JXM-IO-E09

Digital I/O Module on the CAN Bus

User Manual

Jetter

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Assignment to Product

This User Manual is an integral part of JXM-IO-E09:

Type:	
Serial #:	
Year of construction:	
Order #:	

To be entered by the customer:

Inventory #:	
Place of operation:	

Significance

Significance of this User Manual

The User Manual is an integral part of JXM-IO-E09:

- It must be kept in a way that it is always at hand, until the JXM-IO-E09 will be disposed of.
- If the JXM-IO-E09 is sold or loaned/leased out, the User Manual has to be passed on.

In any case you encounter difficulties to clearly understand this User Manual, please contact the manufacturer.

We would appreciate any suggestions and contributions on your part and would ask you to contact us by our e-mail address info@jetter.de. This will help us to produce manuals that are more user-friendly and to address your wishes and requirements.

This User Manual contains important information on how to transport, erect, install, operate, maintain and repair the JXM-IO-E09.

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

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

Hazard Levels

Introduction

This topic describes the safety labels and hazard levels used in this manual.

Safety Labels

Signs using this symbol are to warn you of inuries or even death. It is imperative to follow the instructions to prevent hazards.

Hazard Levels

Safety information is classified into the following hazard levels:

Hazard Level	Consequences	Probability
DANGER	Death/severe injury (irreversible)	The hazard is imminent
WARNING	Death/severe injury (irreversible)	Potential occurrence
CAUTION	Slight injury (reversible)	Potential occurrence
CAUTION	Material damage	Potential occurrence

Table of Contents

1 Safety Instructions

Introduction

This chapter contains the general safety instructions and warns of possible residual dangers.

Contents

This chapter contains the following topics:

General Safety Instructions

Introduction

This device complies with the valid safety regulations and standards. Special emphasis was given 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 JXM-IO-E09 has been designed as a peripheral module for use in commercial vehicles and mobile machines. The peripheral module JXM-IO-E09 is connected to an already existing controller. The JXM-IO-E09 has been designed for various input and output signals.

The JXM-IO-E09 meets the requirement of the European Automotive EMC Directive for electric/electronic subassemblies.

The JXM-IO-E09 must be operated within the limits given in the technical specifications. The operating voltage of the JXM-IO-E09 is classified as SELV (Safety Extra Low Voltage). Therefore, the JXM-IO-E09 is 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 JXM-IO-E09 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 the device is to be run under ambient conditions which differ from the allowed operating conditions, Jetter AG is to be contacted beforehand.

Personnel Qualification

Depending on the life cycle of the product, the persons involved must possess different qualifications. These qualifications are required to ensure proper handling of the device in the corresponding life cycle.

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/automotive engineering, such as automotive mechatronics fitters.
Commissioning / Programming:	Trained and instructed experts with profound knowledge of, and experience with, automotive / automation technology, such as automotive engineers for mobile machinery.
Operation:	Trained, instructed and assigned personnel with knowledge in operating electronic devices for mobile machinery.

Product Life Cycle	Minimum Qualification
Decommissioning:	Specialized personnel with training in electrical/automotive engineering, such as automotive mechatronics fitters.

Modifications and Alterations to the Device

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 on our part, and are, therefore, not released by Jetter AG.

The installation of such parts may impair the safety and the proper functioning of the device.

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

Transport

The JXM-IO-E09 contains electrostatic sensitive components which can be damaged if not handled properly.

To exclude damages to the JXM-IO-E09 during transport it should only be shipped in its original packaging or in packaging protecting against electrostatic discharge. This is particularly true for transport via mail.

- Use an appropriate outer packaging to protect the JXM-IO-E09 against impact or shock.
- In case of damaged packaging inspect the device for any visible damage. Inform your freight forwarder and the manufacturer, if applicable.

Storing

When storing the JXM-IO-E09 observe the environmental conditions given in the technical specification.

Repair and Maintenance

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

The device must be sent to Jetter AG for repair.

Disposal

When disposing of devices, the local environmental regulations must be complied with.

Residual Dangers and Protective Measures

Residual Dangers

Consider the residual dangers mentioned in this chapter when assessing the risks associated with your machine.

DANGER

Hazard in explosive gas atmosphere!

This device can become a source of ignition in potentially explosive atmospheres.

➢ **Do not use this device in potentially explosive atmospheres.**

WARNING

Hot surface hazard!

The JXM-IO-E09 can heat up during operation. During operation the surface temperature of this device will become hot enough (> 60 °C) to cause burns.

➢ **Take protective measures to prevent inadvertent contact with the device, e.g. install protective covers.**

➢ Allow the device to cool down for some time before you start working on it, e.g. to carry out maintenance jobs.

CAUTION

Possible occurrence of malfunctions!

CAN wires which have not been twisted may increase susceptibility to noise. This may disturb communications with the device which, in turn, may cause malfunctions.

➢ Make sure that twisted pair cables are used for connecting the CAN interfaces.

2 Product Description and Design

Introduction

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

Contents

JXM-IO-E09 - Product Description

The Module JXM-IO-E09

The module JXM-IO-E09 is an I/O node and has especially been designed for use in the harsh environment of commercial vehicles and mobile machines. The module JXM-IO-E09 sources high continuous currents which can be used to supply flashing lights and floodlights.

Product Features

The features of this product are listed below:

- CANopen® node with 1 interface to CAN-2.0B
- 4 digital outputs, up to 7.5 A each
- Total output current 21 A max.
- 12-pin male connector
- Degree of protection IP67

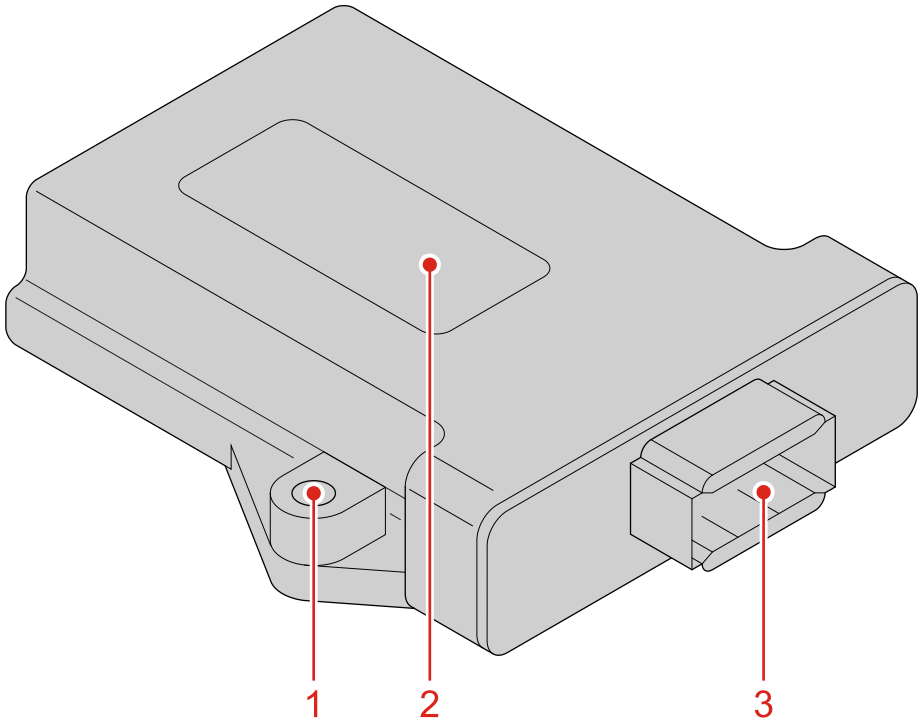
Parts and Interfaces

Introduction

This chapter describes the parts and interfaces of the JXM-IO-E09.

Parts and Interfaces

The illustration below shows the parts and interfaces of the JXM-IO-E09:



Number	Part	Description
1	Mounting holes	For screwing down the module
2	Nameplate	For identifying the module
3	Female connector	For connecting external components and the controller

Order Reference / Options

Order Reference

The JXM-IO-E09 is available in the following configurations. To order a specific module from Jetter AG please specify the corresponding part number.

Part number	Order Reference	Name
10000819	JXM-IO-E09-G07-K00	Standard I/O node

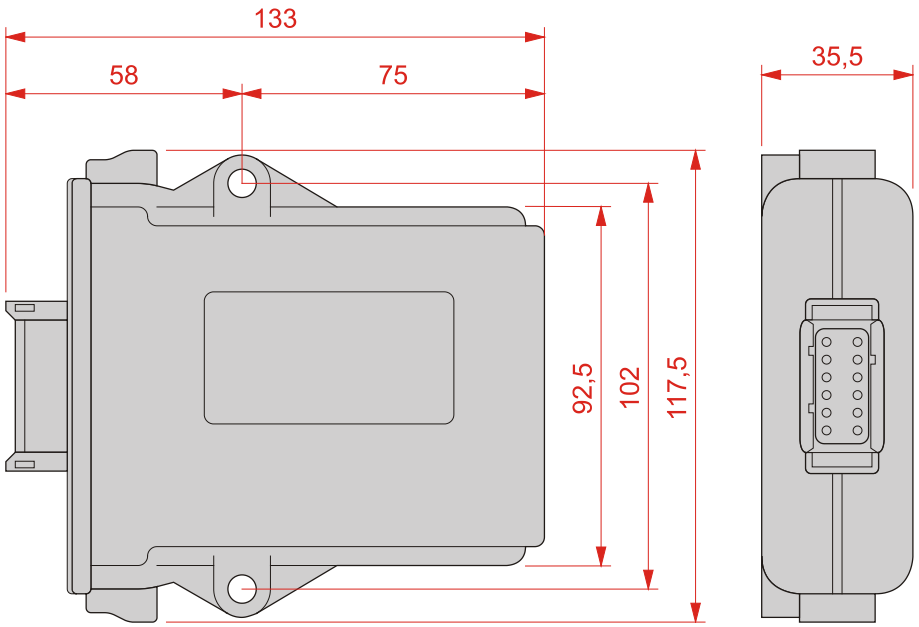
Physical Dimensions

Introduction

This chapter details the physical dimensions of the JXM-IO-E09 and the conditions for installation.

Physical Dimensions

The illustration below shows the dimensions of the JXM-IO-E09:



Proctection Against Overheating

When selecting a place for installing the JXM-IO-E09, consider the following facts:

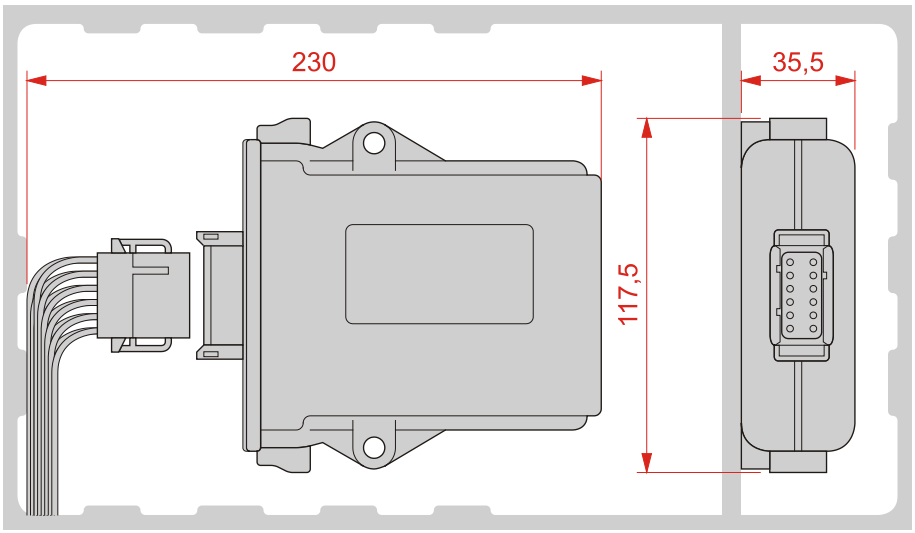
- The JXM-IO-E09 increases the temperature of the environment as a result of heat emission under load.
- The JXM-IO-E09 operates without interruption at an ambient temperature between -40 °C and +85 °C.

Consider the heat emission from the device, in particular when installing it in a critical environment:

- in the vicinity of the fuel tank
- in the vicinity of the fuel pipe
- in the vicinity of flammable vehicle components
- in the vicinity of thermally malleable vehicle components

Space Required for Installation and Service

The illustration below shows the space required for installing the module:



Ensure there is enough space around the connector for servicing requirements. It should be possible to disconnect the connector at any time.

3 Identifying the Module

Purpose of this Chapter

This chapter is for supporting you in obtaining the following information from the JXM-IO-E09 module:

- Hardware revision.
- Electronic data sheet (EDS). Numerous production-relevant data are permanently stored in the EDS.
- Reading out the software components via CANopen®.

Prerequisites

To be able to identify the JXM-IO-E09 module the following prerequisites must be fulfilled:

- The module is connected to a controller and a PC via CANopen® bus.
- Communication with the module takes place via CANopen®.

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 module JXM-IO-E09 ready:

- Serial number
- Software version of the module
- Hardware revision

Contents

3.1 Identification by Means of the Nameplate

Introduction

The nameplate is attached to the housing of the JXM-IO-E09 and contains details, such as hardware revision number and serial number. You will need this information when contacting the Jetter AG hotline in case of a problem.

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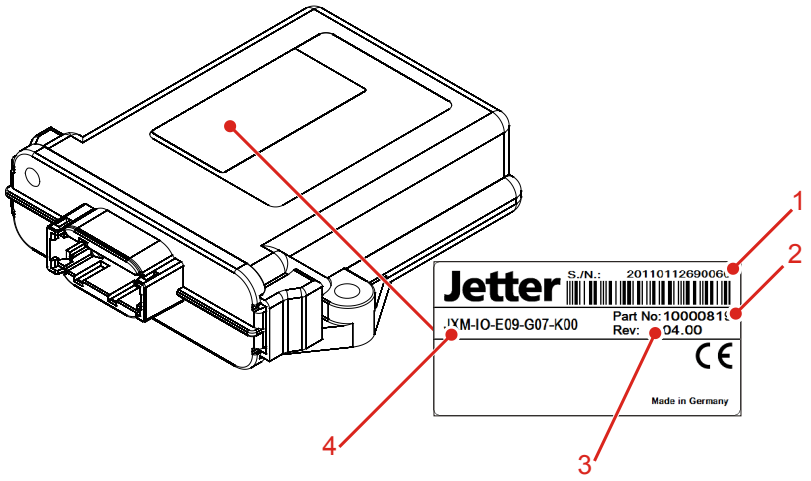
Nameplate

Nameplate

The nameplate of a JXM-IO-E09 contains the following information:



Number	Description
1	Serial number
2	Hardware revision
3	Module type
4	Part number

3.2 Identification via CANopen® Bus

Introduction

Each module features an Electronic Data Sheet (EDS). Numerous production-relevant data are permanently stored in the EDS. EDS data can be read via CANopen® bus.

Contents

Electronic Data Sheet (EDS) and Software Version

Communication with the JXM-IO-E09

Communication with the JXM-IO-E09 takes place via CAN bus. The CANopen® standard is used as protocol. CANopen® is an open standard for networking and communication in the automobile sector.

The CANopen® protocol has been further developed by the CiA e.V. (CAN in Automation) and works on the physical layer with CAN Highspeed in accordance with ISO 11898.

Electronic Data Sheet (EDS)

The Electronic Data Sheet (EDS) provides information clearly identifying the JXM-IO-E09. Data contained in the EDS are production-specific and are relevant for support purposes. If required, the data can be read using the object "Electronic Data Sheet" (0x4555).

Software Version of the JXM-IO-E09

Use the object "Detailed Software Version" (0x4559) to read out the version of the software running in the JXM-IO-E09. This read-only object supplies the same software version as object 0x100A, but in a 32-bit unsigned integer format which is compatible with the standard IP-type version numbers used at Jetter AG.

Example:

The 32-bit word 0x01070001 translates to a software version of 1.07.0.01.

Useful Documents

The CANopen® specifications can be obtained from the **CiA e.V. http://www.can-cia.org** homepage. The key specification documents are:

- CiA DS 301 - This document is also known as the communication profile and describes the fundamental services and protocols used under CANopen®.
- CiA DS 302 - Framework for programmable devices (CANopen® Manager, SDO Manager)
- CiA DR 303 - Information on cables and connectors
- CiA DS 4xx - These documents describe the behavior of a number of device classes in, what are known as, device profiles.

Related Topics

- **Electronic Datasheet Object** on page 52
- **Detailed Software Version Object** on page 56

4 Mounting and Installation

Purpose of this Chapter

This chapter is for supporting you in mounting and installing the JXM-IO-E09 in the vehicle and covers the following topics:

- Planning the wiring of a JXM-IO-E09
- Connecting sensors and actuators to the JXM-IO-E09
- Installation
- CANopen® Bus - Engineering

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4.1 Wiring

Purpose of this Chapter

This chapter covers wiring of the JXM-IO-E09 and contains the following topics:

- Wiring principle
- Pin Assignment
- Example of Wiring
- Technical Specifications

Contents

Wiring Principle

Introduction

This chapter covers the wiring principle of the JXM-IO-E09.

Wiring Principle

The JXM-IO-E09 is connected through a wiring harness with external components, such as:

- Power supply
- Controller
- Peripheral module
- Sensors
- Actuators
- Indicator lights

The wiring harness ends in a connector (male) which is not included in the scope of delivery of the device. This connector is available as accessory.

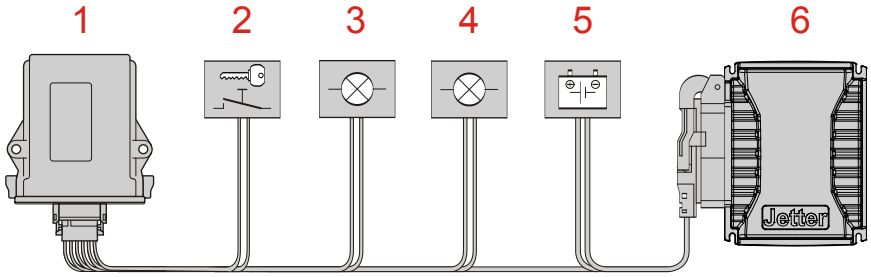
Connector Specification

The connector specification is listed below:

Connector Specification	
Manufacturer/Model	DEUTSCH DTM13-12 PA-R008
Article #	tbd
Design	12-pin

Example

The illustration below shows an example of a layout using a wiring harness.

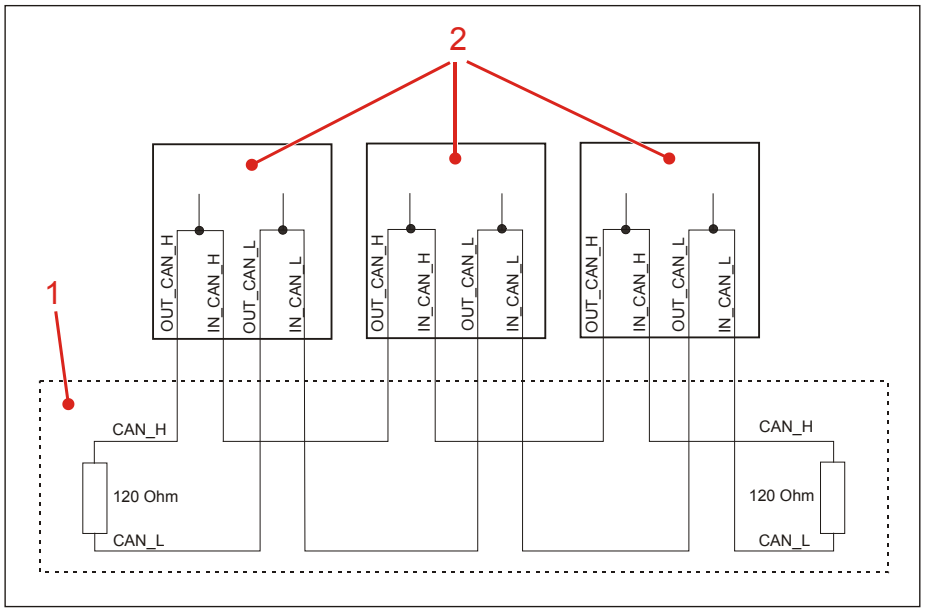


Number	Description
1	Module JXM-IO-E09
2	Ignition lock
3	Blinker light
4	Floodlight
5	Battery
6	Controller JCM-350-E03

Specification - CANopen® Bus Cable

Layout of CAN Bus Wiring

Jetter AG CANopen® devices are wired in accordance with the following diagram.



Number	Description
1	CAN bus
2	Jetter AG CANopen® devices

There is an option to enable a resistor in the device as a bus termination resistor of 120 Ohm.

The stub length with this type of wiring is practically zero.

The CAN_L and CAN_H cables must be twisted together.

CAN Bus Cable Specification

Parameter	Description
Core cross-sectional area	1000 kBaud: 0.25 ... 0.34 mm^2 500 kBaud: 0.34 ... 0.50 mm^2 250 kBaud: 0.34 ... 0.60 mm^2 125 kBaud: 0.50 ... 0.60 mm^2
Cable capacitance	60 pF/m max.
Resistivity	1000 kBaud: max. 70 Ω/km 500 kBaud: max. 60 Ω/km 250 kBaud: max. 60 Ω/km 125 kBaud: max. 60 Ω/km
Number of cores	2
Shield	Complete shielding, no paired shielding
Twisting	Core pairs CAN_L and CAN_H are twisted

Cable Lengths

The maximum permitted cable length depends on the baud rate used and the number of CANopen® devices connected.

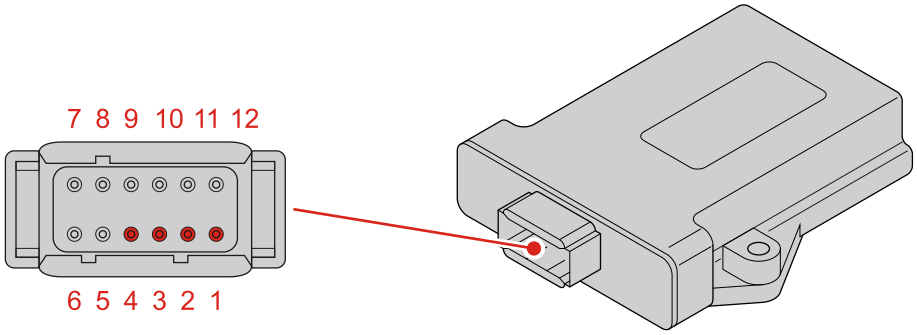
Baud Rate	Cable length	Stub length	Overall stub length
1000 kBaud	max. 25 m	max. 0.3 m	3 m
500 kBaud	max. 100 m	max. 1.0 m	39 m
250 kBaud	max. 200 m	max. 3.0 m	78 m
125 kBaud	max. 200 m	-	-

Connecting the Power Supply

Introduction

The illustration below shows the pin assignment of the connector (view from the front):

Power supply



PIN	Description	Terminal number in vehicles
1	Supply voltage +12 V DC	Terminal # 30
2		
3		
4	Ground (GND)	Terminal # 31

CAN Interface

Introduction

The illustration below shows the pin assignment of the connector (view from the front):

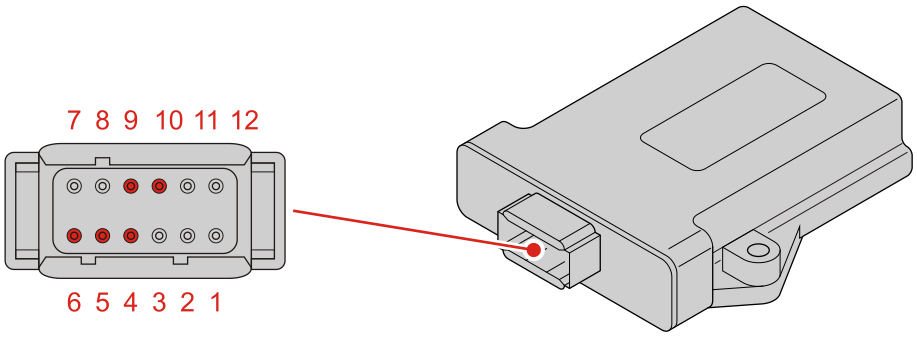
CAUTION

Possible occurrence of malfunctions!

CAN wires which have not been twisted may increase susceptibility to noise. This may disturb communications with the device which, in turn, may cause malfunctions.

Make sure that twisted pair cables are used for connecting the CAN interfaces.

CAN



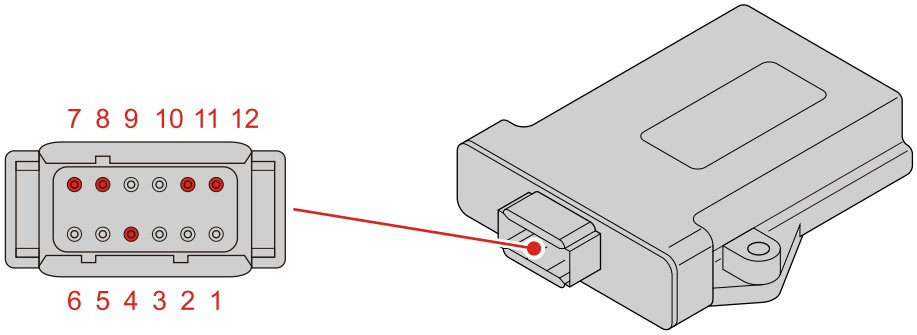
PIN	Description
4	Ground (GND)
5	IN_CAN_H
6	OUT_CAN_H
9	IN_CAN_L
10	OUT_CAN_L

Connecting Digital Outputs

Introduction

The illustration below shows the pin assignment of the connector (view from the front):

Outputs



PIN	Description
4	Ground. The ground return path for the 4 outputs is through the vehicle chassis.
7	Digital output # 1
8	Digital output # 2
11	Digital output # 3
12	Digital output # 4

4.2 Installing the JXM-IO-E09

Introduction

This chapter describes how to install the JXM-IO-E09.

Contents

Installation

Introduction

This chapter describes how to install the JXM-IO-E09.

Selecting a Place for Installation

Select a suitable place for the device to be mounted.
A place is suitable if it fulfils the following requirements:

- The installation surface must be level.
- The installation location must be accessible for servicing.
- The installation location must be of sufficient size.

See also: **JXM-IO-E09: Mounting Dimensions** on page 17

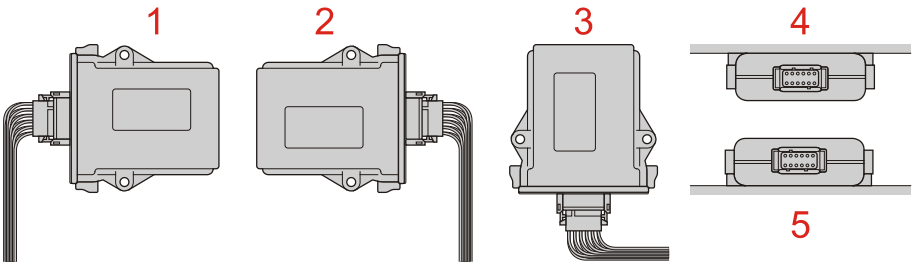
Avoiding Unsuitable Installation Locations

Do not install the module in inappropriate locations.
The following installation locations are unsuitable for mounting the module:

Unsuitable Installation Locations	Reason
Curved installation surface	The installation surface or the module could become misshapen when fitting the module. Installation is unstable and precarious.
Uneven installation surface	
Installation surfaces with seams or curvatures	

Permissible Installation Positions

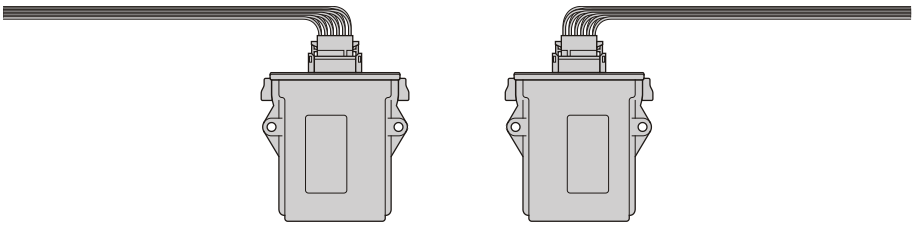
The illustration below shows the positions permitted for installation:



Number	Permissible Installation Positions
1	vertically, connector left
2	vertically, connector right
3	vertically, connector downwards
4	horizontally, hanging
5	horizontally, lying

Prohibited Installation Positions

The illustration below shows the positions prohibited for installation:



A vertical installation position with the connector pointing upwards is prohibited. The accumulation of moisture and water droplets in the connector can lead to current leakages and corrosion.

Selecting Installation Hardware

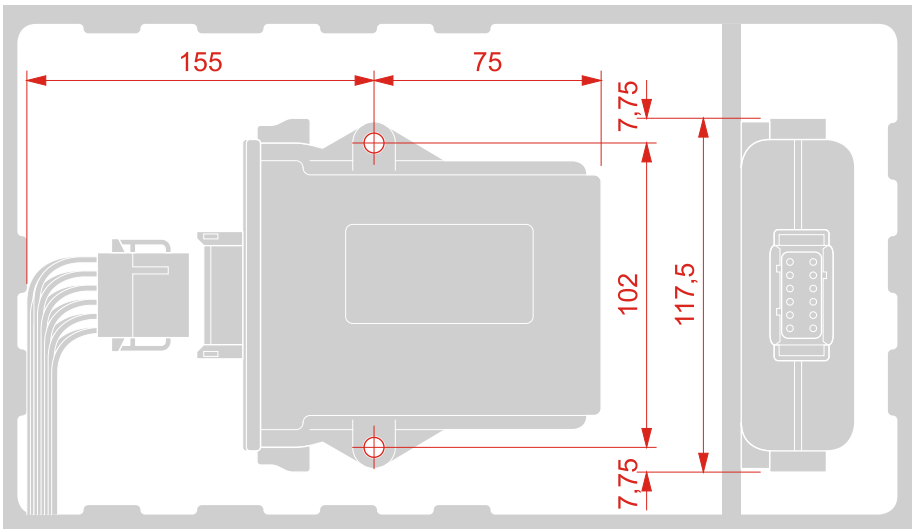
For installation use the following hardware:

Hardware	Description
Screws/bolts	Size: M 5 x 15 Surface: galvanized Strenght class: 8.8
Washers	Size: 5.3 x 10 Surface: galvanized
Screw nuts	Size: M 5 Surface: galvanized Strenght class: 8.8

Preparing for Installation

Mark off the positions of the 2 mounting holes.

Center-punch the 2 holes.



If ...	Then ...
the thickness of the mounting surface is ≥ 6 mm (steel) or ≥ 8 mm (aluminum)	drill the following holes: ■ Pre-drill Ø 4.2 mm. ■ Tap a thread M 5.
the thickness of the mounting surface is < 6 mm (steel) or < 8 mm (aluminum)	drill the following holes: ■ Drill the holes Ø 6 mm. ■ Deburr the holes.

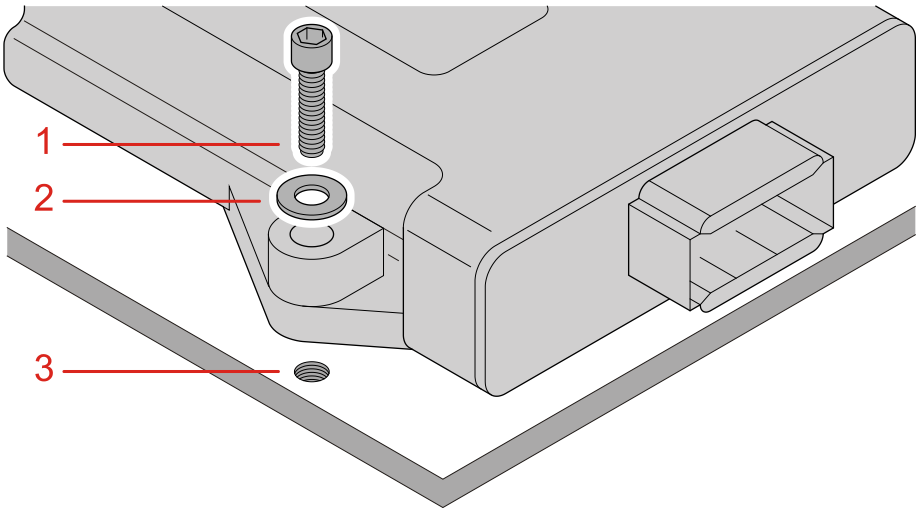
Notes on Installation

Install the module in a way that the housing has full contact with the mounting surface. This will prevent vibration and shocks. Therefore:

- Install the module directly on the mounting surface.
- Do not use spacers.

Installing the Module (Tapped Holes)

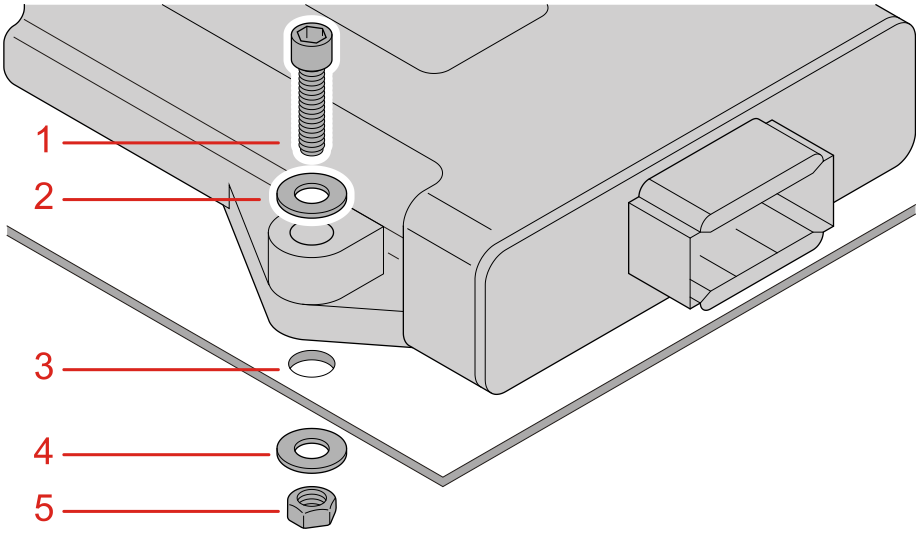
Screw the module down to the mounting surface.



Number	Description
1	Screw
2	Washer
3	Tapped hole

Installing the Module (Through Holes)

Screw the module down to the mounting surface.



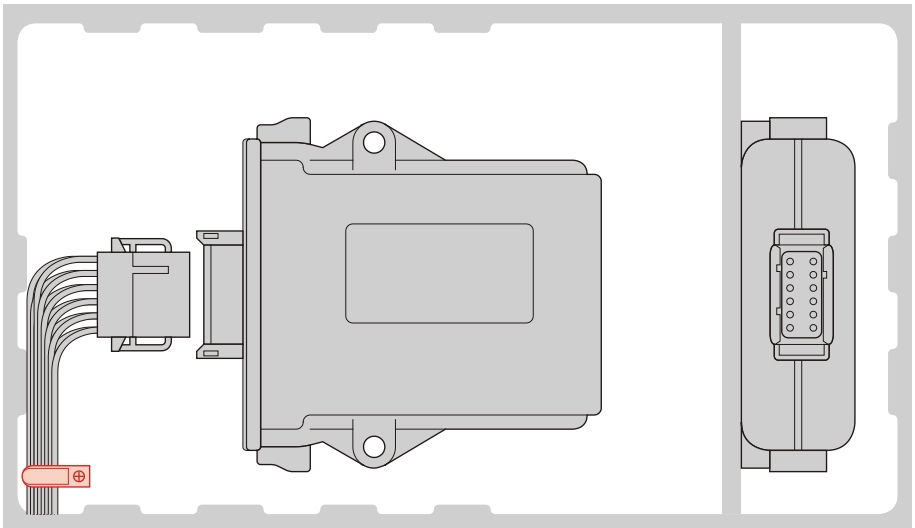
Number	Description
1	Screw
2	Washer
3	Through hole
4	Washer
5	Screw nut

Installing the Strain Relief

Install a strain relief for the connection cable.

Take care to leave enough space for the connector.

The connector should not be obstructed, so that it can be removed in the event of a service requirement.



5 Initial Commissioning

Introduction

This chapter gives a compact description of the initial commissioning of the module JXM-IO-E09 covering the following steps:

- Connecting the power supply and interfaces
- Initial commissioning via CANopen® interface

Contents

Preparatory Work for Initial Commissioning

Introduction

To be able to commission and program the JXM-IO-E09 the following preparations are necessary:

- Connecting a controller with power supply and CAN interface
- Changing the node ID in the case of several CANopen® nodes of the same module type.

Default Values

The default values of the JXM-IO-E09 module are listed below:

- Baud rate: 250 kBaud
- CAN terminating resistor: 0x01 (resistor at the end of the CAN bus is enabled)
- Node ID: 0x24

Wiring

To wire the module JXM-IO-E09, proceed as follows:

Step	Action
1	Connect the following terminals with the power supply DC 8 - 32 V: ■ Power supply **Pin 1** (terminal 30 in the vehicle) ■ Power supply **Pin 2** (terminal 30 in the vehicle) ■ Power supply **Pin 3** (terminal 30 in the vehicle) ■ GROUND **Pin 4** (terminal 31 in the vehicle) ■ The ground return path for the 4 outputs is through the vehicle chassis.
2	Connect the module to the CANopen® bus (**pin 5** and **pin 9, pin 6** and **pin 10**).
3	Make sure that there is a terminating resistor of 120 Ω at both ends of the CAN bus.
4	Energize the power supply. Make sure that the ignition is on. Communication with the module is now possible. During cranking the voltage must not fall below 6.5 V.

Result: The module is now operational and can be initialized by the controller.

Data collision in the case of several modules with the same node ID.

If you connect several nodes of the same type to the CANopen® bus, this leads to data collisions on the CANopen® bus. The reason for this is that modules of the same type in as delivered condition have got the same node ID. To allow communication with all nodes on the bus, the node ID of modules with the same default ID must be changed.

Connect the modules one after the other to the CANopen® bus and change the node ID through the system parameters: The legal range for values is between 1 and 254.

Step	Action	Result
1	Connect module 1 to the CANopen® bus.	

Step	Action	Result
2	Enter a new node ID into the system parameter (index 0x4556, sub-index 4).	As a result, module 1 has got a new node ID.
3	Then, connect module 2 to the CANopen® bus.	
4	Enter a new node ID into the system parameter (index 0x4556, sub-index 4).	As a result, module 2 has got a new node ID.
5	Repeat this procedure for all modules of the same type until all modules are connected to the CANopen® bus.	Now, collision of data is avoided in communication between nodes of the same type connected to the CANopen® bus since each node has got an individual node ID.

Related Topics:

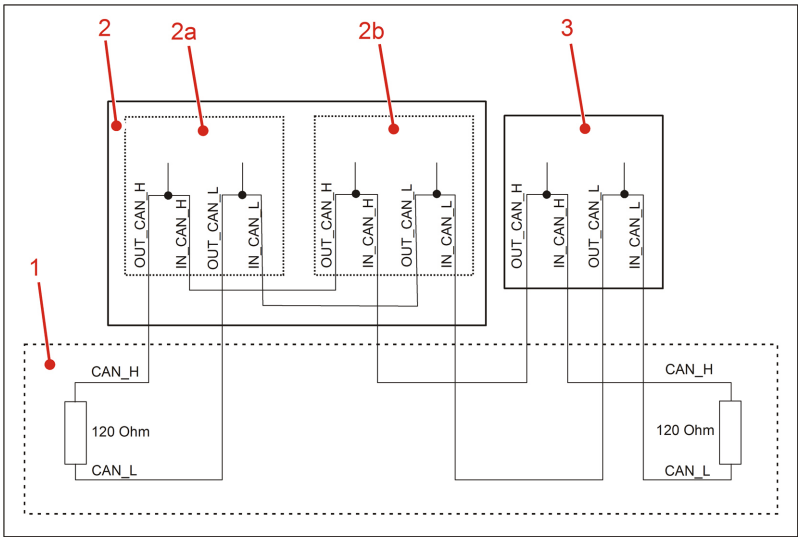
- **Wiring** on page 26
- **CANopen® Interface** on page 31
- **Information on Communication with the Module** on page 42

Information on Communication with a JXM-IO-E09

Example - Wiring Diagram

The illustration below shows an wiring example of the following CANopen® devices by Jetter AG:

- Controller JCM-350-E03
- Peripheral Module JXM-IO-E09



Number	Description	Node ID
1	CAN bus	
2	Controller JCM-350-E03 by Jetter	
2a	Controller JCM-350	0x7F (127 decimal)
2b	I/O module JXM-IO-E02	0x10 (16 decimal)
3	Separate I/O module JXM-IO-E09	0x24 (36 decimal)

CANopen® Interface - Restrictions

During initial commissioning the following restrictions/limitations of the CANopen® interface on the JXM-IO-E09 must be taken into account:

- PDOs are not user configurable.
- PDOs are transmitted only asynchronous on request.

Communication with Peripheral Modules

The following information supports you in commissioning peripheral modules, such as JXM-IO-E09:

- Initialize the controller as described in the corresponding manual.
- Send an RTR frame to the peripheral module JXM-IO-E09. This parameter is needed once in order to prompt the peripheral module JXM-IO-E09 to send the required data to the controller.

JetSym STX Sample Program

The following program code fragment shows how the node ID on the JXM-IO-E09 can be changed from 0x24 to 0x25 by a Jetter controller, such as JCM-350.

```
Const
    CAN_CONTROLLER_0 = 0;
    //Node ID of controller JCM-350
    NodeID_Node_0 = 0x7F;
    //Node ID of I/O module JXM-IOE09
    NodeID_Node_1 = 0x24;
End_Const;

Var
    busy: Int;
    SW_Version: String;
    New_NodeID: Long;
    Objectindex: Word;
    Subindex: Byte;
End_Var;

Task Main Autorun
// Software version of the controller
SW_Version := 'v4.3.0';
// First input active-high
New_NodeID:= 0x25;
// Initializing CAN 0
CanOpenInit(CAN_CONTROLLER_0, NodeID_Node_0, SW_Version);
Objektindex := 0x4556;
Subindex := 4;
// Changing the node ID
CanOpenDownloadSDO(CAN_CONTROLLER_0, NodeID_Node_1, Objectindex,
Subindex, CANOPEN_DWORD, sizeof(New_NodeID), New_NodeID, busy);
End_Task;
```

Restart the JXM-IO-E09 so that the new node ID can be stored.

Result:

The node ID of the JXM-IO-E09 module has been changed to 0x25.

Note:

If you want to address this module, make sure that all other program codes refer to the new node ID of the JXM-IO-E09.

Related Topics:

- **CANopen® Objects** on page 45

6 CANopen® Objects

Introduction

This chapter covers the CANopen® objects implemented on the JXM-IO-E09 and their functions, as well as the permanently mapped process data objects (PDO).

Restrictions

Due to design constraints the following restrictions/limitations apply to the CANopen® interface of the JXM-IO-E09:

- SDO expedited transfer only supports 4-byte transfers. Any smaller data element must be extended to 32 bit before the SDO transfer.
- SDO segmented transfer is only supported on certain objects. Most notably the OS update feature makes use of segmented transfer, but also some other objects that need to transfer strings implement SDO segmented transfer for this purpose. Unless an object is documented to support segmented transfers, assume that it does not.
- SDO block transfer is NOT implemented.
- PDOs are not user configurable.
- PDOs are transmitted only asynchronous on request.
- Although emergency messages are transmitted to notify of detected faults, the CANopen® emergency handling system is not fully implemented.

Contents

6.1 CANopen® Object Dictionary

Purpose of this Chapter

This section describes the SDO objects implemented on the JXM-IO-E09.

Supported Objects

A summary of the objects covered in this document are given in the table below. There are also a few more objects which are mandatory according to the CANopen® specification which are not covered in this document:

Index (hex)	Object Name	Object (Code)	Type	see
1000	Device Type	VAR	Unsigned32	**Page** 47
1001	Error Register	VAR	Unsigned8	**Page** 47
100A	Manufacturer Software Version	VAR	String	**Page** 47
1017	Producer Heartbeat Time	VAR	Unsigned16	**Page** 47
1018	Identity	RECORD	Identity (23h)	
2000	Features	ARRAY	Unsigned32	**Page** 47
2001	Digital Output	ARRAY	Unsigned32	**Page** 49
2200 - 2203	Analog Current Measurement	ARRAY	Unsigned32	**Page** 50
2204	Analog Device Temperature	ARRAY	Unsigned32	**Page** 51
4554	OS Update	ARRAY	Unsigned32	**Page** 52
4555	Electronic Datasheet	ARRAY	Unsigned32	**Page** 52
4556	System Parameters	ARRAY	Unsigned32	**Page** 53
4559	Detailed Software Version	ARRAY	Unsigned32	**Page** 56
5000	User EEPROM Access	ARRAY	Unsigned32	**Page** 57

Contents

Objects Ranging from Index 0x1000 through 0x2000

Device Type (Index 0x1000)

The structure of the object "Device Type" is shown in the following table.

Index	Sub-Index	Default	Description	Attributes
0x1000	0	0x00030191	Type of device	ro (read only)

This value is read-only (ro).

Error Register (Index 0x1001)

The structure of the object "Error Register" is shown in the following table.

Index	Sub-Index	Default	Description	Attributes
0x1001	0	0	Error Register	ro (read only)

This object implements the CANopen® Error Register functionality.

Bit 0 = Generic error
Bit 1 = Current error
Bit 2 = Voltage error
Bit 3 = Temperature error
Bit 4 = Communication error
Bit 5 = Parameter mismatch
Bit 7 = Manufacturer-specific error, for example, hardware error

None of the other bits is currently in use.

Manufacturer Software Version (Index 0x100A)

The structure of the object "Manufacturer Software Version" is shown in the following table.

Index	Sub-Index	Default	Description	Attributes
0x100A	0	-	Software version	const

Use only the STX function CanOpenUploadSDO () to determine the version of the software running in the JXM-IO-E09.

The version string is at least 9 characters long and is of the format "1.06.0.00". The first digit is the major revision followed by the minor revision and the branch and beta indicators (which will usually be zero). This value is read-only (ro).

Producer Heartbeat Time (Index 0x1017)

The structure of the object "Producer Heartbeat Time" is shown in the following table.

Index	Sub-Index	Default	Description	Attributes
0x1017	0	1,000 [ms]	Heartbeat time	rw (read & write)

The legal range for values is 250 ... 65,535.

Features (Index 0x2000)

The structure of the object "Features" is shown in the following table.

Index	Sub-Index	Default	Description	Attributes
0x2000	0	-	Features Object	ro (read only)

This object is provided for compatibility reasons.

Object "Digital Outputs" (Index 0x2100)

Digital Output (Index 0x2100)

The structure of the object "Digital Output" is shown in the following table. This object is for setting or reading out the output states.

Index	Sub-Index	Default	Description	Attributes
0x2100	0	6	Number of entries	ro (read only)
	1	0	Not used	
	2	0	Not used	
	3	4	Not used	
	4	0	Process value 0: Output Read Back States	rw (read & write)
	5	0	Process value 1: Output States	rw
	6	4	Parameter 0: Number of Outputs	ro

Sub-Index 4

The function of sub-index 4 is described below:

- Sub-index 4 can be read to obtain the latest measured output states. The same bit mapping is used as for writing to the outputs.
- Sub-index 4 uses the one bit per channel data structure described below:
  - Bit 0: Channel # 1
  - Bit 1: Channel # 2
  - Bit 2: Channel # 3
  - Bit 3: Channel # 4
- Using this feature, it is possible to use any of the four outputs as a digital input.

Sub-Index 5

The function of sub-index 5 is described below:

- Write to Sub-Index 5 to set the output state. Ensure that the channel is set to be switched off (write zero to it) and read the read back state to sample the input.
- The four output channels are each represented by a single bit in the least significant byte.
- Sub-index 5 uses the one bit per channel data structure described below:
  - Bit 0: Channel # 1
  - Bit 1: Channel # 2
  - Bit 2: Channel # 3
  - Bit 3: Channel # 4

Sub-Index 6

The function of sub-index 6 is described below:

- Sub-index 6 can be read to obtain the number of available outputs.

Objects "Analog Output Current Measurement" (Index 0x2200 through 0x2203)

Analog Current Measurement (Index 0x2200 through 0x2203)

The structure of the objects "Analog output current measurements" is shown in the following table. These objects can be used to monitor the output current on each of the 4 output channels.

Index	Sub-Index	Default	Description	Attributes
0x2200 - 0x2203	0	7	Number of entries	ro (read only)
	1	0	Not used	
	2	0	Not used	
	3	4	Not used	
	4	0	Process value 0: Analog input signal	ro
	5	0	Process value 1: Signal converted to [mA]	ro
	6	1.023	Parameter 0: Not used	
	7	-1	Not used	

Sub-Index 4

The function of sub-index 4 is described below:

- Sub-index 4 can be read to obtain the recently measured output currents.
- The measured value may range from 0 to 1,023.
- The default output current limit of 7,500 mA will result in a measurement of 160 which will be the effective upper limit of the range.

Sub-Index 5

The function of sub-index 5 is described below:

- Sub-index 5 can be read to obtain the value of the converted analog signal in mA units.

Object "Analog Device Temperature Measurement" (Index 0x2204)

Analog Device Temperature (Index 0x2204)

The structure of the object "Analog device temperature measurement" is shown in the following table. This object provides the device's internal temperature.

Index	Sub-Index	Default	Description	Attributes
0x2204	0	7	Number of entries	ro (read only)
	1	0	Not used	
	2	0	Not used	
	3	4	Not used	
	4	0	Process value 0: Analog input signal	ro
	5	0	Process value 1: Temperature [°C]	ro
	6	1.023	Parameter 0: Not used	
	7	-1	Not used	

Sub-Index 4

The function of sub-index 4 is described below:

- Sub-index 4 provides a raw analog value which is then processed by the JXM-IO-E09 to provide the actual temperature value in °C in sub-index 5.
- This value is read-only (ro).

Sub-Index 5

The function of sub-index 5 is described below:

- Sub-index 5 can be read to obtain the temperature value in °C calculated from the converted analog signal in Sub-index 4.
- The temperature in °C is stored in a signed 8-bit integer.
- The value may range from -20 to 125.
- This value is read-only (ro).

OS Update (Index 0x4554) and EDS Objects (Index 0x4555)

OS Update (Index 0x4554)

This object is used for OS updates. Do not access this object. Contact Jetter AG if you intend to update the operation system.

Electronic Data Sheet (Index 0x4555)

The Electronic Data Sheet (EDS) is provided for production and support purposes. It is user readable.

Index	Sub-Index	Default	Description	Attributes
0x4555	0	15	Number of entries	ro (read only)
	1	0	Status	ro
	2	0	Command	ro
	3		Page 0: Version	ro
	4		Page 0: Module code	ro
	5		Page 0: Module name (string)	ro
	6		Page 0: PCB revision	ro
	7		Page 0: PCB options	ro
	8		Page 1: Revision	ro
	9		Page 1: Module serial number (string)	ro
	10		Page 1: Production date: Day	ro
	11		Page 1: Production date: Month	ro
	12		Page 1: Production date: Year	ro
	13		Page 1: Test device number	ro
	14		Page 1: Test device revision	ro
	15		Page 0: Minimum OS version	ro

Object "System Parameters" (Index 0x4556)

System Parameters (Index 0x4556)

Use the object "System Parameters" to permanently change the parameters mentioned below. Any changes made to these parameters are stored in non-volatile memory and are therefore recovered when the JXM-IO-E09 is next powered up.

Note that some of these settings can also be set using other SDO objects. However, the object "System Parameters" is the only way to make these changes permanently.

Index	Sub-Index	Default	Description	Attributes
0x4556	0	10	Number of entries	ro (read only)
	1	1	Version	ro
	2	0	CAN Bus Termination (0 = No, 1 = Enabled)	rw (read & write)
	3	1	CAN Baud rate (0 = 125 kBaud, 1 = 250 kBaud, 2 = 500 kBaud, 3 = 1 MBaud)	rw
	4	0x24	CANopen® Node ID	rw
	5	1.000	CANopen® Heartbeat time period [ms]	rw
	6	85	Internal temperature threshold [°C]	rw
	7	7.500	Output current limit (per channel [mA])	rw
	8	21.000	Output current limit (total current [mA])	rw
	9	0	No-load detection ON	rw
	10	2	Overload Pulse Duration (in units of 5 ms)	rw

Delay

When writing to the System Parameters, a delay **must** be implemented after the SDO command. This delay is required because the JXM-IO-E09 needs to access EEPROM memory on both processors when writing to this object. This process may take several minutes. Therefore, it is recommended that a delay of 50 ms be implemented before the next SDO or PDO access to the same JXM-IO-E09.

CAN Bus Termination

- This parameter enables/disables the CAN termination resistors inside the JXM-IO-E09.
- The CAN termination resistor at the beginning and the end of the CAN bus is 120 Ω.

CAN Baud Rate

- This parameter selects the CAN Baud rate to use.
- The default value is 250 kBaud. To change the Baud rate, the JXM-IO-E09 must be connected to a CAN bus with a BAUD rate of 250 kBaud.
- Valid options are:
  - 0: 125 kBaud
  - 1: 250 kBaud
  - 2: 500 kBaud
  - 3: 1 MBaud

CANopen® Node ID

- This parameter changes the node ID stored to the internal EEPROM.
  If several modules are to be used on one CANopen® bus, a unique node ID must be assigned to each module. There is no automatic node ID assignment.
- The legal range for values is between 0x01 and 0xFE.
- The default value is 0x24.

CANopen® Heartbeat Time Period

- This is the time period, specified in milliseconds (ms), at which the JXM-IO-E09 will transmit a CANopen® heartbeat message.
- The legal range for values is between 250 and 65,535 ms.
- The default value is 1,000 ms.
- Time periods less than 250 ms are allowed by CANopen® but do not make practical sense for the JXM-IO-E09 and are therefore not allowed.

Internal Temperature Threshold

- The **Internal temperature threshold** is the temperature, specified in °C, above which the unit will start transmitting warning messages that it is overheating.
- The legal range for values is between 25 and 85 °C.
- The default value is 85 °C.

Output Current Limit - Per Channel

- This parameter is for setting the maximum output current per channel.
- This value is specified in mA units.
- The legal range for values is between 500 and 7,500 mA.
- The default value is 7,500 mA.

Output Current Limit - Total

- Output current limit (total) sets the limit above which ALL output channels are disabled.
- This value is specified in mA units.
- The legal range for values is between 5,000 and 21,000 mA.
- The default value is 21,000 mA.

No Load Enable (Cable Breakage Detection)	▪ Use this parameter to enable/disable no-load detection for individual output channels.
	▪ This feature can be selected for each channel individually:
	  ▪ Bit 0: Output 1
	  ▪ Bit 1: Output 2
	  ▪ Bit 2: Output 3
	  ▪ Bit 3: Output 4
	▪ This parameter should be updated with a Read-Modify-Write operation to ensure that only the intended output channel(s) is (are) altered.

Overload Pulse Duration	▪ This parameter allows an overload on a single output for the specified duration before the output is disabled. ▪ Note that a CANopen® error message is transmitted when the fault is detected regardless of this setting. ▪ This parameter is specified in units of 5 [ms]. ▪ The legal range for values is between 2 and 100 [ms].

Detailed Software Version Object (Index 0x4559)

Detailed Software Version (Index 0x4559)

The structure of the object "Detailed software version" is shown in the following table.

Index	Sub-Index	Default	Description	Attributes
0x4559	0	3	Number of entries	ro (read only)
	1	-	Software version	ro
	2	0	Bootloader version	ro

Sub-Index 1

The function of sub-index 1 is described below:

- Sub-Index 1 returns the same software version as object 0x100A, but in a 32-bit unsigned integer format.
- This format is compatible with the standard IP-type version number used at Jetter AG.
- **Example:**
  The 32-bit word 0x01070001 translates to a software version of 1.07.0.01.

Sub-Index 2

The function of sub-index 2 is described below:

- Reading sub-index 2 returns the software version number of the boot loader.

Object "User EEPROM Access" (Index 0x5000)

User EEPROM Access (Index 0x5000)

The structure of the object "User EEPROM Access" is shown in the following table. This object grants the user read/write access to the EEPROM.

Index	Sub-Index	Default	Description	Attributes
0x5000	0	6	Number of entries	ro (read only)
	1	0	Byte offset inside memory space	rw (read & write)
	2	1.024	Size of memory in bytes (read only)	ro
	3	1	Auto increment	rw
	4	-	Byte R/W access	rw
	5	-	16-bit word R/W access	rw
	6	-	32-bit word R/W access	rw

Sub-Index 1

The function of sub-index 1 is described below:

- To use this object, enter the byte offset inside the memory space in sub-index 1.
- If the byte offset is less than zero, the CANopen® error “Value of parameter written too low” is returned.
- If the byte offset is larger than the value in sub-index 2 (default value: 1,024), the CANopen® error “Value of parameter written too high” is returned.
- Also, if the byte offset is set to one of the last byte values and an attempt is made to read or write a 16-bit or 32-bit word which would cause reading/writing outside the memory space, the “General error” message is returned.

  Unfortunately CANopen® doesn’t have an error code that accurately describes this condition.

  Example:

  If the byte offset is 1,022 and an attempt is made to read a 32-bit word, this would normally try to read beyond the last memory address of 1,023. This is not allowed and the message "General error" is returned.

Sub-Index 2

The function of sub-index 2 is described below:

- The JXM-IO-E09 offers 1 kByte of EEPROM memory space. But for some special devices the amount may differ.
- Reading sub-index 2 returns the available memory size in bytes.
- This sub-index is read-only.

Sub-Index 3

The function of sub-index 3 is described below:

- Use sub-index 3 to enable/disable the function "Auto Increment":
  - 0: Auto increment is disabled
  - 1: Auto increment is enabled
- Auto increment works as follows:
  - After either a read or write operation, the object will increment the offset in the memory space by the number of bytes that were transferred.
  - **Example:**
    After a byte read the byte offset is incremented by 1.
    After a 32-bit write the byte offset is incremented by 4.

Sub-Index 4

The function of sub-index 4 is described below:

- Read sub-index 4 to read a byte from the memory.
- Enter a value into sub-index 4 to write a byte in the memory.

Sub-Index 5

The function of sub-index 5 is described below:

- Read sub-index 5 to read a 16-bit word from the memory.
- Enter a value into sub-index 5 to write a 16-bit word in the memory.

Sub-Index 6

The function of sub-index 6 is described below:

- Read sub-index 6 to read a 32-bit word from the memory.
- Enter a value into sub-index 6 to write a 32-bit word in the memory.

Delay

When writing to the EEPROM, a delay **must** be implemented after the SDO command. The JXM-IO-E09 first writes to the EEPROM memory. This may take a while before the JXM-IO-E09 transmits the SDO reply. This process can take at least 50 ms. Therefore, it is recommended that a delay of 100 ms be implemented before the next SDO or PDO access to the same JXM-IO-E09.

6.2 CANopen® PDO Specification

Introduction

This chapter describes the CANopen® PDO specification implemented on the JXM-IO-E09. PDO is short for Process Data Object. The PDO data allocation is fixed and cannot be changed by the application. The TX PDO currently allows on request accessing (the JXM-IO-E09 allows PDO access when it has been set to operational state).

Contents

TX PDO Allocation on the JXM-IO-E09

PDO Assignment and Parameters

The table below shows the allocation of TX PDOs implemented on the JXM-IO-E09. CANopen® objects are linked with their corresponding PDOs.

The controller is able to read back the following data from the JXM-IO-E09 via PDO1_RX (0x180 + node ID):

Byte Offset	Index / Sub-index	Size [byte]	Description
0	0x2100/04	1	Digital outputs read back

The controller is able to read back the following data from the JXM-IO-E09 via PDO2_RX (0x280 + node ID):

Byte Offset	Index / Sub-index	Size [byte]	Description
0	0x2200/04	2	Output Current 1
2	0x2201/04	2	Output Current 2
4	0x2202/04	2	Output Current 3
6	0x2203/04	2	Output Current 4

The controller is able to read back the following data from the JXM-IO-E09 via PDO3_RX (0x380 + node ID):

Byte Offset	Index / Sub-index	Size [byte]	Description
0	0x2204/04	2	Temperature Measurement
2	0x2204/05	1	Temperature in °C
4	-	2	Total output current

The final field "Total output current" is not represented by any SDO object. It is the value used to monitor the total output current. The total output current value is set in object "System Parameter" (index 0x4556, sub-index 08).

RX PDO Allocation on the JXM-IO-E09

PDO Assignment and Parameters

The tables below show the allocation of RX PDOs implemented on the JXM-IO-E09. CANopen® objects are linked with their corresponding PDOs. Therefore, writing to that PDO will be the same as writing to that SDO index and sub-index.

The controller is able to read back the following data from the JXM-IO-E09 via PDO1_TX (0x200 + node ID):

Byte Offset	Index / Sub-index	Size [byte]	Description
0	0x2100/05	1	Digital outputs

7 Protection and Diagnostic Features

Purpose of this Chapter

This chapter describes the available protection and diagnostics features implemented on the JXM-IO-E09. The following features are currently supported:

- Detecting faults in the application program or visualization.
- Identifying the root cause of a fault.
- Troubleshooting an error that caused a fault message.

Prerequisites

To be able to locate a fault of the JXM-IO-E09 module the following prerequisites have to be fulfilled:

- The module JXM-IO-E09 is connected to a controller.
- 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.

Background

When a fault is detected, the module JXM-IO-E09 will disable the function that caused the fault. It will transmit a CANopen® Emergency Object to inform the controller of the problem.

The external controller can immediately reactivate the function, but as long as the fault remains, the module JXM-IO-E09 will again disable the function and retransmit the error notification.

Contents

Digital Outputs

Detecting the Error

A threshold can be programmed for both over-current and cable breakage (no load) via the System Parameters interface. Over-current limit can be set to a value between 500 mA and 7,500 mA per channel. The total output current limit can be set to a value between 5,000 mA and 21,000 mA.

Note that the no-load threshold is shared for all digital outputs. The no-load detection can be enabled or disabled for individual output channels. A no-load fault can only be detected when a channel is switched on (enabled).

The software implements a function allowing temporary over-current. This is useful in situations where high peak currents are required.

The device temperature limit can be set to a value between 25 °C and 85 °C.

Root Cause of Error

The error may be caused by the following root causes:

- The programmed limit for over-current has been exceeded.
- The programmed limit for total output current has been exceeded.
- The programmed limit for no-load has been exceeded.
- The programmed limit for device temperature has been exceeded.
- Short circuit to GND on any channel.

Response of the Module to this Error

The module responds to this error in the following levels:

Level	Description
1	The module will send a CANopen® emergency object to the controller.
2	The module will block the function that has caused the error.

The module will set the corresponding bit in the CANopen® error register and will send the following error code:

Error Type	Error Code
Over-current of the total output current	0x2300
Over-current on any channel	0x2301 - 0x2304
Short circuit to GND on any channel	0x9001 - 0x9004
No-load condition on any channel	0x9011 - 0x9014
Over-temperature	0x4200

Fixing the Root Cause

These types of error can only be fixed in a service point. Please contact your service point or your service team.

Appendix

Introduction

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

Contents

A: Technical Data

Introduction

This chapter contains information on electrical and mechanical data, as well as on operating data of the JXM-IO-E09.

Contents

Technical Specifications

Connector

Parameter	Value
Manufacturer/Model	DEUTSCH DTM13-12 PA-R008
Article #	tbd
Design	12-pin

Electrical Data - Power Supply

Parameter	Value
Operating voltage (input voltage)	DC 8.0 ... 32.0 V
Minimum start up voltage	DC 6.5 V
Maximum input voltage	DC 32 V
Maximum input current	21 A

Digital Outputs

Parameter	Value
Allowed output current per channel	500 mA ... 7,500 mA
Allowed total output current of all channels	5,000 mA ... 21,000 mA
Allowed overload pulse duration per output	2 ms ... 100 ms
Over-current detection	Yes

Communication

Parameter	Value
Bus type	CAN bus
Protocol	CANopen®
Baud rate	250 kBaud (1 MBaud max.)
CAN Baud rate	1 MBit/s
Terminating resistor	Can be activated by means of software

Protective and Diagnostic Functions

Type of Fault	Response
Short circuit on any channel	■ The faulty function is disabled automatically ■ A CANopen® emergency object is sent to the controller ■ The error message is stored to a history list which is compatible with the CANopen® standard
Over-current on any channel	
No-load condition on any channel	
Short circuit to GND on any channel	
Over-current of the total output current	
Over-temperature (allowed temperature inside the device has been exceeded)	

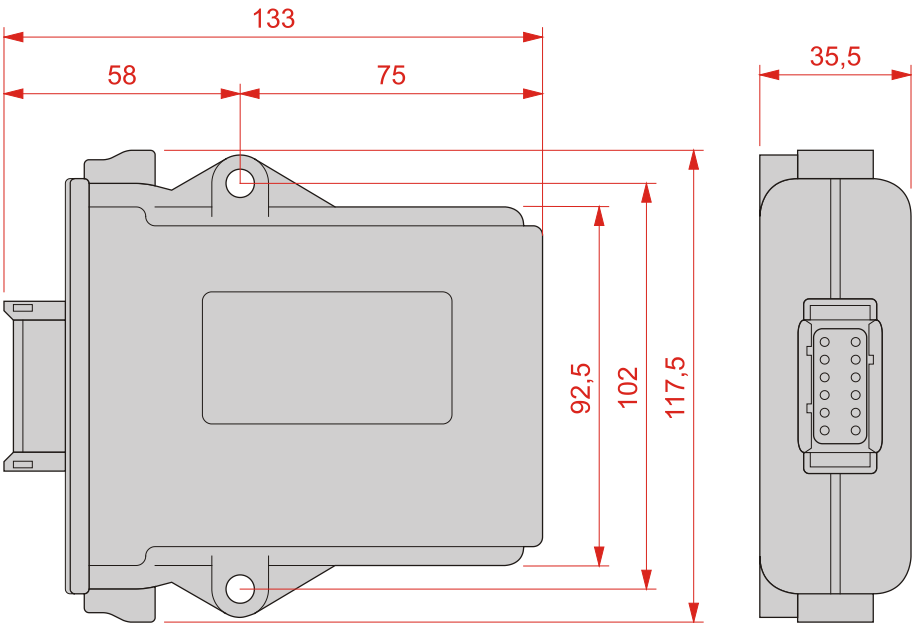
Physical Dimensions

Introduction

This chapter details the physical dimensions of the JXM-IO-E09 and the conditions for installation.

Physical Dimensions

The illustration below shows the dimensions of the JXM-IO-E09:



Proctection Against Overheating

When selecting a place for installing the JXM-IO-E09, consider the following facts:

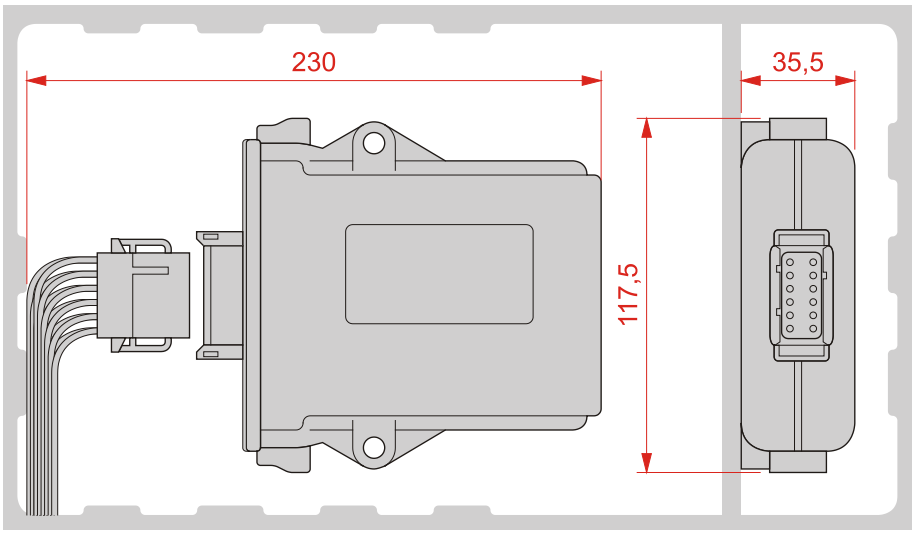
- The JXM-IO-E09 increases the temperature of the environment as a result of heat emission under load.
- The JXM-IO-E09 operates without interruption at an ambient temperature between -40 °C and +85 °C.

Consider the heat emission from the device, in particular when installing it in a critical environment:

- in the vicinity of the fuel tank
- in the vicinity of the fuel pipe
- in the vicinity of flammable vehicle components
- in the vicinity of thermally malleable vehicle components

Space Required for Installation and Service

The illustration below shows the space required for installing the module:



Ensure there is enough space around the connector for servicing requirements. It should be possible to disconnect the connector at any time.

Operating Parameters - Environment and Mechanics

Environment

Parameter	Value	Standard
Operating temperature range	-40 ... +85 °C	
Storage temperature range	-40 ... +85 °C	DIN EN 61131-2 DIN EN 60068-2-1 DIN EN 60068-2-2
Air humidity	10 ... 95 %	DIN EN 61131-2
Climate test	Humid heat	DIN EN 60068-2-30
Pollution degree	2	DIN EN 61131-2

Mechanical Parameters

Parameter	Value	Standard
Vibration resistance	Vibration, broadband noise	DIN EN 60068-2-6 Severity level 2
Shock resistance	30 g occasionally, 18 ms, sinusoidal half-wave, 3 shocks in the directions of all three spatial axes	DIN EN 60068-2-27
Degree of protection	IP67	DIN EN 60529 including all changes to date

Operating Parameters - EMC

EMC - Emitted Interference

This device has been checked as per Directive 72/245/EEC with all amendments up to 2009/19/EC and meets all test criteria.

EMC - Interference Immunity

Parameter	Value	Standard
Interference immunity to conducted faults	compliant	Directive 72/245/EEC with all changes up to 2009/19/EC
Interference immunity to external magnetic field	20 ... 1,000 MHz: 100 V/m 1,000 ... 2,000 MHz: 30 V/m	Directive 72/245/EEC with all amendments including 2009/19/EC
Test pulses	Pulse 2a, 2b, 3a, 3b, and 5b	ISO 7637-2
Load dump	Pulse 5b 80 V, R_i = 2 Ω	ISO 7637-2

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