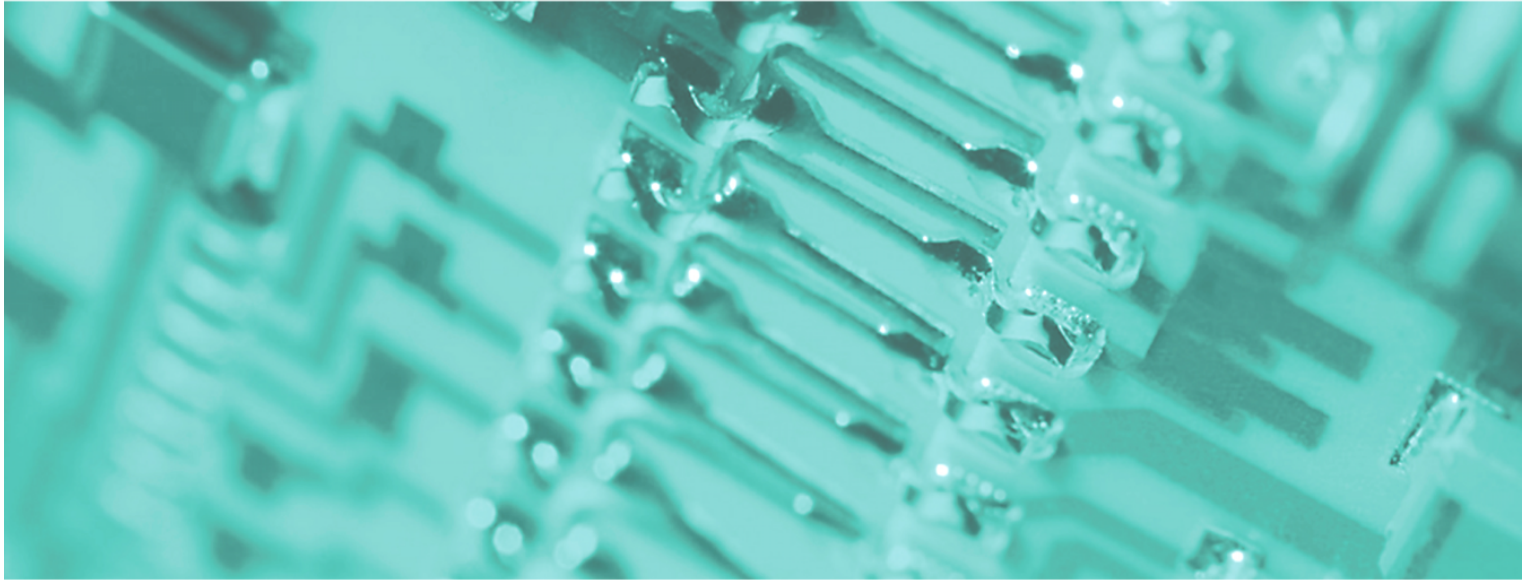




# VIPA System 300S



## **SPEED7 - CPU | 314-2AG12 | Manual**

HB140E\_CPU | RE\_314-2AG12 | Rev. 12/06

February 2012

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- 2006/95/EC Low Voltage Directive

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## About this manual

This manual describes the System 300S SPEED7 CPU 314-2AG12 from VIPA. Here you may find every information for commissioning and operation.

### Overview

#### **Chapter 1: Basics**

These basics contain hints for the usage and information about the project engineering of a SPEED7 system from VIPA.

General information about the System 300S like dimensions and environment conditions will also be found.

#### **Chapter 2: Assembly and installation guidelines**

In this chapter you will find every information, required for the installation and the cabling of a process control with the components of the System 300S with a CPU 314-2AG12.

#### **Chapter 3: Hardware description**

Here the hardware components of the CPU 314-2AG12 are described. The technical data are at the end of the chapter.

#### **Chapter 4: Deployment CPU 314-2AG12**

This chapter describes the deployment of a CPU 314-2AG12 with SPEED7 technology in the System 300S. The description refers directly to the CPU and to the deployment in connection with peripheral modules, mounted on a profile rail together with the CPU at the standard bus.

#### **Chapter 5: Deployment PtP communication**

Content of this chapter is the deployment of the RS485 interface for serial PtP communication. Here you'll find every information about the protocols, the activation and project engineering of the interface, which are necessary for the serial communication using the RS485 interface.

#### **Chapter 6: Deployment PROFIBUS communication**

Content of this chapter is the deployment of the CPU 314-2AG12 with PROFIBUS. After a short overview the project engineering and parameterization of a CPU 314-2AG12 with integrated PROFIBUS-Part from VIPA is shown. Further you get information about usage as DP master and DP slave of the PROFIBUS part. The chapter is ending with notes to commissioning and start-up behavior.

#### **Chapter 7: WinPLC7**

In this chapter the programming and simulation software WinPLC7 from VIPA is presented. WinPLC7 is suited for every with Siemens STEP<sup>®</sup>7 programmable PLC. Besides the system presentation and installation here the basics for using the software is explained with a sample project.

More information concerning the usage of WinPLC7 may be found in the online help respectively in the online documentation of WinPLC7.

**Objective and contents**

This manual describes the System 300S SPEED7 CPU 314-2AG12 from VIPA. It contains a description of the construction, project implementation and usage.

This manual is part of the documentation package with order number HB140E\_CPU and relevant for:

| Product       | Order number   | as of state: |        |        |
|---------------|----------------|--------------|--------|--------|
|               |                | CPU-HW       | CPU-FW | DPM-FW |
| CPU 314SB/DPM | VIPA 314-2AG12 | 01           | V354   | V324   |

**Target audience**

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

**Structure of the manual**

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

**Guide to the document**

The following guides are available in the manual:

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

**Availability**

The manual is available in:

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

**Icons Headings**

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



**Danger!**

Immediate or likely danger.  
Personal injury is possible.



**Attention!**

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



**Note!**

Supplementary information and useful tips.

## Safety information

### Applications conforming with specifications

The SPEED7 CPU is constructed and produced for:

- all VIPA System 300S components
- communication and process control
- general control and automation applications
- industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle



### Danger!

This device is not certified for applications in

- in explosive environments (EX-zone)

### Documentation

The manual must be available to all personnel in the

- project design department
- installation department
- commissioning
- operation



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

- Hardware modifications to the process control system should only be carried out when the system has been disconnected from power!
- Installation and hardware 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!**





# Chapter 1 Basics

**Overview** This Basics contain hints for the usage and information about the project engineering of a SPEED7 system from VIPA.  
 General information about the System 300S like dimensions and environment conditions will also be found.

| <b>Content</b> | <b>Topic</b>                       | <b>Page</b> |
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## Safety Information for Users

### Handling of electrostatic sensitive modules

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

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



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

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

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

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

### Shipping of electrostatic sensitive modules

Modules must be shipped in the original packing material.

### Measurements and alterations on electrostatic sensitive modules

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

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

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



### Attention!

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

## Operating structure of a CPU

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General</b>                     | <p>The CPU contains a standard processor with internal program memory. In combination with the integrated SPEED7 technology the unit provides a powerful solution for process automation applications within the System 300S family.</p> <p>A CPU supports the following modes of operation:</p> <ul style="list-style-type: none"><li>• cyclic operation</li><li>• timer processing</li><li>• alarm controlled operation</li><li>• priority based processing</li></ul> |
| <b>Cyclic processing</b>           | <p><b>Cyclic</b> processing represents the major portion of all the processes that are executed in the CPU. Identical sequences of operations are repeated in a never-ending cycle.</p>                                                                                                                                                                                                                                                                                 |
| <b>Timer processing</b>            | <p>Where a process requires control signals at constant intervals you can initiate certain operations based upon a <b>timer</b>, e.g. not critical monitoring functions at one-second intervals.</p>                                                                                                                                                                                                                                                                    |
| <b>Alarm controlled processing</b> | <p>If a process signal requires a quick response you would allocate this signal to an <b>alarm controlled</b> procedure. An alarm can activate a procedure in your program.</p>                                                                                                                                                                                                                                                                                         |
| <b>Priority based processing</b>   | <p>The above processes are handled by the CPU in accordance with their <b>priority</b>. Since a timer or an alarm event requires a quick reaction, the CPU will interrupt the cyclic processing when these high-priority events occur to react to the event. Cyclic processing will resume, once the reaction has been processed. This means that cyclic processing has the lowest priority.</p>                                                                        |

---

**Applications**

The program that is present in every CPU is divided as follows:

- System routine
- User application

**System routine**

The system routine organizes all those functions and procedures of the CPU that are not related to a specific control application.

**User application**

This consists of all the functions that are required for the processing of a specific control application. The operating modules provide the interfaces to the system routines.

---

**Operands**

The following series of operands is available for programming the CPU:

- Process image and periphery
- Bit memory
- Timers and counters
- Data blocks

**Process image and periphery**

The user application can quickly access the process image of the inputs and outputs PAA/PAE. You may manipulate the following types of data:

- individual Bits
- Bytes
- Words
- Double words

You may also gain direct access to peripheral modules via the bus from user application. The following types of data are available:

- Bytes
- Words
- Blocks

- Bit Memory**                    The bit memory is an area of memory that is accessible by means of certain operations. Bit memory is intended to store frequently used working data.  
You may access the following types of data:
- individual Bits
  - Bytes
  - Words
  - Double words
- Timers and counters**                    In your program you may load cells of the timer with a value between 10ms and 9990s. As soon as the user application executes a start-operation, the value of this timer is decremented by the interval that you have specified until it reaches zero.  
You may load counter cells with an initial value (max. 999) and increment or decrement these when required.
- Data Blocks**                    A data block contains constants or variables in the form of bytes, words or double words. You may always access the current data block by means of operands.  
You may access the following types of data:
- individual Bits
  - Bytes
  - Words
  - Double words

# CPU 314-2AG12

## Overview

The CPU 314-2AG12 bases upon the SPEED7 technology. This supports the CPU at programming and communication by means of co-processors that causes a power improvement for highest needs.

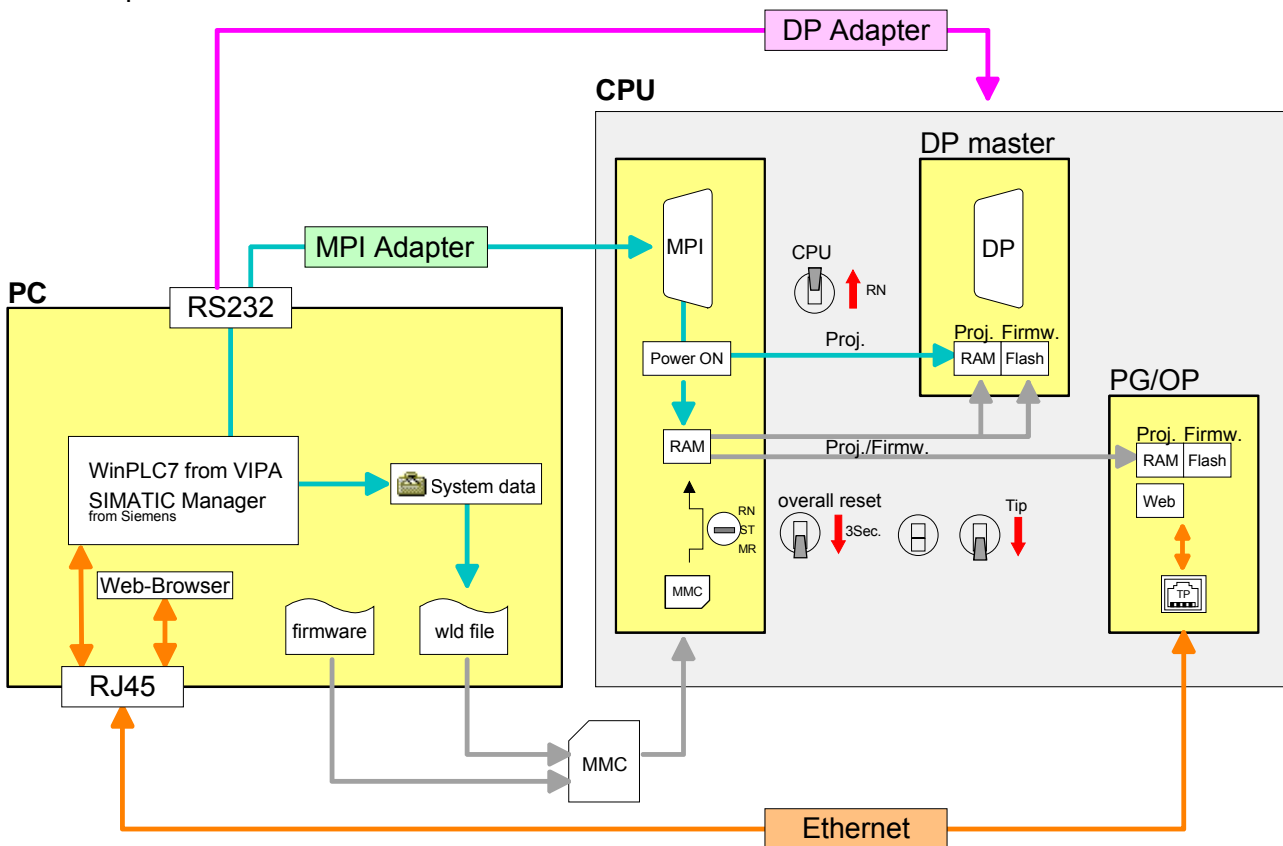
The SPEED7 CPUs from VIPA are instruction compatible to the programming language STEP®7 from Siemens and may be programmed via WinPLC7 from VIPA or via the Siemens SIMATIC Manager. Here the instruction set of the S7-400 from Siemens is used.

Modules and CPUs of the System 300S from VIPA and Siemens may be used at the bus as a mixed configuration.

The user application is stored in the battery buffered RAM or on an additionally pluggable MMC storage module.

The CPU is configured as CPU 318-2 (6ES7 318-2AJ00-0AB0/V3.0) from Siemens.

## Access options



### Note!

Please do always use the **CPU 318-2 (6ES7 318-2AJ00-0AB0/V3.0)** from Siemens of the hardware catalog to project this CPU from VIPA.

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

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Memory management</b>                 | <p>The CPU has an integrated memory. Information about the capacity (min. capacity ... max capacity) of the memory may be found at the front of the CPU.</p> <p>The memory is divided into the following 3 parts:</p> <ul style="list-style-type: none"> <li>• Load memory 512kbyte</li> <li>• Code memory (50% of the work memory)</li> <li>• Data memory (50% of the work memory)</li> </ul> <p>The work memory has 256kbyte. There is the possibility to extend the work memory to its maximum printed capacity 512kbyte by means of a MCC memory extension card.</p> |
| <b>Integrated PROFIBUS DP master</b>     | <p>The CPU has an integrated PROFIBUS DP master, which also may be used as PROFIBUS DP slave.</p> <p>The project engineering takes place or in the hardware configurator from Siemens in WinPLC7 from VIPA.</p>                                                                                                                                                                                                                                                                                                                                                          |
| <b>Integrated Ethernet PG/OP channel</b> | <p>The CPU has an Ethernet interface for PG/OP communication. Via the "PLC" functions you may directly access the Ethernet PG/OP channel and program res. remote control your CPU. A max. of 4 PG/OP connections is available.</p> <p>You may also access the CPU with a visualization software via these connections.</p>                                                                                                                                                                                                                                               |
| <b>Operation Security</b>                | <ul style="list-style-type: none"> <li>• Wiring by means of spring pressure connections (CageClamps) at the front connector</li> <li>• Core cross-section 0.08...2.5mm<sup>2</sup></li> <li>• Total isolation of the wiring at module change</li> <li>• Potential separation of all modules to the backplane bus</li> <li>• ESD/Burst acc. IEC 61000-4-2/IEC 61000-4-4 (up to level 3)</li> <li>• Shock resistance acc. IEC 60068-2-6 / IEC 60068-2-27 (1G/12G)</li> </ul>                                                                                               |
| <b>Environmental conditions</b>          | <ul style="list-style-type: none"> <li>• Operating temperature: 0 ... +60°C</li> <li>• Storage temperature: -25 ... +70°C</li> <li>• Relative humidity: 5 ... 95% without condensation</li> <li>• Ventilation by means of a fan is not required</li> </ul>                                                                                                                                                                                                                                                                                                               |
| <b>Dimensions/Weight</b>                 | <ul style="list-style-type: none"> <li>• Dimensions of the basic enclosure:<br/>1tier width: (WxHxD) in mm: 40x125x120</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Integrated power supply</b>           | <p>The CPU comes with an integrated power supply. The power supply is to be supplied with DC 24V. By means of the supply voltage, the internal electronic is supplied as well as the connected modules via backplane bus. The power supply is protected against inverse polarity and overcurrent.</p>                                                                                                                                                                                                                                                                    |





## Chapter 2 Assembly and installation guidelines

### Overview

In this chapter you will find every information, required for the installation and the cabling of a process control with the components of a CPU 314-2AG12 in the System 300S.

### Content

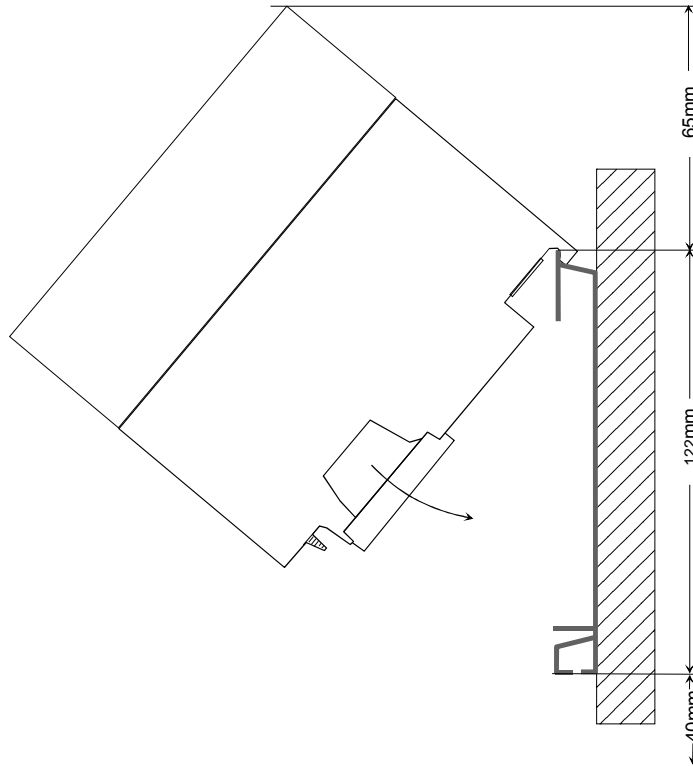
| Topic                                                      | Page       |
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| Assembly standard bus .....                                | 2-3        |
| Cabling.....                                               | 2-5        |
| Installation guidelines .....                              | 2-6        |

## Installation dimensions

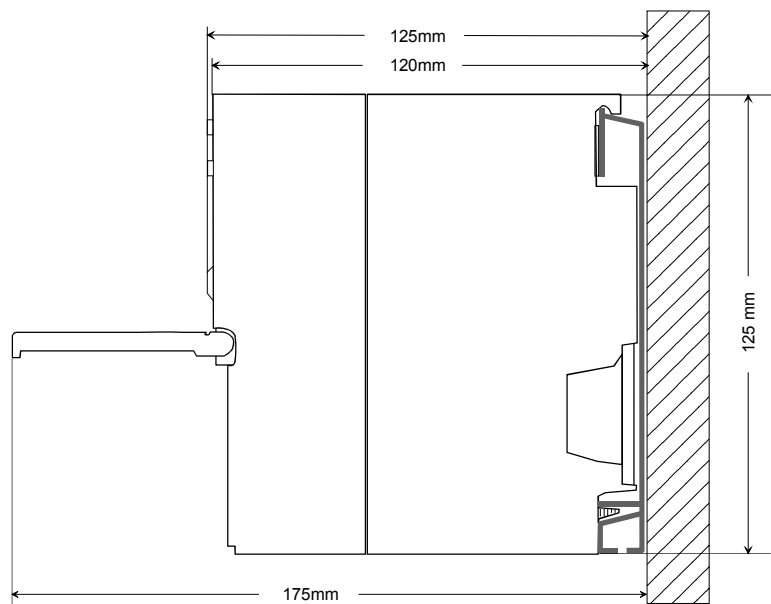
**Dimensions**  
**Basic enclosure**

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

**Dimensions**



**Installation dimensions**



## Assembly standard bus

### General

The single modules are directly installed on a profile rail and connected via the backplane bus connector. Before installing the modules you have to clip the backplane bus connector to the module from the backside.

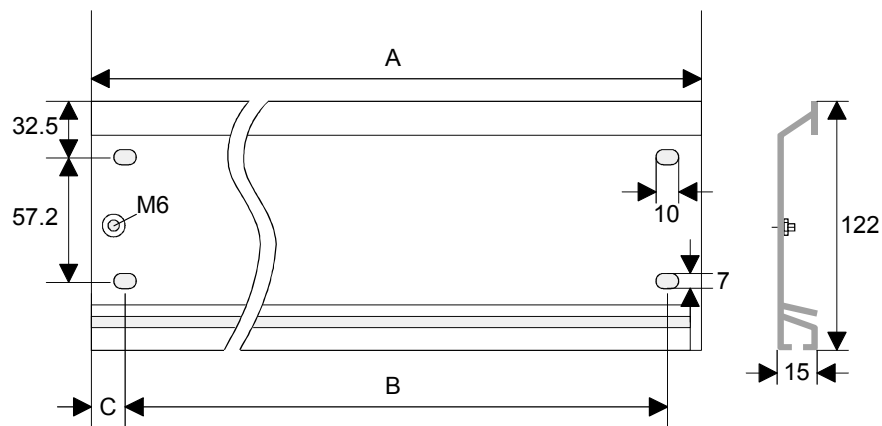
The backplane bus connector is delivered together with the peripheral modules.

### Profile rail

| Order number    | A    | B                   | C   |
|-----------------|------|---------------------|-----|
| VIPA 390-1AB60  | 160  | 140                 | 10  |
| VIPA 390-1AE80  | 482  | 466                 | 8.3 |
| VIPA 390-1AF30  | 530  | 500                 | 15  |
| VIPA 390-1AJ30  | 830  | 800                 | 15  |
| VIPA 390-9BC00* | 2000 | Drillings only left | 15  |

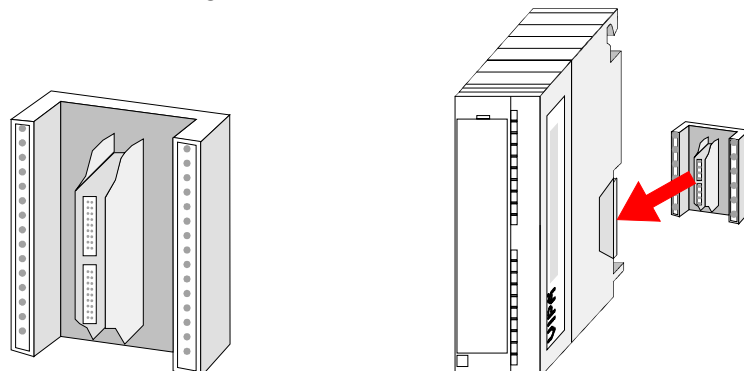
\* Unit pack: 10 pieces

Measures in mm



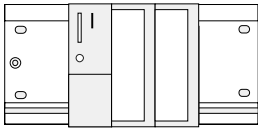
### Bus connector

For the communication between the modules the System 300S uses a backplane bus connector. Backplane bus connectors are included in the delivering of the peripheral modules and are clipped at the module from the backside before installing it to the profile rail.



**Assembly possibilities**

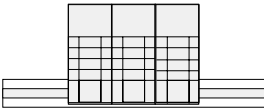
horizontal assembly



vertical assembly



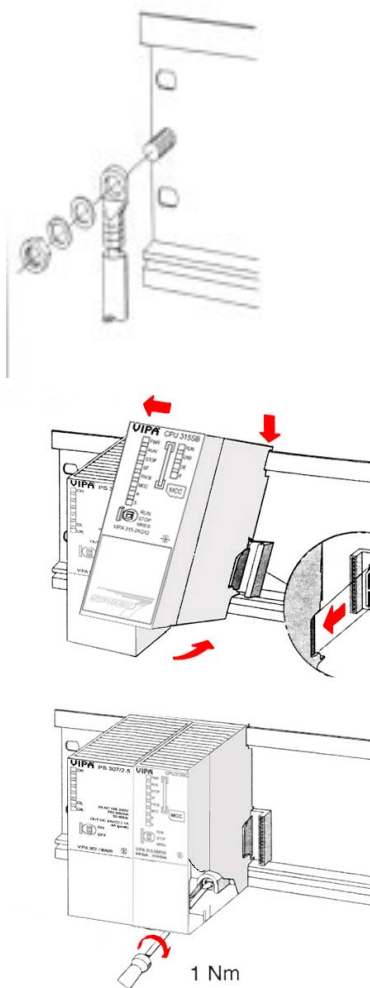
lying assembly



Please regard the allowed environment temperatures:

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

**Approach**



- 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.
- If the background is a grounded metal or device plate, please look for a low-impedance connection between profile rail and background.
- Connect the profile rail with the protected earth conductor. For this purpose there is a bolt with M6-thread.
- The minimum cross-section of the cable to the protected earth conductor has to be 10mm<sup>2</sup>.
- Stick the power supply to the profile rail and pull it to the left side to the grounding bolt of the profile rail.
- Fix the power supply by screwing.
- Take a backplane bus connector and click it at the CPU from the backside like shown in the picture.
- Stick the CPU to the profile rail right from the power supply and pull it to the power supply.
- Click the CPU downwards and bolt it like shown.
- Repeat this procedure with the peripheral modules, by clicking a backplane bus connector, stick the module right from the modules you've already fixed, click it downwards and connect it with the backplane bus connector of the last module and bolt it.



**Danger!**

- 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!

## Cabling



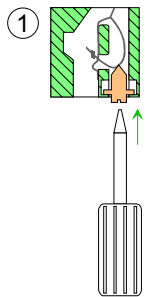
### Danger!

- 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!

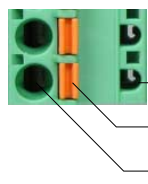
### CageClamp technology (green)

For the cabling of power supply of a CPU, a green plug with CageClamp technology is deployed.

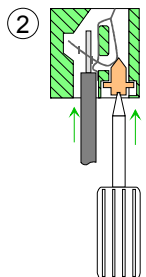
The connection clamp is realized as plug that may be clipped off carefully if it is still cabled.



Here wires with a cross-section of  $0.08\text{mm}^2$  to  $2.5\text{mm}^2$  may be connected. You can use flexible wires without end case as well as stiff wires.

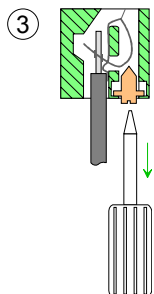


- [1] Test point for 2mm test tip
- [2] Locking (orange) for screwdriver
- [3] Round opening for wires



The picture on the left side shows the cabling step by step from top view.

- For cabling you push the locking vertical to the inside with a suitable screwdriver and hold the screwdriver in this position.
- Insert the de-isolated wire into the round opening. You may use wires with a cross-section from  $0.08\text{mm}^2$  to  $2.5\text{mm}^2$ .
- By removing the screwdriver the wire is connected safely with the plug connector via a spring.



## Installation guidelines

### General

The installation guidelines contain information about the interference free deployment of System 300S systems. There is the description of the ways, interference may occur in your control, how you can make sure the electromagnetic digestibility (EMC), and how you manage the isolation.

### What means EMC?

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

All System 300S components are developed for the deployment in hard industrial environments and fulfill high demands on the EMC. Nevertheless you should project an EMC planning before installing the components and take conceivable interference causes into account.

### Possible interference causes

Electromagnetic interferences may interfere your control via different ways:

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

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

One differs:

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

**Basic rules for EMC**

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

- Take care of a correct area-wide grounding of the inactive metal parts when installing your components.
  - Install a central connection between the ground and the protected earth conductor system.
  - Connect all inactive metal extensive and impedance-low.
  - Please try not to use aluminum parts. Aluminum is easily oxidizing and is therefore less suitable for grounding.
- When cabling, take care of the correct line routing.
  - Organize your cabling in line groups (high voltage, current supply, signal and data lines).
  - Always lay your high voltage lines and signal res. data lines in separate channels or bundles.
  - Route the signal and data lines as near as possible beside ground areas (e.g. suspension bars, metal rails, tin cabinet).
- Proof the correct fixing of the lead isolation.
  - Data lines must be laid isolated.
  - Analog lines must be laid isolated. When transmitting signals with small amplitudes the one sided laying of the isolation may be favorable.
  - Lay the line isolation extensively on an isolation/protected earth conductor rail directly after the cabinet entry and fix the isolation with cable clamps.
  - Make sure that the isolation/protected earth conductor rail is connected impedance-low with the cabinet.
  - Use metallic or metalized plug cases for isolated data lines.
- In special use cases you should appoint special EMC actions.
  - Wire all inductivities with erase links.
  - Please consider luminescent lamps can influence signal lines.
- Create a homogeneous reference potential and ground all electrical operating supplies when possible.
  - Please take care for the targeted employment of the grounding actions. The grounding of the PLC is a protection and functionality activity.
  - Connect installation parts and cabinets with the System 300S in star topology with the isolation/protected earth conductor system. So you avoid ground loops.
  - If potential differences between installation parts and cabinets occur, lay sufficiently dimensioned potential compensation lines.

**Isolation of conductors**

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

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

When isolating cables you have to regard the following:

- If possible, use only cables with isolation tangle.
- The hiding power of the isolation should be higher than 80%.
- Normally you should always lay the isolation of cables on both sides. Only by means of the both-sided connection of the isolation you achieve high quality interference suppression in the higher frequency area.  
Only as exception you may also lay the isolation one-sided. Then you only achieve the absorption of the lower frequencies. A one-sided isolation connection may be convenient, if:
  - the conduction of a potential compensating line is not possible
  - analog signals (some mV res.  $\mu$ A) are transferred
  - foil isolations (static isolations) are used.
- With data lines always use metallic or metalized plugs for serial couplings. Fix the isolation of the data line at the plug rack. Do not lay the isolation on the PIN 1 of the plug bar!
- At stationary operation it is convenient to strip the insulated cable interruption free and lay it on the isolation/protected earth conductor line.
- To fix the isolation tangles use cable clamps out of metal. The clamps must clasp the isolation extensively and have well contact.
- Lay the isolation on an isolation rail directly after the entry of the cable in the cabinet. Lead the isolation further on to the System 300S module and **don't** lay it on there again!

**Please regard at installation!**

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

Remedy: Potential compensation line



## Chapter 3 Hardware description

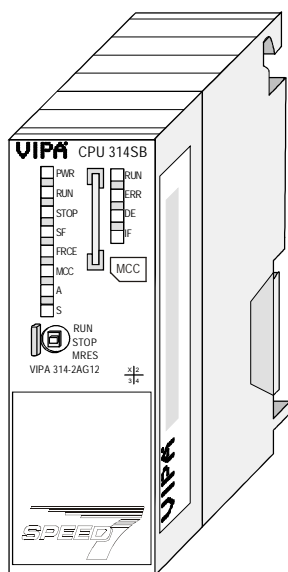
**Overview** Here the hardware components of the CPU 314-2AG12 are described.  
The technical data are at the end of the chapter.

| <b>Content</b> | <b>Topic</b>                                | <b>Page</b> |
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|                | Technical Data .....                        | 3-8         |

## Properties

### CPU 314SB/DPM 314-2AG12

- SPEED7 technology integrated
- 256kbyte work memory integrated (128kbyte code, 128kbyte data)
- Memory expandable to max. 512kbyte (256kbyte code, 256kbyte data)
- Load memory 512kbyte
- PROFIBUS DP master integrated (DP-V0, DP-V1)
- MPI interface
- MCC slot for external memory cards and memory extension
- Status LEDs for operating state and diagnosis
- Real-time clock battery buffered
- Ethernet PG/OP interface integrated
- RS485 interface configurable for PROFIBUS DP master respectively PtP communication
- I/O address range digital/analog 8191byte
- 512 timer
- 512 counter
- 8192 flag byte

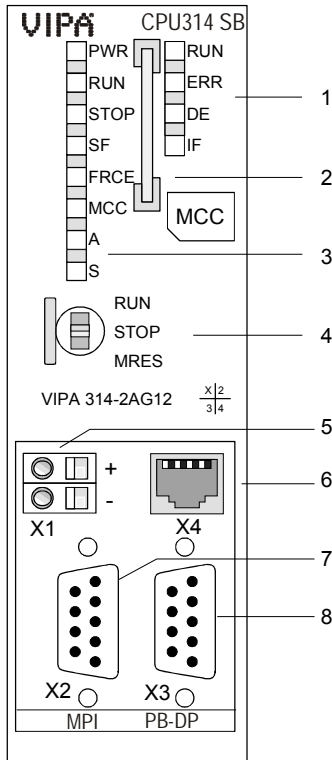


### Ordering data

| Type      | Order number   | Description                                                                                 |
|-----------|----------------|---------------------------------------------------------------------------------------------|
| 314SB/DPM | VIPA 314-2AG12 | MPI interface, card slot, real time clock, Ethernet interface for PG/OP, PROFIBUS DP master |

# Structure

## CPU 314SB/DPM 314-2AG12

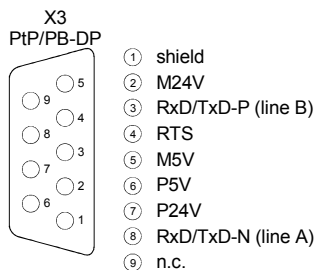
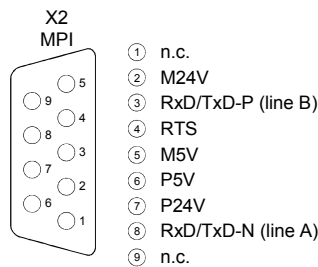
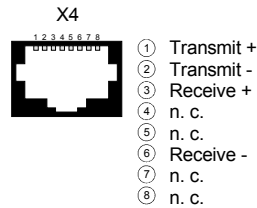
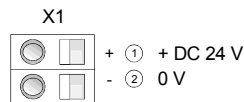


- [1] LEDs of the integrated PROFIBUS DP master
- [2] Storage media slot
- [3] LEDs of the CPU part
- [4] Operating mode switch CPU

The following components are under the front flap

- [5] Slot for DC 24V power supply
- [6] Twisted pair interface for Ethernet PG/OP channel
- [7] MPI interface
- [8] PROFIBUS DP/PtP interface

## Interfaces



|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Power supply X1</b>                                           | <p>The CPU has an integrated power supply. The power supply has to be provided with DC 24V. For this serves the double DC 24V slot, that is underneath the flap.</p> <p>Via the power supply not only the internal electronic is provided with voltage, but by means of the backplane bus also the connected modules. The power supply is protected against polarity inversion and overcurrent. The internal electronic is galvanically connected with the supply voltage.</p>                                                              |
| <b>MPI interface X2</b>                                          | <p><i>9-pin SubD jack:</i></p> <p>The MPI interface serves for the connection between programming unit and CPU. By means of this the project engineering and programming happens. In addition MPI serves for communication between several CPUs or between HMIs and CPU.</p> <p>Standard setting is MPI Address 2.</p>                                                                                                                                                                                                                      |
| <b>Ethernet PG/OP channel X4</b>                                 | <p><i>8pin RJ45 jack:</i></p> <p>The RJ45 jack serves the interface to the Ethernet PG/OP channel. This interface allows you to program res. remote control your CPU, to access the internal website or to connect a visualization. Configurable connections are not possible.</p> <p>For online access to the CPU via Ethernet PG/OP channel valid IP address parameters have to be assigned to this. More may be found at chapter "Deployment CPU ..." at "Initialization Ethernet PG/OP channel".</p>                                    |
| <b>PROFIBUS/PtP interface with configurable functionality X3</b> | <p>The CPU has a PROFIBUS/PtP interface with a fix pinout. After an overall reset the interface is deactivated.</p> <p>By appropriate configuration, the following functionalities for this interface may be enabled:</p> <ul style="list-style-type: none"><li>• PROFIBUS DP master operation</li><li>• PROFIBUS DP slave operation</li><li>• PtP functionality</li></ul>                                                                                                                                                                  |
| PROFIBUS functionality                                           | <p>The PROFIBUS master/slave functionality of this interface is activated by configuring the sub module X1 (MPI/DP) of the CPU in the hardware configuration.</p>                                                                                                                                                                                                                                                                                                                                                                           |
| PtP functionality                                                | <p>Using the <i>PtP</i> functionality the RS485 interface is allowed to connect via serial point-to-point connection to different source res. target systems. Here the following protocols are supported: ASCII, STX/ETX, 3964R, USS and Modbus-Master (ASCII, RTU) .</p> <p>The activation of the PtP functionality happens by embedding the SPEEDBUS.GSD from VIPA in the hardware catalog. After the installation the CPU may be configured in a PROFIBUS master system and here the interface may be switched to PtP communication.</p> |

---

## Memory management

The CPU has an integrated memory. Information about the capacity (min. capacity ... max capacity) of the memory may be found at the front of the CPU.

The memory is divided into the following 3 parts:

- Load memory 512kbyte
- Code memory (50% of the work memory)
- Data memory (50% of the work memory)

The work memory has 256kbyte. There is the possibility to extend the work memory to its maximum printed capacity 512kbyte by means of a MCC memory extension card.

---

## Operating mode switch



With the operating mode switch you may switch the CPU between STOP and RUN.

During the transition from STOP to RUN the operating mode START-UP is driven by the CPU.

Placing the switch to MRES (Memory Reset), you request an overall reset with following load from MMC, if a project there exists.

---

## Storage media slot

As external storage medium for applications and firmware you may use a MMC storage module (**M**ultimedia **c**ard) or a MCC memory extension card. The MCC can additionally be used as an external storage medium.

Both VIPA storage media are pre-formatted with the PC format FAT16 and can be accessed via a card reader. An access to the storage media always happens after an overall reset and PowerON.

After PowerON respectively an overall reset the CPU checks, if there is a storage medium with data valid for the CPU.

**LEDs** The CPU has got LEDs on its front side. In the following the usage and the according colors of the LEDs is described.

**LEDs CPU** As soon as the CPU is supplied with 5V, the green PWR-LED is on.

| RUN<br>green                 | STOP<br>yellow | SF<br>red | FRCE<br>yellow | MCC<br>yellow | Meaning                                                                                      |
|------------------------------|----------------|-----------|----------------|---------------|----------------------------------------------------------------------------------------------|
| <b>Boot-up after PowerON</b> |                |           |                |               |                                                                                              |
| ●                            | ☀*             | ●         | ●              | ●             | * Blinking with 10Hz: Firmware is loaded.                                                    |
| ●                            | ●              | ●         | ●              | ●             | Initialization: Phase 1                                                                      |
| ●                            | ●              | ●         | ●              | ○             | Initialization: Phase 2                                                                      |
| ●                            | ●              | ●         | ○              | ○             | Initialization: Phase 3                                                                      |
| ○                            | ●              | ●         | ○              | ○             | Initialization: Phase 4                                                                      |
| <b>Operation</b>             |                |           |                |               |                                                                                              |
| ○                            | ●              | X         | X              | X             | CPU is in STOP state.                                                                        |
| ☀                            | ○              | X         | X              | X             | CPU is in start-up state, the RUN LED blinks during operating OB100 at least for 3s.         |
| ●                            | ○              | ○         | X              | X             | CPU is in state RUN without error.                                                           |
| X                            | X              | ●         | X              | X             | There is a system fault. More information may be found in the diagnostics buffer of the CPU. |
| X                            | X              | X         | ●              | X             | Variables are forced.                                                                        |
| X                            | X              | X         | X              | ●             | Access to the memory card.                                                                   |
| <b>Overall reset</b>         |                |           |                |               |                                                                                              |
| ○                            | ☀              | X         | X              | X             | Overall reset is requested.                                                                  |
| ○                            | ☀*             | X         | X              | X             | * Blinking with 5Hz: Overall reset is executed.                                              |
| <b>Factory reset</b>         |                |           |                |               |                                                                                              |
| ●                            | ●              | ○         | ○              | ○             | Factory reset is executed.                                                                   |
| ○                            | ●              | ●         | ●              | ●             | Factory reset finished without error.                                                        |
| <b>Firmware update</b>       |                |           |                |               |                                                                                              |
| ○                            | ●              | ☀         | ☀              | ●             | The alternate blinking indicates that there is new firmware on the memory card.              |
| ○                            | ○              | ☀         | ☀              | ●             | The alternate blinking indicates that a firmware update is executed.                         |
| ○                            | ●              | ●         | ●              | ●             | Firmware update finished without error.                                                      |
| ○                            | ☀*             | ☀*        | ☀*             | ☀*            | * Blinking with 10Hz: Error during Firmware update.                                          |

on: ●    off: ○    blinking (2Hz): ☀    not relevant: X

**LEDs Ethernet PG/OP channel A, S** The green A-LED (Activity) indicates the physical connection of the Ethernet PG/OP channel to Ethernet. Irregular flashing of the A-LED indicates communication of the Ethernet PG/OP channel via Ethernet.

If the green S-LED (Speed) is on, the Ethernet PG/OP has a communication speed of 100MBit/s otherwise with 10MBit/s.

### LEDs PROFIBUS/PtP interface X3

Dependent on the mode of operation the LEDs show information about the state of operation of the PROFIBUS part according to the following pattern:

#### Master operation

| RUN<br>green | ERR<br>red | DE<br>green | IF<br>red | Meaning                                                                                                        |
|--------------|------------|-------------|-----------|----------------------------------------------------------------------------------------------------------------|
| ○            | ○          | ○           | ○         | Master has no project, this means the interface is deactivated respectively PtP is active.                     |
| ●            | ○          | ○           | ○         | Master has bus parameters and is in RUN without slaves.                                                        |
| ●            | ○          | ☀           | ○         | Master is in "clear" state (safety state). The inputs of the slaves may be read. The outputs are disabled.     |
| ●            | ○          | ●           | ○         | Master is in "operate" state, this means data exchange between master and slaves. The outputs may be accessed. |
| ●            | ●          | ●           | ○         | CPU is in RUN, at least 1 slave is missing.                                                                    |
| ●            | ●          | ☀           | ○         | CPU is in STOP, at least 1 slave is missing.                                                                   |
| ○            | ○          | ○           | ●         | Initialization error at faulty parameterization.                                                               |
| ○            | ●          | ○           | ●         | Waiting state for start command from CPU.                                                                      |

#### Slave operation

| RUN<br>green | ERR<br>red | DE<br>green | IF<br>red | Meaning                                          |
|--------------|------------|-------------|-----------|--------------------------------------------------|
| ○            | ○          | ○           | ○         | Slave has no project respectively PtP is active. |
| ☀            | ○          | ○           | ○         | Slave is without master.                         |
| ☀*           | ○          | ☀*          | ○         | * Alternate flashing at configuration faults.    |
| ●            | ○          | ●           | ○         | Slave exchanges data between master.             |

on: ●      off: ○      blinking (2Hz): ☀      not relevant: X

## Technical Data

|                                                            |                                                   |
|------------------------------------------------------------|---------------------------------------------------|
| <b>Order number</b>                                        | <b>314-2AG12</b>                                  |
| Type                                                       | CPU 314SB/DPM                                     |
| SPEED-Bus                                                  | -                                                 |
| <b>Technical data power supply</b>                         |                                                   |
| Power supply (rated value)                                 | DC 24 V                                           |
| Power supply (permitted range)                             | DC 20.4...28.8 V                                  |
| Reverse polarity protection                                | ✓                                                 |
| Current consumption (no-load operation)                    | 200 mA                                            |
| Current consumption (rated value)                          | 1 A                                               |
| Inrush current                                             | 5 A                                               |
| Max. current drain at backplane bus                        | 2.5 A                                             |
| <b>Load and working memory</b>                             |                                                   |
| Load memory, integrated                                    | 512 KB                                            |
| Load memory, maximum                                       | 512 KB                                            |
| Work memory, integrated                                    | 256 KB                                            |
| Work memory, maximal                                       | 512 KB                                            |
| Memory divided in 50% program / 50% data                   | ✓                                                 |
| Memory card slot                                           | MMC-Card with max. 1 GB                           |
| <b>Hardware configuration</b>                              |                                                   |
| Racks, max.                                                | 4                                                 |
| Modules per rack, max.                                     | 8 in multiple-, 32 in a single-rack configuration |
| Number of integrated DP master                             | 1                                                 |
| Number of DP master via CP                                 | 4                                                 |
| Operable function modules                                  | 8                                                 |
| Operable communication modules PtP                         | 8                                                 |
| Operable communication modules LAN                         | 8                                                 |
| <b>Status information, alarms, diagnostics</b>             |                                                   |
| Status display                                             | yes                                               |
| Interrupts                                                 | no                                                |
| Process alarm                                              | no                                                |
| Diagnostic interrupt                                       | no                                                |
| <b>Command processing times</b>                            |                                                   |
| Bit instructions, min.                                     | 0.01 µs                                           |
| Word instruction, min.                                     | 0.01 µs                                           |
| Double integer arithmetic, min.                            | 0.01 µs                                           |
| Floating-point arithmetic, min.                            | 0.06 µs                                           |
| <b>Timers/Counters and their retentive characteristics</b> |                                                   |
| Number of S7 counters                                      | 512                                               |
| Number of S7 times                                         | 512                                               |
| <b>Data range and retentive characteristic</b>             |                                                   |
| Number of flags                                            | 8192 Byte                                         |
| Number of data blocks                                      | 4095                                              |
| Max. data blocks size                                      | 64 KB                                             |
| Max. local data size per execution level                   | 510 Byte                                          |
| <b>Blocks</b>                                              |                                                   |
| Number of OBs                                              | 24                                                |
| Number of FBs                                              | 2048                                              |
| Number of FCs                                              | 2048                                              |
| Maximum nesting depth per priority class                   | 8                                                 |
| Maximum nesting depth additional within an error OB        | 4                                                 |



|                                           |                      |
|-------------------------------------------|----------------------|
| <b>Order number</b>                       | <b>314-2AG12</b>     |
| <b>Time</b>                               |                      |
| Real-time clock buffered                  | ✓                    |
| Clock buffered period (min.)              | 6 W                  |
| Accuracy (max. deviation per day)         | 10 s                 |
| Number of operating hours counter         | 8                    |
| Clock synchronization                     | ✓                    |
| Synchronization via MPI                   | Master/Slave         |
| Synchronization via Ethernet (NTP)        | no                   |
| <b>Address areas (I/O)</b>                |                      |
| Input I/O address area                    | 8192 Byte            |
| Output I/O address area                   | 8192 Byte            |
| Input process image maximal               | 2048 Byte            |
| Output process image maximal              | 2048 Byte            |
| Digital inputs                            | 65536                |
| Digital outputs                           | 65536                |
| Digital inputs central                    | 1024                 |
| Digital outputs central                   | 1024                 |
| Integrated digital inputs                 | -                    |
| Integrated digital outputs                | -                    |
| Analog inputs                             | 4096                 |
| Analog outputs                            | 4096                 |
| Analog inputs, central                    | 256                  |
| Analog outputs, central                   | 256                  |
| Integrated analog inputs                  | -                    |
| Integrated analog outputs                 | -                    |
| <b>Communication functions</b>            |                      |
| PG/OP channel                             | ✓                    |
| Global data communication                 | ✓                    |
| Number of GD circuits, max.               | 8                    |
| Size of GD packets, max.                  | 54 Byte              |
| S7 basic communication                    | ✓                    |
| S7 basic communication, user data per job | 76 Byte              |
| S7 communication                          | ✓                    |
| S7 communication as server                | ✓                    |
| S7 communication as client                | -                    |
| S7 communication, user data per job       | 160 Byte             |
| Number of connections, max.               | 32                   |
| <b>Functionality Sub-D interfaces</b>     |                      |
| Type                                      | X2                   |
| Type of interface                         | RS485                |
| Connector                                 | Sub-D, 9-pin, female |
| Electrically isolated                     | ✓                    |
| MPI                                       | ✓                    |
| MP <sup>2</sup> I (MPI/RS232)             | -                    |
| DP master                                 | -                    |
| DP slave                                  | -                    |
| Point-to-point interface                  | -                    |
| Type                                      | X3                   |
| Type of interface                         | RS485                |
| Connector                                 | Sub-D, 9-pin, female |
| Electrically isolated                     | ✓                    |
| MPI                                       | -                    |
| MP <sup>2</sup> I (MPI/RS232)             | -                    |
| DP master                                 | ✓                    |
| DP slave                                  | ✓                    |
| Point-to-point interface                  | ✓                    |

|                                                     |                      |
|-----------------------------------------------------|----------------------|
| <b>Order number</b>                                 | <b>314-2AG12</b>     |
| CAN                                                 | -                    |
| <b>Functionality PROFIBUS master</b>                |                      |
| PG/OP channel                                       | ✓                    |
| Routing                                             | ✓                    |
| S7 basic communication                              | ✓                    |
| S7 communication                                    | ✓                    |
| S7 communication as server                          | ✓                    |
| S7 communication as client                          | -                    |
| Equidistance support                                | -                    |
| Isochronous mode                                    | -                    |
| SYNC/FREEZE                                         | ✓                    |
| Activation/deactivation of DP slaves                | ✓                    |
| Direct data exchange (slave-to-slave communication) | -                    |
| DPV1                                                | -                    |
| Transmission speed, min.                            | 9.6 kbit/s           |
| Transmission speed, max.                            | 12 Mbit/s            |
| Number of DP slaves, max.                           | 124                  |
| Address range inputs, max.                          | 8 KB                 |
| Address range outputs, max.                         | 8 KB                 |
| User data inputs per slave, max.                    | 244 Byte             |
| User data outputs per slave, max.                   | 244 Byte             |
| <b>Functionality PROFIBUS slave</b>                 |                      |
| PG/OP channel                                       | ✓                    |
| Routing                                             | ✓                    |
| S7 communication                                    | ✓                    |
| S7 communication as server                          | ✓                    |
| S7 communication as client                          | -                    |
| Direct data exchange (slave-to-slave communication) | -                    |
| DPV1                                                | -                    |
| Transmission speed, min.                            | 9.6 kbit/s           |
| Transmission speed, max.                            | 12 Mbit/s            |
| Automatic detection of transmission speed           | -                    |
| Transfer memory inputs, max.                        | 244 Byte             |
| Transfer memory outputs, max.                       | 244 Byte             |
| Address areas, max.                                 | 32                   |
| User data per address area, max.                    | 32 Byte              |
| <b>Point-to-point communication</b>                 |                      |
| PtP communication                                   | ✓                    |
| Interface isolated                                  | ✓                    |
| RS232 interface                                     | -                    |
| RS422 interface                                     | -                    |
| RS485 interface                                     | ✓                    |
| Connector                                           | Sub-D, 9-pin, female |
| Transmission speed, min.                            | 150 bit/s            |
| Transmission speed, max.                            | 115.5 kbit/s         |
| Cable length, max.                                  | 500 m                |
| <b>Point-to-point protocol</b>                      |                      |
| ASCII protocol                                      | ✓                    |
| STX/ETX protocol                                    | ✓                    |
| 3964(R) protocol                                    | ✓                    |
| RK512 protocol                                      | -                    |
| USS master protocol                                 | ✓                    |
| Modbus master protocol                              | ✓                    |
| Modbus slave protocol                               | -                    |
| Special protocols                                   | -                    |

|                                      |                      |
|--------------------------------------|----------------------|
| <b>Order number</b>                  | <b>314-2AG12</b>     |
| <b>Functionality RJ45 interfaces</b> |                      |
| Type                                 | X4                   |
| Type of interface                    | Ethernet 10/100 MBit |
| Connector                            | RJ45                 |
| Electrically isolated                | ✓                    |
| PG/OP channel                        | ✓                    |
| Productive connections               | -                    |
| <b>Mechanical data</b>               |                      |
| Dimensions (WxHxD)                   | 40 x 125 x 120 mm    |
| Weight                               | 290 g                |
| <b>Environmental conditions</b>      |                      |
| Operating temperature                | 0 °C to 60 °C        |
| Storage temperature                  | -25 °C to 70 °C      |
| <b>Certifications</b>                |                      |
| UL508 certification                  | in preparation       |



## Chapter 4 Deployment CPU 314-2AG12

### Overview

This chapter describes the deployment of a CPU 314-2AG12 with SPEED7 technology in the System 300S. The description refers directly to the CPU and to the deployment in connection with peripheral modules, mounted on a profile rail together with the CPU at the standard bus.

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## Assembly

**Note!**

Information about assembly and cabling may be found at chapter "Assembly and installation guidelines"

## Start-up behavior

**Turn on power supply**

After the power supply has been switched on, the CPU changes to the operating mode the operating mode lever shows.

**Default boot procedure, as delivered**

When the CPU is delivered it has been reset.  
After a STOP→RUN transition the CPU switches to RUN without program.

**Boot procedure with valid data in the CPU**

The CPU switches to RUN with the program stored in the battery buffered RAM.

**Boot procedure with empty battery**

The accumulator/battery is automatically loaded via the integrated power supply and guarantees a buffer for max. 30 days. If this time is exceeded, the battery may be totally discharged. This means that the battery buffered RAM is deleted.

In this state, the CPU executes an overall reset. If a MMC is plugged, program code and data blocks are transferred from the MMC into the work memory of the CPU.

If no MMC is plugged, the CPU transfers permanent stored "protected" blocks into the work memory if available.

Information about storing protected blocks in the CPU is to find in this chapter at "Extended Know-how protection".

Depending on the position of the operating mode switch, the CPU switches to RUN res. remains in STOP.

This event is stored in the diagnostic buffer as: "Start overall reset automatically (unbuffered PowerON)".

# Addressing

## Overview

To provide specific addressing of the installed peripheral modules, certain addresses must be allocated in the CPU.

At the start-up of the CPU, this assigns automatically peripheral addresses for digital in-/output modules starting with 0 and ascending depending on the slot location.

If no hardware project engineering is available, the CPU stores at the addressing analog modules to even addresses starting with 256.

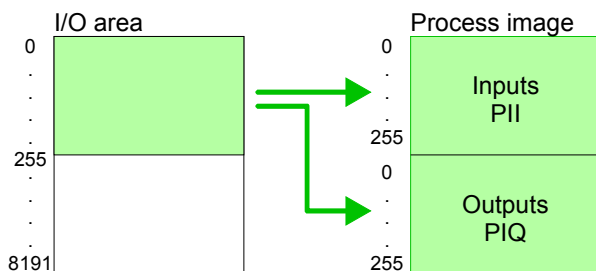
## Addressing Backplane bus I/O devices

The CPU 314-2AG12 provides an I/O area (address 0 ... 8191) and a process image of the in- and outputs (each address 0 ... 255).

The process image stores the signal states of the lower address (0 ... 255) additionally in a separate memory area.

The process image this divided into two parts:

- process image to the inputs (PII)
- process image to the outputs (PIQ)



The process image is updated automatically when a cycle has been completed.

## Max. number of pluggable modules

Maximally 8 modules per row may be configured by the CPU 314-2AG12. For the project engineering of more than 8 modules you may use 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. Considering the max total current with the CPU 314-2AG12 from VIPA up to 32 modules may be arranged in a row. Here the installation of the line connections IM 360/361 from Siemens is not required.

## 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 may be used. For this, click on the properties of the according module and set the wanted address.

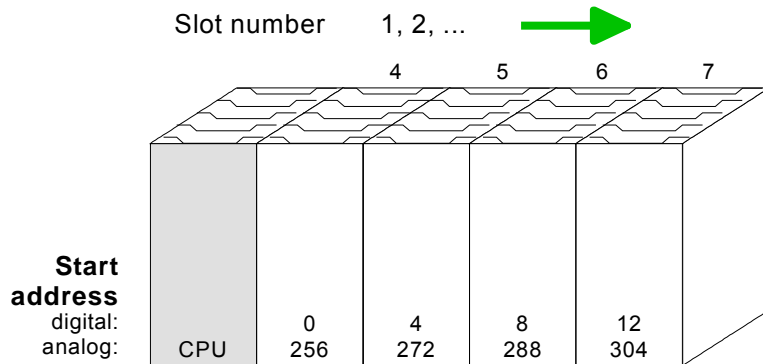
**Automatic addressing**

If you do not like to use a hardware configuration, an automatic addressing comes into force.

At the automatic address allocation DIOs occupy depending on the slot location always 4byte and AIOs, FMs, CPs always 16byte at the bus.

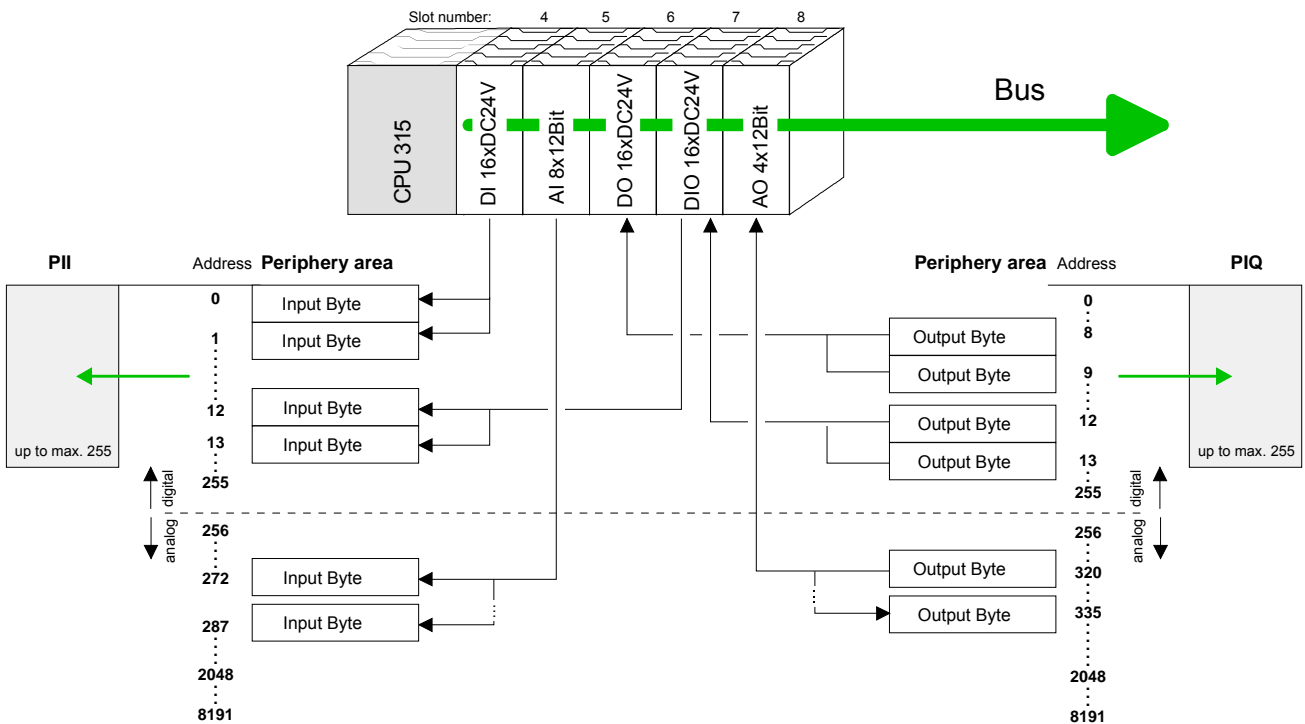
Depending on the slot location the start address from where on the according module is stored in the address range is calculated with the following formulas:

DIOs:  $\text{Start address} = 4 \cdot (\text{slot} - 1)$   
 AIOs, FMs, CPs:  $\text{Start address} = 16 \cdot (\text{slot} - 1) + 256$



Example for automatic address allocation

The following sample shows the functionality of the automatic address allocation:





## Hardware configuration - CPU

### Requirements

The hardware configuration of the VIPA CPU takes place at the Siemens hardware configurator.

The hardware configurator is a part of the Siemens SIMATIC Manager. It serves the project engineering. The modules, which may be configured here are listed in the hardware catalog. If necessary you have to update the hardware catalog with **Options** > *Update Catalog*.

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



### Note!

Please consider that this SPEED7-CPU has 4 ACCUs. After an arithmetic operation (+I, -I, \*I, /I, +D, -D, \*D, /D, MOD, +R, -R, \*R, /R) the content of ACCU 3 and ACCU 4 is loaded into ACCU 3 and 2.

This may cause conflicts in applications that presume an unmodified ACCU2.

For more information may be found in the manual "VIPA Operation list SPEED7" at "Differences between SPEED7 and 300V programming".

### Proceeding

To be compatible with the Siemens SIMATIC manager the following steps should be executed:

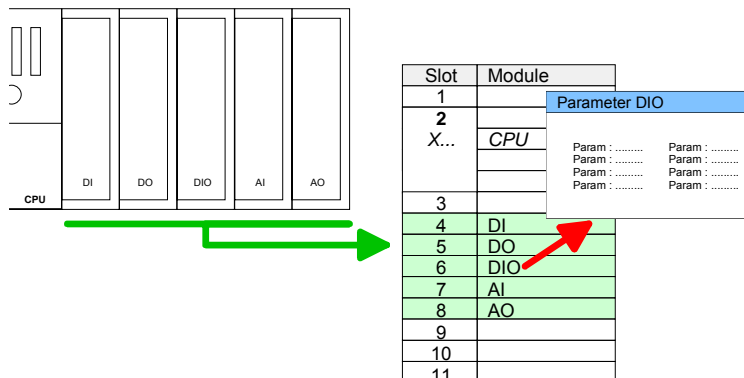
| Slot | Module           |
|------|------------------|
| 1    |                  |
| 2    | <b>CPU 318-2</b> |
| X2   | <i>DP</i>        |
| X1   | <i>MPI/DP</i>    |
| 3    |                  |

- Start the Siemens hardware configurator with a new project.
- Insert a profile rail from the hardware catalog.
- Place at slot 2 the following CPU from Siemens: **CPU 318-2 (6ES7 318-2AJ00-0AB0/V3.0)**.
- The integrated PROFIBUS DP master (X3) is to be configured and connected via the sub module X2 (DP). In the operation mode PROFIBUS the CPU may further more be accessed via the MPI interface (X2) with address 2 und 187.5kbit/s.

## Hardware configuration - I/O modules

### Hardware configuration of the modules

After the hardware configuration place the System 300 modules in the plugged sequence starting with slot 4.



### Parameterization

For parameterization double-click during the project engineering at the slot overview on the module you want to parameterize. In the appearing dialog window you may set the wanted parameters.

### Parameterization during runtime

By using the SFCs 55, 56 and 57 you may alter and transfer parameters for wanted modules during runtime.

For this you have to store the module specific parameters in so called "record sets".

More detailed information about the structure of the record sets is to find in the according module description.

### Bus extension with IM 360 and IM 361

For the project engineering of more than 8 modules you may use 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. Considering the max total current with the VIPA SPEED7 CPUs up to 32 modules may be arranged in a row.

Here the installation of the line connections IM 360/361 from Siemens is not required.

## Hardware configuration - Ethernet PG/OP channel

### Overview

The CPU 314-2AG12 has an integrated Ethernet PG/OP channel. This channel allows you to program and remote control your CPU.

The PG/OP channel also gives you access to the internal web page that contains information about firmware version, connected I/O devices, current cycle times etc.

With the first start-up respectively after an overall reset the Ethernet PG/OP channel does not have any IP address.

For online access to the CPU via Ethernet PG/OP channel valid IP address parameters have to be assigned to this by means of the Siemens SIMATIC manager. This is called "initialization".

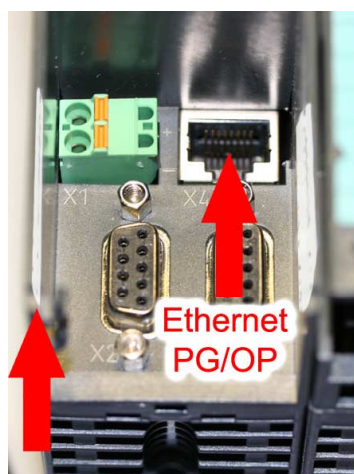
### Assembly and commissioning

- Install your System 300S with your CPU.
- Wire the system by connecting cables for voltage supply and signals.
- Connect the Ethernet jack of the Ethernet PG/OP channel to Ethernet
- Switch on the power supply.  
→ After a short boot time the CP is ready for communication.  
He possibly has no IP address data and requires an initialization.

### "Initialization" via PLC functions

The initialization via PLC functions takes place with the following proceeding:

- Determine the current Ethernet (MAC) address of your Ethernet PG/OP channel. This always may be found as 1. address under the front flap of the CPU on a sticker on the left side.



**Ethernet address**  
Ethernet PG/OP

Assign IP address parameters

You get valid IP address parameters from your system administrator. The assignment of the IP address data happens online in the Siemens SIMATIC manager starting with version V 5.3 & SP3 with the following proceeding:

- Start the Siemens SIMATIC manager and set via **Options** > *Set PG/PC interface* the access path to "TCP/IP -> Network card ....".
- Open with **PLC** > *Edit Ethernet Node* the dialog window with the same name.
- To get the stations and their MAC address, use the [Browse] button or type in the MAC Address. The Mac address may be found at the 1. label beneath the front flap of the CPU.
- Choose if necessary the known MAC address of the list of found stations.
- Either type in the IP configuration like IP address, subnet mask and gateway. Or your station is automatically provided with IP parameters by means of a DHCP server. Depending of the chosen option the DHCP server is to be supplied with MAC address, equipment name or client ID. The client ID is a numerical order of max. 63 characters. The following characters are allowed: "hyphen", 0-9, a-z, A-Z
- Confirm with [Assign IP configuration].



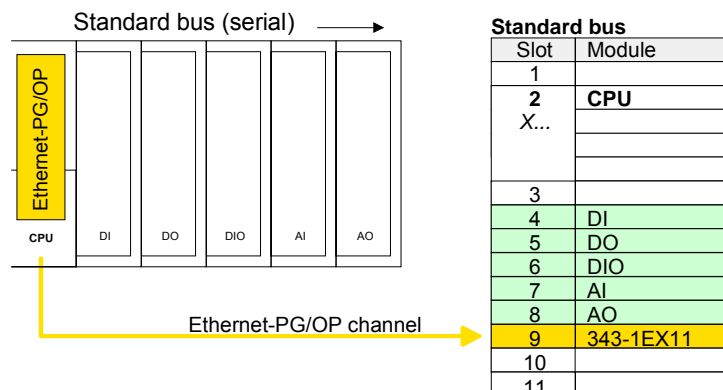
**Note!**

Direct after the assignment the Ethernet PG/OP channel may be reached online by these address data.

The value remains as long as it is reassigned, it is overwritten by a hardware configuration or an factory reset is executed.

Take IP address parameters in project

- Open the Siemens hardware configurator und configure the Siemens CPU 318-2 (318-2AJ00-0AB00 V3.0).
- Configure the modules at the standard bus.
- For the Ethernet PG/OP channel you have to configure a Siemens CP 343-1 (SIMATIC 300 \ CP 300 \ Industrial Ethernet \ CP 343-1 \ 6GK7 343-1EX11 0XE0) always below the really plugged modules.
- Open the property window via double-click on the CP 343-1EX11 and enter for the CP at "Properties" the IP address data, which you have assigned before.
- Transfer your project.



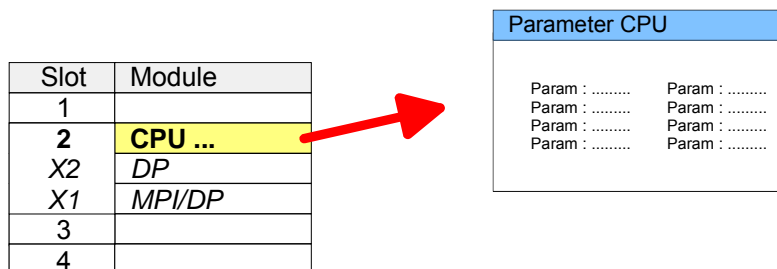
## Setting standard CPU parameters

### Parameterization via Siemens CPU 318-2AJ00

Since the CPU from VIPA is to be configured as Siemens CPU 318-2 (CPU 318-2AJ00 V3.0) in the Siemens hardware configurator, the standard parameters of the VIPA CPU may be set with "Object properties" of the CPU 318-2 during hardware configuration.

Via a double-click on the CPU 318-2 the parameter window of the CPU may be accessed.

Using the registers you get access to every standard parameter of the CPU.



### Supported parameters

The CPU does not evaluate each parameter, which may be set at the hardware configuration.

The following parameters are supported by the CPU at this time:

#### General

##### Short description

The short description of the Siemens CPU 318-2AJ00 is CPU 318-2.

##### Order No. / Firmware

Order number and firmware are identical to the details in the "hardware catalog" window.

##### Name

The *Name* field provides the *short description* of the CPU. If you change the name the new name appears in the Siemens SIMATIC manager.

##### Plant designation

Here is the possibility to specify a plant designation for the CPU. This plant designation identifies parts of the plant according to their function. This has a hierarchical structure and conforms to IEC 1346-1.

##### Comment

In this field information about the module may be entered.

## Startup

Startup when expected/actual configuration differs

If the checkbox for "Startup when expected/actual configuration differ" is *deselected* and at least one module is not located at its configured slot or if another type of module is inserted there instead, then the CPU does not switch to RUN mode and remains in STOP mode.

If the checkbox for "Startup when expected/actual configuration differ" is *selected*, then the CPU starts even if there are modules not located in their configured slots or if another type of module is inserted there instead, such as during an initial system start-up.

Monitoring time for ready message by modules [100ms]

This operation specifies the maximum time for the ready message of every configured module after PowerON. Here connected PROFIBUS DP slaves are also considered until they are parameterized. If the modules do not send a ready message to the CPU by the time the monitoring time has expired, the actual configuration becomes unequal to the preset configuration.

Monitoring time for transfer of parameters to modules [100ms]

The maximum time for the transfer of parameters to parameterizable modules. If not every module has been assigned parameters by the time this monitoring time has expired; the actual configuration becomes unequal to the preset configuration.

## Cycle/Clock memory

Update OB1 process image cyclically

This parameter is not relevant.

Scan cycle monitoring time

Here the scan cycle monitoring time in milliseconds may be set. If the scan cycle time exceeds the scan cycle monitoring time, the CPU enters the STOP mode. Possible reasons for exceeding the time are:

- Communication processes
- a series of interrupt events
- an error in the CPU program

Minimum scan cycle time

This parameter is not relevant.

Scan cycle load from Communication

Using this parameter you can control the duration of communication processes, which always extend the scan cycle time so it does not exceed a specified length.

If the cycle load from communication is set to 50%, the scan cycle time of OB 1 can be doubled. At the same time, the scan cycle time of OB 1 is still being influenced by asynchronous events (e.g. hardware interrupts) as well.

Size of the process image input/output area

Here the size of the process image max. 2048 for the input/output periphery may be fixed.

OB85 call up at I/O access error      The preset reaction of the CPU may be changed to an I/O access error that occurs during the update of the process image by the system. The VIPA CPU is preset such that OB 85 is not called if an I/O access error occurs and no entry is made in the diagnostic buffer either.

Clock memory      Activate the check box if you want to use clock memory and enter the number of the memory byte.

**Note!**

The selected memory byte cannot be used for temporary data storage.

**Retentive Memory**

Number of Memory Bytes from MB0      Enter the number of retentive memory bytes from memory byte 0 onwards.

Number of S7 Timers from T0      Enter the number of retentive *S7 timers* from T0 onwards. Each *S7 timer* occupies 2bytes.

Number of S7 Counters from C0      Enter the number of retentive *S7 counter* from C0 onwards.

Areas      These parameters are not relevant.

**Interrupts**

Priority      Here the priorities are displayed, according to which the hardware interrupt OBs are processed (hardware interrupt, time-delay interrupt, async. error interrupts).

**Time-of-day interrupts**

|                         |                                                                                                                                                                                                    |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Priority                | Here the priorities may be specified according to which the time-of-day interrupt is processed.<br>With priority "0" the corresponding OB is deactivated.                                          |
| Active                  | Activate the check box of the time-of-day interrupt OBs if these are to be automatically started on complete restart.                                                                              |
| Execution               | Select how often the interrupts are to be triggered. Intervals ranging from every minute to yearly are available. The intervals apply to the settings made for <i>start date</i> and <i>time</i> . |
| Start date / time       | Enter date and time of the first execution of the time-of-day interrupt.                                                                                                                           |
| Process image partition | This parameter is not supported.                                                                                                                                                                   |

**Cyclic interrupts**

|                         |                                                                                                                                                                                                                                                |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Priority                | Here the priorities may be specified according to which the corresponding cyclic interrupt is processed. With priority "0" the corresponding interrupt is deactivated.                                                                         |
| Execution               | Enter the time intervals in ms, in which the watchdog interrupt OBs should be processed. The start time for the clock is when the operating mode switch is moved from STOP to RUN.                                                             |
| Phase offset            | Enter the delay time in ms for current execution for the watch dog interrupt. This should be performed if several watchdog interrupts are enabled. Phase offset allows to distribute processing time for watchdog interrupts across the cycle. |
| Process image partition | This parameter is not supported.                                                                                                                                                                                                               |



## Diagnostics/Clock

|                                              |                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Report cause of STOP                         | Activate this parameter, if the CPU should report the cause of STOP to PG respectively OP on transition to STOP.                                                                                                                                                                                                 |
| Number of messages in the diagnostics buffer | Here the number of diagnostics are displayed, which may be stored in the diagnostics buffer (circular buffer).                                                                                                                                                                                                   |
| Synchronization type                         | You can specify whether the CPU clock should be used to synchronize other clocks or not. <ul style="list-style-type: none"><li>- as slave: The clock is synchronized by another clock.</li><li>- as master: The clock synchronizes other clocks as master.</li><li>- none: There is no synchronization</li></ul> |
| Time interval                                | Time intervals within which the synchronization is to be carried out.                                                                                                                                                                                                                                            |
| Correction factor                            | Lose or gain in the clock time may be compensated within a 24 hour period by means of the correction factor in ms. If the clock is 1s slow after 24 hours, you have to specify a correction factor of "+1000" ms.                                                                                                |

## Protection

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level of protection | Here 1 of 3 protection levels may be set to protect the CPU from unauthorized access.<br><i>Protection level 1 (default setting):</i> <ul style="list-style-type: none"><li>• No password adjustable, no restrictions</li></ul> <i>Protection level 2 with password:</i> <ul style="list-style-type: none"><li>• Authorized users: read and write access</li><li>• Unauthorized user: read access only</li></ul> <i>Protection level 3:</i> <ul style="list-style-type: none"><li>• Authorized users: read and write access</li><li>• Unauthorized user: no read and write access</li></ul> |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Parameter for DP** The properties dialog of the PROFIBUS part is opened via a double click to the sub module DP.

### General

|                   |                                                                                                  |
|-------------------|--------------------------------------------------------------------------------------------------|
| Short description | Here the short description "DP" for PROFIBUS DP is specified.                                    |
| Order no.         | Nothing is shown here.                                                                           |
| Name              | Here "DP" is shown. If you change the name, the new name appears in the Siemens SIMATIC manager. |
| Interface         | The PROFIBUS address is shown here.                                                              |
| Properties        | With this button the properties of the PROFIBUS DP interface may be preset.                      |
| Comment           | You can enter the purpose of the DP master in this box.                                          |

### Addresses

|                |                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Diagnostics    | A diagnostics address for PROFIBUS DP is to be preset here. In the case of an error the CPU is informed via this address.                   |
| Operating mode | Here the operating mode of the PROFIBUS part may be preset. More may be found at chapter "Deployment PROFIBUS Communication".               |
| Configuration  | Within the operating mode "DP-Slave" you may configure your slave system. More may be found at chapter "Deployment PROFIBUS communication". |
| Clock          | These parameters are not supported.                                                                                                         |

---

**Parameter for MPI/DP** The properties dialog of the MPI interface is opened via a double click to the sub module MPI/DP.

### General

Short description Here the short description "MPI/DP" for the MPI interface is specified.

Order no. Nothing is shown here.

Name At *Name* "MPI/DP" for the MPI interface is shown. If you change the name, the new name appears in the Siemens SIMATIC manager.

Type Please regard only the type "MPI" is supported by the VIPA CPU.

Interface Here the MPI address is shown.

Properties With this button the properties of the MPI interface may be preset.

Comment You can enter the purpose of the MPI interface in this box.

### Addresses

Diagnostics A diagnostics address for the MPI interface is to be preset here. In the case of an error the CPU is informed via this address.

Operating mode, Configuration, Clock These parameters are not supported.

## Setting VIPA specific CPU parameters

### Overview

Except of the VIPA specific CPU parameters the CPU parameterization takes place in the parameter dialog of the CPU 318-2AJ00.

With installing of the SPEEDBUS.GSD the VIPA specific parameters may be set during hardware configuration.

Here the following parameters may be accessed:

- Function RS485 (PtP, Synchronization DP master and CPU)
- Token Watch
- Number remanence flag, timer, counter
- Priority OB 28, OB 29, OB 33, OB 34
- Execution OB 33, OB 34
- Phase offset OB 33, OB 34

### Requirements

Since the VIPA specific CPU parameters may be set, the installation of the SPEEDBUS.GSD from VIPA in the hardware catalog is necessary.

The CPU may be configured in a PROFIBUS master system and the appropriate parameters may be set after installation.

### Installation of the SPEEDBUS.GSD

The GSD (**G**eräte-**S**tamm-**D**atei) 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.vipa.de](http://www.vipa.de) at the "Service" part.

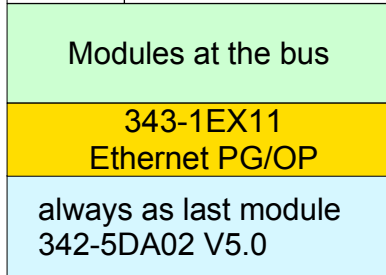
The integration of the SPEEDBUS.GSD takes place with the following proceeding:

- Browse to [www.vipa.de](http://www.vipa.de).
- Click to *Service > Download > GSD- and EDS-Files > PROFIBUS*.
- Download the file *Cx000023\_Vxxx*.
- Extract the file to your work directory. The SPEEDBUS.GSD is stored in the directory *VIPA\_System\_300S*.
- Start the hardware configurator from Siemens.
- Close every project.
- Select **Options > Install new GSD-file**.
- Navigate to the directory *VIPA\_System\_300S* and select **SPEEDBUS.GSD**.

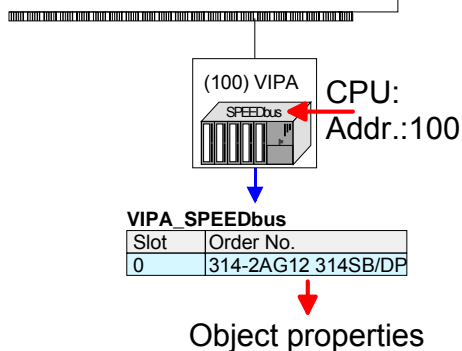
The SPEED7 CPUs and modules of the System 300S from VIPA may now be found in the hardware catalog at *PROFIBUS-DP / Additional field devices / I/O / VIPA\_SPEEDBUS*.

**Proceeding** The embedding of the CPU 314-2AG12 happens by means of a virtual PROFIBUS master system with the following approach:

| Slot | Module         |
|------|----------------|
| 1    |                |
| 2    | <b>CPU ...</b> |
| X2   |                |
| X1   |                |
| 3    |                |



virtual DP-Master for CPU



- Perform a hardware configuration for the CPU (see "Hardware configuration - CPU").
- Configure always as last module a Siemens DP master CP 342-5 (342-5DA02 V5.0). Connect and parameterize it at operation mode "DP-Master".
- Connect the slave system "VIPA\_SPEEDbus". After installing the SPEEDBUS.GSD this may be found in the hardware catalog at *PROFIBUS DP / Additional field devices / I/O / VIPA / VIPA\_SPEEDBUS*.
- For the slave system set the PROFIBUS address 100.
- Configure at slot 0 the VIPA CPU 314-2AG12 of the hardware catalog from VIPA\_SPEEDbus.
- By double clicking the placed CPU 314-2AG12 the properties dialog of the CPU may be opened.

As soon as the project is transferred together with the PLC user program to the CPU, the parameters will be taken after start-up.

**VIPA specific parameters**

The following parameters may be accessed by means of the properties dialog of the VIPA-CPU.

**Function RS485**

Per default the RS485 interface is used for the PROFIBUS DP master.

Using this parameter the RS485 interface may be switched to PtP communication (**point to point**) respectively the synchronization between DP master system and CPU may be set:

|                              |                                                                                                                                                                                                                                                                                                                                    |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Deactivated</i>           | Deactivates the RS485 interface                                                                                                                                                                                                                                                                                                    |
| <i>PtP</i>                   | With this operating mode the PROFIBUS DP master is deactivated and the RS485 interface acts as an interface for serial point-to-point communication.<br>Here data may be exchanged between two stations by means of protocols.<br>More about this may be found at chapter "Deployment RS485 for PtP communication" in this manual. |
| <i>PROFIBUS DP async</i>     | PROFIBUS DP master operation asynchronous to CPU cycle<br>The RS485 interface is preset at default to <i>PROFIBUS DP async</i> . Here CPU cycle and cycles of every VIPA PROFIBUS DP master run independently.                                                                                                                     |
| <i>PROFIBUS DP syncIn</i>    | The CPU is waiting for DP master input data.                                                                                                                                                                                                                                                                                       |
| <i>PROFIBUS DP syncOut</i>   | The DP master system is waiting for CPU output data.                                                                                                                                                                                                                                                                               |
| <i>PROFIBUS DP syncInOut</i> | CPU and DP master system are waiting on each other and form thereby a cycle.                                                                                                                                                                                                                                                       |

Default: PROFIBUS DP async

**Synchronization between master system and CPU**

Normally the cycles of CPU and DP master run independently. The cycle time of the CPU is the time needed for one OB1 cycle and for reading respectively writing the inputs respectively outputs. The cycle time of a DP master depends among others on the number of connected slaves and the baud rate, thus every plugged DP master has its own cycle time.

Due to the asynchronism of CPU and DP master the whole system gets relatively high response times.

The synchronization behavior between every VIPA PROFIBUS DP master and the CPU may be configured by means of a hardware configuration as shown above.

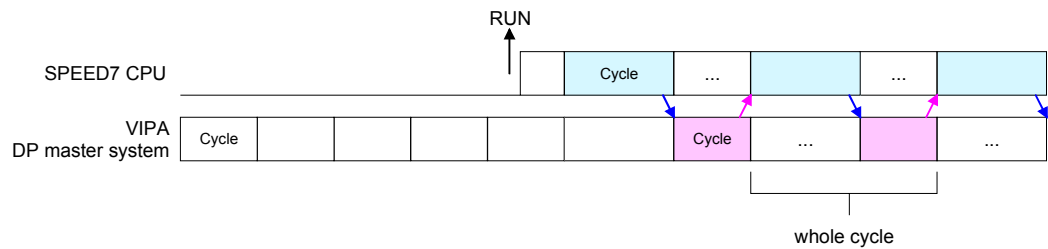
The different modes for the synchronization are in the following described.

PROFIBUS DP  
SynclnOut

In *PROFIBUS DP SynclnOut* mode CPU and DP-Master-System are waiting on each other and form thereby a cycle. Here the whole cycle is the sum of the longest DP master cycle and CPU cycle.

By this synchronization mode you receive global consistent in-/ output data, since within the total cycle the same input and output data are handled successively by CPU and DP master system.

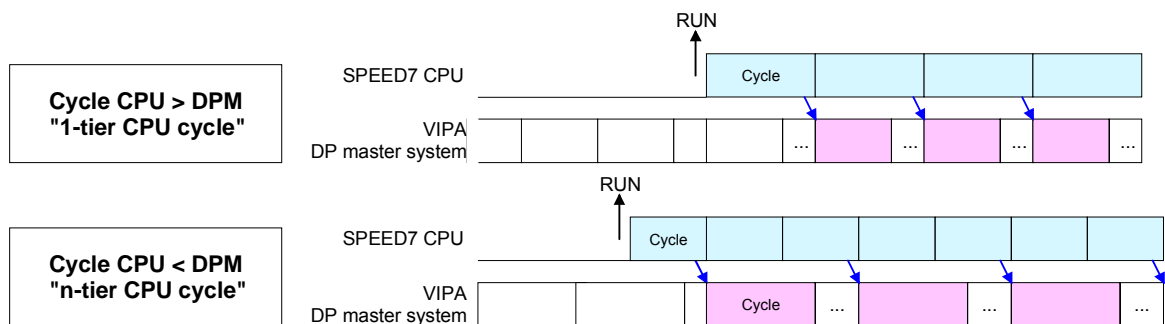
If necessary the time of the *Watchdog* of the bus parameters should be increased at this mode.



PROFIBUS DP  
SyncOut

In this operating mode the cycle time of the VIPA DP master system depends on the CPU cycle time. After CPU start-up the DP master gets synchronized.

As soon as their cycle is passed they wait for the next synchronization impulse with output data of the CPU. So the response time of your system can be improved because output data were directly transmitted to the DP master system. If necessary the time of the *Watchdog* of the bus parameters should be increased at this mode.

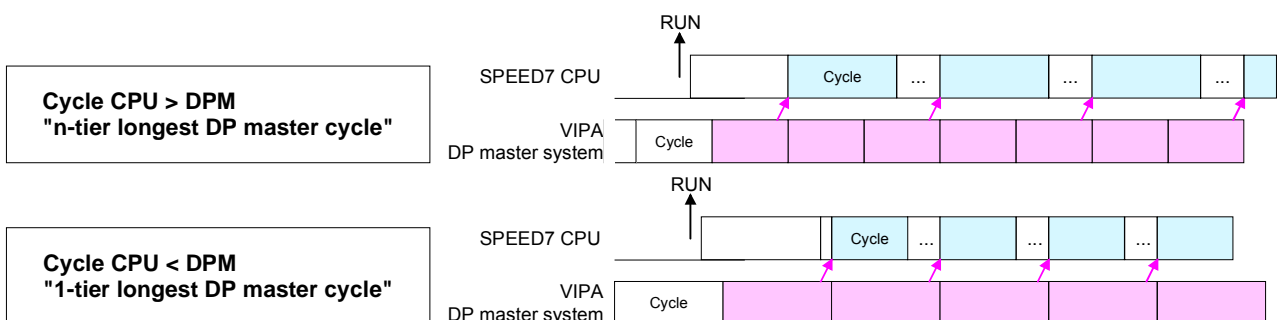


PROFIBUS DP  
Syncln

In the operating mode *PROFIBUS DP Syncln* the CPU cycle is synchronized to the cycle of the VIPA PROFIBUS DP master system.

Here the CPU cycle depends on the VIPA DP master with the longest cycle time. If the CPU gets into RUN it is synchronized with each PROFIBUS DP master. As soon as the CPU cycle is passed, it waits for the next synchronization impulse with input data of the DP master system.

If necessary the *Scan Cycle Monitoring Time* of the CPU should be increased.



- Token Watch** By presetting the PROFIBUS bus parameters within the hardware configuration a *token time* for the PROFIBUS results. The *token time* defines the duration until the token reaches the DP master again.  
Per default this time is supervised. Due to this monitoring disturbances on the bus can affect a reboot of the DP master. Here with the parameter *Token Watch* the monitoring of the token time can be switched off respectively on.  
Default: On
- Number remanence flag** Here the number of flag bytes may be set. With 0 the value *Retentive memory > Number of memory bytes starting with MBO* set at the parameters of the Siemens CPU is used. Otherwise the adjusted value (1 ... 8192) is used.  
Default: 0
- Phase offset and execution of OB33 and OB34** The CPU offers additional cyclic interrupts, which interrupt the cyclic processing in certain distances. Point of start of the time interval is the change of operating mode from STOP to RUN.  
To avoid that the cyclic interrupts of different cyclic interrupt OBs receive a start request at the same time and so a time out may occur, there is the possibility to set a phase offset respectively a time of execution.  
The *phase offset* (0 ... 60000ms) serves for distribution processing times for cyclic interrupts across the cycle.  
The time intervals, in which the cyclic interrupt OB should be processed may be entered with *execution* (1 ... 60000ms).  
Default:                   Phase offset: 0  
                                  Execution:                   OB33: 500ms  
                                                                                  OB34: 200ms
- Priority of OB28, OB29, OB33 and OB34** The priority fixes the order of interrupts of the corresponding interrupt OB. Here the following priorities are supported:  
0 (Interrupt-OB is deactivated), 2, 3, 4, 9, 12, 16, 17, 24  
Default: 24



## Project transfer

### Overview

There are the following possibilities for project transfer into the CPU:

- Transfer via MPI/PROFIBUS
- Transfer via Ethernet
- Transfer via MMC

### Transfer via MPI/PROFIBUS

For transfer via MPI/PROFIBUS there are the following 2 interfaces:

- X2: MPI interface
- X3: PROFIBUS interface

### Net structure

The structure of a MPI net is electrically identical with the structure of a PROFIBUS net. This means the same rules are valid and you use the same components for the build-up. The single participants are connected with each other via bus interface plugs and PROFIBUS cables. Per default the MPI net runs with 187.5kbaud. VIPA CPUs are delivered with MPI address 2.

### MPI programming cable

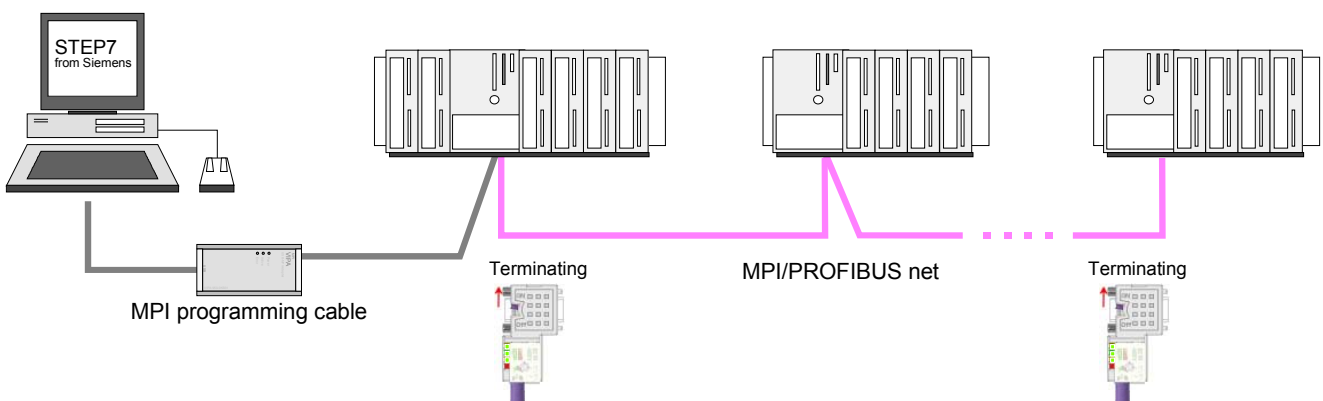
The MPI programming cables are available at VIPA in different variants. The cables provide a RS232 res. USB plug for the PC and a bus enabled RS485 plug for the CPU.

Due to the RS485 connection you may plug the MPI programming cables directly to an already plugged plug on the RS485 jack. Every bus participant identifies itself at the bus with a unique address, in the course of the address 0 is reserved for programming devices.

### Terminating resistor

A cable has to be terminated with its surge impedance. For this you switch on the terminating resistor at the first and the last participant of a network or a segment.

Please make sure that the participants with the activated terminating resistors are always power supplied. Otherwise it may cause interferences on the bus.



Approach transfer  
via MPI interface

- Connect your PC to the MPI jack of your CPU via a MPI programming cable.
- Load your project in the SIMATIC Manager from Siemens.
- Choose in the menu **Options** > *Set PG/PC interface*
- Select in the according list the "PC Adapter (MPI)"; if appropriate you have to add it first, then click on [Properties].
- Set in the register *MPI* the transfer parameters of your MPI net and type a valid *address*.
- Switch to the register *Local connection*
- Set the COM port of the PC and the transfer rate 38400Baud for the MPI programming cable from VIPA.
- Via **PLC** > *Load to module* you may transfer your project via MPI to the CPU and save it on a MMC via **PLC** > *Copy RAM to ROM* if one is plugged.

Approach transfer  
via PROFIBUS  
interface

- Connect your PC to the DP-PB/PtP jack of your CPU via a MPI programming cable.
- Load your project in the Siemens SIMATIC Manager.
- Choose in the menu **Options** > *Set PG/PC interface*
- Select in the according list the "PC Adapter (PROFIBUS)"; if appropriate you have to add it first, then click on [Properties].
- Set in the register *PROFIBUS* the transfer parameters of your PROFIBUS net and type a valid *PROFIBUS address*. The *PROFIBUS address* must be assigned to the DP master by a project before.
- Switch to the register *Local connection*
- Set the COM port of the PCs and the transfer rate 38400Baud for the MPI programming cable from VIPA.
- Via **PLC** > *Load to module* you may transfer your project via PROFIBUS to the CPU and save it on a MMC via **PLC** > *Copy RAM to ROM* if one is plugged.

**Note!**

Transfer via PROFIBUS is available by DP master, if projected as master and assigned with a PROFIBUS address before.

Within selecting the slave mode you have additionally to select the option "Test, commissioning, routing".

---

**Transfer via Ethernet**

For transfer via Ethernet the CPU has the following interface:

- X4: Ethernet PG/OP channel

**Initialization**

So that you may access the Ethernet PG/OP channel you have to assign IP address parameters by means of the "initialization"(see "hardware configuration - Ethernet PG/OP channel").

Information about the initialization of the Ethernet PG/OP channel may be found at "Initialization of Ethernet PG/OP channel".

**Transfer**

- For the transfer, connect, if not already done, the appropriate Ethernet port to your Ethernet.
- Open your project with the Siemens SIMATIC Manager.
- Set via **Options** > *Set PG/PC Interface* the access path to "TCP/IP -> Network card ....".
- Click to **PLC** > Download → the dialog "Select target module" is opened. Select your target module and enter the IP address parameters of the Ethernet PG/OP channel for connection. Provided that no new hardware configuration is transferred to the CPU, the entered Ethernet connection is permanently stored in the project as transfer channel.
- With [OK] the transfer is started.

**Note!**

System dependent you get a message that the projected system differs from target system. This message may be accepted by [OK].

→ your project is transferred and may be executed in the CPU after transfer.

**Transfer via  
MMC**

The MMC (**Memory Card**) serves as external transfer and storage medium. There may be stored several projects and sub-directories on a MMC storage module. Please regard that your current project is stored in the root directory and has one of the following file names:

- *S7PROG.WLD*
- *AUTOLOAD.WLD*

With **File > Memory Card File > New** in the Siemens SIMATIC Manager a new wld file may be created. After the creation copy the blocks from the project blocks folder and the *System data* into the wld file.

**Transfer  
MMC → CPU**

The transfer of the application program from the MMC into the CPU takes place depending on the file name after an overall reset or PowerON.

- *S7PROG.WLD* is read from the MMC after overall reset.
- *AUTOLOAD.WLD* is read after PowerON from the MMC.

The blinking of the LED "MCC" of the CPU marks the active transfer. Please regard that your user memory serves for enough space, otherwise your user program is not completely loaded and the SF LED gets on.

**Transfer  
CPU → MMC**

When the MMC has been installed, the write command stores the content of the battery buffered RAM as *S7PROG.WLD* on the MMC.

The write command is controlled by means of the block area of the Siemens SIMATIC manager **PLC > Copy RAM to ROM**. During the write process the "MCC"-LED of the CPU is blinking. When the LED expires the write process is finished.

If this project is to be loaded automatically from the MMC with PowerON, you have to rename this on the MMC to *AUTOLOAD.WLD*.

**Transfer control**

After a MMC access, an ID is written into the diagnostic buffer of the CPU. To monitor the diagnosis entries, you select **PLC > Module Information** in the Siemens SIMATIC Manager. Via the register "Diagnostic Buffer" you reach the diagnosis window.

When accessing a MMC, the following events may occur:

| Event-ID | Meaning                                           |
|----------|---------------------------------------------------|
| 0xE100   | MMC access error                                  |
| 0xE101   | MMC error file system                             |
| 0xE102   | MMC error FAT                                     |
| 0xE104   | MMC-error with storing                            |
| 0xE200   | MMC writing finished successful                   |
| 0xE210   | MMC reading finished (reload after overall reset) |
| 0xE21F   | Error during reload, read error, out of memory    |

## Access to the internal Web page

### Access to the web page

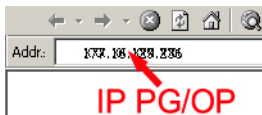
The Ethernet PG/OP channel provides a web page that you may access via an Internet browser by its IP address. The web page contains information about firmware versions, current cycle times etc.

The current content of the web page is stored on MMC by means of the MMC-Cmd WEBPAGE. More information may be found at "MMC-Cmd - Auto commands".

### Requirements

A PG/OP channel connection should be established between PC with Internet browser and CPU 314-2AG12. This may be tested by *Ping* to the IP address of the PG/OP channel.

### Web page



The access takes place via the IP address of the Ethernet PG/OP channel. The web page only serves for information output. The monitored values are not alterable.

#### CPU WITH ETHERNET PG/OP

Slot 100

```
VIPA 314-2AG12 V3.... Px000145.pkg,
SERIALNUMBER 14361
SUPPORTDATA :
PRODUCT V3420, HARDWARE V0111, 5679G-V10,
Hx000026.100,Bx000227 V6420, Ax000086 V1200,
Ax000056 V0000, fx000007.wld V1120,
FlashFileSystem : V102
Memoriesizes (Bytes): LoadMem : 2097152,
WorkMemCode : 524288, WorkMemData : 524288

OnBoardEthernet : MacAddress : 0020D5773819,
IP-Address :, SubnetMask :, Gateway :
Cpu state : Stop
FunctionRS485 X2/COM1: MPI
FunctionRS485 X3/COM2: DPM-async
Cycletime [microseconds] : min=0 cur=0 ave=0
max=0

MCC-Trial-Time: 70:23

ArmLoad [percent] : cur11, max=33
```

Order no., firmware vers., package, serial no.

Information for support

Information about memory configuration, load memory, work memory (code/data)

Ethernet PG/OP: Addresses

CPU status

Operating mode RS485

(MPI: MPI operation, DPM: DP master)

CPU cycle time:

min= minimal

cur= current

max= maximal

Remaining time in hh:mm for deactivation of the expansion memory if MCC is removed.

Information for support

*Additional CPU components:*

Slot 201 (DP master):

Name, firmware version, package

Information for support

Slot 201

```
VIPA 342-1DA70 V3.1.9 Px000062.pkg,
SUPPORTDATA :
PRODUCT V3190, BB000218 V5190, AB000068
V4160, ModuleType CB2C0010, Cycletime
[microseconds]: min=65535000 cur=0 ave=0
max=0 cnt=0
```

*continued ...*

... continue

#### Standard Bus

BaudRate Read Model, BaudRate Write Model

Line 1: ModuleType 94F9:IM36x  
Rack 0 /Slot 4  
ModuleType:9FC3: Digital Input 32  
Baseaddress Input 0

Rack 0 /Slot 5 ...

...

Line 2: ModuleType A4FE:IM36x  
Rack 1 /Slot 4  
ModuleType:9FC3: Digital Input 32  
Baseaddress Input 0

Rack 1 /Slot 5 ...

*Modules at the standard bus*  
Information for the support

*IM interface if exists*  
Rack no. / Slot no.  
Type of module  
Configured base address  
if exists firmware no. and package  
Rack no. / slot no.

*IM interface if exists*

Type of module  
Configured base address  
if exists firmware no. and package  
Rack no. / slot no.

## Operating modes

### Overview

The CPU can be in one of 4 operating modes:

- Operating mode STOP
- Operating mode START-UP
- Operating mode RUN
- Operating mode HOLD

Certain conditions in the operating modes START-UP and RUN require a specific reaction from the system program. In this case the application interface is often provided by a call to an organization block that was included specifically for this event.

### Operating mode STOP

- The application program is not processed.
- If there has been a processing before, the values of counters, timers, flags and the process image are retained during the transition to the STOP mode.
- Outputs are inhibited, i.e. all digital outputs are disabled.
- RUN-LED     off
- STOP-LED    on

### Operating mode START-UP

- During the transition from STOP to RUN a call is issued to the start-up organization block OB 100. The processing time for this OB is not monitored. The START-UP OB may issue calls to other blocks.
- All digital outputs are disabled during the START-UP, i.e. outputs are inhibited.
- RUN-LED     blinks as soon as the OB 100 is operated and for at least 3s, even if the start-up time is shorter or the CPU gets to STOP due to an error. This indicates the start-up.
- STOP-LED    off

When the CPU has completed the START-UP OB, it assumes the operating mode RUN.

### Operating mode RUN

- The application program in OB 1 is processed in a cycle. Under the control of alarms other program sections can be included in the cycle.
- All timers and counters being started by the program are active and the process image is updated with every cycle.
- The BASP-signal (outputs inhibited) is deactivated, i.e. all digital outputs are enabled.
- RUN-LED     on
- STOP-LED    off

**Operating mode HOLD** The CPU offers up to 3 breakpoints to be defined for program diagnosis. Setting and deletion of breakpoints happens in your programming environment. As soon as a breakpoint is reached, you may process your program step by step.

**Precondition** For the usage of breakpoints, the following preconditions have to be fulfilled:

- Testing in single step mode is only possible with STL. If necessary switch the view via **View** > *STL* to STL.
- The block must be opened online and must not be protected.
- The open block must not be altered in the editor.

**Approach for working with breakpoints**

- Activate **View** > *Breakpoint Bar*.
- Set the cursor to the command line where you want to insert a breakpoint.
- Set the breakpoint with **Debug** > *Set Breakpoint*. The according command line is marked with a circle.
- To activate the breakpoint click on **Debug** > *Breakpoints Active*. The circle is changed to a filled circle.
- Bring your CPU into RUN. When the program reaches the breakpoint, your CPU switches to the state HOLD, the breakpoint is marked with an arrow and the register contents are monitored.
- Now you may execute the program code step by step via **Debug** > *Execute Next Statement* or run the program until the next breakpoint via **Debug** > *Resume*.
- Delete (all) breakpoints with the option **Debug** > *Delete All Breakpoints*.

**Behavior in operating state HOLD**

- The LED RUN blinks and the LED STOP is on.
- The execution of the code is stopped. No level is further executed.
- All times are frozen.
- The real-time clock runs is just running.
- The outputs were disabled (BASP is activated).
- Configured CP connections remain exist.



**Note!**

The usage of breakpoints is always possible. Switching to the operating mode test operation is not necessary.

With more than 2 breakpoints, a single step execution is not possible.



**Function security**

The CPUs include security mechanisms like a Watchdog (100ms) and a parameterizable cycle time surveillance (parameterizable min. 1ms) that stop res. execute a RESET at the CPU in case of an error and set it into a defined STOP state.

The VIPA CPUs are developed function secure and have the following system properties:

| Event                      | concerns                | Effect                                                                                                                                                                                         |
|----------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RUN → STOP                 | general                 | BASP ( <b>B</b> efehls- <b>A</b> usgabe- <b>S</b> perre, i.e. command output lock) is set.                                                                                                     |
|                            | central digital outputs | The outputs are disabled.                                                                                                                                                                      |
|                            | central analog outputs  | The Outputs are disabled.<br>- Voltage outputs issue 0V<br>- Current outputs 0...20mA issue 0mA<br>- Current outputs 4...20mA issue 4mA<br>If configured also substitute values may be issued. |
|                            | decentral outputs       | Same behavior as the central digital/analog outputs.                                                                                                                                           |
|                            | decentral inputs        | The inputs are cyclically be read by the decentralized station and the recent values are put at disposal.                                                                                      |
| STOP → RUN<br>res. PowerON | general                 | First the PII is deleted, then OB 100 is called. After the execution of the OB, the BASP is reset and the cycle starts with:<br>Delete PIO → Read PII → OB 1.                                  |
|                            | central analog outputs  | The behavior of the outputs at restart can be preset.                                                                                                                                          |
|                            | decentral inputs        | The inputs are cyclically be read by the decentralized station and the recent values are put at disposal.                                                                                      |
| RUN                        | general                 | The program execution happens cyclically and can therefore be foreseen:<br>Read PII → OB 1 → Write PIO.                                                                                        |

PII = Process image inputs

PIO = Process image outputs

## Overall reset

### Overview

During the overall reset the entire user memory (RAM) is erased. Data located in the memory card is not affected.

You have 2 options to initiate an overall reset:

- initiate the overall reset by means of the function selector switch
- initiate the overall reset by means of the Siemens SIMATIC Manager



### Note!

You should always issue an overall reset to your CPU before loading an application program into your CPU to ensure that all blocks have been cleared from the CPU.

### Overall reset by means of the function selector

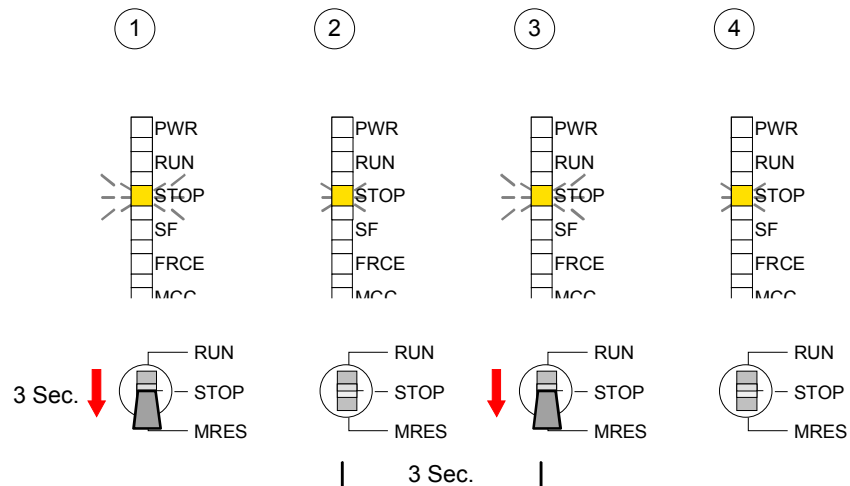
#### Condition

The operating mode of the CPU is STOP. Place the function selector on the CPU in position "STOP" → the STOP-LED is on.

#### Overall reset

- Place the function selector in the position MRES and hold it in this position for app. 3 seconds. → The STOP-LED changes from blinking to permanently on.
- Place the function selector in the position STOP and switch it to MRES and quickly back to STOP within a period of less than 3 seconds. → The STOP-LED blinks (overall reset procedure).
- The overall reset has been completed when the STOP-LED is on permanently. → The STOP-LED is on.

The following figure illustrates the above procedure:



- Automatic reload** If there is a project S7PROG.WLD on the MMC, the CPU attempts to reload this project from MMC → the MCC LED is on.  
When the reload has been completed the LED expires. The operating mode of the CPU will be STOP or RUN, depending on the position of the function selector.
- Overall reset by means of the Siemens SIMATIC Manager** *Condition*  
The operating mode of the CPU must be STOP.  
You may place the CPU in STOP mode by the menu command **PLC > Operating mode**.
- Overall reset*  
You may request the overall reset by means of the menu command **PLC > Clean/Reset**.  
In the dialog window you may place your CPU in STOP mode and start the overall reset if this has not been done as yet.  
The STOP-LED blinks during the overall reset procedure.  
When the STOP-LED is on permanently the overall reset procedure has been completed.
- Automatic reload** If there is a project S7PROG.WLD on the MMC, the CPU attempts to reload this project from MMC → the MCC LED is on.  
When the reload has been completed, the LED expires. The operating mode of the CPU will be STOP or RUN, depending on the position of the function selector.
- Set back to factory setting** The following approach deletes the internal RAM of the CPU completely and sets it back to the delivery state.  
Please regard that the MPI address is also set back to default 2!  
More information may be found at the part "Factory reset" further below.

## Firmware update

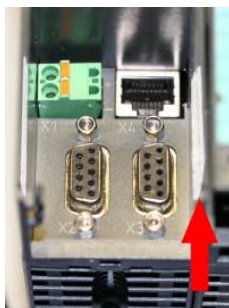
### Overview

There is the opportunity to execute a firmware update for the CPU and its components via MMC. For this an accordingly prepared MMC must be in the CPU during the startup.

So a firmware files can be recognized and assigned with startup, a pkg file name is reserved for each updateable component an hardware release, which begins with "px" and differs in a number with six digits.

The pkg file name of every updateable component may be found at a label right down the front flap of the module.

As soon as with startup a pkg file is on the MMC and the firmware is more current than in the components, all the pkg file assigned components within the CPU get the new firmware.



**Firmware package and version**

### Latest Firmware at [www.vipa.de](http://www.vipa.de)

The latest firmware versions are to be found in the service area at [www.vipa.de](http://www.vipa.de).

For example the following files are necessary for the firmware update of the CPU 314-2AG12 and its components with hardware release 1:

- 314-2AG12, Hardware release 1: Px000145.pkg
- PROFIBUS DP master: Px000062.pkg



### Attention!

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

In this case, please call the VIPA-Hotline!

Please regard that the version of the update firmware has to be different from the existing firmware otherwise no update is executed.

**Display the Firmware version of the SPEED7 system via Web Site**

The CPU has an integrated website that monitors information about firmware version of the SPEED7 components. The Ethernet PG/OP channel provides the access to this web site.

To activate the PG/OP channel you have to enter according IP parameters. This can be made in Siemens SIMATIC manager either by a hardware configuration, loaded by MMC respectively MPI or via Ethernet by means of the MAC address with **PLC** > *Assign Ethernet Address*.

After that you may access the PG/OP channel with a web browser via the IP address of the project engineering. More detailed information is to find in the manual at "Access to Ethernet PG/OP channel and website".

**Load firmware and transfer it to MMC**

- Go to [www.vipa.de](http://www.vipa.de).
- Click on Service > Download > Firmware.
- Navigate via System 300S > CPU to your CPU and download the zip file to your PC.
- Extract the zip file and copy the extracted pkg files to your MMC.

**Attention!**

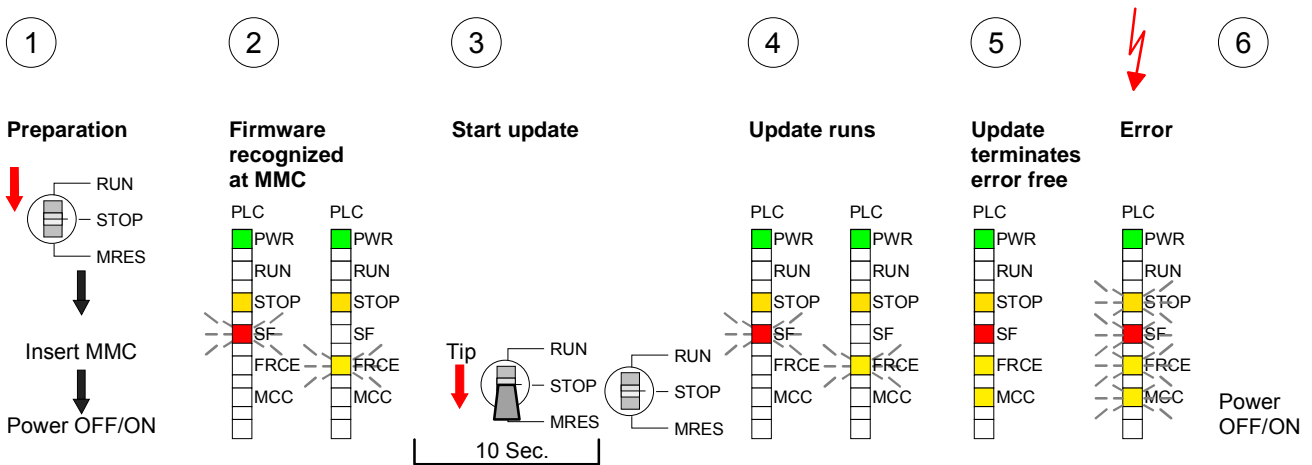
With a firmware update an overall reset is automatically executed. If your program is only available in the load memory of the CPU it is deleted! Save your program before executing a firmware update! After the firmware update you should execute a "Set back to factory settings" (see following page).

**Transfer firmware from MMC into CPU**

1. Switch the operating mode switch of your CPU in position STOP. Turn off the voltage supply. Plug the MMC with the firmware files into the CPU. Please take care of the correct plug-in direction of the MMC. Turn on the voltage supply.
2. After a short boot-up time, the alternate blinking of the LEDs SF and FRCE shows that at least a more current firmware file was found on the MMC.
3. You start the transfer of the firmware as soon as you tip the operating mode switch downwards to MRES within 10s.
4. During the update process, the LEDs SF and FRCE are alternately blinking and MCC LED is on. This may last several minutes.
5. The update is successful finished when the LEDs PWR, STOP, SF, FRCE and MCC are on. If they are blinking fast, an error occurred.
6. Turn Power OFF and ON. Now it is checked by the CPU, whether further current firmware versions are available at the MMC. If so, again the LEDs SF and FRCE flash after a short start-up period. Continue with point 3.

If the LEDs do not flash, the firmware update is ready.

Now a *factory reset* should be executed (see next page). After that the CPU is ready for duty.



# Factory reset

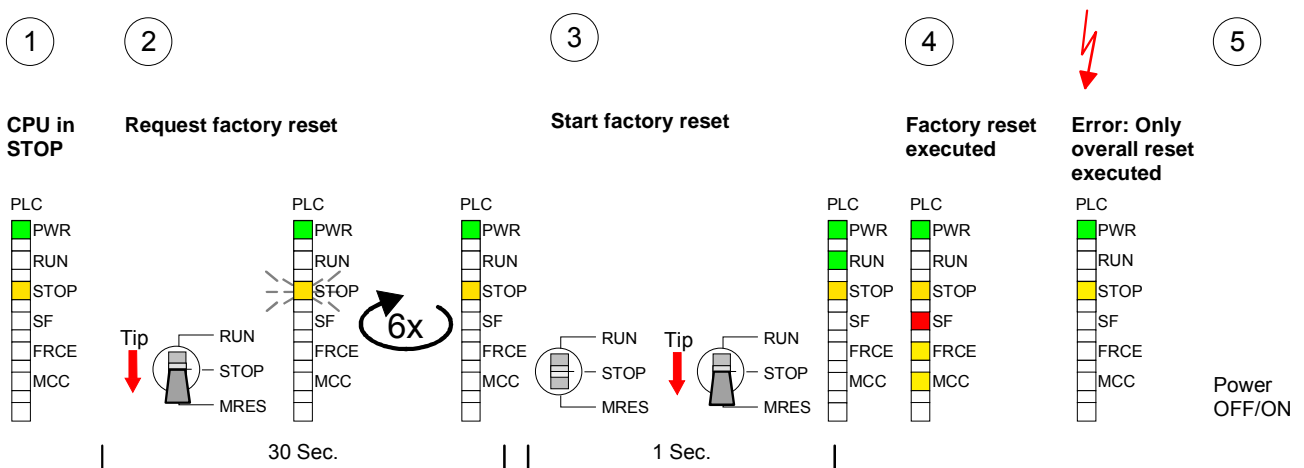
## Proceeding

With the following proceeding the internal RAM of the CPU is completely deleted and the CPU is reset to delivery state. Please note that here also the IP address of the Ethernet PG/OP channel is set to 0.0.0.0 and the MPI address is reset to the address 2!

A factory reset may also be executed by the MMC-Cmd `FACTORY_RESET`. More information may be found at "MMC-Cmd - Auto commands".

1. Switch the CPU to STOP.
2. Push the operating mode switch down to position MRES for 30s. Here the STOP-LED flashes. After a few seconds the stop LED changes to static light. Now the STOP LED changes between static light and flashing. Starting here count the static light states.
3. After the 6. static light release the operating mode switch and tip it downwards to MRES. Now the RUN LED lights up once. This means that the RAM was deleted completely.
4. For the confirmation of the resetting procedure the LEDs PWR, STOP, SF, FRCE and MCC get ON. If not, the factory reset has failed and only an overall reset was executed. In this case you can repeat the procedure. A factory reset can only be executed if the stop LED has static light for exactly 6 times.
5. The end of factory reset is shown by static light of the LEDs STOP, SF, FRCE and MCC. Switch the power supply off and on.

The proceeding is shown in the following illustration:



### Note!

After the firmware update you always should execute a *Factory reset*.

## Slot for storage media

### Overview

At the front of the CPU there is a slot for storage media.

As external storage medium for applications and firmware you may use a multimedia card (MMC) or a VIPA MCC memory extension card. The MCC can additionally be used as an external storage medium.

It has the PC compatible FAT16 file format.

You can cause the CPU to load a project automatically respectively to execute a command file by means of pre-defined file names.

### Accessing the storage medium

To the following times an access takes place on a storage medium:

#### After overall reset

- The CPU checks if there is a project S7PROG.WLD. If exists the project is automatically loaded.
- The CPU checks if there is a project PROTECT.WLD with protected blocks. If exists the project is automatically loaded. These blocks are stored in the CPU until the CPU is reset to factory setting or an empty PROTECT.WLD is loaded.
- The CPU checks if a MCC memory extension card is put. If exists the memory extension is enabled, otherwise a memory expansion, which was activated before, is de-activated.

#### After PowerON

- The CPU checks if there is a project AUTOLOAD.WLD. If exists an overall reset is established and the project is automatically loaded.
- The CPU checks if there is a command file with VIPA\_CMD.MMC. If exists the command file is loaded and the containing instructions are executed.
- After PowerON and CPU STOP the CPU checks if there is a \*.pkg file (firmware file). If exists this is indicated by blinking of the LEDs and the firmware may be installed by an update request (see "Firmware update").

#### Once in STOP

- If a storage medium is put, which contains a command file VIPA\_CMD.MMC, the command file is loaded and the containing instructions are executed.



## Memory extension with MCC

### Overview



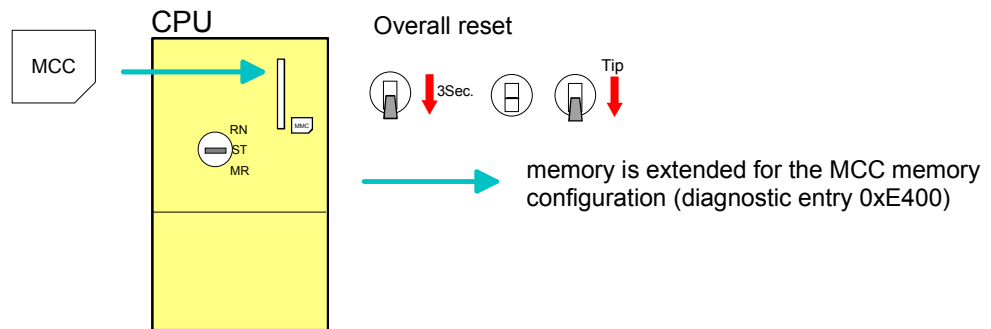
There is the possibility to extend the work memory of the CPU.

For this, a MCC memory extension card is available from VIPA. The MCC is a specially prepared MMC (**M**ultimedia **C**ard). By plugging the MCC into the MCC slot and then an overall reset the according memory expansion is released. There may only one memory expansion be activated at the time.

On the MCC there is the file *memory.key*. This file may not be altered or deleted. You may use the MCC also as "normal" MMC for storing your project.

### Approach

To extend the memory, plug the MCC into the card slot at the CPU labeled with "MCC" and execute an overall reset.



If the memory expansion on the MCC exceeds the maximum extendable memory range of the CPU, the maximum possible memory of the CPU is automatically used.

You may determine the recent memory extension via the integrated web page or with the Siemens SIMATIC Manager at *Module Information - "Memory"*.



### Attention!

Please regard that the MCC must remain plugged when you've executed the memory expansion at the CPU. Otherwise the CPU switches to STOP after 72 hours. The MCC cannot be exchanged with a MCC of the same memory configuration.

### Behavior

When the MCC memory configuration has been taken over you may find the diagnosis entry 0xE400 in the diagnostic buffer of the CPU.

After pulling the MCC the entry 0xE401 appears in the diagnostic buffer, the SF-LED is on and after 72 hours the CPU switches to STOP. A reboot is only possible after plugging-in the MCC again or after an overall reset.

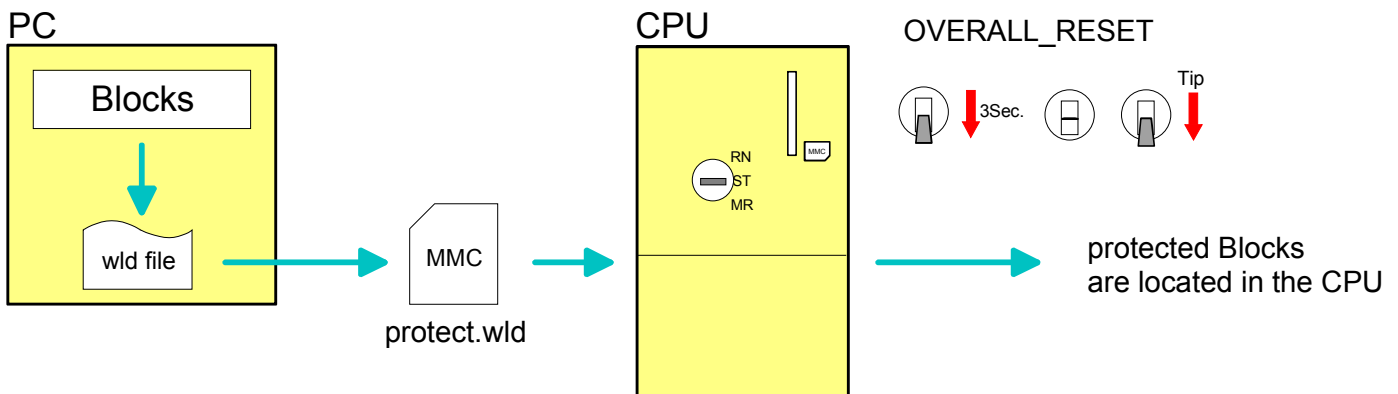
The remaining time after pulling the MCC is always been shown with the parameter *MCC-Trial-Time* on the web page.

After re-plugging the MCC, the SF-LED extinguishes and 0xE400 is entered into the diagnostic buffer.

You may reset the memory configuration of your CPU to the initial status at any time by executing an overall reset without MCC.

## Extended know-how protection

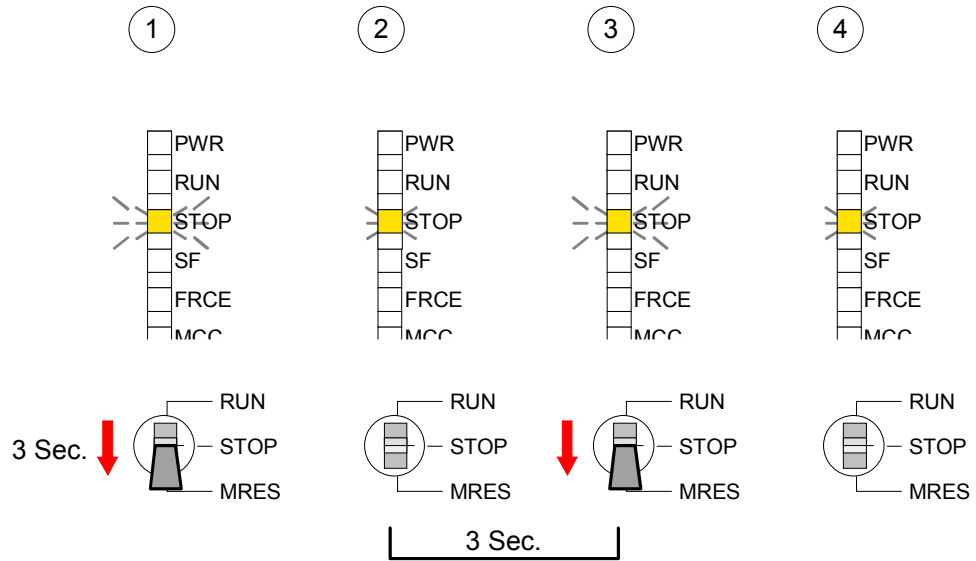
- Overview** Besides the "standard" Know-how protection the SPEED7-CPU's from VIPA provide an "extended" know-how protection that serves a secure block protection for accesses of 3. persons.
- Standard protection** The standard protection from Siemens transfers also protected blocks to the PG but their content is not displayed. But with according manipulation the Know-how protection is not guaranteed.
- Extended protection** The "extended" know-how protection developed by VIPA offers the opportunity to store blocks permanently in the CPU. At the "extended" protection you transfer the protected blocks into a WLD-file named protect.wld. By plugging the MMC and following overall reset, the blocks in the protect.wld are permanently stored in the CPU. You may protect OBs, FBs and FCs. When back-reading the protected blocks into the PG, exclusively the block header are loaded. The block code that is to be protected remains in the CPU and cannot be read.



- Protect blocks with protect.wld** Create a new wld-file in your project engineering tool with **File > Memory Card file > New** and rename it to "protect.wld". Transfer the according blocks into the file by dragging them with the mouse from the project to the file window of protect.wld.

**Transfer protect.wld to CPU with overall reset**

Transfer the file protect.wld to a MMC storage module, plug the MMC into the CPU and execute an overall reset with the following approach:



The overall reset stores the blocks in protect.wld permanently in the CPU protected from accesses of 3. persons.

**Protection behavior**

Protected blocks are overwritten by a new protect.wld.

Using a PG 3. persons may access protected blocks but only the block header is transferred to the PG. The block code that is to be protected remains in the CPU and cannot be read.

**Change respectively delete protected blocks**

Protected blocks in the RAM of the CPU may be substituted at any time by blocks with the same name. This change remains up to next overall reset. Protected blocks may permanently be overwritten only if these are deleted at the protect.wld before.

By transferring an empty protect.wld from the MMC you may delete all protected blocks in the CPU.

**Usage of protected blocks**

Due to the fact that reading of a "protected" block from the CPU monitors no symbol labels it is convenient to provide the "block covers" for the end user.

For this, create a project out of all protected blocks. Delete all networks in the blocks so that these only contain the variable definitions in the according symbolism.

## MMC-Cmd - Auto commands

**Overview** A *command file* at a MMC is automatically executed under the following conditions:

- CPU is in STOP and MMC is stuck
- After each PowerON

**Command file** The *command file* is a text file, which consists of a command sequence to be stored as **vipa\_cmd.mmc** in the root directory of the MMC.

The file has to be started by *CMD\_START* as 1. command, followed by the desired commands (no other text) and must be finished by *CMD\_END* as last command.

Text after the last command *CMD\_END* e.g. comments is permissible, because this is ignored. As soon as the command file is recognized and executed each action is stored at the MMC in the log file logfile.txt. In addition for each executed command a diagnostics entry may be found in the diagnostics buffer.

**Commands** Please regard the command sequence is to be started with *CMD\_START* and ended with *CMD\_END*.

| Command       | Description                                                                                                                                                                                                                                                                                                | Diagnostics entry |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| CMD_START     | In the first line <i>CMD_START</i> is to be located.                                                                                                                                                                                                                                                       | 0xE801            |
|               | There is a diagnostic entry if <i>CMD_START</i> is missing                                                                                                                                                                                                                                                 | 0xE8FE            |
| WAIT1SECOND   | Waits ca. 1 second.                                                                                                                                                                                                                                                                                        | 0xE803            |
| WEBPAGE       | The current web page of the CPU is stored at the MMC as "webpage.htm".                                                                                                                                                                                                                                     | 0xE804            |
| LOAD_PROJECT  | The function "Overall reset and reload from MMC" is executed. The wld file located after the command is loaded else "s7prog.wld" is loaded.                                                                                                                                                                | 0xE805            |
| SAVE_PROJECT  | The recent project (blocks and hardware configuration) is stored as "s7prog.wld" at the MMC.<br>If the file just exists it is renamed to "s7prog.old".<br>If your CPU is password protected so you have to add this as parameter. Otherwise there is no project written.<br>Example: SAVE_PROJECT password | 0xE806            |
| FACTORY_RESET | Executes "factory reset".                                                                                                                                                                                                                                                                                  | 0xE807            |
| DIAGBUF       | The current diagnostics buffer of the CPU is stored as "diagbuff.txt" at the MMC.                                                                                                                                                                                                                          | 0xE80B            |
| SET_NETWORK   | IP parameters for Ethernet PG/OP channel may be set by means of this command.<br>The IP parameters are to be given in the order IP address, subnet mask and gateway in the format xxx.xxx.xxx.xxx each separated by a comma.<br>Enter the IP address if there is no gateway used.                          | 0xE80E            |
| CMD_END       | In the last line <i>CMD_END</i> is to be located.                                                                                                                                                                                                                                                          | 0xE802            |

**Examples** The structure of a command file is shown in the following. The corresponding diagnostics entry is put in parentheses.

Example 1

|                               |                                                                |
|-------------------------------|----------------------------------------------------------------|
| <b>CMD_START</b>              | Marks the start of the command sequence (0xE801)               |
| <b>LOAD_PROJECT proj.wld</b>  | Execute an overall reset and load "proj.wld" (0xE805)          |
| <b>WAIT1SECOND</b>            | Wait ca. 1s (0xE803)                                           |
| <b>WEBPAGE</b>                | Store web page as "webpage.htm" (0xE804)                       |
| <b>DIAGBUF</b>                | Store diagnostics buffer of the CPU as "diagbuff.txt" (0xE80B) |
| <b>CMD_END</b>                | Marks the end of the command sequence (0xE802)                 |
| <b>... arbitrary text ...</b> | Text after the command CMD_END is not evaluated.               |

Example 2

|                                                                |                                                                |
|----------------------------------------------------------------|----------------------------------------------------------------|
| <b>CMD_START</b>                                               | Marks the start of the command sequence (0xE801)               |
| <b>LOAD_PROJECT proj2.wld</b>                                  | Execute an overall reset and load "proj2.wld" (0xE805)         |
| <b>WAIT1SECOND</b>                                             | Wait ca. 1s (0xE803)                                           |
| <b>WAIT1SECOND</b>                                             | Wait ca. 1s (0xE803)                                           |
| <b>SET_NETWORK 172.16.129.210,255.255.224.0,172.16.129.210</b> | IP parameter (0xE80E)                                          |
| <b>WAIT1SECOND</b>                                             | Wait ca. 1s (0xE803)                                           |
| <b>WAIT1SECOND</b>                                             | Wait ca. 1s (0xE803)                                           |
| <b>WEBPAGE</b>                                                 | Store web page as "webpage.htm" (0xE804)                       |
| <b>DIAGBUF</b>                                                 | Store diagnostics buffer of the CPU as "diagbuff.txt" (0xE80B) |
| <b>CMD_END</b>                                                 | Marks the end of the command sequence (0xE802)                 |
| <b>... arbitrary text ...</b>                                  | Text after the command CMD_END is not evaluated.               |



**Note!**

The parameters IP address, subnet mask and gateway may be received from the system administrator.

Enter the IP address if there is no gateway used.

## VIPA specific diagnostic entries

### Entries in the diagnostic buffer

You may read the diagnostic buffer of the CPU via the Siemens SIMATIC Manager. Besides of the standard entries in the diagnostic buffer, the VIPA CPUs support some additional specific entries in form of event-IDs. The current content of the diagnostics buffer is stored on MMC by means of the MMC-Command DIAGBUF. More information may be found at "MMC-Command - Auto commands".

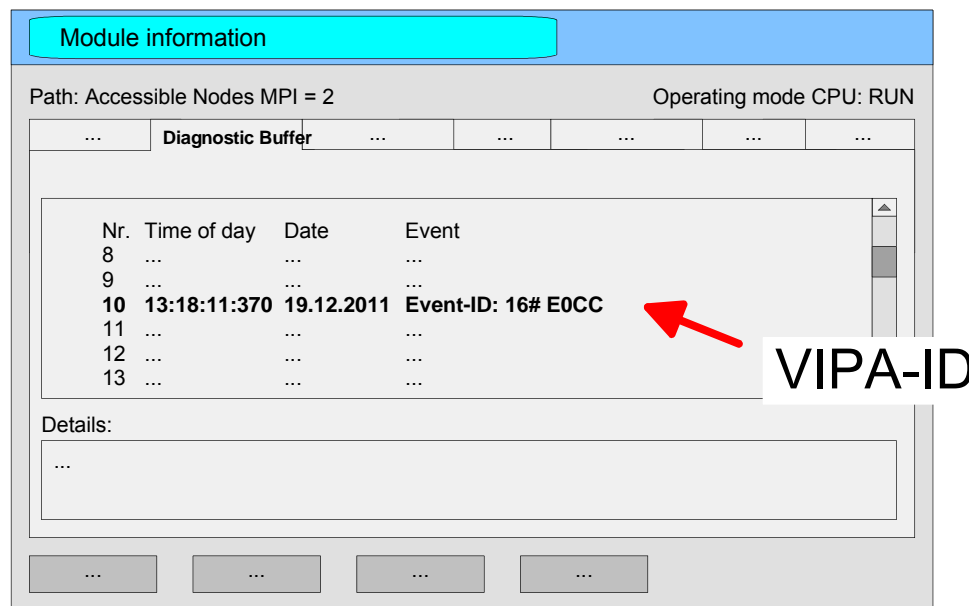


### Note!

Every register of the module information is supported by the VIPA CPUs. More information may be found at the online help of the Siemens SIMATIC manager.

### Monitoring the diagnostic entries

To monitor the diagnostic entries you choose the option **PLC** > *Module Information* in the Siemens SIMATIC Manager. Via the register "Diagnostic Buffer" you reach the diagnostic window:



The diagnosis is independent from the operating mode of the CPU. You may store a max. of 100 diagnostic entries in the CPU. The following page shows an overview of the VIPA specific Event-IDs.

### Overview of the Event-IDs

| Event-ID | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xE003   | Error at access to I/O devices<br>Zinfo1: I/O address<br>Zinfo2: Slot                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 0xE004   | Multiple parameterization of a I/O address<br>Zinfo1: I/O address<br>Zinfo2: Slot                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0xE005   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0xE006   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0xE007   | Configured in-/output bytes do not fit into I/O area                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 0xE008   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0xE009   | Error at access to standard back plane bus                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 0xE010   | Not defined module group at backplane bus recognized<br>Zinfo2: Slot<br>Zinfo3: Type ID                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 0xE011   | Master project engineering at Slave-CPU not possible or wrong slave configuration                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0xE012   | Error at parameterization                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 0xE013   | Error at shift register access to standard bus digital modules                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 0xE014   | Error at Check_Sys                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 0xE015   | Error at access to the master<br>Zinfo2: Slot of the master (32=page frame master)                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 0xE016   | Maximum block size at master transfer exceeded<br>Zinfo1: I/O address<br>Zinfo2: Slot                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 0xE017   | Error at access to integrated slave                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 0xE018   | Error at mapping of the master periphery                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 0xE019   | Error at standard back plane bus system recognition                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 0xE01A   | Error at recognition of the operating mode (8 / 9 Bit)                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 0xE01B   | Error - maximum number of plug-in modules exceeded                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 0xE020   | Error - interrupt information is not defined                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 0xE030   | Error of the standard bus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 0xE033   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0xE0B0   | SPEED7 is not stoppable (probably undefined BCD value at timer)                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 0xE0C0   | Not enough space in work memory for storing code block (block size exceeded)                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 0xE0CC   | Communication error MPI / Serial<br>Zinfo1: Code<br>1: Wrong Priority<br>2: Buffer overflow<br>3: Frame format error<br>7: Incorrect value<br>8: Incorrect RetVal<br>9: Incorrect SAP<br>10: Incorrect connection type<br>11: Incorrect sequence number<br>12: Faulty block number in the telegram<br>13: Faulty block type in the telegram<br>14: Inactive function<br>15: Incorrect size in the telegram<br>20: Error writing to MMC<br>90: Incorrect Buffer size<br>98: Unknown error<br>99: Internal error |

| Event-ID | Description                                                                                                                                                                          |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xE0CD   | Error at DPV1 job management                                                                                                                                                         |
| 0xE0CE   | Error: Timeout at sending of the i-slave diagnostics                                                                                                                                 |
|          |                                                                                                                                                                                      |
| 0xE100   | MMC access error                                                                                                                                                                     |
| 0xE101   | MMC error file system                                                                                                                                                                |
| 0xE102   | MMC error FAT                                                                                                                                                                        |
| 0xE104   | MMC error at saving                                                                                                                                                                  |
| 0xE200   | MMC writing finished (Copy Ram2Rom)                                                                                                                                                  |
| 0xE210   | MMC reading finished (reload after overall reset)                                                                                                                                    |
| 0xE21F   | MMC reading: error at reload (after overall reset), read error, out of memory                                                                                                        |
|          |                                                                                                                                                                                      |
| 0xE300   | Internal flash writing finished (Copy Ram2Rom)                                                                                                                                       |
| 0xE310   | Internal flash writing finished (reload after battery failure)                                                                                                                       |
|          |                                                                                                                                                                                      |
| 0xE400   | Memory expansion MCC has been plugged                                                                                                                                                |
| 0xE401   | Memory expansion MCC has been removed                                                                                                                                                |
|          |                                                                                                                                                                                      |
| 0xE801   | MMC-Cmd: CMD_START recognized and successfully executed                                                                                                                              |
| 0xE802   | MMC-Cmd: CMD_END recognized and successfully executed                                                                                                                                |
| 0xE803   | MMC-Cmd: WAIT1SECOND recognized and successfully executed                                                                                                                            |
| 0xE804   | MMC-Cmd: WEBPAGE recognized and successfully executed                                                                                                                                |
| 0xE805   | MMC-Cmd: LOAD_PROJECT recognized and successfully executed                                                                                                                           |
| 0xE806   | MMC-Cmd: SAVE_PROJECT recognized and successfully executed                                                                                                                           |
| 0xE807   | MMC-Cmd: FACTORY_RESET recognized and successfully executed                                                                                                                          |
| 0xE80B   | MMC-Cmd: DIAGBUF recognized and successfully executed                                                                                                                                |
| 0xE80E   | MMC-Cmd: SET_NETWORK recognized and successfully executed                                                                                                                            |
| 0xE8FB   | MMC-Cmd: Error: Initialization error of the Ethernet-PG/OP channel by means of SET_NETWORK.                                                                                          |
| 0xE8FC   | MMC-Cmd: Error: Some IP parameters are missing in SET_NETWORK.                                                                                                                       |
| 0xE8FE   | MMC-Cmd: Error: CMD_START is missing                                                                                                                                                 |
| 0xE8FF   | MMC-Cmd: Error: Error while reading CMD file (MMC error)                                                                                                                             |
|          |                                                                                                                                                                                      |
| 0xE901   | Check sum error                                                                                                                                                                      |
|          |                                                                                                                                                                                      |
| 0xEA00   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                    |
| 0xEA01   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                    |
| 0xEA02   | SBUS: Internal error (internal plugged sub module not recognized)<br>Zinfo1: Internal slot                                                                                           |
| 0xEA03   | SBUS: Communication error CPU - PROFINET-IO-Controller<br>Zinfo1: Slot<br>Zinfo2: Status (0: OK, 1: ERROR, 2: BUSSY, 3: TIMEOUT, 4: LOCKED, 5: UNKNOWN)                              |
| 0xEA04   | SBUS: Multiple parameterization of a I/O address<br>Zinfo1: I/O address<br>Zinfo2: Slot<br>Zinfo3: Data width                                                                        |
| 0xEA05   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                    |
| 0xEA07   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                    |
| 0xEA08   | SBUS: Parameterized input data width unequal to plugged input data width<br>Zinfo1: Parameterized input data width<br>Zinfo2: Slot<br>Zinfo3: Input data width of the plugged module |



| Event-ID | Description                                                                                                                                                                                  |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xEA09   | SBUS: Parameterized output data width unequal to plugged output data width<br>Zinfo1: Parameterized output data width<br>Zinfo2: Slot<br>Zinfo3: Output data width of the plugged module     |
| 0xEA10   | SBUS: Input address outside input area<br>Zinfo1: I/O address<br>Zinfo2: Slot<br>Zinfo3: Data width                                                                                          |
| 0xEA11   | SBUS: Output address outside output area<br>Zinfo1: I/O address<br>Zinfo2: Slot<br>Zinfo3: Data width                                                                                        |
| 0xEA12   | SBUS: Error at writing record set<br>Zinfo1: Slot<br>Zinfo2: Record set number<br>Zinfo3: Record set length                                                                                  |
| 0xEA14   | SBUS: Multiple parameterization of a I/O address (Diagnostic address)<br>Zinfo1: I/O address<br>Zinfo2: Slot<br>Zinfo3: Data width                                                           |
| 0xEA15   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                            |
| 0xEA18   | SBUS: Error at mapping of the master I/O devices<br>Zinfo2: Master slot                                                                                                                      |
| 0xEA19   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                            |
| 0xEA20   | Error - RS485 interface is not set to PROFIBUS DP master but there is a PROFIBUS DP master configured.                                                                                       |
| 0xEA21   | Error - Project engineering RS485 interface X2/X3:<br>PROFIBUS DP master is configured but missing<br>Zinfo2: Interface x                                                                    |
| 0xEA22   | Error - RS485 interface X2 - value is out of range<br>Zinfo: Configured value X2                                                                                                             |
| 0xEA23   | Error - RS485 interface X3 - value is out of range<br>Zinfo: Configured value X3                                                                                                             |
| 0xEA24   | Error - Project engineering RS485 interface X2/X3:<br>Interface/Protocol is missing, the default settings are used.<br>Zinfo2: Configured value X2<br>Zinfo3: Configured value X3            |
| 0xEA30   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                            |
| 0xEA40   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                            |
| 0xEA41   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                            |
| 0xEA50   | Error - PROFINET configuration<br>Zinfo1: User slot of the PROFINET IO controller<br>Zinfo2: IO device number<br>Zinfo3: IO device slot                                                      |
| 0xEA51   | Error - there is no PROFINET IO controller at the configured slot<br>Zinfo1: User slot of the PROFINET IO controller<br>Zinfo2: Recognized ID at the configured slot                         |
| 0xEA54   | Error - PROFINET IO controller reports multiple configuration at one peripheral addr.<br>Zinfo1: Peripheral address<br>Zinfo2: User slot of the PROFINET IO controller<br>Zinfo3: Data width |

| Event-ID | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0xEA64   | PROFINET configuration error:<br>Zinfo1: error word<br>Bit 0: too many IO devices<br>Bit 1: too many IO devices per ms<br>Bit 2: too many input bytes per ms<br>Bit 3: too many output bytes per ms<br>Bit 4: too many input bytes per device<br>Bit 5: too many output bytes per device<br>Bit 6: too many productive connections<br>Bit 7: too many input bytes in the process image<br>Bit 8: too many output bytes in the process image<br>Bit 9: Configuration not available<br>Bit 10: Configuration not valid |
| 0xEA65   | Communication error CPU - PROFINET-IO-Controller<br>Pk : CPU or PROFINET-IO-Controller<br>Zinfo1: Service ID, with which the error arose<br>Zinfo2: Command, with which the error arose                                                                                                                                                                                                                                                                                                                              |
| 0xEA66   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 0xEA67   | Error - PROFINET-IO-Controller - reading record set<br>Pk: Error type<br>0: DATA_RECORD_ERROR_LOCAL<br>1: DATA_RECORD_ERROR_STACK<br>2: DATA_RECORD_ERROR_REMOTE<br>OBNr: PROFINET-IO-Controller slot<br>DatId: Device no.<br>Zinfo1: Record set number<br>Zinfo2: Record set handle<br>Zinfo3: Internal error code for service purposes                                                                                                                                                                             |
| 0xEA68   | Error - PROFINET-IO-Controller - writing record set<br>Pk: Error type<br>0: DATA_RECORD_ERROR_LOCAL<br>1: DATA_RECORD_ERROR_STACK<br>2: DATA_RECORD_ERROR_REMOTE<br>OBNr: PROFINET-IO-Controller slot<br>DatId: Device no.<br>Zinfo1: Record set number<br>Zinfo2: Record set handle<br>Zinfo3: Internal error code for service purposes                                                                                                                                                                             |
| 0xEA97   | Storage error SBUS service channel<br>Zinfo3 = Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 0xEA98   | Timeout at waiting for reboot of a SBUS module (Server)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0xEA99   | Error at file reading via SBUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 0xEE00   | Additional information at UNDEF_OPCODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 0xEEEE   | CPU was completely overall reset, since after PowerON the start-up could not be finished.                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 0xEFFF   | Internal error - Please contact the VIPA-Hotline!                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## Using test functions for control and monitoring of variables

### Overview

For troubleshooting purposes and to display the status of certain variables you can access certain test functions via the menu item **Debug** of the Siemens SIMATIC Manager.

The status of the operands and the VKE can be displayed by means of the test function **Debug > Monitor**.

You can modify and/or display the status of variables by means of the test function **PLC > Monitor/Modify Variables**.

### Debug > Monitor

This test function displays the current status and the VKE of the different operands while the program is being executed.

It is also possible to enter corrections to the program.



#### Note!

When using the test function "Monitor" the PLC must be in RUN mode!

The processing of the states may be interrupted by means of jump commands or by timer and process-related alarms. At the breakpoint the CPU stops collecting data for the status display and instead of the required data it only provides the PG with data containing the value 0.

For this reason, jumps or time and process alarms can result in the value displayed during program execution remaining at 0 for the items below:

- the result of the logical operation VKE
- Status / AKKU 1
- AKKU 2
- Condition byte
- absolute memory address SAZ. In this case SAZ is followed by a "?".

The interruption of the processing of statuses does not change the execution of the program. It only shows that the data displayed is no longer.

**PLC >**  
*Monitor/Modify*  
*Variables*

This test function returns the condition of a selected operand (inputs, outputs, flags, data word, counters or timers) at the end of program-execution.

This information is obtained from the process image of the selected operands. During the "processing check" or in operating mode STOP the periphery is read directly from the inputs. Otherwise only the process image of the selected operands is displayed.

*Control of outputs*

It is possible to check the wiring and proper operation of output-modules.

You can set outputs to any desired status with or without a control program. The process image is not modified but outputs are no longer inhibited.

*Control of variables*

The following variables may be modified:

I, Q, M, T, C and D.

The process image of binary and digital operands is modified independently of the operating mode of the CPU.

When the operating mode is RUN the program is executed with the modified process variable. When the program continues they may, however, be modified again without notification.

Process variables are controlled asynchronously to the execution sequence of the program.

## Chapter 5 Deployment PtP communication

### Overview

Content of this chapter is the deployment of the RS485 interface for serial PtP communication.

Here you'll find every information about the protocols, the activation and project engineering of the interface, which are necessary for the serial communication using the RS485 interface.

### Content

| Topic                                               | Page       |
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| <b>Chapter 5 Deployment PtP communication</b> ..... | <b>5-1</b> |
| Fast introduction.....                              | 5-2        |
| Principle of the data transfer .....                | 5-3        |
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## Fast introduction

**General** Via a hardware configuration you may de-activate the PROFIBUS part integrated to the SPEED7 CPU and thus release the RS485 interface for PtP (point-to-point) communication.  
The RS485 interface supports in PtP operation the serial process connection to different source res. destination systems.

**Protocols** The protocols res. procedures ASCII, STX/ETX, 3964R, USS and Modbus are supported.

**Switch of RS485 for ptp operation** Per default, every CPU uses the RS485 interface for PROFIBUS communication. A hardware configuration allows you to switch the RS485 interface to point-to-point operation using *Object properties* and the parameter "Function RS485".

**Parameterization** The parameterization of the serial interface happens during runtime using the SFC 216 (SER\_CFG). For this you have to store the parameters in a DB for all protocols except ASCII.

**Communication** The SFCs are controlling the communication. Send takes place via SFC 217 (SER\_SND) and receive via SFC 218 (SER\_RCV).  
The repeated call of the SFC 217 SER\_SND delivers a return value for 3964R, USS and Modbus via RetVal that contains, among other things, recent information about the acknowledgement of the partner station.  
The protocols USS and Modbus allow to evaluate the receipt telegram by calling the SFC 218 SER\_RCV after SER\_SND.  
The SFCs are included in the consignment of the CPU.

**Overview SFCs for serial communication**

The following SFCs are used for the serial communication:

| SFC     |         | Description        |
|---------|---------|--------------------|
| SFC 216 | SER_CFG | RS485 parameterize |
| SFC 217 | SER_SND | RS485 send         |
| SFC 218 | SER_RCV | RS485 receive      |

## Principle of the data transfer

**Overview** The data transfer is handled during runtime by using SFCs. The principle of data transfer is the same for all protocols and is shortly illustrated in the following.

**Principle** Data, which are written into the according data channel by the PLC, is stored in a FIFO send buffer (first in first out) with a size of 2x1024byte and then put out via the interface.

When the interface receives data, this is stored in a FIFO receive buffer with a size of 2x1024byte and can there be read by the PLC.

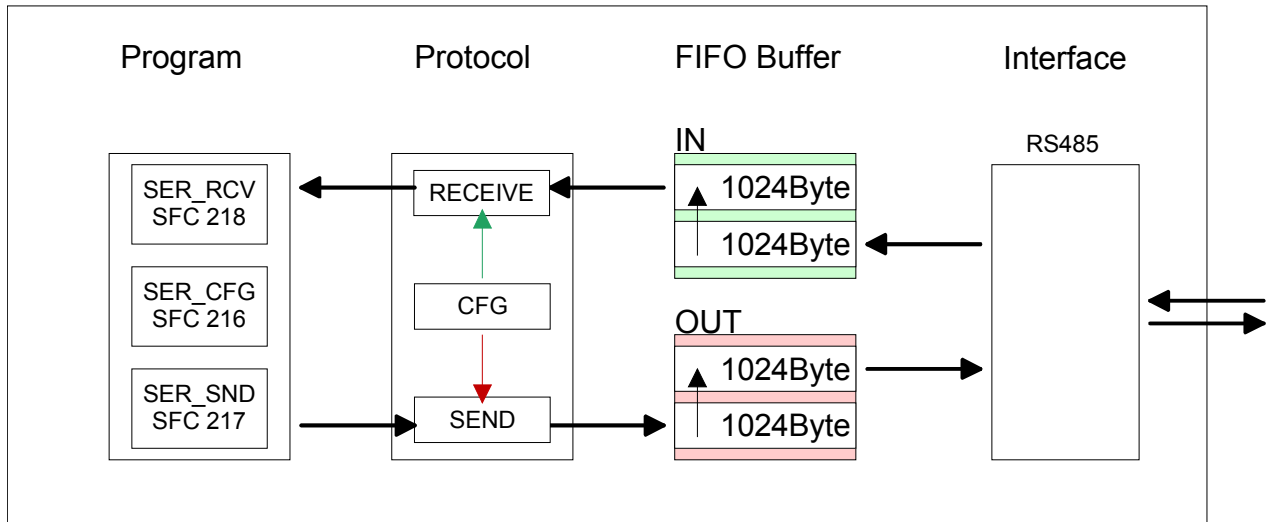
If the data is transferred via a protocol, the adoption of the data to the according protocol happens automatically.

In opposite to ASCII and STX/ETX, the protocols 3964R, USS and Modbus require the acknowledgement of the partner.

An additional call of the SFC 217 SER\_SND causes a return value in RetVal that includes among others recent information about the acknowledgement of the partner.

Further on for USS and Modbus after a SER\_SND the acknowledgement telegram must be evaluated by call of the SFC 218 SER\_RCV.

### RS485 PtP communication



## Deployment of RS485 interface for PtP

### Switch to PtP operation

Per default, the RS485 interface X3 of the CPU is used for the PROFIBUS DP master. Via hardware configuration the RS485 interfaces may be switched to point-to-point communication via the Parameter *Function RS485 X3* of the *Properties*.

For this a hardware configuration of the CPU is required, which is described below.

### Requirements

Since the VIPA specific CPU parameters may be set, the installation of the SPEEDBUS.GSD from VIPA in the hardware catalog is necessary.

The CPU may be configured in a PROFIBUS master system and the appropriate parameters may be set after installation.

### Installation of the SPEEDBUS.GSD

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

| Name         | Language         |
|--------------|------------------|
| SPEEDBUS.GSD | german (default) |
| SPEEDBUS.GSG | german           |
| SPEEDBUS.GSE | english          |

The GSD files may be found at [www.vipa.de](http://www.vipa.de) at the "Service" part.

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

- Browse to [www.vipa.de](http://www.vipa.de).
- Click to *Service > Download > GSD- and EDS-Files > PROFIBUS*.
- Download the file *Cx000023\_Vxxx*.
- Extract the file to your work directory. The SPEEDBUS.GSD is stored in the directory *VIPA\_System\_300S*.
- Start the hardware configurator from Siemens.
- Close every project.
- Select **Options > Install new GSD-file**.
- Navigate to the directory *VIPA\_System\_300S* and select **SPEEDBUS.GSD**.

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



**Proceeding** The embedding of the CPU 314-2AG12 happens by means of a virtual PROFIBUS master system with the following approach:

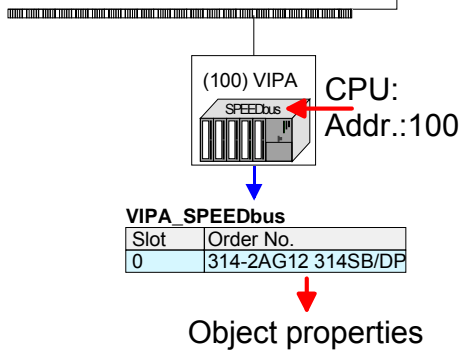
| Slot | Module  |
|------|---------|
| 1    |         |
| 2    | CPU ... |
| X2   |         |
| X1   |         |
| 3    |         |

Modules at the bus

343-1EX11  
Ethernet PG/OP

always as last module  
342-5DA02 V5.0

virtual DP-Master for CPU



- Perform a hardware configuration for the CPU (see "Hardware configuration - CPU").
- Configure always as last module a Siemens DP master CP 342-5 (342-5DA02 V5.0). Connect and parameterize it at operation mode "DP-Master".
- Connect the slave system "VIPA\_SPEEDbus". After installing the SPEEDBUS.GSD this may be found in the hardware catalog at *PROFIBUS DP / Additional field devices / I/O / VIPA / VIPA\_SPEEDBUS*.
- For the slave system set the PROFIBUS address 100.
- Configure at slot 0 the VIPA CPU 314-2AG12 of the hardware catalog from VIPA\_SPEEDbus.
- By double clicking the placed CPU 314-2AG12 the properties dialog of the CPU may be opened.

As soon as the project is transferred together with the PLC user program to the CPU, the parameters will be taken after start-up.

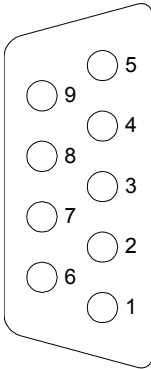
**Setting PtP parameters**

- By double clicking the CPU 314-2AG12 placed in the slave system the properties dialog of the CPU may be opened.
- Switch the Parameter *Function RS485 X3* to "PtP".

**Properties RS485**

- Logical states represented by voltage differences between the two cores of a twisted pair cable
- Serial bus connection in two-wire technology using half duplex mode
- Data communications up to a max. distance of 500m
- Data communication rate up to 115.2kbaud

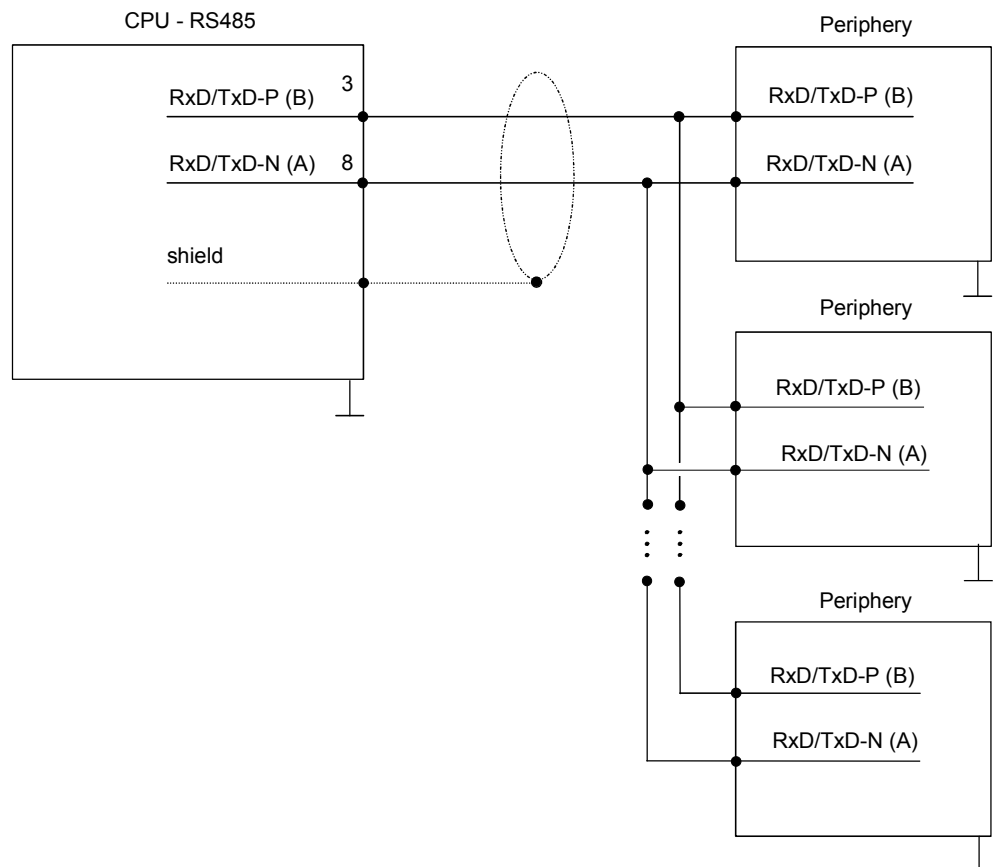
**Connection RS485**



*9polige SubD-Buchse*

| Pin | RS485              |
|-----|--------------------|
| 1   | n.c.               |
| 2   | M24V               |
| 3   | RxD/TxD-P (Line B) |
| 4   | RTS                |
| 5   | M5V                |
| 6   | P5V                |
| 7   | P24V               |
| 8   | RxD/TxD-N (Line A) |
| 9   | n.c.               |

**Connection**



## Parameterization

**SFC 216 (SER\_CFG)** The parameterization happens during runtime deploying the SFC 216 (SER\_CFG). You have to store the parameters for STX/ETX, 3964R, USS and Modbus in a DB.

| Name        | Declaration | Type | Comment                        |
|-------------|-------------|------|--------------------------------|
| Protocol    | IN          | BYTE | 1=ASCII, 2=STX/ETX, 3=3964R    |
| Parameter   | IN          | ANY  | Pointer to protocol parameters |
| Baudrate    | IN          | BYTE | Velocity of data transfer      |
| CharLen     | IN          | BYTE | 0=5bit, 1=6bit, 2=7bit, 3=8bit |
| Parity      | IN          | BYTE | 0=None, 1=Odd, 2=Even          |
| StopBits    | IN          | BYTE | 1=1bit, 2=1.5bit, 3=2bit       |
| FlowControl | IN          | BYTE | 1 (fix)                        |
| RetVal      | OUT         | WORD | Error Code ( 0 = OK )          |

### Parameter description

All time settings for timeouts must be set as hexadecimal value. Find the Hex value by multiply the wanted time in seconds with the baudrate.

Example: Wanted time 8ms at a baudrate of 19200baud

Calculation:  $19200\text{bit/s} \times 0.008\text{s} \approx 154\text{bit} \rightarrow (9\text{Ah})$

Hex value is 9Ah.

### Protocol

Here you fix the protocol to be used. You may choose between:

- 1: ASCII
- 2: STX/ETX
- 3: 3964R
- 4: USS Master
- 5: Modbus RTU Master
- 6: Modbus ASCII Master

**Parameter (as DB)** At ASCII protocol, this parameter is ignored.  
At STX/ETX, 3964R, USS and Modbus you fix here a DB that contains the communication parameters and has the following structure for the according protocols:

*Data block at STX/ETX*

|       |         |      |                                       |
|-------|---------|------|---------------------------------------|
| DBB0: | STX1    | BYTE | (1. Start-ID in hexadecimal)          |
| DBB1: | STX2    | BYTE | (2. Start-ID in hexadecimal)          |
| DBB2: | ETX1    | BYTE | (1. End-ID in hexadecimal)            |
| DBB3: | ETX2    | BYTE | (2. End-ID in hexadecimal)            |
| DBW4: | TIMEOUT | WORD | (max. delay time between 2 telegrams) |



**Note!**

The start res. end sign should always be a value <20, otherwise the sign is ignored!

*Data block at 3964R*

|       |             |      |                                                   |
|-------|-------------|------|---------------------------------------------------|
| DBB0: | Prio        | BYTE | (The priority of both partners must be different) |
| DBB1: | ConnAtmptNr | BYTE | (Number of connection trials)                     |
| DBB2: | SendAtmptNr | BYTE | (Number of telegram retries)                      |
| DBW4: | CharTimeout | WORD | (Character delay time)                            |
| DBW6: | ConfTimeout | WORD | (Acknowledgement delay time)                      |

*Data block at USS*

|       |         |      |                 |
|-------|---------|------|-----------------|
| DBW0: | Timeout | WORD | (Delay time in) |
|-------|---------|------|-----------------|

*Data block at Modbus-Master*

|       |         |      |                      |
|-------|---------|------|----------------------|
| DBW0: | Timeout | WORD | (Respond delay time) |
|-------|---------|------|----------------------|

**Baud rate**

Velocity of data transfer in bit/s (baud).

|      |           |      |           |      |            |      |           |
|------|-----------|------|-----------|------|------------|------|-----------|
| 04h: | 1200baud  | 05h: | 1800baud  | 06h: | 2400baud   | 07h: | 4800baud  |
| 08h: | 7200baud  | 09h: | 9600baud  | 0Ah: | 14400baud  | 0Bh: | 19200baud |
| 0Ch: | 38400baud | 0Dh: | 57600baud | 0Eh: | 115200baud |      |           |

**CharLen**

Number of data bits where a character is mapped to.

|    |      |    |      |    |      |    |      |
|----|------|----|------|----|------|----|------|
| 0: | 5bit | 1: | 6bit | 2: | 7bit | 3: | 8bit |
|----|------|----|------|----|------|----|------|

**Parity** The parity is -depending on the value- even or odd. For parity control, the information bits are extended with the parity bit that amends via its value ("0" or "1") the value of all bits to a defined status. If no parity is set, the parity bit is set to "1", but not evaluated.  
 0: NONE 1: ODD 2: EVEN

**StopBits** The stop bits are set at the end of each transferred character and mark the end of a character.  
 1: 1bit 2: 1.5bit 3: 2bit

**FlowControl** The parameter FlowControl is ignored. When sending RTS=1, when receiving RTS=0.

**RetVal SFC 216 (Error message SER\_CFG)** Return values sent by the block:

| Error code | Description                                                                                                                                                                                                                 |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0000h      | no error                                                                                                                                                                                                                    |
| 809Ah      | Interface is not available or interface is used for PROFIBUS                                                                                                                                                                |
| 8x24h      | Error at SFC-Parameter x, with x:<br>1: Error at "Protocol"<br>2: Error at "Parameter"<br>3: Error at "Baudrate"<br>4: Error at "CharLength"<br>5: Error at "Parity"<br>6: Error at "StopBits"<br>7: Error at "FlowControl" |
| 809xh      | Error in SFC parameter value x, where x:<br>1: Error at "Protocol"<br>3: Error at "Baudrate"<br>4: Error at "CharLength"<br>5: Error at "Parity"<br>6: Error at "StopBits"<br>7: Error at "FlowControl"                     |
| 8092h      | Access error in parameter DB (DB too short)                                                                                                                                                                                 |
| 828xh      | Error in parameter x of DB parameter, where x:<br>1: Error 1. parameter<br>2: Error 2. parameter<br>...                                                                                                                     |

## Communication

**Overview** The communication happens via the send and receive blocks SFC 217 (SER\_SND) and SFC 218 (SER\_RCV).  
The SFCs are included in the consignment of the CPU.

**SFC 217 (SER\_SND)** This block sends data via the serial interface.  
The repeated call of the SFC 217 SER\_SND delivers a return value for 3964R, USS and Modbus via RetVal that contains, among other things, recent information about the acknowledgement of the partner station.  
The protocols USS and Modbus require to evaluate the receipt telegram by calling the SFC 218 SER\_RCV after SER\_SND.

### Parameter

| Name    | Declaration | Type | Comment                                 |
|---------|-------------|------|-----------------------------------------|
| DataPtr | IN          | ANY  | Pointer to Data Buffer for sending data |
| DataLen | OUT         | WORD | Length of data sent                     |
| RetVal  | OUT         | WORD | Error Code ( 0 = OK )                   |

**DataPtr** Here you define a range of the type Pointer for the send buffer where the data that has to be sent is stored. You have to set type, start and length.  
Example: Data is stored in DB5 starting at 0.0 with a length of 124byte.  
DataPtr:=P#DB5.DBX0.0 BYTE 124

**DataLen** Word where the number of the sent bytes is stored.  
At **ASCII** if data were sent by means of SFC 217 faster to the serial interface than the interface sends, the length of data to send could differ from the *DataLen* due to a buffer overflow. This should be considered by the user program.  
With **STX/ETX**, **3964R**, **Modbus** and **USS** always the length set in DataPtr is stored or 0.

**RetVal SFC 217  
(Error message  
SER\_SND)**

Return values of the block:

| Error code | Description                                                                                     |
|------------|-------------------------------------------------------------------------------------------------|
| 0000h      | Send data - ready                                                                               |
| 1000h      | Nothing sent (data length 0)                                                                    |
| 20xxh      | Protocol executed error free with xx bit pattern for diagnosis                                  |
| 7001h      | Data is stored in internal buffer - active (busy)                                               |
| 7002h      | Transfer - active                                                                               |
| 80xxh      | Protocol executed with errors with xx bit pattern for diagnosis (no acknowledgement by partner) |
| 90xxh      | Protocol not executed with xx bit pattern for diagnosis (no acknowledgement by partner)         |
| 8x24h      | Error in SFC parameter x, where x:<br>1: Error in "DataPtr"<br>2: Error in "DataLen"            |
| 8122h      | Error in parameter "DataPtr" (e.g. DB too short)                                                |
| 807Fh      | Internal error                                                                                  |
| 809Ah      | Interface not found or interface is used for PROFIBUS                                           |
| 809Bh      | Interface not configured                                                                        |

Protocol specific  
RetVal values

*ASCII*

| Value | Description                    |
|-------|--------------------------------|
| 9000h | Buffer overflow (no data send) |
| 9002h | Data too short (0byte)         |

*STX/ETX*

| Value | Description                    |
|-------|--------------------------------|
| 9000h | Buffer overflow (no data send) |
| 9001h | Data too long (>1024byte)      |
| 9002h | Data too short (0byte)         |
| 9004h | Character not allowed          |

*3964R*

| Value | Description                                                                  |
|-------|------------------------------------------------------------------------------|
| 2000h | Send ready without error                                                     |
| 80FFh | NAK received - error in communication                                        |
| 80FEh | Data transfer without acknowledgement of partner or error at acknowledgement |
| 9000h | Buffer overflow (no data send)                                               |
| 9001h | Data too long (>1024byte)                                                    |
| 9002h | Data too short (0byte)                                                       |

... Continue  
RetVal SFC 217  
SER\_SND

*USS*

| Error code | Description                                    |
|------------|------------------------------------------------|
| 2000h      | Send ready without error                       |
| 8080h      | Receive buffer overflow (no space for receipt) |
| 8090h      | Acknowledgement delay time exceeded            |
| 80F0h      | Wrong checksum in respond                      |
| 80FEh      | Wrong start sign in respond                    |
| 80FFh      | Wrong slave address in respond                 |
| 9000h      | Buffer overflow (no data send)                 |
| 9001h      | Data too long (>1024byte)                      |
| 9002h      | Data too short (<2byte)                        |

*Modbus RTU/ASCII Master*

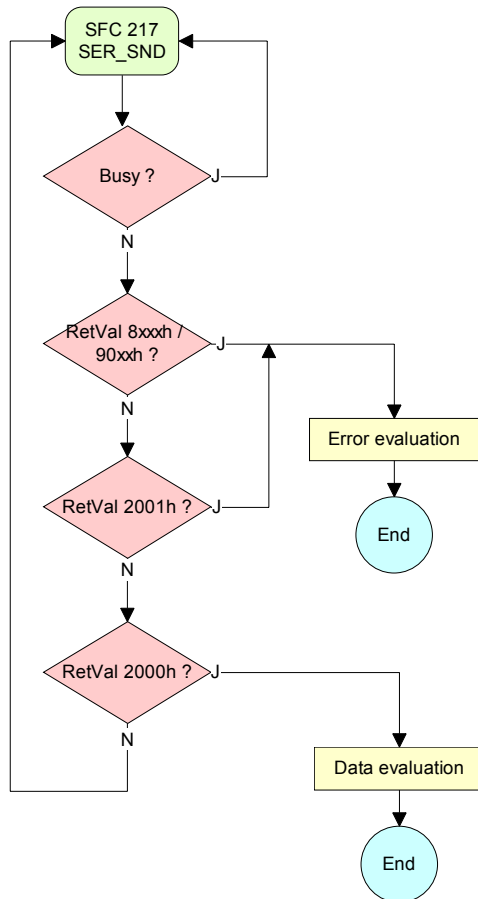
| Error code | Description                                    |
|------------|------------------------------------------------|
| 2000h      | Send ready without error                       |
| 2001h      | Send ready with error                          |
| 8080h      | Receive buffer overflow (no space for receipt) |
| 8090h      | Acknowledgement delay time exceeded            |
| 80F0h      | Wrong checksum in respond                      |
| 80FDh      | Length of respond too long                     |
| 80FEh      | Wrong function code in respond                 |
| 80FFh      | Wrong slave address in respond                 |
| 9000h      | Buffer overflow (no data send)                 |
| 9001h      | Data too long (>1024byte)                      |
| 9002h      | Data too short (<2byte)                        |



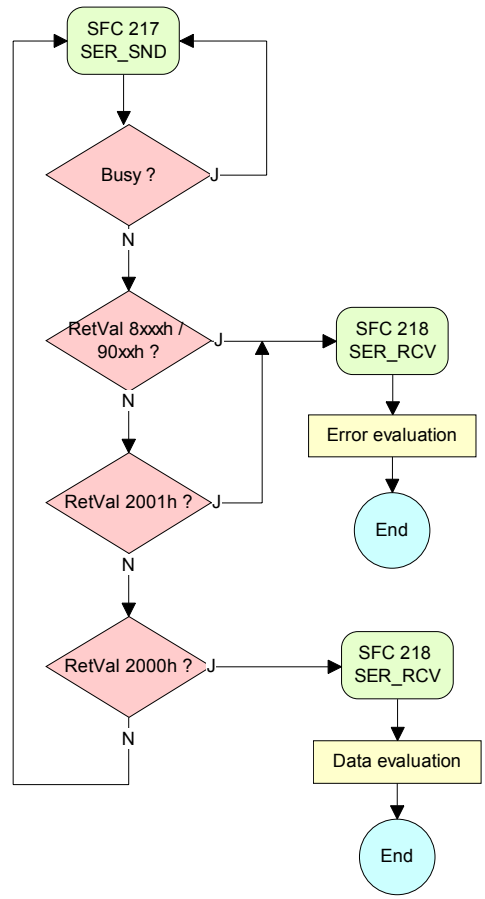
**Principles of programming**

The following text shortly illustrates the structure of programming a send command for the different protocols.

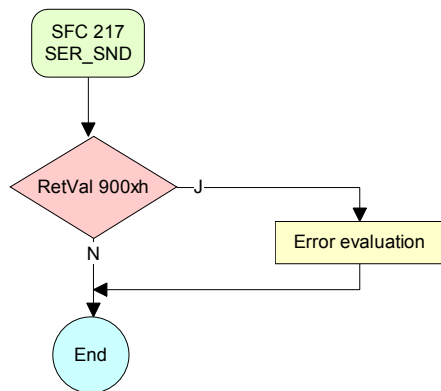
**3964R**



**USS / Modbus**



**ASCII / STX/ETX**



**SFC 218  
(SER\_RCV)**

This block receives data via the serial interface.  
Using the SFC 218 SER\_RCV after SER\_SND with the protocols USS and Modbus the acknowledgement telegram can be read.

**Parameter**

| Name    | Declaration | Type | Comment                                  |
|---------|-------------|------|------------------------------------------|
| DataPtr | IN          | ANY  | Pointer to Data Buffer for received data |
| DataLen | OUT         | WORD | Length of received data                  |
| Error   | OUT         | WORD | Error Number                             |
| RetVal  | OUT         | WORD | Error Code ( 0 = OK )                    |

**DataPtr** Here you set a range of the type Pointer for the receive buffer where the reception data is stored. You have to set type, start and length.  
Example: Data is stored in DB5 starting at 0.0 with a length of 124byte.  
DataPtr:=P#DB5.DBX0.0 BYTE 124

**DataLen** Word where the number of received Bytes is stored.  
At **STX/ETX** and **3964R**, the length of the received user data or 0 is entered.  
At **ASCII**, the number of read characters is entered. This value may be different from the read telegram length.

**Error** This word gets an entry in case of an error. The following error messages may be created depending on the protocol:

*ASCII*

| Bit | Error         | Description                                                                                                                                    |
|-----|---------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 0   | overrun       | Overflow, a sign couldn't be read fast enough from the interface                                                                               |
| 1   | framing error | Error that shows that a defined bit frame is not coincident, exceeds the allowed length or contains an additional Bit sequence (Stopbit error) |
| 2   | parity        | Parity error                                                                                                                                   |
| 3   | overflow      | Buffer is full                                                                                                                                 |

*STX/ETX*

| Bit | Error    | Description                                                   |
|-----|----------|---------------------------------------------------------------|
| 0   | overflow | The received telegram exceeds the size of the receive buffer. |
| 1   | char     | A sign outside the range 20h...7Fh has been received.         |
| 3   | overflow | Buffer is full                                                |

*3964R / Modbus RTU/ASCII Master*

| Bit | Error    | Description                                                   |
|-----|----------|---------------------------------------------------------------|
| 0   | overflow | The received telegram exceeds the size of the receive buffer. |

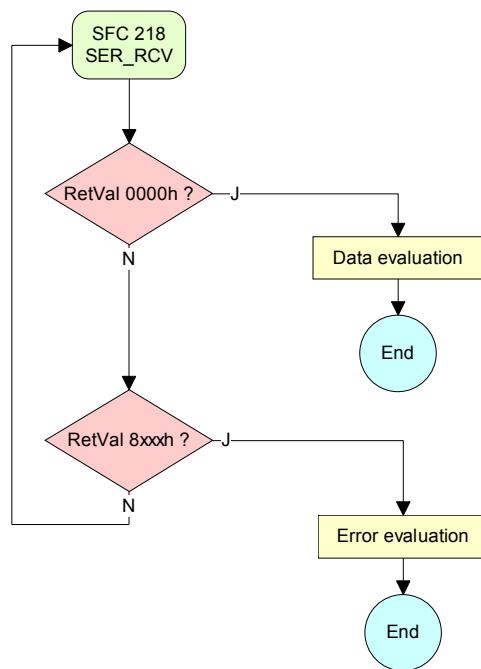
**RetVal SFC 218  
(Error message  
SER\_RCV)**

Return values of the block:

| Error code | Description                                                                                                |
|------------|------------------------------------------------------------------------------------------------------------|
| 0000h      | no error                                                                                                   |
| 1000h      | Receive buffer too small (data loss)                                                                       |
| 8x24h      | Error at SFC-Parameter x, with x:<br>1: Error at "DataPtr"<br>2: Error at "DataLen"<br>3: Error at "Error" |
| 8122h      | Error in parameter "DataPtr" (e.g. DB too short)                                                           |
| 809Ah      | Serial interface not found res. interface is used by PROFIBUS                                              |
| 809Bh      | Serial interface not configured                                                                            |

**Principles of  
programming**

The following picture shows the basic structure for programming a receive command. This structure can be used for all protocols.



## Protocols and procedures

### Overview

The CPU supports the following protocols and procedures:

- ASCII communication
- STX/ETX
- 3964R
- USS
- Modbus

### ASCII

ASCII data communication is one of the simple forms of data exchange.

Incoming characters are transferred 1 to 1.

At ASCII, with every cycle the read-SFC is used to store the data that is in the buffer at request time in a parameterized receive data block. If a telegram is spread over various cycles, the data is overwritten. There is no reception acknowledgement. The communication procedure has to be controlled by the concerning user application. An according Receive\_ASCII FB may be found within the VIPA library in the service area of [www.vipa.de](http://www.vipa.de).

### STX/ETX

STX/ETX is a simple protocol with start and end ID, where STX stands for **Start of Text** and ETX for **End of Text**.

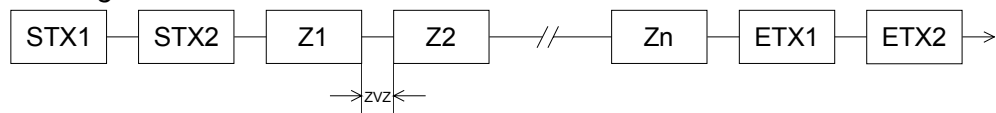
The STX/ETX procedure is suitable for the transfer of ASCII characters. It does not use block checks (BCC). Any data transferred from the periphery must be preceded by a Start followed by the data characters and the end character.

Depending of the byte width the following ASCII characters can be transferred: 5Bit: not allowed; 6Bit: 20...3Fh, 7Bit: 20...7Fh, 8Bit: 20...FFh.

The effective data, which includes all the characters between Start and End are transferred to the PLC when the End has been received.

When data is send from the PLC to a peripheral device, any user data is handed to the SFC 217 (SER\_SND) and is transferred with added Start- and End-ID to the communication partner.

*Message structure:*



You may define up to 2 Start- and End-IDs.

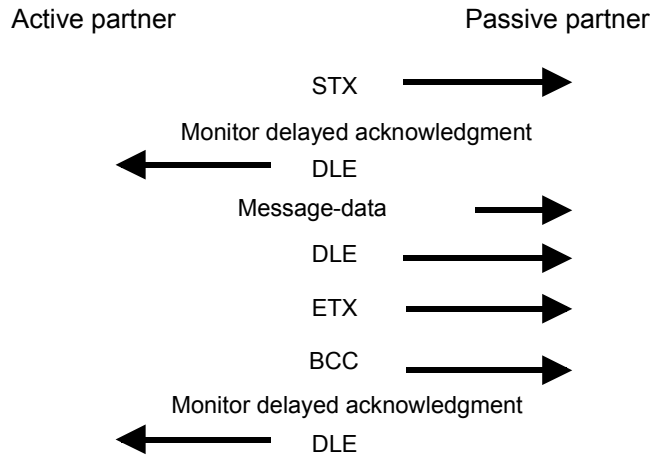
You may work with 1, 2 or no Start- and with 1, 2 or no End-ID. As Start-res. End-ID all Hex values from 01h to 1Fh are permissible. Characters above 1Fh are ignored. In the user data, characters below 20h are not allowed and may cause errors. The number of Start- and End-IDs may be different (1 Start, 2 End res. 2 Start, 1 End or other combinations). For not used start and end characters you have to enter FFh in the hardware configuration. If no End-ID is defined, all read characters are transferred to the PLC after a parameterizable character delay time (Timeout).

**3964R**

The 3964R procedure controls the data transfer of a point-to-point link between the CPU and a communication partner. The procedure adds control characters to the message data during data transfer. These control characters may be used by the communication partner to verify the complete and error free receipt.

The procedure employs the following control characters:

- STX            **Start of Text**
- DLE           **Data Link Escape**
- ETX           **End of Text**
- BCC           **Block Check Character**
- NAK           **Negative Acknowledge**

**Procedure**

You may transfer a maximum of 255byte per message.

**Note!**

When a DLE is transferred as part of the information it is repeated to distinguish between data characters and DLE control characters that are used to establish and to terminate the connection (DLE duplication). The DLE duplication is reversed in the receiving station.

The 3964R procedure requires that a lower priority is assigned to the communication partner. When communication partners issue simultaneous send commands, the station with the lower priority will delay its send command.

**USS**

The USS protocol (**U**niverselle **S**erielle **S**chnittstelle = universal serial interface) is a serial transfer protocol defined by Siemens for the drive and system components. This allows to build-up a serial bus connection between a superordinated master and several slave systems.

The USS protocol enables a time cyclic telegram traffic by presetting a fix telegram length.

The following features characterize the USS protocol:

- Multi point connection
- Master-Slave access procedure
- Single-Master-System
- Max. 32 participants
- Simple and secure telegram frame

You may connect 1 master and max. 31 slaves at the bus where the single slaves are addressed by the master via an address sign in the telegram. The communication happens exclusively in half-duplex operation.

After a send command, the acknowledgement telegram must be read by a call of the SFC 218 SER\_RCV.

The telegrams for send and receive have the following structure:

*Master-Slave telegram*

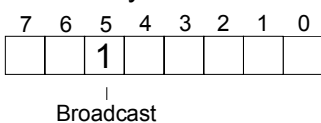
| STX | LGE | ADR | PKE |   | IND |   | PWE |   | STW |   | HSW |   | BCC |
|-----|-----|-----|-----|---|-----|---|-----|---|-----|---|-----|---|-----|
| 02h |     |     | H   | L | H   | L | H   | L | H   | L | H   | L |     |

*Slave-Master telegram*

| STX | LGE | ADR | PKE |   | IND |   | PWE |   | ZSW |   | HIW |   | BCC |
|-----|-----|-----|-----|---|-----|---|-----|---|-----|---|-----|---|-----|
| 02h |     |     | H   | L | H   | L | H   | L | H   | L | H   | L |     |

- |                       |                            |
|-----------------------|----------------------------|
| where STX: Start sign | STW: Control word          |
| LGE: Telegram length  | ZSW: State word            |
| ADR: Address          | HSW: Main set value        |
| PKE: Parameter ID     | HIW: Main effective value  |
| IND: Index            | BCC: Block Check Character |
| PWE: Parameter value  |                            |

Broadcast with set bit 5 in ADR-Byte



A request can be directed to a certain slave ore be send to all slaves as broadcast message. For the identification of a broadcast message you have to set bit 5 to 1 in the ADR-Byte. Here the slave addr. (bit 0 ... 4) is ignored. In opposite to a "normal" send command, the broadcast does not require a telegram evaluation via SFC 218 SER\_RCV. Only write commands may be sent as broadcast.

**Modbus**

The Modbus protocol is a communication protocol that fixes a hierarchic structure with one master and several slaves.

Physically, Modbus works with a serial half-duplex connection.

There are no bus conflicts occurring, because the master can only communicate with one slave at a time. After a request from the master, this waits for a preset delay time for an answer of the slave. During the delay time, communication with other slaves is not possible.

After a send command, the acknowledgement telegram must be read by a call of the SFC 218 SER\_RCV.

The request telegrams send by the master and the respond telegrams of a slave have the following structure:

|            |               |               |      |              |          |
|------------|---------------|---------------|------|--------------|----------|
| Start sign | Slave address | Function Code | Data | Flow control | End sign |
|------------|---------------|---------------|------|--------------|----------|

Broadcast with slave address = 0

A request can be directed to a special slave or at all slaves as broadcast message. To mark a broadcast message, the slave address 0 is used.

In opposite to a "normal" send command, the broadcast does not require a telegram evaluation via SFC 218 SER\_RCV.

Only write commands may be sent as broadcast.

ASCII, RTU mode

Modbus offers 2 different transfer modes:

- ASCII mode: Every byte is transferred in the 2 sign ASCII code. The data are marked with a start and an end sign. This causes a transparent but slow transfer.
- RTU mode: Every byte is transferred as one character. This enables a higher data pass through as the ASCII mode. Instead of start and end sign, a time control is used.

The mode selection happens during runtime by using the SFC 216 SER\_CFG.

Supported Modbus protocols

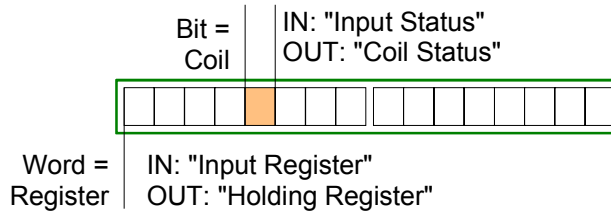
The following Modbus Protocols are supported by the RS485 interface

- Modbus RTU Master
- Modbus ASCII Master

## Modbus - Function codes

### Naming convention

Modbus has some naming conventions:



- Modbus differentiates between bit and word access; Bits = "Coils" and Words = "Register".
- Bit inputs are referred to as "Input-Status" and Bit outputs as "Coil-Status".
- Word inputs are referred to as "Input-Register" and Word outputs as "Holding-Register".

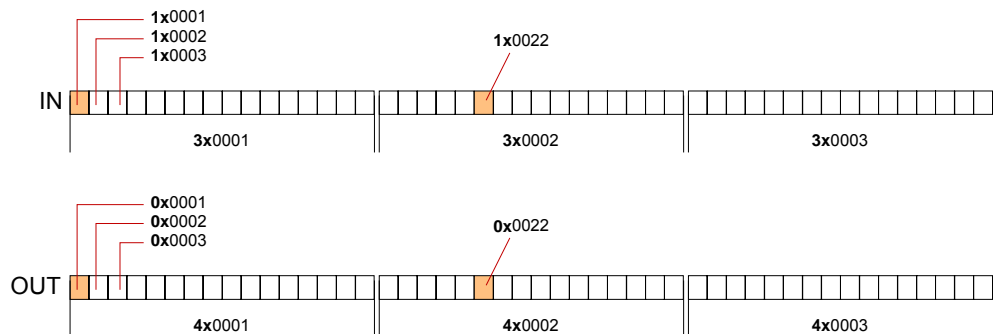
### Range definitions

Normally the access at Modbus happens by means of the ranges 0x, 1x, 3x and 4x.

0x and 1x gives you access to *digital* Bit areas and 3x and 4x to *analog* word areas.

For the CPs from VIPA is not differentiating digital and analog data, the following assignment is valid:

- 0x: Bit area for master output data  
Access via function code 01h, 05h, 0Fh
- 1x: Bit area for master input data  
Access via function code 02h
- 3x: Word area for master input data  
Access via function code 04h
- 4x: Word area for master output data  
Access via function code 03h, 06h, 10h



A description of the function codes follows below.



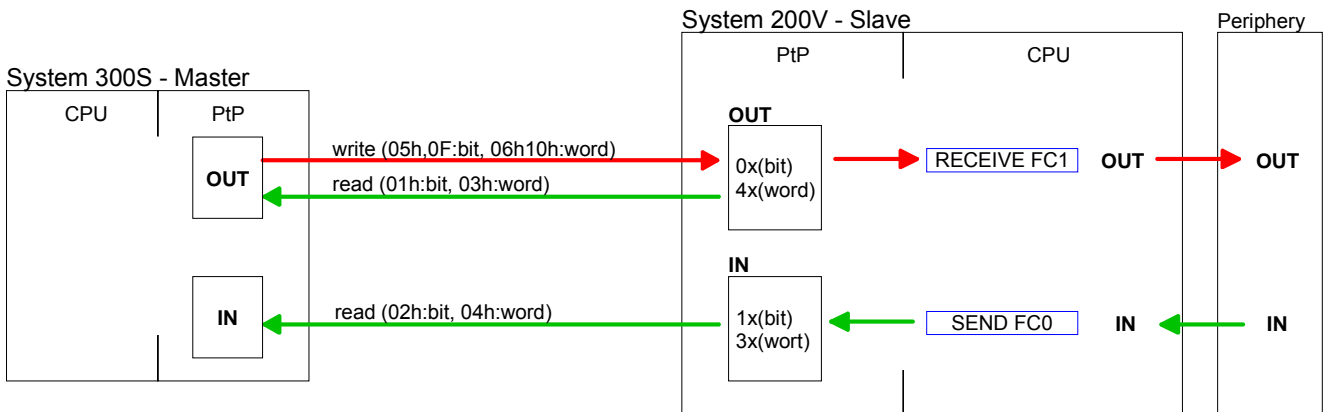
Overview

With the following Modbus function codes a Modbus master can access a Modbus slave: With the following Modbus function codes a Modbus master can access a Modbus slave. The description always takes place from the point of view of the master:

| Code | Command       | Description                            |
|------|---------------|----------------------------------------|
| 01h  | Read n Bits   | Read n Bits of master output area 0x   |
| 02h  | Read n Bits   | Read n Bits of master input area 1x    |
| 03h  | Read n Words  | Read n Words of master output area 4x  |
| 04h  | Read n Words  | Read n Words master input area 3x      |
| 05h  | Write 1 Bit   | Write 1 Bit to master output area 0x   |
| 06h  | Write 1 Word  | Write 1 Word to master output area 4x  |
| 0Fh  | Write n Bits  | Write n Bits to master output area 0x  |
| 10h  | Write n Words | Write n Words to master output area 4x |

Point of View of "Input" and "Output" data

The description always takes place from the point of view of the master. Here data, which were sent from master to slave, up to their target are designated as "output" data (OUT) and contrary slave data received by the master were designated as "input" data (IN).



Respond of the slave

If the slave announces an error, the function code is send back with an "ORed" 80h. Without an error, the function code is sent back.

Slave answer: Function code OR 80h → Error  
Function code → OK

Byte sequence in a Word

For the Byte sequence in a Word is always valid: 1 Word  
High Low  
Byte Byte

Check sum CRC, RTU, LRC

The shown check sums CRC at RTU and LRC at ASCII mode are automatically added to every telegram. They are not shown in the data block.

**Read n Bits** Code 01h: Read n Bits of master output area 0x  
**01h, 02h** Code 02h: Read n Bits of master input area 1x

Command telegram

| Slave address | Function code | Address 1. Bit | Number of Bits | Check sum CRC/LRC |
|---------------|---------------|----------------|----------------|-------------------|
| 1Byte         | 1Byte         | 1Word          | 1Word          | 1Word             |

Respond telegram

| Slave address | Function code | Number of read Bytes | Data 1. Byte | Data 2. Byte | ... | Check sum CRC/LRC |
|---------------|---------------|----------------------|--------------|--------------|-----|-------------------|
| 1Byte         | 1Byte         | 1Byte                | 1Byte        | 1Byte        |     | 1Word             |
|               |               |                      | max. 250Byte |              |     |                   |

**Read n Words** 03h: Read n Words of master output area 4x  
**03h, 04h** 04h: Read n Words master input area 3x

Command telegram

| Slave address | Function code | Address 1. Bit | Number of Words | Check sum CRC/LRC |
|---------------|---------------|----------------|-----------------|-------------------|
| 1Byte         | 1Byte         | 1Word          | 1Word           | 1Word             |

Respond telegram

| Slave address | Function code | Number of read Bytes | Data 1. Word   | Data 2. Word | ... | Check sum CRC/LRC |
|---------------|---------------|----------------------|----------------|--------------|-----|-------------------|
| 1Byte         | 1Byte         | 1Byte                | 1Word          | 1Word        |     | 1Word             |
|               |               |                      | max. 125 Words |              |     |                   |

**Write 1 Bit** Code 05h: Write 1 Bit to master output area 0x  
**05h** A status change is via "Status Bit" with following values:

"Status Bit" = 0000h → Bit = 0

"Status Bit" = FF00h → Bit = 1

Command telegram

| Slave address | Function code | Address Bit | Status Bit | Check sum CRC/LRC |
|---------------|---------------|-------------|------------|-------------------|
| 1Byte         | 1Byte         | 1Word       | 1Word      | 1Word             |

Respond telegram

| Slave address | Function code | Address Bit | Status Bit | Check sum CRC/LRC |
|---------------|---------------|-------------|------------|-------------------|
| 1Byte         | 1Byte         | 1Word       | 1Word      | 1Word             |

**Write 1 Word 06h**

Code 06h: Write 1 Word to master output area 4x

Command telegram

| Slave address | Function code | Address word | Value word | Check sum CRC/LRC |
|---------------|---------------|--------------|------------|-------------------|
| 1Byte         | 1Byte         | 1Word        | 1Word      | 1Word             |

Respond telegram

| Slave address | Function code | Address word | Value word | Check sum CRC/LRC |
|---------------|---------------|--------------|------------|-------------------|
| 1Byte         | 1Byte         | 1Word        | 1Word      | 1Word             |

**Write n Bits 0Fh**

Code 0Fh: Write n Bits to master output area 0x

Please regard that the number of Bits has additionally to be set in Byte.

Command telegram

| Slave address | Function code | Address 1. Bit | Number of Bits | Number of Bytes | Data 1. Byte | Data 2. Byte  | ...   | Check sum CRC/LRC |
|---------------|---------------|----------------|----------------|-----------------|--------------|---------------|-------|-------------------|
| 1Byte         | 1Byte         | 1Word          | 1Word          | 1Byte           | 1Byte        | 1Byte         | 1Byte | 1Word             |
|               |               |                |                |                 |              | max. 250 Byte |       |                   |

Respond telegram

| Slave address | Function code | Address 1. Bit | Number of Bits | Check sum CRC/LRC |
|---------------|---------------|----------------|----------------|-------------------|
| 1Byte         | 1Byte         | 1Word          | 1Word          | 1Word             |

**Write n Words 10h**

Code 10h: Write n Words to master output area 4x

Command telegram

| Slave address | Function code | Address 1. Word | Number of words | Number of Bytes | Data 1. Word | Data 2. Word   | ...   | Check sum CRC/LRC |
|---------------|---------------|-----------------|-----------------|-----------------|--------------|----------------|-------|-------------------|
| 1Byte         | 1Byte         | 1Word           | 1Word           | 1Byte           | 1Word        | 1Word          | 1Word | 1Word             |
|               |               |                 |                 |                 |              | max. 125 Words |       |                   |

Respond telegram

| Slave address | Function code | Address 1. Word | Number of Words | Check sum CRC/LRC |
|---------------|---------------|-----------------|-----------------|-------------------|
| 1Byte         | 1Byte         | 1Word           | 1Word           | 1Word             |

## Modbus - Example communication

**Overview** The example establishes a communication between a master and a slave via Modbus. The following combination options are shown:

|                   |                  |
|-------------------|------------------|
| Modbus master (M) | Modbus slave (S) |
| CPU 31xS          | CPU 21xSER-1     |

---

### Components

The following components are required for this example:

- CPU 31xS as Modbus RTU master
- CPU 21xSER-1 as Modbus RTU slave
- Siemens SIMATIC Manager and possibilities for the project transfer
- Modbus cable connection

### Approach

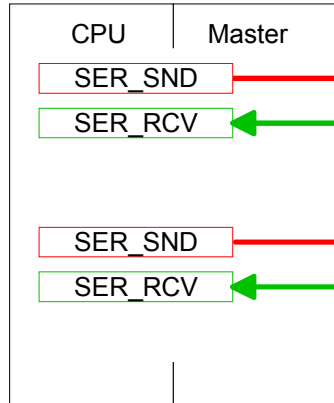
- Assemble a Modbus system consisting of a CPU 31xS as Modbus master and a CPU 21xSER-1 as Modbus slave and Modbus cable.
- Execute the project engineering of the master!  
For this you create a PLC user application with the following structure:
  - OB 100: Call SFC 216 (configuration as Modbus RTU master) with timeout setting and error evaluation.
  - OB 1: Call SFC 217 (SER\_SND) where the data is send with error evaluation. Here you have to build up the telegram according to the Modbus rules.  
Call SFC 218 (SER\_RECV) where the data is received with error evaluation.
- Execute the project engineering of the slave!  
The PLC user application at the slave has the following structure:
  - OB 100: Call SFC 216 (configuration as Modbus RTU slave) with timeout setting and Modbus address in the DB and error evaluation.
  - OB 1: Call SFC 217 (SER\_SND) for data transport from the slave CPU to the output buffer.  
Call SFC 218 (SER\_RECV) for the data transport from the input buffer to the CPU. Allow an according error evaluation for both directions.

The following page shows the structure for the according PLC programs for master and slave.

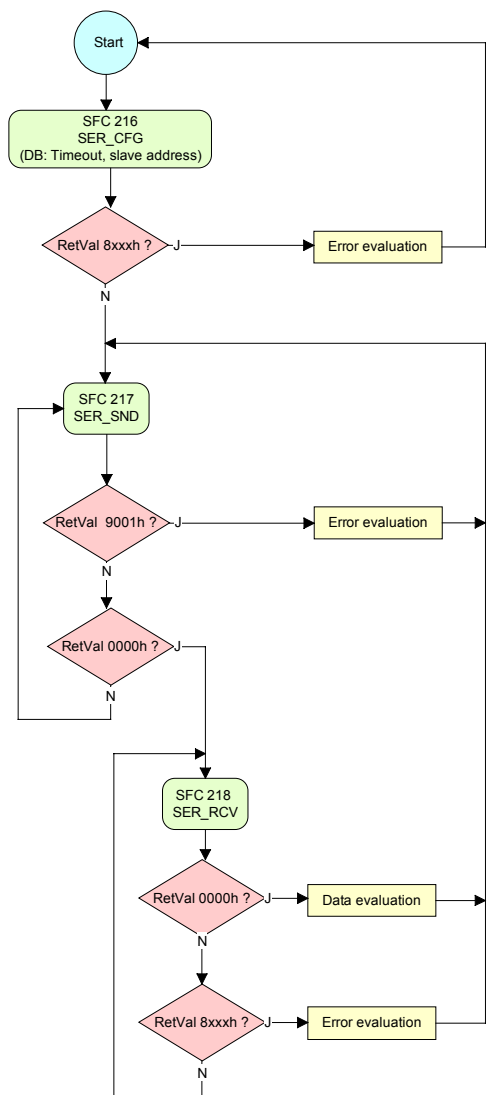
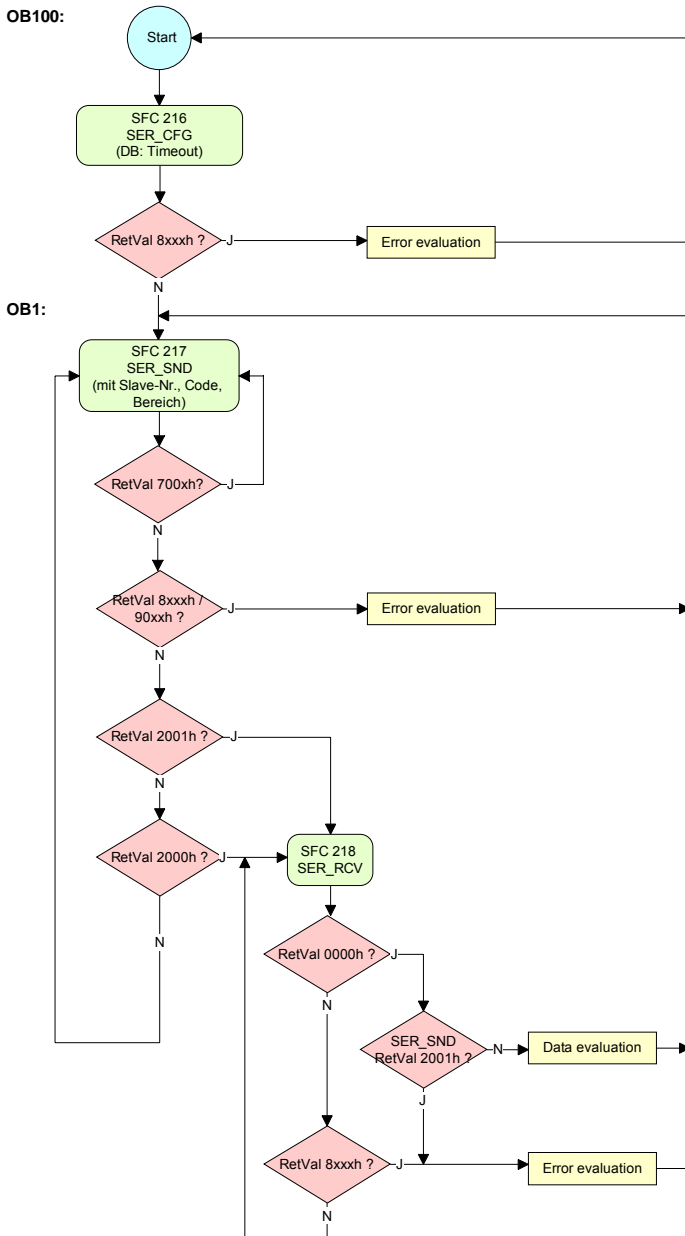
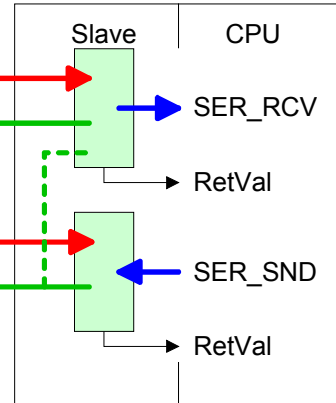
**Master**

**Slave**

**CPU 31xS**



**CPU 21xSER-1**





## Chapter 6 Deployment PROFIBUS communication

### Overview

Content of this chapter is the deployment of the CPU 314-2AG12 with PROFIBUS. After a short overview the project engineering and parameterization of a CPU 314-2AG12 with integrated PROFIBUS-Part from VIPA is shown.

Further you get information about usage as DP master and DP slave of the PROFIBUS part.

The chapter is ending with notes to commissioning and start-up behavior.

### Content

| Topic                                                    | Page       |
|----------------------------------------------------------|------------|
| <b>Chapter 6 Deployment PROFIBUS communication .....</b> | <b>6-1</b> |
| Overview .....                                           | 6-2        |
| Fast introduction.....                                   | 6-3        |
| Hardware configuration - CPU.....                        | 6-4        |
| Deployment as PROFIBUS DP master .....                   | 6-5        |
| Deployment as PROFIBUS DP slave .....                    | 6-6        |
| PROFIBUS installation guidelines .....                   | 6-8        |
| Commissioning and Start-up behavior.....                 | 6-11       |

## Overview

### PROFIBUS DP

PROFIBUS is an international standard applicable to an open and serial field bus for building, manufacturing and process automation that can be used to create a low (sensor-/actuator level) or medium (process level) performance network of programmable logic controllers.

PROFIBUS comprises an assortment of compatible versions. The following details refer to PROFIBUS DP.

PROFIBUS DP is a special protocol intended mainly for automation tasks in a manufacturing environment. DP is very fast, offers Plug'n'Play facilities and provides a cost-effective alternative to parallel cabling between PLC and remote I/O. PROFIBUS DP was designed for high-speed data communication on the sensor-actuator level.

The data transfer referred to as "Data Exchange" is cyclical. During one bus cycle, the master reads input values from the slaves and writes output information to the slaves.

### CPU with DP master

The PROFIBUS DP master is to be configured in the hardware configurator from Siemens. Therefore the configuration happens by the sub module X1 (MPI/DP) of the Siemens CPU.

After the transmission of the data to the CPU, the configuration data are internally passed on to the PROFIBUS master part.

During the start-up the DP master automatically includes his data areas into the address range of the CPU. Project engineering in the CPU is not required.

### Deployment of the DP-Master with CPU

Via the PROFIBUS DP master PROFIBUS DP slaves may be coupled to the CPU. The DP master communicates with the DP 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. At DP slave failure, the ER-LED is on and the OB 86 is requested. If this is not available, the CPU switches to STOP and BASP is set. As soon as the BASP signal comes from the CPU, the DP master is setting the outputs of the connected periphery to zero. The DP master remains in the operating mode RUN independent from the CPU.

### DP slave operation

For the deployment in a super-ordinated master system you first have to project your slave system as Siemens CPU in slave operation mode with configured in-/output areas. Afterwards you configure your master system. Couple your slave system to your master system by dragging the CPU 31x from the hardware catalog at *Configured stations* onto the master system, choose your slave system and connect it.



## Fast introduction

**Overview** The PROFIBUS DP master is to be configured in the hardware configurator. Here the configuration happens by means of the sub module X2 (DP) of the Siemens CPU.

**Steps of configuration** For the configuration of the PROFIBUS DP master please follow the following approach:

- **Hardware configuration - CPU**
- **Deployment as DP master or Deployment as DP slave**
- **Transfer of the complete project to CPU**

Information about transferring a project may be found at chapter "Deployment CPU ..." at "Project transfer".

### Note

To be compatible to the Siemens SIMATIC manager, the CPU 314-2AG12 from VIPA is to be configured as

**CPU 318-2 (318-2AJ00-0AB00 V3.0)**

The integrated PROFIBUS DP master (X3) is to be configured and connected via the sub module X2 (DP).

In the operation mode PROFIBUS the CPU may further more be accessed via the MPI interface (X2) with address 2 und 187.5kbit/s.

The Ethernet PG/OP channel of the CPU 314-2AG12 is always to be configured as 1. module after the really plugged modules at the standard bus as CP343-1 (343-1EX11) from Siemens.

## Hardware configuration - CPU

### Requirements

The hardware configuration of the VIPA CPU takes place at the Siemens hardware configurator.

The hardware configurator is a part of the Siemens SIMATIC Manager. It serves the project engineering. The modules, which may be configured here are listed in the hardware catalog. If necessary you have to update the hardware catalog with **Options > Update Catalog**.

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



### Note!

Please consider that this SPEED7-CPU has 4 ACCUs. After an arithmetic operation (+I, -I, \*I, /I, +D, -D, \*D, /D, MOD, +R, -R, \*R, /R) the content of ACCU 3 and ACCU 4 is loaded into ACCU 3 and 2.

This may cause conflicts in applications that presume an unmodified ACCU2.

For more information may be found in the manual "VIPA Operation list SPEED7" at "Differences between SPEED7 and 300V programming".

### Proceeding

To be compatible with the Siemens SIMATIC manager the following steps should be executed:

| Slot | Module           |
|------|------------------|
| 1    |                  |
| 2    | <b>CPU 318-2</b> |
| X2   | <i>DP</i>        |
| X1   | <i>MPI/DP</i>    |
| 3    |                  |

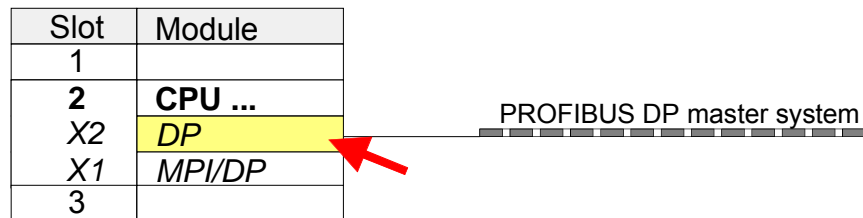
- Start the Siemens hardware configurator with a new project.
- Insert a profile rail from the hardware catalog.
- Place at slot 2 the following CPU from Siemens:  
**CPU 318-2 (6ES7 318-2AJ00-0AB0/V3.0).**
- The integrated PROFIBUS DP master (X3) is to be configured and connected via the sub module X2 (DP). In the operation mode PROFIBUS the CPU may further more be accessed via the MPI interface (X2) with address 2 und 187.5kbit/s.

## Deployment as PROFIBUS DP master

**Precondition** • The hardware configuration described before was established.

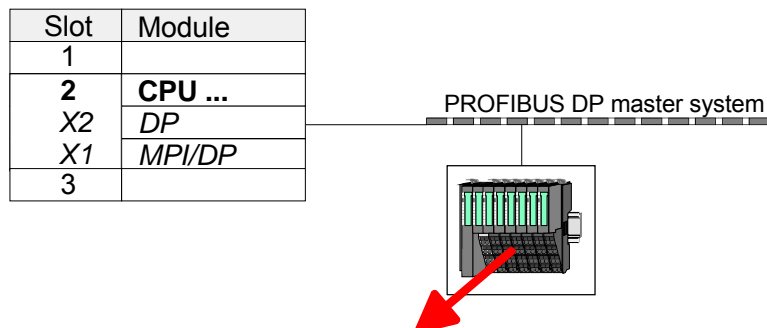
**Proceeding**

- Open the properties dialog of the DP interface of the CPU by means of a double-click at DP.
- Set *Interface type* to "PROFIBUS"
- Connect to PROFIBUS and preset an address (preferably 2) and confirm with [OK].
- Switch at *Operating mode* to "DP master" and confirm the dialog with [OK]. A PROFIBUS DP master system is inserted.



Now the project engineering of your PROFIBUS DP master is finished. Please link up now your DP slaves with periphery to your DP master.

- For the project engineering of PROFIBUS DP slaves you search the concerning PROFIBUS DP slave in the *hardware catalog* and drag&drop it in the subnet of your master.
- Assign a valid PROFIBUS address to the DP slave.
- Link up the modules of your DP slave system in the plugged sequence and add the addresses that should be used by the modules.
- If needed, parameterize the modules.
- Save, compile and transfer your project. More detailed information about project transfer may be found at chapter "Deployment CPU ...".



| Slot | Module | Order number |  |
|------|--------|--------------|--|
| 1    | ...    |              |  |
| 2    | Module |              |  |
| 3    | ...    |              |  |
| 4    |        |              |  |
| 5    |        |              |  |
| ...  |        |              |  |

## Deployment as PROFIBUS DP slave

### Fast introduction

In the following the deployment of the PROFIBUS section as "intelligent" DP slave on master system is described, which exclusively may be configured in the Siemens SIMATIC manager.

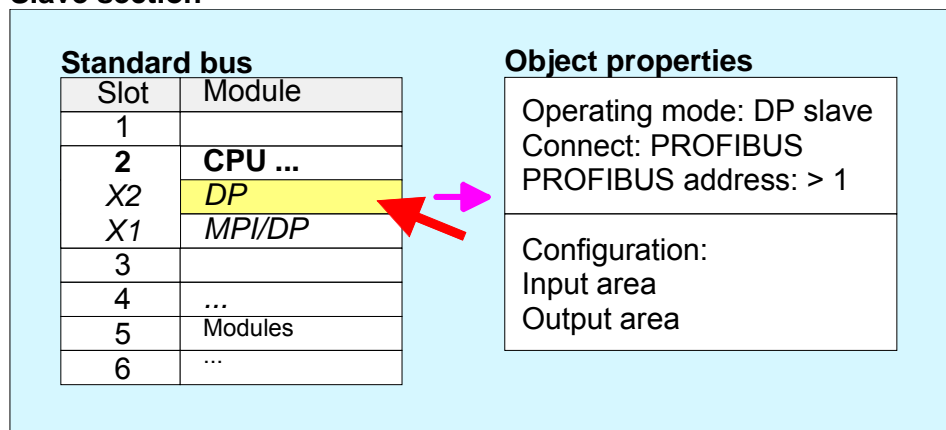
The following steps are required:

- Configure a station with a CPU with operating mode *DP slave*.
- Connect to PROFIBUS and configure the in-/output area for the slave section.
- Save and compile your project.
- Configure another station with another CPU with operating mode *DP master*.
- Connect to *PROFIBUS* and configure the in-/output ranges for the master section
- Save, compile and transfer your project to your CPU.

### Project engineering of the slave section

- Start the Siemens SIMATIC manager and configure a CPU as described at "Hardware configuration - CPU".
- Designate the station as "...DP slave"
- Add your modules according to the real hardware assembly.
- Open the properties dialog of the DP interface of the CPU by means of a double-click at DP.
- Set *Interface type* to "PROFIBUS"
- Connect to PROFIBUS and preset an address (preferably 3) and confirm with [OK].
- Switch at *Operating mode* to "DP slave"
- Via *Configuration* you define the in-/output address area of the slave CPU, which are to be assigned to the DP slave.
- Save, compile and transfer your project to your CPU.

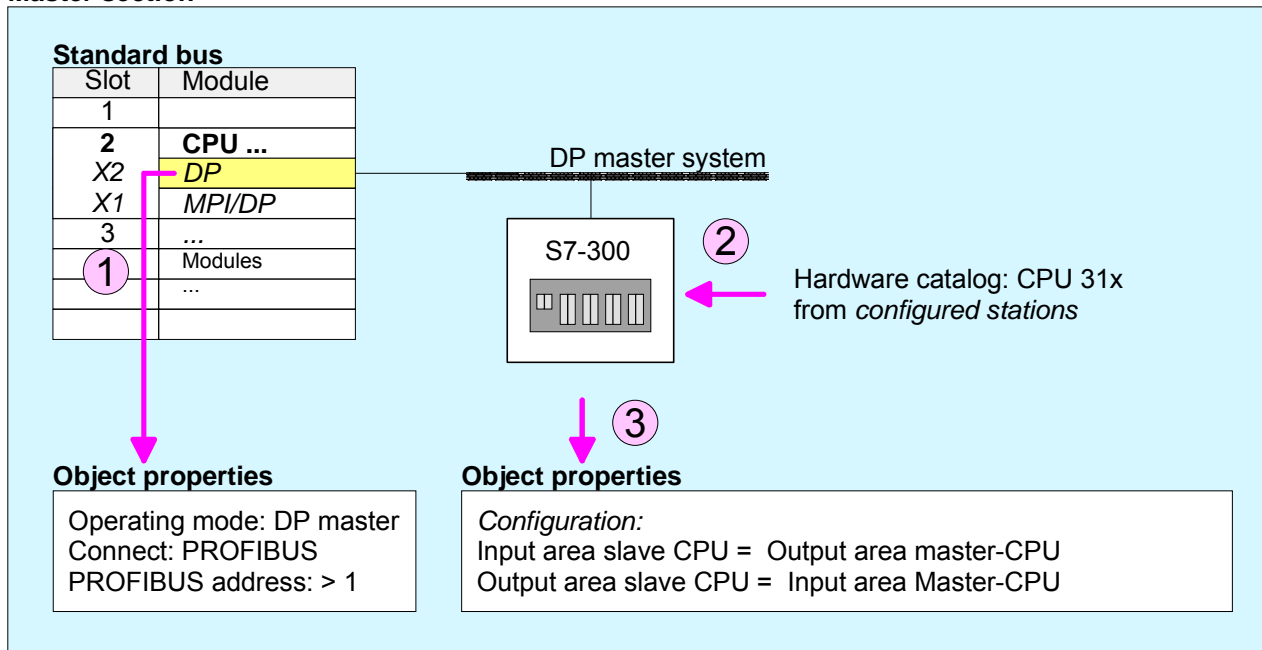
### Slave section



**Project engineering of the master section**

- Insert another station and configure a CPU.
- Designate the station as "...DP master".
- Add your modules according to the real hardware assembly.
- Open the properties dialog of the DP interface of the CPU by means of a double-click at DP.
- Set *Interface: type* to "PROFIBUS".
- Connect to PROFIBUS and preset an address (preferably 2) and confirm with [OK].
- Switch at *Operating mode* to "DP master" and confirm the dialog with [OK].
- Connect your slave system to this master system by dragging the "CPU 31x" from the hardware catalog at *Configured stations* onto the master system and select your slave system to be coupled.
- Open the *Configuration at Object properties* of your slave system.
- Via double click to the according configuration line you assign the according input address area on the master CPU to the slave output data and the output address area to the slave input data.
- Save, compile and transfer your project to your CPU.

**Master section**



## PROFIBUS installation guidelines

### PROFIBUS in general

- A PROFIBUS DP network may only be built up in linear structure.
- PROFIBUS DP consists of minimum one segment with at least one master and one slave.
- A master has always been deployed together with a CPU.
- PROFIBUS supports max. 126 participants.
- Per segment a max. of 32 participants is permitted.
- The max. segment length depends on the baud rate:

|                    |   |       |
|--------------------|---|-------|
| 9.6 ... 187.5kbaud | → | 1000m |
| 500kbaud           | → | 400m  |
| 1.5Mbaud           | → | 200m  |
| 3 ... 12Mbaud      | → | 100m  |
- Max. 10 segments may be built up. The segments are connected via repeaters. Every repeater counts for one participant.
- The bus respectively a segment is to be terminated at both ends.
- All participants are communicating with the same baud rate. The slaves adjust themselves automatically on the baud rate.

### Transfer medium

As transfer medium PROFIBUS uses an isolated twisted-pair cable based upon the RS485 interface.

The RS485 interface is working with voltage differences. Though it is less irritable from influences than a voltage or a current interface. You are able to configure the network as well linear as in a tree structure.

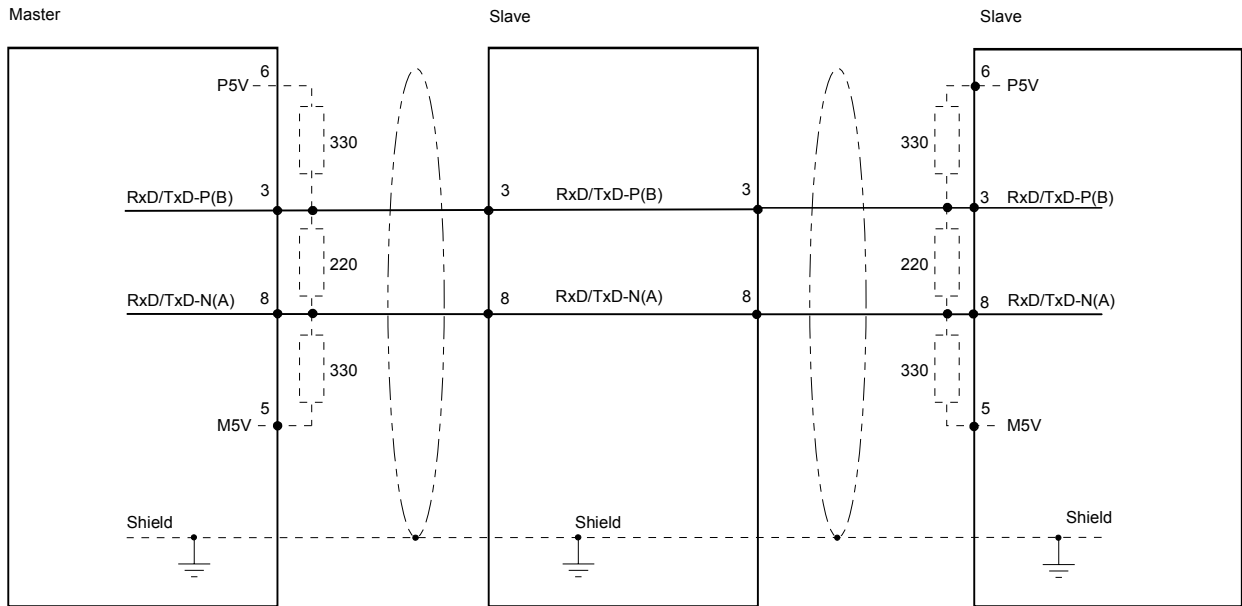
Max. 32 participants per segment are permitted. Within a segment the members are linear connected. The segments are connected via repeaters. The maximum segment length depends on the transfer rate.

PROFIBUS DP uses a transfer rate between 9.6kbaud and 12Mbaud, the slaves are following automatically. All participants are communicating with the same transfer rate.

The bus structure under RS485 allows an easy connection res. disconnection of stations as well as starting the system step by step. Later expansions don't have any influence on stations that are already integrated. The system realizes automatically if one partner had a fail down or is new in the network.

**Bus connection**

The following picture illustrates the terminating resistors of the respective start and end station.



**Note!**

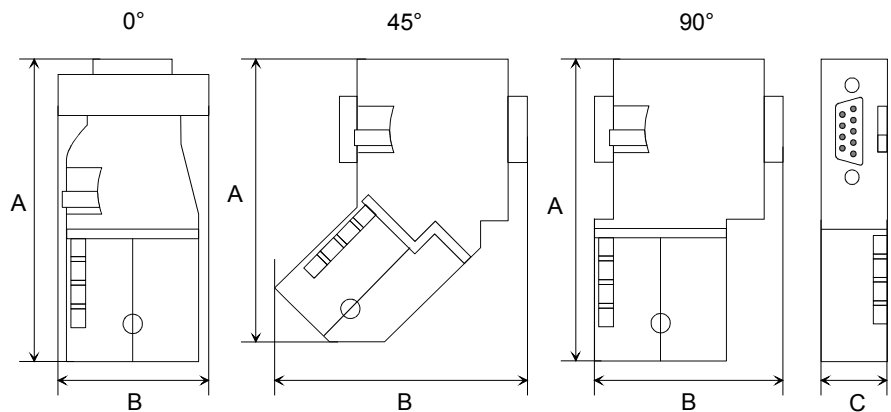
The PROFIBUS line has to be terminated with its ripple resistor. Please make sure to terminate the last participants on the bus at both ends by activating the terminating resistor.

**EasyConn bus connector**



In PROFIBUS all participants are wired parallel. For that purpose, the bus cable must be feed-through.

Via the order number VIPA 972-0DP10 you may order the bus connector "EasyConn". This is a bus connector with switchable terminating resistor and integrated bus diagnostic.



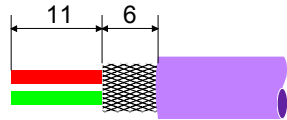
|   | 0°   | 45°  | 90°  |
|---|------|------|------|
| A | 64   | 61   | 66   |
| B | 34   | 53   | 40   |
| C | 15.8 | 15.8 | 15.8 |

all in mm

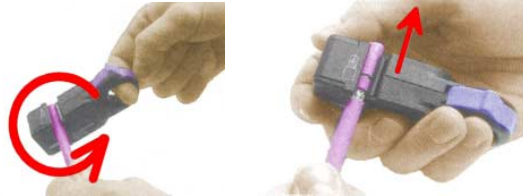


**Note!**

To connect this EasyConn plug, please use the standard PROFIBUS cable type A (EN50170). Starting with release 5 you also can use highly flexible bus cable: Lapp Kabel order no.: 2170222, 2170822, 2170322. With the order no. 905-6AA00 VIPA offers the "EasyStrip" de-isolating tool that makes the connection of the EasyConn much easier.



Dimensions in mm

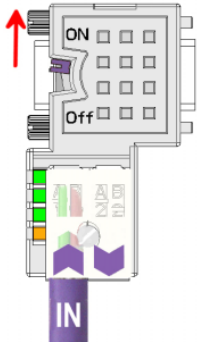


Termination with "EasyConn"

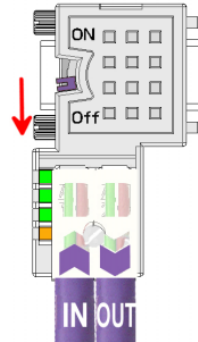
The "EasyConn" bus connector is provided with a switch that is used to activate a terminating resistor.

Wiring

1./last bus participant



further participants



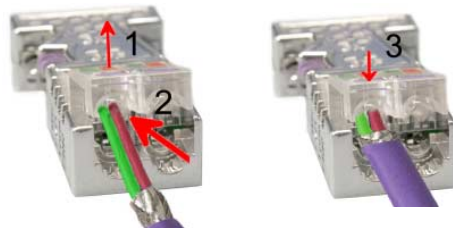
**Attention!**

The terminating resistor is only effective, if the connector is installed at a bus participant and the bus participant is connected to a power supply.

**Note!**

A complete description of installation and deployment of the terminating resistors is delivered with the connector.

Assembly



- Loosen the screw.
- Lift contact-cover.
- Insert both wires into the ducts provided (watch for the correct line color as below!)
- Please take care not to cause a short circuit between screen and data lines!
- Close the contact cover.
- Tighten screw (max. tightening torque 4Nm).

**Please note:**

The green line must be connected to A, the red line to B!



## Commissioning and Start-up behavior

|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Start-up on delivery</b>                            | In delivery the CPU is overall reset. The PROFIBUS part is deactivated and its LEDs are off after Power ON.                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Online with bus parameter without slave project</b> | The DP master can be served with bus parameters by means of a hardware configuration. As soon as these are transferred the DP master goes online with his bus parameter. This is shown by the RUN LED. Now the DP master can be contacted via PROFIBUS by means of his PROFIBUS address. In this state the CPU can be accessed via PROFIBUS to get configuration and DP slave project.                                                                                                    |
| <b>Slave configuration</b>                             | If the master has received valid configuration data, he switches to <i>Data Exchange</i> with the DP Slaves. This is indicated by the DE-LED.                                                                                                                                                                                                                                                                                                                                             |
| <b>CPU state controls DP master</b>                    | After PowerON respectively a receipt of a new hardware configuration the configuration data and bus parameter were transferred to the DP master. Dependent on the CPU state the following behavior is shown by the DP master:                                                                                                                                                                                                                                                             |
| Master behavior at CPU STOP                            | <ul style="list-style-type: none"><li>• The global control command "Clear" is sent to the slaves by the master. Here the DE-LED is blinking.</li><li>• DP slaves with <i>fail safe mode</i> were provided with output telegram length "0".</li><li>• DP slaves without <i>fail safe mode</i> were provided with the whole output telegram but with output data = 0.</li><li>• The input data of the DP slaves were further cyclically transferred to the input area of the CPU.</li></ul> |
| Master behavior at CPU RUN                             | <ul style="list-style-type: none"><li>• The global control command "Operate" is sent to the slaves by the master. Here the DE-LED is on.</li><li>• Every connected DP slave is cyclically attended with an output telegram containing recent output data.</li><li>• The input data of the DP slaves were cyclically transferred to the input area of the CPU.</li></ul>                                                                                                                   |

### LEDs PROFIBUS/PtP interface X3

Dependent on the mode of operation the LEDs show information about the state of operation of the PROFIBUS part according to the following pattern:

#### Master operation

| RUN<br>green | ERR<br>red | DE<br>green | IF<br>red | Meaning                                                                                                        |
|--------------|------------|-------------|-----------|----------------------------------------------------------------------------------------------------------------|
| ○            | ○          | ○           | ○         | Master has no project, this means the interface is deactivated respectively PtP is active.                     |
| ●            | ○          | ○           | ○         | Master has bus parameters and is in RUN without slaves.                                                        |
| ●            | ○          | ☀           | ○         | Master is in "clear" state (safety state). The inputs of the slaves may be read. The outputs are disabled.     |
| ●            | ○          | ●           | ○         | Master is in "operate" state, this means data exchange between master and slaves. The outputs may be accessed. |
| ●            | ●          | ●           | ○         | CPU is in RUN, at least 1 slave is missing.                                                                    |
| ●            | ●          | ☀           | ○         | CPU is in STOP, at least 1 slave is missing.                                                                   |
| ○            | ○          | ○           | ●         | Initialization error at faulty parameterization.                                                               |
| ○            | ●          | ○           | ●         | Waiting state for start command from CPU.                                                                      |

#### Slave operation

| RUN<br>green | ERR<br>red | DE<br>green | IF<br>red | Meaning                                          |
|--------------|------------|-------------|-----------|--------------------------------------------------|
| ○            | ○          | ○           | ○         | Slave has no project respectively PtP is active. |
| ☀            | ○          | ○           | ○         | Slave is without master.                         |
| ☀*           | ○          | ☀*          | ○         | * Alternate flashing at configuration faults.    |
| ●            | ○          | ●           | ○         | Slave exchanges data between master.             |

on: ●      off: ○      blinking (2Hz): ☀      not relevant: X

## Chapter 7 WinPLC7

### Overview

In this chapter the programming and simulation software WinPLC7 from VIPA is presented. WinPLC7 is suited for every with Siemens STEP<sup>®</sup>7 programmable PLC.

Besides the system presentation and installation here the basics for using the software is explained with a sample project.

More information concerning the usage of WinPLC7 may be found in the online help respectively in the online documentation of WinPLC7.

### Content

| Topic                            | Page       |
|----------------------------------|------------|
| <b>Chapter 7 WinPLC7</b> .....   | <b>7-1</b> |
| System presentation.....         | 7-2        |
| Installation .....               | 7-3        |
| Example project engineering..... | 7-4        |

## System presentation

### General

WinPLC7 is a programming and simulation software from VIPA for every PLC programmable with Siemens STEP®7.

This tool allows you to create user applications in FBD, LAD and STL.

Besides of a comfortable programming environment, WinPLC7 has an integrated simulator that enables the simulation of your user application at the PC without additional hardware.

This "Soft-PLC" is handled like a real PLC and offers the same error behavior and diagnosis options via diagnosis buffer, USTACK and BSTACK.



### Note!

Detailed information and programming samples may be found at the online help respectively in the online documentation of WinPLC7.

### Alternatives

There is also the possibility to use the Siemens SIMATIC manager instead of WinPLC7 from VIPA. Here the proceeding is part of this manual.

### System requirements

- Pentium with 233MHz and 64Mbyte work space
- Graphics card with at least 16bit color - we recommend a screen resolution of at least 1024x768 pixel.
- Windows 98SE/ME, Windows 2000, Windows XP (Home and Professional), Windows Vista

### Source

You may receive a *demo version* from VIPA. Without any activation with the *demo version* the CPUs 11x of the System 100V from VIPA may be configured.

To configure the SPEED7 CPUs a license for the "profi" version is necessary. This may be online received and activated.

There are the following sources to get WinPLC7:

### Online

At [www.vipa.de](http://www.vipa.de) in the service area at *Downloads* a link to the current demo version and the updates of WinPLC7 may be found.

### CD

| Order no. | Description                                                                                         |
|-----------|-----------------------------------------------------------------------------------------------------|
| SW211C1DD | WinPLC7 Single license, CD, with documentation in german                                            |
| SW211C1ED | WinPLC7 Single license, CD, with documentation in english                                           |
| SW900T0LA | ToolDemo<br>VIPA software library free of charge respectively demo versions, which may be activated |

## Installation

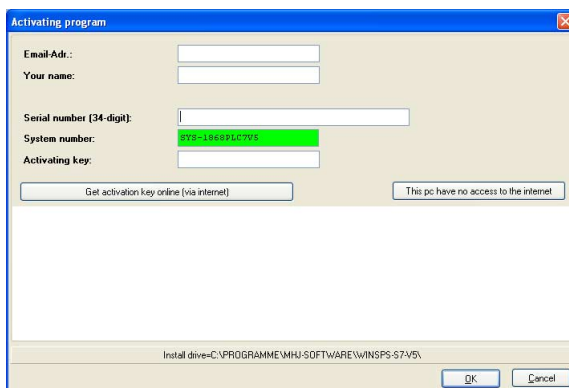
**Preconditions** The project engineering of a SPEED7 CPU from VIPA with WinPLC7 is only possible using an activated "Profi" version of WinPLC7.

**Installation WinPLC7 Demo** The installation and the registration of WinPLC7 has the following approach:

- For installation of WinPLC7 start the setup program of the corresponding CD respectively execute the online received exe file.
- Choose the according language.
- Agree to the software license contract.
- Set an installation directory and a group assignment and start the installation.

Activation of the "Profi" version

- Start WinPLC7. A "Demo" dialog is shown.
- Click at [Activate Software]. The following dialog for activation is shown:



- Fill in the following fields: *Email-Addr.*, *Your Name* und *Serial number*. The serial number may be found on a label at the CD case.
- If your computer is connected to Internet you may online request the *Activation Key* by [Get activation key via Internet]. Otherwise click at [This PC has no access to the internet] and follow the instructions.
- With successful registration the activation key is listed in the dialog window respectively is sent by email.
- Enter the activation key and click to [OK]. Now, WinPLC7 is activated as "Profi" version.

**Installation of WinPCAP for station search via Ethernet** To find a station via Ethernet (accessible nodes) you have to install the WinPCAP driver. This driver may be found on your PC in the installation directory at WinSPS-S7-V5/WinPcap\_... .exe. Execute this file and follow the instructions.

## Example project engineering

### Job definition

In the example a FC 1 is programmed, which is cyclically called by the OB 1. By setting of 2 comparison values (*value1* and *value2*) during the FC call, an output of the PLC-System should be activated depending on the comparison result.

Here it should apply:

if *value1* = *value2* activate output Q 124.0

if *value1* > *value2* activate output Q 124.1

if *value1* < *value2* activate output Q 124.2

### Precondition

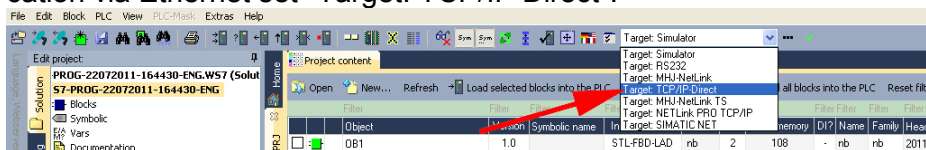
- You have administrator rights for your PC.
- WinPLC7 is installed and activated as "Profi" version.
- One CPU and one digital output module are installed and cabled.
- The Ethernet PG/OP channel of the CPU is connected to your Ethernet network. Your CPU may be connected to your PC with an Ethernet cable either directly or via hub/switch.
- WinPCap for station search via Ethernet is installed.
- The power supply of the CPU and the I/O periphery are activated and the CPU is in STOP state.

### Project engineering

- Start WinPLC7 ("Profi" version)
- Create and open a new project with [Create a new solution].

### Hardware configuration

- For the call of the hardware configurator it is necessary to set WinPLC7 from the *Simulator-Mode* to the *Offline-Mode*. For this and the communication via Ethernet set "Target: TCP/IP Direct".



- Double click to "Hardware stations" and here at "Create new".



- Enter a station name. Please consider that the name does not contain any spaces.
- After the load animation choose in the register *Select PLC-System* the system "VIPA SPEED7" and click to [Create]. A new station is created.
- Save the empty station.
- By double click or drag&drop the according VIPA CPU in the hardware catalog at CPU SPEED7 the CPU is inserted to your configuration.
- For output place a digital output module and assign the start address 124.
- Save the hardware configuration.

Online access via Ethernet PG/OP channel

- Open the *CPU-Properties*, by double clicking to the CPU at slot 2 in the hardware configurator.
- Click to the button [Ethernet CP-Properties (PG/OP-channel)]. The *Properties CP343* is opened.
- Choose the register *Common Options*.
- Click to [Properties Ethernet].
- Choose the subnet "PG\_OP\_Ethernet".
- Enter a valid IP address-and a subnet mask. You may get this from your system administrator.
- Close every dialog window with [OK].
- Select, if not already done, "Target: External TCP/IP direct".
- Open with **Online** > *Send configuration to the CPU* a dialog with the same name.
- Click to [Accessible nodes]. Please regard to use this function it is necessary to install WinPCap before!
- Choose your network card and click to [Determining accessible nodes]. After a waiting time every accessible station is listed. Here your CPU with IP 0.0.0.0 is listed, too. To check this the according MAC address is also listed. This MAC address may be found at a label beneath the front flap of the CPU.
- For the temporary setting of an IP address select you CPU and click to [Temporary setting of the IP parameters]. Please enter the same IP parameters, you configured in the CPU properties and click to [Write Parameters].
- Confirm the message concerning the overall reset of the CPU. The IP parameters are transferred to the CPU and the list of accessible stations is refreshed.
- Select you CPU and click to [Confirm]. Now you are back in the dialog "Send configuration".

Transfer hardware configuration

- Choose your network card and click to [Send configuration]. After a short time a message is displayed concerning the transfer of the configuration is finished.



#### Note!

Usually the online transfer of the hardware configuration happens within the hardware configurator.

With **File** > *Save active station in the WinPL7 sub project* there is also the possibility to store the hardware configuration as a system file in WinPLC7 to transfer it from WinPLC7 to the CPU.

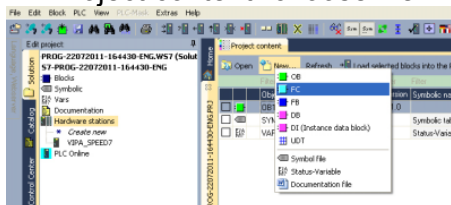
The hardware configuration is finished, now and the CPU may always be accessed by the IP parameters as well by means of WinPLC7.

**Programming of the FC 1**

The PLC programming happens by WinPLC7. Close the hardware configurator and return to your project in WinPLC7. The PLC program is to be created in the FC 1.

Creating block FC 1

- In "Project content" choose New > FC.



- Enter "FC1" as block and confirm with [OK]. The editor for FC 1 is called.

Creating parameters

In the upper part of the editor there is the *parameter table*. In this example the 2 integer values *value1* und *value2* are to be compared together. Since both values are read only by the function, these are to be defined as "in".

- Select the "in -->" row at the *parameter table* and enter at the field *Name* "value1". Press the [Return] key. The cursor jumps to the column with the data type.
- The data type may either directly be entered or be selected from a list of available data types by pressing the [Return] key. Set the data type to INT and press the [Return] key. Now the cursor jumps to the *Comment* column.
- Here enter "1. compare value" and press the [Return] key. A new "in -->" row is created and the cursor jumps to *Name*.
- Proceed for *value2* in the same way as described for *value1*.
- Save the block. A note that the interface of the block was changed may be acknowledged with [Yes].

The parameter table shows the following entries, now:

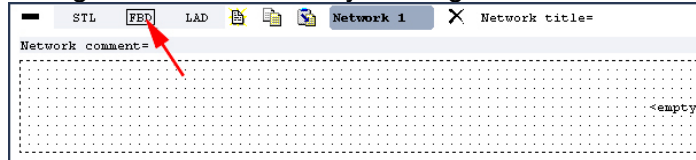
| Address | Declaration | Name   | Type | Initial value | Comment          |
|---------|-------------|--------|------|---------------|------------------|
| 0.0     | in -->      | value1 | INT  |               | 1. compare value |
| 2.0     | in -->      | value2 | INT  |               | 2. compare value |
|         | out <--     |        |      |               |                  |
|         | in_out <->  |        |      |               |                  |



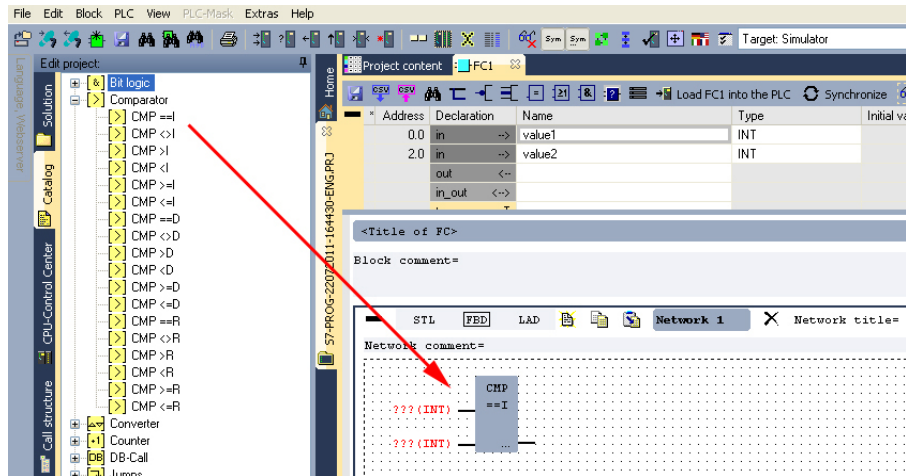
Enter the program

As requested in the job definition, the corresponding output is activated depending on the comparison of *value1* and *value2*. For each comparison operation a separate network is to be created.

- The program is to be created as FBD (function block diagram). Here change to the FBD view by clicking at FBD.



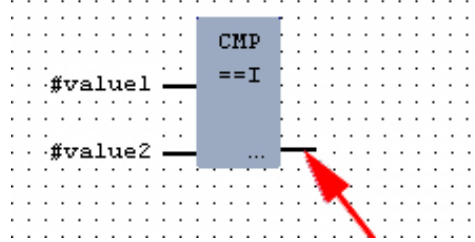
- Click to the input field designated as "<empty>". The available operations may be added to your project by drag&drop from the hardware catalog or by double click at them in the hardware catalog.
- Open in the catalog the category "Comparator" and add the operation "CMP==I" to your network.



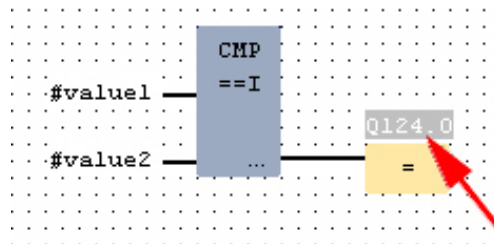
- Click to the input left above and insert *value1*. Since these are block parameters a selection list of block parameters may be viewed by entering "#".
- Type in "#" and press the [Return] key.
- Choose the corresponding parameter and confirm it with the [Return] key.
- Proceed in the same way with the parameter *value2*.

The allocation to the corresponding output, here Q 124.0, takes place with the following proceeding:

- Click to the output at the right side of the operator.



- Open in the catalog the category "Bit logic" and select the function "--[=]". The inserting of "--=" corresponds to the WinPLC7 shortcut [F7].
- Insert the output Q 124.0 by clicking to the operand.



Network1 is finished, now.

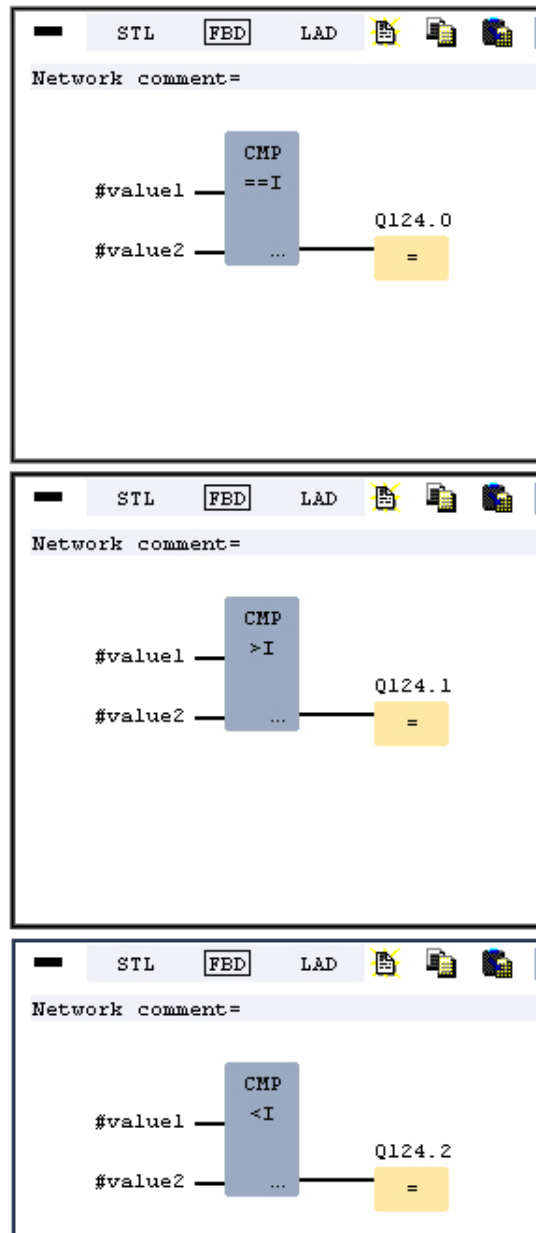
Adding a new network

For further comparisons the operations "CMP>I" at Q 124.1 and "CMP<I" at Q 124.2 are necessary. Create a network for both operations with the following proceeding:

- Move your mouse at an arbitrary position on the editor window and press the right mouse key.
- Select at the context menu "Insert new network". A dialog field is opened to enter the position and number of the networks. Or click at [Add a network at the end of the block].
- Proceed as described for "Network 1".
- Save the FC 1 with **File** > *Save content of focused window* respectively press [Strg]+[S].

FC1

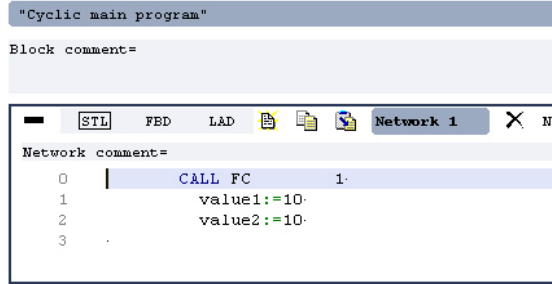
After you have programmed the still missing networks, the FC 1 has the following structure:



**Creating the block OB 1**

The FC 1 is to be called from the cycle OB 1.

- Go to OB 1, which was automatically created with starting the project.
- Go to "Project content" or to "Solution" and open the OB 1 by a double click.
- Change to the STL view.
- Type in "Call FC 1" and press the [Return] key. The FC parameters are automatically displayed and the following parameters are assigned:

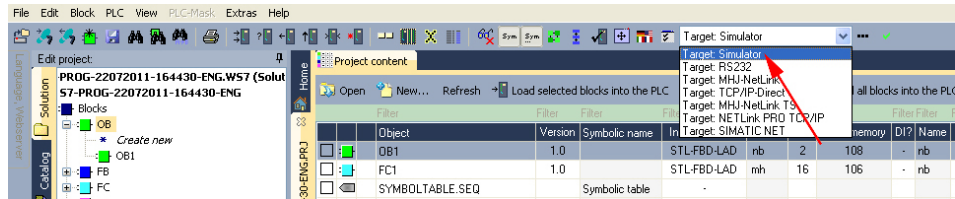


- Save the OB 1 with or [Strg]+[S].

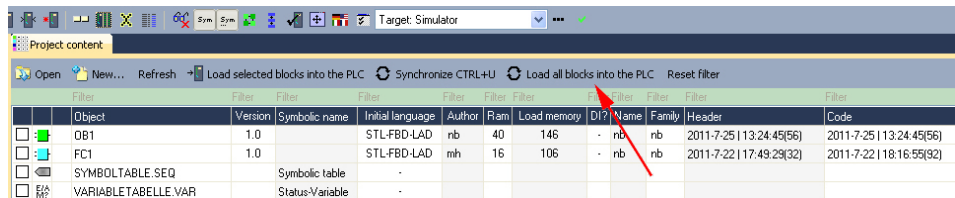
**Test the PLC program in the Simulator**

With WinPLC7 there is the possibility to test your project in a *simulator*.

- Here select "Target: Simulator".



- Transfer the blocks to the simulator with [Load all blocks into the PLC].



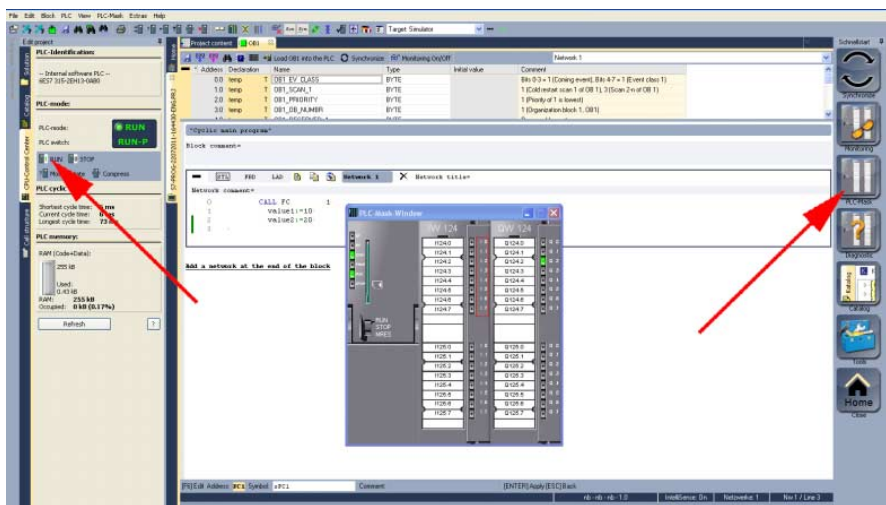
- Switch the CPU to RUN, by clicking at RUN in the "CPU Control Center" of "Edit project". The displayed state changes from STOP to RUN.
- To view the process image select **View > Display process image window** or click at . The various areas are displayed.
- Double click to the process image and enter at "Line 2" the address PQB 124. Confirm with [OK]. A value marked by red color corresponds to a logical "1".
- Open the OB 1.
- Change the value of one variable, save the OB 1 and transfer it to the simulator. According to your settings the process image changes immediately. The status of your blocks may be displayed with **Block > Monitoring On/Off**.

Visualization via PLC mask

A further component of the simulator is the *PLC mask*. Here a CPU is graphically displayed, which may be expanded by digital and analog peripheral modules.

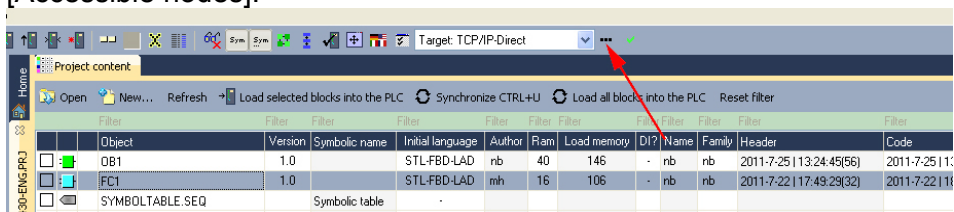
As soon as the CPU of the simulator is switched to RUN state, inputs may be activated by mouse and outputs may be displayed.

- Open the PLC mask with **view > PLC mask**. A CPU is graphically displayed.
- Double-click to the output module, open its properties dialog and enter the *Module address* 124.
- Switch the operating mode switch to RUN by means of the mouse. Your program is executed and displayed in the simulator, now.



Transfer PLC program to CPU and its execution

- For transfer to the CPU set the transfer mode to "Target: TCP/IP-Direct".
- If there are more network adapters in your PC, the network adapter may be selected via **Extras > Select network adapter**.
- For presetting the Ethernet data click to [...] and click to [Accessible nodes].



- Click at [Determining accessible nodes]. After a waiting time every accessible station is listed.
- Choose your CPU, which was provided with TCP/IP address parameters during the hardware configuration and click to [Confirm].
- Close the "Ethernet properties" dialog with [OK].
- Transfer your project to your CPU with **PLC > Send all blocks**.
- Switch your CPU to RUN state.
- Open the OB 1 by double click.
- Change the value of one variable, save the OB 1 and transfer it to the CPU. According to your settings the process image changes immediately. The status of your blocks may be displayed with **Block > Monitoring On/Off**.

