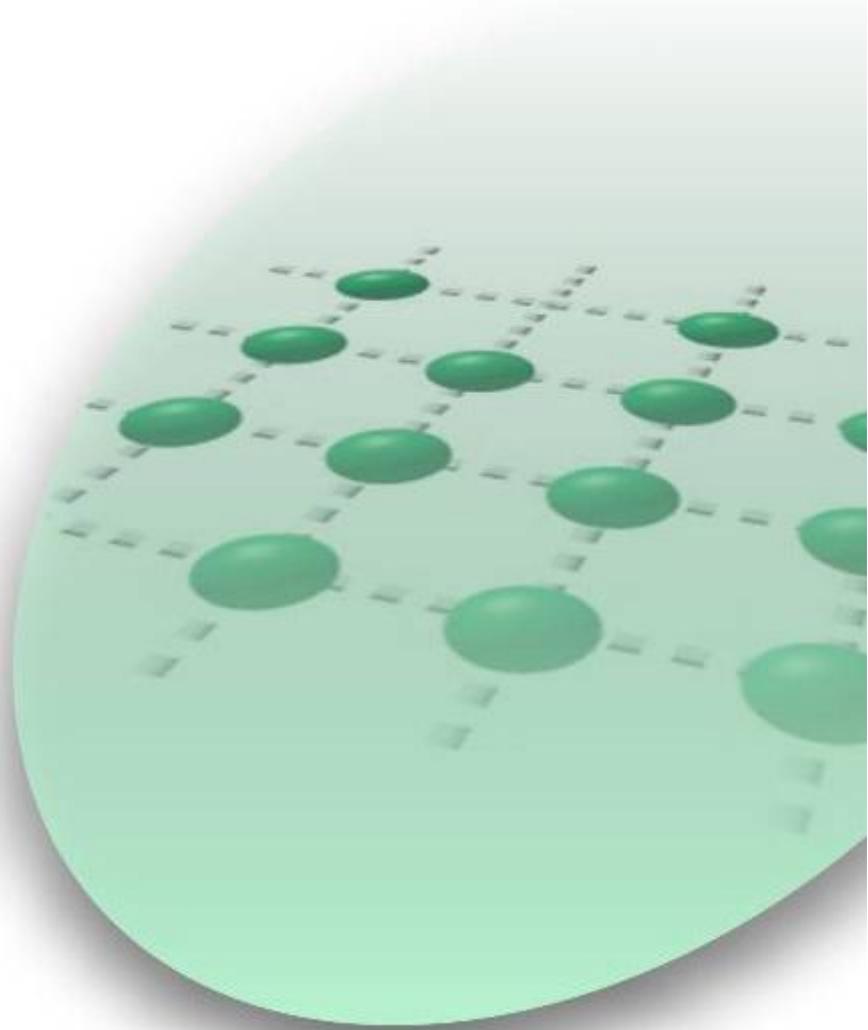
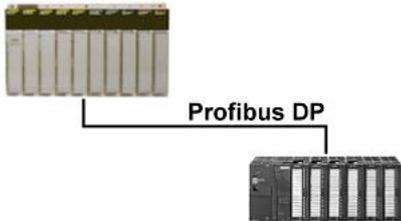


# Modicon Quantum and Siemens S7-300 PLC as DP slave

## *System User Guide*

[source code]



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## Introduction

This document is intended to provide a quick introduction to the described System. It is **not** intended to replace any specific product documentation. On the contrary, it offers additional information to the product documentation, for installing, configuring and starting up the system.

A detailed functional description or the specification for a specific user application is **not** part of this document. Nevertheless, the document outlines some typical applications where the system might be implemented.

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## Application Source Code

### Introduction

Examples of the source code and wiring diagrams used to attain the system function as described in this document can be downloaded from our „Village“ website under [this](#) link.

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# System

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## Introduction

The system chapter describes the architecture, the components, the dimensions and the number of components used within this system.

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## Architecture

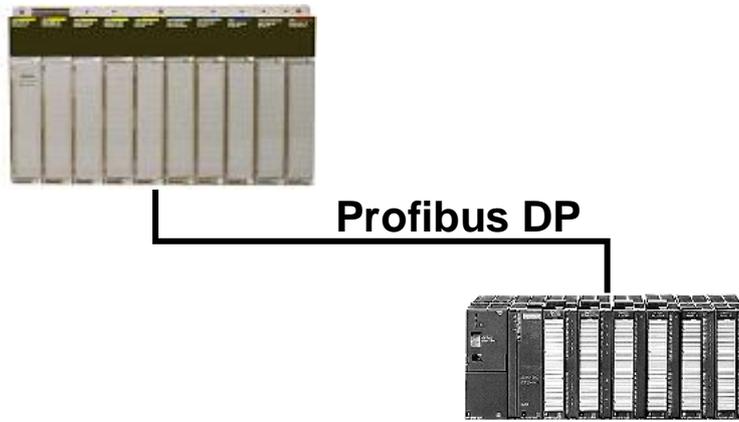
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## Overview

The system consists of a Profibus DP network controlled by a Quantum PLC. A Siemens S7-300 PLC is configured as a Profibus slave.

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## Layout



## Components

### Hardware:

- S7-300 PLC with CPU 315-2DP
- Quantum PLC with Profibus master module 140 CRP 811 00

### Software:

- Concept V2.x
  - Sycon V2.8
  - Step 7 V5.x
-

# Application

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## General Description

A TSX Quantum PLC exchanges data with a Siemens S7-300 PLC via Profibus DP. In this application, the Quantum acts as a Profibus DP master, the S7-300 as a DP slave.

The Quantum Profibus master module is the 140CRP81100, the Siemens Profibus slave module is the CPU 315-2DP (integrated Profibus interface on the CPU). The CPU315-2DP is a CPU with an integrated DP interface. This interface can act as DP master or DP slave. The default setting is DP master.

The S7-300 runs a simple application. It receives data from the Quantum, adjusts it and returns it to the Quantum.

The Quantum sends

- A two-byte block, no consistency

The Siemens PLC sends

- A 16 byte block, with consistency
- A 8 byte block, with consistency

## Schematic overview of the Siemens application

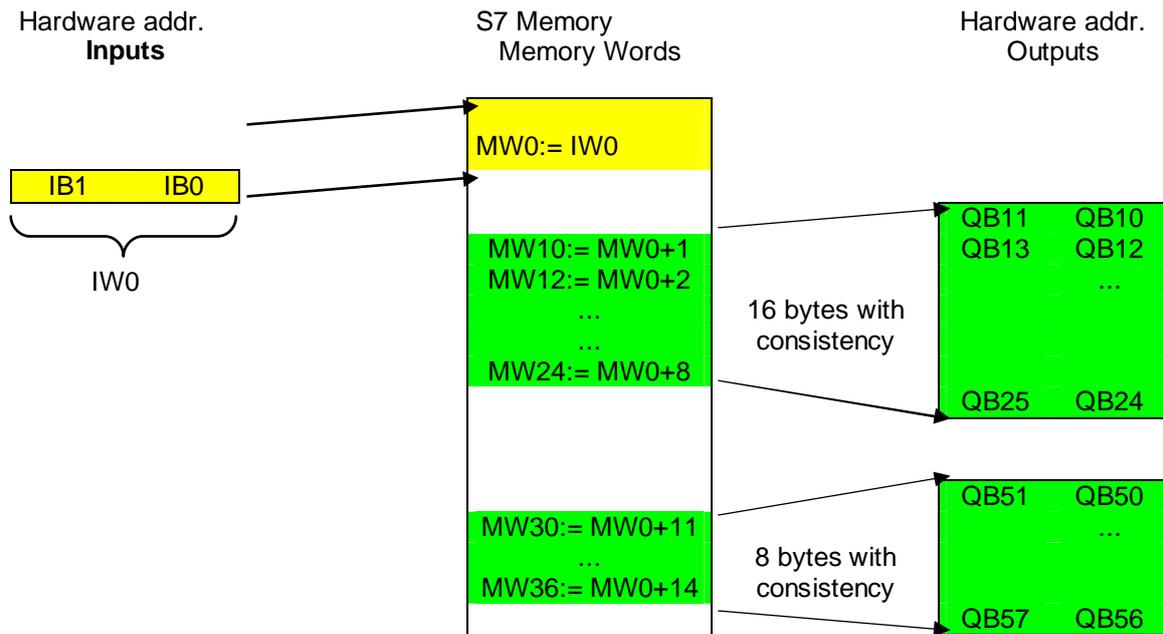
Siemens S7 PLCs are byte orientated machines. In the programming language Step7, input bytes can be addressed as IB0, IB1, ... , output bytes as QB0, QB1, ... , and Memory Bytes as MB0, MB1, ... However, the Siemens PLCs also recognises words, double words: they correspond as follows:

- MW0 (Memory Word 0) consists of MB0 (Memory Byte 0) and MB1, MB0 being the low byte of MW0
- MW2 consists of MB2 and MB3
- MW1 consists of MB1 and MB2

Generally: MWn consists of MBn and MB(n+1) with MBn being the low byte of MWn.

In this simple application, the Siemens PLC receives the data on input bytes IB0 and IB1 and maps them to Memory Word M0. Next, MW10, MW12, ... are derived as MW0 plus offset. In the end, these Memory Words are copied to the output bytes according to the following schematic:

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Assume the Quantum sends the value 0xAA00, the S7-300 sends back:

- 0xAA01, 0xAA02, 0xAA03, 0xAA04, 0xAA05, 0xAA06, 0xAA07, 0xAA08 in the first input block
- 0xAA0B, 0xAA0C, 0xAA0D, 0xAA0E in the second input block.

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**Consistency:  
Some basics**

During transmission Profibus DP differentiates between:

- Unit Consistency (Word or Byte)
- Length Consistency (Telegram length)

The PLC takes the initiative when swapping Profibus data. As the PLC and Profibus cycles are asynchronous, the interrupt triggering this event arrives during the transmission of a Profibus telegram. To check the length consistency, the PLC must wait for the transmission of the Profibus telegram to be completed. Unit consistency is checked as soon as the particular unit (byte or word) is transmitted

It is advisable to use Unit Consistency when transferring binary data. If however you are transferring double words or a data block, you should use a length consistency check.

The consistency check is required to ensure that the PLC data is the same as the Profibus data. The data transfer on the bus itself is always consistent.

I/O data from DP-Nodes is sent to the S7-300 with the default Unit Consistency (except when they are 2 or 4 bytes long). If length consistency is required then you must use SFC14 for the inputs and SFC15 for the outputs in STEP 7

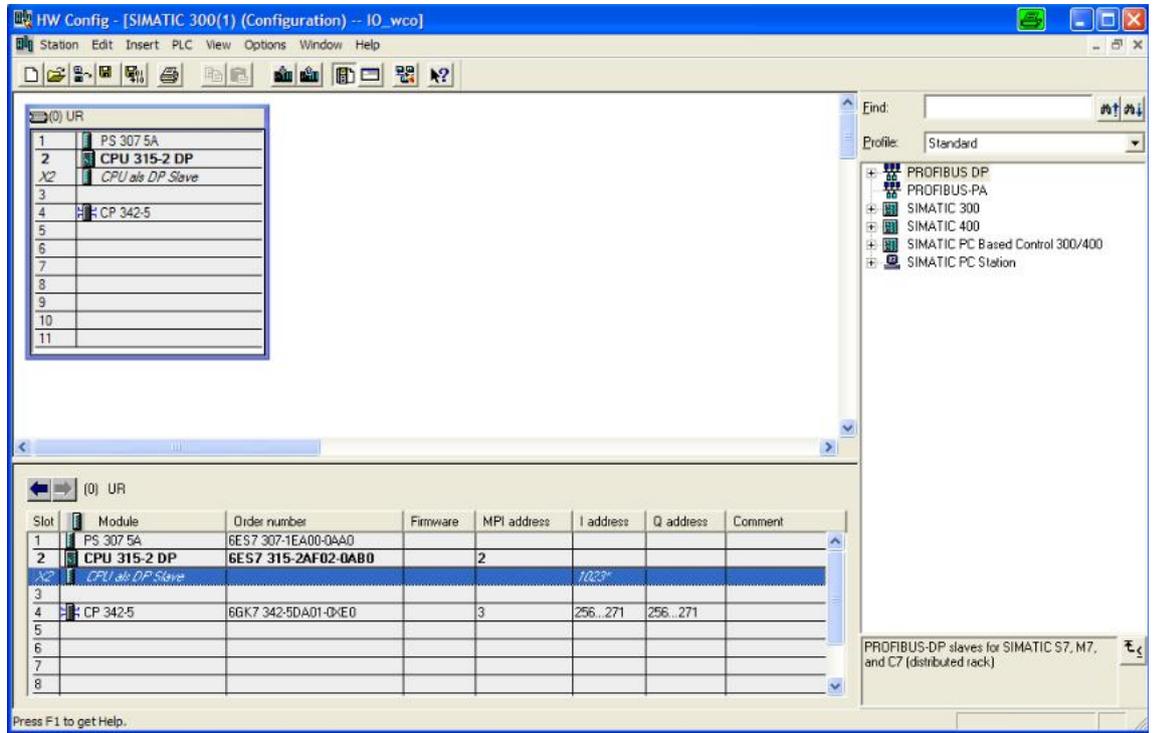
The Quantum always transfers data using length consistency.

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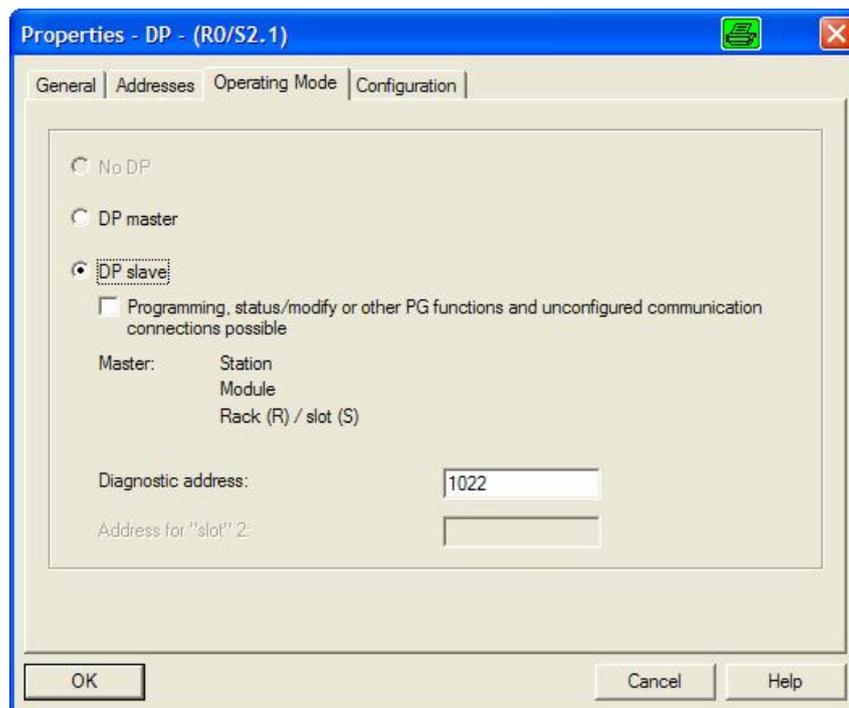
# Hardware Configuration of the S7-300 PLC

## Hardware

Create a Step7 project and configure the hardware (see the hardware configuration screen below).



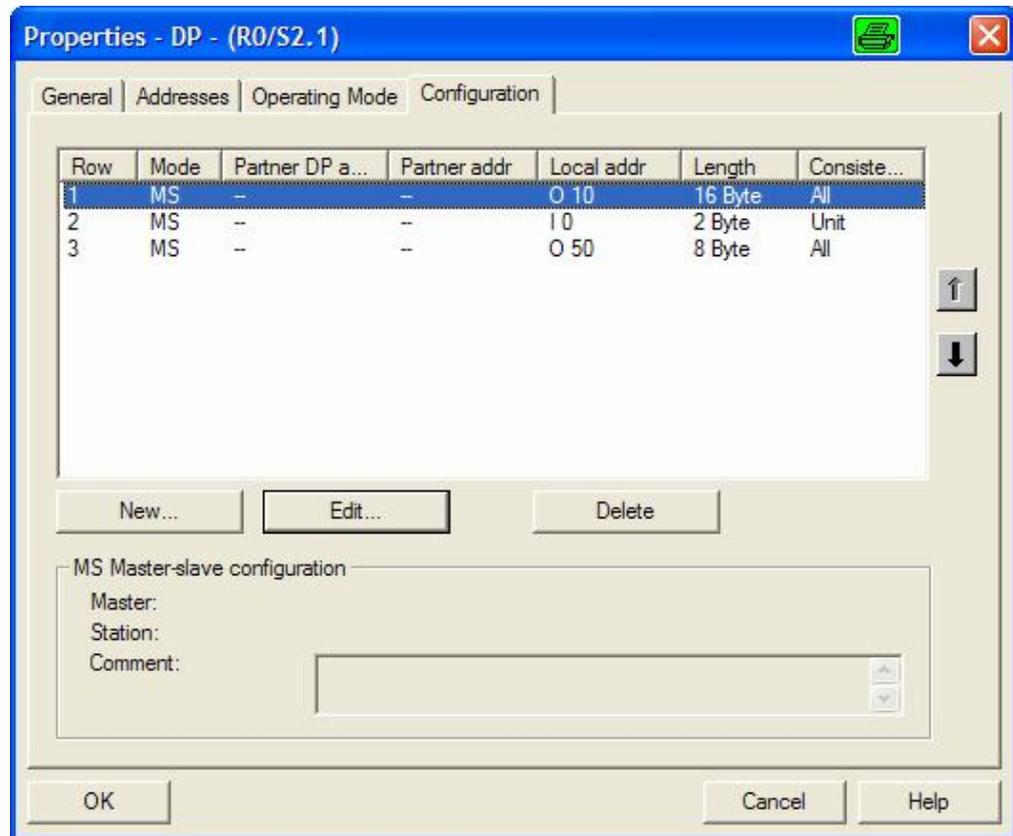
Select the CPU (i.e. CPU315-2DP) and double-click on the Profibus interface to open the “DP properties” window. In the dialog, you will find the tabs “General”, “addresses”, “operating mode”, and “configuration”.



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Make the following settings:

- **General** tab: set the Profibus address and assign the CPU to a Profibus network by using the “property” button in the middle of the screen. You also have access to the Profibus parameters, but you can use the default values.
- **Operating mode** tab: select “DP slave” to configure the CPU as DP slave
- **Configuration** tab: configure the I/O blocks the S7-300 will read and write to.



For our application, we need to configure 3 blocks:

- 16 output bytes, length consistency.
  - 2 input bytes, unit consistency .
  - 8 output bytes, length consistency.
-

---

The configuration for the first output block is as follows:

Properties - DP - (R0/S2.1) - Configuration - Row 1

Mode: MS (Master-slave configuration)

DP Partner: Master	Local: Slave
DP address:	12
Name:	CPU als DP S
Address type:	Output
Address:	10
"Slot":	4
Process image:	---
Interrupt OB:	
Diagnostic address:	

Length: 16      Comment:

Unit: Byte

Consistency: All

OK    Apply    Cancel    Help

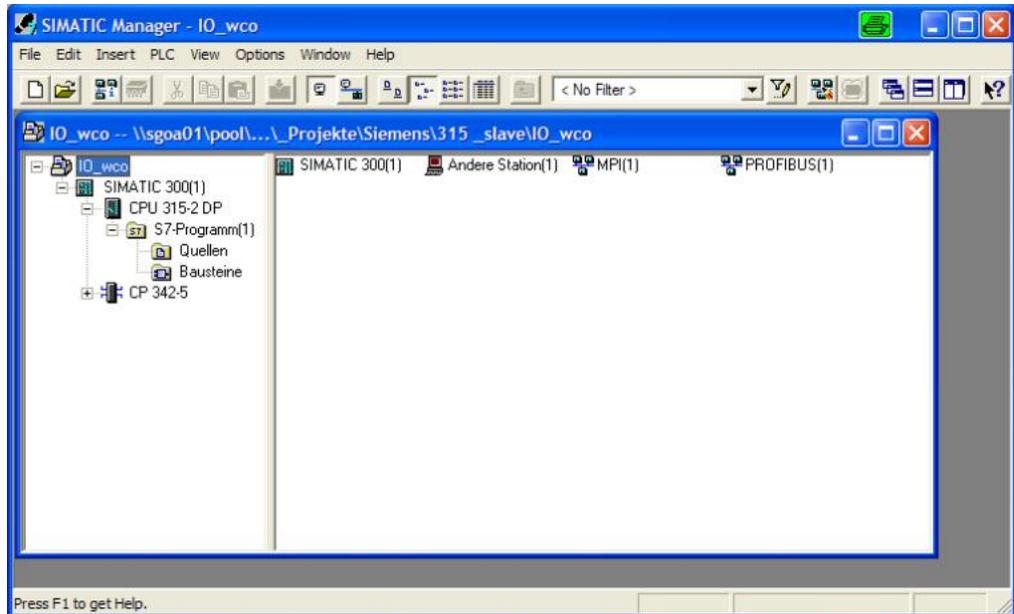
In this dialog, you can configure data length, unit (byte or word), consistency (unit or length), and start address in the PLC memory (memory word 10 in this example).

All other settings are left at their default values.

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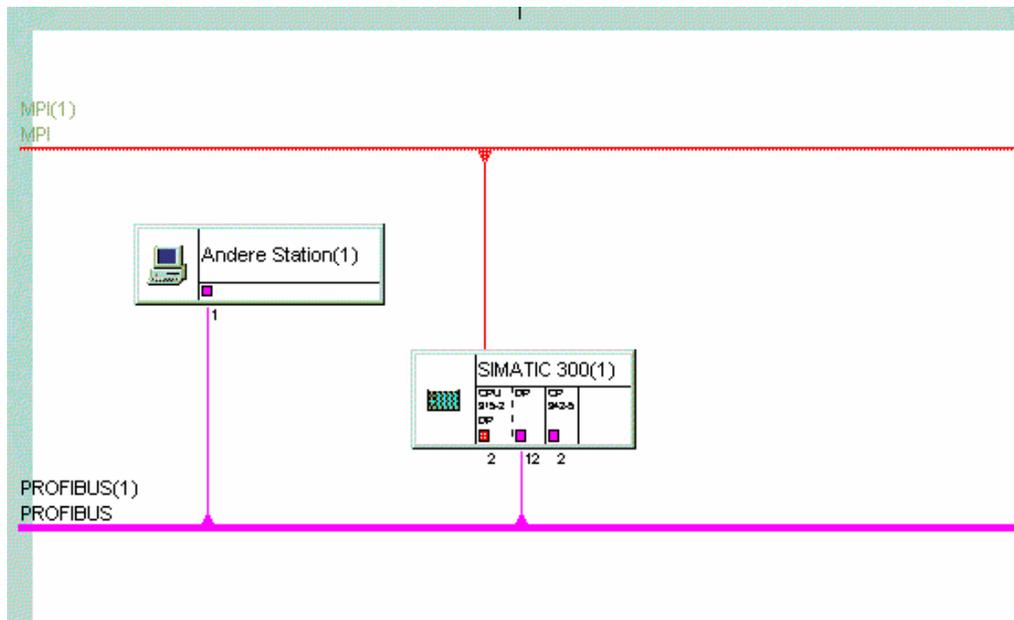
## Result

The following screen shows the Step7 project in the Simatic manager. We have the S7300 PLC, one foreign station (“Andere Station”), one MPI network, and one Profibus network.



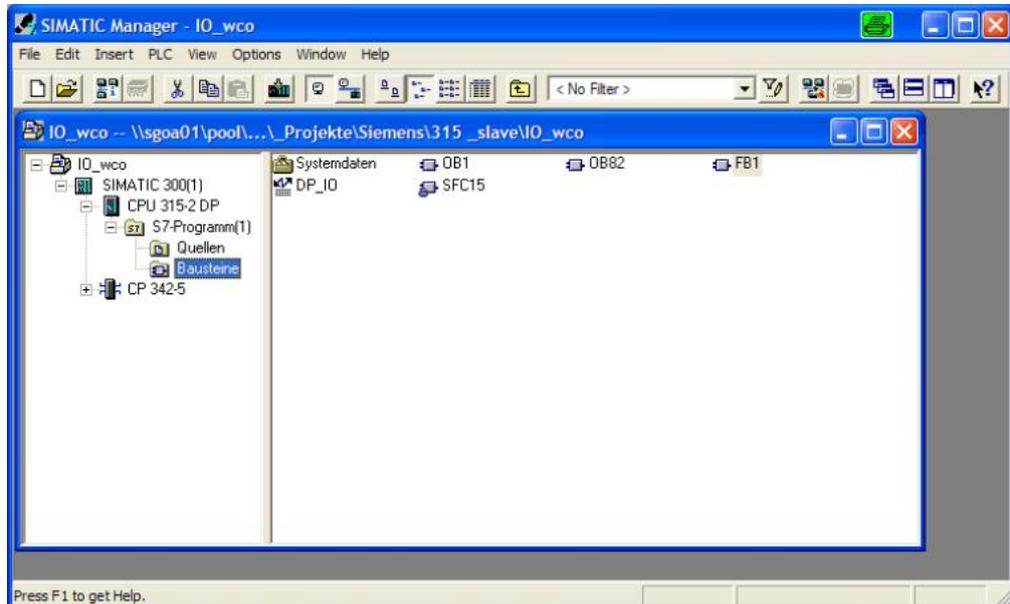
The foreign station is not mandatory but is recommended to symbolize the Quantum master PLC.

The following screen shows the network view. Here you can see the communication relationship between the objects listed in the screen above. You can access this display by double clicking on the “Profibus” icon in the screen above:



# Programming the Siemens PLC

In the Simatic manager, you see the required components of the Step7 program



The logic described in chapter 1 is programmed in function block 1 (FB1). The consistent transfer of the output data requires SFC15, a system function, being called up in FB1. OB1 is the main organization block which is processed cyclically and must be present, once, in each Step7 program. OB1 invokes FB1.

FB1 is divided into 3 networks. The networks are programmed in instruction list (IL) :

- Network 1 copies the input bytes to memory word 0 and writes values to the memory words used for the output values.
- Network 2 copies 16 memory bytes to the first output block, using SFC15
- Network 3 copies 8 memory bytes to the second output, again, using SFC15

The input bytes are copied to memory words using simple load and transfer commands as they are exchanged with "unit consistency". The following list shows the first part of network 1:

```
L      IW  0
T      MW  0

L      MW  0
+      1
T      MW 10

L      MW  0
+      2
T      MW 12

.....
```

SFC15 is used to copy memory bytes to the output bytes as “ length consistency” is required. Proceed as follows:

- Copy SFC15 into networks 2 and 3: Select SFC15 from the path shown on the left side of the screen (SFC comes after SFB), then place it into the network using “drag and drop”.
- Configure SFC15. You must assign values to the parameters “LADDR”, “RECORD”, and “RET\_VAL”. “LADDR” determines the start address of the memory bytes you want to copy to the outputs, the string for “RECORD” contains the start address of the output addresses and length of data to be copied. “RET\_VALUE” is a memory word where the function returns any error codes.

The syntax in Step7 is:

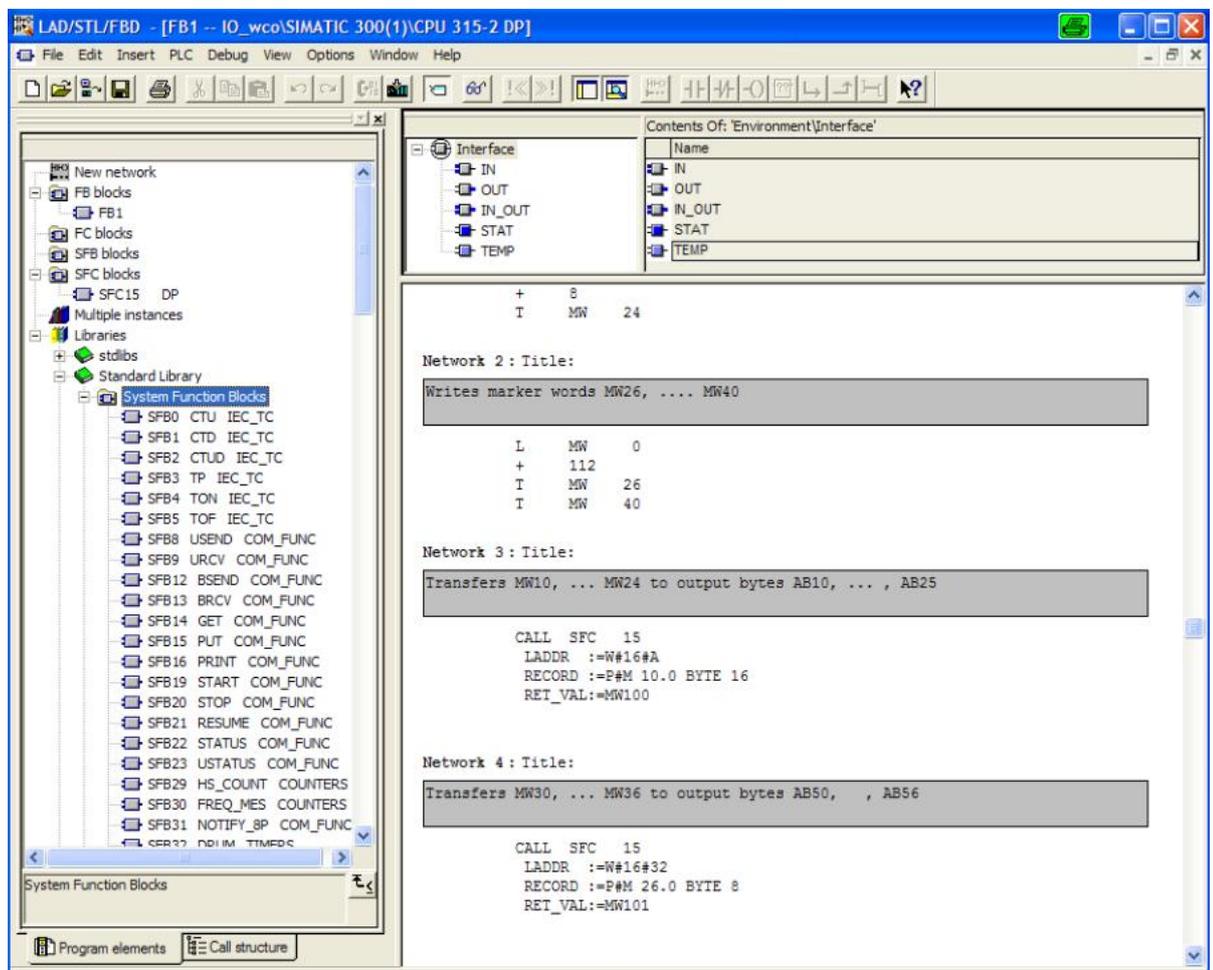
“LADDR :=W#16#A” - the first byte to be copied is memory byte 10.

“RECORD :=PM 10.0 Byte 16” - copy 16 memory bytes to output bytes 10, ....

“RET\_VAL :=MW100” - any error code is copied to memory word 100.

The content is zero if the function block is running properly.

The following screen shows networks 2 and 3 of FB1:



**Notes:**

- If you want to transfer input blocks with consistency you must use SFC14 to copy the input data to memory words/bytes in the PLC memory. Configuring SFC14 is similar to the method described above for the outputs.
- If you remove the master from the network, the S7 CPU stops. You must configure OBxxx in order to maintain the CPU in run state.

# Quantum Configuration

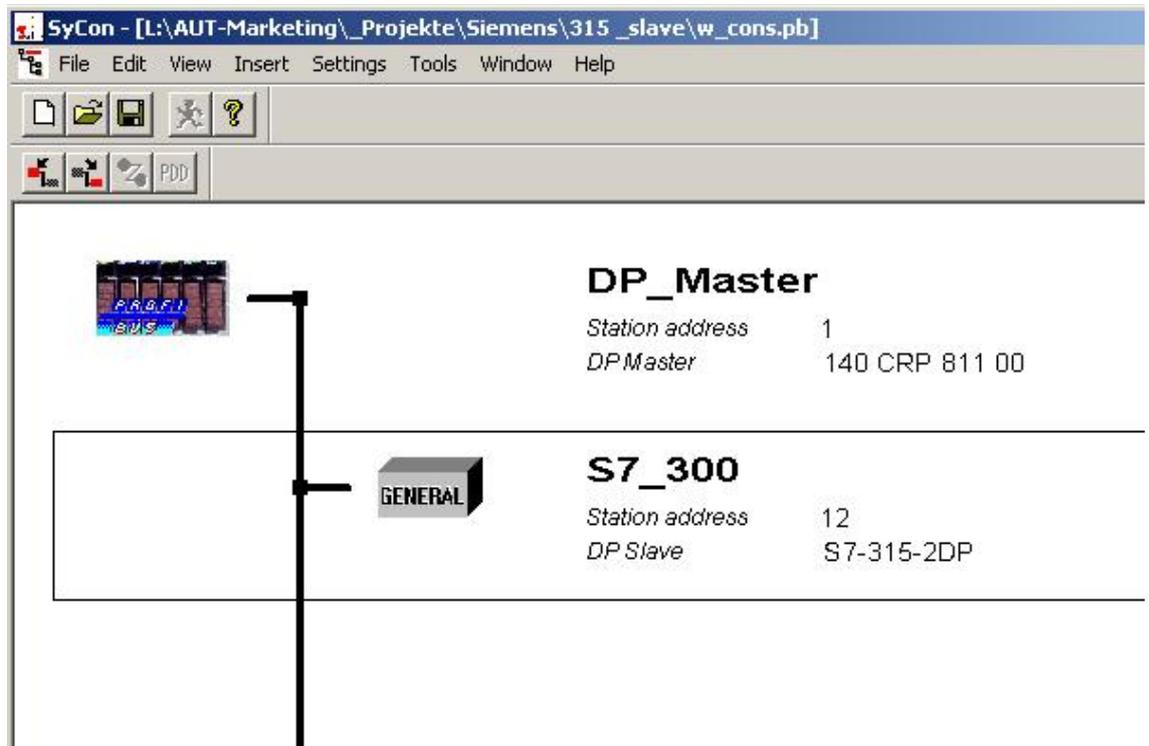
The Quantum configuration consists of a Profibus configuration (Sycon .co file and Sycon .cnf file) and a Concept configuration.

## Sycon configuration

The Sycon configuration contains all the information the Quantum Profibus master module requires to set up and maintain the Profibus communication.

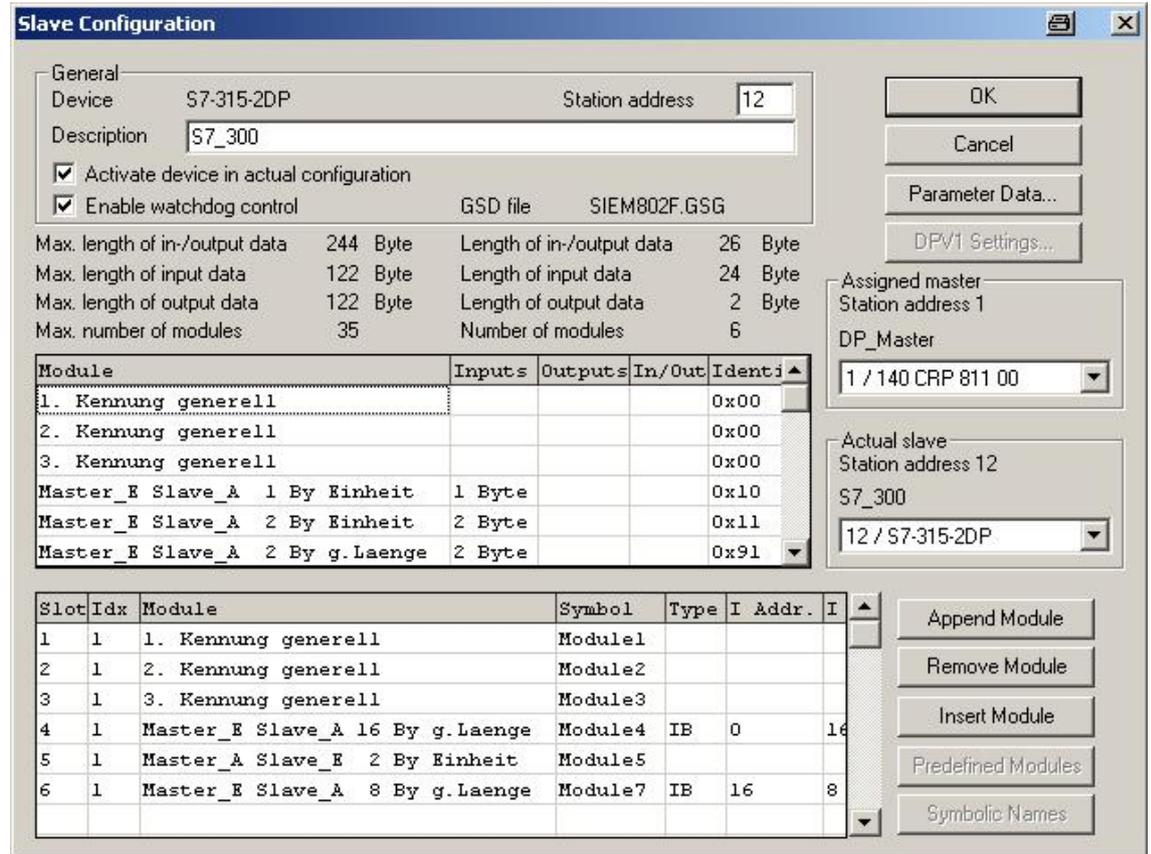
Configure the Quantum CRP module as Profibus master and the S7 CPU as Profibus slave. For the Siemens device to be available in the Sycon slave list, import its GSD file first (menu: File → Copy GSD). The name of the GSD file for the CPU 315-2DP is "siem802f.gsd".

The network view of the Sycon configuration looks like this:



Slave #12 represents the Siemens PLC.

The configuration dialog of the slave is as follows:



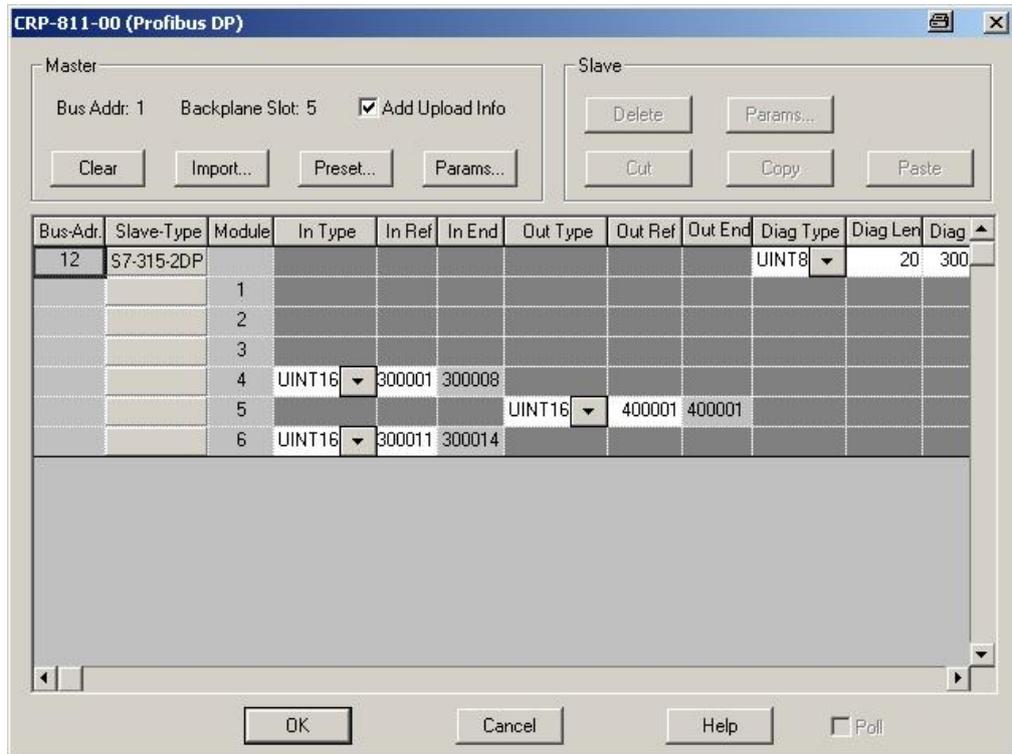
The screen shows two tables: The upper table with all the available blocks and the lower table with all the configured blocks. A block is configured by selecting it in the upper table and double-clicking on it .

For the Siemens CPU, configure slot 1 to 3 as shown above. The entries beginning with slot 4 correspond to the configuration of the property sheet of the Siemens CPU shown on page 4. Here, we define the 16 bytes output block, the 2 bytes input block and the 8 bytes output block from the Siemens Profibus configuration in slot 4, 5, and 6 of the Sycon configuration.

Now, save the Sycon project and create the export file for Concept (cnf-file).

**Concept configuration**

Create a Concept project, enter the CRP811 module in the I/O map and import the Sycon cnf file. In the CRP811 parameter screen you will find the three blocks for I/O data and you can assign Quantum state RAM addresses to them.



Now you can download the project and start the PLC.

**Note:**

If you want to be able to upload the Profibus configuration, you must activate the checkbox "Add Upload Info".

# Contact

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