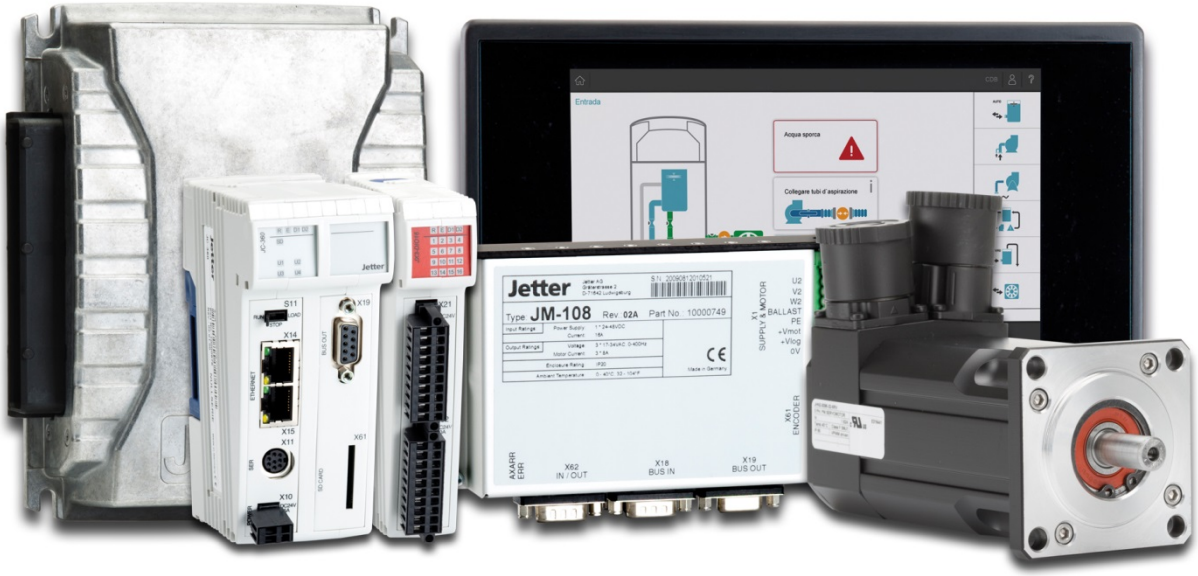
Jetter
automation



Application-Oriented Manual

JCF-SV1

JetControlFunction – SerVo module1

60883105

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1 Product description

This documentation describes the operating system function JCF-SV1 which is to substitute the axis controller module JX2-SV1.
The JCF-SV1 feature is a pure software solution and has been implemented as operating system function in various controllers of the JetControl series.
Connectivity to process variables, such as target position, actual position, reference and limit switch, is provided by JX3 modules. These modules can directly be connected to the JX3 system bus of the JetControl or remote via JX3-BN-ETH bus nodes.

2 System requirements

2.1 Hardware

The JCF-SV1 feature is available for the following controllers of the JetControl series:

Type	Number of JCF-SV1 axes	Minimum HW revision	Min. OS version
JC-340-3 - All variants	3	4.05	1.30
JC-350-4 - All variants	4	4.05	1.30
JC-350-6 - All variants	6	4.05	1.30
JC-350-8 - All variants	8	4.05	1.30
JC-365 - All variants	16	1.05	1.30
JC-365MC - All variants	16	1.05	1.30
JC-940MC - All variants	16	1	1.12
JC-970MC - All variants	16	1.09	1.12

Figure 1 - Compatibility with JetControl controllers

2.2 Software

- Operating system:
  The number of the oldest possible OS version (min. OS) can be taken from **Figure 1 - Compatibility with JetControl controllers** on page 6.

- Development environment:
  JetSym V. 5.x

- Programming
  The JCF-SV1 feature can be used by accessing the register interface described in this document.
  Commands, such as POS, and AXARR, or a Motion API are not available.
  To request the sample program described in chapter 5, please contact our hotline/sales.

2.3 Accessories

This product is an operating system function and can only be used along with the corresponding hardware.

2.4 System design

2.4.1 Hardware configuration - Example

A distributed arrangement is possible using JX3-BN-ETH modules with corresponding configuration in the JetSym Hardware Manager:

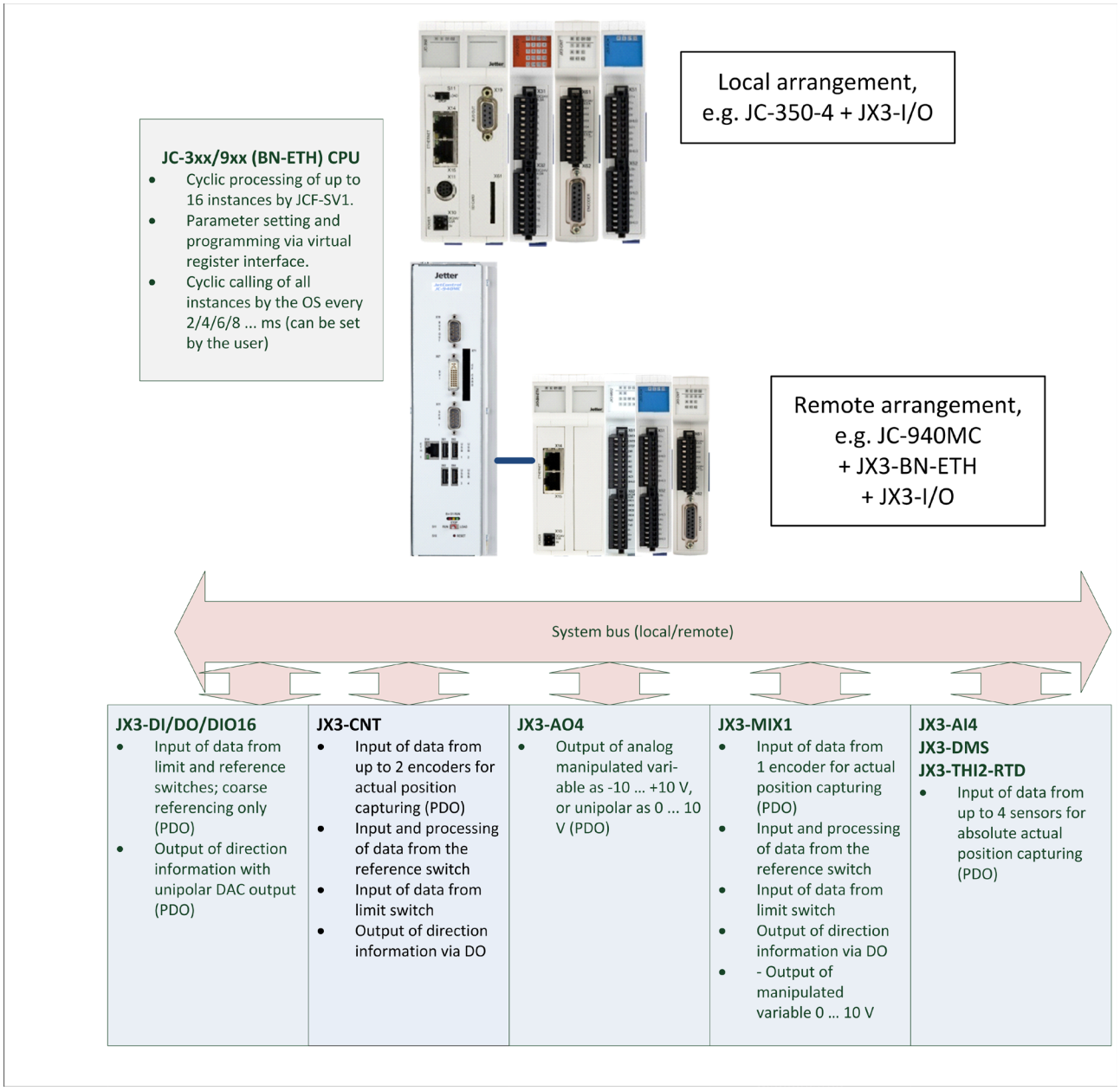


Figure 2 - Hardware configuration

2.4.2 Software design

The JCF-SV1 feature is implemented as an OS module in the JetControl operating system. It is invoked cyclically at an interval that can be defined by the user.
The user can parameterize, initialize and apply the JCF-SV1 feature via a register interface.
The global parameter registers (GP-MR) are available for initialization; for each axis, the axis module registers (A-MR) are available.

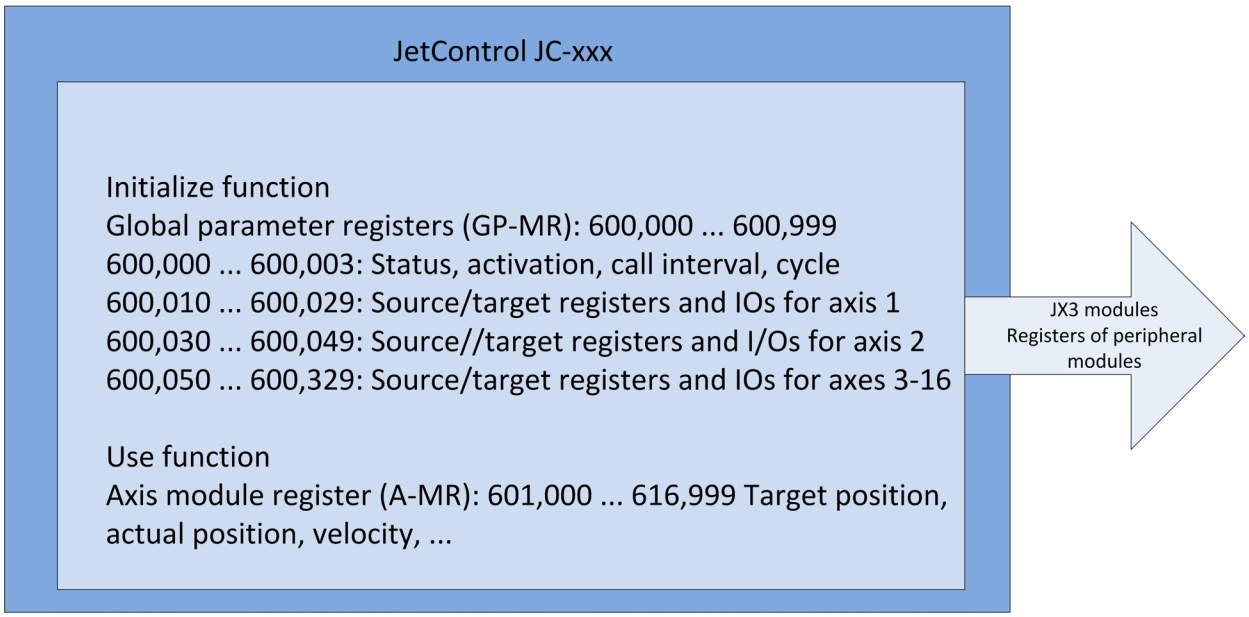


Figure 3 - Software design

2.5 Process data assignment - Overview of the JX3 modules

The following table shows an overview of the JX3 modules that can be used for input and output of process data (PDOs), such as actual position and set speed:

	Limit switch	Reference switch	Actual position/	Set speed	Rotational direction output with DAC unipolar
JX3-DI16	X	X	--	--	--
JX3-DIO16	X	X	--	--	X
JX3-DO16	--	--	--	--	X
JX3-MIX1	X	X	Encoder: relative/ analog, absolute	DAC, 12 bits, unipolar	X
JX3-AI4	--	--	16 bits, absolute	--	--
JX3-THI2	--	--	16 bits, absolute	--	--
JX3-DMS2	--	--	16 bits, absolute	--	--
JX3-AO4	--	--	--	DAC, 16 bits, unipolar/bipolar	--
JX3-CNT	--	--	SSI: absolute/ Encoder: relative	--	--

Figure 4 - JX3 modules for input/output of process data

2.6 Functional properties

This feature, basically, is a software-based proportional position feedback controller. It compares target position and actual position to output a manipulated variable taking into account gain and offset.
Only mode 0 of the JX2 module has been implemented. This means:

- no speed control;
- no tracking error recognition;
- position feedback control takes place only in the target position. Before this happens, the JCF-SV1 feature, upon starting a positioning process, calculates a set speed profile and sends it to the target value output. This corresponds to mode 0 in the JX2-SV1 module.
  The process variables are input and output via JX3 modules. These modules communicate via local JX3 bus of the CPU, or via JX3-BN-ETH bus nodes located in the field.

See Figure 2 - Hardware configuration on page 7.

2.7 Differences between JCF-SV1 and JX2-SV1

- Only mode 0 of position feedback control has been implemented. Position control takes place in the target position only.
  No tracking error recognition and speed control.

- No follower control, such as electronic gearing or table mode.

- Optimized movements for single-turn encoder absolute encoders (commands 48 ... 51) are not implemented.

- The deceleration/acceleration ramp value refers to the set speed defined in register A-MR 003, and not to the maximum speed defined in register A-MR 018. Thus, the duration of the ramps is always the same, regardless of different set speeds. Provided that the acceleration ramp does not directly turn into a deceleration ramp.

- Changes to the acceleration/deceleration ramp value can only be made if the axis is not moving (status register A-MR 000: bit 1 = 1). If the axis is moving, new values are not entered into the register!

- Reference COARSE means, that the JCF-SV1 sets the reference on the JX3 module.

- Reference FINE means that the referencing function on the involved JX3-MIX1, or JX3-CNT modules is used. For this, the reference switch must be connected to the given module.

- JX3 modules are automatically configured for referencing if the source registers for actual position have been entered correctly. The JCF-SV1 feature makes all necessary settings on the modules, such as counter activation, reference search activation, reference switch polarities.

- New status bit 2 in status register A-MR 000 indicating that the axis is in relative positioning mode.

- New status bit 19 in status register A-MR 000 indicating that the axis is in acceleration ramp mode.

- Command 4 in command register A-MR 001 "New search for reference" no longer exists.

- Deceleration ramp offset (register 80 on the JX2-SV1 module) has not been implemented.

- The number of pulses per revolution (A-MR 017) must be entered in increments output by the register of the register which the encoder is connected to. It is not allowed to enter the number of pulses of the encoder as is the case with the JX2-SV1 module.

3 Programming

The JCF-SV1 feature is parameterized via a register interface in the JetControl. You can initialize this function via register interface, commission it via JetSym and operate it via the application program.

3.1 Programming interface (registers)

Access from JetSym and the STX application program is the same as with a JX2-SV1 module, except for the cases described in chapter 2.7.
To this end, two dedicated register arrays are available to the user:

Global parameter module registers (GP-MR) in the address range 600,000 ... 600,999
for initializing the feature.

Axis module registers (A-MR) in the address range 601,000 ... 616,999
for operating the axes.

The registers mentioned above are VOLATILE and the OS will assign their default values to them each time the module is energized. Corresponding application parameters must be written to these registers from the STX program at program start.

Addressing scheme:

6	x	x	y	y	y

6 = Prefix for the JCF-SV1 function in JetControl
xx = Axis number 00 ... 16
Axis number 00 refers to the global parameter registers (GP-MR xxx) dedicated to the JCF-SV1 function.
yyy = module register number (MR) 000 ... 999 of the JCF-SV1 function

3.2 Peripheral registers and I/Os on JX3 modules

The JCF-SV1 function communicates via the module registers and the I/Os of the JX3 modules with external devices such as servo amplifiers, frequency converters, rotary encoders, as well as limit and reference switches.
These peripheral module register and I/Os are for supplying the process data, such as actual and target position, or limit and reference switches of the JX3 modules. They are addressed according to the JX3 pattern.
These peripheral module register and I/O numbers are entered into GP-MR 10 ... 17, see Source registers for actual position of axis 1 and the following chapters 3.3.7 through 3.3.13.

For local modules directly connected to the JX3 system bus, the following addressing scheme applies (also refer to the application-oriented manual "JX3 system bus"):

Register numbers for directly connected (local) JX3 modules

Register numbers for JX3 modules connected to a JC-4xx consist of the following elements:

1	0	0	x	x	z	z	z	z

Element	Purpose	Value range
xx	Module number of the module within the JX3 station	02 ... 17
zzzz	Module register number	0000 ... 9999

I/O numbers for local JX3 modules

I/O numbers for JX3 modules connected to a JC-4xx consist of the following elements:

1	0	0	0	0	x	x	z	z

Element	**Purpose**	**Value range**
xx	Module number of the module within the JX3 station	02 ... 17
zz	Module-specific I/O number	1 ... 16

For remote modules connected to the JX3 system bus via JX3-BN-ETH, the following addressing scheme applies (also refer to the application-oriented manual "JX3 system bus"):

Register numbers for distributed JX3 modules

The register number for JX3 modules connected to an Ethernet bus node consists of the following elements:

1	n	n	n	x	x	z	z	z	z

Element	**Purpose**	**Value range**
nnn	Global Node Number of the JX3-BN-ETH on the Ethernet system bus	001 ... 199
xx	Module number of the module within the JX3 station	02 ... 17
zzzz	Module register number	0000 ... 9999

I/O numbers for distributed JX3 modules

The I/O number for JX3 modules connected to an Ethernet bus node consists of the following elements:

1	n	n	n	0	1	x	x	z	z

Element	Purpose	Value range
nnn	Global Node Number of the JX3-BN-ETH on the Ethernet system bus	001 ... 199
xx	Module number of the module within the JX3 station	02 ... 17
zz	Module-specific I/O number	1 ... 16

3.3 Global parameter module registers (GP-MR)

Global parameter module registers (GP-MR) let the user specify global parameters.
They are for initializing the function once at startup. They are, for example, for setting the amount of axes (instances) to be activated and for defining the intervals of the operating system calling the function.

Another significant feature of the GP-MR is assigning the peripheral module registers and I/Os of the JX3 modules to the actual and set position and to limit and reference switches.

3.3.1 Survey of the global parameters - Address range 600,000 ... 600,999

Global parameter module register number (GP-MR)	Function	Value range	R/W/Ro
00	Status register of the JCF-SV1 function	0 ... 31 (bit-coded)	Ro
01	Activation of instances	0 ... 31 (bit-coded)	R/W
02	Call interval	0 … 255 [ms]	R/W
03	Cycle time of all instances	0 ... 65.536 [µs]	Ro
04	Reserve		
05	Reserve		
06	Reserve		
07	Reserve		
08	Reserve		
09	Reserve		
10	Source register number for actual position of axis 1	Module register number of a JX3-MIX module: 1102, 1202, 1503, JX3-CNT: 1803, 1903, 2003 JX3-AI4: 2, 3, 4, 5	R/W
11	Target register number of the manipulated variable for axis 1	Module register number of a JX3-MIX: 80, JX3-AO4: 2, 3, 4, 5	R/W
12	Input number of the negative limit switch, axis 1	Input number at the JX3 bus, see 3.2 Peripheral registers and I/Os	R/W
13	Input number of the positive limit switch, axis 1	Input number at the JX3 bus, see 3.2 Peripheral registers and I/Os	R/W
14	Input number of the reference switch, axis 1	Input number at the JX3 bus, see 3.2 Peripheral registers and I/Os	R/W
15	Output number: Digital direction select NEGATIVE - axis 1	Output number at the JX3 bus, see 3.2 Peripheral registers and I/Os	R/W
16	Output number: Digital direction select POSITIVE - axis 1	Output number at the JX3 bus, see 3.2 Peripheral registers and I/Os	R/W
17	Output number: Drive ENABLE (e.g. servo amplifier)	Output number at the JX3 bus, see 3.2 Peripheral registers and I/Os	R/W
18 ... 29	Reserve axis 1		
30 ... 49	The same as 10 ... 29 for axis 2		
50 ... 329	The same as 10 ... 29 for axis 3 ... 16		
330 ... 999	Reserve		

3.3.2 Status register - Global axis parameters

GP-MR 00 / 600000	
Function	Global status register - JCF-SV1 function
Value after reset	0
Write access	Not allowed; read only
Description	Bit-coded register displaying the global state of JCF-SV1 If one of the following errors occurs, the red ERROR LED on the controller is lit and bit 2 (error at JCF-SV1 modules) in register 200010 (enhanced error register 2) is set. Resetting errors: Fix the cause of error. Then, manually reset the bit in GP-MR 00, as well as error bit 2 in register 200010. Meaning of the bits in GP-MR 00: Bit 0 = 1: Call interval (GP-MR 02) exceeded. Bit 1 = 1: Axis instance activation (GP-MR 01) without defining the registers for set and actual position (GP-MR 10, and 11). Or at least one process data register has been assigned to an incorrect JX3 module, or to none of the modules. Bit 2 = 1: Access to a non-existent register in the GP-MR, or A-MR register array of the JCF-SV1 module. Bit 3 = 1: Access to GP-MR, or A-MR if the JetControl does not support axes (e.g. JC-340-0). Bits 4 ... 31: Reserve

3.3.3 Activating axis instances

GP-MR 01 / 600001	
Function	Activating axis instances
Value after reset	0
Write access	Bit-coded; each bit 0-15 represents one instance of the JCF-SV1 function

Description	Bit-coded register for activating individual JCF-SV1 instances. If a bit is set, the corresponding instance gets activated. Clearing a bit deactivates the corresponding instance. A drive can be used only if the corresponding bit is set. Bit 0 activates axis 1, bit 1 activates axis 2, etc. The range must be complete. A maximum of 16 instances (axes) can be activated. Provided the applied controller supports such a number of axes. Before activating an axis instance, enter the source register for actual position and the target register for set speed into the corresponding GP-MR. Notice! Do not deactivate an axis instance while the axis is moving or under control. First, stop the axis and then disable the drive (command 2 in AMR-01. Behavior of axes if you fail to disable the drive before deactivating the instance: The axis keeps its current state. The current manipulated variable continues to be output. All internal states remain unchanged. Limit switches are ignored! If the instance is reactivated, the drive resumes operation exactly from that position where it stopped before. If the axis is ahead/behind the target position when the instance is resumed, it stops. It does not automatically move to the target position entered last.

3.3.4 Call interval for all active axis instances

GP-MR 02 / 600002	
Function	Call interval for all active axis instances
Value after reset	8
Write access	2 … 255
Unit	ms
Description	This register lets the user define the call interval common to all instances. If it is not possible to meet the call interval due to CPU load, this condition is indicated in status register GP-MR 000 (bit 0=1). Note: The JCF-SV1 feature has got a higher priority than processing the STX program. Thus, it can influence the runtime behavior of your application program.

3.3.5 Computing time of all active instances

GP-MR 03 / 600003	
Function	Computing time of all active instances
Value after reset	0
Write access	Not allowed; read only
Unit	µs
Description	This register indicates the computing required by all active instances within their call interval.

3.3.6 Source register number for actual position of axis 1

<table>
<tr><th colspan="2">GP-MR 10 / 600010</th></tr>
<tr><td>Function</td><td>Source register number for actual position of axis 1</td></tr>
<tr><td>Value after reset</td><td>0</td></tr>
<tr><td>Write access</td><td>Valid module register on the JX3 bus</td></tr>
<tr><td>Unit</td><td>JX3 register number</td></tr>
<tr><td>Description</td><td>
The register number of the JX3 module as source register for the actual position must be entered into this register.
If an invalid register number is entered, bit 1 in the global status register GP-MR 00 is set.

This value can only be entered if the axis instance is not activated (bit x = 1 in GP-MR 01).

Note:
Once this register has been entered, the JCF-SV1 function checks to which module this setting applies and configures it accordingly to enable the counter/analog input. Then, it maps the input to the fast process data registers of the JX3 module (MR 2 ... 5, depending on the module, see table below).

The module can still be used by the application program. However, conflicts may occur in the case of a write access.

If a JX3-MIX or a JX3-CNT module is used for storing the actual position, there are the following allocations:
<table>
<tr><th>Module</th><th>Type</th><th>Terminal</th><th>Peripheral module registers</th><th>Mapping to JX3-MIX</th></tr>
<tr><td></td><td>Analog IN 1</td><td>X61.AI1</td><td>Prefix *) + 1102</td><td>Prefix + 2</td></tr>
<tr><td>JX3-MIX</td><td>Analog IN 2</td><td>X61.AI2</td><td>Prefix *) + 1202</td><td>Prefix + 4</td></tr>
<tr><td>JX3-MIX</td><td>Dual-channel counter</td><td>X61. CNTA+CNTB</td><td>Prefix *) + 1503</td><td>Prefix + 3</td></tr>
<tr><td>JX3-CNT</td><td>Dual-channel counter DC 24 V</td><td>X61.(A) ,B, C</td><td>Prefix *) + 1803</td><td>Prefix + 2</td></tr>
<tr><td>JX3-CNT</td><td>Dual-channel counter DC 5 V</td><td>X62</td><td>Prefix *) + 1903</td><td>Prefix + 3</td></tr>
<tr><td>JX3-CNT</td><td>SSI absolute encoder</td><td>X62</td><td>Prefix *) + 2003</td><td>Prefix + 3</td></tr>
</table>
*) Prefix for local JX3 modules:
<table>
<tr><td>1</td><td>0</td><td>0</td><td>x</td><td>x</td><td>z</td><td>z</td><td>z</td><td>z</td></tr>
</table>
xx= slot number 2 ... 17.
zzzz = module register number of the JX3 module

*) Prefix for JX3 modules via JX3-BN-ETH:
<table>
<tr><td>1</td><td>n</td><td>n</td><td>n</td><td>x</td><td>x</td><td>z</td><td>z</td><td>z</td><td>z</td></tr>
</table>
nnn = Global Node Number (GNN) 001 ... 199 of the JX3-BN-ETH
xx= slot number 2 ... 17.
zzzz = module register number of the JX3 module
</td></tr>
</table>

	Only analog values, dual-channel counters, or SSI can be used. Single-channel counters can not be used. JX3-AI4, -THI2, -DMS2: If analog modules are used, the process data registers of the respective module are predefined (MR 2 ... 5). Thus, the source registers for the actual value are the process data registers. Example: Incremental 5 V dual-channel rotary encoder connected to a local JX3-CNT: An incremental rotary encoder (DC 5 V) is connected to X62 of a JX3-CNT module. This module is located in the first slot next to a JC-350-4. Thus, the register number of the register being the source register for actual position is R100021903. Example: Incremental 5 V dual-channel rotary encoder connected to a JX3-CNT via JX3-BN-ETH: An incremental rotary encoder is connected to X62 of a JX3-CNT module. This module is located next to a JX3-BN-ETH with GNN 001. Thus, the register number of the register being the source register for actual position is R1001021903. In both cases, the JCF-SV1 function now carries out process data mapping via MR 801 on the JX3-CNT module (MR801:= 9). This way, the JCF-SV function can retrieve the actual position from the fast process data register MR03 of the JX3 module, this way avoiding the slower, asynchronous access to MR1903 which the sensor is connected to. Furthermore, the JCF-SV1 enables the counter and triggers the referencing process once the corresponding command has been issued for this axis.

3.3.7 Output register for manipulated variable of axis 1

GP-MR 11 / 600011	
Function	Output register for manipulated variable of axis 1
Value after reset	0
Write access	Valid module register on the JX3 bus
Unit	JX3 register number
Description	Before activating an axis instance, the register number of the local JX3 module as destination register for set speed must be entered into this register. If an invalid register number is entered, bit 1 in the global status register GP-MR 00 is set. This value can only be entered if the axis instance is not activated (bit x = 1 in GP-MR 01). 100030002, for example, corresponds to the first analog output on a JX3-AO4 module located in the second slot next to a JC-3xx-CPU. Note: Once this register has been entered, the STX function checks to which module this setting applies and configures it accordingly to enable and scale the analog output. The module can still be used by the application program. However, conflicts may occur in the case of a write access.

3.3.8 Input number of the NEGATIVE limit switch - axis 1

GP-MR 12 / 600012	
Function	Input number of the NEGATIVE limit switch - axis 1
Value after reset	0
Write access	Valid input number on the JX3 bus
Unit	JX3 input number
Description	If a negative hardware limit switch is to be used, a valid input number must be contained here. If a hardware limit switch is not required, reset value “0” must be entered or remain here. This value can only be entered if the axis instance is not activated (bit x = 1 in GP-MR 01). 100000402, for example, cor responds to the second digital input on a JX3-MIX1 module located in the third slot next to a JC-3xx-CPU. Note: Axis module register 4 (A-MR 004) lets you define the polarity of the switch (NC or NO).

3.3.9 Input number of the POSITIVE limit switch - axis 1

GP-MR 13 / 600013	
Function	Input number of the POSITIVE limit switch - axis 1
Value after reset	0
Write access	Valid input number on the JX3 bus
Unit	JX3 input number
Description	If a positive hardware limit switch is to be used, a valid input number must be contained here. If a hardware limit switch is not required, reset value “0” must be entered or remain here. This value can only be entered if the axis instance is not activated (bit x = 1 in GP-MR 01). 100000401, for example, corresponds to the first digital input on a JX3-MIX1 module located in the third slot next to a JC-3xx-CPU. Note: Axis module register 4 (A-MR 004) lets you define the polarity of the switch (NC or NO).

3.3.10 Input number of the REFERENCE switch - axis 1

GP-MR 14 / 600014	
Function	Input number of the REFERENCE switch - axis 1
Value after reset	0
Write access	Valid input number on the JX3 bus
Unit	JX3 input number
Description	If a reference switch is to be used, a valid input number must be contained here. If a reference switch is not required, reset value “0” must be entered or remain here. This value can only be entered if the axis instance is not activated (bit x = 1 in GP-MR 01). 100000201, for example, corresponds to the first digital input on a JX3-CNT module located in the first slot next to a JC-3xx-CPU. Note: Axis module register 4 (A-MR 004) lets you define the polarity of the switch (NC or NO). If the reference input is on a JX3-CNT or JX3-MIX module, the JCF-SV1 function activates the referencing function on this module when an automatic search for reference is triggered (commands 9-12 in A-MR 001).

3.3.11 Output number of digital direction select NEGATIVE - axis 1

GP-MR 15 / 600015	
Function	Output number of digital direction select NEGATIVE - axis 1
Value after reset	0
Write access	Valid output number on the JX3 bus
Unit	JX3 output number
Description	In the case of unipolar DAC output of a setpoint, e.g. for drives with 0-10 V setpoint input, the JCF-SV1 function automatically reverses the direction of rotation via two digital outputs. If these outputs are to be used, a valid output number on a JX3 module must be entered here to allow for NEGATIVE direction select. This value can only be entered if the axis instance is not activated (bit x = 1 in GP-MR 01). 100000405, for example, corresponds to the DIO5 on a JX3-MIX1 module located in the third slot next to a JC-3xx-CPU.

3.3.12 Output number of digital direction select POSITIVE - axis 1

GP-MR 16 / 600016	
Function	Output number of digital direction select POSITIVE - axis 1
Value after reset	0
Write access	Valid output number on the JX3 bus
Unit	JX3 output number
Description	In the case of unipolar DAC output of a setpoint, e.g. for drives with 0-10 V setpoint input, the JCF-SV1 function automatically reverses the direction of rotation via two digital outputs. If these outputs are to be used, a valid output number on a JX3 module must be entered here to allow for POSITIVE direction select. This value can only be entered if the axis instance is not activated (bit x = 1 in GP-MR 01). 100000406, for example, corresponds to the DIO6 on a JX3-MIX1 module located in the third slot next to a JC-3xx-CPU.

3.3.13 Output number of digital drive ENABLE - axis 1

GP-MR 17 / 600017	
Function	Output number of digital drive ENABLE - axis 1
Value after reset	0
Write access	Valid output number on the JX3 bus
Unit	JX3 output number
Description	This register lets you define a digital output for switching the drive hardware enable signal ON or OFF. If a valid output number is entered here, command 1 (Power enable) in the command register of the axis (A-MR 001) sets the corresponding output, command 2 clears it. This value can only be entered if the axis instance is not activated (bit x = 1 in GP-MR 01). 100000403, for example, corresponds to the DIO3 on a JX3-MIX1 module located in the third slot next to a JC-3xx-CPU.

3.3.14 Reserved registers

GP-MR 18 … 29 / 600018 … 600029	
Function	Reserved
Value after reset	0
Write access	-
Unit	-
Description	-

3.3.15 Global parameter registers - axis 2

GP-MR 30 … 49 / 600018 … 600029	
Function	Global parameter registers - axis 2
Value after reset	See axis 1
Write access	See axis 1
Unit	See axis 1
Description	See axis 1

3.3.16 Global parameter registers - axes 3 ... 16

GP-MR 50 ... 329 / 600050 ... 600329	
Function	Global parameter registers - axes 3 ... 16
Value after reset	See axis 1
Write access	See axis 1
Unit	See axis 1
Description	See axis 1

3.4 Axis module registers (A-MR)

This chapter describes individual module registers within the JCF-SV1 function that let you address an axis. As to their numbering system and function, they largely correspond to aJX2-SV1 module.

3.4.1 Axis module registers (A-MR) - Overview

Overview of axis module registers (A-MR):
Address range 601.000 … 616.999
Axis 1: 601,000 … 601,999
Axis 2: 602,000 … 602,999
Axis 16: 616,000 … 616,999

Number of axis module register (A-MR)	Function	Value range	R/W/Ro
000	Status register	0 ... 31 (bit-coded)	Ro
001	Command register	0 ... 255	R/W
002	Target position	-1,073,741,824 … 1,073,741,823	R/W
003	Set speed	0 ... 32,767	R/W
004	Input polarities	0 ... 31 (bit-coded)	R/W
005	Acceleration ramp	0 ... 32,767	R/W
006	Deceleration ramp	0 ... 32,767	R/W
007	Target window	0 … 1,073,741,823	R/W
008	Digital offset	0 ... 2047	R/W
009	Actual position	-1,073,741,824 … 1,073,741,823	Ro
010	P gain of position feedback controller	0 ... 32767	R/W
011	Set speed of position feedback controller (manipulated variable)	-32,768 … +32,767	Ro
012	Actual speed	+- A-MR 018	Ro
013	Time base for measuring the actual speed (number of cycles)	2 ... 255	R/W
014	Positive software limit switch	-1,073,741,824 ... +1,073,741,823	R/W
015	Negative software limit switch	-1,073,741,824 ... +1,073,741,823	R/W
016	Analog offset	-32,768 ... +32,767	R/W
017	Number of increments per encoder revolution	1 ... 65,535	R/W
018	Maximum Speed	1 ... 32,767	R/W
021	Reference value related to register A-MR 003 Set Speed	1 ... 32,767	R/W
068	Last setpoint position in relative mode	-1,073,741,824 ... +1,073,741,823	Ro
071	Reference point shift	-1,073,741,824 ... +1,073,741,823	R/W
081	Disabling digital direction outputs below a certain setpoint	0 … 32,768	R/W
085	Absolute maximum position (endless positioning, relative positioning)	0 ... 1,073,741,823	R/W

3.4.2 Status register

A-MR 000 / 6xx000 (xx = Axis number 01 ... 16)	
Function	Status register of axis
Value after reset	Current axis state
Write access	Not allowed; read only
	Bit-coded register indicating the current state of the axis
Description	Meaning of the individual bits: Bit 0: Referencing TRUE: Reference is set. If search for reference has been completed successfully OR if command 3 is set in command register 01. FALSE: No reference position set. DEFAULT state when the controller is powered up, OR during search for reference triggered by command 9, 10, 11, 12, OR if endless positioning mode has been triggered by command 56/57. Bit 1: AXARR Default: FALSE TRUE: - If the axis has reached the target window (A-MR 007) as a result of a positioning process (write access to A-MR 002) - If the axis is at standstill following command 0, 3, 5, 6, 9 … 12. FALSE: If a positioning process has been started (by entering a target position (A-MR 002), or if one of the commands 9 ... 12, 56, 57 has been issued. Bit 2: Relative positioning is activated (command 17 in command register A-MR 001) Bit 3: Not assigned Bit 4: Negative hardware limit switch is active Bit 5: Positive hardware limit switch is active Bit 6: Reference switch is active Bit 7: One of the software limit switches is/was active Bit 8: One of the hardware limit switches was active Bit 9: Position controller is enabled (command 1 in A-MR 001) Bit 10: Control after AXARR is enabled (command 7 in A-MR 001) Bit 11: The controller is enabled Bit 12: Machine referencing error Bit 13: Busy, applies only to commands 9 ... 12 Bit 14: Software limit switches are activated Bit 15: Not assigned Bit 16: Axis is in deceleration ramp Bit 17: Not assigned Bit 18: Not assigned Bit 19: Axis is in acceleration ramp Bit 20: Not assigned Bit 21: Not assigned Bit 22: Not assigned Bit 23: Not assigned

3.4.3 Command register

A-MR 001 / 6xx001 (xx = Axis number 01 ... 16)	
Function	**Command register of the given axis**
Value after reset	0
Read access	Command entered last
Write access	New command
Value range	0 ... 255
Description	**0: The axis stops according to the set deceleration ramp**. Once it has reached its internally calculated target position, it sets status bit AXARR (bit 1 in the status register). **1: Power Enable.** => Sets status register bit 11 and activates the Power Enable output. If command 1 is issued for the first time after powering up the controller, the drive issues setpoint 0 plus the offsets from A-MR 8 + A-MR 16 The position is not controlled yet. Position feedback control will be activated not before a target position is set or one of the AXARR commands with position feedback control (command 0 + 5) or reference commands (3, 9 … 12) is issued. **2: Clearing Power Enable.** The drive remains active, but it does not output a target position (manipulated variable = 0). It clears the Power Enable output. **3: Setting the reference position.** The reference position is set at the current position of the axis. At the same time, actual and target position of the axis are set to 0. Status bit 16 (axis is in deceleration ramp) is cleared. Status bit AXARR (bit 1 in the status register) is set. **4: Reserved** **5: Stopping the axis without deceleration ramp.** The axis is stopped without deceleration ramp and position feedback control (**AXARR** command) is active. Status bit **AXARR** (bit 1 in the status register) is set. **6: Stopping the axis without deceleration ramp and position feedback control** The axis is stopped and its position is not controlled (analog output = 0 V). Status bit AXARR (bit 1 in the status register) is set. **7: Upon positioning, the position is controlled at the target point (DEFAULT after power-up).** **8: Upon positioning, the position is not controlled at the target point**. Status bit AXARR (bit 1 in the status register) is NOT set when the axis has come to a standstill. **9: Automatic machine referencing** at the speed specified in register A-MR **003.**The axis starts in POSITIVE direction taking into account the reference switch without delay. 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 and actual and target 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 **A-MR 000**. Commands 0, 3, 5, 6 let you abort the machine referencing process. **10: Automatic machine referencing** at the speed specified in register A-MR **003** The axis starts in NEGATIVE direction taking into account the reference switch without delay. 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 actual and target positions are then set to 0. • the positive limit switch is actuated, whereby the machine referencing ends, the target

	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 A-MR **000**. Commands 0, 3, 5, 6 let you abort the machine referencing process. **11: Automatic machine referencing** at the speed specified in register A-MR **003.** The axis starts in positive direction towards the positive limit switch ignoring the reference switch. At the positive limit switch, the axis reverses its direction and moves in negative direction until it actuates the reference switch. When the negative limit switch is actuated, machine referencing is terminated and an error (Bit 12) is signaled in status register A-MR **000**. Commands 0, 3, 5, 6 let you abort the machine referencing process. **12: Automatic machine referencing** at the speed specified in register **A-MR 003**.The axis starts mowing in negative direction towards the negative limit switch ignoring the reference switch. At the negative limit switch, the axis reverses its direction and moves in positive direction until it actuates the reference switch. When the positive limit switch is actuated, machine referencing is terminated and an error (Bit 12) is signaled in status register A-MR **000**. Commands 0, 3, 5, 6 let you abort the machine referencing process. **13:** Function"**Axis control at limit switch position**" **OFF:** When the limit switch is reached, 0 V will be output. **14:** Function"**Axis control at limit switch position**" **ON:** When a limit switch is reached, the axis remains stationary under control at the current position (DEFAULT on power-up). **15 ... 16: Reserved** **17: Enabling "Relative positioning mode".** The newly entered target position relates to the target position entered last, but not to the reference position. **18: Enabling "Absolute positioning mode".** The newly entered target position relates to the reference position. (DEFAULT after power-up). **19: Continuing the interrupted positioning motion.** If a positioning motion is interrupted by command 0, 5, 6, 56, or 57, this motion can be continued by command 19. Please note, that command 56/57 (endless positioning) will clear the reference position. **20: Reserved** **21: Reserved** **22: Stop at reference position - Enabled** During machine referencing the axis stops at the reference position (DEFAULT after power-up). **23: Stop at reference position - Disabled** The axis does not stop at the reference point during a machine referencing cycle, yet continues to travel to the setpoint (A-MR 002). **24 ... 27: Reserved** **28: Machine referencing, COARSE** The signal from the reference switch input is applicable, and not the K0 signal from the rotary encoder, for instance, if a JX3-MIX module is used as counter input. In referencing, the actual position is set on the module where the rotary encoder is connected to. **29: Machine referencing, FINE (DEFAULT after power-up)** Both, the signal from the reference switch input, and the K0 signal from the rotary encoder are applicable. In referencing, the actual position is set on the module where the rotary encoder is connected to. **30 ... 55: Reserved.** **56: Activating endless positioning in positive direction** Please note that reference position, and status bit 0 in the status register are cleared. **57: Starting endless positioning in negative direction** Please note that reference position, and status bit 0 in the status register are cleared.

	58 ... 69: Reserved! **70: Enabling unipolar DAC output** **71: Enabling bipolar DAC output** (DEFAULT after power-up) **72 ... 73: Reserved** **74: Digital output 1 ON** **75: Digital output 1 OFF** **76: Digital output 2 ON** **77: Digital output 2 OFF** **78: Enabling linear ramps** **79: Enabling sine-square ramps (DEFAULT after power-up)** **80: Enabling software limit switch => sets bit 14 in A-MR 000** **81: Disabling software limit switch => clears bit 14 in A-MR 000**

3.4.4 Target position register

A-MR 002 / 6xx002 (xx = Axis number 01 ... 16)	
Function	Target position of axis
Value after reset	0
Read access	Target position entered last
Write access	New target position
Value range	-1,073,741,824 … 1,073,741,823
Description	When a new target position is entered here, it will take immediate effect. If the axis is at standstill, it starts moving according to the set acceleration ramp (A-MR 005) and, at the corresponding point in time, switches over to deceleration ramp (A-MR 006). Once the axis reaches the target position, position feedback control is activated. **⚠ WARNING** If a new target position is entered, while the axis is moving, the axis movement directly changes over to the new target position **without stopping** and **without acceleration ramp**.

3.4.5 Set speed register

A-MR 003 / 6xx003 (xx = Axis number 01 ... 16)	
Function	Set speed of the axis
Value after reset	300
Read access	Set speed entered last
Write access	New set speed
Value range	0 .... [content of A-MR 021 (reference value related to maximum set speed)]
Description	The entered value refers proportionately to the maximum possible set speed entered in A-MR 021. The value is immediately valid and has the following effect: • If the axis is at standstill at the moment: The new value is saved for the next positioning operation. • If a positioning operation is taking place: The new set speed is applied. The changeover takes place according to the set acceleration ramp (A-MR 005). This applies to the increase or reduction of the setpoint speed.

3.4.6 Input polarities of limit and reference switches

A-MR 004 / 6xx004 (xx = Axis number 01 ... 16)	
Function	Setting the polarities for limit and reference switches
Value after reset	0
Read access	Polarity entered last
Write access	New polarity
Value range	Bit-oriented; at the moment only the lowest 2 bits (0 ... 1) are used
Description	Meaning of the individual bits Bit 0: 0 = Reference input is active at 0 V (NC contact) 1 = Reference input is active at 24 V (NO contact) Bit 1: 0 = Limit switch is active at 0 V (NC contact) 1 = Limit switch is active at 24 V (NO contact)

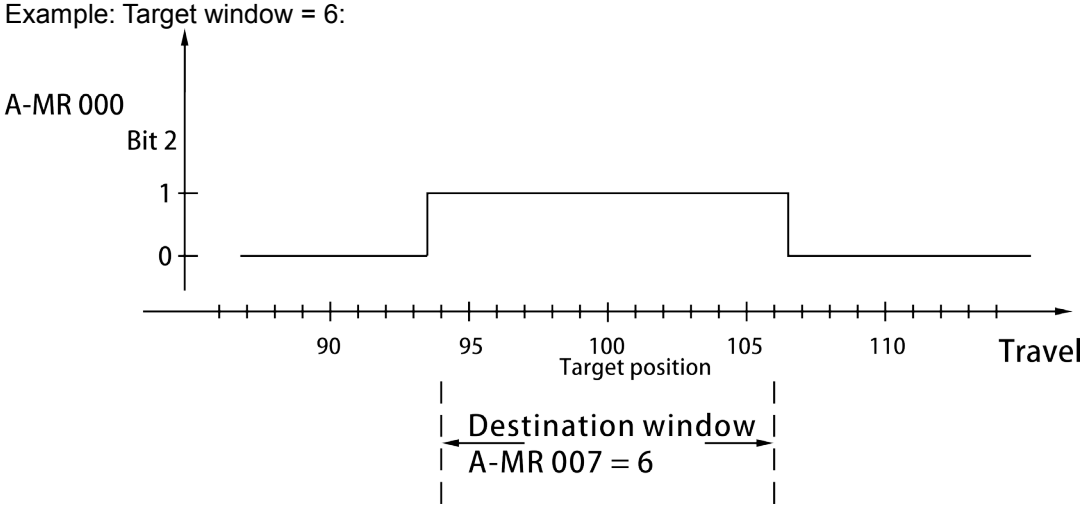
3.4.7 Acceleration ramp

A-MR 005 / 6xx005 (xx = Axis number 01 ... 16)	
Function	Acceleration ramp duration
Value after reset	1000 [ms]
Read access	Acceleration ramp duration entered last
Write access	New acceleration ramp duration
Value range	0 … 32,767 [ms]
Description	New values can be entered into this register only if the axis is at standstill (state AXARR, bit 1 in the status register (A-MR 000) is set). This register doesn't accept new values while the axis is moving. The value entered defines the time period in milliseconds (ms) within which the axis should changeover from current speed to desired set speed (A-MR 003). Please note that in case of long acceleration and deceleration ramps the ramps may overlap and that sometimes the desired set speed may not be reached. Note: Acceleration and deceleration ramps (A-MR 006) are calculated using different algorithms. In calculating the deceleration ramp, the amount of increments per encoder revolution (A-MR 017) and the maximum speed (A-MR 018) are taken into account. At entering values, take the mounting situation of the encoder (gear ratio/motor/mechanics/mechanical system) into account.

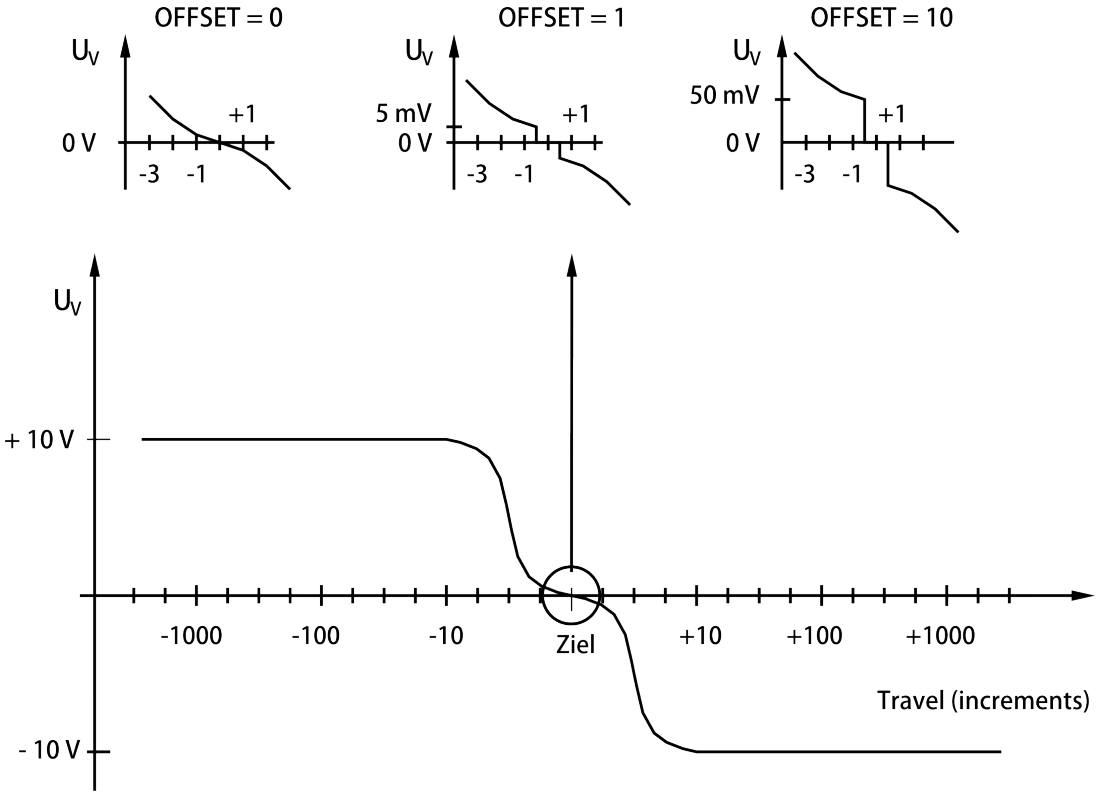
3.4.8 Deceleration ramp

A-MR 006 / 6xx006 (xx = Axis number 01 ... 16)	
Function	Deceleration ramp duration
Value after reset	1000 [ms]
Read access	Deceleration ramp duration entered last
Write access	New deceleration ramp duration
Value range	0 … 32,767 [ms]
Description	New values can be entered into this register only if the axis is at standstill (state AXARR, bit 1 in the status register (A-MR 000) is set). This register doesn't accept new values while the axis is moving. The value entered defines the time period in milliseconds (ms) within which the axis should come to a standstill. Please note that in case of long acceleration and deceleration ramps the ramps may overlap and that sometimes the desired set speed may not be reached. Note: Acceleration and deceleration ramps (A-MR 006) are calculated using different algorithms. In calculating the deceleration ramp, the amount of increments per encoder revolution (A-MR 017) and the maximum speed (A-MR 018) are taken into account. At entering values, take the mounting situation of the encoder (gear ratio/motor/mechanics/mechanical system) into account.

3.4.9 Target window

A-MR 007 / 6xx007 (xx = Axis number 01 ... 16)	
Function	Area around the target position, where the status AXARR becomes 1.
Value after reset	0 [increments]
Read access	Target window entered last
Write access	New target window
Value range	0 ... 1,073,741,823 [increments]
Description	If during a positioning process the axis at the end of the deceleration ramp reaches the target window, status bit AXARR (A-MR 000, bit 1) is set. The target window can be used as step enabling condition in the execution of the application program. The axis remains under control in the target position until a new motion command is issued. Example: Target window = 6: 

3.4.10 Digital offset

A-MR 008 / 6xx008 (xx = Axis number 01 ... 16)	
Function	The "Digital Offset" parameter may be be useful for overcoming friction.
Value after reset	0 [digits]
Read access	Target window entered last
Write access	New target window
Value range	0 ... 2,047 [digits]
Description	Towards the end of a positioning cycle, it may happen that the axis no longer can overcome mechanical friction. The "Digital Offset" parameter can help you solve this problem. The digital offset value is added to the manipulated variable calculated by the servo drive controller as long as the control deviation > 0. Example of a digital offset where the maximum manipulated variable is 2047 digits (analog output JX3-MIX).  Note! The digital offset is also output in cases where the axis has already been instantiated (bit x = 1 in GP-MR 01), but Power Enable has not yet taken place.

3.4.11 Actual position

A-MR 009 / 6xx009 (xx = Axis number 01 ... 16)	
Function	This register indicates the present actual position of the axis in increments
Value after reset	0 [increments]
Read access	Present actual position
Write access	Not allowed; read only
Value range	-1,073,741,824 ... +1,073,741,823 [increments]
Description	This register shows the actual position based on the value returned by a JX3 module. The value indicated in the Actual Position register is not necessarily the same as the value in the source register on the JX3 module. It is influenced by overflows or by commands for referencing, relative positioning, endless positioning, etc. Therefore, proceed with due caution when entering values into the source register on the JX3 module.

3.4.12 Position feedback controller - P-gain

A-MR 010 / 6xx010 (31)	
Function	This parameter lets you define the P-gain of the position feedback controller
Value after reset	750 [1]
Read access	Present P-gain factor
Write access	New P-gain factor
Value range	1 ... 32,767 [1]
Description	The position feedback controller of the JCF-SV1 module is a mere proportional-action controller. At the moment, only mode 0 is implemented. That is, the position feedback controller will not become active until the axis has reached its target position (difference between target and actual position = 0), or has exceeded it (difference between target and actual position > 0).

3.4.13 Set speed of the position controller

A-MR 011 / 6xx011 (xx = Axis number 01 ... 16)	
Function	This register lets you read out the manipulated variable currently output by the position feedback controller
Value after reset	0 [digits]
Read access	Current value of manipulated variable (set speed)
Write access	Not allowed; read only
Value range	-32,768 ... 32,767 [digits] max., depending on the target register of the JX3 module
Description	This register lets you read out the manipulated variable currently output by the position feedback controller. The variable consists of the value calculated by the controller, and the offsets defined in registers A-MR 008, and A-MR 016.

3.4.14 Actual speed of the axis

A-MR 012 / 6xx012 (xx = Axis number 01 ... 16)	
Function	This register lets you read out the actual speed of the axis
Value after reset	0 [ ]
Read access	Current value of actual speed
Write access	Not allowed; read only
Value range	+- value in register A-MR 013 (maximum speed of the axis)
Description	This register lets you read out the actual speed of the axis. Its calculation is based on the actual position returned by the corresponding JX3 module, and the number of increments per revolution defined in register A-MR 017, and relates to the maximum speed defined in register A-MR 018. At entering values, take the mounting situation of the encoder (gear ratio/motor/mechanics/mechanical system) into account.

3.4.15 Number of samples for calculating the actual speed

A-MR 013 / 6xx013 (xx = Axis number 01 ... 16)	
Function	Number of samples used for calculating the actual speed
Value after reset	6 [1]
Read access	Actual number of samples
Write access	New number of samples required for refreshing A-MR 012.
Value range	2 ... 255 [1]
Description	This register lets you define the number of measuring cycles (samples) which will be used for calculating the actual speed. Thus, the refresh rate for indicating the actual speed is A-MR 013 * GP-MR 02 (call interval of position feedback controllers).

3.4.16 Positive software limit switch

A-MR 014 / 6xx014 (xx = Axis number 01 ... 16)	
Function	This parameter lets you define the value at which the positive software limit switch becomes active.
Value after reset	1,073,741,823 [increments]
Read access	Actual value of the positive software limit switch
Write access	New value of the positive software limit switch
Value range	-1,073,741,824 ... 1,073,741,823 [increments]
Description	Command 80 in status register A-MR 001 lets you ENABLE the two software limit switches. Command 81 in status register A-MR 001 lets you DISABLE the two software limit switches. Status bit 14 in A-MR 000 indicates whether the software switches are enabled or disabled. When the axis actuates a software limit switch, bit 7 in status register A-MR 000 is set. When the axis actuates the positive limit switch, it stops and can move in negative direction only.

3.4.17 Negative software limit switch

A-MR 015 / 6xx015 (xx = Axis number 01 ... 16)	
Function	This parameter lets you define the value at which the negative software limit switch becomes active.
Value after reset	-1,073,741,824 [increments]
Read access	Actual value of the negative software limit switch
Write access	New value of the negative software limit switch
Value range	-1,073,741,824 ... 1,073,741,823 [increments]
Description	Command 80 in status register A-MR 001 lets you ENABLE the two software limit switches. Command 81 in status register A-MR 001 lets you DISABLE the two software limit switches. Status bit 14 in A-MR 000 indicates whether the software switches are enabled or disabled. When the axis actuates a software limit switch, bit 7 in status register A-MR 000 is set. When the axis actuates the positive limit switch, it stops and can move in positive direction only.

3.4.18 Analog offset

A-MR 016 / 6xx016 (xx = Axis number 01 ... 16)	
Function	Value for compensating the analog offset of the servo drive
Value after reset	0 [digits]
Read access	Actual value of the analog offset
Write access	New value of the analog offset
Value range	-32,768 ... 32,768 [digits]
Description	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. Notice! The analog offset is also output in cases where the axis has already been instantiated (bit x = 1 in GP-MR 01), but Power Enable has not yet taken place. Thus, this register can be used to output a target speed for the servo drive via JetSym Setup.

3.4.19 Number of increments per encoder revolution

A-MR 017 / 6xx017 (xx = Axis number 01 ... 16)	
Function	Value for compensating the analog offset of the servo drive
Value after reset	500 [increments]
Read access	Actual number of increments per encoder revolution
Write access	New number of increments per encoder revolution
Value range	1 ... 65,535 [increments]
Description	In order for deceleration ramp and actual speed to be computed correctly, the actual number of increments per encoder revolution must be entered into this register. That is, the value returned by the source register on the JX3 module per encoder revolution, but NOT the encoder line count! Example: A 2-channel incremental encoder with a resolution of 125 lines per revolution is connected to a JX3-MIX or JX3-CNT. The encoder pulses are subject to a quadruple evaluation by the JX3-MIX/CNT module. That is, a value of 500 must be entered into A-MR 017. At entering values, take the mounting situation of the encoder (gear ratio/motor/mechanics/mechanical system) into account.

3.4.20 Maximum speed of the axis

A-MR 018 / 6xx018 (xx = Axis number 01 ... 16)	
Function	Maximum speed of the axis
Value after reset	3000 [user-specific]
Read	Actual maximum speed
Write access	New maximum speed
Value range	1 ... 32,767 [user-specific]
Description	This register lets you enter the maximum speed that can be reached by the given servo drive and motor combination. At entering values, take the mounting situation of the encoder (gear ratio/motor/mechanics/mechanical system) into account.

3.4.21 Reference value related to maximum set speed

A-MR 021 / 6xx021 (xx = Axis number 01 ... 16)	
Function	This parameter lets you scale the set speed
Value after reset	1000 [per mil]
Read access	Actual reference value
Write access	New reference value
Value range	1 ... 32,767 [user-specific]
Description	This parameter lets you define a reference value for the set speed in register A-MR 003. Examples: If you enter here a value of 1000, the maximum value in A-MR 003 is 1000, too. This means, the scaling factor is in per mil. If A-MR 018, representing the speed in RPM, holds a value of 3,000 and if you enter a value of 3,000 into A-MR 021 as reference value, the set speed value in A-MR 003 is indicated in RPM (scaling factor of 1). At entering values, take the mounting situation of the encoder (gear ratio/motor/mechanics/mechanical system) into account.

3.4.22 Most recent target position in the relative mode

A-MR 068 / 6xx068 (xx = Axis number 01 ... 16)	
Function	Saves the most recent target position in the relative mode
Value after reset	0 [increments]
Read access	Most recent target position
Write access	Not allowed; read only
Value range	-1,073,741,824 ... 1,073,741,823 [increments]
Description	If the process was interrupted during the relative positioning by an AXARR command, the absolute target position of the last positioning process can be retrieved from register A-MR 068 in order to resume the positioning process. When in A-MR 001 command 19 is issued, the axis moves to the absolute position resulting from the values in registers A-MR 068 and A-MR 002. Then, the axis can resume the normal relative positioning process.

3.4.23 Reference point shift

A-MR 071 / 6xx071 (xx = Axis number 01 ... 16)	
Function	Lets you define the shift value for both, target and actual position
Value after reset	0 [increments]
Read access	Most recent shift value
Write access	New shift value
Value range	-1,073,741,824 ... 1,073,741,823 [increments]
Description	New values can be entered into this register only if the axis is at standstill (state AXARR, bit 1 in status register A-MR 000 is set). A previous difference between target value and actual value is ignored.

3.4.24 Threshold for disabling digital direction outputs

A-MR 081 / 6xx081 (xx = Axis number 01 … 16)	
Function	Lets you define the threshold for disabling the digital direction outputs.
Value after reset	0 [digits]
Read access	Most recent threshold value
Write access	New threshold value
Value range	0 ... 32,767 [digits]
Description	When an axis is travelling by unipolar DAC output, both digital outputs are disabled if the DAC output value falls below the threshold value in this register. This feature lets you quickly switch a servo drive to braking operation.

3.4.25 Absolute max. position

A-MR 085 / 6xx085 (xx = Axis number 01 … 16)	
Function	Overflow value for actual position
Value after reset	7,490,000 [increments]
Read access	Most recent maximum position
Write access	New absolute maximum position
Value range	0 ... 1,073,741,823 [increments]
Description	In the case of relative or endless positioning, the actual position in A-MR 009 is set to 0 as soon as the absolute position has exceeded the maximum value in A-MR 085. This feature can be applied to modulo or endless axes.

3.5 Sample program using local JX3 modules

This chapter provides a brief description of a sample project.

3.5.1 Project name

The name of the project is "JCF_SV1_Sample.wsp". This project is located in the ZIP file "JCF-SV1_Sample.zip".

3.5.2 Hardware configuration

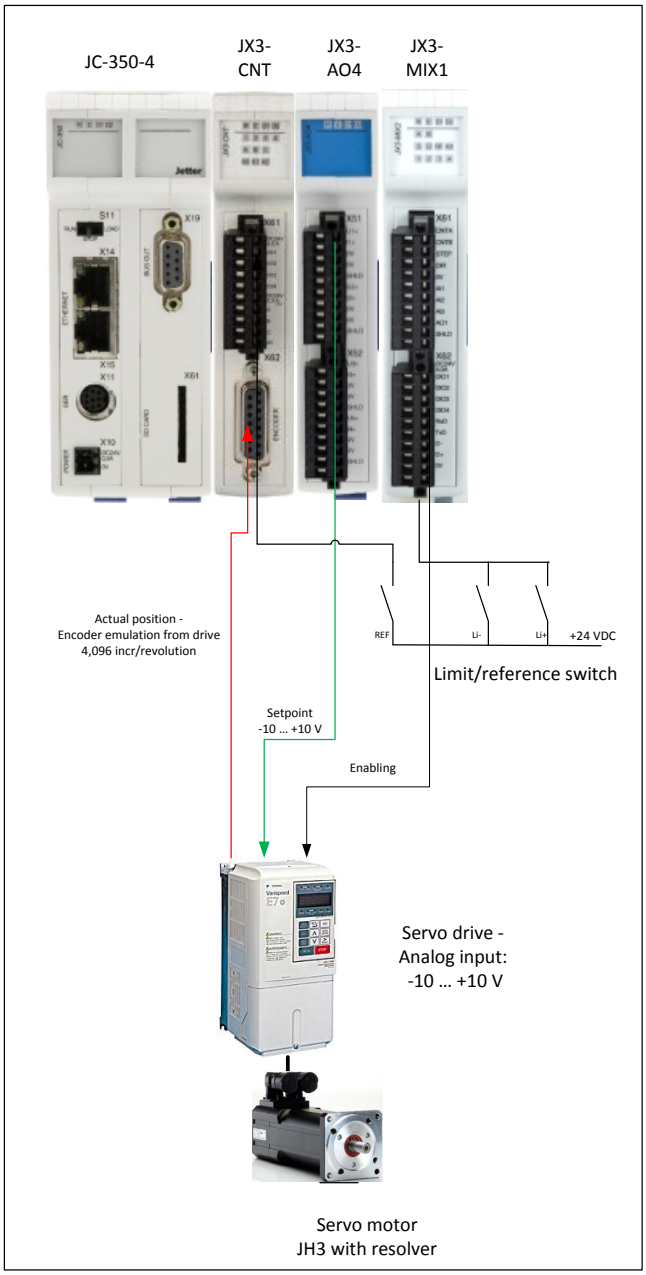


Figure 5 - Hardware configuration

3.5.3 Main file

After successful initialization by "t_init" (Autorun Task), the task "t_automatik" is started from there, which reverses the axis between "n_Endpos" and "n_Startpos".
The positioning is started by writing into the axis module register (A-MR) "nSollpos".in program lines 38 and 41.

```
1  // ---------------------------------------- //
2  //              JCF_SV1 Sample              //
3  // ---------------------------------------- //
4  //                                          //
5  // ---------------------------------------- //
6
7  // ---------------------------------------- //
8  //              Used Hardware               //
9  // ---------------------------------------- //
10 //  CPU: JC-350-4, HW-Rev: 4.05, OS: 1.30   //
11 //                                          //
12 //  Modules on JX3-Bus:                     //
13 //  Slot #1:    JX3-CNT                     //
14 //  Connected: - Encoder emulation 5V-RS422 //
15 //                 of the amplifier         //
16 //               -Reference switch          //
17 //                                          //
18 //  Slot #2:    JX3-AO4                     //
19 //  Connected: - Setpoint  +- 10V for       //
20 //                 anal. amplifier          //
21 //                                          //
22 //  Slot #3 :   JX3-MIX1                    //
23 //  Connected:  - Limit switches            //
24 //              - Enable amplifier          //
25 // ---------------------------------------- //
26
27 #include ".\ConstVar.stxp"
28 #include ".\t_init.stxp"
29 #include ".\t_simulation.stxp"
30
31 Task t_automatic; // Will be started from t_Init
32
33 // When Bit b_start is set, the axis starts to reverse between
34 // n_StartPosition and n_EndPosition
35 loop
36     when b_Start continue; // Wait for b_start
37         nSetSpeed := n_Velocity;     // load the set speed
38         nTargetPos := n_EndPosition;     // start the positioning to n_EndPosition
39     when nA_MR_status.1 = TRUE continue;
40         delay (t#1000ms);
41         nTargetPos := n_StartPosition;  // start the positioning to n_StartPosition
42     when nA_MR_status.1 = TRUE continue;
43         delay (t#1000ms);
44     End_Loop;
45 end_task;
46
```

3.5.4 Variables

```
var
//___________  GP-MR Registers ___________________

    nGP_MR_status            : int at %vl 600000;
    nInstanceActivation      : int at %vl 600001;
    nCallInterval            : int at %vl 600002;
    nProcessingTime          : int at %vl 600003;
    nVersion                 : int at %vl 600009;
    nActualPosRegNo          : int at %vl 600010;
    nSetSpeedRegNo           : int at %vl 600011;
    nLimitSwitchNegINPUTNo   : int at %vl 600012;
    nLimitSwitchPosINPUTNo   : int at %vl 600013;
    nRefSwitchINPUTNo        : int at %vl 600014;
    nDirSelctNegOUTPUTNo     : int at %vl 600015;
    nDirSelctPosOUTPUTNo     : int at %vl 600016;
    nEnableOUTPUTNo          : int at %vl 600017;

//_________  A-MR Registers ____________________________

    nA_MR_status             : int at %vl 601000;
    nCmd                     : int at %vl 601001;
    nTargetPos               : int at %vl 601002;// Reg(2)
    nSetSpeed                : int at %vl 601003;// Reg(3)
    nInputPolarities         : int at %vl 601004;// Reg(4)
    nAccelarationRamp        : int at %vl 601005;// Reg(5)
    nDecelarationRamp        : int at %vl 601006;// Reg(6)
    nTargetWindow            : int at %vl 601007;// Reg(7)
    nDigitalOffset           : int at %vl 601008;// Reg(8)
    nActualPosition          : int at %vl 601009;// Reg(9)
    nPGainPositionController: int at %vl 601010;// Reg(10)
    nSetpontToOutput         : int at %vl 601011;// Reg(11)
    nActualVelocity          : int at %vl 601012;// Reg(12)
    nSoftLimitSwitchPOS      : int at %vl 601014;// Reg(14)
    nSoftLimitSwitchNEG      : int at %vl 601015;// Reg(15)
    nAnalogOffset            : int at %vl 601016;// Reg(16)
    nIncrementsEncoderRevol  : int at %vl 601017;// Reg(17)
    nMaxSpeedOfTheDrive      : int at %vl 601018;// Reg(18)
    nSetSpeedReferenceValue  : int at %vl 601021;// Reg(21)
    nLastReleativePosition   : int at %vl 601068;// Reg(68)
    nReferencePointShift     : int at %vl 601071;// Reg(71)
    nTresholdDirOUTPUTSOFF   : int at %vl 601081;// Reg(81)
    nAbsoluteMaximumPosition: int at %vl 601085;// Reg(85)

// JX3-CNT
JX3CNT_DualCounter5V_Value   : int at%VL 100021903;

// Global Variables
    b_Start                  : bool;
    n_StartPosition          : int := 0;
    n_EndPosition            : int := 10000;
    n_Velocity               : int := 300;
end_var;
```

3.5.5 Initializing the JCF-SV1 module

In this section, the process variables on the JX3 modules are assigned to the global module registers GP-MR. At least the GP module register for the actual position and the GP module register for the velocity setpoint must be defined.

```
Task t_init autorun
// ------------------------------------------------------------------------
//                              JCF_SV1_Init
// ------------------------------------------------------------------------
// Initialize global parameter registers GP-MR of Axis 1
    // INPUT number for POSITIVE Limit Switch
    nLimitSwitchPosINPUTNo := 100000401;    // JX3-MIX DIO 1
    // INPUT number for NEGATIVE Limit Switch
    nLimitSwitchNegINPUTNo := 100000402; //JX3-MIX DIO2
    // OUTPUT number to enable the amplifier
    nEnableOUTPUTNo := 100000403;   // JX3-MIX DIO3
    // OUTPUT number digital direction selection NEGATIVE (unipolar DAC)
    nDirSelctNegOUTPUTNo := 100000405;  // JX3-MIX DIO5
        // OUTPUT number digital direction selection POITIVE (unipolar DAC)
    nDirSelctPosOUTPUTNo := 100000406; // JX3-MIX DIO6
    // Register number of the speed setpoint
    nSetSpeedRegNo := 100030002;     // JX3-AO4 analog ouput1
    // nSetSpeedRegNo := 100040080; // alternative MIX1 with unipolar DAC
    // INPUT number of the  reference switch
    nRefSwitchINPUTNo := 100000201;
    // Cource register number of the actual position
    nActualPosRegNo := 100021903;       // JX3-CNT 5V Encoder
    // Activate Axis instance No 1
    nInstanceActivation := 1;

// Initialize of the Axis module register A-MR of Axis 1
    // Positive software limit switch
    nSoftLimitSwitchPOS :=100500;
    // Negative software limit switch
    nSoftLimitSwitchNEG := -100500;
    // P-Gain position controller
    nPGainPositionController := 200;
    // Analog offset
    nAnalogOffset := -4;
    // Number of the increments per encoder revolution
    nIncrementsEncoderRevol := 4096;
    // Input polarities of the limit and reference switches
    nInputPolarities := 3; // all normally open

// Set reference, switch on the JCF-SV1 axis controller and enable the amplifier
    nCmd := 3; // Command 3: set reference at the current position
    nCmd := 1; // Command 1: Switch the controller and the output enable amplifier ON

// Start the automatic task
Taskrestart t_automatic;
End_task;
```

3.5.6 Simulating an axis

In the task "t_simulate" an axis is simulated in the simplest way.
For this purpose, the count value of the encoder 5V-RS-422 on the JX3-CNT module is updated cyclically with a simple calculation formula.
The calculated actual position does not correspond to reality.
The task only serves to test the function without drive.

```
// TASK for a simple siumlation of the actual position.
// To do this,the output setpoint is multiplied by a factor
// and added to the current count value.
// Be aware!! This is not a represantative simulation.

Task t_simulation autorun;
var
    f_Factor : float := 1.0;
end_var;

loop
    when nA_MR_status.11 = true continue; //Bit 11 = Axis is enabled
        JX3CNT_DualCounter5V_Value := JX3CNT_DualCounter5V_Value + (nSetpontToOutput * f_Factor);
        delay (t#10ms);
end_loop;

end_task;
```

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