impulsverlängerung

Programmauszug

```
...
REGISTER_LOAD (3008, 30)             // Selecting the register
                                     // array element 30 -> Edge/
                                     // State
BIT_CLEAR (3009, 0)                  // Selecting "Edge"
REGISTER_LOAD (3008, 29)             // Selecting register array
                                     // element 29 -> Polarity
                                     //
BIT_SET (3009, 0)                    // Rising edge
REGISTER_LOAD (3008, 31)             // Selecting register array
                                     // element 31 -> Pulse
                                     // stretching duration
REGISTER_LOAD (3009, 10)             // Pulse stretching duration
                                        of 10 ms
...
LABEL l_Check_Input_1                // Beginning of loop
 WHEN BIT_SET (3000, 16) THEN        // Waiting until pulse
                                     // stretching of input 1 is
                                     // active
 ...                                 // Doing anything
 WHEN BIT_CLEAR (3000, 16) THEN      // Waiting until pulse
                                     // stretching of input 1 is
                                     // reset
GOTO l_Check_Input_1                 // End of loop
...
```

10.5 Register Description

Register 3xx1: Manual pulse stretching - Setting	
Function	**Description**
Read	Inputs for manual pulse stretching enabled and reset last
Write	Enabling and resetting inputs for manual pulse stretching with immediate effect
Value range	Bit-coded, 8 bits
Value after reset	0

Through this register pulse stretching of inputs can be enabled. When enabling this function, a pulse stretching process, which is already active, will be reset. Therefore, the pulse stretching condition has again to be fulfilled for this function to become active. Bits 16 - 23 in register 3xx0 "Status / Controller" display whether the pulse stretching function is active.

For all inputs to be enabled and reset a 1 has to be entered. For all inputs which should remain unaffected, a 0 has to be entered. Bits 0 - 7 in register 3xx0 "Status / Controller" display which inputs are enabled/disabled for manual pulse stretching.

Through register 3xx2 "Manual pulse stretching - Reset" the pulse stretching function is disabled and reset.

Meaning of values:

0 : Input remains unaffected

1 : Input is enabled and reset

Meaning of the individual bits:

Bit 0:	Input # 1
Bit 1:	Input # 2
Bit 2:	Input # 3
Bit 3:	Input # 4
Bit 4:	Input # 5
Bit 5:	Input # 6
Bit 6:	Input # 7
Bit 7:	Input # 8

Register 3xx2: Manual pulse stretching - Resetting	
Function	**Description**
Read	Inputs for manual pulse stretching disabled and reset last
Write	Disabling and resetting inputs for manual pulse stretching with immediate effect
Value range	Bit-coded, 8 bits
Value after reset	0

Through this register pulse stretching of inputs can be disabled again. When disabling this function, a pulse stretching process, which is already active, will be reset. Therefore, the actual input state is displayed again. Bits 16 - 23 in register 3xx0 "Status / Controller" display whether the pulse stretching function is active.

For all inputs to be disabled and reset a 1 has to be entered. For all inputs which should remain unaffected, a 0 has to be entered. Bits 0 - 7 in register 3xx0 "Status / Controller" display which inputs are enabled/disabled for manual pulse stretching.

Through register 3xx2 "Manual pulse stretching - Setting" the pulse stretching function is enabled and reset.

Meaning of values:

0 : Input remains unaffected

1 : Input is disabled and reset

Meaning of the individual bits:

Bit 0:	Input # 1
Bit 1:	Input # 2
Bit 2:	Input # 3
Bit 3:	Input # 4
Bit 4:	Input # 5
Bit 5:	Input # 6
Bit 6:	Input # 7
Bit 7:	Input # 8

Register 3xx3: Present input state	
Function	**Description**
Read	Present input state at the input terminal
Write	Illegal
Value range	Bit-coded, 8 bits
Value after reset	0b 00000000

Meaning of values:

0 : Input is not active (0 V state)

1 : Input is active (24 V state)

Meaning of the individual bits:

Bit 0:	Input # 1
Bit 1:	Input # 2
Bit 2:	Input # 3
Bit 3:	Input # 4
Bit 4:	Input # 5
Bit 5:	Input # 6
Bit 6:	Input # 7
Bit 7:	Input # 8

The input state of the JX2-IO16 module is normally read out through the input numbers of the controller.

When using manual pulse stretching on the JX2-IO16 module, register 3xx3 has to be used for reading the present input state.

Register 3xx8 = 29 Register 3xx9: Edge evaluation - Polarity	
Function	**Description**
Read	Present polarity
Write	New polarity (will immediately become effective)
Value range	Bit-coded, 8 bits
Value after reset	0b 11111111

Polarity is always set together with register array element 30 "Edge evaluation - Edge / State". The condition for starting the pulse stretching function or incrementing the single-channel counter of an input is specified using these register array elements.

Meaning of values:

0 : Register array element 30 = Edge: Action with falling edge of input signal
Register array element 30 = State: Action with input signal = 0 V

1 : Register array element 30 = Edge: Action with rising edge of input signal
Register array element 30 = State: Action with input signal = 24 V

Meaning of the individual bits:

Bit 0:	Input # 1
Bit 1:	Input # 2
Bit 2:	Input # 3
Bit 3:	Input # 4
Bit 4:	Input # 5
Bit 5:	Input # 6
Bit 6:	Input # 7
Bit 7:	Input # 8

Register 3xx8 = 30 Register 3xx9: Edge evaluation - Edge / State	
Function	**Description**
Read	Present value
Write	New value (will immediately become effective)
Value range	Bit-coded, 8 bits
Value after reset	0

The value is always set together with register array element 29 "Edge evaluation - Edge / Polarity". The condition for starting the pulse stretching function or incrementing the single-channel counter of an input is specified using these register array elements.

Meaning of values:

0 : Action with edge

An signal edge evaluation is carried out. In register array element 29 the type of edge (rising or falling) is specified.

1 : Action with state (level)

The voltage level (0 V or 24 V) is evaluated, and not the signal edge. In register array element 29 the type of level (0 V or 24 V) is specified.

Meaning of the individual bits:

Bit 0:	Input # 1
Bit 1:	Input # 2
Bit 2:	Input # 3
Bit 3:	Input # 4
Bit 4:	Input # 5
Bit 5:	Input # 6
Bit 6:	Input # 7
Bit 7:	Input # 8

Register 3xx8 = 31 ... 38 Register 3xx9: Automatic pulse stretching - Pulse stretching duration - Input 1 ... 8	
Function	**Description**
Read	Present pulse stretching duration
Write	New pulse stretching duration (will become effective only on completion of the active pulse stretching process).
Value range	0 ... 255 ms
Value after reset	0 ms (disabled)

These register array elements are for specifying the pulse stretching duration for automatic pulse stretching.

If the value is 0 ms, automatic pulse stretching is disabled. When entering the value 0, an active pulse stretching process will be completed. Then, automatic pulse stretching will be disabled.

It is not allowed to enter a value for an input, as long as manual pulse stretching for this input is active.

11 Counter Function

11.1 Overview of Registers

Register Name	Brief Description
General:	
3xx8 20 3xx9 Counter configuration	Configuration of an input as counter input, Page 91
3xx8 45 - 48 3xx9 Software filter - Filtering interval	Software filter for inputs 5 ... 8, Page 67
3xx8 8 3xx9 Difference in counter reading Input # 5	For determining the counting frequency of the dual-channel, or single-channel counter of input # 5, Page 90
3xx8 9 3xx9 Timebase for counter reading difference - Input 5	For determining the counting frequency of the dual-channel, or single-channel counter of input # 5, Page 91
Single-channel counter:	
3xx8 25 - 28 3xx9 single-channel counter reading Inputs 5 - 8	Single-channel counter readings, Page 92
3xx8 29 3xx9 Edge evaluation - Polarity	Polarity (0 V / 24 V) of input signal, Page 79
3xx8 30 3xx9 Edge evaluation - Edge / State	Counting with (rising / falling) edge or state (0 V / 24 V), Page 80
Registers for pulse stretching	Pulse stretching working with single-channel counter, Page 69
Dual-channel counter:	
3xx0 Status / Controller	Dual-channel counter configuration, Page 63
3xx8 25 3xx9 dual-channel counter reading - Input 5 / input 6	Dual-channel counter reading, Page 92

11.2 General Information

The fast inputs 5 - 8 are provided with a single-channel counter function. The inputs 5 - 6 are together provided with one dual-channel counter function. If the dual-channel counter function is used, the single-channel counter function is not available for inputs 5 - 6.

If an input is used as counter, the corresponding bit in register array element 20 "Counter configuration" must be set.

Note!

Configuring the input as counter in register array element 20 "Counter configuration" reduces the system bus communication, because the changed input status will no longer be sent automatically from the JX2-IO16 module to the controller.

The update frequency for the input state in the controller now depends from the cycle time the controller uses to update the input state of the JX2-IO16 module.

This fact has to be taken into consideration if the input state of a counter input is also used in the application program via input number, or via register-overlaid input information.

With low counting frequencies (< 25 Hz), the bit for the counter input in register array element 20 needs not to be set.

11.3 Single-channel counter

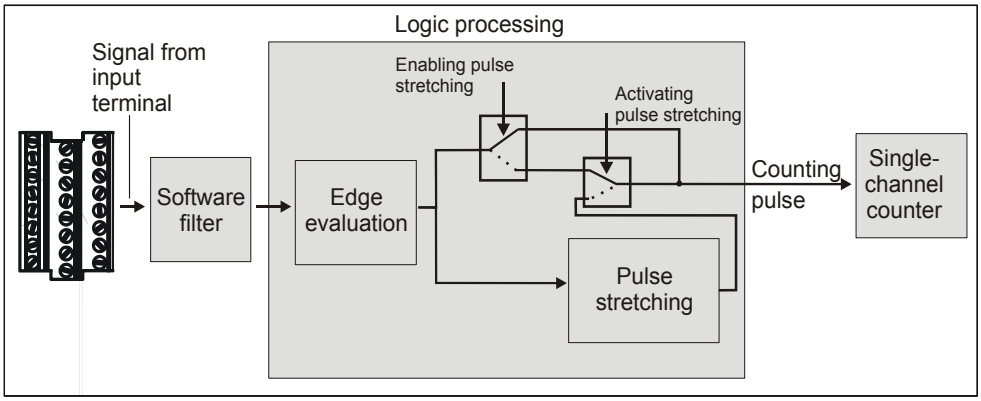


Fig. 23: Generating the single-channel counter pulse

Basically, the single-channel counter counts in ascending order. Read and write access to the counter readings is made via register array lements 25 - 28 "Single-channel counter - Counter reading input 5 - 8". Besides using the register array, read and write access to the counter readings of inputs 5 and 8 can be made via registers 3xx6 and 3xx7. The counter readings can be set to any value by entering the corresponding number.

With single-counters, edge evaluation is activated by default. That is, the reading is incremented only if the condition is fulfilled which has been parameterized using register array elements 29 "Edge evaluation - Polarity", and 30 "Edge evaluation - Edge / State".

Furthermore, an enabled pulse stretching function also has an effect on counter reading incrementation.

Using manual pulse stretching, incrementation of the single-channel counter reading can be stopped, or re-started through the application program. When doing so, it has to be taken into account that the write process for enabling and disabling manual pulse stretching via register 3xx1 and 3xx2 requires a short turnaround time, which is not exactly quantifiable. In the worst case, the turnaround time is within several milliseconds.

The maximum pulse length is given in the technical data on the inputs (for more information refer to chapter "Technical Data of Digital Inputs", page 30).
.

Note!

In case of erronous readings, the software filter settings and edge evaluation parameters have to be checked first.

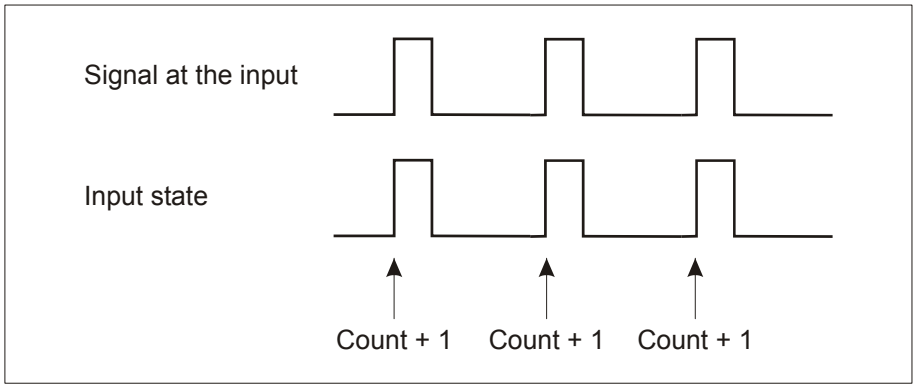


Fig. 24: Counting with rising edge

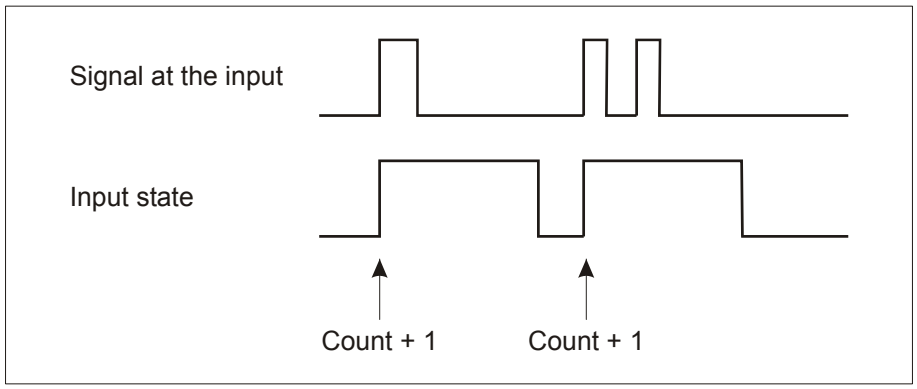


Fig. 25: Counting with pulse stretching

Example

Example 9: Single-channel counter

Pulses are to be counted via input 8 of a JX2-IO16 module which is connected as second IO module. Once a certain number of pulses is reached, a stop signal is to be output via output 1.

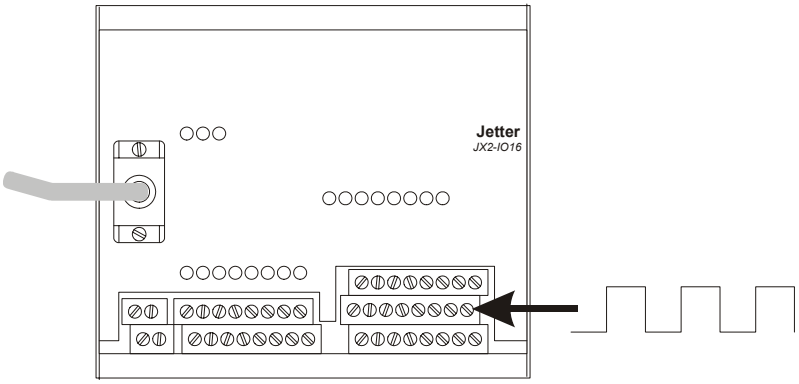


Fig. 26: Example: Single-channel counter

Excerpt from the program

```
...
REGISTER_LOAD (3008, 30)              // Selecting register array
                                      // element 30 -> Edge/State
                                      //
BIT_CLEAR (3009, 0)                   // Selecting edge
REGISTER_LOAD (3008, 29)              // Selecting register array
                                      // element 29 -> Polarity
                                      //
BIT_SET (3009, 0)                     // Rising edge
REGISTER_LOAD (3008, 20)              // Selecting register array
                                      // element 20 -> Counter
                                      // configuration
BIT_SET (3009, 7)                     // Configuring input 8 as
                                      // counter
REGISTER_LOAD (3008, 48)              // Selecting register array
                                      // element 45 -> Software
                                      // filter for input 8
                                      //
REGISTER_LOAD (3009, 10)              // Softwarefilter für
                                      // Eingang 8 anpassen
...
REG_ZERO 3007                         // Zeroing counter reading
WHEN REG 3007 > 94 THEN               // Does the reading exceed
                                      // 94?
OUT 201                               // Setting output 1 on the
                                      // module
...
```

11.4 Dual-channel counter

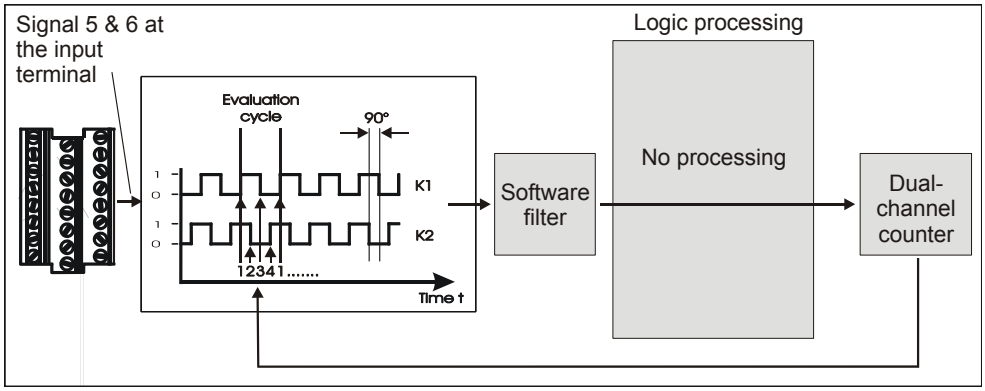


Fig. 27: Evaluating a dual-channel counter signal

The dual-channel counter signal is read in via input 5 (K1) and input 6 (K2). The shift between these two signals is 90°. Depending on the fact which rising edge of these two signals is detected first, the counter reading is incremented or decremented. The two signals are subject to quadruple evaluation, i.e. per evaluation cycle the rising and falling edge of both signals are counted.
Following software filtering, dual-channel signals are directly evaluated. No logical processing is carried out.

The maximum counting frequency is given in the technical data on the inputs (for more information refer to chapter "Technical Data of Digital Inputs", page 30).

The dual-channel counter is to be activated via control bit 10 "Counter configuration" in register 3xx0 "Status / Controller".

Read or write access to the readings of the dual-channel counter is made via register 3xx6 "Dual channel counter - Counter reading", or via register array element 25 "Dual channel counter - Counter reading". The counter reading can be set to any value by entering the corresponding number.

Note!

In case of erronous readings, the software filter setting, as well as the activation of the dual-channel counter via control bit 10 in register 3xx0 "Status / Controller" have to checked first.

Example

Example 10: Dual-channel counter

Position sensing is to be carried out using the dual-channel counter of a JX2-IO16 module which is connected as second IO module. Once a certain position is reached, a stop signal is to be output via output 1.

Excerpt from the program

```
...
BIT_SET (3000, 10)                    // Dual-counter activation
                                      //
REGISTER_LOAD (3008, 20)              // Selecting register array
                                      // element 20 -> Counter
                                      // configuration
BIT_SET (3009, 4)                     // Configuring input 5 as
                                      // counter
BIT_SET (3009, 5)                     // Configuring input 6 as
                                      // counter
REGISTER_LOAD (3008, 45)              // Selecting register array
                                      // element 45 -> Software
                                      // filter for input 5
                                      //
REGISTER_LOAD (3009, 0)               // Setting the software
                                      // filter for input 5 to the
                                      // lowest possible value
REGISTER_LOAD (3008, 46)              // Selecting register array
                                      // element 46 -> Software
                                      // filter for input 6
                                      //
REGISTER_LOAD (3009, 0)               // Setting the software
                                      // filter for input 6 to the
                                         lowest possible value
...
REG_ZERO 3006                         // Setting the dual-channel
                                      // counter to zero
WHEN REG 3006 > 10000 THEN            // Waiting for position
                                      // 10000
OUT 201                               // Setting input 1 on the
                                      // module
...
```

11.5 Frequency measurement

The JX2-IO16 module supports frequency measurement of counting pulses for the dual-channel counter and the single-channel counter of input 5. The JX2-IO16 module measures counting pulses which are sensed during an adjustable time base.

Once the time base has elapsed, the JX2-IO16 module subtracts the current reading of the dual-channel counter or the single-channel counter of input 5 from the reading which has been sensed last, and calculates the difference by the following formula:

$$\text{Counter reading difference} = \text{Reading}_n - \text{Reading}_{n-1}$$

The frequency is calculated in the application program using the following formula:

$$\text{Frequency (Hz)} = \frac{\text{Counter reading difference}}{\text{Time base for counter reading difference} \times 10\ \text{ms}}$$

Read and write access to the time base is made via register array element 9 "Time base for counter reading difference". The difference in counter readings is read out of register array element 8 "Counter reading difference - Input 5".

This function is always active, irrespective of the fact whether input 5 is used as single-channel or dual-channel counter. It is of special interest when using the dual-channel counter.

11.6 Register Description

Register 3xx6: Dual-channel counter - Counter reading Single-channel counter - Counter reading of input 5	
Function	**Description**
Read	Current result of count
Write	New counter reading (immediately effective)
Value range	-8.388.608 ... 8.388.607
Value after reset	0

Register 3xx6 provides faster access to the counter reading of single-channel counter of input 5 or of the dual-channel counter than the register array does.

Register 3xx7: Single-channel counter - Counter reading of input 8	
Function	**Description**
Read	Current result of count
Write	New counter reading (immediately effective)
Value range	-8.388.608 ... 8.388.607
Value after reset	0

Register 3xx7 provides faster access to the counter reading of single-channel counter of input 8 or of the dual-channel counter than the register array does.

Register 3xx8 = 8 Register 3xx9: Counter reading difference - Input 5	
Function	**Description**
Read	Present counter reading difference
Write	Illegal
Value range	-32.768 ... + 32.767
Value after reset	0

This function is always active, irrespective of the fact whether input 5 is used as single-channel or dual-channel counter. It is of special interest when using the dual-channel counter.

The frequency is calculated in the application program using the following formula:

$$\text{Frequency (Hz)} = \frac{\text{Counter reading difference}}{\text{Time base for counter reading difference} \times 10\ \text{ms}}$$

Register 3xx8 = 9 Register 3xx9: Timebase for counter reading difference - Input 5	
Function	**Description**
Read	Present time base
Write	New time base (immediately effective)
Value range	1 ... 255 (x 10 ms)
Value after reset	10 (= 100 ms)

The time basis is a multiple of 10 ms.
1: 10 ms
...
255: 2.550 s

Register 3xx8 = 20 Register 3xx9: Counter configuration	
Function	**Description**
Read	Present counter configuration
Write	New counter configuration
Value range	Bit-coded, 8 bits
Value after reset	0

This register is for specifying whether an input is used as counter or not.

Meaning of values:

0 : Input is used as usual input

1 : Input is used as counter

Meaning of the individual bits:

Bit 0:	Input # 1
Bit 1:	Input # 2
Bit 2:	Input # 3
Bit 3:	Input # 4
Bit 4:	Input # 5

Meaning of the individual bits:

Bit 5:	Input # 6
Bit 6:	Input # 7
Bit 7:	Input # 8

Note!

Configuring the input as counter in register array element 20 "Counter configuration" reduces the system bus communication, because the changed input status will no longer be sent automatically from the JX2-IO16 module to the controller.

The update frequency for the input state in the controller now depends from the cycle time the controller uses to update the input state of the JX2-IO16 module.

This fact has to be taken into consideration if the input state of a counter input is also used in the application program via input number, or via register-overlaid input information.

With low counting frequencies (< 25 Hz), the bit for the counter input in register array element 20 needs not to be set.

Register 3xx8 = 25 - 28 Register 3xx9: Single-channel counter - Counter reading - Inputs 5 - 8	
Function	**Description**
Read	Current result of count
Write	New counter reading (immediately effective)
Value range	-8.388.608 ... 8.388.607
Value after reset	0

Register 3xx8 = 25 Register 3xx9: Dual-channel counter - Counter reading	
Function	**Description**
Read	Current result of count
Write	New counter reading (immediately effective)
Value range	-8.388.608 ... 8.388.607
Value after reset	0

12 Diagnostic and Administrative Functions

12.1 Error Diagnosis

The JX2-IO16 module displays the following errors:

- System bus communication - Timeout
- System bus communication - Data buffer overflow
- Error in the output circuit

Response to faults

When an error occurs the JX2-IO16 module will respond as follows:

- The red ERR-LED lights up.
- In Register 3xx0 "Status / Controller" bit 15 "Error" is set.
- In register array element 2 "Error" the corresponding error bit(s) is (are) set.
- The contents of register array element 2 "Error" are automatically entered into the remanent error history by JX2-IO16 - register array elements 10 - 19.

12.1.1 Error in System bus communication - Timeout

A timeout exists if the JX2-IO16 module for a specified period does not receive monitoring messages from the controller via system bus.

The timeout threshold is set using the two register array elements 4 "Communication - Time base", and 5 "Communication - Multiplicator".

The communication error is deactivated by default. If one of the register array elements 4 or 5 contains the value 0, no timeout error will be generated.

Once a communication error has occurred, the module is in STOP state. Thus, without re-initialization it can no longer be addressed, except that control bit 8 "Timeout - Response" in register 3xx0 is set to 0.

Note!

The timeout response of outputs can be defined using register array element 50 "Outputs - Error Mode", and 51 "Outputs - Error Status". For more information refer to chapter 12.2 "Response of Digital Outputs to Timeout", page 96.

Possible causes for timeout

- Controller failure
- Cable breakage or contact problems of system bus cable.

Troubleshooting

- Switch controller off and on.
- Replace or repair system bus cable.

Error acknowledgement

Once the error cause has been eliminated, the error is acknowledged as follows:

- Switch the module off and on again.

or

- re-initialize the system bus via controller,

or

- enter 0 into register array element 2 "Error" if control bit 8 "Timeout - Response" in register 3xx0 was set to 0.

12.1.2 System bus communication error - Data buffer overflow

Data buffer overflow indicates that the JX2-IO16 has received more system bus requests than the data buffer memory can hold. Along with this error, the controller may display a timeout for the JX2-IO16 module.

Possible causes for data buffer overflow

- This error message indicates an overload of the system bus or the JX2-IO16 module.

Troubleshooting

- Increase the access times for register requests and output changes of JX2-IO16 in the application program.

Error acknowledgement

- Enter 0 into register array element 2 "Error",

or

- switch the module off and on again,

or

- re-initialize the system bus via controller.

12.1.3 Error in the output circuit

An error in the output circuit exists when the output circuit signals an error for at least 30 ms.

Possible error causes

- Overcurrent at one output at the least (I > 0.5 A per output)
- Undervoltage of the power supply voltage; refer to Fig. 28
- Overtemperature of the output circuit

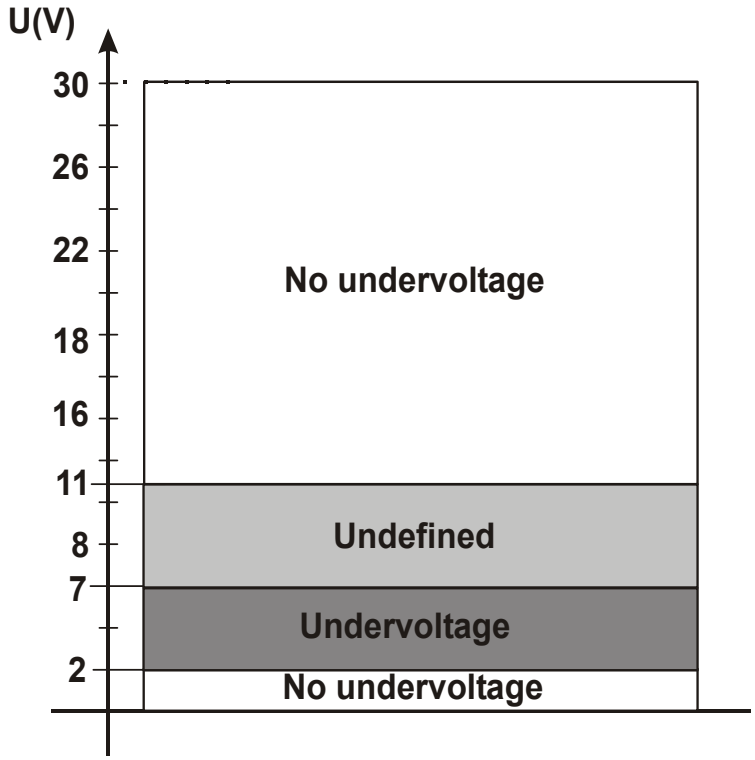


Fig. 28: Voltage levels of the undervoltage detection system

Troubleshooting

- Eliminate short circuit at one or several outputs
- Ensure a stable power supply

Error acknowledgement

- This error message will automatically be deleted by the JX2-IO16 module once the error signal from the output circuit is canceled.

12.2 Response of Digital Outputs to Timeout

In case of a timeout in system bus communication, each of the outputs can be set to an error status to be defined by the user.

The user can specify whether an output should maintain its state or whether it is to be set or reset in case of an error..

The error status of outputs can be defined using register array element 50 "Outputs - Error Mode", and 51 "Outputs - Error Status".

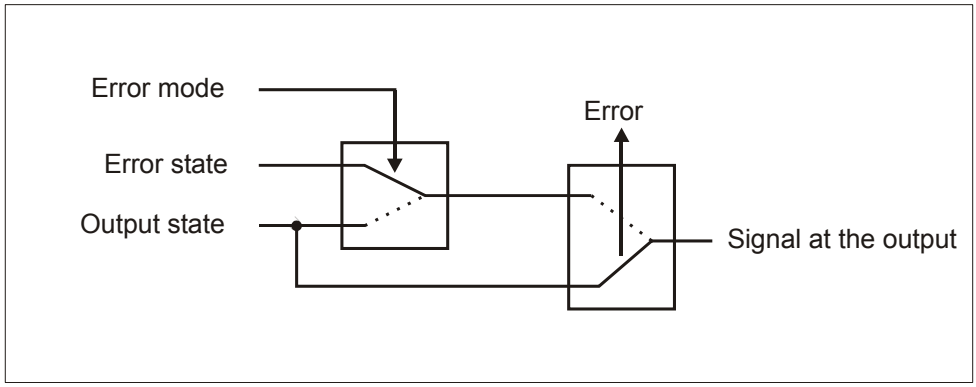


Fig. 29: Definition of output error statuses

Re-initialization of JX2-IO16 following timeout

Once a timeout error has occurred, the module is in STOP state. Thus, without re-initialization it can no longer be addressed.

Note!

The controller saves the last output state of the JX2-IO16 module before the timeout has occurred. If the output state has changed as a result of an error status on the JX2-IO16 module, the output state, which has been saved by the controller for the JX2-IO16, is no longer applicable.

There are two ways to re-initialize the module:

- Initialization # 1:
  The module is re-initialized from the controller using a command or a special function.

- Initialization # 2:
  The module is re-initialized by switching the controller and the module off and, then, on again.

The output state is influenced by these two ways of initialization differently:

- Initialization # 1:
  The output error status, which has been set due to the communication error, is maintained in the JX2-IO16 module. To do so, the JX2-IO16 automatically sets control bit 8 "Output initialization" in register 3xx0 "Status / Controller". For more information refer to chapter 8 "Status and Control Functions", page 63. During re-initialization the output state saved by the controller for the JX2-IO16 module is also set to the output state of the JX2-IO16. For more information refer to Fig. 30.

- Initialization # 2:
  The output state within the module, as well as in the controller is set to 0. For more information refer to Fig. 30

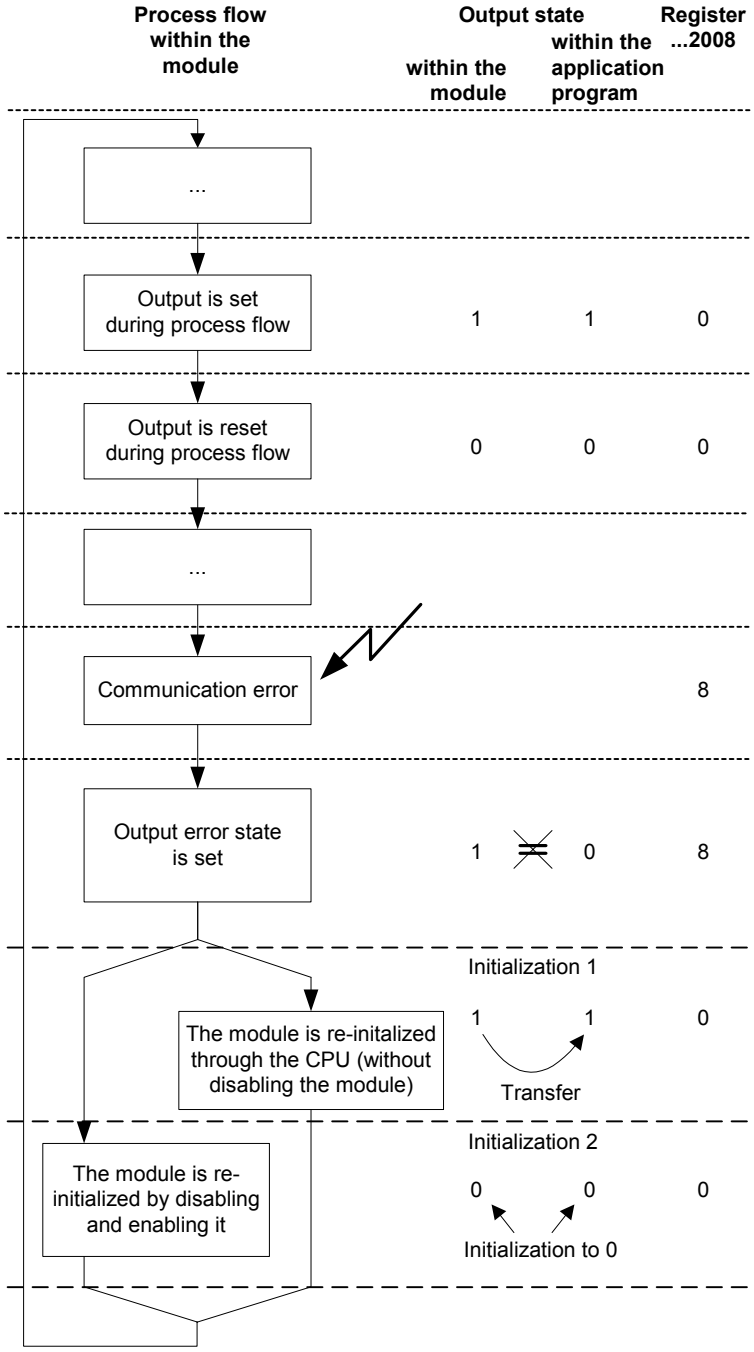


Fig. 30: Ouput state response when restarting the module

12.3 Overview of Registers

Register 3xx8 = 1 Register 3xx9: Firmware version	
Function	**Description**
Read	Up-to-date firmware version
Write	Illegal
Value range	1 ... 99.999
Value after reset	Up-to-date firmware version

Interpreting the value: 300 corresponds to version 3.00.

Note!

When submitting technical support queries the firmware version must be specified.

Register 3xx8 = 2 Register 3xx9: Error	
Function	**Description**
Read	Present error message
Write	Resetting the errors
Value range	Bit-coded, 8 bits
Value after reset	0

See also chapter 12.1 "Error Diagnosis", page 93.

When errors have occurred, the register array element is zeroed by entering the value 0. At the same time, bit 15 in register "Status / Controller" is also reset and the ERROR LED is switched off.

Errors which are automatically deleted by the JX2-IO16 module are marked with an *.

Meaning of the individual bits:

Bit 0:	**Reserved**
Bit 1:	**Error in the output circuit ***
	Possible causes for this error bit are: • Overcurrent at one output at the least (I > 0.5 A per output) • Undervoltage of the power supply voltage • Overtemperature of the output circuit
Bit 2:	**System bus communication - Timeout** The interruption of system bus communication between controller and JX2-IO16 module exceeded the set interval. The timeout threshold (interval) is set using the two register array elements 4 "Communication - Time base", and 5 "Communication - Multiplicator". **ATTENTION:** If one of these two register array elements is 0, no error will be generated.
Bit 3:	**Reserved**
Bit 4:	**Reserved**
Bit 5:	**Reserved**
Bit 6:	**Reserved**
Bit 7:	**System bus communication - Data buffer overflow**
	Data buffer overflow indicates that the JX2-IO16 has received more system bus requests than the data buffer memory can hold. Along with this error, the controller may display a timeout for the JX2-IO16 module. **ATTENTION:** This error message indicates an overload of the system bus or the JX2-IO16 module.

Register 3xx8 = 4
Register 3xx9: System bus communication - Timeout - Time base

Function	Description
Read	Present time base
Write	New time base
Value range	0 ... 255 ms
Value after reset	255 ms

Together with register array element 5 this register array element is for setting the timeout threshold for system bus communication.

The timout threshold is calculated using the following formula:

Timeout threshold = Time base (register array element 4)* Multiplicator (register array element 5).

Important!

The timeout threshold must in any case exceed 200 ms.

If one of the register array elements 4 or 5 contains the value 0, no communication error will be generated.

Register 3xx8 = 5 Register 3xx9: System bus communication - Timeout - Multiplikator	
Function	**Description**
Read	Present multiplicator
Write	New multiplicator
Value range	0 ... 255
Value after reset	0

Together with register array element 4 this register array element is for setting the timeout threshold for system bus communication.

The timout threshold is calculated using the following formula:

Timeout threshold = Time base (register array element 4)* Multiplicator (register array element 5).

Important!

The timeout threshold must in any case exceed 200 ms.

If one of the register array elements 4 or 5 contains the value 0, no communication error will be generated.

Register 3xx8 = 10 ... 19 Register 3xx9: Error history - Entry 0 ... 9	
Function	**Description**
Read	Entries for the last 10 errors
Write	Illegal
Value range	Bit-coded, 8 bits
Value after reset	Error entry (0 = No error)

The last 10 errors are saved to the remanent error history register, i.e. they will be saved even when the module is switched off. If less than 10 errors have occurred during the lifecycle of the module, the history contains entries with the value 0. This is to indicate that no errors have been saved.

Please mind the following order of entries:
Register array element 10 = latest error entry
....
Register array element 19 = oldest error entry

Meaning of the individual bits:

Bit 0:	**Reserved**
Bit 1:	**Error in the output circuit**
Bit 2:	**System bus communication - Timeout**
Bit 3:	**Reserved**
Bit 4:	**Reserved**
Bit 5:	**Reserved**
Bit 6:	**Reserved**
Bit 7:	**System bus communication - Data buffer overflow**

For an error definition please refer to description of register array element 2 "Error", Page 99, and chapter 12.1 "Error Diagnosis", page 93.

Register 3xx8 = 50 Register 3xx9: Outputs - Error mode	
Function	**Description**
Read	Present error mode
Write	New error mode
Value range	Bit-coded, 8 bits
Value after reset	0

Through the error mode register the response to a system bus communication timeout can be defined for each output separately:

0 : Maintaining the actual status

1 : Setting the error status

Meaning of the individual bits:

Bit 0:	Output 1
Bit 1:	Output 2
Bit 2:	Output 3
Bit 3:	Output 4
Bit 4:	Output 5
Bit 5:	Output 6
Bit 6:	Output 7
Bit 7:	Output 8

Register 3xx8 = 51 Register 3xx9: Outputs - Error status	
Function	**Description**
Read	Actual error condition
Write	New error condition
Value range	Bit-coded, 8 bits
Value after reset	0

Through the error condition register the response to a system bus communication timeout can be defined for each output separately, if the error condition for the given output is set to 1 "Setting the error condition":

0 : Reset output

1 : Set output

Meaning of the individual bits:

Bit 0:	Output 1
Bit 1:	Output 2
Bit 2:	Output 3
Bit 3:	Output 4
Bit 4:	Output 5
Bit 5:	Output 6

Meaning of the individual bits:

Bit 6:	Output 7
Bit 7:	Output 8

Appendices

Appendix A: Recent Revisions

Chapter	Comment	Revised	Added	Deleted
Various	Various changes to the wording	✓		
Installation	Description of status LEDs has been revised	✓		
Pulse Stretching	Description of manual pulse stretching: "Enabling is displayed in register through bits 0 .. 8" has been replaced by "... bits 0 .. 7."	✓		
Pulse Stretching	Register description of register 3xx2: "The pulse stretching function is enabled and reset through register 3xx2." has been replaced by "... register 3xx1."	✓		
Appendix B	Overview of Registers: Description of bits for bit-oriented registers has been added		✓	

Appendix B: Overview of Registers

For communication with the CPU, 10 registers are provided by the JX2-IO16 module. In addition, a register array is available, which can be addressed via register 8, and register 9. When doing so, register 8 indicates the index of the register array element, and register 9 contains the value of the element.

In column "R/W", the type of access to the register, or the register array element is identified:

R = Read
W = Write

Registers

Register Number	Name	R/W	1) Value Range 2) Default value 3) Cross Reference
3xx0	Status / Controller	R/W	1) bit-oriented, 24 bits 2) 0b 00000000 00000001 00000000 3) Page 63
	Status bits:		
	Bit 0:	Manual pulse stretching - Input # 1 0 = Manual pulse stretching disabled 1 = Manual pulse stretching enabled	
	Bit 1:	Manual pulse stretching - Input # 2	
	Bit 2:	Manual pulse stretching - Input # 3	
	Bit 3:	Manual pulse stretching - Input # 4	
	Bit 4:	Manual pulse stretching - Input # 5	
	Bit 5:	Manual pulse stretching - Input # 6	
	Bit 6:	Manual pulse stretching - Input # 7	
	Bit 7:	Manual pulse stretching - Input # 8	
	Control bits:		
	Bit 8:	Time-out - Reaction (only for commissioning) 0 = In case of timeout, the module remains accessible 1 = In case of timeout, the module assumes stop state and has to be re-initialized	
	Bit 9:	Output initialization	

Register Number	Name	R/ W	1) Value Range 2) Default value 3) Cross Reference
		0 =	With a warm restart, outputs are set to 0.
		1 =	With a warm restart, outputs maintain the last state.
	Bit 10:	Counter configuration	
		0 =	Inputs 5 - 6 are used as single-channel counters
		1 =	Input 5 + 6 are used as dual-channel counter
	Status bits:		
	Bit 15:	Error	
		0 =	Module is in faultless condition
		1 =	Module signals error
	Bit 16:	Pulse stretching - Input # 1	
		0 =	Pulse stretching not enabled
		1 =	Pulse stretching enabled
	Bit 17:	Pulse stretching - Input # 2	
	Bit 18:	Pulse stretching - Input # 3	
	Bit 19:	Pulse stretching - Input # 4	
	Bit 20:	Pulse stretching - Input # 5	
	Bit 21:	Pulse stretching - Input # 6	
	Bit 22:	Pulse stretching - Input # 7	
	Bit 23:	Pulse stretching - Input # 8	
3xx1	Manual pulse stretching - Setting	R/ W	1) bit-oriented, 8 bits 2) 0 3) Page 76
	Bit 0:	Input # 1	
		0 =	Manual pulse stretching remains unaffected
		1 =	Manual pulse stretching is enabled
	Bit 1:	Input # 2	
	Bit 2:	Input # 3	
	Bit 3:	Input # 4	
	Bit 4:	Input # 5	
	Bit 5:	Input # 6	
	Bit 6:	Input # 7	

Register Number	Name	R/ W	1) Value Range 2) Default value 3) Cross Reference
	Bit 7:	Input # 8	
3xx2	Manual pulse stretching - Resetting	R/ W	1) bit-oriented, 8 bits 2) 0 3) Page 77
	Bit 0:	Input # 1 0 = Manual pulse stretching remains unaffected 1 = Manual pulse stretching is disabled	
	Bit 1:	Input # 2	
	Bit 2:	Input # 3	
	Bit 3:	Input # 4	
	Bit 4:	Input # 5	
	Bit 5:	Input # 6	
	Bit 6:	Input # 7	
	Bit 7:	Input # 8	
3xx3	Present input state	R/ W	1) bit-oriented, 8 bits 2) Present input state 3) Page 78
	Bit 0:	Input # 1 0 = not active (0 V state) 1 = active (24 V state)	
	Bit 1:	Input # 2	
	Bit 2:	Input # 3	
	Bit 3:	Input # 4	
	Bit 4:	Input # 5	
	Bit 5:	Input # 6	
	Bit 6:	Input # 7	
	Bit 7:	Input # 8	
3xx4 - 3xx5	Reserved		
3xx6	Single-channel counter - Counter reading of input 5 Dual-channel counter - Counter reading (inputs 5 and 6)	R/ W	1) -8.388.608 ... 8.388.607 2) 0 3) Page 90

Register Number	Name	R/ W	1) Value Range 2) Default value 3) Cross Reference
3xx7	Single-channel counter - Counter reading of input 8	R/ W	1) -8.388.608 ... 8.388.607 2) 0 3) Page 90
3xx8	Register Array: Index	R/ W	1) 1...51 2) 1 3) Page 62
3xx9	Register Array: Value	R/ W	1) Depending from register array index 2) Firmware version 3) Page 62

Register array

Index	Name	R/ W	1) Value Range 2) Default value 3) Cross Reference
1	Firmware version	R	1) 0 ... 8.388.607 2) Firmware version 3) Page 99
2	Error	R/ W	1) bit-oriented, 8 bits 2) 0 3) Page 99
	Bit 1:	1 =	Error in output driver circuit
	Bit 2:	1 =	System bus communication - Timeout
	Bit 7:	1 =	System bus communication - Data buffer overflow
3	Reserved		
4	System bus communication - Timeout - Time base	R/ W	1) 0 ... 255 ms 2) 255 ms 3) Page 100
5	System bus communication - Timeout - Multiplikator	R/ W	1) 0 ... 255 2) 0 (no error generation) 3) Page 101
6 - 7	Reserved		
8	Counter reading difference - Input 5	R/ W	1) -32.768 ... 32.767 2) 0 3) Page 90
9	Timebase for counter reading difference - Input 5	R/ W	1) 0 ... 255 (x 10 ms) 2) 10 (= 100 ms) 3) Page 91

Index	Name	R/ W	1) Value Range 2) Default value 3) Cross Reference
10	Error history - Entry 0	R	1) bit-oriented, 8 bits 2) Error code saved last 3) Page 102
	Bit 1:	1 =	Error in output driver circuit
	Bit 2:	1 =	System bus communication - Timeout
	Bit 7:	1 =	System bus communication - Data buffer overflow
11	Error history - Entry 1	R	1) bit-oriented, 8 bits 2) Error code saved last but one 3) Page 102
	Refer to bit definitions with index 10		
12	Error history - Entry 2	R	1) bit-oriented, 8 bits 2) Error code saved last but two 3) Page 102
	Refer to bit definitions with index 10		
13	Error history - Entry 3	R	1) bit-oriented, 8 bits 2) Error code saved last but three 3) Page 102
	Refer to bit definitions with index 10		
14	Error history - Entry 4	R	1) bit-oriented, 8 bits 2) Error code saved last but four 3) Page 102
	Refer to bit definitions with index 10		
15	Error history - Entry 5	R	1) bit-oriented, 8 bits 2) Error code saved last but five 3) Page 102
	Refer to bit definitions with index 10		
16	Error history - Entry 6	R	1) bit-oriented, 8 bits 2) Error code saved last but six 3) Page 102
	Refer to bit definitions with index 10		
17	Error history - Entry 7	R	1) bit-oriented, 8 bits 2) Error code saved last but seven 3) Page 102
	Refer to bit definitions with index 10		
18	Error history - Entry 8	R	1) bit-oriented, 8 bits 2) Error code saved last but eight 3) Page 102

Index	Name	R/W	1) Value Range 2) Default value 3) Cross Reference
	Refer to bit definitions with index 10		
19	Error history - Entry 9	R	1) bit-oriented, 8 bits 2) Oldest error code saved 3) Page 102
	Refer to bit definitions with index 10		
20	Counter configuration	R/W	1) bit-oriented, 8 bits 2) 0 3) Page 91
	Bit 0:	Input # 5 0 = Configuration as regular input 1 = Configuration as counter	
	Bit 1:	Input # 6	
	Bit 2:	Input # 7	
	Bit 3:	Input # 8	
21 - 24	Reserved		
25	Single-channel counter - Counter reading of input 5 Dual-channel counter - Counter reading (inputs 5/6)	R/W	1) -8.388.608 ... 8.388.607 2) 0 3) Page 92
26	Single-channel counter - Counter reading of input 6	R/W	1) -8.388.608 ... 8.388.607 2) 0 3) Page 92
27	Single-channel counter - Counter reading of input 7	R/W	1) -8.388.608 ... 8.388.607 2) 0 3) Page 92
28	Single-channel counter - Counter reading of input 8	R/W	1) -8.388.608 ... 8.388.607 2) 0 3) Page 92
29	Edge evaluation - Polarity	R/W	1) bit-oriented, 8 bits 2) 0b 11111111 (rising edge) 3) Page 79
	Bit 0:	Input # 1 0 = Action with falling edge or 0 V state 1 = Action with rising edge or 24 V state	
	Bit 1:	Input # 2	
	Bit 2:	Input # 3	
	Bit 3:	Input # 4	
	Bit 4:	Input # 5	

Index	Name	R/ W	1) Value Range 2) Default value 3) Cross Reference
	Bit 5: Input # 6		
	Bit 6: Input # 7		
	Bit 7: Input # 8		
30	Edge evaluation - Edge / State	R/ W	1) bit-oriented, 8 bits 2) 2 (edge-triggered) 3) Page 80
	Bit 0: Input # 1 0 = Action with edge 1 = Action with state		
	Bit 1: Input # 2		
	Bit 2: Input # 3		
	Bit 3: Input # 4		
	Bit 4: Input # 5		
	Bit 5: Input # 6		
	Bit 6: Input # 7		
	Bit 7: Input # 8		
31	Automatic pulse stretching - Stretching period - Input # 1	R/ W	1) 0 ... 255 ms 2) 0 (deactivated) 3) Page 81
32	Automatic pulse stretching - Stretching period - Input # 2	R/ W	1) 0 ... 255 ms 2) 0 (deactivated) 3) Page 81
33	Automatic pulse stretching - Stretching period - Input # 3	R/ W	1) 0 ... 255 ms 2) 0 (deactivated) 3) Page 81
34	Automatic pulse stretching - Stretching period - Input # 4	R/ W	1) 0 ... 255 ms 2) 0 (deactivated) 3) Page 81
35	Automatic pulse stretching - Stretching period - Input # 5	R/ W	1) 0 ... 255 ms 2) 0 (deactivated) 3) Page 81
36	Automatic pulse stretching - Stretching period - Input # 6	R/ W	1) 0 ... 255 ms 2) 0 (deactivated) 3) Page 81
37	Automatic pulse stretching - Stretching period - Input # 7	R/ W	1) 0 ... 255 ms 2) 0 (deactivated) 3) Page 81

Index	Name	R/ W	1) Value Range 2) Default value 3) Cross Reference
38	Automatic pulse stretching - Stretching period - Input # 8	R/ W	1) 0 ... 255 ms 2) 0 (deactivated) 3) Page 81
39 - 44	Reserved		
45	Software filter - Delay time for input # 5	R/ W	1) 0 ... 255 2) 21 (2.8 ms = 22 x 128 µs) 3) Page 67
46	Software filter - Delay time for input # 6	R/ W	1) 0 ... 255 2) 21 (2.8 ms = 22 x 128 µs) 3) Page 67
47	Software filter - Delay time for input # 7	R/ W	1) 0 ... 255 2) 21 (2.8 ms = 22 x 128 µs) 3) Page 67
48	Software filter - Delay time for input # 8	R/ W	1) 0 ... 255 2) 21 (2.8 ms = 22 x 128 µs) 3) Page 67
49	Reserved		
50	Outputs - Error mode	R/ W	1) bit-oriented, 8 bits 2) 0 (keep present state) 3) Page 102
	Bit 0:	Input # 1 0 = in case of timeout: keep present state 1 = in case of timeout: Set the error status	
	Bit 1:	Input # 2	
	Bit 2:	Input # 3	
	Bit 3:	Input # 4	
	Bit 4:	Input # 5	
	Bit 5:	Input # 6	
	Bit 6:	Input # 7	
	Bit 7:	Input # 8	
51	Outputs - Error status	R/ W	1) bit-oriented, 8 bits 2) 0 (resetting the output) 3) Page 103
	Bit 0:	Input # 1 0 = in case of timeout: Reset output 1 = in case of timeout: Set output	

Index	Name	R/ W	1) Value Range 2) Default value 3) Cross Reference
	Bit 1: Input # 2		
	Bit 2: Input # 3		
	Bit 3: Input # 4		
	Bit 4: Input # 5		
	Bit 5: Input # 6		
	Bit 6: Input # 7		
	Bit 7: Input # 8		

Appendix C: Glossary

AC	**A**lternating **C**urrent
CE	**C**ommunautés **E**uropéennes = European Union
D	**D**epth
DC	**D**irect **C**urrent
DIN	**D**eutsches **I**nstitut für **N**ormung e.V. = German Industry Standard
EC Low Voltage Directive	To be considered when using electric devices of a rated voltage between 50 and 1,000 V AC and between 75 and 1,500 V DC.
Electro-Magnetic Compatibility (EMC)	Definition according to the EMC regulations: "EMC is the ability of a device to function in a satisfactory way in electro-magnetic surroundings without causing electromagnetic disturbances itself, which would be unbearable for other devices in these surroundings.“
EN	**E**uropäische **N**orm, that is: European Standard
ESD	**E**lectro **S**tatic **D**ischarge
EU	**E**uropean **U**nion
H	**H**eight
IEC	**I**nternational **E**lectrotechnical **C**ommission
IP	**I**nternational **P**rotection
JETTER System Bus	The Jetter system bus is a system-bus system with a cable length of max. 200 m, and a data transmission rate of 1 Mbit/s. In addition to this, the Jetter system bus is highly immune to interferences. Therefore, the Jetter system bus is suited to realise field bus applications in a limited space.
JetWeb	Control technology comprising control systems, motion systems, user interfaces, visualization devices, remote I/Os and industrial PCs. Programming by means of multitasking and a modern sequence-oriented language. Communication by means of Ethernet TCP/IP and making use of the Web technologies. Control technology which is characterized by seamless integration of all automation function, in particular with regard to motion technology.
PE	**P**rotective **E**arth , respectively "Protective Earth Conductor"
Residual ripple	The percentage of AC left on a DC signal after rectifying.

SELV	Safe Extra Low Voltage: Voltage, which, under all operating conditions will not exceed a peak or DC voltage of 42.4 V. This voltage is either measured between two conductors or between one conductor and earth. The circuit, in which this voltage occurs, must be separated from the mains power supply by a safety isolating transformer or some equivalent.
SUB-D	Type name of a plug-in connector
t_r/t_n	**t**ime **r**ise/**t**ime **n**ormal:"rise time of a pulse/total duration of a pulse" "rise time of a pulse / total duration of a pulse"
VDE	**V**erband **d**eutscher **E**lektrotechniker e.V. = Association of German Electrical Engineers
W	**W**idth

Units:

A	Ampere
dB	Dezibel
g	Gram
Hz	Hertz
m	Meter
mm	Millimeter (1 mm = 10^{-3} m)
min	Minute
s	Second
V	Volt
W	Watt

Appendix D: List of Illustrations

Appendix E: Index of Examples

Appendix F: Index

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