YASKAWA

System 300S

CP | 342-1CA70 | Manual

HB140 | CP | 342-1CA70 | en | 17-16

SPEED7 CP 342S-CAN

YASKAWA Europe GmbH
Philipp-Reis-Str. 6
65795 Hattersheim
Germany
Tel.: +49 6196 569-300
Fax: +49 6196 569-398
Email: info@yaskawa.eu
Internet: www.yaskawa.eu.com

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1 General

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Tel.: +49 6196 569 300
Fax.: +49 6196 569 398
Email: info@yaskawa.eu
Internet: www.yaskawa.eu.com

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YASKAWA Europe GmbH,
European Headquarters, Philipp-Reis-Str. 6, 65795 Hattersheim, Germany
Tel.: +49 6196 569 500 (hotline)
Email: support@yaskawa.eu

1.2 About this manual

Objective and contents

This manual describes the CP 342-1CA70 of the System 300S from Yaskawa. It contains a description of the construction, project implementation and usage.

Product	Order number	as of state:	
		CP-HW	CP-FW
CP 342S-CAN	342-1CA70	1	V1.2.5

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
- References with page numbers

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.

⚠ **CAUTION!**
Damages to property is likely if these warnings are not heeded.

ℹ *Supplementary information and useful tips.*

1.3 Safety information

Applications conforming with specifications

The system is constructed and produced for:

- communication and process control
- general control and automation tasks
- 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

CAUTION!
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 modifications 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!

2 Basics

2.1 Safety information for users

Handling of electrostatic sensitive modules

The 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 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.

> **CAUTION!**
> Personnel and instruments should be grounded when working on electrostatic sensitive modules.

2.2 Hints for the project engineering

Overview

For the project engineering of a SPEED7 system please follow this approach:

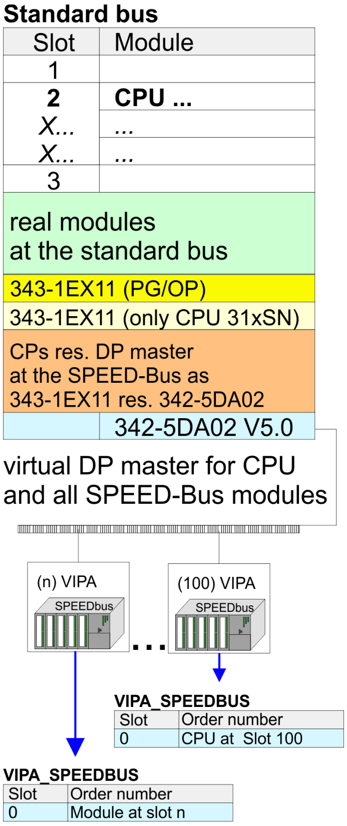
- Project engineering of the SPEED7-CPU and the internal DP master (if existing)
- Project engineering of the real plugged modules at the standard bus
- Project engineering of the internal Ethernet PG/OP channel after the real plugged modules as virtual CP 343-1 (Setting of IP address, subnet mask and gateway for online project engineering)
- Project engineering of an internal CP343 (if existing) as 2. CP 343-1
- Project engineering and connection of the SPEED-Bus-CPs res. -DP master as CP 343-1 (343-1EX11) res. CP 342-5 (342-5DA02 V5.0)
- Project engineering of all SPEED-Bus modules as single DP slaves in a virtual DP master module (SPEEDBUS.GSD required)

Please do always use the corresponding CPU from Siemens in the hardware catalog to configure a CPU 31xS from Yaskawa. For the project engineering, a thorough knowledge of the SIMATIC manager and the hardware configurator from Siemens is required!

Requirements

The hardware configurator is part of the Siemens SIMATIC manager. It serves the project engineering. Please look at the hardware catalog for the modules that may be configured. For the deployment of the System 300S modules at the SPEED-Bus the inclusion of the System 300S modules into the hardware catalog via the GSD-file SPEEDBUS.GSD from Yaskawa is necessary.

Approach



Standard bus

Slot	Module
1	
2	**CPU ...**
X...	...
X...	...
3	

real modules
at the standard bus

343-1EX11 (PG/OP)

343-1EX11 (only CPU 31xSN)

CPs res. DP master
at the SPEED-Bus as
343-1EX11 res. 342-5DA02

342-5DA02 V5.0

virtual DP master for CPU and all SPEED-Bus modules

VIPA_SPEEDBUS

Slot	Order number
0	CPU at Slot 100

VIPA_SPEEDBUS

Slot	Order number
0	Module at slot n

The project engineering of the SPEED7-CPU has the following components: To be compatible with the Siemens SIMATIC manager, the following steps are required:

1. Preparation

   Start the hardware configurator from Siemens and include the SPEEDBUS.GSD for the SPEED-Bus from Yaskawa.

2. Project engineering of the CPU

   Project the corresponding CPU. If your SPEED7-CPU contains a DP master, you may now connect it with PROFIBUS and configure your DP slaves.

3. Project engineering of the real plugged modules at the standard bus

   Set the modules that are at the right side of the CPU at the standard bus starting with slot 4.

4. Project engineering of the integrated CPs

   For the internal Ethernet PG/OP channel you have to set a CP 343-1 (343-1EX11) as 1. module at the real plugged modules. If your SPEED7-CPU has additionally an integrated CP 343, this is also configured as CP 343-1 but always below the former placed CP 343-1.

5. Project engineering of the SPEED-Bus-CPs and -DP master

   Plug and connect all CPs as 343-1EX11 and DP master as 342-5DA02 V5.0 at the SPEED-Bus below the former configured internal CPU components.

> *Please regard that the sequence within a function group (CP res. DP master) corresponds the sequence at the SPEED-Bus from right to left.*

6. Project engineering of the CPU and all SPEED-Bus modules in a virtual master system

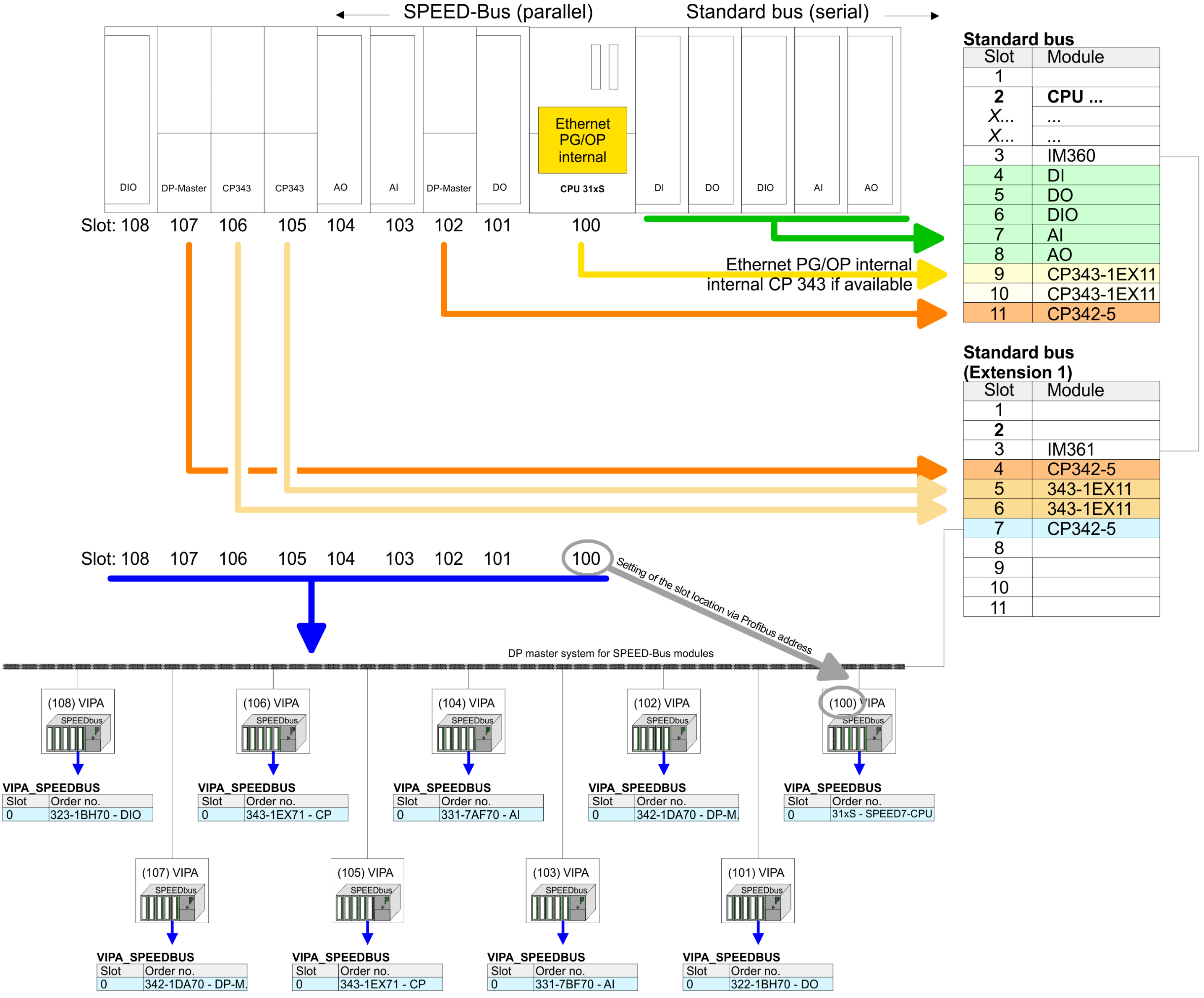
   The slot assignment of the SPEED-Bus modules and the parameterization of the in-/output periphery happens via a virtual PROFIBUS DP master system. For this, place a DP master (342-5DA02 V5.0) with master system as last module. The PROFIBUS address must be < 100! Now include the slave "VIPA_SPEEDBUS" for the CPU and every module at the SPEED-Bus. After the installation of the SPEEDBUS.GSD you may find this under *Profibus-DP / Additional field devices / I/O / VIPA_SPEEDBUS*. Set the slot number of the module (100...110) as PROFIBUS address and plug the according module at slot 0 of the slave system.

Bus extension with IM 360 and IM 361

To extend the bus you may use the IM 360 from Siemens, where 3 further extensions racks can be connected via the IM 361. Bus extensions must be placed at slot 3. More detailed information is to be found in the chapter "Deployment CPU 31xS" at "Addressing".

Summary

The following illustration summarizes all project engineering steps:



Standard bus

Slot	Module
1	
2	**CPU ...**
X...	...
X...	...
3	IM360
4	DI
5	DO
6	DIO
7	AI
8	AO
9	CP343-1EX11
10	CP343-1EX11
11	CP342-5

Standard bus (Extension 1)

Slot	Module
1	
2	
3	IM361
4	CP342-5
5	343-1EX11
6	343-1EX11
7	CP342-5
8	
9	
10	
11	

VIPA_SPEEDBUS (108)

Slot	Order no.
0	323-1BH70 - DIO

VIPA_SPEEDBUS (107)

Slot	Order no.
0	342-1DA70 - DP-M.

VIPA_SPEEDBUS (106)

Slot	Order no.
0	343-1EX71 - CP

VIPA_SPEEDBUS (105)

Slot	Order no.
0	343-1EX71 - CP

VIPA_SPEEDBUS (104)

Slot	Order no.
0	331-7AF70 - AI

VIPA_SPEEDBUS (103)

Slot	Order no.
0	331-7BF70 - AI

VIPA_SPEEDBUS (102)

Slot	Order no.
0	342-1DA70 - DP-M.

VIPA_SPEEDBUS (101)

Slot	Order no.
0	322-1BH70 - DO

VIPA_SPEEDBUS (100)

Slot	Order no.
0	31xS - SPEED7-CPU

The according module is to be taken over from the HW catalog of VIPA_SPEEDBUS on slot 0.

The sequence of the DPM and CP function groups is insignificant. You only have to take care to regard the sequence within a function group (DP1, DP2... res. CP1, CP2 ...).

Hint, valid for all SPEED-Bus modules!

The SPEED-Bus always requires the Siemens DP master CP 342-5 (342-5DA02 V5.0) as last module to be included, connected and parameterized to the operation mode DP master. Every SPEED-Bus module has to be connected as VIPA_SPEED-Bus slave into this master system. By setting the SPEED-Bus slot number via the PROFIBUS address and by including the according SPEED-Bus module at slot 0, the SIMATIC manager receives information about the modules at the SPEED-Bus.

2.3 General data

Conformity and approval		
Conformity		
CE	2014/35/EU	Low-voltage directive
	2014/30/EU	EMC directive
Approval		
UL		Refer to Technical data
others		
RoHS	2011/65/EU	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		-
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 hanging	EN 61131-2	0…+60°C
Horizontal installation lying	EN 61131-2	0…+55°C
Vertical installation	EN 61131-2	0…+50°C
Air humidity	EN 60068-2-30	RH1 (without condensation, rel. humidity 10…95%)
Pollution	EN 61131-2	Degree of pollution 2
Installation altitude max.	-	2000m
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, degree of severity 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.

2.3.1 Use in difficult operating conditions

Without additional protective measures, the products must not be used in locations with difficult operating conditions; e.g. due to:

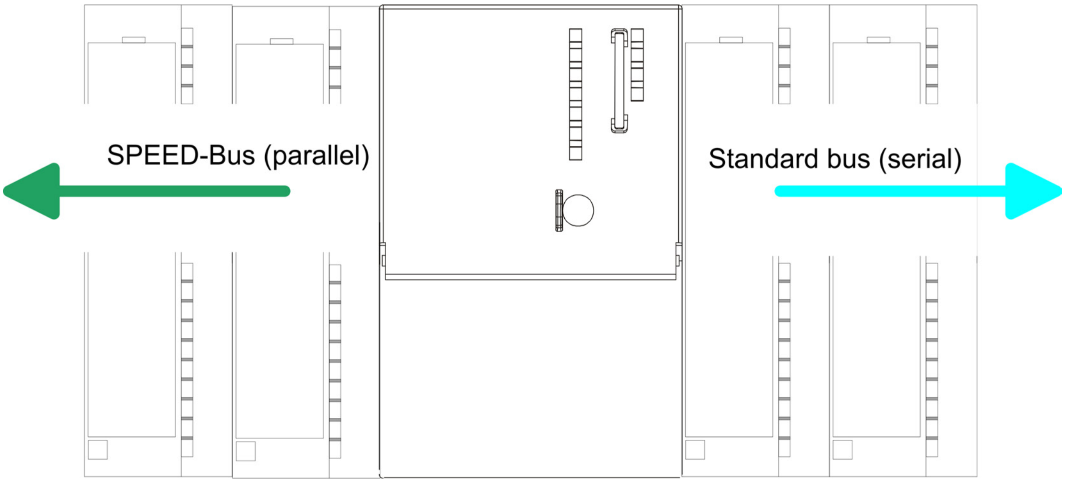
- *dust generation*
- *chemically active substances (corrosive vapors or gases)*
- *strong electric or magnetic fields*

3 Assembly and installation guidelines

3.1 Overview

SPEED-Bus

- The SPEED-Bus is a 32bit parallel bus developed from Yaskawa.
- Via the SPEED-Bus you may connect up to 10 SPEED-Bus modules to your CPU.
- In opposite to the "standard" backplane bus where the modules are plugged-in at the right side of the CPU by means of single bus connectors, the modules at the SPEED-Bus are plugged-in at the left side of the CPU via a special SPEED-Bus rail.
- Yaskawa delivers profile rails with integrated SPEED-Bus for 2, 6, or 10 SPEED-Bus peripheral modules with different lengths.
- Each SPEED-Bus rail has a slot for an external power supply. This allows you to raise the maximum current at the back plane bus. Only the "SLOT1 DCDC" allows you to plug-in either a SPEED-Bus module or an additional power supply (307-1FB70).



SPEED-Bus peripheral modules

The SPEED-Bus peripheral modules may exclusively plugged at the SPEED-Bus slots at the left side of the CPU. The following SPEED-Bus modules are in preparation:

- Fast fieldbus modules like PROFIBUS DP, Interbus, CANopen master and CANopen slave
- Fast CP 343 (CP 343 Communication processor for Ethernet)
- Fast CP 341 with double RS 422/485 interface
- Fast digital input-/output modules (Fast Digital IN/OUT)

Serial Standard bus

The single modules are directly installed on a profile rail and connected via the backplane bus coupler. Before installing the modules you have to clip the backplane bus coupler to the module from the backside. The backplane bus couplers are included in the delivery of the peripheral modules.

Parallel SPEED-Bus

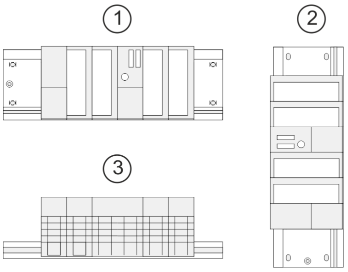
With SPEED-Bus the bus connection happens via a SPEED-Bus rail integrated in the profile rail at the left side of the CPU. Due to the parallel SPEED-Bus not all slots must be occupied in sequence.

SLOT 1 for additional power supply

At slot (SLOT 1 DCDC) you may plug either a SPEED-Bus module or an additional power supply.

Assembly possibilities

You may assemble the System 300 horizontally, vertically or lying. Please regard the allowed environment temperatures:



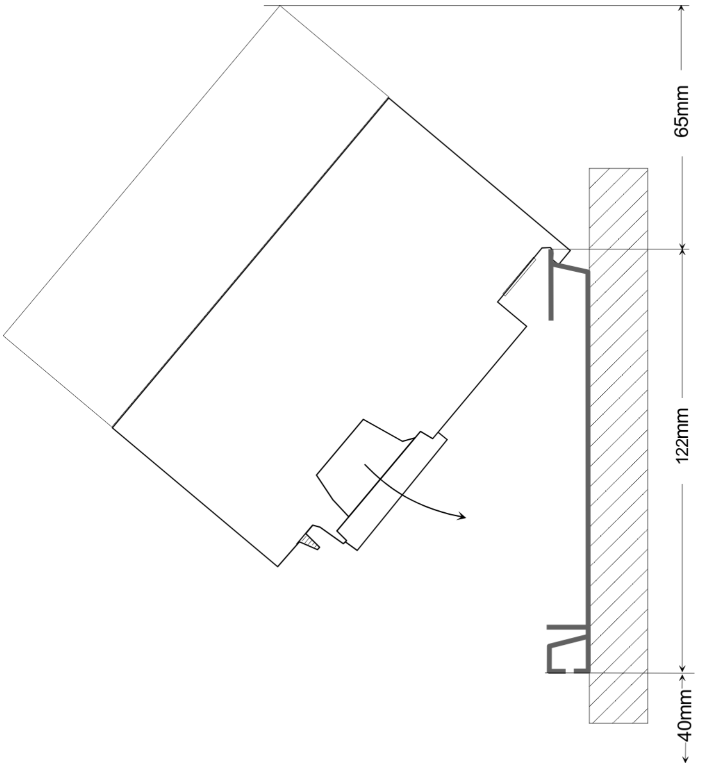
1 horizontal assembly: from 0 to 60°C
2 vertical assembly: from 0 to 50°C
3 lying assembly: from 0 to 55°C

3.2 Installation dimensions

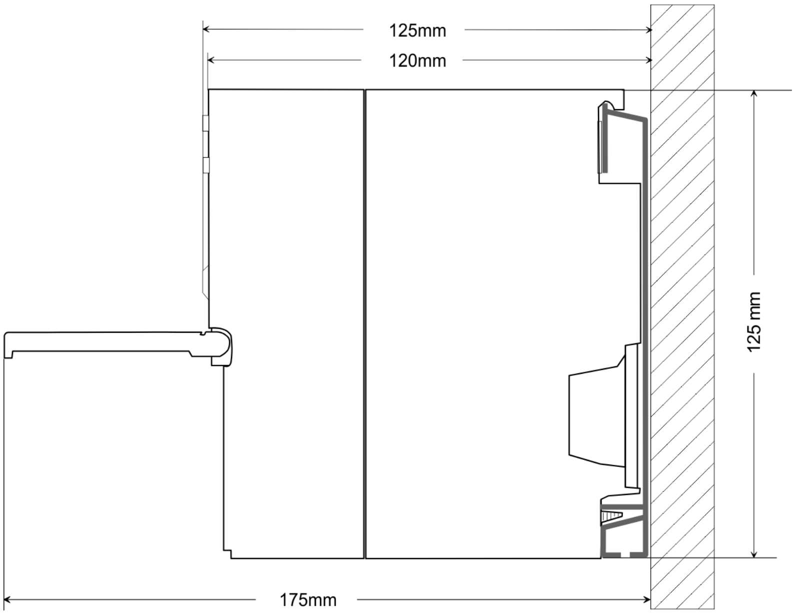
Dimensions Basic enclosure

1tier width (WxHxD) in mm: 40 x 125 x 120

Dimensions



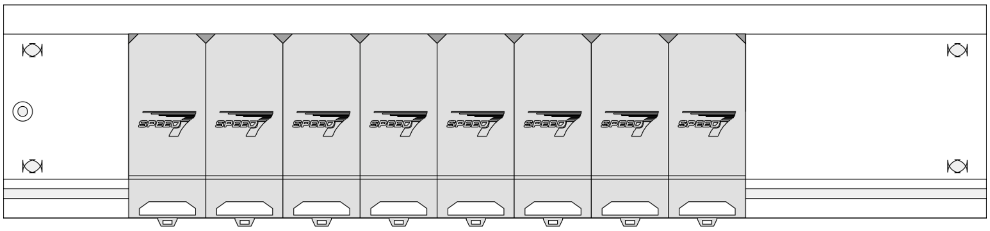
Installation dimensions



3.3 Assembly SPEED-Bus

Pre-manufactured SPEED-Bus profile rail

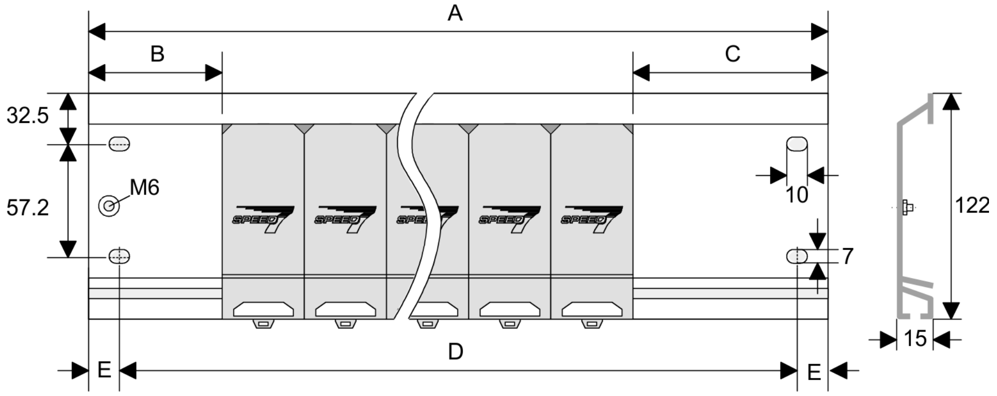
For the deployment of SPEED-Bus modules, a pre-manufactured SPEED-Bus rail is required. This is available mounted on a profile rail with 2, 6 or 10 extension slots.



Dimensions

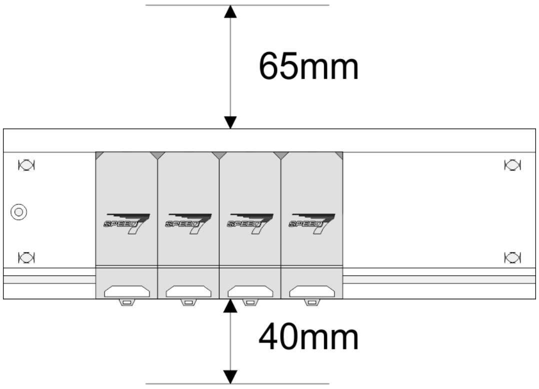
Order number	Number of modules SPEED-Bus/Standard bus	A	B	C	D	E
391-1AF10	2/6	530	100	268	510	10
391-1AF30	6/2	530	100	105	510	10
391-1AF50	10/0	530	20	20	510	10
391-1AJ10	2/15	830	22	645	800	15
391-1AJ30	6/11	830	22	480	800	15
391-1AJ50	10/7	830	22	320	800	15

Measures in mm

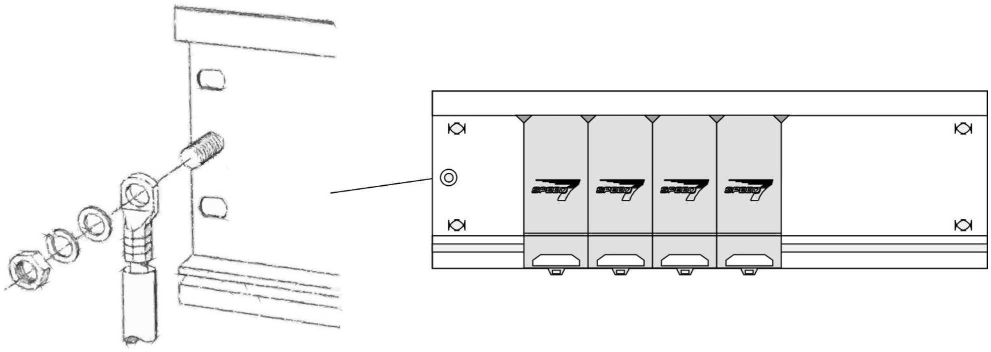


Installation of the profile rail

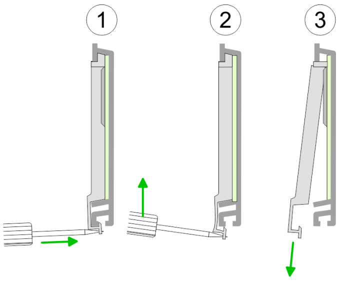
1. Bolt the profile rail with the background (screw size: M6), so that you still have minimum 65mm space above and 40mm below the profile rail. Please look for a low-impedance connection between profile rail and background.



2. Connect the profile rail with the protected earth conductor. The minimum cross-section of the cable to the protected earth conductor has to be 10mm^2.

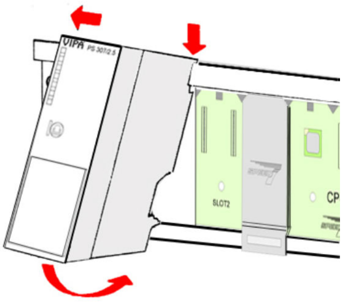


Installation SPEED-Bus module

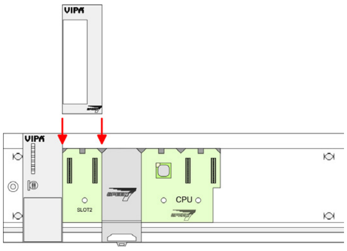


1. Dismantle the according protection flaps of the SPEED-Bus slot with a screw driver (open and pull down).

   For the SPEED-Bus is a parallel bus, not every SPEED-Bus slot must be used in series. Leave the protection flap installed at an unused SPEED-Bus slot.

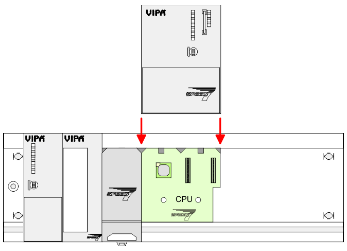


2. At deployment of a DC 24V power supply, install it at the shown position at the profile rail at the left side of the SPEED-Bus and push it to the left to the isolation bolt of the profile rail.
3. Fix the power supply by screwing.

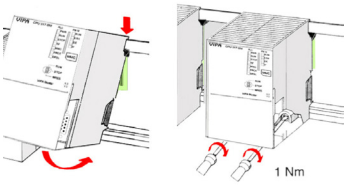


4. To connect the SPEED-Bus modules, plug it between the triangular positioning helps to a slot marked with "SLOT ..." and pull it down.
5. Only the "SLOT1 DCDC" allows you to plug-in either a SPEED-Bus module or an additional power supply.
6. Fix the CPU by screwing.

Installation CPU without Standard-Bus-Modules

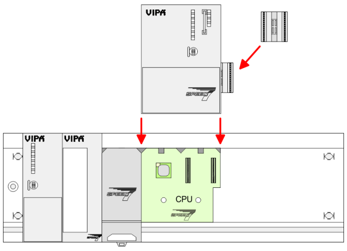


1. To deploy the SPEED7-CPU exclusively at the SPEED-Bus, plug it between the triangular positioning helps to the slot marked with "CPU SPEED7" and pull it down.

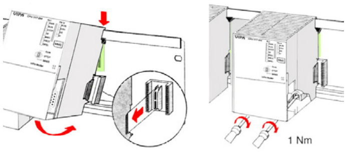


2. Fix the CPU by screwing.

Installation CPU with Standard-Bus-Modules

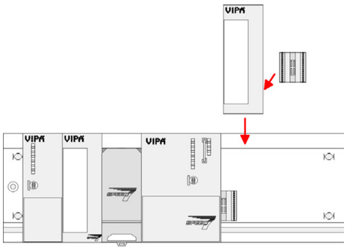


1. If also standard modules shall be plugged, take a bus coupler and click it at the CPU from behind like shown in the picture. Plug the CPU between the triangular positioning helps to the slot marked with "CPU SPEED7" and pull it down.



2. Fix the CPU by screwing.

Installation Standard-Bus-Modules



Repeat this procedure with the peripheral modules, by clicking a backplane bus coupler, stick the module right from the modules you've already fixed, click it downwards and connect it with the backplane bus coupler of the last module and bolt it.

CAUTION!

– The power supplies must be released before installation and repair tasks, i.e. before handling with the power supply or with the cabling you must disconnect current/voltage (pull plug, at fixed connection switch off the concerning fuse)!

– Installation and modifications only by properly trained personnel!

3.4 Installation guidelines

General

The installation guidelines contain information about the interference free deployment of a PLC system. There is the description of the ways, interference may occur in your PLC, how you can make sure the electromagnetic compatibility (EMC), and how you manage the isolation.

What does EMC mean?

Electromagnetic compatibility (EMC) means the ability of an electrical device, to function error free in an electromagnetic environment without being interfered respectively without interfering the environment.

The components of Yaskawa are developed for the deployment in industrial environments and meets 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:

- Electromagnetic fields (RF coupling)
- Magnetic fields with power frequency
- Bus system
- Power 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.

There are:

- 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 aluminium parts. Aluminium 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 respectively 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 shielded.
  - Analog lines must be shielded. When transmitting signals with small amplitudes the one sided laying of the isolation may be favourable.
  - Cables for frequency inverters, servo and stepper motors must be shielded.
  - 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 metallised plug cases for isolated data lines.
- In special use cases you should appoint special EMC actions.
  - Consider to 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 serves for protection and functionality activity.
  - Connect installation parts and cabinets with your PLC in star topology with the isolation/protected earth conductor system. So you avoid ground loops.
  - If there are potential differences between installation parts and cabinets, 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. Here 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 respectively µA) are transferred.
  - foil isolations (static isolations) are used.
- With data lines always use metallic or metallised 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 your PLC and don't lay it on there again!

CAUTION!

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

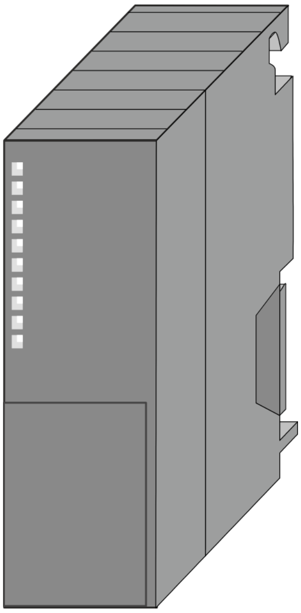
4 Hardware description

4.1 Properties

CP 342-1CA70

The CP in the following may only be used at the SPEED-Bus.

- CANopen master for SPEED-Bus
- 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. 320bytes
- In-/output range 0xAxxx each max. 320bytes

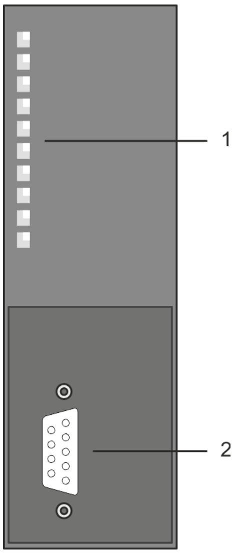


Order data

Type	Order No	Description
CP 342S-CAN	342-1CA70	CANopen master for SPEED-Bus

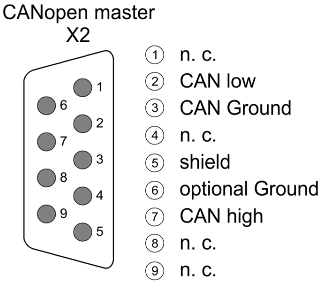
4.2 Structure

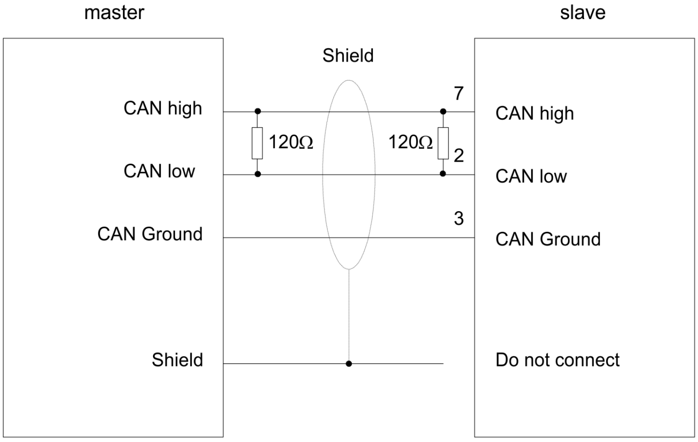
CP 342-1CA70



1 LED status indicators
The following components are under the front flap
2 CAN interface

CAN interface

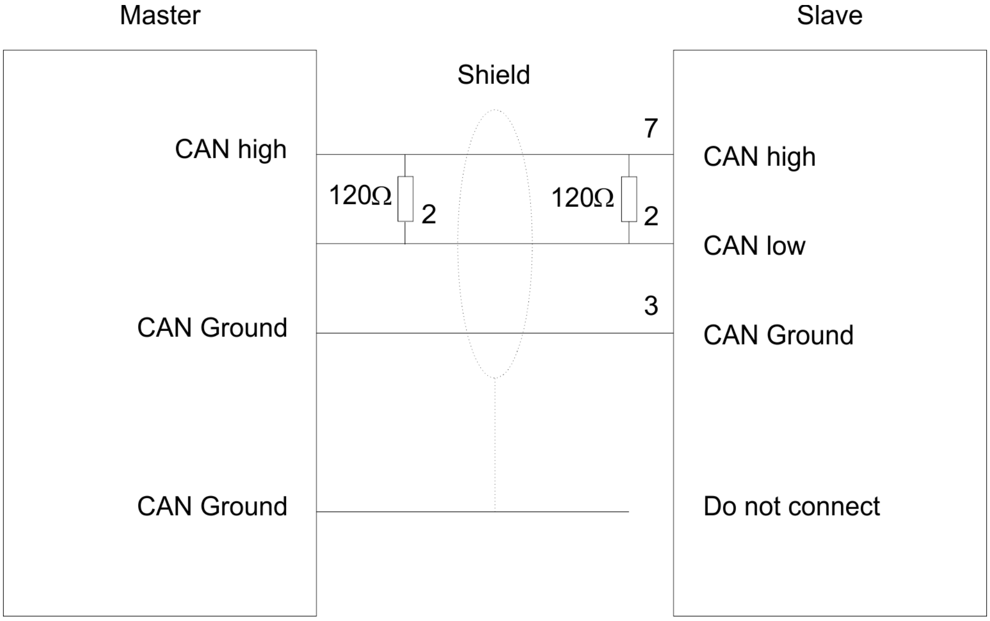




Bus connection

9 pin CAN plug:

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



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

LEDs

The CP 342-1CA70 carries a number of LEDs that are available for diagnostic purposes on the bus and for displaying the local status. Dependent on the mode of operation these give information according to the following pattern over the operating condition of the CP:

Master operation

RUN	ERR	BA	IF	Meaning
🟩 green	🟥 red	🟨 yellow	🟥 red	
□	□	□	□	Master has no project, this means the interface is deactivated.
◪	◪	◪	◪	Flashing 1Hz: Master is waiting for valid parameters from the CPU.
🟩	□	🟨	□	CPU is still in RUN. Master is in "operational" state, this means data exchange between master and slaves. Inputs may be read and outputs may be accessed.
🟩	🟥	🟨	□	CPU is still in RUN. Master is in "operational" state, at least 1 slave is missing.
🟩	□	◪	□	CPU is still in RUN. Flashing 1Hz: Master is in "pre-operational" state. The inputs are undefined and the outputs are disabled.
🟩	🟥	◪	□	CPU is still in RUN. Flashing 1Hz: Master is in "pre-operational" state, at least 1 slave is missing.
🟩	□	◪	□	CPU is still in RUN. Flashing 10Hz: Master is in "prepared" state.
□	🟥	□	□	CPU is in STOP. At least 1 slave is missing.
□	🟥	□	🟥	CPU is in STOP. Master shows initialization error at faulty parameterization.

Slave operation

RUN	ERR	BA	IF	Meaning
🟩 green	🟥 red	🟨 yellow	🟥 red	
□	□	□	□	Slave has no project, this means the interface is deactivated.
◪	◪	◪	□	Flashing 1Hz: Slave is waiting for valid parameters from the CPU.
🟩	□	🟨	□	CPU is still in RUN. Slave is in "operational" state, this means data exchange between master and slaves. Inputs may be read and outputs may be accessed.

RUN 🟩 green	ERR 🟥 red	BA 🟨 yellow	IF 🟥 red	Meaning
🟩	□	◩	□	CPU is still in RUN. Flashing 1Hz: Master is in "pre-operational" state. The inputs are undefined and the outputs are disabled. If configured, it shows master failed.
□	🟥	□	🟥	CPU is in STOP. Slave shows initialization error at faulty parameterization.

Power supply

The CP 342-1CA70 gets its power supply via the SPEED-Bus.

Chap. 4.3 'Technical data' page 26

Firmware update

There is the possibility to execute a firmware update of the CP 342-1CA70 among others via the SPPED7 CPU by means of a memory card. So a firmware file may be recognized and assigned with startup, a pkg file name is reserved for each updateable component and hardware release, which begins with "px" and differs in a number with six digits. The pkg file name may be found at a label right down the front flap of the module.

Set Node-ID via Yaskawa WinCoCT

The assignment of a Node-ID (node address) happens during WinCoCT configuration. The Node-ID may be within the range 1 ... 126 in the course of which every address must be unique within the bus system. During configuration with WinCoCT a just set Node-ID may not be changed later.

I/O data

The CP may maximally process 320byte input and 320byte output data, this means max. 40 PDOs.

Deployment

With one CANopen master up to 126 CANopen slaves may be connected to the CPU. The CANopen master communicates with the CANopen slaves and links up its data areas with the address area of the CPU. At every POWER ON res. OVERALL RESET the CPU fetches the I/O mapping data from the master. If the CP does not have any parameters, the LEDs are off and the CANopen interface is deactivated.

4.3 Technical data

Order no.	**342-1CA70**
Type	CP 342S CAN, CANopen master SPEED-Bus
SPEED-Bus	✓
Current consumption/power loss	
Current consumption from backplane bus	550 mA
Power loss	2.75 W
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Supply voltage display	none
Group error display	yes
Channel error display	none
Functionality Sub-D interfaces	
Type	CAN
Type of interface	CAN
Connector	Sub-D, 9-pin, male
Electrically isolated	✓
MPI	-
MP²I (MPI/RS232)	-
Point-to-point interface	-
5V DC Power supply	-
24V DC Power supply	-
Type	-
Type of interface	-
Connector	-
Electrically isolated	-
MPI	-
MP²I (MPI/RS232)	-
Point-to-point interface	-
5V DC Power supply	-
24V DC Power supply	-

Order no.	342-1CA70
Functionality RJ45 interfaces	
Type	-
Type of interface	-
Connector	-
Electrically isolated	-
PG/OP channel	-
Number of connections, max.	-
Productive connections	-
Fieldbus	-
Type	-
Type of interface	-
Connector	-
Electrically isolated	-
PG/OP channel	-
Number of connections, max.	-
Productive connections	-
Fieldbus	-
Housing	
Material	PPE
Mounting	DIN rail SPEED-Bus
Mechanical data	
Dimensions (WxHxD)	40 mm x 125 mm x 120 mm
Net weight	210 g
Weight including accessories	-
Gross weight	-
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	-

5 Deployment

5.1 Basics CAN

General

- CANopen (Control Area Network) 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=CAN application layer) defines various level-7 user profiles for the CAN bus. One standard user profile defined by the CIA (CAN in Automation) 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 1Mbit/s limits the network to 40m and 80kbit/s 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 CP 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 transfer rate. 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.

5.2 Addressing at SPEED-Bus

Overview

To provide specific addressing of the installed peripheral modules, certain addresses must be allocated in the CPU. With no hardware configuration present, the CPU assigns automatically peripheral I/O addresses during boot procedure depending on the plug-in location amongst others also for plugged modules at the SPEED-Bus.

Maximal pluggable modules

In the hardware configurator from Siemens up to 8 modules per row may be parameterized. At deployment of SPEED7 CPUs up to 32 modules at the standard bus and 10 further modules at the SPEED-Bus may be controlled. CPs and DP masters that are additionally virtual configured at the standard bus are taken into the sum of 32 modules at the standard bus. For the project engineering of more than 8 modules you may use virtual line interface connections. For this you set in the hardware configurator the module IM 360 from the hardware catalog to slot 3 of your 1. profile rail. Now you may extend your system with up to 3 profile rails by starting each with an IM 361 from Siemens at slot 3.

Define addresses by hardware configuration

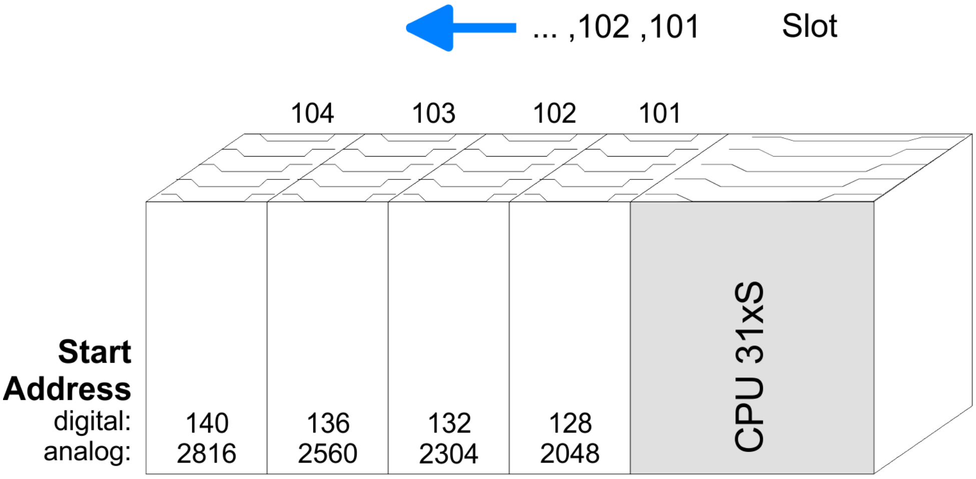
You may access the modules with read res. write accesses to the peripheral bytes or the process image. To define addresses a hardware configuration via a virtual PROFIBUS system by including the SPEEDBUS.GSD may be used. For this, click on the properties of the according module and set the wanted address.

Automatic addressing

If you do not like to use a hardware configuration, an automatic addressing comes into force. At the automatic address allocation DIOs are mapped depending on the slot location with a distance of 4byte and AIOs, FMs, CPs with a distance of 256byte.

Depending on the slot location the start address from where on the according module is stored in the address range is calculated with the following formulas:

- DIOs: Start address = 4×(slot -101)+128
- AIOs, FMs, CPs: Start address = 256×(slot -101)+2048



5.3 Project engineering fast introduction

Overview

The project engineering of the CANopen master happens in WinCoCT (**Win**dows **C**AN**o**pen **C**onfiguration **T**ool) from Yaskawa. You export your project from WinCoCT as wld-file. This wld-file can then be imported into the hardware configurator from Siemens. To connect a CAN master module to your SPEED7-CPU, you have to configure the CAN master module as VIPA_SPEEDBUS DP slave from the SPEED-Bus hardware catalog at a virtual DP master.

Fast introduction

For the deployment of System 300S modules and the CAN master at SPEED-Bus, you have to include the System 300S modules into the hardware catalog via the GSD-file from Yaskawa. For the project engineering in the hardware configurator you have to execute the following steps:

1. Start WinCoCT and project the CANopen network.
2. Create a master group with G and insert a SPEED-Bus CANopen master via ▣. Please consider that the Node-ID may not be changed later.
3. Activate the master functionality by **Node** > *CANopen Manager* with "Device is NMT Master" and confirm your setting by [Close].
4. Set parameters like diagnostics behavior and CPU address ranges with **Node** > *PLC Parameters*.
5. Create a slave group with G and add your CANopen slaves via ▣.
6. Add modules to your slaves via "Modules" and parameterize them if needed.
7. Set your process data connections in the matrix via "Connections" and proof your entries if needed in the process image of the master.
8. Save the project and export it as wld-file by **File** > *Export*.
9. Switch to the SIMATIC manager from Siemens and copy the data block from the CAN-wld-file into the block directory.
10. Start hardware configurator from Siemens and include SPEEDBUS.GSD for SPEED7 from Yaskawa.
11. Project engineering of corresponding CPU from Siemens.
12. Starting with slot 4, place the System 300 modules in the plugged sequence.
13. For the SPEED-Bus you always include, connect and parameterize to the *operating mode* DP master the DP master CP 342-5 (342-5DA02 V5.0) as last module. To this master system you assign every SPEED-Bus module as VIPA_SPEEDBUS slave. Here the PROFIBUS address corresponds to the slot no. Beginning with 100 for the CPU. Place on slot 0 of every slave the assigned module and alter the parameters if needed.

5.4 Project engineering

Preconditions

The hardware configurator is part of the Siemens SIMATIC manager and it serves the project engineering. The modules that may configured here are listed in the hardware catalog. For the deployment of the System 300S modules at the SPEED-Bus you have to include the System 300S modules into the hardware catalog via the GSD-file SPEEDBUS.GSD from Yaskawa.

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

Installation of the SPEEDBUS.GSD

The GSD (Geräte-Stamm-Datei) is online available in the following language versions. Further language versions are available on inquires:

Name	Language
SPEEDBUS.GSD	German (default)
SPEEDBUS.GSG	German
SPEEDBUS.GSE	English

The GSD files may be found at www.yaskawa.eu.com at the service area.

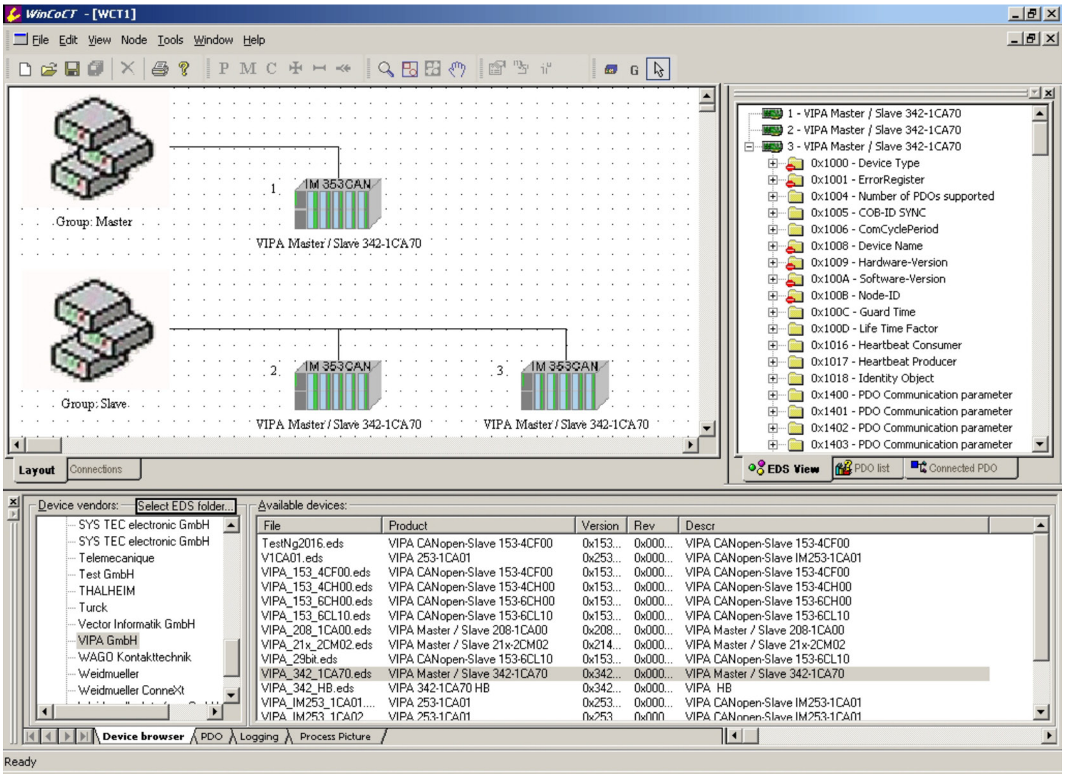
The integration of the SPEEDBUS.GSD takes place with the following proceeding:

1. Go to the service area of www.yaskawa.eu.com.
2. Load from the download area at *'Config files ➔ PROFIBUS'* the according file for your System 300S.
3. Extract the file to your work directory.
4. Start the hardware configurator from Siemens.
5. Close every project.
6. Select *'Options ➔ Install new GSD-file'*.
7. Navigate to the directory VIPA_System_300S and select **SPEEDBUS.GSD** an.

   ⇨ The SPEED7 CPUs and modules of the System 300S from Yaskawa may now be found in the hardware catalog at PROFIBUS-DP / Additional field devices / I/O / VIPA_SPEEDBUS.

WinCoCT

WinCoCT (Windows **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 PDOs are monitored in a matrix with TxPDOs as rows and RxPDOs as columns.



- 1 - VIPA Master / Slave 342-1CA70
- 2 - VIPA Master / Slave 342-1CA70
- 3 - VIPA Master / Slave 342-1CA70
  - 0x1000 - Device Type
  - 0x1001 - ErrorRegister
  - 0x1004 - Number of PDOs supported
  - 0x1005 - COB-ID SYNC
  - 0x1006 - ComCyclePeriod
  - 0x1008 - Device Name
  - 0x1009 - Hardware-Version
  - 0x100A - Software-Version
  - 0x100B - Node-ID
  - 0x100C - Guard Time
  - 0x100D - Life Time Factor
  - 0x1016 - Heartbeat Consumer
  - 0x1017 - Heartbeat Producer
  - 0x1018 - Identity Object
  - 0x1400 - PDO Communication parameter
  - 0x1401 - PDO Communication parameter
  - 0x1402 - PDO Communication parameter
  - 0x1403 - PDO Communication parameter

Device vendors:

- SYS TEC electronic GmbH
- SYS TEC electronic GmbH
- Telemecanique
- Test GmbH
- THALHEIM
- Turck
- Vector Informatik GmbH
- VIPA GmbH
- WAGO Kontakttechnik
- Weidmueller
- Weidmueller ConneXt

Available devices:

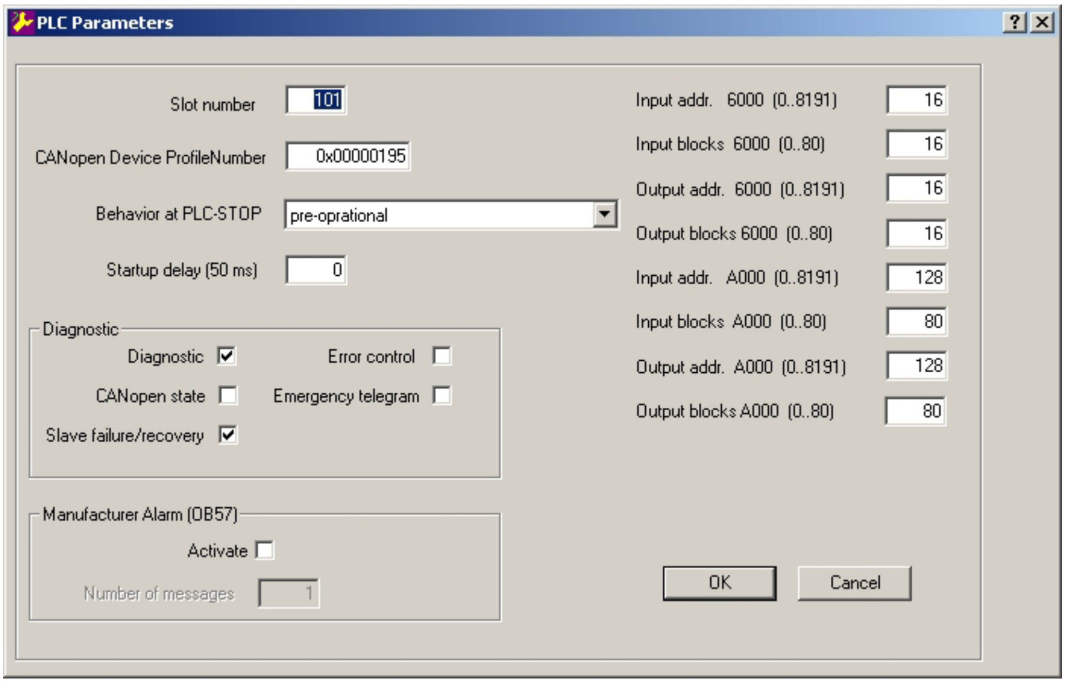
File	Product	Version	Rev	Descr
TestNg2016.eds	VIPA CANopen-Slave 153-4CF00	0x153...	0x000...	VIPA CANopen-Slave 153-4CF00
V1CA01.eds	VIPA 253-1CA01	0x253...	0x000...	VIPA CANopen-Slave IM253-1CA01
VIPA_153_4CF00.eds	VIPA CANopen-Slave 153-4CF00	0x153...	0x000...	VIPA CANopen-Slave 153-4CF00
VIPA_153_4CH00.eds	VIPA CANopen-Slave 153-4CH00	0x153...	0x000...	VIPA CANopen-Slave 153-4CH00
VIPA_153_6CH00.eds	VIPA CANopen-Slave 153-6CH00	0x153...	0x000...	VIPA CANopen-Slave 153-6CH00
VIPA_153_6CL10.eds	VIPA CANopen-Slave 153-6CL10	0x153...	0x000...	VIPA CANopen-Slave 153-6CL10
VIPA_208_1CA00.eds	VIPA Master / Slave 208-1CA00	0x208...	0x000...	VIPA Master / Slave 208-1CA00
VIPA_21x_2CM02.eds	VIPA Master / Slave 21x-2CM02	0x214...	0x000...	VIPA Master / Slave 21x-2CM02
VIPA_29bit.eds	VIPA CANopen-Slave 153-6CL10	0x153...	0x000...	VIPA CANopen-Slave 153-6CL10
VIPA_342_1CA70.eds	VIPA Master / Slave 342-1CA70	0x342...	0x000...	VIPA Master / Slave 342-1CA70
VIPA_342_HB.eds	VIPA 342-1CA70 HB	0x342...	0x000...	VIPA HB
VIPA_IM253_1CA01....	VIPA 253-1CA01	0x253...	0x000...	VIPA CANopen-Slave IM253-1CA01
VIPA_IM253_1CA02	VIPA 253-1CA01	0x253	0x000	VIPA CANopen-Slave IM253-1CA01

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 SPEED-Bus 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:



Slot number: 101

CANopen Device ProfileNumber: 0x00000195

Behavior at PLC-STOP: pre-oprational

Startup delay (50 ms): 0

Diagnostic

- Diagnostic ☑
- Error control □
- CANopen state □
- Emergency telegram □
- Slave failure/recovery ☑

Manufacturer Alarm (OB57)

- Activate □
- Number of messages: 1

Input addr. 6000 (0..8191)	16
Input blocks 6000 (0..80)	16
Output addr. 6000 (0..8191)	16
Output blocks 6000 (0..80)	16
Input addr. A000 (0..8191)	128
Input blocks A000 (0..80)	80
Output addr. A000 (0..8191)	128
Output blocks A000 (0..80)	80

Slot number

Slot number at the bus

101 ... 110: Addressing at SPEED-Bus, Slot number 101 corresponds SLOT 1 at SPEED-Bus

CANopen DeviceProfile-Number

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 the outputs to 0. The slave is still in operational state.
- *Keep last value:*
  Keeps the recent state of the outputs. The slave is still in operational state.
- *Pre-operational:*
  Every configured slave is set to pre-operational state. At STOP to RUN transition every slave is set to operational state.
- *Pre-operational + switch substitute value:*
  Sets the outputs to 0. Then every configured slave is set to pre-operational state. At STOP to RUN transition every slave is set to operational state.

Diagnostics

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

- *Diagnostic:*
  Activates the diagnostics function

NMT-Slave

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

NMT-Master

- *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
  PII basic address in the CPU that are occupied from 0x6000 CAN input data. For input blocks max. 80 (320byte) can be entered.
- *Output addr. 6000, Output blocks*
  PIQ basic address in the CPU that are occupied from 0x6000 CAN output data. For output blocks max. 80 (320byte) can be entered.
- *Input addr. A000, Input blocks*
  PII 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*
  PIQ basic address in the CPU that are occupied from 0xA000 CAN output network variables. For output blocks max. 80 (320byte) can be entered.

Manufacturer Specific Interrupt (OB 57)

- *Activate:* Activates the Manufacturer Specific Interrupt OB 57.
- *Number of Messages:* Number of messages to be received to release the OB 57. Additionally the index 2000h in the CANopen directory must be initialized.

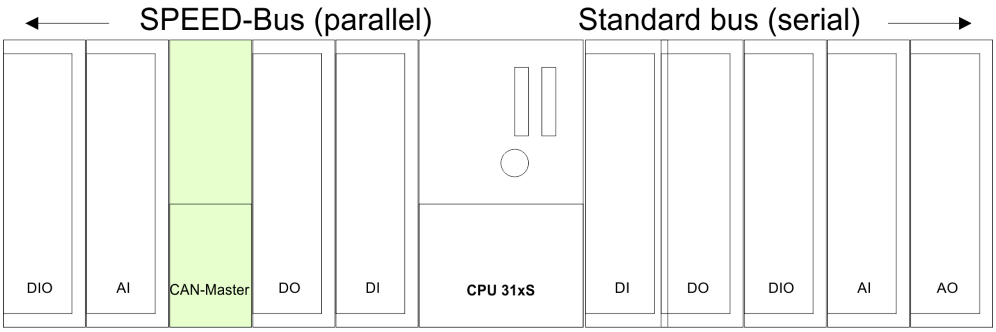
Steps of the project engineering

The following text describes the approach of the project engineering with an abstract sample: The project engineering is divided into four parts:

1. CAN master project engineering in WinCoCT and export as wld-file
2. Import CAN master project engineering
3. Project engineering of the modules at the standard bus
4. Project engineering of all SPEED-Bus modules as a virtual PROFIBUS net.

   You need SPEEDBUS.GSD.

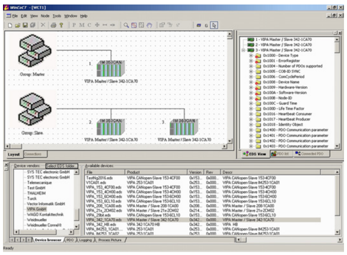
Hardware



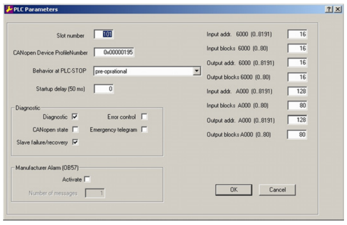
Preconditions

- 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 300S modules, you have to include the System 300S modules with the GSD-file SPEEDBUS.GSD from VIPA into the hardware catalog.

CAN master project engineering in WinCoCT



1. Copy the required EDS-files into the EDS-directory and start WinCoCT.
2. Create a "master" group via G and insert a CANopen master via
3. Create a "slave" group with G and add your CANopen slaves via
4. Right click on the according slave and add the needed modules via "Modules".
5. Parameterize the modules with [Parameter] res. via the according object directory.



PLC Parameters

Slot number: 101

CANopen Device ProfileNumber: 0x00000195

Behavior at PLC-STOP: pre-oprational

Startup delay (50 ms): 0

Diagnostic

Diagnostic ☑ Error control □

CANopen state □ Emergency telegram □

Slave failure/recovery ☑

Manufacturer Alarm (OB57)

Activate □

Number of messages: 1

Input addr. 6000 (0..8191): 16

Input blocks 6000 (0..80): 16

Output addr. 6000 (0..8191): 16

Output blocks 6000 (0..80): 16

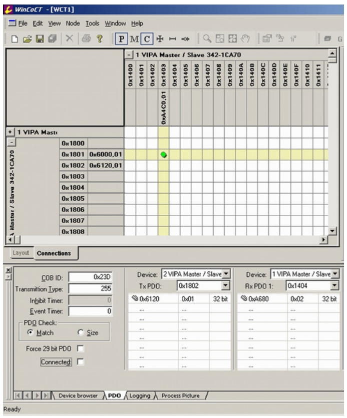
Input addr. A000 (0..8191): 128

Input blocks A000 (0..80): 80

Output addr. A000 (0..8191): 128

Output blocks A000 (0..80): 80

6. 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. At "Slot number" type the SPEED-Bus slot no. added with 100 (101...110), where your CAN master is plugged. At export, WinCoCT creates the according DB no. + 2000.



WinCoCT - [WCT1]

1 VIPA Master / Slave 342-1CA70

	0x1400	0x1401	0x1402	0x1403	0x1404	0x1405	0x1406	0x1407	0x1408	0x1409	0x140A	0x140B	0x140C	0x140D	0x140E	0x140F	0x1410	0x1411
				0xA4C0,01														
0x1800																		
0x1801 0x6000,01				●														
0x1802 0x6120,01																		
0x1803																		
0x1804																		
0x1805																		
0x1806																		
0x1807																		
0x1808																		

COB ID: 0x23D

Transmittion Type: 255

Inhibit Timer: 0

Event Timer: 0

PDO Check: ● Match ○ Size

Force 29 bit PDO □

Connected □

Device: 2 VIPA Master / Slave

Tx PDO: 0x1802

0x6120	0x01	32 bit

Device: 1 VIPA Master / Slave

Rx PDO 1: 0x1404

0xA680	0x02	32 bit

Ready

7. 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.

8. 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.

   → now the connection may be configured in the according PDO window. The connection may be checked by swapping to the "Layout" window and clicking to the master to get its "Process Picture".

9. Save your project.

10. Via **File** > *Export* your CANopen project is exported into a wld-file. The name is the combination of project name + node address + ID **Ma**ster/**Sl**ave.

11. From this wld files the according data block may be imported to the associated PLC program. More may be found at the following page.

   ⇨ Now your CANopen project engineering with WinCoCT is ready.

Import to PLC-Program

1. Start the Siemens SIMATC Manager with a new project. Open the hardware configurator and insert a profile rail from the hardware catalog.

2. Place the corresponding Siemens CPU at slot 2.

3. Open the wld file by using **File** > *Memory Card File* > *open*

4. Copy the DB 2xxx into your DB directory

   ⇨ As soon as you transfer this block to your SPEED7-CPU, it is recognized by the CPU and the according parameters are transferred to the wanted CAN master. This is only possible when the CAN master module is included into the hardware configuration at the SPEED-Bus. The following pages show the according approach. .

Project engineering of the modules at the standard bus

The modules at the right side of the CPU at the standard bus are configured with the following approach:

1. Start the hardware configurator from Siemens with a new project and insert a profile rail from the hardware catalog.

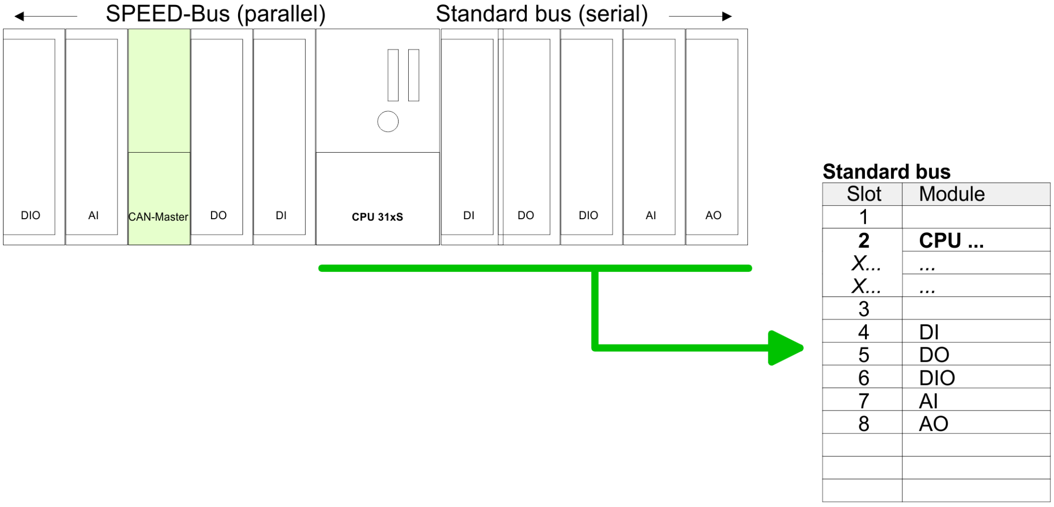
2. Place the corresponding Siemens CPU at slot 2.

3. Include your System 300V modules at the standard bus in the plugged sequence starting with slot 4.

4. Parameterize the CPU res. the modules where appropriate. The parameter window opens by a double click on the according module.

5. To extend the bus you may use the IM 360 from Siemens where you can connect up to 3 further extension racks via the IM 361. Bus extensions are always placed at slot 3.

6. Save your project



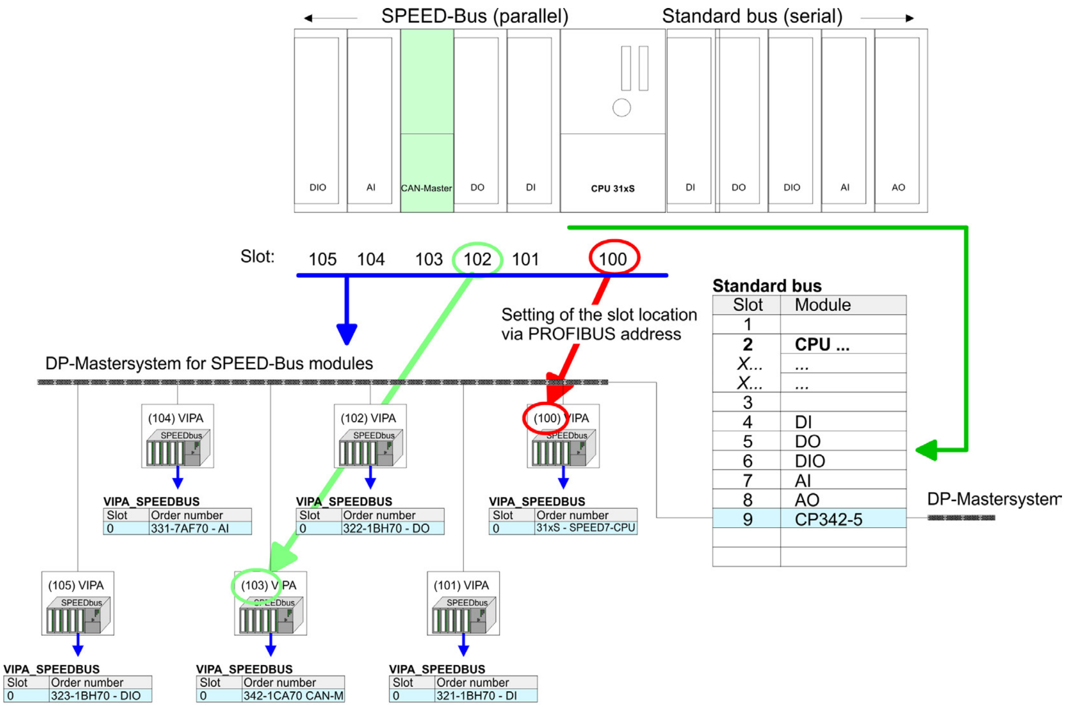
Standard bus

Slot	Module
1	
2	**CPU ...**
X...	...
X...	...
3	
4	DI
5	DO
6	DIO
7	AI
8	AO

Project engineering of all SPEED-Bus modules in a virtual master system

The slot assignment of the SPEED-Bus modules and the parameterization of the in-/output periphery happens via a virtual PROFIBUS DP master system. For this, place as last module a DP master (342-5DA02 V5.0) with master system. For the employment of the System 300S modules at the SPEED-Bus the inclusion of the System 300S modules into the hardware catalog via the GSD-file SPEEDBUS.GSD from VIPA is required. After the installation of the SPEEDBUS.GSD you may locate under *Profibus DP / Additional field devices / I/O / VIPA_SPEEDBUS* the DP slave system VIPA_SPEEDBUS. Now include for the CPU and every module at the SPEED-Bus a slave system "VIPA_SPEEDBUS". Set as PROFIBUS address the slot no. (100...110) of the module and place the according module from the hardware catalog of VIPA_SPEEDBUS to slot 0 of the slave system.

CAUTION!
Please take care to not configure ambiguous address assignments at the connection via external PROFIBUS DP master - for the project engineering of SPEED-Bus systems required! The Siemens hardware configurator does not execute an address check for external DP master systems!



Standard bus

Slot	Module
1	
2	**CPU ...**
X...	...
X...	...
3	
4	DI
5	DO
6	DIO
7	AI
8	AO
9	CP342-5

VIPA_SPEEDBUS

Slot	Order number
0	331-7AF70 - AI

VIPA_SPEEDBUS

Slot	Order number
0	322-1BH70 - DO

VIPA_SPEEDBUS

Slot	Order number
0	31xS - SPEED7-CPU

VIPA_SPEEDBUS

Slot	Order number
0	323-1BH70 - DIO

VIPA_SPEEDBUS

Slot	Order number
0	342-1CA70 CAN-M

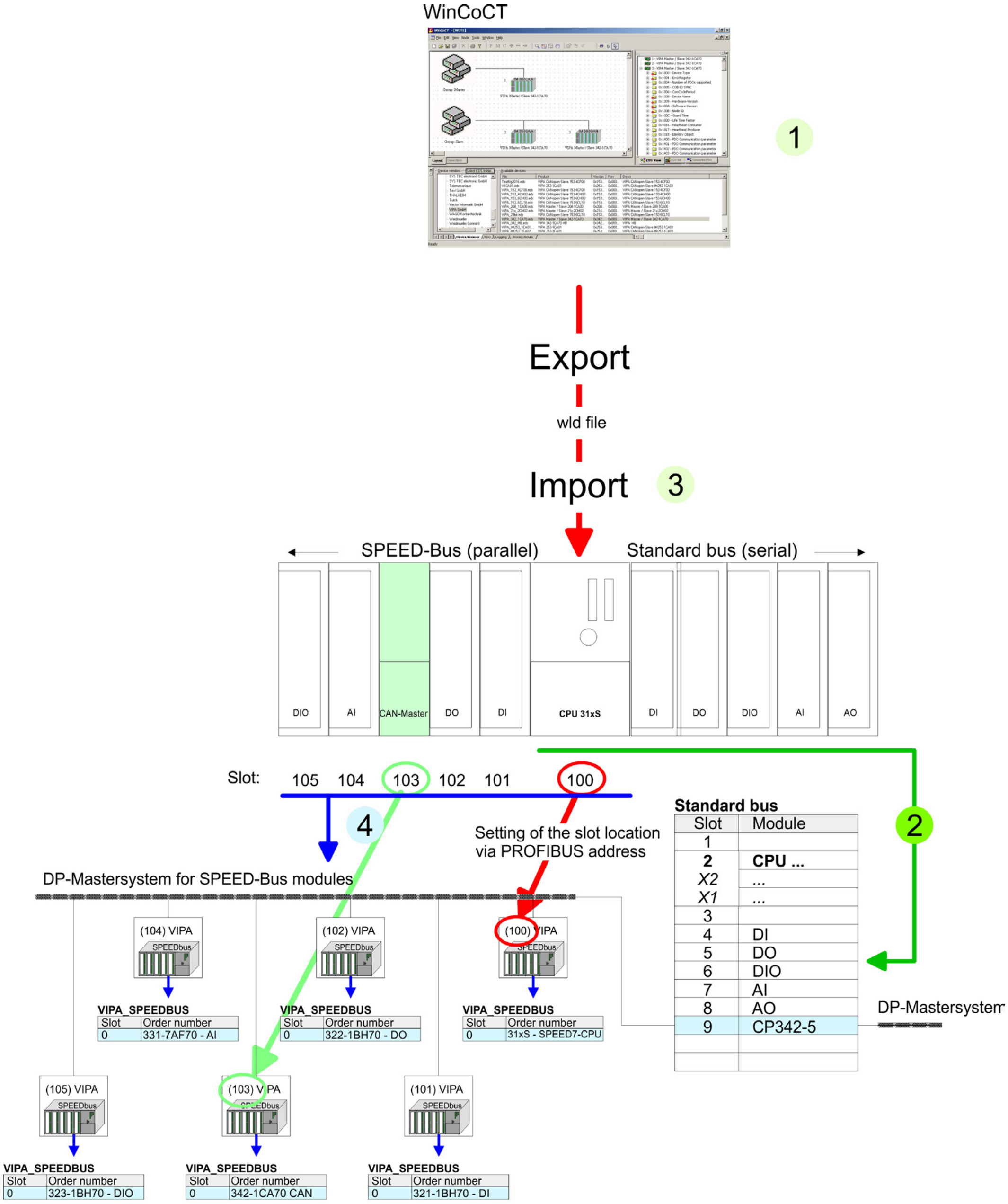
VIPA_SPEEDBUS

Slot	Order number
0	321-1BH70 - DI

- The according module is to be taken over from the HW Catalog of VIPA_SPEEDBUS to slot 0.
- Together with your hardware configuration you may transfer your DP master project engineering into the CPU. This passes the project on to the CAN master.

Summary

The following illustration summarizes the steps of project engineering:



Standard bus

Slot	Module
1	
2	**CPU ...**
X2	...
X1	...
3	
4	DI
5	DO
6	DIO
7	AI
8	AO
9	CP342-5

VIPA_SPEEDBUS

Slot	Order number
0	331-7AF70 - AI

VIPA_SPEEDBUS

Slot	Order number
0	322-1BH70 - DO

VIPA_SPEEDBUS

Slot	Order number
0	31xS - SPEED7-CPU

VIPA_SPEEDBUS

Slot	Order number
0	323-1BH70 - DIO

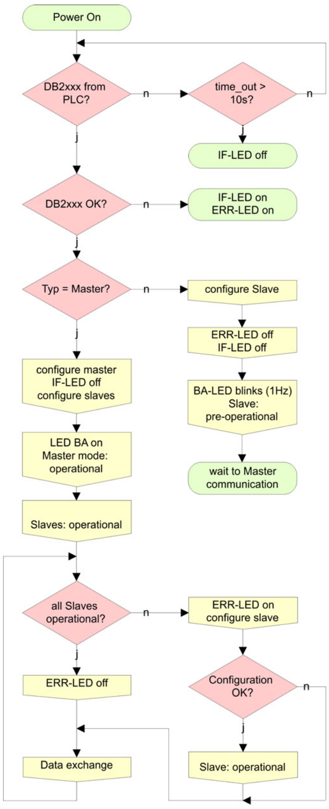
VIPA_SPEEDBUS

Slot	Order number
0	342-1CA70 CAN

VIPA_SPEEDBUS

Slot	Order number
0	321-1BH70 - DI

5.5 Operation modes



- **STOP →RUN (automatically)**
  - After POWER ON and at valid project data in the CPU, the master switches automatically into RUN. The master has no operating mode lever.
  - After POWER ON, 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.

5.6 Process image

The process image is build of the following parts:

- Process image for input data (PII) for RPDOs
- Process image for output data (PIQ) for TPDOs

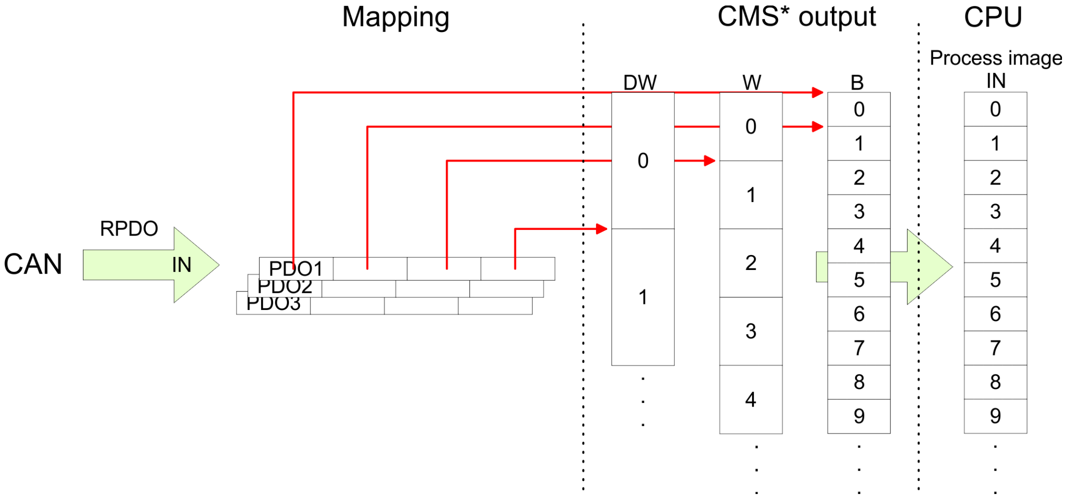
Every part consists of 320byte "Digital-Data"- and 320byte "Network Variables".

Process image input

CANopen input Objects:

- 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 different CANopen objects 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.



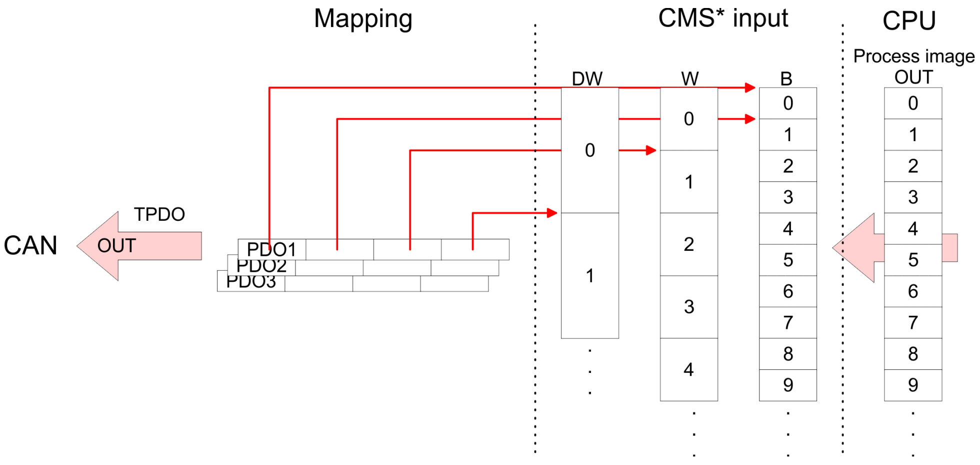
*) CMS = **C**ANopen **M**aster/**S**lave

Process image output

CANopen output Objects:

- 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 different CANopen objects 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

5.7 Message structure

Identifier

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

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

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.

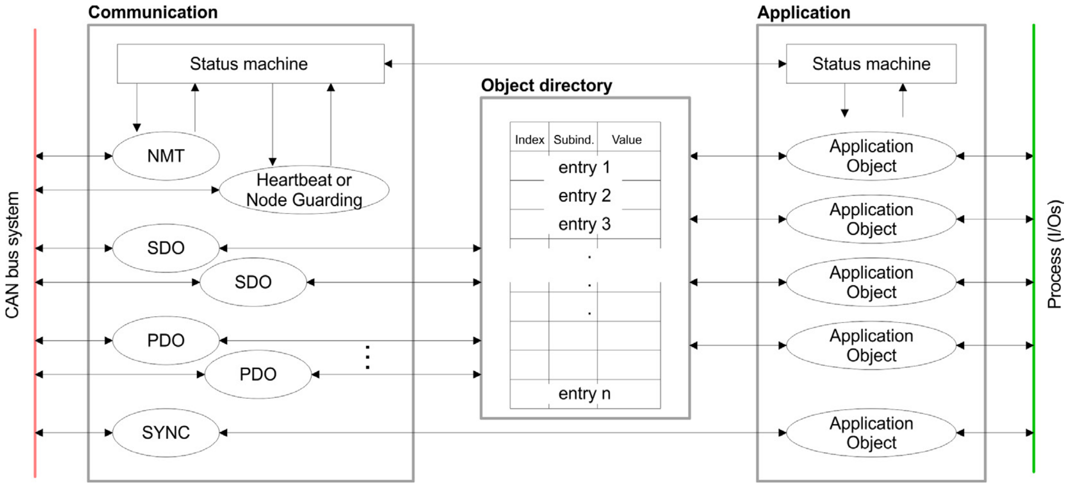
The Yaskawa CAN master for SPEED-Bus supports the following objects:

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

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 subindex.

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 stored at the PII (**p**rocess **i**mage of the **i**nputs).
- Transmit PDOs (TxPDOs) are send by the CAN-Master and contain output data stored at the PIQ (**p**rocess **i**mage of the **o**utputs).

The assignment of the PDOs to input or output data happens 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.

> *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*

FC/SFC 219 CAN_TLGR

Every SPEED7-CPU provides the integrated FC/SFC 219. This allows you to initialize a SDO read or write access from the PLC program to the CAN master. For this you address the master via the slot number and the destination slave via its CAN address. The process data is defined by the setting of INDEX and SUBINDEX. Via SDO per each access a max. of one data word process data can be transferred.

> *More information about the usage of these blocks may be found in the manual "SPEED7 Operation List" from Yaskawa.*

5.8 Object directory

Structure

- The CANopen object directory contains all relevant CANopen objects for the CP. 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 – 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 may find the manufacturer specific entries like e.g. PDO Control, CAN transfer rate (transfer rate after RESET) etc.
- **Standardized device profile area (0x6000 – 0x9FFF)**
  - This area contains the objects for the device profile acc. DS-401.

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
0x1005	COB-ID SYNC
0x1006	Communication Cycle Period
0x1007	Synchronous Window Length
0x1008	Manufacturer Hardware Version
0x1009	Hardware version
0x100A	Software version
0x100C	Guard time
0x100D	Life time factor
0x1016	Consumer Heartbeat Time
0x1017	Producer Heartbeat Time
0x1018	Identity Object
0x1400 - 0x1427	Receive PDO Communication Parameter
0x1600 - 0x1627	Receive PDO Mapping Parameter
0x1800 - 0x1827	Transmit PDO Communication Parameter
0x1A00 - 0x1A27	Transmit PDO Mapping Parameter
0x1F22	Concise DCF
0x1F25	Post Configuration
0x1F80	NMT StartUp
0x1F81	Slave Assignment
0x1F82	Request NMT
0x1F83	Request Guarding
0x2000	Initialize Rx-COB-ID for OB57
0x2001	Node-ID - PLC-STOP
0x2002	Node-ID - PLC-RUN
0x2003	Start address RxPDO-Counter
0x2004	Start address NG/HB- ToggleBit

Index	Content of Object
0x2005	Start address L2-Message-Area
0x2016	Lenze NodeGuarding
0x2100	Message PLC-RUN
0x2101	Message PLC-STOP
0x2200	J1939: PGN for Multipaket Transfer
0x3000	Special settings for CAN
0x6000	Digital-Input-8-Bit Array (see DS 401)
0x6100	Digital-Input-16-Bit Array (see DS 401)
0x6120	Digital-Input-32Bit Array (see DS 401)
0x6200	Digital-Output-8-Bit Array (see DS 401)
0x6300	Digital-Output-16-Bit Array (see DS 401)
0x6320	Digital-Output-32-Bit Array (see DS 401)
0xA040	Dynamic Unsigned8 Input
0xA100	Dynamic Unsigned16 Input
0xA200	Dynamic Unsigned32 Input
0xA440	Dynamic Unsigned64 Input
0xA4C0	Dynamic Unsigned8 Output
0xA580	Dynamic Unsigned16 Output
0xA680	Dynamic Unsigned32 Output
0xA8C0	Dynamic Unsigned64 Output

Device Type

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x1000	0	DeviceType	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 → digital outputs

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 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	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 syncmessage	Unsigned32	ro	N	0x00000080	Identifier of the SYNC message

The lower 11bit of the 32bit value contains the identifier (0x80 = 128dez).

Bit 30 = 0: Slave works as Sync Consumer (0x00000080)

Bit 30 = 1: Slave works as Sync Producer (0x40000080)

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 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 CP

- Yaskawa 342-1CA70 = Yaskawa CANopen master/slave 342-1CA70
- 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 CP

- Yaskawa 342-1CA70 = 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

- Yaskawa 342-1CA70 = 1.xx
- 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 lifeguarding)

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 0043h.

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	0xAFFEAFF	Vendor ID
	2	Product Code	Unsigned32	ro	N	0x3421CA70	Product Code
	3	Revision Number	Unsigned32	ro	N		Revision Number
	4	Serial Number	Unsigned32	ro	N		Serial Number

Communication parameter RxPDO1

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, sub-index 0: number of following parameters
	1	COB-ID	Unsigned32	rw	N	0xC0000200 + NODE_ID	COB-ID RxPDO1
	2	Transmission 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 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	1. mapped object	Unsigned32	rw	N	0x62000108	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	2	2. mapped object	Unsigned32	rw	N	0x62000208	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8. mapped	Unsigned32	rw	N	0x62000808	(2 byte index, 1 byte sub-index, 1 byte bit-width)

The 1. 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.

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.

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	1. mapped object	Unsigned32	rw	N	0x60000108	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	2	2. mapped object	Unsigned32	rw	N	0x60000208	(2 byte index, 1 byte sub-index, 1 byte bit-width)
	...	...	...	...	...	...	...
	8	8. mapped object	Unsigned32	rw	N	0x60000808	(2 byte index, 1 byte sub-index, 1 byte bit-width)

The 1. 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.

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	Meaning
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 7.. 3	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
Pre-operational	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.

Initialize Rx-COB-ID for OB 57

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2000	0	Number of elements	Unsigned8	ro	N	8	Number of available entries.
	1	1. COB-ID	Unsigned32	rw	N	0	COB-ID which generates OB 57
	2	2. COB-ID	Unsigned32	rw	N	0	COB-ID which generates OB 57
	...	...	...	...	...	...	...
	8	8. COB-ID	Unsigned32	rw	N	0	COB-ID which generates OB 57

Structur COB-ID

	UNSIGNED32				LSB
	MSB				
Bits	31	30	29	28-11	10-0
11-bit-ID	0/1	0/1	0	000000000000000000	11-bit Identifier
29-bit-ID	0/1	0/1	1	29-bit Identifier	

Bit number	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid
30	0	
	1	no RTR allowed on this PDO
29	0	11-bit ID (CAN 2.0A)
	1	29-bit ID (CAN 2.0B)
28-11	0	if bit 29=0
	X	if bit 29=1: bits 28-11 of 29-bit-COB-ID
10-0 (LSB)	X	bits 10-0 of COB-ID

Node-ID - PLC-STOP

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2001	0x00	Number of elements	Unsigned8	ro	N	0	Number of available entries.
	0x01	1. Node-ID for PLC-STOP	Unsigned8	rw	N	0	Node-ID (value range: 1...127)
	...	...	...	...	...	...	...
	0x10	16. Node-ID for PLC-STOP	Unsigned32	rw	N	0	COB-ID which generates OB 57

At PLC-RUN → PLC-STOP transition the CAN devices listed here, were set to state pre-operational by the NMT command *Preoperational*.

Node-ID - PLC-Run

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2002	0x00	Number of elements	Unsigned8	ro	N	0	Number of available entries.
	0x01	1. Node-ID for PLC-STOP	Unsigned8	rw	N	0	Node-ID (value range: 1...127)
	...	...	...	...	...	...	...
	0x10	16. Node-ID for PLC-STOP	Unsigned8	rw	N	0	Node-ID (value range: 1...127)

At PLC-STOP → PLC-RUN transition the CAN devices listed here, were set to state operational by the NMT command *Operational.*

Start address RxPDO-Counter

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2003	0x00	Start address RxPDO-Counter	Unsigned8	rw	N	0	Start address RxPDO-Counter

For the RxPDO counter a start address in the process input image of the PLC may be defined by this index.

1. There is one counter for each RxPDO.
2. The corresponding counter is incremented with the receipt of a PDO.
3. During the transition 255 → 0 the counter jumps automatically to 1.
4. The counter is reset to 0 in the default and in CPU STOP state.

PII address	Meaning
X	Counter for RxPDO 1
X+1	Counter for RxPDO 2
X+2	Counter for RxPDO 3
X+3	Counter for RxPDO 4
X+4	Counter for RxPDO 5
X+5	Counter for RxPDO 6
….	
X+35	Counter for RxPDO 36
X+36	Counter for RxPDO 37
X+37	Counter for RxPDO 38
X+38	Counter for RxPDO 39
X+39	Counter for RxPDO 40
X+40	Counter for SYNC-Message

Start address NG/HB-ToggleBit

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2003	0x00	Start address RxPDO-Counter	Unsigned8	rw	N	0	Start address RxPDO-Counter

- For the NG/HB a start address in the process input image (PII) of the PLC may be defined by this index.
- There is one bit reserved for each NodeGuarding/Heartbeat COB-ID.
- With each receipt NG/HB-COB-ID a bit is toggled.
- The toggle bit is reset to 0 in the default and in CPU STOP state.

PII address	Meaning
X	Toggle Bit for COB-ID 0x701 .. 0x708
X+1	Toggle Bit for COB-ID 0x709 .. 0x710
X+2	Toggle Bit for COB-ID 0x711 .. 0x718
X+3	Toggle Bit for COB-ID 0x719 .. 0x720
X+4	Toggle Bit for COB-ID 0x721 .. 0x728
X+5	Toggle Bit for COB-ID 0x729 .. 0x730
X+6	Toggle Bit for COB-ID 0x731 .. 0x738
X+7	Toggle Bit for COB-ID 0x739 .. 0x740
X+8	Toggle Bit for COB-ID 0x741 .. 0x748
X+9	Toggle Bit for COB-ID 0x749 .. 0x750
X+10	Toggle Bit for COB-ID 0x751 .. 0x758
X+11	Toggle Bit for COB-ID 0x759 .. 0x760
X+12	Toggle Bit for COB-ID 0x761 .. 0x768
X+13	Toggle Bit for COB-ID 0x769 .. 0x770
X+14	Toggle Bit for COB-ID 0x771 .. 0x778
X+15	Toggle Bit for COB-ID 0x779 .. 0x77F

Start address L2-Message-Area

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2005	0x00	Start address L2-Message-Area	Unsigned8	rw	N	0	L2-Message-Area

- For the L2-Message-Area a start address in the process input image of the PLC may be defined by this index.
- CAN telegrams may be send by the user program by means of the Message-Area.
- There are 5 different message puffer available.
- The sending of the CAN telegram is controlled by the status byte.
- The whole data structure is initialized to 0 in the default and in CPU STOP state.

PIQ Addr.	Chan.	Type	Meaning		PII Addr.	Chan.	Type	Meaning
X	0	B	Status byte		X	0	B	Status byte
X+1		B	Data length		X+1	1	B	Status byte
X+2		DW	COB-ID		X+2	2	B	Status byte
X+3					X+3	3	B	Status byte
X+4					X+5	4	B	Status byte
X+5								
X+6		B	Data byte 0					
X+7		B	Data byte 1					
X+8		B	Data byte 2					
X+9		B	Data byte 3					
X+10		B	Data byte 4					
X+11		B	Data byte 5					
X+12		B	Data byte 6					
X+13		B	Data byte 7					
X+14	1	B	Status-Byte					
X+15		B	Data length					
X+16		DW	COB-ID					
X+17								
X+18								
X+19								
X+20		B	Data byte 0					
X+21		B	Data byte 1					
X+22		B	Data byte 2					
X+23		B	Data byte 3					
X+24		B	Data byte 4					
X+25		B	Data byte 5					
X+26		B	Data byte 6					
X+27		B	Data byte 7					
X+28	2	B	Status byte					
X+29		B	Data length					
X+30		DW	COB-ID					
X+31								
X+32								
X+33								
X+34		B	Data byte 0					
X+35		B	Data byte 1					
X+36		B	Data byte 2					
X+37		B	Data byte 3					
X+38		B	Data byte 4					
X+39		B	Data byte 5					
X+40		B	Data byte 6					

PIQ Addr.	Chan.	Type	Meaning		PII Addr.	Chan.	Type	Meaning
X+41		B	Data byte 7					
X+42	3	B	Status byte					
X+43		B	Data length					
X+44		DW	COB-ID					
X+45								
X+46								
X+47								
X+48		B	Data byte 0					
X+49		B	Data byte 1					
X+50		B	Data byte 2					
X+51		B	Data byte 3					
X+52		B	Data byte 4					
X+53		B	Data byte 5					
X+54		B	Data byte 6					
X+55		B	Data byte 7					
X+56	4	B	Status byte					
X+57		B	Data length					
X+58		DW	COB-ID					
X+59								
X+60								
X+61								
X+62		B	Data byte 0					
X+63		B	Data byte 1					
X+64		B	Data byte 2					
X+65		B	Data byte 3					
X+66		B	Data byte 4					
X+67		B	Data byte 5					
X+68		B	Data byte 6					
X+69		BV	Data byte 7					

CANmaster	SPS
Initialization/PLC-STOP	
■ L2-Message-Area: – Data structure is initialized with 0	■ OB 100: – Initialize PIQ area of the L2-Message-Area with 0

CANmaster	SPS
Send telegram	
PII status unequal PIQ status? → enter telegram in send queue → set PII status = PIQ status	PII status equal PIQ status? → COB-ID + write data → increment the PIQ status

Lenze NodeGuarding

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2016	0x00	Number of elements	Unsigned8	ro	N	127	Number of available entries.
	0x01	1. entry	Unsigned32	rw	N	0	NodeGuarding for Node-ID = 1
	0x02	2. entry	Unsigned32	rw	N	0	NodeGuarding for Node-ID = 2
	0x03	3. entry	Unsigned32	rw	N		NodeGuarding for Node-ID = 3
	...	...	...	...	...	...	...
	0x7F	127. entry	Unsigned32	rw	N	0	NodeGuarding for Node-ID = 127

This index works especially for the Lenze cycloconverter drives. Nodeguarding/Heartbeat with CANopen, specified by DS301, is not supported by Lenze. Here a SDO transfer may be established by this index. A SDO request is sent by the CAN master to the cycloconverter drive in the temporal distance (TimeOutValue * 100ms). If there is no SDO.response receipt from the Lenze cycloconverter drive after a timeout from 1sec, a slave failure is reported to the CPU by the CAN master (OB 86 is called).

Structure of the Lenze node guarding entry

Bits	31-16	15-8	7-0
Value	Index	SubIndex	TimeOut-value * 100ms
Encoded as	Unsigned16	Unsigned8	Unsigned8

- Example for Lenze:
  – 0x5E980005 // Index 0x5E98 is equivalent to the Lenze code C0359, SubIndex 0, Timeout 5 == 500ms

Message PLC-RUN

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2100	0x00	Number of elements	Unsigned8	ro	N	10	Number of available entries.
	0x01	COB-ID	Unsigned32	rw	N	0	COB-ID
	0x02	Data length	Unsigned8	rw	N	0	Data length

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
	0x03	Data 1	Unsigned8	rw	N	0	Data 1
	0x04	Data 2	Unsigned8	rw	N	0	Data 1
	0x05	Data 3	Unsigned8	rw	N	0	Data 1

A CAN telegram may be defined by this index to be executed at PLC-STOP → PLC-RUN transition.

Message PLC-STOP

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2101	0x00	Number ofelements	Unsigned8	ro	N	10	Number of available entries
	0x01	COB-ID	Unsigned32	rw	N	0	COB-ID
	0x02	Data length	Unsigned8	rw	N	0	Data length
	0x03	Data 1	Unsigned8	rw	N	0	Data 1
	0x04	Data 2	Unsigned8	rw	N	0	Data 1
	0x05	Data 3	Unsigned8	rw	N	0	Data 1
	0x06	Data 4	Unsigned8	rw	N	0	Data 1
	0x07	Data 5	Unsigned8	rw	N	0	Data 1
	0x08	Data 6	Unsigned8	rw	N	0	Data 1
	0x09	Data 7	Unsigned8	rw	N	0	Data 1
	0x0A	Data 8	Unsigned8	rw	N	0	Data 1

A CAN telegram may be defined by this index to be executed at PLC-RUN → PLC-STOP transition.

J1939: PGN for Multipaket Transfer

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x2200	0x00	Number of elements	Unsigned8	ro	N	16	Number of available entries.
	0x01	1. PGN	Unsigned8	rw	N	0	PGN
	...	...	...	...	...	...	...
	0x10	16. PGN	Unsigned8	rw	N	0	PGN

This is a index for the J1939 protocol. Larger data sets were transferred by the multi package protocol of the J1939 protocol. Here the COB-IDs 20ECFF00h and 20EBFF00h were used. The PNG number and the data length is transferred by the COB-ID 20ECFF00h. The data are segmented transferred by the COB-ID 20EBFF00h. In the configuration tool WinCoCT the PLC parameter "Manufacturer Alarm (OB 57)" is to be activated and the "Number of messages" is to be set to 1 for the correct work with the data. Furthermore the COB-IDs 20ECFF00h and 20EBFF00h are to be entered in the Index 2000h. The number of PLC OB 57 calls may be limited now by the index 0x2200. A OB 57 call is only generated by the data telegrams of the PGN numbers entered here.

Special Settings for CAN

Index	Sub-index	Name	Type	Attr.	Map.	Default value	Meaning
0x3000	0x00	Special Settings for CAN	Unsigned8	rw	N	0	Special Settings for CAN

Special functions of the CAN firmware may be adjusted by this index.

- **Bit 0:** The RxPDO- length check may be deactivated
  - Bit = 0: Length check is activated
  - Bit = 1: Length check is deactivated
- **Bit 6...1:** reserved
- **Bit 7:** special bit for J1939
  - Bit = 0: The priority of the J1939 COB-IDs is checked
  - Bit = 1: The priority of the J1939 COB-IDs is not checked

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
	...	...	...	...	...	...	...
	0x40	160. 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 fitted components	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		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
	...	...	...	...	...	...	...
	0x0A	160. 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 32bit output blocks
	0x01	1. output block	Unsigned32	rw	N		1. digital output block
	...	...	...	...	...	...	...
	0x50	80. 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
	...	...	...	...	...	...	...
	0xFE	254. 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 compo-nents	Number of available digital 16bit input blocks
	0x01	1. input block	Unsigned16	ro	N		1. digital input block

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
	...	...	...	...	...	...	...
	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 fitted components	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 input block	Unsigned8	ro	N	0x01	Number of available digital 8bit output blocks
	0x01	1. output block	Unsigned8	rw	Y		1. digital output block
	...	...	...	...	...	...	...
	0xFE	254. 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

Index	Sub-Index	Name	Type	Attr.	Map.	Default value	Meaning
	...	...	...	...	...	...	...
	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 32bit 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

5.9 Diagnostics

Overview

If "Diagnostic" at "PLC-Parameters" from WinCoCT was activated, the following events may release a diagnostic message to the CPU and the corresponding OB is called.

- Change of CANopen state (OB 82)
- Slave fail and und recovery (OB 86)
- Guarding error (OB 82)
- Emergency telegram (OB 82)

Evaluate diagnostics with SFC 13

In the corresponding OB the diagnostics data may be accessed by means of the SFC 13 DPNRM_DG.

- Input parameter RECORD determines the target area where the data read from the slave is saved after it has been transferred without error.
- The read operation is started when input parameter REQ is set to 1.

More information about the usage of this block may be found in the manual "SPEED7 Operation List" from Yaskawa.

5.9.1 Structure of diagnostics data

Normally the length of the diagnostics data is 35byte. Is in station state 1 the bit 3 "DiagExtDiag" = 0, only the CAN diagnostics data with a length of 6byte were transferred. Information about the fundamental structure of the diagnostics data is shown in the following table:

	Byte	Description
CAN diagnostics	0	Station state 1
	1	Station state 2
	2	Station state 3
	3	Node-ID
	4	fix 0
	5	Device type
Extended diagnostics	6 ... 34	Status message

Station state 1

Bit	Name	Description
0	DiagStationNonExistent	1 = Station does not exist 0 = Station does exist (if a boot-up messages was received or node guarding was activated, the bit is set to 0.)
1	DiagStationNotReady	1 = Station is in pre-operational state 0 = Station is in operational state
2	-	reserved

Bit	Name	Description
3	DiagExtDiag	0 = Station only has CAN diagnostics 1 = Station has extended diagnostics data
7...4	-	reserved

Station state 2

Bit	Name	Description
0	DiagPrmReq	0 = Station is successfully configured 1 = Station should be configured once more
1	-	reserved
2	-	fix 1
3	DiagWD_ON	0 = Node Guarding is not supported 1 = Node Guarding is activated
7...4	-	reserved

Station state 3

The byte is reserved for future extensions.

Node-ID

ID of the station the diagnostics come from.

Device type

Type of station the diagnostics come from.

0 = Slave

1 = NMT master

Status message

Byte	Name	Description
0	Header	fix 29
1	Type	fix 81hex
2	SlotNr	fix 0
3	Specifier	Characteristic of the status message 0 = no further differentiation 1 = Status message appears 2 = Status message disappears
4...7	VendorID	CANopen Index 1018 SubIndex 1
8...11	ProductCode	CANopen Index 1018 SubIndex 2
12...15	RevisionNr	CANopen Index 1018 SubIndex 3
16...19	SerialNr	CANopen Index 1018 SubIndex 4

Byte	Name	Description
20	DiagError	Diagnostics error code (10h ... 31h) 10h = DIAG_SLAVEBOOTUP 11h = DIAG_SLAVEGRDERROR 12h = DIAG_SLAVESDOERROR 13h = DIAG_SLAVEEMCYIND
21...28	DiagErrorData	Additional data to diagnostics error

Overview DiagError DiagErrorData

The length of the additional data is always 8byte.

DIAG_SLAVE BOOTUP (10h)

This message is generated as soon as the master has received the bootup message from the appropriate slave station.

Additional data: 8byte fix 0

DIAG_SLAVE GRDERROR (11h)

If node guarding telegrams are not responded by the slave station or the slave station does not generate any heartbeat, this message is generated by the master.

Additional data:

Byte	Code
0	Event code
1	Active Status
2	Respected Status
3...7	fix 0

Event code	Description
0	Guarding is not activated.
1	The guarding was activated (again). This message takes also place, if the guarding of a slave station was transferred from an error condition into an error free condition.
2	The guarding answer of a slave station was not received within a guarding time.
3	The guarding answer of a slave station was not received within the time *Guardtime* t * *LifeTime-Factor* n. Before this event code 2 was already sent n times. The guarding for this slave station fails thereby.
4	The toggle bit of the slave message does not agree with the expected value. The master adapts its toggle value, so that this error is only uniquely released.
5	The slave station announced a communication status, which the master did not give. This error arises with a local status transition in the slave station. The error is permanently announced, until the inconsistency is corrected.
6	A heartbeat event happened. The heartbeat time of a slave station registered in the heartbeat table ran off, without receiving any heartbeat.

Active/respected status code	Description
4	Prepared
5	Operational
6	Reset
7	Reset Communication
127	Pre-operational

DIAG_SLAVE SDOERROR (12h)

Additional data:

Byte	Code
0	HighByte SDO-Index
1	LowByte SDO-Index
2	SDO-Subindex
3...6	CANOPENERROR
7	fix 0

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	Subindex 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)
0x08000024	The inquired job is not supported by the application.

DIAG_SLAVE EMCYIND (13h)

Additional data: Emergency telegram

To send internal device failures to other participants at the CAN-Bus with a high priority, the CANopen CPs supports the Emergency Object. It is provided with a high priority and supplies valuable information about the state of the device and the net. The emergency telegram has always a length of 8byte. It starts with the 2byte error code, then the 1byte error register and finally the additional code with a length of 5byte.

Telegram structure

Error code		ErrorRegister Index 0x1001	Info 0	Info 1	Info 2	Info 3	Info 4
LowByte	HighByte						

Error code	Meaning	Info 0	Info 1	Info 2	Info 3	Info4
0x0000	Reset Emergency					
0x1000	PDO Control	0xFF	0x10	PDO Number	LowByte Timer Value	HighByte Timer Value
0x6200	PLC-STOP	1=PLC-STOP	0x00	0x00	0x00	0x00
0x6363	PDO-Mapping	LowByte: Mapping parameter	HighByte: Mapping parameter	Mapping 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

5.10 Read SZL

Overview

The current state of your automation system is described by the system status list (SZL). The SZL may only be accessed by reading the partial list (extracts). These lists are build by the CPU on requirement. For the identification of a partial list there is the SZL-ID.

5.10.1 SFC 51 - RDSYSST - Read system status list SSL

Description

With the SFC 51 RDSYSST (read system status) a partial list respectively an extract of a partial list of the SSL (**s**ystem **s**tatus **l**ist) may be requested. Here with the parameters *SSL_ID* and *INDEX* the objects to be read are defined.

The *INDEX* is not always necessary. It is used to define an object within a partial list.

By setting *REQ* the query is started. As soon as *BUSY* = 0 is reported, the data are located in the target area *DR*.

IInformation about the SSL may be found in Chapter "System status list SSL".

Parameters

Parameter	Declaration	Data type	Memory block	Description
REQ	INPUT	BOOL	I, Q, M, D, L, constant	*REQ* = 1: start processing
SSL_ID	INPUT	WORD	I, Q, M, D, L, constant	*SSL_ID* of the partial list or the partial list extract
INDEX	INPUT	WORD	I, Q, M, D, L, constant	Type or number of an object in a partial list
RET_VAL	OUTPUT	INT	I, Q, M, D, L	The return value contains an error code if an error is detected when the function is being processed
BUSY	OUTPUT	BOOL	I, Q, M, D, L	*BUSY* = 1: read operation has not been completed
SSL_HEADER	OUTPUT	STRUCT	D, L	WORD structure with 2 types: LENGTHDR: length record setN_DR: number of existing related records (for access to partial list header information) or number of records transmitted in DR.
DR	OUTPUT	ANY	I, Q, M, D, L	Target area for the SSL partial list or the extraction of the partial list that was read: If you have only read the SSL partial list header info of a SSL partial list, you may not evaluate DR, but only *SSL_HEADER*. Otherwise the product of LENGTHDR and N_DR shows the number of bytes stored in *DR*.

RET_VAL (Return value)

The return value contains an error code if an error is detected when the function is being processed.

Value	Description
0000h	no error
0081h	The length of the result field is too low. The function still returns as many records as possible. The SSL header indicates the returned number of records.
7000h	First call with *REQ* = 0: data transfer not active; *BUSY* = 0.
7001h	First call with *REQ* = 1: data transfer initiated; *BUSY* = 1.
7002h	Intermediate call (*REQ* irrelevant): data transfer active; *BUSY* = 1.
8081h	The length of the result field is too low. There is not enough space for one record.
8082h	*SSL_ID* is wrong or unknown to the CPU or the SFC.
8083h	Bad or illegal *INDEX*.
8085h	Information is not available for system-related reasons, e.g. because of a lack of resources.
8086h	Record set may not be read due to a system error.
8087h	Record set may not be read because the module does not exist or it does not return an acknowledgement.
8088h	Record set may not be read because the current type identifier differs from the expected type identifier.
8089h	Record set may not be read because the module does not support diagnostic functions.
80A2h	DP protocol error - Layer-2 error (temporary fault).
80A3h	DP protocol error on user-interface/user (temporary fault).
80A4h	Bus communication failure. This error occurs between the CPU and the external DP interface (temporary fault).
80C5h	Decentralized periphery not available (temporary fault).

5.10.2 SZL lists of the CAN master

The SZL lists here have a length of 8 words. Starting with 0 each bit of the SZL corresponds to a Node-ID in ascending order. Bit 0 of byte 0 corresponds to Node-ID 1. Bit 3 of byte 1 corresponds to Node-ID 12. The following SZL-IDs are supported by the CAN master:

SZL-ID	Description
0x92	State configured stations of the CAN master system ■ Bit=0: Station is not configured ■ Bit=1: Station is configured
0x192	State activated stations of the CAN master system. ■ Bit=0: Station is not projected or projected and activated ■ Bit=1: Station is configured and deactivated

SZL-ID	Description
0x292	Actual state of the stations of the CAN master system. ■ Bit=0: Station failed, deactivated or not configured ■ Bit=1: Station is present, activated and in operational state
0x692	Diagnostics state of the stations of the CAN master system. ■ Bit=0: Station is present, available, not disturbed and activated. ■ Bit=1: Station is not OK or deactivated

5.11 Station (de-)activate

Overview

There is the possibility to deactivate respectively reactivate connected slave stations and determine the state by means of the SFC 12. If you configure slaves in a CPU which are not actually present or not currently required, the CPU will nevertheless continue to access these slaves at regular intervals. After the slaves are deactivated, further CPU accessing will stop. In this way, the fastest possible CAN bus cycle may be achieved and the corresponding error events no longer occur.

As long as any SFC 12 job is busy you cannot download a modified configuration from your PG to the CPU. The CPU rejects initiation of an SFC 12 request when it receives the download of a modified configuration.

More information about the usage of this block may be found in the manual "SPEED7 Operation List" from Yaskawa.