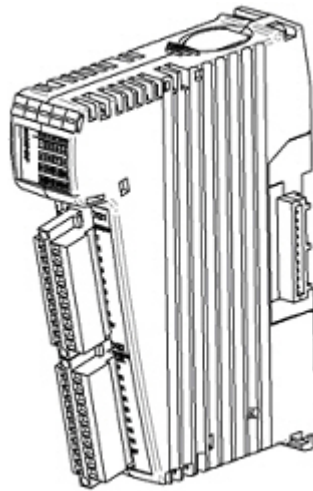


JX3-AI4

Peripheral Module



JetWeb

User Manual



Revision 1.01.2

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

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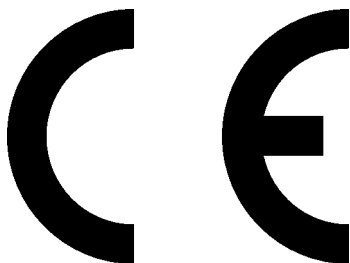
This User Manual belongs to the JX3-AI4:

Type:

Serial #:

Year of construction:

Order #:



To be entered by the customer:

Inventory #:

Place of operation:

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Significance of this User Manual

This User Manual is part of the JX3-AI4 and

- and must be kept in a way that it is always at hand until the JX3-AI4 will be disposed
- the JX3-AI4 must be handed over, if it is sold, alienated, or loaned

Please contact the manufacturer in any case you encounter difficulties to clearly understand this User Manual.

We would appreciate any suggestions and contributions on your part and would ask you to contact us. This will help us to produce manuals that are more user-friendly and to address your wishes and requirements.

This User Manual contains important information on how to transport, erect, install, operate, maintain and repair the JX3-AI4.

Therefore, the persons carrying out these jobs must carefully read, understand and observe this User Manual, and especially the safety instructions.

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

History

Revision	Comment
1.01.1	Original issue
1.01.2	For revisions see JX3-AI4 – Recent Revisions on page 78

Description of Symbols



Warning

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



Caution

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



Warning

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



Warning

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



Warning

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



This sign is to warn you of material damage due to applying hard blows or shocks to the motor flange and shaft.



Important

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

It also identifies requirements necessary to ensure faultless operation.



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

It also gives you words of advice on how to efficiently use hardware and software in order to avoid unnecessary efforts.

Note

· / -

Enumerations are marked by full stops, strokes or scores.



Operating instructions are marked by this arrow.



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



PC and user interface keys.



Reference to a program or file.



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

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1 Safety Instructions

1.1 Generally Valid Safety Instructions

The device complies with the valid safety regulations and standards. Special emphasis was given to the safety of the users.

Further, the user should adhere to the following regulations:

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

1.1.1 Usage to the Intended Purpose

Usage to the intended purpose includes operation in accordance with the User Manual.

The JX3-AI4 module is a JX3 expansion module equipped with four analog inputs for connecting analog sensors. It can be connected to the JX3 system bus. The JX3 system bus starts at the JX3-BN-xxx module. Via the JX3-BN-CAN module, the JX3-AI4 module can be connected to all controllers of the JetControl series. The JX3-BN-XXX or JX3-PS1 module supplies the JX3-AI4 module with voltage. This operating voltage is classified as SELV (Safety Extra Low Voltage). The JX3-AI4 module is therefore not subject to the EU Low Voltage Directive.

The JX3-AI4 module may only be operated within the limits of the stated data.

The device is used to control machinery, such as conveyors, production machines, and handling machines.

1.1.2 Non-Intended Use

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

If the device is to be run under ambient conditions which differ from the conditions mentioned in chapter **Operating Conditions** (on page 84), the manufacturer is to be contacted beforehand.

1.1.3 Who may Operate the Device?

Only instructed, trained and authorised persons are permitted to operate this device.

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

1.1.4 Modifications and Alterations to the Module

For safety reasons, no modifications and changes to the device and its functions are permitted.

Any modifications to the device 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 device. 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 device.

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

1.1.5 Repair and Maintenance

This device must not be repaired by the operators themselves. The device does not contain any parts that could be repaired by the operator.

The device must be sent to Jetter AG for repair.

1.1.6 Decommissioning and Disposal

The environmental regulations for the respective country apply to decommissioning and disposing of devices on the operating company's premises.

1.2 Ensure Your Own Safety



Warning

- Isolate the JX3-AI4 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.
- Safety and protective devices, e.g. the barrier and cover of the terminal box must never be shunted or by-passed.
- Dismantled protective equipment, such as the fuses must be reattached prior to commissioning and checked for proper functioning.
- Prior to commissioning, the machine manufacturer shall conduct a hazard analysis for the machine and take appropriate measures to prevent personal injury and damage to property resulting from accidental movements.

1.2.1 Malfunctions

- **In case of failures or damages, disconnect the device from the mains immediately.**
- Malfunctions or other damages are to be reported to an authorised person at once.
- The device must be protected from improper or inadvertent use.

1.2.2 Information Signs and Labels

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

1.3 Instructions on EMI

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

**Important!**

Measures for increasing immunity to interfering in electric plants:

- The JX3-AI4 module has to be attached to a DIN rail acc. to EN 50022-35 x 7.5.
- Follow the instructions given in Application Note 016 "EMC-Compatible Installation of the Electric Cabinet" published by Jetter AG.

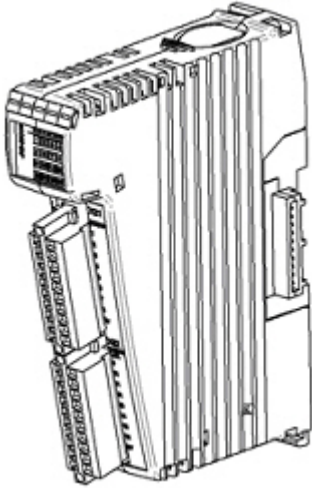
The following instructions are excerpts from Application Note 016:

- On principle, **physical separation** should be maintained between signal and power lines. We recommend spacings greater than 20 cm. Cables and lines should cross each other at an angle of 90°.
- Shielded cables **must** be used for the following lines:
Analog lines, data lines, motor cables coming from inverter drives (servo output stage, frequency converter), lines between components and interference suppressor filter, if the suppressor filter has not been placed at the component directly.
- Shield cables **at both ends**.
- Unshielded wire ends of shielded cables should be as short as possible.
- The entire shield has, **in its entire perimeter**, be drawn behind the isolation, and then be clamped under an earthed strain relief **with the greatest possible surface area**.

2 Introduction

2.1 Product Description JX3-AI4

The JX3-AI4 module is an expansion module for connecting analog sensors. The module is equipped with four analog inputs. Via the JX3-BN-CAN module, the JX3-AI4 module can be connected to all controllers of the JetControl series.

Product Description JX3-AI4	
	
Interfaces	4 analog inputs
Voltage ranges	0 V ... +10 V, -10 V ... +10 V
Current ranges	0 mA ... 20 mA, 4 mA ... 20 mA
Types of connections	<ul style="list-style-type: none"> • Single-ended • differential
LED-display	<ul style="list-style-type: none"> • Supply voltage • Communication
Additional functions	<ul style="list-style-type: none"> • Averaging • User-scaling • Monitoring and evaluation of limits • Recording function, oscilloscope • Operating system update by means of JetSym • Slave pointer • Forcing the analog inputs
Article #	10000542
Module code	303

2.2 Minimum Requirements

The functions described in this document have got minimum requirements to modules, controllers and software. They have been listed in the following table.

Minimum Requirements	
Module / Controller / Software	Starting from Software Release
JX3-AI4	V 1.01
JX3-BN-CAN	V 1.04
JC-24x	V 3.23 Oscilloscope Function: V 3.24
JX6-SB / JX6-SB-I	V 2.18 Oscilloscope Function: V 2.19
JC-64x	V 3.50
JetSym	V 3.00 Oscilloscope Function: V 4.00
JM-D203-JC-24x	V 1.12 Oscilloscope Function: V 1.13

2.3 Scope of Delivery

Scope of Delivery JX3-AI4		
Article #	Quantity	Description
10000542	1	JX3-AI4
60869252	2	BU_10_BLZF_SW_RM3.5 10-pin plug-in connector, spring cage technology, contact spacing 3.5 mm
60870411	10	DIV_DEK_5/5_MC-10_NEUT._WS Terminal markers
60871898	1	Installation Instructions
60870410	1	DIV_BL_SL_3.5_KO_OR Keying pins

2.4 Document Survey

Document Survey of the JX3 I/O System



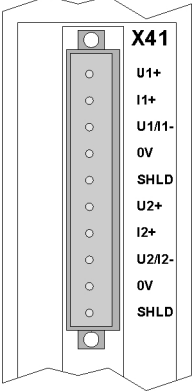
JX3 I/O System, User Information
JX3-AI4, Installation Manual

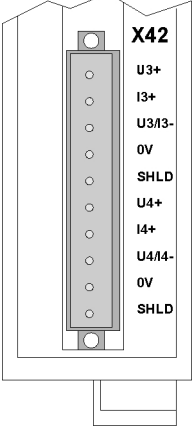
3 Description of Connections

3.1 Functional Data

Functional Data	
Voltage ranges	0 V ... +10 V -10 V ... +10 V
Current ranges	0 mA ... 20 mA 4 mA ... 20 mA via user-scaling
Type of connection	Single-ended or differential

3.2 Assignment of Terminals X41 and X42

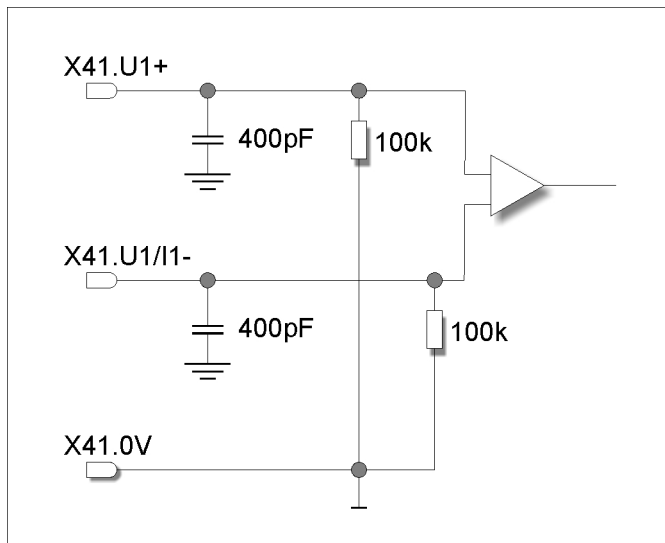
Assignment of Terminal X41			
View 	Analog Input # 1		
	Pin	Signal	Comment
	X41.U1+	Voltage input	
	X41.I1+	Current input	
	X41.U1/I1-	Differential input	In case of single-ended connection technology, pin X41.U1/I1- has to be connected with pin X41.0V.
	X41.0V	Reference potential	
	X41.SHLD	Connection of the shielding	
	Analog Input # 2		
	Pin	Signal	Comment
	X41.U2+	Voltage Input	
	X41.I2+	Current input	
	X41.U2/I1-	Differential input	In case of single-ended connection technology, pin X41.U2/I2- has to be connected with pin X41.0V.
	X41.0V	Reference potential	
	X41.SHLD	Connection of the shielding	

Assignment of Terminal X42			
View 	Analog Input # 3		
	Pin	Signal	Comment
	X42.U3+	Voltage input	
	X42.I3+	Current input	
	X42.U3/I3-	Differential input	In case of single-ended connection technology, pin X42.U3/I3- has to be connected with pin X42.0V.
	X42.0V	Reference potential	
	X42.SHLD	Connection of the shielding	
	Analog Input # 4		
	Pin	Signal	Comment
	X42.U4+	Voltage input	
	X42.I4+	Current input	
	X42.U4/I4-	Differential input	In case of single-ended connection technology, pin X42.U2/I2- has to be connected with pin X42.0V.

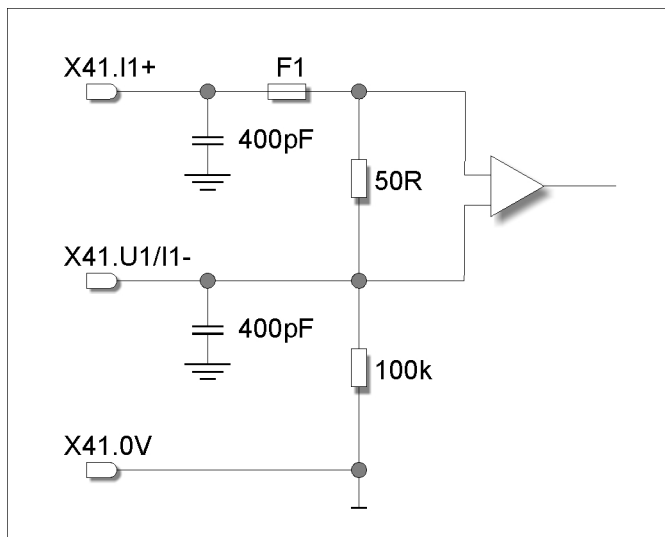
Assignment of Terminal X42			
	X42.0V	Reference potential	
	X42.SHLD	Connection of the shielding	

3.3 Block Diagram Analog Input

Internal Block Diagram for the Analog Voltage Input



Internal Block Diagram for the Analog Current Input



F1 is an automatically resetting circuit breaker

3.4 Connection of Voltage Sensors

Voltage sensors can be connected to the JX3-AI4 module in single-ended or differential mode.

Connection of Voltage Sensors, Single-Ended

- Pins U1-/I1-, as well as 0 V, have to be bridged.
- If only pin U1+ is connected, the analog sensor and the JX3-AI4 module have to be supplied via the same power supply unit.
- These rules apply to all four analog inputs.

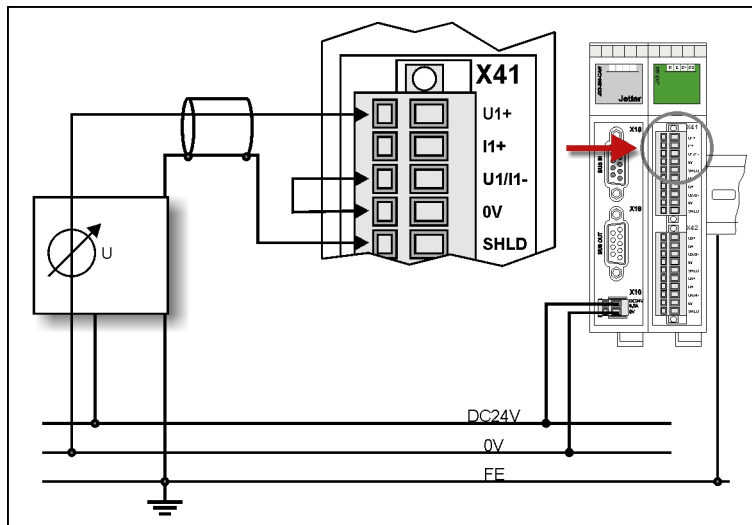


Figure 1: Connection of a voltage sensor single-ended without reference potential

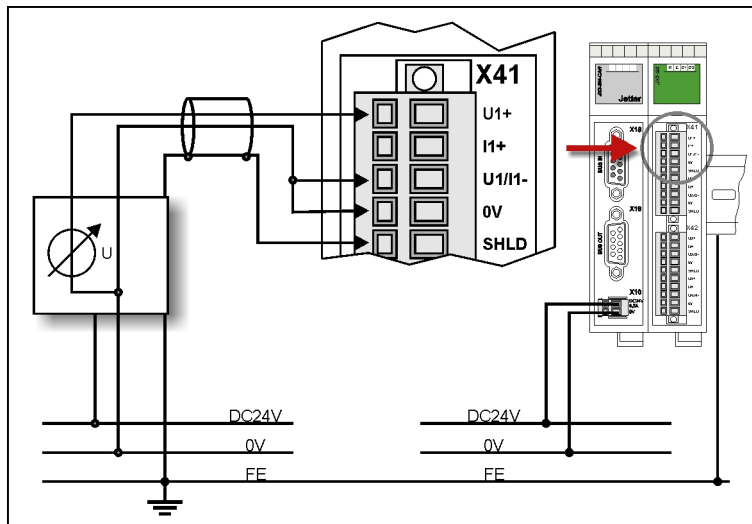


Figure 2: Connection of a voltage sensor single-ended with reference potential

Connection of Voltage Sensors, Differential

- The analog sensor and the JX3-AI4 module can be supplied via various power supplies.
- At full use of the nominal input voltage range of ± 10 V, the voltage difference between the module voltage of der 0 V and 0 V of the analog sensor has to be ± 2 V max. (common mode range).

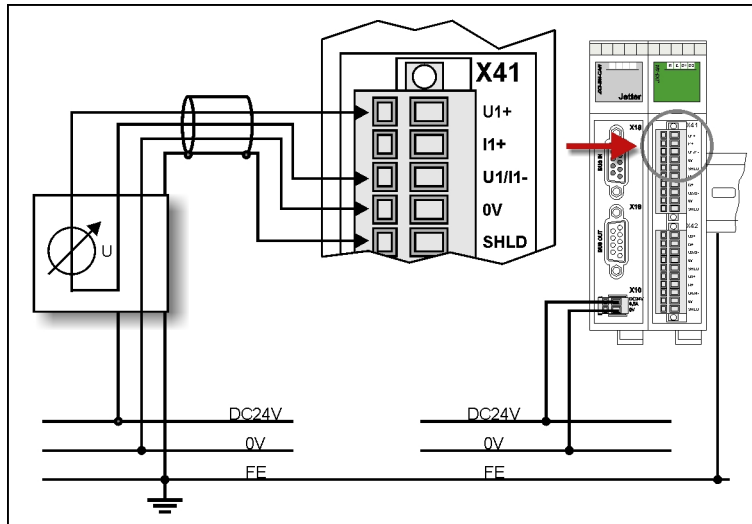


Figure 3: Connection of a voltage sensor, differential

3.5 Connection of Current Sensors

Current sensors can be connected to the JX3-AI4 module in single-ended or differential mode.

Connection of Current Sensors, Single-Ended

- Pins U1-/I1-, as well as 0 V, have to be bridged.
- If only pin I1+ is connected, the analog sensor and the JX3-AI4 module have to be supplied via the same power supply unit.
- These rules apply to all four analog inputs.

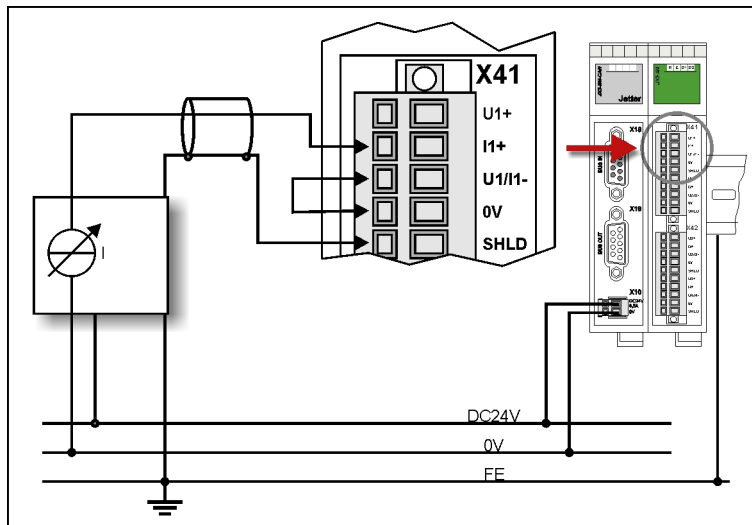


Figure 4: Connection of a current sensor single-ended without reference potential

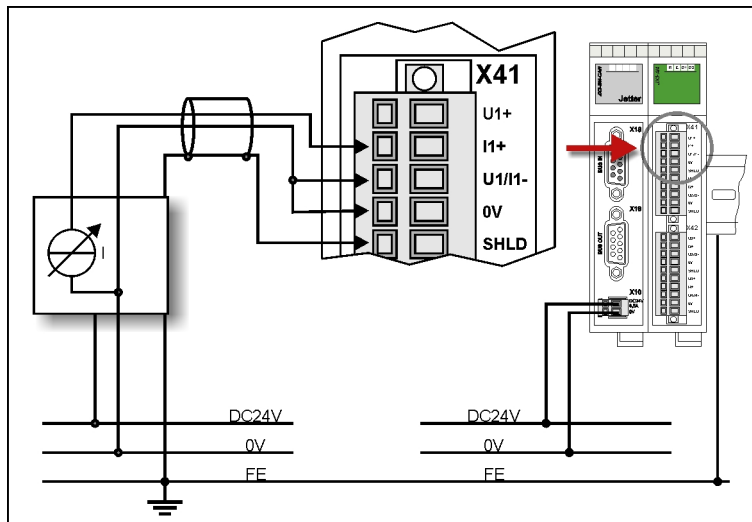


Figure 5: Connection of a current sensor, single-ended with reference potential

Connection of Current Sensors, Differential

- The analog sensor and the JX3-AI4 module can be supplied via various power supplies.

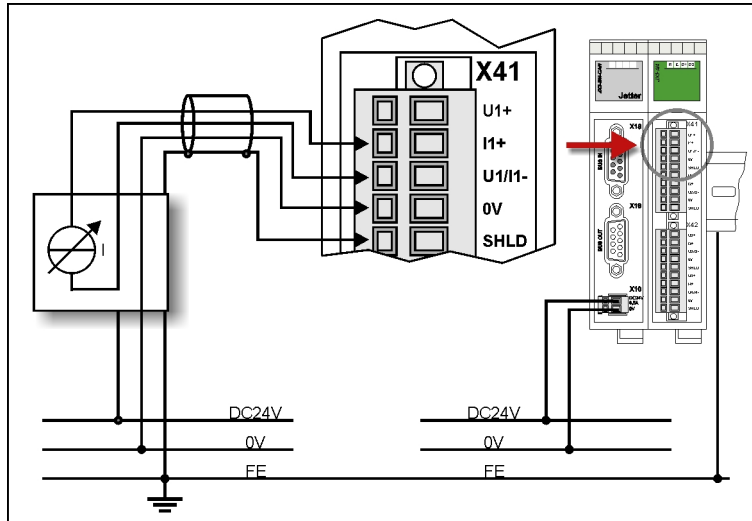


Figure 6: Connection of a current sensor, differential

3.6 Improving the Noise Immunity

For improving the noise immunity, please give heed to the following points:

- For the connection of analog sensors, uses a shielded connector.
- Connect the shielding to terminal X41, respectively X42 directly.
- Use a shielding terminal (1) for additionally earthing the shield of the wire.
- Use a ferrite core (e.g. 74271222 by Würth Elektronik).

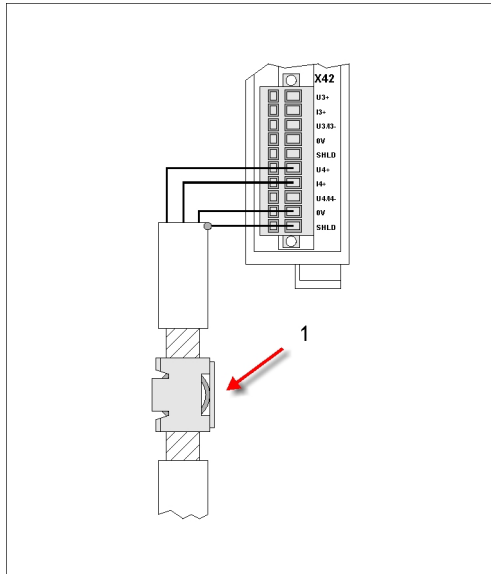


Figure 7: Additional earthing of a shield by means of a shielding terminal

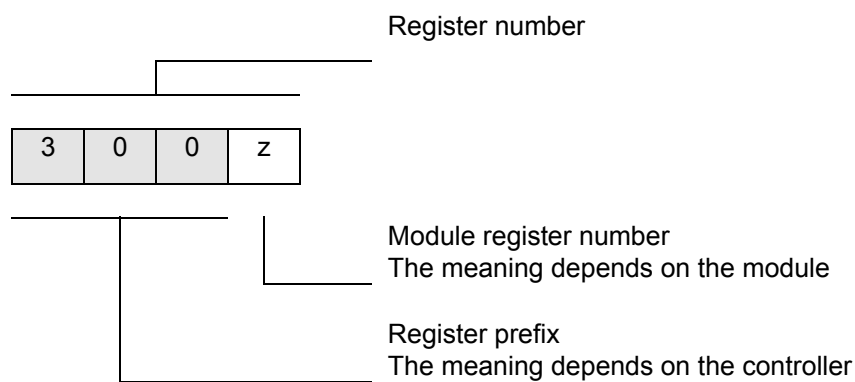
4 Numbering of Registers and I/Os

4.1 Register Addressing

4.1.1 Register Array for JX3 Modules

Each JX3 module is equipped with over 10,000 module registers. The module registers, on the other hand, have been assigned to the controller registers. By means of registers, process, configuration and diagnose data can be read by module JX3-AI4, respectively written to the module.

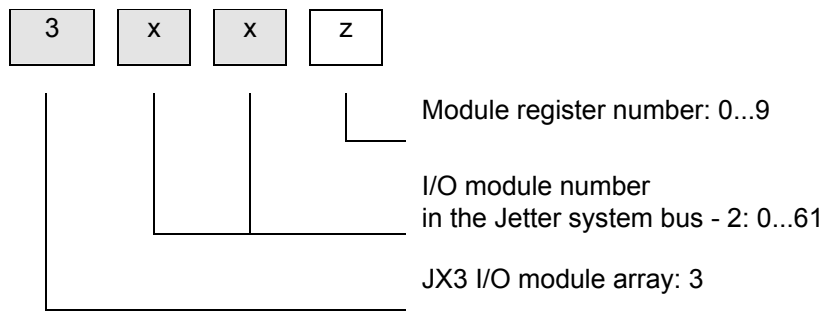
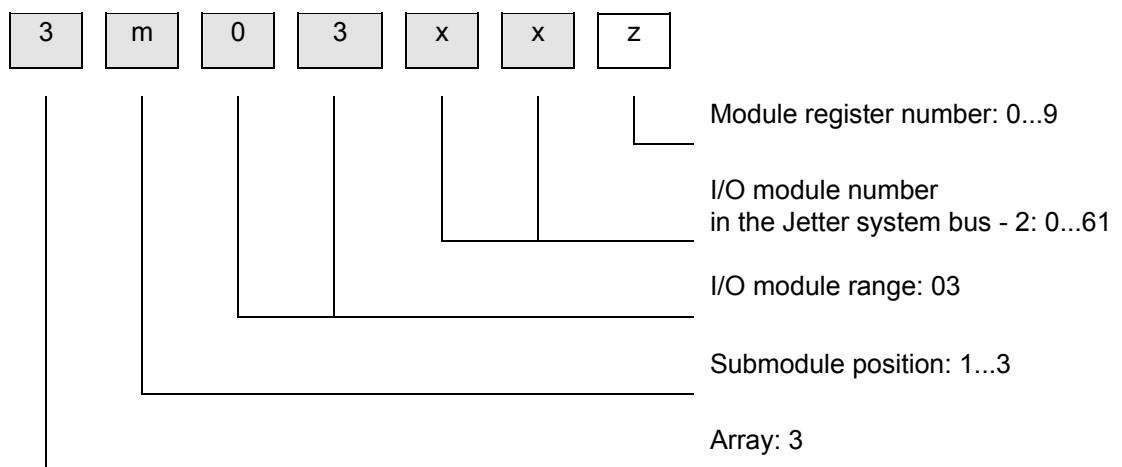
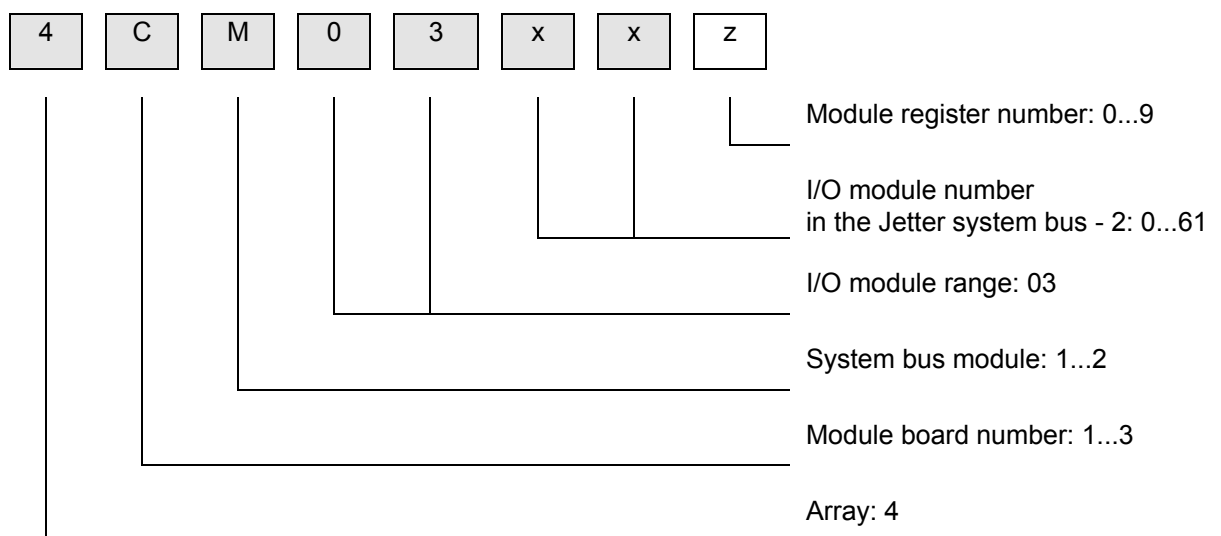
Registers can be accessed directly in the application program of the controller, in a setup window of JetSym, or via the user interface directly.



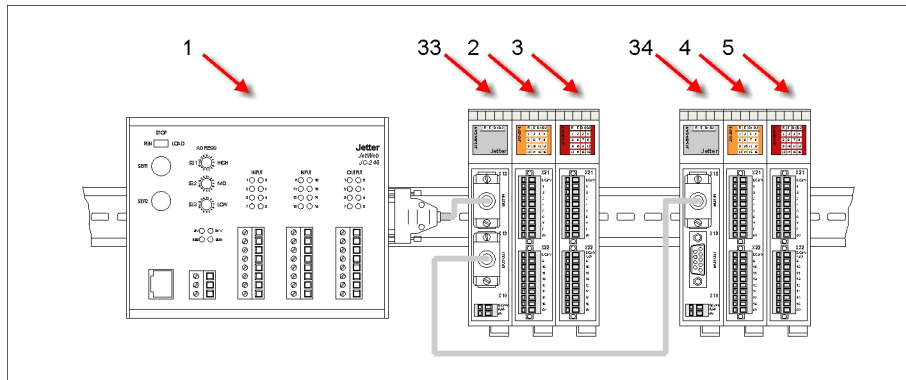
The register number results from a register prefix and a module register number. The register prefix depends on the position of the JX3-AI4 module in the Jetter system bus, and on the controller that is applied.

At determining the register prefixes, the following parameters have to be considered:

- Controller (JC-24x, JC-64x, JC-800, JM-D203-JC-24x)
- Submodule position (at JX6-SB, JX6-SB-I)
- I/O module number in the Jetter system bus

JX3 I/O modules connected to JC-24x and JM-D203-JC-24x**JX3 I/O modules connected to JX6-SB(-I) and JC-647****JX3 I/O modules connected to JX6-SB(-I) and JC-800**

Example: Register and I/O Addressing of a JX3 Module in the Jetter System Bus



Six modules, JX3-BN-CAN (33, 34), JX3-DI16 (2, 4) and JX3-DIO16 (3, 5), have been connected to a JC-24x controller. The register and I/O numbers listed in the table below result from the module position in the Jetter system bus.

- In the Jetter system bus, no I/O numbers have been assigned to the JX3-BN-CAN.
- The first JX3-BN-CAN connected to the JetControl is assigned the I/O module number 33.
- The first JX3 module is assigned I/O module number 2.

Register and I/O Numbers			
I/O Module Number	Module	Register Number	I/O Numbers
1	JC-24X	0 ... 1999 20000 ... 49999	101 ... 116
33	JX3-BN-CAN	3310 ... 3319	-
02	JX3-DI16	3000 ... 3009	201 ... 216
03	JX3-DIO16	3010 ... 3019	301 ... 316
34	JX3-BN-CAN	3320 ... 3329	
04	JX3-DI16	3020 ... 3029	401 ... 416
05	JX3-DIO16	3030 ... 3039	501 ... 516

4.1.2 Direct Access to JX3 Module Registers

Each JX3 module is equipped with over 10,000 module registers. Eight of these are directly accessible via Jetter system bus.

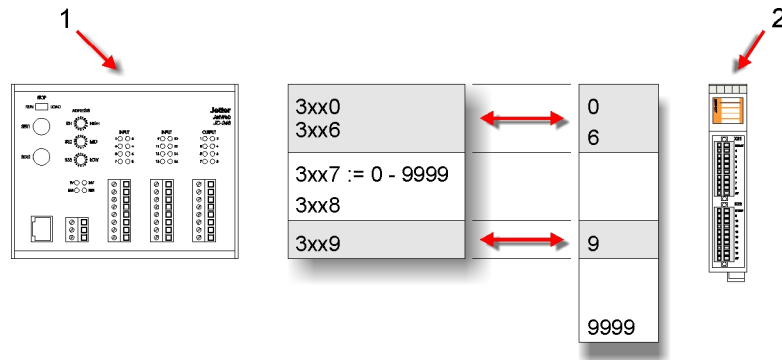


Figure 8: Direct register access to JX3 modules

Above, direct access to the JX3 module registers (2) has been illustrated. In the Jetter system bus of a JC-24x controller, the JX3 modules can be accessed via register numbers 3xxz (1). The JX3 module registers 0 through 6, and 9, are directly accessed via registers 3xxz.

Register Numbering Dependent on the Controller

- For JC-24x controllers: Register number 3xxz
- For JC-647 controllers: Register number 3m03xxz
- For JC-800 controllers: Register number 4CM03xxz

Example: Directly Checking Communication with the JX3 Modules

In a JX3-BN-CAN module, communication with the connected JX3 modules is to be checked. For this, bit 15 in register 0 **the status of the JX3-BN-CAN** must be queried.

```

VAR
    nm_State : INT at %v1 3310;           // Status register JX3-BN-CAN
END_VAR;

CONST
    c_ComActive = 15;                     // Bit number
END_CONST;

TASK 0
    WHEN
        BIT_SET (nm_State, c_ComActive)  // Communication active
        CONTINUE;
    // ...
END_TASK;

```

4.1.3 Indirect Access to JX3 Module Registers

Each JX3 module is equipped with over 10,000 module registers. One index and one data register make access to all 10,000 module registers possible.

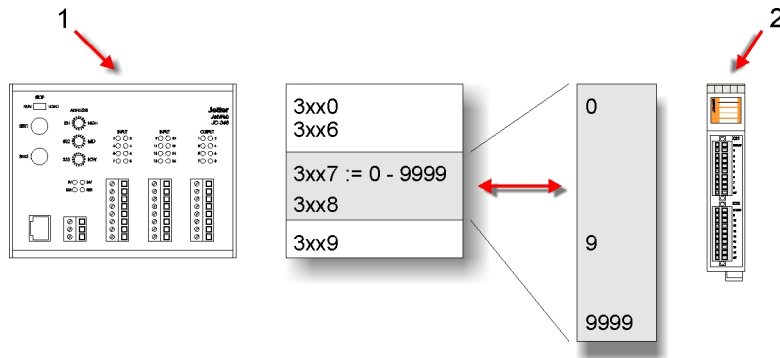


Figure 9: Indirect register access to JX3 modules

Above, indirect access to the JX3 module registers (2) has been illustrated. In the Jetter system bus, the JX3 modules can be accessed via register numbers 3xxz (1). At indirect access, the number of the JX3 module register is written to 3xx7. After this, the content of the JX3 module register can be accessed via 3xx8.

Register Numbering Dependent on the Controller

- For JC-24x controllers: Register number 3xxz
- For JC-647 controllers: Register number 3m03xxz
- For JC-800 controllers: Register number 4CM03xxz

Indirect Register Access in the Application Program

- Indirect access to JX3 module registers of a module may only be carried out within a task. If indirect access is made out of several tasks, the index may be overwritten after a task change.

Index for Indirect Register Access	
Module Register	7
Description	At indirect register access to JX3 modules, the index contains the module register number. It functions as a pointer.
Access	read and write access
Value Range	0 ... 9999
Value After Reset	9
Comment	After switching on, the index points to the module register "operating system version".

Data for Indirect Register Access	
Module Registers	8
Description	This module register is for reading, respectively writing, the value of the selected module register. The JX3-AI4 module copies the value of the actual module register to this register.
Access	Read and write access
Value Range	32 bits
Value After Reset	Operating System Release

Example: Indirect Reading of the Connected JX3 Modules

The number of JX3 modules connected to a JX3-BN-CAN is to be read. The number of connected JX3 modules has been written to module register 256 of the JX3-BN-CAN.

The JX3-BN-CAN has got I/O module number 33.

As a first step, JX3 module register number 256 has to be written into the index register. As a next step, the number of connected modules can be read via the data register.

```

VAR
    nm_Index : INT at %v1 3317;           // Index register
    nm_Data : INT at %v1 3318;           // Data register JX3-BN-CAN
END_VAR;

CONST
    c_RegNumModules = 256;               // Parameter number
END_CONST;

TASK 0
    nm_Index := c_RegNumModules;
    IF
        nm_Data = 0                       // there are no modules
                                         // connected
    THEN
        // ...
    END_IF;

                                         // ...
END_TASK;
```

Example of an Error: Indirect Register Access out of Two Tasks

This error example illustrates the results of indirect register access to a module out of two tasks.

- Task 0 checks the slave pointer for the minimum value of analog input 1
- Task 1 configures analog input 2 of a JX3-AI4 module

Process of the Error Example

1. Task 0 sets the index to module register 1120 **slave pointer for minimum value**.
2. The following WHEN instruction checks the slave pointer for falling below a certain limit. The condition has not been met - a changeover to task 1 is made.
3. Task 1 sets the index to module register 1207 **Configuration Analog Input**.
4. Analog input 2 is configured for voltage range 0 ... 10 V.
5. The following WHEN instruction delays until the analog input data are valid again.
6. There will be a changeover to the WHEN instruction in task 0.
7. The index has now been set to 1207; the WHEN instruction now checks module register 1207 **Configuration of the Analog Input**. The result is not correct.

```

VAR
    nm_State : INT at %v1 3000;           // Status register JX3-AI4
    nm_Index : INT at %v1 3007;           // Index register JX3-AI4
    nm_Data : INT at %v1 3008;           // Data register JX3-AI4
END_VAR;

TASK 0
    nm_Index := 1120;                     // Index to slave pointer
    WHEN
        nm_Data < 100                     // Checking for the limit
    CONTINUE;
    // ...
END_TASK;

TASK 1
    nm_Index := 1207;                     // Index to configuration
    nm_Data := 5;                         // Measuring range 0..10 V
    WHEN
        BIT_SET(nm_State, 16)             // wait, until data are valid
    CONTINUE;
    // ...
END_TASK;

```

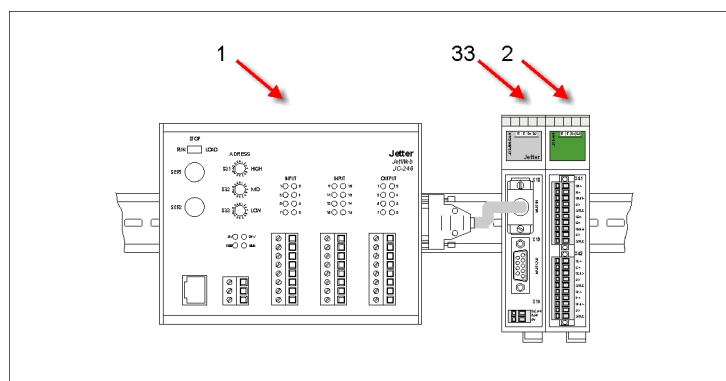

5 Steps of Commissioning

5.1 Procedure

Carry out the following steps for commissioning the JX3-AI4 module:

Steps of Commissioning	
Step	Procedure
1	Connect the analog sensors to terminals X41 and X42.
2	Configure the voltage, respectively current measuring range via module register 1y07 (y: Number of the analog input). <ul style="list-style-type: none"> Measuring range -10 ... +10 V : 1 Measuring range 0 ... +10 V : 5 Measuring range 0 ... 20 mA / 4 ... 20 mA : 6
3	Configure - if needed - the additional functions: <ul style="list-style-type: none"> Scale the measured values (default: none) Configuration of averaging (default: 16-fold) Configure monitoring the limits (default : -32768 respectively +32767)
4	After configuring the measuring ranges, respectively the additional functions, until bit 16 - "Collective bit Validity" - in module register 0 Status Module has been set.
5	Read the digitized values of the analog sensors via module registers 2 through 5. <ul style="list-style-type: none"> Analog input 1 -> Module register 2 Analog input 2 -> Module register 3 Analog input 3 -> Module register 4 Analog input 4 -> Module register 5

Example: Commissioning the JX3-AI4 Module



At a JX3-AI4 module (2), all four analog inputs are to be configured.

- Analog input # 1: -10 ... +10V
- Analog input # 2: 0 ... +10V
- Analog input # 3: 0 ... 20 mA
- Analog input # 4: 0 ... 20 mA
- All additional functions remain in the default settings.

```

VAR
    nm_State : INT at %v1 3000;           // Status
    nm_AI_1 : INT at %v1 3002;           // Analog Input # 1
    nm_AI_2 : INT at %v1 3003;           // Analog Input # 2
    nm_AI_3 : INT at %v1 3004;           // Analog Input # 3
    nm_AI_4 : INT at %v1 3005;           // Analog Input # 4
    nm_Index : INT at %v1 3007;           // Index
    nm_Data : INT at %v1 3008;           // Data
    n_Local : INT at %v1 100;           // User register
END_VAR;

TASK 0
    nm_Index := 1107;                   // Configuration analog input 1
    nm_Data := 1;                       // -10 ... +10 V
    nm_Index := 1207;                   // Configuration analog input 2
    nm_Data := 5;                       // 0 ... +10 V
    nm_Index := 1307;                   // Configuration analog input 3
    nm_Data := 6;                       // 0 ... 20 mA
    nm_Index := 1407;                   // Configuration analog input 4
    nm_Data := 6;                       // 0 ... 20 mA

    WHEN
        BIT_SET (nm_State, 16)           // Wait for values to be valid
    CONTINUE;

    n_Local := nm_AI_1;                 // Read analog input 1
    n_Local := nm_AI_2;                 // Read analog input 2
    n_Local := nm_AI_3;                 // Read analog input 3
    n_Local := nm_AI_4;                 // Read analog input 4

END_TASK;

```

5.2 Configuration

Configuration of the Analog Input	
Module Register	1y07 y: Number of the Analog Input
Description	Configuration of an analog input
Access	Read / write
Value Range	32 bits
Value After Reset	1
Comment	<ul style="list-style-type: none"> The four analog inputs are configured independent of each other. At changing the measured value, the displayed measured value becomes invalid. The JX3-AI4 module makes a restart after changing the measuring range with averaging.

Values for Configuring the Analog Input:

1	Voltage measuring range -10 ... +10 V
5	Voltage measuring range 0 ... +10 V
6	Current measuring range 0 ... 20 mA

6 Digitizing the Analog Values

6.1 Registers with Digitized Analog Value

Analog Input # 1	
Module Register	2
Description	The digitized value of analog input 1
Access	read
Value Range	-32,768 ... 32,767
Value After Reset	Value at analog input 1
Comment	At configuring the analog input for voltages of 0 ... +10 V or for currents of 0 ... 20 mA, only positive values are transmitted for calculating the scaling for the user.

Analog Input # 2	
Module Register	3
Description	The digitized value of analog input 2
Access	read
Value Range	-32,768 ... 32,767
Value After Reset	Value at analog input 2
Comment	At configuring the analog input for voltages of 0 ... +10 V or for currents of 0 ... 20 mA, only positive values are transmitted for calculating the scaling for the user.

Analog Input # 3	
Module Register	4
Description	The digitized value of analog input 3
Access	read
Value Range	-32,768 ... 32,767
Value After Reset	Value at analog input 3
Comment	At configuring the analog input for voltages of 0 ... +10 V or for currents of 0 ... 20 mA, only positive values are transmitted for calculating the scaling for the user.

Analog Input # 4	
Module Register	5
Description	The digitized value of analog input 4
Access	read
Value Range	-32,768 ... 32,767
Value After Reset	Value at analog input 4
Comment	At configuring the analog input for voltages of 0 ... +10 V or for currents of 0 ... 20 mA, only positive values are transmitted for calculating the scaling for the user.

6.2 Presentation of the Measured Voltages

- The analog input voltages are digitized at a resolution of 16 bit and displayed in module registers 2 through 5.
- The highest bit of the digital value (bit 15) serves as a sign bit.
- At configuring the analog input for the voltage range 0 V ... +10 V, the lowest digital value is 0. The resolution for this configuration is 15 bit.
- If user-scaling is applied, the digitized value differs from the digitized value of the conversions and measuring ranges described above.

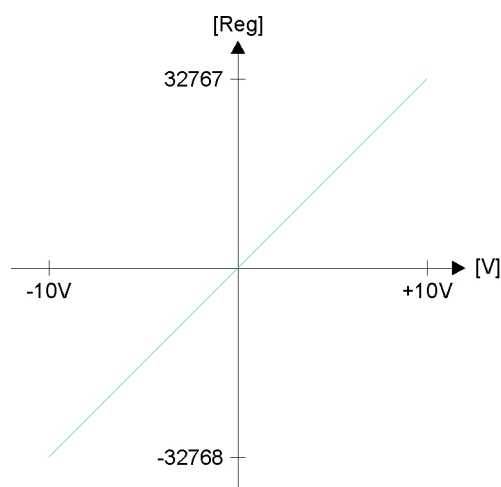


Figure 10: Graphic assignment of voltage and value in the module register

The voltage connected to the analog input is converted into a digital value in linear mode. Conversion is made according to the following formula:

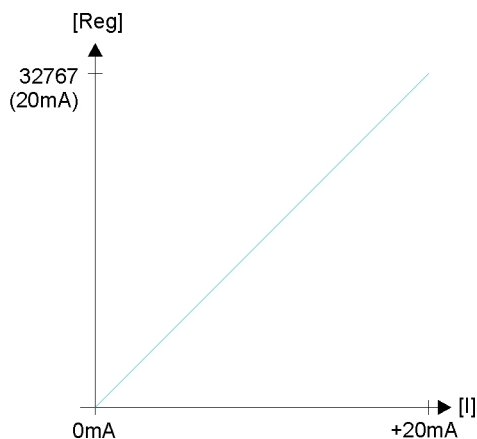
$$\text{ModReg}[2...5] = U \cdot \frac{32767}{10V}$$

Measuring Range Configured to -10 V ... +10 V	
Voltage	Measured Value in Module Register
+ 10 V	32,767
...	
0 V	0
...	
-10,00033 V	-32,768

Measuring Range Configured to 0 V ... +10 V	
Voltage	Measured Value in Module Register
+ 10 V	32,767
...	
0 V	0
< 0 V	0

6.3 Presentation of the Measured Current Values

- The analog input currents are digitized at a resolution of 15 bit and displayed in module registers 2 through 5.
- The highest bit of the digital value (bit 15) is always 0.
- If user-scaling is applied, the digitized value differs from the digitized value of the conversions and measuring ranges described above.



The current connected to the analog input is converted into a digital value in linear mode. Conversion is made according to the following formula:

$$\text{ModReg}[2\dots5] = I \cdot \frac{32767}{20mA}$$

Measuring range configured to 0 mA ... 20 mA	
Voltage	Measured Value in the Module Register
20 mA	32,767
...	
0 mA	0

7 Status and Command

7.1 Status

Status Module	
Module Register	0
Description	Status and error reports of the module and of all analog channels
Access	read
Value Range	32 bits, bit-coded
Value After Reset	0xC1010000 in faultless condition

The Meaning of the Individual Bits in the Module Status:

Bit 0: Hardware error

- 0 = No error
- 1 = There is a hardware error. Bit 0 can be set after a delay when bit 4 and bit 7 have been set.
The exact error cause can be specified via bit 4 through bit 7.

Bit 4: Error regarding adjusted values

- 0 = Adjusted values have been read correctly.
- 1 = Hardware error at reading the stored adjusted values.
The error cannot be fixed by the user. The Jetter maintenance service has to be called on.

Bit 6: Error regarding the AD converter

- 0 = No error
- 1 = Hardware error at reading the analog input values of the AD converter. The error can be acknowledged by means of command 5 **Acknowledge hardware errors**.
If the error remains after acknowledging, the hardware is defective. The Jetter maintenance service has to be called on.

Bit 7: Error regarding internal voltages

- 0 = No error
- 1 = At least one internal voltage is or was not within the permitted limits.
The error bit is set by the JX3-AI4 module.

Bit 16: Collective bit "Validity"

- 0 = The analog input value in module registers 2 ... 5 is not valid.
The average of at least one analog input is still to be calculated.
The collective bit "Validity" is reset for the following actions:
- The configuring procedure of the analog input is modified.
 - The user-scaling procedure is modified.
 - The averaging procedure is modified.
 - In case of an error regarding internal voltages
 - In case of an error regarding the AD converter
- 1 = The analog input values in module registers 2 ... 5 are valid.
The bit remains set, until the procedures of user-scaling, configuring the analog input or averaging have been modified.
In case of a hardware error, the bit is reset as well.

Bit 19: Collective bit "Falling below the lower limit"

- 1 = The configured lower limit of at least one analog input has been fallen below.
The bit is set by the JX3-AI4 module when the limit has been fallen below. It is not reset by the module any more.
Resetting the bit is carried out by the user.

Bit 20: Collective bit "Exceeding the upper limit"

- 1 = The configured upper limit of at least one analog input has been exceeded.
The bit is set by the JX3-AI4 module when the limit has been exceeded. It is not reset by the module any more.
Resetting the bit is carried out by the user.

Bit 21: Collective bit "Analog input signal out of range in negative direction"

- 1 = The voltage at at least one analog input has been fallen below.
At a bipolar input, the limit is -11 V, at a unipolar input, it is -0.5 V.
The bit is reset by the user.

Bit 22: Collective bit "Analog input signal out of range in positive direction"

- 1 = The voltage at at least one analog input was greater than +11 V, respectively, the current at at least one analog input was greater than 22 mA.
The bit is reset by the user.

Bit 23: Collective bit "Forcing"

- 0 = Forcing is not active
- 1 = Forcing is active for at least one analog input
Forcing can be activated, resp. deactivated, by commands via the command register of the analog input.

Bit 24: Monitoring internal voltages

- 0 = Monitoring is not active
- 1 = Monitoring is active
Monitoring can be activated, respectively deactivated, by commands.

Bit 30: Synchronous data exchange

- 1 = Between the JX3-AI4 module and the bus head, respectively the JetControl JC-3xx, there is synchronous data exchange.

Bit 31: Operating mode

- 0 = Collective conversion
- 1 = Individual conversion
- The operating mode can be configured via commands.

Analog Input Status	
Module Register	1y00 y: Number of the Analog Input
Description	Status messages of an analog input
Access	Read
Value Range	32 bits, bit-coded
Value After Reset	0x00010000

The Meaning of the Individual Bits in the Analog Input Status:**Bit 16: Validity of the analog input value**

- 0 = The analog input value in module registers 2 ... 5 is not valid. The average of the analog input is still to be calculated.
- 1 = The analog input value in module registers 2 ... 5 is valid. The bit remains set, until the procedures of user-scaling, configuring the analog input or averaging have been modified. In case of a hardware error, the bit is reset as well.

Bit 19: Falling below the lower limit

- 1 = The lower limit of the analog input configured by the user has been fallen below. The bit is set by the JX3-AI4 module when the limit has been fallen below. It is not reset by the module any more. The bit is reset by the user.

Bit 20: Exceeding the upper limit

- 1 = The upper limit of the analog input configured by the user has been exceeded. The bit is set by the JX3-AI4 module when the limit has been exceeded. It is not reset by the module any more. The bit is reset by the user.

Bit 21: Analog input signal out of range in negative direction

- 1 = The voltage at the analog input has been fallen below. At a bipolar input, the limit is -11 V, at a unipolar input, it is -0.5 V. The bit is reset by the user.

Bit 22: Analog input signal out of range in positive direction

- 1 = The voltage at the analog input was greater than +11 V, respectively, the current at the analog input was greater than 22 mA. The bit is reset by the user.

Bit 23: Forcing

- 0 = Forcing is not active
- 1 = Forcing has been activated for this analog input
Forcing can be activated, respectively deactivated, by commands via the command register of the analog input.

7.2 Command

Command	
Module Register	1
Description	Via commands, various functions of the JX3-AI4 module can be activated.
Access	Read / write
Value Range	32 bits
Value After Reset	0

The module has the following commands available:

- | | |
|----------|---|
| 1 | Activate operating mode "Individual Conversion"

In the operating mode "Individual conversion", every 500 µs one analog input is read in.
The conversion time for all four analog inputs is 2 ms. |
| 2 | Activate operating mode "Collective Conversion"

In the operating mode "Collective Conversion", all four analog inputs are read one after the other in time gaps of 1,000 µs.
The conversion time for all four analog inputs is 1 ms. |
| 3 | Deactivate monitoring of internal voltages

Monitoring is not carried out any more. |
| 4 | Activate monitoring of internal voltages

Monitoring is carried out. |
| 5 | Acknowledge hardware errors

All error bits in the status module register are reset. |
| 6 | Acknowledge collective status bits

All collective status bits in status module register 0 are reset.
The bits in status module register 1y00 of the individual analog inputs remain unchanged. |

8 Additional Functions

8.1 Survey of Additional Functions

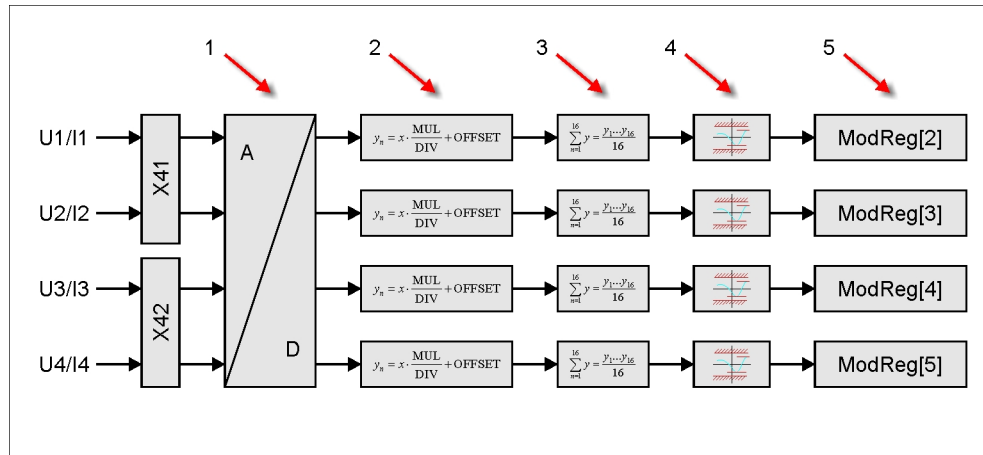
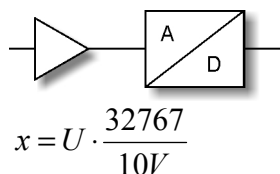


Figure 11: Illustration of operating principle

The digitalized value of each analog input can be exactly adjusted to the respective application by means of additional functions.

- The additional functions can generally be configured for each analog input individually.
- The additional functions are always processed in a definite sequence.

(1) AD-Conversion



1. Digitizing the analog signal at terminals X41 and X42.
2. Checking the digitized values for the analog input signal being out of range in positive or negative direction.

Relevant Module Registers

- 0 : Status module
1y00 : Status of the analog input y

(2) User-Scaling

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

1. Scaling of the digitized value according to settings made by the user.
2. Scaling is carried out internally according to the equation of a straight line.
3. At configuring the analog input for unipolar voltages or currents, x is always positive.

Relevant Module Registers

- 0 : Status module
1y00 : Status of the analog input y

- 1y24 : 1. Voltage / current value of the analog input y
- 1y25 : 1. Digital value of analog input y
- 1y26 : 2. Voltage / current value of the analog input y
- 1y27 : 2. Digital value of analog input y

(3) Averaging

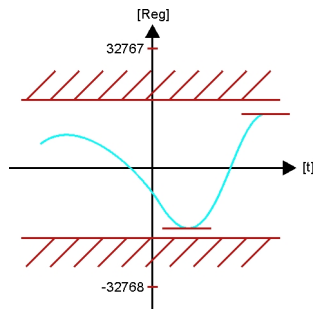
$$\sum_{n=1}^{16} y = \frac{y_1 + y_2 + \dots + y_{16}}{16}$$

- Now, averaging is carried out by means of the user scaling results.

Relevant Module Registers

- 0 : Status module
- 1y00 : Status of the analog input y
- 1y06 : Averaging of analog input y

(4) Monitoring of Limits / Slave Pointer



- The average is checked for being within a lower and an upper limit.
When a limit is exceeded, a bit is set in the status module register and in the diagnose of the analog input.
- Updating the slave pointers

Relevant Module Registers

- 0 : Status module
- 1y00 : Status of the analog input y
- 1y08 : Lower limit of analog input y
- 1y09 : Upper limit of analog input y
- 1y20 : Slave pointer to minimum value of analog input y
- 1y21 : Slave pointer to maximum value of analog input y

(5) Transmission

$y \Rightarrow \text{CPU}$

- The result of y is transmitted to the controller as a digitized analog value.

Relevant Module Registers

- 2 : Analog input value 1
- 3 : Analog input value 2
- 4 : Analog input value 3
- 5 : Analog input value 4

8.2 AD Conversion

All analog input values are converted into digital values by a 16-bit AD converter.

8.3 User-Scaling

User scaling offers the possibility of converting the digitized analog value on the module directly. It can be configured for each analog input individually. User-scaling parameters are calculated directly after reading the values rendered by the AD converter. After these calculations, averaging, as well as monitoring the limits and the slave pointers is carried out.

If scaling the measured values is modified, the data of the analog input become invalid; bit 16 *Collective bit Validity* in register 0 *Status Module* is reset. Averaging is restarted.

The digitized analog value is calculated by the following formula:

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

Individual Elements of Calculation

x	Digitized analog value
MUL	Multiplier out of module register 1y13 The internal intermediate result of the multiplication is a 32-bit value.
DIV	Divisor out of module register 1y14
OFFSET	Offset out of module register 1y15
y _n	Result of the calculation. Via module registers 2 ... 5, this value is transmitted to the controller.

Multiplication is the first operation within calculating the scaling. The intermediate result is a 32-bit value, which is then divided by the divisor. No earlier than in the last step, the OFFSET is added to the value.

Activation of the Scaling

After switching on, user scaling is deactivated. Only by defining two pairs of points in the system of coordinates, user-scaling is started.

User-scaling is configured by defining two pairs of points. Each pair consists of a voltage, respectively current value and a digitized analog value. Out of these two pairs of points, the JX3-AI4 module then calculates the multiplier, the divisor, and the offset. Calculating then starts by specifying the second digital value in module register 1y27.

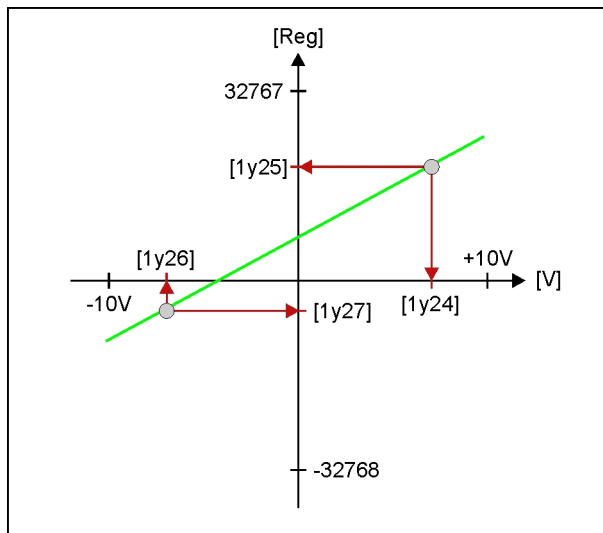


Figure 12: User-scaling by setting two pairs of points

The transfer function between the physical analog value and the digitized analog value is shown by a straight line. A straight line is unambiguously defined by two points. For user-scaling, the module calculates linear transmission in a way, that in the system of coordinates, a straight line results from the two set pairs of points.

1. Voltage / Current Value for User-Scaling	
Module Register	1y24 y: Number of the Analog Input
Description	Into this module register, the voltage, respectively current value of the first pair of points is entered. The values are presented in mV, respectively in 1/1,000 mA.
Access	Read / write
Value Range	Configuration as a voltage input: -10,000 ... 10,000 Configuration as a current input: -20,000 ... 20,000
Value After Reset	-10,000

1. Digital Value for User-Scaling

Module Register	1y25 y: Number of the Analog Input
Description	Into this module register, the digital value of the first pair of points is entered. The value is presented as a digitized value.
Access	Read / write
Value Range	-32,768 ... 32,767
Value After Reset	-32,768

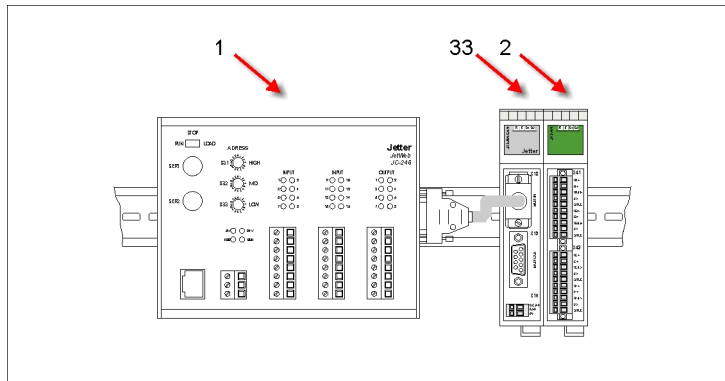
2. Voltage / Current Value for User-Scaling

Module Register	1y26 y: Number of the Analog Input
Description	Into this module register, the voltage, respectively current value of the second pair of points is entered. The values are presented in mV, respectively in 1/1,000 mA.
Access	Read / write
Value Range	Configuration as a voltage input: -10,000 ... 10,000 Configuration as a current input: -20,000 ... 20,000
Value After Reset	-10,000

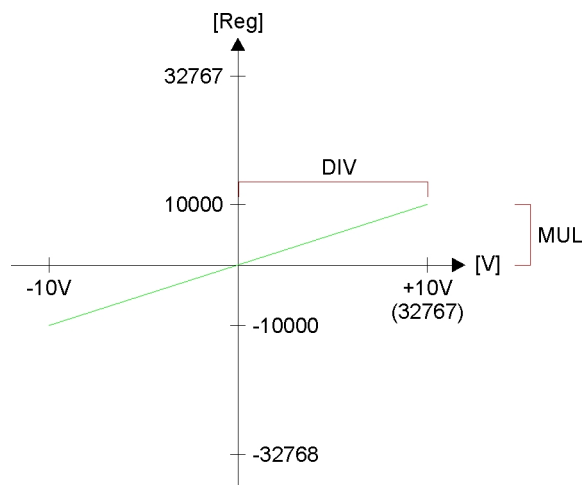
2. Digital Value for User-Scaling

Module Register	1y27 y: Number of the Analog Input
Description	Into this module register, the digital value of the second pair of points is entered. The value is presented as a digitized value.
Access	Read / write
Value Range	-32,768 ... 32,767
Value After Reset	-32,768
Comment	Writing into this module register starts the calculation of multiplier, divisor, and offset. The bit Validity of Analog Value in register 1y00 Status of the Analog Input and the collective bit Validity in register 0 Status Module is reset.

Example: Scaling of a Pressure Value



The analog input 2 of a JX3-AI4 module has been configured to measuring value -10 V to +10 V. A pressure sensor for measuring range 10 bar to 200 bar has been connected to the analog input. The pressure sensor renders a voltage of +10 V. In the controller, the pressure value is to be displayed at a resolution of 10 mbar.



The transmit function of the measured values has been defined by two point pairs. A voltage of -10 V corresponds to 10 bar. A voltage of +10 V corresponds to 200 bar. For configuring, the voltage has to be specified in millivolt; the pressure has to be specified in 10 mbar.

- The JX3-AI4 module has got I/O module number 2 in the Jetter system bus.

```

VAR
    nm_State : INT at %v1 3000;           // Status
    nm_Index : INT at %v1 3007;           // Index
    nm_Data : INT at %v1 3008;           // Data
END_VAR;

CONST
    c_UserPointx1 = 1224;                 // Numbers of JX3 module regs.
    c_UserPointy1 = 1225;                 // 1. 1st pair of points
    c_UserPointx2 = 1226;                 // 2. 2nd pair of points
  
```

```

        c_UserPointy2 = 1227;
END_CONST;

TASK 0
nm_Index := c_UserPointx1;           // 1. Specify 1st pair of points
nm_Data := -10000;                   // -10,000 mV
nm_Index := c_UserPointy1;
nm_Data := 1000;                     // 1000 [10 mbar]
nm_Index := c_UserPointx2;           // 2. Specify 2nd pair of points
nm_Data := 10000;                    // 10,000 mV
nm_Index := c_UserPointy1;
nm_Data := 20000;                    // 20000 [10 mbar]

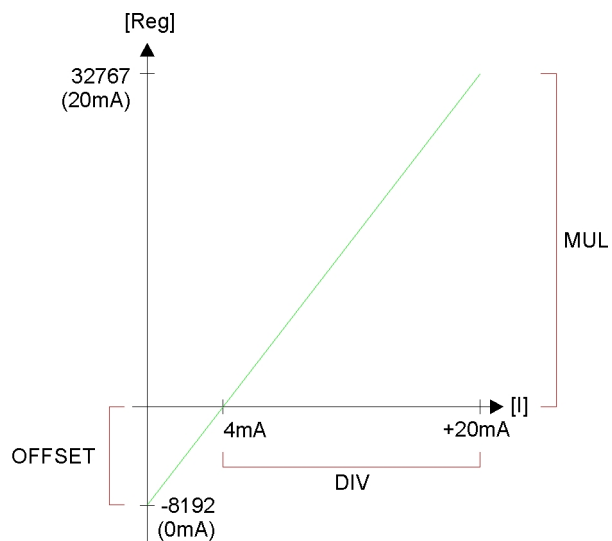
WHEN
BIT_SET (nm_State, 16)               // Wait for values to be valid
CONTINUE;                             // ...

END_TASK;

```

Example: Scaling a Measured Value to 4 through 20 mA

The analog input 3 of a JX3-AI4 module has been configured to measuring value 0 to 20 mA. A current of 4 mA is to be presented as 0 in digital mode, a current of 20 mA is to be presented as 32767 in digital mode.



The transmit function of the measured values has been defined by two point pairs. A current of 4 mA corresponds to 0. A current of 20 mA corresponds to 32767. For configuring, the current has to be specified in 1/1,000 mA.

- The JX3-AI4 module has got I/O module number 2 in the Jetter system bus.

```

VAR
    nm_State : INT at %v1 3000;           // Status
    nm_Index : INT at %v1 3007;           // Index
    nm_Data : INT at %v1 3008;           // Data
END_VAR;

CONST                                     // Numbers of JX3 module
                                           registers
    c_UserPointx1 = 1224;                 // 1. 2nd pair of points
    c_UserPointy1 = 1225;
    c_UserPointx2 = 1226;                 // 2. 2nd pair of points
    c_UserPointy2 = 1227;
END_CONST;

TASK 0
    nm_Index := c_UserPointx1;           // 1. Specify 1st pair of points
    nm_Data := 4000;                     // 4000 1/1,000 mA
    nm_Index := c_UserPointy1;
    nm_Data := 0;                       // 0
    nm_Index := c_UserPointx2;           // 2. Specify 2nd pair of points
    nm_Data := 20000;                    // 20000 1/1,000 mA
    nm_Index := c_UserPointy1;
    nm_Data := 32767;                   // 32767

    WHEN
    BIT_SET (nm_State, 16)               // Wait for values to become
                                           valid
    CONTINUE;

                                           // ...
END_TASK;

```

8.4 Averaging

The JX3-AI4 module carries out continuous averaging for each analog input individually. By each newly digitized measured value, new averaging of the latest 16 or 4 measurings is carried out. Averaging is carried out according to the user-scaling calculation.

Averaging increases accuracy of an analog input signal. Short peaks of the input signal lead to just a minimum modification of the value in module registers 2 through 5. Averaging functions like a filter.

Averaging can be configured for each analog input individually. At changing the configuration, the data of the analog input become invalid. Bit 16 of the *Collective Bit Validity* in register 0 *Status Module* is reset. Averaging is restarted.

Averaging of the Analog Channel	
Module Register	1y06 y: Number of the Analog Input
Description	Configuration of averaging
Access	Read / write
Value Range	0 ... 16
Value After Reset	16

The following average procedures can be configured

1	No averaging
4	Quadruple averaging
16	16-fold averaging

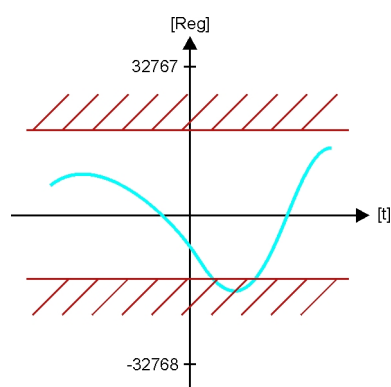
8.5 Monitoring of Limits

At each conversion, the JX3-AI4 module checks, if the converted measured value has left a set range. This range has been hatched red in the illustration. This range is defined by the user for each analog input individually by an upper and a lower limit.

At falling below the limits, bit 19 *Collective Bit Lower Limit* is set in register 0 *Status Module*, while bit 19 *Fallen Below Lower Limit* is set in register 1y00 *Status of the Analog Input*.

At exceeding the limits, bit 20 *Collective Bit Upper Limit* is set in register 0 *Status Module* and bit 20 *Upper Limit Exceeded* is set in register 1y00 *Status of Analog Input*.

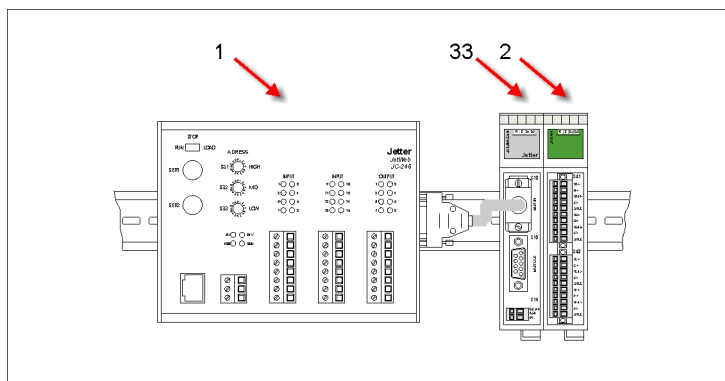
This is checked according to the user-scaling calculation. The limits can be configured for each analog input individually.



Lower Limit	
Module Register	1y08 y: Number of the Analog Input
Description	The lower limit is set. The JX3-AI4 module checks if the lower limit has been fallen below at each conversion.
Access	Read / write
Value Range	-32,768 ... 32,767
Value After Reset	-32,768

Upper Limit	
Module Register	1y09 y: Number of the Analog Input
Description	The upper limit is set. The JX3-AI4 module checks if the upper limit has been exceeded at each conversion.
Access	Read / write
Value Range	-32,768 ... 32,767
Value After Reset	32,767

Example: Configuration of Limit Monitoring



In the system illustrated above, the voltage is to be checked at analog input 1 of the JX3-AI4 (2) module for being either below -3 V or above 7 V. The voltages correspond to the digitized values -9830 and 22937.

```

VAR
    nm_Index : INT at %v1 3007;           // Index
    nm_Data : INT at %v1 3008;           // Data
END_VAR;

CONST
    c_State = 1100;                       // Numbers of JX3 module registers
    c_LowerLimit = 1108;                   // Status of analog input 1
                                           // Lower limit of analog input 1

```

```

        c_UpperLimit = 1109;                                // Upper limit of analog input 1
    END_CONST;

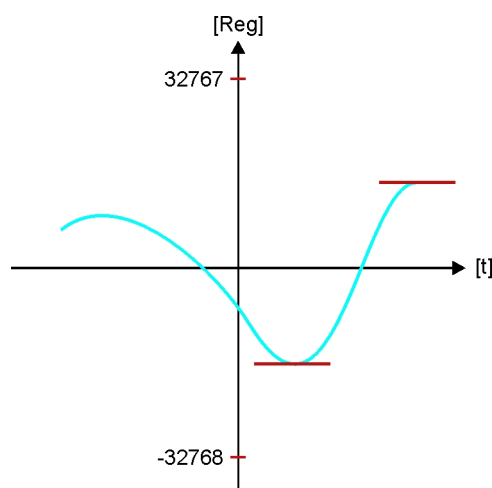
TASK 0
    nm_Index := c_LowerLimit;                                // Lower limit
    nm_Data := -9830;                                         //
    nm_Index := c_UpperLimit;                                // Upper limit
    nm_Data := 22937;                                         //
    nm_Index := c_State;                                     // Status
    WHEN
        BIT_SET(nm_Data, 19) OR                               // Checking the limits
        BIT_SET(nm_Data, 20)
    CONTINUE;

END_TASK;

```

8.6 Slave Pointer

The JX3-AI4 module updates the slave pointers for the lower and upper limit. The slave pointer (red line in the illustration) display both the lowest and the greatest value measured so far. The slave pointer is cleared of its content at switching off the module. The slave pointers are checked according to the user-scaling calculation.



Slave Pointer for Minimum Value	
Module Register	1y20 y: Number of the Analog Input
Description	The lowest value converted so far has been written to this module register.
Access	Read / write
Value Range	-32,768 ... 32,767
Value After Reset	32,767

Slave Pointer for Maximum Value	
Module Register	1y21 y: Number of the Analog Input
Description	The highest value converted so far has been written to this module register.
Access	Read / write
Value Range	-32,768 ... 32,767
Value After Reset	-32,768

8.7 Transmission to the Controller

The digitized values are transmitted to the controller by four module registers.

- Analog input 1 -> Module register 2
- Analog input 2 -> Module register 3
- Analog input 3 -> Module register 4
- Analog input 4 -> Module register 5

9 Oscilloscope

9.1 Operating Principle

The JX3-AI4 has got an integrated oscilloscope function. By this function, the JX3-AI4 module records specific values over a set time. On this module, the values are recorded within time grids of 1 millisecond without straining the JetControl. Then, the stored values can be loaded and displayed in JetSym as graphs. This way, the module can be adjusted best.

Technical Data of the Oscilloscope	
Module registers that can be recorded	2 : Analog Input # 1 3 : Analog Input # 2 4 : Analog Input # 3 5 : Analog Input # 4
Time Base	1 ms ... 65,535 ms
Number of measured values	4 values simultaneously: 300 each 3 values simultaneously: 400 each 2 values simultaneously: 600 each 1 value: 1200
Module registers, to which a trigger condition can be assigned	2 : Analog Input # 1 3 : Analog Input # 2 4 : Analog Input # 3 5 : Analog Input # 4

9.2 Graphic Presentation by Oscilloscope

As of JetSym version 4.00, data can be recorded on a JX3 module by means of an oscilloscope. In the **Oscilloscope** directory of the JetSym operating range, create a new **Extended JetSym Oscilloscope** file. For this, select **New File ...** in the context menu.

Recording is carried out in **compatible mode**. Via the **Sampling** tab, **JX3 series** has to be selected for recording as a module. The slot number corresponds to the I/O module number in the system bus. In this case, the JX3-AI4 module has got the I/O module number 2.

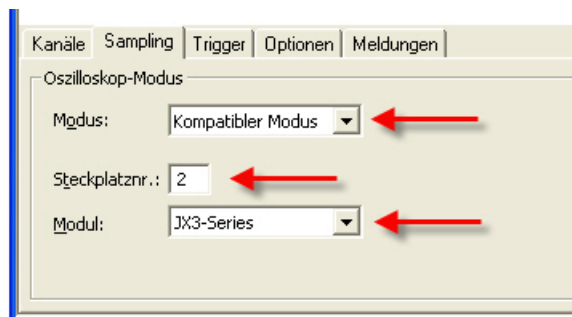


Figure 13: Settings for JX3 modules

After opening the oscilloscope file, the following window is displayed:

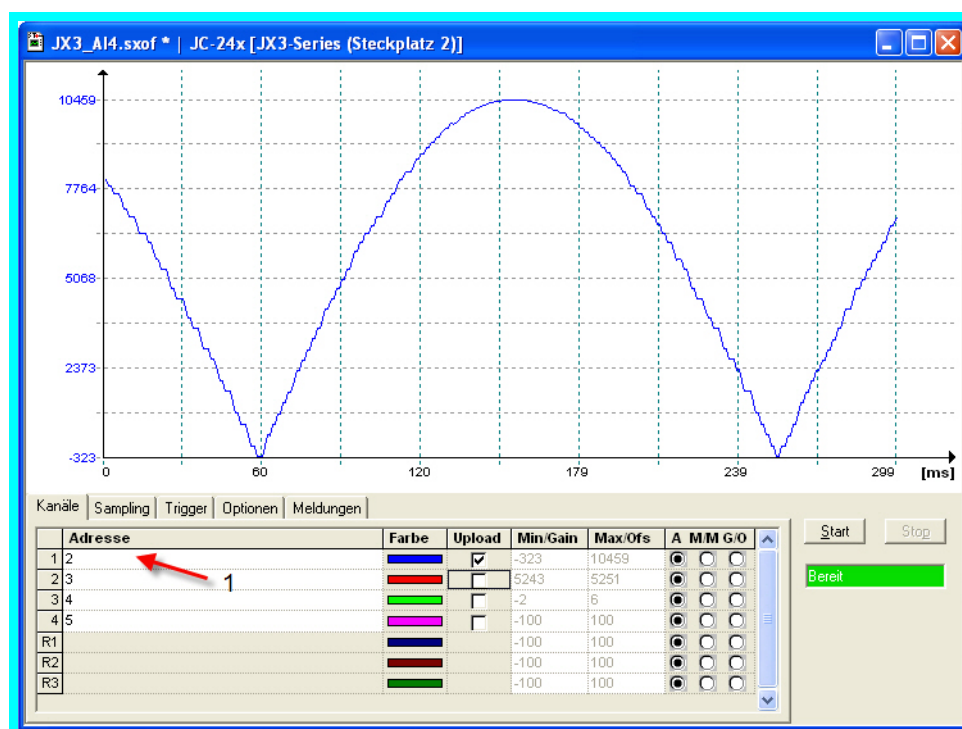


Figure 14: Recording an input signal

In the **Adresse** column (1), the numbers of the module registers to be reported have to be entered. By pressing the **Start** key, the module starts recording 300 values by

intervals of one millisecond. At the end of the recording, JetSym loads the data to display them graphically.

9.3 Triggering a Recording

At triggering a recording, the JX3-AI4 module continually checks whether a condition for triggering has been met. When the condition has been met, the module starts recording and storing the configured measured values.

The result of the recording can then be read from JetSym and be graphically displayed.

Trigger Condition

Module register[trigger 1] > Value[trigger1] and Module register[trigger 2] < Value[trigger2]

Example: ConfigureTrigger-Recording in Oscilloscope Mode

The JX3-AI4 module is to start recording the measured values, when in module register 2 a value between 10,000 and 15,000 has been measured.

As trigger 1 and trigger 2, module register number 2 has to be entered for analog input 1. The trigger values have to be entered as well. When triggering has been started, the module starts monitoring the trigger condition. When the condition has been met, the data can be loaded to JetSym and be graphically displayed.

9.4 Survey of Module Registers

Besides JetSym, the oscilloscope mode can also be started in the application program via module register. This enables the user to start recording in dependence of the application program. Data upload and graphic display in JetSym can be carried out later.



Note!

The recorded data get lost at switching off the module.

Commands for the Oscilloscope Mode	
Module Register	9740
Description	By means of commands, the functions of the oscilloscope mode are controlled on the module
Access	Read / write
Value Range	0 ... 3
Value After Reset	0

The following commands are available in the oscilloscope mode:

1 Start recording

The module starts recording the previously configured values. When the internal memory for measured values has been filled, the module stops recording.

2 Stop recording

By means of the "Stop" command, a recording process can be stopped.

3 Start recording when the trigger condition has been met

The module starts by monitoring the trigger condition. When the trigger condition has been met, the module starts recording the values.

Parameter Index for Oscilloscope Mode	
Module Register	9741
Description	By means of the parameter index, the parameter needed for the oscilloscope mode is selected. The parameter value can then be read out of module register 9742, respectively be written into module register 9742.
Access	Read / write
Value Range	0 ... 23

Parameters for the Oscilloscope Mode	
Module Register	9742
Description	This module register contains the value of the parameter for the oscilloscope mode. The parameter is selected via the parameter index (module register 9741).
Access	Read / write
Value Range	32 bits
Value After Reset	0

Parameters for Oscilloscope Mode:

0	Status (read only) Bit 0: 1 = Recording is in process Bit 1: 1 = Trigger is active
2	Max. number of channel After reset, the maximum number of channels to be recorded is specified in this parameter. By writing into this parameter, the number of channels can be reduced. At the same time, the possible number of measured value per channels is increased. Value range: 1, 2, 3, 4
3	Maximum number of measured values per channel (read only) When recording has been started, the module saves the measured values of the configured channels. When the maximum number has been reached, recording is stopped. This maximum number of measured values is dependent on the configured number of channels.
4	Minimum scan time (read only) This parameter renders the minimum scan time in milliseconds.
10	Scan time The scan time sets time intervals for the module in which the measured values are to be recorded. The product of the minimum scan time and actual scan time is the time interval between two recordings in milliseconds. Value range: 1 ... 65,535
11	Number of the module register for oscilloscope channel 1 Value range: 2, 3, 4, 5
12	Number of the module register for oscilloscope channel 2 Value range: 2, 3, 4, 5
13	Number of the module register for oscilloscope channel 3 Value range: 2, 3, 4, 5

14 **Number of the module register for oscilloscope channel 4**

Value range: 2, 3, 4, 5

20 **Number of the module register for trigger 1**

Value range: 2, 3, 4, 5

21 **Value for trigger 1**

Value range: -32,768 ... +32,767

22 **Number of the module register for trigger 2**

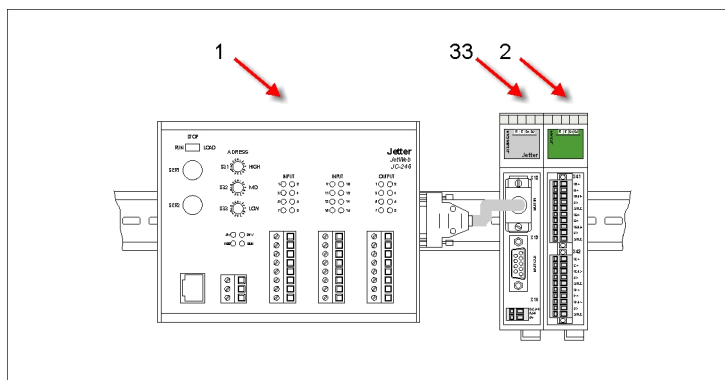
Value range: 2, 3, 4, 5

23 **Value for trigger 2**

Value range: -32,768 ... +32,767

9.5 Recording by the Application Program

Example: Start a Recording Procedure via Application Program



The measured values at analog input 2 of a JX3-AI4 module are to be recorded exactly at a set time instance of the application program. For this purpose, the oscilloscope function is to be configured and started via the module registers.

Recording is to last 6 seconds altogether. This means that scan time has to be configured to 20 milliseconds.

- The JX3-AI4 module has got I/O module number 2 in the Jetter system bus.

VAR

```
nm_Index : INT at %v1 3007;           // Index
nm_Data  : INT at %v1 3008;           // Data
```

END_VAR;

CONST

```
c_OsciCommand = 9740;                // Numbers of JX3 module registers
c_OsciParaIdx  = 9741;
c_OsciPara     = 9742;
```

END_CONST;

TASK 0

```
nm_Index := c_OsciParamIdx;
nm_Data := 10;
nm_Index := c_OsziPara;
nm_Date := 20;
nm_Index := c_OsziCommand;
nm_Date := 1;

// ...
// Osci Parameter Index
// Select scan time
// Osci Parameter
// Scan time to 20 ms
// Osci Command
// Start recording
// after recording, load up values
// in JetSym

END_TASK;
```

10 Forcing the Analog Inputs

10.1 Operating Principle

At forcing, the value of module register 1y04 *Force Value* is transmitted to the controller instead of the analog value of a connected sensor. At commissioning, the behavior of the connected sensor can be simulated that way. Exceptional cases that do not occur during normal operation can be tested as well.

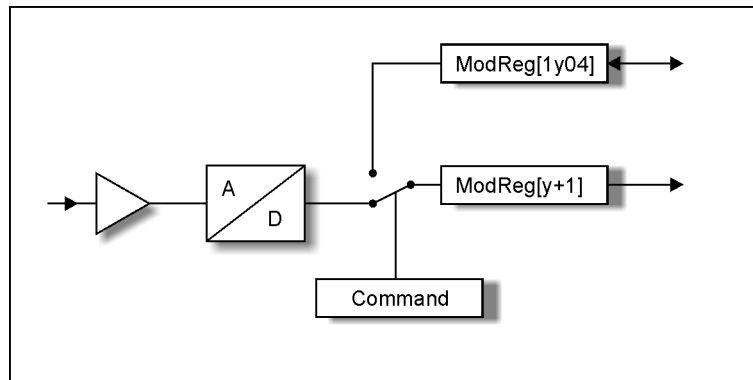


Figure 15: The function principle of forcing

At forcing, the connection between the module and the AD-converter is interrupted. Out of module register 1y04 *Force Value*, the value is copied to module register y+1 *Analog Input Value*. The controller itself now reads the simulated analog input value out of the JX3-AI4 module.

All additional functions of the JX3-AI4 module are kept completely. Only the function of checking, whether the analog input signal is beyond the measuring range, is deactivated. Forcing can be configured for each analog input individually.

When forcing is activated or deactivated, the data of the analog input become invalid. Bit 16 of the *Collective Bit Validity* in module register 0 *Status Module* is reset. Averaging is restarted.

10.2 Module Registers "Forcing"

Command Analog Input	
Module Register	1y01 y: Number of the Analog Input
Description	By means of certain commands, various functions of the analog input can be activated, respectively deactivated.
Access	Read / write
Value Range	8 bits
Value After Reset	0

The analog input has the following commands available:

30 Deactivate forcing

The AD-converter now transmits the values from analog input y to the controller.

When forcing is deactivated, the data of the analog input become invalid. Bit 16 of the *Collective Bit Validity* in module register 0 *Status Module* is reset. Averaging is restarted.

31 Activate forcing

By analog input y, the values are now transmitted from module register 1y04 *Force Value* to the controller.

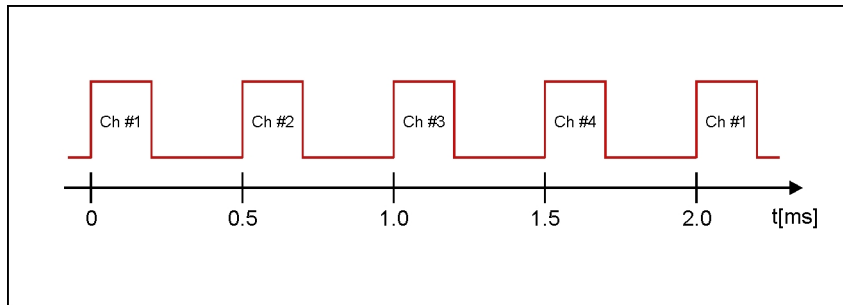
When forcing is activated, the data of the analog input become invalid. Bit 16 of the *Collective Bit Validity* in module register 0 *Status Module* is reset. Averaging is restarted.

Force Value	
Module Register	1y04 y: Number of the Analog Input
Description	The simulated value of analog input y.
Access	Read / write
Value Range	-32,768 ... 32,767
Value After Reset	0

11 Operating Modes

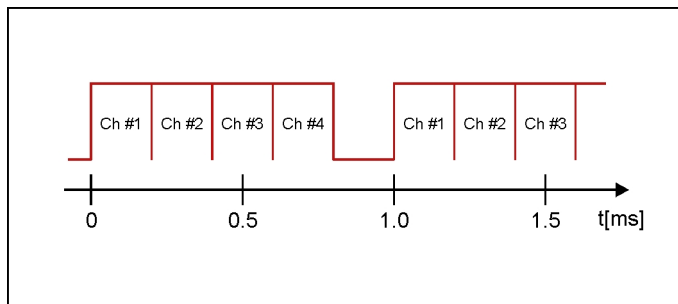
The JX3-AI4 module supports the operating mode **Individual Conversion** and **Collective Conversion**. After commissioning, the operating mode "Individual Conversion" is active. An operating mode is changed by writing command 1 *Activate Operating Mode "Individual Conversion"* or command 2 *Activate Operating Mode "Collective Conversion"* into module register 1 *Command*.

Operating Mode "Individual Conversion"



In the operating mode "Individual Conversion", the conversion time for all four analog inputs is 2 ms. In intervals of 0.5 ms, one analog input is read. The operating mode "Individual Conversion" is well apt for analog voltage sensors of a high output resistance of the sensor signal.

Operating Mode "Collective Conversion"



In the operating mode "Collective Conversion", the conversion time for all four analog inputs is 1 ms. In intervals of 1 ms, all four analog inputs are always read one after the other. The operating mode "Collective Conversion" is well apt for analog voltage sensors of a low output resistance of the sensor signal.

12 Diagnostics and Administration

12.1 Behavior in Fault Condition

Hardware Errors During the Operating Phase

The JX3-AI4 module checks the hardware regularly for various errors.

- Auxiliary voltages are ok.
- Communication with the ID converter is ok.

At identifying an error, the module changes to fault condition. In fault condition, the following actions are carried out:

- The error cause is entered into module register 0 *Status Module*.
- Bit 16 *Collective Bit Validity* in module register 0 *Status Module* is reset.
- Bit 16 *Validity of Analog Input Value* in module register 1y00 *Status of the Analog Input* is reset.
- All digitized values of the analog inputs are assigned value 0.

Error of Calibration Values

After activating, the JX3-AI4 module checks the calibration values stored to the EEPROM for their validity. If the calibration values are not valid, bit 4 *Error of Calibration Values* is set in module register 0 *Status Module*. The analog values are further being converted and transmitted to the controller. Yet, the accuracy of the analog values is not guaranteed any more.

12.2 Diagnostics by LEDs

The JX3-AI4 module is equipped with four LEDs for displaying various statuses.

LEDs				
View	LED	Color	Status	Function
	R	green	Off	Logic supply of the module is not ok
			is lit	Logic supply of the module is ok
	E	red	Off	Communication with the bus head, respectively with the JC-3xx, is active
			is lit	No communication
	D1	red	is lit	Hardware error
	D2	red	shortly flashing	There is no valid operating system available on the JX3-AI4 module. Carry out the update.
	D1 / D2	red	both are flashing	The operating system update is active.

12.3 Diagnostics by JX3 Module Registers

Status Module	
Module Register	0
Description	Status and error reports of the module and of all analog channels
Access	read
Value Range	32 bits, bit-coded
Value After Reset	0xC1010000 in faultless condition

The Meaning of the Individual Bits in the Module Status:

Bit 0: Hardware error

- 0 = No error
- 1 = There is a hardware error. Bit 0 can be set after a delay when bit 4 and bit 7 have been set.
The exact error cause can be specified via bit 4 through bit 7.
-

Bit 4: Error regarding adjusted values

- 0 = Adjusted values have been read correctly.
- 1 = Hardware error at reading the stored adjusted values.
The error cannot be fixed by the user. The Jetter maintenance service has to be called on.
-

Bit 6: Error regarding the AD converter

- 0 = No error
- 1 = Hardware error at reading the analog input values of the AD converter. The error can be acknowledged by means of command 5 **Acknowledge hardware errors**.
If the error remains after acknowledging, the hardware is defective. The Jetter maintenance service has to be called on.
-

Bit 7: Error regarding internal voltages

- 0 = No error
- 1 = At least one internal voltage is or was not within the permitted limits.
The error bit is set by the JX3-AI4 module.
-

Bit 16: Collective bit "Validity"

- 0 = The analog input value in module registers 2 ... 5 is not valid. The average of at least one analog input is still to be calculated.
The collective bit "Validity" is reset for the following actions:
- The configuring procedure of the analog input is modified.
 - The user-scaling procedure is modified.
 - The averaging procedure is modified.
 - In case of an error regarding internal voltages
 - In case of an error regarding the AD converter
- 1 = The analog input values in module registers 2 ... 5 are valid. The bit remains set, until the procedures of user-scaling, configuring the analog input or averaging have been modified. In case of a hardware error, the bit is reset as well.

Bit 19: Collective bit "Falling below the lower limit"

- 1 = The configured lower limit of at least one analog input has been fallen below.
The bit is set by the JX3-AI4 module when the limit has been fallen below. It is not reset by the module any more.
Resetting the bit is carried out by the user.

Bit 20: Collective bit "Exceeding the upper limit"

- 1 = The configured upper limit of at least one analog input has been exceeded.
The bit is set by the JX3-AI4 module when the limit has been exceeded. It is not reset by the module any more.
Resetting the bit is carried out by the user.

Bit 21: Collective bit "Analog input signal out of range in negative direction"

- 1 = The voltage at at least one analog input has been fallen below. At a bipolar input, the limit is -11 V, at a unipolar input, it is -0.5 V.
The bit is reset by the user.

Bit 22: Collective bit "Analog input signal out of range in positive direction"

- 1 = The voltage at at least one analog input was greater than +11 V, respectively, the current at at least one analog input was greater than 22 mA.
The bit is reset by the user.

Bit 23: Collective bit "Forcing"

- 0 = Forcing is not active
- 1 = Forcing is active for at least one analog input
Forcing can be activated, resp. deactivated, by commands via the command register of the analog input.

Bit 24: Monitoring internal voltages

- 0 = Monitoring is not active
- 1 = Monitoring is active
Monitoring can be activated, respectively deactivated, by commands.

Bit 30: Synchronous data exchange

- 1 = Between the JX3-AI4 module and the bus head, respectively the JetControl JC-3xx, there is synchronous data exchange.

Bit 31: Operating mode

- 0 = Collective conversion
- 1 = Individual conversion
The operating mode can be configured via commands.

Analog Input Status	
Module Register	1y00 y: Number of the Analog Input
Description	Status messages of an analog input
Access	Read
Value Range	32 bits, bit-coded
Value After Reset	0x00010000

The Meaning of the Individual Bits in the Analog Input Status:**Bit 16: Validity of the analog input value**

- 0 = The analog input value in module registers 2 ... 5 is not valid.
The average of the analog input is still to be calculated.
- 1 = The analog input value in module registers 2 ... 5 is valid.
The bit remains set, until the procedures of user-scaling, configuring the analog input or averaging have been modified.
In case of a hardware error, the bit is reset as well.

Bit 19: Falling below the lower limit

- 1 = The lower limit of the analog input configured by the user has been fallen below.
The bit is set by the JX3-AI4 module when the limit has been fallen below. It is not reset by the module any more.
The bit is reset by the user.

Bit 20: Exceeding the upper limit

- 1 = The upper limit of the analog input configured by the user has been exceeded.
The bit is set by the JX3-AI4 module when the limit has been exceeded. It is not reset by the module any more.
The bit is reset by the user.

Bit 21: Analog input signal out of range in negative direction

- 1 = The voltage at the analog input has been fallen below. At a bipolar input, the limit is -11 V, at a unipolar input, it is -0.5 V.
The bit is reset by the user.

Bit 22: Analog input signal out of range in positive direction

- 1 = The voltage at the analog input was greater than +11 V, respectively, the current at the analog input was greater than 22 mA.
The bit is reset by the user.

Bit 23: Forcing

- 0 = Forcing is not active
- 1 = Forcing has been activated for this analog input
Forcing can be activated, respectively deactivated, by commands via the command register of the analog input.

Operating System Release	
Module Register	9
Description	The operating system release of the JX3-AI4 module in the "Major.Minor.Branch.Build" format
Access	read
Value Range	32 bits
Value After Reset	Up-to-date operating system release
Comment	A released operating system can be recognized by both Branch and Build having got value zero. For displaying the operating system release number in the setup window of JetSym, please select the format "IP address".

Via JetSym, a new operating system can be transmitted to the JX3-AI4 module.
Operating systems can be downloaded via the Internet of the Jetter AG.

12.4 Electronic Data Sheet (EDS)

In the individual JX3 modules, various product relevant data have been stored to a remanent memory. These include serial number, hardware version, etc. All data have been combined in the so-called Electronic Data Sheet (EDS).

Survey of the EDS Registers		
Register(s)	Description	Remanent
10040 ... 10041	EDS data are selected	no
10042 ... 10105	EDS data	yes (read only)

Pointer onto I/O-Module Number for EDS	
Register(s)	10040
Description	Via this register, a JX3 module of which the EDS data are to be accessed is selected.
Access	Read / Write
Value Range	2 ... 63
Value After Reset	33

Pointer to EDS Page	
Register(s)	10041
Description	By means of this register, an EDS page of the JX3 module is selected.
Access	Read / Write
Value Range	0 ... 1
Value After Reset	0

The EDS data can be read by the controller via registers. Writing data is not possible. In order to read the EDS files, the I/O module number has to be written to register 10040. Then, the respective EDS page has to be written to register 10041. Dependent on the selected EDS page, the EDS data can then be read out of register 10042 and the following. At reading the EDS files in JetSym, the respective type has to be selected.

EDS Page 0 - Identification		
Register(s)	Type	Description
10042	int	Version of the EDS page
10043	int	Module code
10044 ... 10054	string	Module name
10055	int	Hardware version
10056	int	Hardware version

EDS Page 1 - Production		
Register(s)	Type	Description
10042	int	Version of the EDS page
10043 ... 10049	string	Module serial number
10050	int	Production date, day
10051	int	Date of production, month
10052	int	Production date, year

Example: Reading the EDS via the JetSym Setup Window

For reading the EDS via setup window of JetSym, the structure of the EDS pages is defined as a type. After this, three variables are defined basing on the type.

```

TYPE
JX3_EDS:                                     // EDS selection of registers
STRUCT
    ns_Module : INT;
    ns_page : INT;
END_STRUCT;
JX3_EDS0:                                     // Registers of EDS page 0
STRUCT
    ns_Version : INT;
    ns_Code : INT;
    s_Name : STRING[31];
    ns_PCB_Rev : INT;
    ns_PCB_Opt : INT;
END_STRUCT;
JX3_EDS1:                                     // Registers of EDS page 1
STRUCT

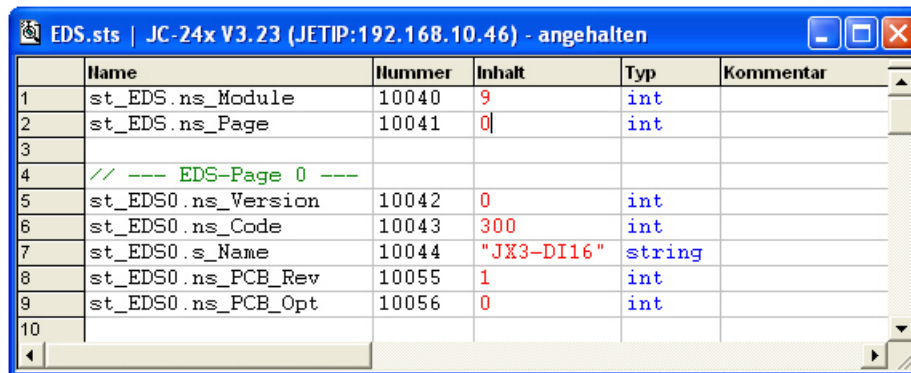
```

```

    ns_Version : INT;
    s_Sernum : STRING[19];
    ns_TS_Day : INT;
    ns_TS_Month : INT;
    ns_TS_Year : INT;
END_STRUCT;
END_TYPE;

VAR
    st_EDS : JX3_EDS at %v1 10040;           // EDS selection
    st_EDS0 : JX3_EDS0 at %v1 10042;        // EDS Page 0
    st_EDS1 : JX3_EDS1 at %v1 10042;        // EDS Page 1
END_VAR;

```



	Name	Nummer	Inhalt	Typ	Kommentar
1	st_EDS.ns_Module	10040	9	int	
2	st_EDS.ns_Page	10041	0	int	
3					
4	// --- EDS-Page 0 ---				
5	st_EDS0.ns_Version	10042	0	int	
6	st_EDS0.ns_Code	10043	300	int	
7	st_EDS0.s_Name	10044	"JX3-DI16"	string	
8	st_EDS0.ns_PCB_Rev	10055	1	int	
9	st_EDS0.ns_PCB_Opt	10056	0	int	
10					

Figure 16: EDS Page 0 displayed in the setup window

In the setup window above, EDS Page 0 (st_EDS.ns_Page) is displayed by the JX3 module of I/O module number 9 (st_EDS.ns_Module).

Appendix

13 Recent Revisions

The following changes have been made to revision 1.01.2 of this manual:

- Instead of “Edition”, “Revision” is used in the future.
- Minimum requirements of module JX3-AI4: Starting from Software release V 1.01.
- Illustrations in chapter “Connection of Voltage Sensors” have been modified.
- Illustrations in chapter “Connection of Current Sensors” have been modified.
- Chapter 7 “Status and Command” has been subdivided into chapters 7.1 “Status” and 7.2 “Command” .

14 Survey of Module Registers

Survey of the JX3 Module Registers		
Module Register	Description	Remanent
0 ... 1	Status and Command	no
2 ... 5	Analog values of the individual inputs	no
7 ... 8	Module registers for indirect access	no
9	Operating system release	no
1100 ... 1199	Module registers for analog input # 1	no
1200 ... 1299	Module registers for analog input # 2	no
1300 ... 1399	Module registers for analog input # 3	no
1400 ... 1499	Module registers for analog input # 4	no
9470 ... 9474	Oscilloscope	no

Register Table		
Direct Access via Jetter System Bus		
Module Register	Description	1) Value Range 2) Reset Value 3) Cross Reference
0	Status module	1) 32 bit 2) 0xC1010000 3) (on page 40)
1	Command	1) 32 bit 2) 0 3) (on page 43)
2	Analog input value 1	1) -32768 .. 32767 2) Input value 3) (on page 36)
3	Analog input value 2	1) -32768 .. 32767 2) Input value 3) (on page 36)
4	Analog input value 3	1) -32768 .. 32767 2) Input value 3) (on page 36)
5	Analog input value 4	1) -32768 .. 32767 2) Input value 3) (on page 37)
7	Index for indirect module register access	1) 0 ... 9.999 2) 9 3) (on page 30)
8	Data for indirect module register access	1) 32 bit 2) Version 3) (on page 31)
9	Operating system release	1) 32 bit 2) Version 3) (on page 72)
Indirect Access via Jetter System Bus - Analog Input y: 1 ... 4		
Module Register	Description	1) Value Range 2) Reset Value 3) Cross Reference
1y00	Status of the analog input	1) 32 bit 2) Diagnostics 3) (on page 43)
1y01	Command analog input	1) 32 bit 2) 0 3)
1y06	Averaging	1) 1, 4, 16 2) 16 3) (on page 53)
1y07	Configuration	1) 1, 5, 6 2) 1 3) (on page 35)

1y08	Lower limit	1) -32768 .. 32767 2) -32768 3) (on page 54)
1y09	Upper limit	1) -32768 .. 32767 2) 32767 3) (on page 54)
1y20	Slave pointer to the minimum value	1) -32768 .. 32767 2) 32767 3) (on page 55)
1y21	Slave pointer to the maximum value	1) -32768 .. 32767 2) -32768 3) (on page 56)
1y24	1. voltage / current value for user-scaling	1) -20000 .. 20000 2) -10000 3) (on page 48)
1y25	1. digital value for user-scaling	1) -32768 .. 32767 2) -32768 3) (on page 49)
1y26	2. voltage / current value for user-scaling	1) -20000 .. 20000 2) 10000 3) (on page 49)
1y27	2. digital value for user-scaling	1) -32768 .. 32767 2) 32767 3) (on page 49)
Indirect Access via Jetter System Bus - Oscilloscope		
Module Register	Description	1) Value Range 2) Reset Value 3) Cross Reference
9470	Command for oscilloscope	1) 8 bit 2) 0 3) (on page 60)
9471	Parameter index for the oscilloscope mode	1) 8 bit 2) 0 3) (on page 60)
9472	Parameters for the oscilloscope mode	1) 32 bit 2) 0 3) (on page 61)

15 Design

15.1 Physical Dimensions

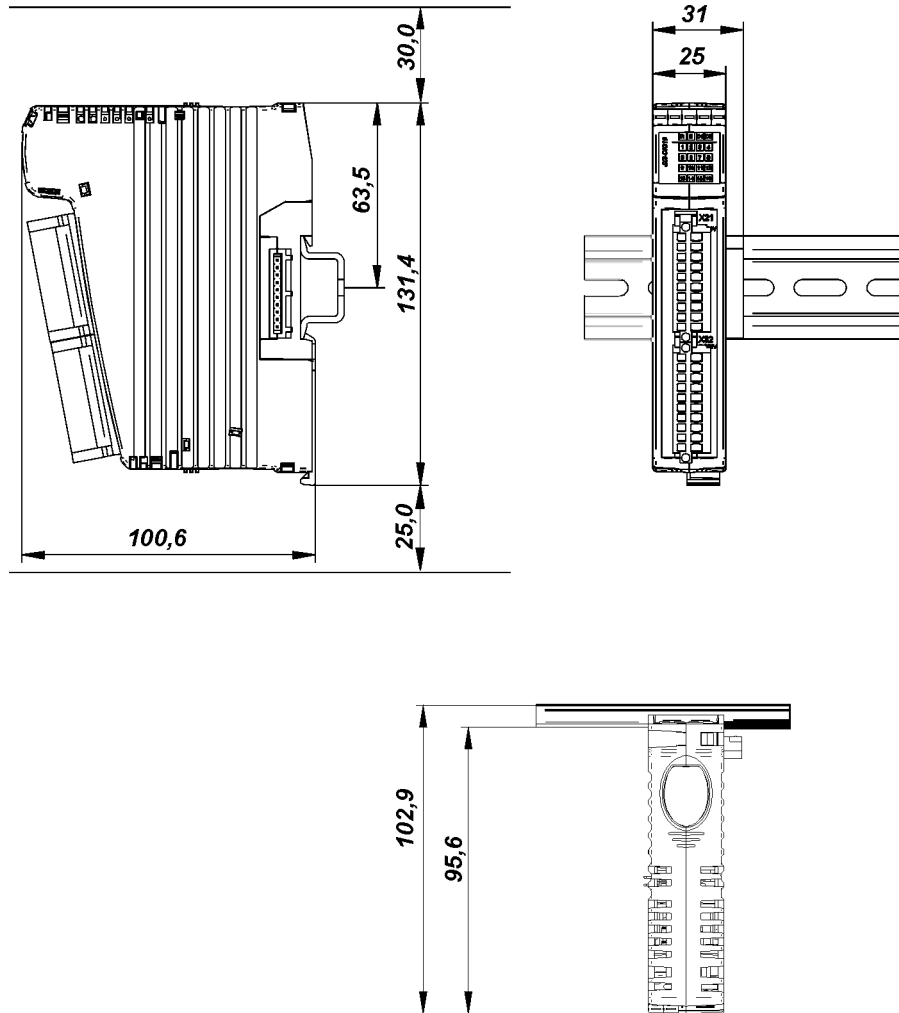


Figure 17: Physical dimensions in mm, mounted on DIN-rail EN 50022 - 35 x 7.5

**Note!**

At mounting the JX3 modules, a minimum clearance above and below must be maintained. The minimum clearance above is 30 mm, the minimum clearance below is 25 mm.

The clearance is needed for dismounting the JX3 module from the JX3 backplane module.

The first JX3 module requires a space of 31 mm width. Each further JX3 module increases the width of a JX3 station by 25 mm.

The JX3 modules must be mounted in vertical position. Only at vertical mounting, optimum heat dissipation of the modules is guaranteed.

Design	
Dimensions (H x W x D in mm)	131 x 31 x 100
Weight	160 g
LED sheeting	Color: RAL 6018, yellow-green
JX3 module enclosure	Plastic, Color: RAL 7035, light grey
JX3 backplane module	Plastic, Color: RAL 5002, ultramarine blue
Installation	On DIN-rail EN 50022 – 35 x 7.5 or EN 50022 – 35 x 15

15.2 Description of Connections

Module JX3-AI4 has been equipped with the following connections:

X41	Connection for analog inputs 1 and 2 10-pin male connector, 3.5 mm pitch, with an integrated screwed gland for the female connector
X42	Connection for analog inputs 3 and 4 10-pin male connector, 3.5 mm pitch, with an integrated screwed gland for the female connector

16 Operating Conditions

16.1 Environment and Mechanics

Operating Parameters (Environmental Data)		
Parameters	Value(s)	Standard
Operating Temperature Range	0 ... +50 °C	
Storage Temperature Range	-40 ... +70 °C	DIN EN 61131-2 DIN EN 60068-2-1 DIN EN 60068-2-2
Air Humidity	10 ... 95 % (non-condensing)	DIN EN 61131-2
Pollution Degree	2	DIN EN 61131-2
Corrosion Immunity / Chemical Resistance	No special protection against corrosion. Ambient air must be free from higher concentrations of acids, alkaline solutions, corrosive agents, salts, metal vapours, or other corrosive or electroconductive contaminants	
Atmospheric Pressure	2,000 m	DIN EN 61131-2

Operating Parameters (Mechanical Data)		
Parameters	Value(s)	Standard
Free Falls Withstanding Test	Free fall at ... Shipping container 1 m Product packaging 0.3 m	DIN EN 61131-2 DIN EN 60068-2-32
Vibration Resistance	5 Hz - 9 Hz: 3.5 mm amplitude 9 Hz - 150 Hz: 1 g Acceleration 1 octave/minute, 10 frequency sweeps (sinusoidal), all 3 spatial axes	DIN EN 61131-2 DIN EN 60068-2-6
Shock Resistance	15 g occasionally, 11 ms, sinusoidal half-wave, 3 shocks in the directions of all three spatial axes	DIN EN 61131-2 DIN EN 60068-2-27
Protection Class	IP 20	DIN EN 60529
Mounting Position	Vertical position, snapped on DIN rail	

16.2 Enclosure

Operating Parameters (Electrical Safety)		
Parameters	Value(s)	Standard
Protection Class	III	DIN EN 61131-2
Dielectric Test Voltage	Functional ground is connected to chassis ground internally.	DIN EN 61131-2
Protective Connection	0	DIN EN 61131-2
Overvoltage Category	II	DIN EN 61131-2

Operating Parameters (EMC) - Emitted Interference		
Parameters	Value(s)	Standard
Enclosure	Frequency band 30-230 MHz, limit 30 dB ($\mu\text{V/m}$) at 10 m distance Frequency band 230 through 1,000 MHz, limit 37 dB ($\mu\text{V/m}$) at 10 m distance (class B)	DIN EN 61000-6-3 DIN EN 61000-6-4 DIN EN 55011

Operating Parameters (EMC) - Immunity to Interference		
Parameters	Value(s)	Standard
Magnetic Field with Mains Frequency	50 Hz 30 A/m	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-8
RF Field, amplitude-modulated	Frequency band 80 MHz - 2 GHz Test Field Strength 10 V/m AM 80 % with 1 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-3
ESD	Discharge through air: Test peak voltage 8 kV Contact Discharge: Test peak voltage 4 kV Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-2

16.3 Direct Current Input Connectors and Output Connectors

Operating Parameters (EMC) - Emitted Interference		
Parameters	Value(s)	Standard
Signal and Control Connection Direct Voltage Supply Inputs and Outputs	Frequency bands: 0.15 to 0.5 MHz, limit 40 to 30 dB 0.5 to 30 MHz, limit 30 dB (class B)	DIN EN 61000-6-3

Operating Parameters (EMC) - Immunity to Interference		
Parameters	Value(s)	Standard
RF, asymmetric	Frequency band 0.15 - 80 MHz Test voltage 3 V AM 80 % with 1 kHz Source impedance 150 Ohm Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-6
Bursts	Test voltage 2 kV tr/tn 5/50 ns Repetition rate 5 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-4
Voltage Surges, asymmetric (line to earth), symmetric (line to line)	tr/th 1.2/50 μ s Common mode launching 1 kV Push-pull launching 0.5 kV	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-5

16.4 Shielded Data and I/O Lines

Operating Parameters (EMC) - Immunity to Interference		
Parameters	Value(s)	Standard
Asymmetric RF, amplitude-modulated	Frequency band 0.15 - 80 MHz Test voltage 3 V AM 80 % with 1 kHz Source impedance 150 Ohm Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-6
Burst (Bursts)	Test voltage 1 kV tr/tn 5/50 ns Repetition rate 5 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-4
Voltage Surges, asymmetric (line to earth)	tr/th 1.2/50 µs Common mode launching 1 kV	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-5

Operating Parameters EMC - Immunity to Interference Functional Ground Connection		
Parameters	Value(s)	Standard
RF, asymmetric	Frequency band 0.15 - 80 MHz Test voltage 3 V AM 80 % with 1 kHz Source impedance 150 Ohm Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-6
Bursts	Test voltage 1 kV tr/tn 5/50 ns Repetition rate 5 kHz Criterion A	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-4

17 Technical Data

Data of the JX3 System Bus	
Logic voltage of the backplane	DC + 5 V (-15 % ... +10 %)
Current consumption of the backplane logic voltage	typical : 135 mA
Additional voltage of backplane	DC + 24 V (-15 % ... +20 %)
Current consumption of the additional backplane voltage	typical : 10 mA
Rated output consumption out of the JX3 system bus	typical : 915 mW

Electrical Data of the Analog Voltage Input	
Rated voltage input range	-10 V ... +10 V
Protection against overvoltage	- 30 V ... + 30 V
Input impedance	differential: 200 k Ω Single-ended: 100 k Ω
Accuracy	< 0,5 %
Resolution	15 bit + sign
Input frequency	0 Hz ... 200 Hz
Common mode range	\pm 2 V
Conversion time	< 1 ms
Electrical isolation	None

Electrical Data of the Analog Current Input	
Rated current input range	0 ... 20 mA
Protection against overvoltage	- 30 V ... + 30 V
Input impedance	< 100 Ω
Accuracy	< 0,5 %
Resolution	15 bits
Input frequency	0 Hz ... 200 Hz
Conversion time	< 1 ms
Electrical isolation	None
Current limitation	Self-resetting circuit-braker
Tripping current	min. > 0.15A

18 Glossary General

A

A/D

Analog/**D**igital

AC

Alternating **C**urrent Alternating Current

AM

Amplitude **M**odulate

C

CAN

Controller **A**rea **N**etwork

CE

Communautés **E**uropéennes

or

Windows CE

COM

COMunication;

The first serial port is identified as COM 1, the second as COM 2, etc.

CTS

Clear **T**o **S**end

D

D/A

Digital/**A**nalog

DC

Direct **C**urrent Direct current

DIN

Deutsches Institut für **N**ormung = German Industry Standard

E

EC Low Voltage Directive

To be considered when using electric devices of a rated voltage between 50 V and 1,000 V AC and between 75 and 1,500 V DC.

Electro-Magnetic Compatibility (EMC)

Definition according to the EMC regulations:

"EMC is the ability of a device to function in a satisfactory way in an electro-magnetic environment without causing electromagnetic disturbances itself, which would be unbearable for other devices in this environment."

EMC

Electro **M**agnetic **C**ompatibility;

Definition according to the EMC regulations: "EMC is the ability of a device to function in a satisfactory way in an electro-magnetic environment without causing electromagnetic disturbances itself, which would be unbearable for other devices in this environment."

EN

Europäische **N**orm, that is: European Standard

ESD

Electro **S**tatic **D**ischarge

EU

European **U**nion

F**Firmware**

Startup routines and low-level software are stored in the firmware. Firmware falls between software and hardware in terms of ease of modification.

H**Hazard Analysis**

Extract from the Machinery Directive 98/37/EC:

The manufacturer is under an obligation to assess the hazards in order to identify all of those which apply to his machine; he must then design and construct it taking account of his assessment.

I**IEC**

International **E**lectrotechnical **C**ommission .

IP

International **P**rotection

or

Internet **P**rotocol

J**Jetter System Bus**

The Jetter system bus is a system-bus system of a cable length of 200 m max., and of fast data transmission rates of 1 Mbit/s. In addition to this, the Jetter system bus is highly immune to interferences. Therefore, the Jetter system bus is suited to realise field bus applications in a limited space.

JetWeb

Control technology comprising control systems, motion systems, user interfaces, visualization devices, remote I/Os and industrial PCs. Programming by means of multitasking and a modern sequence-oriented language. Communication by means of Ethernet TCP/IP and making use of the Web technologies.

L

LED

Light - **E**mitting **D**iode .

N

NN

Normal **N**ull = Sea Level

R

RS-232

An accepted industry standard for serial data transmission.

RS: **R**ecommended **S**tandard

For transmission distances of less than 15 m. No differential evaluation. Transmitting and receiving on different lines.

RS-422

An accepted industry standard for serial data transmission.

RS: **R**ecommended **S**tandard

For transmission distances over 15 m. Two differential evaluations each. Transmitting and receiving on different lines.

RS-485

An accepted industry standard for serial data transmission.

RS: **R**ecommended **S**tandard

For transmission distances over 15 m. Two lines with differential evaluation. Transmitting and receiving on the same line.

RTS

Request **T**o **S**end

RxD

Receive (**RX**) **D**ata: Receive Data

A line used to carry received serial data from one device to another.

S

SELV

Safe Extra Low Voltage:

Voltage, which, under all operating conditions will not exceed a peak or DC voltage of 42.4 V. This voltage is either measured between two conductors or between one conductor and earth.

The circuit, in which this voltage occurs, must be separated from the mains power supply by a safety isolating transformer or some equivalent.

SUB-D

Type name of a plug-in connector

T

th

Hold time of a burst ('time hold')

tn	Total time of burst ('time normal')
tr	Rise time of burst ('time rise')
TXD	Transmit (TX) Data: Transmit data A line used to carry transmitted serial data from one device to another.
V	
Vcc	Supply voltage; generally DC 5 V

19 Glossary Peripheral Modules

D

Diagnostic bit

A diagnostic bit describes a status. A status can be, for example, missing supply of the actuators or reaching a limit.

Diagnostic bits can be read via status register.

E

ENC

Encor: "Coding device"

Error bit

An error bit marks a critical error requiring intervention by the user. A critical error might be cable break or short circuit.

Error bits can be read via status register.

J

JX3 backplane module

The JX3 modules are linked with each other by means of the backplane module (via the JX3 system bus connector).

The JX3 backplane module is snapped onto the DIN rail.

JX3 module

It consists of a JX3 module enclosure and a JX3 backplane module.

JX3 module enclosure

Contains the specific electronic devices for the respective JX3 module.

JX3 system bus

The JX3 modules are interconnected via the JX3 system bus.

M

Module Registers

Every module has got a diagnostics, administration and configuration to be carried out via module register.

The entire register number results from the number of the module register, and of a register prefix. The register prefix is determined by the position of the module in the system.

P

PID

Proportional-Integral-Differential (controller)

R

Register Prefix

The register prefix is part of the register number. It is determined by the position of a module in the system. The register prefix in connection with the module register number results in the register number.

Register(s)

Registers can be accessed directly in the application program of the controller, in a setup window of JetSym, or via the user interface directly. A register is marked by a number consisting of a register prefix and a module register number.

T

Tap Line

Open end of a line connected to the system bus.

Thermistor

A thermistor is a thermometer, at which the temperature is measured by means of the temperature dependence of the electric resistance of a substance. Frequently, thermistors are also called resistive sensors. Pt100 and Pt1000, for example, are thermistors.

U

Universal I/O

Combined digital I/Os are called universal I/Os. Sensors and actuators can be connected to a universal I/O.

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