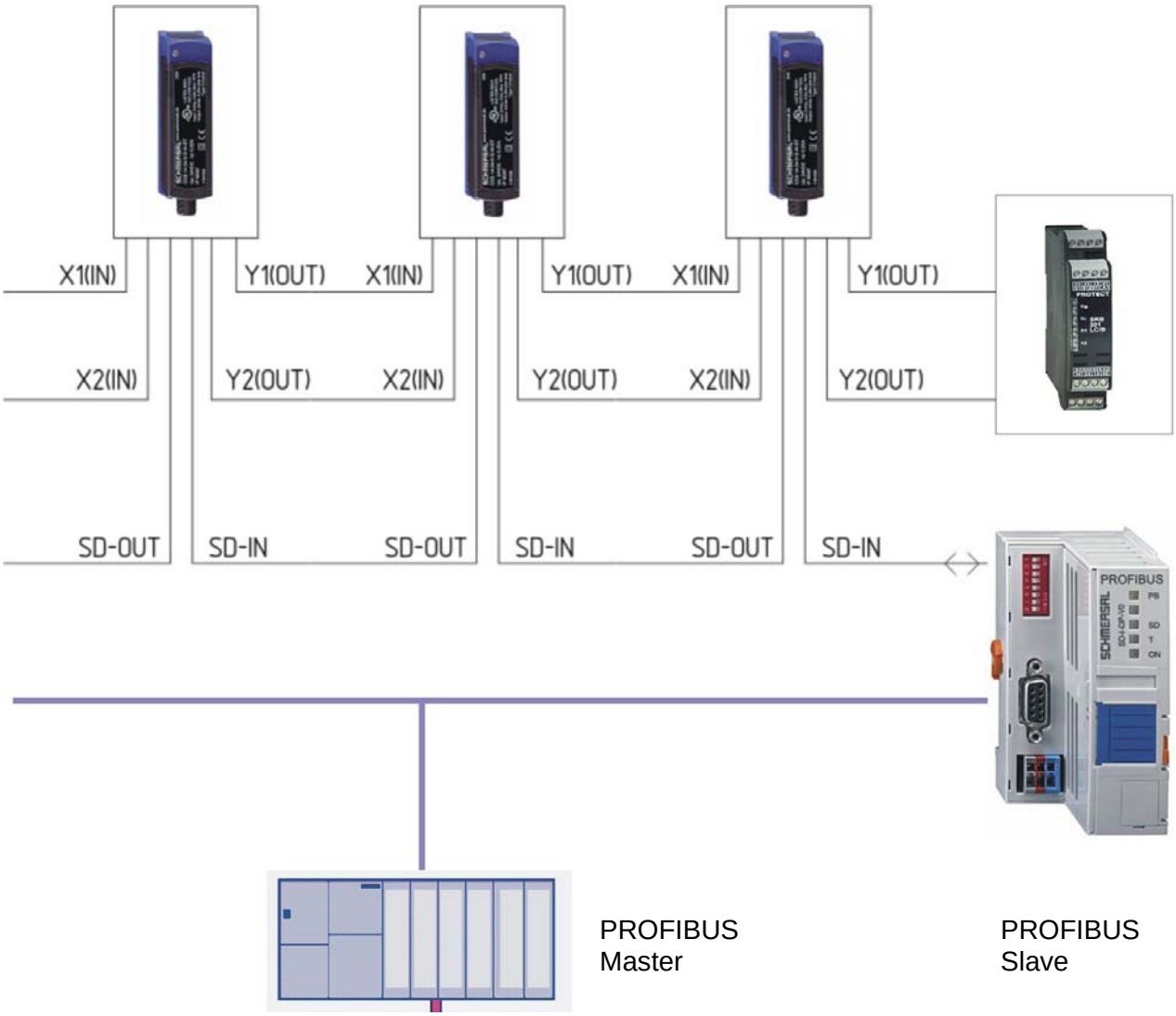
Project engineering instructions for applications with the PROFIBUS gateway SD-I-DP-V0-2

Setting up data communication between CSS safety sensors, MZM or AZM solenoid interlocks and the local PROFIBUS Master



PROFIBUS Master

PROFIBUS Slave

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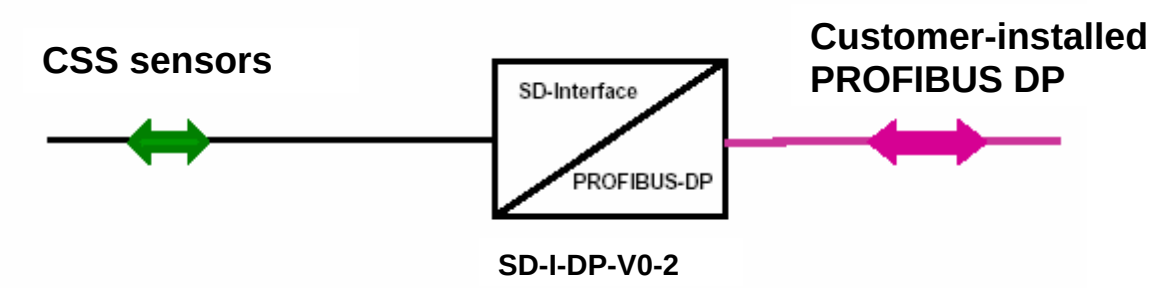
2. Introduction

Setting up data communication between CSS safety sensors, MZM or AZM solenoid interlocks and the local PROFIBUS Master



The PROFIBUS gateway **SD-I-DP-V0-2** is the "collective PROFIBUS interface" for non-contacting safety sensors and solenoid interlocks. These devices do not have their own PROFIBUS interface. The series connection of the serial diagnostic outputs of these devices is in this respect implemented on the PROFIBUS gateway.

The PROFIBUS gateway converts the serial diagnostic signals of the devices connected in series to the PROFIBUS DP-V0 protocol. The gateway is then integrated as a slave into a PROFIBUS DP system.

In this way, the local PROFIBUS Master has access to the operational data of the CSS sensors / solenoid interlocks. The Master furthermore can give (inter)locking commands to the individual local solenoid interlocks through the bus system.

The diagnostic signals are not suitable for the safety applications.

Irrespective of the diagnosis described here, the safety circuits of the sensors and interlocks are wired and evaluated in series for safety applications.

This manual describes the basic principles for setting up the data communication. As an example, the configuration of the PROFIBUS Master for an S7 processor is described. As PROFIBUS Master, every device possessing the authorisation from the PROFIBUS User Organisation (PNO) can be used.
Systems from other manufacturers must be programmed in accordance with the described configuration steps by means of the device-specific handling specifications.

Details about the connection and mechanical addressing of the PROFIBUS gateway SD-I-DP-V0-2 are summarised in the mounting and wiring instructions for the gateway.
Details on the connection and the formation of a series connection of CSS sensors or interlocks are given in the respective data sheets and mounting instructions for these devices. Optionally, the Schmersal Online Catalogue is available on the Internet at www.schmersal.com.

3. User CD-ROM

Data communication between PROFIBUS gateway SD-I-DP-V0-2 and the PROFIBUS Master Processor

The project engineering instructions describe the tasks of programme files for setting up data communication. Along with additional information, these files are saved on the CD-ROM enclosed with the instructions. They are also available for download at our homepage: www.schmersal.com.

Assignment	File name	Function
Auxiliary files:		
GSD file:	KAS_0b13.GSD	Characteristics of the SD-I-DP slave in the PROFIBUS connection, handling specifications for the PROFIBUS master PLC
for Siemens S7-300/400 graphical SD-I-DP-V0-2 symbols:	S_GDiag.bmp S_Gatew.bmp	Integration of the SD gateway into the hardware S7 PLC configuration
Information files:		
Product information: Elektronische Sicherheits-Sensoren und -Zuhaltungen	b_csap01.pdf	German
Electronic safety sensors and solenoid interlocks	b_csap02.pdf	English
Mounting instructions CSS 34	m_cs3p01.df	German, English, French
Mounting instructions AZM 200	mazm2p01.pdf	German, English, French
Mounting instructions MZM 100	mmzm1p01.pdf	German, English, French
Mounting instructions SD-I-DP-V0-2	m_sdip01.pdf	German, English, French
Project Engineering Instructions for data communication SD-I-DP-V0-2 data link SD-I-DP-V0-2	m_sdip02.pdf m_sdip03.pdf	German English

4. Integration of the PROFIBUS gateway into the PROFIBUS communication S7-300 is used as an example

4.1.1 Preparatory steps

It is recommended that the auxiliary files on the enclosed CD-ROM are first loaded in a subdirectory that is created on the programming device or programming PC.

Loading SD-I-DP symbols into the graphics table in the S7 programme

To do this, open the subdirectory NSBMP in the tree structure of the Step 7 programme.
The directory is called: Programme\Siemens\Step7\S7DATA\NSBMP.
The files in this directory all have the file extension .bmp.
Copy the files S_Gdiag.bmp and S_Gatew.bmp from the supplied CD-ROM into the subdirectory NSBMP.

4.1.2 Working with the SIMATIC Manager

The handling of the programming software is explained in the operating manuals for SIMATIC STEP 7 and the SIMATIC Manager.
For this reason, the procedure to create a new project is assumed to be known and will not be further explained below.

Note:
Upon a failure of a PROFIBUS standard slave (e.g. SCHMERSAL PROFIBUS gateway), the SIEMENS S7 CPU enters the STOP mode. To prevent this, the organisational blocks OB82 (diagnostic interrupt) and OB86 (Rack failure) must be included in the S7 programme.
The blocks FC125 and FB125 for an extended PROFIBUS diagnosis can be downloaded from the SIEMENS Internet page www.4.ad.siemens.de, menu item Downloads and search term "FB125".

4.2.1 Integrating the GSD file

The GSD file for the device must be integrated as a first step for the integration of the PROFIBUS gateway SD-I-DP-V0-2. This is necessary in order to have the PROFIBUS gateway accepted in the pick list in the following configuration steps.

Procedure:
1. Click with your mouse on "SIMATIC 300 Station" in the left structure tree.
2. The symbol "Hardware" appears in the right part of the window.

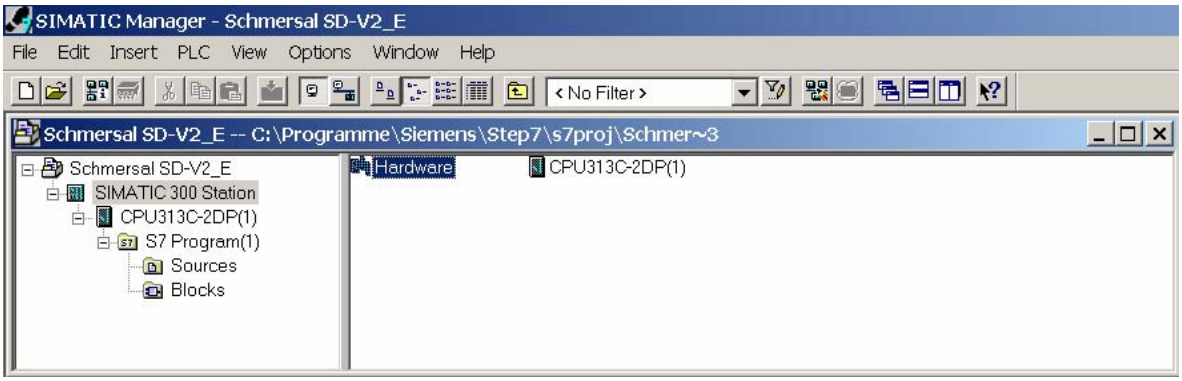


Fig. 1: Window <SIMATIC Manager>

3. Double-click on “Hardware”; the mode changes to "HW Config".

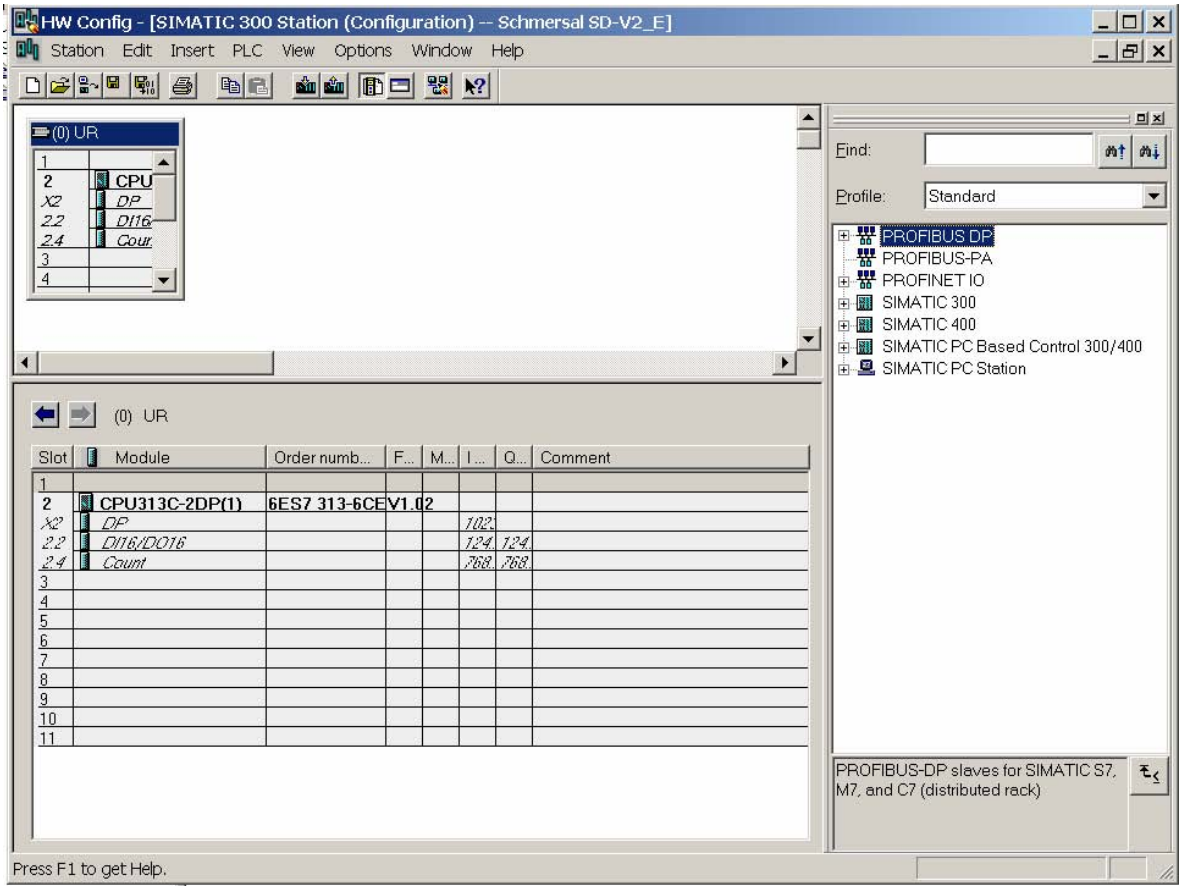


Fig. 2: Window <HW Config - installing a new GSD file>

4. Close the current project with a mouse click at the top right.
   The left side of the window now is blank again. The system remains in the mode "HW Config".

5. The directory with the GSD file can be opened via <Options> and <Install GSD files>.

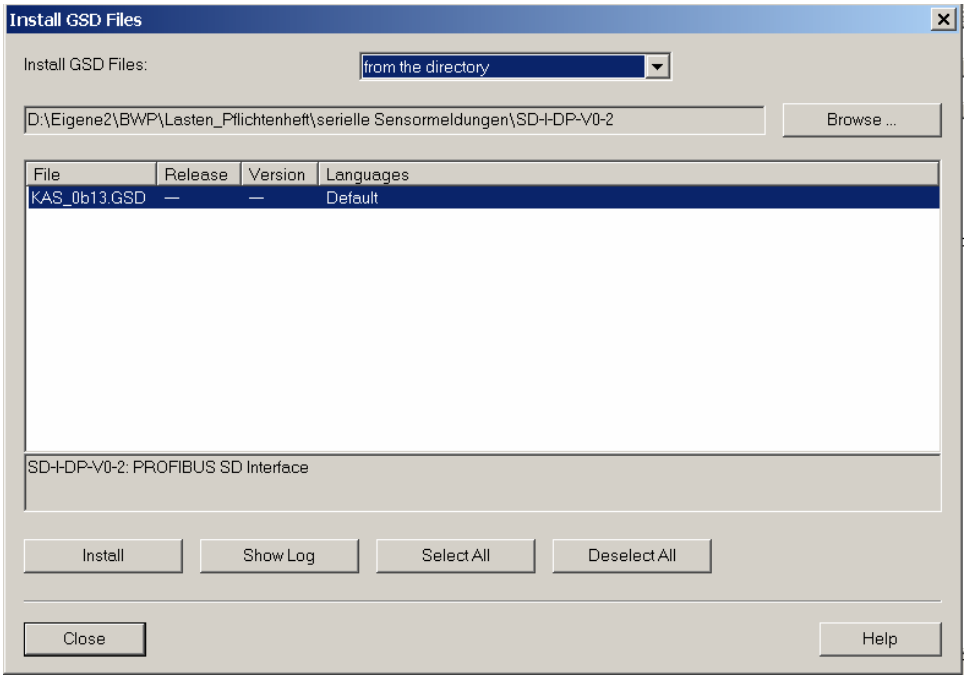


Fig. 3: Window <Install GSD files>

6. Click on the <Browse> button; select the desired subdirectory, highlight it with a mouse click and confirm with <OK>.

7. The name of the GSD file "KAS_0b13.GSD" now is displayed; highlight it with a mouse click and save with <Install>.

8. The integration is terminated and the subprogram is exited.

In the next step, the PROFIBUS master and the SD gateway must be configured.

4.2.2 Configuring the hardware

In practice, the user programme, including the associated configuration, is already entered.
Now, these details must be completed with the PROFIBUS configuration of the PLC and the SD gateway.
Open the SIMATC Manager and the user programme to start.
In the following example, the project "S7_Schmersal" is opened.
This project does not contain any user programme.
After opening the project, the mode "HW Config" must be activated.

To do this:
1. Select "SIMATIC 300 Station" with the mouse cursor in the left structure tree.

2. The symbol “Hardware” appears in the right part of the window; change the mode to "HW Config" by double-clicking "Hardware".

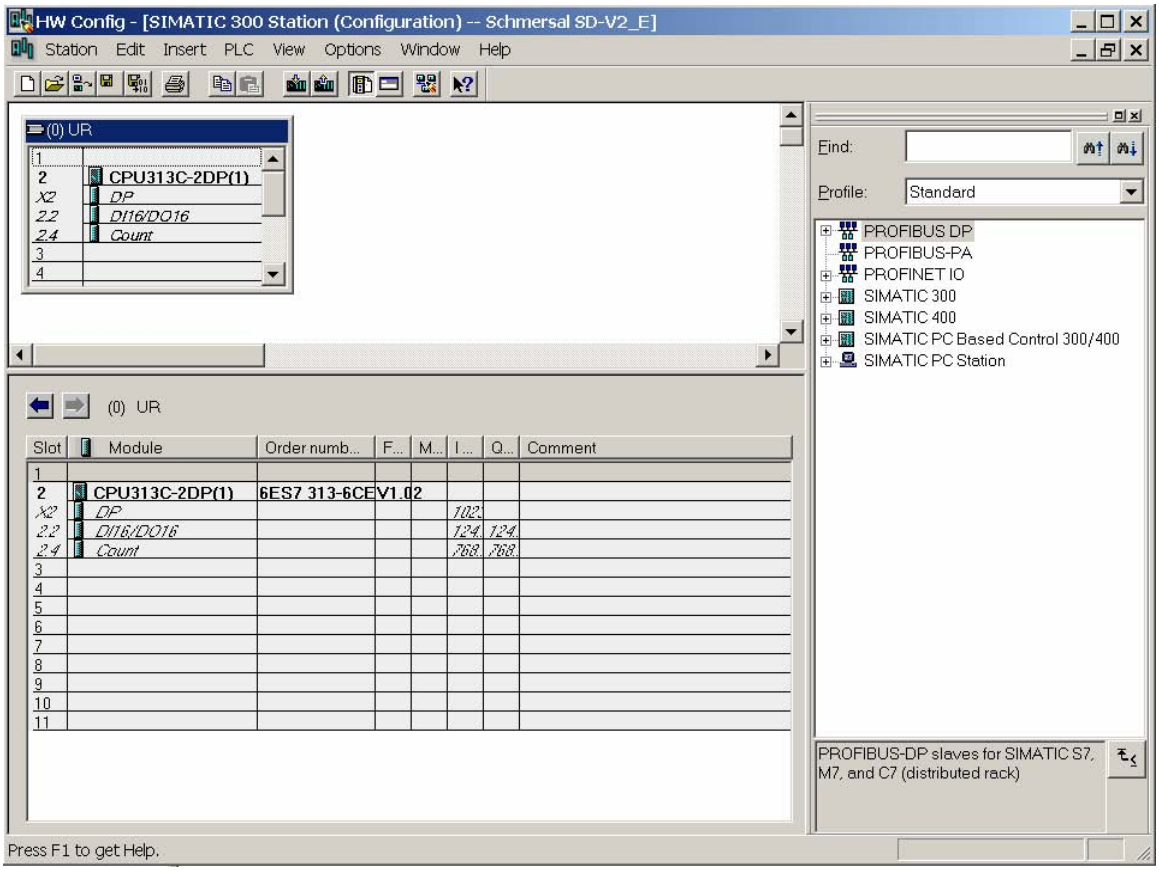


Fig. 4: Window <HW Config>

The PROFIBUS master is configured in the following step.

3. Click on slot X2 (DP) with the right mouse button; the associated menu window is displayed.

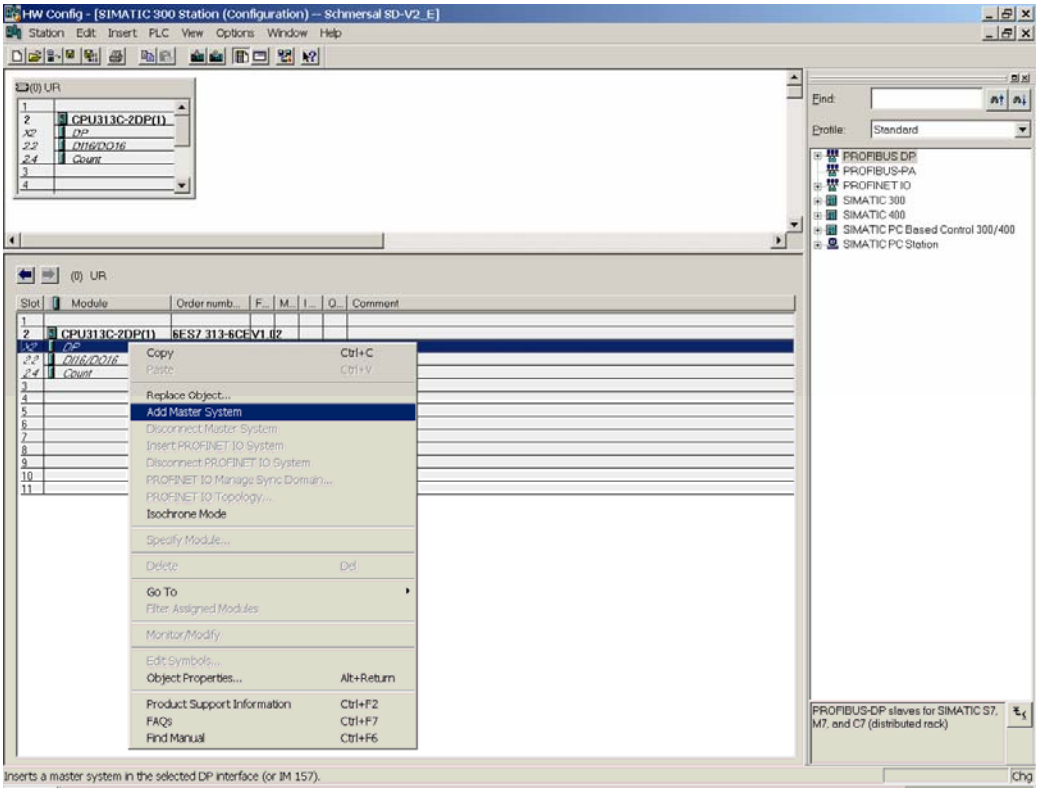


Fig. 5: Window <HW Config - Add master system>

4. Select <Add Master System>; the window "Properties – PROFIBUS Interface DP" is opened.

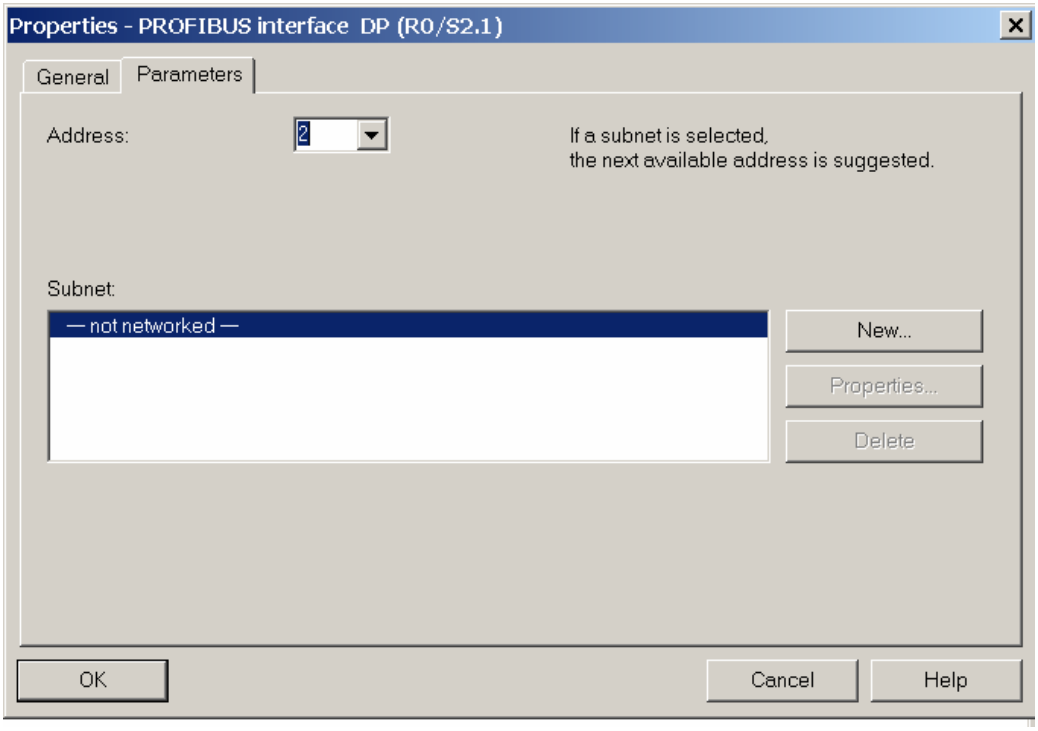


Fig. 6: Window <Properties – PROFIBUS Interface DP>

5. The PROFIBUS address for the master can be entered.

6. The details about the PROFIBUS are displayed with a mouse click on <New...>

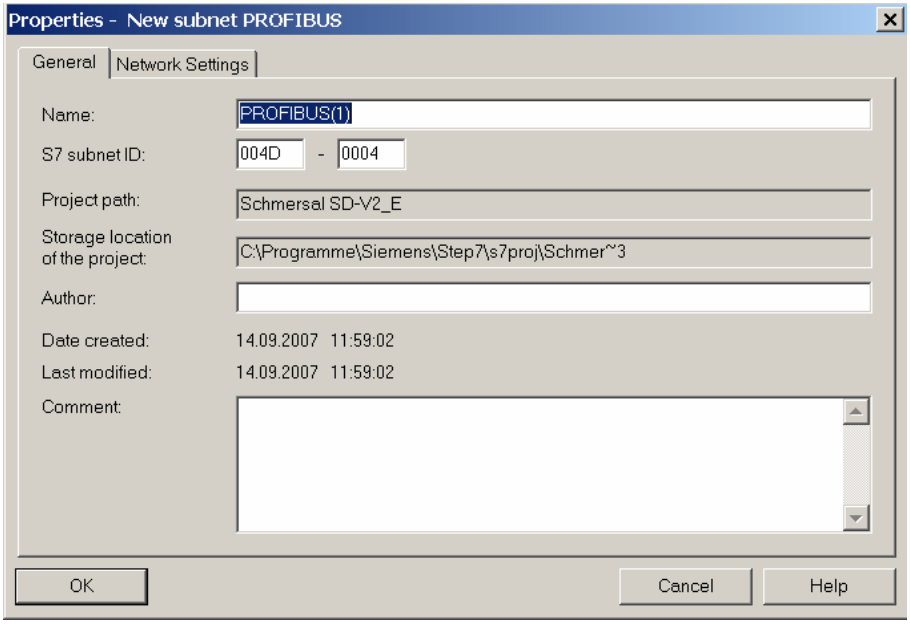


Fig. 7: Window <Properties – New subnet PROFIBUS>

7. The required baud rate can be selected by clicking on <Network Settings>.

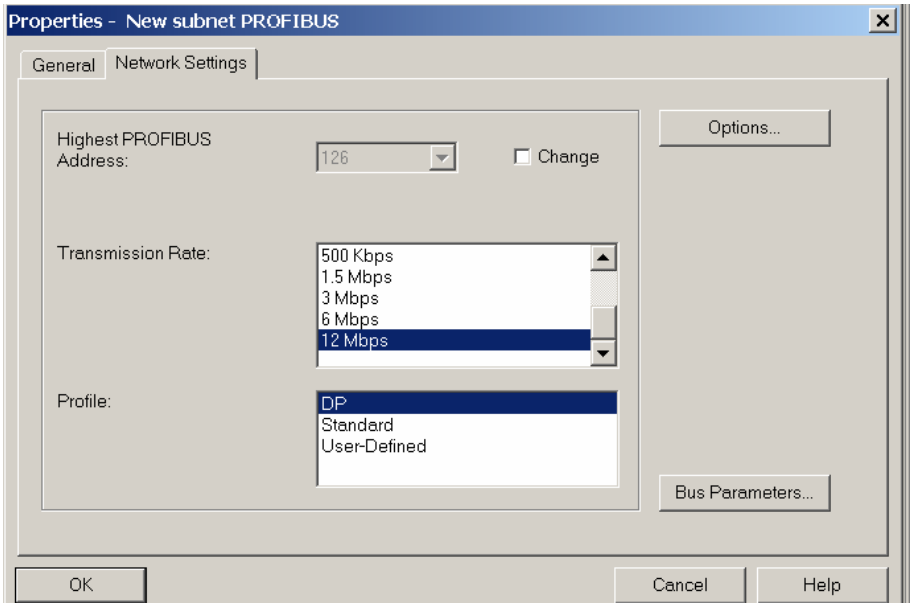


Fig. 8: Window <Setting baud rate and profile>

In this example, 12 Mbit/s is selected; the PROFIBUS system automatically suggests the baud rate of the slowest bus device.

8. The default profile is "DP". Confirm the properties with <OK>.

In the following step, the properties are displayed again.

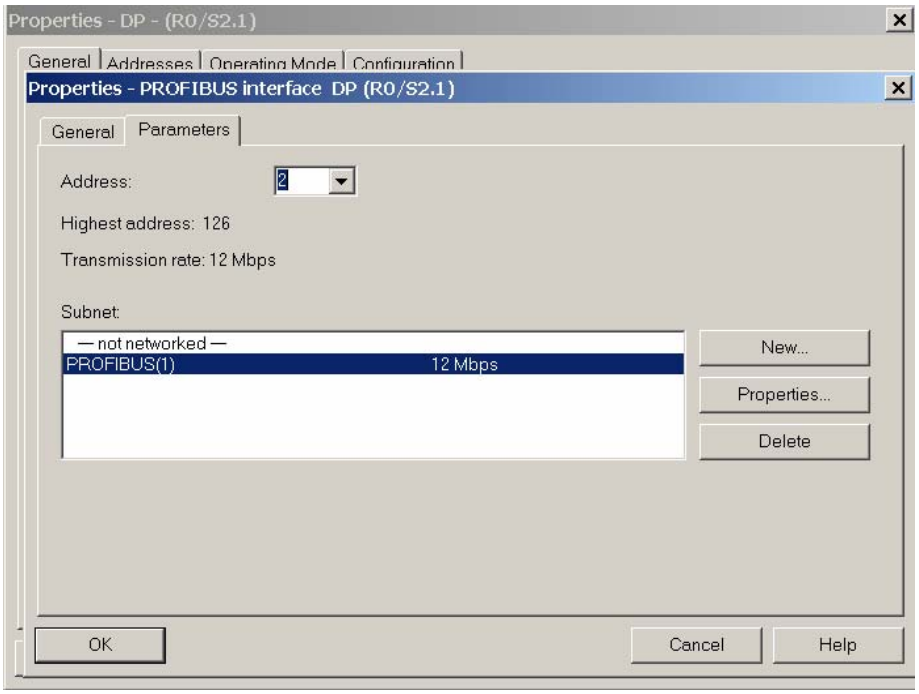


Fig. 9: Window <Confirmation – PROFIBUS Interface DP>

9. Confirm your input with <OK>.

10. When you click <OK>, the mode "HW Config" is displayed again.
    The previously defined PROFIBUS DP master system is now represented with a call-out line at position X2 (DP).

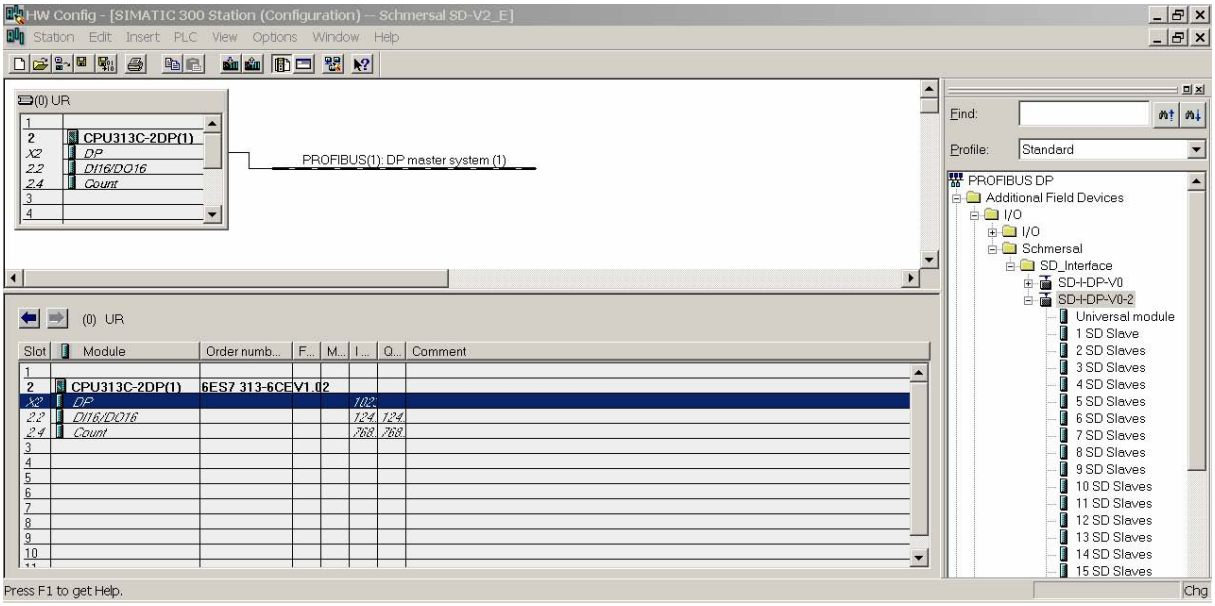


Fig. 10: Window <HW Config with PROFIBUS>

In the following step, the PROFIBUS slave SD-I-DP-V0-2 is assigned to the PROFIBUS system.

11. The gateway SD-I-DP-V0-2 is activated in the right window via the file structure.
    The path is: "PROFIBUS-DP \ Further FIELDDEVICES \ I/O \ Schmersal \ SD_Interface \ SD-I-DP-V0-2".
    The path "SD-I-DP-V0-2" can now be clicked and “dragged & dropped” to the line "DP-Master system (1)" in the left window.

12. The window for the slave interface SD-I-DP-V0-2 is displayed

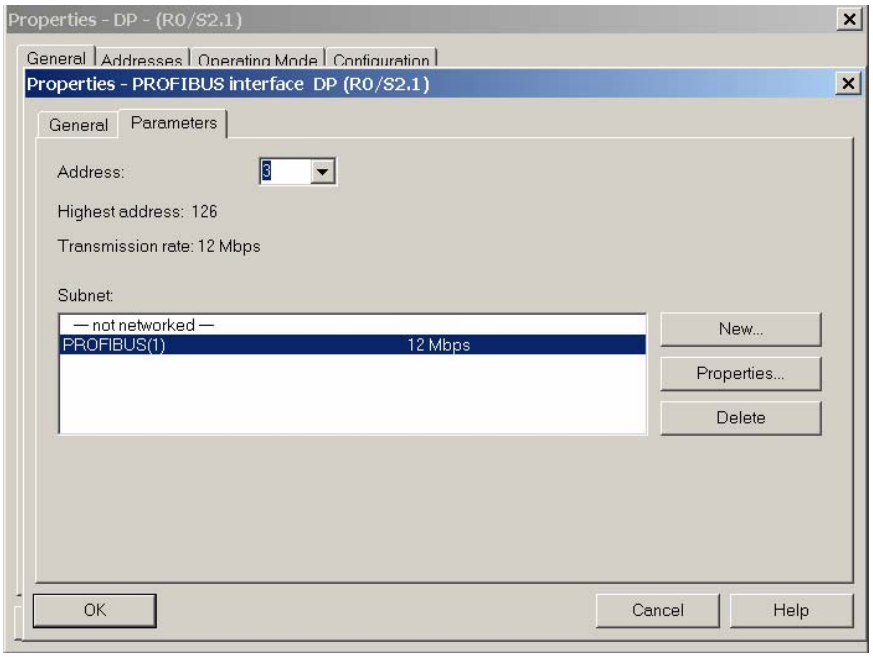


Fig. 11: Window <Properties – PROFIBUS interface slave>

13. The PROFIBUS slave address of the gateway SD-I-DP-V0-2 is entered into the field "Address".
    This is the address, which was set by means of the DIP switch on the device, in this example address 3.
    The address input is confirmed with <OK>.
    Now, the window "HW Config" is displayed again.
    The SD-I-DP-V0-2 slave is now connected to the PROFIBUS line.
    The SD-I-DP-V0-2 configuration however is not yet finished.

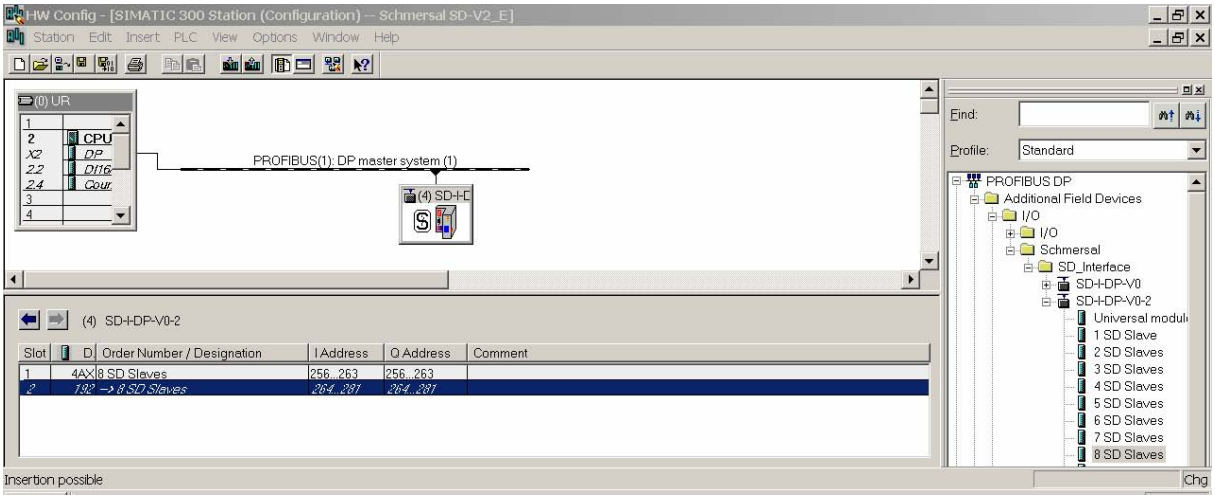


Fig. 12: Window <HW Config – SD module selection>

The number of SD-I-DP-V0-2 sensors / solenoid interlocks serving the gateway must be defined. Their information should be written into the master PLC via the PROFIBUS.

14. To this end, the item "8 SD slaves" (in this example) must be clicked and “dragged & dropped” to slot 1.
    The slot assignment then indicates the address assignment.
    In this example, the data are transmitted from eight connected devices.

15. Upon saving and translation, the entire entry will be checked for errors and the format for transmission to the PLC will be prepared.

16. The configuration of the PROFIBUS gateway SD-I-DP-V0-2 for cyclical data transmission is now finished. The programme can be downloaded in the target system.

4.3 Downloading the programme in the target system

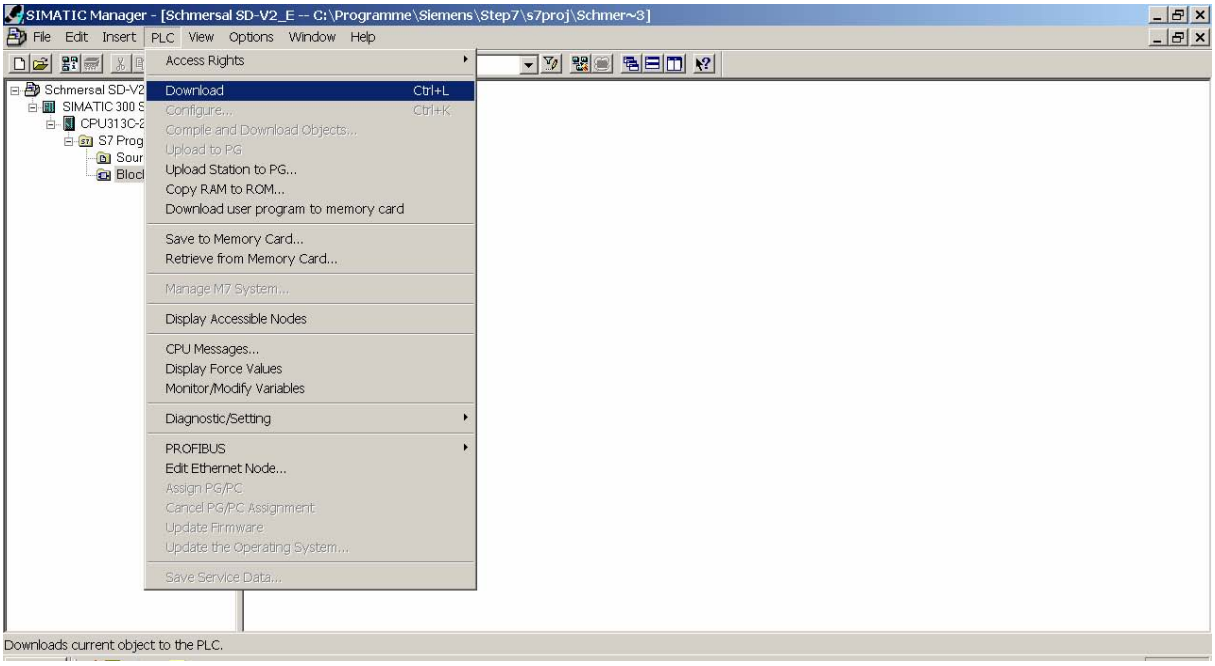


Fig. 13: Window <SIMATIC Manager>

Click the “PLC Download” option in the SIMATIC Manager.
If the CPU already contains blocks, a pop-up window asks whether they should be overwritten. If you choose to do so, old projects might be lost.

Fig. 14: Window <Download>

After downloading the blocks, the programme asks whether the system data must be loaded.
The question should be confirmed with "Yes".
The S7 then starts the data exchange with the addressed slave.

4.4 Short description of the PROFIBUS Data Exchange

The cyclic data traffic of PROFIBUS DP consists of a ***Request*** and the corresponding ***Response***.

The user data in PROFIBUS consist of the PIV data and the PCD data.

PIV data: Parameter – Identification – Value, to read/write the parameter values.
In this application used to read the SD diagnostic data.

The data are available as possible additional alternatives to the PCD data for SIEMENS PLC systems. If necessary, a specific function block from Schmersal is available for the Siemens PLC.

PCD: Process data; to read/write data values
SD control data (request), SD status data & SD diagnostic data (response)

The explanations below describe the details of the PCD data.
The user data of the PIV mode are also available as PCD data.
PCD data can be used hardware-independent.

The number of bytes containing data for the Data Exchange / PROFIBUS is composed in the following manner:
- 4 words (8 bytes) for the PIV data.
- Always 1 word (2 bytes) in the PCD for the SD gateway and for each SD slave.

In the PCD response, the response byte is transferred first, followed by the diagnostic byte of the SD slave concerned.

The total number of bytes in the PCD depends on the number of addressed SD slaves. After the GSD file has been loaded, the number of SD slaves is defined in the configuration software of the PLC.

4.5 Protocol SD data and SD diagnostic data

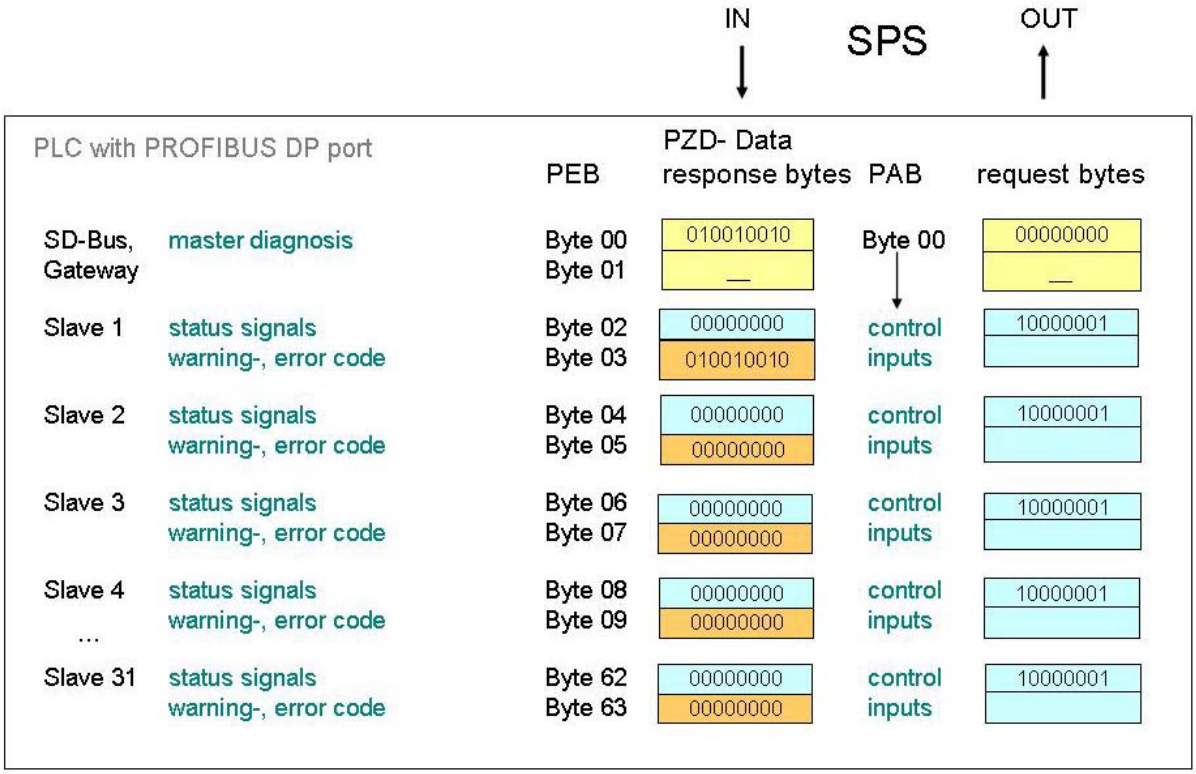


Fig. 15 Schematic representation of the PCD communication data provided in the PROFIBUS Master

Protocol structure in the PCD

PROFIBUS *Request* (OUTPUT PLC, sending the request data to the SD slaves)

Service	**PIV**	**PCD**						
Byte n°	1st-4th word	Byte **00**	Byte **01**	Byte **02**	Byte **03**	...	Byte **62**	Byte **63**
SD component	gateway	gateway	gateway	Slave **01**	Slave **01**	...	Slave **31**	Slave **31**
Content	PKE / IND / PWE	---	---	Request byte	---		Request byte	---

PROFIBUS *Response* (INPUT PLC, receiving the response data from the SD slaves)

Service	**PIV**	**PCD**						
Byte n°	1.-4.Wort	Byte **00**	Byte **01**	Byte **02**	Byte **03**	...	Byte **62**	Byte **63**
SD component	gateway	gateway	gateway	Slave **01**	Slave **01**	...	Slave **31**	Slave **31**
Content	PKE / IND / PWE	Diagnostic byte	---	Response byte	Diagnostic byte		Response byte	Diagnostic byte

The response of every SD slave, which is transferred to the Master, consists of 2 bytes: one byte containing the status information regarding the function and the operating principle of the Slave and another one containing details about error or warning messages from the SD slave concerned.
Bits 6 and 7 of the first response or status byte of an SD slave define whether the bits of the second response byte must be considered as error messages or error warnings.

To this end, SD-Slave 01 writes to the PCD bytes 02 and 03, SD-Slave 02 writes to the PCD bytes 04 and 05, and so on. The data from SD-Slave 31 therefore are contained in the bytes 62 and 63.

The PCD bytes 00 and 01 are reserved as Master Diagnosis for displaying communication errors between the SD slaves and the SD gateway.

Different sensors and solenoid interlocks are suitable for use as SD slave. The requirements and possibilities depend on the component used.
The precise meaning of the individual bits of both SD bytes therefore must be looked up in the mounting instructions of the SD component concerned.

Meaning and function of the individual bits

Request byte of an SD slave

1. Byte of an SD-Slave / PROFIBUS PCD-*Request*

The individual bits of the **response byte** have the following meaning:

	Request byte SD-Slave Output byte PLC
Bit 0	Device-specific, e.g. solenoid interlocks: AZM, MZM “Magnet IN“
Bit 1	---
Bit 2	---
Bit 3	---
Bit 4	---
Bit 5	---
Bit 6	---
Bit 7	Error reset

Response byte of every individual SD slave with status information

Always the 1st byte of an SD-Slave / PROFIBUS PCD-*Response*

The individual bits of the **response byte** have the following meaning:

	Response byte SD-Slave Input byte PLC
Bit 0	Release safety outputs Y1 and Y2
Bit 1	Actuator detected
Bit 2	Device-specific e.g. MZM: “Magnet actuated” AZM: “Locking bolt locked in position“
Bit 3	Device-specific, e.g. CSS 34F: “waiting for release or reset signal“
Bit 4	Voltage on X1 andX2
Bit 5	Device-specific, e.g. CSS 34: “Sensor actuated in limit range“ AZM: “Guard detected”
Bit 6	Active error warning
Bit 7	Active error

Diagnostic byte of an SD-Slave with warning or error messages

2nd byte of an SD-Slave / PROFIBUS PCD-*Response*

Bits 6 and 7 of the first response/status byte define the corresponding diagnostic byte as warning or error message.

Response byte		Content of the diagnostic byte
Bit 7	**Bit 6**	
0	0	---
0	1	Warning message (error warning)
1	0	Error message (error)
1	1	Error message (error)

The individual bits in the **diagnostic byte** of an **SD-Slave** have the following meaning:

Bit	**Error warning**	**Error**
Bit 0	Error output Y1	Error output Y1
Bit 1	Error output Y2	Error output Y2
Bit 2	Cross-wire short outputs	Cross-wire short outputs
Bit 3	SD-Slave temperature too high	SD-Slave temperature too high
Bit 4	---	Target error, coding or target combination
Bit 5	Internal device error	Internal device error
Bit 6	SD communication error	Device-specific meaning, refer to the device's mounting instructions
Bit 7	SD-Slave operating voltage too low	---

Master Diagnosis of the SD gateway to display communication errors between the SD-gateway and the sensors/solenoid interlocks

The Master Diagnosis with byte 00, byte 01 precedes the information from the individual devices.
To this end, byte 00 is available.
The individual bits of byte 00 / **PROFIBUS PCD-*Response*** have the following meaning.

	Error	**Description**	**SD** Red	**T** Yellow
Bit 0	Failure SD-Interface	Common failure message, message delayed, data no longer valid	ON	See below
Bit 1			-	-
Bit 2	---		-	-
Bit 3	---		-	-
Bit 4	SD initialisation error	New initialisation of the SD chain required, the operating voltage of the gateway and the SD slaves must be switched off once. Possibly, no SD-Slave is connected	ON	ON
Bit 5	SD-teach error	The structure of the SD chain has changed after Power On, if OK, push “TEACH“.	ON	Flash
Bit 6	SD short circuit	Short circuit on the SD-Interface cables	ON	-
Bit 7	SD communication error	One or more SD-Slave cannot be reached. Data of the SD-Slave no longer valid.	ON	-

4.6 Exemplary PLC programme
Reading the diagnostic data from an SD-Slave

Below, an exemplary PLC programme for the BYTE-oriented processing of the diagnostic data is represented.

The response byte and the diagnostic byte of SD-Slave 01 previously were moved from the periphery address range of the PLC to flag bytes.

- MB101 Response byte SD-Slave 01
- M101.6 Status bit active error warning
- M101.7 Status bit active error
- MB181 Diagnostic byte SD-Slave 01
- E124.0 etc. Clearing conditions for diagnostic data
- MB201 Buffer errors for evaluation
- MB231 Buffer error warnings for evaluation

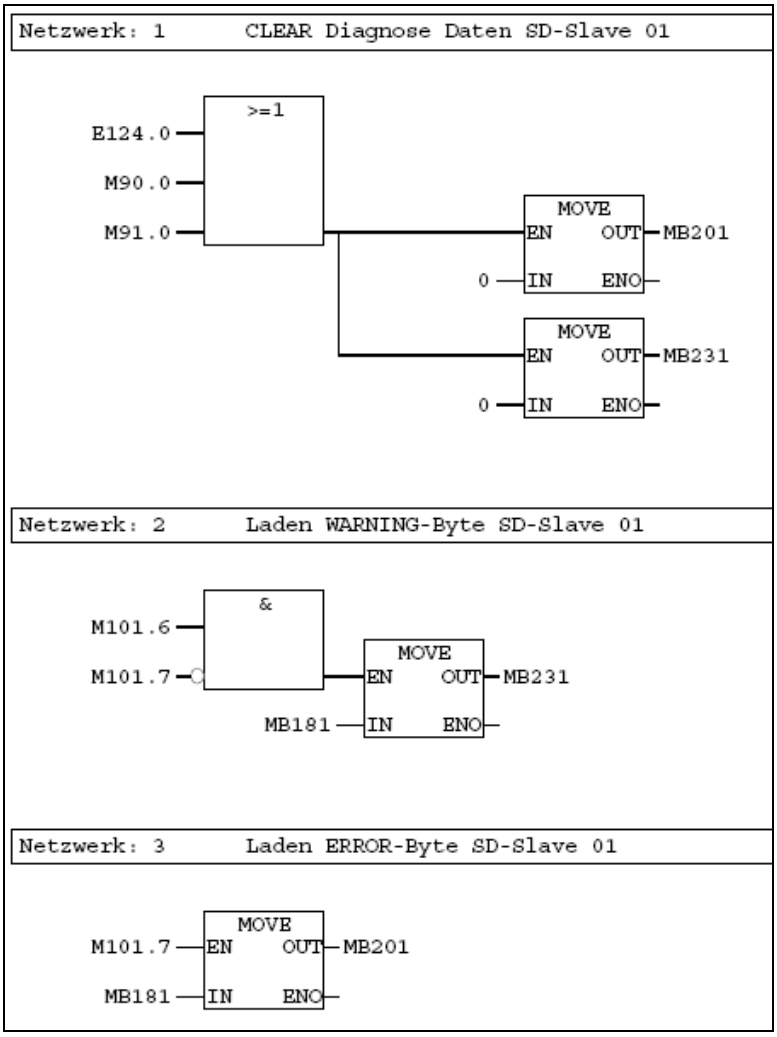


Fig. 16 Exemplary PCL programme to read out the status/diagnostic data of an SD-Slave

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