VIPA System 200V

IM | Manual

HB97E_IM | RE_253-1CAxx | Rev. 14/21

May 2014

VIPA
A YASKAWA COMPANY

VIPA, Gesellschaft für Visualisierung und Prozessautomatisierung mbH
Ohmstraße 4, D-91074 Herzogenaurach, Germany
Tel.: +49 (91 32) 744 -0
Fax.: +49 9132 744 1864
EMail: info@vipa.de
http://www.vipa.com

Note

Every effort has been made to ensure that the information contained in this document was complete and accurate at the time of publishing. Nevertheless, the authors retain the right to modify the information. This customer document describes all the hardware units and functions known at the present time. Descriptions may be included for units which are not present at the customer site. The exact scope of delivery is described in the respective purchase contract.

CE Conformity Declaration

Hereby, VIPA GmbH declares that the products and systems are in compliance with the essential requirements and other relevant provisions.

Conformity is indicated by the CE marking affixed to the product.

Conformity Information

For more information regarding CE marking and Declaration of Conformity (DoC), please contact your local VIPA customer service organization.

Trademarks

VIPA, SLIO, System 100V, System 200V, System 300V, System 300S, System 400V, System 500S and Commander Compact are registered trademarks of VIPA Gesellschaft für Visualisierung und Prozessautomatisierung mbH.

SPEED7 is a registered trademark of profichip GmbH.

SIMATIC, STEP, SINEC, TIA Portal, S7-300 and S7-400 are registered trademarks of Siemens AG.

Microsoft und Windows are registered trademarks of Microsoft Inc., USA.

Portable Document Format (PDF) and Postscript are registered trademarks of Adobe Systems, Inc.

All other trademarks, logos and service or product marks specified herein are owned by their respective companies.

Information product support

Contact your local VIPA Customer Service Organization representative if you wish to report errors or questions regarding the contents of this document. If you are unable to locate a customer service center, contact VIPA as follows:

VIPA GmbH, Ohmstraße 4, 91074 Herzogenaurach, Germany

Telefax:+49 9132 744 1204
EMail: documentation@vipa.de

Technical support

Contact your local VIPA Customer Service Organization representative if you encounter problems with the product or have questions regarding the product. If you are unable to locate a customer service center, contact VIPA as follows:

VIPA GmbH, Ohmstraße 4, 91074 Herzogenaurach, Germany

Telephone: +49 9132 744 1150 (Hotline)
EMail: support@vipa.de

Contents

About this manual **1**
Safety information **2**
Chapter 1 Basics and Assembly **1-1**
Safety Information for Users 1-2
System conception 1-3
Dimensions 1-5
Installation 1-7
Demounting and module exchange 1-11
Wiring 1-12
Installation guidelines 1-14
General data 1-17
Chapter 2 Hardware description **2-1**
Properties 2-2
Structure - 253-1CA01 2-3
Structure - 253-1CA30 2-6
Wiring under CAN-Bus 2-9
Technical data 2-10
Chapter 3 Deployment **3-1**
Basics CANopen 3-2
Fast introduction 3-4
Baudrate and module-ID 3-8
Message structure 3-9
PDO 3-11
SDO 3-15
Object directory 3-17
Emergency Object 3-58
NMT - network management 3-60

About this manual

This manual describes the System 200V CANopen slave modules IM 253-1CAxx from VIPA. Here you may find every information for commissioning and operation.

Overview

Chapter 1: Basics and Assembly

The focus of this chapter is on the introduction of the VIPA System 200V. Here you will find the information required to assemble and wire a controller system consisting of System 200V components.

Besides the dimensions the general technical data of System 200V will be found.

Chapter 2: Hardware description

Here the hardware components of the IM 253-1CAxx are described.

The technical data are at the end of the chapter.

Chapter 3: Deployment

This chapter contains the description of the VIPA CANopen slave modules. Another section of this chapter concerns the project engineering for "experts" and an explanation of the telegram structure and the function codes of CANopen.
The description of the Emergency Object and NMT conclude the chapter.

Objective and contents

This manual describes the System 200V CANopen slave modules IM 253-1CAxx from VIPA. It contains a description of the construction, project implementation and usage.

This manual is part of the documentation package with order number HB97E_IM and relevant for:

Product	Order number	as of state: HW
IM 253CAN	VIPA 253-1CAxx	01

Target audience

The manual is targeted at users who have a background in automation technology.

Structure of the manual

The manual consists of chapters. Every chapter provides a self-contained description of a specific topic.

Guide to the document

The following guides are available in the manual:

- an overall table of contents at the beginning of the manual
- an overview of the topics for every chapter

Availability

The manual is available in:

- printed form, on paper
- in electronic form as PDF-file (Adobe Acrobat Reader)

Icons Headings

Important passages in the text are highlighted by following icons and headings:

Danger!
Immediate or likely danger.
Personal injury is possible.

Attention!
Damages to property is likely if these warnings are not heeded.

Note!
Supplementary information and useful tips.

Safety information

Applications conforming with specifications

The IM 253CAN is constructed and produced for:

- all VIPA System 200V components
- communication and process control
- general control and automation applications
- industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle

Danger!

This device is not certified for applications in

- in explosive environments (EX-zone)

Documentation

The manual must be available to all personnel in the

- project design department
- installation department
- commissioning
- operation

The following conditions must be met before using or commissioning the components described in this manual:

- Hardware modifications to the process control system should only be carried out when the system has been disconnected from power!
- Installation and hardware modification only by properly trained personnel.
- The national rules and regulations of the respective country must be satisfied (installation, safety, EMC ...)

Disposal

National rules and regulations apply to the disposal of the unit!

Chapter 1 Basics and Assembly

Overview

The focus of this chapter is on the introduction of the VIPA System 200V. Here you will find the information required to assemble and wire a controller system consisting of System 200V components.

Besides the dimensions the general technical data of System 200V will be found.

Contents

Topic	Page
Chapter 1 Basics and Assembly	**1-1**
Safety Information for Users	1-2
System conception	1-3
Dimensions	1-5
Installation	1-7
Demounting and module exchange	1-11
Wiring	1-12
Installation guidelines	1-14
General data	1-17

Safety Information for Users

Handling of electrostatic sensitive modules

VIPA modules make use of highly integrated components in MOS-Technology. These components are extremely sensitive to over-voltages that can occur during electrostatic discharges.

The following symbol is attached to modules that can be destroyed by electrostatic discharges.

The Symbol is located on the module, the module rack or on packing material and it indicates the presence of electrostatic sensitive equipment.

It is possible that electrostatic sensitive equipment is destroyed by energies and voltages that are far less than the human threshold of perception. These voltages can occur where persons do not discharge themselves before handling electrostatic sensitive modules and they can damage components thereby, causing the module to become inoperable or unusable.

Modules that have been damaged by electrostatic discharges can fail after a temperature change, mechanical shock or changes in the electrical load.

Only the consequent implementation of protection devices and meticulous attention to the applicable rules and regulations for handling the respective equipment can prevent failures of electrostatic sensitive modules.

Shipping of electrostatic sensitive modules

Modules must be shipped in the original packing material.

Measurements and alterations on electrostatic sensitive modules

When you are conducting measurements on electrostatic sensitive modules you should take the following precautions:

- Floating instruments must be discharged before use.
- Instruments must be grounded.

Modifying electrostatic sensitive modules you should only use soldering irons with grounded tips.

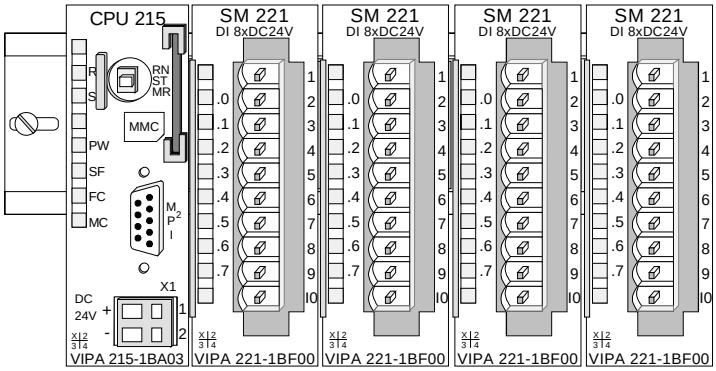
Attention!

Personnel and instruments should be grounded when working on electrostatic sensitive modules.

System conception

Overview

The System 200V is a modular automation system for assembly on a 35mm profile rail. By means of the peripheral modules with 4, 8 and 16 channels this system may properly be adapted matching to your automation tasks.

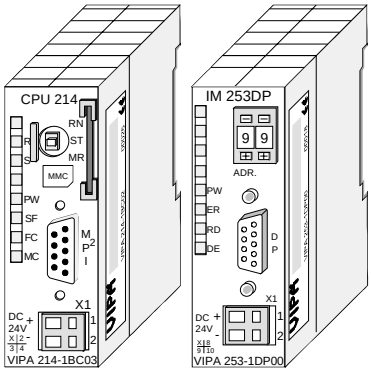


Components

The System 200V consists of the following components:

- *Head modules* like CPU and bus coupler
- *Periphery modules* like I/O, function und communication modules
- *Power supplies*
- *Extension modules*

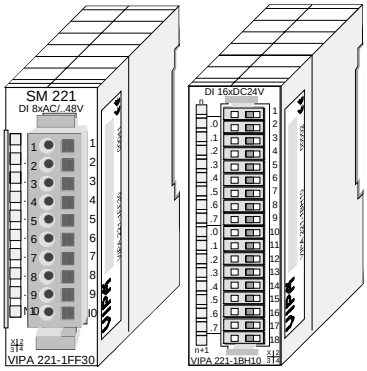
Head modules



With a head module CPU respectively bus interface and DC 24V power supply are integrated to one casing.

Via the integrated power supply the CPU respectively bus interface is power supplied as well as the electronic of the connected periphery modules.

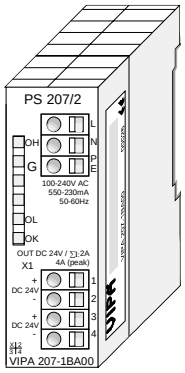
Periphery modules



The modules are direct installed on a 35mm profile rail and connected to the head module by a bus connector, which was mounted on the profile rail before.

Most of the periphery modules are equipped with a 10pin respectively 18pin connector. This connector provides the electrical interface for the signaling and supplies lines of the modules.

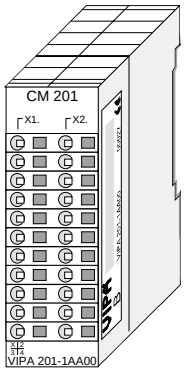
Power supplies



With the System 200V the DC 24V power supply can take place either externally or via a particularly for this developed power supply.

The power supply may be mounted on the profile rail together with the System 200V modules. It has no connector to the backplane bus.

Expansion modules



The expansion modules are complementary modules providing 2- or 3wire connection facilities.

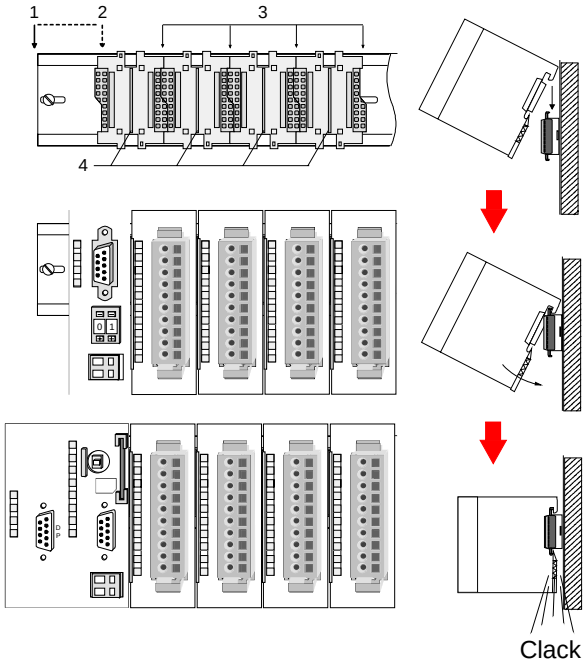
The modules are not connected to the backplane bus.

Structure/ dimensions

- Profile rail 35mm
- Dimensions of the basic enclosure:
  1tier width: (HxWxD) in mm: 76x25.4x74 in inches: 3x1x3
  2tier width: (HxWxD) in mm: 76x50.8x74 in inches: 3x2x3

Installation

Please note that you can only install head modules, like the CPU, the PC and couplers at slot 1 or 1 and 2 (for double width modules).



[1]	Head module (double width)
[2]	Head module (single width)
[3]	Periphery module
[4]	Guide rails

Note

Information about the max. number of pluggable modules and the max. current at the backplane bus can be found in the "Technical Data" of the according head module.

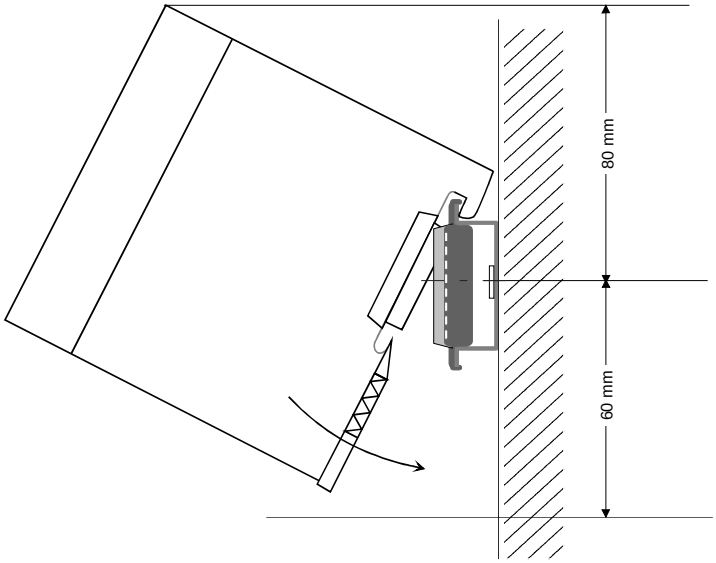
Please install modules with a high current consumption directly beside the head module.

Dimensions

Dimensions Basic enclosure

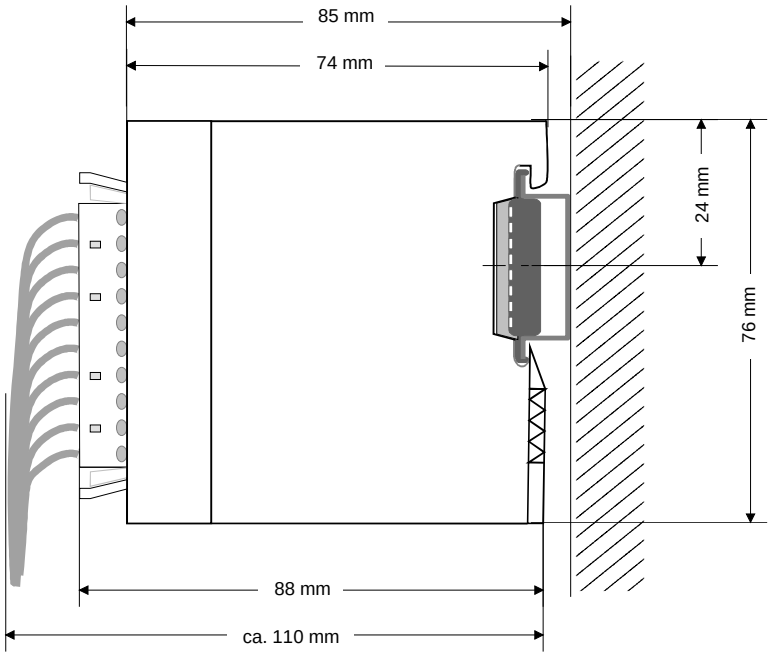
1tier width (HxWxD) in mm: 76 x 25.4 x 74
2tier width (HxWxD) in mm: 76 x 50.8 x 74

Installation dimensions

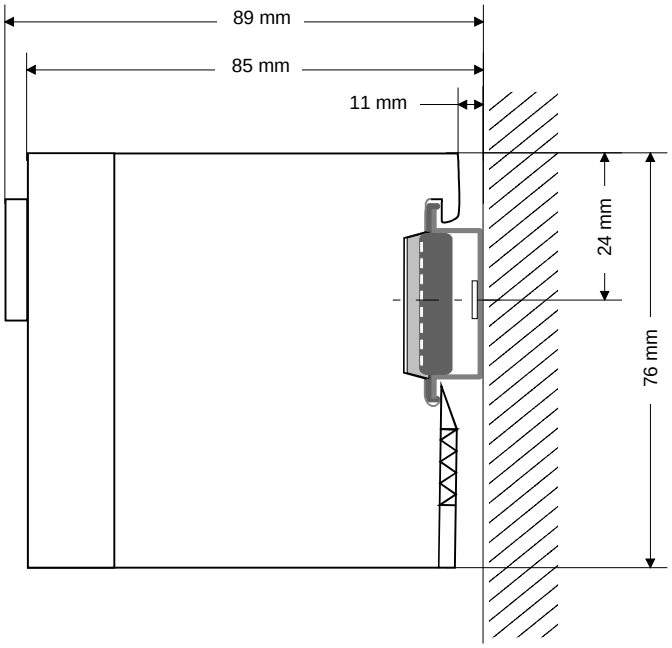


Installed and wired dimensions

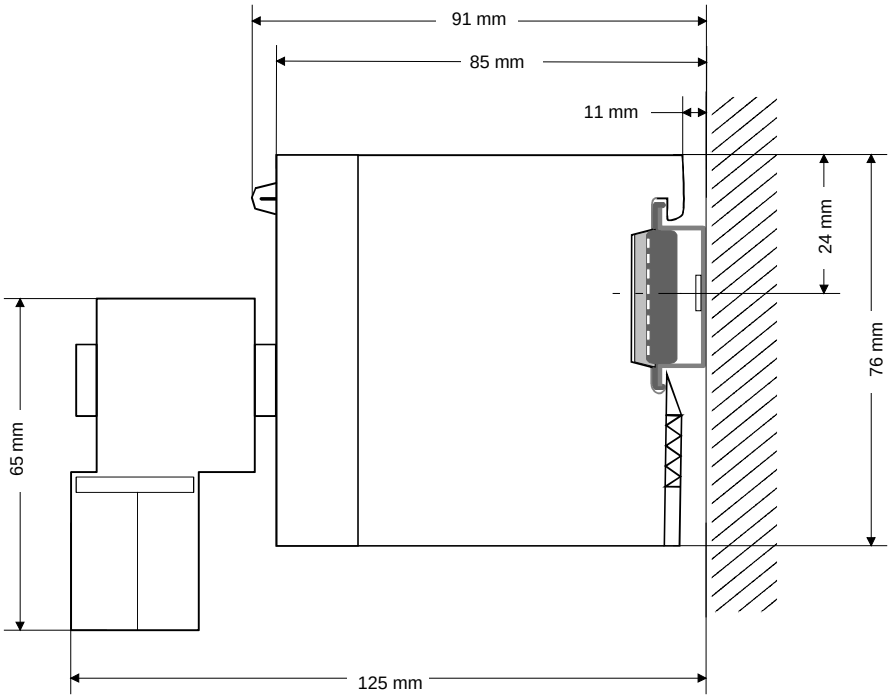
In- / Output modules



Function modules/
Extension modules



CPUs (here with
EasyConn from
VIPA)



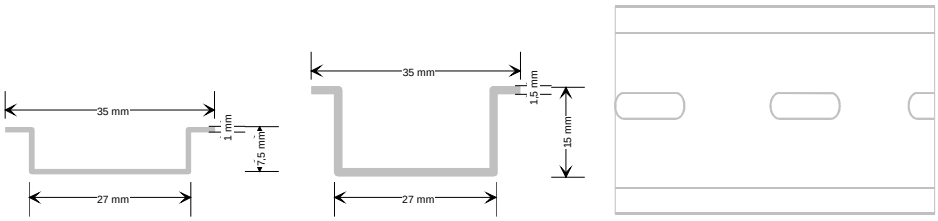
Installation

General

The modules are each installed on a 35mm profile rail and connected via a bus connector. Before installing the module the bus connector is to be placed on the profile rail before.

Profile rail

For installation the following 35mm profile rails may be used:

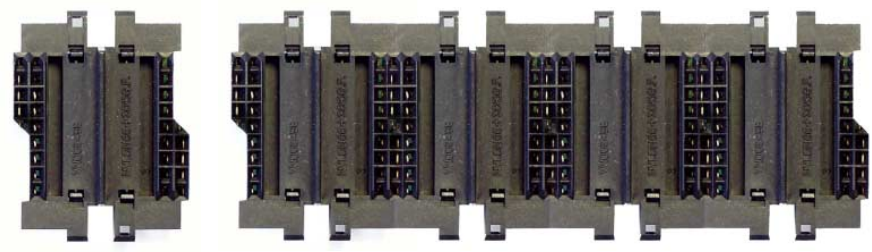


Order number	Label	Description
290-1AF00	35mm profile rail	Length 2000mm, height 15mm
290-1AF30	35mm profile rail	Length 530mm, height 15mm

Bus connector

System 200V modules communicate via a backplane bus connector. The backplane bus connector is isolated and available from VIPA in of 1-, 2-, 4- or 8tier width.

The following figure shows a 1tier connector and a 4tier connector bus:



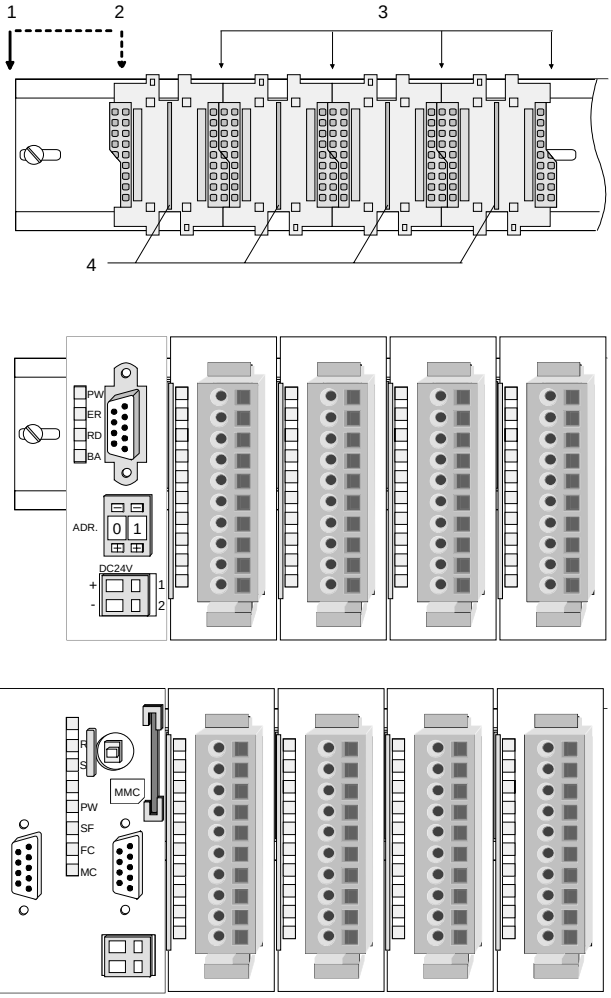
The bus connector is to be placed on the profile rail until it clips in its place and the bus connections look out from the profile rail.

Order number	Label	Description
290-0AA10	Bus connector	1tier
290-0AA20	Bus connector	2tier
290-0AA40	Bus connector	4tier
290-0AA80	Bus connector	8tier

Installation on a profile rail

The following figure shows the installation of a 4tier width bus connector in a profile rail and the slots for the modules.

The different slots are defined by guide rails.



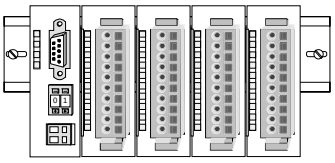
[1] Head module (double width)
[2] Head module (single width)
[3] Peripheral module
[4] Guide rails

Assembly regarding the current consumption

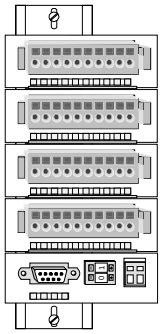
- Use bus connectors as long as possible.
- Sort the modules with a high current consumption right beside the head module. In the service area of www.vipa.com a list of current consumption of every System 200V module can be found.

Assembly possibilities

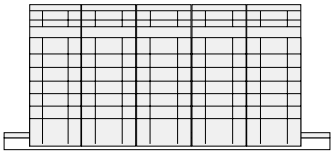
hoizontal assembly



vertical assembly



lying assembly

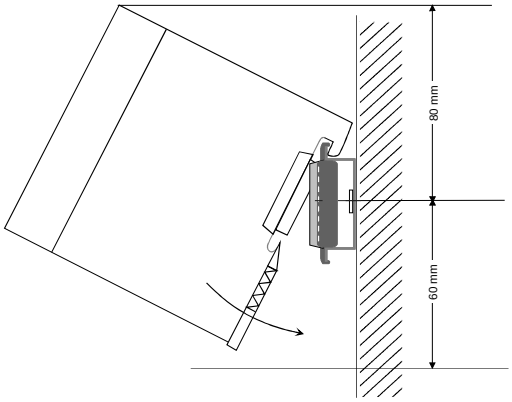


Please regard the allowed environmental temperatures:

- horizontal assembly: from 0 to 60°C
- vertical assembly: from 0 to 40°C
- lying assembly: from 0 to 40°C

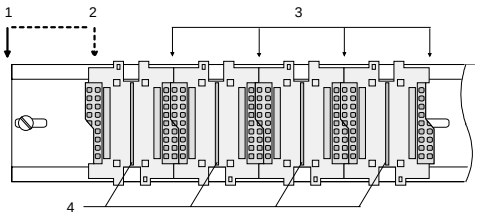
The horizontal assembly always starts at the left side with a head module, then you install the peripheral modules beside to the right.

You may install up to 32 peripheral modules.



Please follow these rules during the assembly!

- Turn off the power supply before you install or remove any modules!
- Make sure that a clearance of at least 60mm exists above and 80mm below the middle of the profile rail.



- Every row must be completed from left to right and it has to start with a head module.

  [1] Head module (double width)
  [2] Head module (single width)
  [3] Peripheral modules
  [4] Guide rails

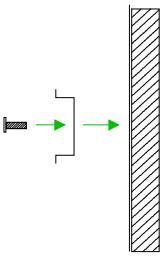
- Modules are to be installed side by side. Gaps are not permitted between the modules since this would interrupt the backplane bus.
- A module is only installed properly and connected electrically when it has clicked into place with an audible click.
- Slots after the last module may remain unoccupied.

Note!

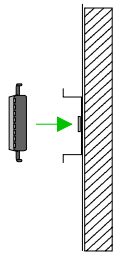
Information about the max. number of pluggable modules and the max. current at the backplane bus can be found in the "Technical Data" of the according head module.

Please install modules with a high current consumption directly beside the head module.

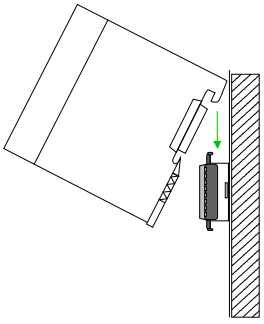
Assembly procedure



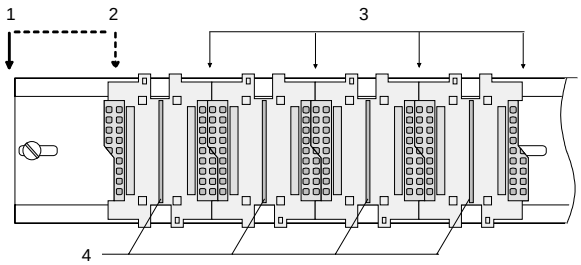
- Install the profile rail. Make sure that a clearance of at least 60mm exists above and 80mm below the middle of the profile rail.



- Press the bus connector into the profile rail until it clips securely into place and the bus-connectors look out from the profile rail. This provides the basis for the installation of your modules.



- Start at the outer left location with the installation of your head module and install the peripheral modules to the right of this.

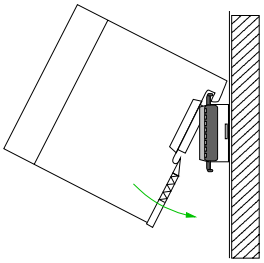


[1] Head module (double width)

[2] Head module (single width)

[3] Peripheral module

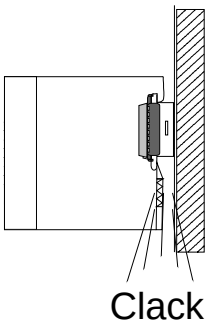
[4] Guide rails



- Insert the module that you are installing into the profile rail at an angle of 45 degrees from the top and rotate the module into place until it clicks into the profile rail with an audible click. The proper connection to the backplane bus can only be guaranteed when the module has properly clicked into place.

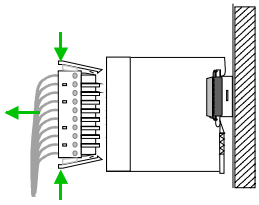
Attention!

Power must be turned off before modules are installed or removed!



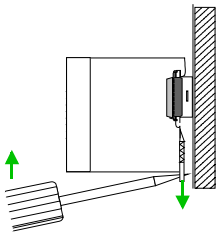
Demounting and module exchange

1



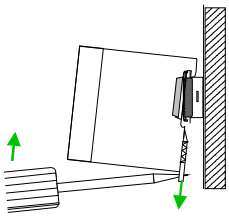
- Remove if exists the wiring to the module, by pressing both locking lever on the connector and pulling the connector.

2



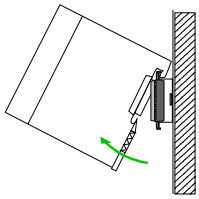
- The casing of the module has a spring loaded clip at the bottom by which the module can be removed.

3



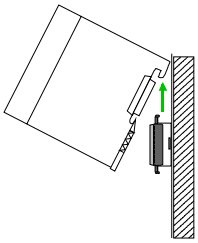
- The clip is unlocked by pressing the screwdriver in an upward direction.

4



- Withdraw the module with a slight rotation to the top.

5



Attention!

Power must be turned off before modules are installed or removed!

Please regard that the backplane bus is interrupted at the point where the module was removed!

Wiring

Overview

Most peripheral modules are equipped with a 10pole or a 18pole connector. This connector provides the electrical interface for the signaling and supply lines of the modules.

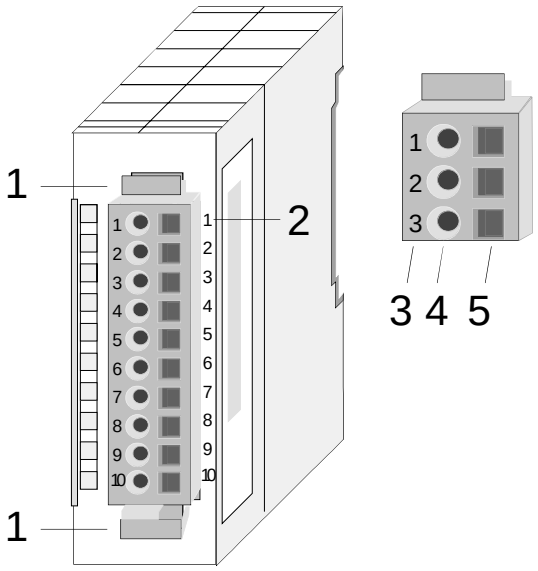
The modules carry spring-clip connectors for interconnections and wiring.

The spring-clip connector technology simplifies the wiring requirements for signaling and power cables.

In contrast to screw terminal connections, spring-clip wiring is vibration proof. The assignment of the terminals is contained in the description of the respective modules.

You may connect conductors with a diameter from 0.08mm^2 up to 2.5mm^2 (max. 1.5mm^2 for 18pole connectors).

The following figure shows a module with a 10pole connector.



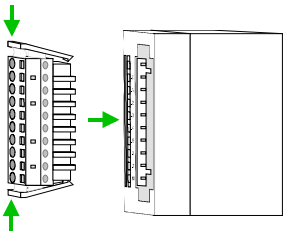
[1] Locking lever
[2] Pin no. at the module
[3] Pin no. at the connector
[4] Wiring port
[5] Opening for screwdriver

Note!

The spring-clip is destroyed if you push the screwdriver into the wire port!

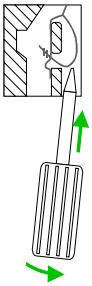
Make sure that you only insert the screwdriver into the square hole of the connector!

Wiring procedure

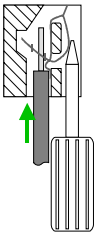


- Install the connector on the module until it locks with an audible click. For this purpose you press the two clips together as shown.
  The connector is now in a permanent position and can easily be wired.

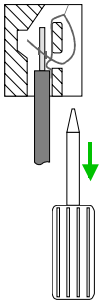
The following section shows the wiring procedure from top view.



- Insert a screwdriver at an angel into the square opening as shown.
- Press and hold the screwdriver in the opposite direction to open the contact spring.



- Insert the stripped end of the wire into the round opening. You can use wires with a diameter of 0.08mm^2 to 2.5mm^2 (1.5mm^2 for 18pole connectors).



- By removing the screwdriver the wire is connected safely with the plug connector via a spring.

Note!

Wire the power supply connections first followed by the signal cables (inputs and outputs).

Installation guidelines

General

The installation guidelines contain information about the interference free deployment of System 200V systems. There is the description of the ways, interference may occur in your control, how you can make sure the electromagnetic digestibility (EMC), and how you manage the isolation.

What means EMC?

Electromagnetic digestibility (EMC) means the ability of an electrical device, to function error free in an electromagnetic environment without being interferenced res. without interferencing the environment.

All System 200V components are developed for the deployment in hard industrial environments and fulfill high demands on the EMC. Nevertheless you should project an EMC planning before installing the components and take conceivable interference causes into account.

Possible interference causes

Electromagnetic interferences may interfere your control via different ways:

- Fields
- I/O signal conductors
- Bus system
- Current supply
- Protected earth conductor

Depending on the spreading medium (lead bound or lead free) and the distance to the interference cause, interferences to your control occur by means of different coupling mechanisms.

One differs:

- galvanic coupling
- capacitive coupling
- inductive coupling
- radiant coupling

Basic rules for EMC

In the most times it is enough to take care of some elementary rules to guarantee the EMC. Please regard the following basic rules when installing your PLC.

- Take care of a correct area-wide grounding of the inactive metal parts when installing your components.
  - Install a central connection between the ground and the protected earth conductor system.
  - Connect all inactive metal extensive and impedance-low.
  - Please try not to use aluminum parts. Aluminum is easily oxidizing and is therefore less suitable for grounding.
- When cabling, take care of the correct line routing.
  - Organize your cabling in line groups (high voltage, current supply, signal and data lines).
  - Always lay your high voltage lines and signal res. data lines in separate channels or bundles.
  - Route the signal and data lines as near as possible beside ground areas (e.g. suspension bars, metal rails, tin cabinet).
- Proof the correct fixing of the lead isolation.
  - Data lines must be laid isolated.
  - Analog lines must be laid isolated. When transmitting signals with small amplitudes the one sided laying of the isolation may be favorable.
  - Lay the line isolation extensively on an isolation/protected earth conductor rail directly after the cabinet entry and fix the isolation with cable clamps.
  - Make sure that the isolation/protected earth conductor rail is connected impedance-low with the cabinet.
  - Use metallic or metalized plug cases for isolated data lines.
- In special use cases you should appoint special EMC actions.
  - Wire all inductivities with erase links.
  - Please consider luminescent lamps can influence signal lines.
- Create a homogeneous reference potential and ground all electrical operating supplies when possible.
  - Please take care for the targeted employment of the grounding actions. The grounding of the PLC is a protection and functionality activity.
  - Connect installation parts and cabinets with the System 200V in star topology with the isolation/protected earth conductor system. So you avoid ground loops.
  - If potential differences between installation parts and cabinets occur, lay sufficiently dimensioned potential compensation lines.

Isolation of conductors

Electrical, magnetically and electromagnetic interference fields are weakened by means of an isolation, one talks of absorption.

Via the isolation rail, that is connected conductive with the rack, interference currents are shunt via cable isolation to the ground. Hereby you have to make sure, that the connection to the protected earth conductor is impedance-low, because otherwise the interference currents may appear as interference cause.

When isolating cables you have to regard the following:

- If possible, use only cables with isolation tangle.
- The hiding power of the isolation should be higher than 80%.
- Normally you should always lay the isolation of cables on both sides. Only by means of the both-sided connection of the isolation you achieve high quality interference suppression in the higher frequency area.

  Only as exception you may also lay the isolation one-sided. Then you only achieve the absorption of the lower frequencies. A one-sided isolation connection may be convenient, if:
  - the conduction of a potential compensating line is not possible
  - analog signals (some mV res. µA) are transferred
  - foil isolations (static isolations) are used.
- With data lines always use metallic or metalized plugs for serial couplings. Fix the isolation of the data line at the plug rack. Do not lay the isolation on the PIN 1 of the plug bar!
- At stationary operation it is convenient to strip the insulated cable interruption free and lay it on the isolation/protected earth conductor line.
- To fix the isolation tangles use cable clamps out of metal. The clamps must clasp the isolation extensively and have well contact.
- Lay the isolation on an isolation rail directly after the entry of the cable in the cabinet. Lead the isolation further on to the System 200V module and **don't** lay it on there again!

Please regard at installation!

At potential differences between the grounding points, there may be a compensation current via the isolation connected at both sides.

Remedy: Potential compensation line.

General data

Structure/ dimensions

- Profile rail 35mm
- Peripheral modules with recessed labelling
- Dimensions of the basic enclosure:
  1tier width: (HxWxD) in mm: 76x25.4x74 in inches: 3x1x3
  2tier width: (HxWxD) in mm: 76x50.8x74 in inches: 3x2x3

Reliability

- Wiring by means of spring pressure connections (CageClamps) at the front-facing connector, core cross-section 0.08 ... 2.5mm^2 or 1.5 mm^2 (18pole plug)
- Complete isolation of the wiring when modules are exchanged
- Every module is isolated from the backplane bus

General data

Conformity and approval		
Conformity		
CE	2006/95/EC	Low-voltage directive
	2004/108/EC	EMC directive
Approval		
UL	UL 508	Approval for USA and Canada
others		
RoHS	2011/65/EU	Product is lead-free; Restriction of the use of certain hazardous substances in electrical and electronic equipment

Protection of persons and device protection		
Type of protection	-	IP20
Electrical isolation		
to the field bus	-	electrically isolated
to the process level	-	electrically isolated
Insulation resistance	EN 61131-2	-
Insulation voltage to reference earth		
Inputs / outputs	-	AC / DC 50V, test voltage AC 500V
Protective measures	-	against short circuit

Environmental conditions to EN 61131-2		
Climatic		
Storage / transport	EN 60068-2-14	-25…+70°C
Operation		
Horizontal installation	EN 61131-2	0…+60°C
Vertical installation	EN 61131-2	0…+60°C
Air humidity	EN 60068-2-30	RH1 (without condensation, rel. humidity 10…95%)
Pollution	EN 61131-2	Degree of pollution 2
Mechanical		
Oscillation	EN 60068-2-6	1g, 9Hz ... 150Hz
Shock	EN 60068-2-27	15g, 11ms

Mounting conditions		
Mounting place	-	In the control cabinet
Mounting position	-	Horizontal and vertical

EMC	**Standard**		**Comment**
Emitted interference	EN 61000-6-4		Class A (Industrial area)
Noise immunity zone B	EN 61000-6-2		Industrial area
		EN 61000-4-2	ESD 8kV at air discharge (degree of severity 3), 4kV at contact discharge (degree of severity 2)
		EN 61000-4-3	HF irradiation (casing) 80MHz … 1000MHz, 10V/m, 80% AM (1kHz) 1.4GHz ... 2.0GHz, 3V/m, 80% AM (1kHz) 2GHz ... 2.7GHz, 1V/m, 80% AM (1kHz)
		EN 61000-4-6	HF conducted 150kHz … 80MHz, 10V, 80% AM (1kHz)
		EN 61000-4-4	Burst, degree of severity 3
		EN 61000-4-5	Surge, installation class 3 *)

*) Due to the high-energetic single pulses with Surge an appropriate external protective circuit with lightning protection elements like conductors for lightning and overvoltage is necessary.

Chapter 2 Hardware description

Overview

Here the hardware components of the IM 253-1CAxx are described.
The technical data are at the end of the chapter.

Contents

Topic	Page
Chapter 2 Hardware description	**2-1**
Properties	2-2
Structure - 253-1CA01	2-3
Structure - 253-1CA30	2-6
Wiring under CAN-Bus	2-9
Technical data	2-10

Properties

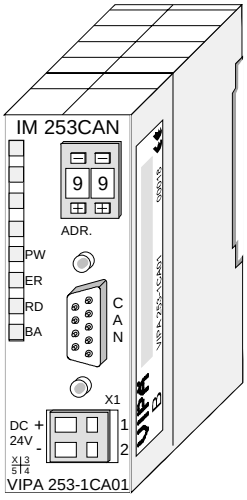
IM 253CAN
253-1CA01

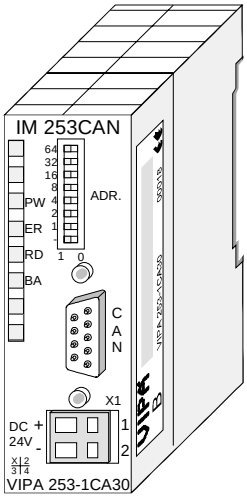
- 10 Rx and 10 Tx PDOs
- 2 SDOs
- Support of all baud rates
- PDO linking
- PDO mapping

Restrictions 253-1CA30 - ECO

The IM 253-1CA30 - ECO is functionally identical to the IM 253-1CA01 and has the following restrictions:

- CANopen slave for max. 8 peripheral modules
- Integrated DC 24V power supply for the peripheral modules 0.8A max.
- The CAN-Bus address can be adjusted by DIP switch.



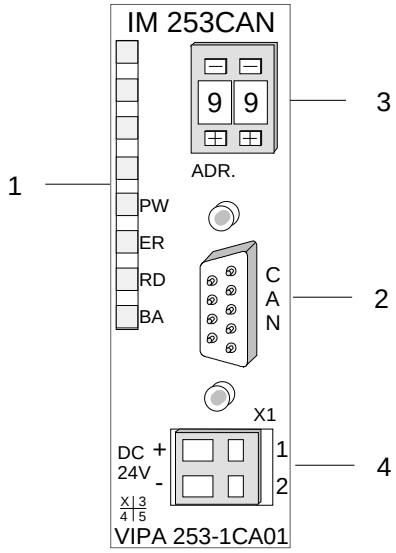


Order data

Type	Order number	Description
IM 253CAN	VIPA 253-1CA01	CAN-Bus CANopen slave
IM 253CAN_ECO	VIPA 253-1CA30	CAN-Bus CANopen slave - ECO

Structure - 253-1CA01

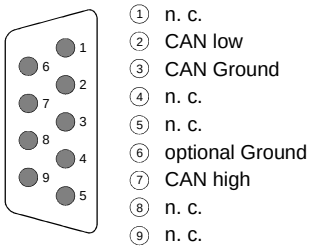
Front view
253-1CA01



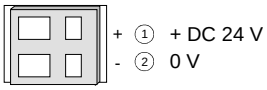
[1] LED status indicators
[2] CAN-Bus plug
[3] Address or baudrate selector (Coding switch)
[4] Connector for an external 24V supply

Interfaces

CAN



X1



9pin D-type plug

The VIPA CAN-Bus coupler is connected to the CAN-Bus system by means of a 9pin plug.

LEDs

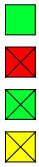
The module is equipped with four LEDs for diagnostic purposes.
The following table shows how the diagnostic LEDs are used along with the respective colors.

Name	Color	Description
PW	green	Indicates that the supply voltage is available.
ER	red	Blinks at overflow of the error counters (e.g. there is no further CAN station at the bus or wrong CAN transfer rate)
		On when an error was detected in the backplane bus communications.
RD	green	Blinks at 1Hz when the self-test was positive and initialization was OK.
		Is turned on when data is being communicated via the V-Bus.
BA	yellow	Off the self-test was positive and the initialization was OK.
		Blinks at 1Hz when the status is "Pre-operational".
		Is turned on when the status is "Operational".
		Blinks at 10Hz when the status is "Prepared".

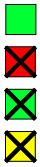
Status indicator as a combination of LEDs

Various combinations of the LEDs indicate the different operating states:

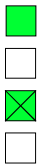
PW on	Error during RAM or EEPROM initialization
ER on	
RD on	
BA on	



PW on	Baudrate setting activated
ER blinks 1Hz	
RD blinks 1Hz	
BA blinks 1Hz	



PW on	Error in the CAN baudrate setting
ER blinks 10Hz	
RD blinks 10Hz	
BA blinks 10Hz	



PW on	Module-ID setting activated
ER off	
RD blinks 1Hz	
BA off	

Power supply

The CAN-bus coupler is equipped with an internal power supply. This power supply requires DC 24V. In addition to the internal circuitry of the bus coupler the supply voltage is also used to power any modules connected to the backplane bus. The "max. current drain at backplane bus" can be found in the Technical Data.

The power supply is protected against reverse polarity.

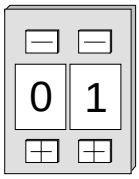
CAN-Bus and backplane bus are isolated from each other.

Attention!

Please ensure that the polarity is correct when connecting the power supply!

Address selector for Baudrate and module-ID

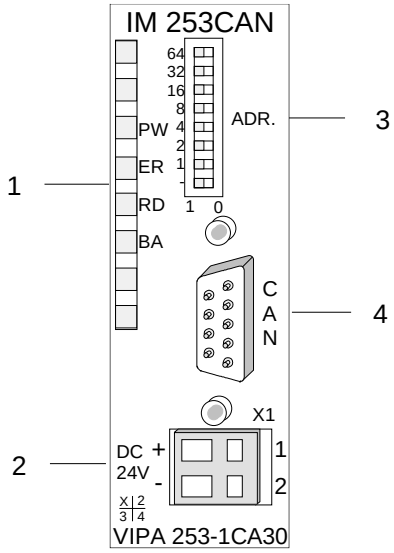
The address selector is used to specify the module-ID as well as the CAN baudrate. Each module ID must be unique on the bus.



For details, please refer to "Baudrate and module-ID".

Structure - 253-1CA30

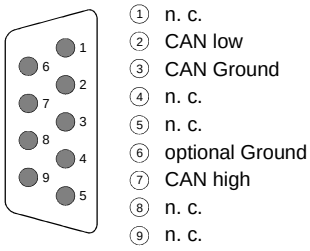
Front view
253-1CA30 - ECO



[1] LED status indicators
[2] Connector for an external 24V supply
[3] Address or baudrate selector (DIP switch)
[4] CAN-Bus plug

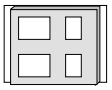
Interfaces

CAN



① n. c.
② CAN low
③ CAN Ground
④ n. c.
⑤ n. c.
⑥ optional Ground
⑦ CAN high
⑧ n. c.
⑨ n. c.

X1



\+ ① + DC 24 V
\- ② 0 V

9pin D-type plug

The VIPA CAN-Bus coupler is connected to the CAN-Bus system by means of a 9pin plug.

Power supply

The CAN-bus coupler is equipped with an internal power supply. This power supply requires DC 24V. In addition to the internal circuitry of the bus coupler the supply voltage is also used to power any modules connected to the backplane bus. The "max. current drain at backplane bus" can be found in the Technical Data.

The power supply is protected against reverse polarity.

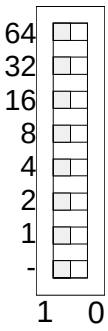
CAN-Bus and backplane bus are isolated from each other.

Attention!

Please ensure that the polarity is correct when connecting the power supply!

Address selector
IM 253CAN - ECO

The IM 253-1CA30 - ECO is equipped with a DIL switch for addressing.



LEDs

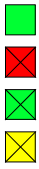
The module is equipped with four LEDs for diagnostic purposes.
The following table shows how the diagnostic LEDs are used along with the respective colors.

Name	Color	Description
PW	green	Indicates that the supply voltage is available.
ER	red	Blinks at overflow of the error counters (e.g. there is no further CAN station at the bus or wrong CAN transfer rate)
		On when an error was detected in the backplane bus communications.
RD	green	Blinks at 1Hz when the self-test was positive and initialization was OK.
		Is turned on when data is being communicated via the V-Bus.
BA	yellow	Off the self-test was positive and the initialization was OK.
		Blinks at 1Hz when the status is "Pre-operational".
		Is turned on when the status is "Operational".
		Blinks at 10Hz when the status is "Prepared".

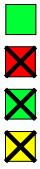
Status indicator as a combination of LEDs

Various combinations of the LEDs indicate the different operating states:

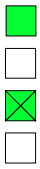
PW on	Error during RAM or EEPROM initialization
ER on	
RD on	
BA on	



PW on	Baudrate setting activated
ER blinks 1Hz	
RD blinks 1Hz	
BA blinks 1Hz	



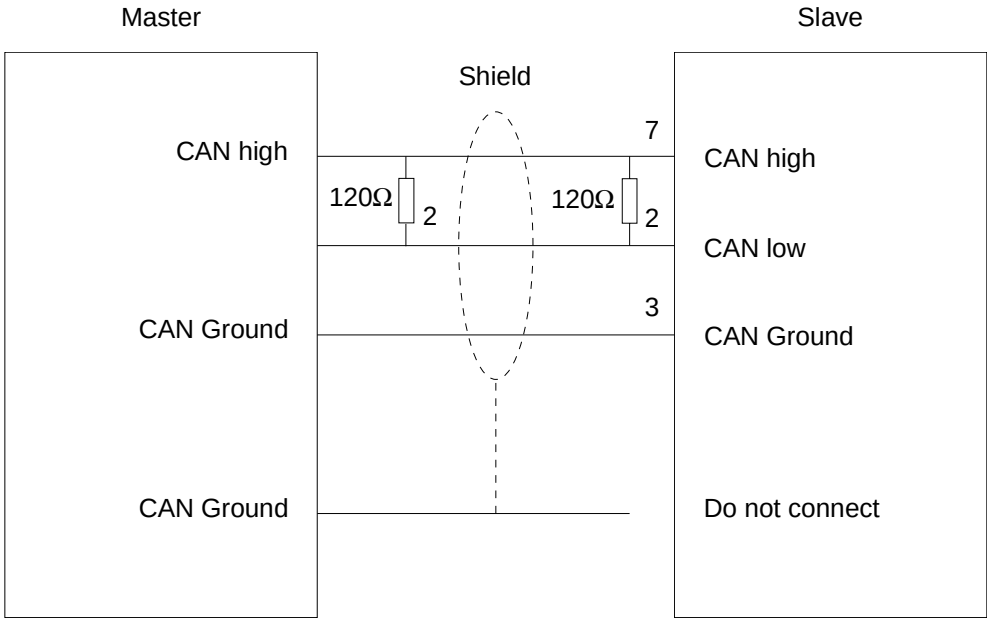
PW on	Error in the CAN baudrate setting
ER blinks 10Hz	
RD blinks 10Hz	
BA blinks 10Hz	



PW on	Module-ID setting activated
ER off	
RD blinks 1Hz	
BA off	

Wiring under CAN-Bus

The CAN-Bus communication medium bus is a screened three-core cable.



Line termination

All stations on systems having more than two stations are wired in parallel. This means that the bus cable must be looped from station to station without interruptions.

Note!

The end of the bus cable must be terminated with a 120Ω terminating resistor to prevent reflections and the associated communication errors!

Technical data

253-1CA01

Order number	253-1CA01
Type	IM 253CAN, CANopen slave
Technical data power supply	
Power supply (rated value)	DC 24 V
Power supply (permitted range)	DC 20.4...28.8 V
Reverse polarity protection	✓
Current consumption (no-load operation)	50 mA
Current consumption (rated value)	800 mA
Inrush current	65 A
I^2t	0.85 A^2s
Max. current drain at backplane bus	3.5 A
Max. current drain load supply	-
Power loss	2 W
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Supply voltage display	yes
Service Indicator	-
Group error display	yes
Channel error display	none
Hardware configuration	
Racks, max.	1
Modules per rack, max.	32
Number of digital modules, max.	32
Number of analog modules, max.	16
Communication	
Fieldbus	CANopen
Type of interface	CAN
Connector	Sub-D, 9-pin, male
Topology	Linear bus with bus termination at both ends
Electrically isolated	✓
Number of participants, max.	127
Node addresses	1 - 99
Transmission speed, min.	10 kbit/s
Transmission speed, max.	1 Mbit/s
Address range inputs, max.	80 Byte
Address range outputs, max.	80 Byte
Number of TxPDOs, max.	10
Number of RxPDOs, max.	10
Housing	
Material	PPE / PA 6.6
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	25.4 x 76 x 78 mm
Weight	100 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

253-1CA30

Order number	**253-1CA30**
Type	IM 253CAN, CANopen slave
Technical data power supply	
Power supply (rated value)	DC 24 V
Power supply (permitted range)	DC 20.4...28.8 V
Reverse polarity protection	✓
Current consumption (no-load operation)	50 mA
Current consumption (rated value)	300 mA
Inrush current	60 A
I^2t	0.4 A^2s
Max. current drain at backplane bus	0.8 A
Max. current drain load supply	-
Power loss	1.5 W
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Supply voltage display	yes
Service Indicator	-
Group error display	yes
Channel error display	none
Hardware configuration	
Racks, max.	1
Modules per rack, max.	8
Number of digital modules, max.	8
Number of analog modules, max.	8
Communication	
Fieldbus	CANopen
Type of interface	CAN
Connector	Sub-D, 9-pin, male
Topology	Linear bus with bus termination at both ends
Electrically isolated	✓
Number of participants, max.	127
Node addresses	1 - 99
Transmission speed, min.	10 kbit/s
Transmission speed, max.	1 Mbit/s
Address range inputs, max.	80 Byte
Address range outputs, max.	80 Byte
Number of TxPDOs, max.	10
Number of RxPDOs, max.	10
Housing	
Material	PPE / PA 6.6
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	25.4 x 76 x 78 mm
Weight	90 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

Chapter 3 Deployment

Overview

This chapter contains the description of the VIPA CANopen slave modules. Another section of this chapter concerns the project engineering for "experts" and an explanation of the telegram structure and the function codes of CANopen.
The description of the Emergency Object and NMT conclude the chapter.

Contents

Topic	Page
Chapter 3 Deployment	**3-1**
Basics CANopen	3-2
Fast introduction	3-4
Baudrate and module-ID	3-8
Message structure	3-9
PDO	3-11
SDO	3-15
Object directory	3-17
Emergency Object	3-58
NMT - network management	3-60

Basics CANopen

General

CANopen (**C**ontrol **A**rea **N**etwork) is an international standard for open fieldbus systems intended for building, manufacturing and process automation applications that was originally designed for automotive applications.

Due to its extensive error detection facilities, the CAN-Bus system is regarded as the most secure bus system. It has a residual error probability of less than $4.7x10^{-11}$. Bad messages are flagged and retransmitted automatically.

In contrast to PROFIBUS and Interbus, CAN defines under the CAL-level-7-protocol (CAL=**C**AN **a**pplication **l**ayer) defines various level-7 user profiles for the CAN-Bus. One standard user profile defined by the CIA (**C**AN **i**n **A**utomation) e.V. is CANopen.

CANopen

CANopen is a user profile for industrial real-time systems, which is currently supported by a large number of manufacturers. CANopen was published under the heading of DS-301 by the CAN in Automation association (CIA). The communication specifications DS-301 define standards for CAN devices. These specifications mean that the equipment supplied by different manufacturers is interchangeable. The compatibility of the equipment is further enhanced by the equipment specification DS-401 that defines standards for the technical data and process data of the equipment. DS-401 contains the standards for digital and analog input/output modules.

CANopen comprises a communication profile that defines the objects that must be used for the transfer of certain data as well as the device profiles that specify the type of data that must be transferred by means of other objects.

The CANopen communication profile is based upon an object directory that is similar to the profile used by PROFIBUS. The communication profile DS-301 defines two standard objects as well as a number of special objects:

- Process data objects (PDO)
  PDOs are used for real-time data transfers
- Service data objects (SDO)
  SDOs provide access to the object directory for read and write operations

Communication medium

CAN is based on a linear bus topology. You can use router nodes to construct a network. The number of devices per network is only limited by the performance of the bus driver modules.

The maximum distance covered by the network is determined by the runtimes of the signals. This means that a data rate of 1Mbaud limits the network to 40m and 80kBaud limits the network to 1000m.

The CAN-Bus communication medium employs a screened three-core cable (optionally a five-core).

The CAN-Bus operates by means of differential voltages. For this reason it is less sensitive to external interference than a pure voltage or current based interface. The network must be configured as a serial bus, which is terminated by a 120Ω terminating resistor.

Your VIPA CAN-Bus coupler contains a 9pin socket. You must use this socket to connect the CAN-Bus coupler as a slave directly to your CAN-Bus network.

All devices on the network use the same baudrate.

Due to the bus structure of the network it is possible to connect or disconnect any station without interruption to the system. It is therefore also possible to commission a system in various stages. Extensions to the system do not affect the operational stations. Defective stations or new stations are recognized automatically.

Bus access method

Bus access methods are commonly divided into controlled (deterministic) and uncontrolled (random) bus access systems.

CAN employs a Carrier-Sense Multiple Access (CSMA) method, i.e. all stations have the same right to access the bus as long as the bus is not in use (random bus access).

Data communications is message related and not station related. Every message contains a unique identifier, which also defines the priority of the message. At any instance only one station can occupy the bus for a message.

CAN-Bus access control is performed by means of a collision-free, bit-based arbitration algorithm. Collision-free means that the final winner of the arbitration process does not have to repeat his message. The station with the highest priority is selected automatically when more than one station accesses the bus simultaneously. Any station that is has information to send will delay the transmission if it detects that the bus is occupied.

Fast introduction

Outline

This section is for experienced CANopen user that are already common with CAN. It will be shortly outlined, which messages are necessary for the deployment of the System 200V under CAN in the start configuration.

Note!

Please regard that this manual prints the hexadecimal numbers in the type for developers "0x".

e.g.: **0x**15AE = 15AE**h**

Adjusting baudrate and module-ID

Via the address selector you have to adjust a common baudrate at the bus couplers as well as different node-IDs.

After starting your power supply, you program the baudrate and the module-ID via 00 at the address selector within 10s.

For details please refer to the section under the heading "Baudrate and module-ID" in this chapter.

CAN identifier

The CAN identifier for the in-/output data of the System 200V are generated from the node addresses (1...99):

Kind of data	Default CAN identifier	Kind of data	Default CAN identifier
digital inputs 1 ... 64Bit	0x180 + Node address	digital outputs 1 ... 64Bit	0x200 + Node address
analog inputs 1 ... 4 words	0x280 + Node address	analog outputs 1 ... 4 Words/Channels	0x300 + Node address
other digital or analog inputs	0x380 + Node address	other digital or analog outputs	0x400 + Node address
	0x480 + Node address		0x500 + Node address
	0x680 + Node address		0x780 + Node address
	0x1C0 + Node address		0x240 + Node address
	0x2C0 + Node address		0x340 + Node address
	0x3C0 + Node address		0x440 + Node address
	0x4C0 + Node address		0x540 + Node address
	0x6C0 + Node address		0x7C0 + Node address

Digital in-/outputs

The CAN messages with digital input data are represented as follows:

Identifier 0x180+Node address + up to 8Byte user data

Identifier 11Bit	**DI 0** 8Bit	**DI 1** 8Bit	**DI 2** 8Bit	**...**	**DI 7** 8Bit

The CAN messages with digital output data are represented as follows:

Identifier 0x200+Node address + up to 8Byte user data

Identifier 11Bit	**DO 0** 8Bit	**DO 1** 8Bit	**DO 3** 8Bit	**...**	**DO 7** Bit

Analog in-/outputs

The CAN messages with analog input data are represented as follows::

Identifier 0x280+Node address + up to 4Words user data

Identifier 11Bit	**AI 0** 1Word	**AI 1** 1Word	**AI 2** 1Word	**AI 3** 1Word

The CAN messages with analog output data are represented as follows:

Identifier 0x300+Node address + up to 4Words user data

Identifier 11Bit	**AI 0** 1Word	**AI 1** 1Word	**AI 2** 1Word	**AI 3** 1Word

Node Guarding

For the System 200V works per default in event-controlled mode (no cyclic DataExchange), a node failure is not always immediately detected. Remedy is the control of the nodes per cyclic state request (Node Guarding).

You request cyclically a state telegram via Remote-Transmit-Request (RTR): the telegram only consists of a 11Bit identifier:

Identifier 0x700+Node address

Identifier 11Bit

The System 200V node answers with a telegram that contains one state byte:

Identifier 0x700+Node address + State byte

Identifier 11Bit	**Status** 8Bit

Bit 0 ... 6: Node state
- 0x7F: Pre-Operational
- 0x05: Operational
- 0x04: Stopped res. Prepared

Bit 7: Toggle-Bit, toggles after every send

To enable the bus coupler to recognize a network master failure (watchdog function), you still have to set the Guard-Time (Object 0x100C) and the Life-Time-Factor (Object 0x100D) to values≠0.

(reaction time at failure: Guard-Time x Life Time Factor).

Heartbeat

Besides the Node Guarding, the System 200V CANopen coupler also supports the Heartbeat Mode.

If there is a value set in the index 0x1017 (Heartbeat Producer Time), the device state (Operational, Pre-Operational, ...) is transferred when the Heartbeat-Timer run out by using the COB identifier (0x700+Module-Id):

Identifier 0x700+Node address + State byte

Identifier 11Bit	**Status** 8Bit

The Heartbeat Mode starts automatically as soon as there is a value in index 0x1017 higher 0.

Emergency Object

To send internal device failures to other participants at the CAN-Bus with a high priority, the VIPA CAN-Bus coupler supports the Emergency Object.

To activate the emergency telegram, you need the **COB-Identifier** that is fixed after boot-up in the object directory of the variable 0x1014in hexadecimal view: **0x80 + Module-ID.**

The emergency telegram has always a length of 8Byte. It consists of:

Identifier 0x80 + Node address + 8Byte user data

Identifier 11Bit	**EC0**	**EC1**	**Ereg**	**Inf0**	**Inf1**	**Inf2**	**Inf3**	**Inf4**

Error Code	Meaning	Info 0	Info 1	Info 2	Info 3	Info4
0x0000	Reset Emergency	0x00	0x00	0x00	0x00	0x00
0x1000	Module Configuration has changed and Index 0x1010 is equal to 'save'	0x06	0x00	0x00	0x00	0x00
0x1000	Module Configuration has changed	0x05	0x00	0x00	0x00	0x00
0x1000	Error during initialization of backplane modules	0x01	0x00	0x00	0x00	0x00
0x1000	Error during module configuration check	0x02	Module Number	0x00	0x00	0x00
0x1000	Error during read/write module	0x03	Module Number	0x00	0x00	0x00
0x1000	Module parameterization error	0x30	Module Number	0x00	0x00	0x00
0x1000	Diagnostic alarm from an analog module	0x40 + Module Number	diagnostic byte 1	diagnostic byte 2	diagnostic byte 3	diagnostic byte 4
0x1000	Process alarm from an analog module	0x80 + Module Number	diagnostic byte 1	diagnostic byte 2	diagnostic byte 3	diagnostic byte 4

continued ...

... continue Emergency Object

Error Code	Meaning	Info 0	Info 1	Info 2	Info 3	Info4
0x1000	PDO Control	0xFF	0x10	PDO Number	LowByte Timer Value	HighByte Timer Value
0x5000	Module					
0x6300	SDO PDO-Mapping	LowByte MapIndex	HighByte MapIndex	No. Of Map Entries	0x00	0x00
0x8100	Heartbeat Consumer	Node ID	LowByte Timer Value	HighByte Timer Value	0x00	0x00
0x8100	SDO Block Transfer	0xF1	LowByte Index	HighByte Index	SubIndex	0x00
0x8130	Node Guarding Error	LowByte GuardTime	HighByte GuardTime	LifeTime	0x00	0x00
0x8210	PDO not processed due to length error	PDO Number	Wrong length	PDO length	0x00	0x00
0x8220	PDO length exceeded	PDO Number	Wrong length	PDO length	0x00	0x00

Note!

The now described telegrams enable you to start and stop the System 200V, read inputs, write outputs and control the modules.

In the following, the functions are described in detail.

Baudrate and module-ID

Overview

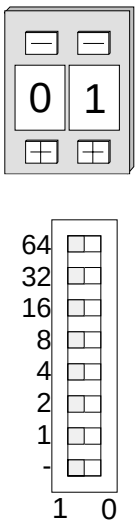
You have the option to specify the baudrate and the module-ID by setting the address selector to 00 within a period of 10s after you have turned the power on.

The selected settings are saved permanently in an EEPROM and can be changed at any time by means of the procedure shown above.

Specifying the baudrate by means of the address selector

- Set the address selector to 00.
- Turn on the power to the CAN-Bus coupler.

  The LEDs ER, RD, and BA will blink at a frequency of 1Hz. For a period of 5s you can now enter the CAN baudrate by means of the address selector:



Address selector	CAN baudrate	max. guar. bus distance
"00"	1MBaud	25m
"01"	500kBaud	100m
"02"	250kBaud	250m
"03"	125kBaud	500m
"04"	100kBaud	600m
"05"	50kBaud	1000m
"06"	20kBaud	2500m
"07"	10kBaud	5000m
"08"	800kBaud	50m

After 5 seconds the selected CAN baudrate is saved in the EEPROM.

Module-ID selection

- LEDs ER and BA are turned off and the red RD-LED continues to blink. At this point you have 5s to enter the required module-ID.
- Define the module-ID in a range between 01 ... 99 by means of the address selection switch. Every module-ID may only exist once on the bus. The module-ID must be defined before the bus coupler is turned on. The entered module-IDs are accepted when a period of 5s has expired after which the bus coupler returns to the normal operating mode (status: "Pre-Operational").

Baudrate selection by an SDO-write operation

You can also modify the CAN baudrate by means of an SDO-Write operation to the object "2001h". The entered value is used as the CAN baudrate when the bus coupler has been RESET. This method is a most convenient when you must change the CAN baudrate of all the bus couplers of a system from a central CAN terminal. The bus couplers use the programmed baudrate when the system has been RESET.

Message structure

Identifier

All CANopen messages have the following structure according to CiA DS-301:

Identifier

Byte	Bit 7 ... Bit 0
1	Bit 3 ... Bit 0: most significant 4 bits of the module-ID Bit 7 ... Bit 4: CANopen function code
2	Bit 3 ... Bit 0: data length code (DLC) Bit 4: RTR-Bit: 0: no data (request code) 1: data available Bit 7 ... Bit 5: Least significant 3 bits of the module-ID

Data

Data

Byte	Bit 7 ... Bit 0
3 ... 10	Data

An additional division of the 2Byte identifier into function portion and a module-ID gives the difference between this and a level 2 message. The function determines the type of message (object) and the module-ID addresses the receiver.

CANopen devices exchange data in the form of objects. The CANopen communication profile defines two different object types as well as a number of special objects.

The VIPA CAN-Bus coupler IM 253 CAN supports the following objects:

- 10 transmit PDOs (PDO Linking, PDO Mapping)
- 10 receive PDOs (PDO Linking, PDO Mapping)
- 2 standard SDOs
- 1 emergency object
- 1 network management object NMT
- Node Guarding
- Heartbeat

CANopen function codes

Every object is associated with a function code. You can obtain the required function code from the following table:

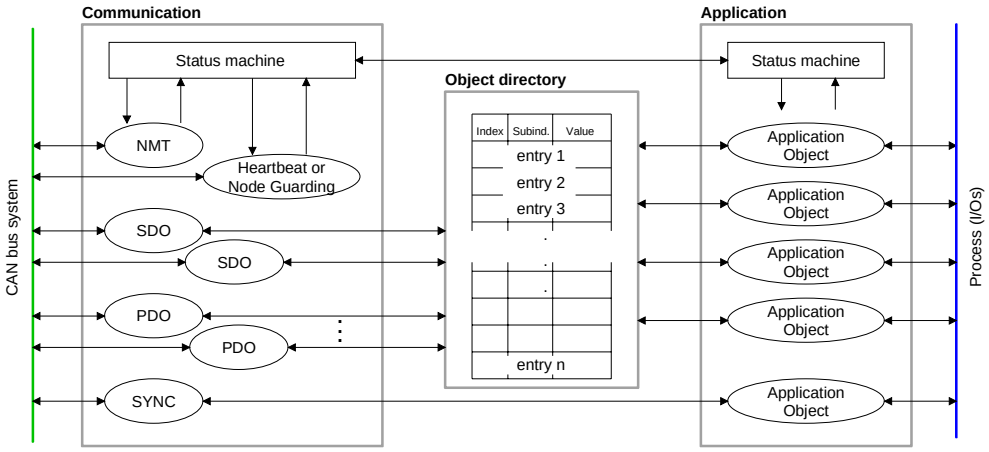
Object	Function code (4 bits)	Receiver	Definition	Function
NMT	0000	Broadcast	CiA DS-301	Network management
EMERGENCY	0001	Master	CiA DS-301	Error message
PDO1S2M	0011	Master, Slave (RTR)	CiA DS-301	Digital input data 1
PDO1M2S	0100	Slave	CiA DS-301	Digital output data 1
SDO1S2M	1011	Master	CiA DS-301	Configuration data
SDO1M2S	1100	Slave	CiA DS-301	Configuration data
Node Guarding	1110	Master, Slave (RTR)	CiA DS-301	Module monitoring
Heartbeat	1110	Master, Slave	Application spec.	Module monitoring

Note!

A detailed description of the structure and the contents of these objects is available in "CiA Communication Profile DS-301 Version 3.0" and "CiA Device Profile for I/O-Modules DS-401 Version 1.4".

Structure of the device model

A CANopen device can be structured as follows:



Communication

Serves the communication data objects and the concerning functionality for data transfer via the CANopen network.

Application

The application data objects contain e.g. in- and output data. In case of an error, an application status machine switches the outputs in a secure state.

The object directory is organized as 2 dimension table. The data is addressed via index and sub-index.

Object directory

This object directory contains all data objects (application data + parameters) that are accessible and that influence the behavior of communication, application and status machines.

PDO

PDO

In many fieldbus systems the whole process image is transferred - mostly more or less cyclically. CANopen is not limited to this communication principle, for CAN supports more possibilities through multi master bus access coordination.

CANopen divides the process data into segments of max. 8Byte. These segments are called **p**rocess **d**ata **o**bjects (PDOs). Every PDO represents one CAN telegram and is identified and prioritized via its specific CAN identifier.

For the exchange of process data, the VIPA CAN-Bus coupler IM 253CAN supports 20 PDOs. Every PDO consists of a maximum of 8 data bytes. The transfer of PDOs is not verified by means of acknowledgments since the CAN protocol guarantees the transfer.

There are 10 Tx transmit PDOs for input data and 10 Rx receive PDOs for output data. The PDOs are named seen from the bus coupler:

Receive PDOs (RxPDOs) are received by the bus coupler and contain output data.

Transmit PDOs (TxPDOs) are send by the bus coupler and contain input data.

The assignment of the PDOs to input or output data occurs automatically.

Variable PDO mapping

CANopen predefines the first two PDOs in the device profile. The assignment of the PDOs is fixed in the mapping tables in the object directory. The mapping tables are the cross-reference between the application data in the object directory and the sequence in the PDOs.

The assignment of the PDOs, automatically created by the coupler, are commonly adequate. For special applications, the assignment may be changed. Herefore you have to configure the mapping tables accordingly.

First, you write a 0 to sub-index 0 (deactivates the current mapping configuration). Then you insert the wanted application objects into sub-index 1 ... 8. Finally you parameterize the number of now valid entries in sub-index 0 and the coupler checks the entries for their consistency.

PDO identifier COB-ID

The most important communication parameter of a PDOs is the CAN identifier (also called "Communication Object Identifier", COB-ID). It serves the identification of the data and sets the priority of bus access.

For every CAN data telegram only one sending node may exist (producer). Due to the ability of CAN to send all messages per broadcast procedure, however, a telegram may be received by several bus participants at the same time (consumer). Therefore, one node may deliver its input information to different bus stations similarly - without needing the pass through a logical bus master.

The System 200V provides receive and transmit PDOs default identifier in dependence of the node address.

Below follows a list of the COB identifiers for the receive and the transmit PDO transfer that are pre-set after boot-up.

The transmission type in the object directory (indices 0x1400-0x1409 and 0x1800-0x1809, sub-index 0x02) is preset to asynchronous, event controlled (= 0xFF). The EVENT-timer (value * 1ms) can be used to transmit the PDOs cyclically.

Send:	0x180 + module-ID: PDO1S2M digital	(acc. DS-301)
	0x280 + module-ID: PDO2S2M analog	
	0x380 + module-ID: PDO3S2M digital or analog	
	0x480 + module-ID: PDO4S2M	
	0x680 + module-ID: PDO5S2M	
	0x1C0 + module-ID: PDO6S2M	
	0x2C0 + module-ID: PDO7S2M	
	0x3C0 + module-ID: PDO8S2M	
	0x4C0 + module-ID: PDO9S2M	
	0x6C0 + module-ID: PDO10S2M	
Receive:	0x200 + module-ID: PDO1M2S digital	(acc. DS-301)
	0x300 + module-ID: PDO2M2S analog	
	0x400 + module-ID: PDO3M2S digital or analog	
	0x500 + module-ID: PDO4M2S	
	0x780 + module-ID: PDO5M2S	
	0x240 + module-ID: PDO6M2S	
	0x340 + module-ID: PDO7M2S	
	0x440 + module-ID: PDO8M2S	
	0x540 + module-ID: PDO9M2S	
	0x7C0 + module-ID: PDO10M2S	

PDO linking

If the Consumer-Producer model of the CANopen PDOs shall be used for direct data transfer between nodes (without master), you have to adjust the identifier distribution accordingly, so that the TxPDO identifier of the producer is identical with the RxPDO identifier of the consumer:

This procedure is called PDO linking. this enables for example the simple installation of electronic gearing where several slave axis are listening to the actual value in TxPDO of the master axis.

PDO Communication types

CANopen supports the following possibilities for the process data transfer:

- Event triggered
- Polled
- Synchronized

Event triggered

The "event" is the alteration of an input value, the data is send immediately after value change. The event control makes the best use of the bus width for not the whole process image is send but only the changed values. At the same time, a short reaction time is achieved, because there is no need to wait for a master request.

Polled

PDOs may also be polled via data request telegrams (remote frames) to give you the opportunity to e.g. send the input process image of event triggered inputs to the bus without input change for example a monitoring or diagnosis device included during runtime.

The VIPA CANopen bus couplers support the query of PDOs via remote frames - for this can, due to the hardware, not be granted for all CANopen devices, this communication type is only partially recommended.

Synchronized

It is not only convenient for drive applications to synchronize the input information request and the output setting. For this purpose, CANopen provides the SYNC object, a CAN telegram with high priority and no user data which receipt is used by the synchronized nodes as trigger for reading of the inputs res. writing of the outputs.

PDO transmission type

The parameter "PDO transmission type" fixes how the sending of the PDOs is initialized and what to do with received ones:

Transmission Type	Cyclical	Acyclical	Synchronous	Asynchronous
0		x	x	
1 - 240	x		x	
254, 255				x

Synchronous

The transmission type 0 is only wise for RxPDOs: the PDO is analyzed at receipt of the next SYNC telegram.

At transmission type 1-240, the PDO is send res. expected cyclically: after every "n^{th}" SYNC (n=1 ... 240). For the transmission type may not only be combined within the network but also with a bus, you may thus e.g. adjust a fast cycle for digital inputs (n=1), while data of the analog inputs is transferred in a slower cycle (e.g. n=10). The cycle time (SYNC rate) may be monitored (Object 0x1006), at SYNC failure, the coupler sets its outputs in error state.

Asynchronous

The transmission types 254 + 255 are asynchronous or also event triggered. The transmission type 254 provides an event defined by the manufacturer, at 255 it is fixed by the device profile.

When choosing the event triggered PDO communication you should keep in mind that in certain circumstances there may occur a lot of events similarly. This may cause according delay times for sending PDOs with lower priority values.

You should also avoid to block the bus by assigning a high PDO priority to an often alternating input ("babbling idiot").

Inhibit time

Via the parameter "inhibit time" a "send filter" may be activated that does not lengthen the reaction time of the relatively first input alteration but that is active for the following changes.

The inhibit time (send delay time) describes the min. time span that has to pass between the sending of two identical telegrams.

When you use the inhibit time, you may ascertain the max. bus load and for this the latent time in the "worst case".

SDO

SDO

The **S**ervice **D**ata **O**bject (SDO) serves the read or write access to the object directory. The CAL layer 7 protocol gives you the specification of the Multiplexed-Domain-Transfer-Protocol that is used by the SDOs. This protocol allows you to transfer data of any length because where appropriate, messages are distributed to several CAN messages with the same identifier (segment building).

The first CAN message of the SDO contain process information in 4 of the 8 bytes. For access to object directory entries with up to 4Byte length, one single CAN message is sufficient. The following segments of the SDO contain up to 7Byte user data. The last Byte contains an end sign. A SDO is delivered with acknowledgement, i.e. every reception of a message is receipted.

The COB identifiers for read and write access are:

- Receive-SDO1: 0x600 + Module-ID
- Transmit-SDO1: 0x580 + Module-ID

Note!

A detailed description of the SDO telegrams is to find in the DS-301 norm from CiA.

In the following only the error messages are described that are generated at wrong parameterization.

SDO error codes

Code	Error
0x05030000	Toggle bit not alternated
0x05040000	SDO protocol timed out
0x05040001	Client/server command specifier not valid or unknown
0x05040002	Invalid block size (block mode only)
0x05040003	Invalid sequence number (block mode only)
0x05040004	CRC error (block mode only)
0x05040005	Out of memory
0x06010000	Unsupported access to an object
0x06010001	Attempt to read a write only object
0x06010002	Attempt to write a read only object
0x06020000	Object does not exist in the object dictionary
0x06040041	Object cannot be mapped to the PDO
0x06040042	The number and length of the objects to be mapped would exceed PDO length
0x06040043	General parameter incompatibility reason
0x06040047	General internal incompatibility in the device
0x06060000	Access failed due to an hardware error
0x06070010	Data type does not match, length of service parameter does not match
0x06070012	Data type does not match, length of service parameter too high
0x06070013	Data type does not match, length of service parameter too low
0x06090011	Sub-index does not exist
0x06090030	Value range of parameter exceeded (only for write access)
0x06090031	Value of parameter written too high
0x06090032	Value of parameter written too low
0x06090036	Maximum value is less than minimum value
0x08000000	general error
0x08000020	Data cannot be transferred or stored to the application
0x08000021	Data cannot be transferred or stored to the application because of local control
0x08000022	Data cannot be transferred or stored to the application because of the present device state
0x08000023	Object directory dynamic generation fails or no object directory is present (e.g. object directory is generated from file and generation fails because of an file error)

Object directory

Structure

The CANopen object directory contains all relevant CANopen objects for the bus coupler. Every entry in the object directory is marked by a 16Bit index.

If an object exists of several components (e.g. object type Array or Record), the components are marked via an 8Bit sub-index.

The object name describes its function. The data type attribute specifies the data type of the entry.

The access attribute defines, if the entry may only be read, only be written or read and written.

The object directory is divided into the following 3 parts:

Communication specific profile area (0x1000 – 0x1FFF)

This area contains the description of all relevant parameters for the communication.

0x1000 – 0x1018	General communication specific parameters (e.g. device name)
0x1400 – 0x140F	Communication parameters (e.g. identifier) of the receive PDOs
0x1600 – 0x160F	Mapping parameters of the receive PDOs The mapping parameters contain the cross-references to the application objects that are mapped into the PDOs and the data width of the depending object.
0x1800 – 0x180F 0x1A00 – 0x1A0F	Communication and mapping parameters of the transmit PDOs

Manufacturer specific profile area (0x2000 – 0x5FFF)

Here you may find the manufacturer specific entries like e.g. PDO Control, CAN baudrate (baudrate after RESET) etc..

Standardized device profile area (0x6000 – 0x9FFF)

This area contains the objects for the device profile acc. DS-401.

Note!

For the CiA norms are exclusively available in English, we adapted the object tables. Some entries are described below the according tables.

Object directory overview

Index		Content of Object
0x1000		Device type
0x1001		Error register
0x1003		Error store
0x1004		Number of PDOs
0x1005		SYNC identifier
0x1006		SYNC interval
0x1008		Device name
0x1009		Hardware version
0x100A		Software version
0x100B		Node number
0x100C		Guard time
0x100D		Life time factor
0x100E		Node Guarding Identifier
0x1010	X	Save parameter
0x1011	X	Load parameter
0x1014		Emergency COB-ID
0x1016	X	Heartbeat consumer time
0x1017	X	Heartbeat producer time
0x1018		Device identification
0x1027		Module list
0x1029		Error behavior
0x1400 - 0x1409	X	Communication parameter for receive PDOs (RxPDO, Master to Slave)
0x1600 - 0x1609	X	Mapping parameter for receive PDOs (RxPDO)
0x1800 - 0x1809	X	Communication parameter for transmit PDOs (TxPDO, Slave to Master)
0x1A00 - 0x1A09	X	Mapping parameter for transmit PDOs (TxPDO)
0x2001		CAN-Baudrate
0x2100		Kill EEPROM
0x2101		SJA1000
0x2400	X	PDO Control
0x3001 - 0x3010	X	Module Parameterization
0x3401	X	Module Parameterization
0x6000		Digital-Input-8-Bit Array (see DS 401)
0x6002	X	Polarity Digital-Input-8-Bit Array (see DS 401)
0x6100		Digital-Input-16-Bit Array (see DS 401)
0x6102		Polarity Digital-Input-16-Bit Array (v DS 401)
0x6120		Digital-Input-32Bit Array (see DS 401)
0x6122		Polarity Digital-Input-32-Bit Array (see DS 401)
0x6200		Digital-Output-8-Bit Array (see DS 401)
0x6202	X	Polarity Digital-Output-8-Bit Array (see DS 401)
0x6206	X	Fault Mode Digital-Output-8-Bit Array (see DS 401)
0x6207	X	Fault State Digital-Output-8-Bit Array (see DS 401)
0x6300		Digital-Output-16-Bit Array (see DS 401)

continue ...

... continued object directory overview

Index		Content of Object
0x6302		Polarity Digital-Output-16-Bit Array (see DS 401)
0x6306		Fault Mode Digital-Output-16-Bit Array (see DS 401)
0x6307		Fault State Digital-Output-16-Bit Array (see DS 401)
0x6320		Digital-Output-32-Bit Array (see DS 401)
0x6322		Polarity Digital-Output-32-Bit Array (see DS 401)
0x6326		Fault Mode Digital-Output-32-Bit Array (see DS 401)
0x6327		Fault State Digital-Output-32-Bit Array (see DS 401)
0x6401		Analog-Input Array (see DS 401)
0x6411		Analog-Output Array (see DS 401)
0x6421	X	Analog-Input Interrupt Trigger Array (see DS 401)
0x6422		Analog-Input Interrupt Source Array (see DS 401)
0x6423	X	Analog-Input Interrupt Enable (see DS 401)
0x6424	X	Analog-Input Interrupt Upper Limit Array (see DS 401)
0x6425	X	Analog-Input Interrupt Lower Limit Array (see DS 401)
0x6426	X	Analog-Input Interrupt Delta Limit Array (see DS 401)
0x6443	X	Fault Mode Analog-Output Array (see DS 401)
0x6444	X	Fault State Analog-Output Array (see DS 401)

X = save into EEPROM

Device Type

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1000	0	Device Type	Unsigned32	ro	N	0x00050191	Statement of device type

The 32Bit value is divided into two 16Bit fields:

MSB	LSB
Additional information device	**Profile number**
0000 0000 0000 wxyz (bit)	401dec=0x0191

The "additional information" contains data related to the signal types of the I/O device:

z=1 → digital inputs

y=1 → digital outputs

x=1 → analog inputs

w=1 → analog outputs

Error register

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1001	0	Error Register	Unsigned8	ro	Y	0x00	Error register

Bit7							**Bit0**
ManSpec	reserved	reserved	Comm.	reserved	reserved	reserved	Generic

ManSpec.: Manufacturer specific error, specified in object 0x1003.

Comm.: Communication error (overrun CAN)

Generic: A not more precisely specified error occurred (flag is set at every error message)

Error store

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1003	0	Predefined error field (error store)	Unsigned8	ro	N	0x00	Object 0x1003 contains a description of the error that has occurred in the device - sub-index 0 has the number of error states stored
	1	Actual error	Unsigned32	ro	N		Last error state to have occurred
	...	...	...	...	...	...	...
	254		Unsigned32	ro	N		A maximum of 254 error states

The "predefined error field" is divided into two 16Bit fields:

MSB	LSB
Additional information	**Error code**

The additional code contains the error trigger (see emergency object) and thereby a detailed error description.

New errors are always saved at sub-index 1, all the other sub-indices being appropriately incremented.

By writing a "0" to sub-index 0, the whole error memory is cleared. If there has not been an error since PowerOn, then object 0x1003 exists only of sub-index 0 with entry "0".

Via reset or PowerCycle, the error memory is cleared.

Number of PDOs

Index	Sub index	Name	Type	Attr.	Map.	Default value	Meaning
0x1004	0	Number of PDOs supported	Unsigned32	ro	N	0x000A000A	Number of PDOs supported
	1	Number of synchronous PDOs supported	Unsigned32	ro	N	0x000A000A	Number of synchronous PDOs supported
	2	Number of asynchronous PDOs supported	Unsigned32	ro	N	0x000A000A	Number of asynchronous PDOs supported

The 32Bit value is divided into two 16Bit fields:

MSB	LSB
Number of receive (Rx)PDOs supported	**Number of send (Tx)PDOs supported**

SYNC identifier

Index	Sub index	Name	Type	Attr.	Map.	Default value	Meaning
0x1005	0	COB-Id sync message	Unsigned32	ro	N	0x80000080	Identifier of the SYNC message

The lower 11Bit of the 32Bit value contain the identifier (0x80=128dez), while the MSBit indicates whether the device receives the SYNC telegram (1) or not (0).

Attention: In contrast to the PDO identifiers, the MSB being set indicates that this identifier is relevant for the node.

SYNC interval

Index	Sub index	Name	Type	Attr.	Map.	Default value	Meaning
0x1006	0	Communication cycle period	Unsigned32	rw	N	0x00000000	Maximum length of the SYNC interval in µs.

If a value other than zero is entered here, the coupler goes into error state if no SYNC telegram is received within the set time during synchronous PDO operation.

Synchronous Window Length

Index	Sub index	Name	Type	Attr.	Map.	Default value	Meaning
0x1007	0	Synchronous window length	Unsigned32	rw	N	0x00000000	Contains the length of time window for synchronous PDOs in µs.

Device name

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1008	0	Manufacturer device name	Visible string	ro	N		Device name of the bus coupler

VIPA IM 253 1CA01 = VIPA CANopen slave IM 253-1CA01

VIPA IM 253 1CA30 = VIPA CANopen slave IM 253-1CA30 - ECO

Since the returned value is longer than 4Byte, the segmented SDO protocol is used for transmission.

Hardware version

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1009	0	Manufacturer Hardware version	Visible string	ro	N		Hardware version number of bus coupler

VIPA IM 253 1CA01 = 1.00
VIPA IM 253 1CA30 = 1.00

Since the returned value is longer than 4Byte, the segmented SDO protocol is used for transmission.

Software version

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x100A	0	Manufacturer Software version	Visible string	ro	N		Software version number CANopen software

VIPA IM 253 1CA01 = 3.xx
VIPA IM 253 1CA30 = 3.xx

Since the returned value is longer than 4Byte, the segmented SDO protocol is used for transmission.

Node number

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x100B	0	Node ID	Unsigned32	ro	N	0x00000000	Node number

The node number is supported for reasons of compatibility.

Guard time

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x100C	0	Guard time [ms]	Unsigned16	rw	N	0x0000	Interval between two guard telegrams. Is set by the NMT master or configuration tool.

Life time factor

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x100D	0	Life time factor	Unsigned8	rw	N	0x00	Life time factor x guard time = life time (watchdog for life guarding)

If a guarding telegram is not received within the life time, the node enters the error state. If the life time factor and/or guard time =0, the node does not carry out any life guarding, but can itself be monitored by the master (node guarding).

Guarding identifier

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x100E	0	COB-ID Guarding Protocol	Unsigned32	ro	N	0x000007xy, xy = node ID	Identifier of the guarding protocol

Save parameters

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1010	0	Store Parameter	Unsigned8	ro	N	0x01	Number of store Options
	1	Store all parameters	Unsigned32	ro	rw	0x01	Stores all (storable) Parameters

By writing the string "save" in ASCII code (hex code: 0x65766173) into sub-index 1, the current parameters are placed into non-volatile storage (byte sequence at the bus incl. SDO protocol: 0x23 0x10 0x10 0x01 0x73 0x61 0x76 0x65).

If successful, the storage process is confirmed by the corresponding TxSDO (0x60 in the first byte).

Note!

For the bus coupler is not able to send or receive CAN telegrams during the storage procedure, storage is only possible when the node is in pre-operational state.

It is recommended to set the complete net to the pre-operational state before storing data to avoid a buffer overrun.

Load default values

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1011	0	Restore parameters	Unsigned8	ro	N	0x01	Number of reset options
	1	Restore all parameters	Unsigned32	rw	N	0x01	Resets all parameters to their default values

By writing the string "load" in ASCII code (hex code: 0x64616F6C) into sub-index 1, all parameters are set back to default values (delivery state) **at next start-up (reset)** (byte sequence at the bus incl. SDO protocol: 0x23 0x11 0x10 0x01 0x6C 0x6F 0x61 0x64).

This activates the default identifiers for the PDOs.

Emergency COB-ID

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1014	0	COB-ID Emergency	Unsigned32	ro	N	0x00000080 + Node_ID	Identifier of the emergency telegram

Consumer heartbeat time

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1016	0	Consumer heartbeat time	Unsigned8	ro	N	0x05	Number of entries
	1		Unsigned32	rw	N	0x00000000	Consumer heartbeat time

Structure of the "Consumer Heartbeat Time" entry:

Bits	31-24	23-16	15-0
Value	Reserved	Node-ID	Heartbeat time
Encoded as	Unsigned8	Unsigned8	Unsigned16

As soon as you try to configure a consumer heartbeat time unequal zero for the same node-ID, the node interrupts the SDO download and throws the error code 0604 0043hex.

Producer heartbeat time

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1017	0	Producer heartbeat time	Unsigned16	rw	N	0x0000	Defines the cycle time of heartbeat in ms

Identity Object

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1018	0	Identity Object	Unsigned8	ro	N	0x04	Contains general information about the device (number of entries)
	1	Vendor ID	Unsigned32	ro	N	0xAFFEAFFE	Vendor ID
	2	Product Code	Unsigned32	ro	N	*	Product Code
	3	Revision Number	Unsigned32	ro	N		Revision Number
	4	Serial Number	Unsigned32	ro	N		Serial Number

*) Default value Product Code: at 253-1CA01: 0x2531CA01
at 253-1CA30: 0x2531CA30

Modular Devices

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1027	0	Number of connected modules	Unsigned8	ro	N		Contains general information about the device (number of entries)
	1	Module 1	Unsigned16	ro	N		Identification number of Module 1
	...	...	...	...	...	...	...
	N	Module N	Unsigned16	ro	N		Identification number of Module N

Module types

Module type	Identification (hex)	No. of Digital Input-Byte	No. of Digital Output-Byte
DI 8	9FC1h	1	-
DI 8 - Alarm	1FC1h	1	-
DI 16	9FC2h	2	-
DI 16 / 1C	08C0h	6	6
DI 32	9FC3h	4	-
DO 8	AFC8h	-	1
DO 16	AFD0h	-	2
DO 32	AFD8h	-	4
DIO 8	BFC9h	1	1
DIO 16	BFD2h	2	2
AI2	15C3h	4	-
AI4	15C4h	8	-
AI4 - fast	11C4h	8	-
AI8	15C5h	16	-
AO2	25D8h	-	4
AO4	25E0h	-	8
AO8	25E8h	-	16
AI2 / AO2	45DBh	4	4
AI4 / AO2	45DCh	8	4
SM 238	45DCh 38C4h	8 16	4 16
CP 240	1CC1h	16	16
FM 250	B5F4h	10	10
FM 250-SSI	B5DBh	4	4
FM 253, FM 254	18CBh	16	16

Error Behavior

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1029	0	Error behavior	Unsigned8	ro	N	0x02	Number of Error Classes
	1	Communication Error	Unsigned8	ro	N	0x00	Communication Error
	2	Manufacturer specific error	Unsigned8	ro	N	0x00	Manufacturer specific error

As soon as a device failure is detected in "operational" state, the module should automatically change into the "pre-operational" state.

If e.g. an "Error behavior" is implemented, the module may be configured that its going into STOP at errors.

The following error classes may be monitored:

0 = pre-operational

1 = no state change

2 = stopped

3 = reset after 2 seconds

Communication parameter RxPDO1

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1400	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000200 + NODE_ID	COB-ID RxPDO1
	2	Transmis-sion type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Sub-index 1 (COB-ID): The lower 11Bit of the 32Bit value (Bits 0-10) contain the CAN identifier, the MSBit (Bit 31) shows if the PDO is active (0) or not (1), Bit 30 shows if a RTR access to this PDO is permitted (0) or not (1).

The sub-index 2 contains the transmission type.

Communication parameter RxPDO2

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1401	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000300 + NODE_ID	COB-ID RxPDO2
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Communication parameter RxPDO3

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1402	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000400 + NODE_ID	COB-ID RxPDO3
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Communication parameter RxPDO4

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1403	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000500 + NODE_ID	COB-ID RxPDO4
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Communication parameter RxPDO5

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1404	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000780 + NODE_ID	COB-ID RxPDO5
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Communication parameter RxPDO6

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1405	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000240 + NODE_ID	COB-ID RxPDO6
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Communication parameter RxPDO7

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1406	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000340 + NODE_ID	COB-ID RxPDO7
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Communication parameter RxPDO8

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1407	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000440 + NODE_ID	COB-ID RxPDO8
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Communication parameter RxPDO9

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1408	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000540 + NODE_ID	COB-ID RxPDO9
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Communication parameter RxPDO10

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1409	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC00007C0 + NODE_ID	COB-ID RxPD10
	2	transm. type	Unsigned8	rw	N	0xFF	Transmission type of the PDO

Mapping RxPDO1

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1600	0	Number of Elements	Unsigned8	rw	N	0x01	Mapping parameter of the first receive PDO; sub-index 0: number of mapped objects
	1	1st mapped object	Unsigned32	rw	N	0x62000108	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	2	2nd mapped object	Unsigned32	rw	N	0x62000208	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8th mapped	Unsigned32	rw	N	0x62000808	(2 byte index, 1 byte sub-index, 1 byte bit-width)

The first receive PDO (RxPDO1) is per default for the digital outputs. Depending on the number of the inserted outputs, the needed length of the PDO is calculated and mapped into the according objects.

For the digital outputs are organized in bytes, the length of the PDO can be directly seen in sub-index 0.

If the mapping is changed, the entry in sub-index 0 has to be adjusted accordingly.

Mapping RxPDO2

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1601	0	Number of Elements	Unsigned8	rw	N	0x01	Mapping parameter of the second receive PDO; sub-index 0: number of mapped objects
	1	1st mapped object	Unsigned32	rw	N	0x64110110	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	2	2nd mapped object	Unsigned32	rw	N	0x64110210	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8th mapped	Unsigned32	rw	N	0x00000000	(2 byte index, 1 byte sub-index, 1 byte bit-width)

The 2. receive PDO (RxPDO2) is per default for the analog outputs. Depending on the number of the inserted outputs, the needed length of the PDO is calculated and the according objects are mapped.

For the digital outputs are organized in words, the length of the PDO can be directly seen in sub-index 0.

If the mapping is changed, the entry in sub-index 0 has to be adjusted accordingly.

Mapping RxPDO3-RxPDO10

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1602 - 0x1609	0	Number of Elements	Unsigned8	rw	N	0x01	Mapping parameter of the 3rd to 10th receive PDO; sub-index 0: number of mapped objects
	1	1st mapped object	Unsigned32	rw	N	0x00000000	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	2	2 nd mapped object	Unsigned32	rw	N	0x00000000	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8th mapped	Unsigned32	rw	N	0x00000000	(2 byte index, 1 byte sub-index, 1 byte bit-width)

The receive PDOs 3 to 10 (RxPDO3) get an automatic default mapping via the coupler depending from the connected terminals. The procedure is described under "PDO mapping".

Communication parameter TxPDO1

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1800	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter of the first transmit PDO, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0x80000180 + NODE_ID	COB-ID TxPDO1
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Sub-index 1 (COB-ID): The lower 11Bit of the 32Bit value (Bits 0-10) contain the CAN identifier, the MSBit (Bit 31) shows if the PDO is active (0) or not (1), Bit 30 shows if a RTR access to this PDO is permitted (0) or not (1). The sub-index 2 contains the transmission type, sub-index 3 the repetition delay time between two equal PDOs. If an event timer exists with a value unequal 0, the PDO is transmitted when the timer exceeds.

If a inhibit timer exists, the event is delayed for this time.

Communication parameter TxPDO2

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1801	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter of the second transmit PDO, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0x80000280 + NODE_ID	COB-ID TxPDO2
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Communication parameter TxPDO3

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1802	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter for the 3rd transmit PDO.
	1	COB-ID	Unsigned32	rw	N	0x80000380 + NODE_ID	COB-ID TxPDO3
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Communication parameter TxPDO4

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1803	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter for the 4th transmit PDO.
	1	COB-ID	Unsigned32	rw	N	0x80000480 + NODE_ID	COB-ID TxPDO4
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Communication parameter TxPDO5

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1804	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter for the 5th transmit PDO.
	1	COB-ID	Unsigned32	rw	N	0x80000680 + NODE_ID	COB-ID TxPDO5
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Communication parameter TxPDO6

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1805	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter for the 6th transmit PDO.
	1	COB-ID	Unsigned32	rw	N	0x800001C0 + NODE_ID	COB-ID TxPDO6
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Communication parameter TxPDO7

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1806	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter for the 7th transmit PDO.
	1	COB-ID	Unsigned32	rw	N	0x800002C0 + NODE_ID	COB-ID TxPDO7
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Communication parameter TxPDO8

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1807	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter for the 8th transmit PDO.
	1	COB-ID	Unsigned32	rw	N	0x800003C0 + NODE_ID	COB-ID TxPDO8
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Communication parameter TxPDO9

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1808	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter for the 9th transmit PDO.
	1	COB-ID	Unsigned32	rw	N	0x800004C0 + NODE_ID	COB-ID TxPDO9
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Communication parameter TxPDO10

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1809	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter for the 10th transmit PDO.
	1	COB-ID	Unsigned32	rw	N	0x800006C0 + NODE_ID	COB-ID TxPDO10
	2	Transmission type	Unsigned8	rw	N	0xFF	Transmission type of the PDO
	3	Inhibit time	Unsigned16	rw	N	0x0000	Repetition delay [value x 100 µs]
	5	Event time	Unsigned16	rw	N	0x0000	Event timer [value x 1 ms]

Mapping TxPDO1

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1A00	0	Number of Elements	Unsigned8	rw	N	depending on the components fitted	Mapping parameter of the first transmit PDO; sub-index 0: number of mapped objects
	1	1st mapped object	Unsigned32	rw	N	0x60000108	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	2	2nd mapped object	Unsigned32	rw	N	0x60000208	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8th mapped object	Unsigned32	rw	N	0x60000808	(2 byte index, 1 byte sub-index, 1 byte bit-width)

continue ...

... continue Mapping TxPD01

The first send PDO (TxPDO1) is per default for digital inputs. Depending on the number of the inserted inputs, the needed length of the PDO is calculated and the according objects are mapped.

For the digital inputs are organized in bytes, the length of the PDO can be directly seen in sub-index 0.

If the mapping is changed, the entry in sub-index 0 has to be adjusted accordingly.

Mapping TxPDO2

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1A01	0	Number of Elements	Unsigned8	rw	N	depending on the components fitted	Mapping parameter of the second transmit PDO; sub-index 0: number of mapped objects
	1	1st mapped object	Unsigned32	rw	N	0x64010110	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	2	2nd mapped object	Unsigned32	rw	N	0x64010210	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8th mapped object	Unsigned32	rw	N	0x00000000	(2 byte index, 1 byte sub-index, 1 byte bit-width)

The 2nd send PDO (RxPDO2) is per default for the analog inputs. Depending on the number of the inserted outputs, the needed length of the PDO is calculated and the according objects are mapped.

For the digital outputs are organized in words, the length of the PDO can be directly seen in sub-index 0.

If the mapping is changed, the entry in sub-index 0 has to be adjusted accordingly.

Mapping TxPDO3-TxPDO10

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1A02 - 0x1A09	0	Number of Elements	Unsigned8	rw	N	depending on the components fitted	Mapping parameter of the 3rd to 10 th transmit PDO; sub-index 0: number of mapped objects
	1	1st mapped object	Unsigned32	rw	N	0x00000000	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	2	2nd mapped object	Unsigned32	rw	N	0x00000000	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8th mapped object	Unsigned32	rw	N	0x000000000	(2 byte index, 1 byte sub-index, 1 byte bit-width)

The send PDOs 3 to 10 (RxPDO3) get an automatic default mapping via the coupler depending from the connected terminals. The procedure is described under "PDO mapping".

CAN baudrate

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2001	0	CAN-Baudrate	Unsigned8	rw	N	0x01	Setting CAN-Baudrate

This index entry writes a new baudrate into the EEPROM.

At the next start-up (reset) the CAN coupler starts with the new baudrate.

Value	CAN baudrate
"00"	1MBaud
"01"	500kBaud
"02"	250kBaud
"03"	125kBaud
"04"	100kBaud
"05"	50kBaud
"06"	20kBaud
"07"	10kBaud
"08"	800kBaud

KILL EEPROM

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2100	0	KILL EEPROM	Boolean	wo	N		KILL EEPROM

The KILL EEPROM is supported for reasons of compatibility.

Writing to index 0x2100 deletes all stored identifiers from the EEPROM.

The CANopen coupler start **at the next start-up (reset)** with the default configuration.

SJA1000
Message Filter

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2101	0	Number of Elements	Unsigned8	ro	N	0x02	SJA1000 Message Filter
	1	Acceptance mask	Unsigned8	ro	N		Acceptance mask
	2	Acceptance code	Unsigned8	ro	N		Acceptance code

With the help of the acceptance filter, the CAN controller is able to allow passing of received messages to the RXFIFO only when the identifier bits of the received message are equal to the predefined ones within the acceptance filter. The acceptance filter is defined via the acceptance code register and the acceptance mask register.

These filters are updated after start-up and communication reset.

Acceptance mask: The acceptance mask register qualifies which of the corresponding bits of the acceptance code are relevant (AM.X = 0) and which ones are ‘don’t care’ (AM.X = 1) for acceptance filtering.

Acceptance code: The acceptance code bits (AC.7 to AC.0) and the eight most significant bits of the message identifier (ID.10 to ID.3) have to be in the same bit positions which are marked as relevant by the acceptance mask bits (AM.7 to AM.0). If the following condition is fulfilled, the messages are accepted:

$0(ID.10 \text{ to } ID.3) \equiv (AC.7 \text{ to } AC.0)] \vee (AM.7 \text{ to } AM.0) \equiv 11111111$

PDO control

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2400	0	Number of Elements	Unsigned8	ro	N	0x0A	Time control for RxPDOs
	1	RxPDO1	Unsigned16	rw	N	0x0000	Timer value [ms]
	2	RxPDO2	Unsigned16	rw	N	0x0000	Timer value [ms]
	...	...	...	...	...	...	...
	10	RxPDO10	Unsigned16	rw	N	0x0000	Timer value [ms]

The control starts as soon as the timer is unequal 0. Every received RxPDO resets the timer. When the timer has been expired, the CAN coupler switches into the state "pre-operational" and sends an emergency telegram.

Module Parameterization

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x3001 - 0x3010	0	Number of Elements	Unsigned8	ro	N	0x04 or 0x00	Number of entries 0x04 : module available 0x00 : no module available
	1	Prm 0 to 3	Unsigned32	rw	N	depending on the compo-nents fitted	Parameter bytes 0 to 3
	2	Prm 4 to 7	Unsigned32	rw	N	depending on the compo-nents fitted	Parameter bytes 4 to 7
	3	Prm 8 to 11	Unsigned32	rw	N	depending on the compo-nents fitted	Parameter bytes 8 to 11
	4	Prm 12 to 15	Unsigned32	rw	N	depending on the compo-nents fitted	Parameter bytes 12 to 15

Via the indices 0x3001 to 0x3010 you may parameterize the analog modules, counter and communication modules.

Default configuration

AI4	0x00, 0x00, 0x28, 0x28, 0x28, 0x28, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
AI8	0x00, 0x00, 0x26, 0x26, 0x26, 0x26, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
AO4	0x00, 0x00, 0x09, 0x09, 0x09, 0x09, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
AI/AO	0x00, 0x00, 0x09, 0x09, 0x09, 0x09, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
CP 240	0x00, 0x00, 0x00, 0x00, 0x00, 0x13, 0x06, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
FM 250	0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
FM 254	0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00

Example 1 **Set AI4 to mode 0x2C**

Read default configuration

Read SubIndex 0 M2S: 0x40 0x01 0x30 0x00 0x00 0x00 0x00 0x00
S2M: 0x4F 0x01 0x30 0x00 0x04 0x00 0x00 0x00
Read SubIndex 1 M2S: 0x40 0x01 0x30 0x01 0x00 0x00 0x00 0x00
S2M: 0x43 0x01 0x30 0x01 0x00 0x00 0x28 0x28
Read SubIndex 2 M2S: 0x40 0x01 0x30 0x02 0x00 0x00 0x00 0x00
S2M: 0x43 0x01 0x30 0x02 0x28 0x28 0x00 0x00
Read SubIndex 3 M2S: 0x40 0x01 0x30 0x03 0x00 0x00 0x00 0x00
S2M: 0x43 0x01 0x30 0x03 0x00 0x00 0x00 0x00
Read SubIndex 4 M2S: 0x40 0x01 0x30 0x04 0x00 0x00 0x00 0x00
S2M: 0x43 0x01 0x30 0x04 0x00 0x00 0x00 0x00

Write new configuration

Write SubIndex 1 M2S: 0x23 0x01 0x30 0x01 0x00 0x00 0x2C 0x2C
S2M: 0x60 0x01 0x30 0x01 0x00 0x00 0x00 0x00
Write SubIndex 2 M2S: 0x23 0x01 0x30 0x02 0x2C 0x2C 0x00 0x00
S2M: 0x60 0x01 0x30 0x02 0x00 0x00 0x00 0x00

Read new configuration

Read SubIndex 0 M2S: 0x40 0x01 0x30 0x00 0x00 0x00 0x00 0x00
S2M: 0x4F 0x01 0x30 0x00 0x04 0x00 0x00 0x00
Read SubIndex 1 M2S: 0x40 0x01 0x30 0x01 0x00 0x00 0x00 0x00
S2M: 0x43 0x01 0x30 0x01 0x00 0x00 0x2C 0x2C
Read SubIndex 2 M2S: 0x40 0x01 0x30 0x02 0x00 0x00 0x00 0x00
S2M: 0x43 0x01 0x30 0x02 0x2C 0x2C 0x00 0x00
Read SubIndex 3 M2S: 0x40 0x01 0x30 0x03 0x00 0x00 0x00 0x00
S2M: 0x43 0x01 0x30 0x03 0x00 0x00 0x00 0x00
Read SubIndex 4 M2S: 0x40 0x01 0x30 0x04 0x00 0x00 0x00 0x00
S2M: 0x43 0x01 0x30 0x04 0x00 0x00 0x00 0x00

Example 2 **Set FM250 to Counter Mode 0x08 and 0x0B**

Read default configuration

Read SubIndex 0	M2S: 0x40 0x02 0x30 0x00 0x00 0x00 0x00 0x00
	S2M: 0x4F 0x02 0x30 0x00 0x04 0x00 0x00 0x00
Read SubIndex 1	M2S: 0x40 0x02 0x30 0x01 0x00 0x00 0x00 0x00
	S2M: 0x43 0x02 0x30 0x01 0x00 0x00 0x00 0x00

Write new configuration

Write SubIndex 1	M2S: 0x23 0x02 0x30 0x01 0x08 0x0B 0x00 0x00
	S2M: 0x60 0x02 0x30 0x01 0x00 0x00 0x00 0x00

Read new configuration

Read SubIndex 0	M2S: 0x40 0x02 0x30 0x00 0x00 0x00 0x00 0x00
	S2M: 0x4F 0x02 0x30 0x00 0x04 0x00 0x00 0x00
Read SubIndex 1	M2S: 0x40 0x02 0x30 0x01 0x00 0x00 0x00 0x00
	S2M: 0x43 0x02 0x30 0x01 0x08 0x0B 0x00 0x00

Module parameterization

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x3401	0x00	Number of Elements	Unsigned8	ro	N	depending on the components fitted	Number of entries
	0x01	1st mapped object	Unsigned32	rw	N		
	...	...	...	...	...	...	
	0x40	8th mapped object	Unsigned32	rw	N		

The index 0x3401 is supported for reasons of compatibility.

Use index 3001 to 3010 for new projects. Alternative options to write/read analog parameters:

Sub-index 0…0x40 (256 bytes):

Sub-index 0: number of sub-indices

Sub-index 1: parameter byte 0 ... 3

...

Sub-index 0x20: parameter byte 124 ... 127

Every sub-index consists of 2 data words. Enter your parameter bytes here. Every analog input or output module has 16Byte parameter data, i.e. they occupy 4 sub-indices, e.g.:

1. analog module sub-indices 1 to 4,
2. analog module sub-indices 5 to 8,
3. analog module sub-indices 9 to 12.

8bit digital inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6000	0x00	8bit digital input block	Unsigned8	ro	N	0x01	Number of available digital 8bit input blocks
	0x01	1st input block	Unsigned8	ro	Y		1st digital input block
	...	...	...	...	...	...	...
	0x48	72nd input block	Unsigned8	ro	Y		72nd digital input block

8bit polarity digital inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6002	0x00	8bit digital input block	Unsigned8	ro	N	0x01	Number of available digital 8bit input blocks
	0x01	1st input block	Unsigned8	rw	N	0x00	1st polarity digital input block
	...	...	...	...	...	...	...
	0x48	72nd input block	Unsigned8	rw	N	0x00	72nd polarity digital input block

Individual inverting of input polarity:

1 = input inverted
0 = input not inverted

16bit digital inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6100	0x00	16bit digital input block	Unsigned8	ro	N	depending on the fitted components	Number of available digital 16bit input blocks
	0x01	1st input block	Unsigned16	ro	N		1st digital input block
	...	...	...	...	...	...	...
	0x24	36nd input block	Unsigned16	ro	N		36nd digital input block

16bit polarity digital inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6102	0x00	16bit digital input block	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available digital 16bit input blocks
	0x01	1st input block	Unsigned16	rw	N	0x0000	1st polarity digital input block
	...	...	...	...	...	...	...
	0x24	36th input block	Unsigned16	rw	N	0x0000	36th polarity digital input block

Individual inverting of input polarity:

1 = input inverted
0 = input not inverted

32bit digital inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6120	0x00	32bit digital input block	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available digital 32bit input blocks
	0x01	1st input block	Unsigned32	ro	N		1st digital input block
	...	...	...	...	...	...	...
	0x12	18th input block	Unsigned32	ro	N		18th digital input block

32bit polarity digital inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6122	0x00	8bit digital input block	Unsigned8	ro	N	depending on the components fitted	Number of available digital 32bit input blocks
	0x01	1st input block	Unsigned32	rw	N	0x00000000	1st polarity digital input block
	...	...	...	...	...	...	...
	0x12	18th input block	Unsigned32	rw	N	0x00000000	18th polarity digital input block

Individual inverting of input polarity:

1 = input inverted
0 = input not inverted

8bit digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6200	0x00	8bit digital output block	Unsigned8	ro	N	0x01	Number of available digital 8bit output blocks
	0x01	1st output block	Unsigned8	rw	Y		1st digital output block
	...	...	...	...	...	...	...
	0x48	72nd output block	Unsigned8	rw	Y		72nd digital output block

8bit change polarity digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6202	0x00	8bit digital output block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 8bit output blocks
	0x01	1st output block	Unsigned8	rw	N	0x00	1st polarity digital output block
	...	...	...	...	...	...	...
	0x48	72nd output block	Unsigned8	rw	N	0x00	72nd polarity digital output block

Individual inverting of input channels:

1 = input inverted
0 = input not inverted

8bit error mode digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6206	0x00	8bit digital output block	Unsigned8	ro	N	0x01	Number of available digital 8bit output blocks
	0x01	1st output block	Unsigned8	rw	N	0xFF	1st error mode digital output block
	...	...	...	...	...	...	...
	0x48	72nd output block	Unsigned8	rw	N	0xFF	72nd error mode digital output block

This object indicates whether an output is set to a pre-defined error value (set in object 0x6207) in case of an internal device failure.

1 = overtake the value from object 0x6207
0 = keep output value in case of error

8bit error value digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6207	0x00	8bit digital output block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 8bit output blocks
	0x01	1st output block	Unsigned8	rw	N	0x00	1st error value digital output block
	...	...	...	...	...	...	...
	0x48	72nd output block	Unsigned8	rw	N	0x00	72nd error value digital output block

Presupposed that the error mode is active, device failures set the output to the value configured by this object.

16bit digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6300	0x00	16bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 16bit output blocks
	0x01	1st output block	Unsigned16	rw	N		1st digital output block
	...	...	...	...	...	...	...
	0x24	36th output block	Unsigned16	rw	N		36th digital output block

16bit change polarity digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6302	0x00	16bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 16bit output blocks
	0x01	1st output block	Unsigned16	rw	N	0x0000	1st polarity digital output block
	...	...	...	...	...	...	...
	0x24	36th output block	Unsigned16	rw	N	0x0000	36th polarity output block

Individual inverting of output polarity:

1 = output inverted
0 = output not inverted

16bit error mode digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6306	0x00	16bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 16bit output blocks
	0x01	1st output block	Unsigned16	rw	N	0xFFFF	1st error mode digital output block
	...	...	...	...	...	...	...
	0x24	36th output block	Unsigned16	rw	N	0xFFFF	36th error mode digital output block

This object indicates whether an output is set to a pre-defined error value (set in object 0x6307) in case of an internal device failure.

1 = overtake the value from object 0x6307
0 = keep output value in case of error

16bit error value digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6307	0x00	16bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 16bit output blocks
	0x01	1st output block	Unsigned16	rw	N	0x0000	1st error value digital output block
	...	...	...	...	...	...	...
	0x24	36th output block	Unsigned16	rw	N	0x0000	36th error value digital output block

Presupposed that the error mode is active, device failures set the output to the value configured by this object.

32bit digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6320	0x00	32bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 32bit output blocks
	0x01	1st output block	Unsigned32	rw	N		1st digital output block
	...	...	...	...	...	...	...
	0x12	18th output block	Unsigned32	rw	N		18th digital output block

32bit change polarity digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6322	0x00	32bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 32bit output blocks
	0x01	1st output block	Unsigned32	rw	N	0x00000000	1st polarity digital output block
	...	...	...	...	...	...	...
	0x12	18th output block	Unsigned32	rw	N	0x00000000	18th polarity output block

Individual inverting of output polarity:

1 = output inverted
0 = output not inverted

32bit error mode digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6326	0x00	32bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 32bit output blocks
	0x01	1st output block	Unsigned32	rw	N	0xFFFFFFFF	1st error mode digital output block
	...	...	...	...	...	...	...
	0x48	18th output block	Unsigned32	rw	N	0xFFFFFFFF	18th error mode digital output block

This object indicates whether an output is set to a pre-defined error value (set in object 0x6307) in case of an internal device failure.

1 = overtake the value from object 0x6307
0 = keep output value in case of error

32bit error value digital outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6237	0x00	32bit digital input block	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available digital 32bit output blocks
	0x01	1st output block	Unsigned32	rw	N		1st error value digital output block
	...	...	...	...	...	...	...
	0x12	18th output block	Unsigned32	rw	N		18th error value digital output block

Presupposed that the error mode is active, device failures set the output to the value configured by this object.

Analog inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6401	0x00	2byte input block	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available analog inputs
	0x01	1st input channel	Unsigned16	ro	Y		1st analog input channel
	...	...	...	...	...	...	...
	0x24	24th input channel	Unsigned16	ro	Y		24th analog input channel

Analog outputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6411	0x00	2byte output block	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available analog outputs
	0x01	1st output channel	Unsigned16	ro	Y		1st analog output channel
	...	...	...	...	...	...	...
	0x24	24th output channel	Unsigned16	ro	Y		24th analog output channel

Analog input interrupt trigger selection

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6421	0x00	Number of Inputs	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available analog inputs
	0x01	Trigger 1st input channel	Unsigned8	rw	N	0x07	Input interrupt trigger for 1st analog input channel
	...	...	...	...	...	...	...
	0x24	Trigger 24th input channel	Unsigned8	rw	N	0x07	Input interrupt trigger for 24th analog input channel

This object determines which events shall cause an interrupt for a specific channel. Bits set in the list below refer to the interrupt trigger.

Bit no.	Interrupt trigger
0	Upper limit exceeded 6424
1	Input below lower limit 6425
2	Input changed by more than negative delta 6426
3 to 7	Reserved

Analog input interrupt source

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6422	0x00	Number of Interrupt	Unsigned8	ro	N	0x01	Number of interrupt source bank
	0x01	Interrupt source bank	Unsigned32	ro	N	0x00000000	Interrupt source bank 1

This object defines the channel that is responsible for the Interrupt. Bits set refer to the number of the channel that caused the Interrupt. The bits are automatically reset, after they have been read by a SDO or send by a PDO.

1 = Interrupt produced

0 = Interrupt not produced

Event driven analog inputs

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x6423	0x00	Global interrupt enable	Boolean	rw	N	FALSE ("0")	Activates the event-driven transmission of PDOs with analog inputs

Although the analog inputs are -acc. to CANopen - per default set to the transmission type 255 (event triggered) in the TxPDO2, the "event" (the alteration of an input value) is suppressed by the event control in object 0x6423 in order to prevent the bus from being swamped with analog signals.

Before activation, it is convenient to parameterize the transmission behavior of the analog PDOs:

- inhibit time (object 0x1800ff, sub-index 3)
- limit value monitoring (objects 0x6424 + 0x6425)
- delta function (object 0x6426)

Upper limit value analog inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6424	0x00	Number of Inputs	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available analog inputs
	0x01	Upper limit 1st input channel	Unsigned32	rw	N	0x00000000	Upper limit value for 1st analog input channel
	...	...	...	...	...	...	...
	0x24	Upper limit 24th input channel	Unsigned32	rw	N	0x00000000	Upper limit value for 24th analog input channel

Values unequal to zero are activating the upper limit value for this channel. A PDO is then transmitted when the upper limit value is exceeded. In addition, the event trigger has to be active (object 0x6423). The data format corresponds to that of the analog inputs.

Lower limit value analog inputs

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6425	0x00	Number of Inputs	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available analog inputs
	0x01	Lower limit 1st input channel	Unsigned32	rw	N	0x00000000	Lower limit value for 1st analog input channel
	...	...	...	...	...	...	...
	0x24	Lower limit 24th input channel	Unsigned32	rw	N	0x00000000	Lower limit value for 24th analog input channel

Values unequal to zero are activating the lower limit value for this channel. A PDO is then transmitted when the lower limit value is underrun. In addition, the event trigger has to be active (object 0x6423). The data format corresponds to that of the analog inputs.

Delta function

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6426	0x00	Number of Inputs	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available analog inputs
	0x01	Delta value 1st input channel	Unsigned32	rw	N	0x00000002	Delta value for 1st analog input channel
	...	...	...	...	...	...	...
	0x24	Delta value 24th input channel	Unsigned32	rw	N	0x00000002	Delta value for 24th analog input channel

Values unequal to zero are activating the delta function for this channel. A PDO is then transmitted when the value has been changed for more than the delta value since the last transmission. In addition, the event trigger has to be active (object 0x6423). The data format corresponds to that of the analog inputs (The delta function accepts only positive values).

Analog output error mode

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6443	0x00	Analog output block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available analog outputs
	0x01	1st analog output block	Unsigned8	rw	N	0xFF	1st error mode analog output block
	...	...	...	...	...	...	...
	0x24	36th analog output block	Unsigned8	rw	N	0xFF	36th error mode analog output block

This object indicates whether an output is set to a pre-defined error value (set in object 0x6444) in case of an internal device failure.

0 = current value

1 = set to error value 0x6444

Analog output error value

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x6444	0x00	16bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available analog output blocks
	0x01	1st analog block	Unsigned16	rw	N	0x0000	1st analog output block
	...	...	...	...	...	...	...
	0x24	36th analog block	Unsigned16	rw	N	0x0000	36th analog output block

Presupposed that the corresponding error (0x6443) is active, device failures set the output to the value configured by this object.

SDO Abort Codes

0x05030000 //Toggle bit not alternated
0x05040000 //SDO protocol timed out
0x05040001 //Client/server command specifier not valid or unknown
0x05040002 //Invalid block size (block mode only)
0x05040003 //Invalid sequence number (block mode only)
0x05040004 //CRC error (block mode only)
0x05040005 //Out of memory
0x06010000 //Unsupported access to an object
0x06010001 //Attempt to read a write only object
0x06010002 //Attempt to write a read only object
0x06020000 //Object does not exist in the object dictionary
0x06040041 //Object cannot be mapped to the PDO
0x06040042 //The number and length of the objects to be mapped would exceed PDO length
0x06040043 //General parameter incompatibility reason
0x06040047 //General internal incompatibility in the device
0x06060000 //Access failed due to an hardware error
0x06070010 //Data type does not match, length of service parameter does not match
0x06070012 //Data type does not match, length of service parameter too high
0x06070013 //Data type does not match, length of service parameter too low
0x06090011 //Sub-index does not exist
0x06090030 //Value range of parameter exceeded (only for write access)
0x06090031 //Value of parameter written too high
0x06090032 //Value of parameter written too low
0x06090036 //Maximum value is less than minimum value
0x08000000 //general error
0x08000020 //Data cannot be transferred or stored to the application
0x08000021 //Data cannot be transferred or stored to the application because of local control
0x08000022 //Data cannot be transferred or stored to the application because of the present device state
0x08000023 //Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated
from file and generation fails because of an file error)

Emergency Object

Outline

The VIPA CAN-Bus coupler is provided with the emergency object to notify other devices connected to the CANopen bus about internal error events or CAN-Bus errors. It has a high priority and gives you important information about the states of device and network.

Note!

We strongly recommend to analyze the emergence object - it is an important information pool!

Telegram structure

The emergency telegram has always a length of 8Byte. It starts with 2Byte error code followed by the 1Byte error register and closes with 5Byte additional code.

Error code low byte	Error code high byte	ErrorRegister Index 0x1001	Info 0	Info 1	Info 2	Info 3	Info 4

Error messages

Error Code	Meaning	Info 0	Info 1	Info 2	Info 3	Info4
0x0000	Reset Emergency	0x00	0x00	0x00	0x00	0x00
0x1000	Module Configuration has changed and Index 0x1010 is equal to 'save'	0x06	0x00	0x00	0x00	0x00
0x1000	Module Configuration has changed	0x05	0x00	0x00	0x00	0x00
0x1000	Error during initialization of backplane modules	0x01	0x00	0x00	0x00	0x00
0x1000	Error during module configuration check	0x02	Module Number	0x00	0x00	0x00
0x1000	Error during read/write module	0x03	Module Number	0x00	0x00	0x00
0x1000	Module parameterization error	0x30	Module Number	0x00	0x00	0x00
0x1000	Diagnostic alarm from an analog module	0x40 + Module Number	diagnostic byte 1	diagnostic byte 2	diagnostic byte 3	diagnostic byte 4
0x1000	Process alarm from an analog module	0x80 + Module Number	diagnostic byte 1	diagnostic byte 2	diagnostic byte 3	diagnostic byte 4

continued ...

... continue Emergency Object

Error Code	Meaning	Info 0	Info 1	Info 2	Info 3	Info4
0x1000	PDO Control	0xFF	0x10	PDO Number	LowByte Timer Value	HighByte Timer Value
0x5000	Module					
0x6300	SDO PDO-Mapping	LowByte MapIndex	HighByte MapIndex	No. Of Map Entries	0x00	0x00
0x8100	Heartbeat Consumer	Node ID	LowByte Timer Value	HighByte Timer Value	0x00	0x00
0x8100	SDO Block Transfer	0xF1	LowByte Index	HighByte Index	SubIndex	0x00
0x8130	Node Guarding Error	LowByte GuardTime	HighByte GuardTime	LifeTime	0x00	0x00
0x8210	PDO not processed due to length error	PDO Number	Wrong length	PDO length	0x00	0x00
0x8220	PDO length exceeded	PDO Number	Wrong length	PDO length	0x00	0x00

NMT - network management

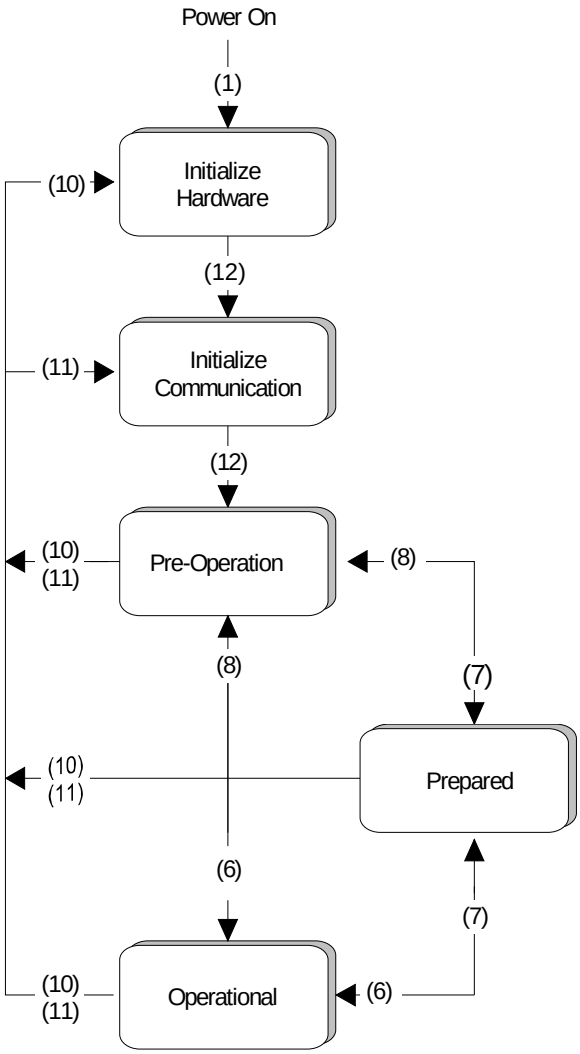
Network management (NMT) provides the global services specifications for network supervision and management. This includes the login and logout of the different network devices, the supervision of these devices as well as the processing of exceptions.

NMT service messages have the COB identifier 0000h. An additional module-ID is not required. The length is always 2 data bytes.

The 1. data byte contains the NMT command specifier: **CS**.

The 2. data byte contains the module-ID (0x00 for broadcast command).

The following picture shows an overview over all CANopen status changes and the corresponding NMT command specifiers:



(1): The initialization state is reached automatically after start-up.

(6): "Start_Remote_Node" (CS: 0x01)
Starts the module, releases outputs and starts the PDO transmission.

(7): "Stop_Remote_Node" (CS: 0x02)
Outputs are switching into error state, SDO and PDO are switched off.

(8): "Enter_Pre-operational_State" (CS:0x80)
Stops PDO transmission, SDO still active.

(10): "Reset_Node" (CS:0x81)
Executes reset. All objects are set back to PowerOn defaults.

(11): "Reset_Communication" (CS:0x82)
Executes reset of the communication functions. Objects 0x1000 - 0x1FFF are set back to PowerOn defaults.

(12): After initialization the state pre-operational is automatically reached - here the boot-up message is send.

Node Guarding

The bus coupler also supports the Node Guarding object as defined by CANopen to ensure that other devices on the bus are supervised properly.

Node Guarding operation is started when the first guard requests (RTR) is received from the master. The respective COB identifier is permanently set to 0x700 + module-ID at variable 0x100E in the object directory. If the coupler does not receive a guard request message from the master within the "guard time" (object 0x100C) when the node guarding mode is active the module assumes that the master is not operating properly. When the time determined by the product of "guard time" (0x100C) and "life-time factor" (0x100D) has expired, the module will automatically assume the status "pre-operational".

When either the "guard time" (object 0x100C) or the "life-time factor" (0x100D) has been set to zero by an SDO download from the master, the expiry of the guard time is not monitored and the module remains in its current operating mode.

Heartbeat

The VIPA CAN coupler also supports the Heartbeat Mode in addition to Node Guarding.

When a value is entered into index 0x1017 (Heartbeat Producer Time) then the device status (Operational, Pre-Operational,...) of the bus coupler is transferred by means of the COB identifier (0x700+module-ID) when the heartbeat timer expires.

The Heartbeat Mode starts automatically as soon as the index 1017h contains a value that is larger than 0.