Training document for the company-wide automation solution Totally Integrated Automation (T I A)

MODULE D10

PROFIBUS DP with

Master CP 342-5DP / Slave ET 200L

We thank the company Michael Dziallas Engineering and the instructors of vocational schools as well as further persons for the support with the production of the document.

PAGE:

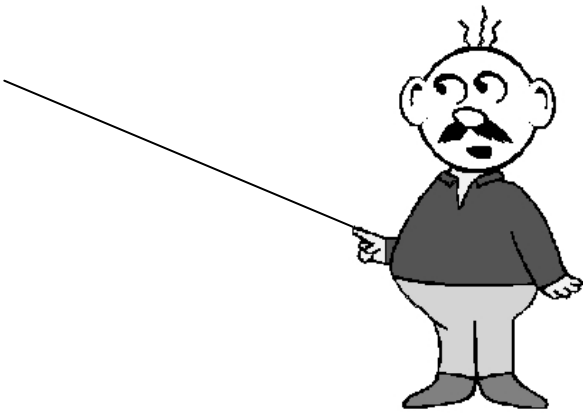
The following symbols stand for the specified modules:

Information

Programming

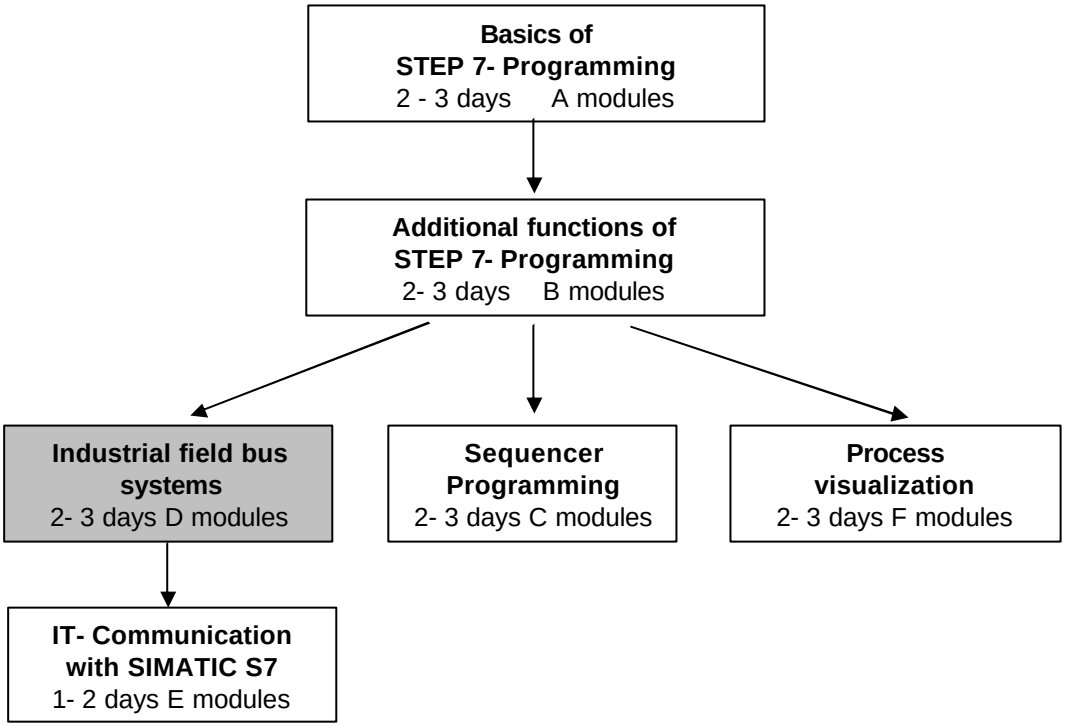
Example exercise

Notes



1. FORWARD

The module D9 is assigned content wise to **Industrial field bus systems**.



Learning goal:

In this module, the reader should learn how the PROFIBUS DP is taken into operation with a SIMATIC S7-300 with the communication processor CP 342-5DP as master and the ET 200L as a slave. The module shows the principle procedure by means of a short example.

Requirements:

For the successful use of this module, the following knowledge is assumed:

- Knowledge in the use of Windows 95/98/2000/ME/NT4.0
- Basics of PLC- Programming with STEP 7 (e.g. Module A3 - 'Startup' PLC programming with STEP 7)
- Basics of the PROFIBUS DP (e.g. Appendix IV – Basics of field bus systems with SIMATIC S7-300)

Required hardware and software

1 PC, Operating system Windows 95/98/2000/ME/NT4.0 with
- Minimal: 133MHz and 64MB RAM, approx. 65 MB free hard disk space
- Optimal: 500MHz and 128MB RAM, approx. 65 MB free hard disk space

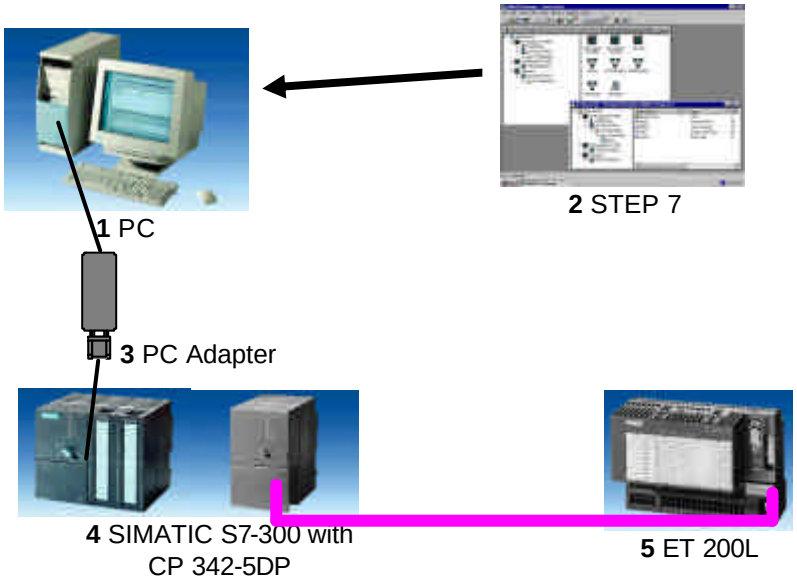
2 Software STEP 7 V 5.x with option NCM S7 PROFIBUS

3 MPI- Interface for the PC (e.g. PC- Adapter)

4 PLC SIMATIC S7-300 with the CP 342-5DP
Example configuration:
- Power supply: PS 307 2A
- CPU: CPU 314IFM
- PROFIBUS- Communication processor: CP 342-5DP

5 Distributed I/O ET 200L with 16 digital in- and outputs

6 PROFIBUS cable with 2 PROFIBUS slots



2. NOTES FOR THE OPERATION OF THE CP 342-5DP

The PROFIBUS communication processor CP 342-5DP makes it possible to attach to it the SIMATIC S7-300 by the PROFIBUS with the protocol profile distributed I/O (DP).

The parameterizing of the PROFIBUS parameters for the PLC, such as the configuration of the PROFIBUS network, takes place with the software STEP 7. The requirement is the CP342-5DP and additionally the software “NCM S7 PROFIBUS “ (Contained already in STEP 7 V5.x!), so that the user has a uniform configuration tool for centralized and distributed configuration.

For the SIMATIC S7-300 with the CP342-5 as a Combimaster, the following protocol profiles are at your disposal:

- DP- Interface as master or slave according to EN 50170. PROFIBUS-DP (Distributed I/O) is the protocol profile for the connection of the distributed I/O/field equipment with a quick reaction time.
- SEND/RECEIVE- Interface (AG/AG) according to the SDA-Service (Layer 2 of the PROFIBUS). SEND/RECEIVE (FDL- Interface) offers functions with which the communication between SIMATIC S5 and S7 are under one another and they can simply and quickly be realized to the PC.
- S7-Functions. These offer optimal communication in the SIMATIC S7/M7/PC-connection.

On the part of the user program, the transmission of the data range for the DP and FDL communication is activated through programmed FC-Block calls and monitoring of effective execution monitored.
The block calls for the important communication FC blocks are found in the library **“SIMATIC_NET_CP“**. In order to use these functions, the function must be copied into the project.

Note: Here the CP 342-5DP is appointed to the PROFIBUS as a master.

NOTES FOR THE OPERATIONS OF THE ET 200L

The ET 200L is a distributed I/O system with a small, compact configuration. The ET 200L is a passive participator (Slave) on the PROFIBUS-DP.
The PROFIBUS address is adjusted with two rotary switches.
Another possible adjustment of the PROFIBUS address is with a power recovery. Therefore, the ET 200L must be turned off and then back on.

4. COMMISSIONING THE PROFIBUS (MASTER CP 342-5DP / SLAVE ET200L)

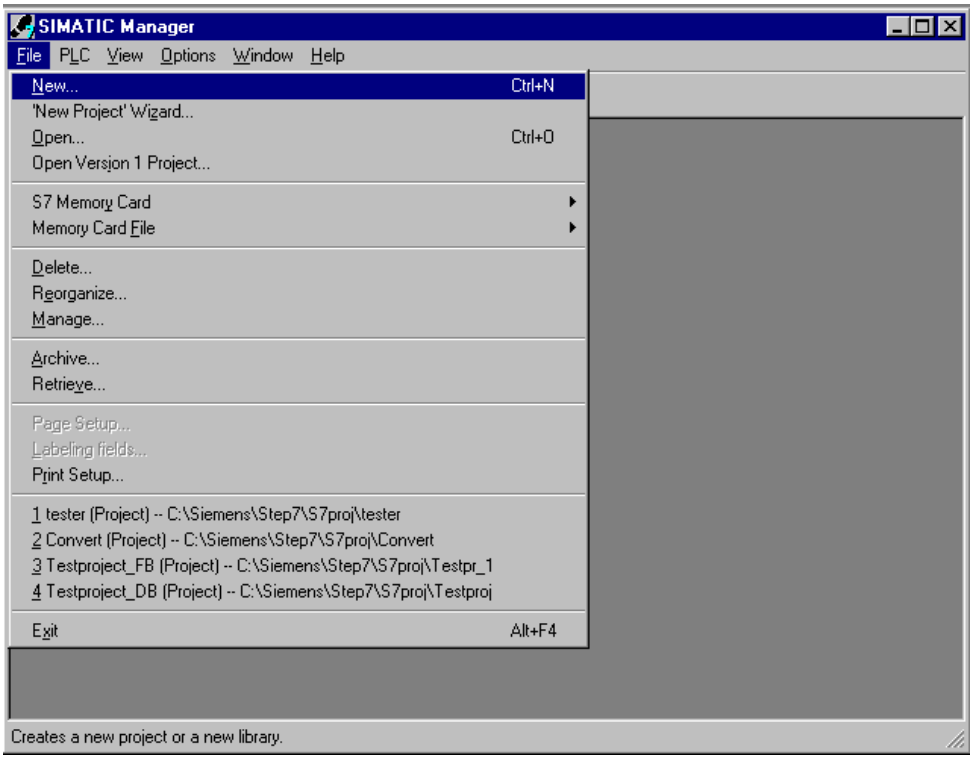
In the following example, the commissioning of a mono master system with the SIMATIC S7-300 with CP 342-5DP as a master and an ET200L as a slave is described.
For the testing of the configuration, a program will be written in which a display lamp H1 is triggered by the simultaneous activation of two buttons S0 and S1.

Assignment list:

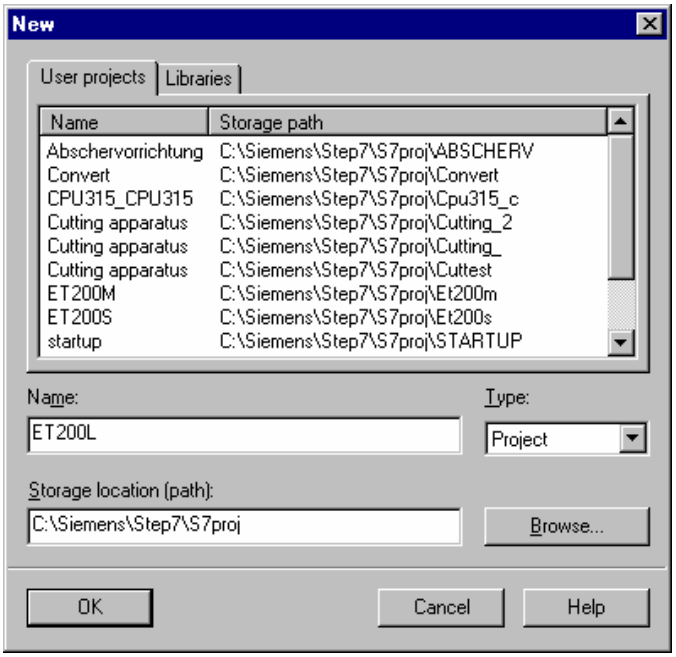
I 64.0	S0	Button selection 1 on ET200L
I 64.1	S1	Button selection 2 on ET200L
Q 64.0	H1	Display lamp on ET200L

1. The central tool in STEP 7 is the **SIMATIC Manager**, which is opened here with a double click (→ SIMATIC Manager).

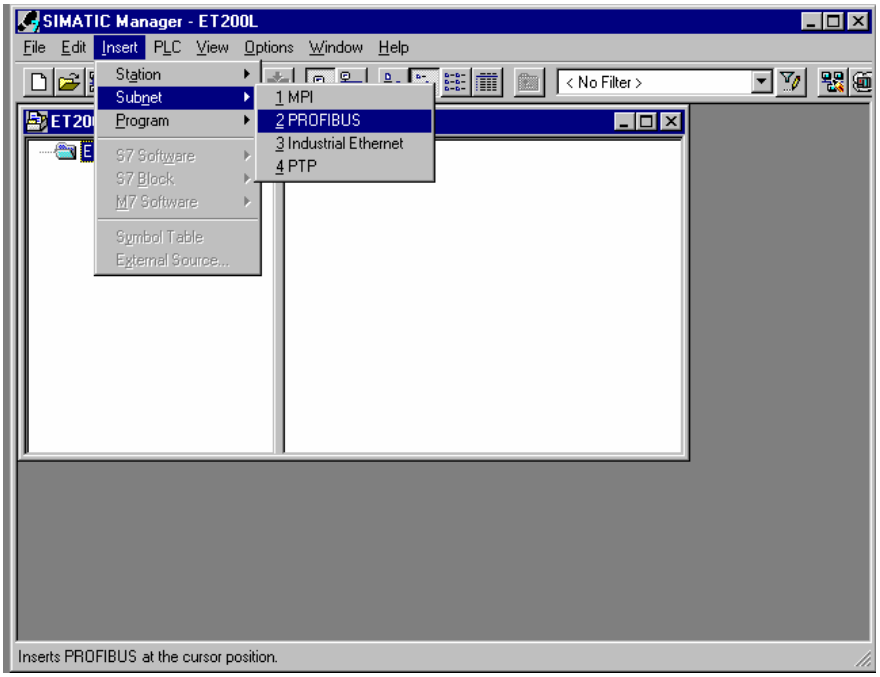
2. STEP 7- Programs are administered in projects . Such a project will be created (→ File → New).



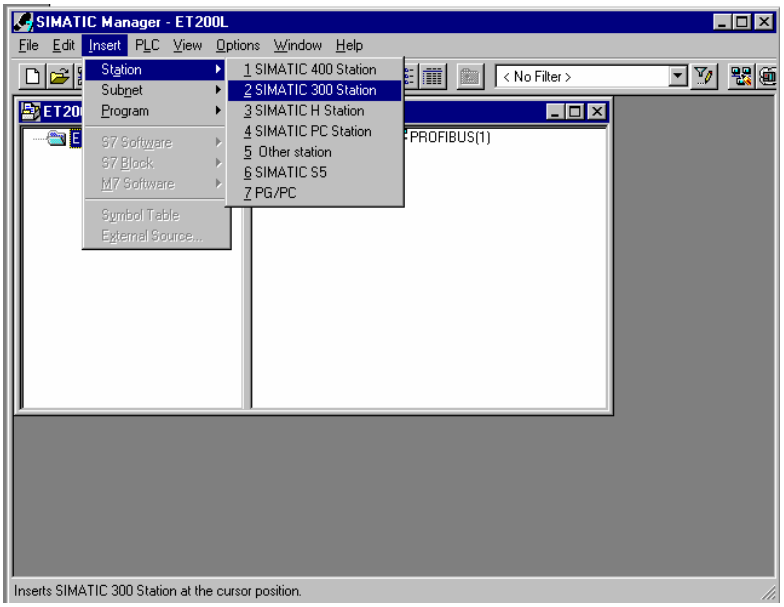
3. Give the **Name ET200L** to the project (→ ET200L → OK).



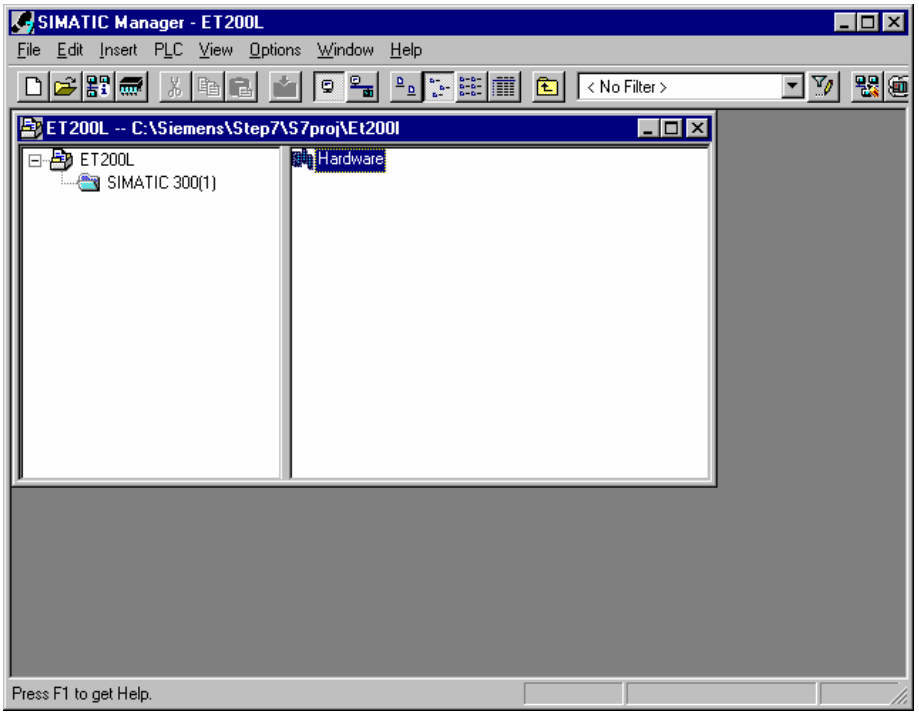
4. Highlight your project and insert a **PROFIBUS Subnet** (→ ET200L → Insert → Subnet → PROFIBUS).



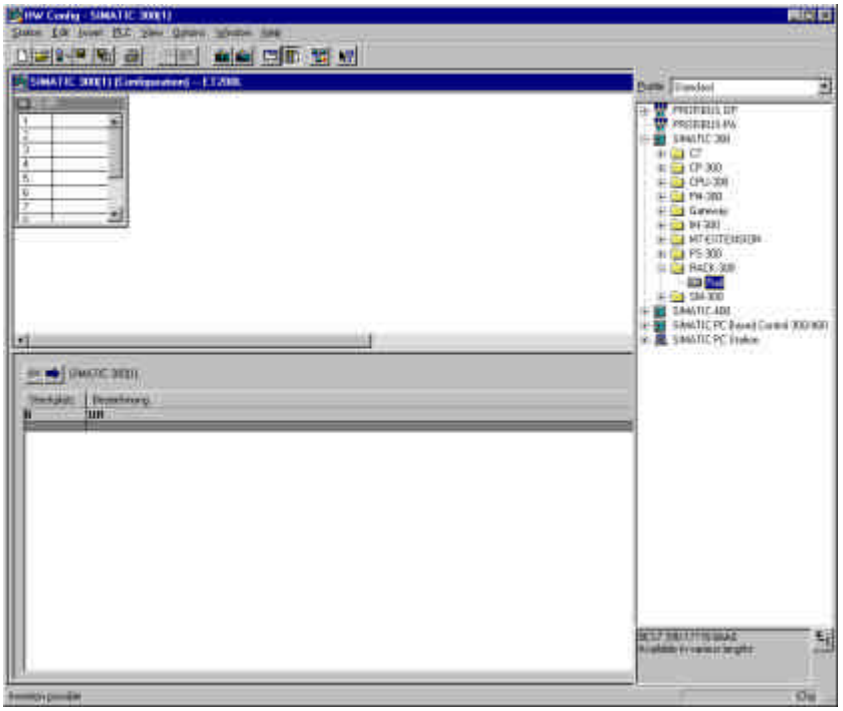
5. Then insert a **SIMATIC 300-Station** (→ Insert → Station → SIMATIC 300-Station).



6. Open the configuration tool for the **Hardware** with a double click (→ Hardware).

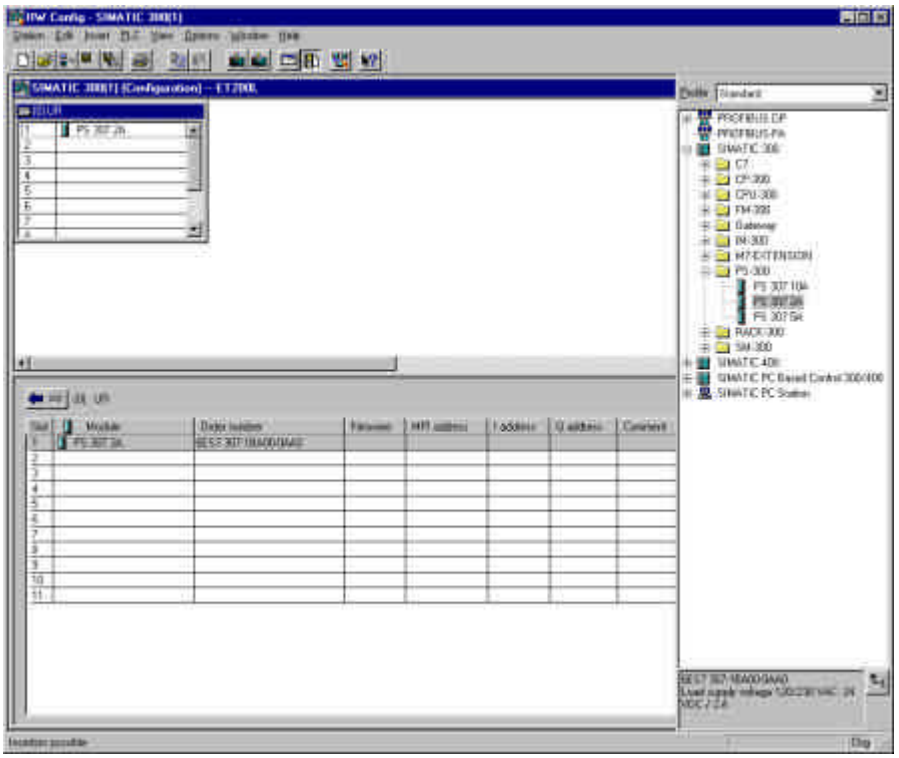


7. Open the hardware catalog with a click on the symbol  (→ ).
   There you will see the directories are divided into the following:
   - PROFIBUS-DP, SIMATIC 300, SIMATIC 400 and SIMATIC PC Based Control,
   all module racks, modules and interface modules for the configuration of your hardware configuration are made available.
   Insert a **Rail** with a double click(→ SIMATIC 300 → RACK-300 → Rail).



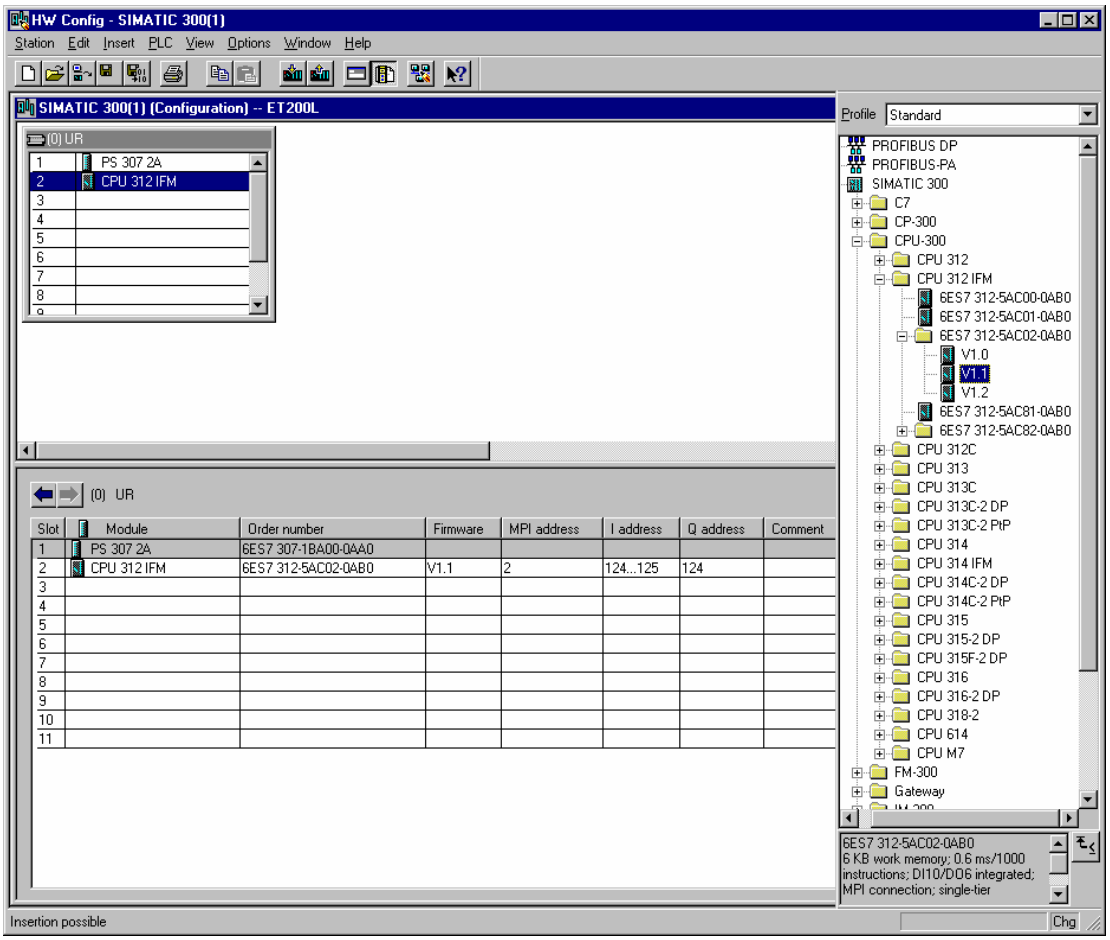
After the insert, a configurations table for the configuration of the Rack 0 appears automatically.

8. Now all modules can be chosen out of the hardware catalog and inserted into the configuration table and are also inserted into your rack. To insert, you must click on the name of the respective module, hold the mouse button and Drag & Drop the module into a line of the configurations table. We will begin with the power supply **PS 307 2A** (→ SIMATIC 300 →PS-300 → PS 307 2A).

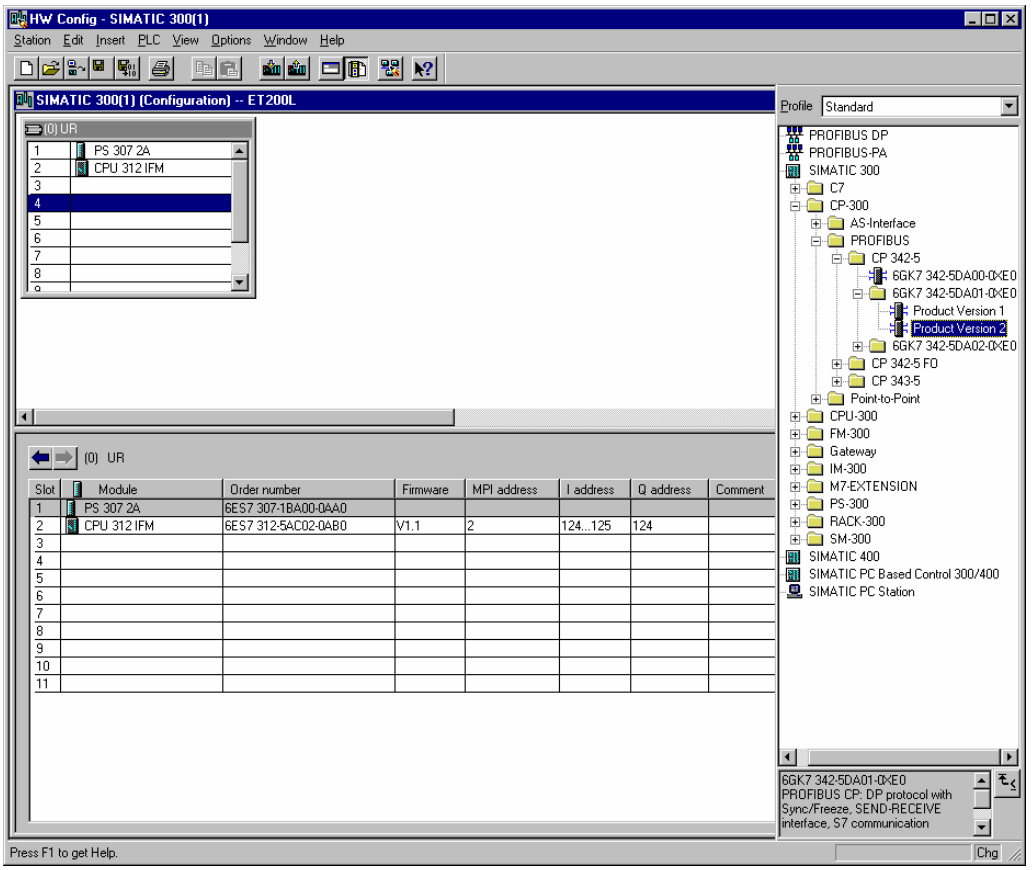


Note: If your hardware differs from what is shown above, then you must select the appropriate modules from the catalog and insert them into the rack. The part numbers of the individual modules, which are found on the components, are indicated in the footer of the catalog.

9. In the next step, we drop the CPU 314IFM into the second slot. This allows for the part number and version of the CPU to be read off (→ SIMATIC 300 → CPU-300 → CPU 314IFM → 6ES7 314-5AE03-0AB0 → V1.1).

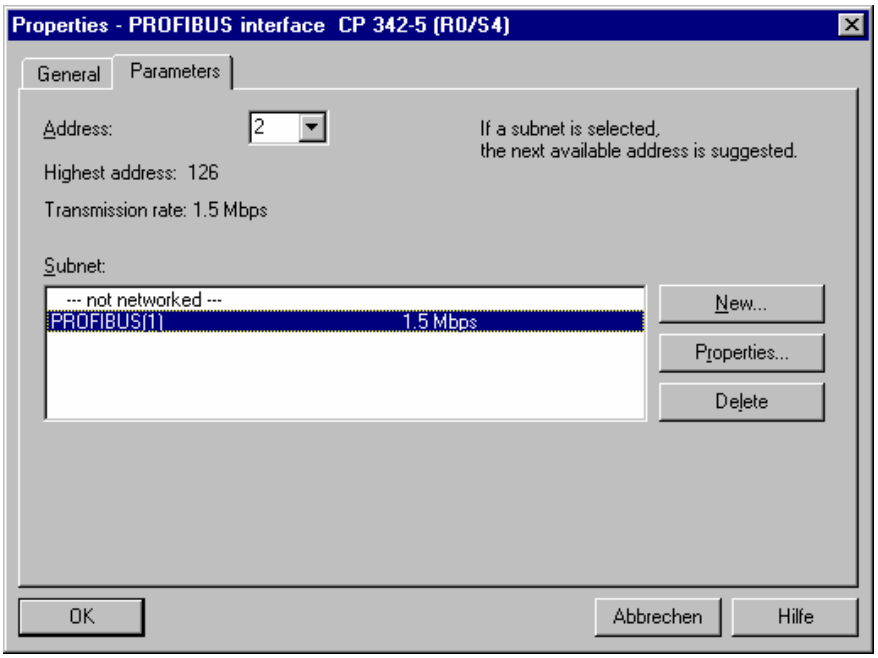


10. Then we drag the communication processor for the PROFIBUS **CP 342-5DP** onto the fourth slot. Now the order number and version of the model can be read off the front (→ SIMATIC 300 → CP-300 → PROFIBUS → CP 342-5DP → 6GK7 342-5DA01-0XE0 → Product Version 2).

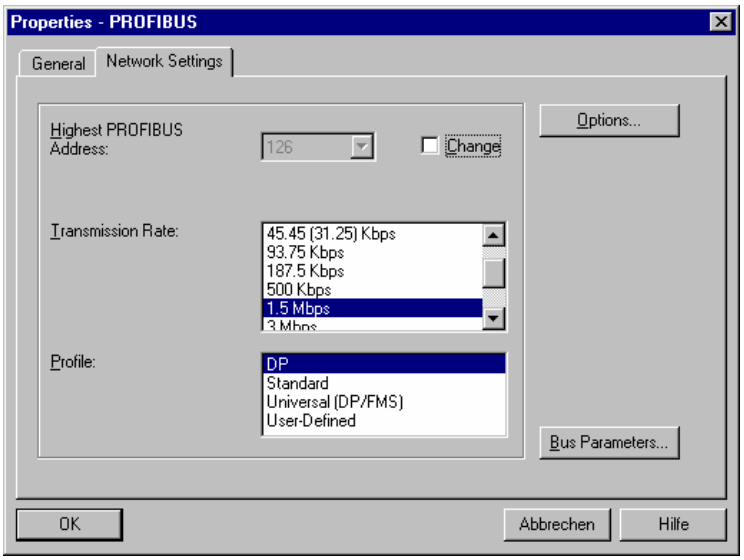


Note: Slot number 3 is reserved for interface modules and remains empty. The order number of the module is displayed in the footer of the catalog.

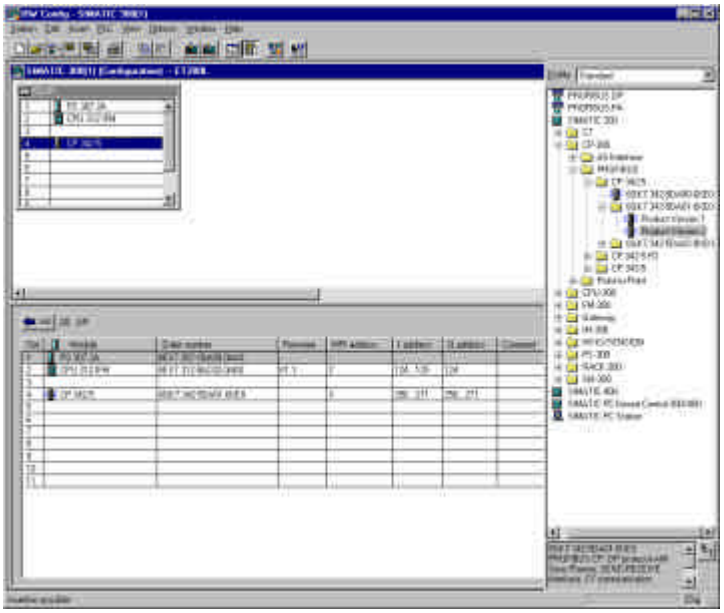
11. By the entering of the communication processor, the following window appears, in which you assign a PROFIBUS address to the CPU 342-5DP and must already choose the first PROFIBUS net. When you want to alter the parameter of the PROFIBUS net, you must highlight it and then click on **Properties** (→ Properties).



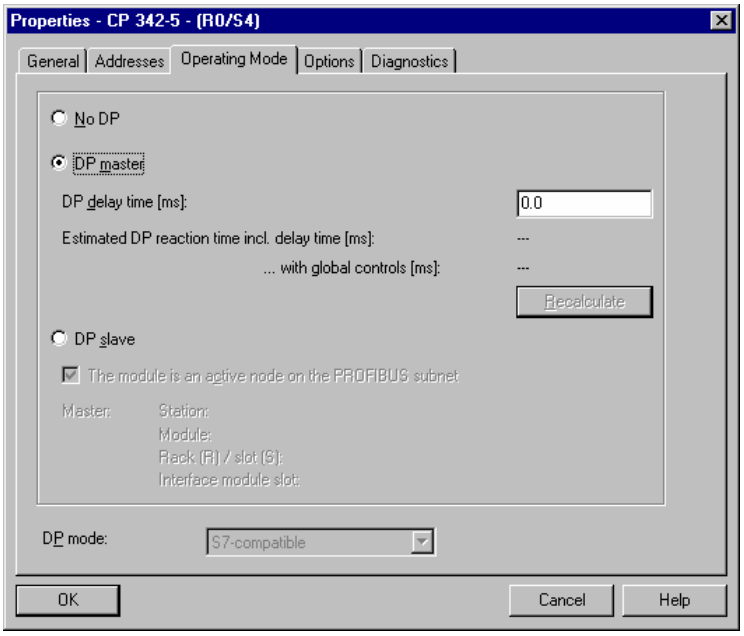
12. Now you can choose the **Highest PROFIBUS Address** (here → 126), the **Transmission Rate** (here → 1,5 Mbit/s) and the **Profile** (here → DP). (→ OK).



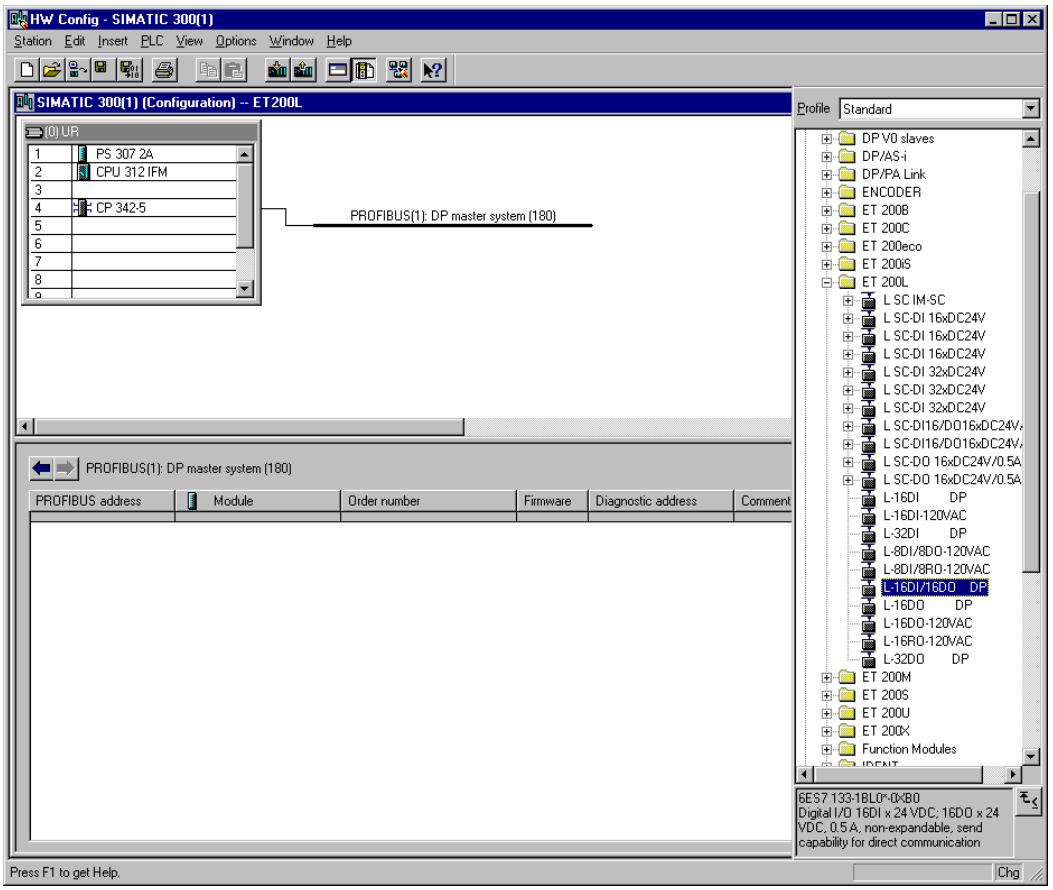
13. Now the addresses of the communication processor in the I/O address space of the CPU are noted (Here: PI 256...271 / PQ 256..271). Choose the properties of the communication process through a double click on the 'CP 342-5DP' (→ CP 342-5).



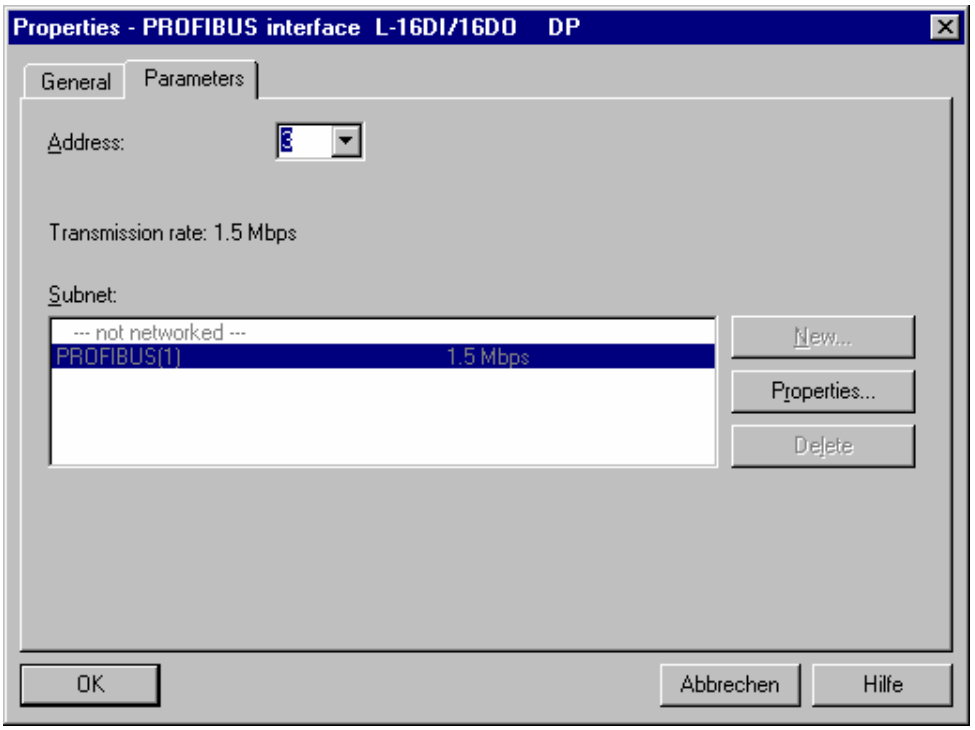
14. **Set** the **Operation Mode** to **DP master** and accept with **OK** (→ Operation Mode → DP master → OK).



15. Then a bar chart for the **Master system** is shown to the right of the CP342-5DP, in which you can arrange the PROFIBUS slaves. This happens by clicking the desired module (here the **ET 200L** with **16DI/16DO**) from the hardware catalog in path **PROFIBUS-DP**. By Drag & Drop with the mouse, it can be dropped into the master system (→ PROFIBUS DP → ET 200L → L-16DI/16DO→ 6ES7 133-1BL00-0XB0).



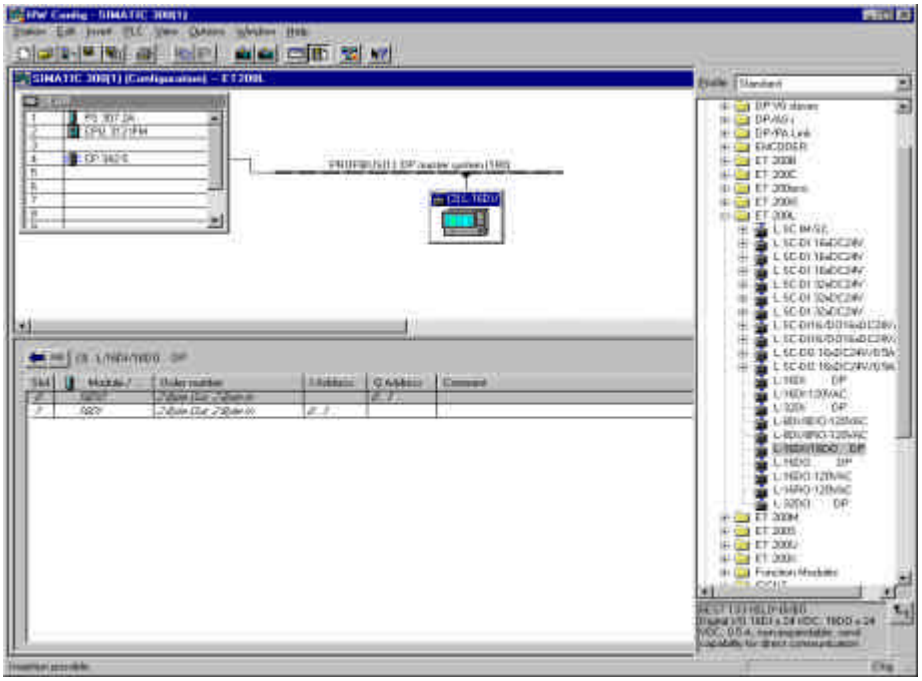
16. By the entering of the slave, the following window is displayed in which you must assign a PROFIBUS address to the slave. This address must be identical to the address that you chose for the rotary switch of the ET 200L (→ 3 → OK).



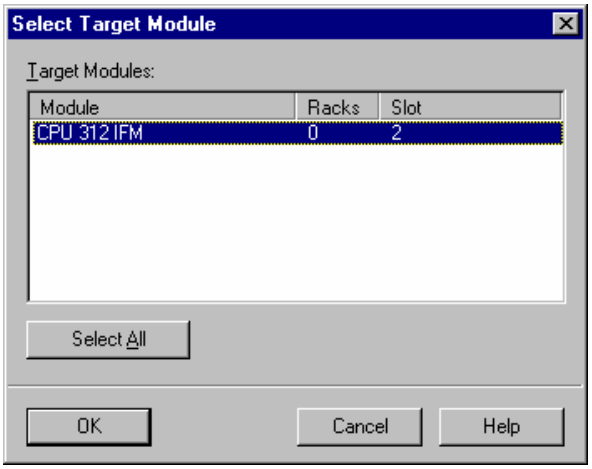
17. The addresses of the in- and outputs on the ET 200L can now be noted (Here: I 0...1/Q 0...1). An automatic address assignment takes place in the order similar to how slaves are inputed.

Note: The declared addresses are the in-/output addresses within the communication processor. In the program of the CPU, one cannot directly access these addresses. First the in-/output address ranges must be transferred over the FC blocks in the address ranges of the CPU.

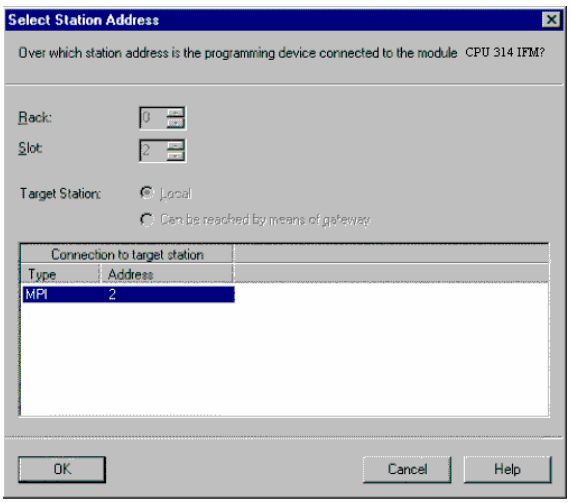
The configuration table should first be saved and compiled with a click on and then downloaded in to the PLC . The mode switch of the CPU must be on STOP! (→ →)



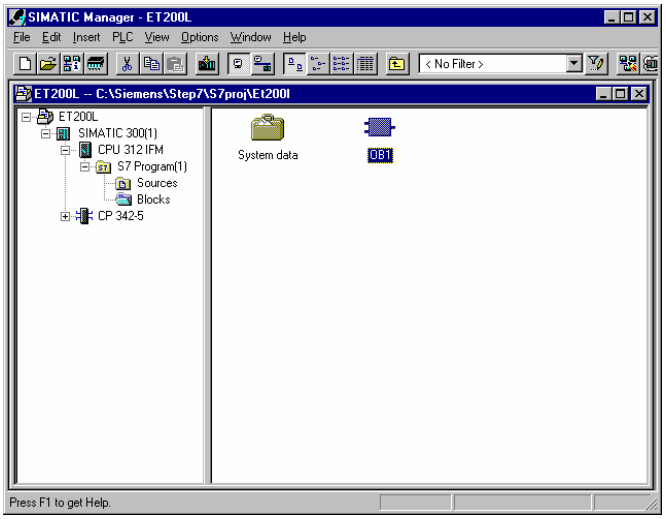
18. The CPU 315-2DP is then activated as a target module of the download activity (→ OK).



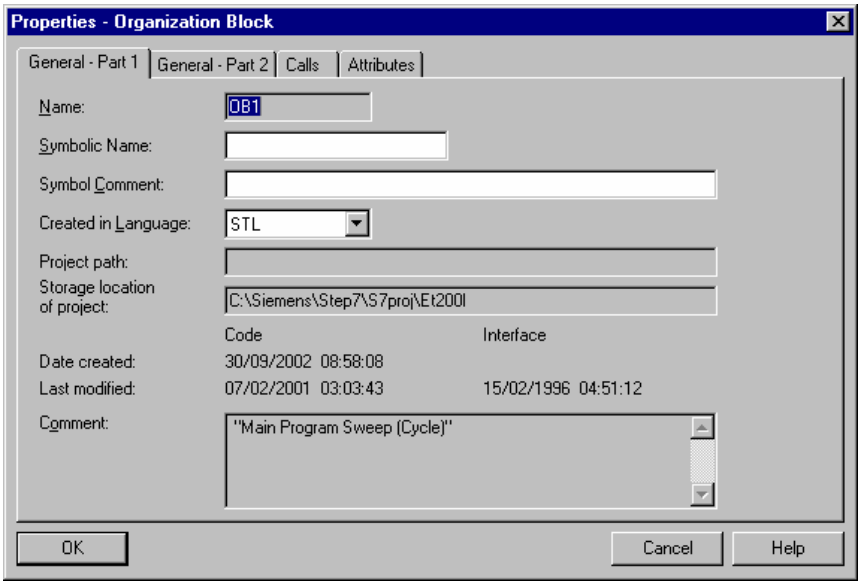
19. The station address of the CPU in the MPI net is then chosen. You are only connected with the CPU so you can accept with **OK** (→ OK).



20. From the **SIMATIC Manager**, open the data block **OB1** with a double click (→ OB1).



21. Optional: Enter the properties of the OB1 for documentation and accept with OK (→OK).



The transmission of the data range for the in- and outputs of the PROFIBUS DP slaves is activated through the programmed FC block calls of the user program. These FCs also monitor the effective execution.
The block calls for the important communication FC blocks are found in the library **"SIMATIC_NET_CP"**. In order to use these functions, the functions must be copied into the project.

The FC block **DP-SEND** transfers data from the user program in the CPU to the PROFIBUS- CP. For the operation type of the PROFIBUS– CP, the DP-SEND has the following importance:

- For the application in DP-Master
  The block assigns the data of the indicated DP output range to the PROFIBUS-CP for the output module by the distributed I/O.
- For the application in DP-Slave
  The block assigns the data of the indicated DP data range of the CPU in the send buffer of the PROFIBUS-CP for transmission to the DP-Master.
  By the call of the FC block DP-SEND, the following parameters must be entered:

Name	Type	Range of values	Comment
CPLADDR	WORD		Module-start address (The configuration table can be extracted in STEP 7).
SEND	ANY		Indication of the address and length of DP-Send range (the address can refer to the I/O-Ranges, bit memory address areas and data block areas).
DONE	BOOL	0: - 1: New data	Displays, if the job was handled error free.
ERROR	BOOL	0: - 1: Error	Error display
STATUS	WORD		Status display

The FC-Block **DP-RECV** receives data over the PROFIBUS DP. For the operation type of the PROFIBUS –CP, the DP-SEND has the following importance:

- For the application in DP- Master
  The block accepts process data of the distributed I/O as status information in the indicated DP input range.
- For the application in DP- Slave
  The block accepts the transferred DP data of the DP- Master from the receive buffer of the PROFIBUS -CP in the indicated DP data range of the CPU.
  By the call of the FC block DP-RECV, the following parameters must be entered:

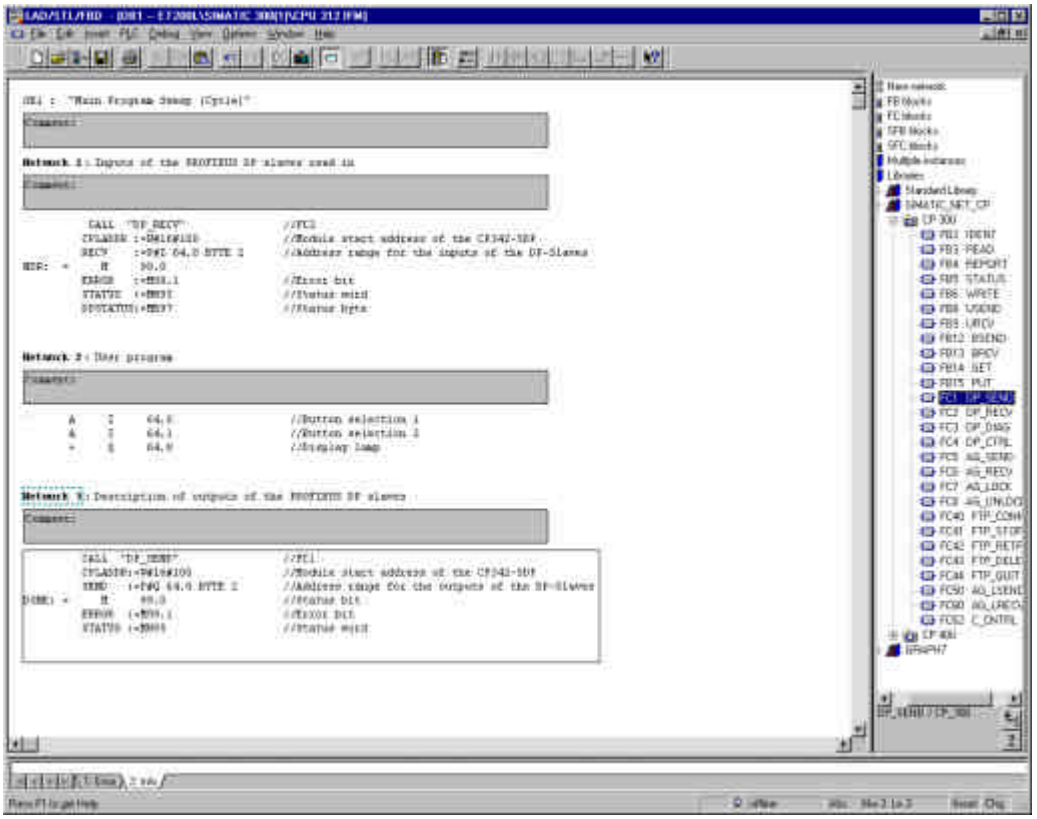
Name	Type	Range of values	Comment
CPLADDR	WORD		Module-start address (The configuration table can be extracted in STEP 7).
RECV	ANY		Indication of the address and length of DP-receive range (the address can refer to the I/O-Ranges, bit memory address areas and data block areas).
NDR	BOOL	0: - 1: New data accepted	The state parameter displays, if new data was accepted.
ERROR	BOOL	0: - 1: Error	Error display
STATUS	WORD		Status display
DPSTATUS	BYTE		DP-Status display

22. With **LAD, STL, FBD: Program blocks**, you now have an editor which gives you the possibility to generate your STEP 7- Program. Here the organization block OB1 was already opened with the first network. In order to generate your first logical operation, you must highlight the first network. Now you can write your first STEP 7- Program. Several programs can usually be divided into networks. Open a new network by clicking on the network symbol .

Here the inputs of the DP slaves are read into network 1 with the block **DP_RECV**. You can insert this block into your network from the **Libraries** of blocks in the catalog (→ Libraries → SIMATIC_NET_CP → CP 300 → FC2 DP_RECV).

In Network 3, the outputs of the DP slaves are written with the block **DP_SEND**. You can insert this block into your network from the **Libraries** of blocks in the catalog (→ Libraries → SIMATIC_NET_CP → CP 300 → FC1 DP_SEND).

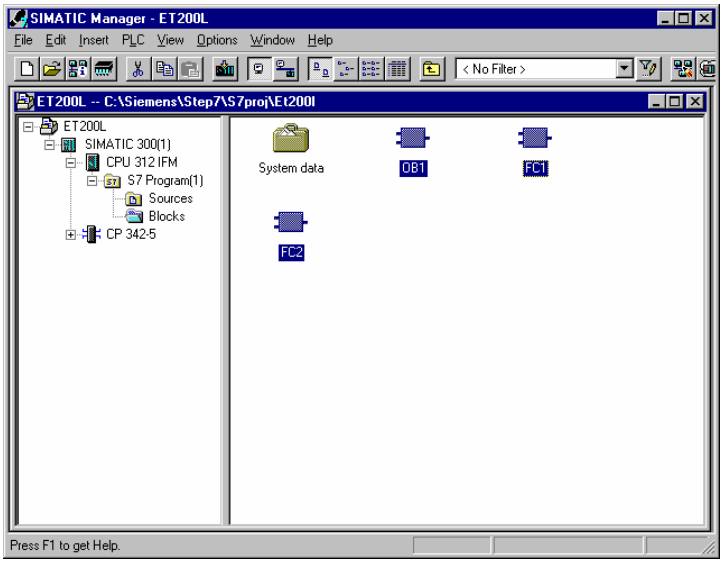
Now save the OB1 block (→).



Note: Here an ET200L is integrated with 2 byte input data and 2 byte output data over a CP342-5 DP on slot 5 (Module start address decimal: 256 / Hexadecimal 100).
The input data should be in the input word IW 64 and the output data should be written to the output word QW64 in the ET200L.

It is important that all data in the defined DP slaves hardware configuration is integrated with block DP_RECV and DP_SEND, whereby all DP slaves are combined in a DP_RECV and DP_SEND.
The addresses of several modules can be extracted from the hardware configuration.

23. The STEP 7- Program must now be downloaded into the PLC. In our case, this is done from **SIMATIC Manager.** There you must highlight the **OB1** and the FCs **FC1** and **FC2** in the folder 'Blocks' and click on download . The mode switch of the CPU must be on STOP! (→ SIMATIC Manager → Blocks → OB1 → FC1 → FC2 →).



24. Through the switching of the mode switch to RUN, the program is started.