VIPA System 200V

IM | Manual

HB97E_IM | RE_208-1CA00 | Rev. 15/14

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VIPA
A YASKAWA COMPANY

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Note

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Contents

About this manual

This manual describes the System 200V CANopen master IM 208-1CA00 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 208-1CA00 are described. The technical data are at the end of the chapter.

Chapter 3: Deployment IM 208CAN

This chapter contains the description of the VIPA CANopen master module. 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 master IM 208-1CA00 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 208CAN	VIPA 208-1CA00	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 208CAN 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

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.

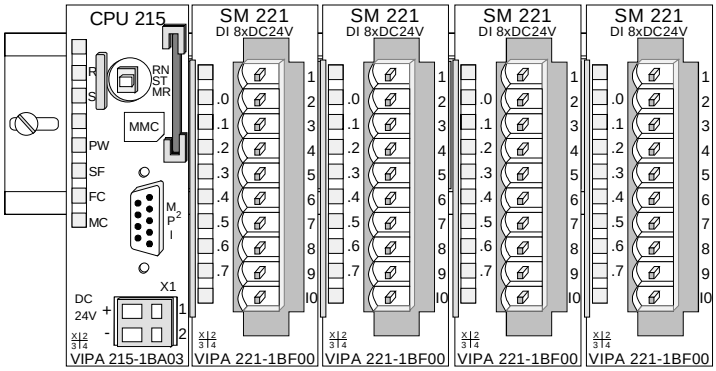
Attention!

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.

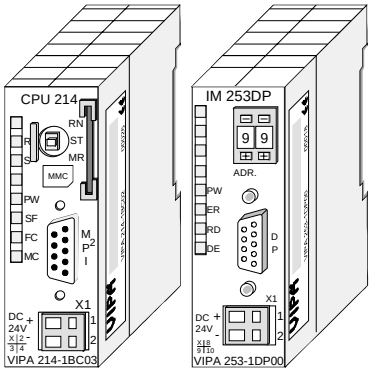


Components

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*

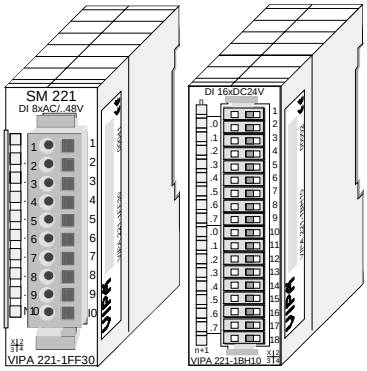
Head modules



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.

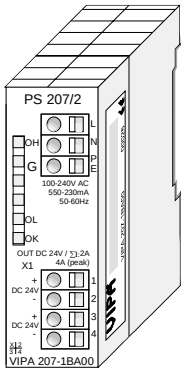
Periphery modules



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.

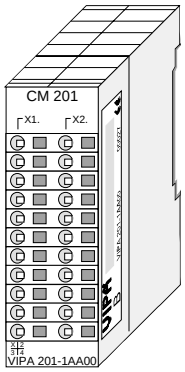
Power supplies



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.

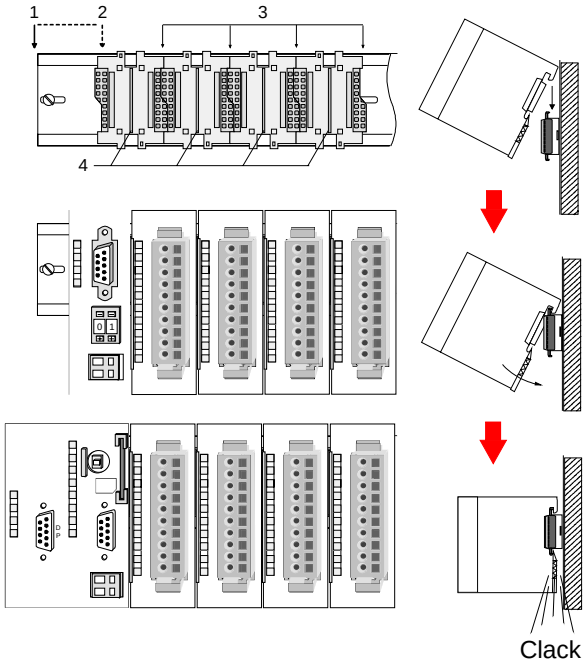
The modules are not connected to the backplane bus.

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.

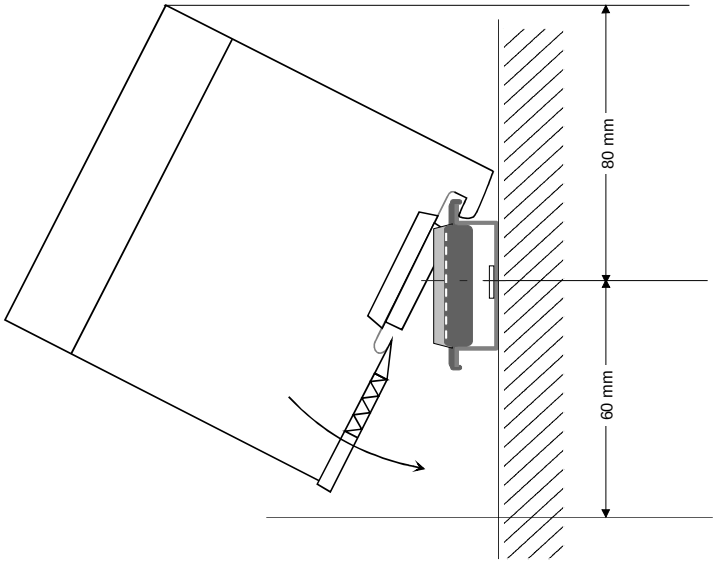
Please install modules with a high current consumption directly beside the head module.

Dimensions

Dimensions Basic enclosure

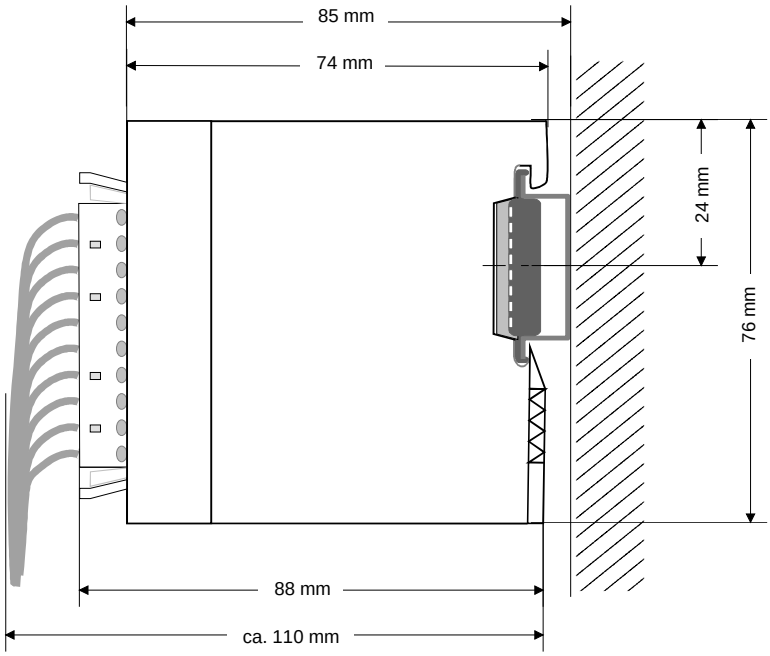
1tier width (HxWxD) in mm: 76 x 25.4 x 74
2tier width (HxWxD) in mm: 76 x 50.8 x 74

Installation dimensions

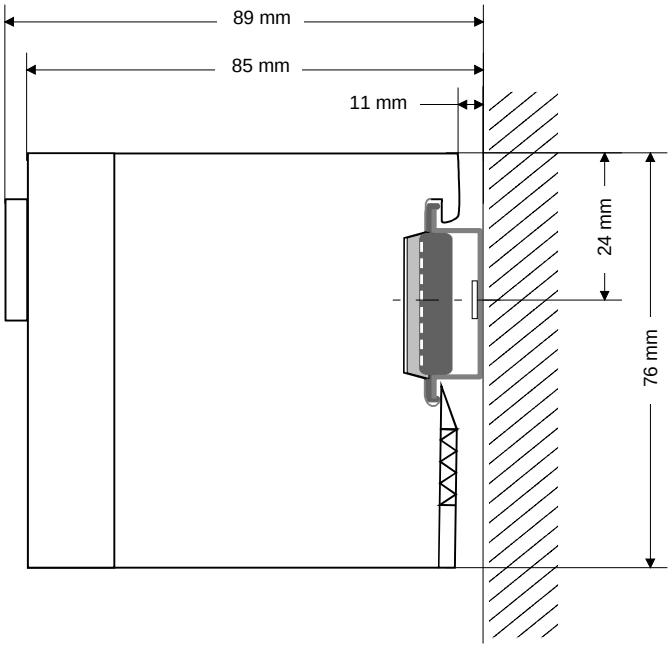


Installed and wired dimensions

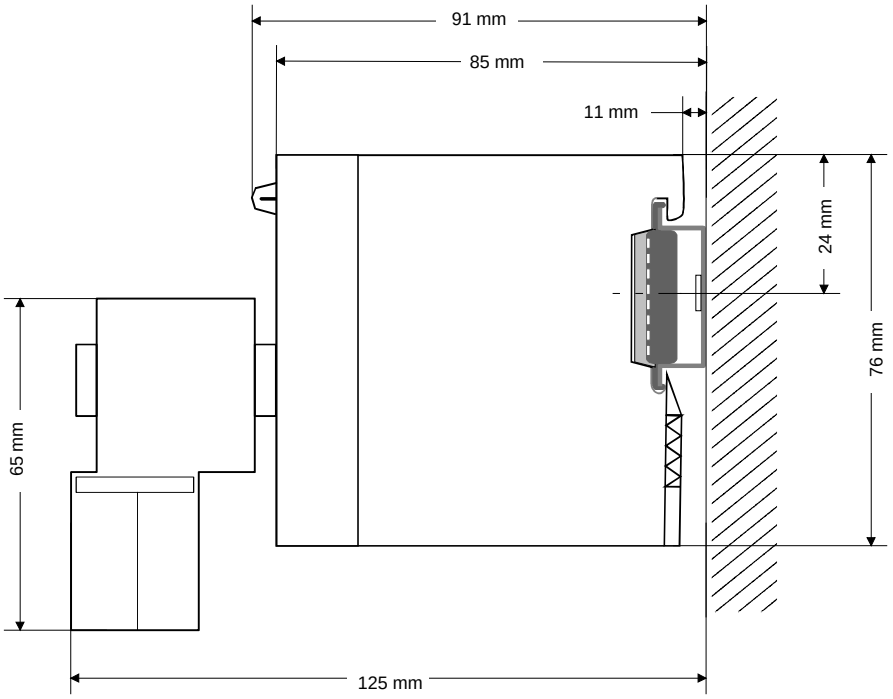
In- / Output modules



Function modules/
Extension modules



CPUs (here with
EasyConn from
VIPA)



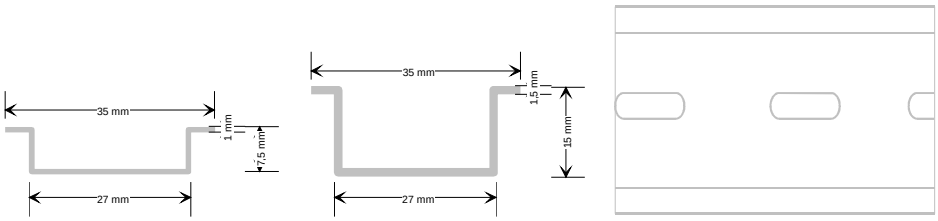
Installation

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:

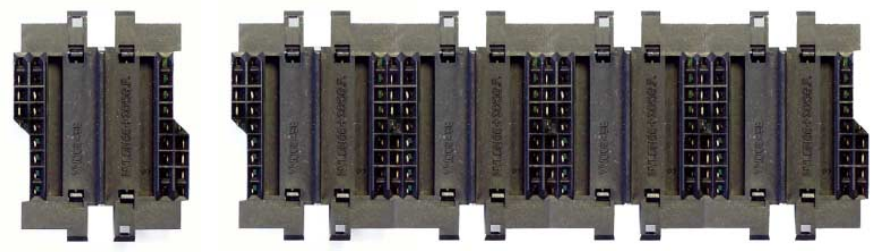


Order number	Label	Description
290-1AF00	35mm profile rail	Length 2000mm, height 15mm
290-1AF30	35mm profile rail	Length 530mm, height 15mm

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:



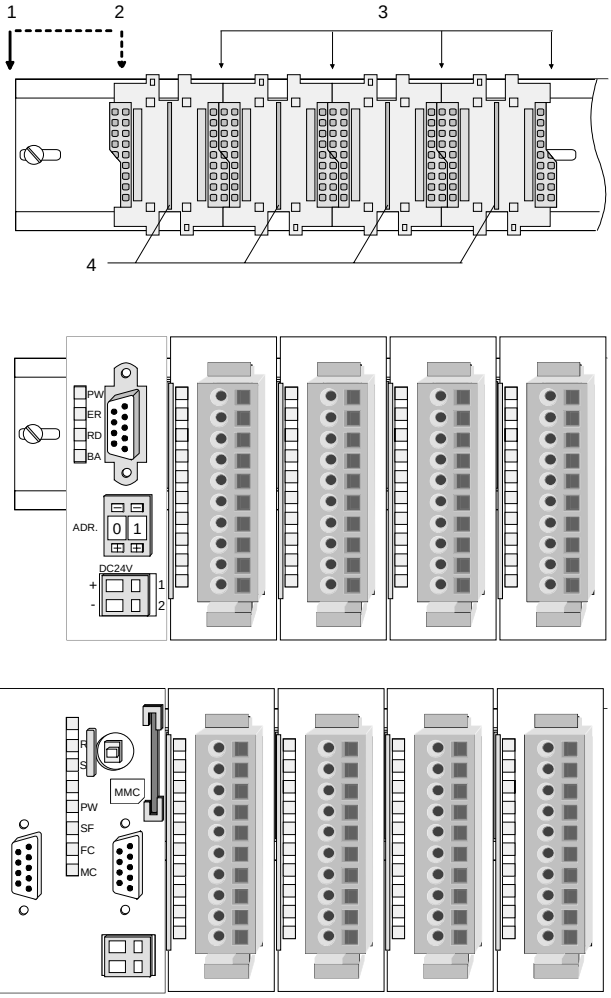
The bus connector is to be placed on the profile rail until it clips in its place and the bus connections look out from the profile rail.

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.



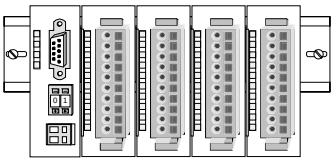
[1] Head module (double width)
[2] Head module (single width)
[3] Peripheral module
[4] Guide rails

Assembly regarding the current consumption

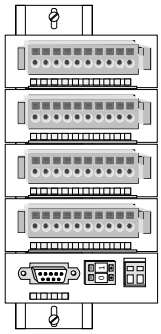
- Use bus connectors as long as possible.
- Sort the modules with a high current consumption right beside the head module. In the service area of www.vipa.com a list of current consumption of every System 200V module can be found.

Assembly possibilities

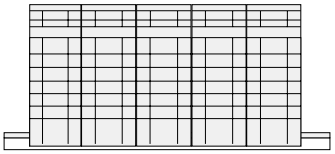
hoizontal assembly



vertical assembly



lying assembly

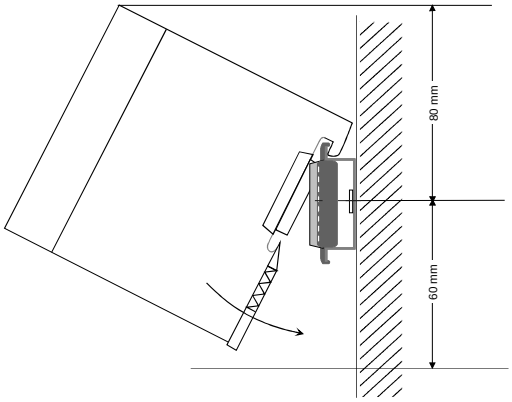


Please regard the allowed environmental temperatures:

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

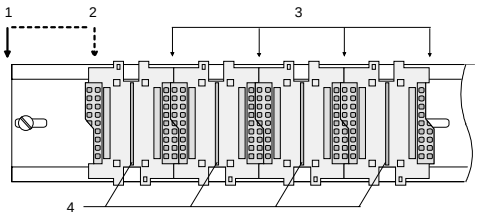
The horizontal assembly always starts at the left side with a head module, then you install the peripheral modules beside to the right.

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

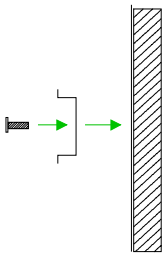
- Modules are to be installed side by side. Gaps are not permitted between the modules since this would interrupt the backplane bus.
- A module is only installed properly and connected electrically when it has clicked into place with an audible click.
- Slots after the last module may remain unoccupied.

Note!

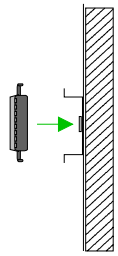
Information about the max. number of pluggable modules and the max. current at the backplane bus can be found in the "Technical Data" of the according head module.

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

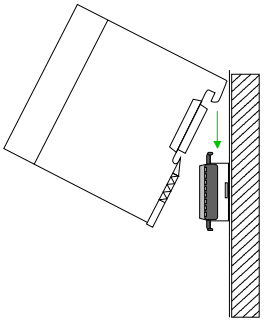
Assembly procedure



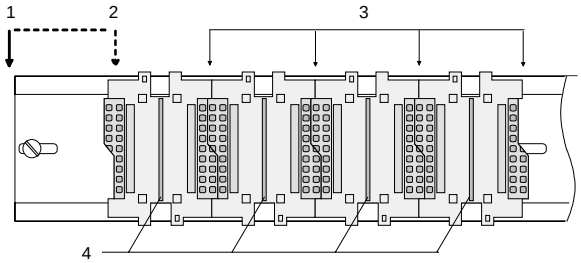
- Install the profile rail. Make sure that a clearance of at least 60mm exists above and 80mm below the middle of the profile rail.



- 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.

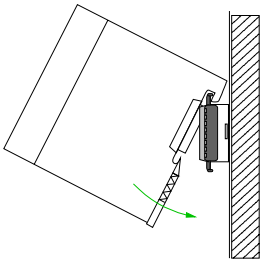


[1] Head module (double width)

[2] Head module (single width)

[3] Peripheral module

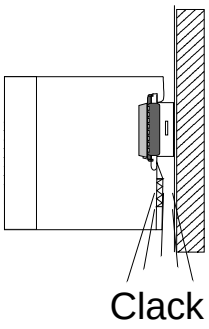
[4] Guide rails



- 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.

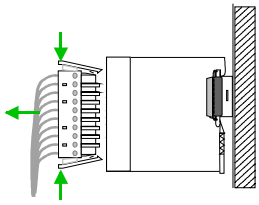
Attention!

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



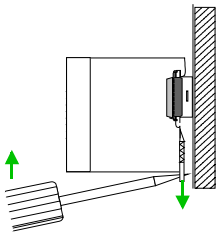
Demounting and module exchange

1



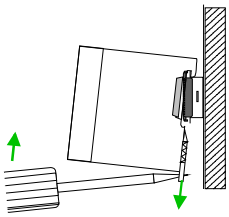
- Remove if exists the wiring to the module, by pressing both locking lever on the connector and pulling the connector.

2



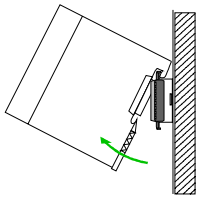
- The casing of the module has a spring loaded clip at the bottom by which the module can be removed.

3



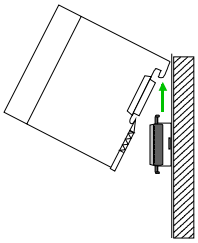
- The clip is unlocked by pressing the screwdriver in an upward direction.

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.

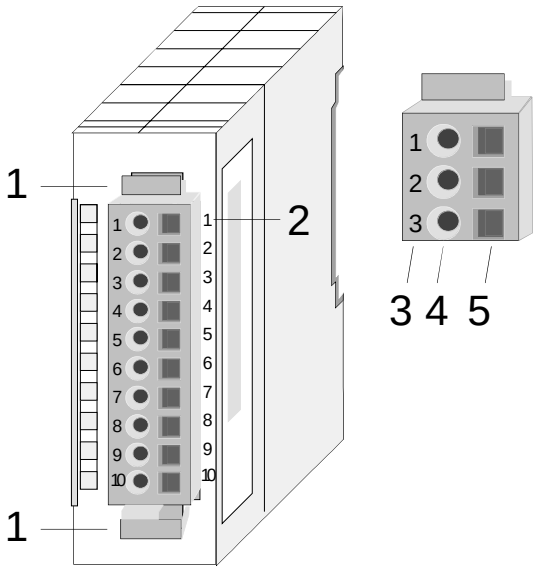
The modules carry spring-clip connectors for interconnections and wiring.

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.



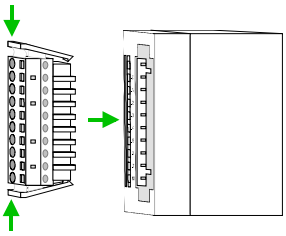
[1] Locking lever
[2] Pin no. at the module
[3] Pin no. at the connector
[4] Wiring port
[5] Opening for screwdriver

Note!

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

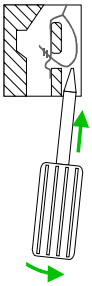
Make sure that you only insert the screwdriver into the square hole of the connector!

Wiring procedure

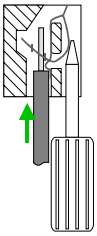


- Install the connector on the module until it locks with an audible click. For this purpose you press the two clips together as shown.
  The connector is now in a permanent position and can easily be wired.

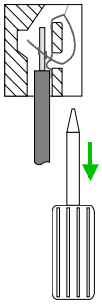
The following section shows the wiring procedure from top view.



- 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 1.5mm^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 field immunity (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

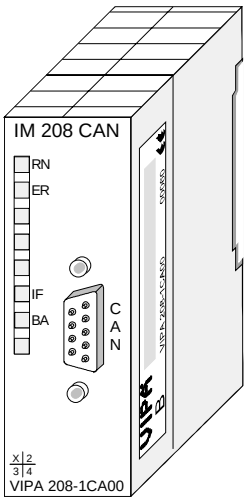
Here the hardware components of the IM 208-1CA00 described.
The technical data are at the end of the chapter.

Contents

Properties

IM 208CAN
208-1CA00

- 125 CAN slaves can be connected to one CANopen master
- Project engineering under WinCoCT from VIPA
- Diagnosis ability
- 40 Transmit PDOs
- 40 Receive PDOs
- PDO-Linking
- PDO-Mapping
- 1 SDO as Server, 127 SDO as Client
- Emergency Object
- NMT Object
- Node Guarding, Heartbeat
- In-/output range 0x6xxx each max. 64Bytes
- In-/output range 0xAxxx each max. 320Bytes

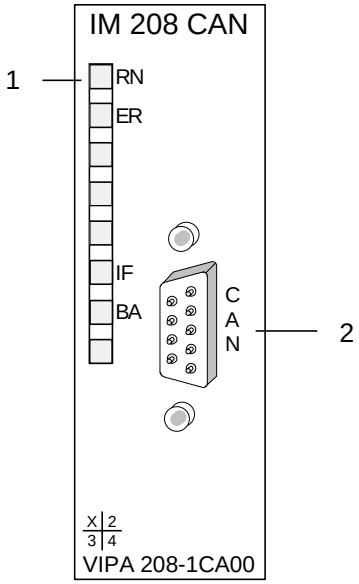


Order data

Type	Order number	Description
IM 208CAN	VIPA 208-1CA00	CAN-Bus CANopen master 1MBaud, up to 125 slaves

Structure

Front view IM 208CAN

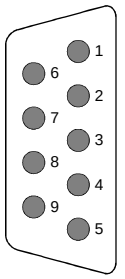


[1] LED status indicators
[2] CAN-Bus socket

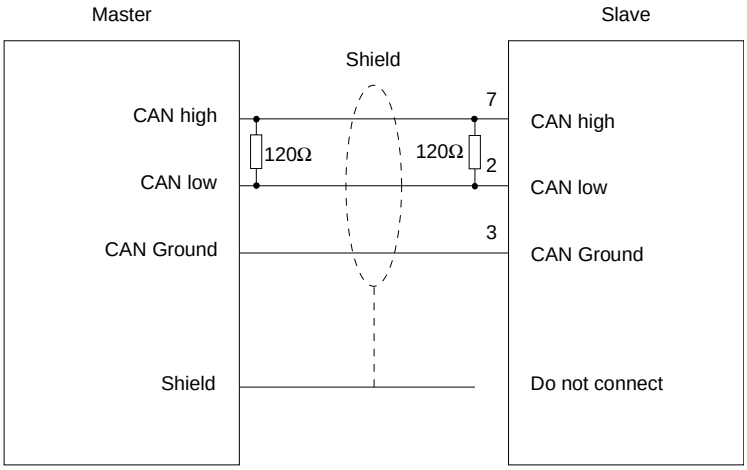
CAN interface

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

The following diagram shows the pin assignment for the interface:



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



Note!

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

LEDs

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

Name	Color	Description
RN	green	ON: CPU is in RUN OFF: CPU is in STOP
ER	red	ON: During initialization and at slave failure OFF: All slaves are in the state "operational"
BA	yellow	BA (**B**us **a**ctive) shows communication via CAN bus ON: state "operational" Blinks with 1Hz: shows state "pre-operational" Blinks with 10Hz: shows state "prepared"
IF	red	ON: "**I**nitialisierungs**f**ehler" (i.e. initialization error) at wrong parameterization OFF: Initialization is OK

Note!

All the LEDs flash at 1Hz, expects the CAN master valid parameters from the CPU. Gets the CAN master no parameters from the CPU, after 5sec all LEDs are off.

Power supply

The CANopen master receives the voltage supply via the backplane bus.

Technical data

Order no.	**208-1CA00**
Type	IM 208CAN, CANopen master
Current consumption/power loss	
Current consumption from backplane bus	300 mA
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
Diagnostics information read-out	possible
Supply voltage display	none
Group error display	red LED
Channel error display	none
Functionality Sub-D interfaces	
Type	-
Type of interface	CAN
Connector	Sub-D, 9-pin, male
Electrically isolated	✓
MPI	-
MP²I (MPI/RS232)	-
Point-to-point interface	-
Housing	
Material	PPE
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	25.4 x 76 x 78 mm
Weight	80 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

Chapter 3 Deployment IM 208CAN

Overview

This chapter contains the description of the VIPA CANopen master module. 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

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.

Project engineering

The project engineering of the CANopen master happens in WinCoCT (**Win**dows **C**AN**o**pen **C**onfiguration **T**ool) from VIPA. You export your project from WinCoCT as wld-file. This wld-file can then be imported into the hardware configurator from Siemens.

Fast introduction

For the deployment of System 200V modules and the CAN master, you have to include the System 200V modules into the hardware catalog via the GSD-file from VIPA. For the project engineering in the hardware configurator you have to execute the following steps:

- Start WinCoCT and project the CANopen network.
- Create a master group with  and insert a CANopen master via  .
- Activate the master function via "Device Access" and "Device is NMT Master".
- Activate in the register "CANopen Manager" Device is NMT Master and confirm your entry.
- Set parameters like diagnosis behavior and CPU address ranges with "Set PLC Parameters".
- Create a slave group with  and add your CANopen slaves via  .
- Add modules to your slaves via "Modules" and parameterize them if needed.
- Set your process data connections in the matrix via "Connections" and proof your entries if needed in the process image of the master.
- Save the project and export it as wld-file.
- Switch to the SIMATIC manager from Siemens and copy the data block from the CAN-wld-file into the block directory.
- Project the PROFIBUS DP master system in the hardware configurator with the following Siemens-CPU: CPU 315-2DP (6ES7 315-2AF03-0AB0)
- The DP master receives an address >1.
- Add the System 200V DP slave system from the hardware catalog to the master system.
- The System 200V DP slave system always requires the address 1.
- Save all and transfer the PLC project together with the wld-file via MPI into the CPU.

In the following you'll find a description of this steps.

Note!

Starting with the firmware version 3.5.0, please use the hardware catalog CPU **6ES7-315-2AF03** V1.2 from Siemens for the project engineering of the VIPA standard CPUs of the Systems 100V, 200V, 300V and 500V!

Precondition for the project engineering

The hardware configurator is a part of the Siemens SIMATIC Manager. It serves the project engineering. The modules that can be parameterized with are monitored in the hardware catalog.

For the deployment of the System 200V modules, the inclusion of the System 200V modules into the hardware catalog is necessary. This happens via a GSD-file from VIPA.

Note!

For the project engineering a thorough knowledge of the Siemens SIMATIC manager and the hardware configurator from Siemens is required!

Include GSD-file

- Copy the delivered VIPA GSD-file VIPA_21x.gsd into your GSD-directory... \siemens\step7\s7data\gsd
- Start the hardware configurator from Siemens
- Close all projects
- Choose **Options** > *Install new GSD-file*
- Select **VIPA_21x.GSD**

Now the modules of the System 200V from VIPA are integrated in the hardware catalog and can be projected.

Note

To be compatible to the Siemens SIMATIC Manager, the System 200V CPUs from VIPA have to be projected as

CPU 315-2DP (6ES7 315-2AF03-0AB0)!

To be able to directly address the modules, you have to include them in the hardware configurator from Siemens in form of a virtual PROFIBUS system. By including the GSD-file from VIPA, you are able to access the complete function range of the modules.

The concrete project engineering happens in the CANopen configuration tool WinCoCT. You may export your project as wld-file and transfer it as DB into your PLC program.

WinCoCT

WinCoCT (**Win**dows **C**AN**o**pen **C**onfiguration **T**ool) is a configuration tool developed from VIPA to allow the comfortable project engineering of CANopen networks.

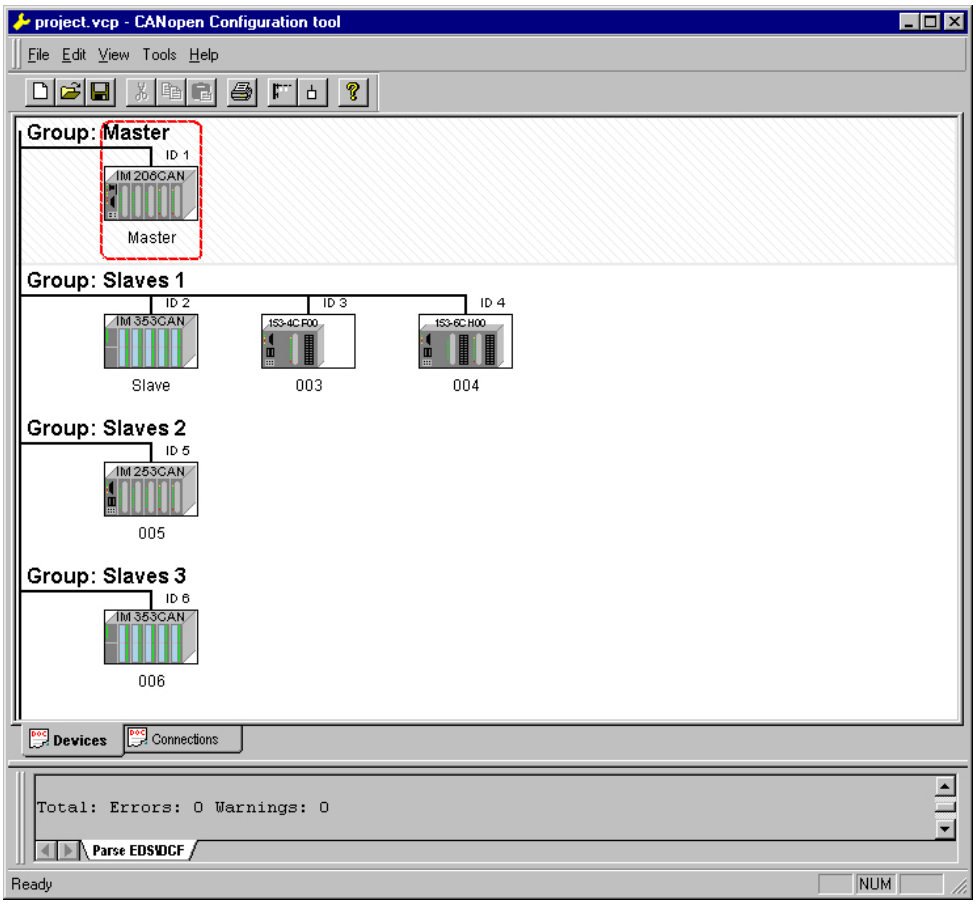
WinCoCT monitors the CANopen network topology in a graphical user interface. Here you may place, parameterize and group field devices and controls and engineer connections.

The selection of the devices happens via a list that can be extended for your needs with an EDS-file (**E**lectronic **D**ata **S**heet) at any time.

A right click onto a device opens a context menu consisting partly of static and partly of dynamic components.

For the configuration of the process data exchange, all process data are monitored in a matrix with the device inputs as rows and the device outputs as columns. Mark a cross point to create the wanted connection.

The telegram collection and optimization is executed by WinCoCT.



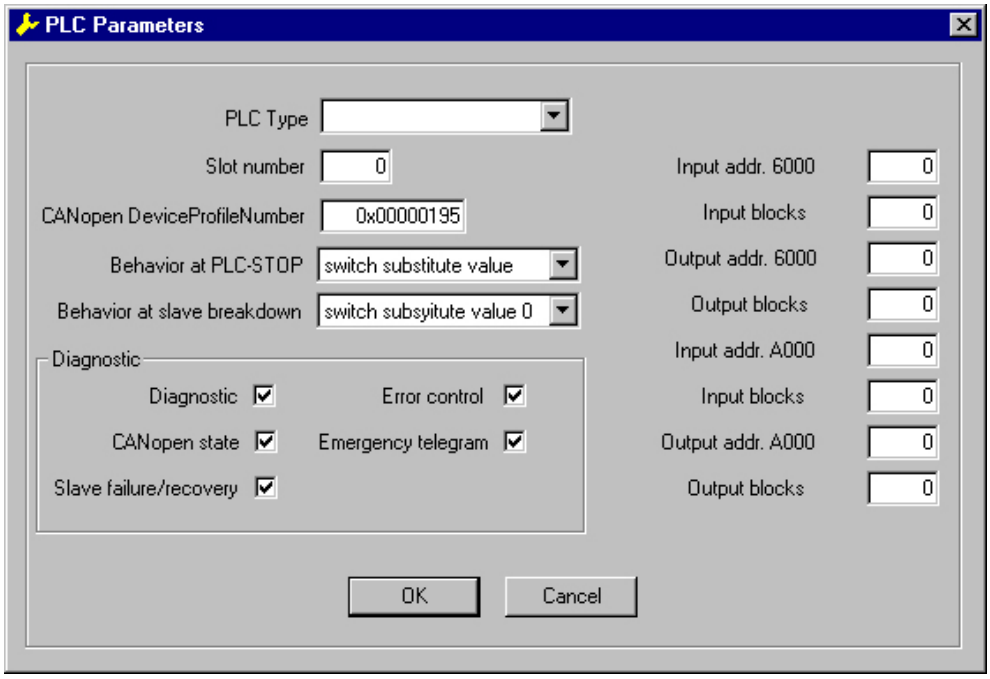
Set project parameters

Via **Tools** > *Project options* you may preset CAN specific parameters like baud rate, selection of the master etc.

More detailed information is to find in the WinCoCT manual.

Parameter CAN master

WinCoCT allows you to preset VIPA specific parameters for the CAN master by doing a right click onto the master and call the following dialog window with Set PLC-Parameters:



PLC Type

Reserved for later extensions

Slot number

Plug-in location no. at the bus

0: For the addressing of the CAN master integrated in the CPU

1 ... 32: For the addressing of CAN master at the standard bus

CANopen DeviceProfileNumber

Fix at 0x195

Behavior at PLC-STOP

Here you can define the reaction of the output channels if the CPU switches to STOP. The following values are available:

Switch substitute value 0: Sets all outputs to 0

Keep last value: Keeps the recent state of the outputs.

Behavior at Slave breakdown

Here you set the reaction for the slave input data in case of a slave failure.

Switch substitute value 0: The data is set to 0.

Keep the last value: The recent date remain unchanged.

Diagnostic

This area allows you to define the diagnostic reaction of the CAN master.

Diagnostic: Activates the diagnostic function

CANopen state: When activated, the CAN master sends its state "preoperational" or "operational" to the CPU. You may request the state via SFC 13.

Slave failure/recovery: When activated, the OB 86 is called in the CPU in case of slave failure and reboot.

Error control: If this option is selected, the NMT master sends all Guarding errors as diagnosis to the CPU, that calls the OB 82.

Emergency Telegram: At activation, the NMT master sends all Emergency telegrams as diagnosis to the CPU, that calls the OB 82.

Address range in the CPU

The following fields allow you to preset the address ranges in the CPU for the CANopen master in- and output ranges. Each block consists of 4Byte.

Input addr. 6000, Input blocks

PI basic address in the CPU that are occupied from 0x6000 CAN input data. For input blocks max. 16 (64Byte) can be entered.

Output addr. 6000, Output blocks

PO basic address in the CPU that are occupied from 0x6000 CAN output data. For output blocks max. 16 (64Byte) can be entered.

Input addr. A000, Input blocks

PI basic address in the CPU that are occupied from 0xA000 CAN input network variables. For input blocks max. 80 (320Byte) can be entered.

Output addr. A000, Output blocks

PO basic address in the CPU that are occupied from 0xA000 CAN output network variables. For output blocks max. 80 (320Byte) can be entered.

Activate CANopen slave in the CANopen Manager

To enable the master to access a CANopen slave, you have to register it at the according master via WinCoCT. Right click onto your CAN master, choose "Device access" and switch to the register "CANopen Manager".

Via [Change] you can register every single slave res. via [Global] all slaves at your master and preset the error behavior.

Please don’t forget to apply the settings into your project engineering by clicking on [Apply to slaves].

Steps of the project engineering

The following text describes the approach of the project engineering with an abstract sample:

The project engineering is divided into three parts:

- CAN master project engineering in WinCoCT and export as wld-file
- Import CAN master project engineering
- Project engineering of the modules

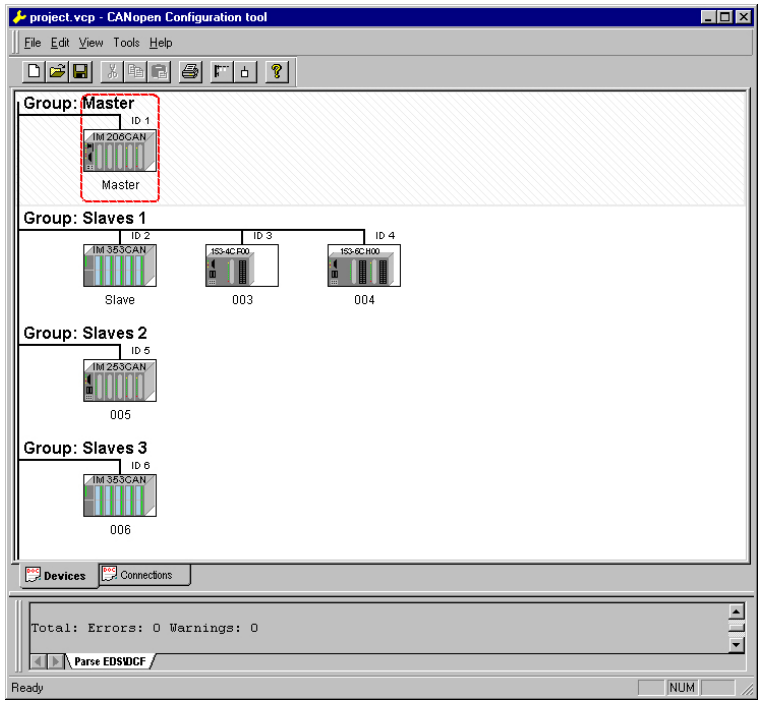
Preconditions

For the project engineering of a CANopen system, the most recent EDS-file has to be transferred into the EDS-directory of WinCoCT.

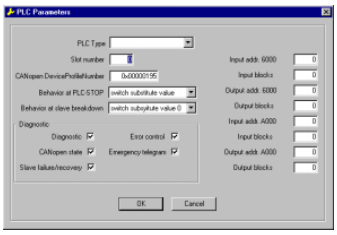
For the deployment of the System 200V modules, you have to include the System 200V modules with the GSD-file VIPA_21x.gsd from VIPA into the hardware catalog.

CAN master project engineering in WinCoCT

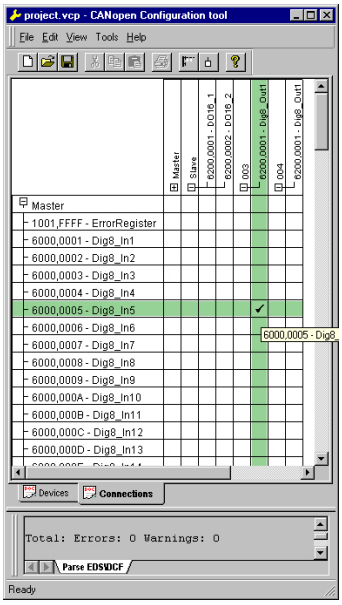
- Copy the required EDS-files into the EDS-directory and start WinCoCT.
- Create a master group via  and insert a CANopen master via  (VIPA_208_1CA00.eds).
- Create a slave group with  and add your CANopen slaves via  .
- Right click on the according slave and add the needed modules via „Modules“.
- Parameterize the modules with [Parameter] res. via the according object directory.
- Right click on the master and open the dialog "Device Access".
- Activate Device is NMT Master in the register "CANopen Manager" and register the according slaves at the master. Don’t forget to apply your settings into your project engineering with [Apply to slaves]!



... CAN master
project engineering



- Right click onto the master and open the VIPA specific dialog "Set PLC Parameters". Here you may adjust the diagnosis behavior and the address ranges that the master occupies in the CPU.
  Under "Slot number" type the slot no., where your CAN master is plugged. At export, WinCoCT creates the according DB no. + 2000.



- Change to the register "Connections" in the main window. Here the process data are shown in a matrix as inputs (1. column) and as outputs (1. row).
  To monitor the process data of a device with a "+" click on the according device.
- For helping you, you may only define a connection when the appearing cross has green color. Select the according cell with the mouse pointer in row and column in the matrix and click on it. → The cell is marked with a "■". You can control the connection by changing into "Devices", click on the master and monitor the process image of the master via "Device Access".
- Save your project.
- Via **File** > *Export* your CANopen project is exported into a wld-file. The name is the combination of project name + node address + ID **Ma**s**t**er/**Sl**a**v**e.

Now your CANopen project engineering under WinCoCT is ready.

Import into PLC program and transfer to CAN master

- Start the SIMATIC manager from Siemens with your PLC project and open the wld-file via **File** > *Memory Card File* > *open*.
- Copy the DB 2xxx into your block directory.
- Start the hardware configurator from Siemens with a new project and insert a profile rail from the hardware catalog.
- Place the following Siemens CPU onto plug-in location 2:
  CPU 315-2DP (6ES7 315-2AF03-0AB0). For the project engineering of the VIPA standard CPUs of the Systems 100V, 200V, 300V and 500V please use starting with the firmware version 3.5.0 the CPU **6ES7-315-2AF03** V1.2 from Siemens from the hardware catalog!
- If for example your CAN master module is directly placed beside the CPU, you project your CAN master on plug-in location 4.
- Starting with plug-in location 5, you include your System 200V modules on the standard bus in the plugged sequence.
- Parameterize your CPU res. the modules when needed. The parameter window is opened when you double click on the according module.
- Save your project and transfer it to your CPU.

After the transfer the CPU recognizes the DB for the CAN master and passes the contents of the DB on to the according CAN master at STOP-RUN change.

Firmware update

Overview

Starting with CPU firmware version 3.4.8 a MMC inside your CPU can be used to update the firmware of CPU an CAN master. The latest 2 firmware versions are to find in the service area at www.vipa.com. For more details see the manual of the CPU.

For designation the master firmware has the following name convention:

canxx.**bin** xx specifies the slot number the CAN master is plugged in (Slot: 01 ... 32)

Attention!

When installing a new firmware you have to be extremely careful. Under certain circumstances you may destroy the CAN-Master, for example if the voltage supply is interrupted during transfer or if the firmware file is defective.

In this case, please call the VIPA-Hotline!

Seek firmware version

A label on the rear of the module indicates the firmware version.

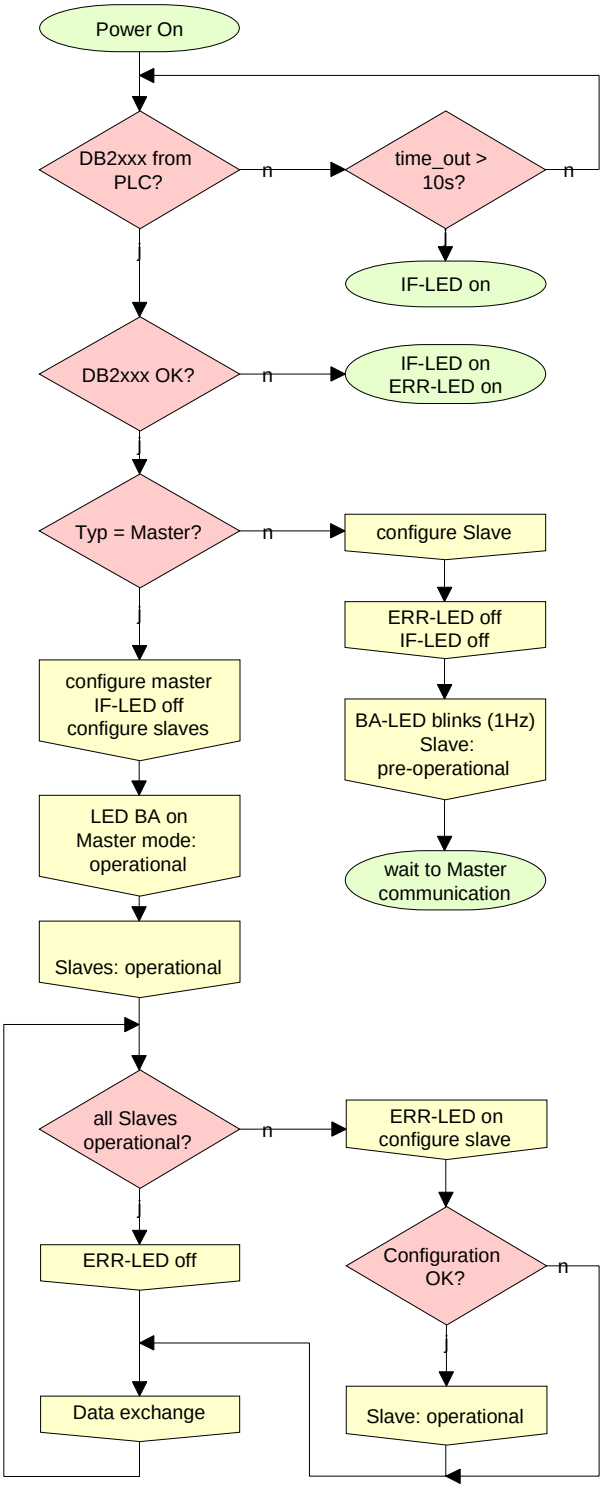
Load firmware and transfer it to MMC as canxx*.bin*

- Go to www.vipa.com
- Click on Service > Download > Firmware Updates.
- Click on "Firmware for CAN Master System 200V".
- Select the according IM 208 order no. and download the firmware to your PC.
- Rename the file to "canxx.**bin**" (xx specifies the slot number the DP master is plugged in, starting with 01) and transfer this file onto a MMC.

Note!

The server always stores the latest two firmware versions.

Mode



STOP → RUN (automatically)

After PowerON and at valid project data in the CPU, the master switches automatically into RUN. The master has no operating mode lever.

After PowerON, the project data is automatically send from the CPU to the CAN master. This establishes a communication to the CAN slaves.

At active communication and valid bus parameters, the CAN master switches into the state "operational". The LEDs RUN and BA are on.

At invalid parameters, the CAN master remains in STOP and shows the parameterization error via the IF-LED.

RUN

In RUN, the RUN- and BA-LEDs are on. Now data can be exchanged.

In case of an error, like e.g. slave failure, the ERR-LED at the CAN master is on and an alarm is send to the CPU.

Process image

The process image is build of the following parts:

- Process image for input data (PI) for RPDOs
- Process image for output data (PO) for TPDOs

Every part consists of 64byte "Digital-Data"- and 320Byte "Network Variables".

Input data

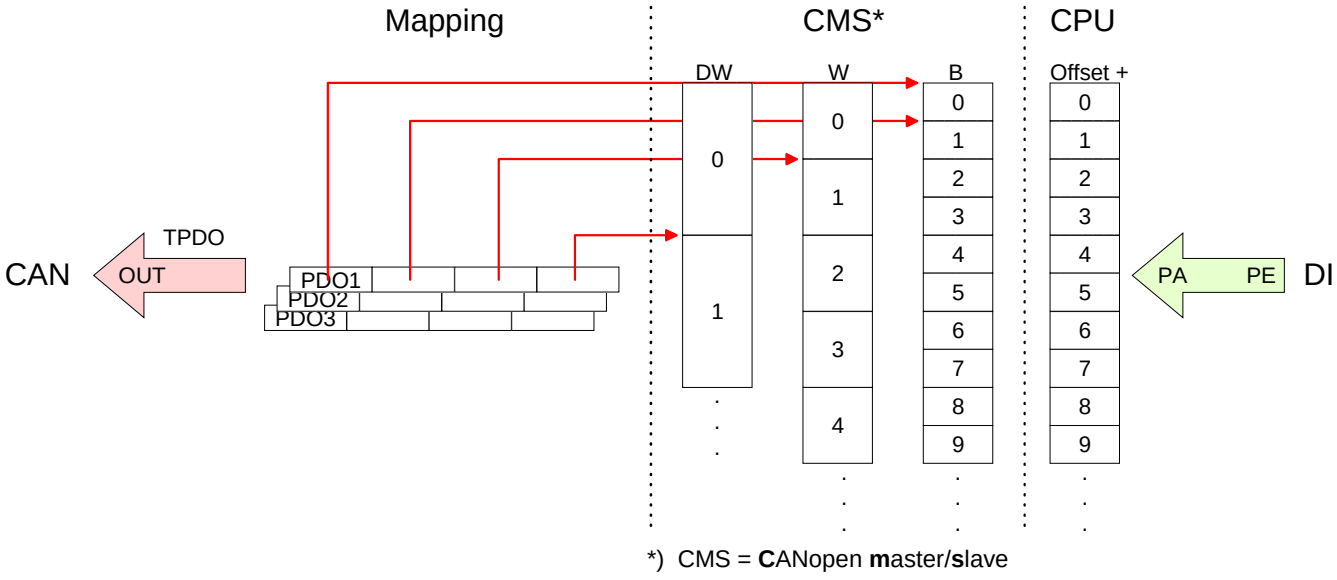
For input data, the following objects are available:

- 8 Bit digital input (Object 0x6000)
- 16 Bit digital input (Object 0x6100)
- 32 Bit digital input (Object 0x6120)
- 8 Bit input network variables (Object 0xA040)
- 16 Bit input network variables (Object 0xA100)
- 32 Bit input network variables (Object 0xA200)
- 64 Bit input network variables (Object 0xA440)

Like to see in the following illustration, the objects of the digital input data use the same memory area of the CPU.

For example, an access to Index 0x6000 with Subindex 2 corresponds an access to Index 0x6100 with Subindex 1. Both objects occupy the same memory cell in the CPU.

Please regard that the input network variables also use the same memory area.



Output-data

For the digital output data, the assignment is similar.

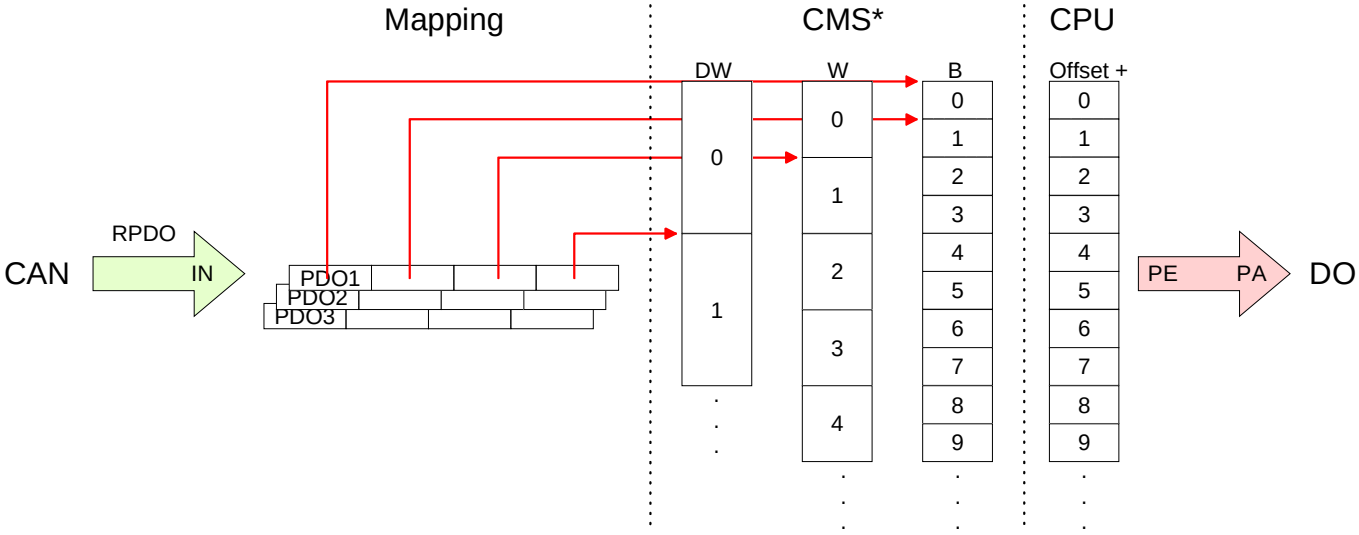
For output data, the following objects are available:

- 8 Bit digital output (Object 0x6200)
- 16 Bit digital output (Object 0x6300)
- 32 Bit digital output (Object 0x6320)
- 8 Bit output network variables (Object 0xA400)
- 16 Bit output network variables (Object 0xA580)
- 32 Bit output network variables (Object 0xA680)
- 64 Bit output network variables (Object 0xA8C0)

Like to see in the following illustration, the objects of the digital output data use the same memory area of the CPU.

For example, an access to Index 0x6200 with Subindex 2 corresponds an access to Index 0x6300 with Subindex 1. Both objects occupy the same memory cell in the CPU.

Please regard that the output network variables also use the same memory area.



*) CMS = **C**ANopen **m**aster/**s**lave

Messages

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 master supports the following objects:

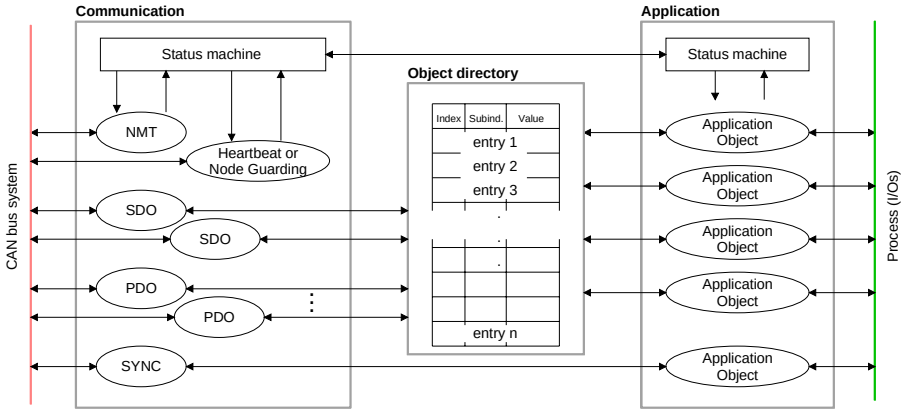
- 40 Transmit PDOs (PDO Linking, PDO Mapping)
- 40 Receive PDOs (PDO Linking, PDO Mapping)
- 2 Standard SDOs (1 Server, 127 Clients)
- 1 Emergency Object
- 1 Network management Object NMT
- Node Guarding
- Heartbeat

Note!

The exact structure and data content of all objects is described in the CIA-Profiles DS-301, DS-302, DS-401 and DS-405.

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

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-Master supports 80 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 40 Tx transmit PDOs for input data and 40 Rx receive PDOs for output data. The PDOs are named seen from the CAN-Master:

Receive PDOs (RxPDOs) are received by the CAN-Master and contain input data.

Transmit PDOs (TxPDOs) are send by the CAN-Master and contain output data.

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

SDO

For access to the object directory, the **S**ervice-**D**ata-**O**bject (SDO) is used. The SDO allows you a read or write access to the object directory. In the CAL-Layer-7-Protocol you find the specification of the Multiplexed-Domain-Transfer-Protocol that is used by the SDOs. This protocol allows you to transfer data with any length. At need, the messages are divided into several CAN messages with identical identifier (segmentation). A SDO is transferred acknowledged, i.e. every reception of a message is acknowledged.

Note!

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

In the following only the error messages are described that may occur at a wrong parameter communication.

SFC 219 CAN_TLGR SDO request to CAN master

Every CPU has the SFC 219 integrated. This allows you to start a SDO read or write access from your PLC program to the CAN master.

You address your master via the plug-in location and the destination slave via its CAN address. The process data is defined by index and subindex. Via SDO every access transfers max. one data word process data. The SFC 219 contains the following parameters:

Parameter	Declaration	Type	Description
REQUEST	IN	BOOL	
SLOT_MASTER	IN	BYTE	
NODEID	IN	BYTE	
TRANSFERTYP	IN	BYTE	
INDEX	IN	DWORD	
SUBINDEX	IN	DWORD	
CANOPENERROR	OUT	DWORD	
RETVAL	OUT	WORD	
BUSY	OUT	BOOL	
DATABUFFER	IN_OUT	ANY	

REQUEST — Control parameter: 1: Start the order

SLOT_MASTER — 0: VIPA 21x-2CM0x
1...32: VIPA 208-1CA00, depending on plug-in location no.

NODELD — Address of the CANopen node (1...127)

TRANSFER TYPE — 40h, 60h: Read SDO
61h: Write SDO (undefined length)
23h: Write SDO (1 DWORD)
2Bh: Write SDO (1 WORD)
2Fh: Write SDO (1 BYTE)

INDEX — CANopen Index

SUBINDEX — CANopen Subindex

CANOPENERROR If no error occurs *CANOPENERROR* returns value 0.

In case of error the *CANOPENERROR* contains one of the following error messages which are generated in the CAN master:

Code	Description
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)

RETVAL

When the function has been executed successfully, the return value contains the valid length of the respond data: 1: BYTE, 2: WORD, 4: DWORD.

If an error occurs during function processing, the return value contains an error code.

Value	Description
F021h	Invalid slave address (Call parameter equal 0 or above 127)
F022h	Invalid Transfer type (Value unequal 60h, 61h)
F023h	Invalid data length (data buffer to small, at SDO read access it should be at least 4Byte, at SDO write access 1Byte, 2Byte or 4Byte).
F024h	The SFC is not supported
F025h	Write buffer in the CANopen master full, service can not be processed at this time.
F026h	Read buffer in the CANopen master full, service can not be processed at this time.
F027h	The SDO read or write access returned wrong answer, see CANopen Error Codes.
F028h	SDO-Timeout (no CANopen participant with this Node-Id has been found).

BUSY

Busy = 1: The read/write job is not yet completed.

DATABUFFER

SFC data communication area.

Read SDO: Destination area for the SDO data that were read.

Write SDO: Source area for the SDO data that were write.

Note

Unless a SDO demand was processed error free, *RETVAL* contains the length of the valid response data in 1, 2 or 4 byte and the *CANOPENERROR* the value 0.

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 – 0x1011	General communication specific parameters (e.g. device name)
0x1400 – 0x1427	Communication parameters (e.g. identifier) of the receive PDOs
0x1600 – 0x1627	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 – 0x1827 0x1A00 – 0x1A27	Communication and mapping parameters of the transmit PDOs

Manufacturer specific profile area (0x2000 – 0x5FFF)

Here you find the manufacturer specific entries. The CAN master from VIPA has no manufacturer specific entries.

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
1000h	Device type
1001h	Error register
1005h	COB-ID SYNC
1006h	Communication Cycle Period
1007h	Synchronous Window Length
1008h	Manufacturer Hardware Version
1009h	Hardware Version
100Ah	Software Version
100Ch	Guard Time
100Dh	Life Time Factor
1016h	Consumer Heartbeat Time
1017h	Producer Heartbeat Time
1018h	Identity Object
1400h ... 1427h	Receive PDO Communication Parameter
1600h ... 1627h	Receive PDO Mapping Parameter
1800h ... 1827h	Transmit PDO Communication Parameter
1A00h ... 1A27h	Transmit PDO Mapping Parameter
1F22h	Concise DCF
1F25h	Post Configuration
1F80h	NMT StartUp
1F81h	Slave Assignment
1F82h	Request NMT
1F83h	Request Guarding
6000h	Digital-Input-8-Bit Array (see DS 401)
6100h	Digital-Input-16-Bit Array (see DS 401)
6120h	Digital-Input-32Bit Array (see DS 401)
6200h	Digital-Output-8-Bit Array (see DS 401)
6300h	Digital-Output-16-Bit Array (see DS 401)
6320h	Digital-Output-32-Bit Array (see DS 401)
A040h	Dynamic Unsigned8 Input
A100h	Dynamic Unsigned16 Input
A200h	Dynamic Unsigned32 Input
A4400h	Dynamic Unsigned64 Input
A4C0h	Dynamic Unsigned8 Output
A580h	Dynamic Unsigned16 Output
A680h	Dynamic Unsigned32 Output
A8C0h	Dynamic Unsigned64 Output

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)	405dec=0x0195

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

Bit 7							Bit 0
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)

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	Communi-cation cycle period	Unsigned32	rw	N	0x00000000	Maximum length of the SYNC interval in µs.

If a value other than zero is entered here, the master 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 Master / Slave 208-1CA00

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	1.00	Hardware version number of bus coupler

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	1.xx	Software version number CANopen software

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

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).

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...127		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	0x2081CA00	Product Code
	3	Revision Number	Unsigned32	ro	N		Revision Number
	4	Serial Number	Unsigned32	ro	N		Serial Number

Communication parameter RxPDO

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1400 ... 0x1427	0	Number of Elements	Unsigned8	ro	N	0x02	Communication parameter for the first receive PDOs, Subindex 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.

Mapping RxPDO

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1600 ... 0x1627	0	Number of Elements	Unsigned8	rw	N	0x01	Mapping parameter of the first receive PDO; subindex 0: number of mapped objects
	1	1st mapped object	Unsigned32	rw	N	0x62000108	(2 byte index, 1 byte subindex, 1 byte bit-width)
	2	2nd mapped object	Unsigned32	rw	N	0x62000208	(2 byte index, 1 byte subindex, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8th mapped	Unsigned32	rw	N	0x62000808	(2 byte index, 1 byte subindex, 1 byte bit-width)

The reception PDOs get a default mapping automatically from the master depending on the connected modules.

Communication parameter TxPDO1

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1800 ... 0x1827	0	Number of Elements	Unsigned8	ro	N	0x05	Communication parameter of the first transmit PDO, subindex 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.

Mapping TxPDO1

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1A00 ... 0x1A27	0	Number of Elements	Unsigned8	rw	N	depending on the components fitted	Mapping parameter of the first transmit PDO; subindex 0: number of mapped objects
	1	1st mapped object	Unsigned32	rw	N	0x60000108	(2 byte index, 1 byte subindex, 1 byte bit-width)
	2	2nd mapped object	Unsigned32	rw	N	0x60000208	(2 byte index, 1 byte subindex, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8th mapped object	Unsigned32	rw	N	0x60000808	(2 byte index, 1 byte subindex, 1 byte bit-width)

The send PDOs get a default mapping automatically from the coupler depending on the connected modules.

Concise DCF

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1F22	Array	Concise DCF	Domain	rw	N		

This object is required for the Configuration Manager. The Concise-DCF is the short form of the DCF (**D**evice **C**onfiguration **F**ile).

Post Configuration

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1F25	Array	ConfigureSlave	Unsigned32	rw	N	0x00000000	

Via this entry, the Configuration Manager can be forced to transfer a stored configuration into the net.

The configuration can be initiated for a defined node at any time via the index 0x1F25.

Subindex 0 has the value 128.

Subindex x (with x = 1..127): Starts the reconfiguration for nodes with the node ID x.

Subindex 128: reconfiguration of all nodes.

For example: If you want to initiate the configuration for node 2 and there are configuration data for this node available, you have to write the value 0x666E6F63 (ASCII = "conf") to the object 1F25h Subindex 2.

NMT Start-up

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1F80	0x00	NMTStartup	Unsigned32	rw	N	0x00000000	

Define the device as NMT master.

Bit	Meaning
Bit 0	0 : Device is NOT the NMT Master. All other bits have to be ignored. The objects of the Network List have to be ignored. 1 : Device is the NMT Master.
Bit 1	0 : Start only explicitly assigned slaves. 1 : After boot-up perform the service NMT Start Remote Node All Nodes
Bit 2..31	Reserved by CiA, always 0

Slave Assignment

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1F81	0x00	SlaveAssignment	Unsigned32	rw	N	0x00000000	

Enter the nodes that are controlled by the master. For every assigned node you need one entry.

Subindex 0 has the value 127. Every other Subindex corresponds with the Node-ID of the node.

Byte	Bit	Description
Byte 0	Bit 0	0: Node with this ID is not a slave 1: Node with this ID is a slave. After configuration (with Configuration Manager) the Node will be set to state Operational.
	Bit 1	0: On Error Control Event or other detection of a booting slave inform the application. 1: On Error Control Event or other detection of a booting slave inform the application and automatically start Error Control service.
	Bit 2	0: On Error Control Event or other detection of a booting slave do NOT automatically configure and start the slave. 1: On Error Control Event or other detection of a booting slave do start the process Start Boot Slave.
	Bit 3..7	Reserved by CiA, always 0
Byte 1		8 Bit Value for the RetryFactor
Byte 2,3		16 Bit Value for the GuardTime

Request NMT

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
0x1F82	0x00	RequestNMT	Unsigned8	rw	N	0x00000000	

If a totally automatic start of the stack is not wanted, the functionalities:

- Status change
- Start of the guarding
- Configuration via CMT

can be also executed at request for every node. The request always happens via objects in the object directory.

The switch of the communication state of all nodes in the network (including the local slaves) happens via the entry 1F82h in the local object directory:

Subindex 0 has the value 128.

Subindex x (with x=1 ... 127): Initiates the NMT service for nodes with Node ID x.

Subindex 128: Initiates NMT service for all nodes.

At write access, the wanted state is given as value.

State	Value
Prepared	4
Operational	5
ResetNode	6
ResetCommunication	7
PreOperational	127

Request Guarding

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1F83	0x00	RequestGuarding	Unsigned32	rw	N	0x00000000	

Subindex 0 has the value 128.

Subindex x (with x=1..127): Initiates guarding for the slave with Node ID x.

Value	Write Access	Read Access
1	Start Guarding	Slave actually is guarded
0	Stop Guarding	Slave actually is not guarded

Subindex 128: Request Start/Stop Guarding for all nodes.

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	1. input block	Unsigned8	ro	Y		1. digital input block
	...	...	...	...	...	...	...
	0x40	64. input block	Unsigned8	ro	Y		64. digital input block

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	1. input block	Unsigned16	ro	N		1. digital input block
	...	...	...	...	...	...	...
	0x20	32. input block	Unsigned16	ro	N		32. digital input block

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	1. input block	Unsigned32	ro	N		1. digital input block
	...	...	...	...	...	...	...
	0x10	16. input block	Unsigned32	ro	N		16. digital input block

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	1. output block	Unsigned8	rw	Y		1. digital output block
	...	...	...	...	...	...	...
	0x40	64. output block	Unsigned8	rw	Y		64. digital output block

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	1. output block	Unsigned16	rw	N		1. digital output block
	...	...	...	...	...	...	...
	0x20	32. output block	Unsigned16	rw	N		32. digital output block

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 32-bit output blocks
	0x01	1. output block	Unsigned32	rw	N		1. digital output block
	...	...	...	...	...	...	...
	0x10	16. output block	Unsigned32	rw	N		16. digital output block

8bit Network input variables

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0xA040	0x00	8bit digital input block	Unsigned8	ro	N	0x01	Number of available digital 8bit input blocks
	0x01	1. input block	Unsigned8	ro	Y		1. digital input block
	...	...	...	...	...	...	...
	0x140	320. input block	Unsigned8	ro	Y		320. digital input block

16bit Network input variables

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0xA100	0x00	16bit digital input block	Unsigned8	ro	N	depending on the fitted components	Number of available digital 16bit input blocks
	0x01	1. input block	Unsigned16	ro	N		1. digital input block
	...	...	...	...	...	...	...
	0xA0	160. input block	Unsigned16	ro	N		160. digital input block

32bit Network input variables

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0xA200	0x00	32bit digital input block	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available digital 32bit input blocks
	0x01	1. input block	Unsigned32	ro	N		1. digital input block
	...	...	...	...	...	...	...
	0x50	80. input block	Unsigned32	ro	N		80. digital input block

64bit Network input variables

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0xA440	0x00	64bit digital input block	Unsigned8	ro	N	depending on the compo-nents fitted	Number of available digital 64bit input blocks
	0x01	1. input block	Unsigned32	ro	N		1. digital input block
	...	...	...	...	...	...	...
	0x28	40. input block	Unsigned32	ro	N		40. digital input block

8bit Network output variables

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0xA400	0x00	8bit digital output block	Unsigned8	ro	N	0x01	Number of available digital 8bit output blocks
	0x01	1. output block	Unsigned8	rw	Y		1. digital output block
	...	...	...	...	...	...	...
	0x140	320. output block	Unsigned8	rw	Y		320. digital output block

16bit Network output variables

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0xA580	0x00	16bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 16bit output blocks
	0x01	1. output block	Unsigned16	rw	N		1. digital output block
	...	...	...	...	...	...	...
	0xA0	160. output block	Unsigned16	rw	N		160. digital output block

32bit Network output variables

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0xA680	0x00	32bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 32-bit output blocks
	0x01	1. output block	Unsigned32	rw	N		1. digital output block
	...	...	...	...	...	...	...
	0x50	80. output block	Unsigned32	rw	N		80. digital output block

64bit Network output variables

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0xA8C0	0x00	64bit digital input block	Unsigned8	ro	N	Depending on the compo-nents fitted	Number of available digital 64bit output blocks
	0x01	1. output block	Unsigned32	rw	N		1. digital output block
	...	...	...	...	...	...	...
	0x50	40. output block	Unsigned32	rw	N		40. digital output block