JX3-DIO16

Digital Input and Output Module

User Manual

Jetter

60872136

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Address

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Assignment to product

This user manual is an integral part of JX3-DIO16:

Type: _____

Serial #: _____

Year of manufacture: _____

Order #: _____

CE

To be entered by the customer:

Inventory #: _____

Place of operation: _____

Significance of this user manual

This document is an integral part of the JX3-DIO16:

- Keep this document in a way that it is always at hand until the JX3-DIO16 will be disposed of.
- Pass this document on, if the JX3-DIO16 is sold or loaned/leased out.

In any case you encounter difficulties to clearly understand this document, please contact Jetter AG.

Jetter AG would appreciate any suggestions and contributions on your part and would ask you to contact Jetter AG at the following e-mail address: info@jetter.de. This will help the documentation department produce documents that are more user-friendly, as well as address your wishes and requirements.

This document contains important information on the following topics:

- Transport
- Mounting
- Installation
- Programming
- Operation
- Maintenance
- Repair

Therefore, the user must carefully read, understand and observe this document and especially the safety instructions.

In the case of missing or inadequate knowledge of this document, Jetter AG shall be exempted from any liability. Therefore, the operating company is recommended to obtain the persons' confirmation in writing that they have read and understood this document.

Table of Contents

1 Safety instructions

Introduction

This chapter informs the user of general safety instructions. It also warns of residual dangers, if applicable. This chapter also contains information on EMC.

Contents

Basic Safety Instructions

Introduction

This device complies with the valid safety regulations and standards. Jetter AG attaches great importance to the safety of the users.

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

- Relevant accident prevention regulations;
- Accepted safety rules;
- EC guidelines and other country-specific regulations

Intended conditions of use

Usage according to the intended conditions of use implies operation in accordance with this user manual.

The JX3-DIO16 has been designed as a peripheral module for use in machines and is intended for connection to an already existing controller. The JX3-DIO16 is a peripheral module.

Only operate the JX3-DIO16 module within the limits and conditions set forth in the technical specifications. Because of its low operating voltage, the JX3-DIO16 module is classified as SELV (Safety Extra Low Voltage). The JX3-DIO16 module is therefore not subject to the EU Low Voltage Directive.

Usage other than intended

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

The JX3-DIO16 is no safety-related part as per Machinery Directive 2006/42/EC. This device is not qualified for safety-relevant applications and must, therefore, NOT be used to protect persons.

If you intend to operate the device at ambient conditions not being in conformity with the permitted operating conditions, please contact Jetter AG beforehand.

Personnel qualification

Depending on the life cycle of the product, the persons involved must possess different qualifications. In order to grant safety in handling the device at each phase of the product life cycle, the following requirements must be met.

Product life cycle	Minimum qualification
Transport/storage:	Trained and instructed personnel with knowledge in handling electrostatic sensitive components.
Mounting/installation:	Specialized personnel with training in electrical engineering, such as industrial electronics technician.
Commissioning/ programming:	Trained and instructed experts with profound knowledge of, and experience with, electrical/drive engineering, such as electronics engineer for automation technology.
Operation:	Trained, instructed and assigned personnel with knowledge in operating electronic devices.
Decommissioning:	Specialized personnel with training in electrical engineering, such as industrial electronics technician.

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 authorized by Jetter AG will result in a loss of any liability claims to Jetter AG. **The original parts are specifically designed for the device. Parts and equipment from other manufacturers are not tested, and therefore not released by Jetter AG.** 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.
Transporting JX3 modules	The JX3 module contains electrostatic sensitive components which can be damaged if not handled properly. To prevent damages to JX3 modules, the JX3 backplane bus has to be attached during transport. This is particularly true for transport via mail. To prevent the JX3 module from being damaged, ship it only in its original packaging and in packaging protecting against electrostatic discharge. In case of damaged packaging inspect the device for any visible damage. Inform your freight forwarder and Jetter AG.
Storing	When storing the JX3-DIO16 observe the environmental conditions given in the technical specification.
Repair and maintenance	The operator is not allowed to repair the device. The device does not contain any parts that could be repaired by the operator. If the device needs repairing, please send it to Jetter AG.
Replacing modules	During exchange of JX3 modules, class of protection IP20 is not ensured. Do not touch any electronic components once a JX3 module housing has been removed from the JX3 backplane module. If you touch the EMC clip, you may damage this clip. A damaged clip may result in lower noise immunity.
Disposal	When disposing of the device, the local environmental regulations must be complied with.

Instructions on EMI

Noise immunity of a system

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

Measures

Measures for increasing EMI in electric plants:

- The module JX3-DIO16 must 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:

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

Downloading Application Note 016

You can download Application Note 016 from the Jetter AG homepage at **www.jetter.de http://www.jetter.de**. In order to download Application Note 016 "EMC-Compatible Installation of Electric Cabinets" browse the following path: Industrial Automation - Support - Downloads - 07_application_notes".

2 Product description and equipment configuration

Introduction

This chapter covers the design of the device, as well as how the order reference is made up including all options.

Contents

Product description - JX3-DIO16

The JX3-DIO16 module

The JX3-DIO16 module is a peripheral module for connection of digital sensors and actuators. This module is equipped with 8 digital inputs and 8 multi-purpose digital I/Os. A multi-purpose I/O can be used as digital input or digital output.

Product features

The features of this product are listed below:

- 8 digital inputs
- Input type: IEC 61131-2 type 3, pnp
- 8 multi-purpose I/Os (can be used as inputs or outputs)
- Input type: IEC 61131-2 type 3, pnp
- Output voltage: DC +24 V
- Output current: 0.5 A
- Short-circuit proof
- Color of LED membrane: traffic red (RAL 3020)

Additional features

Additional features of the JX3-DIO16 module are the following:

- Pulse stretching for digital inputs (8 digital inputs can be configured)
- Digital input filters for digital inputs
- Sensor and actuator voltage recognition
- Read back the condition of digital outputs
- Pulse width modulation (PWM) (8 digital outputs can be configured)
- Counter function
- Short-circuit detection

Scope of delivery

The following items are included in the scope of delivery of the JX3-DIO16 module:

Jetter item no.	Quantity	Description
10000517	1	JX3-DIO16
60869252	2	10-pin connector, spring-cage technology
60870411	10	Terminal labels
60871025	1	Installation Instruction
60870410	1	Keying pins

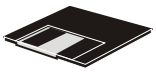
JX3 modules: List of documentation

Introduction

Various documents and software tools will support the user when engineering, installing and programming the JX3-DIO16 module. These documents and software tools can be downloaded from the Jetter AG **homepage http://www.jetter.de**.

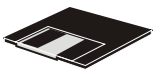
Engineering

When performing engineering tasks, the following documents and files will support you:

	**Data sheet on the JX3-DIO16 module**
	■ Product description
	■ Technical specifications
	■ Dimensional drawings
	**User manual on the JX3-DIO16 module**
	■ the document at hand
	**CAD data of the JX3-DIO16 module**
	■ dxf file with 2D illustrations
	■ stp file with 3D illustrations
	**User manual on the JC-3xx control system**
	■ Engineering a JX3 station
	■ Product descriptions of JX3 modules

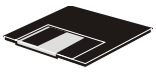
Engineering a JX3 station on the JX2 system bus

The following document and software tool will support you in engineering a JX3 station on the JX2 system bus (JC-24x and JC-647):

	**JX2-I/O system - User information**
	■ System bus topology
	■ JX2 system bus specification
	■ Product descriptions of JX3-BN-CAN, JX2 and IP67 modules, as well as third-party modules
	**System bus configurator**
	■ Excel file for designing the system bus
	■ SysBus_Configuration_xxx_e.xls (xxx: version)

Engineering a JX3 Station on the JX3 System Bus

The following document and software tool will support you in engineering a JX3 station on the JX3 system bus (JC-3xx):

	**System bus configurator**
	■ Excel file for designing the system bus
	■ JX3-SysBus_Configurator_xxx_e.xls (xxx: version)

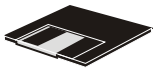
Installation

The following document will support you in installing modules:

	**Installation Instruction**
	It is included in the boxed module JX3-DIO16 and contains information on:
	■ Installation of the module on a DIN rail
	■ Terminal assignment
	■ Specification of conductor terminals
	■ Diagnostics via LEDs
	**User manual on the JX3-DIO16 module**
	■ the document at hand

Programming

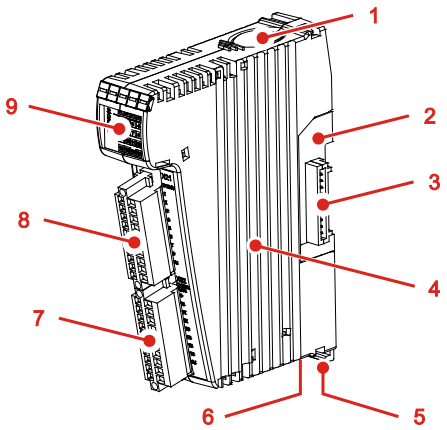
The following documents and software tools will support you in programming the module:

	**User manual on the JX3-DIO16 module**
	■ the document at hand
	**JX2-I/O system - User information**
	■ Module numbering system
	■ Diagnostics of the modules on the JX2 system bus
	**JetSym**
	■ Programming tool
	**User manual on the controller**
	■ Depending on the controller used you will need the corresponding manual

Parts and interfaces of the module

Parts and interfaces

The illustration below shows the parts and interfaces of the JX3-DIO16 module:

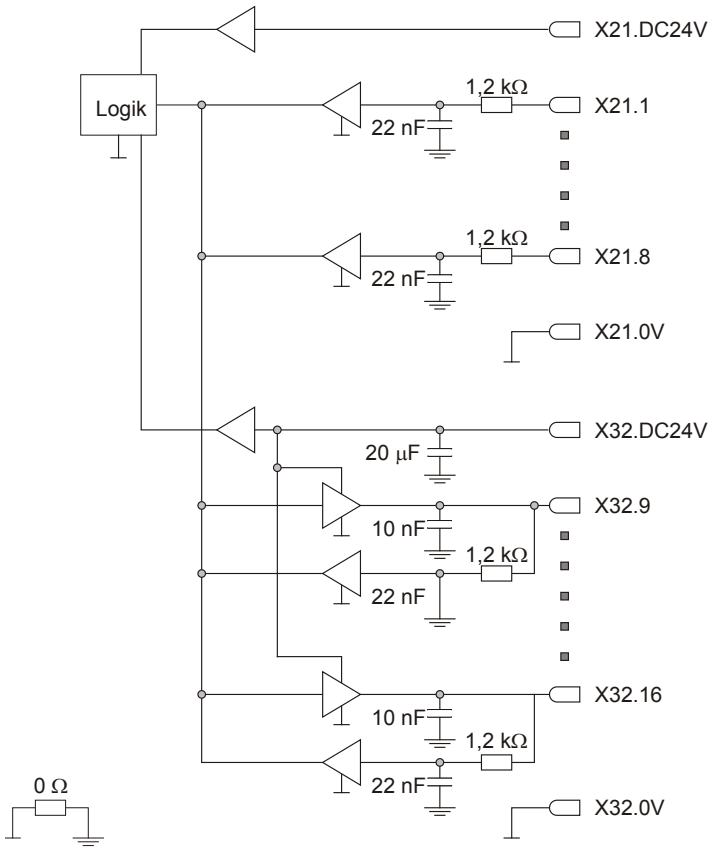


Number	Element	Description
1	Upper latch	Lets you remove the JX3 module enclosure from the JX3 backplane module
2	JX3 backplane module	Support and connecting device
3	Connectors	Connectors for further JX3-modules
4	JX3 module enclosure	Can be removed from the JX3 backplane module
5	DIN rail latch	For removing the JX3 module from the DIN rail.
6	Lower latch	Lets you remove the JX3 module enclosure from the JX3 backplane module ■ Not visible in illustration
7	Terminal X32	Connecting multi-purpose I/Os: ■ As digital inputs IN 9 ... 16 ■ As digital outputs OUT 9 ... 16
8	Terminal X21	Connecting digital inputs IN 1 ... 8
9	LED	Diagnostic and status LEDs

Internal block diagram

Internal block diagram

The illustration shows that you can use inputs X21.1 ... X21.8 as mere inputs. Due to dual-purpose circuitry of the drivers, X32.9 ... X32.16 can be used both as input- and output. This lets you read back the level of the switched output and check, whether the output has actually been set.



Element	Description
Logic circuit	Communication
22 nF	Capacitance on the digital input
10 nF	Capacitance on the digital output
20 µF	Capacitance on the output supply
X21.DC24V	Recognition of the sensor supply at inputs IN 1 ... 8
X32.DC24V	Recognition of the sensor supply at inputs IN 9 ... 16 and supply of the output driver of the digital outputs OUT 9 ... 16

Minimum requirements

Keeping the software version up-to-date

You operate the JX3-DIO16 module in a system consisting of various components by Jetter AG. In order to ensure proper interaction of these components the operating system used and the programming tool JetSym must have the release numbers listed below.

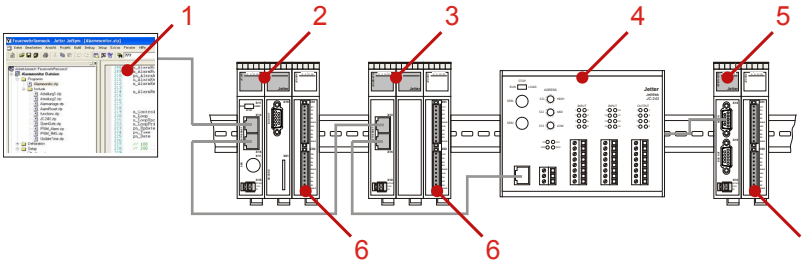
Configurations

The module JX3-DIO16 can be connected to

- JetControl 3xx
- Ethernet bus node JX3-BN-ETH
- JX2 system bus of a JetControl 24x via CAN bus node JX3-BN-CAN
- JX2 system bus of a dual-axis controller JM-D203-JC24x via CAN bus node JX3-BN-CAN
- JX2 system bus of a JetControl JC-647 equipped with a submodule JX6-SB(-I) via CAN bus head JX3-BN-CAN
- JX2 system bus of a JetControl 9xx equipped with a submodule JX6-SB(-I) via CAN bus node JX3-BN-CAN

Minimum requirements

To be able to use the functions described in this document, the modules, controllers and software must meet the following minimum requirements:



No.	Element	Description	Software version (or higher)
1	JetSym	Programming software	V. 3.00
2	JC-3xx	PLC JetControl 3xx	V. 1.09.0.00
3	JX3-BN-ETH	Ethernet bus node	V. 1.09.0.00
4	JC-24x	PLC JetControl 240	V. 3.23
	JC-647	PLC JetControl 647	V. 3.50
	JX6-SB(-I)	Submodule for system bus	V. 2.17
	JM-D203-JC24x	Dual-axis controller with integrated PLC JetControl 240	V. 1.12.0.00
5	JX3-BN-CAN	CAN bus node	V. 1.03.0.00
6	JX3-DIO16	Digital input/output module	V. 2.35.0.00

Accessories for the JX3 system

Labelling strips

Ten labelling strips are included in the scope of delivery of the JX3-DIO16 module.

	Designation	DIV_DEK_5/5_MC-10_NEUT_WS
	Jetter item no.	60870411
	Packaging unit	100 pcs.

Keying pins

One keying pin is included in the scope of delivery of the JX3-DIO16 module:

	Designation	DIV_BL_SL_3.5_KO_OR
	Jetter item no.	60870410

Strain relief for BU_10_E_BLZF_GE_RM 3.5

	Designation	DIV_BL_3.5_ZE_8
	Jetter item no.	60870963

End clamp for DIN rail

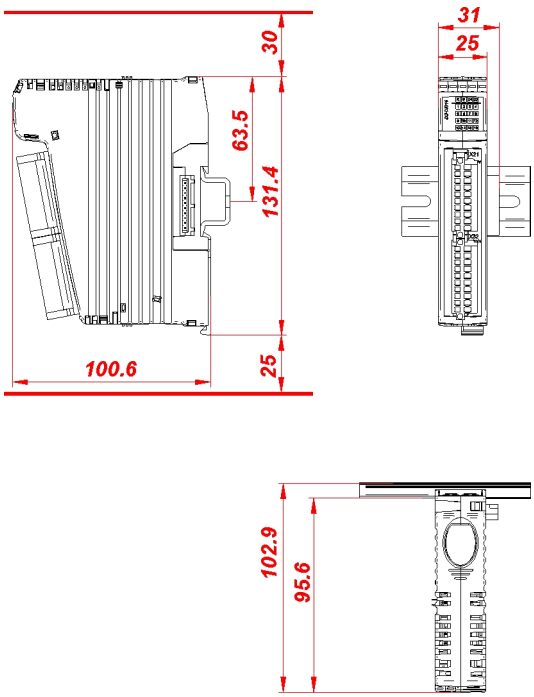
	Designation	DIV_CLIPFIX_35
	Jetter item no.	60863970

Screwdriver

	Type	SD 0.4 x 2.5 - DIN 5264-A
	Designation	DIV_SCHRAUBENDREHER_2,5*75
	Jetter item no.	60871712

Physical dimensions

Physical dimensions



Minimum clearances

At mounting the JX3-DIO16 module, make sure to maintain a minimum clearance above and below. This ensures that there will be enough room to press the latches of the JX3 backplane module when replacing modules.

- Minimum clearance, above: 30 mm
- Minimum clearance, below: 25 mm

Module width

The JX3-DIO16 module requires a space of 31 mm width. At connecting the JX3-DIO16 module to a JX3 station, the width is increased by 25 mm.

Mounting orientation

The mounting orientation of the JX3-DIO16 module is vertical.

3 Identifying the module

Purpose of this chapter

This chapter supports you in obtaining the following information from the JX3-DIO16 module:

- Determining the revision of this module.
- Retrieving Electronic Data Sheet (EDS) information. Numerous manufacturing-relevant data are stored to EDS.

Prerequisites

To be able to identify the JX3-DIO16 module the following prerequisites must be fulfilled:

- The JX3-DIO16 module is connected to a JetControl PLC.
- The controller is connected to a PC.
- The programming tool JetSym is installed on the PC.
- The minimum requirements regarding modules, controllers and software are fulfilled.

Information for hotline requests

If you wish to contact the hotline of Jetter AG in case of a problem, please have the following information on the JX3-DIO16 module ready:

- Version number in MR 9
- Hardware revision

Module code

The module code of the JX3-DIO16 is 301.

Contents

Module revisions

Introduction

Each JX3 module features software with a unique revision number which can be read out via module registers. You will need these revision data if you have to contact the hotline of Jetter AG in case of a problem.

Revision number format

The revision numbers of the JX3-DIO16 module are four-figure values.

1	.	2	.	3	.	4

Element	Description
1	Major or main version number
2	Minor or secondary version number
3	Branch or intermediate version number
4	Build version number

Register overview

Revision numbers can be read out of the following module registers:

Register	Description
MR 9	OS version
MR 32	FPGA revision
MR 769	Bootloader version

Released version

A released version can be recognized by both Branch and Build having got the value 0.

Version numbers in the JetSym setup

For displaying the version number in the setup pane of JetSym, select the format "IP address".

	Name	Number	Content	Type
1	Version	3019	1.1.0.0	int
2				

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-24x of OS version 3.27.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

Revision numbers in the JetSym ST application program

To display a revision number in the application program use identifier *IP#*. The JX3 module out of which the OS version specified in this example is read out, has got I/O-module number 3.

```
Var
    JX3_Module_revision : Int At %VL 3019;
End_Var;

Task 0
    // Checking a revision number
    When
        JX3_Module_revision = IP#1.1.0.0
    Continue;
    // ...
End_Task;
```

Related topics

- **Register description - Identification** (see page 36)

Electronic Data Sheet EDS with JC-3xx

Introduction

Numerous production-relevant data are permanently stored to the EDS. EDS information can be retrieved from registers on the controller JC-3xx.

Register overview

The following registers let you read out EDS data:

Register	Description
R 100500	Interface: 1 = Peripheral modules of the JX3 station
R 100501	Module number within the JX3 station
R 100600 ... R 100614	EDS page 0 - Data
R 100700 ... R 100710	EDS page 1 - Data

EDS page 0 - Contents

Production-related data can be read from EDS page 0.

Register	Type	Description
R 100600	int	Revision of EDS page 0
R 100601	int	Module code
R 100602 ... R 100612	string	Module name
R 100613	int	Hardware revision
R 100614	int	Hardware revision

EDS page 1 - Contents

Production-related data can be read from EDS page 1.

Register	Type	Description
R 100700	int	Revision of EDS page 1
R 100701 ... R 100707	string	Serial number
R 100708	int	Production date: day
R 100709	int	Production date: month
R 100710	int	Production date: year

Reading an EDS page

To read an EDS page of a JX3 module connected to a JC-3xx proceed as follows:

Step	Action
1	Select the interface by entering 1 into R 100500.
2	Select the JX3-module by entering the module number into R 100501.
3	Read out EDS data from registers R 100600 ... 100710.

Related topics

- **Example: Reading out an EDS - JC-3xx**

Electronic Data Sheet EDS - JC-24x

Introduction

Numerous production-relevant data are permanently stored to the EDS. Special registers let you retrieve EDS information. This information is distributed among EDS page 0 and EDS page 1. Only one page at a time can be accessed via registers.

Register overview

The following registers let you read out EDS data:

Register	Description
R 10040	I/O module number on the JX2 system bus
R 10041	EDS page
R 10041 ... R 10056	EDS page 0 - Data
R 10041 ... R 10052	EDS page 1 - Data

EDS page 0 - Contents

Production-related data can be read from EDS page 0. To be able to read out EDS page 0 register R 10041 must contain value 0.

Register	Type	Description
R 10042	int	Revision of EDS page 0
R 10043	int	Module code
R 10044 ... R 10054	string	Module name
R 10055	int	Hardware revision
R 10056	int	Hardware revision

EDS page 1 - Contents

Production-related data can be read from EDS page 1. To be able to read out EDS page 1 special register 10041 must contain value 1.

Register	Type	Description
R 10042	int	Revision of EDS page 1
R 10043 ... R 10049	string	Serial number
R 10050	int	Production date: day
R 10051	int	Production date: month
R 10052	int	Production date: year

Reading an EDS page

To read an EDS page of a JX3 module connected to a JC-24x proceed as follows:

Step	Action
1	Select the JX3 module by entering the I/O module number into R 10040.
2	Select the EDS page by entering the page number into R 10041.
3	Read out EDS data from registers R 10042 ... 10056.

Related topics

- **Example: Reading out an EDS - JC-24x** (see page 34)

Electronic Data Sheet EDS - JC-647 + JX6-SB(-I)

Introduction

Numerous production-relevant data are permanently stored to the EDS. Special registers let you retrieve EDS information. This information is distributed among EDS page 0 and EDS page 1. Only one page at a time can be accessed via registers.

Register overview

The register numbers for reading the EDS are dependent on the submodule socket number *m* where the JX6-SB(-I) is located:

Register	Description
R 3m10040	I/O module number on the JX2 system bus
R 3m10041	EDS page
R 3m10041 ... R 3m10056	EDS page 0 - Data
R 3m10041 ... R 3m10052	EDS page 1 - Data

EDS page 0 - Contents

Production-related data can be read from EDS page 0. To be able to read out EDS page 0 register R 3m10041 must contain value 0.

Register	Type	Description
R 3m10042	int	Revision of EDS page 0
R 3m10043	int	Module code
R 3m10044 ... R 3m10054	string	Module name
R 3m10055	int	Hardware revision
R 3m10056	int	Hardware revision

EDS page 1 - Contents

Production-related data can be read from EDS page 1. To be able to read out EDS page 1 register R 3m10041 must contain value 1.

Register	Type	Description
R 3m10042	int	Revision of EDS page 1
R 3m10043 ... R 3m10049	string	Serial number
R 3m10050	int	Production date: day
R 3m10051	int	Production date: month
R 3m10052	int	Production date: year

Reading an EDS page

To read out an EDS page proceed as follows:

Step	Action
1	Select the JX3 module by entering the I/O module number into R 3m10040.
2	Select the EDS page by entering the page number into R 3m10041.
3	Read the EDS data from registers R 3m10042 ... 3m10056

Example: Reading out an EDS - JC-3xx

Task

Have JetSym display EDS data of any JX3 module in its Setup pane.

Solution

In a JetSym application program, declare the EDS registers variables. Then enter the variables in the setup pane.

Sample configuration

A JX3-xxx module is connected to a JC-3xx controller. The module JX3-xxx is part of a JX3 station and its module number is 2.

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-350 of OS version 1.16.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym STX program

```
Type
        // Defining interface and module number
    JX3_EDS:
    Struct
        _Interface  : Int;
        Module      : Int;
    End_Struct;

        // Defining EDS page 0
    JX3_EDS_PAGE0:
    Struct
        Version     : Int;
        Code        : Int;
        ModuleName  : String[31];
        PCB_REV     : Int;
        PCB_Opt     : Int;
    End_Struct;

        // Defining EDS page 1
    JX3_EDS_PAGE1:
    Struct
        Version     : Int;
        Sernum      : String[19];
        TS_Day      : Int;
        TS_Month    : Int;
        TS_Year     : Int;
    End_Struct;
End_Type;

Var
```

```
    EDS  : JX3_EDS At %VL 100500;
    EDS0 : JX3_EDS_PAGE0 At %VL 100600;
    EDS1 : JX3_EDS_PAGE1 At %VL 100700;
End_Var;

Task main Autorun
// ...
End_Task;
```

Reading EDS page 0

	Name	Number	Content	Type
1	⊟ EDS	100500	struct	
2	├ EDS.Interface	100500	1	int
3	└ EDS.Module	100501	2	int
4				
5	⊟ EDS0	100600	struct	
6	├ EDS0.Version	100600	0	int
7	├ EDS0.Code	100601	300...399	int
8	├ EDS0.ModuleName	100602	"JX3-xxx"	string
9	├ EDS0.PCB_REV	100613	1	int
10	└ EDS0.PCB_Opt	100614	0	int
11				

Element	Description
EDS.Interface	1 = EDS data of the modules within the JX3 station
EDS.Module	2 = Module number

Reading EDS page 1

	Name	Number	Content	Type
1	⊟ EDS	100500	struct	
2	├ EDS.Interface	100500	1	int
3	└ EDS.Module	100501	2	int
4				
5	⊟ EDS1	100700	struct	
6	├ EDS1.Version	100700	0	int
7	├ EDS1.Sernum	100701	"20080305070007"	string
8	├ EDS1.TS_Day	100708	5	int
9	├ EDS1.TS_Month	100709	3	int
10	└ EDS1.TS_Year	100710	2008	int
11				

Element	Description
EDS.Interface	1 = EDS data of the modules within the JX3 station
EDS.Module	2 = Module number

Example: Reading out an EDS - JC-24x

Task

Have JetSym display EDS data of any JX3 module in its Setup pane.

Solution

In a JetSym application program, declare the EDS registers variables. Then, enter these variables into the setup pane.

Sample configuration

A JX3-BN-CAN equipped with a JX3-xxx module is connected to a JC-24x controller. The JX3-xxx module has got I/O module number 2 on the JX2 system bus.

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-24x of OS version 3.27.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym ST program

```
Type
    // Defining module number and EDS page
    JX3_EDS:
    Struct
        Module   : Int;
        Page     : Int;
    End_Struct;

        // Defining EDS page 0
    JX3_EDS_PAGE0:
    Struct
        Version  : Int;
        Code     : Int;
        Name     : String[31];
        PCB_REV  : Int;
        PCB_Opt  : Int;
    End_Struct;

        // Defining EDS page 1
    JX3_EDS_PAGE1:
    Struct
        Version  : Int;
        Sernum   : String[19];
        TS_Day   : Int;
        TS_Month : Int;
        TS_Year  : Int;
    End_Struct;
End_Type;

Var
```

```
    EDS  : JX3_EDS At %VL 10040;
    EDS0 : JX3_EDS_PAGE0 At %VL 10042;
    EDS1 : JX3_EDS_PAGE1 At %VL 10042;
End_Var;

Task
//
End_Task;
```

Reading EDS page 0

	Name	Nummer	Content	Type
1	EDS.Module	10040	2	int
2	EDS.Page	10041	0	int
3				
4	EDS0.Version	10042	0	int
5	EDS0.Code	10043	300...399	int
6	EDS0.Name	10044	"JX3-xxx"	string
7	EDS0.PCB_REV	10055	1	int
8	EDS0.PCB_Opt	10056	1	int
9				

Element	Description
EDS.Module	2 = Module number
EDS.Page	0 = Data of EDS page 0

Reading EDS page 1

	Name	Number	Content	Type
1	EDS.Module	10040	2	int
2	EDS.Page	10041	1	int
3				
4	EDS1.Version	10042	0	int
5	EDS1.Sernum	10043	"20080215070060"	string
6	EDS1.TS_Day	10050	25	int
7	EDS1.TS_Month	10051	4	int
8	EDS1.TS_Year	10052	2007	int
9				

Element	Description
EDS.Module	2 = Module number
EDS.Page	1 = Data of EDS page 1

Identifying the module

MR 9

OS version

MR 9 indicates the OS version number of the module JX3-DIO16. JetSym lets you transfer another operating system to the JX3-DIO16 module.

Module register properties	
Values	Released OS version: IP#1.0.0.0 ... IP#254.255.0.0
	Bootloader version IP#255.1.0.0 ... IP#255.255.0.0
Type of access	Read access
Value after reset	OS version

MR 32

FPGA revision

In MR 32, the FPGA revision of the module JX3-DIO16 is displayed. The user is not allowed to change the FPGA revision number.

Module register properties	
Values	IP#1.0.0.0 ... IP#255.255.0.0
Type of access	Read access
Value after reset	FPGA revision

Related topics

- **Programming the JX3 modules** (see page 67)

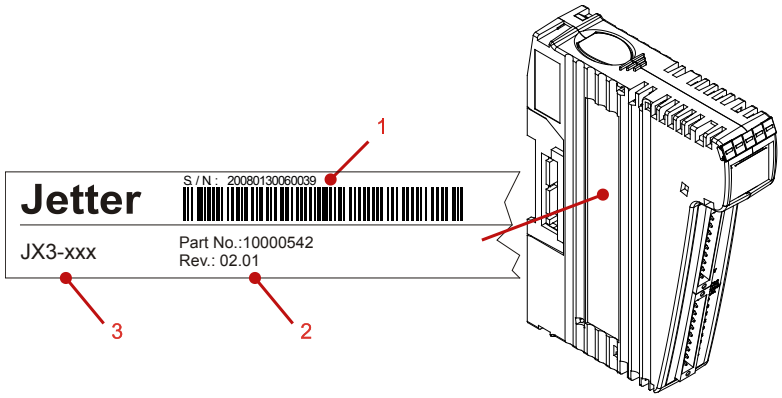
Identification by means of the nameplate

Introduction

Each JX3 module can be identified by its nameplate attached to its enclosure. You will need the hardware revision data if you have to contact the hotline of Jetter AG in case of a problem.

Nameplate

The nameplate of JX3 modules contains the following information:



Number	Description
1	Serial number
2	Hardware revision
3	Module name

4 Mounting and installation

Purpose of this chapter

This chapter is for supporting you in mounting and installing the JX3-DIO16 as regards the following points:

- Planning the wiring of a JX3-DIO16
- Supplying the JX3-DIO16 with power
- Connecting sensors and actuators to the JX3-DIO16
- Description of the display items
- Installation

Contents

4.1 Interfaces

Depending on the individual JX3 peripheral module, the respective terminals have got differing functions and pin assignments.

Contents

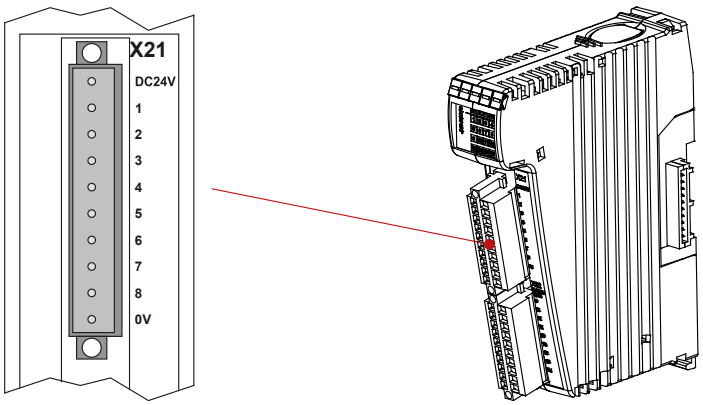
Assignment of terminal X21

Interfaces of terminal X21

Terminal X21 lets you connect the signals of the following interfaces:

- Sensor supply at digital inputs IN 1 ... 8 at 3-wire- connection
- Digital inputs IN 1 ... 8
- Sensor supply recognition

Assignment of terminal X21



Terminal point	Function
DC24V	Sensor supply at digital inputs IN 1 ... 8 at 3-wire connection
1	Digital input IN 1
2	Digital input IN 2
3	Digital input IN 3
4	Digital input IN 4
5	Digital input IN 5
6	Digital input IN 6
7	Digital input IN 7
8	Digital input IN 8
0V	Reference potential

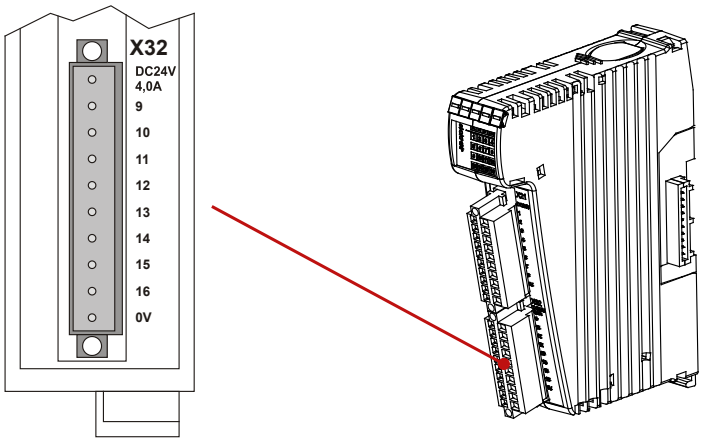
Assignment of terminal X32

Interfaces of terminal X32

Terminal X32 lets you connect the following interface signals:

- Sensor supply at the digital inputs IN 9 ... 16 at 3-wire- connection
- Digital inputs IN 9 ... 16
- Power supply of the output driver of digital outputs OUT 9 ... 16
- Digital outputs 9 ... 16
- Sensor and actuator supply recognition

Assignment of terminal X32

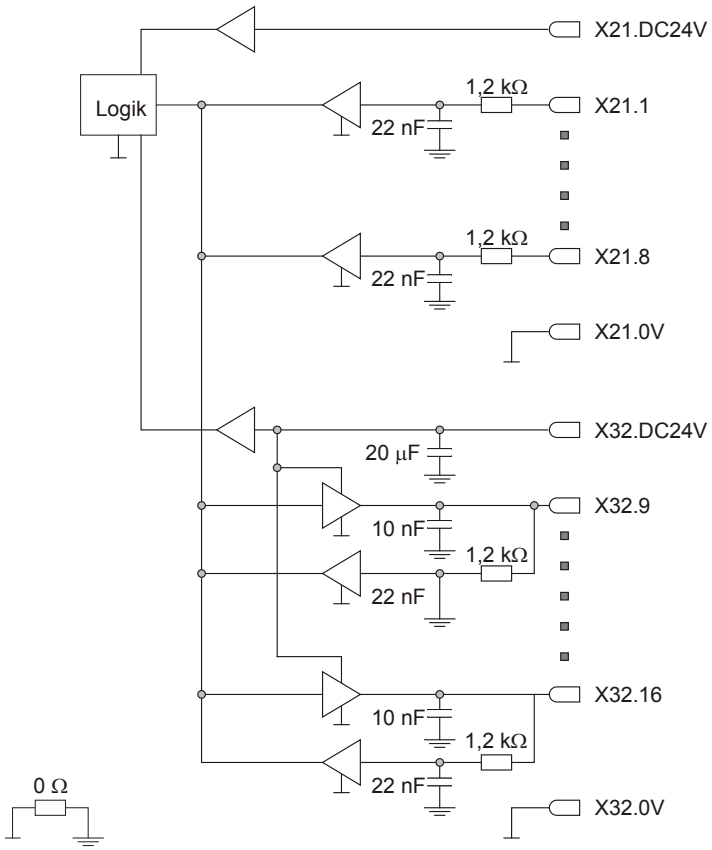


Terminal point	Function
DC24V 4.0A	Sensor supply at digital inputs IN 9 ... 16 at 3-wire connection, and supply of the output driver of digital outputs OUT 9 ... 16
9	Multi-purpose I/O, input IN 9 or output OUT 9
10	Multi-purpose I/O, input IN 10 or output OUT 10
11	Multi-purpose I/O, input IN 11 or output OUT 11
12	Multi-purpose I/O, input IN 12 or output OUT 12
13	Multi-purpose I/O, input IN 13 or output OUT 13
14	Multi-purpose I/O, input IN 14 or output OUT 14
15	Multi-purpose I/O, input IN 15 or output OUT 15
16	Multi-purpose I/O, input IN 16 or output OUT 16
0V	Reference potential

Internal block diagram

Internal block diagram

The illustration shows that you can use inputs X21.1 ... X21.8 as mere inputs. Due to dual-purpose circuitry of the drivers, X32.9 ... X32.16 can be used both as input- and output. This lets you read back the level of the switched output and check, whether the output has actually been set.

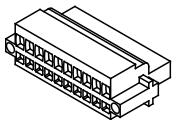


Element	Description
Logic circuit	Communication
22 nF	Capacitance on the digital input
10 nF	Capacitance on the digital output
20 µF	Capacitance on the output supply
X21.DC24V	Recognition of the sensor supply at inputs IN 1 ... 8
X32.DC24V	Recognition of the sensor supply at inputs IN 9 ... 16 and supply of the output driver of the digital outputs OUT 9 ... 16

BLZF connector specification for terminals X21/X32

Ordering data of the connector

Two 10-pin plugs are included in the scope of delivery of the JX3-DIO16 module. They can also be ordered individually by the following ordering data:

	Designation	BU_10_E_BLZF__GE_RM3.5
	Jetter item no.	60869252

Connector specification

For information on connector specification refer to the following list:

Connector specification	
Connector technology	Spring cage connection
Type	10-pin, contact spacing 3.5 mm
Connectable conductors	
Outer diameter of the isolation	2.90 mm max.
AWG	16 ... 28
Terminal range	0.13 … 1.5 mm^2
Stripping length	10 mm
Specification without wire end ferrules	
Single conductor H05(07) V-U	0.2 … 1.5 mm^2
Finely stranded conductor H05(07) V-K	0.2 … 1.5 mm^2
Specification with wire end ferrules	
Wire end ferrule without collar to DIN 46228/1	0.2 … 1.5 mm^2
Wire end ferrule with collar to DIN 46228/4	0.2 … 1.5 mm^2
Crimping tool to DIN 46228	PZ 4, PZ 6 ROTO, PZ 6/5

Screwdriver

The corresponding screwdriver can be obtained from Jetter AG.

Type	SD 0.4 x 2.5 - DIN 5264-A
Designation	DIV_SCHRAUBENDREHER_2,5*75
Jetter item no.	60871712

Connecting digital actuators

Conductor design

Please observe the following aspects when connecting digital signals:

- Shielding is not required.
- Use the proper wire size for the amperage requirement of the actuator

Separation of load and logic voltage

Separate load and logic voltage Use separate power supply units for connecting the load voltage of digital inputs or outputs and the logic voltage.

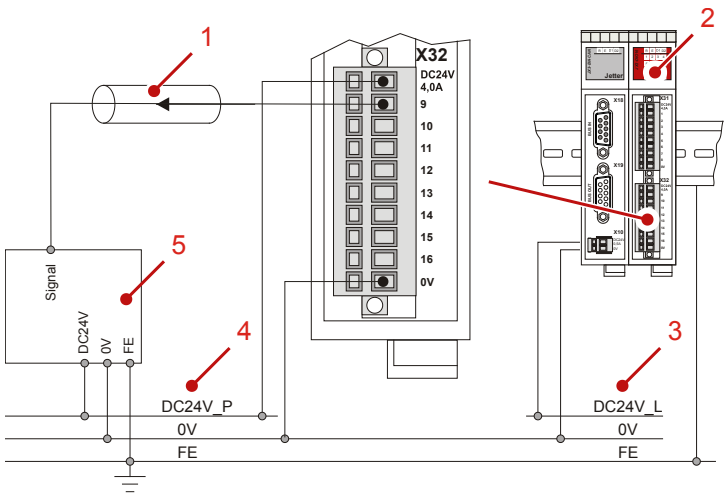
Separating load and logic voltage has got the following advantage:

- When the load voltage is switched off, communication with the JX3 modules is still possible.

Connecting digital actuators

To all 8 outputs digital actuators are connected in the same way. The following illustration shows an actuator connected to output OUT 9.

Load voltage DC24V_P at terminal X32.DC24V and logic voltage DC24V_L at terminal X10 of the JX3-BN-CAN module are supplied by separate power supply units.



Number	Description
1	Line to the digital actuator
2	Digital input/output module JX3-DIO16
3	Power supply for the JX3 station
4	Power supply for the digital actuator
5	Digital actuator with separate power supply

Related topics

- **Technical specifications** (see page 153)

Connecting digital sensors in 1-wire technology

Conductor design

Please observe the following aspects when connecting digital signals:

- Shielding is not required.
- Use the proper wire size for the amperage requirement of the actuator

Separation of load and logic voltage

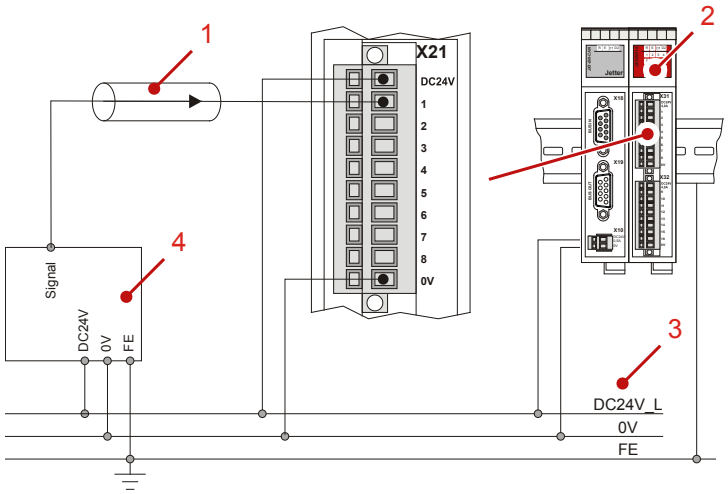
Separate load and logic voltage Use separate power supply units for connecting the load voltage of digital inputs or outputs and the logic voltage.

Separating load and logic voltage has got the following advantage:

- When the load voltage is switched off, communication with the JX3 modules is still possible.

Connecting digital sensors

The connection of digital sensors is identical for all 8 inputs and all 8 multi-purpose I/Os. In the following illustration, a sensor has been connected to input IN 1.



Number	Description
1	Cable leading to the digital sensor
2	Digital input/output module JX3-DIO16
3	Power supply for the JX3 station and the digital sensor
4	Digital sensor with individual power supply

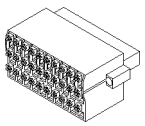
Related topics

- **Technical specifications** (see page 153)

BLIO connector specification for terminals X21/X32

Ordering data of the connector

As an option, digital inputs can be connected by 3-wire technology via BLIO connector. This connector can be ordered separately using the following order data:

	Designation	BU_30_E_BL-I/O_GE_RM3.5
	Jetter item no.	60869253

Connector specification

For information on connector specification refer to the following list:

Connector specification	
Connector technology	Spring connection, push in
Type	30-pin, contact spacing 3.5 mm
Connectable conductors	
Outer diameter of the isolation	2.90 mm max.
AWG	16 ... 28
Terminal range	0.05 … 1.5 mm^2
Stripping length	10 mm
Specification without wire end ferrules	
Single conductor H05(07) V-U	0.2 … 1.0 mm^2
Finely stranded conductor H05(07) V-K	0.2 … 1.5 mm^2
Specification with wire end ferrules	
Wire end ferrule without collar to DIN 46228/1	0.25 … 1.0 mm^2
Wire end ferrule with collar to DIN 46228/4	0.25 … 0.75 mm^2
Crimping tool to DIN 46228	PZ 4, PZ 6 ROTO, PZ 6/5

Screwdriver

The corresponding screwdriver can be obtained from Jetter AG.

Type	SD 0.4 x 2.5 - DIN 5264-A
Designation	DIV_SCHRAUBENDREHER_2,5*75
Jetter item no.	60871712

Connecting digital sensors in 3-wire technology

Prerequisites

For connecting digital sensors in 3-wire technology, you need the BLIO connector. This connector does not belong to the scope of delivery of the JX3-DIO16 module and must therefore be ordered separately.

Advantages of 3-wire technology

There are the following advantages of connecting digital sensors in 3-wire technology:

- An additional terminal block in the control cabinet to distribute the sensor supply is not necessary.
- Voltage diagnostics for supplying the digital sensors

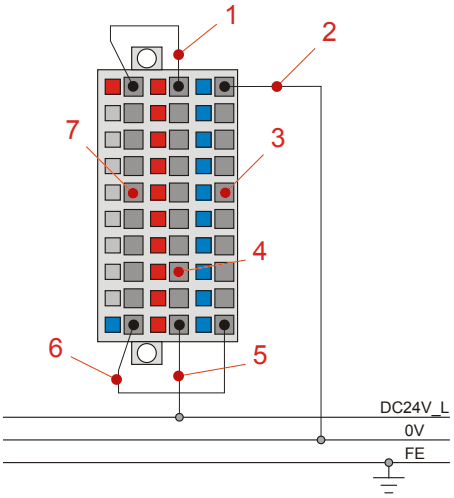
Conductor design

Please observe the following aspects when connecting digital signals:

- Shielding is not required.
- Use the proper wire size for the amperage requirement of the actuator

Connection of BLIO

The following illustration shows the connection of BLIO for digital sensors in 3-wire technology:

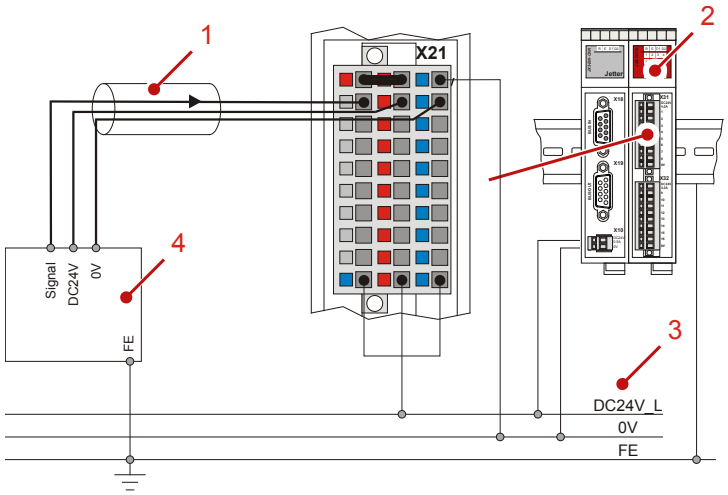


Number	Description
1	Jumper between sensor supply and sensor supply recognition of the JX3-DIO16 module
2	Connecting the reference potential 0 V of the power supply unit with the BLIO connector
3	Connecting the reference potential 0 V with the sensors The 10 terminal points at the right hand side are connected with each other.
4	Connecting the sensor supply with the sensors The 10 terminal points of the middle row are connected with each other.
5	Connecting the sensor supply of the power supply unit with the BLIO connector
6	Jumper between the reference potential of the power supply unit and of the JX3-DIO16 module

Number	Description
7	Terminal points of the 8 signals leading to the sensors

Connecting digital sensors

The connection of digital sensors is identical for all 8 inputs and all 8 multi-purpose I/Os. In the following illustration, a sensor has been connected to input IN 1 in 3-wire technology.



Number	Description
1	Cable leading to the digital sensor
2	Digital input/output module JX3-DIO16
3	Power supply for the JX3 station and the digital sensor
4	Digital sensor, power supply via BLIO-connector directly

Related topics

- **Technical specifications** (see page 153)

Connecting digital sensors for the count function

Conductor design

Please observe the following aspects when connecting digital signals:

- Shielding is recommended
- Use the proper wire size for the amperage requirement of the sensor

Separation of load and logic voltage

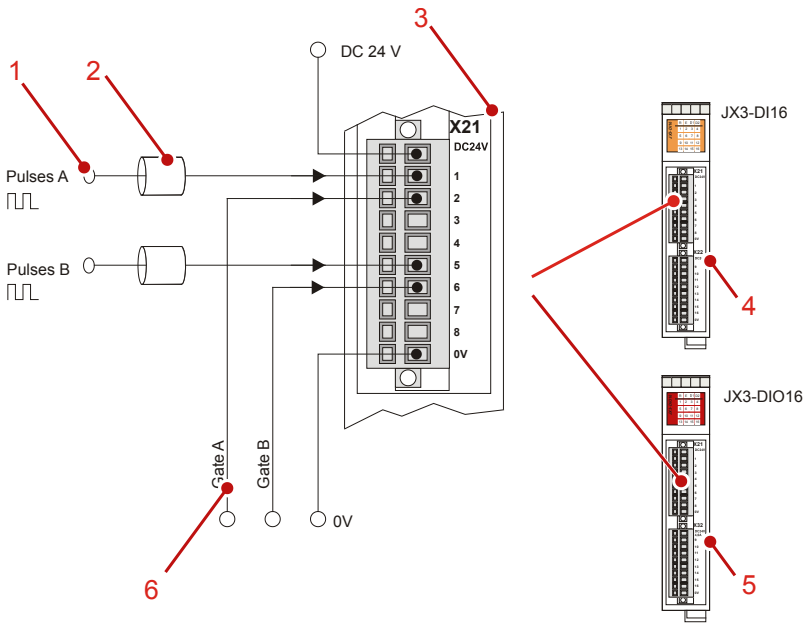
Separate load and logic voltage Use separate power supply units for connecting the load voltage of digital inputs or outputs and the logic voltage.

Separating load and logic voltage has got the following advantage:

- When the load voltage is switched off, communication with the JX3 modules is still possible.

Connecting digital sensors

The connection of digital sensors is identical for both counting inputs.The connection of terminal X21 is identical for both peripheral modules JX3-DI16 and JX3-DIO16.



Number	Description
1	Digital pulses of a sensor
2	Shielded line leading to the sensor
3	Here: Terminal X21 of the JX3-DIO16 module
4	Peripheral module JX3-DI16
5	Peripheral module JX3-DIO16
6	Gate input for locking and unlocking the counter function

Related topics

- **Technical specifications** (see page 153)
- **Counter configuration** (see page 128)
- **Register description - Counter function** (see page 131)

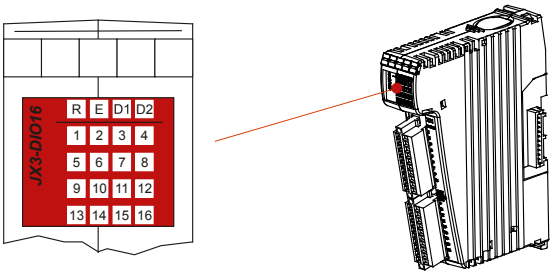
LEDs on the JX3-DIO16 module

Introduction

The module JX3-DIO16 indicates conditions and errors through its LEDs. This feature lets you directly locate an error.

LEDs on the JX3-DIO16 module

The JX3-DIO16 module is equipped with 20 LEDs which indicate conditions and errors.



LED	Color	Description
R	green	Run LED
E	red	Error LED
D1	red	Diagnostic function 1
D2	red	Diagnostic function 2
1	amber	Status LED for input IN 1
2	amber	Status LED for input IN 2
3	amber	Status LED for input IN 3
4	amber	Status LED for input IN 4
5	amber	Status LED for input IN 5
6	amber	Status LED for input IN 6
7	amber	Status LED for input IN 7
8	amber	Status LED for input IN 8
9	amber	Status LED for multi-purpose I/O 9
10	amber	Status LED for multi-purpose I/O 10
11	amber	Status LED for multi-purpose I/O 11
12	amber	Status LED for multi-purpose I/O 12
13	amber	Status LED for multi-purpose I/O 13
14	amber	Status LED for multi-purpose I/O 14
15	amber	Status LED for multi-purpose I/O 15
16	amber	Status LED for multi-purpose I/O 16

Normal operating condition

In normal operating condition, the LEDs of the module JX3-DIO16 indicate the following:

R	E	D1	D2	Normal operating condition
ON	OFF	OFF	OFF	No error, communication is active

LEDs on the JX3-DIO16 module

The JX3-DIO16 module is equipped with 20 LEDs which indicate conditions and errors.

R	E	D1	D2	State
ON	OFF	OFF	OFF	No error, communication is active
ON	ON	-	-	Communication with the bus node, or JC-3xx or JC-9xx is not active.
ON	-	ON	-	Hardware error
ON	-	-	1Hz	OS of the module is not valid
ON			2Hz	Short circuit of an output on terminal X32
ON	-	2Hz	2Hz	OS update is running

State of the amber status LEDs for X21

The amber LEDs on the module JX3-DIO16 indicate the digital signal level of connected hardware. You will see whether a sensor actually returns the expected level.

The amber LEDs 1 ... 8 apply to terminal **X21**.

- IN 1 ... IN 8

If ...	... then ...
the voltage level of the terminal < +11 V,	the amber LED is not lit.
the voltage level of the terminal > +11 V,	the amber LED is lit.

Status of the amber status LEDs for X32

The amber LEDs on the module JX3-DIO16 indicate the digital signal level of connected hardware. You will see whether a sensor or actuator actually returns the expected level.

The amber LEDs 9 ... 16 apply to terminal **X32**.

- I/O 9 ... I/O 16

If ...	... then ...
the voltage level of the terminal < +11 V,	the amber LED is not lit.
the voltage level of the terminal > +11 V,	the amber LED is lit.

In case of multi-purpose I/Os it does not make any difference regarding the LED status whether the terminal functions as an input, an output or a counter.

Description of the amber LEDs

LED	State	Description
1	○ OFF	Input 1 has low level.
	● ON	Input 1 has high level.
2	○ OFF	Input 2 has low level.
		Input 2 has high level.
...		...
9	○ OFF	Multi-purpose I/O 9 has low level.
	● ON	Multi-purpose I/O 9 has high level.
16	○ OFF	Multi-purpose I/O 16 has low level.
	● ON	Multi-purpose I/O 16 has high level.

4.2 Installing, replacing and removing the module

Introduction

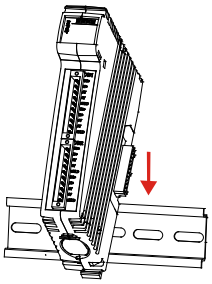
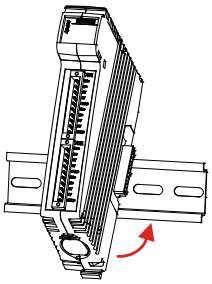
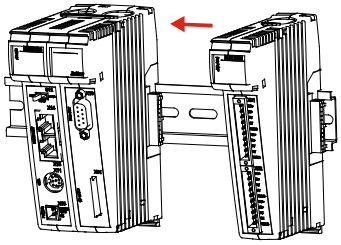
This chapter covers installation, replacement and removal of JX3 modules.

Contents

Installing the JX3 peripheral module on a DIN rail

Installation

To install a JX3 peripheral module on a DIN rail (to DIN EN 50022) proceed as follows:

Step	Action	
1		Place the JX3 peripheral module on the upper edge of the DIN rail.
2		Snap the JX3 peripheral module onto the lower edge of the DIN rail.
3		Slide the JX3 peripheral module to the other modules of the JX3 station.

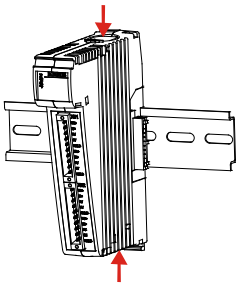
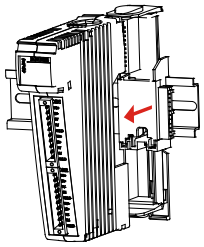
Related topics

- **Replacing the JX3 peripheral module** (see page 57)
- **Removing the JX3 peripheral module from the DIN rail** (see page 59)

Replacing the JX3 peripheral module

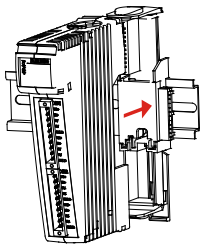
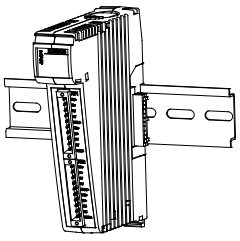
Removing the JX3 enclosure

To remove the JX3 enclosure of the JX3 peripheral module from the JX3 backplane module proceed as follows:

Step	Action	
1	Remove power from the JX3 station.	
2		Press the upper and lower latches simultaneously. Keep the latches pressed.
3		Pull off the JX3 enclosure from the JX3 backplane module.

Mounting the JX3 enclosure

To attach the enclosure of the JX3 peripheral module to the JX3 backplane module proceed as follows:

Step	Action	
1		Slide the JX3 enclosure onto the JX3 backplane module until the latches snap into place.
⇨		**Result:** Installation of the JX3 peripheral module to the JX3 backplane module is now completed.

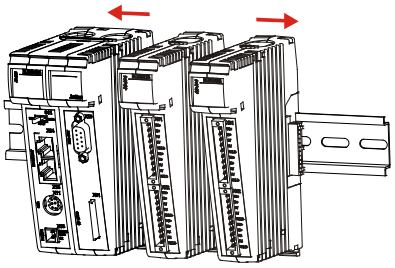
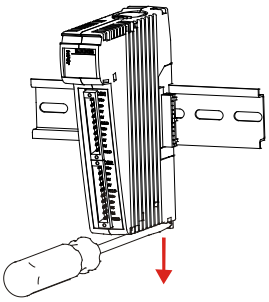
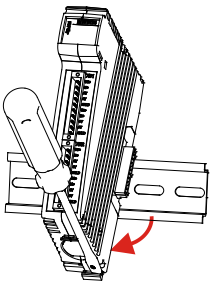
Related topics

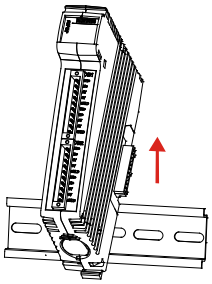
- **Installing the JX3 peripheral module on a DIN rail** (see page 56)
- **Removing the JX3 peripheral module from the DIN rail** (see page 59)

Removing the JX3 peripheral module from the DIN rail

Removal

To remove a JX3 peripheral module from a rail proceed as follows:

Step	Action
1	Remove power from the JX3 station.
2	Slide the adjacent JX3 peripheral modules aside. By doing so, the JX3 backplane to the other JX3 peripheral modules is disconnected. 
3	Pull down the DIN rail latch. 
4	Swing the lower part of the JX3 peripheral module forward. 

Step	Action
5	Remove the JX3 peripheral module from the DIN rail. 

Related topics

- **Installing the JX3 peripheral module on a DIN rail** (see page 56)
- **Replacing the JX3 peripheral module** (see page 57)

5 Initial commissioning

Purpose of this chapter

This chapter gives a compact description on how to commission the module JX3-DIO16 and covers the following functions:

- Switching multi-purpose I/Os as outputs 9 through 16 via JetSym setup pane.
- Reading digital inputs 1 ... 8 via JetSym setup pane.

Prerequisites

To be able to commission the JX3-DIO16 module the following prerequisites have to be fulfilled:

- The JX3-DIO16 module is connected to a JetControl PLC.
- The controller is connected to a PC.
- The programming tool JetSym is installed on the PC.
- The minimum requirements regarding modules, controllers and software are fulfilled.

Contents

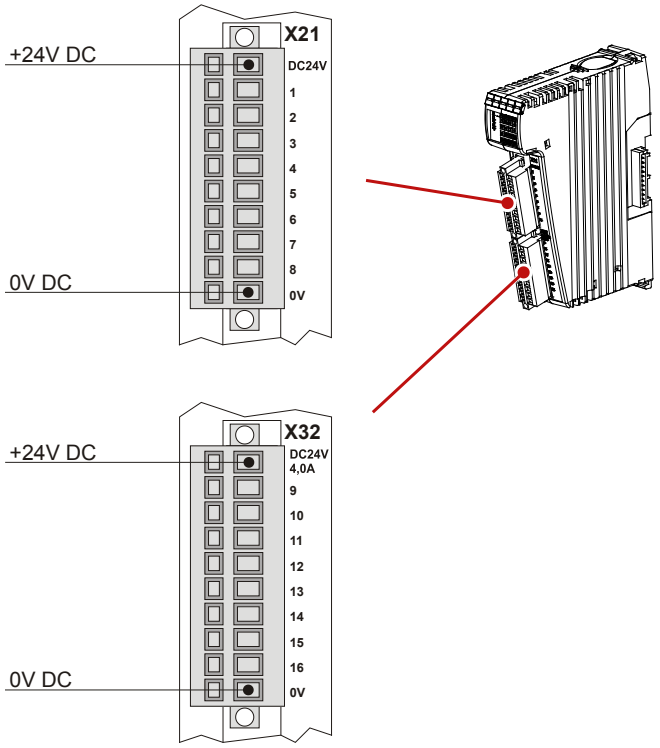
Preparatory work for initial commissioning

Behavior after power-up

For switching digital outputs the module JX3-DIO16 needs not be configured after it has been switched on. After switching-on, all 8 digital outputs are in OFF state. A voltage of 0 V is applied.

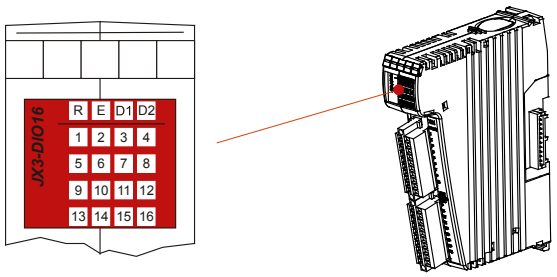
Terminal points of digital outputs 1 ... 8

Apply voltage to terminal point X21.DC24V and X32.DC24V to be able to switch the digital outputs X32.9...16.



Status of the LEDs

After switching-on the module JX3-DIO16 its LEDs are lit as follows:

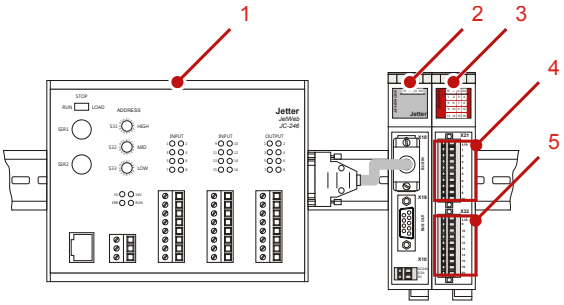


R	E	D1	D2	1 ... 16	Normal operating condition
ON	OFF	OFF	OFF	-	No error, communication is active

Initial commissioning along with a JC-24x

Configuration

Initial commissioning along with a JC-24x is based on the following configuration:



Number	Element	Description
1	JC-24x	Controller
2	JX3-BN-CAN	Bus node for JX2 system bus
3	JX3-DIO16	Digital input and output module of I/O module number 2
4	X21	Terminals for digital outputs OUT 1 ... 8
5	X32	Terminal for multi-purpose I/O 9 ... 16

Determining the I/O number

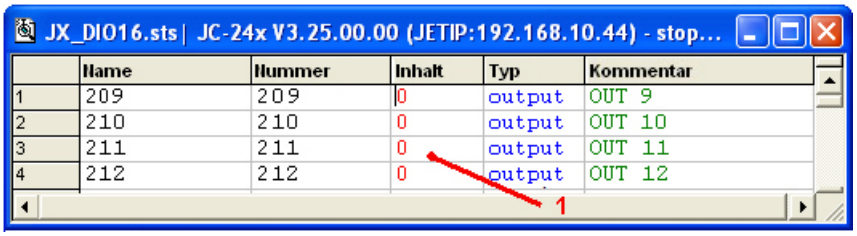
The digital outputs of the module JX3-DIO16 are assigned to the following I/O numbers:

x	x	z	z

Element	Description
xx	I/O module number of the module in the JX2 system bus, here 02
zz	Number of the input/output, 1 ... 16

Switching an output via JetSym

Switch the digital outputs OUT 9 ... OUT 13 via JetSym setup pane using I/O numbers 209 ... 213:

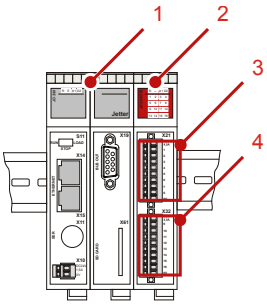


Number	Element	Description
1	New state for the digital output	1 = ON (24 V at the output) 0 = OFF (0 V at the output)

Initial commissioning along with a JC-3xx

Configuration

Initial commissioning along with a JC-3xx is based on the following configuration:



Number	Element	Description
1	JC-3xx	Controller
2	JX3-DIO16	Digital input and output module, module number 2
4	X31 and X32	Terminals for digital outputs OUT 1 ... 16

Determining the I/O number

The digital outputs of the module JX3-DIO16 are assigned to the following I/O numbers:

1	0	0	0	0	m	m	z	z

Element	Description
mm	Module number of the module within the JX3 station: here 02
zz	Number of the input/output, 1 ... 16

Switching an output via JetSym

Switch the digital outputs OUT 9 ... OUT 16 in the JetSym setup pane via I/O numbers 100000209 ... 10000216:

	Name	Nummer	Inhalt	Typ	Kommentar
1	100000209	100000209	0	output	OUT 9
2	100000210	100000210	1	output	OUT 10
3	100000211	100000211	0	output	OUT 11
4	100000212	100000212	1	output	OUT 12
5	100000213	100000213	0	output	OUT 13
6	100000214	100000214	1	output	OUT 14
7	100000215	100000215	1	output	OUT 15
8	100000216	100000216	1	output	OUT 16
9					
10	100020003	100020003	0b00000000000000001110101000000000		Process Data Out

Number	Element	Description
1	New state for the digital output	1 = ON (24 V at the output) 0 = OFF (0 V at the output)

Reading an input via JetSym

You can read the inputs either individually, bit-coded, or as a date at the process data input.

6 Programming

Purpose of this chapter

This chapter is for supporting you in programming the JX3-DIO16 module in the following fields of activity:

- Determining the register numbers depending on the system configuration.
- Reading digital inputs
- Switching digital outputs
- Programming additional features and their functions

Prerequisites

To be able to program the JX3-DIO16 module the following prerequisites have to be fulfilled:

- The JX3-DIO16 module is connected to a JetControl PLC.
- The controller is connected to a PC.
- The programming tool JetSym is installed on the PC.
- The minimum requirements regarding modules, controllers and software are fulfilled.

Contents

Abbreviations, module register properties and formats

Abbreviations

The abbreviations used in this document are listed in the following table:

Abbreviation	Description
R 100	Register 100
MR 150	Module register 150

Module register properties

Each module register is characterized by certain properties. For many module registers most properties are identical. For example, their value after reset is zero. In the following description, module register properties are mentioned only if a property deviates from the following default properties.

Module register properties	Default property for most module registers
Type of access	Read/write
Value after reset	0 or undefined (e.g. the release number)
Takes effect	Immediately
Write access	Always
Data type	Integer

Number formats

The number formats used in this document are listed in the following table:

Notation	Numerical format
100	Decimal
0x100	Hexadecimal
0b100	Binary

JetSym sample programs

The notation for sample programs used in this document is listed in the following table:

Notation	Description
`Var, When, Task`	Keyword
`BitClear();`	Commands
`100 0x100 0b100`	Constant numerical values
`// This is a comment`	Comment
`// ...`	Further program processing

6.1 Register and I/O Numbering for JX3 Modules

Introduction

The modules supplied by Jetter AG can carry out a great number of functions which can be called up by the user via registers. Each register and each digital input or output has been designated by an unambiguous number.

Purpose of register numbers

Register numbers are applied in the following cases:

- Reading from, or writing to a module register from within the JetSym setup window.
- Declaring a module register as variable in the JetSym application program.
- Declaring a module register as tag in JetViewSoft.

Purpose of I/O numbers

I/O numbers are applied in the following cases:

- Reading a digital input in the JetSym setup window.
- Reading from, or writing to a digital output from within the JetSym setup window.
- Declaring a digital input or output as variable in the JetSym application program.
- Declaring a digital input or output as tag in JetViewSoft.

Contents

Registers and module registers

Definition - Module register

Module registers let you read process, configuration and diagnostics data from the module JX3-DIO16, or write such data to it. The module register number within a module is unique.

Definition - Registers

Direct access to registers is possible from:

- an application program
- the JetSym setup pane
- a visualization application

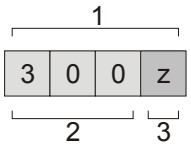
The register number within a system is unique.

Example - Module register

Module register 9 lets you access the OS revision of a JX3-AI4 module.

Example - Register

A JX3-AI4 module is connected to the system bus of a JC-24x via bus node JX3-BN-CAN. The module has got I/O module number 2.



No.	Element	Description
1	Register number	Can be used directly
2	Register prefix	300: For JX3 modules on the system bus of a JC-24x.
3	Module register number	z = 9: Operating system version

Register number 3009 lets you directly read out the OS version 1.2.0.0 in the setup pane of JetSym.

	Name	Number	Content	Type	Comment
1	3009	3009	1.2.0.0	int	Version
2					
3					

Counterexample - Module register

If you enter number 9 in the setup pane of JetSym, the operating system version is not read out.

	Name	Number	Content	Type	Comment
1	9	9	0.0.0.0	int	Version
2					
3					

I/O module numbers on the JX2 system bus

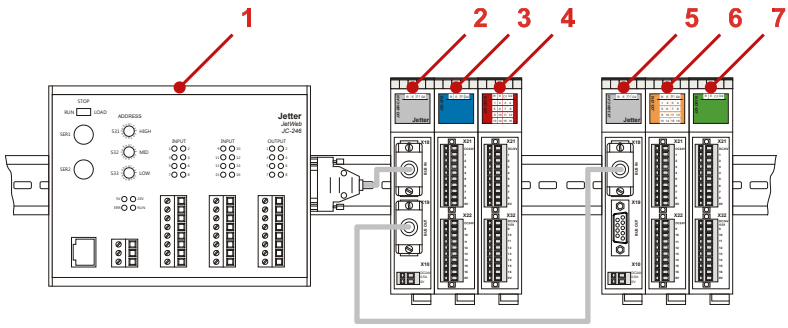
I/O module number

Each module on the JX2 system bus is assigned an I/O module number for clear identification. The I/O module number is dependent on the position of the module on the JX2 system bus. Assigning this module number is carried out according to the following rules:

- The controller has always got I/O module number 1.
- JX3-BN-CAN modules are counted separately.
- The first JX3-BN-CAN is assigned I/O module number 33.
- The JX2-PS1 and JX3-PS1 modules are not assigned an I/O module number.
- The first non-intelligent JX2 or JX3 module is assigned I/O module number 2.
- Intelligent JX2 modules, e.g. JX2-SV1, are not assigned an I/O module number.

Example: I/O module numbering

Several JX3 modules are connected to a JC-24x controller via JX2 system bus.



Number	Module	I/O module number
1	JC-24x	1
2	JX3-BN-CAN	33
3	JX3-AO4	2
4	JX3-DIO16	3
5	JX3-BN-CAN	34
6	JX3-DI16	5
7	JX3-AI4	6

Register and I/O Numbers with JC-24x and JM-D203-JC-24x

Register numbers for JX3 modules

Register numbers for JX3 modules connected to a JC-24x or JM-D203-JC24x consist of the following elements:

3	x	x	z

Element	Description	Value range
xx	I/O module number on the JX2 system bus - 2	0 ... 30
	Module number of the JX3-BN-CAN minus 2	31 ... 61
z	Module register number	0 ... 9

I/O numbers for JX3 modules

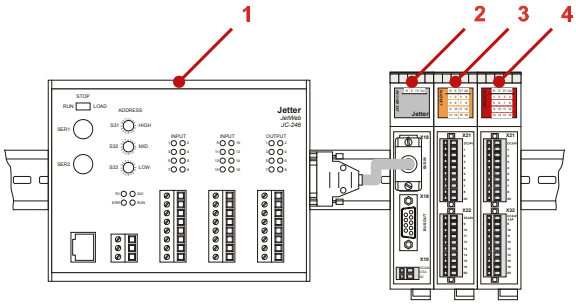
I/O numbers for JX3 modules connected to a JC-24x or JM-D203-JC24x consist of the following elements:

x	x	z	z

Element	Description	Value range
xx	I/O module number on the JX2 system bus	2 ... 32
zz	Module-specific I/O number	1 ... 16

Example

Several JX3 modules are connected to a controller JC-24x.



Number	Module	I/O module number	Register	I/O
1	JC-24x	1	0 ... 1999	101 ... 116
2	JX3-BN-CAN	33	3310 ... 3319	-
3	JX3-DI16	2	3000 ... 3009	201 ... 216
4	JX3-DIO16	3	3010 ... 3019	301 ... 316

Register and I/O Numbers with JC-3xx

Module numbers in a JX3 station

To determine the I/O module number in a JX3 station proceed as follows:

- Count the module numbers left-to-right, starting from 1.
- Do not count the power supply module JX3-PS1.

Register numbers for JX3 modules

Register numbers for JX3 modules connected to a JC-3xx consist of the following elements:

1	0	0	x	x	z	z	z	z

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

I/O numbers for JX3 modules

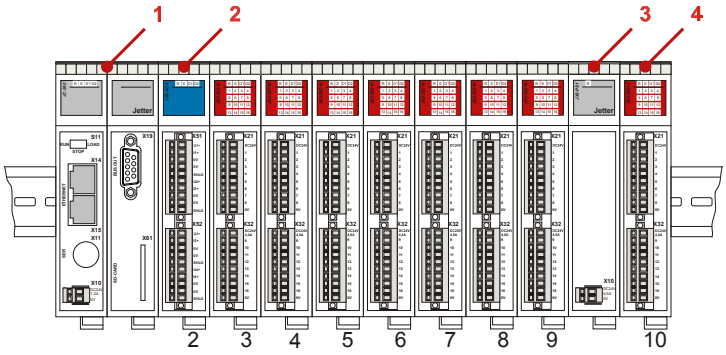
I/O numbers for JX3 modules connected to a JC-3xx consist of the following elements:

1	0	0	0	0	x	x	z	z

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

Example

Several JX3 modules are connected to a controller JC-3xx.



Number	Module	Module number	Register	I/O
1	JC-3xx	1	Refer to documentation on JC-3xx	
2	JX3-AO4	2	10002zzzz	1000002zz
3	JX3-PS1	-	-	-
4	JX3-DIO16	10	10010zzzz	1000010zz

Register and I/O Numbers for JC-647 with JX6-SB(-I)

Register numbers for JX3 modules

Register numbers for JX3 modules connected to a JC-647 equipped with a JX6-SB(-I) consist of the following elements:

3	m	0	3	x	x	z

Element	Description	Value range
m	Submodule socket	1 ... 3
xx	I/O module number on the JX2 system bus - 2	0 ... 30
	Module number of the JX3-BN-CAN minus 2	31 ... 61
z	Module register number	0 ... 9

I/O numbers for JX3 modules

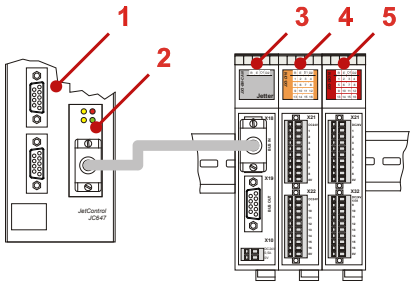
I/O numbers for JX3 modules connected to a JC-647 equipped with a JX6-SB(-I) consist of the following elements:

m1	x	x	z	z

Element	Description	Value range
m1	Submodule socket + 1	2 ... 4
xx	I/O module number on the JX2 system bus	2 ... 32
zz	Module-specific I/O number	1 ... 16

Example

Several JX3 modules are connected to a JetControl JC-647 equipped with a submodule JX6-SB(-I).



Number	Module	I/O module number	Register	I/O
1	JC-647	-	Module slot: 1	
2	JX6-SB	-	Submodule socket: 1	
3	JX3-BN-CAN	33	3103310 ... 3103319	-
4	JX3-DI16	2	3103000 ... 3103009	20201 ... 20216
5	JX3-DIO16	3	3103010 ... 3103019	20301 ... 20316

Register and I/O Numbers for JC-800 with JX6-SB(-I)

Register numbers for JX3 modules

Register numbers for JX3 modules connected to a JC-800 equipped with a JX6-SB(-I) consist of the following elements:

4	C	M	0	3	x	x	z

Element	Description	Value range
C	Module board number	1 ... 3
M	System bus module	1 ... 2
xx	I/O module number on the JX2 system bus - 2	0 ... 30
	Module number of the JX3-BN-CAN minus 2	31 ... 61
z	Module register number	0 ... 9

I/O numbers for JX3 modules

I/O numbers for JX3 modules connected to a JC-800 equipped with a JX6-SB(-I) consist of the following elements:

5	2 ... 3	C	M	x	x	z	z

Element	Description	Value range
2 ... 3	Input	2
2 ... 3	Output	3
C	Module board number	1 ... 3
M	System bus module	1 ... 2
xx	I/O module number on the JX2 system bus	2 ... 32
zz	Module-specific I/O number	1 ... 16

Register and I/O Numbers for JC-9xx with JX6-SB(-I)

Register numbers for JX3 modules

Register numbers for JX3 modules connected to a JC-9xx equipped with a JX6-SB(-I) consist of the following elements:

2	0	S	J	0	3	x	x	z

Element	Description	Value range
S	Number of the module board	1 ... 5
J	Number of the JX6-I/O board (JX2 system bus) located on the module board	1 ... 2
xx	I/O module number on the JX2 system bus - 2	0 ... 30
	Module number of the JX3-BN-CAN minus 2	31 ... 61
z	Module register number	0 ... 9

I/O numbers for JX3 modules

I/O numbers for JX3 modules connected to a JC-9xx equipped with a JX6-SB(-I) consist of the following elements:

2	0	S	J	0	x	x	z	z

Element	Description	Value range
S	Number of the module board	1 ... 5
J	Number of the JX6-I/O board (JX2 system bus) located on the module board	1 ... 2
xx	I/O module number on the JX2 system bus	02 ... 32
zz	Module-specific I/O number	1 ... 16

6.2 Register access to JX3 modules on the JX2 system bus

Introduction

Each JX3 module supports over 10,000 module registers. On the JX2 system bus, the 10,000 module registers are accessed via 10 registers. Eight module registers can directly be accessed by entering a register number. The remaining 9,992 module registers are accessible indirectly via an index register and a value register.

Direct register access

The following module registers have been assigned to register numbers directly.

- Status
- Command
- Process data
- Operating system, respectively firmware version

Indirect register access

Any remaining module registers of the JX3 modules can only be accessed indirectly via an index register and a value register.

Contents

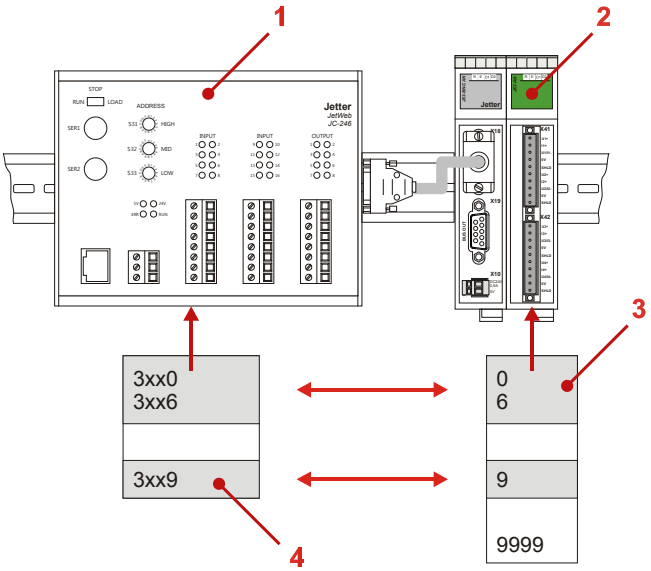
Direct register access to JX3 modules on the JX2 system bus

Direct register access

At direct register access, a module register of the module is directly assigned to a register number. Via this register, the value of the module register can be read and written.

Assignment of the register numbers

At direct register access, the module registers are assigned to the register numbers as follows:



Number	Element	Description
1	JC-24x	Controller
2	JX3-AI4	JX3 module with 10,000 module registers
3	Module registers	Module register numbers of the JX3 module for direct access
4	Register numbers	Register numbers of the controller for direct access

Overview of direct and indirect module registers

In the following table, the module registers are shown which can be accessed on the JX2 system bus either in direct or in indirect mode.

Module register number	Direct	Indirect
0 ... 6	✓	
7 ... 8		✓
9	✓	
10 ... 9,999		✓

Example - Direct register access

Purpose of this example

This example demonstrates how to directly enter values into module registers. The exact functionality of the power supply unit used in this example is not relevant.

Task

Check on a JX3-DIO16 module the power supply of digital outputs at terminal point X32.DC24V. If the power supply fails, an error handling routine is to be executed.

Solution

Check MR 0 on the JX3-DIO16 module whether bit 2 has been cleared. If this is the case, trigger the error handling routine.

Configuration

This example is based on the following configuration:

Number	Element	Description
1	JC-24x	Controller
2	JX3-BN-CAN	Bus node for the JX2 system bus I/O module number 33
3	JX3-DIO16	Digital I/O module I/O module number 2

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-24x of OS version 3.27.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym ST program

```
Var
    // Status register
    State : Int At %VL 3000;
End_Var;

Task 0
        // Waiting until power is zero
    When
        BIT_CLEAR(State, 2)
    Continue;
        // Error handling routine
End_Task;
```

Indirect register access to JX3 modules on the JX2 system bus

Register overview

At indirect register access, the following module registers are used:

Register	Description
MR 7	Index for indirect register access
MR 8	Value for indirect register access

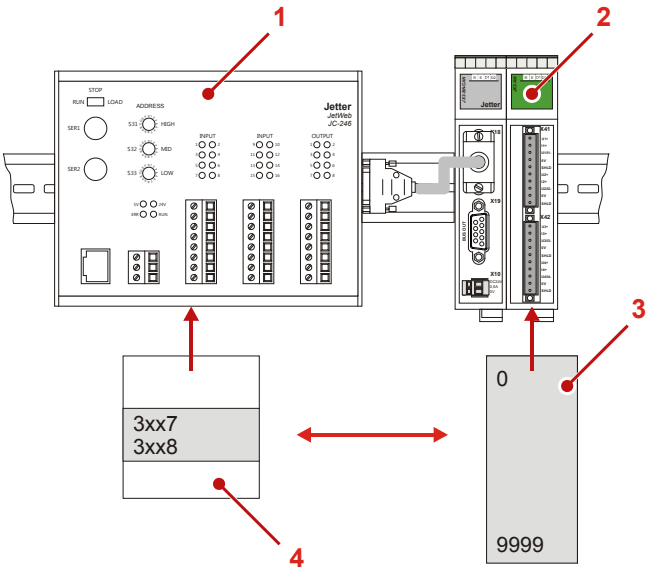
Indirect register access

The indirect register access to a module register is carried out via an index and a value register in two steps.

Step	Action
1	Write the number of the module register into MR 7 *Index for indirect register access*.
2	Read, respectively write, the value of the module register, via MR 8 *Value for indirect register access*.

Assignment of the register numbers

At indirect register access, the module registers are assigned to the register numbers as follows:



Number	Element	Description
1	JC-24x	Controller
2	JX3-AI4	JX3 module with 10,000 module registers
3	Module registers	Module register numbers of the JX3 module for indirect access
4	Register numbers	Register numbers of the controller for indirect access

Overview of direct and indirect module registers

In the following table, the module registers are shown which can be accessed either in direct or in indirect mode:

Module register number	Direct	Indirect
0 ... 6	✓	
7 ... 8		✓
9	✓	
10 ... 9,999		✓

Rules applying to indirect register access

Please make sure at indirect register access, that MR 7 *Index for indirect register access* is not overwritten by another source.

Please keep to the following rules when applying indirect register access to JX3 modules:

- In the application program, the registers may only be accessed within the same task.
- Simultaneous register access from various sources is not permitted.

These are possible sources:

- Various tasks of the application program in the controller
- JetSym setup
- a visualization application

Related topics

- **Register description for indirect register access** (see page 83)
- **Example: Indirect register access** (see page 82)

Example - Indirect register access

Purpose of this example

This example demonstrates how to indirectly enter values into module registers. The exact function of the digital filters used is not relevant.

Task

Set the digital filters of inputs IN1 through IN3 on the module JX3-DIO16 to 16 ms.

Solution

Set the filter interval in MR 263 to 16 ms. Then, enable the filters in MR 262. All module registers allow indirect access.

Configuration

This example is based on the following configuration:

Number	Element	Description
1	JC-24x	Controller
2	JX3-BN-CAN	Bus node for the JX2 system bus I/O module number 33
3	JX3-DIO16	Digital I/O module I/O module number 2

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-24x of OS version 3.27.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym ST program

```
Var
    // Index registers
    Index : Int At %VL 3007;
    // Value registers
    Data  : Int At %VL 3008;
End_Var;

Task 0
    // Setting index register to MR 263
    Index := 263;
        // Indirectly entering a filter interval of 7 into MR 263
    Data  := 7;
        // Setting index register to MR 262
    Index := 262;
        // Enabling filter for IN 1 ... IN 4 in MR 262
    BIT_SET(Data, 0);
    BIT_SET(Data, 1);
    BIT_SET(Data, 2);
End_Task;
```

Module registers for indirect register access

MR 7

Index for indirect register access

MR 7 lets you specify a module register number for indirect register access.

Module register properties	
Values	0 ... 9,999
Value after reset	9

MR 8

Value for indirect register access

MR 8 lets you read or write a module register value.

Module register properties	
Values	Dependent on the specified module register number in MR 7

6.3 Programming by JetSym module headers

Introduction

Jetter AG supplies a file for the user, in which all module registers of the JX3-DIO16 have been declared as a variable. In this document, the variable names of the module headers are used in the sample programs and in the register description.

Optional usage

Usage of the JetSym module headers is optional. The declaration of the JX3-DIO16 module registers as a variable can further be carried out by the JetSym instructions VAR and END_VAR.

Benefits

Programming by JetSym module headers offers the following benefits to the user:

- Time-saving at the declaration of module registers.
- Avoiding errors at the declaration of module registers.
- Increase in efficiency at setting up JetSym programs

Contents

This chapter covers the following topics:

Module headers for JC-24x or JX6-SB(-I) and JetSym ST

JetSym ST module headers

For programming JetSym ST applications in connection with a JC-24x controller or the submodule JX6-SB(-I), the following module header is needed:

Module header	Description
jx3_dio16.stp	JetSym ST module headers

Download of the module header

The module header for the JX3-DIO16 module can be downloaded from the Jetter **homepage http://www.jetter.de**. The module header can be found via quicklink on the product site of the JX3-DIO16 module.

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-24x of OS version 3.27.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

Example: JetSym ST

At a JC-24x, a JX3-AO4 module has been connected via a JX3-BN-CAN bus node to the system bus. The JX3-AO4 module has got I/O module number 2. For the module register MR 0, register number 3000 results.

```
// Loading module header
#include "JX3_AO4.stp"

Var
        // Declaring module JX3-AO4 as of register number 3000
    JX3AO4: TYPE_JX3_AO4 at %VL 3000;
End_Var;

Task 0
        // Indirect writing of value 5 into MR 1101
    JX3AO4.MR_Index := 1101;
    JX3AO4.MR_Data := 5;
End_Task;
```

Module header for JC-3xx and JetSym STX

Module header for JetSym STX

For programming JetSym STX applications in connection with a JC-3xx controller, the following module header is needed:

Module header	Description
jx3_dio16.stxp	Module header for JetSym STX

Download of the module header

The module header for the JX3-DIO16 module can be downloaded from the **Jetter homepage http://www.jetter.de**. The module header can be found via quicklink on the product site of the JX3-DIO16 module.

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-350 of OS version 1.16.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

Example: JetSym STX

A module JX3-AO4 is connected to a JC-340 directly. The JX3-AO4 module has got module number 2. For the module register MR 0, register number 01.0002.0000 results.

```
// Loading module header
#include "JX3_AO4.stxp"

Var
        // Declaring module JX3-AO4 as of register number 100020000
     st_JX3AO4 : TYPE_JX3_AO4 At %VL 100020000;
End_Var;

Task main autorun
    // Direct writing of value 5 into MR 1101 n_Config_1
    st_JX3AO4.Out1.Config  := 5
End_Task;
```

6.4 Reading inputs and switching outputs

Introduction

This chapter describes the steps towards reading a digital input and switching a digital output.

Applications

The following applications are possible:

- Reading the state of digital sensors
- Controlling digital actuators

Contents

This chapter covers the following topics:

Multi-purpose I/Os

Multi-purpose I/Os

A multi-purpose I/O can be used as digital input or digital output. Configuration is not required.

- You can configure as many multi-purpose I/Os as required as digital input or output.
- If a multi-purpose I/O is used as digital input, the related digital output must be disabled (OFF).

Technical specifications

Type of input/output	Number of input/output
Digital input	IN 1 ... IN 8
Multi-purpose I/O	IN 9 ... IN 16/OUT 9 ... OUT 16

Reading back the outputs

If multi-purpose I/Os are applied, you can read back the physical state of the digital output by means of the corresponding digital input.

Reading all inputs/writing all output values

Reading all inputs

Via MR 256, you read all inputs of the JX3-DIO16 module in one read cycle: all inputs IN 1 ... IN 16 are stored in bit-coded format.

Writing all output values

Via MR 512, you write all output values of the JX3-DIO16 module in one write cycle: all outputs OUT 9 ... OUT 16 are stored in bit-coded format.

Technical specifications

Module registers	Number of input/output
MR 256	IN 1 ... IN 16
MR 512	OUT 9 ... OUT 16

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-350 of OS version 1.16.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym STX program

```
Var
    // Declaring the inputs
    All_In : Int At %vl 100020256;
    // Declaring the outputs
    All_Out :Int At %vl 100020512;

End_Var;

Task In_Output__SetRead Autorun
    // if all inputs are 1, all outputs are set
    If All_In = 0b000000011111111 Then
        All_Out := 0xff00;
    End_If;
End_Task;
```

Example: Switching digital outputs - JC-3xx/JC-9xx

Task

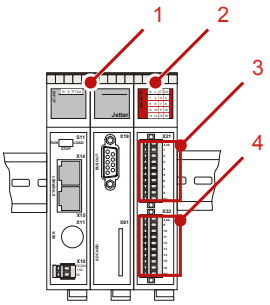
Read the digital inputs IN 1 ... IN 16 and activate the digital outputs OUT 9 ... OUT 16 of the JX3-DIO16 module.

Solution

Declare in JetSym variables of the type boolean. Assign the digital inputs and outputs of the JX3-DIO16 module to the variables.

Sample configuration

This example is based on the following configuration:



Number	Element	Description
1	JC-3xx	PLC JetControl 3xx
2	JX3-DIO16	Digital input/output module I/O module number 2
3	IN 1 ... IN 8	Digital inputs IN 1 ... 8
4	IN 9 ... IN 16 OUT 9 ... OUT 16	Digital inputs IN 9 ... 16 Digital outputs 9 ... 16

I/O numbers for JX3 modules

I/O numbers for JX3 modules connected to a JC-3xx consist of the following elements:

m	m	z	z

Element	Description	Value range
mm	Module number of the module within the JX3 station	02 ... 17
zz	Module-specific I/O number	01 ... 16

Determining input/output numbers

The module JX3-DIO16 is part of a JX3- station and its module number is 2. The output numbers of the digital outputs OUT 9 ... OUT 16 and the input numbers of the digital inputs IN 1 ... IN 8 are the following:

Input/output	I/O module number	I/O number
IN 1	2	100000201
...	...	...
IN 8	2	100000208
IN 9/OUT 9	2	100000209
...	...	...
IN 16/OUT 16	2	100000216

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-350 of OS version 1.16.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym STX program

```
Var
    // Declaring the inputs
    bi_In1 : bool At %Ix 100000201;
    bi_In2 : bool At %Ix 100000202;
    // ...
    // Declaring the outputs
    bo_Out9 : bool At %Qx 100000209;
    bo_Out10 : bool At %Qx 100000210;
    // ...
End_var;

Task  Autorun
    // Sensing the inputs
    When
        bi_In1 = TRUE AND
        bi_In2 = FALSE
    Continue;
    // Setting the outputs
    bo_Out9 := TRUE;
    bo_Out10 := TRUE;
    // Resetting the outputs
    bo_Out9 := FALSE;
    bo_Out10 := FALSE;
    // ...
End_task;
```

Example: Reading the inputs and switching the outputs - JC-24x

Task

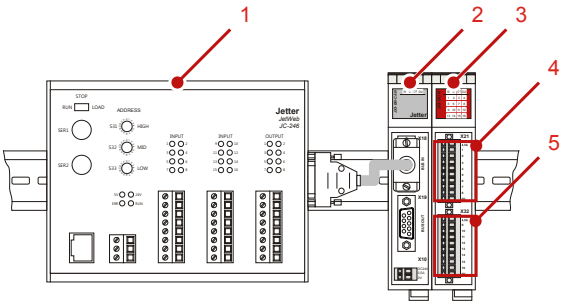
Read the digital inputs IN 1 ... IN 16 and activate the digital outputs OUT 9 ... OUT 16 of the JX3-DIO16 module.

Solution

Declare in JetSym variables of the type boolean. Assign the digital inputs and outputs of the JX3-DIO16 module to the variables.

Sample configuration

This example is based on the following configuration:



Number	Element	Description
1	JC-24x	PLC JetControl 24x
2	JX3-BN-CAN	Bus node for the JX2 system bus
3	JX3-DIO16	Digital input/output module I/O module number 2
4	IN 1 ... IN 8	Digital inputs IN 1 ... 8
5	IN 9 ... IN 16 OUT 9 ... OUT 16	Digital inputs IN 9 ... 16 Digital outputs 9 ... 16

I/O numbers for JX3- modules

I/O numbers for JX3 modules connected to a JC-24x or JM-D203-JC24x consist of the following elements:

x	x	z	z

Element	Description	Value range
xx	I/O module number on the system bus	2 ... 32
zz	Module-specific I/O number	1 ... 16

Determining output numbers

In the given example, the module JX3-DIO16 has got I/O module number 2 on the system bus. I/O numbers of the digital inputs/outputs are listed below:

Input/output	I/O module number	I/O number
IN 1	2	IN 201
...	...	...
IN 8	2	IN 208
IN 9/OUT 9	2	IN 209/OUT 209
...	...	...
IN 16/OUT 16	2	IN 216/OUT 216

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-24x of OS version 3.27.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym ST program

```
Var
    // Declaring the inputs
    bi_In1 : bool At %Ix 201;
    bi_In2 : bool At %Ix 202;
    // ...
    // Declaring the outputs
    bo_Out9 : bool At %Qx 209;
    bo_Out10 : bool At %Qx 210;
    // ...
End_Var;

Task Reading Inputs
    // Sensing the inputs
    When
        bi_In1 = TRUE AND
        bi_In2 = FALSE
    Continue;
    // Setting the outputs
    bo_Out9 := TRUE;
    bo_Out10 := TRUE;
    // Resetting the outputs
    bo_Out9 := FALSE;
    bo_Out10 := FALSE;
    // ...
End_task;
```

Example: Switching digital outputs - JC-647

Task

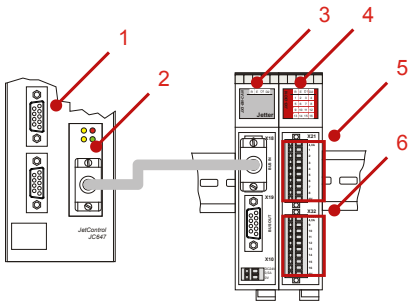
Read the digital inputs IN 1 ... IN 16 and activate the digital outputs OUT 9 ... OUT 16 of the JX3-DIO16 module.

Solution

Declare in JetSym variables of the type boolean. Assign the digital inputs and outputs of the JX3-DIO16 module to the variables.

Sample configuration

This example is based on the following configuration:



Number	Element	Description
1	JC-647	PLC JetControl 647
2	JX6-SB(-I)	Submodule for the JX2 system bus: Submodule socket 2
3	JX3-BN-CAN	Bus node for the JX2 system bus
4	JX3-DIO16	Digital input/output module I/O module number 2
5	IN 1 ... IN 8	Digital inputs IN 1 ... 8
6	IN 9 ... IN 16 OUT 9 ... OUT 16	Digital inputs IN 9 ... 16 Digital outputs 9 ... 16

I/O numbers for JX3 modules

I/O numbers for JX3 modules connected to a JC-647 equipped with a JX6-SB(-I) consist of the following elements:

m1	x	x	z	z

Element	Description	Value range
m1	Submodule socket + 1	2 ... 4
xx	I/O module number on the system bus	2 ... 32
zz	Module-specific I/O number	1 ... 16

Determining output numbers

The JX6-SB(-I) submodule has got module number 1, the JX3-DIO16 module has got I/O module number 2 on the JX2 system bus. I/O numbers of the digital inputs/outputs are listed below:

Input/output	Submodule socket	I/O module number	I/O number
IN 1	1	2	20201
...	...	...	...
IN 8	1	2	20208
IN 9/OUT 9	1	2	20209
...	...	...	...
IN 16/OUT 16	1	2	20216

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-647 of OS version 3.60.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym ST program

```
Var
    // Declaring the inputs
    bi_In1 : bool At %Ix 20201;
    bi_In2 : bool At %Ix 20202;
    // ...
    // Declaring the outputs
    bo_Out9 : bool At %Qx 20209;
    bo_Out10 : bool At %Qx 20210;
    // ...
End_Var;

Task 0
    // Sensing the inputs
    When
        bi_In1 = TRUE AND
        bi_In2 = FALSE
    Continue;
    // Setting the outputs
    bo_Out9 := TRUE;
    bo_Out10 := TRUE;
    // Resetting the outputs
    bo_Out9 := FALSE;
    bo_Out10 := FALSE;
    // ...
End_task;
```

6.5 Input filters

Introduction

The JX3-DIO16 module lets you configure input filters for inputs IN 1 ... IN 16.

Interdependence of the inputs

- Inputs IN 1 ... IN 16 can be configured in groups of four.
- The input filter is in bit-coded format and can be activated for each input.

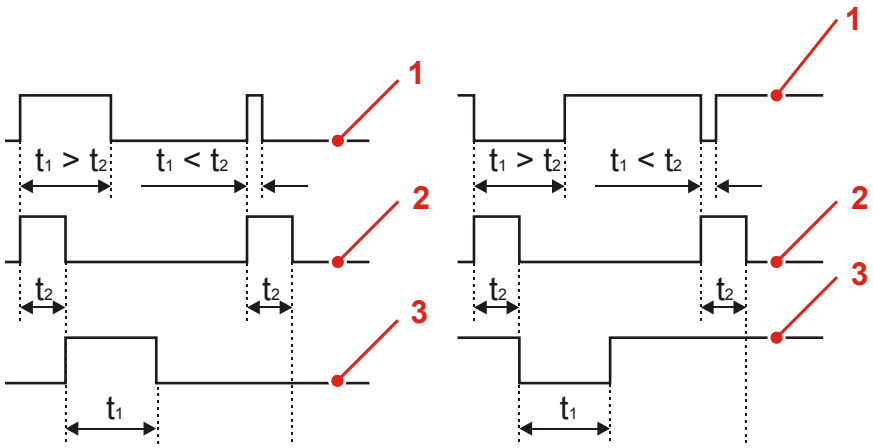
Contents

Configuring the input filter

The functioning principle of the input filter

All digital inputs are provided with an input delay feature. The JX3-DIO16 module does not recognize the input signal before the delay time has elapsed.

The illustration to the left shows filtering to the high edge. The illustration to the right shows filtering to the low edge.



Number	Description
1	Input pulse at IN 1 ... IN 16
2	Time t_2 of the input filter
3	Recognized input pulse at IN 1 ... IN 16

Technical specifications

Parameter	Description
Configurable digital inputs	IN 1 ... IN 16
Input filters	Can be set in steps of 8
Filter can be set for group 1	IN 1 ... IN 4
Filter can be set for group 2	IN 5 ... IN 8
Filter can be set for group 3	IN 9 ... IN 12
Filter can be set for group 4	IN 13 ... IN 16
IN 1 ... IN 16 can also be selected.	bit-coded

Register overview

The following module registers let you configure the input filters:

Register	Description	Default value:
262	Assigning bit-coded inputs IN 1 ... IN 16 to the input filter	0x0000FFFF
263	Input filters for inputs IN 1 ... IN 4	4
264	Input filters for inputs IN 5 ... IN 8	4
265	Input filters for inputs IN 9 ... IN 12	4
266	Input filters for inputs IN 13 ... IN 16	4

Register description - Input filter

Introduction

The following module registers let you configure the input filters:

MR 262

Activating the input filters, bit-coded

In this module register, the input filters for inputs IN 1 ... IN 16 are configured in bit-coded format. Each input is assigned a bit in the module register.

Meaning of the individual bits	
Bit 0	**Activating the input filter for IN 1** 1 = The input filter for input IN 1 has been activated.
Bit 1	**Activating the input filter for IN 2** 1 = The input filter for input IN 2 has been activated.
Bit 2	**Activating the input filter for IN 3** 1 = The input filter for input IN 3 has been activated.
Bit 3	**Activating the input filter for IN 4** 1 = The input filter for input IN 4 has been activated.
Bit 4	**Activating the input filter for IN 5** 1 = The input filter for input IN 5 has been activated.
Bit 5	**Activating the input filter for IN 6** 1 = The input filter for input IN 6 has been activated.
Bit 6	**Activating the input filter for IN 7** 1 = The input filter for input IN 7 has been activated.
Bit 7	**Activating the input filter for IN 8** 1 = The input filter for input IN 8 has been activated.
Bit 8	**Activating the input filter for IN 9** 1 = The input filter for input IN 9 has been activated.
Bit 9	**Activating the input filter for IN 10** 1 = The input filter for input IN 10 has been activated.
Bit 10	**Activating the input filter for IN 11** 1 = The input filter for input IN 11 has been activated.
Bit 11	**Activating the input filter for IN 12** 1 = The input filter for input IN 12 has been activated.
Bit 12	**Activating the input filter for IN 13** 1 = The input filter for input IN 13 has been activated.
Bit 13	**Activating the input filter for IN 14** 1 = The input filter for input IN 14 has been activated.

Meaning of the individual bits	
Bit 14	**Activating the input filter for IN 15**
	1 = The input filter for input IN 15 has been activated.
Bit 15	**Activating the input filter for IN 16**
	1 = The input filter for input IN 16 has been activated.

Module register properties	
Value after reset	0x0000FFFF

MR 263

Input filters for inputs IN 1 ... IN 4

This module register lets you configure the time delay of the input filter for inputs IN 1 ... IN 4:

Module register properties	
Values	0 ... 7
0	No time delay
1	Time delay of 0.25 ms
2	Time delay of 0.5 ms
3	Time delay of 1 ms
4	Time delay of 2 ms (default value)
5	Time delay of 4 ms
6	Time delay of 8 ms
7	Time delay of 16 ms

Value after reset	4

MR 264

Input filters for inputs IN 5 ... IN 8

This module register lets you configure the time delay of the input filter for inputs IN 5 ... IN 8:

Module register properties	
Values	0 ... 7
0	No time delay
1	Time delay of 0.25 ms
2	Time delay of 0.5 ms
3	Time delay of 1 ms
4	Time delay of 2 ms (default value)
5	Time delay of 4 ms
6	Time delay of 8 ms
7	Time delay of 16 ms
Value after reset	4

MR 265

Input filters for inputs IN 9 ... IN 12

This module register lets you configure the time delay of the input filter for inputs IN 9 ... IN 12:

Module register properties	
Values	0 ... 7
0	No time delay
1	Time delay of 0.25 ms
2	Time delay of 0.5 ms
3	Time delay of 1 ms
4	Time delay of 2 ms (default value)
5	Time delay of 4 ms
6	Time delay of 8 ms
7	Time delay of 16 ms
Value after reset	4

MR 266

Input filters for inputs IN 13 ... IN 16

This module register lets you configure the time delay of the input filter for inputs IN 13 ... IN 16:

Module register properties	
Values	0 ... 7
0	No time delay
1	Time delay of 0.25 ms
2	Time delay of 0.5 ms
3	Time delay of 1 ms
4	Time delay of 2 ms (default value)
5	Time delay of 4 ms
6	Time delay of 8 ms
7	Time delay of 16 ms

Value after reset	4

Example: Applying the input filter

Task

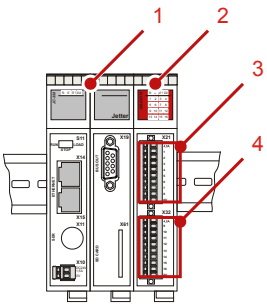
Read digital inputs IN 1 ... IN 16 and delay the time for IN 1 ... IN 3 by 2 ms, and for IN 5, IN 7, IN 8 by 0.125 ms.

Solution

Set pulse stretching by means of module registers 262 ... 266.

Sample configuration

This example is based on the following configuration:



Number	Element	Description
1	JC-3xx	PLC JetControl 3xx
2	JX3-DIO16	Digital input/output module I/O module number 2
3	Inputs	IN 1 ... IN 8
4	Multi-purpose I/Os	IN 9 ... IN 16 and OUT 9 ... OUT 16

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-350 of OS version 1.16.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym STX program

```
Var
    // Declaration
    Filter_On : Int At %VL 100020262;
    Filter1_4 : Int At %VL 100020263;
    Filter5_8 : Int At %VL 100020264;
End_Var;
Task Start_Filter
    //Setting a filter of 2.0 ms for IN 1 ... IN 4:
    Filter1_4 := 5;
    //Setting a filter of 0.125 ms for IN 5 ... IN 8:
    Filter5_8 := 1;
    // Activating time delay
    Filter_On := 0xD7;
End_Task;
```

6.6 Pulse stretching

Introduction

The JX3-DIO16 module lets you stretch pulses for the first eight inputs IN 1 ... IN 8.

Applications

The following applications are possible, for example:

- Making a pulse visible in JetSym or by an LED
- Debouncing a pushbutton
- etc.

Interdependence of the inputs

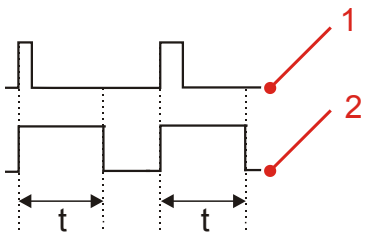
- Pulse stretching for inputs IN 1 ... IN 8 can be configured in two groups of four.
- Pulse stretching can be activated for each input in bit-coded format.

Contents

Configuring pulse stretching

Principle of pulse stretching

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



Number	Description
1	Input pulse at IN 1 ... IN 8
2	Pulse stretched by time t

Technical specifications

Parameter	Description
Configurable digital inputs	IN 1 ... IN 8
Pulse stretching	0 ... 7.5 ms in steps of 0.5 ms
Time can be set for group 1	IN 1 ... IN 4
Time can be set for group 2	IN 5 ... IN 8
IN 1 ... IN 8 can also be selected.	bit-coded

Register overview

The following module registers let you configure pulse stretching:

Register	Description	Default value:
257	Bit-coding inputs IN 1 ... IN 8 and assigning them to the input filter	0
258	Pulse stretching time for inputs IN 1 ... IN 4	0
259	Pulse stretching time for inputs IN 5 ... IN 8	0

Register description - Pulse stretching

Introduction

The following module registers let you configure pulse stretching:

MR 257

Activating pulse stretching, bit-coded

In this module register, pulse stretching for inputs IN 1 ... IN 8 are configured in bit-coded format. Each input is assigned a bit in the module register.

Meaning of the individual bits	
Bit 0	**Activating pulse stretching for input IN 1**
	1 = The pulse of input IN 1 is stretched.
Bit 1	**Activating pulse stretching for input IN 2**
	1 = The pulse of input IN 2 is stretched.
Bit 2	**Activating pulse stretching for input IN 3**
	1 = The pulse of input IN 3 is stretched.
Bit 3	**Activating pulse stretching for input IN 4**
	1 = The pulse of input IN 4 is stretched.
Bit 4	**Activating pulse stretching for input IN 5**
	1 = The pulse of input IN 5 is stretched.
Bit 5	**Activating pulse stretching for input IN 6**
	1 = The pulse of input IN 6 is stretched.
Bit 6	**Activating pulse stretching for input IN 7**
	1 = The pulse of input IN 7 is stretched.
Bit 7	**Activating pulse stretching for input IN 8**
	1 = The pulse of input IN 8 is stretched.

MR 258

Pulse stretching for inputs IN 1 ... IN 4

This module register lets you configure the duration of pulse stretching for inputs IN 1 ... IN 4:

Module register properties	
Values	0 ... 15
0	No pulse stretching (default value)
1	Pulse stretching of 0.5 ms
2	Pulse stretching of 1.0 ms
3	Pulse stretching of 1.5 ms
4	Pulse stretching of 2.0 ms
5	Pulse stretching of 2.5 ms
6	Pulse stretching of 3.0 ms
7	Pulse stretching of 3.5 ms
8	Pulse stretching of 4.0 ms
9	Pulse stretching of 4.5 ms
10	Pulse stretching of 5.0 ms
11	Pulse stretching of 5.5 ms
12	Pulse stretching of 6.0 ms
13	Pulse stretching of 6.5 ms
14	Pulse stretching of 7.0 ms
15	Pulse stretching of 7.5 ms

MR 259

Pulse stretching of inputs IN 5 ... IN 8

This module register lets you configure the duration of pulse stretching for inputs IN 5 ... IN 8:

Module register properties	
Values	0 ... 15
0	No pulse stretching (default value)
1	Pulse stretching of 0.5 ms
2	Pulse stretching of 1.0 ms
3	Pulse stretching of 1.5 ms
4	Pulse stretching of 2.0 ms
5	Pulse stretching of 2.5 ms
6	Pulse stretching of 3.0 ms
7	Pulse stretching of 3.5 ms
8	Pulse stretching of 4.0 ms
9	Pulse stretching of 4.5 ms
10	Pulse stretching of 5.0 ms
11	Pulse stretching of 5.5 ms
12	Pulse stretching of 6.0 ms
13	Pulse stretching of 6.5 ms
14	Pulse stretching of 7.0 ms
15	Pulse stretching of 7.5 ms

Example: Applying pulse stretching

Task

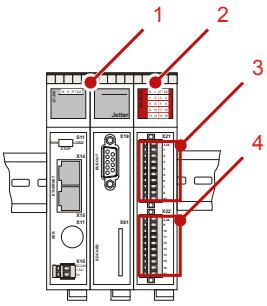
Read digital inputs IN 3 and IN 7. Delay IN 3 by 2.5 ms and IN 7 by 6.5 ms.

Solution

Declare in JetSym variables of the type boolean. Assign the digital input numbers of the JX3-DIO16 module to the variables. Pulse stretching is set by means of module registers 257 ... 259.

Sample configuration

This example is based on the following configuration:



Number	Element	Description
1	JC-3xx	PLC JetControl 3xx
2	JX3-DIO16	Digital input/output module I/O module number 2
3	Inputs	IN 1 ... IN 8
4	Multi-purpose I/Os	IN 9 ... IN 16 and OUT 9 ... OUT 16

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-350 of OS version 1.16.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym STX program

```
Var
    // Declaring the inputs
    bi_In1   : bool At %IX 100000203;
    bi_In2   : bool At %IX 100000207;
    Delay_On  : int At %VL 100020257;
    DelayGrp1 : int At %VL 100020258;
    DelayGrp2 : int At %VL 100020259;
End_Var;

Task Start_PulseDelay
    //Setting pulse stretching of 2.5 ms for IN 1 ... IN 4:
    Delay_Grp1 := 5;
        //Setting pulse stretching of 6.5 ms for IN 5 ... IN 8:
    Delay_Grp2 := 13;
    // Activating pulse stretching
    Delay_On := 0b01000100;
    // ...
End_Task;
```

6.7 Pulse-width modulation (PWM)

Introduction

With pulse-width modulation PWM, the module JX3-DIO16 independently issues periodic signals at the output. Module registers let you configure PWM frequency and duty cycle.

Applications

Pulse-width modulation lets you control

- the speed of a DC motor
- the flow of a proportional valve
- the flashing frequency of a lamp
- etc.

Technical specifications

Parameter	Description
Configurable digital outputs	OUT 9 ... OUT 16
PWM- groups with common basic frequency	OUT 9 ... OUT 16
PWM group 1 with PWM frequency divider 1	OUT 9 ... OUT 12
PWM group 2 with PWM frequency divider 2	OUT 13 ... OUT 16
Frequency band	0.4768 Hz ... 1.008 kHz can be configured separately for each PWM group
Duty cycle	can be set in steps of 1/256 per output

Interdependency of digital outputs

When configuring PWM, between digital outputs the following interdependencies exist:

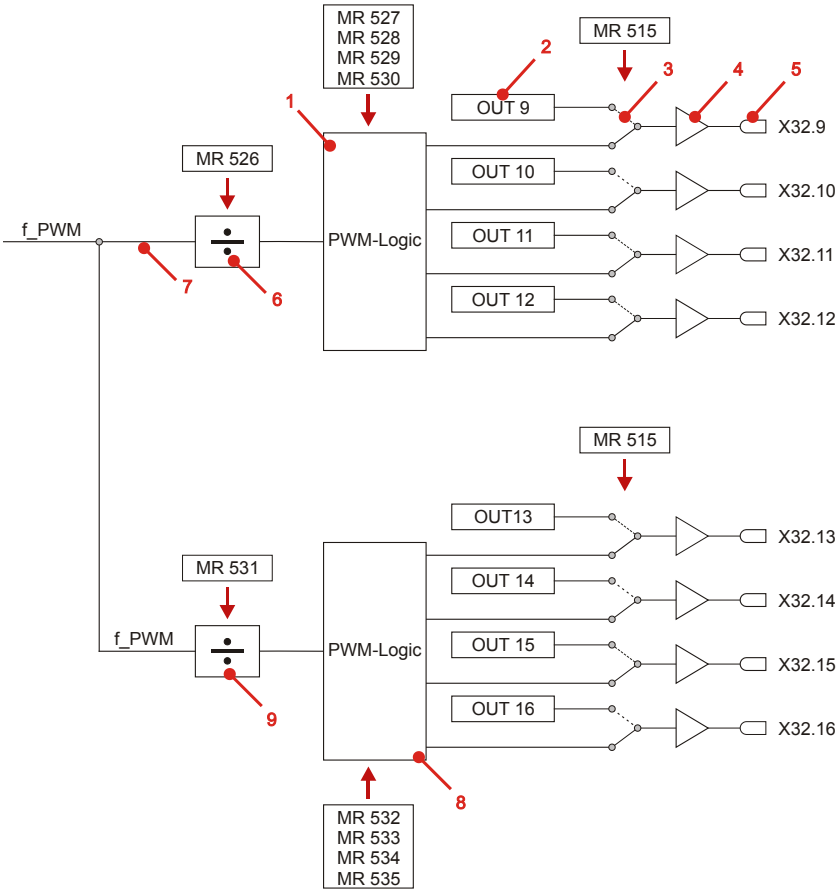
- A common PWM frequency is configured for four digital outputs each.
  - For each digital output a separate PWM duty cycle is configured.
- The PWM function is activated for each digital output separately.

Contents

Functionality of pulse width modulation PWM

Principle of a PWM logic circuit

The module JX3-DIO16 generates PWM signals in an internal logic circuit. The following figure shows the design of the PWM logic circuit:



Number	Description
1	PWM logic circuit for digital outputs 9 ... 12
2	Digital output value
3	Switch for activating the PWM function
4	Output driver
5	Terminal point of the digital output
6	Frequency divider 1 for PWM of the digital outputs 9 ... 12
7	f_PWM: PWM basic frequency
8	PWM logic circuit for digital outputs 13 ... 16
9	Frequency divider 2 for PWM of the digital outputs 13 ... 16

Technical specifications

Parameter	Description
Configurable digital outputs	OUT 9 ... OUT 16
Frequency band	0.4768 Hz ... 1.008 kHz
Duty cycle Can be configured for each output	Can be set in 256 steps

Interdependency of digital outputs

When configuring PWM, between digital outputs the following interdependencies exist:

- A common PWM frequency is configured for four digital outputs each.
  - For each digital output a separate PWM duty cycle is configured.
- The PWM function is activated for each digital output separately.

Blocked functions in PWM mode

If the PWM function of a digital output is active, the following functions are blocked:

- Switching the digital output, e.g. from the controller or from JetSym.
- Reading the state of the digital output, e.g. from the controller or from JetSym.

Synchronicity of outputs

PWM output is synchronous within the following outputs

- Outputs 9 ... 12 are synchronous
- Outputs 13 ... 16 are synchronous

Related topics

- **Register description - Pulse width modulation** (see page 119)
- **Example: Enabling the PWM functionality** (see page 123)

Configuring PWM

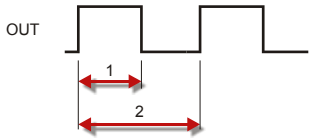
Register overview

For configuring the PWM function, the following module registers are used:

Register	Description
515	Activating PWM
526	PWM frequency divider 1 for outputs 9 ... 12
527	PWM duty cycle for output OUT 9
528	PWM duty cycle for output OUT 10
529	PWM duty cycle for output OUT 11
530	PWM duty cycle for output OUT 12
531	PWM frequency divider 2 for outputs 13 ... 16
532	PWM duty cycle for output OUT 13
533	PWM duty cycle for output OUT 14
534	PWM duty cycle for output OUT 15
535	PWM duty cycle for output OUT 16

PWM signal

The PWM signal of a digital output is characterized by the following parameters:



Number	Description
1	Turn-on time
2	Period

Calculating the PWM frequency by frequency divider 1

The PWM frequency is generated from a basic frequency of 31,250 Hz. The PWM frequency for outputs 9 ... 12 is calculated by the following formula based on the basic frequency:

$$f_{OUT9\_12} = \frac{31250\,\text{Hz}}{\text{MR}[526]+1}$$

Calculating the PWM value of module register 526

If you know the desired output frequency f_{Out9_12}, you can calculate the value of module register 526:

$$\text{MR}[526] = \frac{31250Hz}{f_{OUT9\_12}} - 1$$

Calculating the PWM frequency by frequency divider 2

The PWM frequency is generated from a basic frequency of 31,250 Hz. The PWM frequency for outputs 13 ... 16 is calculated by the following formula based on the basic frequency:

$$f_{OUT13\_16} = \frac{31250\,Hz}{MR[531]+1}$$

Calculating the PWM value of module register 531

If you know the desired output frequency f_{Out113_16}, you can calculate the value of module register 531:

$$MR[531] = \frac{31250Hz}{f_{OUT13\_16}} - 1$$

Calculating the PWM duty cycle

The duty cycle defines the duration of the ON state of the digital output. The ON duration is calculated by the following formula:

$$t = \frac{1}{f_{OUTx\_x}} = \frac{MR[527..530,532..535]+1}{256}$$

Enabling the PWM functionality

To activate the PWM function proceed as follows:

Step	Action	
1	Configure the PWM frequency by setting the PWM frequency divider.	
	If ...	**... then ...**
	you want to activate one of the outputs OUT 9 ... 12,	configure the PWM frequency via MR 526.
	you want to activate one of the outputs OUT 13 ... 16,	configure the PWM frequency via MR 531.
2	Configure the PWM duty cycle for this output in the corresponding module register.	
3	Enable the PWM function of the output by setting the corresponding bit in MR 515 *Enabling PWM*.	
	If ...	**... then ...**
	you want to activate output OUT 9,	set Bit 8 = 1 in MR 515.
	you want to activate output OUT 10,	set Bit 9 = 1 in MR 515.
	...	
	you want to activate output OUT 16,	set Bit 15 = 1 in MR 515.
⇨	**Result:** At the output, a PWM signal is issued.	

Disabling the PWM functionality

To activate the PWM function, proceed as follows:

Step	Action	
1	Disable the PWM function of the output by resetting the corresponding bit in MR 515 *Enabling PWM*.	
	If ...	**... then ...**
	you want to deactivate the PWM function for output OUT 9,	set Bit 8 = 0 in MR 515.
	you want to deactivate the PWM function for output OUT 10,	set Bit 9 = 0 in MR 515.
	...	
	you want to deactivate the PWM function for output OUT 16,	set Bit 15 = 0 in MR 515.
⇨	**Result:** At the output, a low level is output.	

Related topics

- **Register description - Pulse width modulation** (see page 119)
- **Example: Enabling the PWM functionality** (see page 123)

Changing PWM parameters while PWM is active

Introduction

PWM parameters may be changed even while PWM is active. PWM parameters are the following:

- PWM duty cycle
- PWM frequency divider
- Disabling the PWM functionality

Changing the PWM duty cycle

To change the PWM duty cycle, proceed as follows:

Step	Action
1	Change the duty cycle in module register *PWM duty cycle for output OUT X* by the controller.
2	The module JX3-DIO16 completes the current PWM period using the old PWM duty cycle setting.
3	The module JX3-DIO16 starts a new PWM period using the new PWM duty cycle setting.

Changing the PWM frequency

To change the PWM frequency, proceed as follows:

Step	Action
1	Enter the new value into the PWM frequency divider in MR 526 or MR 531.
2	The module JX3-DIO16 immediately changes the PWM frequency.

Disabling the PWM functionality

To activate the PWM function, proceed as follows:

Step	Description	
1	Set the PWM duty cycle of the output in the corresponding module register to 0.	
2	The module JX3-DIO16 completes the current PWM period. Then its output issues the state OFF.	
3	Disable the PWM function of the output by resetting the corresponding bit in MR 515 *Enabling PWM*.	
	If ...	**... then ...**
	OUT 9,	Bit 8 = 0 in MR 515.
	OUT 10,	Bit 9 = 0 in MR 515.
	...	...
	OUT 16,	Bit 15 = 0 in MR 515.
⇨	The output of module JX3-DIO16 issues the state of the corresponding PLC output number.	

Related topics

- **Example: Enabling the PWM functionality** (see page 123)

Register description - Pulse width modulation PWM

Introduction

The following module registers allow you to configure all PWM functions of the JX3-DIO16 module:

MR 515

Enabling the PWM functionality

This module register is for enabling the PWM function of individual outputs. Each output is assigned a bit in the module register.

Meaning of the individual bits	
Bit 8	**Activating the PWM function for output OUT 9** 1 = PWM function is active
Bit 9	**Activating the PWM function for output OUT 10** 1 = PWM function is active
Bit 10	**Activating the PWM function for output OUT 11** 1 = PWM function is active
Bit 11	**Activating the PWM function for output OUT 12** 1 = PWM function is active
Bit 12	**Activating the PWM function for output OUT 13** 1 = PWM function is active
Bit 13	**Activating the PWM function for output OUT 14** 1 = PWM function is active
Bit 14	**Activating the PWM function for output OUT 15** 1 = PWM function is active
Bit 15	**Activating the PWM function for output OUT 16** 1 = PWM function is active

MR 526

PWM frequency divider for outputs OUT 9 ... 12

This module register is used to configure the frequency divider for the PWM frequency of outputs OUT 9 ... 12. The PWM frequency is calculated by the following formula:

$$f_{OUT9\_12} = \frac{31250\,\text{Hz}}{MR[526]+1}$$

Module register properties	
Values	Reasonable values: 30 ... 65535
Enabling conditions	With activated PWM function of outputs OUT 9 ... 12

MR 527 **PWM duty cycle for output OUT 9**

This module register is used to configure the PWM duty factor of output OUT 9.

Module register properties	
Values	0 ... 255
Enabling conditions	With activated PWM function of output OUT 9

MR 528 **PWM duty cycle for output OUT 10**

This module register is used to configure the PWM duty factor of output OUT 10.

Module register properties	
Values	0 ... 255
Enabling conditions	With activated PWM function of output OUT 10

MR 529 **PWM duty cycle for output OUT 11**

This module register is used to configure the PWM duty factor of output OUT 11.

Module register properties	
Values	0 ... 255
Enabling conditions	With activated PWM function of output OUT 11

MR 530 **PWM duty cycle for output OUT 12**

This module register is used to configure the PWM duty factor of output OUT 12.

Module register properties	
Values	0 ... 255
Enabling conditions	With activated PWM function of output OUT 12

MR 531

PWM frequency divider for outputs OUT 13 ... 16

This module register is used to configure the frequency divider 2 for the PWM frequency of outputs OUT 13 ... 16. The PWM frequency is calculated by the following formula:

$$f_{OUT13\_16} = \frac{31250\,Hz}{MR[531]+1}$$

Module register properties	
Values	Reasonable values: 30 ... 65535
Enabling conditions	With activated PWM function of outputs OUT 13 ... 16

MR 532

PWM duty cycle for output OUT 13

This module register is used to configure the PWM duty factor of output OUT 13.

Module register properties	
Values	0 ... 255
Enabling conditions	With activated PWM function of output OUT 13

MR 533

PWM duty cycle for output OUT 14

This module register is used to configure the PWM duty factor of output OUT 14.

Module register properties	
Values	0 ... 255
Enabling conditions	With activated PWM function of output OUT 14

MR 534

PWM duty cycle for output OUT 15

This module register is used to configure the PWM duty factor of output OUT 15.

Module register properties	
Values	0 ... 255
Enabling conditions	With activated PWM function of output OUT 15

MR 535

PWM duty cycle for output OUT 16

This module register is used to configure the PWM duty factor of output OUT 16.

Module register properties	
Values	0 ... 255
Enabling conditions	With activated PWM function of output OUT 16

Example: Enabling the PWM Function - JC-24x

Task

Digital output OUT 10 of a <Produktname module is to output a periodic 10 Hz pulse. The ON duration of the signal at the output must be at least 50 ms.

Solution

The periodic pulse is output using the PWM function.

Calculate the value for MR 526 *PWM frequency divider four outputs OUT 9 ... 12* by the following formula:

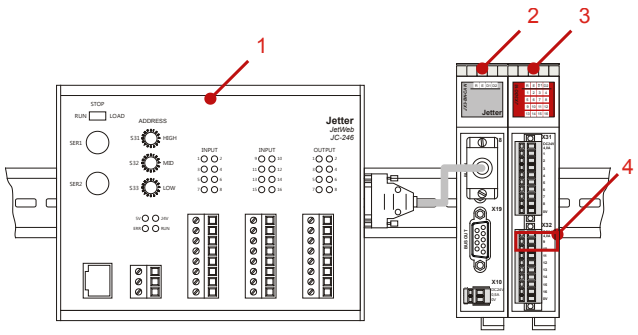
$$MR[256] = \frac{31250\,Hz}{10Hz} - 1 = 3124$$

Calculate the value for MR 528 *PWM duty cycle for output OUT 10* by the following formula:

$$MR[528] = 50ms \cdot 10Hz \cdot 256 - 1 = 127$$

Sample configuration

This example is based on the following configuration:



Number	Element	Description
1	JC-24x	Controller
2	JX3-BN-CAN	Bus node for the JX2 system bus I/O module number 33
3	JX3-DIO16	Digital output module I/O module number 2
4	OUT 10	Digital output I/O number 210

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-24x of OS version 3.27.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym ST program

```
Var
    JX3DO16 : Struct
        // Register for indirect register access MR 7, MR 8
        Index   : Int;
        Data    : Int;
        // OS version in MR 9
        Version : Int;
    End_Struct At %VL 3000;
End_Var;

Task 0
    // Configuring the PWM frequency divider for 10 Hz
    JX3DO16.Index := 526;
    JX3DO16.Data  := 3124;
    // Configuring the PWM duty cycle for 50 ms
    JX3DO16.Index := 528;
    JX3DO16.Data  := 127;
    // Enabling the PWM function for OUT 10
    JX3DO16.Index := 515;
    BIT_SET(JX3DO16.Data, 9);
    // ...
End_Task;
```

6.8 Counter function

Introduction

The JX3-DIO16 module lets you can make use of two counters at two independent inputs.

Technical data - Counter function

Parameter	Description
Digital inputs of the counter	■ Counter A ■ IN 1 at X21.1 for counter A ■ IN 2 at X21.1 for gate input A ■ Counter B ■ IN 5 at X21.5 for counter B ■ IN 6 at X21.6 for gate input B
Special counter functions	■ Gate function ■ Configurable edge evaluation ■ Configurable upper counting limit
Edge evaluation of the counter	Rising or falling edge
Level evaluation of the gate function	Low or high active counter enable
Value range	32 bits
Counting direction	Positive only
Pre-divider can be set to counting input	0 ... 255
Maximum counting rate	3 kHz

Independence of inputs

- You can activate the counter function at input IN 1.
- You can activate the counter function at input IN 5.
- Regarding the counter function, input IN 1 does not influence input IN 5 and vice versa.

Contents

Properties of the counter function

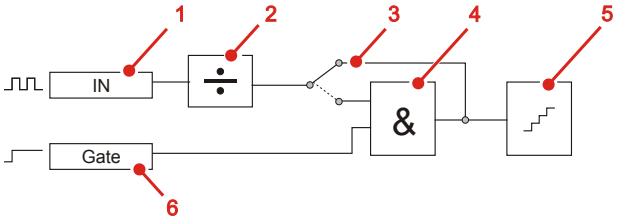
Counter setting options

The module JX3-DIO16 lets you set the following options:

Option	Description
Edge type for counter inputs IN 1 and IN 5	■ Rising edge ■ Falling edge
Level type for gate inputs IN 2 and IN 6	■ Low level for low-active counter enable ■ High level for high-active counter enable
Upper counting limit	■ An upper counting limit can be set. If this limit is exceeded, a bit is set, and the counter restarts at count value 0.

Block diagram of a counter

Both the block diagram of counter A and counter B look the same:



Number	Description
1	Hardware input X21.1 for counter A or X21.5 for counter B
2	Pre-divider of pulses at the hardware input
3	Gate function (hardware enable) ON or OFF
4	Gate function/Hardware enable
5	Actual counter
6	Hardware input X21.2 for counter A and X21.6 for counter B as counter enable

Count value after power-up

After power-up, both counters have got value 0.

Starting and stopping the counters

An enable signal at the gate input or in the application program starts and stops the counters.

Functioning as a digital output

When the counter function of a digital input has been activated, the following functions of this output are disabled:

- Switching the digital output, e.g. from the controller or from JetSym.
- Reading the state of the digital output, e.g. from the controller or from JetSym.

Setting a counter to zero

A counter is reset to zero in the application program. To reset the counter to zero proceed as follows:

Step	Action
1	Stop the single-channel counter by entering the value 0x02 into MR 322 for counter A or into MR 338 for counter B.
2	For counter A, enter value 0x01 into MR 321. For counter A, enter value 0x01 into MR 337.
⇨	The respective counter is set to 0.

Counting direction

The counting direction of both counters is always positive.

Related topics

- **Connecting the counters** (see page 50)
- **Configuring the counters** (see page 128)
- **Register description - Counter function** (see page 131)

Configuring the counter function

Register overview - Counter A

The following module registers let you configure the count function of counter A:

Register	Description
320	Status register of counter A
321	Command register of counter A
322	Enable of counter A
324	Pre-divider of counter A
325	Set value of a count value A
326	Actual count value of counter A

Register overview - Counter B

The following module registers let you configure the count function of counter B:

Register	Description
336	Status register of counter B
337	Command register of counter B
338	Enable of counter B
340	Pre-divider of counter B
341	Set count value of count value B
342	Actual count value of counter B

Setting options for counter A and B

For counter A and B respectively, you have got the following setting options:

- Gate
- Edge
- Pre-divider

Commissioning counter A

Carry out the following steps for commissioning counter A:

Step	Action	
1	Connect a signal with valid pulses to hardware input X21.1.	
2	Deactivate the hardware input filter by writing value 0 to MR 262.	
3	To activate counter A, write value 0x82 to MR 322.	
4	To configure the counter, enter the following values into its command register:	
	If ...	**... then ...**
	you want to evaluate falling edges,	write value 0x02 to MR 321.
	you want to evaluate rising edges,	write value 0x12 to MR 321.
	you want to evaluate falling edges in low-active mode,	write value 0x06 to MR 321.
	you want to evaluate falling edges in high-active mode,	write value 0x26 to MR 321.
	you want to evaluate rising edges in low-active mode,	write value 0x16 to MR 321.
	you want to evaluate rising edges in high-active mode,	write value 0x36 to MR 321.
	you want to evaluate falling edges with upper counting limit activated,	write value 0x42 to MR 321.
	you want to evaluate rising edges with upper counting limit activated,	write value 0x52 to MR 321.
5	Enter a pre-divider value ranging from 1 ... 255 into MR 324.	
⇨	**Result:** The counting pulses applied to input X21.1 are counted.	

Commissioning counter B

Carry out the following steps for commissioning counter B:

Step	Action	
1	Connect a signal with valid pulses to hardware input X21.5.	
2	Deactivate the hardware input filter by writing value 0 to MR 262.	
3	To activate counter B, write value 0x82 to MR 337.	
4	To configure the counter, enter the following values into its command register:	
	If ...	**... then ...**
	you want to evaluate falling edges,	write value 0x02 to MR 337.
	you want to evaluate rising edges,	write value 0x12 to MR 337.
	you want to evaluate falling edges in low-active mode,	write value 0x06 to MR 337.
	you want to evaluate falling edges in high-active mode,	write value 0x26 to MR 337.
	you want to evaluate rising edges in low-active mode,	write value 0x16 to MR 337.
	you want to evaluate rising edges in high-active mode,	write value 0x36 to MR 337.
	you want to evaluate falling edges with upper counting limit activated,	write value 0x42 to MR 337.
	you want to evaluate rising edges with upper counting limit activated,	write value 0x52 to MR 337.
5	Enter a pre-divider value ranging from 1 ... 255 into MR 340.	
⇨	**Result:** The counting pulses applied to input X21.5 are counted.	

Related topics

- **Connecting the counters** (see page 50)
- **Register description - Counter function** (see page 131)

Register description - Counter function

Introduction

The following module registers let you configure the counter function of counter A and counter B.

MR 320

Status register of counter A

This module register lets you read out the state of the upper counting limit:

Meaning of the individual bits	
Bit 1	**The upper counting limit set in MR 325 was exceeded.**
1 =	The upper counting limit was exceeded.

Module register properties	
Type of access	Read access
Resetting MR 320	The bit can only be cleared via MR 321.

MR 321

Command register of counter A

This module register lets you set various counter functions: The individual functions are bit-coded.

Meaning of the individual bits		
Bit 1	**Bit 0**	**Resetting counter A/Activating counter A**
0 =	0 =	Reset counter A to value 0.
0 =	1 =	Reset counter A to value 0.
1 =	0 =	The count value is incremented by 1, if an edge is recognized at input X21.1. Bit 4 determines the type of edge (falling or rising edge).
1 =	1 =	Reset counter A to value 0.
Bit 2	**Activating or deactivating the gate function**	
	0 =	Deactivate the gate function for input X21.2.
	1 =	Activate the gate function for input X21.2.

Meaning of the individual bits	
Bit 4	**Edge type**
0 =	The counter responds to the falling edge.
1 =	The counter responds to the rising edge.
Bit 5	**Level at the gate input**
0 =	The gate input X21.2 responds to low-level.
1 =	The gate input X21.2 responds to high-level.
Bit 6	**Mode**
0 =	Endless counting mode
1 =	Upper counting limit. After exceeding the set upper limit, the counter is reset to value 0.
Bit 7	**Resetting status register 320**
1 =	The status register (upper counting limit) is reset.

Sample commands	
Type of access	Write access
0x01	Reset the count value to 0.
0x02	Count falling edges.
0x12	Count rising edges.
0x06	Count falling edges at X21.1. The gate function at X21.2 responds to low level.
0x26	Count falling edges at X21.1. The gate function at X21.2 responds to high level.
0x16	Count rising edges at X21.1. The gate function at X21.2 responds to low level.
0x36	Count rising edges at X21.1. The gate function at X21.2 responds to high level.
0x42	Count falling edges. The adjustable upper limit in MR 325 of counter A is enabled.
0x52	Count rising edges. The adjustable upper limit in MR 325 of counter A is enabled.
0x80	Reset the state in MR 320 to 0.

MR 324

Pre-divider of counter A

This module register lets you delay counting by means of a pre-divider.

Values of the pre-divider	
0	Stops counter A. Count pulses may be present at input X21.1. These are not counted.
1	At each pulse, counter A is incremented by one.
2	At each second pulse, counter A is incremented by one.
...	...
255	After registration of 255 pulses at input X21.1 of counter A, the count value is incremented by one.

Module register properties	
Values	0 ... 255

MR 325

Upper counting limit of counter A

This module register lets you define an upper counting limit. If this limit is exceeded, bit 1 in MR 320 is set and the counter restarts at count value 0. Command register 321 lets you activate or deactivate the function.

Module register properties	
Values	32 bits, 0 ... 4,294,967,295

MR 326

Count value of counter A

MR 326 shows the as-is count value of the counter.

Module register properties	
Values	32 bits, 0 ... 4,294,967,295
Type of access	Read access

MR 336

Status register of counter B

This module register lets you read out the state of the upper counting limit:

Meaning of the individual bits	
Bit 1	**The upper counting limit set in MR 341 was exceeded.**
	1 = The upper counting limit was exceeded.

Module register properties	
Type of access	Read access
Resetting MR 336	The bit can only be cleared via MR 337.

MR 337

Command register of counter B

This module register lets you set various counter functions: The individual functions are bit-coded.

Meaning of the individual bits		
Bit 1	**Bit 0**	**Resetting counter B/Activating counter B**
0 =	0 =	Reset counter B to 0.
0 =	1 =	Reset counter B to 0.
1 =	0 =	If an edge at input X21.5 is recognized, the count value is incremented by 1.
1 =	1 =	Reset counter B to 0.
Bit 2	**Activating or deactivating the gate function**	
	0 =	Deactivate the gate function for input X21.6.
	1 =	Activate the gate function for input X21.6.
Bit 4	**Edge type**	
	0 =	The counter responds to the falling edge.
	1 =	The counter responds to the rising edge.
Bit 5	**Level at the gate input**	
	0 =	The gate input X21.6 responds to low level.
	1 =	The gate input X21.6 responds to high level.
Bit 6	**Mode**	
	0 =	Endless counting mode
	1 =	Upper counting limit. After exceeding the set upper limit, the counter is reset to value 0.
Bit 7	**Resetting status register 336**	
	1 =	The status register (upper counting limit) is reset.

Sample commands	
Type of access	Write access
0x01	Reset the count value to 0.
0x02	Count falling edges.
0x12	Count rising edges.
0x06	Count falling edges at X21.5 The gate function at X21.6 responds to low level.
0x26	Count falling edges at X21.5 The gate function at X21.6 responds to high level.
0x16	Count rising edges at X21.5. The gate function at X216 responds to low level.
0x36	Count rising edges at X21.5. The gate function at X21.6 responds to high level.
0x42	Count falling edges. The adjustable upper limit in MR 341 of counter B is enabled.
0x52	Count rising edges. The adjustable upper limit in MR 341 of counter B is enabled.
0x80	Reset the state in MR 336 to 0.

MR 340

Pre-divider of counter B

This module register lets you delay counting by means of a pre-divider.

Values of the pre-divider	
0	Stops counter B. Count pulses may be present at input X21.1. These are not counted.
1	Each single pulse increments the count value of counter B by one.
2	Every second pulse increments the count value of counter B by one.
...	...
255	After registration of 255 pulses at input X21.5 of counter B, the count value is incremented by one.

Module register properties	
Values	0 ... 255

MR 341 **Upper counting limit of counter B**

This module register lets you define an upper counting limit. If this limit is exceeded, bit 1 in MR 336 is set and the counter restarts at count value 0. Command register 337 lets you activate or deactivate the function.

Module register properties	
Values	32 bits, 0 ... 4,294,967,295

MR 342 **Count value of counter B**

MR 342 shows the as-is count value of counter B.

Module register properties	
Values	32 bits, 0 ... 4,294,967,295
Type of access	Read access

6.9 Error states of digital outputs

Introduction

For each digital output the user may specify a default value or a certain behavior in case of an error. Should this case occur, the digital output of the module JX3-DIO16 issues the configured value.

Error case

The configured value is issued when the following error occurs:

- Interruption of cyclic data exchange with the bus node or controller

Applications

This error value can be used for the following application:

- When the line between bus node and the controller is interrupted, the module JX3-DIO16 causes a connected valve to switch to a given position.
- etc.

Contents

Configuring error states

Register overview

For configuring error values, the following module registers are used:

Register	Description
MR 513	Activate error state from MR 514
MR 514	Error state of digital outputs

Error case

The configured value is issued when the following error occurs:

- Interruption of cyclic data exchange with the bus node or the controller

Function

In case of an error the module checks for each output which error state is to be output.

If ...	... then ...
in case of an error the present state is to be output,	the state which is output remains unchanged.
the error value is to be output,	the value of the bit in MR 514 is output as state.

Behavior after power-up

In case of an error, after power-up all digital outputs signal their present state without any modifications.

Configuring error states

To configure error states proceed as follows:

If ...	... then ...
in case of an error the state is to remain unchanged,	set bit x = 0 in MR 513; x: 0 ... 15 (output number - 1).
the state OFF is to be output,	set bit x = 1 in MR 513 and bit x = 0 in MR 514; x: 0 ... 15 (output number - 1).
the state ON is to be output,	set bit x = 1 in MR 513 and bit x = 1 in MR 514; x: 0 ... 15 (output number - 1).

Related topics

- **Description of registers - Error states** (see page 139)
- **Example: Configuring error states** (see page 141)

Description of registers - Error states

Variable name

In this document a variable name is assigned to each module register. These variable names are used by the hardware manager integrated into JetSym.

MR 513

Activate error state from MR 514

This module register specifies whether in case of an error the state at the output is to remain unchanged or whether the state from MR 514 is to be output.

Meaning of the individual bits		
Bit 8	**Activation of error state for output OUT 9**	
	0 =	Output remains unchanged
	1 =	Output assumes the state from MR 514
Bit 9	**Activation of error state for output OUT 10**	
	0 =	Output remains unchanged
	1 =	Output assumes the state from MR 514
Bit 10	**Activation of error state for output OUT 11**	
	0 =	Output remains unchanged
	1 =	Output assumes the state from MR 514
Bit x	**Activation of error state for output OUT (x+1)**	
	0 =	Output remains unchanged
	1 =	Output assumes the state from MR 514
Bit 15	**Activation of error state for output OUT 16**	
	0 =	Output remains unchanged
	1 =	Output assumes the state from MR 514

MR 514

Error state of digital outputs

This module register defines the states the digital outputs are to assume in case of an error.

Meaning of the individual bits		
Bit 8	**Error state for output OUT 9**	
	0 =	Output assumes the state OFF
	1 =	Output assumes the state ON
Bit 9	**Error state for output OUT 10**	
	0 =	Output assumes the state OFF
	1 =	Output assumes the state ON
Bit 10	**Error state for output OUT 11**	
	0 =	Output assumes the state OFF
	1 =	Output assumes the state ON
Bit 11	**Error state for output OUT 12**	
	0 =	Output assumes the state OFF
	1 =	Output assumes the state ON
Bit 12	**Error state for output OUT 13**	
	0 =	Output assumes the state OFF
	1 =	Output assumes the state ON
Bit 13	**Error state for output OUT 14**	
	0 =	Output assumes the state OFF
	1 =	Output assumes the state ON
Bit 14	**Error state for output OUT 15**	
	0 =	Output assumes the state OFF
	1 =	Output assumes the state ON
Bit 15	**Error state for output OUT 16**	
	0 =	Output assumes the state OFF
	1 =	Output assumes the state ON

Example: Configuring error states for a JC-24x

Task

If connection to the controller fails, the JX3-DIO16 module can output a defined state at the outputs.

For this, define error states. At the JX3-DIO16 module, output a defined state of the outputs OUT 9 and OUT 10:

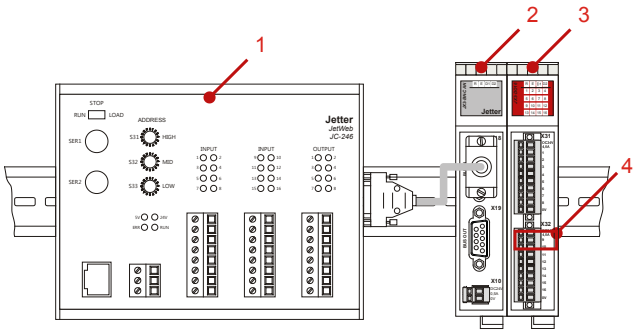
- Output OUT 9 is to assume state OFF.
- Output OUT 10 is to remain unchanged.

Solution

Configure the required states via module registers MR 513 and MR 514.

Sample configuration

This example is based on the following configuration:



Number	Element	Description
1	JC-24x	Controller
2	JX3-BN-CAN	Bus node for the JX2 system bus I/O module number 33
3	JX3-DIO16	Digital output module I/O module number 2
4	OUT 9	Digital output, I/O number 209
	OUT 10	Digital output, I/O number 210

Software versions

The sample program has been tested on the following software versions:

- JetSym version 4.4.3
- Control system JC-24x of OS version 3.27.0.00
- Module JX3-DIO16 of OS version 2.35.0.00

For sample programs on the most recent software releases please turn to the JetSym online help.

JetSym ST program

```
Var
    stJX3DO16 : Struct
        // Register for indirect register access MR 7, MR 8
        Index   : Int;
        Data    : Int;
        // OS version in MR 9
        Version : Int;
    End_Struct At %VL 3000;
End_Var;

Task 0

    // Activating error state
    stJX3DO16.Index := 513;
    // Error state OUT 9: Value from MR 514
    Bit_Set(stJX3DO16.Data, 8);
    // Error state OUT 10: unchanged
    Bit_Clear(stJX3DO16.Data, 9);

    // Configuring the error state
    stJX3DO16.Index := 514;
    // Error state OUT 9: OFF
    Bit_Clear(stJX3DO16.Data, 8);

End_Task;
```

7 Detecting faults

Purpose of this chapter

This chapter is for supporting you in locating faults of the JX3-DIO16 module in the following fields of activity:

- Identifying the root cause of a fault
- Detecting faults in the application program or visualization
- Acknowledging an error message

Prerequisites

To be able to locate a fault of the JX3-DIO16 module the following prerequisites must be fulfilled:

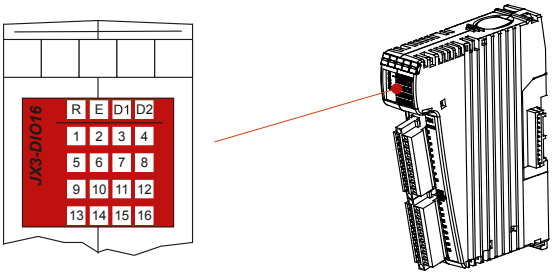
- The JX3-DIO16 module is connected to a JetControl PLC.
- The controller is connected to a PC.
- The programming tool JetSym is installed on the PC.
- The minimum requirements regarding modules, controllers and software are fulfilled.

Contents

LEDs on the JX3-DIO16 module

LEDs on the module

The module JX3-DIO16 indicates conditions and errors through its LEDs.You can detect faults directly:.



LED	Color	Designation
R	green	Run LED
E	red	Error LED
D1	red	Diagnostic LED 1
D2	red	Diagnostic LED 2
1 ... 16	amber	Status-LED of digital I/Os 1 ... 16

Normal operating condition

In normal operating condition, the LEDs of the module JX3-DIO16 indicate the following:

R	E	D1	D2	1 ... 16	Normal operating condition
ON	OFF	OFF	OFF	-	No error, communication is active

LEDs on the JX3-DIO16 module

The JX3-DIO16 module is equipped with 3 LEDs which indicate errors.

R	E	D1	D2	1 ... 16	Status
ON	OFF	OFF	OFF	-	No error, communication is active
ON	-	ON	-	-	Short circuit/overload or undervoltage of inputs 1 ... 8
ON	-	-	ON	-	Short circuit/overload or undervoltage of I/Os 9 ... 16

Diagnostics of error messages via module registers

Introduction

The module signals error messages in module register 0 *Module state*. Once the root cause has been eliminated, the JX3-DIO16 module automatically resets all error messages.

Register overview

To diagnose the module and its outputs, the following module registers are used:

Register	Description
MR 0	Module state

Signaling an error

The module JX3-DIO16 signals an error in the following way:

Step	Description
1	The module JX3-DIO16 detects an error and sets the corresponding error bit in MR 0 *Module state*.
2	The JX3-DIO16 module activates the red LED D1 or D2.
3	**Result:** The controller and the bus node, if any, respond to the error.

Response to error messages in the application program

The application program responds to an error message as follows:

Step	Description
1	The application program detects in certain registers on the controller that module JX3-DIO16 signals an error.
2	Depending on the error bit in MR 0 *Module state* the application program responds to the error.
3	The user eliminates the cause of the error.
4	**Result:** ■ Error bits = 0 in MR 0 ■ LEDs D1 and D2 on the JX3 module go out.
5	The application program acknowledges the error message in the controller and bus node, if any.

Short circuit/overload at the output driver

Detecting the error

The JX3-DIO16 module permanently checks the output driver for short-circuit or overload.

Root cause of the error

The error may be caused by the following root causes:

- The current drawn by a connected actuator exceeds 0.5 A.

Response of the module to this error

The module responds to this error in the following levels:

Step	Description	
1	The state at the failing output starts to alternate between OFF and ON.	
2	**If ...**	**... then ...**
	there is a short circuit of outputs OUT 1 ... 8,	■ LED D1 goes on. ■ Bit 0 = 1 in MR 0 *Module state*
	there is a short circuit of outputs OUT 9 ... 16,	■ LED D1 goes on. ■ Bit 1 = 1 in MR 0 *Module state*

Fixing the root cause

To fix the root cause proceed as follows:

Step	Action
1	Check the line to the actuator for a short-circuit to 0 V.
2	Reduce the current consumed by the actuator.

Resetting the error

Once the error is fixed, the module JX3-DIO16 reacts in the following way:

- LED D1 or D2 goes out.
- Bit 0 or bit 1 in MR 0 *Module state* is reset.

Related topics

- **Description of registers: Evaluation of errors** (see page 147)

Description of registers: Evaluation of errors

Variable name

In this document a variable name is assigned to each module register. These variable names are used by the hardware manager integrated into JetSym.

MR 0

Module state

In MR 0 *Module state*, the module signals error messages.

Once the short-circuit or overload have been eliminated, the module JX3-DIO16 automatically resets the corresponding bits in MR 0 *Module state*.

Meaning of the individual bits		
Bit 0	**Short circuit/overload of outputs OUT 1 ... OUT 8**	
	1 =	There is a short circuit/overload
Bit 1	**Short circuit/overload of outputs OUT 9 ... OUT 16**	
	1 =	There is a short circuit/overload

Module register properties	
Type of access	Read access
Value after reset	Depending on error messages of the module

8 Quick reference - JX3-DIO16

Matching OS version

This quick reference summarizes the registers and I/O numbers of the digital input/output module JX3-DIO16 with OS version 2.35.0.00.

Module code

For identification purposes, a unique module code is assigned to each JX3 module.
R 100002015 and R 100002016 let you read out the module code, for example, by a JC-3xx .
The module code is also contained in the EDS.
Module code JX3-DIO16: 301

I/O numbers

JC-3xx	10000xxzz	
	xx	Module number: 02 ... 17
	zz	I/O number: 01 ... 16
IN/OUT	100000201 ... 100000216	I/O numbers for module # 02
JC-24x	xxzz	
	xx	I/O module number: 02 ... 32
	zz	I/O number: 01 ... 16
IN/OUT	201 ... 216	I/O numbers for I/O module # 02
JC-647	m1xxzz	
	m1	Submodule socket + 1: 2 ... 4
	xx	I/O module number: 02 ... 32
	zz	I/O number: 01 ... 16
IN/OUT	20201 ... 20216	I/O numbers for submodule socket 1 and I/O module # 02
JC-9xx	20SJ0xxzz	
	S	Number of the module board: 1 ... 5
	J	Number of the JX6-I/O board: 1 ... 2
	xx	I/O module number: 02 ... 32
	zz	I/O number: 01 ... 16
IN/OUT	201100201 ... 201100216	I/O numbers for S = 1; J = 1 and I/O module # 02

General overview - Registers

0	Status registers of the module
2	Process data input
3	Process data output
9	Version
256	All inputs IN 1 ... IN 8
257 ... 259	Pulse stretching with digital inputs
262 ... 266	Digital input filters
320 ... 342	Counters A and B
512	All outputs OUT 9 ... OUT 16
513 ... 514	Error states
515 ... 535	PWM

Register numbers

JC-3xx	100xxzzzz	
	xx	Module number: 02 ... 17
	zzzz	Module register number: 0000 ... 9999
JC-24x	3xxz	
	xx	I/O module number - 2: 00 ... 30
	z	Module register number: 0 ... 9
	Only indirect access to additional module registers	
JC-647	3m03xxz	
	m	Submodule socket: 1 ... 3
	xx	I/O module number - 2: 00 ... 30
	z:	Module register number: 0 ... 9
	Only indirect access to additional module registers	
JC-9xx	20SJ03xxz	
	S	Number of the module board: 1 ... 5
	J	Number of the JX6-I/O board: 1 ... 2
	xx	I/O module number - 2: 00 ... 30
	z	Module register number: 0 ... 9
	Only indirect access to additional module registers	

State and diagnostics

0	Module state	
	Bit 0 = 1:	Short circuit/overload of OUT 9 ... 16
	Bit 1 = 1:	Voltage at X21.DC24V < 16.3 V
	Bit 2 = 1:	Voltage at X31.DC24V < 16.3 V
9	FPGA revision	
32	FPGA revision	

Pulse stretching

257	Activation of pulse stretching	
	Bit 0 = 1:	Activating pulse stretching for IN 1
	Bit 1 = 1:	Activating pulse stretching for IN 2
	etc.	
	Bit 7 = 1:	Activating pulse stretching for IN 8
258	Duration of pulse stretching for IN 1 ... IN 4 can be configured in steps of 0.5 ms, 7.5 ms max.	
259	Duration of pulse stretching for IN 5 ... IN 8 can be configured in steps of 0.5 ms, 7.5 ms max.	

Digital input filters

262	Activation of digital input filters	
	Bit 0 = 1:	Activating the digital filter for IN 1
	Bit 1 = 1:	Activating the digital filter for IN 2
	etc.	
	Bit 15 = 1:	Activating the digital filter for IN 16

Steps 0 = 0.125 ms; 1 = 0.25 ms; 2 = 2 ms; 3 = 1 ms; 4 = 2 ms; 5 = 4 ms; 6 = 8 ms; 7 = 16 ms

263	Delay of digital filters for IN 1 ... IN 4
264	Delay of digital filters for IN 5 ... IN 8
265	Delay of digital filters for IN 9 ... IN 12
266	Delay of digital filters for IN 13 ... IN 16

Counter function

320	State of counter A	
	Bit 1 = 1:	The upper counting limit was exceeded.
321	Command registers of counter A	
	0x01	Count value is reset to 0.

0x02 Counting falling edges

0x12 Counting rising edges

0x06 Counting falling edges at X21.1
The gate function at X21.2 responds to low-level.

0x26 Counting falling edges at X21.1
Gate function at X21.2 responds to high-level.

0x16 Counting rising edges at X21.1
The gate function at X21.2 responds to low-level.

0x36 Counting rising edges at X21.1
Gate function at X21.2 responds to high-level.

0x42 Counting falling edges The adjustable upper limit in MR 325 of counter A is enabled.

0x52 Counting rising edges The adjustable upper limit in MR 325 of counter A is enabled.

0x80 Reset the state in MR 320 to 0.

324 Pre-divider A
0 Stops counter A. Counting pulses at the input are not taken into account.
1 Each single pulse increments the count value by one.
2 Every second pulse increments the count value.
etc.
255 After registration of 255 pulses at the input the count value is incremented by one.

325 Upper counting limit (0 ... 4,294,967,295)

326 Count value A (0 ... 4,294,967,295)

336 State of counter B
Bit 1 = 1: The upper counting limit was exceeded.

337 Command registers of counter B
0x01 Count value is reset to 0.

0x02 Counting falling edges

0x12 Counting rising edges

0x06 Counting falling edges at X21.5
The gate function at X21.6 responds to low-level.

0x26 Counting falling edges at X21.1
Gate function at X21.2 responds to high-level.

0x16 Counting rising edges at X21.1
The gate function at X21.2 responds to low-level.

0x36 Counting rising edges at X21.1
Gate function at X21.2 responds to high-level.

0x42 Counting falling edges The adjustable upper limit in MR 341 of counter B is enabled.

0x52 Counting rising edges The adjustable upper limit in MR 341 of counter B is enabled.

0x80 Reset the state in MR 336 to 0.

340 Pre-divider B
0 Stops counter B. Counting pulses at the input are not taken into account.
1 Each single pulse increments the count value of counter B by one.
2 Every second pulse increments the count value of counter B by one.
etc.
255 After registration of 255 pulses at input X21.5 of counter B, the count value is incremented by one.

341 Upper counting limit (0 ... 4,294,967,295)

342 Count value B (0 ... 4,294,967,295)

Error states

513 Activating the error state
Bit 8 = 0: OUT 9 remains unchanged
Bit 8 = 1: OUT 9 assumes the state from MR 514
Bit 9 = 0: OUT 10 remains unchanged
Bit 9 = 1: OUT 10 assumes the state from MR 514
etc.

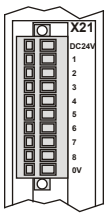
514 Error state of the outputs
Bit 8 = 0: OUT 9 assumes the state OFF
Bit 8 = 1: OUT 9 assumes the state ON
Bit 9 = 0: OUT 10 assumes the state OFF
Bit 9 = 1: OUT 10 assumes the state ON
etc.

PWM

515 Activating the PWM function
Bit 8 = 1: Activating the PWM function for OUT 9
Bit 9 = 1: Activating the PWM function for OUT 10
Bit 10 = 1: Activating the PWM function for OUT 11
Bit 11 = 1: Activating the PWM function for OUT 12
Bit 12 = 1 Activating the PWM function for OUT 13
Bit 13 = 1 Activating the PWM function for OUT 14
Bit 14 = 1 Activating the PWM function for OUT 15
Bit 15 = 1 Activating the PWM function for OUT 16

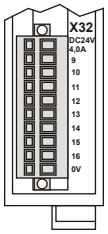
526 PWM frequency divider 1 for outputs OUT 9 ... 12
527 PWM duty cycle for output OUT 9
528 PWM duty cycle for output OUT 10
529 PWM duty cycle for output OUT 11
530 PWM duty cycle for output OUT 12
531 PWM frequency divider 2 for outputs OUT 13 ... 16
532 PWM duty cycle for output OUT 13
533 PWM duty cycle for output OUT 14
534 PWM duty cycle for output OUT 15
535 PWM duty cycle for output OUT 16

Assignment of terminal X21



Terminal point	Digital inputs 1 ... 8
X21.DC24V	Sensor voltage recognition
X21.1	Digital input IN 1
X21.2	Digital input IN 2
X21.3	Digital input IN 3
X21.4	Digital input IN 4
X21.5	Digital input IN 5
X21.6	Digital input IN 6
X21.7	Digital input IN 7
X21.8	Digital input IN 8
X21.0V	Reference potential

Assignment of terminal X32



Terminal point	Digital inputs/outputs 9 ... 16
X32.DC24V	Actuator supply infeed or sensor voltage detection
X32.9	Multi-purpose I/O: IN 9/OUT 9
X32.10	Multi-purpose I/O: IN 10/OUT 10
X32.11	Multi-purpose I/O: IN 11/OUT 11
X32.12	Multi-purpose I/O: IN 12/OUT 12
X32.13	Multi-purpose I/O: IN 13/OUT 13
X32.14	Multi-purpose I/O: IN 14/OUT 14
X32.15	Multi-purpose I/O: IN 15/OUT 15
X32.16	Multi-purpose I/O: IN 16/OUT 16
X32.0V	Reference potential

Appendix

Introduction

This appendix contains electrical and mechanical data, as well as operating data.

Contents

A: Technical Data

Introduction

This section of the appendix contains both electrical and mechanical data, as well as operating data of the JX3-DIO16 module.

Contents

Technical specifications

Electrical data: Digital inputs

Parameter	Description
Input current range	2.8 mA ... 4.3 mA
Input resistance	6.7 kΩ
Hardware-related input delay time	< 200 µs
Type	IEC 61131-2 type 3, pnp
Galvanic isolation	None
Input frequency	2.5 kHz (50 % duty cycle)
Operating point OFF (maximum)	5 V (input current max. 1.5 mA)
Operating point ON (minimum)	11 V (input current min. 2.0 mA)
Permissible voltage range	DC -30 V ... +30 V
Galvanic isolation	None

Electrical data: Digital outputs

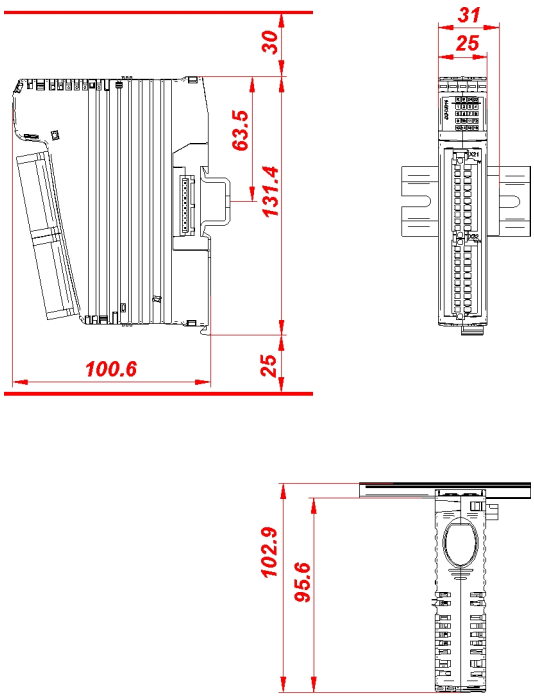
Parameter	Description
Load current	Max. 0.5 A per output
Permissible voltage range	DC +24 V -15 % ... + 20 %
Protection against short-circuit, overtemperature	Yes
Protection against polarity reversal	Yes
Protection against overvoltage	Is ensured when the module is installed on a grounded top hat rail
Protection against breakage of earthing cable	Yes
Protection against inductive loads	Yes
Short-circuit proof	Yes
Output design	IEC 61131-2 type 3, pnp
Operating point	
OFF (maximum)	3 V
ON (min.)	Vcc - 1.0 V
Response of outputs to overload, overvoltage, overtemperature	Output pulsates

Data of the JX3 system bus as of rev. 04.xx

Parameter	Description
Logic voltage of the JX3 system bus	DC +5 V (-15 % ... +10 %)
Current consumption absorbed from the logic voltage of the JX3 system bus	Typically: 55 mA
Additional voltage of JX3 system bus	DC +24 V (-15 % ... +20 %)
Current consumption absorbed from the additional voltage of the JX3 system bus	Typically: 12 mA
Nominal power absorbed from the JX3 system bus	Typically: 563 mW

Physical dimensions

Physical dimensions



Minimum clearances

At mounting the JX3-DIO16 module, make sure to maintain a minimum clearance above and below. This ensures that there will be enough room to press the latches of the JX3 backplane module when replacing modules.

- Minimum clearance, above: 30 mm
- Minimum clearance, below: 25 mm

Module width

The JX3-DIO16 module requires a space of 31 mm width. At connecting the JX3-DIO16 module to a JX3 station, the width is increased by 25 mm.

Mounting orientation

The mounting orientation of the JX3-DIO16 module is vertical.

Operating parameters - Environment and mechanics

Environment

Parameter	Value	Standard
Operating temperature range	0 ... +55 °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/ chemical resistance	No special protection against corrosion. Ambient air must be free from higher concentrations of acids, alkaline solutions, corrosive agents, salts, metal vapors, or other corrosive or electroconductive contaminants	
Maximum operating altitude	3,000 m above sea level	DIN EN 61131-2

Mechanical parameters

Parameter	Value	Standard
Free falls withstanding test	Weight < 10 kg: Height of fall (units within packing): 1 m Product packaging 0.3 m	DIN EN 61131-2 DIN EN 60068-2-31
Vibration resistance	5 Hz - 9 Hz: Amplitude: 3.5 mm 9 Hz - 150 Hz: Acceleration: 1 g 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
Degree of protection	IP20	DIN EN 60529
Mounting orientation	Vertical position, snapped on DIN rail	

Operating parameters - Enclosure

Electrical safety

Parameter	Value	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

EMC - Emitted interference

Parameter	Value	Standard
Enclosure	Frequency band 30 ... 230 MHz, limit 30 dB (µV/m) in 10 m Frequency band 230 ... 1,000 MHz, limit 37 dB (µV/m) in 10 m (class B)	DIN EN 61000-6-3 DIN EN 61131-2 DIN EN 55011

EMC - Immunity to interference

Parameter	Value	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

DC power supply inputs and outputs

EMC - Immunity to interference

Parameter	Value	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
Surge voltages asymmetric (line to earth), symmetrical (line to earth)	tr/th 1.2/50 µs Common-mode interference voltage 1 kV Series-mode interference voltage 0.5 kV	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-5

Shielded data and I/O lines

EMC - Immunity to interference

Parameter	Value	Standard
Asymmetric RF, amplitude-modulated	Frequency band 0.15 ... 80 MHz Test voltage 10 V AM 80 % with 1 kHz Source impedance 150 Ohm Criterion A	DIN EN 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
Voltage surges, asymmetric (line to earth)	tr/th 1.2/50 µs Common-mode interference voltage 1 kV	DIN EN 61131-2 DIN EN 61000-6-2 DIN EN 61000-4-5

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