

Polytron 7000FB Installation Manual

PROFIBUS PA



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1 Scope

1.1 Purpose of Document

This document is a supplement of the installation manual with PROFIBUS PA specific items.

- This document ...

1.2 Applicable Documents

This document should be read in conjunction with the following documents:

<i>Ref. Title</i>	<i>File name</i>	<i>Version</i>
[1]		
[2]		
[3]		
[4]		
[5]		

Table 1-1 : Applicable Documents

2 Application Guide SIMATIC STEP 7

2.1 Necessary equipment

You need following equipment to use SIMATIC Manager with STEP 7:

- PROFIBUS PA instrument (DUT)
- PROFIBUS interface (e.g. CP5611 or CP5612)
- SIMATIC S7-300 (e.g. CPU315-2DP)
- DP/PA-coupler (e.g. Pepperl+Fuchs KFD2-BR-Ex1.PA)
- SIMATIC Step 7 ver. 5.2 (SP1) or higher
- PC or laptop

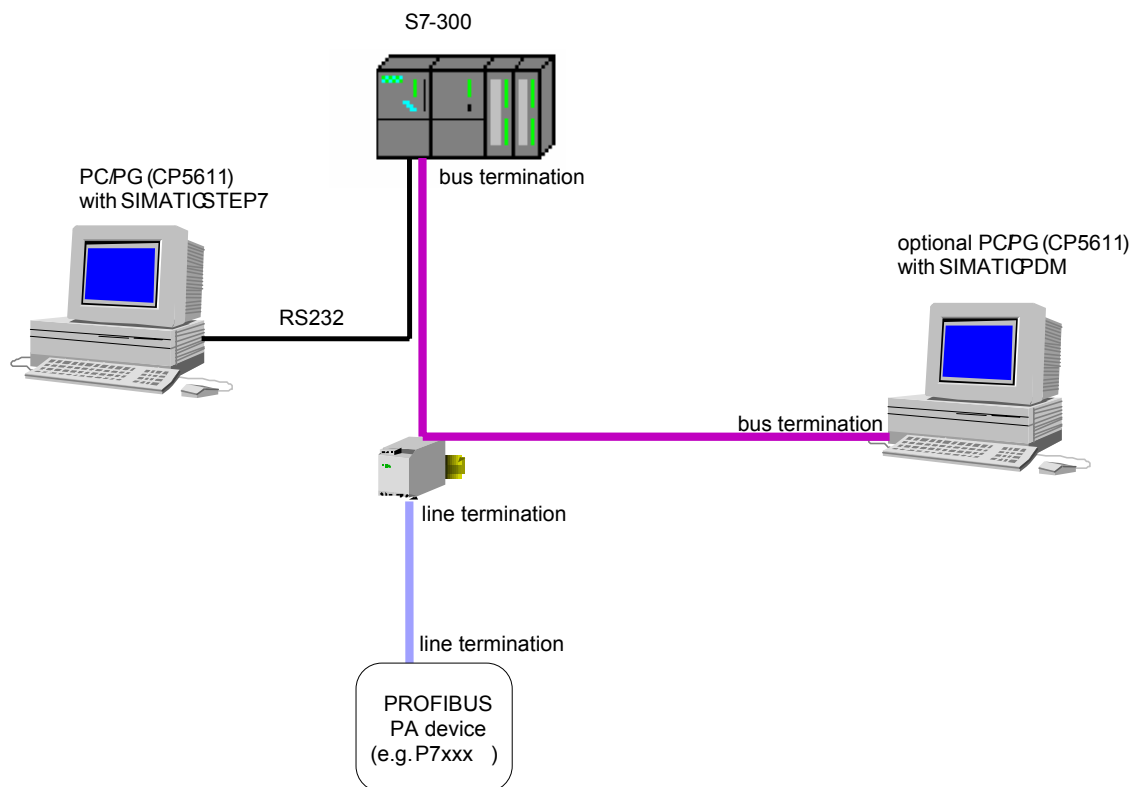


Figure 1: HW structure DP/PA

While every effort was made to verify the following information, no warranty of accuracy or usability is expressed or implied.

2.2 Overview

SIMATIC S7 is a Siemens PLC. It is used with the software STEP 7. Tools for configuration, diagnosis and commission are integrated in STEP 7. The SIMATIC S7-300 family offers the automation solutions for the lower and middle performance range. Extensive diagnostic possibilities with help from STEP 7. Error message buffer with time stamp and module diagnostic help the user during error searching. The PROFIBUS serves as a connection from field devices such as distributed I/O or drives with automation systems like SIMATIC S7. The PROFIBUS is a performance capable, assembly and open field bus system. It enacts over quick reaction times, an open interface and is applicable in different protocol variants.

The PROFIBUS-PA is the inherently safe type of the PROFIBUS, specified for data transmission in explosive fields (i.e. chemical industry).

An extensive product pallet for the protocol variants is available for the connection to the PROFIBUS. The configuration and programming takes place over the software STEP 7, where extensive diagnostic possibilities are available to the user.

2.3 Set the PROFIBUS DP interface card

You can use the PROFIBUS interface cards CP5611 for desktop computers or CP5511/CP5512 for laptop computers (PCM/CIA). After installing the card in the computer open the SIMATIC manager and click options. Choose “Set PG/PC Interface” and highlight CP5611, 5511 or 5512 (MPI).

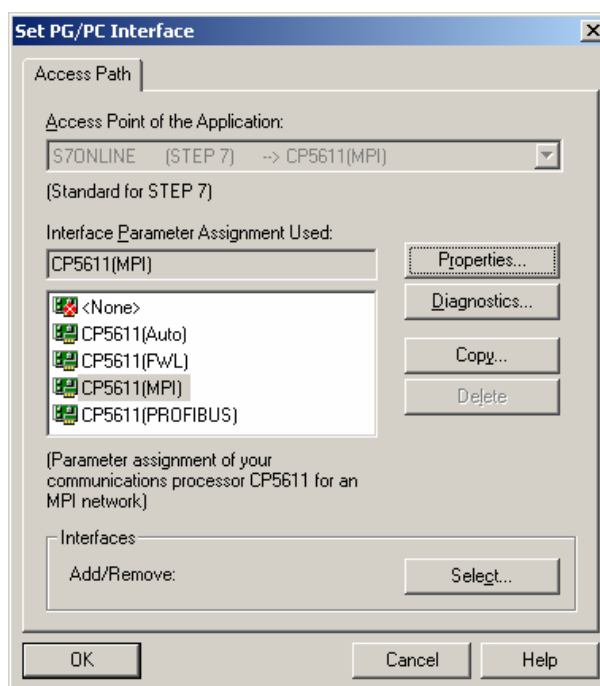


Figure 2: Set PG/PC Interface

2.4 Integration GSD-File in SIMATIC S7

In the HW Config view you can import a new GSD-File. The GSD-File will be checked before it build in the HW catalogue of STEP 7.

If you not have created a project before, you must do this first, before you can install a new GSD-file or overwrite an existing. Otherwise change in an existing project to the “HW Config window” and proceed with figure 5.

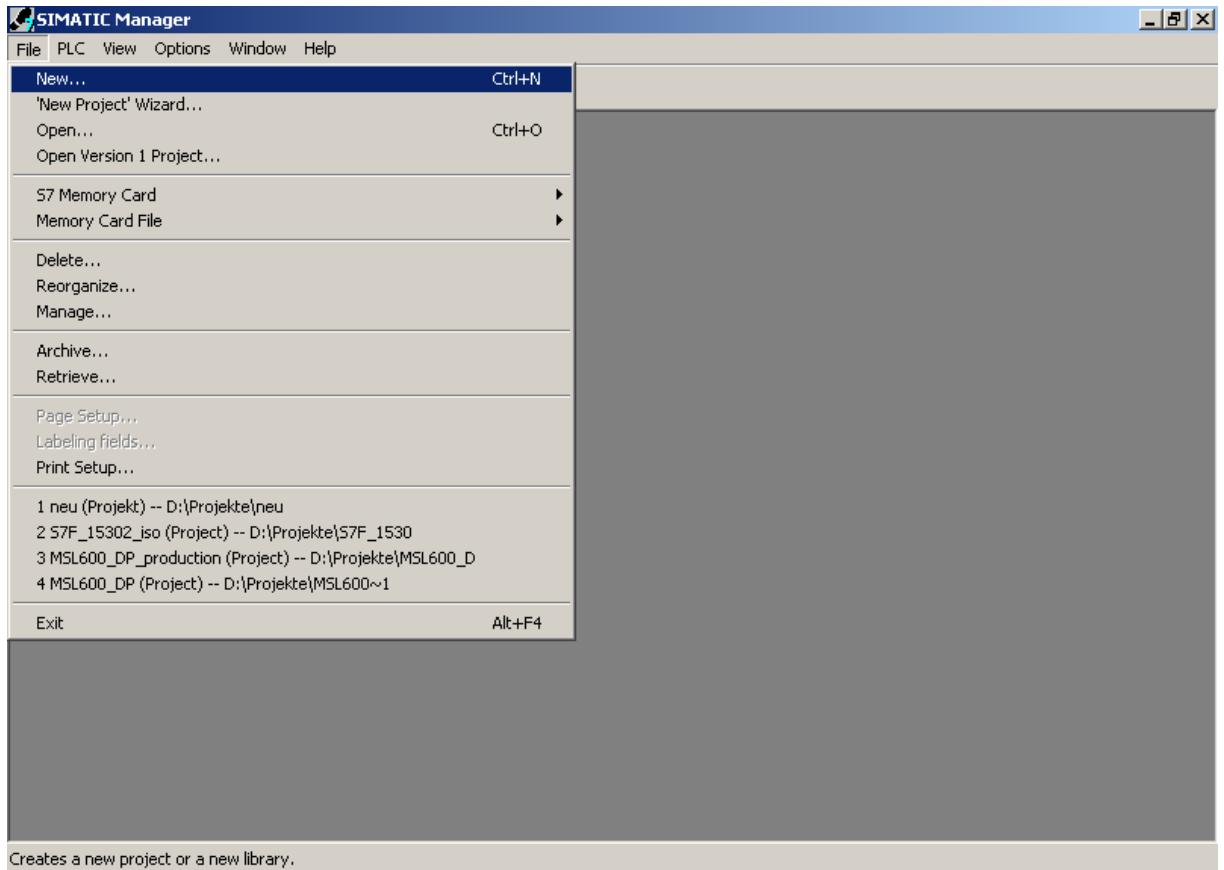


Figure 3: Create a new project

Click “File” → “New...” to create a new project (you must choose a project name, e.g. “new”) and choose your SIMATIC station with “Insert” → “Station”.

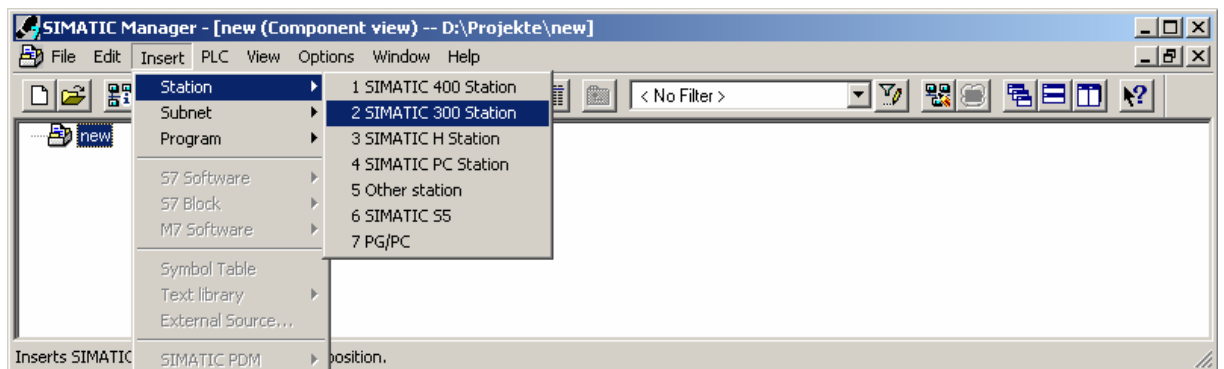


Figure 4: insert SIMATIC station

Switch in the “HW Config view” by clicking the “SIMATIC 300(1)” and double-click at Hardware.

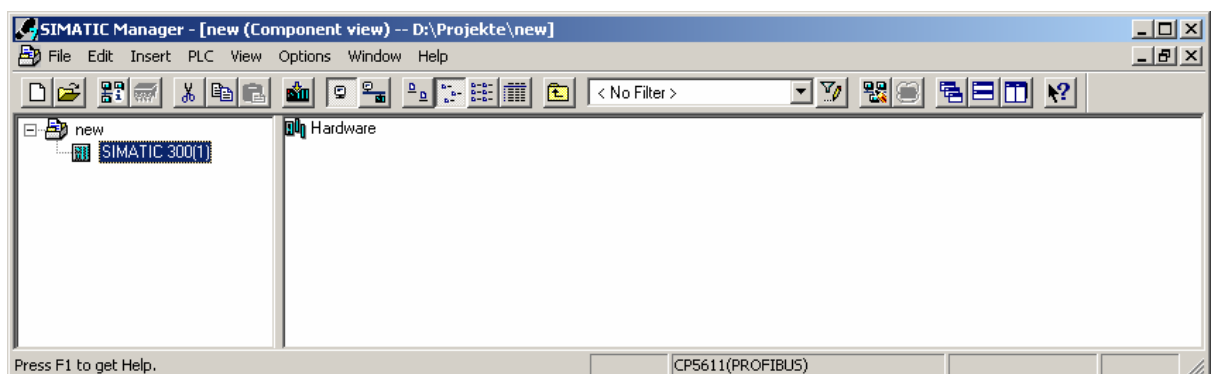


Figure 5: SIMATIC manager [new...]

Now you must close the window SIMATIC 300(1) (Configuration) – window to insert a GSD.

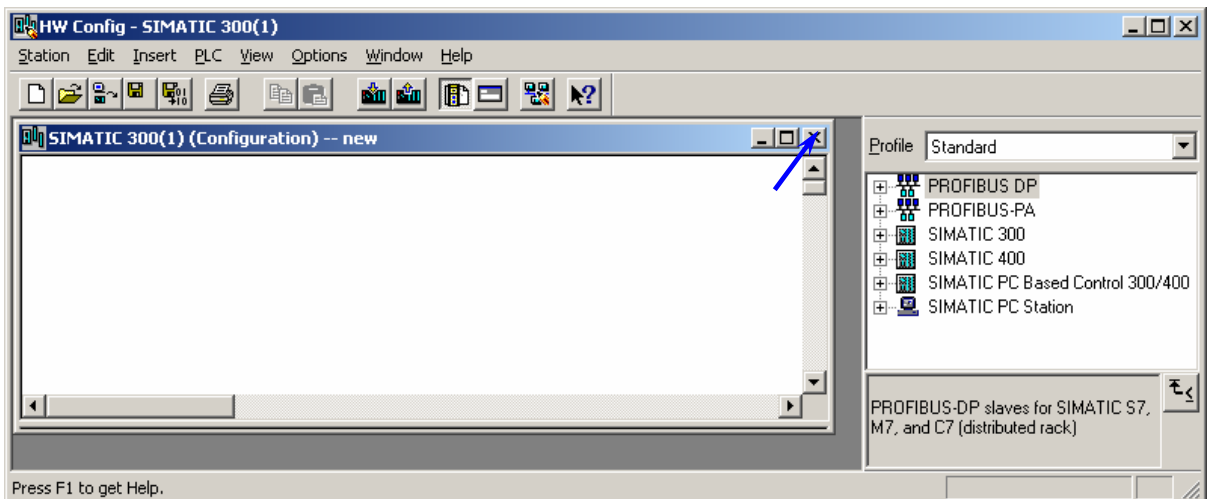


Figure 6: HW Config – SIMATIC 300

Click “Options” → “Install New GSD...”, choose the GSD-file you want to install.

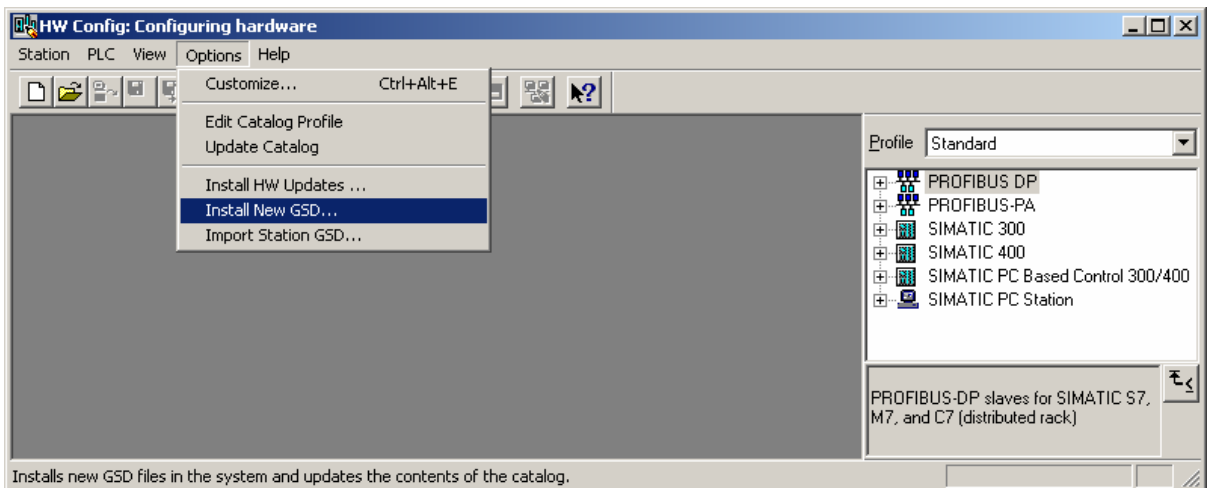


Figure 7: Install New GSD

You can install the manufacturer specific gsd with Ident number 0x0A96 or the standard PA gsd (with ID-number 0x9750).

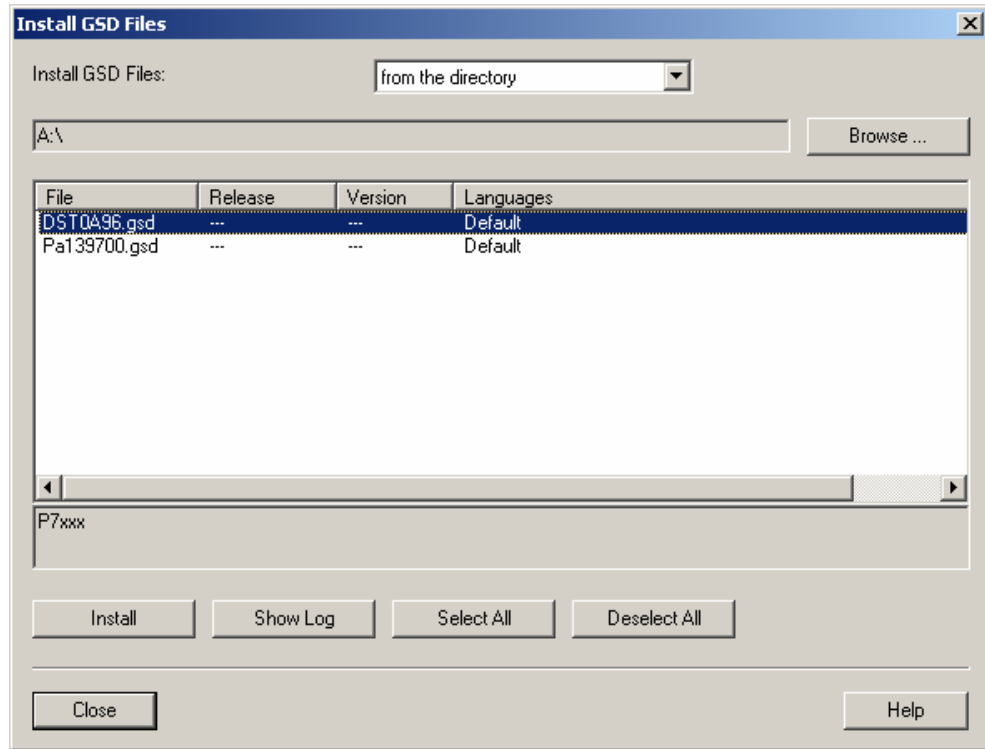


Figure 8: Example for file “DST0A96.gsd”

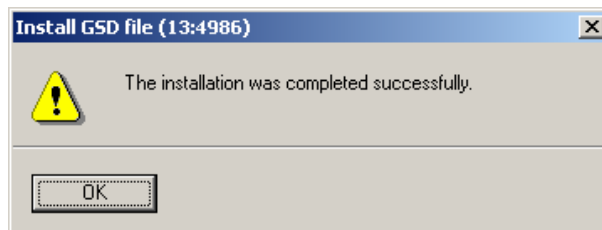


Figure 9: Message after successful installation

After this you find the device in the HW catalogue depending on the GSD-settings.

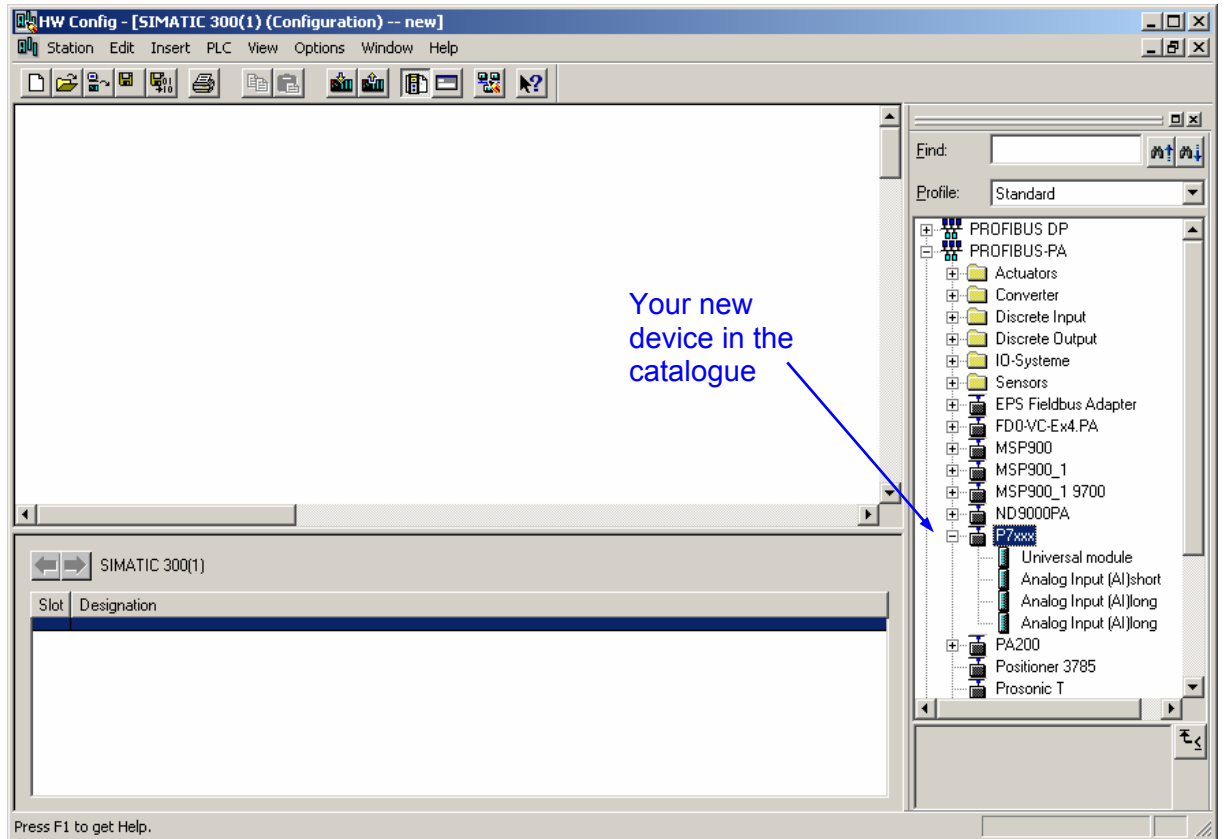


Figure 10: HW Config – HW catalogue

2.5 Create a new project with STEP 7

To create a new Step 7 project from the SIMATIC Manager window, use the wizard “New Project” which will guide you through the necessary steps. Click “Next” to create your project step-by-step.

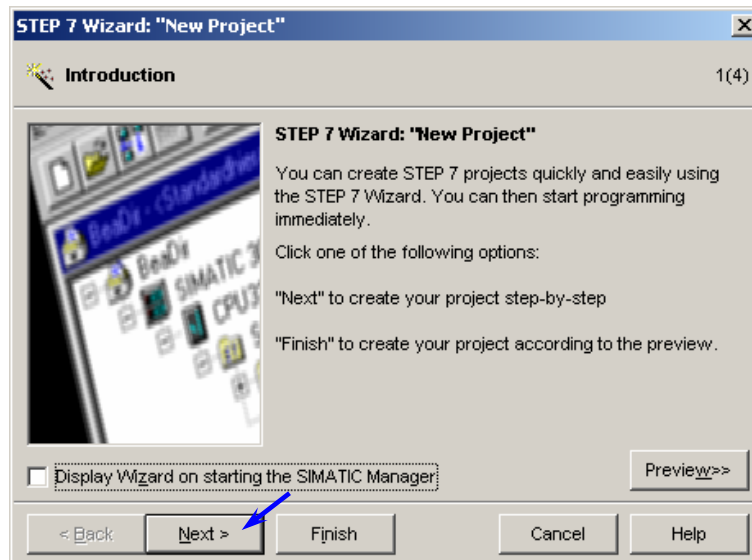


Figure 11: STEP 7 wizard “New Project”

First choose the CPU you are using

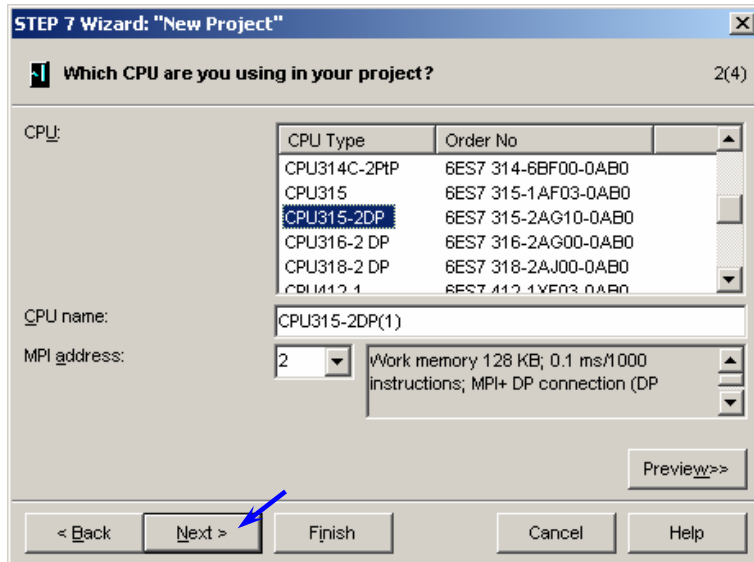


Figure 12: STEP 7 wizard "New Project" – CPU

Next add the blocks you need (for the first tests and cyclic data exchange the OB1 and OB82 is adequate).

If a module with diagnostic capability for which you have enabled the diagnostic interrupt detects an error, it outputs a request for a diagnostic interrupt to the CPU (when entering and outgoing event). The operating system then calls the OB82.

If OB82 has not been programmed, the CPU changes to the STOP mode. It depends on the PLC program if there are further OB are necessary. Please refer to the „Online Help“ of your Step 7 for more information how to use the S7-OB.

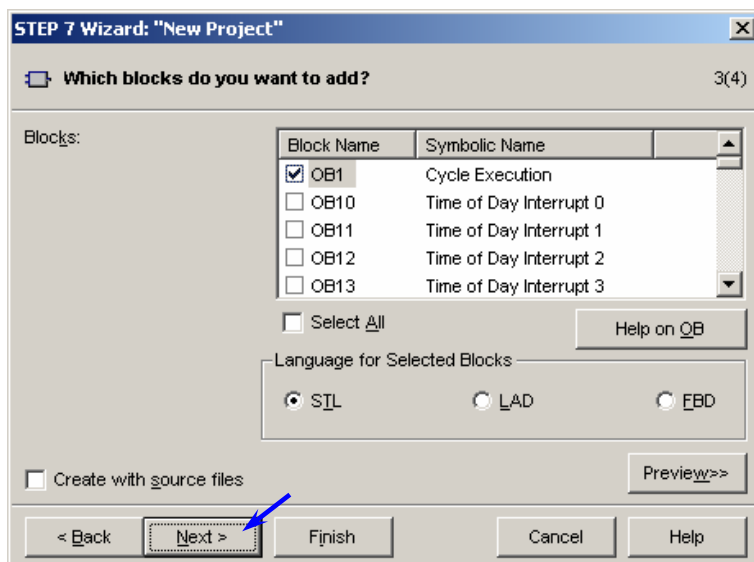


Figure 13: STEP 7 wizard "New Project" – blocks

Click next and you can give your new project a name (for example Draeger-P7xxx)

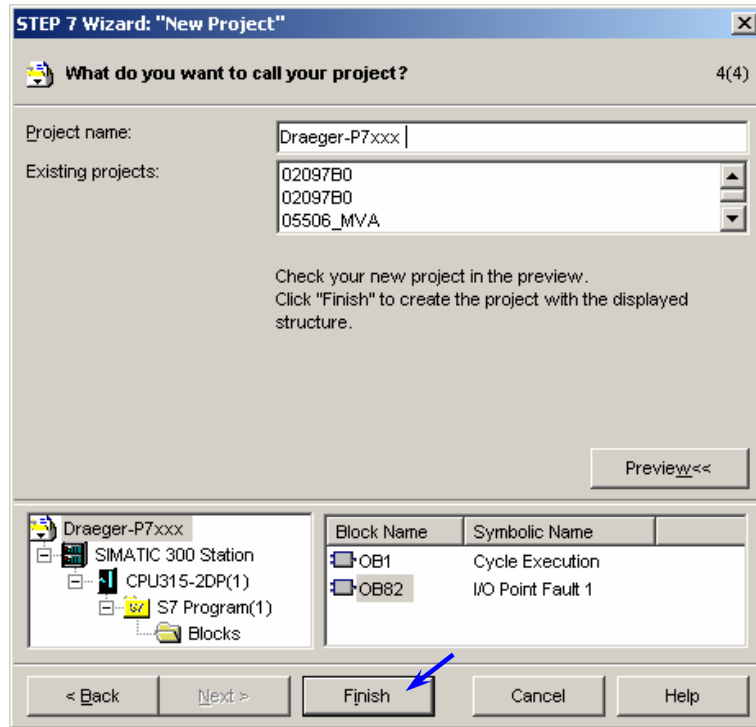


Figure 14: STEP 7 wizard "New Project" – project name

Click Finish to save your new project. Next switch from the SIMATIC Manager component view to the "HW Config" view, by double click to "Hardware".

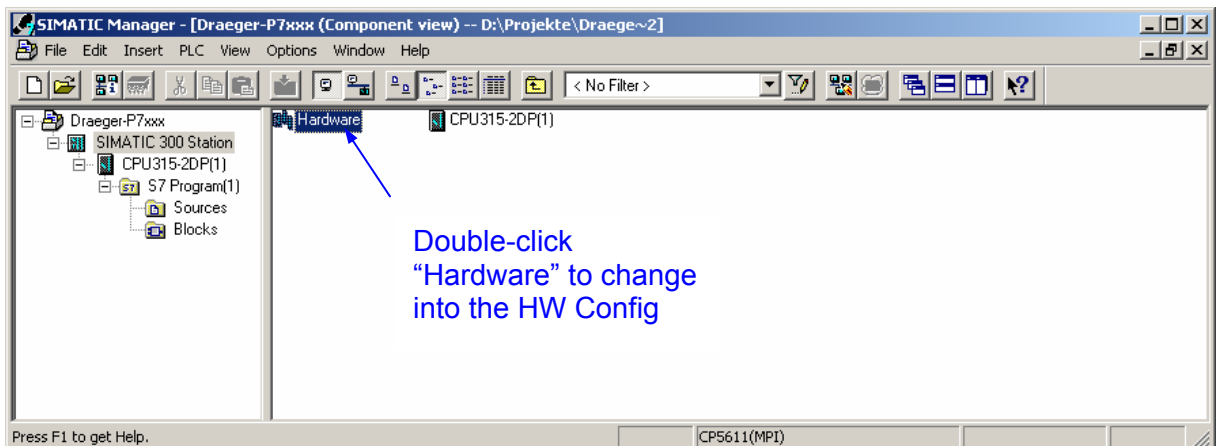


Figure 15: SIMATIC manager – Component View

You can insert a power supply in Slot1 of the configuration table by double click on line 1 and choosing the correct supply (e.g. PS 307 4A).

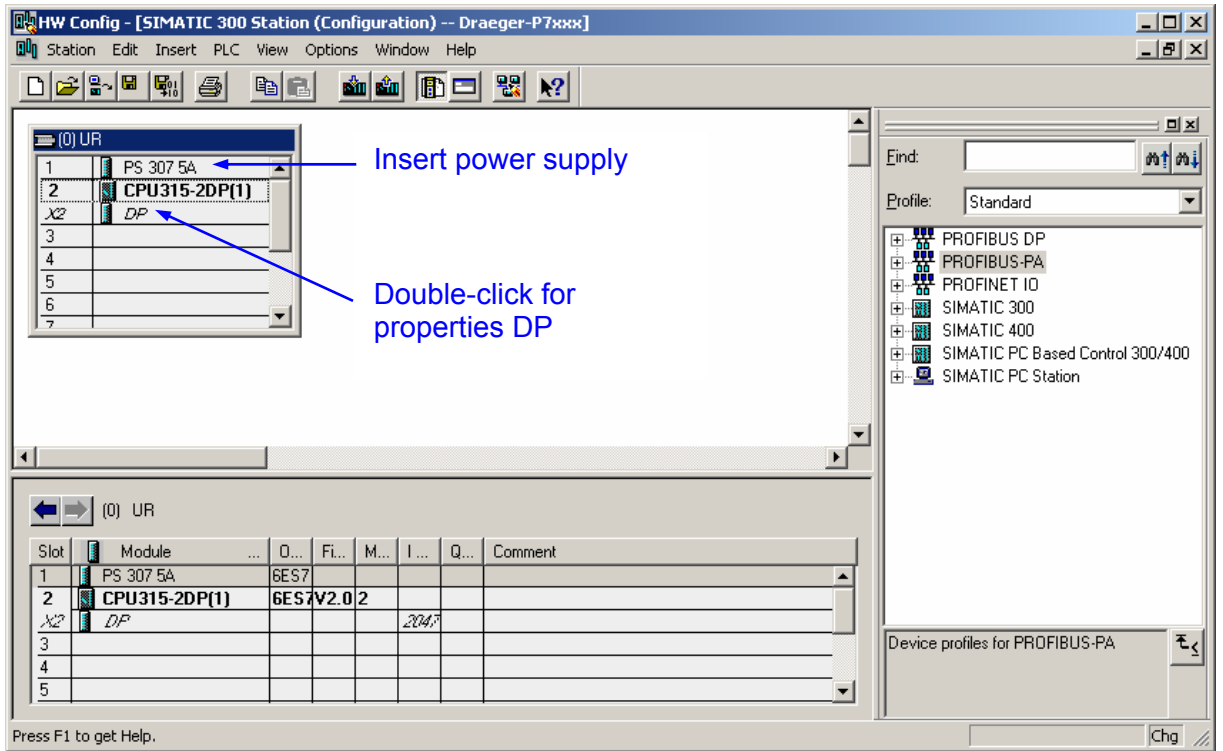


Figure 16: HW Config

After this double-click on line X2 to choose your PROFIBUS line

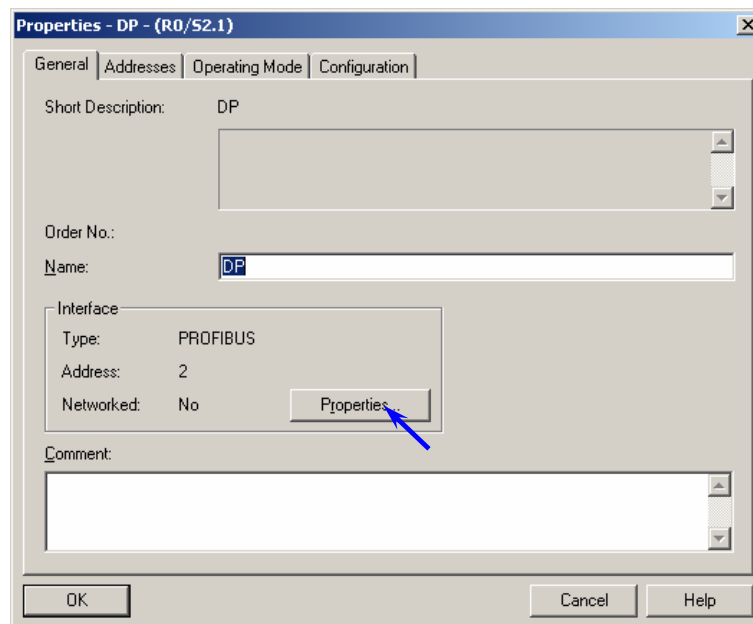


Figure 17: Properties – DP

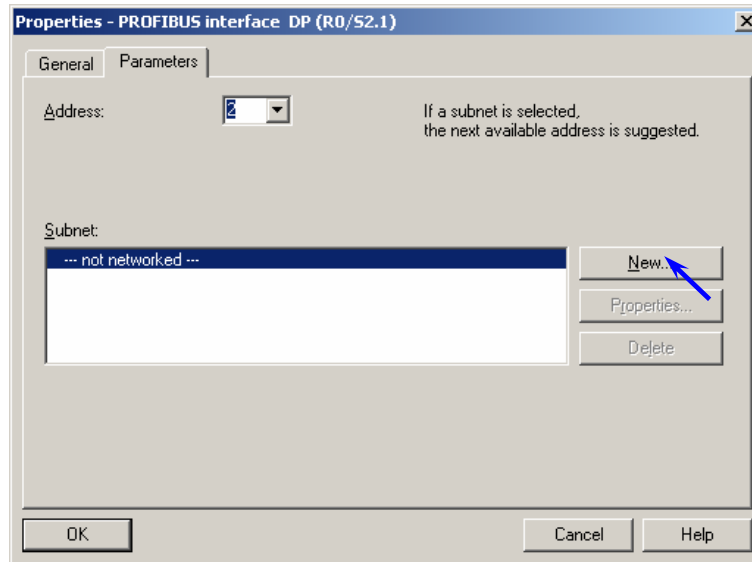


Figure 18: Properties – PROFIBUS interface DP

and click “New...”

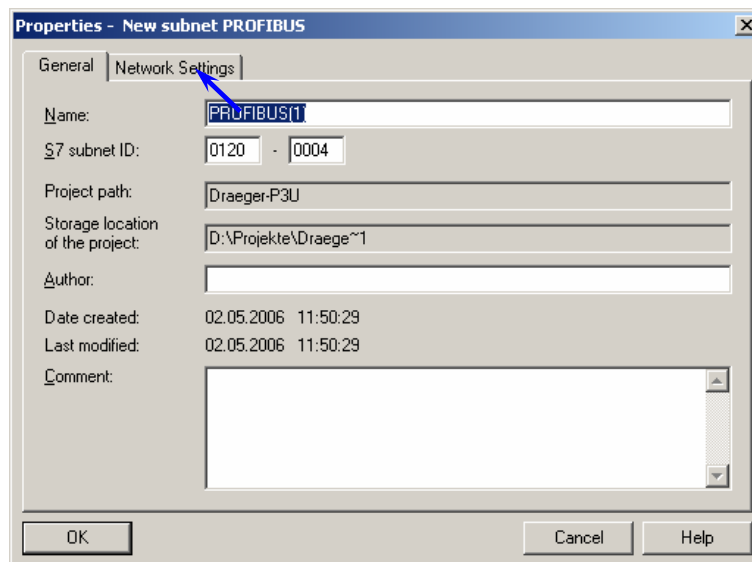


Figure 19: Properties – New subnet PROFIBUS

Change the following adjustments if you use a Pepperl+Fuchs segment coupler. For this click “Properties”

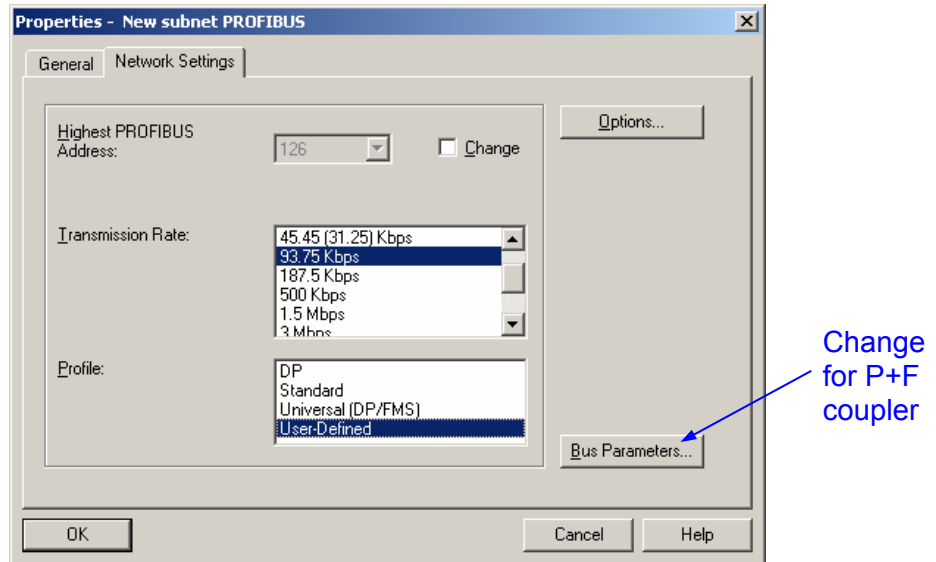


Figure 20: Properties – New subnet PROFIBUS (for P+F coupler)

Pay attention to change the bus parameters only if you use a Pepperl+Fuchs segment coupler as follows.

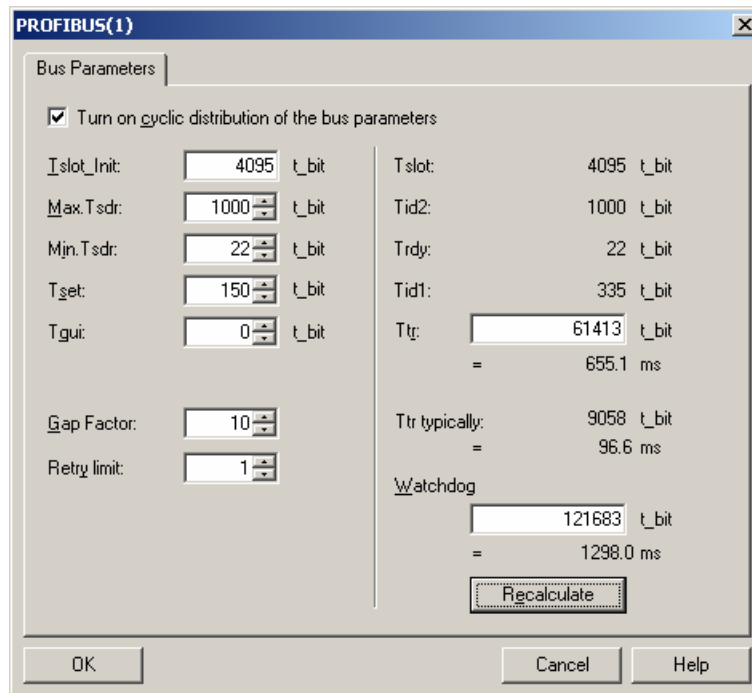


Figure 21: PROFIBUS – bus parameters Pepperl+Fuchs segment coupler

If you use a Siemens segment coupler choose a Transmission rate of 45,45 Kbps and the Profile DP.

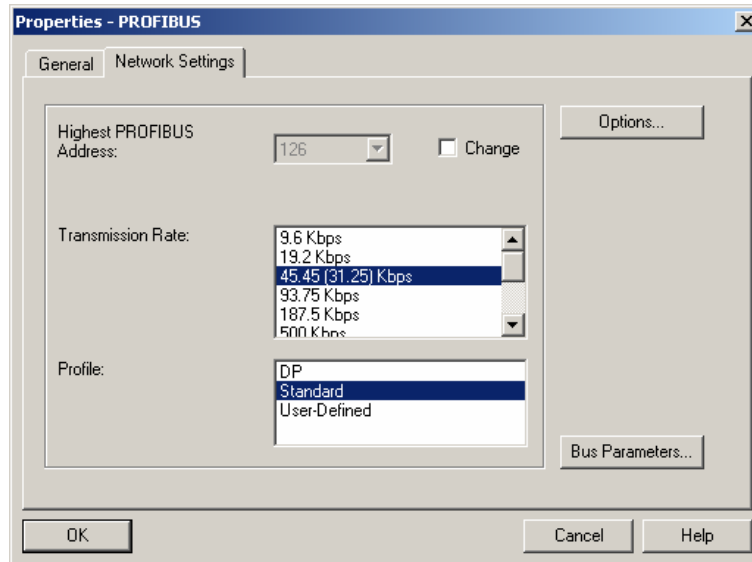


Figure 22: Properties – New subnet PROFIBUS (for Siemens coupler)

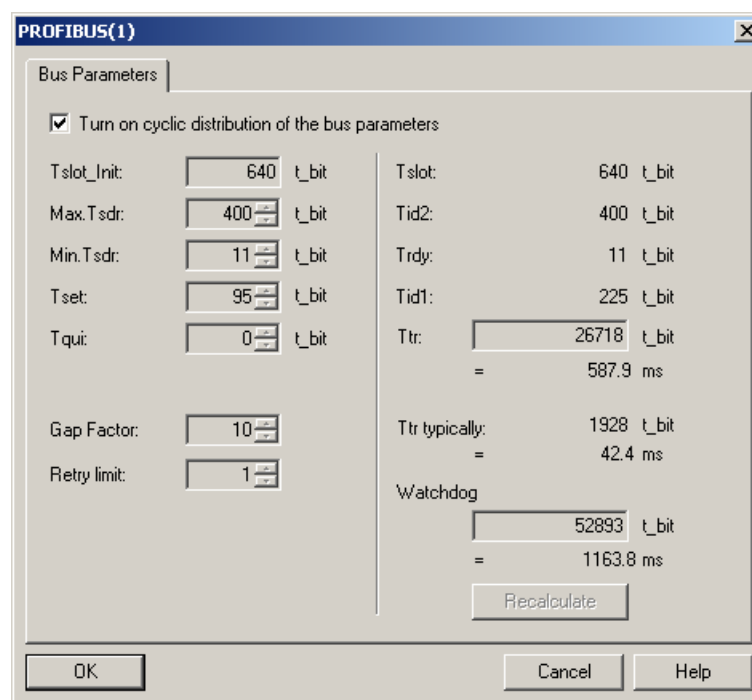


Figure 23: PROFIBUS – bus parameters Siemens segment coupler

After you finished these adjustments you can insert the slave. Therefore choose your slave (Draeger P7xxx) from the catalogue at the right side of the HW Config window and drop it to the DP master system (Step 1.) and 2.) of the following figure). Change the slave address in the value you adjust in the slave (e.g. slave address 3). Now choose your module (for example Analogue Input (AI) short) and drop it in Slot 1 of the Slave (step 3.) of the following figure). After this save and compile the HW configuration.

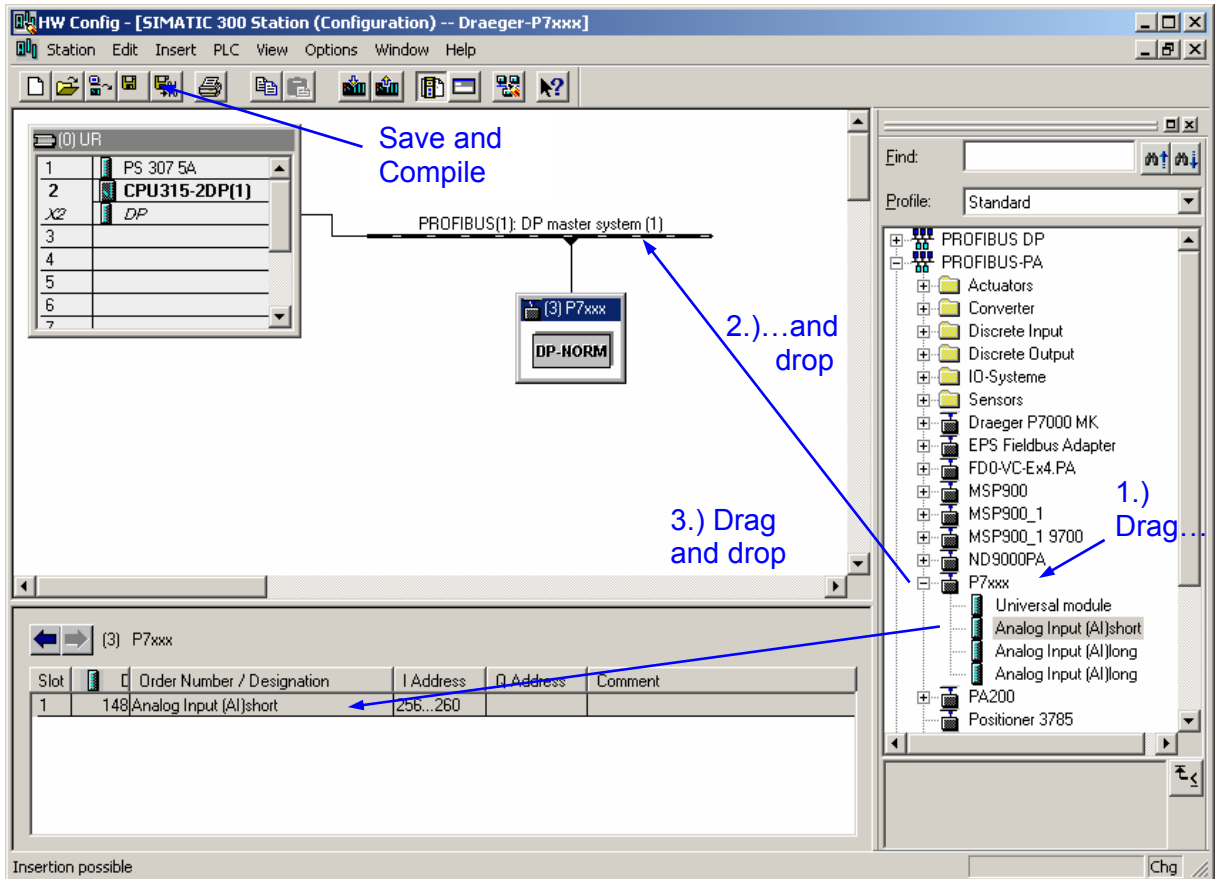


Figure 24: HW Config – save and translate

Now close the HW Config View and download the project to the PLC

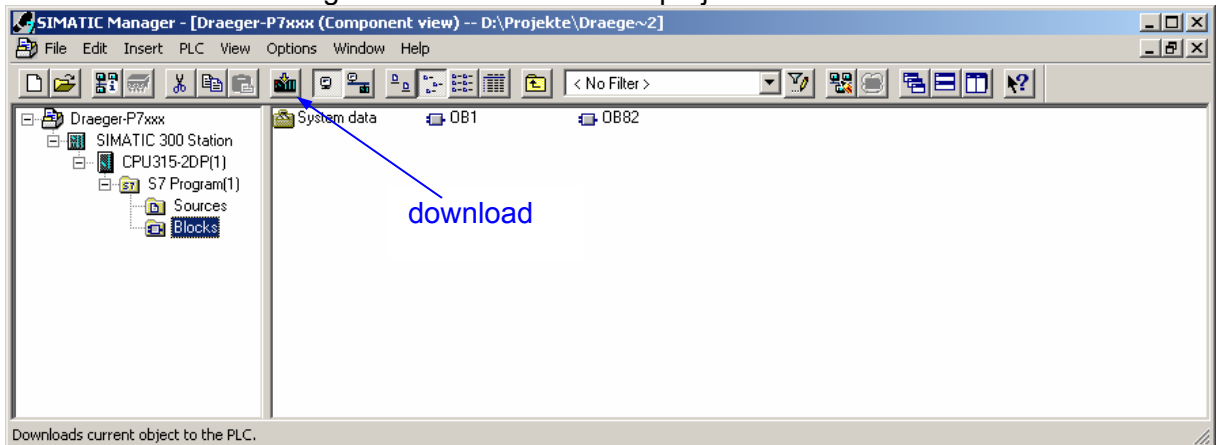


Figure 25: SIMATIC Manager - download

After following all commands in the windows, now your System (PLC- Slave) is in data exchange. (Conditions: Slave Address must be “3” and Ident-Number Selector to manufacturer specified). If the device is not in data exchange please check and change the slave address and the PROFIBUS ident number of the device.
 If the PLC is in Mode “Stop”, you can start the PLC over “PLC-Diagnostics/Setting-Operating Mode...”.

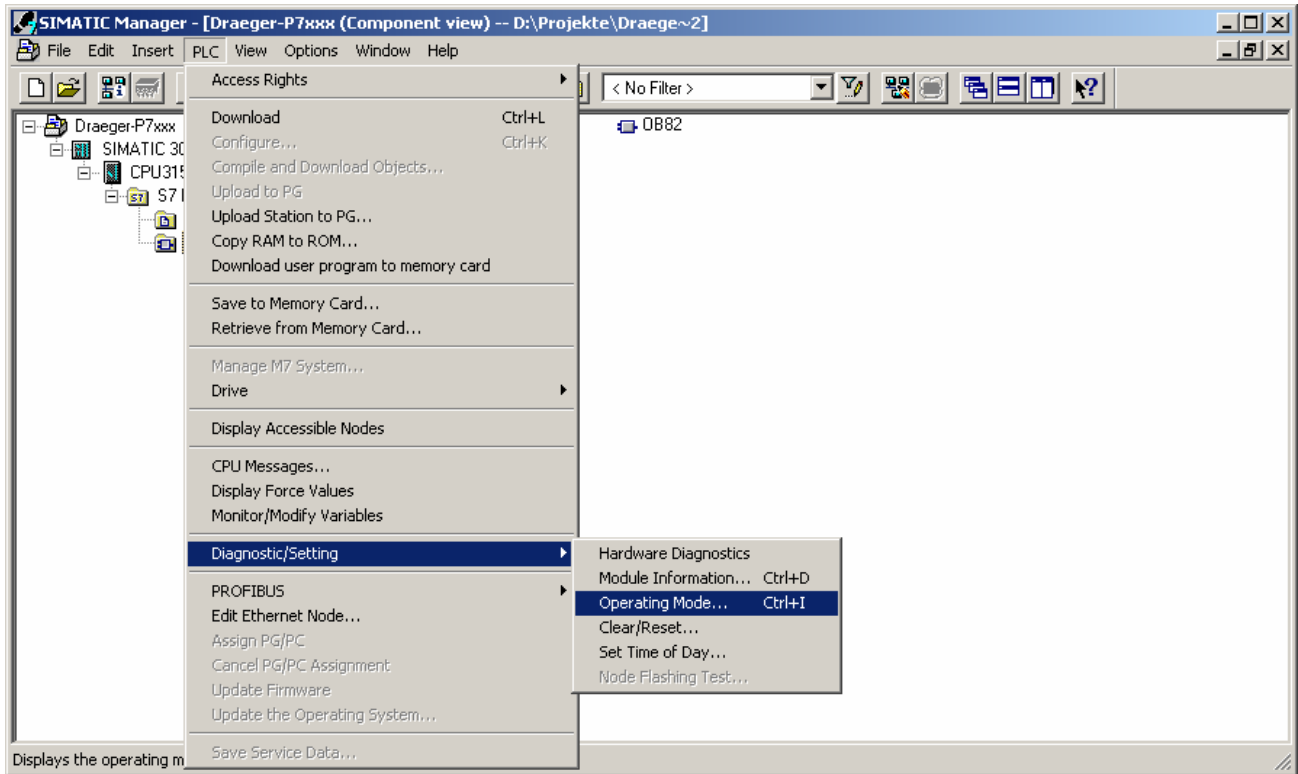


Figure 26: SIMATIC Manager - Operating Mode

Click “Warm Restart” to restart the CPU315.

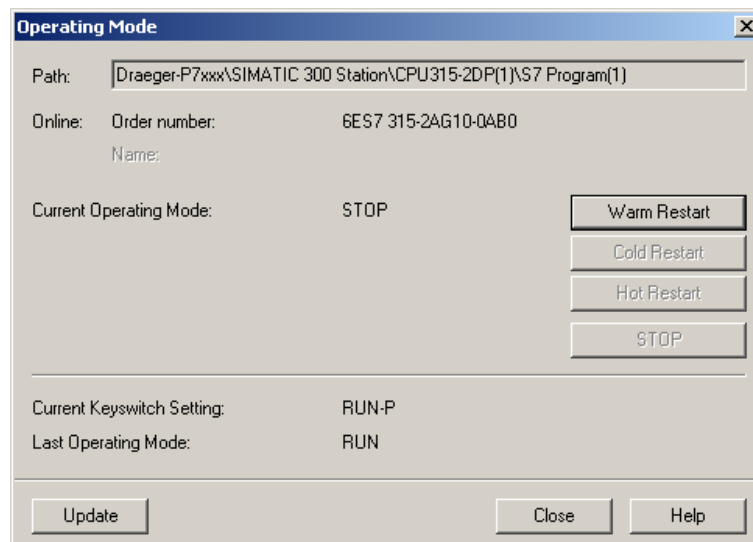


Figure 27: Operating Mode - STOP

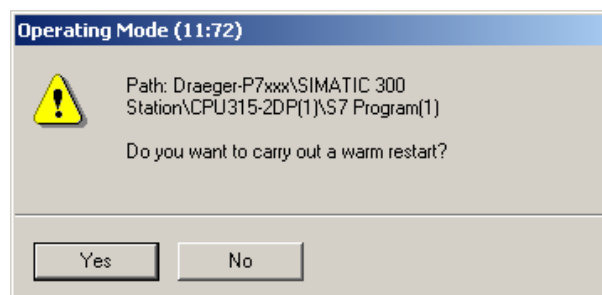


Figure 28: Operating Mode – Warm Restart

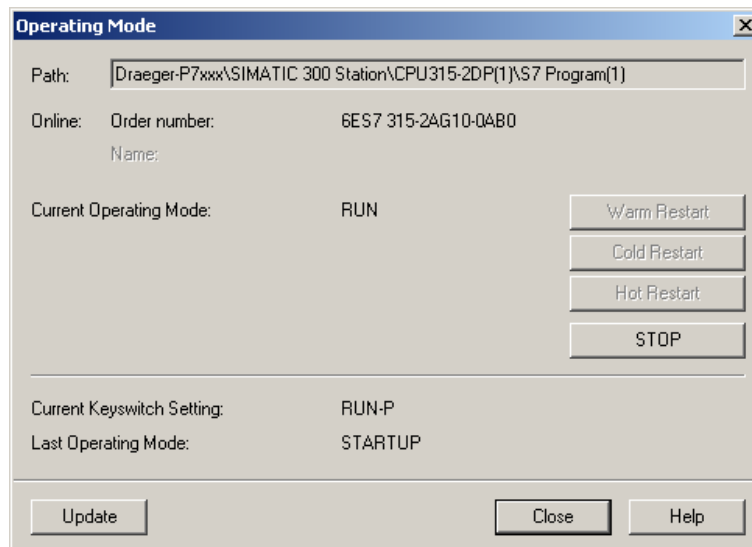


Figure 29: Operating Mode - RUN

3 Application Guide SIMATIC PDM

3.1 Necessary equipment

You need following equipment to use PDM:

- PROFIBUS PA instrument (P7xxx)
- PROFIBUS interface (e.g. CP5611 or CP5612)
- SIMATIC S7-300 (e.g. CPU315-2DP)
- DP/PA coupler (to connect your PA-device)
- SIMATIC PDM ver. 5.2 (SP1) or higher
- PC or laptop

While every effort was made to verify the following information, no warranty of accuracy or usability is expressed or implied.

3.2 Overview

SIMATIC PDM (Process Device Manager) is a Siemens configuration software to set up different PROFIBUS PA devices. All parameters are accessed through SIMATIC PDM and it also provides diagnostic information.

It is possible to connect a PROFIBUS PA network using a DP/PA-coupler (transparent network gateway) or a DP/PA-link (modular network gateway) to a PROFIBUS DP network. The simplest solution is using a coupler; therefore this guide describes this solution.

You need the latest version of the Device Description (DD) of the P7xxx PROFIBUS PA. In the following chapters the setting up of SIMATIC PDM and a PROFIBUS network will be discussed.

3.3 Set the PROFIBUS DP interface card

You can use the PROFIBUS interface cards CP5611 for desktop computers or CP5511/CP5512 for laptop computers (PCM/CIA). After installing the card in the computer open the SIMATIC manager and click options. Choose "Set PG/PC Interface" and highlight CP5611, CP5511 or CP5512 (MPI) and click Properties.

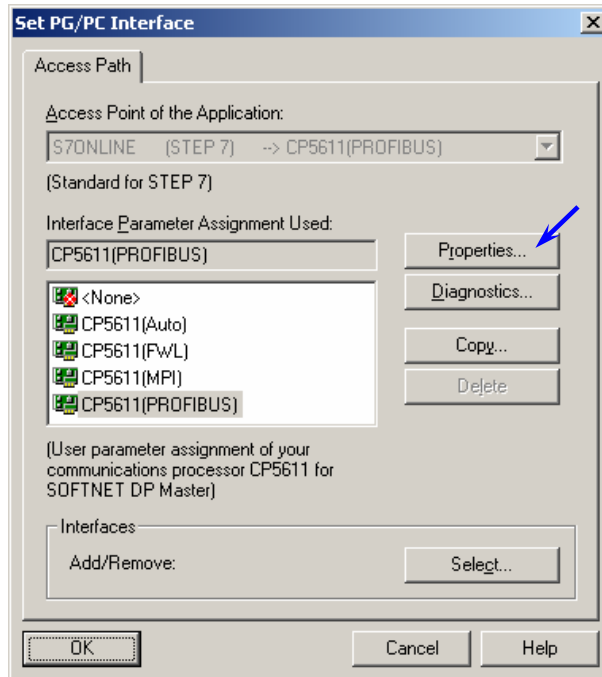


Figure 30: Set PG/PC Interface

If you use a Siemens DP/PA-coupler click to profile “DP” and set the “Transmission Rate” to 45,45 kbps

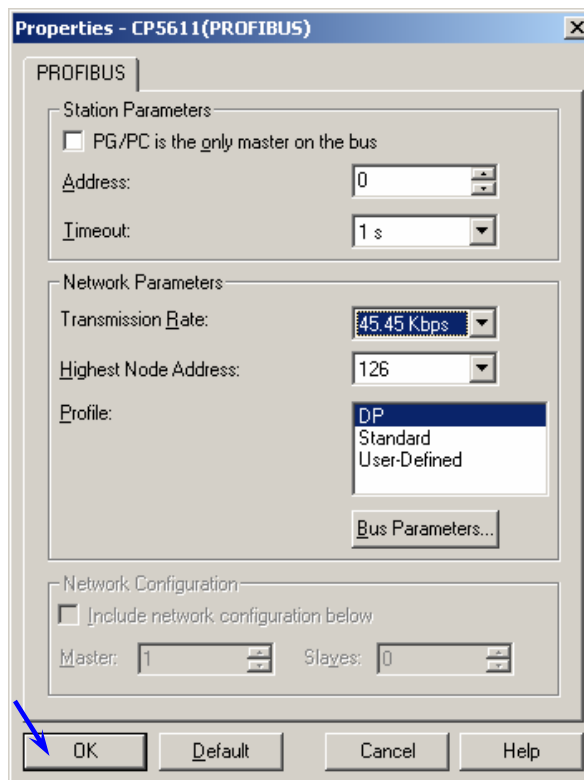


Figure 31: properties SIEMENS coupler

If you use a Pepperl+Fuchs segment coupler choose “User-Defined” and a “Transmission Rate” of 93,75 kbps.

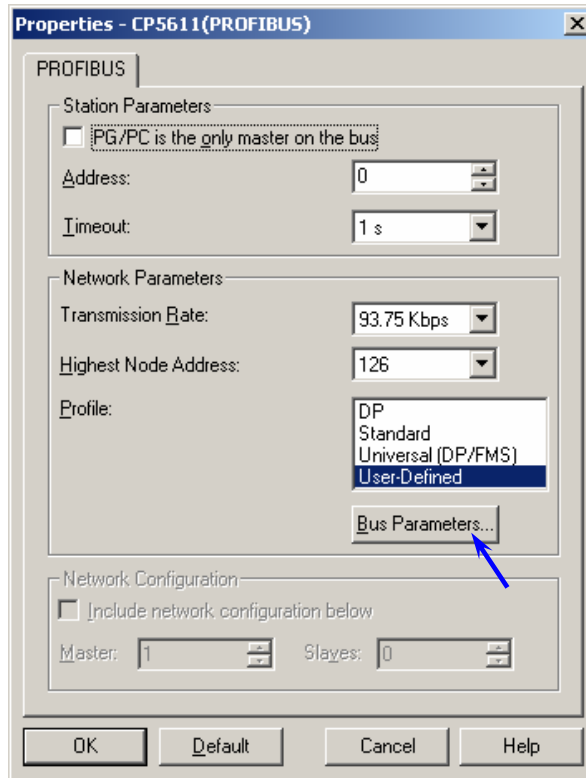


Figure 32: properties P+F coupler

In this case you must change the bus parameters to the values of the following picture.

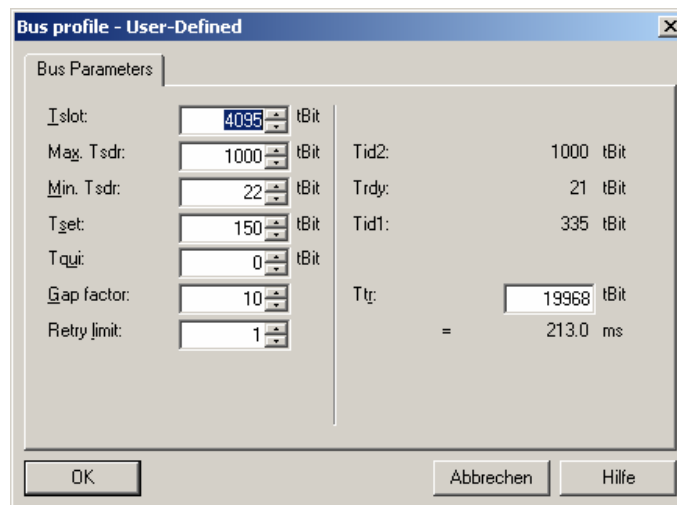


Figure 33: bus parameters P+F coupler

3.4 Update the Device Description

In general SIMATIC PDM is shipped with the DD's that were available when the software was last released. You should make sure that your DD matches the revision number of the actual P7xxx. We recommend updating to the latest DD as described below.

Unzip the file PDM.zip . Run the SIMATIC manager and start the Manage Device Catalog under the Menu Options→SIMATIC PDM.

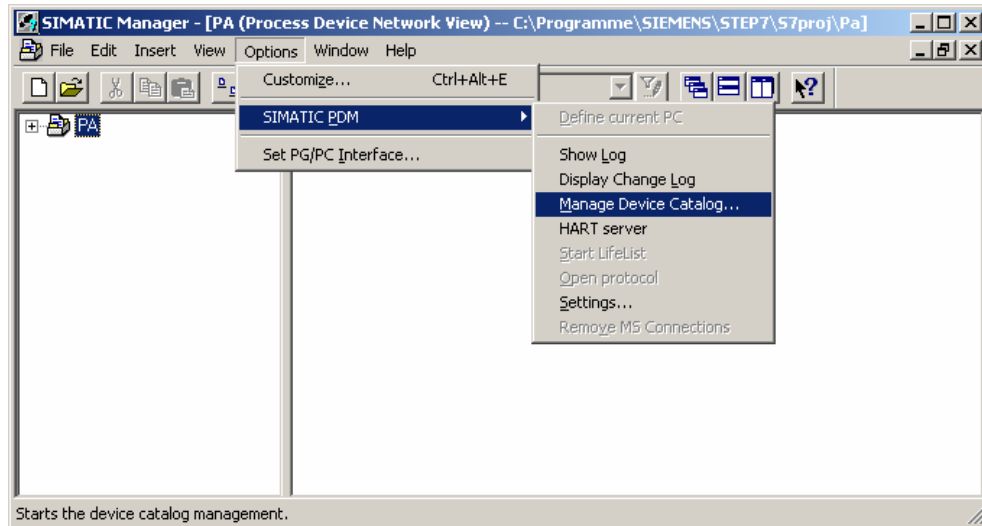


Figure 34: SIMATIC Manager

Then browse into the source of the unzipped DD files and select the Device type P7xxx.

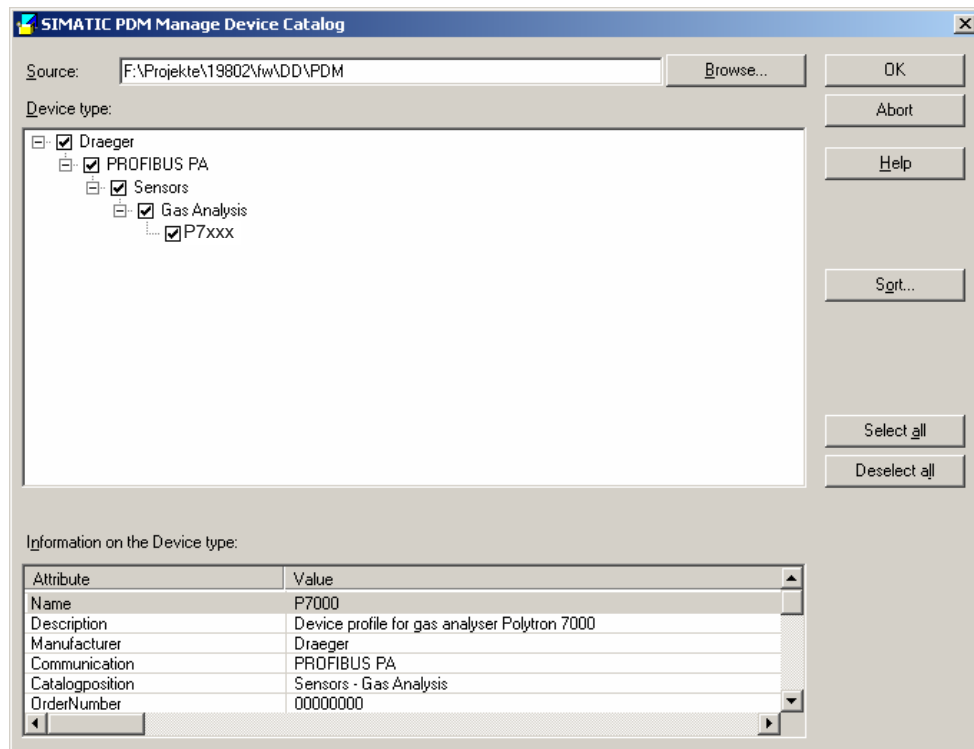


Figure 35: Device Catalog



Figure 36: Message Import complete

3.5 Configuring with SIMATIC PDM

Select "FILE/NEW" to open the "New..." Window in the SIMATIC manager. Now enter the project name (for example "Draeger-P7xxx_pdm") and click "OK".

Now select “VIEW/Process Device Network View” to access the “Process Device Network View” window.

Right click networks and select “Insert New Object/PC”.

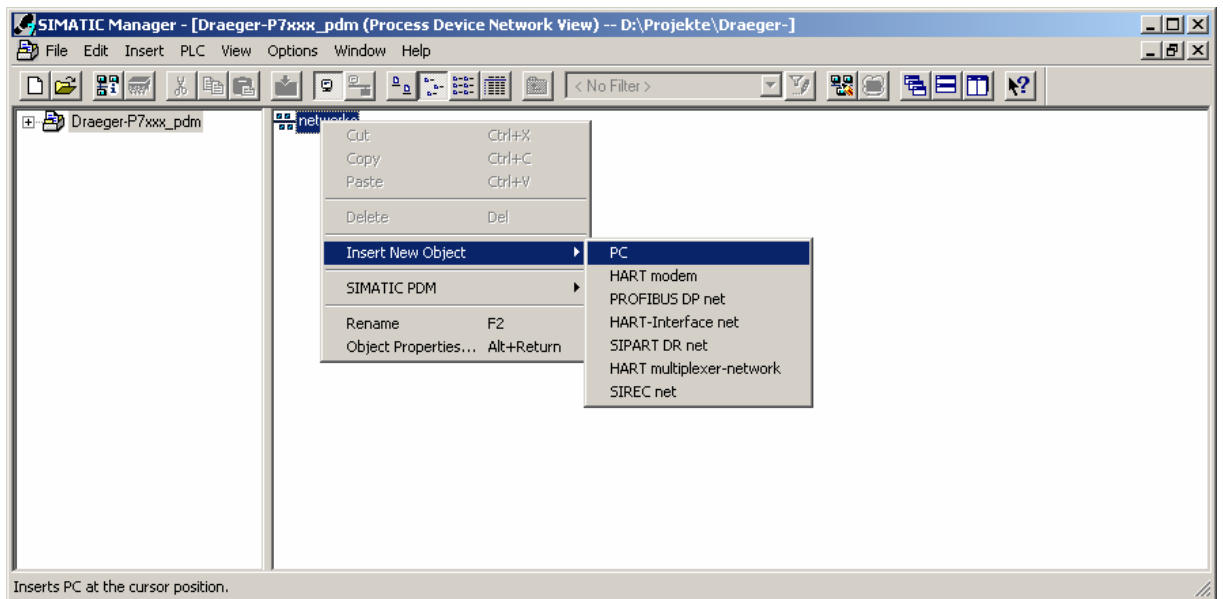


Figure 37: Insert New Object - PC

Right click networks and select “Insert New Object/PROFIBUS DP net”.

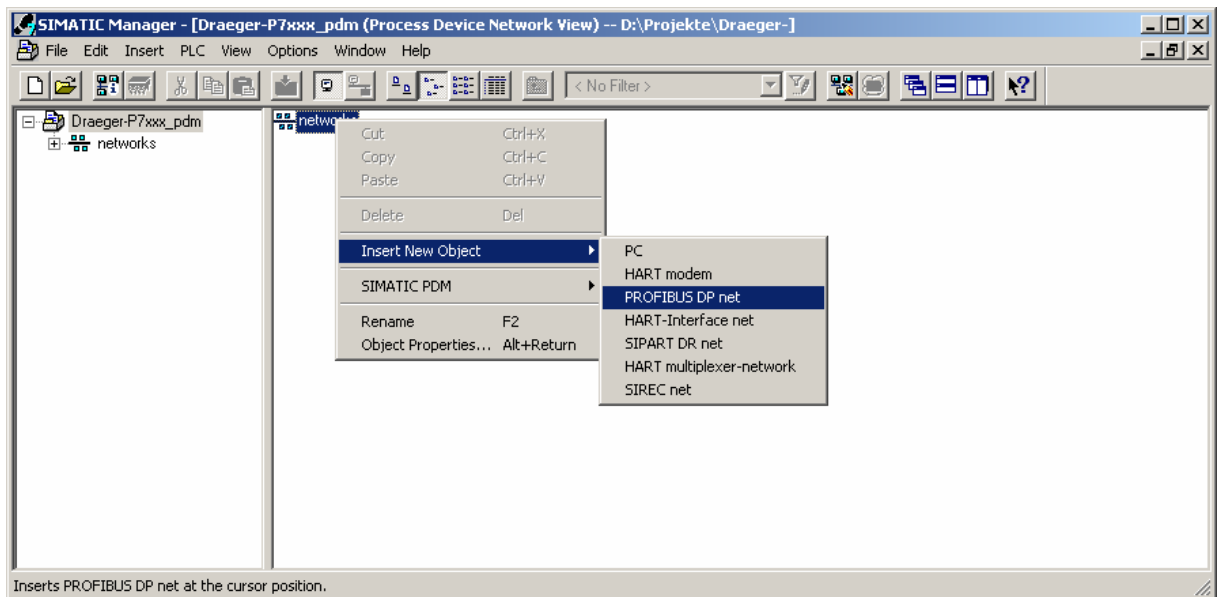


Figure 38: Insert New Object – PROFIBUS DP net

Now insert the PA device by right click onto “PROFIBUS DP net” and select “Insert New Object/PROFIBUS PA device”.

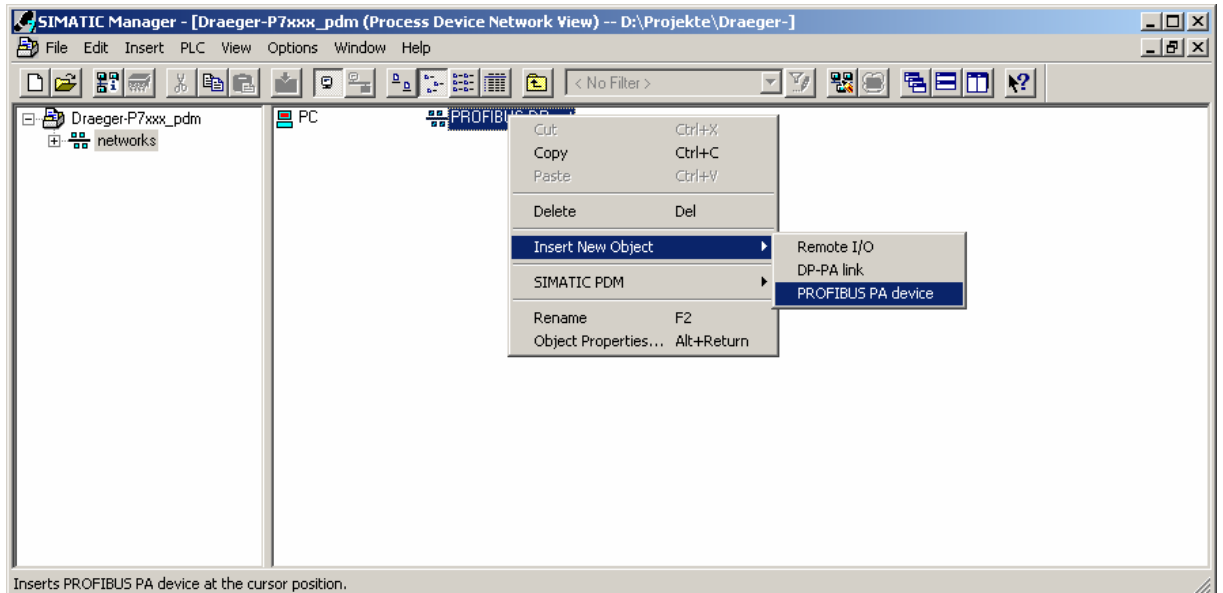


Figure 39: Insert New object/PROFIBUS PA device

Now edit the name. For example change it to P7xxx.

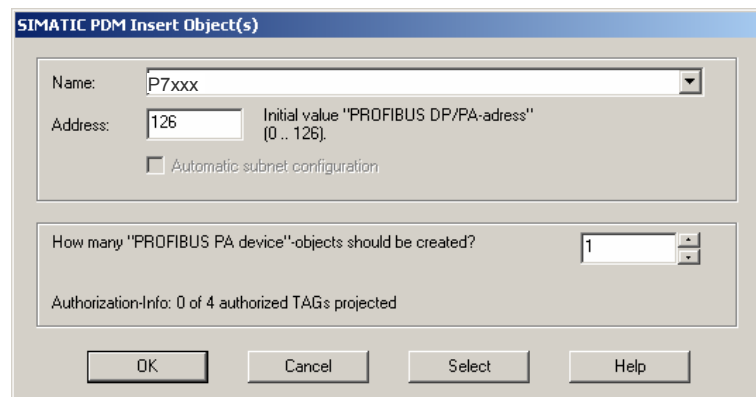


Figure 40: Edit device name

Note that the address must match the address in the device. The factory default address is 126. The device in this manual has the PROFIBUS address 3.

Then click OK. The "Process Device Network View" window will be re-open.

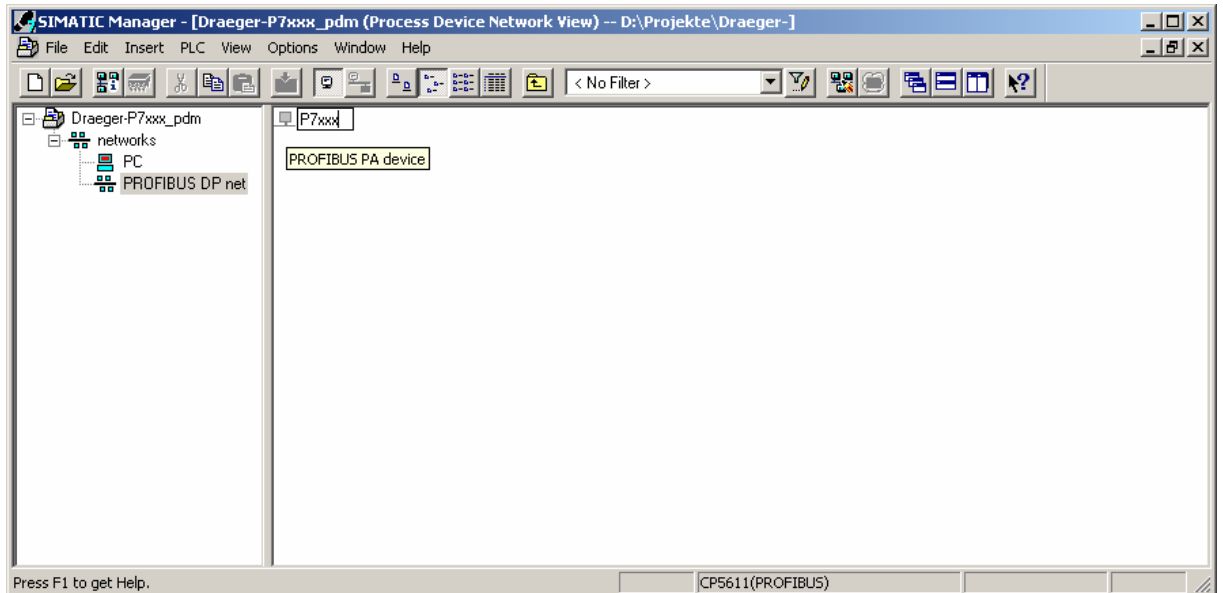


Figure 41: “Process Device Network View” window

Double Click to “P7xxx”. Go to “Sensors/Gas Analysis/Draeger” and select the instrument you are using (e.g. P7xxx). Then click “OK” to proceed. This step is only at the first time necessary. If have chosen a device before, you can continue with figure 40.

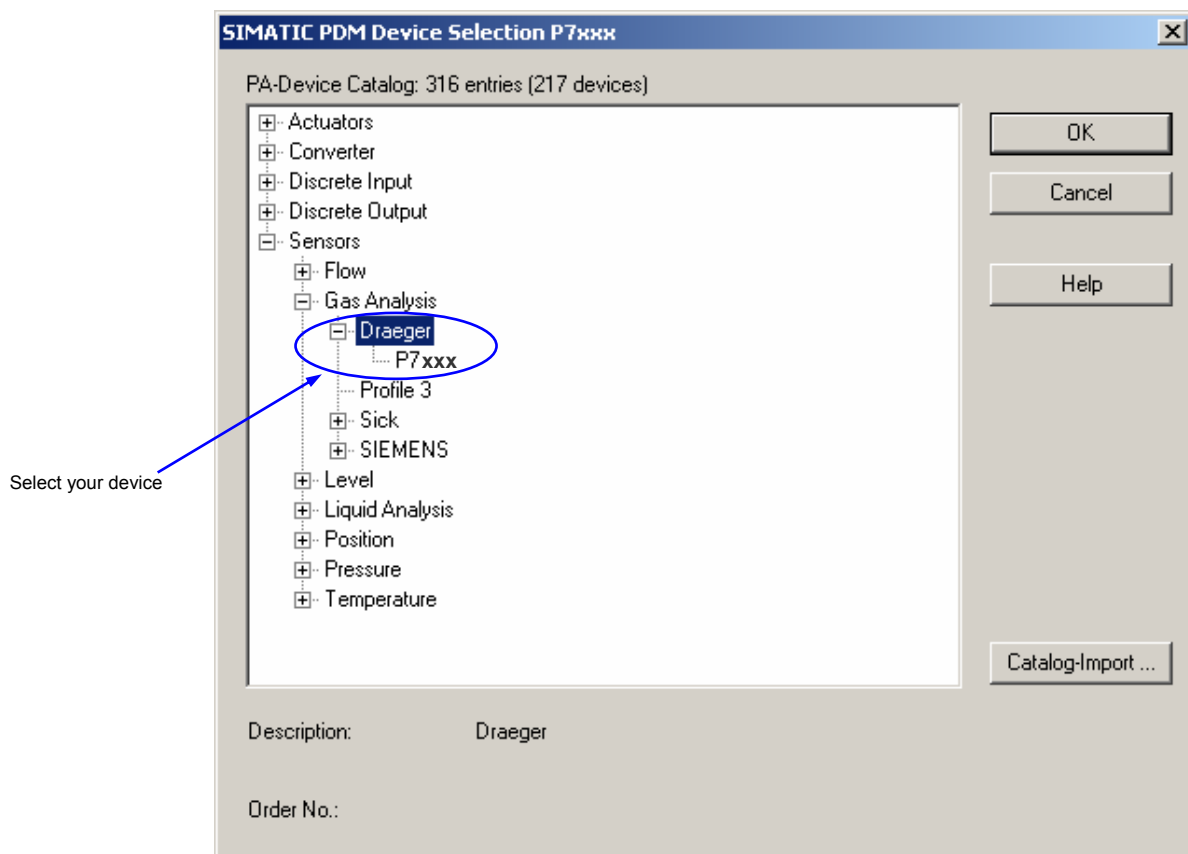


Figure 42: SIMATIC PDM Device Selection

Select “specialist” and click “OK”.

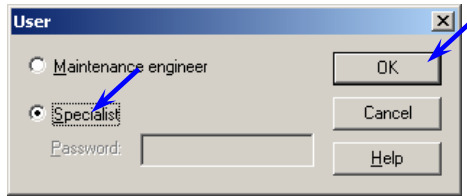


Figure 43: User window

The SIMATIC PDM window opens as follows.

Parameter	Value	Unit	Status	Name in DD
P7xxx				
» Identification				Tab s ident
» » Operation Unit				Tab s ident opunit
TAG	P7xxx		Loaded	phys_tag_desc
» » Device				Tab s ident device
Manufacturer	Draeger		Loaded	phys_device_man_id
Product designation	P7xxx		Loaded	phys_device_id
Device Serial Num	P-EC7000		Loaded	phys_device_ser_num
Software Revision	1		Loaded	phys_software_rev
Hardware Revision	1		Loaded	phys_hardware_rev
Profile Revision	3.01		Loaded	phys_blk_profile_rev
STATIC Revision No.	2		Loaded	phys_st_rev
PROFIBUS Ident Number	Manufacturer specific		Loaded	phys_ident_number
» » Fieldbus				Tab s ident device specific
SW version Fieldbus mod	1.2		Loaded	phys_fieldbus_module_sw_versio
HW version Fieldbus mod	1.0		Loaded	phys_fieldbus_module_hw_versio
Polytron Module Software	7.7		Loaded	phys_polytron_sw_version
» » Configuration				Tab s ident conf
Device Configuration			Loaded	phys_analysis_device_configurati
Initialization State	Run		Loaded	phys_analysis_init_state
Device State	Run		Loaded	phys_analysis_device_state
Global Status	OK		Loaded	phys_analysis_global_status
» Input				Tab s input
» » Measurand 1				Tab s trans1 analysis
Static Revision No.	8		Loaded	trans1_st_rev
Name			Loaded	trans1_analysis_component_nam
Unit	special		Loaded	trans1_analysis_unit
Unit Text	ppm		Loaded	trans1_analysis_unit_text
Sensor temperature unit	Degree celcius		Loaded	trans1_secondary_value_unit
Active Range	Range 1		Loaded	trans1_analysis_active_range
Automatic Range Choice	Off		Loaded	trans1_analysis_autorange_on
Sampling Rate	0	ms	Loaded	trans1_analysis_sampling_rate
Number of Ranges	1		Loaded	trans1_analysis_number_of_range

Figure 44: parameters SIMATIC PDM

Click “View Display” button to connect to the instrument and display real time information. It shows the actual value of the sensor.

Figure 45: Display – Analog Input Block 1

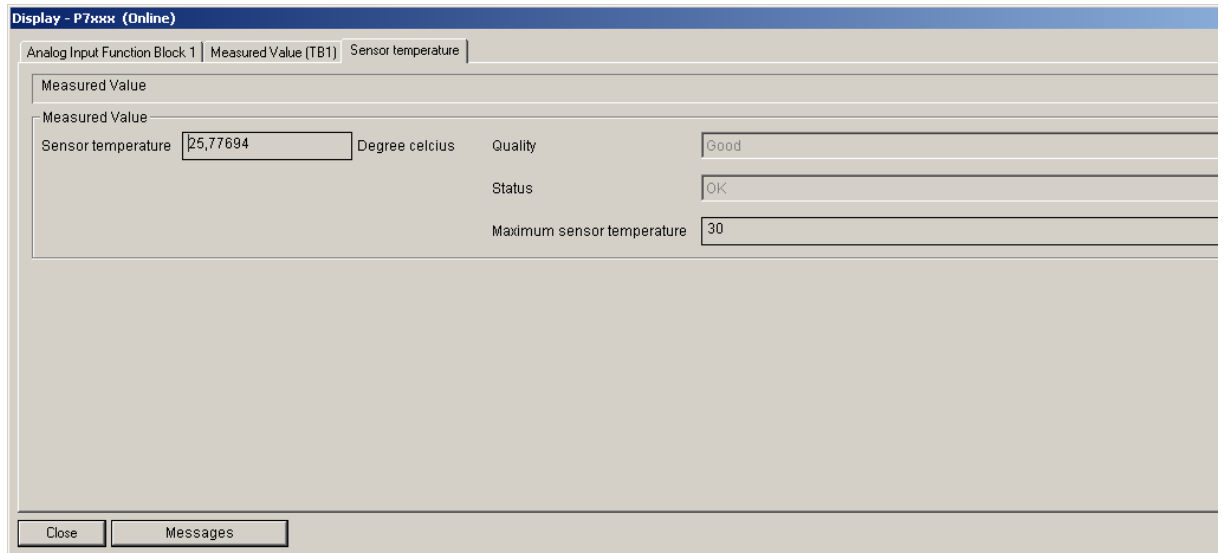


Figure 46: Display – Sensor temperature

3.6 Viewing and Editing Parameters with SIMATIC PDM

The parameters used to operate the device are accessed through the folder tree in the left pane of the “Project Manager” window. It provides full access to the parameters of the instrument and to PDM features. The features are accessed through the “Project Manager” window menu bar.

Device parameters:

- active fields are white, static fields are grey
- whenever possible use dropdown arrows to select values
- use upload and download buttons to change device settings and to store accumulated application data

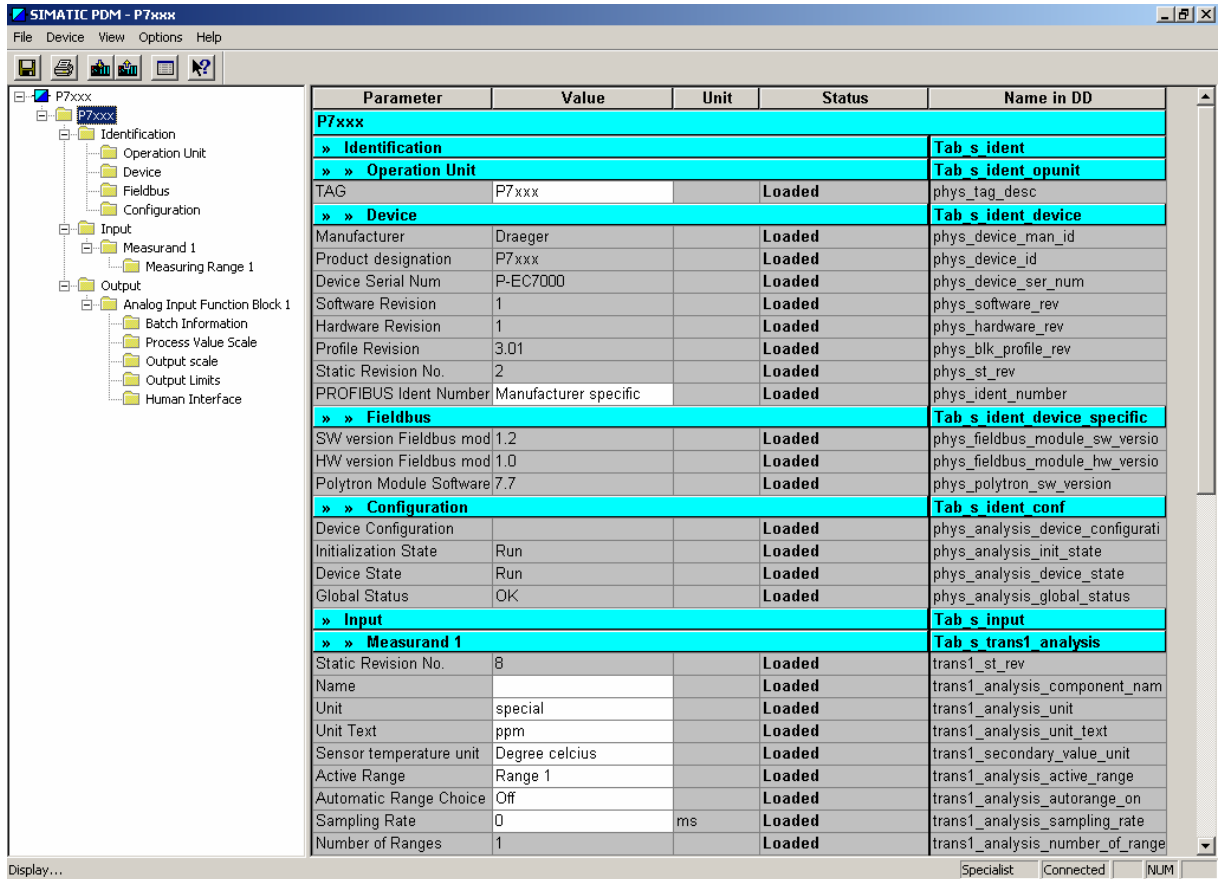


Figure 47: SIMATIC PDM – device parameters

You can view Device Status...

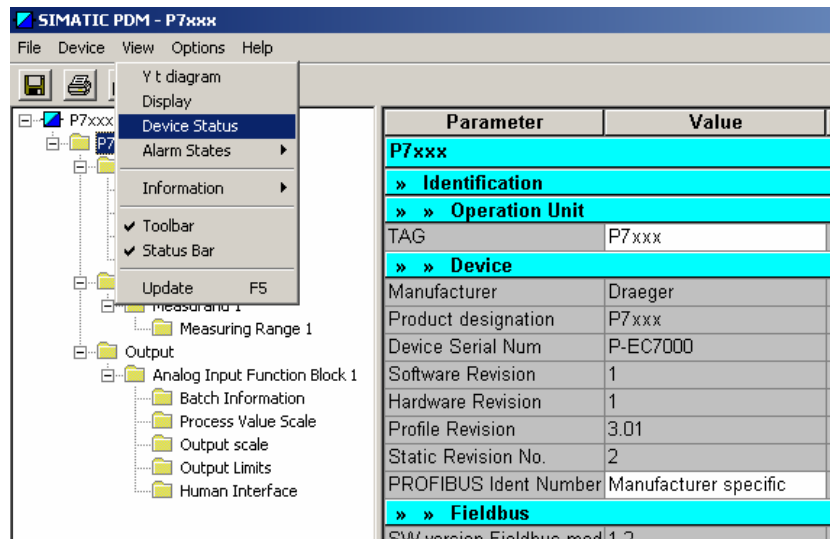


Figure 48: choose Device Status

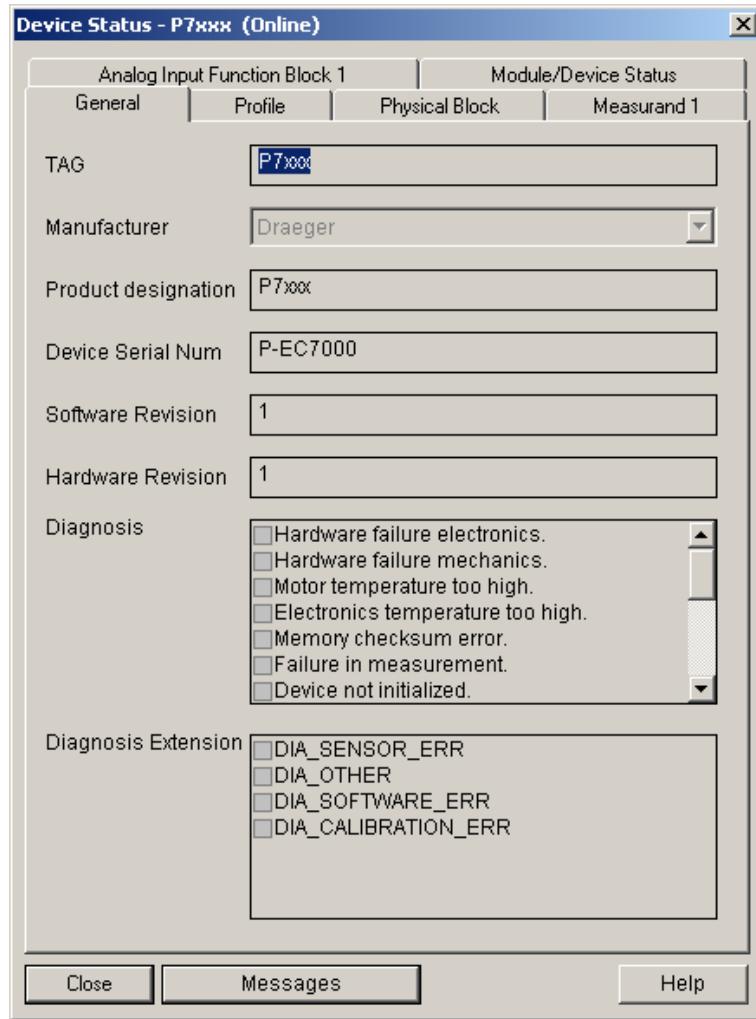


Figure 49: Device Status

... or over the menu Set Address... you can change the slave address...

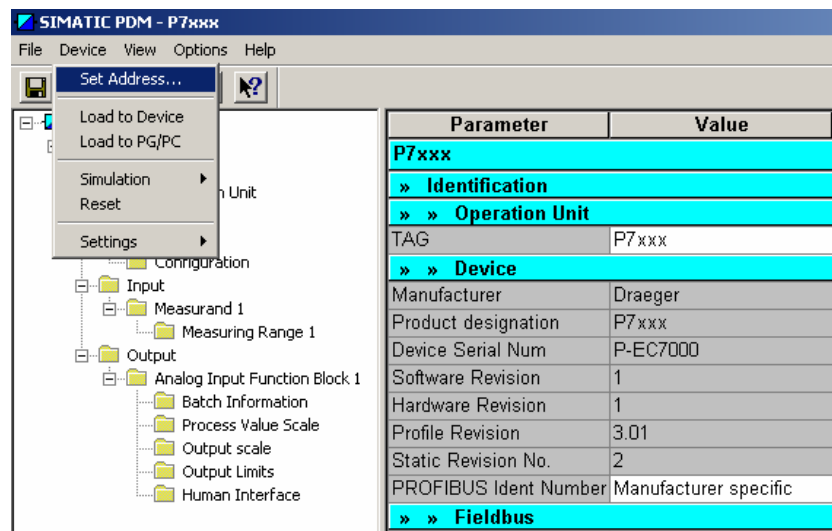


Figure 50: choose Set Address

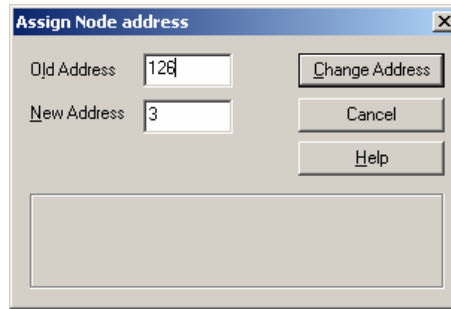


Figure 51: Set Slave Address...

...or you can view online informations about the sensor and the instrument.

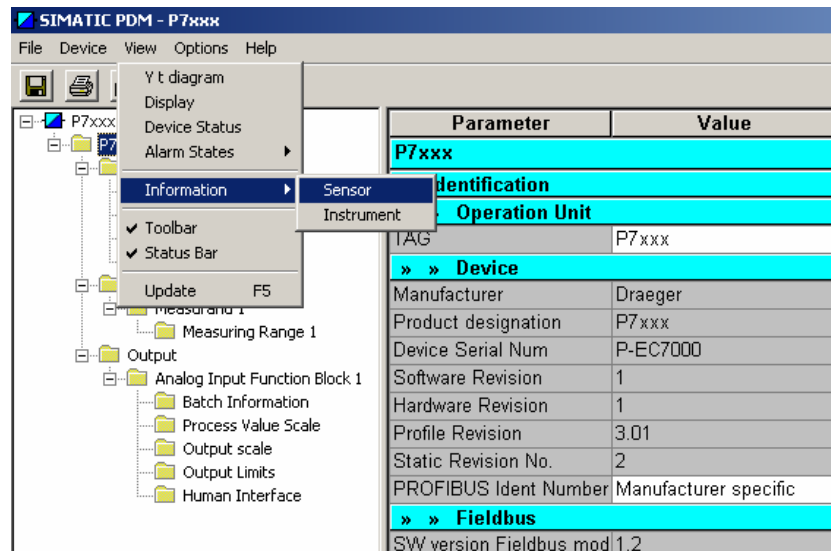


Figure 52: choose Sensor Information

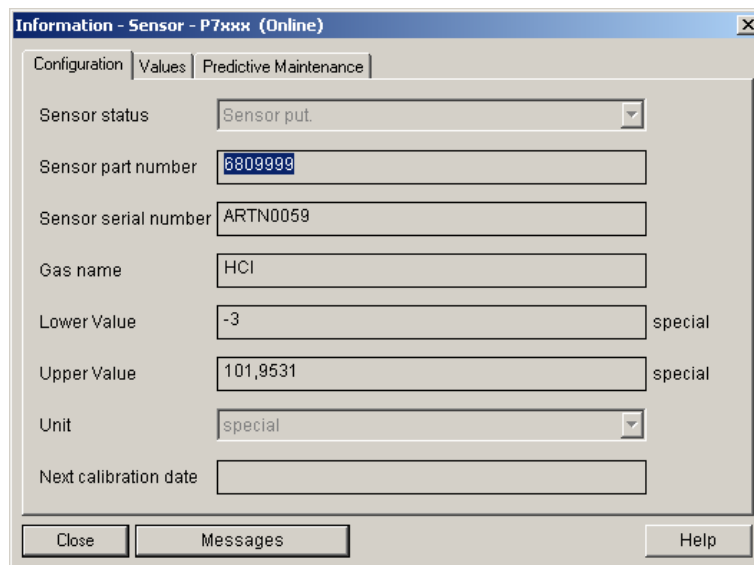


Figure 53: Information – Sensor

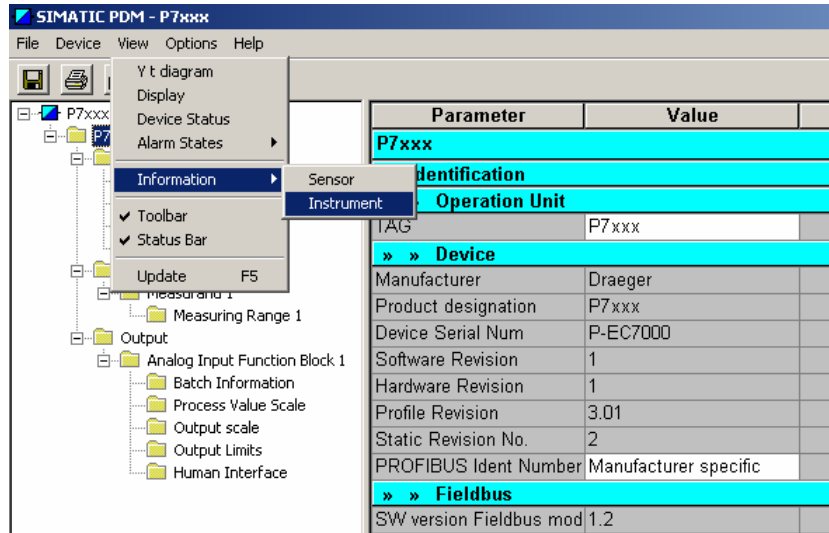


Figure 54: choose Instrument Information

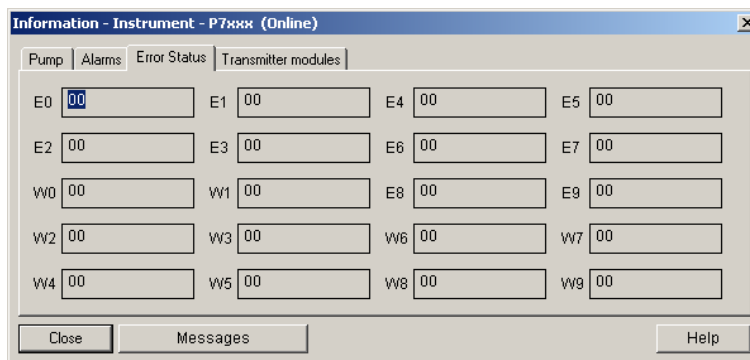


Figure 55: Information – Instrument

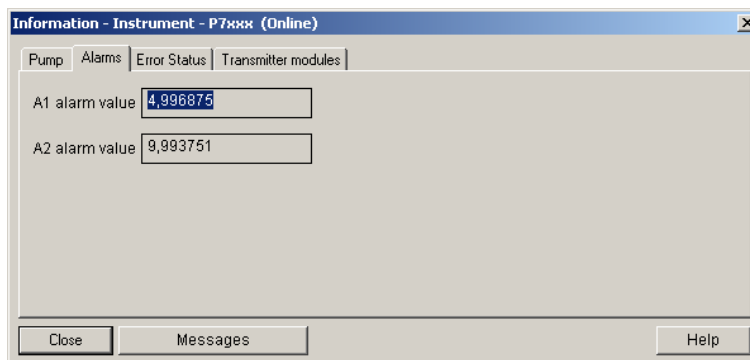


Figure 56: Information – Instrument

3.7 SIMATIC PDM LifeList

PDM Lifelist gives you immediate access to the instruments connected to your terminal. You can monitor the settings. Also you can change the parameters of a device, but this changes will not be reflected in the instrument's permanent project file.

To start the LifeList select in your SIMATIC program folder Step 7 and click SIMATC PDM LifeList .

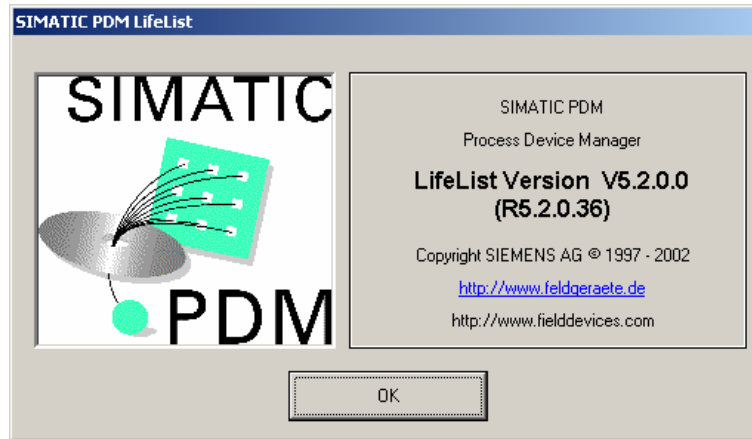


Figure 57: SIMATIC PDM LifeList – Start Window

Click “OK” to open the access window and click “Get LifeList”.

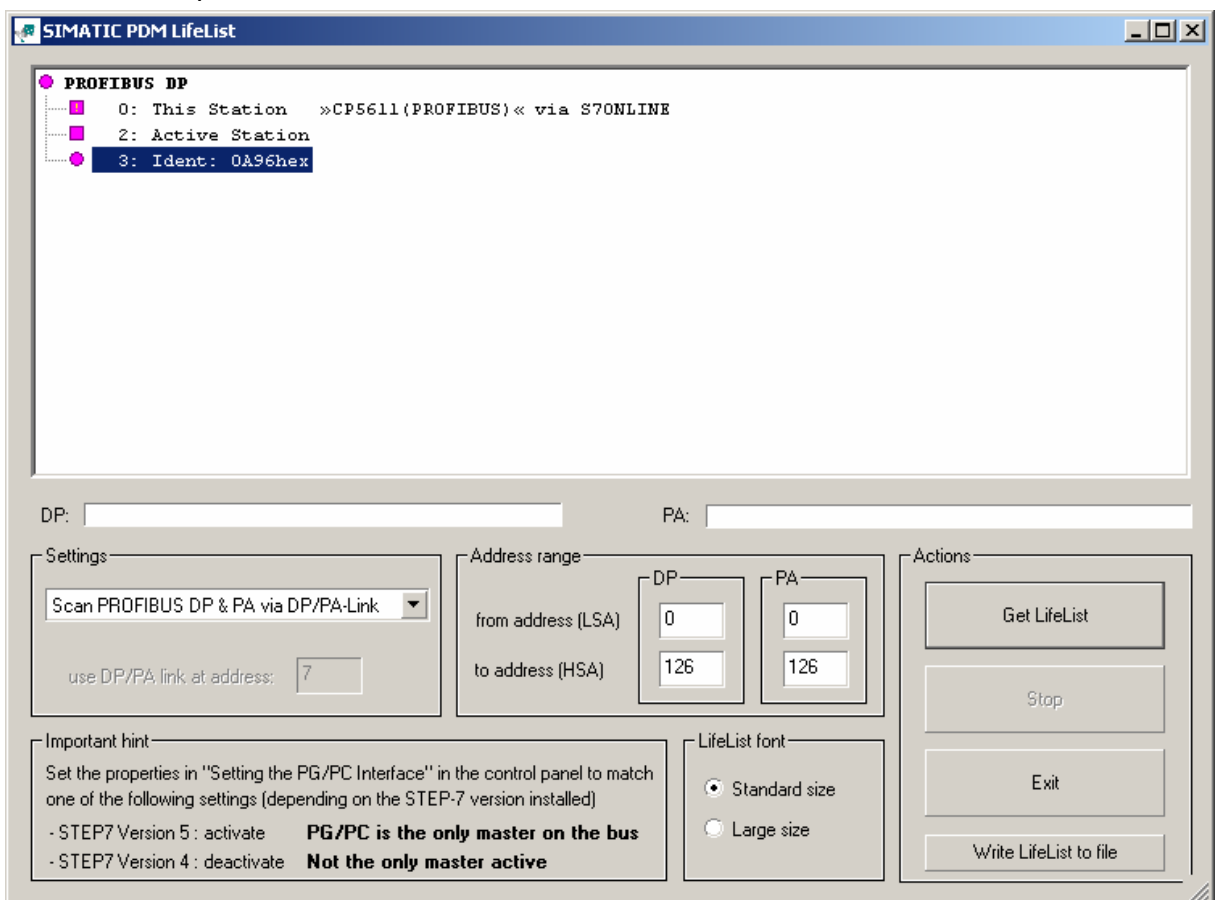


Figure 58: SIMATIC PDM LifeList

Now you can see all reachable stations and devices. To get more information about one device right-click on it.

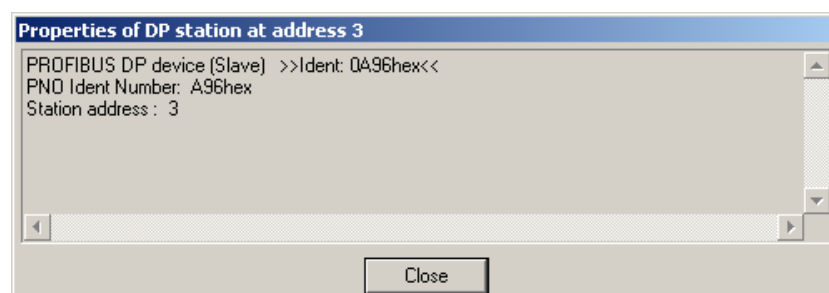


Figure 59: Properties of DP station

4 Installation Requirements PROFIBUS PA

4.1 PROFIBUS

PROFIBUS is a vendor-independent, open field bus standard for a wide range of applications in manufacturing and process automation. Vendor-independence and openness are ensured by the international standards IEC 61158 and IEC 61784. PROFIBUS allows communication between devices of different manufacturers without any special interface adjustment.

PROFIBUS can be used for both high-speed time critical applications and complex communication tasks.

The PROFIBUS communication is specified in IEC 61158 Type 3 and IEC 61784. IEC 61158 Type 3 includes the entire range of PROFIBUS, consisting of the versions DP-V0, DP-V1 and DP-V2. IEC 61784 specifies the properties of the Communication Profile Family CPF 3, which is PROFIBUS.

The Documents can be purchased from the IEC Website.

4.2 Introduction

For a detailed explanation look into the PROFIBUS guideline 2.092 (**PROFIBUS PA – user and installation guideline**).

PROFIBUS PA is using the special physical layer according to the standard IEC 61158-2, clause 21.

We recommend the set-up of a PROFIBUS-PA network in the hazardous area conforming to PTB's FISCO model. For this purpose, all the electrical components to be connected (including the bus termination) must be approved in conformance with the FISCO model.

MBP type transmission technology ("**M**anchester Coding" and "**B**us **P**owered") is a new term that replaces the previously common terms for intrinsically safe transmission such as "Physics in accordance with IEC 61158-2", "1158-2", etc. The reason for this change is that, in its definitive version, the IEC 61158-2 (physical layer) describes *several different* connection technologies, MBP technology being just one of them. MBP is *synchronous transmission with a defined transmission rate of 31.25 Kbit/s and Manchester coding* and frequently used in process automation as it satisfies the key demands of the chemical and petrochemical industries for *intrinsic safety and bus power using two-wire technology*. [Source: PNO]

4.3 Bus cable

The statements of FISCO model only apply if the bus cable in use complies with the following specifications: $R' = 15 \dots 150 \text{ Ohm/km}$; $L' = 0.4 \dots 1 \text{ mH/km}$; $C' = 80 \dots 200 \text{ nF/km}$.

4.4 Shielding and grounding

For optimum system electromagnetic compatibility it is very important that the bus cables connecting the components, are shielded and that these shields provide an electrical shield, which is as complete as possible.

This means for use in non-hazardous-systems that the cable shield must be grounded as often as possible.

In hazardous systems, adequate equipotential bonding should be provided in the hazardous and non-hazardous areas throughout the whole field bus installation.

The use of twisted and shielded cables is urgently recommended, since otherwise the requirements for industrial devices relating to "EMC" cannot be assured.

Note the following points on handling the shielding:

- always use metal clamps to mount shielding braid. The clamps must contact a large area of the shielding and provide appropriate contact force.
- directly behind the cabinet's cable entry, terminate the shielding on a shielding bus. Then, route the cable to the module; however, do not connect the shielding once again to ground in this place.
- in installations outside of cabinets (e.g. for wall-mounting) you can also terminate the shielding on a cable duct.

4.5 Line termination

Line termination of the PA-side consists of one capacitor (1 μ F +/-20%) and one resistor (100 Ohm +/- 2%) in series on both ends of the bus main line.

5 Diagnostics with Step7

5.1 Introduction

You have different possibilities to use the diagnostic functions of your Step 7. You can view information over the HW structure or directly with PDM.

5.2 HW diagnostic

By viewing the online information on the module you are able to locate the cause of a module. An error in the user program cycle you can locate with the help of the diagnostic buffer and the stack content.

In the overview symbols shows the error status of each module. If you double-click the faulty module you get detailed error information. Following information you can view:

- general information on the module (e.g. order No., version, designation) and module status (e.g. error)
- module errors (e.g. channel error) in the central I/O and DP slave
- messages from the diagnostic buffer

CPUs provides also following module status information:

- Cause of an error in the user program cycle
- cycle time (longest, shortest and last cycle)
- performance data (number of possible I/Os, memory bits, counters, timers and blocks)
- Options and utilization of MPI communication

Details on diagnostic options in STEP 7 and procedures are found in the manual of your S7.

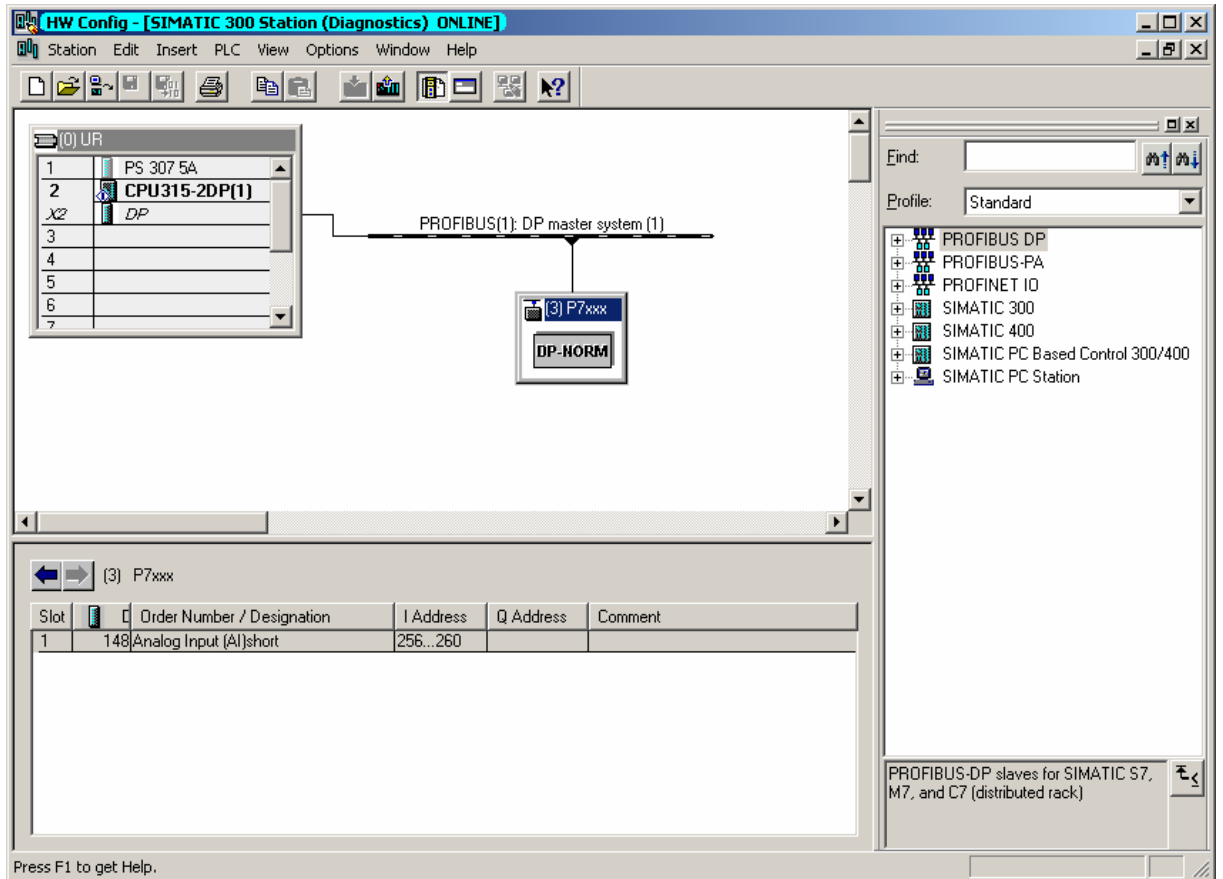


Figure 60: Online – HW Config (no error)

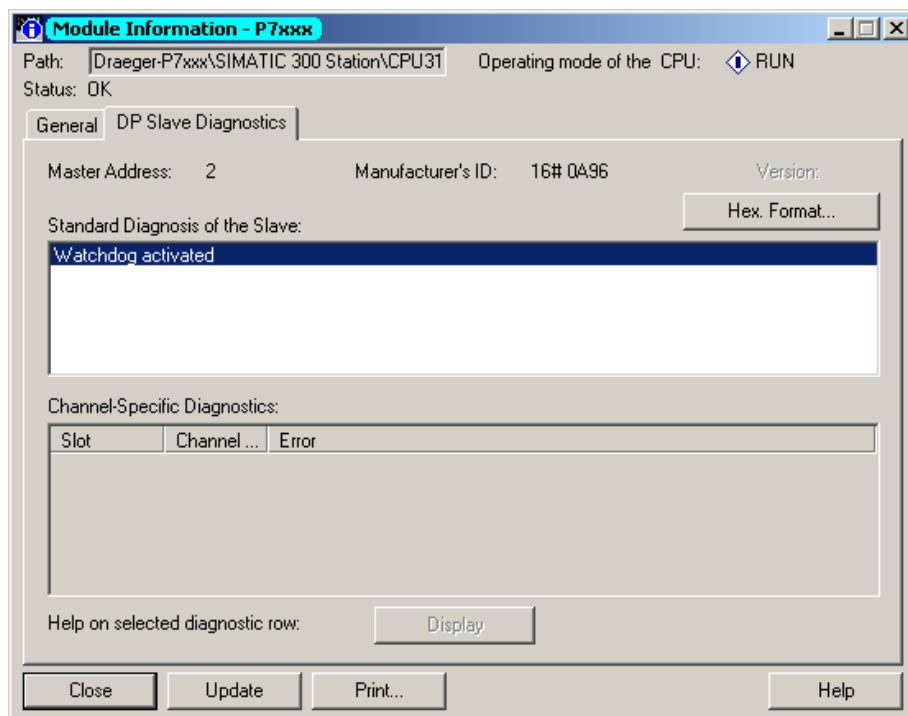


Figure 61: Module Information Transmitter 1 AI (no error)

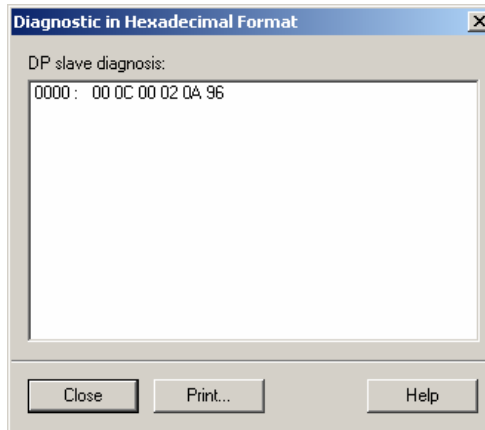


Figure 62: Diagnostic in Hex format (no error)

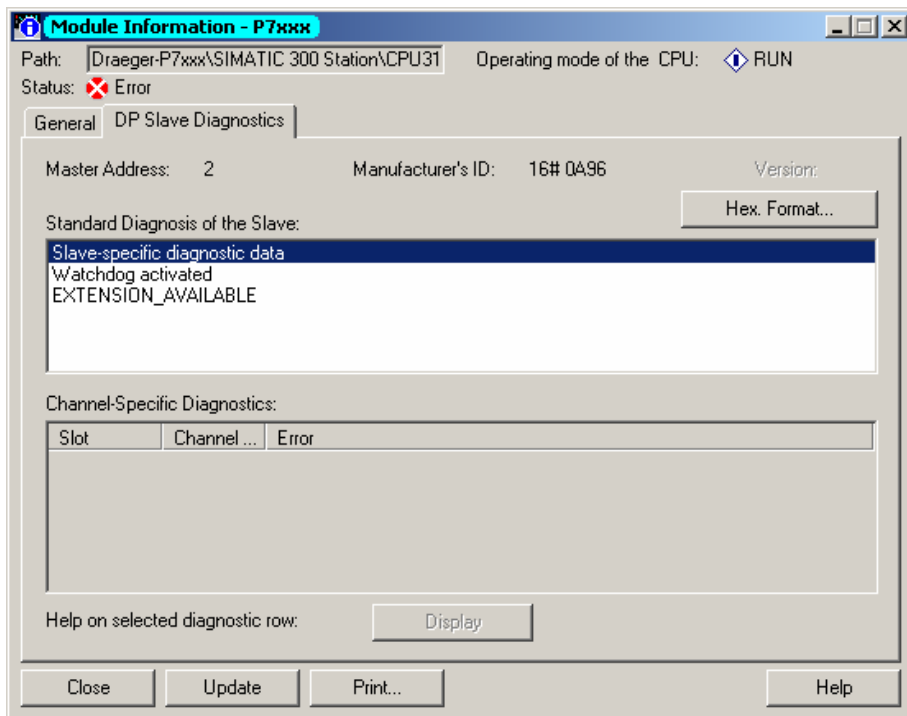


Figure 63: Module Information P7xxx (sensor not connected)

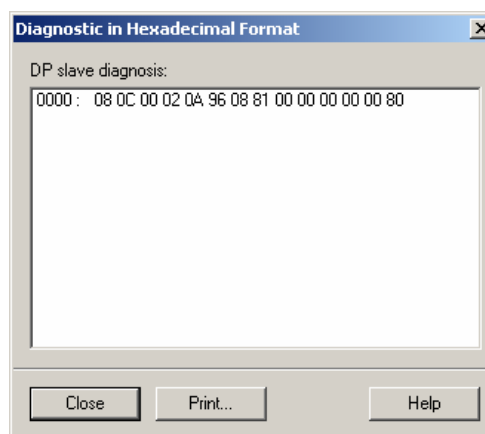


Figure 64: Diagnostic in Hex format (sensor not connected)

Another way for example for the modul information of the CPU direct from the SIMATIC Manager by clicking PLC diagnostics.

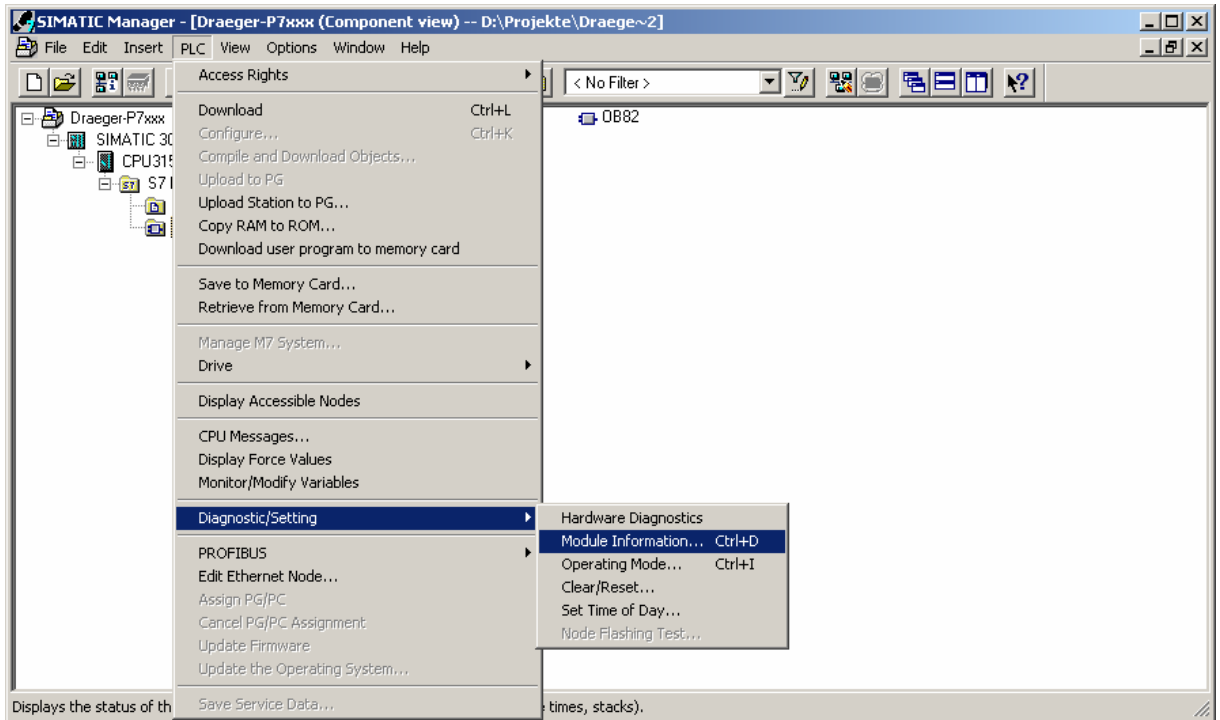


Figure 65: CPU Diagnostic from SIMATIC Manager

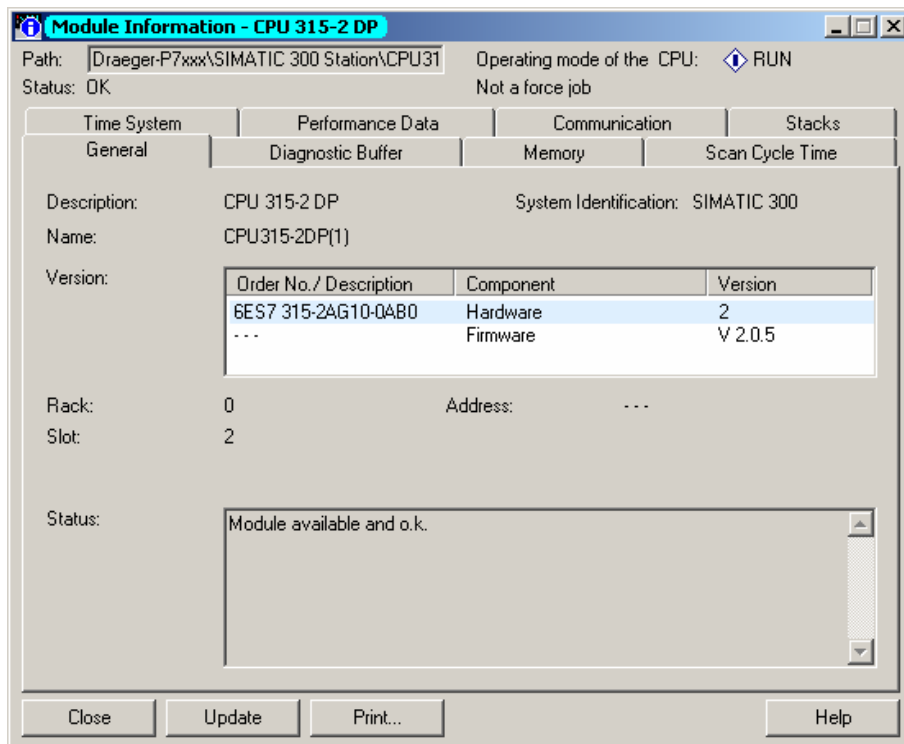


Figure 66: CPU Diagnostic from SIMATIC Manager

5.3 Diagnostics with SIMATIC PDM

The diagnostics and status informations are accessed over the menu bar.

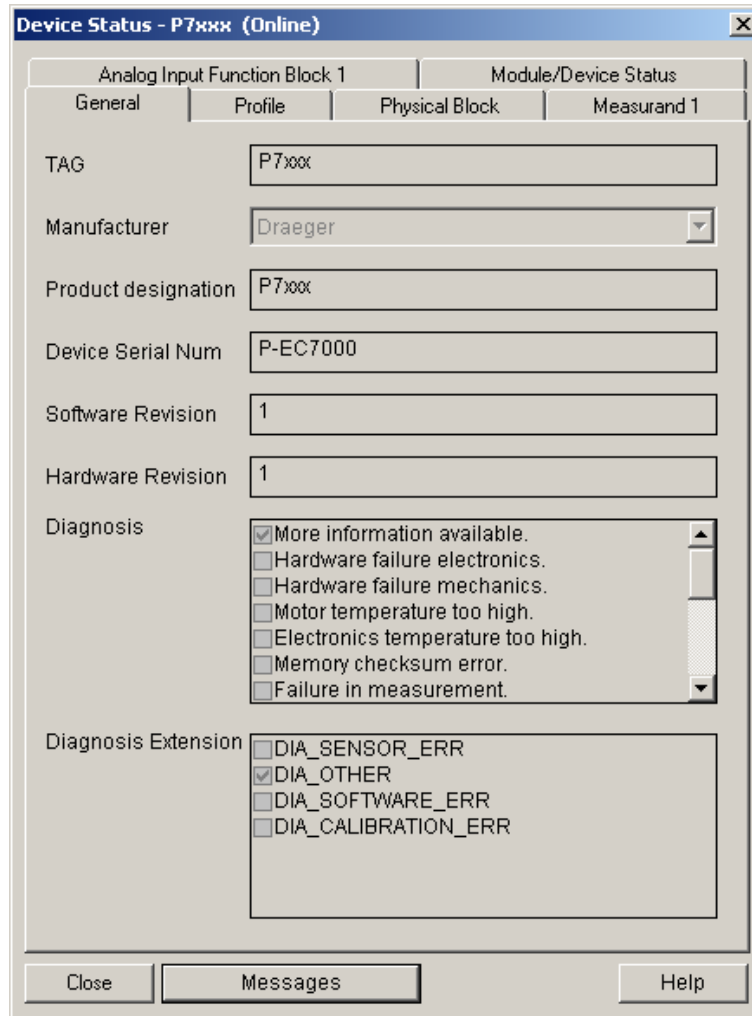


Figure 67: Device Status (Sensor not connected)

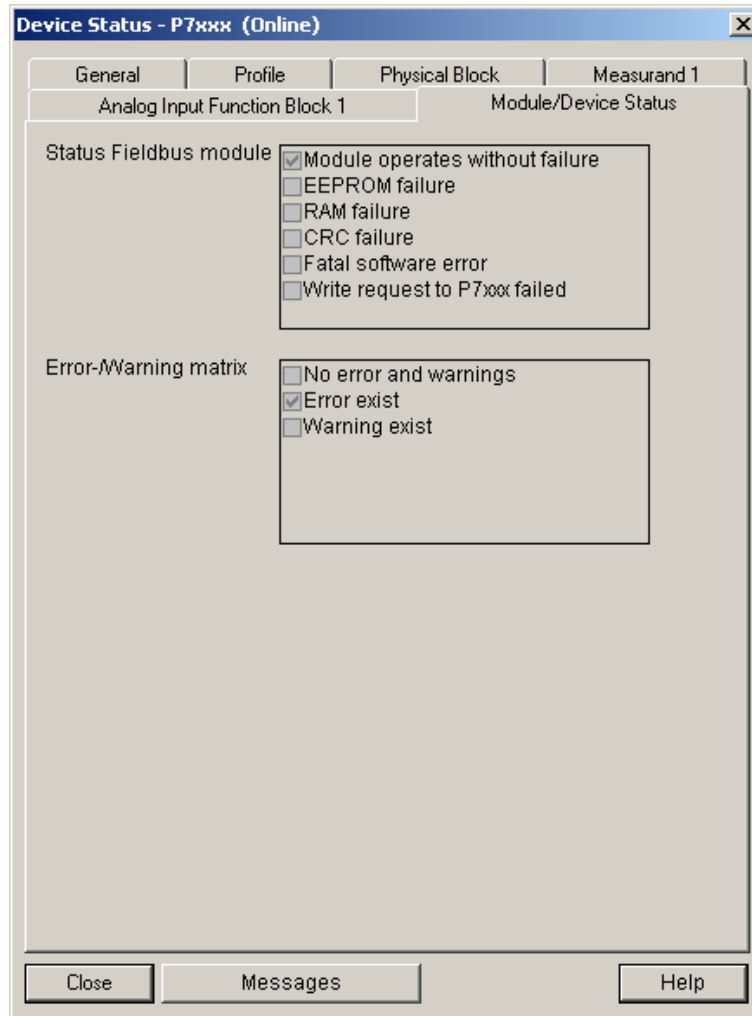


Figure 68: Device Status (Sensor not connected)

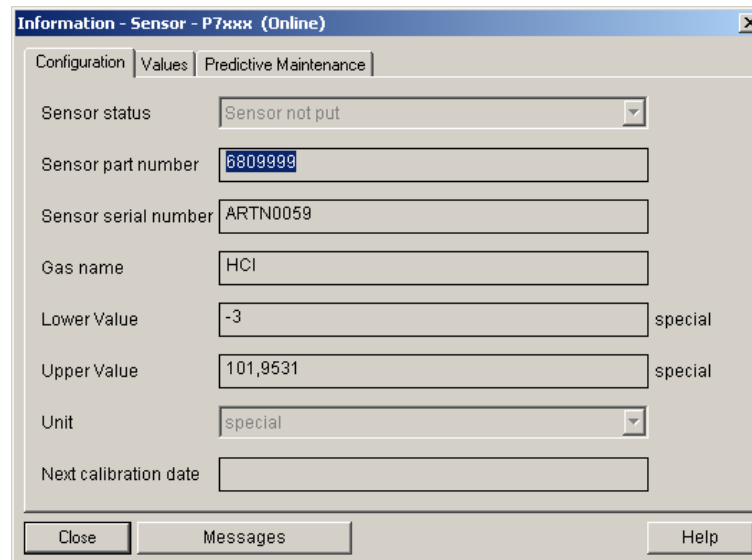


Figure 69: Sensor Information (Sensor not connected)

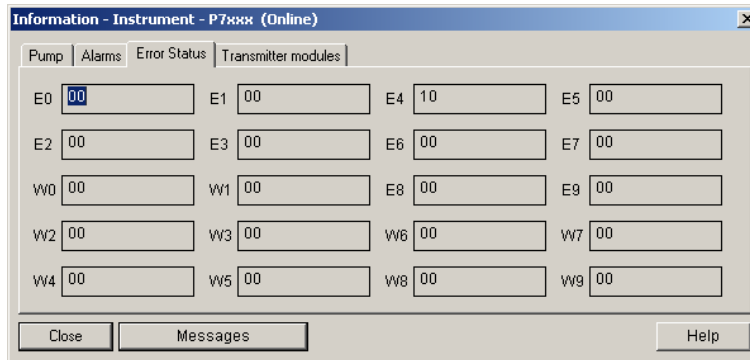


Figure 70: Sensor Information (Sensor not connected)

6 Cyclic Data Format

6.1 Analog Input Function Block

The Analog Input Function Block (AI) processes the measurements from the sensor and makes them available to other function blocks in the transmitter. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement.

The AI consists of 4 Byte process data value and 1 byte status information.

There are four states of quality of the data, an enumerated set of sixteen sub-status values for each quality, and four states of the limits placed on the data. Limit information is generated for all status attributes of all parameters having status.

For the meaning of the Status Byte please look at PROFIBUS-PA Profile for Process Control Devices V3.01.

6.2 Configuration GSD

The GSD-File include following informations about the Input-Data of the Polytron P7xxx:

```

;Modules for Analog Input
Module      = "Analog Input (AI)short"      0x94
1
EndModule
;Modules for Analog Input
Module      = "Analog Input (AI)long"       0x42,0x84,0x08,0x05
2
EndModule

```