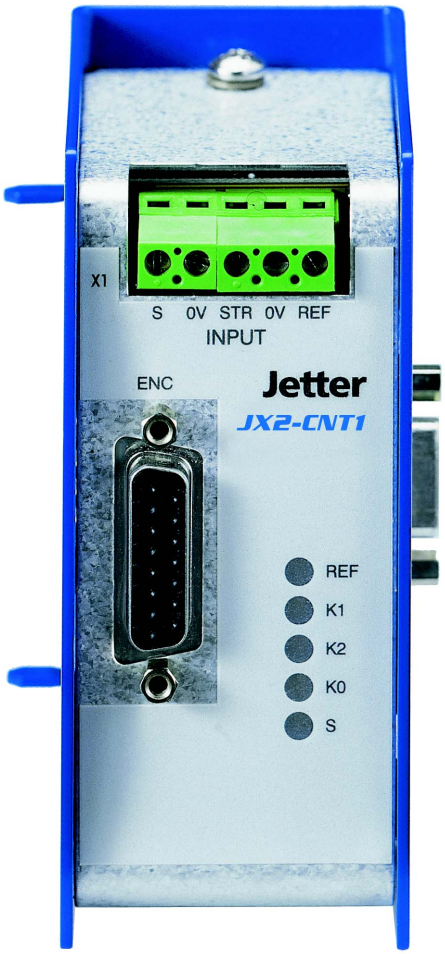
JX2-CNT1

Peripheral Module



JetWeb

User Manual

Jetter
Automation. Made easy.

Item # 608 633 15 / Revision 3.02.4 June 2010 / Printed in Germany

Rev. 3.02.4

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This User Manual is an Integral Part of the JetWeb-Module JX2-CNT1:

Type:	
Serial #:	
Year of manufacture:	
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-CNT1 module, and

- must be kept in a way that it is always at hand until the JX2-CNT1 module will be disposed of;
- If the JX2-CNT1 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-CNT1 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.

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 have 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.

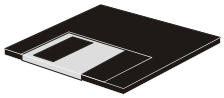
Note

· / - 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.

Reference to PC keyboard and HMI 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

1 Safety Instructions

1.1 Generally Valid Safety Instructions

The JX2-CNT1 module complies with the applicable safety regulations and standards. Special emphasis was given to the safety of the users.

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

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

1.1.1 Intended Conditions of Use

The intended conditions of use include operation in accordance with the user manual.
The JX2-CNT1 can be connected as peripheral module to the Jetter system bus.
The JX2-CNT1 module is used for position capturing and for counting events.
In the case of position capturing signals from an incremental encoder (via dual-channel counter) or an absolute encoder (SSI) are evaluated. The single-channel counter is for counting events.

The module JX2-CNT1 is supplied with power from the Jetter system bus, that is, by the basic unit - the controller - in the case of centralized arrangement. In the case of remote arrangement by the power supply module JX2-PS1.
The supply voltage of the JX2-CNT1 module is DC 5 V. This operating voltage is classified as SELV (Safety Extra Low Voltage). The JX2-CNT1 module is therefore not subject to the EU Low Voltage Directive.

The JX2-CNT1 module may only be operated within the limits of the stated data (for more information refer to chapter 5 "Technical Data", page 27).

The JX2-CNT1 module is used to control machinery, such as conveyors, production machines, and handling machines.

1.1.2 Usage Other Than Intended

The JX2-CNT1 module must not be used in technical systems which to a high degree have to be fail-save, e.g. ropeways and aeroplanes.l

If the JX2-CNT1 module is to be run under ambient conditions, which differ from the conditions mentioned in chapter 4 "Operating Conditions", page 23, the manufacturer is to be contacted beforehand.

1.1.3 Who is Permitted to Operate the JX2-CNT1 Module?

Only instructed, trained and authorized persons are permitted to operate the JX2-CNT1 module.
Mounting and backfitting may only be carried out by specially trained personnel, as specific know-how will be required.

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-CNT1 module and its functions are permitted.
Any modifications to the JX2-CNT1 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-CNT1 module. Parts and equipment from other manufacturers are not tested on our part, and are, therefore, not released by Jetter AG.
The installation of such parts may impair the safety and the proper functioning of the JX2-CNT1 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 Servicing the JX2-CNT1 Module

The JX2-CNT1 module must not be repaired by the operator itself. The JX2-CNT1 module does not contain any parts which can be repaired by the operator.
If the JX2-CNT1 module needs repairing, please send it to Jetter AG.

The JX2-CNT1 module is maintenance-free. Therefore, absolutely no inspection or maintenance works are required for the operation of this device.

1.1.6 Decommissioning and Disposal of the JX2-CNT1 Module

Decommissioning and disposal of the JX2-CNT1 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-CNT1 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 a responsible person at once.
- Safeguard the JX2-CNT1 module against misuse or accidental use.
- Only qualified experts are allowed to carry out repairs.

1.2.2 Information Signs and Labels

- Markings, information signs, and labels always have to be observed and kept readable.
- Damaged or unreadable information signs and labels have to be replaced.

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 importance.

Important!

Measures for increasing immunity to interference:

- Attach the JX2-CNT1 module to a DIN rail acc. to EN 50022-35 x 7.5.
- Connect the JX2-CNT1 module to the controller or the power supply module JX2-PS1 via Jetter system bus.
- Connect the JX2-CNT1 module to the Jetter system bus by directly plugging it into a JX2 module (not through a cable).
  The system bus can be extended by means of a cable.
- 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°.
- Shielded cables **must** be used for the following lines:
  Analog lines, data lines, motor cables coming from inverter drives (servo output stage, frequency converter), lines between components and interference suppressor filter, if the suppressor filter has not been placed at the component directly.
- 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 metallized connector housing, respectively of the EMC gland bushing, its greatest possible surface area being clamped under a strain relief.

➢ Only use metallized connectors, e.g. SUB-D with metallized housing. Make sure that the strain relief is directly connected with the housing here as well (see Fig. 1).

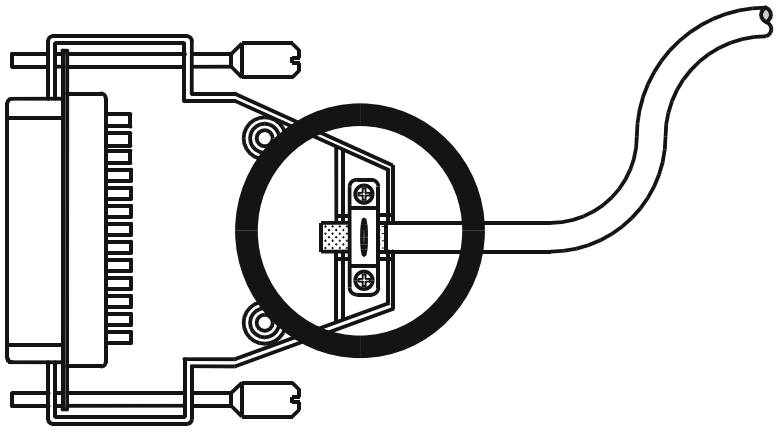


Fig. 1: Shielding of SUB-D connectors in conformity with EMC standards.

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

➢ It is important that shield and strain relief are highly conductive and directly connected to a grounded surface with the greatest possible surface area. When doing so, grounding must be implemented in a way that the unshielded portion of the cable is as short as possible (refer to Fig. 2).

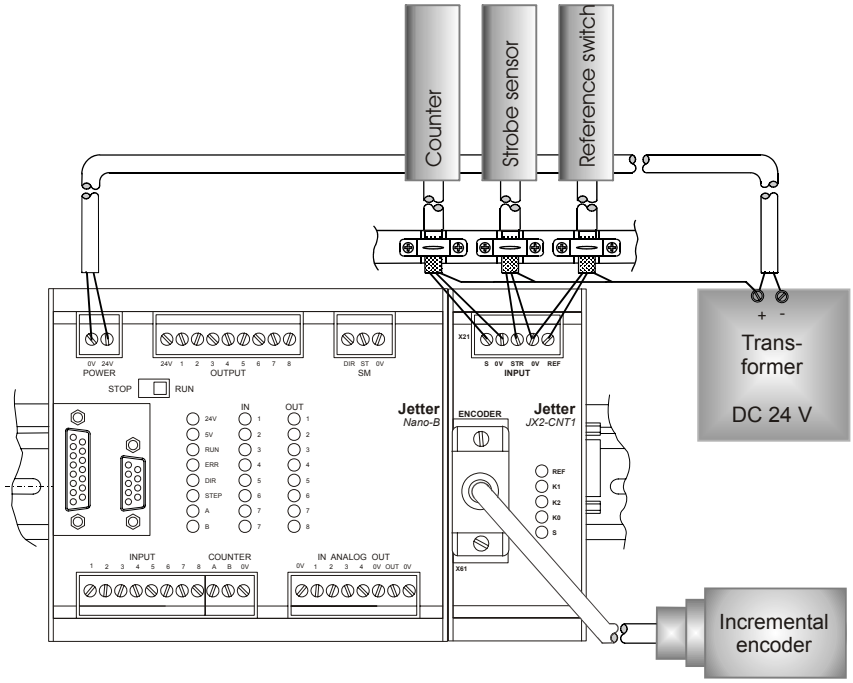


Fig. 2: Shielding of screw terminals in conformity with the EMC standards.

Important!

To avoid malfunctions the following must be ensured:

- The shielding must be clamped under a strain relief with the greatest possible surface area.
- The connection between shielding and ground must be electrically conducting.
- The length of unshielded conductor ends must not exceed 8 cm (refer to Fig. 2).

2 Introduction

This manual contains important information on how to transport, erect, install, operate, maintain and repair the non-intelligent expansion module JX2-CNT1 with firmware version 3.02 or higher.

2.1 Product Description

The JX2-CNT1 module is for position capturing and for counting events. In the case of position capturing signals from an incremental encoder (via dual-channel counter) or an absolute encoder (SSI) are evaluated. The single-channel counter is for counting events.

The position obtained from position capturing can be evaluated in the application program or be sent via system bus as set position (master position) to an axis controller by Jetter AG. The single-channel counter is used e.g. as workpiece counter.

2.2 Ordering Information

Designation	Description	Article No.
JX2-CNT1	Counter module: 1 dual-channel counter (1 MHz) + 1 single-channel counter (10 kHz) or 1 SSI absolute encoder + 1 single-channel counter	10000139
Jetter system bus cable	Cable assy # 530 + length: 0.2 m; 0.5 m; 1.0 m; 1,5 m; 3 m; 4 m; 5 m (other lengths on request)	see table below

Jetter system bus connecting cable:

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

2.3 Update Information

It is not possible to update the operating system of JX2-CNT1 modules from JetSym. The operating system can be updated only by Jetter AG.

2.4 System Requirements

Software Versions	
Module	**Minimum Software Version**
JX2-CNT1	3.02
Controller	**Minimum Software Version**
JC-241, JC-243, JC-246	3.00
NANO-B, NANO-C, NANO-D	2.01
JX6-SB(-I) (for JC-647(-MC), DELTA, JC-800)	2.12

3 Physical Dimensions

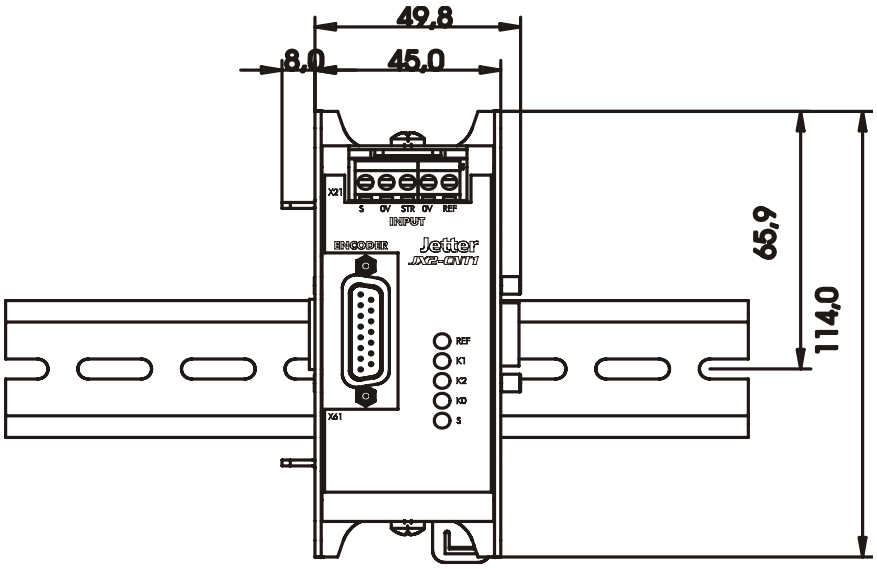


Fig. 3: Front View - JX2-CNT1

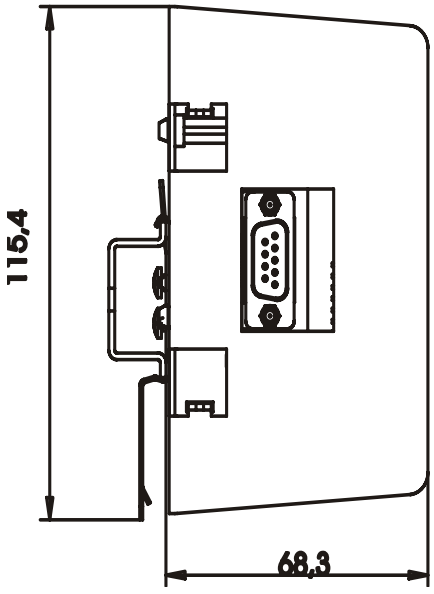


Fig. 4: Side View - JX2-CNT1

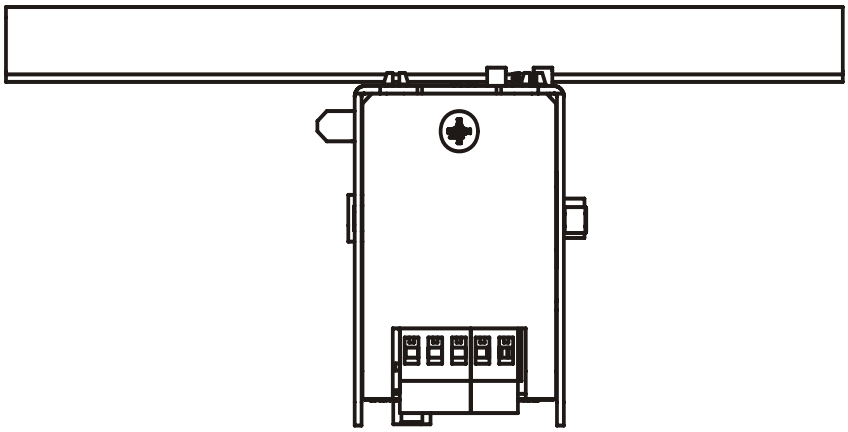


Fig. 5: Top View - JX2-CNT1

Design	
Connection to the basic unit via Jetter system bus	Male connector SUB-D, 9 pins
Encoder connection	Female connector SUB-D, 15 pins
Counter Connection	COMBICON terminal block
Dimensions (H x W x D in mm)	115 x 45 x 68
Housing bottom	Aluminium, powder coated Color: blue
Housing cover	Steel sheet metal coated with AlZn
Weight	190 g
Installation	DIN-rail EN 50022-35 x 7.5

4 Operating Conditions

Operating Parameters - Environmental Data		
Parameter	**Value**	**Reference**
Operating Temperature Range	0° C through 50° C	
Storage Temperature Range	-25° C through +70° C	DIN EN 61131-2 DIN EN 60068-2-1 DIN EN 60068-2-2
Air Humidity / Humidity Rating	5 % to 95 % No condensing	DIN EN 61131-2
Pollution Degree	2	DIN EN 61131-2
Corrosion Immunity/ Chemical Resistance	No special protection against corrosion. Ambient air must be free from higher concentrations of acids, alkaline solutions, corrosive agents, salts, metal vapors, or other corrosive or electroconductive contaminants	
Max. Operating Altitude	max. 2,000 m above sea level	DIN EN 61131-2

Operating Parameters - Mechanical Data		
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 68-2-6
Shock Resistance	15 g occasionally, 11 ms, sinusoidal half-wave, 2 shocks in all three spatial axes	DIN EN 61131-2 IEC 2/27/1968
Degree 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

Operating Parameters - EMC (Emitted Interference)		
Parameter	**Value**	**Reference**
Enclosure	Frequency 30 - 230 MHz, limit 30 dB (µV/m) at 10 m distance Frequency band 230 to 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) - Enclosure		
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 - 1,000 MHz Test field strength: 10 V/m AM 80% at 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

Operating Parameters (EMC) - Signal Ports		
Parameter	**Value**	**Reference**

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

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

5 Technical Data

Technical Data - JX2-CNT1	
Environment / Design / Installation	
Ambient temperature	0 °C – +50 °C
Dimensions (H x W x D in mm)	115 x 45 x 68
Weight	190 g
Housing bottom	Aluminium, powder coated Color: blue
Enclosure	Steel sheet metal coated with AlZn
Installation	DIN-rail EN 50022-35 x 7.5
Logic Circuit - Power Supply	
Power supply	DC 5 V supplied by system bus: • Centralized arrangement: via basic unit • remote arrangement: via power supply module JX2-PS1.
Current consumption (from system bus)	200 mA max. (module logic circuit and sensor supply)
Power dissipation of logic circuit	≤ 0.5 W
Connection to System Bus	
Connection to the basic unit via system bus	Male connector SUB-D, 9 pins
Module code on the system bus	5

Technical Data - JX2-CNT1 (continued)	
Counter Interfaces	
Counter Inputs	• 1 single-channel counter, 24 V signal level • 1 dual-channel counter Incremental encoder 5 V, signal level: 5 V differential voltage (symmetrical, antivalent), to RS-422 or Incremental encoder 24 V, signal level: single-ended (asymmetrical) or Single-channel counter, 24 V signal level • 1 SSI absolute encoder
Counters which can be operated simultaneously	• Single-channel and dual-channel counter or • Single-channel counter and SSI encoder
Single-Channel Counter 24 V	
Type of connection	Terminal block X21
Maximum counting rate (minimum pulse width)	10 kHz (≥ 50 µs)
Signal Level	24 V
Operating Point	- Low level: up to 2 V - High level: 20 V ... 30 V
Input current	6 mA max.
Electrical isolation	None
Counting method	Single evaluation
Selection of counting direction	Yes, via software

Technical Data - JX2-CNT1 (continued)	
Dual-Channel Counter - General Information	
Type of connection	Female connector SUB-D, 15 pins - X61
Power supply for encoders (with operating voltage of DC 5 V)	DC 5 V (-5%), 100 mA max., short-circuit-proof, via X61
Frequency filter	Parameter range: 7.8 kHz - 1 MHz
Reference function	Yes, signal from reference switch rounded with K0 signal from encoder. Reference switch connection: Terminal block X21.REF
Strobe function (capture function)	Yes Connection: Terminal block X21.STR Sampling time: >10 µs (in the case of disabled filter)
Digital inputs - Reference switch (X21.REF) - Strobe signal (X21.STR)	DC 24 V relating to X21.0V, at max. 6 mA, each Operating points: - Low level: up to 2 V - High level: 20 V ... 30 V
Dual-Channel Counter - 5 V	
Maximum counting rate	1 MHz
Signal level	5 V differential voltage (symmetrical, antivalent), to RS-422 (**do not use terminating resistors**)
Terminating resistor	Not installed
Electrical isolation	None
Counting method	Quadruple evaluation
Selection of counting direction	Yes, via hardware (reversal of K1 and K2)
Dual-Channel Counter - 24 V	
Maximum counting rate	500 kHz
Signal level	24 V - single-ended (asymmetrical)
Operating point	- Low level: up to 10 V - High level: 15 V ... 30 V
Input current	Max. 10 mA per channel (K0, K1, K2)
Electrical isolation	None
Counting method	Quadruple evaluation
Selection of counting direction	Yes, via hardware (reversal of K1 and K2)

Technical Data - JX2-CNT1 (continued)	
Dual-Channel Counter as 24 V Single-Channel Counter	
Maximum counting rate (minimum pulse width)	500 kHz (≥ 1 µs)
Signal level	24 V
Operating point	- Low level: up to 10 V - High level: 15 V ... 30 V
Input current	Max. 10 mA per channel (K0, K1, K2)
Electrical isolation	None
Counting method	Single evaluation
Selection of counting direction	Yes, via hardware (based on signal K2)
SSI Encoder	
Type of connection	Female connector SUB-D, 15 pins - X61
Power supply for encoders (with operating voltage of DC 5 V)	DC 5 V (-5 %), 100 mA max., short-circuit-proof, via X61
Position resolution	10 - 24 bits
Type of signal decoding	Gray-code and binary code
Accepted data formats	- Standard format - Left-justified - Right-justified - Fir-tree format
Parity bit evaluation	Yes, maximum: *one* parity bit
Selection of counting direction	Yes, via software

6 Installation Guide

6.1 Installation Steps

Important!

Make sure that the connection cables are **correctly wired** when installing the JX2-CNT1 module.

- Please check the shipment for completeness.
- Choose the place of the DIN rail for mounting the JX2-CNT1 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 correct 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-CNT1 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.
- **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-CNT1 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.

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-CNT1 module that have been sufficiently isolated from the connected electric circuits;
- Protect the JX2-CNT1 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

All voltage signals relate to 0 V.

Within the module, the 0 V signal is connected to chassis ground.

6.5 Sample Circuitry

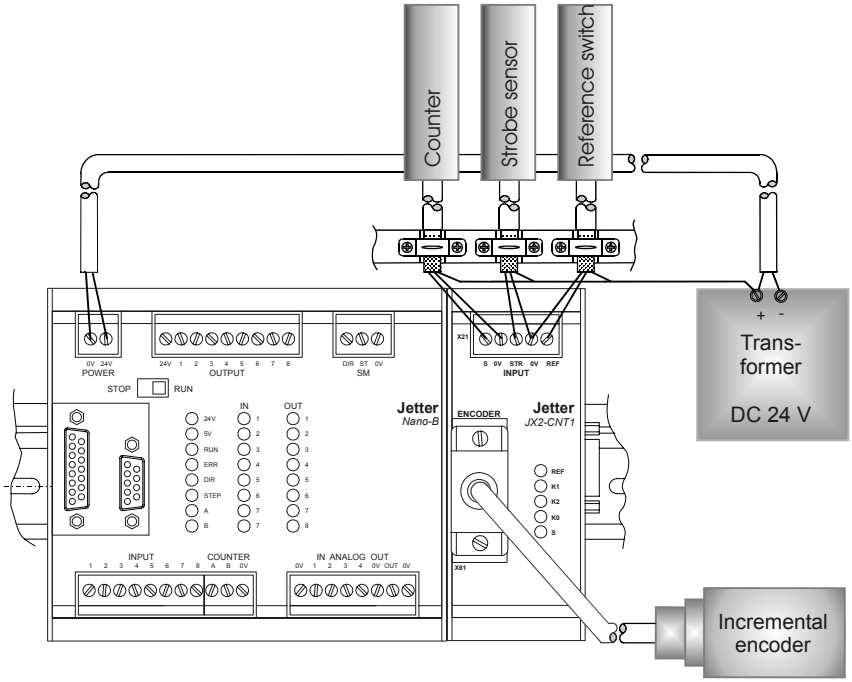


Fig. 6: Diagram of input wiring of a JX2-CNT1 module with NANO-B

6.6 Single-Channel Counter

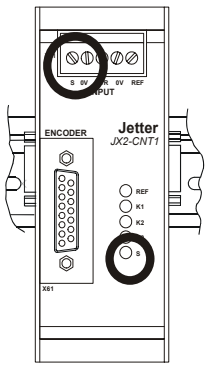


Fig. 7: Single-channel counter

The single-channel counter is connected to terminal blocks X21.S and X21.0V (see Fig. 8).

6.6.1 Description of Connections

Terminal Specifications

- 5-pole terminal block COMBICON RM 5.08 (for printed circuit boards)
- 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 must be followed
- Bladed screw-driver: 0.6 x 3.5 x 100 mm

Connecting Cable Specifications

- Not needed

Cable Shielding

Make sure that the signal lines are shielded (see Fig. 6):

- Clamp the shield with the greatest possible surface area under the grounding clamp and establish an electroconductive connection with the grounding block.

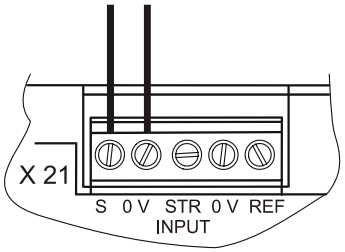
Terminal Block X21 - Single-Channel Counter			
	**Pin**	**Signal**	**Comment**
	X21.S	Counting signal	Counter input: DC 24 V, max. 6 mA - Low level: up to 2 V - High level: 20 V ... 30 V
	X21.0V	0 V	Reference potential

Fig. 8: Connection of single-channel counter to terminal block X21

6.6.2 Description of LEDs

Signal LED - Single-Channel Counter			
LED	**Color**	**State**	**Function**
S	amber	Off	Low level of counter input
		is lit	High level of counter input

6.7 Dual-Channel Counter

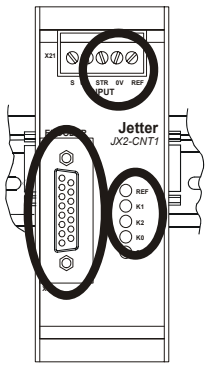
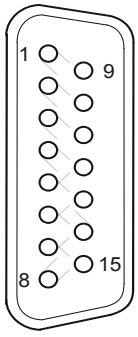
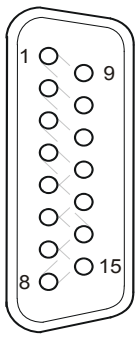


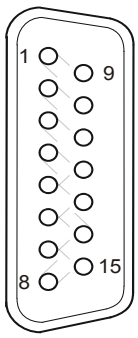
Fig. 9: Dual-Channel Counter

Incremental encoders with 5 V differential voltage (symmetrical, antivalent) to RS-422 or incremental encoders with 24 V single-ended (asymetrical) can be connected to the female 15-pin SUB-D connector as dual-channel counter.
The dual-channel can also be used as single-channel counter with 24 V signal level. In addition, for reference purposes a reference switch can be connected to terminal block X21.REF. In order to use the strobe function, a sensor can be connected to terminal block X21.STR.

6.7.1 Description of Connections - Encoder Signals

15-Pin Female SUB-D Connector X61 Dual-Channel Counter 5 V - Differential Voltage			
View	**Pin**	**Signal**	**Comment**
	1	GND	Reference potential
	2	K0 +	Channel N (zero pulse)
	3	K0 -	Channel N (zero pulse) inverted
	4	K1 +	Channel A
	5	K1 -	Channel A inverted
	6	K2 +	Channel B
	7	K2 -	Channel B inverted
	8	Do not connect	
	9	Do not connect	
	10	DC 5 V (-5%),	Power supply for encoders with operating voltage DC 5 V, short-circuit proof up to 100 mA
	11	Do not connect	
	12	Do not connect	
	13	Do not connect	
	14	Do not connect	
	15	Do not connect	

15-Pin Female SUB-D Connector X61 Dual-Channel Counter 24 V - Single-Ended			
View	**Pin**	**Signal**	**Comment**
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	GND K0 + Do not connect K1+ Do not connect K2 + Do not connect Do not connect Do not connect Do not connect Do not connect Do not connect Do not connect Do not connect Do not connect	Reference potential Channel N (zero pulse) Channel A Channel B

15-Pin Female SUB-D Connector X61 Dual-Channel Counter as 24 V Single-Channel Counter			
View	**Pin**	**Signal**	**Comment**
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	GND K0 + Do not connect K1+ Do not connect K2 + Do not connect Do not connect Do not connect Do not connect Do not connect Do not connect Do not connect Do not connect Do not connect	Reference potential Channel N (for zeroing) Counter input 24 V Definition of direction: 0 V = positive counting direction 24 V = negative counting direction

Cable Specification

Specifications of Connector (on JX2-CNT1 side)

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

Specifications of Connecting Cable

- Allowed cable length at maximum counting frequency:
  - Dual-channel counter 5 V, differential signal: approx. 30 m
  - Dual-Channel Counter 24 V, single-ended: approx. 20 m
  - Single-channel counter 24 V: approx. 20 m
- Other specifications: see specifications of cables on encoder side

Cable Shielding

- Connect the shield with the greatest possible surface area to the metallized housing.

6.7.2 Description of Connections - Reference Switch and Strobe Input

Terminal Specifications

- 5-pole terminal block COMBICON RM 5.08 (for printed circuit boards)
- 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 must be followed
- Bladed screw-driver: 0.6 x 3.5 x 100 mm

Specifications of Connecting Cable

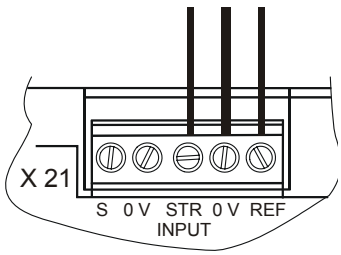
- Not needed

Cable Shielding

Make sure that the signal lines are shielded (see Fig. 6):

- Clamp the shield with the greatest possible surface area under the grounding clamp and establish an electroconductive connection with the grounding block.

Terminal Block X21 - Strobe and Reference Switch Input



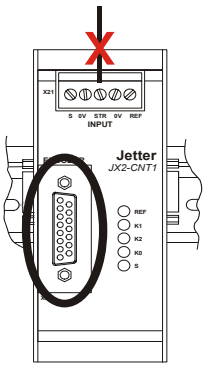
Pin	Signal	Comment
X21.STR	Strobe pulse	Strobe input: DC 24 V, max. 6 mA - Low level: up to 2 V - High level: 20 V ... 30 V
X21.REF	Reference signal	Reference switch: DC 24 V, max. 6 mA - Low level: up to 2 V - High level: 20 V ... 30 V
X21.0V	0 V	Reference potential for both inputs

Fig. 10: Connection of strobe sensor and reference switch to X21

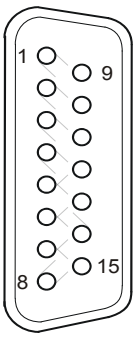
6.7.3 Description of LEDs

Signal LEDs - Dual-Channel Counter			
LED	**Color**	**State**	**Function**
REF	amber	Off	Low level of reference switch input
		is lit	High level of reference switch input
K1	amber	Off	Low level applied to channel A (inverted high level applied to channel A)
		is lit	High level applied to channel A (inverted low level applied to channel A)
K2	amber	Off	Low level applied to channel B (inverted high level applied to channel B)
		is lit	High level applied to channel B (inverted low level applied to channel B)
K0	amber	Off	Low level applied to channel N (zero pulse) (inverted high level applied to channel N)
		is lit	High level applied to channel N (zero pulse) (inverted low level applied to channel N)

6.8 SSI Encoder



6.8.1 Description of Connections

15-Pin Female SUB-D Connector X61 SSI Encoder			
View	**Pin**	**Signal**	**Comment**
	1	GND	Reference potential
	2	Do not connect	
	3	Do not connect	
	4	DATA +	Data line
	5	DATA -	Inverted data line
	6	Do not connect	
	7	Do not connect	
	8	CLOCK -	Inverted clockline
	9	CLOCK +	Clockline
	10	DC 5 V (-5%)	Power supply for encoders with operating voltage DC 5 V, short-circuit proof up to 100 mA
	11	Do not connect	
	12	Do not connect	
	13	Do not connect	
	14	Do not connect	
	15	Do not connect	

Important!

Reversal of CLOCK signals produces invalid position values.

If DATA + and DATA - are reversed, the JX2-CNT1 module reads out the first complement of the binary or Gray-coded encoder value. **In the case of Gray-coding this error has fatal effects: The module fails to produce continuous position values which, therefore, cannot be used.** In the case of binary coding the counting direction is reversed.

Important!

Binary Coding: If DATA + and DATA - are correctly connected to the encoder, the JX2-CNT1 indicates that the counting direction is reversed compared to the counting direction of the encoder. In order to maintain the original counting direction in JX2-CNT1, the counting direction must be reversed by means of bit 9 in register 3xx3 "Status / Controller".

Cable Specification

Specifications of Connector (on JX2-CNT1 side)

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

Specifications of Connecting Cable

- The maximum cable length depends on the clock frequency:

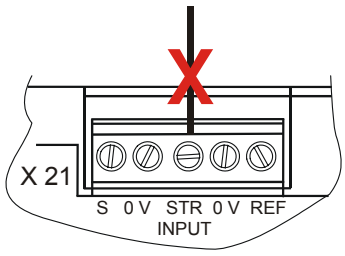
Clock frequency:	Length:
100 kHz	max. 400 m
200 kHz	max. 200 m
300 kHz	max. 100 m
400 kHz	max. 50 m

- Other specifications: see specifications of cables on encoder side

Cable Shielding

- Connect the shield with the greatest possible surface area to the metallized housing.

Important!



When reading in an SSI encoder, the strobe input X21.STR must be open-circuited. Otherwise errors may occur when reading in the position values from the SSI encoder.

6.9 System Bus

Important!

A detailed description of this topic is given in the User Manual of the controller. Refer to this manual for further information on the system bus, such as cable lengths, baud rate, monitoring functions, etc.

Centralized and Remote Arrangement of Expansion Modules

The JX2-CNT1 module has been designed for direct or remote connection to the controller. Both types of connection are described in detail below.

6.9.1 Centralized Arrangement on the System Bus

– The centralized arrangement allows up to 5 non-intelligent expansion modules to be directly connected to the controller. Power supply of these 5 expansion modules is provided by the controller.
– Electrical and mechanical connection is established via SUB-D connector. These connectors excel by their reliable mechanical and electrical connections, as well as good EMI characteristics.

JC-24x equipped with a maximum of 5 non-intelligent modules

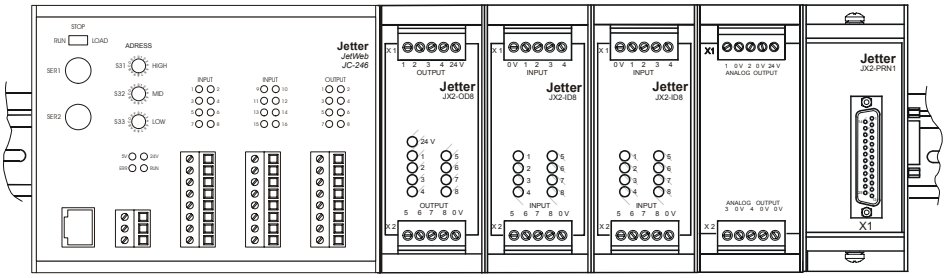


Fig. 11: Centralized arrangement on the Jetter System Bus

6.9.2 Remote Arrangement on the System Bus

– Remote modules are located at a certain distance from the controller and JX2 expansion modules directly connected to it.
– Each remote module set is connected to the controller or another remote unit via system bus cable.
– Each remote module set must be connected to a power supply unit JX2-PS1. One power supply unit JX2-PS1 is designed for supplying 5 non-intelligent expansion modules.
– The JX2-PS1 modules must be located at the beginning of the remote module set, so as to meet EMC requirements. This is also true for module sets consisting only of intelligent expansion modules.
– For a remote module set consisting of a mix of intelligent and non-intelligent expansion modules a JX2-PS1 is required, since intelligent modules are not able to supply non-intelligent modules with current and voltage.
– The remote modules are controlled by the application program as if they were directly connected to the controller.

JC-24x equipped with 5 non-intelligent modules and several remote module sets

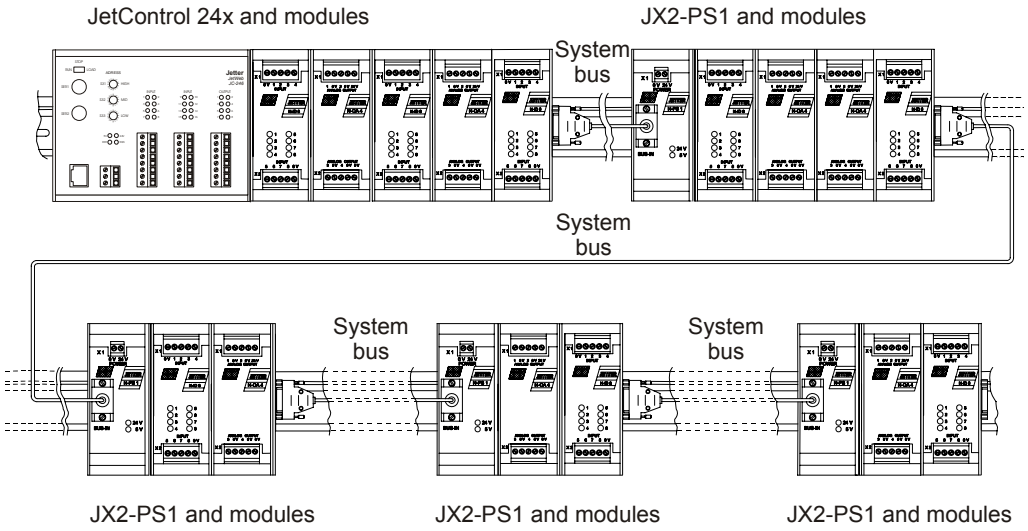


Fig. 12: Remote Arrangement on the Jetter System Bus

6.9.3 System Bus Cable Specification

Specification of Connector/Socket

Male connector (BUS-OUT side - controller / expansion modules)
- 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

Female connector (BUS-IN side - JX2-PS1)
- 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 pairs CL and CH must be twisted.	

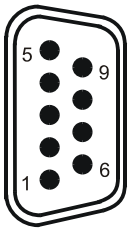
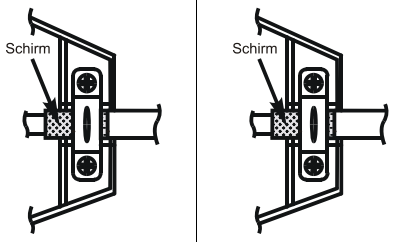
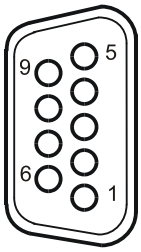
Allowed Cable Lengths			
Baud Rate	**Max. cable length**	**Max. tap line length**	**Max. overall tap line length**
1 MBaud	30 m	0.3 m	3 m
500 kBaud	100 m	1 m	39 m
250 kBaud	200 m	3 m	78 m
125 kBaud	200 m	-	-

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 more information refer to the table below.

System Bus Cable - Cable Confection # 530		
	Shield	
		
BUS-OUT	Connect shield with the greatest possible surface area! Use metallized housing only!	**BUS-IN**
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

Ordering Information

The system bus cable can be purchased from Jetter AG in various lengths. For more information refer to chapter 2.2 "Ordering Information", page 19.

7 Software Programming

Virtual outputs and registers are used to parameterize or operate the JX2-CNT1 from the controller.

7.1 Virtual Outputs

The module JX2-CNT1 is treated as I/O expansion module. That is, outputs and the corresponding output numbers are assigned to the JX2-CNT1 module. But, because the JX2-CNT1 has no physical outputs these are refered to as virtual outputs. These virtual outputs can be regarded as flags which can be set or reset to parameterize the JX2-CNT1 (apart from registers).

8 virtual outputs are available.

Appendix A provides a brief overview of these virtual outputs (see Appendix A: "Overview - Outputs", page 97).

7.1.1 Addressing the Virtual Outputs

The address is derived from the module position and the number of the corresponding output.

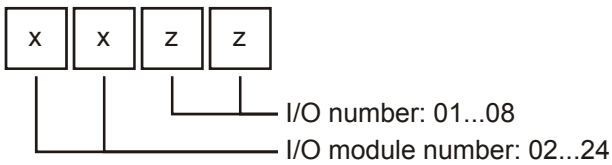
Note!

Outside this chapter of this manual output numbers are specified only with their last 4 digits.

Addressing in the case of JC-24x / NANO-A/B/C/D controllers:

Output number: xxzz

Meaning:

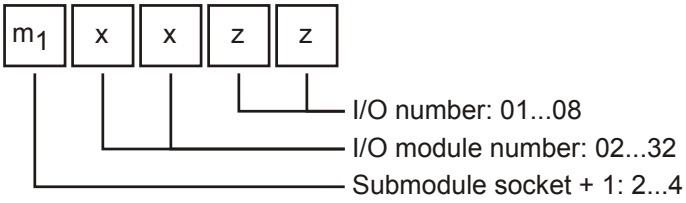


For more information, for example on register overlaying of outputs, refer to the User's Manual supplied with the corresponding controller.

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

Output number: $m_1$xxzz

Meaning:



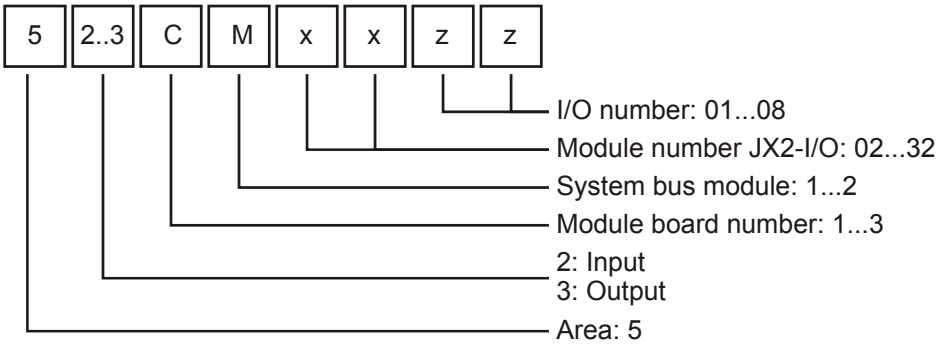
For more information, for example on register overlaying of outputs, refer to the User's Manual that comes with the JX6-SB(-I) module.

Addressing in the case of JC-800 controllers equipped with JX6-SB(-I):

The IO address starts with the area number 5.

Output number: 53CM xxzz

Meaning:



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

Note!

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

Module # 1 is assigned to the basic controller. Starting from there, the module numbers are counted left to right.
Basically, the granularity is 16. That means, for example, that 16 outputs are allocated to the JX2-CNT1 module, irrespective of the fact that only 8 virtual outputs can be addressed.

Example 1: Configuration consisting of digital input and output modules only

System consisting of the following modules: 1 JC-24x, 2 JX2-IO16 and 1 JX2-CNT1:

Basic controller JC-24x	I/O Module JX2-IO16	I/O Module JX2-IO16	Input module JX2-CNT1
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**	Output **401 .. 408**

Example 2: Configuration consisting of one JX2-SV1

System consisting of the following modules: 1 JC-24x, 1 JX2-IO16, 1 JX2-SV1 and 1 JX2-CNT1:

Module	Basic controller JC-24x	Output module JX2-IO16	Servo module JX2-SV1	Input module JX2-CNT1
Non intelligent	Module # 1	Module # 2	-	Module # 3
Intelligent	Module # 1	-	Module # 2	-
	Input **101 .. 116** Outputs **101 .. 108**	Input **201 .. 208** Output **201 .. 208**	JX2-SV1 Module	**! ! !** Output **301 .. 308**

7.2 Register Interface

10 registers are available. These registers are used to parameterize and operate the module.

An overview of registers is included in the appendix. For more information refer to Appendix B: "Overview of Registers", page 100.

7.2.1 Register Addressing

The register address is derived from the module number and the respective register number.

Note!

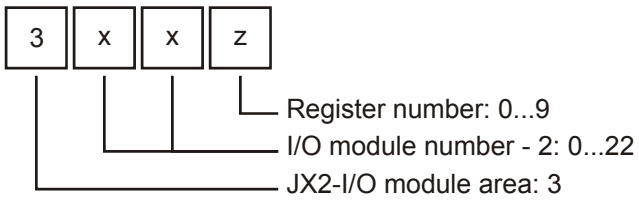
Outside this chapter of this manual register numbers are specified only with their last 4 digits.

Addressing register numbers in the case of JC-24x / NANO-B/C/D controllers:

The register address always starts with the area number 3.

Register number: 3xxz

Meaning:



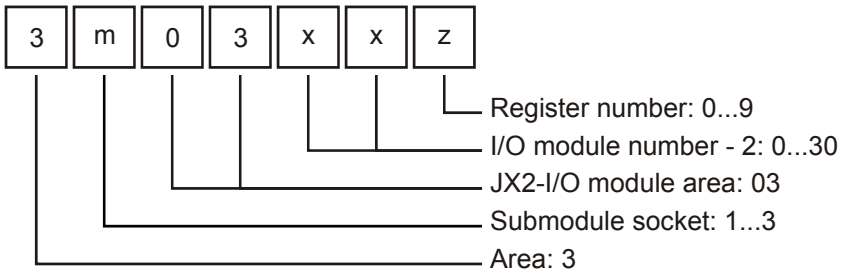
For more information refer to the manual on the corresponding controller.

Addressing register numbers in the case of 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:



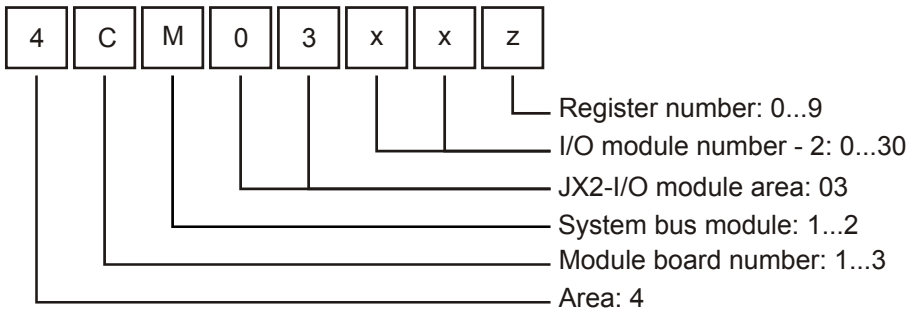
For more information refer to the User's Manual that comes with the JX6-SB(-I) module.

Addressing register numbers in the case of 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.

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

Note!

To determine the I/O module number, only non-intelligent modules are 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 taken into consideration.

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

```
Register number = 3000 + (I/O module number - 2) * 10 + local register number
```

Example 3: Determining Register Numbers

Determinig the register number of the third I/O expansion module connected to a JetControl-246:

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

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

8 Configuration and Diagnostics

8.1 Status and Control Functions

The current state of the JX2-CNT1 can be queried from register 3xx3. This register is also used for enabling/disabling certain functions.

Register 3xx3: Status / Controller	
Function	**Description**
Read	Current status or control information
Write	Setting or resetting the control bits 8-15 and resetting the status bits 0, 4 and 6
Value range	Bit-coded, 16 bits
Value following reset	0b 00000000 00000000

Note!

On write access bits 0, 4 and 6 are automatically reset irrespective of whether the bits of the value to be entered are already set or not.

Status

Meaning of the individual bits:

Bit 0: Dual-channel counter - Strobe status

Indicates whether the count value has been strobed by the dual-channel counter. This value is reset on write access to register 3xx3.

0 = No strobe

1 = Strobe event arrived

Value following reset: 0

Bit 1: Reserved

Bit 2: Reserved

Bit 3: Dual-channel counter - reference status

Indicates whether the dual-counter count value has been zeroed. This value is reset by resetting output xx01.

0 = No zeroing

1 = Zeroing completed

Value following reset: 0

Meaning of the individual bits (continued):

Bit 4:	**Dual-channel counter - Strobe overflow status**
	Indicates whether the JX2-CNT1 has received one more strobe signal before the last strobe message (bit 0 of the given register) has been reset. This value is reset on write access to register 3xx3. 0 = No strobe overflow 1 = Strobe overflow Value following reset: 0
Bit 5:	**Reserved**
Bit 6:	**Dual-channel counter - Z track error status**
	Indicates whether simultaneous change of tracks K1 and K2 or too high a counting frequency or rate has been detected. The latter applies only with the input filter enabled (see register 3xx8 "Filter frequency"). This value is reset on write access to register 3xx3. 0 = No Z track error 1 = Z track error Value following reset: 0
Bit 7:	**Reserved**

Controller

Meaning of the individual bits:

Bit 8:	**Reserved**
Bit 9:	**SSI - Reversal of counting direction**
	Selection of the counting direction for SSI encoder 0 = Counting direction as per transmitted data (this is true for Gray coding. In the case of binary coding, the counting direction of the JX2-CNT1 module and the SSI encoder is inverted). 1 = Inverted counting direction Value following reset: 0
Bit 10 - bit 11:	**Reserved**

Meaning of the individual bits (continued):

Bit 12:	**Frequency display - Activation**
	Is for enabling/disabling the frequency display of the dual-channel counter or SSI encoder via register 3xx7 "Parity error counter / Frequency display" 0 = The SSI parity error counter is displayed in register 3xx7 The offset of dual-channel counter is displayed in register 3xx1 1 = The frequency is displayed in register 3xx7 The time base for frequency measurement is displayed in register 3xx1 Value following reset: 0
Bit 13:	**Reserved**
Bit 14:	**Master mode - Selection**
	Is for selecting the master mode which is used to output the counter value in register 3xx0 on the system bus. 0 = Mode 1: Operation along with JX2-SV1 or CAN-DIMA 1 = Mode 2: Operation in synchronous mode (JetMove 2xx, JetMove D203, JetMove 105)
Bit 15:	**Reserved**

8.2 Firmware Version

Register 3xx9: Firmware Version	
Function	**Description**
Read	Version number of the operating system e.g. 101 = V 1.01
Write	Illegal
Value range	0 ... 8.388.607
Value following reset	Version number of the operating system

Note!

Please state this number when making technical inquiries.

9 Single-Channel Counter

For technical information on the single-channel counter refer to "Technical Data" in chapter 5 "Technical Data", page 27. For information on how to install the single-channel counter refer to chapter 6.6 "Single-Channel Counter", page 35.

The single-channel counter is always active. The count value of the single-channel counter can be seen from register 3xx4 "Single-channel counter - count value". The count value is incremented or decremented whenever the edge of the counting signal rises. It is not possible to change this setting.

Note!

The counting direction is set via virtual output xx05 of the JX2-CNT1 module.

Register 3xx4: Single-Channel Counter - Count Value	
Function	**Description**
Read	Present count value
Write	Defining the new count value
Value range	- 8,388,608 ... + 8,388,607 [pulses]
Value following reset	0

The count value can be changed by manually entering a value into register 3xx4.

10 Dual-Channel Counter

The dual-channel counter is for reading in signals from incremental encoders. In doing so, the signal is subject to quadruple evaluation, that is, all 4 edges of both signals K1 and K2 are counted. The dual-channel can also be used as single-channel counter with 24 V signal level. For more information on this refer to “Dual-Channel Counter as Single-Channel Counter" on page 62. For technical information on the dual-channel counter refer to "Technical Data" in chapter 5 "Technical Data", page 27. For information on how to connect the different counter signals to the dual-channel counter refer to chapter 6.7 "Dual-Channel Counter", page 37.

The dual-channel counter is enabled if virtual output xx04 "Encoder selection" is reset. This is the default setting.

Furthermore, the count value of the dual-channel counter can be zeroed by means of a reference switch and the K0 signal of an incremental encoder. The strobe function is used to save the count value at the time when the strobe signal was issued (capture function).

The built-in digital filter is for filtering out interfering frequencies out of the useful signal. The digital filter is disabled by default.

10.1 Reversal of Counting Direction

If the dual-channel counter is used along with incremental encoders, the counting direction depends on the wiring of the K1 and K2 signals. To reverse the counting direction, signals K1 and K2 must be reversed.

10.2 Count Value

The count value of the dual-channel counter can be seen in register 3xx4 "Count value".

Output xx04 = 0 Register 3xx0: Count Value	
Function	**Description**
Read	Maximum count of dual-channel counter
Write	New count of dual-channel counter
Value range	- 8.388.608 ... + 8,388,607 [increments]
Value following reset	0

The count value can be changed by manually entering a value into register 3xx0, for example zero to reset the count to zero.

The count value consists of the following elements:

R3xx0 (count) = internal count + R3xx1 (reference position offset)

Note!

By writing a value into register 3xx0, exact referencing of the position value from the incremental encoder **cannot** be achieved. Significant position inaccuracies may occur if a reference position is written into the register, for example, when the encoder moves while the value is written into the register.

Exact referencing of the incremental encoder position can be achieved if the referencing function is used along with register 3xx1 "Offset value". For more information refer to chapter 10.4 "Referencing", page 64.

10.3 Dual-Channel Counter as Single-Channel Counter

It is possible to operate the dual-channel counter as single-channel counter. To do so, virtual output xx02 "Counter type" of the JX2-CNT1 module must be set = single-channel counter. For information on how to install the single-channel counter refer to chapter 6.7.1 "Description of Connections - Encoder Signals", page 37.

The counting direction depends on the level of the K2 signal. For more information refer to Fig. 13. The count value is incremented or decremented at every positive edge of the counting channel K1. The count value of the single-channel counter can be seen from register 3xx0 "Count value", or it can be changed there manually.

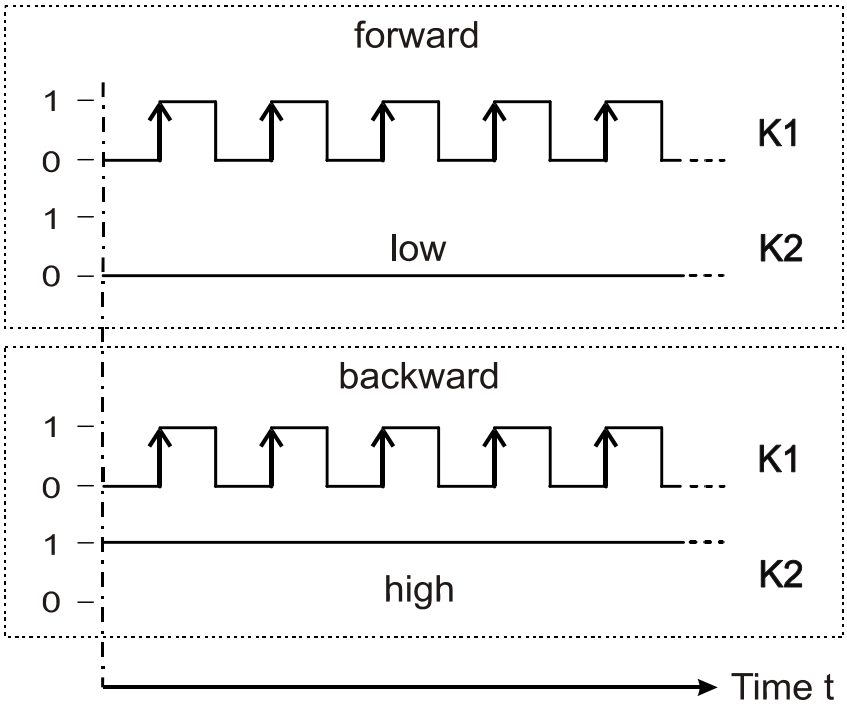


Fig. 13: Signal waveform for single-channel counting

10.4 Referencing

There are two possible ways for referencing an incremental encoder position:

- relatively coarse referencing: by directly entering the value into register 3xx0 "Count value"
- exact referencing: by means of the reference signal (reference switch) and the K0 pulse from of the incremental encoder (recommended).

This subchapter describes the exact referencing process. For exact referencing proceed as follows:

- Set reference position
- Define reference offset (if needed)

10.4.1 Setting the Reference Position

To determine the reference position use the built-in referencing function. This function is enabled via virtual output xx01 "Signal activation" of the JX2-CNT1 module. To enable referencing, this output is to be set by the user = STR disabled / REF enabled. If this output has already been set, for example due to a previous referencing, it must be reset first. The referencing function sets the count value in register 3xx0 to zero if the following condition is fulfilled:

R3xx0 (count value) = 0 if:

- K0 (zero pulse of the incremental encoder) = 1

AND

- REF (reference switch) = 0

Please also refer to Fig. 14.

Bit 3 "Dual-channel counter - reference status" in register 3xx3 "Status / Controller" shows whether the referencing function is active or completed. It the bit is set, referencing is completed. Once output xx01 is reset, bit 3 is reset, too.

Note!

For referencing, the low-level state of the REF input is decisive, that is, on enabling the reference function, the system will not wait for a negative edge event when the REF input is already on low level. **If no reference switch is connected to the module, the REF input is on low level by default.**

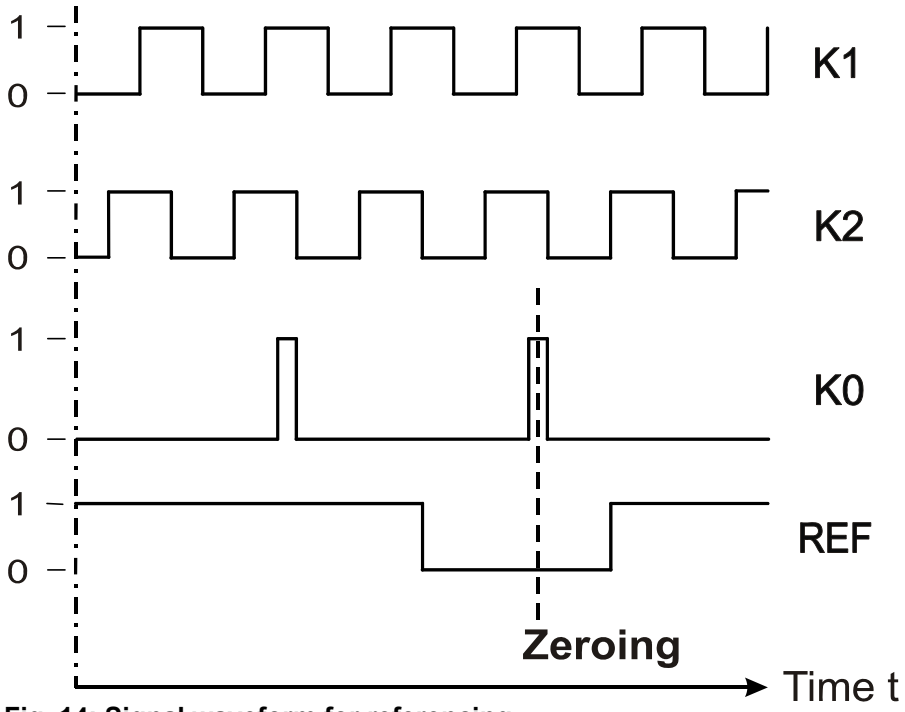


Fig. 14: Signal waveform for referencing

10.4.2 Setting the Reference Offset

The count value of the dual-channel counter (register 3xx0) is zeroed using the reference function. This way, the reference position is set to position 0 (refer to “Setting the Reference Position" on page 64). Register 3xx1 "Dual-channel counter - Offset" can be used to define any position as reference position (refer to “Reference Offset" on page 66). In this connection, the previously determined reference position of the mechanical system is maintained.

10.5 Reference Offset

The offset in register 3xx1 "Dual-channel counter - Offset" can be used to shift the count value in register 3xx0 into positive or negative direction. This way, the reference position is shifted accordingly. In doing so, the reference position of the mechanical system remains unchanged.

Status bit 12 = 0 Register 3xx1: Dual-channel counter - offset	
Function	**Description**
Read	Actual reference position offset of the dual-channel counter
Write	New reference position offset of the dual-channel counter
Value range	- 8.388.608 ... + 8,388,607 [increments]
Value following reset	0

The reference position offset has the following effect on register 3xx0 "Count value":

R3xx0 (count) = internal count + R3xx1 (reference position offset)

Example

The count value of the dual-channel counter is zeroed using the reference function (register 3xx0 = 0). Via offset register 3xx1 the reference position is to be set to 10,000 increments.

– The user enters 10,000 into register 3xx1.
– The count value is set to 10,000 increments, or to a value around 10,000 if the incremental encoder has moved during this process or is between 2 PPR counts and is permanently oscillating.

10.6 Digital Filter

The dual-channel counter features a digital filter. This filter can also be used if the dual-channel counter is operated as single-channel counter. The digital filter filters higher-frequency disturbance signals out of the input signals to ensure that they are not counted. The filter is disabled by default. To activate the filter, specify a fundamental frequency in register 3xx8 "Dual-channel counter - Filter frequency". By doing so, all signals ≤ the fundamental frequency are taken into account and all signals > the fundamental frequency are filtered out and ignored by the counter.

Register 3xx8: Dual-channel counter - filtering frequency	
Function	**Description**
Read	Actual fundamental frequency f_{fund} of the dual-channel counter
Write	New fundamental frequency f_{fund} of the dual-channel counter
Value range	0: Filtering function disabled 192: f_{fund} = 1 MHz 448: f_{fund} = 500 kHz ... ... 32.704 f_{fund} = 7,812.5 Hz
Value following reset	0

The fundamental frequency is not directly entered into register 3xx8. Rather, a value is entered which corresponds to a fundamental frequency. The value corresponding to the desired fundamental frequency is calculated by the following formula:

$$\text{Register 3xx8} = \left(\frac{4000000}{f_{fund}} - 1\right) \times 64 \qquad \text{at } f_{fund} \text{ in Hz}$$

10.7 Strobe Function

The strobe function is for storing the actual count value to register 3xx0 because of an external hardware pulse, the so-called strobe signal. The count value is stored once the edge of the strobe signal **rises**, and can be read out of register 3xx2 "Dual-channel counter - strobe value".

The JX2-CNT1 hardware directly issues the strobe signal and stores the count value. With digital filter disabled, the sampling time is >10 µs. This means that within 10 µs after a rising edge arrives at terminal X21.STR the current count value is stored. If the filter is enabled, the sampling time extends by one cycle of the fundamental frequency set for the filter.

The strobe function is enabled if virtual output xx01 "Signal activation" of the JX2-CNT1 module is reset (0 = STR enabled / REF disabled). If this is the case, the count value is stored every time the edge of the strobe signal rises. Bit 0 "Dual-channel counter - strobe status" in register 3xx3 "Status / Controller" shows whether a strobe signal has been issued and the count value in register 3xx2 is valid. If bit 0 equals to 1, a strobe event has occurred, and the stored count value can be read out of register 3xx2.

Bit 0 remains set until it is reset by the user by entering a value into register 3xx3 "Status / Controller". If a strobe event is received before bit 0 is reset, bit 4 "Dual-channel counter - strobe overflow status" in register 3xx3 is set additionally. Bit 4 is not reset until a value is entered into register 3xx3.

Register 3xx2: Dual-Channel Counter - Strobe Value	
Function	**Description**
Read	Actual count value or value that has been stored last
Write	Illegal
Value range	- 8.388.608 ... + 8,388,607 [increments]
Value following reset	0

11 SSI Absolute Encoder

JX2-CNT1 modules are able to read in SSI absolute encoder signals (SSI = **S**ynchronous **S**erial **I**nterface) with a resolution of 10 - 24 bits in various data formats. For more information refer to “Reading in SSI data" on page 69. Signal decoding for Gray or binary code is available. Automatic parity check of data transmission is also available if the encoder sends a parity bit.

For technical information on the SSI interface refer to "Technical Data" in chapter 5 "Technical Data", page 27. For information on installation refer to chapter 6.8 "SSI Encoder", page 42.

11.1 Reading in SSI data

The following subchapters first introduce the data formats prevailing in the market. Then, this manual explains which data formats can be read by the JX2-CNT1 and how they are read in.

The position value which has been read in can be seen from register 3xx0 "Count value".

Output xx04 = 1 Register 3xx0: Count value	
Function	**Description**
Read	Actual count value of the SSI encoder
Write	Illegal
Value range	Depending on the position resolution of the encoder
Value following reset	0

11.1.1 Standard Format

In standard format, the position bits do not include leading or trailing zeroes. However, special bits or a parity bit may be included directly after the position bits.

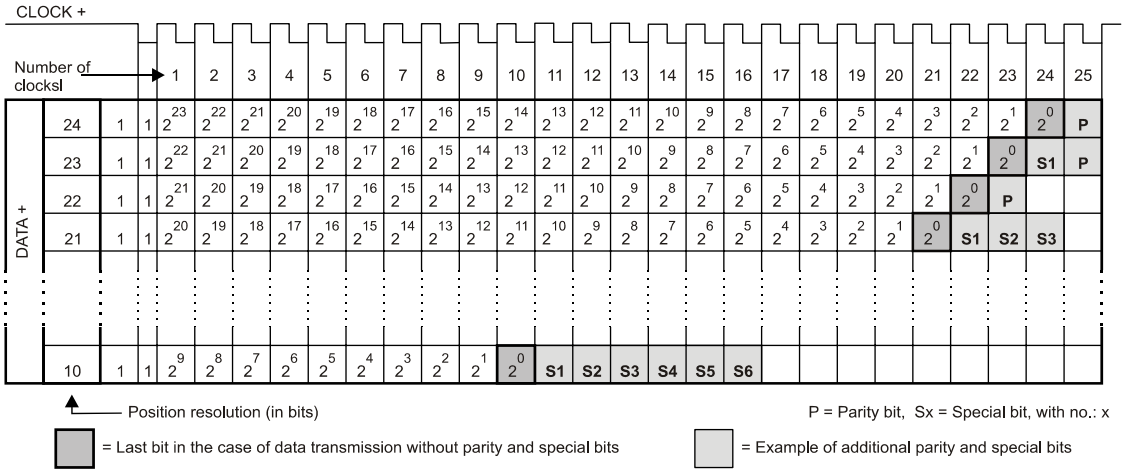


Fig. 15: SSI Standard Format

11.1.2 Fir-Tree Format

In the fir-tree format all position resolutions are output always with the same number of clocks. There is a center line (for example between clock 12 and 13) which divides the resolution into number of revolutions (to the left of the center line) and steps per revolution (to the right of the center line). If less than 12 bits are needed for the number of revolutions, unused places are filled with leading zeroes up to the required length of 12 bits. On the other hand, if less than 12 bits are needed for the number of steps per revolution, unused places are filled with trailing zeroes up to the required length of 12 bits.
Here, special bits or a parity bit can be added, as well. However, only after the zero bits which have been added to reach the required length, for example, starting from clock 25.

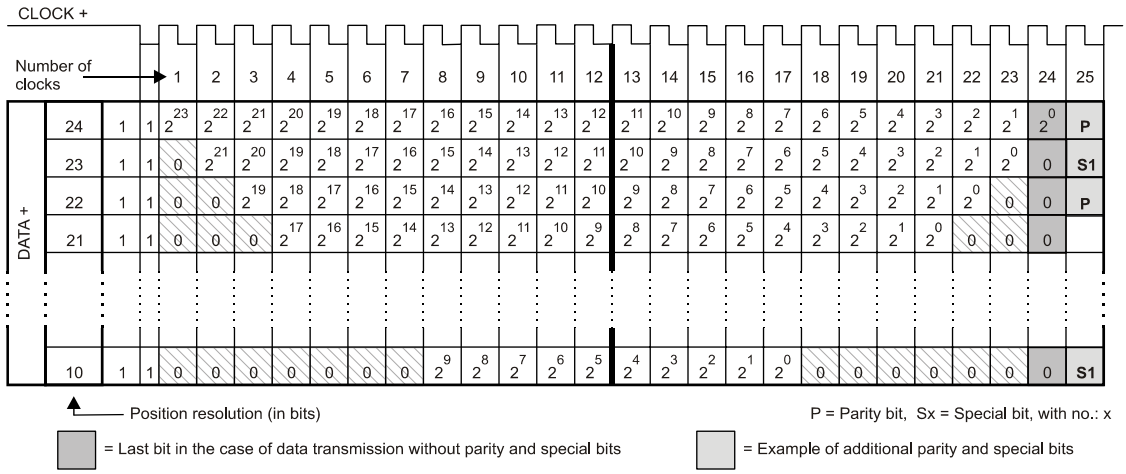


Fig. 16: SSI - Fir-Tree Format

11.1.3 Left- and Right-Justified Data Format

In the case of left- or right justified data format, there are leading and trailing zero bits like in the case of fir-tree format. However, the position bits can be placed at any location within the maximum clock number. Leading or trailing zero bits required to reach the maximum clock number are inserted around the position bits.
Here, special bits or a parity bit can be added, as well. They can be placed directly after the position bits or after the trailing zero bits.

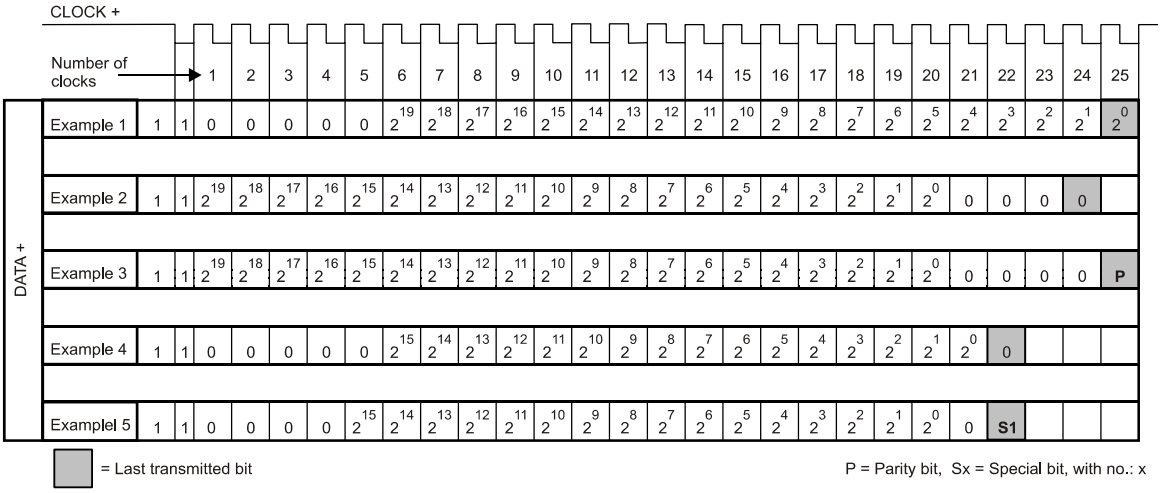


Fig. 17: SSI - Left- or right justified data format

11.1.4 Reading-In Data Formats

The JX2-CNT1 module is able to output a maximum of 31 clocks. If the encoder attaches a parity bit at the end of data transmission, the parity evaluation implemented in JX2-CNT1 can check the parity. The attached parity bit is automatically separated from the position bits and not taken into account when creating the position value.

Certain SSI encoders also insert special bits into the data stream after the position bits. These special bits may contain, for example, information on the encoder status. These bits are not evaluated by the JX2-CNT1 module. Together with the position bits, the special bits are stored to the position value (register 3xx0). The user must arrange for their evaluation by means of the application program as follows:

- Masked reading of the special bits
- Shifting the position value to the right (as often as there were special bits)
- Evaluating the special bits

The 12 examples below describe the different SSI formats with different data streams for a 10-bit position resolution. An illustration of these examples is given in Fig. 18. The examples apply to both types of signal coding (Gray and binary coding).

Example 1
In this example, 10 position bits in usual standard format are read. As number of clocks the value 10 must be entered. The encoder does not transmit a parity bit, therefore, parity check must be disabled. Position range displayed in register 3xx0: 0 ... 1023 (in steps of 1).

Example 2
Like example 1, but with one additional clock as the encoder sends a parity bit. Parity check is enabled. The parity bit is not taken into account when calculating the position.

Example 3
Like example 2, however with parity check disabled. The parity bit **is** taken into account when calculating the position and is incorporated into the position value as least significant bit. The user must arrange for parity check in the application program by programming masked reading and restoring the original position value as a result of a right shift by one place.

Example 4
Like example 1, however with parity check enabled irrespective of the fact that no parity bit has been sent. This results in the least significant of the position bits being used for parity check while not being taken into account for calculating the position value which causes parity errors. In the case of a parity error, the position value contained in register 3xx0 is not updated. Therefore, this configuration is not allowed.

Example 5
Like example 1. But the encoder appends 3 special bits after the position bits. Therefore, 13 clocks are required. The special bits are taken into account when the position value is evaluated. The user must arrange for separation of special bits from the position value in the application program by programming masked reading and restoring the original position value as a result of right shift by the corresponding number of places.

Example 6
In this example, 10 position bits are transmitted right-justified with a rate of 25 clocks. The leading zero bits entered into register 3xx0 have no effect on the transmitted position value. Even deletion of the most significant bit, which has been read in cycle 1, has not effect on the position value. Position range displayed in register 3xx0: 0 ... 1023 (in steps of 1).

Example 7
Like example 6, however with parity bit and parity check enabled.

Example 8
In this example, 10 position bits are read out left-justified with a rate of 25 clocks. Instead of placing the zero bits before the position bits, like in example 6, they are appended after the position bits. This results in a significant change in the position range, as the 10 position bits are shifted to the left by several binary places (depending on the number of inserted zero bits). As the value has been read out at 25 clocks and only the lowest 24 bits can be taken over, the highest bit, which has been read out in clock 1, gets lost. Position range displayed in register 3xx0: - 8.388.608 ... + 8,388,607 in steps of 32,768. However, it is also possible to reduce the number of clocks, and to do without reading out the trailing zero bits. Thus, the position values remains at the correkt binary location.

Example 9
Like example 8, however with 2 special bits appended. To evaluate the data proceed according to example 5.

Example 10
In this example, 10 position bits are read out in fir-tree format with 24 clocks. The leading zero bits do not have an effect on the position value. But the appended zero bits shift the position bits upwards by several binary places, like in example 8. This has an significant effect on the position range. Position range displayed in register 3xx0: - 32.768 ... + 32,767 in steps of 128. However, it is also possible to reduce the number of clocks, and to do without reading out the trailing zero bits. Thus, the position values remains at the correkt binary location.

Example 11
Like example 10, but with one additional clock due to the parity bit and parity check.

Example 12
Like example 11, however without parity check, Furthermore, a special bit is sent instead of the parity bit. Due to the 25 clocks, the zero bit, which has been read out in cycle 1, is not taken into account when generating the position value. However, the special bit is included in the position value. To separate the special bit from the position value proceed according to example 5.

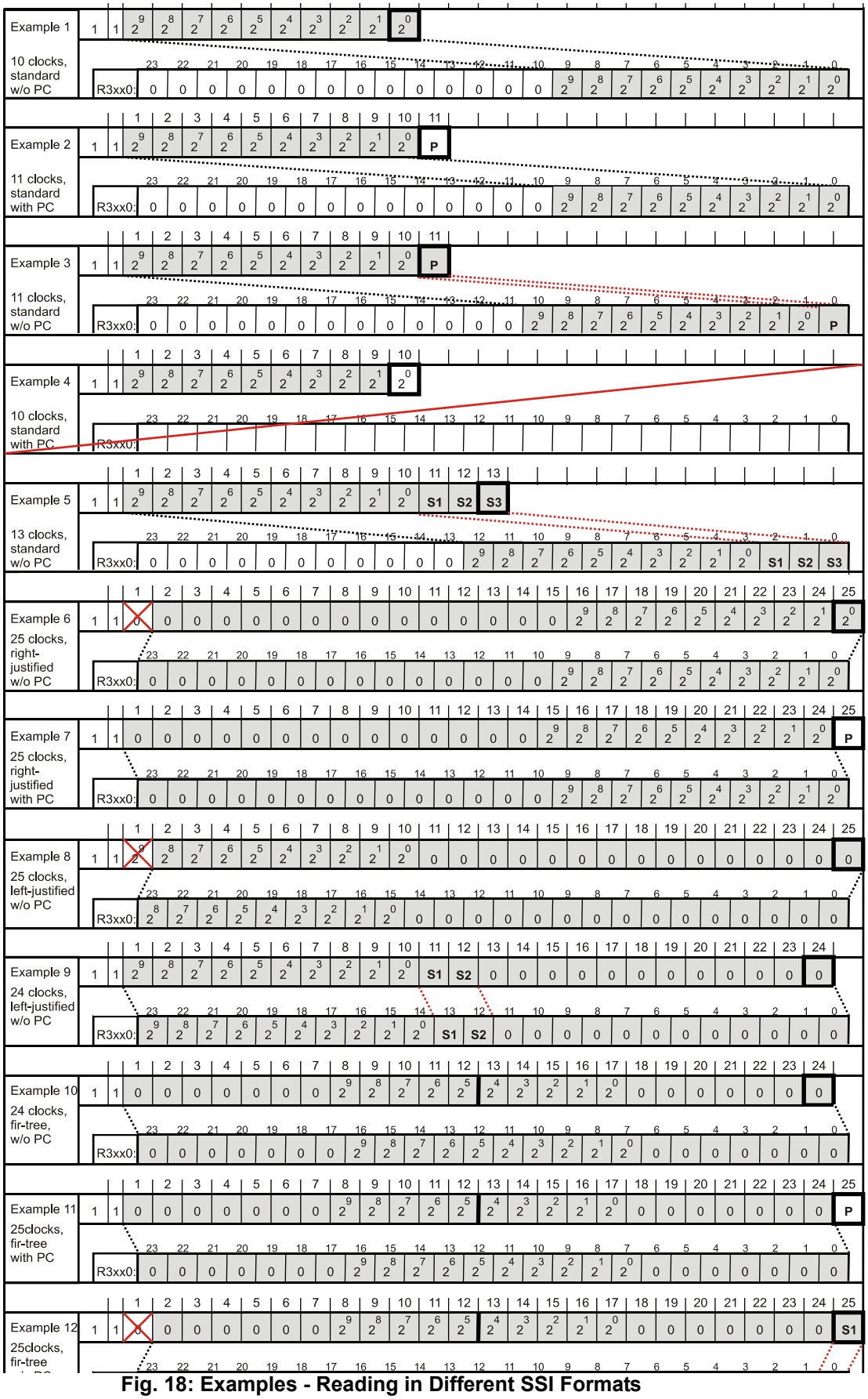


Fig. 18: Examples - Reading in Different SSI Formats

11.2 Configuration

Configuration Steps

- Define the clock number and rate using register 3xx6 "SSI Configuration".
- Define the signal coding using virtual ouput xx06 "Signal Coding".
- Define the type of parity using virtual output xx08 "Parity Settings" if a parity bit is included in the data stream.
- Enable parity check using virtual output xx07 "Enable Parity Check" if a parity bit is included in the data stream.
- Enable the SSI function using virtual ouput xx04 "Encoder Selection".

11.2.1 Number and Rate of Clocks

The number of clocks and the clock rate is set in register 3xx6 "SSI Configuration". The number of clocks depends on the position resolution and the output format of the related SSI encoder. For more information refer to “Reading in SSI data" on page 69. The clock frequency depends on the length of the encoder cable. For more information refer to chapter 6.8 "SSI Encoder", page 42.

Register 3xx6: SSI Configuration	
Function	**Description**
Read	Actual configuration value of the SSI encoder
Write	New configuration value of the SSI encoder
Value range	0 = No SSI encoder connected 21.464 ... 65,535 (see below)
Value following reset	0

Note!

Register 3xx6 is automatically set to 0 if the SSI function is not enabled (virtual output xx04 "Encoder Selection" is not set = dual-channel encoder is enabled) and values are entered into register 3xx0.

The value of register 3xx6 (number of clocks and clock rate) is calculated by the formulas given in the following table. In this table, configuration values for clock rates of 100 kHz and 200 kHz along with the most common clock numbers are listed:

Configuration Values		
Number of Clocks	**100 kHz**	**200 kHz**
10	1,543	21,503
11	23,591	23,551
12	25,639	25,599
13	27,687	27,647
14	29,735	29,695
15	31,783	31,743
16	33,831	33,791
17	35,879	35,839
18	37,927	37,887
19	39,975	39,935
20	42,023	41,983
21	44,071	44,031
22	46,119	46,079
23	48,167	48,127
24	50,215	50,175
25*	52,263	52,223

* Mainly for SSI encoders with a position resolution of 24 bits and parity bit.

Calculation Formula:

Number of clocks - value range: 10 ... 31
Clock rate - value range: 100 kHz ... 8 Mhz

A = (((**number of clocks** + 1) x 2) - 1) x 1024
B = (16.000.000 / (**clock rate** x 2)) - 41

Register 3xx6 = A + B

Example

An SSI encoder is to be read out at a clock rate of 200 kHz and 20 clocks.

A = (((**20** + 1) x 2) - 1) x 1024 = 41,984
B = (16,000,000 / (**200,000** x 2)) - 41 = -1

Register 3xx6 = 41,984 - 1 = 41,983

11.3 Reversal of Counting Direction

The counting direction for SSI position values can be reversed by means of bit 9 "SSI - Reversal of counting direction" in register 3xx3 "Status / Controller". For more information refer to chapter 8.1 "Status and Control Functions", page 55.

Important!

Binary Coding: If DATA + and DATA - are correctly connected to the encoder, the JX2-CNT1 indicates that the counting direction is reversed compared to the counting direction of the encoder. In order to maintain the original counting direction in JX2-CNT1, the counting direction must be reversed.

11.4 Parity Check

The JX2-CNT1 is able to perform automatic parity checks. For correct parity checks the following requirements have to be fulfilled:

- Parity check must be set correctly (even or odd parity)
- Parity check must be enabled
- The number of clocks must be set correctly
- The connected SSI encoder must include **one parity bit at the end of the data stream**.

For more information on setting and enabling parity check please refer to “Configuration" on page 75. For information on how to set the correct number of clocks refer to “Reading in SSI data" on page 69. If the SSI encoder provides a parity bit in the data stream, this bit must be taken into account when specifying the number of clocks in register 3xx6 "SSI configuration". That is, if, for example, the encoder provides 24 position bits and one parity bit, the number of clocks must be set to 25 bits.

If the SSI encoder performs parity evaluation can be seen from the manual that comes with the encoder.

If the JX2-CNT 1 module detects a parity error, the position value received is ignored (**register 3xx0 "Count value" is not updated**) and register 3xx7 "Counter of SSI parity errors" is incremented.

Status bit 12 = 0 Register 3xx7: Counter of SSI parity errors	
Function	**Description**
Read	Actual number of parity errors
Write	Start value of parity error count
Value range	- 8.388.608 ... + 8.388.607
Value following reset	0

The parity error counter can be set to zero manually by entering zero into register 3xx7. To set this register to any other "initial value" enter this value into it.

11.5 Reference Offset

The reference offset feature in register 3xx1 "Dual-channel counter - Offset" can only be used with SSI encoders which meet the following requirements:

- 24-bit position resolution
- no special bits or parity bits in the data stream

Note!

If the counting direction is reversed by means of bit 9, the reference offset must be entered into register 3xx1 **only after bit 9 has been set**.

12 Frequency Measurement

Frequency measurements are carried out by means of the count value in register 3xx0. This measurement is always carried out in the background. The frequency value can be read out at any time. The frequency value is used for calculating the speed (RPM). The frequency measurement is carried out for both the dual-channel counter (incremental encoder), and the SSI encoder.

The frequency value indicates the number of increments captured during a time interval (time between 2 measurements). The duration of the time interval is set by means of the time base value (see formula below).

The frequency value is displayed in register 3xx7 "Frequency - Display" and the time base is set in register 3xx1 "Frequency - Time base". Both registers have got a double function: Register 3xx7 is used to read or write the SSI parity error counter and register 3xx1 is used to read or write the dual-channel offset. The function of these two registers is set by means of bit 12 in register 3xx3 "Status / Controller":

Bit 12 = 0:

Register 3xx7: Counter of SSI parity errors

Register 3xx1: Dual-channel counter - offset

Bit 12 = 1:

Register 3xx7: Frequency - display

Register 3xx1: Frequency - time base

The frequency value is calculated as follows:

$$\text{Register 3xx7} = \frac{\text{Count}_n - \text{Count}_{n-1}}{\text{Register 3xx1} \times 10\ \text{ms}}$$

Count value $_n$ is captured later by the value of register 3xx1 x 10 ms than count value $_{n-1}$.

Status bit 12 = 1 Register 3xx7: Frequency - Display	
Function	**Description**
Read	Present frequency value (for dual-channel counter or SSI encoder)
Write	Illegal
Value range	- 8,388,608 ... + 8,388,607 [increments / time interval]
Value following reset	0

Status bit 12 = 1 Register 3xx1: Frequency - Time Base	
Function	**Description**
Read	Present time interval of frequency measurement
Write	New time interval
Value range	1 ... 255 [10 ms]
Value following reset	10 (= 100 ms)

The time interval is set to a multiple of 10 ms via time base. For value 1 this means that the number of increments which have been counted within 10 ms are displayed as frequency value.

12.1 Sample Program

The speed of an SSI encoder is to be measured by a JX2-CNT1 which is located at the first I/O position after the basic device. This encoder has a position resolution of 4096 increments. The time interval for frequency measurements is set to 1 second. This makes the readings more stable as minor fluctuations in frequency measurements will have no great impact.

JetSym - Symbol Listing

```
**********  Registers  *************
rmStatusControl        3003        ;  Status / Controller
rmFrequency            3007        ;  Frequency value
rmTimeBase             3001        ;  Frequency - time base
rRPM                   100         ;  Speed in RPM
;**********  Bit Symbols *************
nbSelectFrequency      12          ;  Bit for selecting the
                                   ;  frequency display
```

JetSym - Program Listing

```
...
     ; +++ Frequency Measurement Initialization +++
     BIT_SET (rmStatusControl, nbSelectFrequency)
     REGISTER_LOAD (rmTimeBase, 100) ; time interval to 1 s
     BIT_CLEAR (rmStatusControl, nbSelectFrequency)
...
     ; +++ Speed Calculation ++++
     ; +++ is executed at regular intervals +++
     BIT_SET (rmStatusControl, nbSelectFrequency)
     REG rRPM = REG rmFrequency * 60 / 4096
     BIT_CLEAR (rmStatusControl, nbSelectFrequency)
...
```

JetSym ST - Program Listing

```
//***** Declaration of Variables ************************************
VAR
//   Register
     nmFrequency:          INT AT %VL 3007;     //   Frequency value
     nmTimeBase:           INT AT %VL 3001;     //   Frequency - time
                                                     base
     nRPM:                 INT AT %VL 100;      //   Speed in RPM
//   Register bits
     bnSelectFrequency:    BOOL AT %VL          //   Bit for selecting
                           3003.12;             //   the frequency
                                                     display

END_VAR;
//***** Program *****************************************************
...
     //   +++ Frequency Measurement Initialization +++
     bnSelectFrequency:= TRUE;
     nmTimeBase:= 100;                          //   Time interval to 1
                                                //   s
     bnSelectFrequency:= FALSE;
...
     //   +++ Speed calculation - is executed at regular intervals +++
     bnSelectFrequency:= TRUE;
     nRPM:= nmFrequency * 60 / 4096;
     bnSelectFrequency:= FALSE;
...
```

13 Master-Slave Operation

Introduction

A relatively common task in industrial automation is the coupling of axes to achieve a coordinated motion. Such a mode of operation is called technological function.

Definition Technological Function

A technological function is a motion function where individual axes are moved dependent on each other. There is one master axis and one or more slave axes. The technological function determines at any given moment how the slave axes move with respect to the master axis.

Examples

The following functions are technological functions:
- Electronic gearbox
- Cam disc
- Flying saw

JX2-CNT1 as Master Axis in Technological Functions

JX2-CNT1 can be used as master axis for technological functions. The count value of the dual-channel counter or SSI encoder can be transmitted as master axis position for master/slave operation to one or more Jetter axis modules via system bus.

Important!

If JX2-CNT1 is operated in master/slave operation and one or more slave axes are coupled in, changes relating to the count value made by the user may have negative effects on the slave axes. For example, entering a value into register 3xx0 which significantly changes the count value causes the slave axis to jerk.

Two Modes

The JX2-CNT1 module can be operated in two different master/slave modes:
- Mode 1: Master/slave operation along with JX2-SV1 axis modules, or CAN-DIMA drive control modules
- Mode 2: Master/slave operation along with JM-2xx drive control modules

The JX2-CNT1 module can be operated only in one mode at a time. However, both modes can be active on the system bus at the same time (one JX2-CNT1 in mode 1 and one JX2-CNT1 in mode 2). The modes are configured in different ways.

13.1 Mode 1 - Operation along with JX2-SV1, etc.

Introduction

In mode 1 of master/slave operation, the JX2-CNT 1 module can be used as master axis in a servo control system for JX2 axis modules (such as JX2-SV1, JX2-SM2, etc.), as well as for drive control modules of the CAN-DIMA series.

Operating Principle

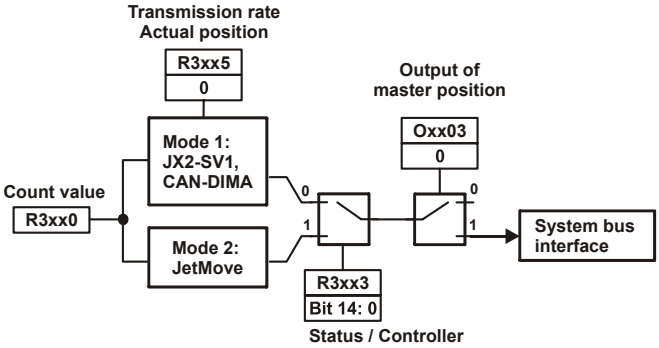
Between two position scans, the module sends its position and time (as time stamp) onto the system bus. The axis modules, which are to follow this JX2-CNT1, will do this with a fixed or variable (table mode) transmission ratio as to position. Position and speed of the master axis can be seen from registers 1x195 and 1x196 on the axis module or drive control module.

Further Information

For detailed information on the functioning of master/slave operation in mode 1 and on the configuration of the axis module or drive control module for operation along with JX2-CNT1 refer to the following manual: "can-dima_user's_manual_editon_1_0.pdf", chapter "Functioning Principle of the Follower".

Function Plan - Configuration

The function plan below shows the registers, which are required for configuring the JX2-CNT1 as master axis in mode 1, as well as their functions.



Configuration Steps

Below the steps are listed to configure a JX2-CNT1 as master axis in mode 1:

Step	Action
1	Select master/slave mode 1 on the JX2-CNT1. Procedure: Delete bit 14 "Master Mode - Selection" in register 3xx3 "Status / Controller"
2	Define the transmission rate. Procedure: Enter the desired value into register 3xx5 "Transmission Rate - Actual Position" (see overleaf). Recommendation: 1 ms

3	Enable the master position to be output onto the system bus. Procedure: Set virtual ouput xx003 "Master Position Output".

Register 3xx5 **Transmission Rate - Actual Position**

Status bit 14 = 0 Register 3xx5: Transmission Rate - Actual Position	
Function	**Description**
Read	Present transmission rate for "Actual Position"
Write	New transmission rate
Value range	0 ... 5 [ms] (0 = approx. 250 µs)
Value following reset	0 (= approx. 250 µs)

Register 3xx5 "Transmission Rate - Actual Position" defines the transmission rate, thus, the bus load. If register 3xx5 = 0, the JX2-CNT1 sends the actual position after each position scan, i.e. every 250 µs. In normal operating mode, such a high transmission rate is not required for follower control. *Therefore, we recommend to set the transmission rate to at least 1 ms.*

Sample Program A JX2-CNT1module which is located at the first I/O position after the basic device is to be used as master axis.

JetSym - Symbol Listing

```
**********  Registers  *************
rmStatusControl        3003        ;  Status / Controller
rmSendRate             3005        ;  Transmission rate
;**********  Bit Symbols *************
nbSelectMS_Modus2      14          ;  Bit for selecting master/
                                   ;  slave operation
;**********  Output Symbols  *************
oSendMasterPos         203         ;  Virtual output xx03
```

JetSym - Program Listing

```
...
     ;+++ Initializing Master/Slave Operation in Mode 1 +++
     BIT_CLEAR (rmStatusControl, nbSelectMS_Modus2) ; if set
     REGISTER_LOAD (rmSendRate, 1)        ;  Transmission rate = 1  ms
     OUT oSendMasterPos
...
```

JetSym ST - Program Listing

```
//***** Declaration of Variables ****************************************
VAR
//   Registers
     nmSendRate:          INT AT %VL 3005;      //   Transmission rate
//   Register Bits
     bnSelectMS_Modus2:   BOOL AT %VL 3003.14;  //   Bit for selecting
                                                //   master/slave
                                                    operation
//   Outputs
     boSendMasterPos:     BOOL AT %QX 203;      //   Virtual output xx03
                                                //
END_VAR;
//***** Program  ********************************************************
...
     //  +++ Initializing Master/Slave Operation in Mode 1 +++
     bnSelectMS_Modus2:= FALSE;  // if set
     nmSendRate:= 1;                            //   Transmission rate = 1 ms
     boSendMasterPos:= TRUE;
...
```

13.2 Mode 2 - Operation along with JM-2xx

JX2-CNT1 as master, as well as Time Master

In mode 2 of master/slave operation, the JX2-CNT 1 module can be used as master axis in a technology group along with a JM-2xx drive control module.

Once the JX2-CNT1 has been configured as master axis in mode 2, it is *automatically* configured as *Time Master* for synchronizing the system bus. This condition cannot be changed.

Only 1 JX2-CNT1 per System Bus

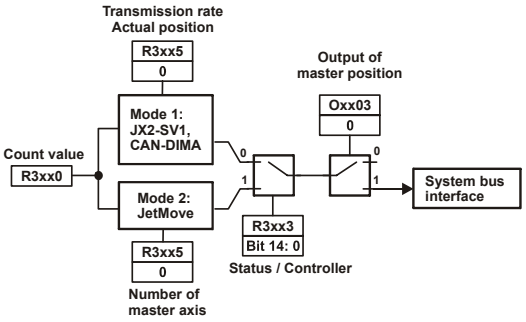
Only *one* JX2-CNT1 module is allowed as master axis in mode 2 on the system bus.
Reason: Only one Time Master is allowed to exist on the system bus. As the JX2-CNT1 module automatically acts as Time Master if configured as master axis, another JX2-CNT1 module acting as master axis would break this rule.
If you require an additional master axis for another technology group, you must use a JM-2xx as second master axis.

Further Information

For detailed information on configuration and operation of master/slave systems based on JM-2xx modules refer to the following manual: "jm2xx_at_jetcontrol_bi_xxxx_user_information.pdf", chapter "Technology Functions".

Function Plan - Configuration

The function plan below shows the registers, which are required for configuring the JX2-CNT1 as master axis in mode 2, as well as their functions.



Configuration Steps

Below the steps are listed to configure a JX2-CNT1 as master axis in mode 2:

Step	Action
1	Select master/slave mode 2 on the JX2-CNT1. Procedure: Set bit 14 "Master Mode - Selection" in register 3xx3 "Status / Controller"

2	Define the master axis number. Procedure: Enter the corresponding number into register 3xx5 "Master Axis Number".
3	Enable the master position to be output onto the system bus. Procedure: Set virtual ouput xx003 "Master Position Output".

Register 3xx5 **Transmission Rate - Actual Position**

Status bit 14 = 1 Register 3xx5: Number of master axis	
Function	**Description**
Read	Actual master axis number
Write	New master axis number
Value range	0; 1 ... 2 In the case of 0 sending is disabled even if virtual output xx03 is set.
Value following reset	0

SampleProgram A JX2-CNT1module which is located at the first I/O position after the basic device is to be used as master axis with master axis number 1.

JetSym - Symbol Listing

```
**********  Registers  *************
rmStatusControl        3003        ;  Status / Controller
rmMasternumber         3005        ;  Master number
;**********  Bit Symbols *************
nbSelectMS_Modus2      14          ;  Bit for selecting master/
                                   ;  slave operation
;**********  Output Symbols  *************
oSendMasterPos         203         ;  Virtual output xx03
```

JetSym - Program Listing

```
...
     ;+++ Initializing Master/Slave Operation in Mode 2 +++
     BIT_SET (rmStatusControl, nbSelectMS_Modus2)
     REGISTER_LOAD (rmMasternumber, 1)    ;  Master number = 1
     OUT oSendMasterPos
...
```

JetSym ST - Program Listing

```
//***** Declaration of Variables ************************************
VAR
//   Register
```

```
    nmMasternumber:      INT AT %VL 3005;      //   Master number
//  Register bits
    bnSelectMS_Modus2:   BOOL AT %VL 3003.14;  //   Bit for selecting
                                               //   master/slave
                                                    operation
//  Outputs
    boSendMasterPos:     BOOL AT %QX 203;      //   Virtual output xx03
                                               //
END_VAR;
//***** Program  ******************************************************
...
    //  +++ Initializing Master/Slave Operation in Mode 2 +++
    bnSelectMS_Modus2:= TRUE;
    nmMasternumber:= 1;                        //   Master number = 1
    boSendMasterPos:= TRUE;
...
```

Appendix

Appendix A: Overview - Outputs

The JX2-CNT1 module provides 8 virtual outputs enabling parameterization via controller. A reset will clear all outputs.

Output Number	Name	1) Default value 2) Cross reference
Single-channel counter		
xx05	Counting Direction	1) Counting up 2) Page 59
	0 = counting up 1 = counting down	
Dual-channel counter + SSI encoder		
xx03	Output of Master Position	1) Output of master position disabled 2) Page 87
	0 = output of master position disabled 1 = output of master position on the system bus enabled	
xx04	Encoder Selection	1) Dual-channel counter enabled 2) Page 75, Page 61
	0 = dual-channel counter enabled 1 = SSI encoder enabled	
Dual-Channel Counter		
xx01	Signal Activation	1) STR enabled / REF disabled 2) Page 64
	0 = STR enabled / REF disabled 1 = STR disabled / REF enabled STR -> strobe function; REF -> reference function (When this bit is set to 1, bit 3 in register 3xx3 "Status / Controller" is reset automatically)	
xx02	Counter Type	1) Dual-channel counter 2) Page 62
	0 = dual-channel counter 1 = single-channel counter	
SSI Encoder		
xx06	Signal Coding	1) Gray code 2) Page 75
	0 = Gray code 1 = binary code	
xx07	Activation of Parity Check	1) Parity check disabled 2) Page 75
	0 = parity check disabled 1 = parity check enabled	

Output Number	Name	1) Default value 2) Cross reference
xx08	Parity Settings	1) odd parity 2) Page 75
	0 = odd parity 1 = even parity	

Appendix B:Overview of Registers

The JX2-CNT1 module provides 10 registers for communication with the CPU.

In column "R/W", the type of access to a register is specified:

R = Read
W = Write

Register Number	Name	R/W	1) Value Range 2) Default value 3) Cross reference
3xx0 Output xx04 = 0	Count value (dual-channel counter)	R/W	1) - 8,388,608 ... + 8,388,607 2) 0 3) Page 61
3xx0 Output xx04 = 1	Count value (SSI Encoder)	R	1) Depending on position resolution 2) 0 3) Page 69
3xx1 Status bit 12 = 0	Dual-channel counter - offset	R/W	1) - 8,388,608 ... + 8,388,607 2) 0 3) Page 66
3xx1 Status bit 12 = 1	Frequency - time base	R/W	1) 1 ... 255 2) 10 3) Page 78
3xx2	Dual-channel counter - strobe value	R	1) - 8,388,608 ... + 8,388,607 2) 0 3) Page 68
3xx3	Status / Controller	R/W	1) bit-oriented, 16 bits 2) 0b 00000000 00000000 3) Page 55
	Status Bits		
	Bit 0:	Dual-channel counter - Strobe status	
		0 = no strobe 1 = strobe event arrived	
	Bit 1:	Reserved	
	Bit 2:	Reserved	
	Bit 3:	Dual-channel counter - reference status	
		0 = No zeroing 1 = Setting to zero completed	
	Bit 4:	Dual-channel counter - strobe overflow status	
		0 = No strobe overflow 1 = Strobe overflow	
	Bit 5:	Reserved	

Register Number	Name	R/ W	1) Value Range 2) Default value 3) Cross reference
	Bit 6:	Dual-channel counter - Z track error status	
		0 = No Z track error 1 = Z track error	
	Bit 7:	Reserved	
		Control Bits	
	Bit 8:	Reserved	
	Bit 9:	SSI - Reversal of counting direction	
		0 = Counting direction as per data transmission 1 = Inverted counting direction	
	Bit 10 - bit 11:	Reserved	
	Bit 12:	Frequency display - Activation	
		0 = R3xx1 = dual-channel counter Offset R3xx7 = SSI - Parity error counter 1 = R3xx1 = Frequency - display R3xx7 = Frequency - time base	
	Bit 13:	Reserved	
	Bit 14:	Master mode - selection	
		0 = Operation along with JX2-SV1 / CAN-DIMA 1 = Operation in synchronous mode (JetMoves)	
	Bit 15:	Reserved	
3xx4	Single-channel counter - count value	R/ W	1) - 8,388,608 ... + 8,388,607 2) 0 3) Page 59
3xx5 Status bit 14 = 0	Transmission rate - actual position	R/ W	1) 0 ... 5 2) 0 3) Page 89
3xx5 Status bit 14 = 1	Number of leading axis	R/ W	1) 1 ... 2 2) 0 3) Page 92
3xx6	SSI - configuration	R/ W	1) 0; 21,464 ... 65,535 2) 0 3) Page 75

Register Number	Name	R/ W	1) Value Range 2) Default value 3) Cross reference
3xx7 Status bit 12 = 0	SSI - counter of parity errors	R/ W	1) - 8,388,608 ... + 8,388,607 2) 0 3) Page 78
3xx7 Status bit 12 = 1	Frequency - display	R	1) - 8,388,608 ... + 8,388,607 2) 0 3) Page 77
3xx8	Dual-channel counter - filtering frequency	R/ W	1) 0 ... 32,704 2) 0 3) Page 67
3xx9	Firmware version	R	1) 0 .. 8,388,607 2) Firmware version 3) Page 57

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