# JetWeb

# JX2-SV1

## Operator’s Manual

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# This Operator's Manual is an Integral Part of the JetWeb Module JX2-SV1:

Type: _____

Serial #: _____

Year of construction: _____

Order #: _____

CE

To be entered by the customer:

Inventory #: _____

Place of operation: _____

# Significance of this user’s manual

This manual forms part of the JX2-SV1 module

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

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

From this JX2-SV1 module may result inherent residual risks to persons and physical assets. For this reason, any person who has to deal with the operation, transport, installation, maintenance and repair of the JX2-SV1 module must have been familiarised with it and must be aware of these dangers.
Therefore, this person 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.

# Table of Contents



# List of Appendices

# 1 Safety Instructions

The JX2-SV1 module reflects the present state of the art. The JX2-SV1and JX2-SV1C modules fulfill the applicable safety regulations and standards. Special emphasis was given to the safety of the users. Only the term JX2-SV1 module will be used below for the modules JX2-SV1 and JX2-SV1C. Differences will be explicitly described.

Of course, the following regulations apply to the user:
- relevant accident prevention regulations;
- the generally recognised technical safety regulations,
- EC guidelines and other country-specific regulations.

## Usage as agreed upon

Usage as agreed upon includes operation in accordance with the operating instructions.
The JX2-SV1 module is used to control machinery, such as conveyors, production machines, and handling machines. The JX2-SV1 module can logically be operated and controlled only with the basic modules of the NANO control system.
Power supply of the JX2-SV1 module must be made through the SELV module exclusively.
The use of other power supply modules is not admissible.

## Usage other than agreed upon

The JX2-SV1 module must not be used in technical systems which to a high degree have to be fail-save, e.g. ropeways and aeroplanes.

If the N-SV1 module is to be operated under ambient conditions which differ from those stated in chapter 2: "Operating Conditions“, page 11, consult the manufacturer first.

## Who is permitted to operate the JX2-SV1 module?

Only instructed, trained and authorised persons are permitted to operate the JX2-SV1 module.
Mounting and backfitting may only be carried out by specially trained personnel, as specific know-how will be required.

## Maintenance of the JX2-SV1 module

The JX2-SV1 module is maintenance-free. Therefore, for the operation of the module no inspection or maintenance are required.

## Shutting down and disposing of the JX2-SV1 module

Decommissioning and disposal of the JX2-SV1 module are subject to the environmental legislation of the respective country in effect for the operator's premises.

# Descriptions of symbols

**Danger**

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.

**Important!**

This sign is to indicate a possible impending situation which might bring damage to the product or to its surroundings.

**Note!**

You will be informed of various possible applications and will receive further useful suggestions.

**· / -**

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.


Illustration of PC and user interface keys.

# Ensure your own safety

Isolate the JX2-SV1 module from the mains if maintenance works have to be carried out. By doing so, you will prevent accidents resulting from electric voltage and moving parts.

# 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 the cables is important.

**Important!**

Measures for increasing immunity to interfering:

- The shielding must be fitted on both sides.
- The entire circumference of the shielding must be pulled back behind the insulation and then extensively clamped under a strain relief.
- When the signal is connected to terminal screws: The strain relief must be directly and extensively connected to an earthed surface.
- When male connectors are used: Only use metallised connectors, e.g. SUB-D with metallised housing. Please take care of direct connection here as well.
- On principle, separate signal and voltage connections spatially.

## Male/female SUB-D connectors (9, 15 or 25 pins) with metallised housing.

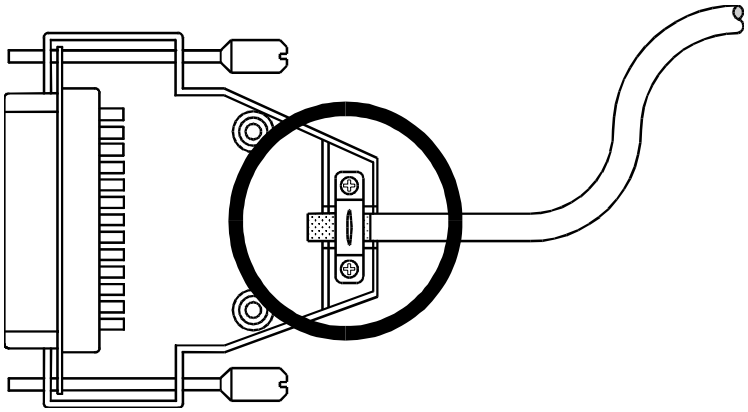


**Fig. 1: Shielding in conformity with the EMC standards**

**Important!**

To avoid malfunctions the following must be ensured:

- The shielding must be extensively clamped under a strain relief.
- The connection between the housing and the shielding must be electrically conductive.
- The distance between unshielded conductor ends must be as short as possible.

## Modifications and alterations to the module

Due to safety reasons, no modifications and alterations to the JX2-SV1 module and its functions are allowed. Any modifications to the module JX2-SV1 not expressly authorised by the manufacturer will result in a loss of any liability claims to Jetter AG.

The original parts are specifically designed for the JX2-SV1 module. Parts and equipment of other manufacturers are not tested on our part, and are, therefore, not released by us. The installation of such parts may impair the safety and the proper functioning of the JX2-SV1 module.

For any damages resulting from the use of non original parts and equipment any claims with respect to liability of Jetter AG are excluded.

## Malfunctions

Malfunctions or other damages are to be reported to an authorised person at once.
Safeguard the JX2-SV1 module against misuse or accidental use. Only qualified experts are allowed to carry out repairs.
Safety and protective devices, e.g. the barrier and cover of the terminal box must not in any case be shunted or by-passed.
Dismantled protective equipment must be reattached prior to commissioning and checked for proper functioning.

## Information signs and labels

Writings, information signs, and labels always have to be observed and kept readable.

Damaged or unreadable information signs and labels are to be exchanged.

# Residual dangers

## Danger resulting from electric shock!

If the JX2-SV1 module is not isolated from the mains, for example during maintenance and repair works, you can suffer from an electric shock.
Please, observe the following measures in order to avoid injuries, muscle cramps, burns, as well as possibly unconsciousness and respiratory standstill:

- Disconnect the JX2-SV1 module from the power mains (pull out the mains plug) when working on the controller.
- Have works on the electric and electronic system performed by qualified personnel only.

# 2 Operating Conditions

| Operating conditions | | |
|---|---|---|
| **Condition** | | **Comment** |
| Ambient Temperature | 0 .. 50 °C | |
| Storing temperature | -10 .. 70 °C | |
| Air humidity | 5% - 95% | RH-2 acc. to IEC 61131-2 |
| Contamination level | II | acc. to IEC 61131-2 |
| Oscillation fatigue limit | IEC 61131-2 | |
| Protective system | IP20 | |
| Category of protection | III | acc. to IEC 61131-2 |
| ESD | Level ESD-4 | acc. to IEC 61131-2 |

**Important!**

Measures to avoid damages in transit and storage:

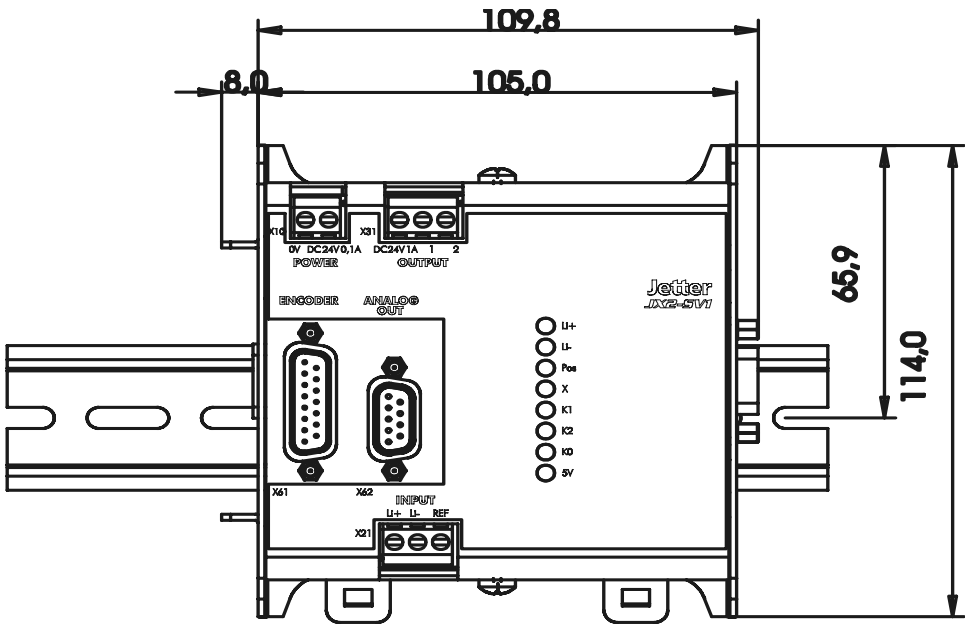
➢ The packaging material and the storage location must be selected so that the values in the table above are maintained.

# 3 Servo Controller Module JX2-SV1

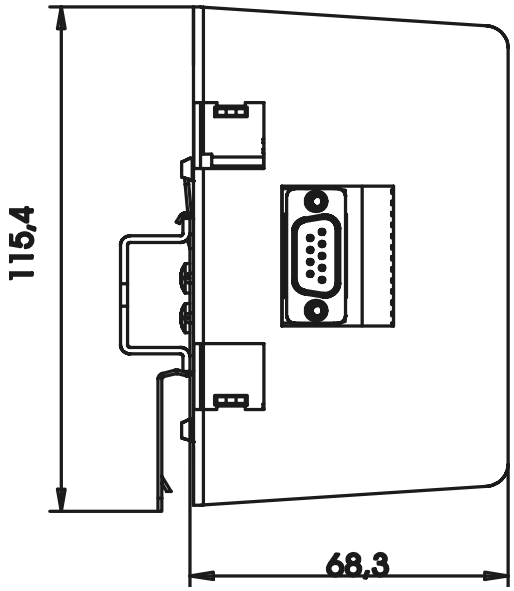
The intelligent extension module JX2-SV1 is designed for the control systems NANO, JetControl and JetNode. It is used to control external servo axes.
A ± 10 V analog signal is provided as the output. Incremental or absolute value encoder signals (SSI) can be evaluated as the feedback value.

## 3.1 Mounting Dimensions

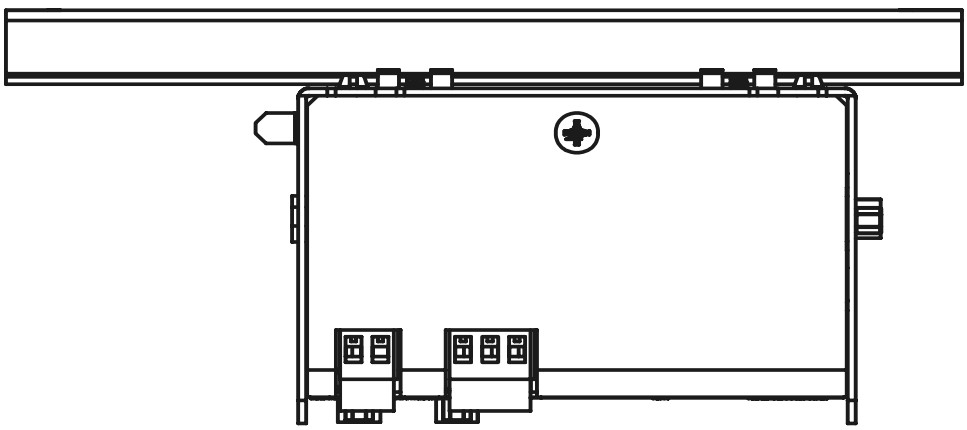
### 3.1.1 Front View



### 3.1.2 Side View




### 3.1.3 Top View



## 3.2 Technical Data

| Technical data - JX2-SV1 module | |
|---|---|
| Positioning range | -8388608 .. +8388607 |
| Max. encoder frequency K1, K2: | 100 kHz*) |
| Resolution | 12 Bit |
| Positioning accuracy | ± 1 increment |
| Acceleration / Deceleration ramp | sine square, steepness programmable |
| Interface to the servo controller | Speed setpoint value<br>analog -10V .. +10V |
| Inputs | Limit switch left / right<br>(24V, NC or NO contact)<br><br>Reference switch<br>(24V, NC or NO contact) |
| Outputs | 2 digital outputs |
| Housing | Aluminium, powder coated, black |

*) see Section 5: "Differences Between Modules JX2-SV1C and JX2-SV1", page 59.

| Connection of the servo controller (X1, X2, X3) | |
|---|---|
| 0 V (X10) | Gnd |
| 24 V (X10) | Voltage supply, logic |
| 24 V (X31) | Power supply<br>Output 1and output 2 |
| 1 (X31) | Digital output, positive direction |
| 2 (X31) | Digital output, negative direction |
| Li+ (X21) | Positive limit switch |
| Li- (X21) | Negative limit switch |
| Ref (X21) | Reference switch |

| Technical data - Digital outputs | |
|---|---|
| Type of outputs | Transistor, pnp |
| Nominal voltage | DC 24 V |
| Voltage range | 20.. 30 V |
| Load current | max. 0.5 A / output |
| Electrical isolation | None |
| Protective circuit | Overload, overvoltage, overtemperature |
| Protection against inductive loads | yes |
| Signal voltage ON | typ. $V_{Supply}$ - 1.5 V |

# 3.3 Connection Diagram

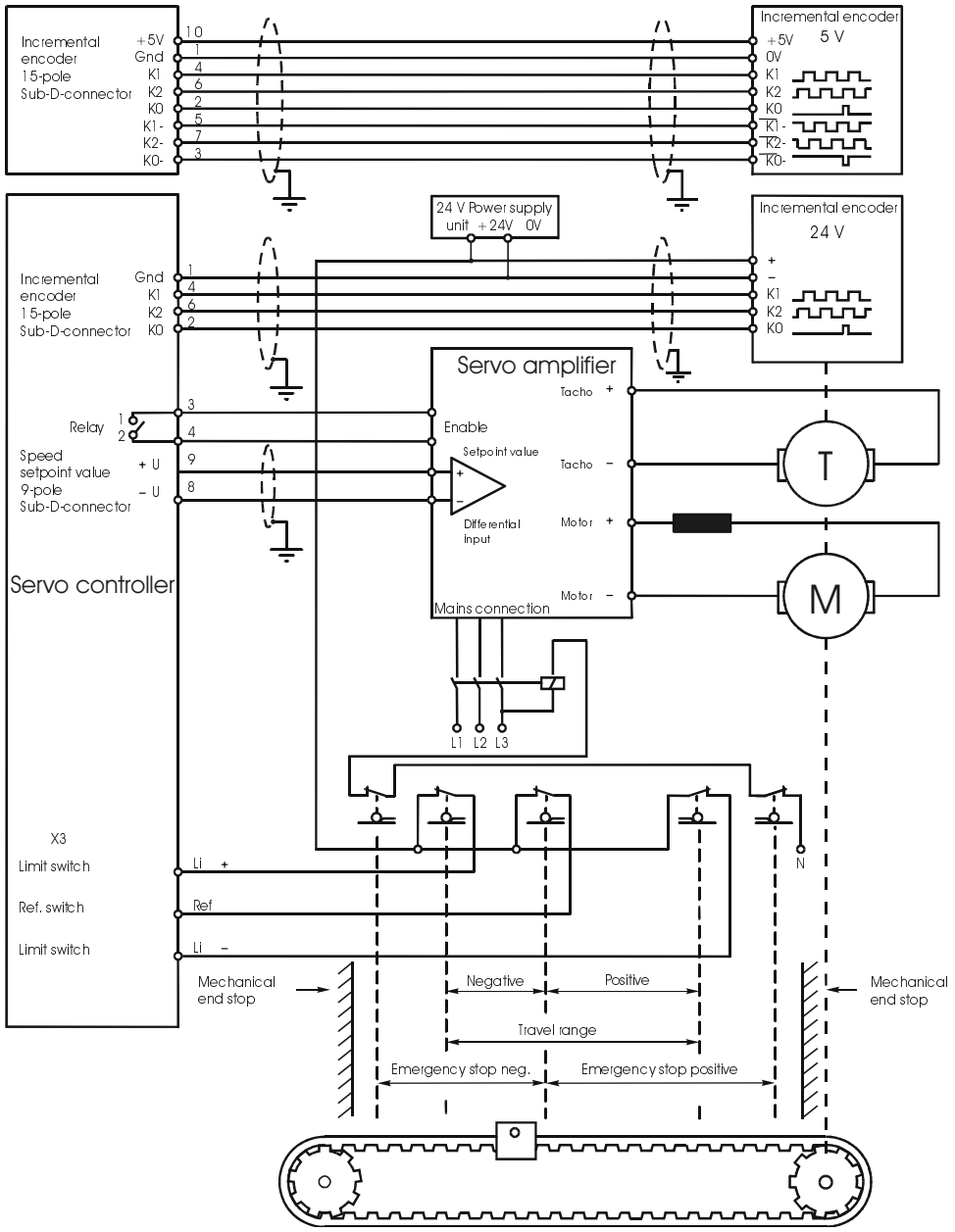
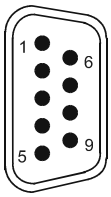
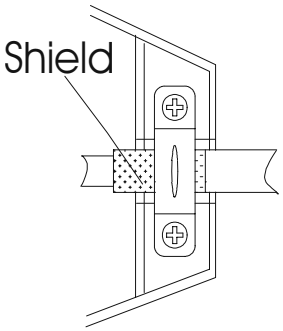



**Fig. 2: System interconnect diagram**

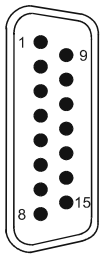
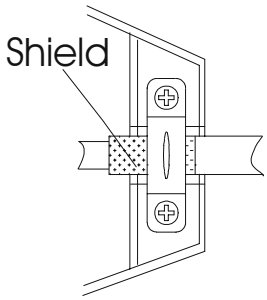
**Note!**

The relay is a NO contact and must be connected potential-free.

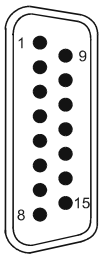
| Analog output with 9-pole SUB-D connector | | |
|---|---|---|
| **Controller** | **Shielding** | **Specification max. length** |
| 9-pole SUB-D connector X62   |   Connect shield with the greatest possible surface area! Use a metallised housing | Maximum cable length: 20 m |

| Pin | Signal | Comment |
|---|---|---|
| 1 | Gnd | Voltage supply |
| 2 | not assigned | |
| 3 | Relay contact 1*) | Release (max. 30 V, max. 1 A) |
| 4 | Relay contact 2*) | Servo amplifier |
| 5 | not assigned | |
| 6 | not assigned | |
| 7 | not assigned | |
| 8 | Gnd | for 9 |
| 9 | Speed setpoint value | -10V .. +10V (max. ± 5 mA) |

*) floating contact

| Encoder with 15-pole SUB-D connector | | |
|---|---|---|
| **Controller** | **Shielding** | **Cable specification, max. length** |
| 15-pole<br>SUB-D connector<br>X61<br>  |  <br>Connect shield with the greatest possible surface area!<br>Use a metallised housing | Maximum cable length:<br><br>5 V differential voltage:<br>100 m<br><br>24 V:<br>20 m |

| Pin | Signal | Comment |
|---|---|---|
| 1 | Gnd | Voltage supply |
| 2 | K0 + | Input |
| 3 | K0 - | Input |
| 4 | K1 +, D + (SSI) | Input |
| 5 | K1 -, D - (SSI) | Input |
| 6 | K2 + | Input |
| 7 | K2 - | Input |
| 8 | Clock - (SSI) | Output |
| 9 | Clock + (SSI) | Output |
| 10 | DC 5 V (50mA) | Voltage supply |
| 11 | not assigned | not assigned |
| 12 | not assigned | not assigned |
| 13 | not assigned | not assigned |
| 14 | not assigned | not assigned |
| 15 | not assigned | not assigned |

| Encoder inputs of the JX2-SV1 module | | | |
|---|---|---|---|
| **Male connector SUB-D, 15 pins**<br><br>**X61** | **PIN** | **24 Volt encoder** | **5 Volt differential voltage** |
|  | 1 | GND | GND |
| | 2 | K0 + | K0 + |
| | 3 | not assigned | K0 - |
| | 4 | K1 + | K1 + |
| | 5 | not assigned | K1 - |
| | 6 | K2 + | K2 + |
| | 7 | not assigned | K2 - |
| | 8 | not assigned | not assigned |
| | 9 | not assigned | not assigned |
| | 10 | not assigned | 5 Volt (- 5%) encoder supply with max. 50 mA input current |
| | 11 | not assigned | not assigned |
| | 12 | not assigned | not assigned |
| | 13 | not assigned | not assigned |
| | 14 | not assigned | not assigned |
| | 15 | not assigned | not assigned |

**Important!**

To prevent functional problems or destruction of the module JX2-SV1:

- an encoder connected to Pin 1 and Pin 10 and supplied with 5 Volt must not consume more than maximum 50 mA current.
- encoders with higher power consumption must be connected externally and supplied with current / voltage externally.

# 3.4 Description of LEDs

The eight LEDs of the JX2-SV1 module light up in various operating states, whereby:
- the first four LEDs indicate output states controlled via the software.
- the second four LEDs indicate the unit state.

| | |
|---|---|
| LED Li+: | The positive limit switch is or was active. |
| LED Li-: | The negative limit switch is or was active. |
| LED Pos: | The axis has reached the position. The LED lights up as soon as the axis has reached the destination window. The LED goes out as soon as a new positioning is started. |
| X: | flashes when an update of the operating system is being loaded |
| K1: | Encoder channel 1 |
| K2: | Encoder channel 2 |
| K0: | Encoder channel 0 |
| 5V: | 5V Logic voltage of the servo module is OK. |

The LEDs for the limit switches have four display modes:

| | |
|---|---|
| • lights up continuously: | The axis is at the limit switch, the limit switch is active. |
| • even flashing: | The limit switch was active, is no longer active and no new positioning was started. |
| • uneven flashing: | The software limit switch was triggered. |
| • even flashing of the LED Pos: | Tracking error recognised. |

# 3.5 Software Description

## 3.5.1 Axis Numbering

The example of the **xy axis** is used to explain the axis numbering system.

- The first digit defines the number of the module at which the module JX2-SV1 is located:
  **x = Module number**.

- The second digit defines the number of the axis which is to be addressed on the module:
  **y =Axis numbe**r.

  In the case of module JX2-SV1, the axis number is always 1 and in the case of module JX2-SM2 it is either 1 or 2.

**Note!**

To determine the module number, only the intelligent modules and no non-intelligent modules are counted. See the table below.

**Number assignment of the modules**

| Basic unit | JX2-SV1 Servo module | JX2-ID8 Input module | JX2-SM1D Servo module |
|---|---|---|---|
| Module 1 | Module 2 | Module 3 | Module 4 |
| Input **101 .. 108** | Axis **2**1 | Input **201 .. 208** | Axis **3**1 and axis **3**2 |

## 3.5.2 Register Numbering

Using the example of the register REG **1xyzz**, the method by which the axis numbering is performed is demonstrated.

- The registers are addressed via five-digit numbers.
- The first digit is 1.
- The second digit x is obtained from the module number, at which the N-SV1 module is located.
- The third digit y corresponds to the number of the axis which is addressed via the register, in the case of module JX2-SV1 it is always 1.
- The digits four and five zz define the actual register number, whereby zz correspond to the register numbers 0 to 99.

**Note!**

To determine the module number, only the intelligent modules and no non-intelligent modules are counted. See the table below.

**Number assignment of the modules in the case of axes**

| Basic unit | JX2-SV1 Servo module | JX2-ID8 Input module | JX2-SM1 Servo module |
|---|---|---|---|
| Module 1 | Module 2 | Module 3 | Module 4 |
| Input **101 .. 108** | Register numbers **121zz** | Input **201 .. 208** | Register numbers **131zz** |

### 3.5.3 Position Control Modes: Mode 0, 1, 2, 3

The JX2-SV1 module can be operated in 4 different position control modes. All position control modes require the basic register as the basis for control, see Section 3.7: "Registers of the JX2-SV1 Module", page 28.

**Mode 0**

In the case of Mode 0, the axis moves outside the Acceleration and Deceleration Ramps with a constant default speed (Register **1xy03**) towards the target point. When the target point is reached, the position is controlled to the target position; to achieve this, the difference between the setpoint and actual positions is multiplied by the gain factor (Register **1xy10**).

The output setpoint voltage is calculated on the basis of the following formula:

$$\text{Output value} = \frac{\Delta(\text{Setpoint value} - \text{Actual value})}{16} \times \frac{\text{REG 1xy10}}{128} \times 4,88\text{mV}$$

**Mode 1**

Mode 1 includes Mode 0 and also uses the digital speed control (see Mode 3).

**Mode 2**

Mode 2 realises a full position control over the full distance. The current setpoint position is calculated for each time and the setpoint / actual difference is formed. The product with the gain factor defines the speed setpoint value. Calculation of the current setpoint position is performed with a software or virtual axis, which mathematically “runs” the required speed profile, see Section 3.7.1: "Registers for Mode 2: Full Position Control", page 42 for details. This corresponds to the tracking error monitoring.

**Mode 3**

Mode 3 includes Mode 2 and also uses the digital speed control.
The requirement is:
The speed controller in the servo amplifier must be bypassed. See Section 3.7.2: "Registers for Mode 1 and 3: Digital Speed Control", page 47.

# 3.6 Register Overview - JX2-SV1 Module

| Reg. No. | Register type – Servo controller | | R/W Ro*) |
|---|---|---|---|
| **General registers** | | | |
| 1xy00 | Status register | 0 ... 23 Bit | R/W |
| 1xy01 | Command register | 0 ... 255 | R/W |
| 1xy02 | Setpoint position | - 8388608 ... + 8388607 | R/W |
| 1 xy03 | Setpoint speed | 0 ... 32767 | R/W |
| 1xy04 | Input polarities | 0 ... 7 Bit | R/W |
| 1xy05 | Acceleration ramp | 1 ... 32767 | R/W |
| 1xy06 | Deceleration ramp | 1 ... 32767 | R/W |
| 1xy07 | Destination window | 0 ... 8388607 | R/W |
| 1xy08 | Digital offset | 0 ... 2047 | R/W |
| 1xy09 | Actual position | - 8388608 ... + 8388607 | R/W |
| 1xy10 | P-gain | 0 ... 32767 | R/W |
| 1xy11 | Setpoint speed of the position controller | - 32768 ... + 32767 | R/W |
| 1xy12 | Actual speed | - 32768 ... 32767 | Ro |
| 1xy13 | Time basis for the measurement of the actual speed | 0 ... 32767 | Ro |
| 1xy14 | Positive software limit switch | - 8388608 ...+ 8388607 | R/W |
| 1xy15 | Negative software limit switch | - 8388608 ...+ 8388607 | R/W |
| 1xy16 | Digital offset | - 2048 ... + 2047 | R/W |
| 1xy17 | Encoder line count | 0 ... 10000 | R/W |
| 1xy18 | Maximum speed of the servo amplifier / motor combination | 0 ... 32767 | R/W |
| 1xy19 | Tracking error | - 8388608 ... + 8388607 | Ro |
| 1xy20 | Tracking error limit | 0 ... 8388607 | R/W |
| 1xy21 | Reference value for Register 03. Maximum setpoint speed | 0 ... 32767 | R/W |

| Reg. No. | Register type – Servo controller | | R/W Ro*) |
|---|---|---|---|
| **Register for the digital speed controller** | | | |
| 1xy24 | P-gain of the digital speed controller | 0 ... 32767 | R/W |
| 1xy25 | Current setpoint value | -2048 ... + 2047 | Ro |
| 1xy26 | I-component of the speed controller | 0 ... 32767 | R/W |
| 1xy27 | Current limitation within the speed controller | 0 ... 2047 | R/W |
| 1xy28 | Present I-component of the speed controller | - 30000 ...+ 30000 | R/W |
| 1xy29 | Limitation of the I-component within the speed controller | 0...30000 | R/W |
| **Register for the absolute value encoder (SSI)** | | | |
| 1xy64 | Word size of the absolute value encoder | 1 ... 24 | R/W |
| 1xy65 | Offset to the reference position | - 8388608 ... + 8388607 | R/W |
| 1xy66 | Bit number for the word size | 1 ... 23 | R/W |
| **Relative positioning** | | | |
| 1xy67 | Relative position in the relative mode | - 8388608 ... + 8388607 | R/W |
| 1xy68 | Last setpoint position in the relative mode | - 8388608 ... + 8388607 | R/W |
| 1xy71 | Move reference point | - 8388608 ... + 8388607 | R/W |
| 1xy80 | Move deceleration ramp | 0 ... + 8388607 (Incremental) | R/W |
| **Other registers** | | | |
| 1xy43 | Axis (slave) receives actual position | 21, 22, 31, 41, 42 102 ... 116 | R/W |
| 1xy78 | Time basis, table mode in 0.5 ms | 0 ... 32767 | R/W |
| 1xy81 | Switch off outputs below an output value | 0 ... 2047 (0 .. 10 V) | R/W |
| 1xy85 | Absolute maximum position (endless positioning, relative positioning) | 0 ... 7490000 | R/W |

| Reg. No. | Register type – Servo controller | | R/W Ro*) |
|---|---|---|---|
| 1xy95 | Present position of the Master | - 8388608 ... + 8388607 | Ro |
| 1xy96 | Present speed of the Master | -32768 ... 32767 | Ro |
| 1xy98 | Endless positioning and relative positioning mode | 0 ... 3 | R/W |
| 1xy99 | Version number | + 8388607 | Ro |

*) R/W means Read/Write; Ro means Read only

# 3.7 Registers of the JX2-SV1 Module

| Register 1xy00: Status Register | |
|---|---|
| **Function** | **Description** |
| Read | Present status of the axis<br><br>Value following a reset: Bit 10 set |
| Write | defines a new status |
| Value range | bit-oriented, 24 Bit |

**Meaning of the individual bits**

| | |
|---|---|
| **Bit 0:** | Reference set |
| **Bit 1:** | **AXARR=** Position was reached. The bit is deleted and set at the start of the positioning as soon as the destination window is reached. |
| **Bit 2:** | not assigned |
| **Bit 3:** | Tracking error recognised in the case of<br>**REG \|1xy19\| > REG 1xy20** |
| **Bit 4:** | Negative limit switch active |
| **Bit 5:** | Positive limit switch active |
| **Bit 6:** | Reference switch active |
| **Bit 7:** | Software limit switch was active |
| **Bit 8:** | Limit switch was active |
| **Bit 9:** | Position controller switched on |
| **Bit 10:** | Switched on following **AXARR** |
| **Bit 11:** | Relay switched on |
| **Bit 12:** | Machine referencing error |
| **Bit 13:** | **BUSY,** applies only to commands 9 to 12 and command 42, as well as to register 1xy43 |
| **Bit 14:** | Software limit switch switched on.<br>Entering **1** into this bit activates this function. |
| **Bit 15:** | Speed controller active |
| **Bit 16:** | Axis is in the deceleration ramp |
| **Bit 17:** | Do not switch off if tracking error is recognised.<br>Entering **1** into this bit activates this function. |
| **Bit 18:** | Print-mark not found |

| | |
|---|---|
| **Bit 19:** | not assigned |
| **Bit 20:** | not assigned |
| **Bit 21:** | not assigned |
| **Bit 22:** | Error recognised on a digital output |
| **Bit 23:** | Tracking error correction deactivated.<br>Setting the bit deactivates the correction. |

| Register 1xy01: Command Register | |
|---|---|
| **Function** | **Description** |
| Read | Present or most recently processed command<br><br>Value following a reset: 0 |
| Write | Starts the execution of a new command |
| Value range | 0 .. 255 |

**Writing values between 0 and 79 into this register starts one of the following commands:**

**0:** The axis stops with the Deceleration ramp.

**1:** Switches the controller **ON** and issues a release.

**2:** The relay is switched off and controller remains active.

**3:** The reference point is set at the present position of the axis. At the same time, the actual and setpoint position of the axis are set to 0.

**4:** The reference is searched for again. The next coincidence of the reference switch and the K0 signal of the incremental encoder references the axis again. Use of command 4 is not necessary if the commands 9 to 12 are used.

**5:** The axis is stopped and the position is controlled (**AXARR** command).

**6:** The axis is stopped and the position is not controlled (analog output = 0 V).

**7:** The position is controlled in the target point (*).

**8:** The position is not controlled in the target point.

**9:** Automatic machine referencing with the speed entered into register **1xy03.**
Start in the positive direction, attention must immediately be paid to the reference switch.

If the positive limit switch is actuated, the rotation direction of the axis is reversed and it continues to rotate in the negative direction until:

- The reference switch is found, whereby the actual and setpoint positions are then set to 0.
- The negative limit switch is actuated, whereby the machine referencing ends, the setpoint position is set the same as the actual position, the controller is switched off and an error (Bit 12) is reported in the status register **1xy00**.

**10:** Automatic machine referencing with the speed contained in register **1xy03.**

Start in the negative direction and immediately pay attention to the reference switch. If the negative limit switch is actuated, the rotation direction of the axis is reversed and it continues to rotate in the positive direction until:

- The reference switch is found and the actual and setpoint positions are then set to 0.
- The positive limit switch is actuated, whereby the machine referencing ends, the setpoint position is set the same as the actual position, the controller is switched off and an error (Bit 12) is reported in the status register **1xy00**.

**11:** Automatic machine referencing with the speed contained in register **1xy03.**

Start in the positive direction to the positive limit switch and ignore the reference switch. Turn round there, move in the negative direction and observe the reference switch at the same time.

If the negative limit switch is actuated, machine referencing is ended and an error (Bit 12) is signalled in the status register **1xy00**.

**12:** Automatic machine referencing with the speed contained in register **1xy03.**

Start in the negative direction to the negative limit switch and ignore the reference switch. Reverse there, move in the positive direction and observe the reference switch at the same time.

If the positive limit switch is actuated, machine referencing is ended and an error is signalled in the status register.

**13:** Axis control at limit switch position **OFF:** 0 V is output when the limit switch is reached

**14:** Axis control at limit switch position **ON:** When a limit switch is reached the axis is kept in this position (*).

**15 - 16:** Reserved!

**17:** Relative positioning: refers to the last setpoint position, not to the reference position.

**18:** Absolute positioning: refers to the reference position (*).

**19:** Interrupted positioning is continued with the **AXARR command**

**20:** Relative position with start input. - **ON**

**21:** Relative position with start input - **OFF**

| | |
|---|---|
| **22:** | Stop at reference point - **ON:** during the machine referencing cycle, the axis stops at the reference point (*). |
| **23:** | Stop at reference point - **OFF:** the axis does not stop at the reference point during a machine referencing cycle, instead it continues to travel to the setpoint. |
| **24 - 25:** | Reserved! |
| **26:** | Activate the print-mark recognition mode. |
| **27:** | Deactivate the print-mark recognition mode (*). |
| **28:** | Machine referencing, coarse: ON |
| **29:** | Machine referencing, coarse: OFF |
| **30:** | Master axis in servo-controller mode: this command is given in the Master |
| **31 - 41:** | Reserved! |
| **42:** | Switch off function of command **30** and register **1xy43**. This command can be used in both the Master and the Slave. |
| **43:** | Reserved! |
| **44:** | Servo-controller - ON |
| **45:** | Servo-controller - OFF |
| **46:** | Servo-controller mode via table - ON |
| **47:** | Servo-controller mode via table - OFF |
| **48:** | Clockwise rotation: Always move to the right when using single-turn rotary encoders |
| **49:** | Counter-clockwise rotation: Always move to the left when using single-turn rotary encoders. |
| **50:** | Optimised path: When using single-turn rotary encoders, always move to position on the shortest path. |
| **51:** | The commands **48 to 50** for using single-turn rotary encoders are deactivated |
| **52 - 55:** | Reserved! |
| **56:** | Endless positioning in the positive direction is started and is only valid for this single positioning cycle. |
| **57:** | Endless positioning in the negative direction is started and is only valid for this single positioning cycle. |
| **58 - 69:** | Reserved! |
| **70:** | Unipolar DAC output |
| **71:** | Bipolar DAC output |
| **72 - 73:** | Reserved |
| **74:** | Digital output 1 **ON** |

| | |
|---|---|
| **75:** | Digital output 1 **OFF** |
| **76:** | Digital output 2 **ON** |
| **77:** | Digital output 2 **OFF** |
| **78:** | Linear ramps |
| **79:** | Sine square ramps (*) |

(*) = Default setting after Reset

| Register 1xy02: Setpoint Position | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 0 |
| Write | Defines a new setpoint position for the axis and at the same time starts the positioning to this set-point position. |
| Value range | -8388608 ... +8388607 |

**Examples:**

**1)** **THEN**

```
LOAD_REGISTER [1xy02 with 10000]
```

Starts the positioning of the axis to the absolute position 10000 increments.

**2)** **THEN**

```
DISPLAY_REG [#0, cp=1, Reg=1xy02]
```

Shows the momentary setpoint position of the axis in the top left corner on user interface LCD9, LCD10 or LCD12.

**3)** **THEN**

```
REG 1xy02
=
REG 1xy02
+
100
```

Starts the positioning in absolute mode of the axis to the relative position 100, i.e. continue 100 increments.

**Note!**

This register can also be changed at any time during positioning. The positioning process then refers to the new value. The axis does not stop in this positioning process and a reversal of the axis rotation direction takes place jerkily.

| Register 1xy03: Setpoint Speed | |
|---|---|
| **Function** | **Description** |
| Read | Present setpoint speed of the axis<br><br>Value following a reset: 300 (‰) |
| Write | Transfer of a new setpoint speed for the axis |
| Value range | 0 .. 32767; the upper limit is defined with the register **1xy21**. (Default 1000) |

The value is immediately valid and results in:

- Presently no movement of the axis:
  The new value is saved for the next positioning cycle.

- Positioning currently running:
  The new setpoint speed is accepted. The speed change does not take place suddenly. The change takes place with the acceleration ramp defined in the register **1xy05**. This applies to the increase or reduction of the setpoint speed.

**Examples:**

**1)**
```
THEN
    LOAD_REGISTER [1xy03 with 20]
```

Results in travel at creep rate with approx. 2% of the maximum speed value.

**2)**
```
THEN
    REG 1xy03
    =
    REG 1xy03
    +
    80
```

Increases the speed of the axis to 10% of the maximum speed value.

| Register 1xy04: Input Polarities | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 131 |
| Read | Defines a new setting of the inputs for reference switches and limit switches |
| Value range | bit-oriented, 7 Bit |

**Meaning of the individual bits**

**Bit 0:**
0 = Reference input 0V-active
1 = Reference input 24V-active

**Bit 1:**
0 = Limit switch 0V-active = (NC contact)
1 = Limit switch 24V-active (NO contact)

**Bit 2:**
0 = K0 input high-active
1 = K0 input low-active

**Bit 3:**
0 = Standard rotation direction, rotation direction depends on the encoder connection.
1 = Rotation direction reversal

**Bit 4:**
0 = Lower half of table or the entire table
1 = Upper half of table

**Bit 5:**
0 = Deactivate function
1 = Set output 1 inactive and activate the following function: Output 1 becomes active as soon as the actual position becomes less than the value in Reg. **1xy77** (the Bit is then deleted again)

**Bit 6:**
0 = Deactivate function
1 = Set output 1 inactive and activate the following function: Output 1 becomes active as soon as the actual position becomes greater than the value in Reg. **1xy77** (the Bit is then deleted again)

**Bit 7:**
0 = Digital outputs 0 active
1 = Digital outputs 1 active

| Register 1xy05: Acceleration Ramp | |
|---|---|
| **Function** | **Description** |
| Read | Presently valid value for acceleration ramp<br><br>Value following a reset: 1000 (ms) |
| Write | Transfer of a new value for the given parameter |
| Value range | Transfer of a new value for the given parameter |

If the register **1xy05** is written into during a positioning, this has no effect on the ongoing positioning. Only at the start of the next positioning the new value for the acceleration ramp is used, i.e. when writing into register **1xy02** or in the case of the **POS** command.

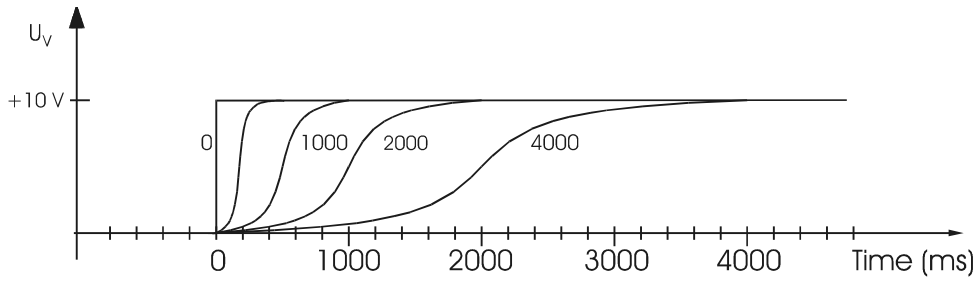



**Fig. 3: Acceleration ramp**

| Register 1xy06: Deceleration Ramp | |
|---|---|
| **Function** | **Description** |
| Read | Presently valid value for deceleration ramp<br><br>Value following a reset: 1000 (ms) |
| Write | Transfer of a new value for the given parameter |
| Value range | 1 ... 32767 |

If the register **1xy06** is written into during a positioning, this has no effect on the ongoing positioning. Only at the start of the next positioning the new value for the deceleration ramp is used, i.e. when writing into register **1xy02** or in the case of the **POS** command.

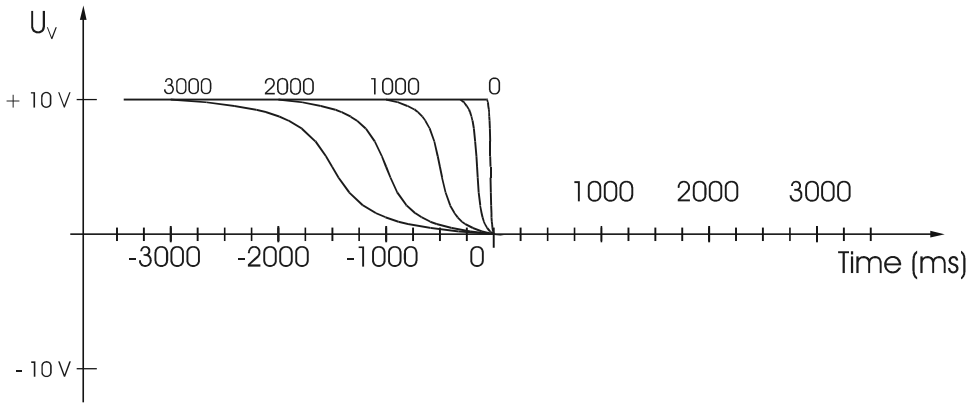



**Fig. 4: Deceleration ramp**

| Register 1xy07: Destination Window | |
|---|---|
| **Function** | **Description** |
| Read | Presently valid value of the given parameter<br><br>Value following a reset: 0 increments |
| Write | 0 ... 8388607 |
| Value range | 0 ... 8388607 |

Using the parameter destination window area accelerates the program sequence, as the condition for progression:

```
WHEN
    AXARR
```

is then fulfilled before the exact target position is reached. Despite this, the exact target position is still aimed for.

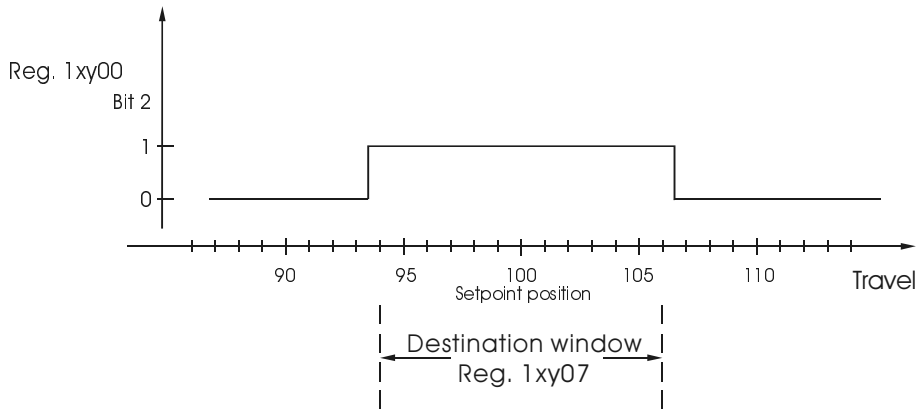



**Fig. 5: Destination window**

| Register 1xy08: Digital Offset | |
|---|---|
| **Function** | **Description** |
| Read | Presently valid value of the given parameter<br><br>Value following a reset: 0 |
| Write | Transfer of a new value for the given parameter. This new value is saved and is effective immediately. |
| Value range | 0 ... 2047 with 5 mV steps per bit |

**Note!**

The parameter "Digital Offset" is required to overcome friction.

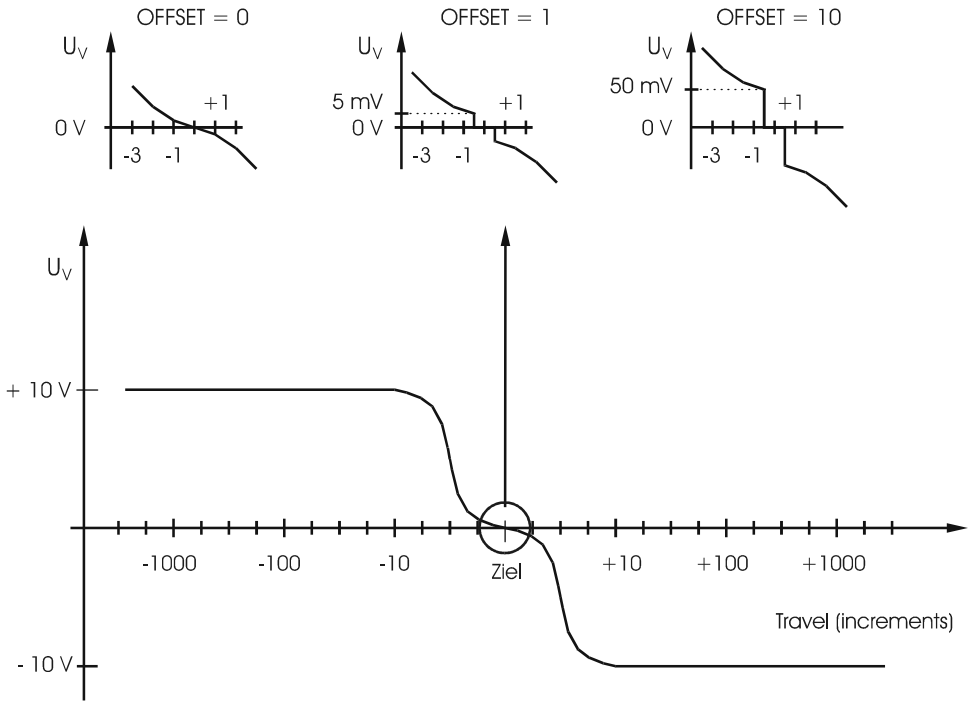



**Fig. 6: Digital offset**

| Register 1xy09: Actual Position | |
|---|---|
| **Function** | **Description** |
| Read | Present actual position of the axis;<br>in increments.<br><br>Value following a reset: 0 |
| Write | Defines a new actual position. The reference is lost. |
| Value range | -8388608 ... +8388607 |

Example:

```
WHEN
    REG 1xy09
    >
    2000
THEN
    A 3
    ...
```

| Register 1xy10: P-gain of the position controller | |
|---|---|
| **Function** | **Description** |
| Read | Presently valid value of the given parameter.<br><br>Value following a reset: 750 |
| Write | Transfer of a new P-gain output value *) of the position controller. The new value is valid immediately, i.e. also during a positioning cycle. |
| Value range | 0 to 32767 |

*) The P-gain is calculated with the following formula:

$$\text{Output value} = \frac{\Delta(\text{Setpoint""value} - \text{Actual""value})}{16} \times \frac{\text{REG 1xy10}}{128} \times 4,88\text{mV}$$

### 3.7.1 Registers for Mode 2: Full Position Control

| Register 1xy11: Setpoint speed of the position controller | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the parameter<br><br>Value following a reset: 0 |
| Write | Illegal |
| Value range | -32768 ... +32767 with the unit RPM, if the register **1xy18** is correctly set. |

| Register 1xy12: Actual speed | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 0 (1/min) |
| Write | Illegal |
| Value range | -32768 ... +32767 |

To calculate the actual speed with the module JX2-SV1, quote in this register the physical line number of the incremental encoder used. Four-fold evaluation occurs, i.e. counting is performed four times per graduation.

Example:

$$\text{Present speed} = \frac{\text{Number of counts x constant}}{\text{Time constant x line count}}$$

$$= \frac{\text{Number of counts x 30000}}{\text{Register 1xy13 x Register 1xy17}}$$

| Register 1xy13: Time Basis for the Measurement of the Actual Speed in Register 1xy12 | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 6 (3ms) |
| Write | New time basis |
| Value range | 0 .. 32767 |

| Register 1xy14: Positive Software Limit Switch | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: +8388607 |
| Write | New value for the positive software limit switch |
| Value range | -8388608 ... +8388607 |

The status of the two software limit switches can be checked in the status register **1xy00 Bit 7**. A set **Bit 7** means that one of the two software limit switches has been activated. With **Bit 14** of the status register, it is possible to switch on the function „Software limit switch“. The numerical value in increments at which the positive software limit switch becomes active is defined in the register **1xy14**. The axis then stops in the positive direction.

| Register 1xy15: Negative Software Limit Switch | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: -8388608 |
| Write | Defines a new value for the given parameter. |
| Value range | -8388608 ... +8388607 |

The status of the two software limit switches is checked in the status register **1xy00 Bit 7**. A set **Bit 7** means that one of the two software limit switches has been activated. The function „Software limit switch“ is activated with **Bit 14** of the status register. The numerical value (in increments) with which the negative software limit switch is activated is defined in the register **1xy15**. This stops the axis in the negative direction.

| Register 1xy16: Digital Analog Offset | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 0 |
| Write | New value for the given parameter. |
| Value range | -2048 ... +2047 (in 5mV steps) |

The analog offset of the servo amplifier is compensated with this register. The value entered into this register is added to the output voltage of the position controller algorithm.

| Register 1xy17: Encoder Line Count | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 500 |
| Write | Defines a new value for the given parameter. |
| Value range | 0 ... 10000 |

| Register 1xy18: Maximum Speed of the Servo-controller / Motor Combination | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 3000 (rpm) |
| Write | Defines a new value for the given parameter. |
| Value range | 0 ... 32767 |

The maximum speed which can be reached by the servo-controller/motor combination is to be entered into this register.

**Important!**

The product from the registers **1xy17** and **1xy18** must not exceed the value 15.359.000, as a higher value causes malfunctions of the servo module.

**Note!**

If the setpoint speed of 3000 rpm should be reached for an application, set a value of e.g. 3200 rpm on the servo amplifier and in the register 1xy18 so that there is a reserve in mode 2 and mode 3 for compensating the tracking error.

| Register 1xy19: Tracking Error | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 0 (increments) |
| Write | Illegal |
| Value range | -8388608 ... +8388607 |

The value of the register indicates by how many increments the axis deviates from the position of the virtual axis. This functions only in modes 2 and modes 3.

| Register 1xy20: Tracking Error Limit | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 8388607 (increments) |
| Write | Defines a new value for the tracking error limit. |
| Value range | 0 ... 8388607 |

This register defines the value from which the tracking error recognition function reacts and signals a tracking error in the status register; **Bit 3 = 1**. A tracking error is recognised when the amount of the value in register **1xy19** becomes greater than the value in register **1xy20**.
If a tracking error is recognised, enabling of the axis can be cancelled and the axis can be deenergised with **Bit 17** of the status register. **Bit 17=0**: Tracking error recognition cancels axis enabling.

| Register 1xy21: Reference Value to Register 1xy03 (maximum setpoint speed) | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 1000 |
| Write | Defines a new reference value for the values in Register 1xy03. |
| Value range | 0 .. 32767 |

| Values in Register 1xy21 | |
|---|---|
| **Value** | **Comment** |
| 1000 | The details in register **1xy03** are per mil figures of the maximum setpoint speed.<br>1000 ‰ corresponds to the maximum speed of the axis. |
| 100 | The details in register **1xy03** are percentages of the maximum setpoint speed.<br>100 % corresponds to the maximum speed of the axis. |
| **1xy21 = 1xy18** | The values in the register **1xy03** are given in rpm. |

**Note!**

Other reference values can be defined accordingly in the register **1xy21**.

### 3.7.2 Registers for Mode 1 and 3: Digital Speed Control

| Register 1xy24: P-gain of the Digital Speed Controller | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 70 |
| Write | Defines a new value of the given parameter. |
| Value range | 0 ... 32767 |

| Register 1xy25: Current Setpoint value | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 0 |
| Write | Illegal *) |
| Value range | -2048 ... +2047 |

**) Is calculated by the tachometer.

| Register 1xy26: I-component | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 1000 |
| Write | Defines a new value |
| Value range | 0 ... 32767 |

| Register 1xy27: Current limitation | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 2047<br>(corresponds to an output value of 10 V) |
| Write | Defines a new value. |
| Value range | 0 ... 2047 |

| Register 1xy28: Present I-component | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the I-component.<br><br>Value following a reset: 0 |
| Write | Defines a new value. |
| Value range | -30000 ... 30000 |

| Register 1xy29: Limitation of the I-component | |
|---|---|
| **Function** | **Description** |
| Read | Present I-component limitation<br><br>Value following a reset: 30000 |
| Write | Defines a new value for limitation of the I-component |
| Value range | 0 ... 30000 |

| Register 1xy43: Axis receives the Actual Position of the Master | |
|---|---|
| **Function** | **Description** |
| Read | Present module number of the Masters (only intelligent modules are taken into account)<br><br>Value following a reset: 0 |
| Write | New module number of the Master |
| Value range | 21 ... 42 The Master is an intelligent module<br><br>102 ... 106 The Master is a CNT module |

| Register 1xy64: Word Size of the Absolute Value Encoder (SSI) | |
|---|---|
| **Function** | **Description** |
| Read | Present word size.<br><br>Value following a reset: 0 (no absolute value encoder installed) |
| Write | New word size |
| Value range | 3 ... 25 |

| Register 1xy65: Offset to the reference position | |
|---|---|
| **Function** | **Description** |
| Read | Present offset to the reference position.<br><br>Value following a reset: 0 |
| Write | Defines a new offset. |
| Value range | -8388608 ... +8388607 |

**Note!**

The reference position of the axis relative to the zero position of the absolute-value encoder is defined with this register, but not for the incremental encoder. The following relationship applies:

Axis position = Absolute-value encoder position - Register 1xy65

| Register 1xy66: Bit Number for the Word Size | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 0 |
| Write | Defines a new value of the given parameter. |
| Value range | bit-oriented, 24 Bit |

If an absolute value encoder should use a smaller range than the bit number for the word size of the hardware, this range can be defined with the aid of the register **1xy66**. In this way, for example, a **24-Bit**-encoder can be operated as a **12-Bit** single-turn encoder. The number of bits which should actually be used is stated in register **1xy66**. In this case, the register **1xy66** must be written after register **1xy64**.

| Register 1xy67: Relative Positioning with Start Input | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 0 |
| Write | Defines a new value of the given parameter. |
| Value range | -8388608 ... +8388607 |

**Note!**

The value in the register **1xy67** indicates by how many increments the axis should continue to be positioned if 24 Volts are applied to the start input and the axis is in the **AXARR** state.

| Register 1xy68: Last Setpoint Position in the Relative Mode | |
|---|---|
| **Function** | **Description** |
| Read | Value of the last setpoint position.<br><br>Value following a reset: 0 |
| Write | Defines a new value of the given parameter. |
| Value range | -8388608 ... +8388607 |

If the process was interrupted during the relative positioning by a **AXARR** command, the absolute setpoint position of the last positioning can be read in the register **1xy68** in order to recommence the positioning. With the command **19**, the axis moves to the absolute position value given in registers **1xy68** + **1xy67** or registers **1xy68** + **1xy02**. It is then possible to continue with normal relative positioning.

| Register 1xy71: Reference Point Shift | |
|---|---|
| **Function** | **Description** |
| Read | Value of the last reference point shift.<br><br>Value following a reset: 0 |
| Write | Defines a new value of the given parameter. |
| Value range | -8388608 ... +8388607 |

Register **1xy71** at the same time writes into register **1xy02** (Setpoint Position) and register **1xy09** (Actual Position), without an axis movement having to be carried out. If write access is made to register **1xy71** the value is transferred directly to the setpoint position. The actual position is shifted by the difference between the old and the new setpoint postion so that the setpoint / actual difference is maintained.

| Register 1xy80: Deceleration Ramp Shift | |
|---|---|
| **Function** | **Description** |
| Read | Value of the last deceleration ramp shift.<br><br>Value following a reset: 0 |
| Write | Defines a new value of the given parameter. |
| Value range | 0 .. 8388607 (increments) |

With this register it is possible to shift the deceleration ramp towards the start position. The remaining travel is then traversed with the analog output value which corresponds to the value in the register 1xy08. In certain circumstances, this can be of interest for positioning with a frequency converter.

| Register 1xy81: Switch off outputs below an output value | |
|---|---|
| **Function** | **Description** |
| Read | Value of the last default value for the lower limit.<br><br>Value following a reset: 0 |
| Write | Defines a new value of the given parameter. |
| Value range | 0 .. 2047 (0 .. 10V) |

When travelling with a unipolar DAC output, both digital outputs become inactive if the DAC output value falls below the value in this register. This enables e.g. a frequency converter to be rapidly switched to braking operation if its speed setpoint value becomes too low.

| Register 1xy85: Absolute maximum position with endless and relative positioning | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 7490000 |
| Write | Defines a new value of the given parameter. |
| Value range | 0 ... 7490000 |

For the relative or endless positioning, the value of register **1xy85** is set to 0 as soon as the absolute position has exceeded the maximum value 7490000 of register **1xy85**.

| Register 1xy95: Present Position of the Master | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 0 |
| Write | Illegal |
| Value range | -8388608 ... + 8388607 |

| Register 1xy96: Present Speed of the Master | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter.<br><br>Value following a reset: 0 |
| Write | Illegal |
| Value range | -8388608 ... + 8388607 |

| Register 1xy98: Position Controller Mode | |
|---|---|
| **Function** | **Description** |
| Read | Present mode of the JX2-SV1 module<br><br>Value following a reset: 0 |
| Write | Defines a new mode with which the JX2-SV1 module works. |
| Value range | bit-oriented, 2 Bit |

**Note!**

The JX2-SV1 module can be operated in various modes.

| | |
|---|---|
| Register **1xy98 = 0** | Position control only for AXARR |
| Register **1xy98 = 1** | Mode P with digital controller |
| Register **1xy98 = 2** | Full position control without digital speed controller |
| Register **1xy98 = 3** | Full position control with digital speed controller with:<br><br>– Bit 0 = 1 tachometer in the JX2-SV1 module is addressed.<br>– Bit 1 = 1 full position control and tracking error recognition are enabled. |

| Register 1xy99: Version of the operating system of the N-SV 1 module | |
|---|---|
| **Function** | **Description** |
| Read | Present version number.<br><br>Value following a reset:<br>Version of the operating system |
| Write | Illegal |
| Value range | 23-bit-signed integer |

The version number of the operating system can be read out of this register by the JX2-SV1 module. The version number must be stated in the case of technical enquiries, e.g. 116 = Version 1.16.

# 4 Putting a servo controller axis into operation

Preparatory work:

- Disconnect the motor mechanically.
- Check the function of the Emergency Stop switch.
- Check the function of the limit switch.
- Check the axis direction.
- Check the function of the incremental encoder.
- Adjust the servo amplifier in accordance with the manufacturer's description. The following framework conditions must be met here:
  - P-gain = 0
  - Speed factor = 0
  - Offset factor = 0

## 4.1 Putting the speed control loop into operation

- Disconnect the speed setpoint value input on the servo controller (input voltage 0 V) and enable the servo amplifier by way of a command with the register **1xy01 = 1** -> Relay on. If the motor now turns at a high speed, the tacho controller has reverse polarity.
- After correct polarity is restored, the motor stops or continues to drift slowly. Now, the motor shaft remains in this position and can be hardly moved out of it. If the motor is oscillating, the gain on the servo amplifier is set too high.
- Now, cancel the „Enable“ signal with the register **1xy01 = 2**
- Relay off, and connect the speed setpoint value input.

# 4.2 Putting the position control loop into operation

- Define the polarities of the limit switches in the register **1xy04**.
- Enter the encoder line count into register **1xy17**. This realises the speed measurement.
- Enter the maximum speed of the motor in the register **1xy18**. An approximate value is sufficient in the first instance.
- In the offset adjustment, first enter the command **3** and then the command **1** into the register **1xy01**. Define the positioning with the speed 0:

  Register **1xy03 = 0** (Speed 0)
  Register **1xy02 = 500000** (Position forwards)

- 0V is now present at the output of the servo amplifier. The motor now rotates slowly.
- Now adjust the servo amplifier with the offset potentiometer ("zero point") so that the motor shaft comes to a standstill.
- Applies only to direct current: To define the rotation direction, increase the speed to 300 with the register **1xy03 = 300**. The motor must now rotate in the positive direction. If it does not, the connections on the motor and on the tacho generator must be swapped round. Rearrange the Plus / Minus cable on the motor and the Plus / Minus cable on the tacho generator.
- To adjust the speed, increase the speed to 100% with the register **1xy03 = 1000**. If the motor rotates rapidly in the positive direction, set the required maximum speed of the motor with the potentiometer “Speed” on the servo amplifier. The actual speed of the motor can be read off in the register **1xy12**. The set value can now be entered into the register **1xy18**, as well as also later in the initialisation part of the program.
- Define the counting direction of the incremental encoder. Cancel the „Enable“ signal of the servo amplifier with the command **2**. With the command **3**, set the reference point and turn the motor shaft in the positive direction. If the incremental encoder counts in the positive direction in the case of register **1xy09**, the incremental encoder is correctly connected. Otherwise, the connections K1 and K2 must be swapped round. K1- and K2- must also be swapped round in the case of the differential inputs. Now again issue the command **1** to set the setpoint and actual positions to the same value. Again issue the „Enable“ signal with the command **3**. The motor is now stationary. If it oscillates, the gain factor in the register **1xy10** must be reduced.

- Check the limit and reference switches. Activate the positive limit switch: To do this, **Bit 5** must be set in the status register **1xy00** and deleted again if the positive limit switch is no longer actuated. Depending on the bit status and the corresponding limit switch state, it is possible to examine the correctness of the polarity definition in the register **1xy04**. The same procedure applies to the negative limit switch with status bit **4** and the reference switch with the status bit **6**.

- Reconnect the motor mechanically and readjust the servo gain if necessary.

- Define the parameters „Acceleration Ramp“, „Deceleration Ramp“ and „Digital Offset“ by way of trial positioning. To do so, carry out several positioning cycles back and forth.

## 4.3 Position Controller Mode 2: Complete Position Control

In contrast to the mode **0**, the SV module in mode **2** provides complete position control. This requires the value **2** to be written into register **1xy98** when the unit is stationary. In this case, the positioning must function in the same way as in the mode **0**. The P-gain of the position control is now also set through register **1xy10**. If the positioning runs unevenly or if the axis oscillates, the value in the register **1xy10** must be reduced. Otherwise, to adjust the register, the value is increased until the axis begins to run unevenly or oscillate. Now, reduce the value in the register **1xy10** so that the axis runs smoothly.

# 5 Differences Between Modules JX2-SV1C and JX2-SV1

| Comparison between JX2-SV1 and JX2-SV1C Modules | |
|---|---|
| **JX2-SV1 module** | **JX2-SV1C module** |
| Max. encoder frequency K1, K2:<br>fixed 100 kHz | Max. encoder frequency K1, K2:<br>24 Volt with max. 500 kHz<br>5 Volt with max. 1 MHz |

An additional counter module for evaluating incremental encoders and absolute value encoders is used in module JX2-SV1C. This extends the functionality of the module by:

- Filtering incremental encoder signals in a value range of 7812 Hz up to 1 MHz.
- Single and double evaluation of the signal encoders.
- Variation of the clock frequency of the SSI interface between 55 kHz and 1 MHz. This is important for different cable lengths of the module JX2-SV1 to the absolute value encoder. The standard clock frequency has a fixed value of 333 kHz, without the extensions of the JX2-SV1C module.
- Option to change between binary and gray code in the case of the SSI absolute value encoder.
- Using the test bit of the SSI absolute value encoder.

**Note!**

Additional registers and commands are required in order to use the additional counter. These registers are defined with the number 5 at the third point in the register designation.
When using the JX2-SV1C module, the additionally installed counter is automatically used. Use of the counter is indicated by Bit 7 of the register 1x560.

| Register 1x560: Counter Calibration | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the given parameter<br><br>Value following a reset: 11(4-fold evaluation of the incremental value encoder, Gray-Code for SSI, without test bit) |
| Write | Defines the values for the counter calibration. |
| Value range | bit-oriented, 7 bit (0 .. 59) |

Meaning of the individual bits

**Bit 1,0:** Evaluation of the incremental value encoder:

00 = Pulse direction mode
01 = Single evaluation
10 = Double evaluation
11 = 4-fold evaluation

**Bit 2** 0 = Setpoint adjustment

**Bit 3** 0 = Adjustment, binary code for evaluation of the SSI absolute value encoder
1 = Adjustment, gray code for evaluation of the SSI absolute value encoder

**Bit 4** 0 = No use of the test bit for the SSI absolute value encoder

1 = Use of the test bit for the SSI absolute value encoder

**Bit 5** 0 = Uneven test bit, when Bit 4 = 1 is set
1 = Even test bit, when Bit 4 = 1 is set

**Bit 5** No function

**Bit 7** 0 = Additional counter active
1 = Additional counter

| Register 1x561: Test Bit Counter | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the parameter „Test Bit Counter“<br><br>Value following a reset: 0 |
| Write | Illegal |
| Value range | -8388608 ... +8388607 |

If an SSI absolute value encoder is used with a test bit and if the bit 4 of register 1x560 is set, the register 1x561 is displayed in the case of a test bit error. The register 1x561 must be reset by the application program.

| Register 1x562: SSI Clock Generator Frequency | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the parameter „Clock Generator Frequency“<br><br>Value following a reset: 75000 (75 kHz) |
| Write | New value of the parameter “Clock Generator Frequency“ |
| Value range | 55000 ... 1000000 (55 kHz bis 1 MHz) |

The register allows transfer of a clock frequency in the range 55 kHz to 1 MHz to a SSI absolute-value encoder.

| Register 1x563: Filter Frequency for the Incremental Value Encoder | |
|---|---|
| **Function** | **Description** |
| Read | Present value of the parameter „Filter Frequency of the Incremental Value Encoder“<br><br>Value following a reset: 0 (filter deactivated) |
| Write | New value of the parameter Filter Frequency |
| Value range | 0, 7812 .. 1000000 (0, 7812 Hz bis 1 MHz) |

This register allows filtering of transmitted signals of an incremental value encoder. Signals with a higher frequency than stated in this register are not evaluated.

# Appendices

# Appendix A: Glossary

| | |
|---|---|
| Absolute value encoder | Rotary encoder which completely measures the momentary position and not just the position change. |
| Analogue | A parameter, e.g. voltage, which is steplessly adjustable. Contrasted with digital. |
| Digital | Presentation of a parameter, e.g. time, in the form of characters or figures. This parameter in digital representation can be changed in given steps only. Contrasted with analogue. |
| Electro-Magnetic Compatibility | Definition according to the EMC regulations: "EMC is the ability of a device to function in a satisfactory way in electro-magnetic surroundings without causing electromagnetic disturbances itself, which would be unbearable for other devices in these surroundings." |
| Gray-Code | Also called cyclical binary code. A binary method of representing numbers in which each number differs from the one before only in one unit (bit) in one position. The numbers in the gray code deviate from the usual binary numbers, both codes being based on 0 and 1. The gray code is used for fault reduction when showing unit measurements, as the individual ascending numbers differ only in one bit. |
| I-component | Integral component of a controller. |
| Incremental encoder | A rotary encoder which measures the position change. Machine referencing is required here ahead of the measurement. |
| Increment | The minimum amount by which a digital variable increases. |
| Integer | Also referred to as an »integral number« or »whole number«. A positive or negative whole number, e.g. 37, -50 or 764.<br>In programming, »integer« designates a data type which represents whole numbers. Calculations with integers are considerably faster than calculations with floating point numbers. Therefore, integers are commonly used for counting and numbering procedures. Integers can have a leading sign (positive or negative) or be unsigned (positive). In addition to this, distinction is made between long and short integers depending on the number of bytes they occupy in the memory. Short integers comprise a smaller range of numbers (e.g. - 32,768 to +32,767) than long integers do (e.g. - 2,147,483,648 to +2,147,483,647).<br>At Jetter AG:<br>24 Bit = - 8388608 to + 8388607 |
| P-component | Proportional component of a controller |

| | |
|---|---|
| Process | A program or a part of it. A related sequence of steps carried out by program. |
| Process level | Level of a system overriding the field level. |
| Pull-Up resistors | A functional resistor generating defined states for measurements and evaluations. Such a resistor pulls up the potential to a high level in contrast to a pull down transistor pulling down the potential to the ground. |
| Register | A high-speed memory for a group of bits placed in a microprocessor or in another electronic device where data can be buffered for a specific purpose. At Jetter AG, usually, these are 24 bit wide storage positions in a remanent RAM. |
| Feedback | The feedback of a part of the system output to the input of the same system. In most cases, feedback is intentionally used in a system, but it can also be unwanted. In electronics, feedback is used for monitoring, control and in amplifier circuits. |
| Tracking error | Setpoint / actual difference of the position |
| Servo | The part of a servo mechanism which, controlled by the control circuit of the servo mechanism, produces the actual mechanical output variable. |
| Servo mechanism | A control system, the output variable of which is a mechanical movement. A servo mechanism based on a control circuit for controlling the position, velocity or acceleration of a mechanical element. |
| Servo controller | Controls a servo amplifier |
| Servo amplifier | Controller and drive unit for a servo (motor or hydraulics) |
| Single-turn encoder | Absolute value encoder for 1 rotation |
| Slave | A device, e.g. a JetControl 241 controller, which is controlled or influenced by another device called "Master", e.g. a JetControl 243 controller. |
| TASK | An individual application or sub-program which can be executed as an independent unit. |
| Timeout | The amount of time the system will wait for a peripheral device to respond before it detects and reports this as an error. |
| Token | An unambiguous, structured data object or a message which continuously circulates between the node of a token ring network and describes the current state of the network. |

# Appendix B: List of abbreviations

| | |
|---|---|
| A/D | **A**nalogue/**D**igital |
| AC | **A**lternating **C**urrent |
| ADC | **A**nalogue-to-**D**igital **C**onverter |
| CPU | **C**entral **P**rocessing **U**nit |
| D/A | **D**igital/**A**nalogue |
| DAC | **D**igital-to-**A**nalogue **C**onverter |
| EMC | **E**lectro **M**agnetic **C**ompatibility |
| ENC | **Enc**oder: "Coder, encryption unit " |
| ESD | **E**lectro **S**tatical **D**ischarge |
| Gnd | **G**rou**nd** GROUND |
| I/O | **I**nput/**O**utput |
| IEC | **I**nternational **E**lectrotechnical **C**ommission |
| LC | **L**iquid **C**rystal |
| LCD | **L**iquid **C**rystal **D**isplay |
| LED | **L**ight - **E**mitting **D**iode |
| Li | **Li**mit Switch |
| ms | **M**illi**s**econd |
| NUM 25 | Keyboard module for LCD 16 user interface |
| PID | **P**roportional **I**ntegral **D**ifferential (controller) |
| PWM | **P**ulse **w**idth **M**odulation |
| SELV | **S**afe **E**xtremly **L**ow **V**oltage: Voltage up to 60 V, galvanically separated from the network. |
| PLC | **P**rogrammable **L**ogical **C**ontroller |
| SSI | **S**yncronous **S**erial **I**nterface |
| SUB-D | Type name of a plug-in connector |
| SYMPAS | **Sym**bolische **P**rogramm**a**blauf**s**prache "symbolic program sequence language" |
| cf. | compare |
| e.g. | for example |

# Appendix C: Index of Illustrations

# Appendix D: Index