PSSu 312040 Profinet with SIMATIC S7

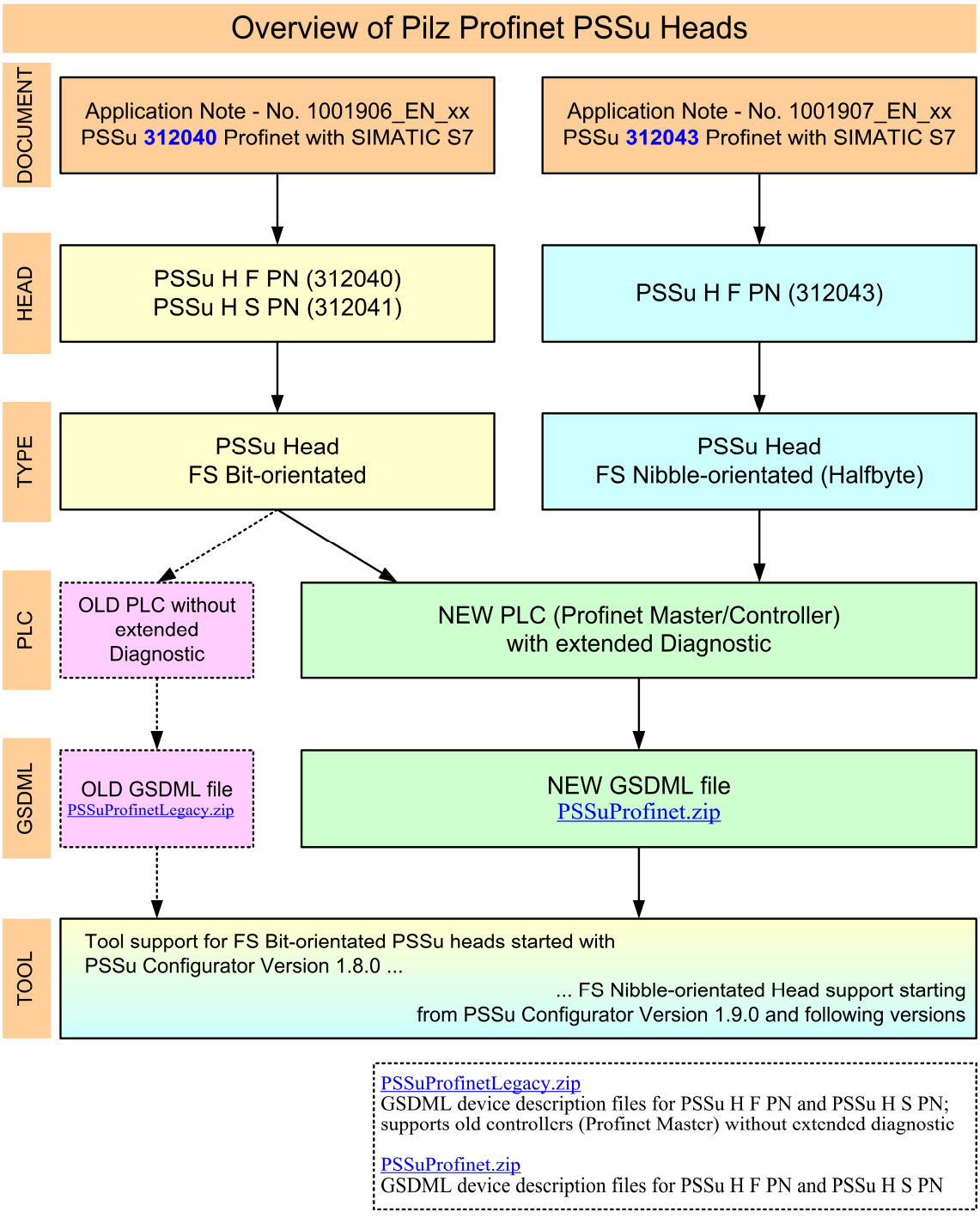
Product
Type: PSSu
Name: PSSu H F PN, PSSu H S PN
Manufacturer: Pilz GmbH & Co. KG, Safe Automation

Document
Release Number: 04
Release Date: 23 July 2010net

Important Note
There are two versions of Application Note about “PSSu Profinet”.
Consider the overview on the following page.

Document Revision History

Release	Date	Changes	Chapter
01	26.08.2008	Creation	all
02	23.04.2009	Complete Revision	all
03	14.12.2009	2 different documents: “PSSu **312040** ..” and “PSSu **312043** ..”	Doc-History, Chapter 6
04	23.07.2010	Make ready for Internet-Release	only logistic data



Exclusion of liability

We have taken great care in compiling our application note. It contains information about our company and our products. All statements are made in accordance with the current status of technology and to the best of our know-ledge and belief.
However, we cannot accept liability for the accuracy and entirety of the information provided, except in the case of gross negligence. In particular it should be noted that statements do not have the legal quality of assurances or assured properties.
We are grateful for any feedback on the contents.

July 2010

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Contents

1. Useful documentation

Reading the documentation listed below is necessary for understanding this application note. The availability of the indicated tools and safe handling are also presupposed with the user.

Scope
This document provide a Step by Step example of interfacing a Siemens S7 PLC with PROFINET/PROFIsafe-Master to the PSSuniversal PROFINET/PROFIsafe-Module.

The document is not intended as a technical documentation for general use of the Simatic Manager Step 7. It may not be distributed to customers without a special note to its scope.

1.1. Documentation from Pilz GmbH & Co. KG

No.	Description	Item No.
1	Pilz international homepage, download section	www.pilz.com
2	Software "PSSuniversal Assistant", Online Help Pilz's international homepage > Products section > Safety control technology > PSSuniversal > Selection guides (download link)	www.pilz.com
3	Operating manual of module "PSSu H F PN" (english)	22 072-xx
4	Operating manual of module "PSSu H S PN" (english)	22 103-EN-xx
5	Technical Catalogue of PSSuniversal (english)	21 144-xx (5-1-2-2-xxx)
6	System Description of PSSuniversal (english)	21 257-xx
7	Installation Manual of PSSuniversal (english)	21 263-xx

1.2. Documentation from other sources of information

No.	Description	Item No.
1	SIMATIC portal “Automation Systems” (international) http://www.automation.siemens.com/simatic/portal/index_00.htm	
2	PROFINET portal (english) http://www.profinet.com	
3	Siemens portal “Training material” (english) http://www.automation.siemens.com/fea/html_76/down_module.htm#E.	Section “Downloads”, Module “E”
4	Siemens homepage, Safety Integrated – Overview http://www.automation.siemens.com/cd/safety/html_76/produkte/si_ueberblick.htm	

2. Used Software

This Application Note has been tested with the following Software:

No.	Description	Item No.
1	Pilz: PSSu Assistant	V1.8.0 Build 6
2	Siemens: Simatik Manager Step 7	V5.4 + SP4
3	Siemens: S7 Distributed Safety Programming	V5.4 + SP3
4	Siemens: S7 F Configuration Pack	V5.5 + SP5
5		
6		

- Note:
  Dialogs and Message boxes can be differ to other Software Releases
  (e.g. Siemens Step 7 V5.4 SP3 HF1).

3. Preface

This document provide a Step by Step example of interfacing a Siemens S7 PLC with PROFINET/PROFIsafe Master to the PSSuniversal PROFINET/PROFIsafe Module.
The document is not intended as a technical documentation for general use of the Simatic Manager Step 7. It may not be distributed to customers without a special note to its scope.

4. Application Task

Implement a E-STOP-CALL with PSSu E F 4DI–Inputs used by a PSSu H F PN-System. The initial S7-Hardware configuration is not implemented in this “Application Note”. One can get further details if one read the Siemens Simatik Step 7 manual.
(e.g. http://www.automation.siemens.com/fea/html_76/down_module.htm).

5. Hardware configuration

5.1. Siemens Safety PLC

This Application Note has been tested with the following Hardware:

- CPU 416F-3 PN/DP 416-3FR05-0AB0 V5.2.0
- ST Input Slot: DI31xDC24V 421-1BL01-0AA0 (used for the E-Stop reset)

5.2. Pilz Failsafe- & Standard- I/Os

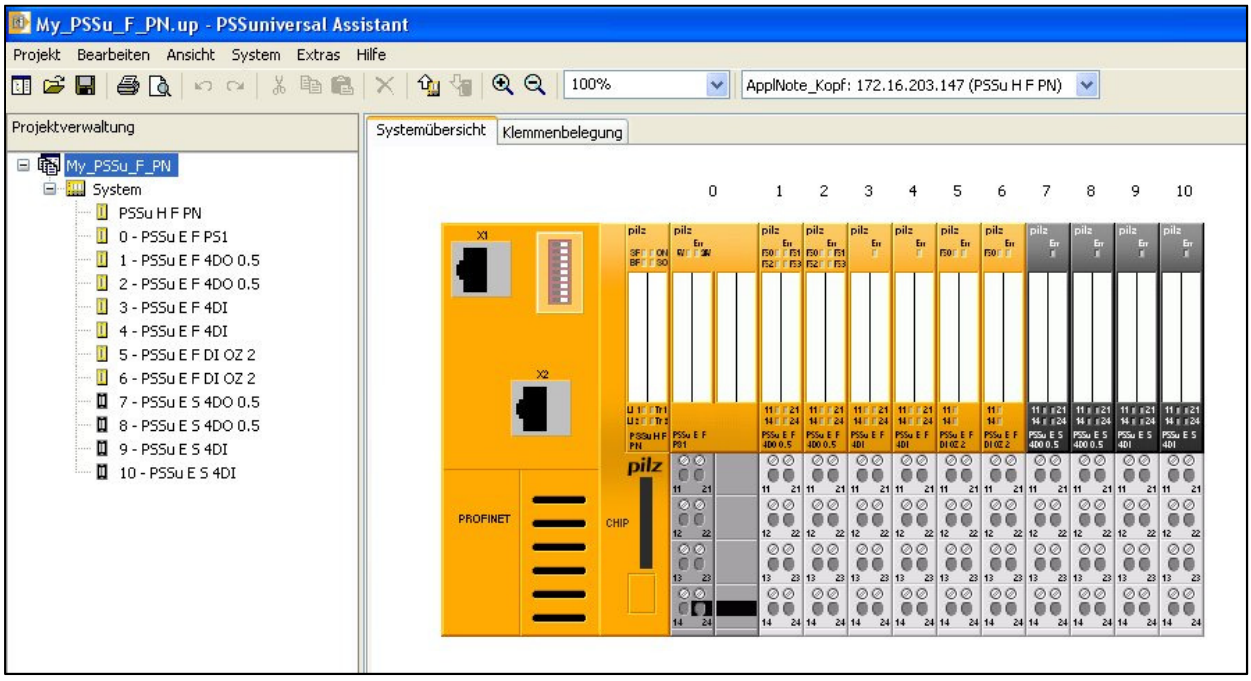


Fig. 1: PSSu Configurator – Configuration of PSSu system used by a PSSu H F PN-System

This Application Note has been tested with the following Hardware:

- PSSu H F PN (PSSu PROFISafe Head module)
- Slot 00 PSSu E F PS1 (Power Supply)
- Slot 01 PSSu E F 4DO (PSS Failsafe Outputs)
- Slot 02 PSSu E F 4DO (PSS Failsafe Outputs)
- Slot 03 PSSu E F 4DI (PSS Failsafe Inputs)
- Slot 04 PSSu E F 4DI (PSS Failsafe Inputs)
- Slot 05 PSSu E F DI OZ 2 (PSS Failsafe Input and one Dual Output)
- Slot 06 PSSu E F DI OZ 2 (PSS Failsafe Input and one Dual Output)
- Slot 07 PSSu E S 4DO 0.5 (ST outputs)
- Slot 08 PSSu E S 4DO 0.5 (ST outputs)
- Slot 09 PSSu E S 4 DI (ST Inputs)
- Slot 10 PSSu E S 4 DI (ST Inputs)

5.3. Maximum PSSu Failsafe- & Standard- I/O-Process Images

- Standard: 64 Byte Inputs, 64 Byte Outputs
- Failsafe: 32 Bit Inputs, 32 Bit Outputs

5.4. Diagnostic Information

- Process Image: 32 Bit Diagnostic Inputs
- PROFINET Diagnostic data: Like Profibus-Diagnostic (e.g. FB149), see Siemens Manual

6. Configuration of S7 PLC

6.1. Download actual device description file (‘GSDML’)

- Download actual modularly XML-File (‘GSDML’) with associated bitmaps as an packed file (ZIP-format) from Internet presence of Pilz GmbH & Co. KG.
  - Download section; Link: http://www.pilz.com/support/downloads/index.en.jsp

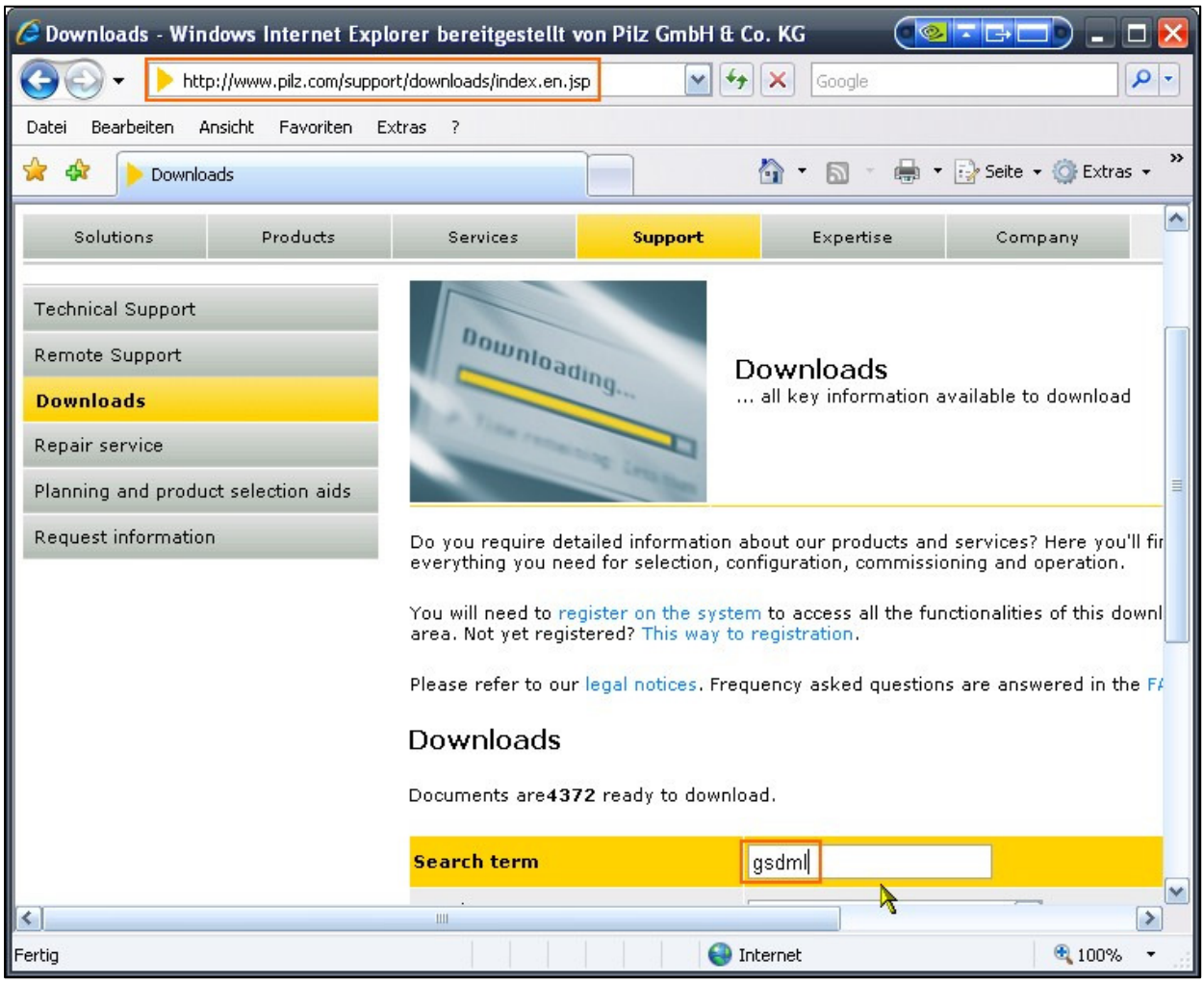


Fig. 2: Pilz Web page – Search for XML-File (‘GSDML’) for PSSu System on www.pilz.com

- Search for “GSDML” and download actual file for your Pilz-device:

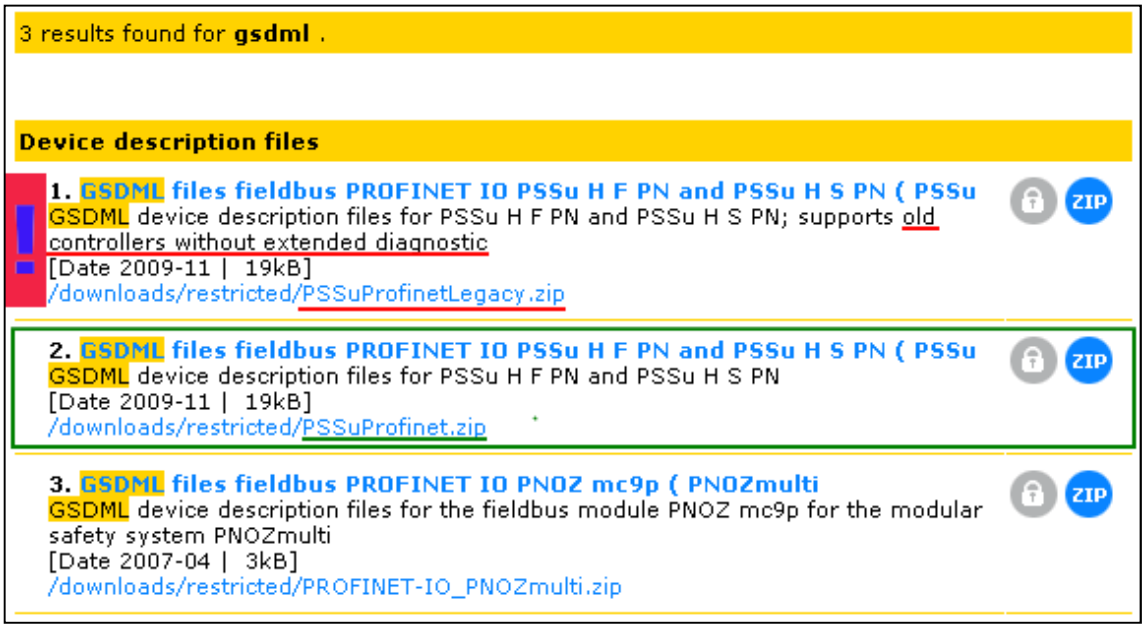


Fig. 3: Pilz Web page – Download-ZIP-File for PSSu System from www.pilz.com

- Notice:
  One will need to register on the system to access all the functionalities of this download area.

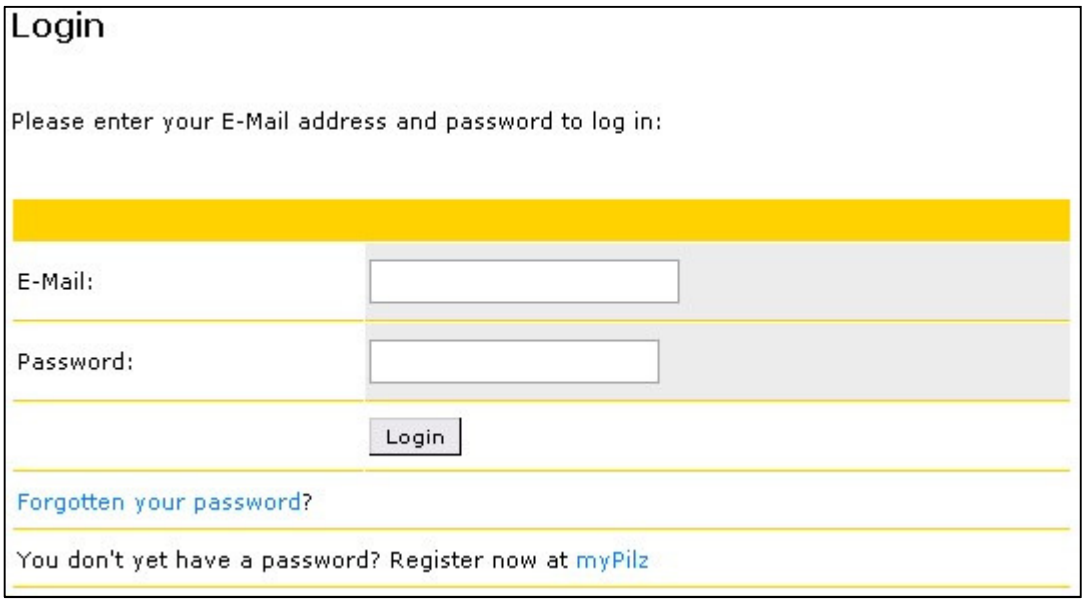


Fig. 4: Pilz Web page – Login on www.pilz.com

6.2. Import the GSDML-file to the Step hardware catalogue

- The first user operation should be the import the last version of the GSDML-File to the Siemens S7 Hardware-Manager.

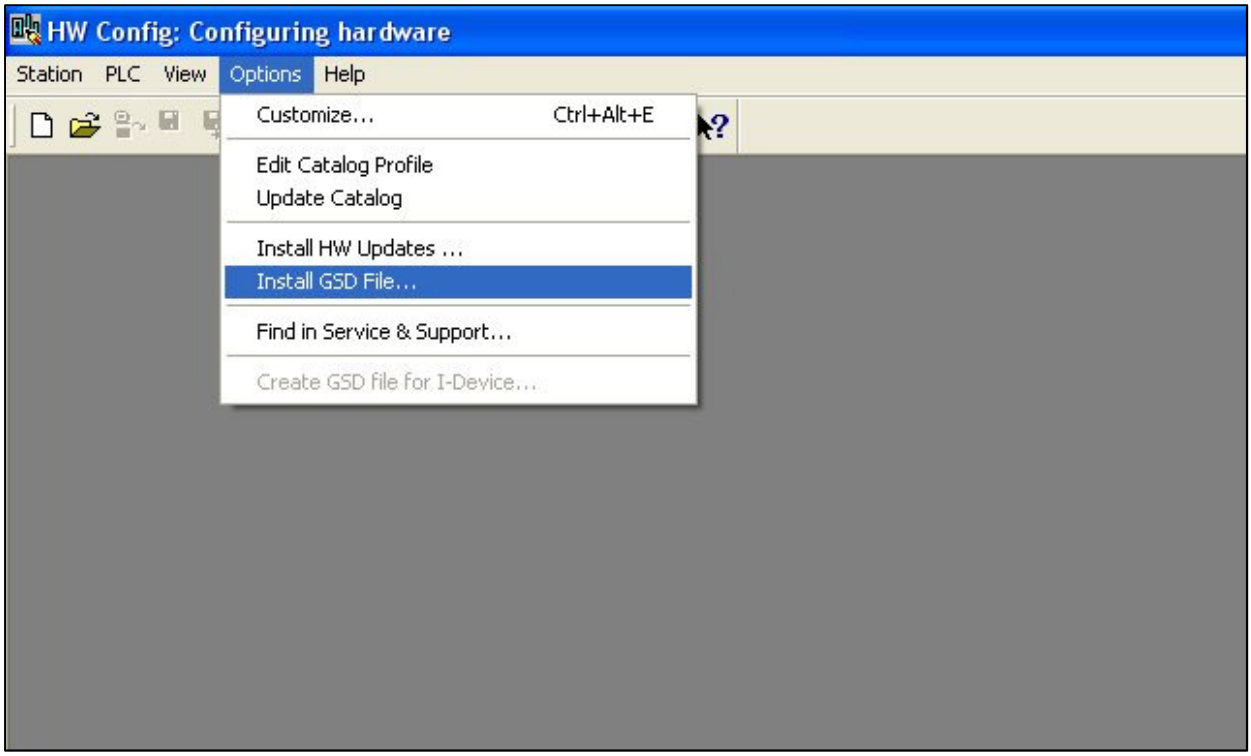


Fig. 5: S7 HW Config – Install a GSD(ML)-File Step1

- Troubleshooting Note:
  If one have to open and download a project from a third person one don´t need the same GSDML-File version in hardware catalogue.
  If there is a difference between PSSu-device GSDML-file of the created PSSu device and GSDML-file of the S7 hardware catalogue, one can´t expand the used hardware type of the existing device.
- The first user operation should be the import the last version of the GSDML-File to the Siemens S7 Hardware-Manager.

- Select the actual XML-file:

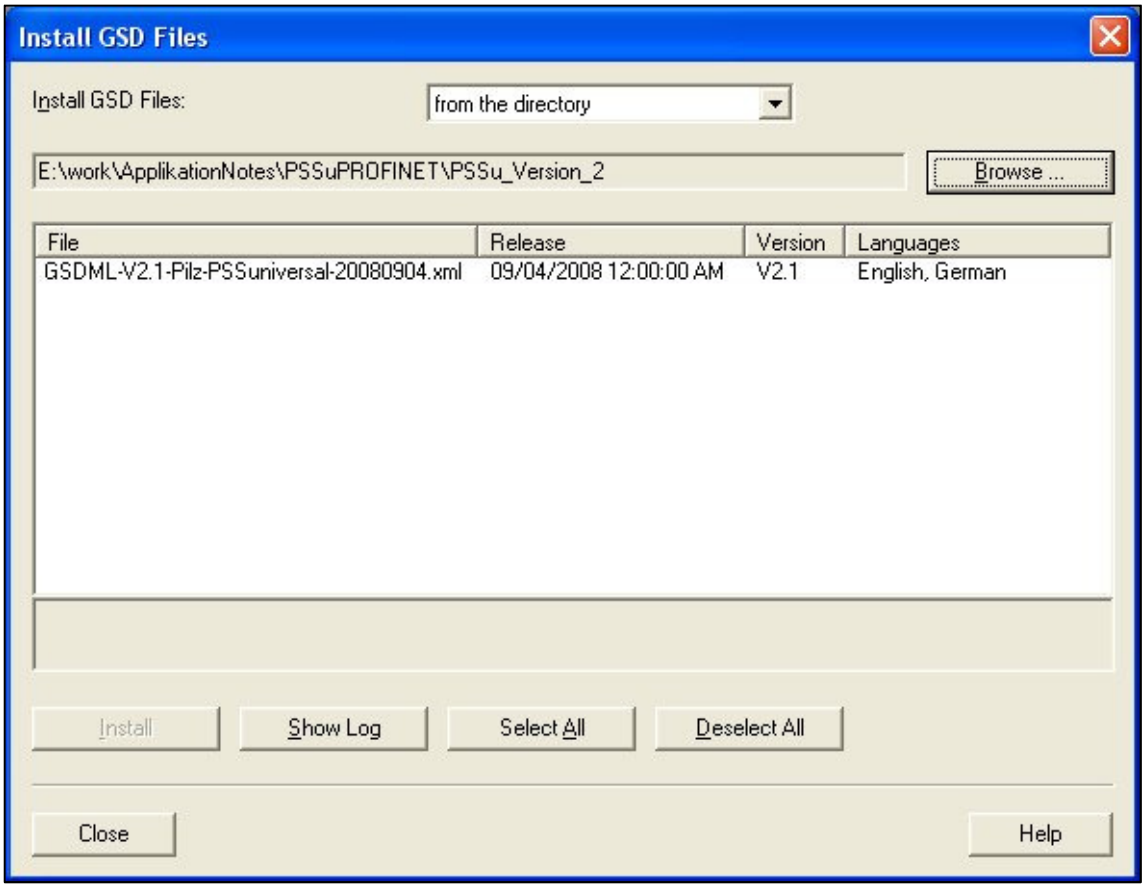


Fig. 6: S7 HW Config – Select a GSD (XML)-File Step2

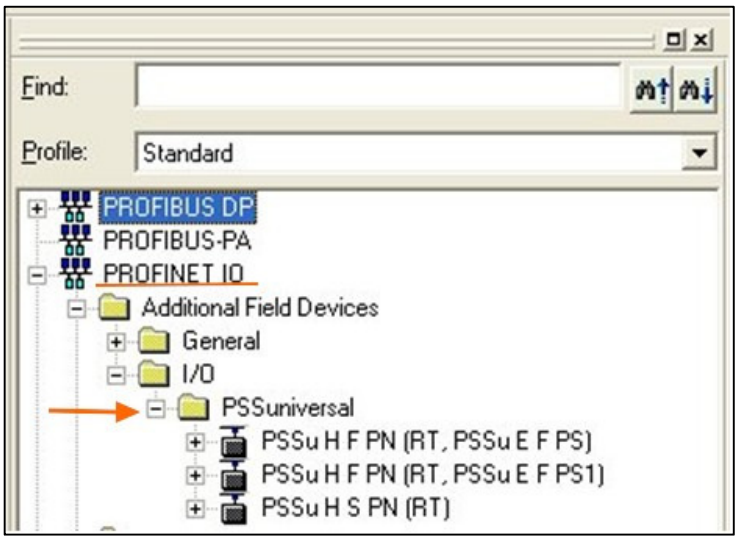


Fig. 7: S7 HW Config – Get the PSSu PN heads in S7 hardware catalogue

- If the GSDML-file is imported there are the different PSSu types in the “Additional Field Devices”-leaflets.

6.3. Configuration of S7 PROFISafe-I/O-Controller

To enable the Siemens PLC as a Safe Module, one have to open the Hardware configurator.

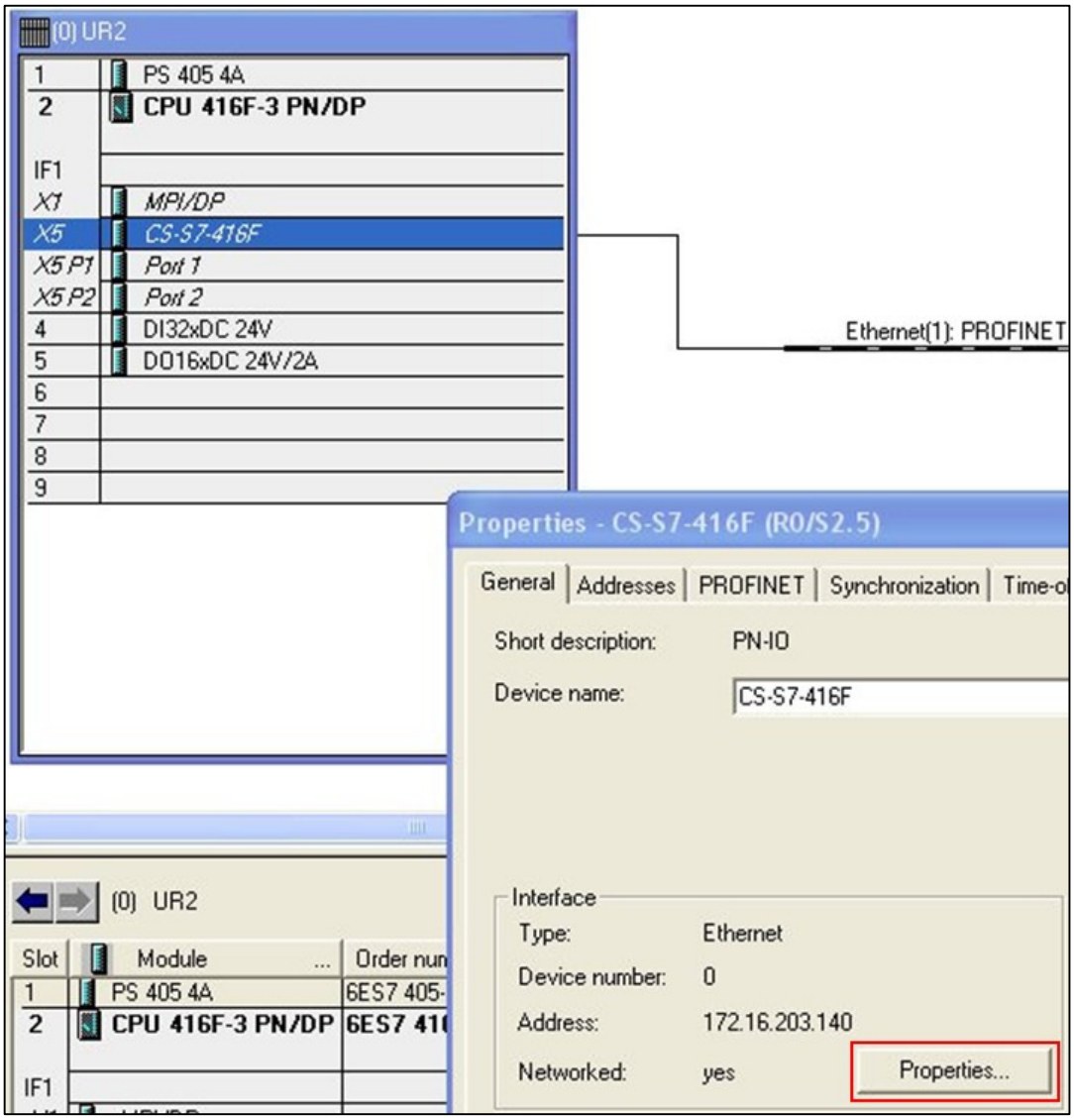


Fig. 8: S7 HW Config – Enable the S7-PROFINET I/O Controller Step1

- In this “Application Note” one have to edit the IP-address of the PROFINET I/O-Controller. The PROFINETI/O-Controller will assign the IP-addresses of the PSSu device(s) later (like a DHCP-workflow).

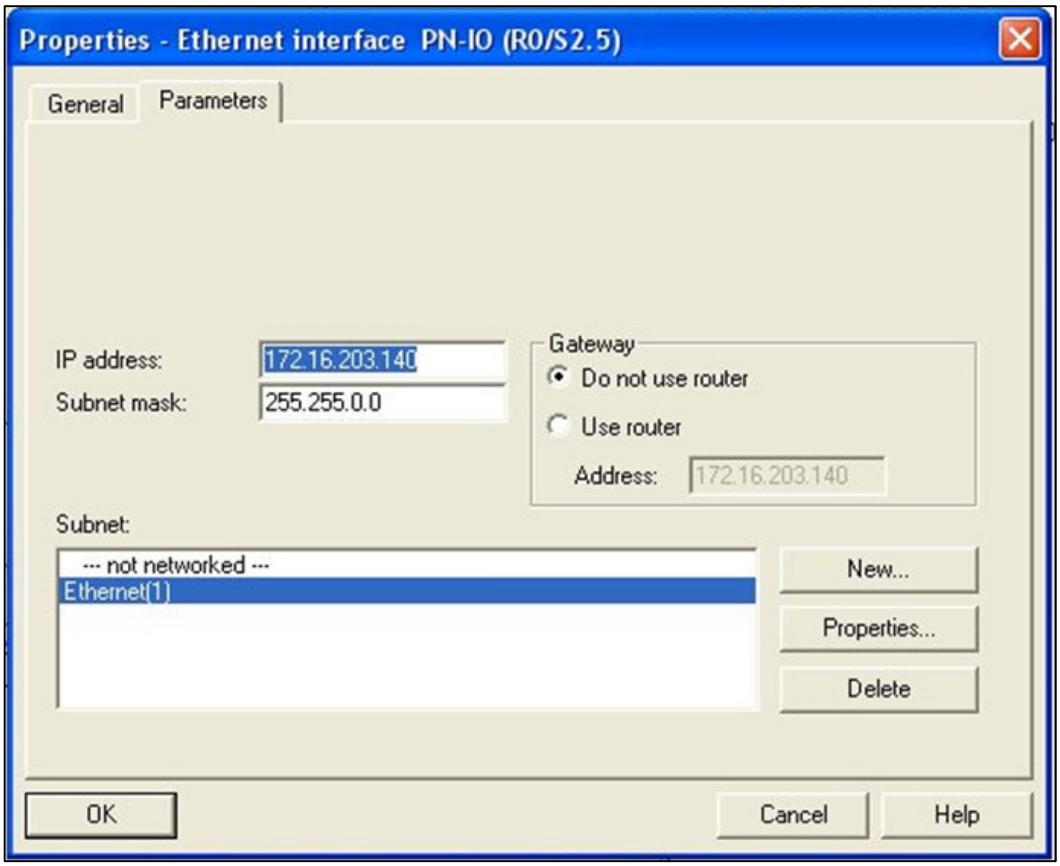


Fig. 9: S7 HW Config – Enable the S7-PROFINET I/O Controller Step2

- One can change the name of PROFINET-I/O-Controller. This name has to be assigned via Ethernet-Online (Edit Ethernet nodes).
- Note:
  One can´t use all kinds of characters (e.g. space “ ”) for the PN-IO Device name. See the Siemens manual please.

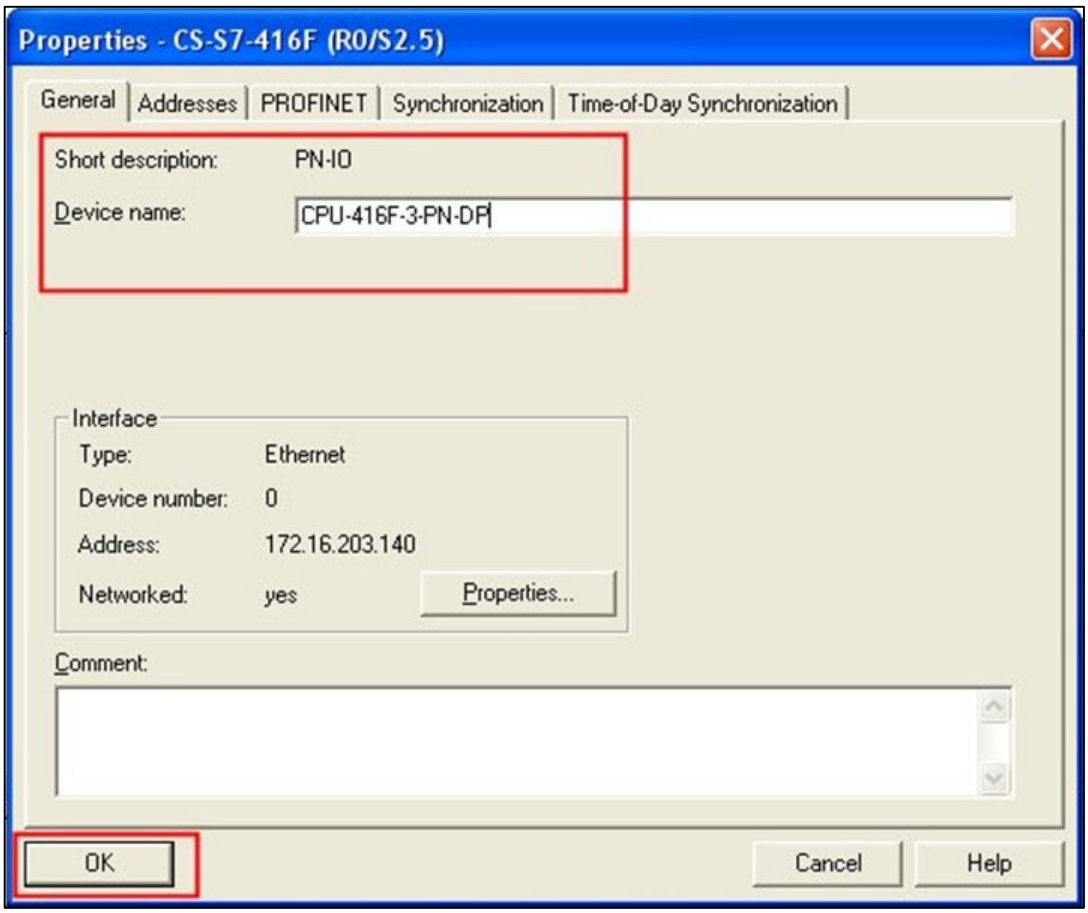


Fig. 10: S7 HW Config – Change the PROFINET name of the PROFINET I/O-Controller

- Edit PLC-Ethernet Node and…

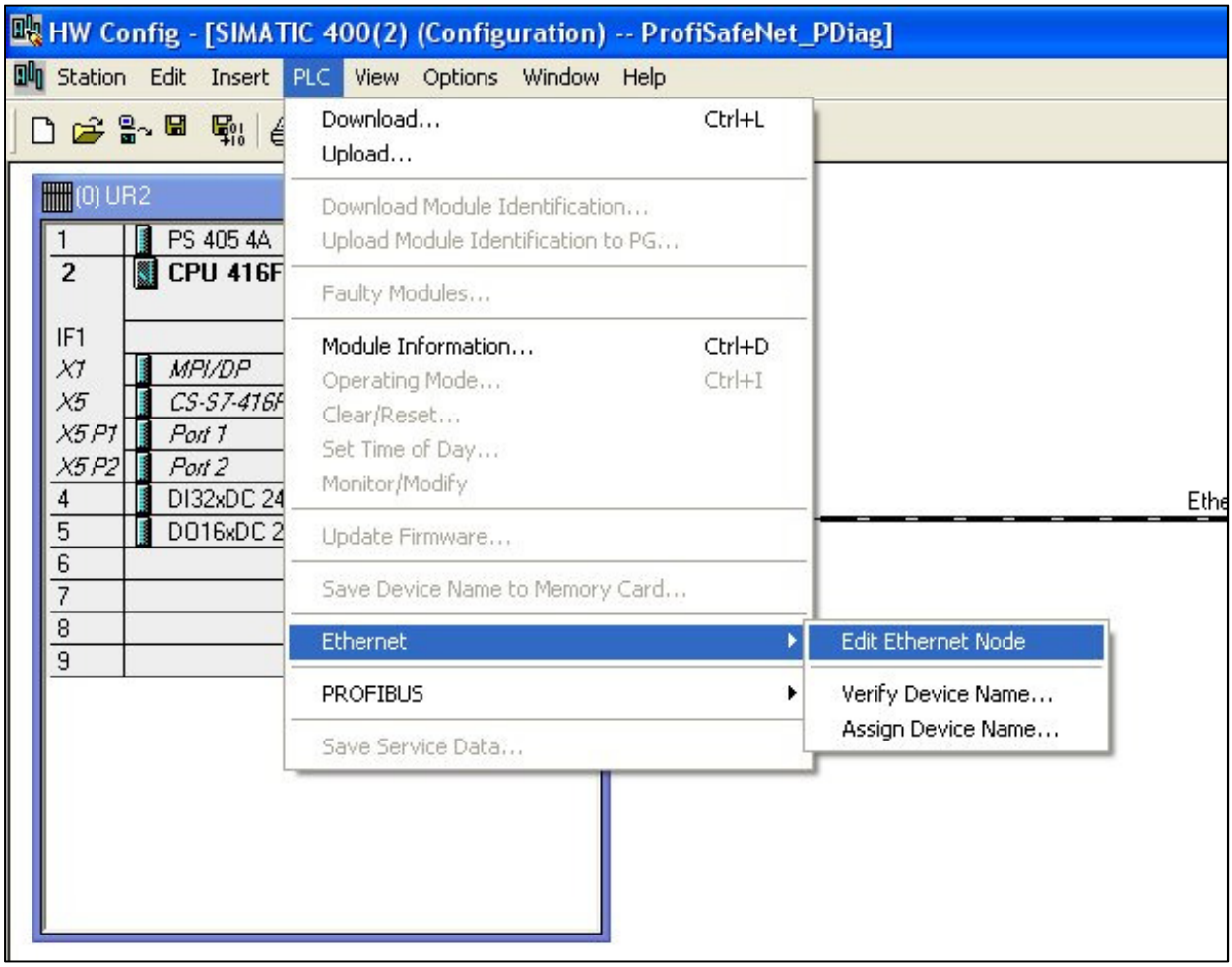


Fig. 11: S7 HW Config – Edit Ethernet Node

- …start search accessible online devices:

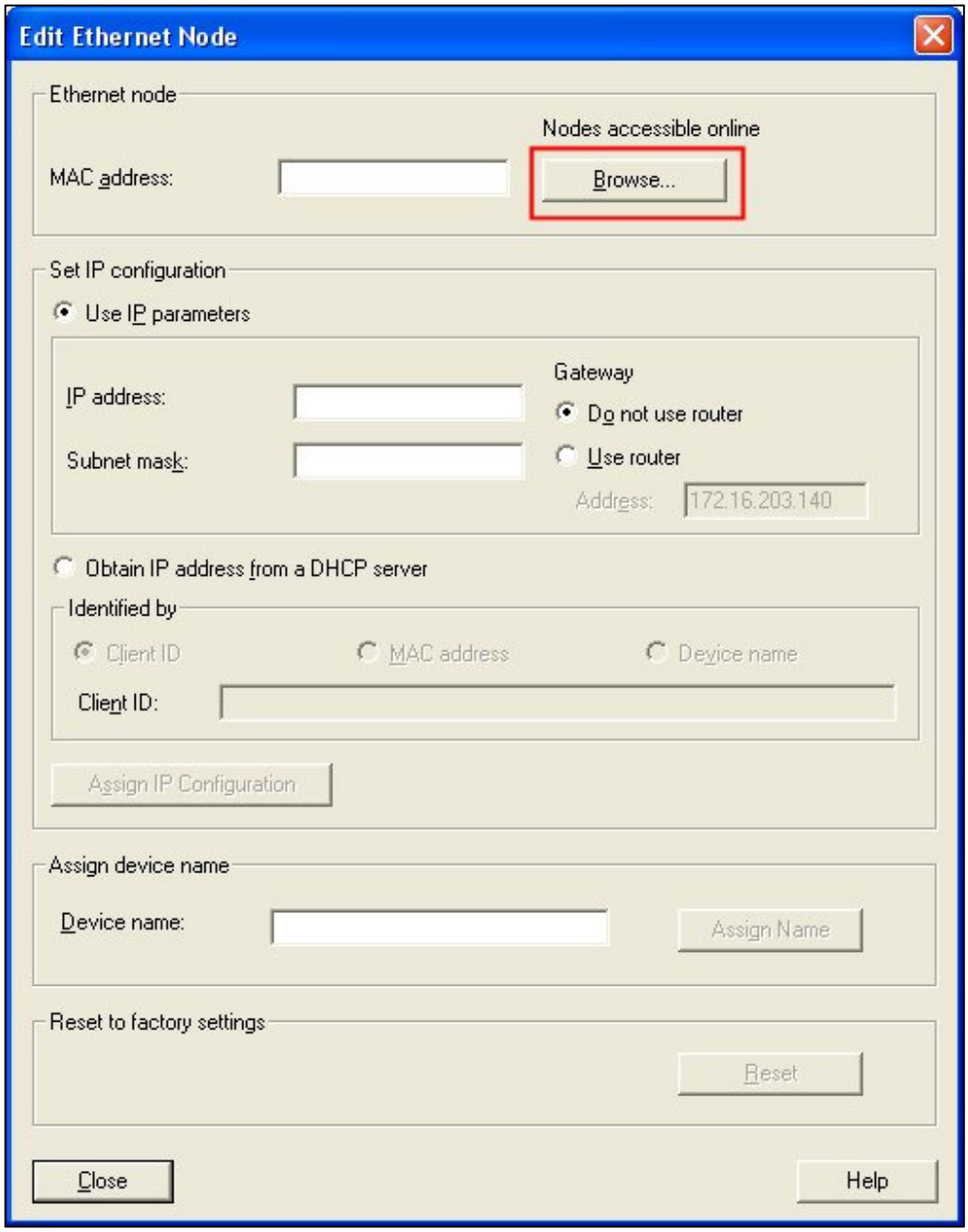


Fig. 12: S7 HW Config – Start the Ethernet broadcast dialog

- If the S7 PROFINET-I/O-Controller is connected to the hardware, start the Ethernet online connection:

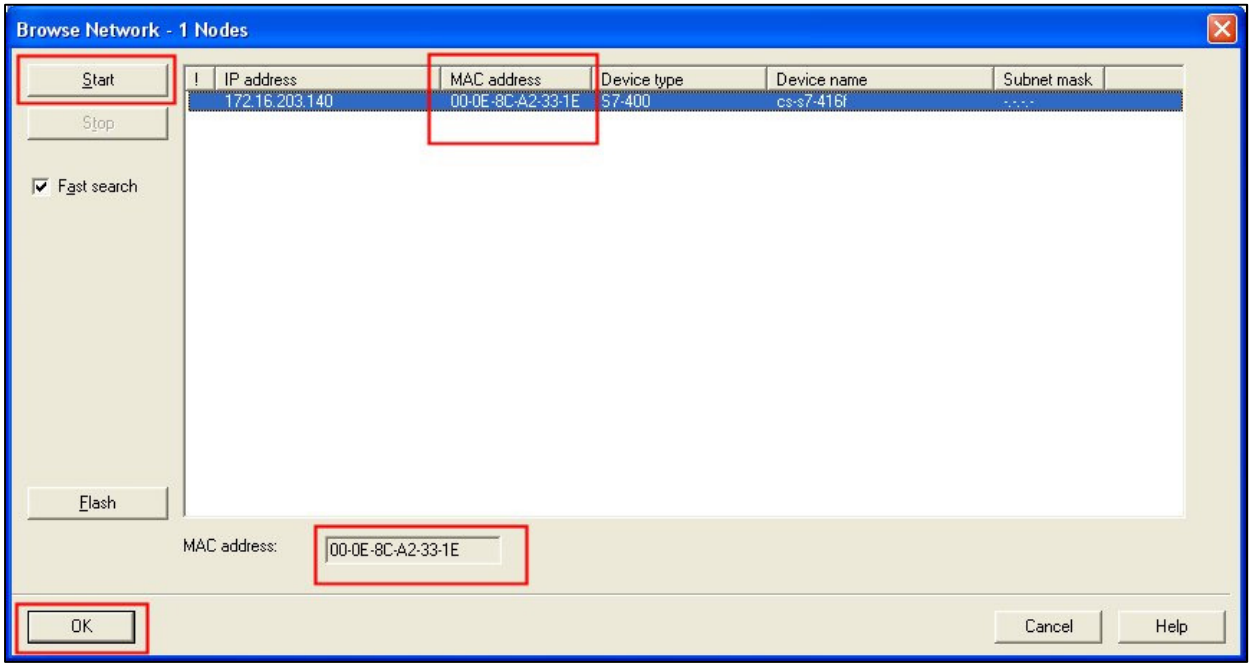


Fig. 13: S7 HW Config – Enable the PROFINET-I/O-Controller

- Note:
  If the S7 PROFINET-I/O-Controller uses a default IP-Address, check:
  - the IP-address and
  - Subnet mask of the PG-PC please.
- A wrong setting would cause a failed assignment.

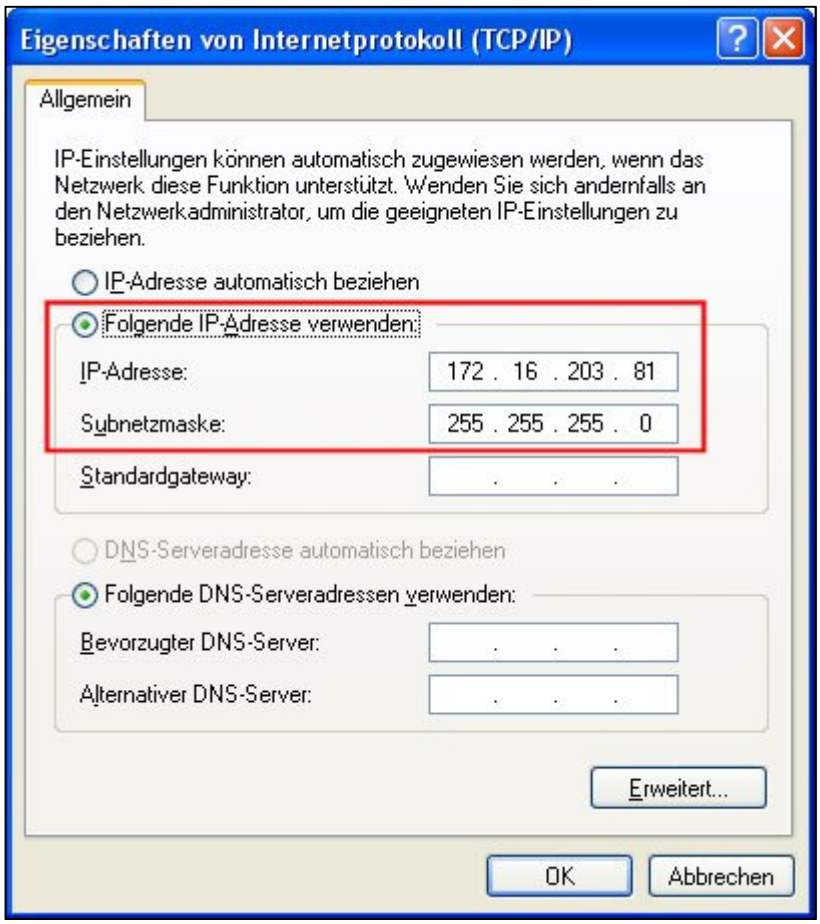


Fig. 14: Windows OS – Check the Ethernet settings of the PG-PC

- Assign the PROFINET-name to the S7 PN-I/O-Controller:

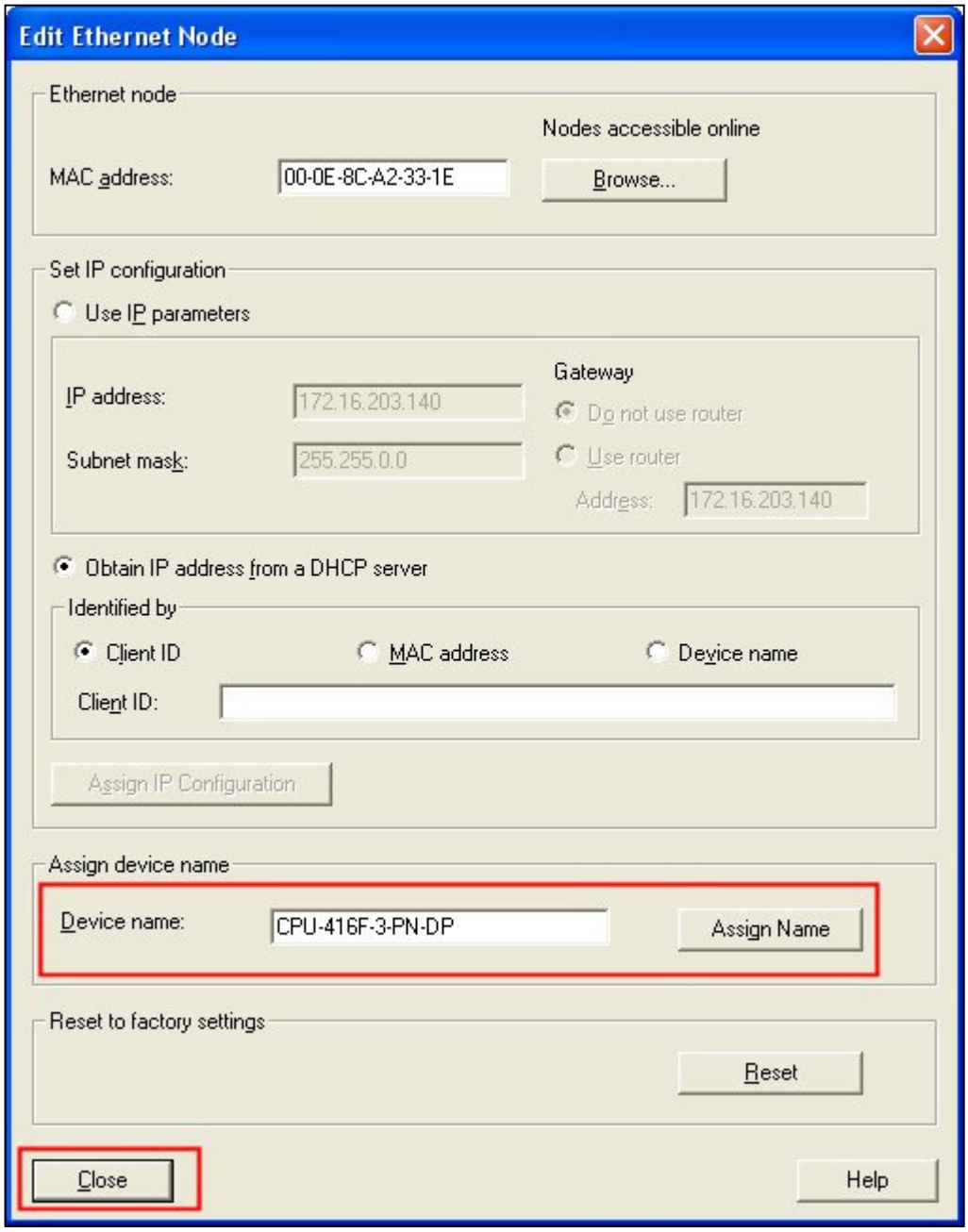


Fig. 15: S7 HW Config – Assign the PROFINET name to the S7 PN-I/O-Controller

- Select the PLC and open the properties of the PLC:
  - Click at the register ‘Protection’,
  - insert a new password and
  - enable the “CPU contains a safety program” too.

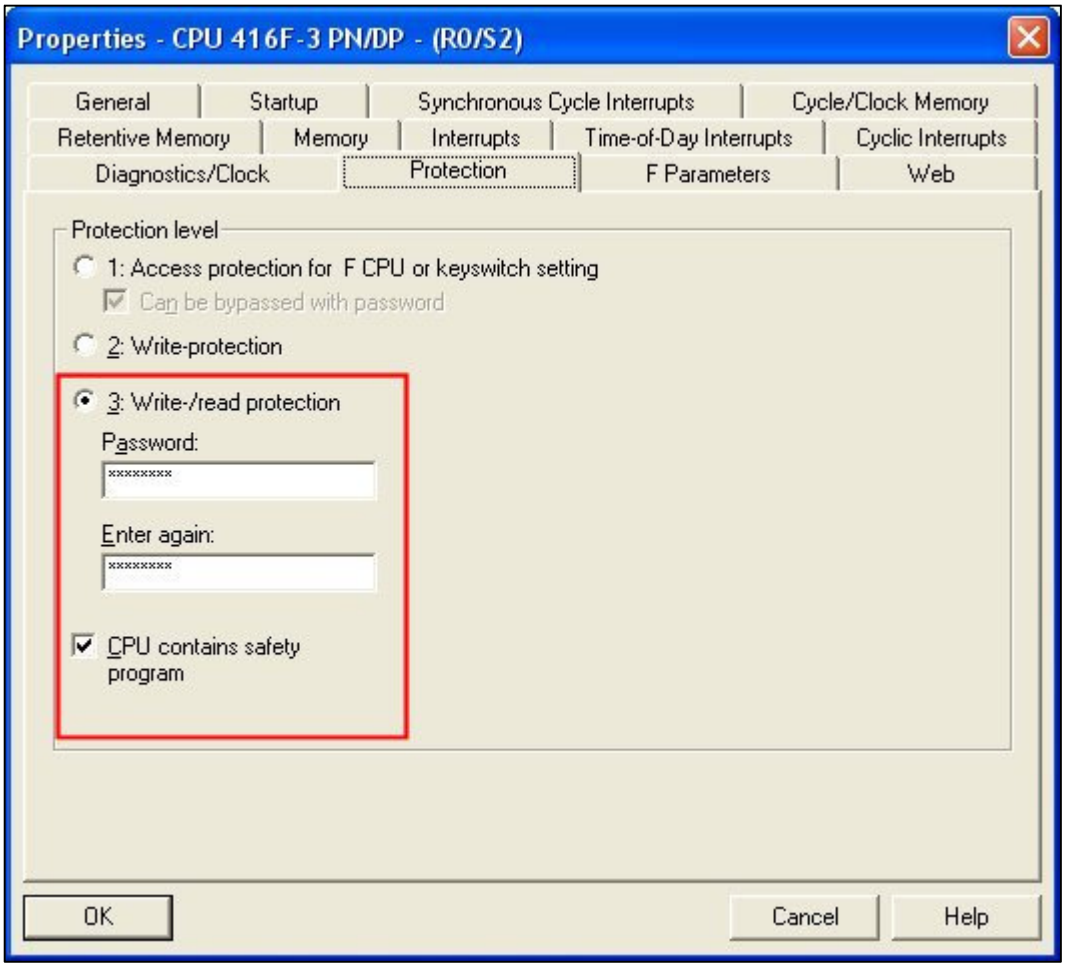


Fig. 16: S7 HW Config – Insert or change the Failsafe password

- At the register ‘F-parameter’ one are able to change settings for the Failsafe program.
  One can change or use the default Failsafe-address (2000) of S7-I/O-Controller
  It is not necessary to change the default values.

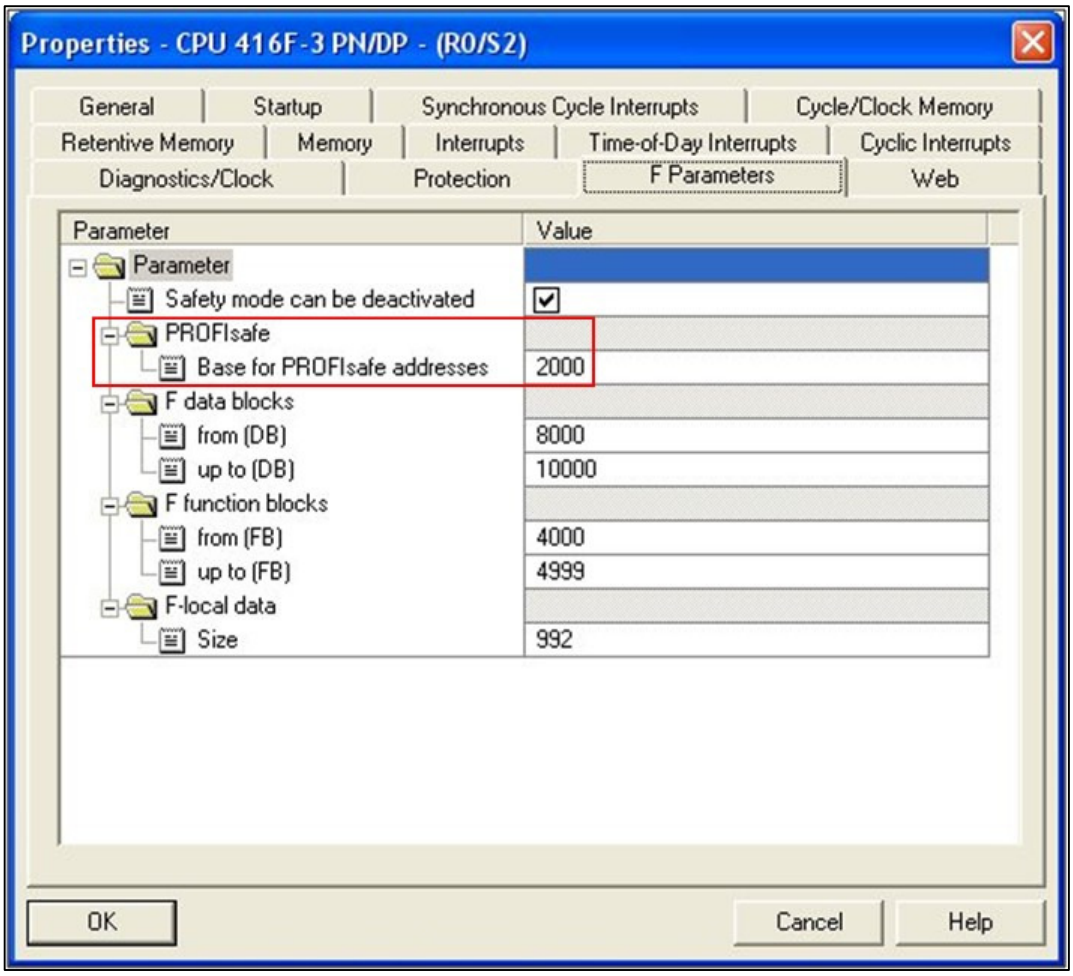


Fig. 17: S7 HW Config – Failsafe parameters of S7-I/O-Controller

- This “Application Note” should use the cyclic interrupt OB35 for calling the Failsafe-program.

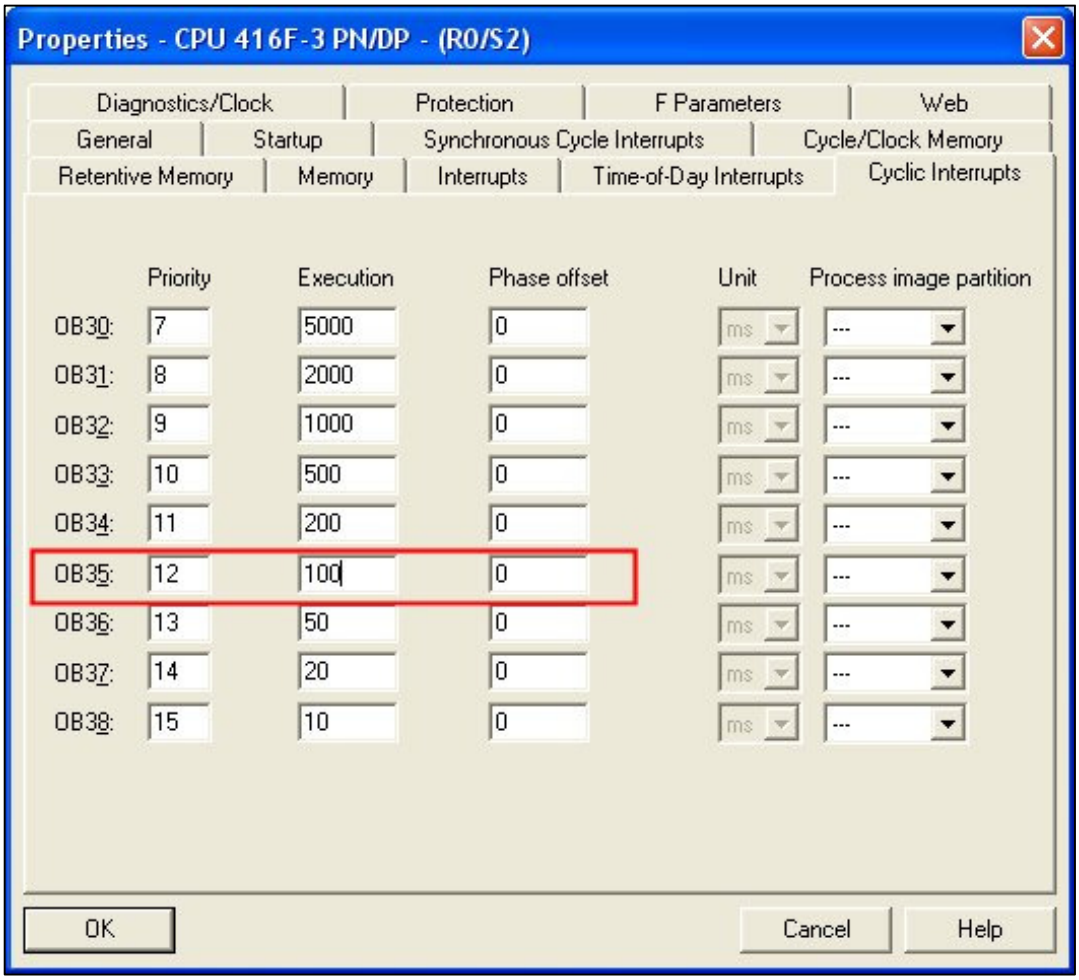


Fig. 18: S7 HW Config – Take cyclic OB35 for Failsafe-tasks

6.4. Configuration of PSSu H F PN-System

- After the PROFINET bus is enabled drag an drop the PSSu device box to the S7-configuration.

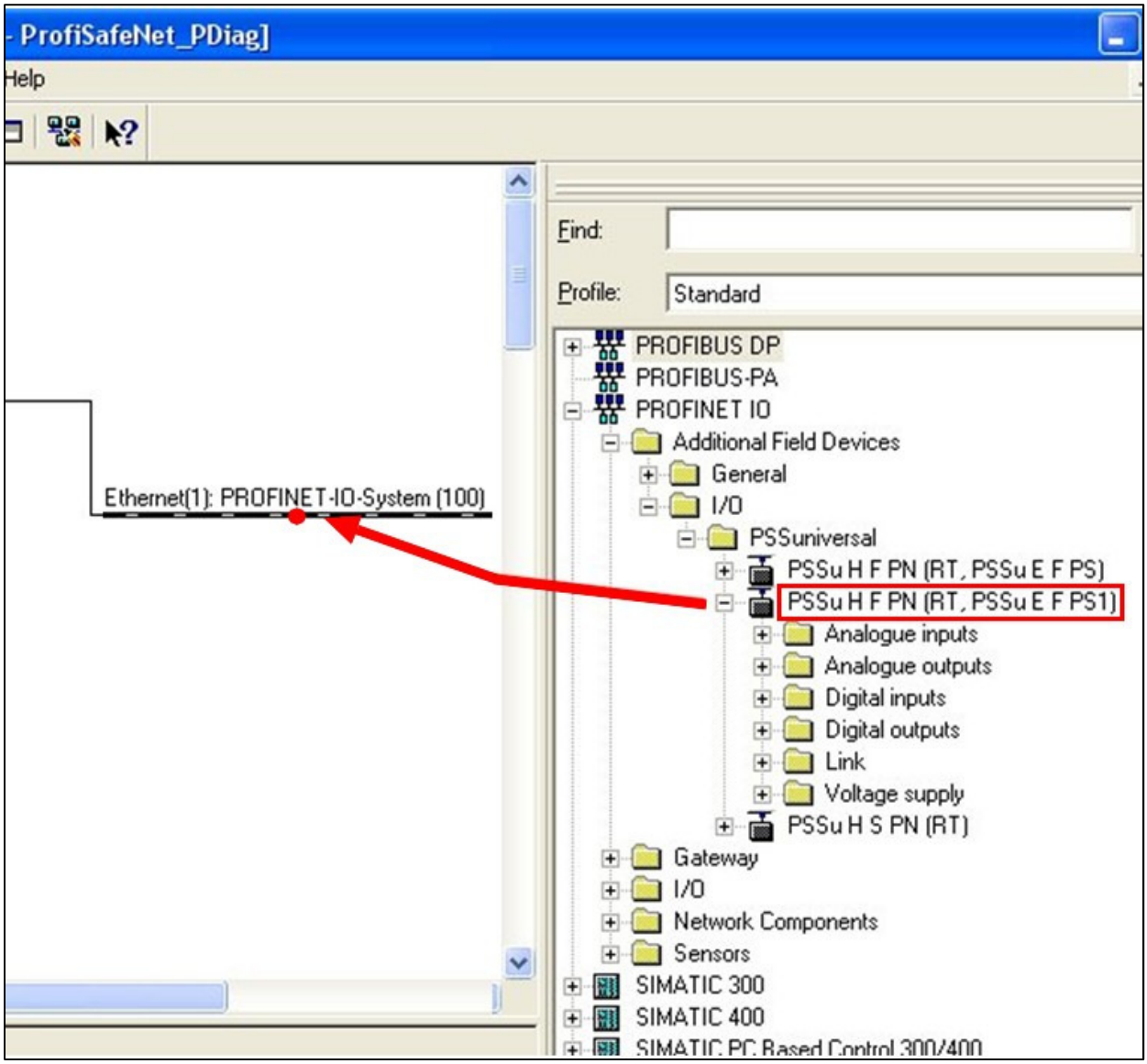


Fig. 19: S7 HW Config – Insert a new PSSu-System

- Enable the PSSu properties dialog an insert a individual PN-I/O-name. Like the S7 PROFINET I/O-Controller name the PSSu PN-I/O name has to be assigned too.

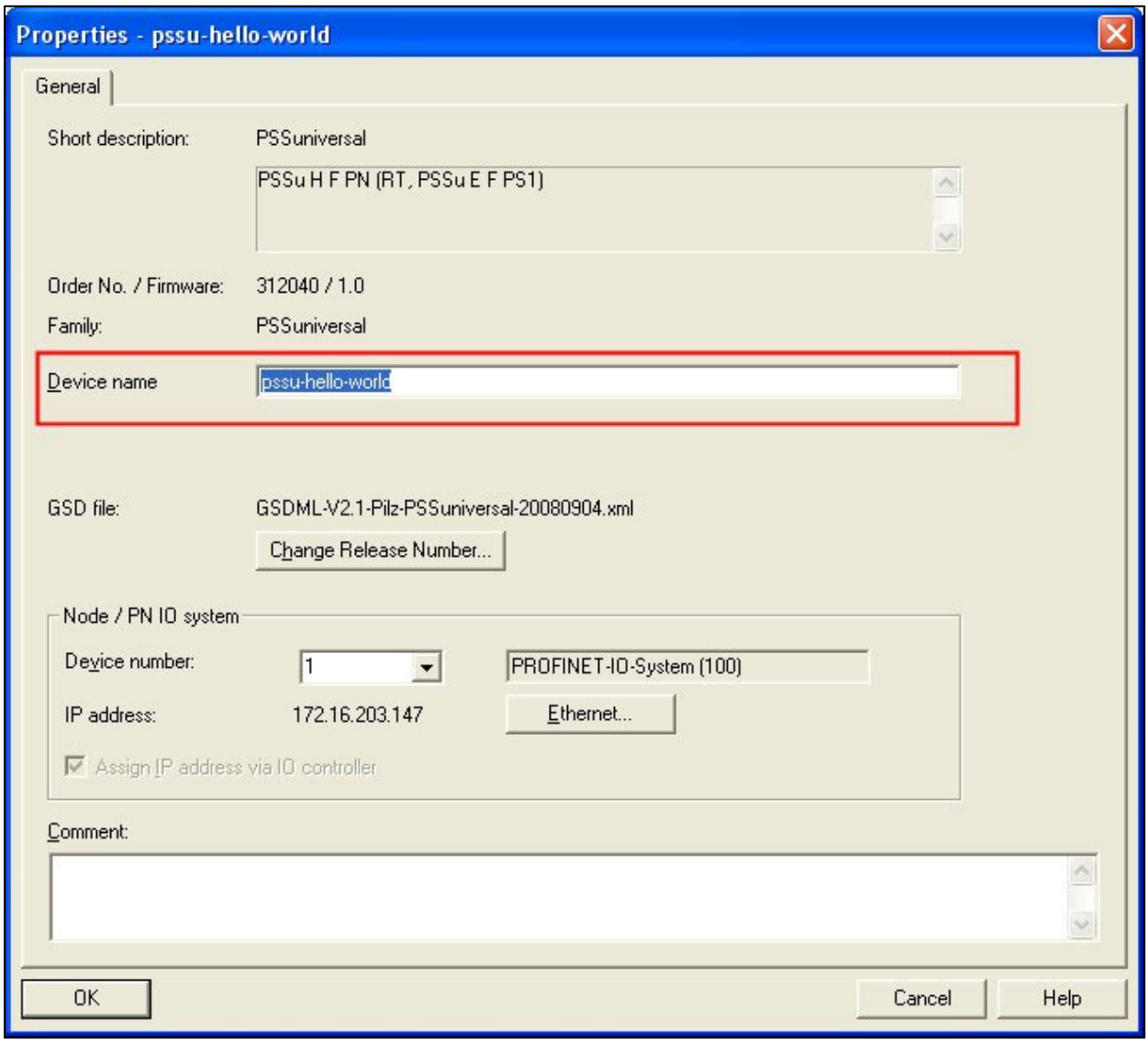


Fig. 20: S7 HW Config – Change the name of the PSSu-System

- After the PSSu Head module is enabled, add the PSSu I/O modules to the S7-configuration.

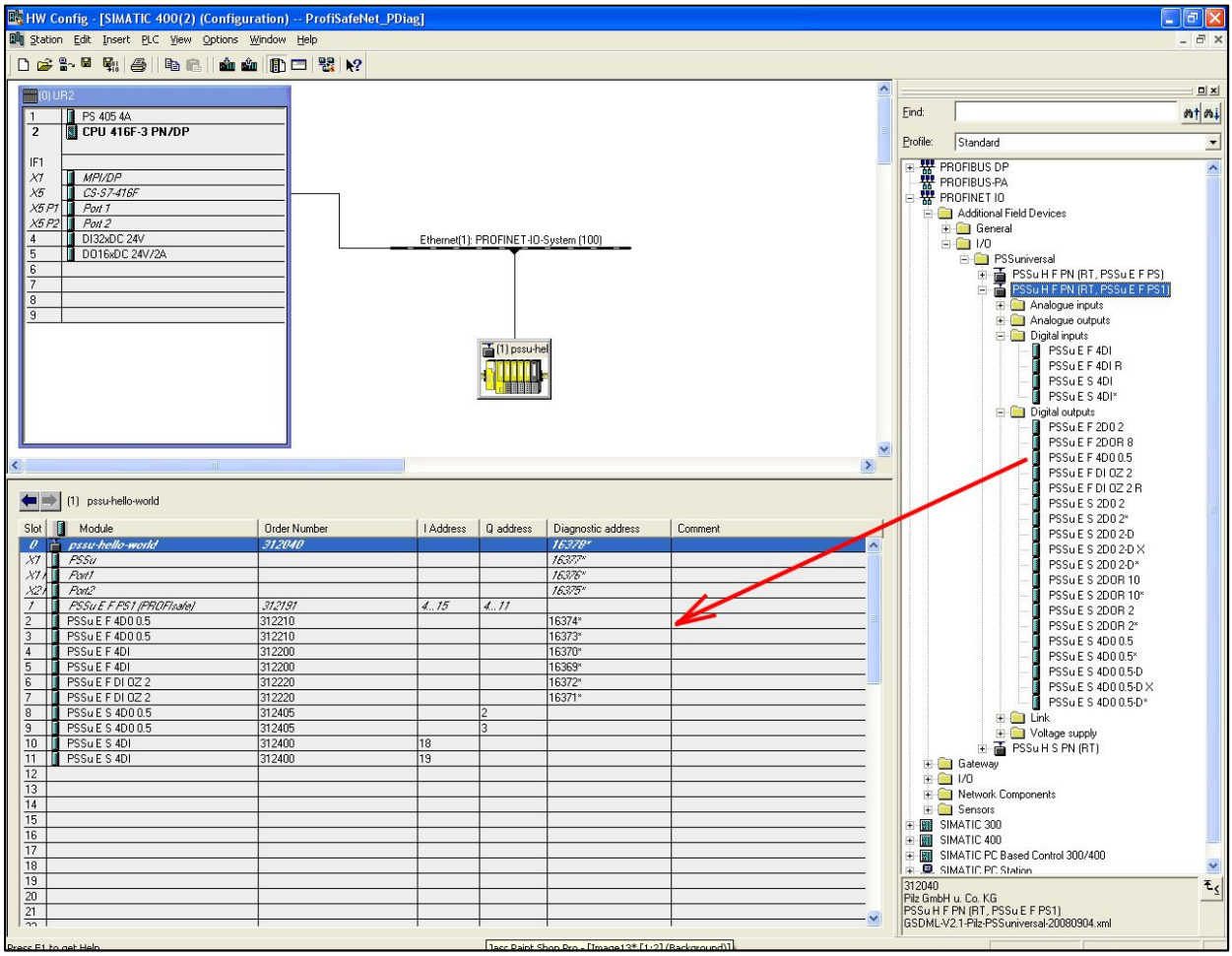


Fig. 21: S7 HW Config – Insert the PSSu Standard & Failsafe Electronic Modules

- Check physical PSSu-hardware and drag & drop the needed Electronic Modules to PSSu hardware registry.

6.5. Change default configuration of PSSu H F PN-System

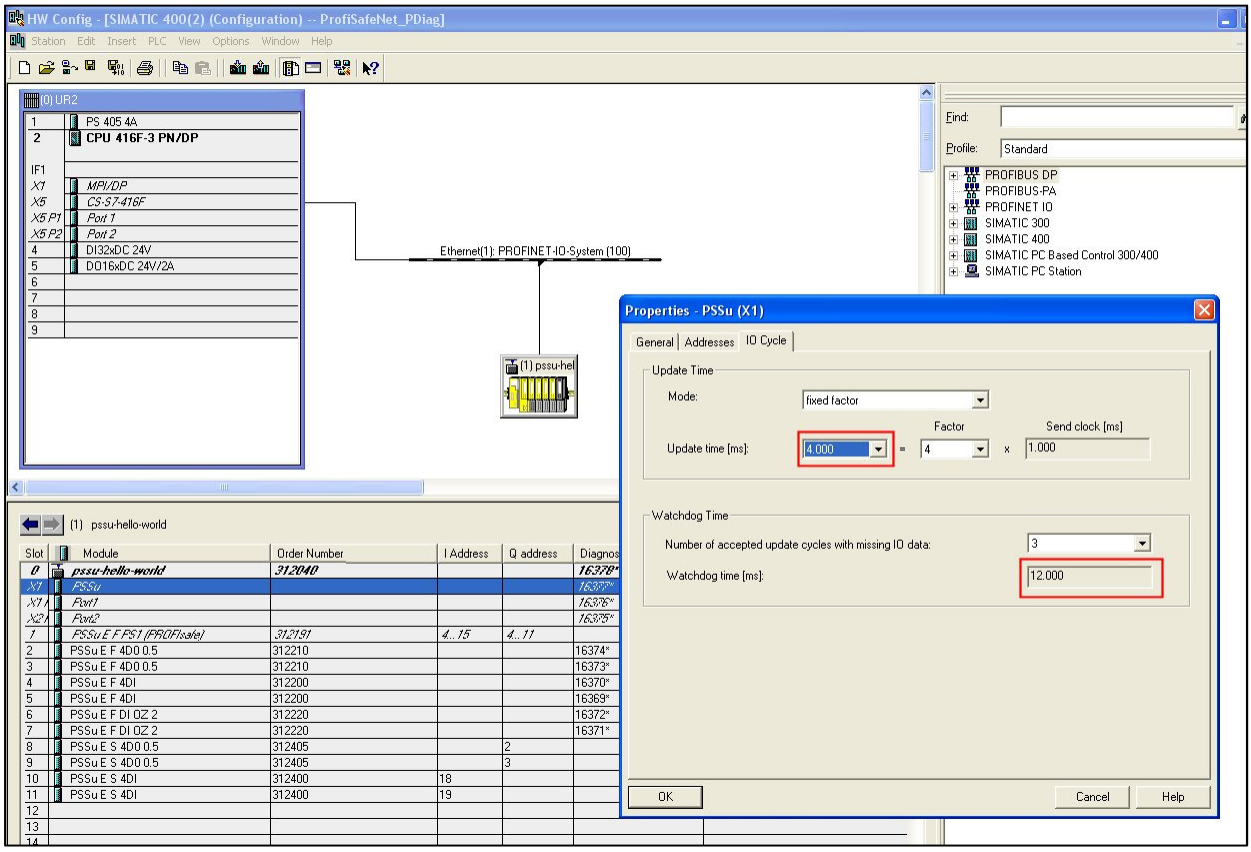


Fig. 22: S7 HW Config – Change the PSSu-"Update Time" (View1)

- The “Update time” and the “Watchdog time” have to be adjust to field and application:

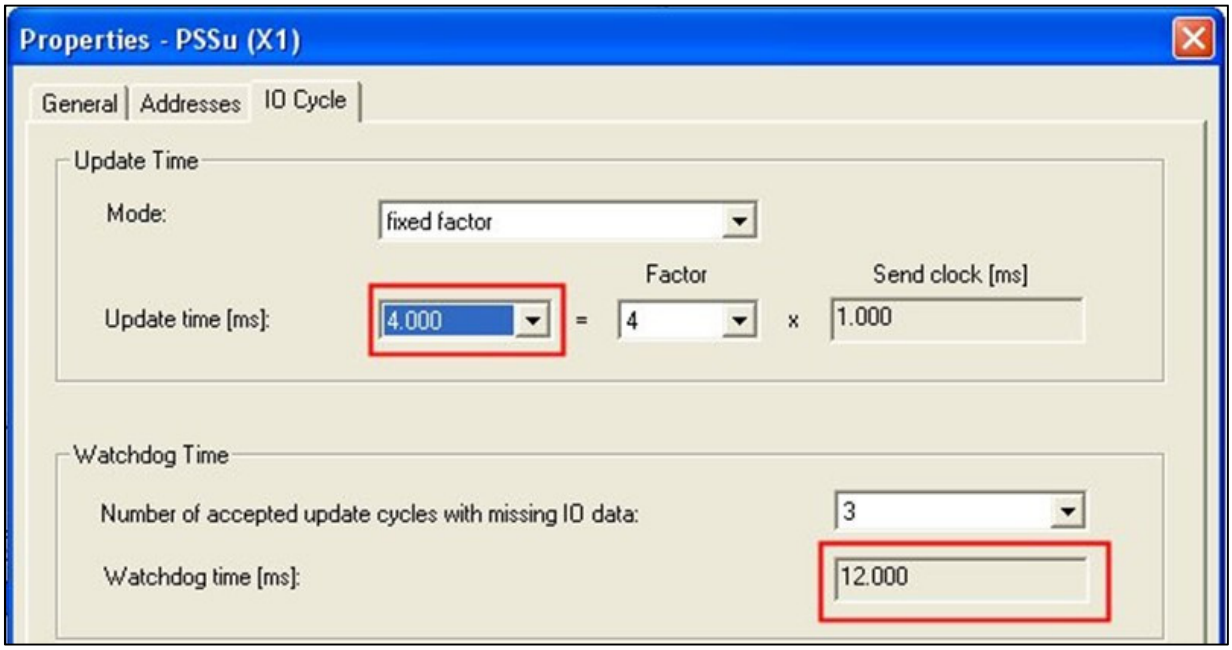


Fig. 23: S7 HW Config – Change the PSSu-"Update Time" (View2)

- Change ‘Properties’ of PSSu Head module ("Watchdog Time"):

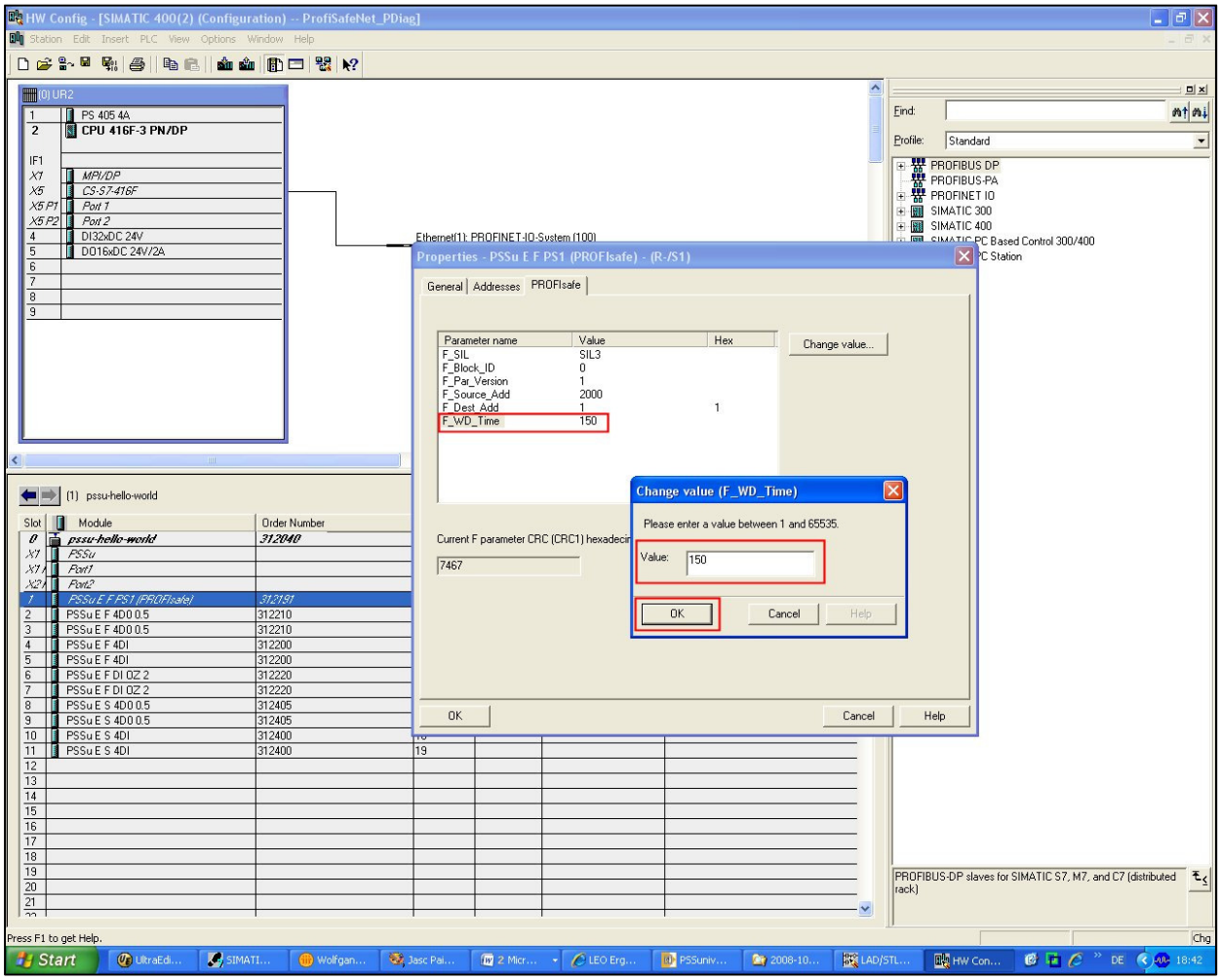


Fig. 24: S7 HW Config – Change PSSu-"Watchdog Time" (View1)

- Change PSSu-"Watchdog Time":

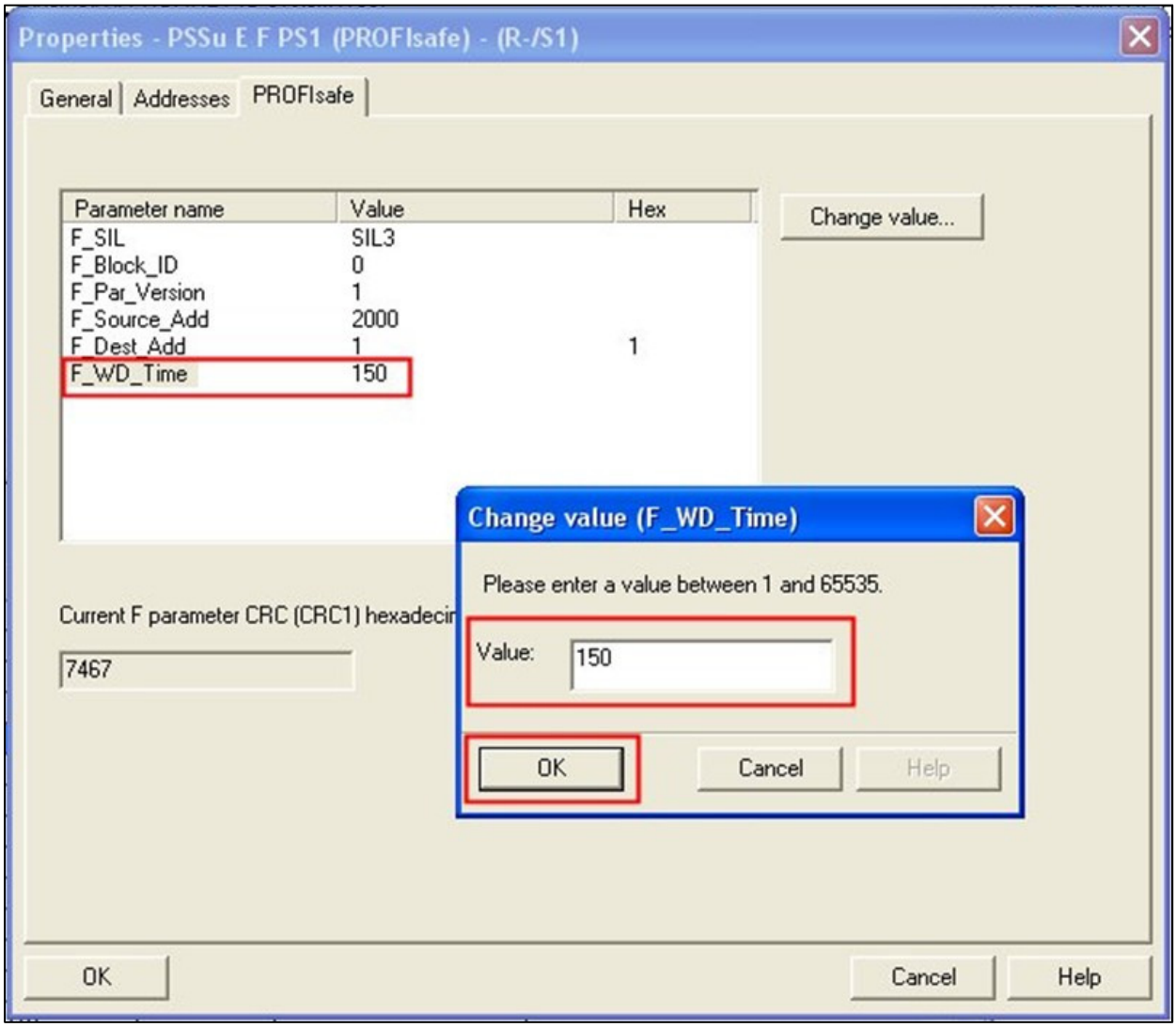


Fig. 25: S7 HW Config – Change PSSu-"Watchdog Time" (View2)

- The “F-ADDRESS” are binary coded and permitted in the range 1D ... 511D.
  A station address is set via a combination of the relevant binary coded switches:

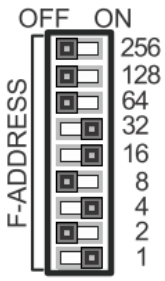
“F-ADDRESS” DIP switch	Key		Example
Switch designation	**OFF**	**ON**	**Station address 52_D**
256	0	256_D	
128	0	128_D	
64	0	64_D	
32	0	32_D	
16	0	16_D	
8	0	8_D	
4	0	4_D	
2	0	2_D	
1	0	1_D	

Fig. 26: PSSu H F PN – DIP switch for setting PROFINET-Failsafe-Address

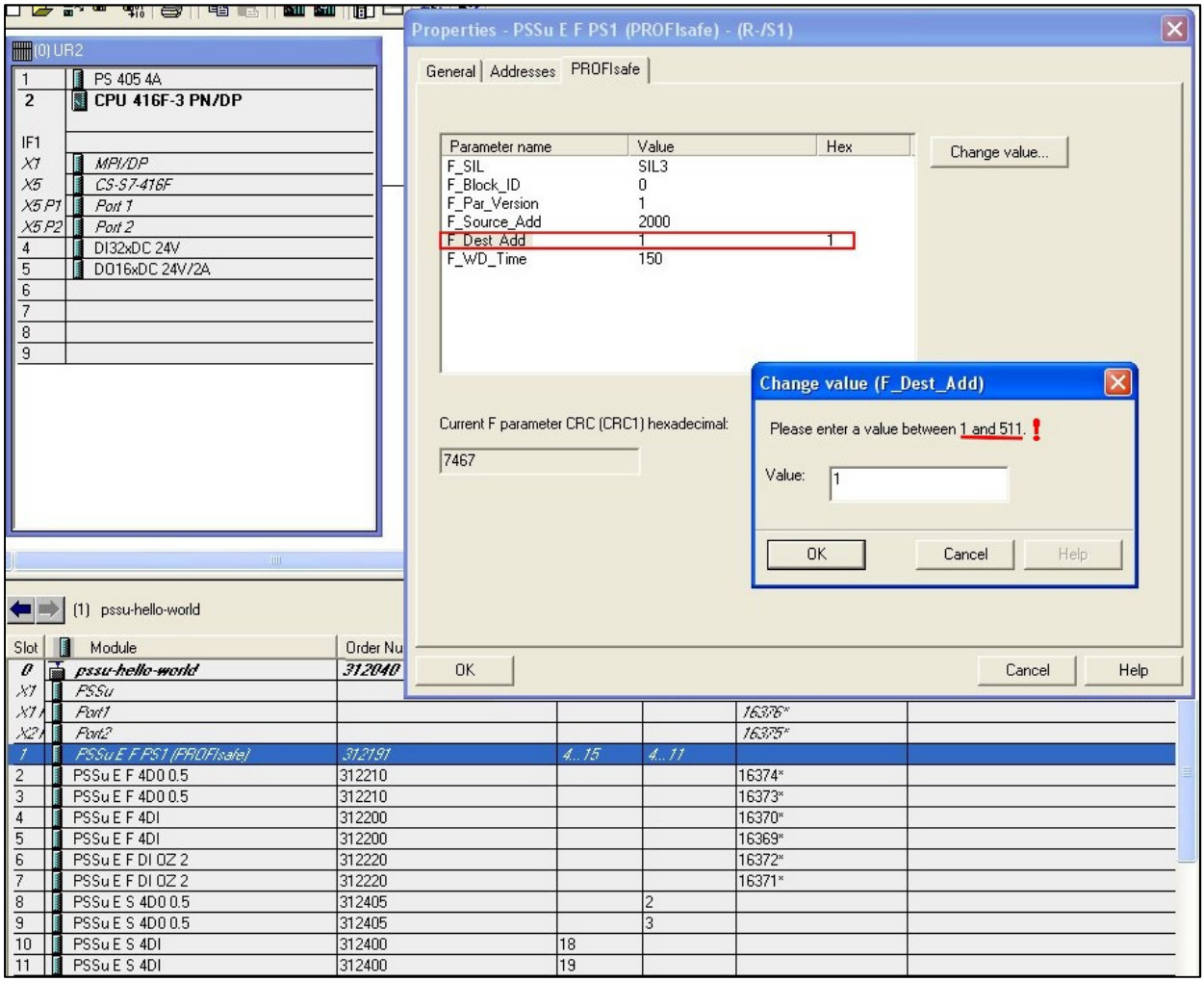


Fig. 27: S7 HW Config – Change PROFINET-Failsafe-Address (View1)

- Change "PSSu Failsafe-Address":

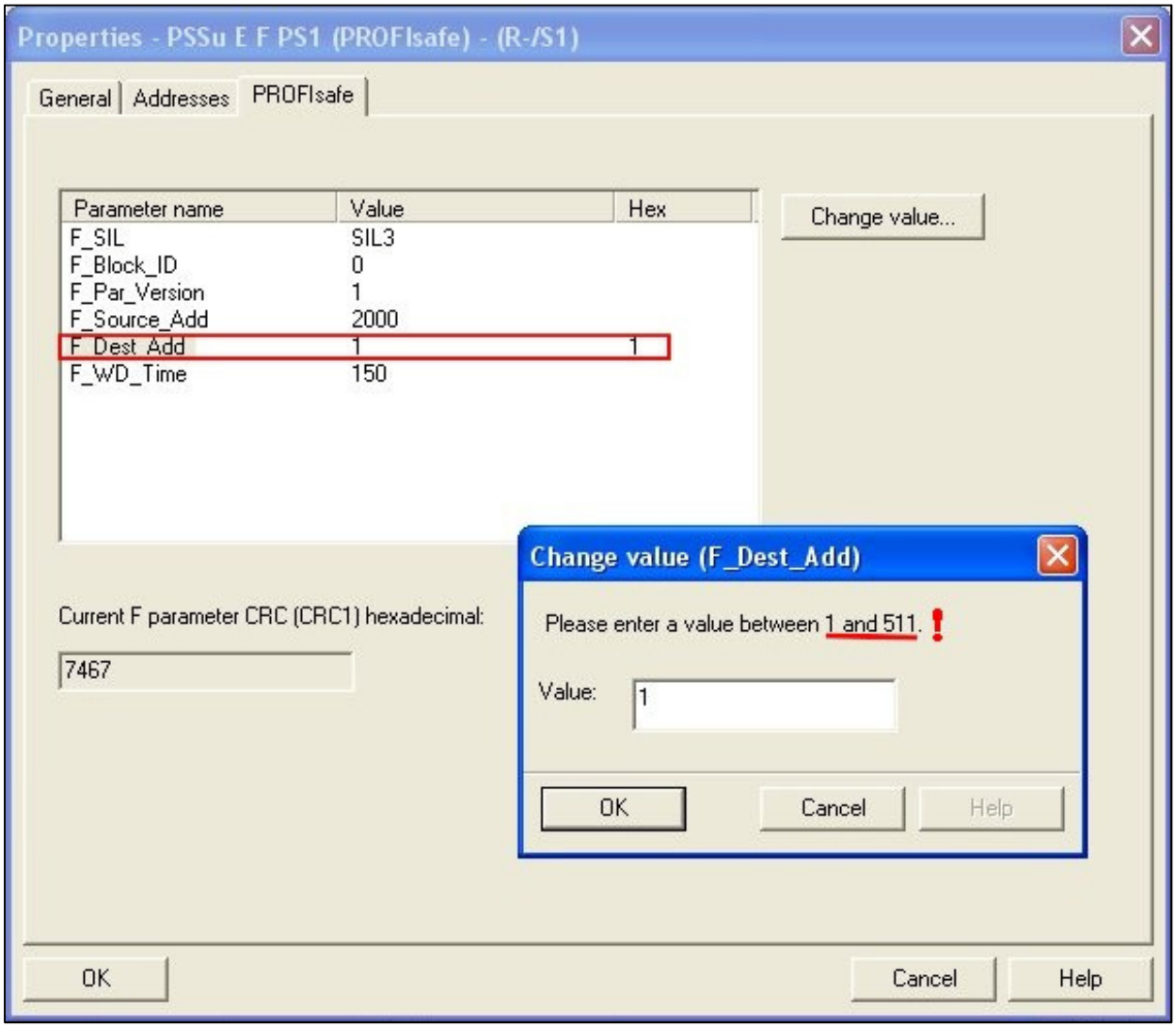


Fig. 28: S7 HW Config – Change PROFINET-Failsafe-Address (View2)

- Note:
  - The Failsafe-address and in the S7-hardware settings ('F_Dest_Add') and the PSSu-DIP switch position ('F-ADDRESS') have to be equal.
  - Is not necessary to reboot the PSSu system. The change of address is recognized immediately.
    But if there are problems, the PSSu-System should again be complete initialized by a Reboot (switch power supply off/on).

6.6. Transfer PSSu PROFINET Name

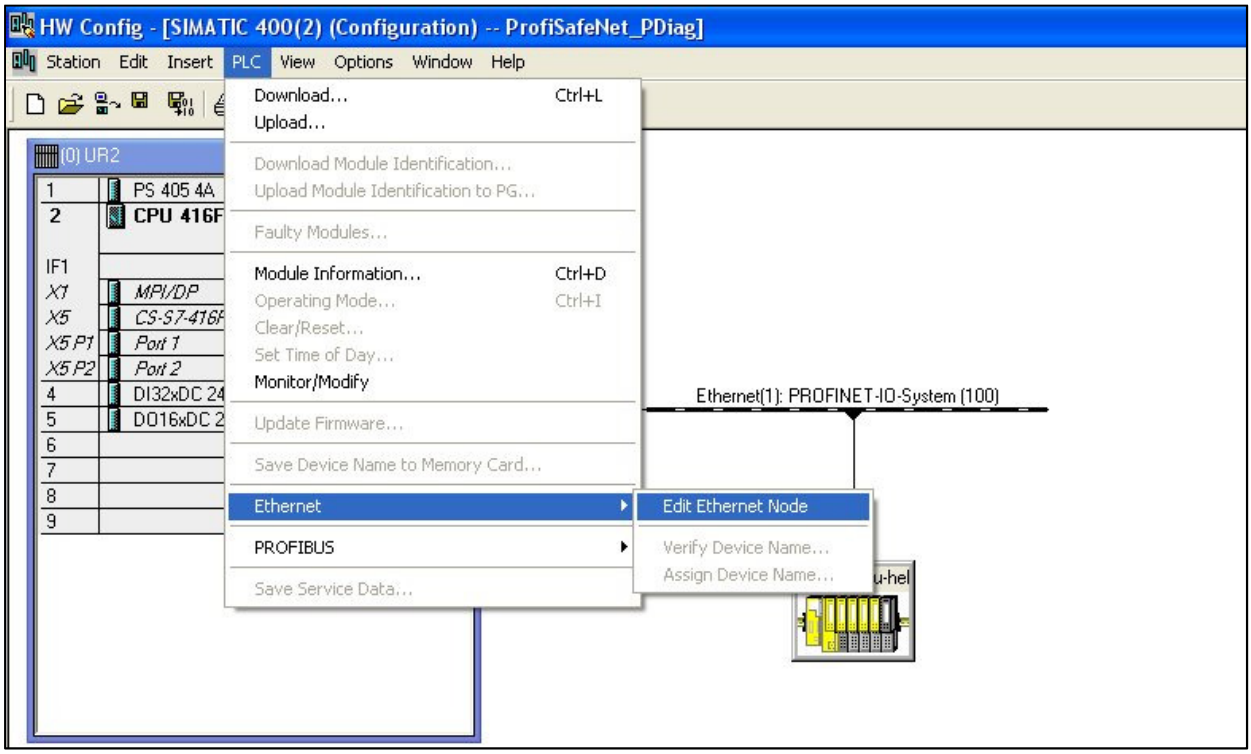


Fig. 29: S7 HW Config – Go online to Ethernet

- Open “Browse network”:

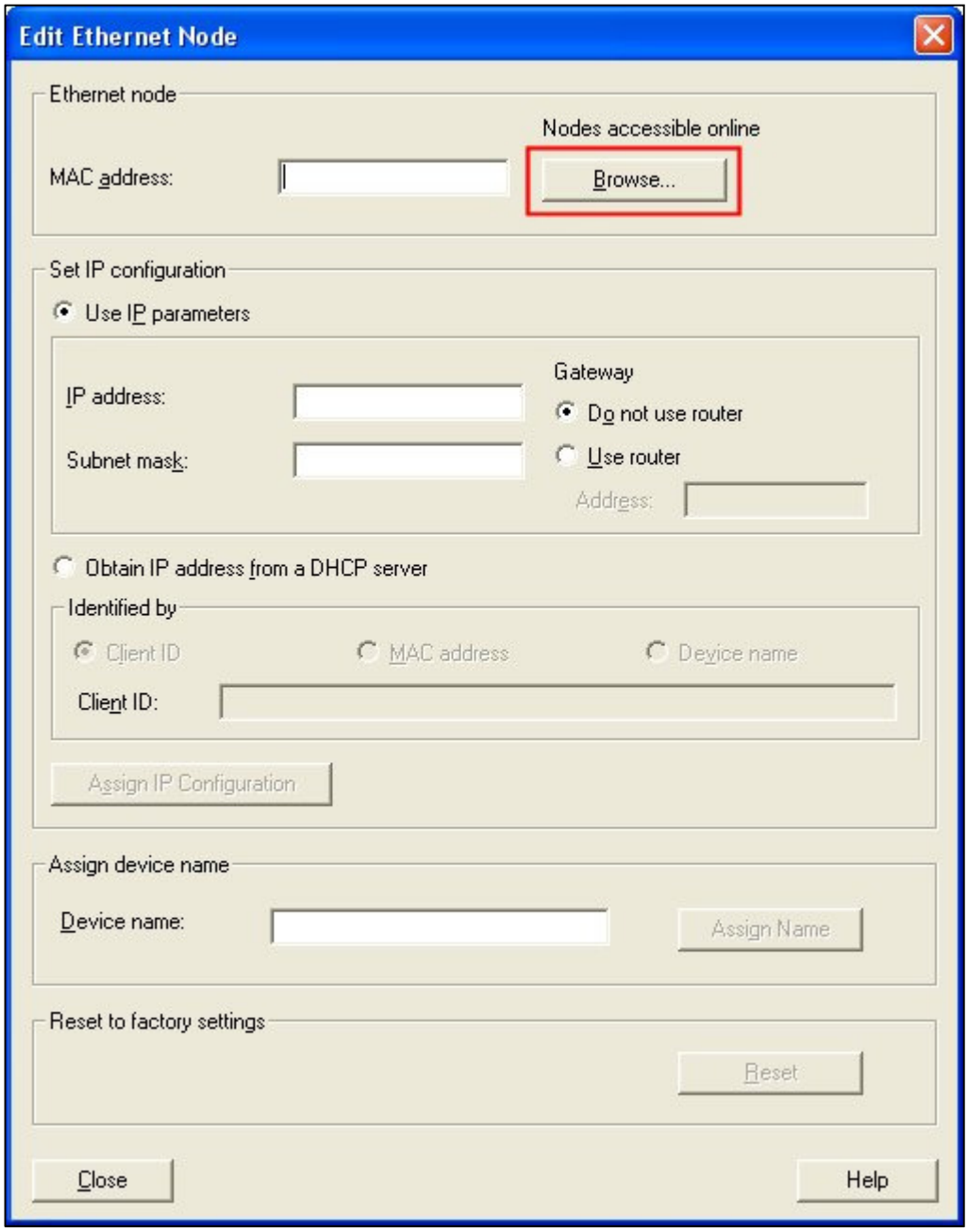


Fig. 30: S7 HW Config – Browse to the Ethernet hardware

- Start a broadcast search and
- Verify the connected PSSu device via flashing PSSu-LEDs: SF, Li1, Li2.

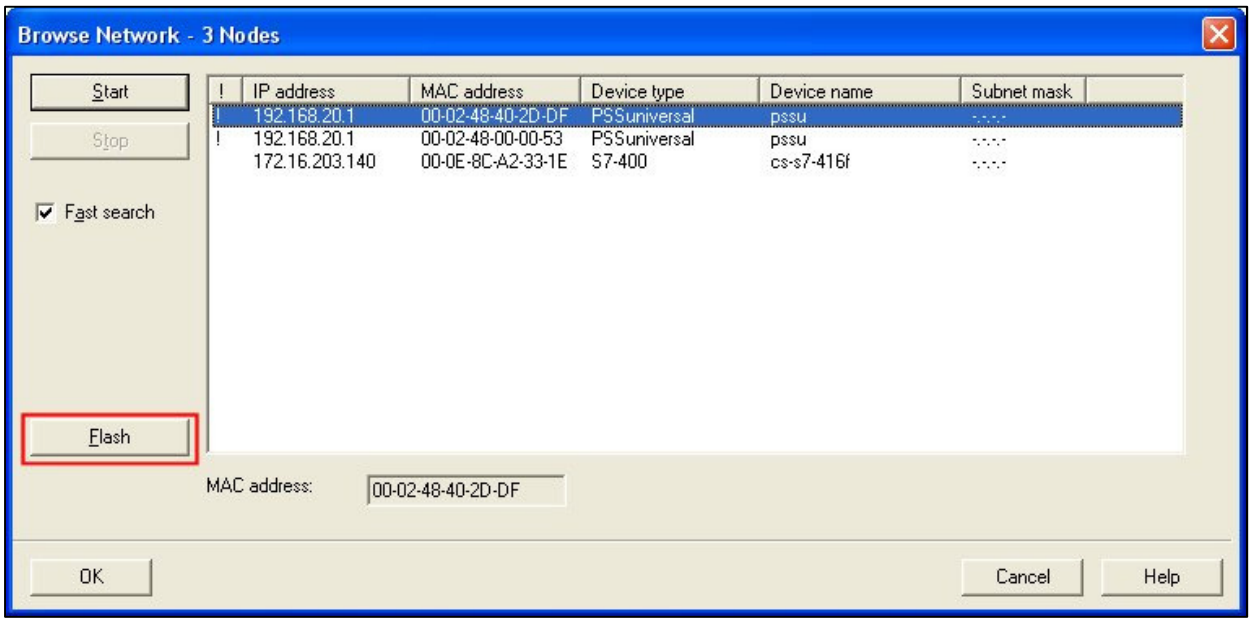


Fig. 31: S7 HW Config – Broadcast search ('Flash')

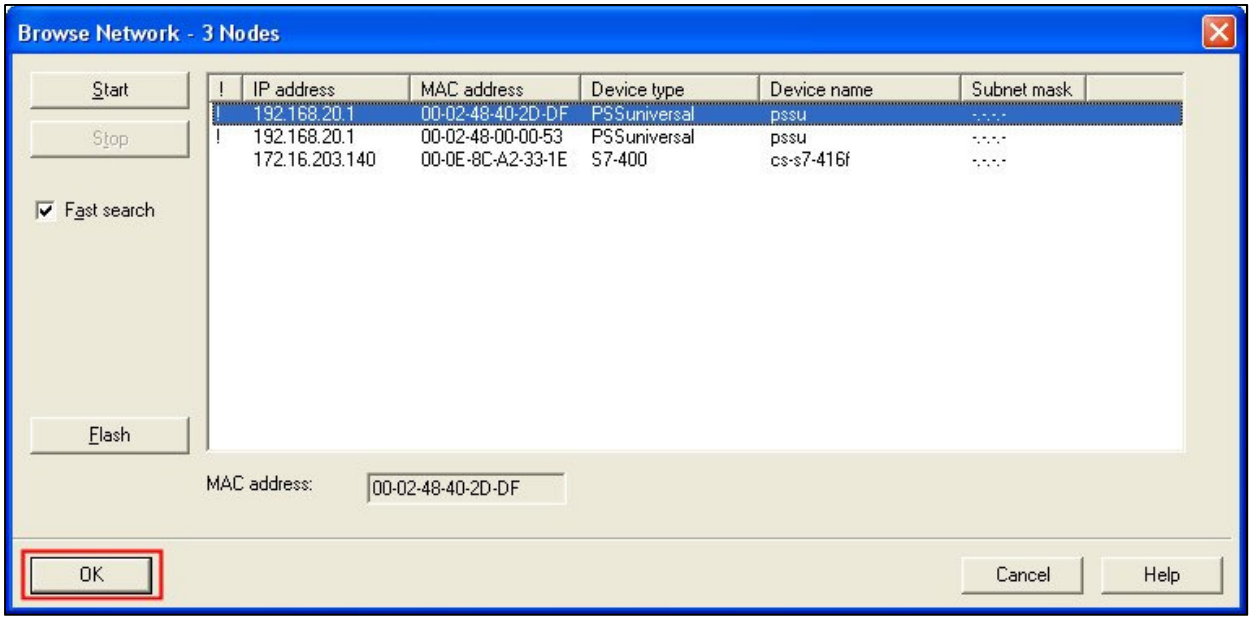


Fig. 32: S7 HW Config – Select the PSSu device ('OK')

- Assign device name to PSSu hardware

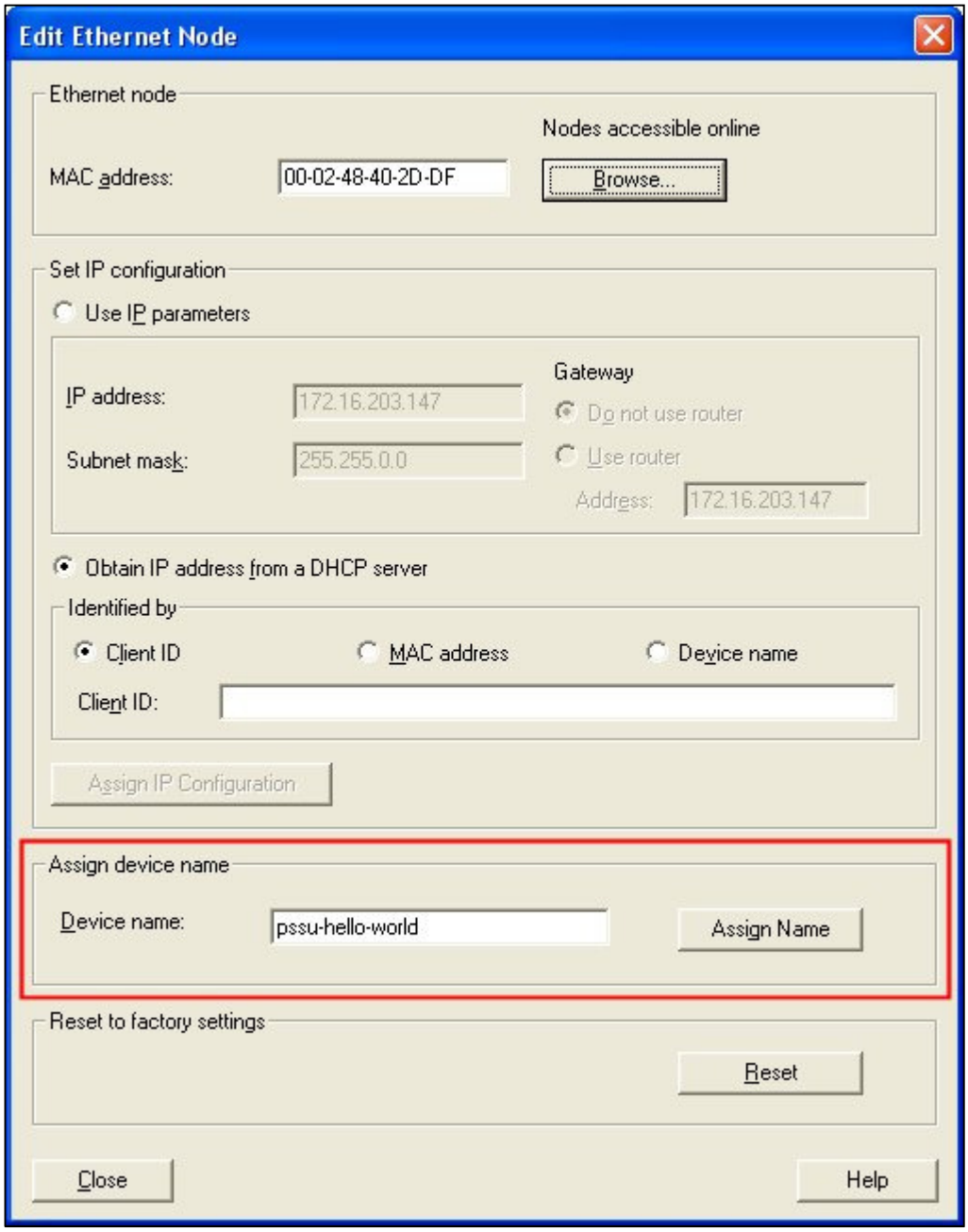


Fig. 33: S7 HW Config – Assign PROFINET-name

- The PROFINET/Safe-S7-I/O-Controller will assign the IP-Addresses in this application. One have to assign the PROFINET name “pssu-hello-world” only.

- Message after successful transfer:

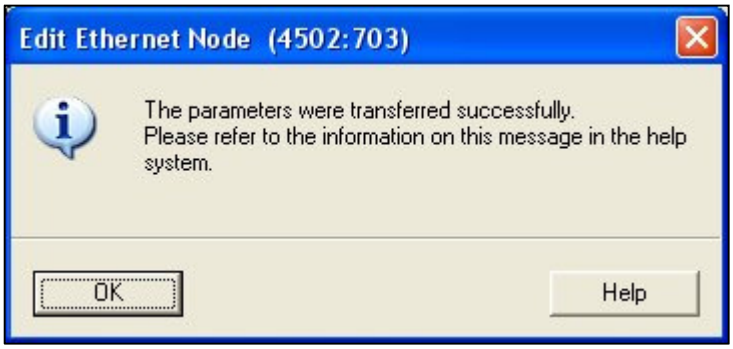


Fig. 34: S7 HW Config – Response name accepted

7. Configuration of PSSu Failsafe System

7.1. Start the PSSu Configurator via the S7 Hardware Manager

The PSSu-Configurator is a plug-in of the S7 Hardware-Manager. This means, one have to start it from the S7-Hardware–Manager.

- Note:
  If one are using a chip card, the PSSu-configuration data would be stored a this persistent memory. It is possible to exchange ready configured PSSu system memory to a spare PSSu head without using the Siemens-PG.

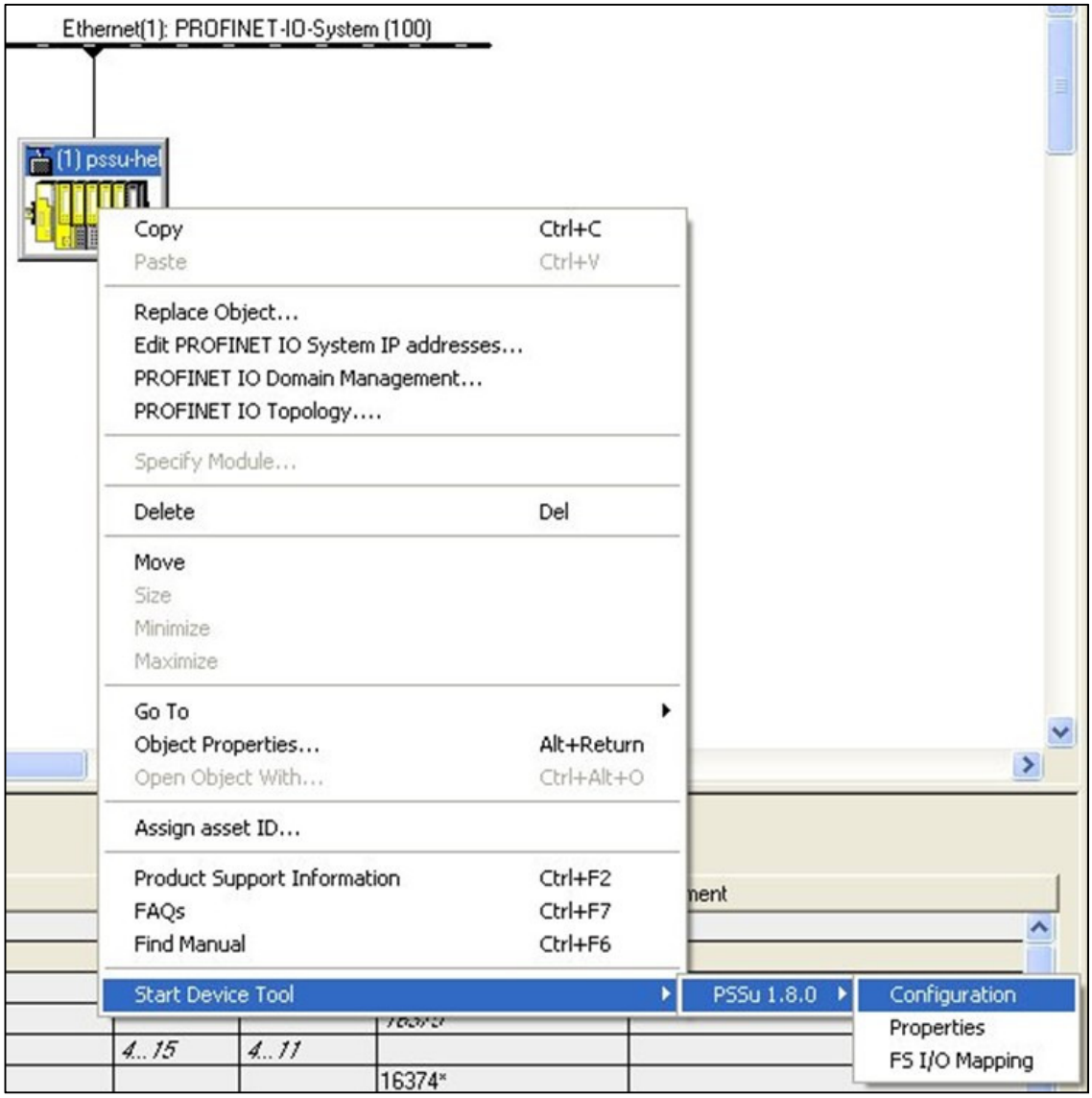


Fig. 35: S7 HW Config – Start PSSu Configurator for Failsafe-configuration

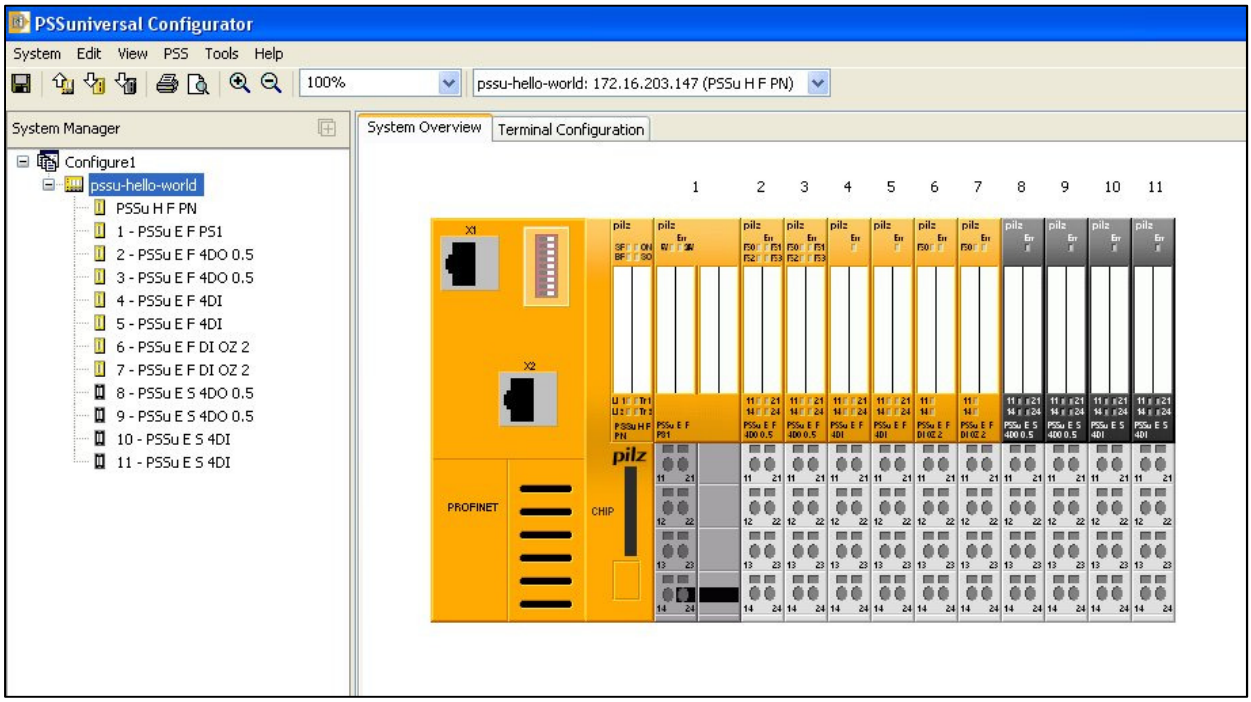


Fig. 36: PSSu Configurator – Overview of implemented Electronic Modules

7.2. Configuration of PSSu system

- First start configuration of Failsafe part of PSSu system:

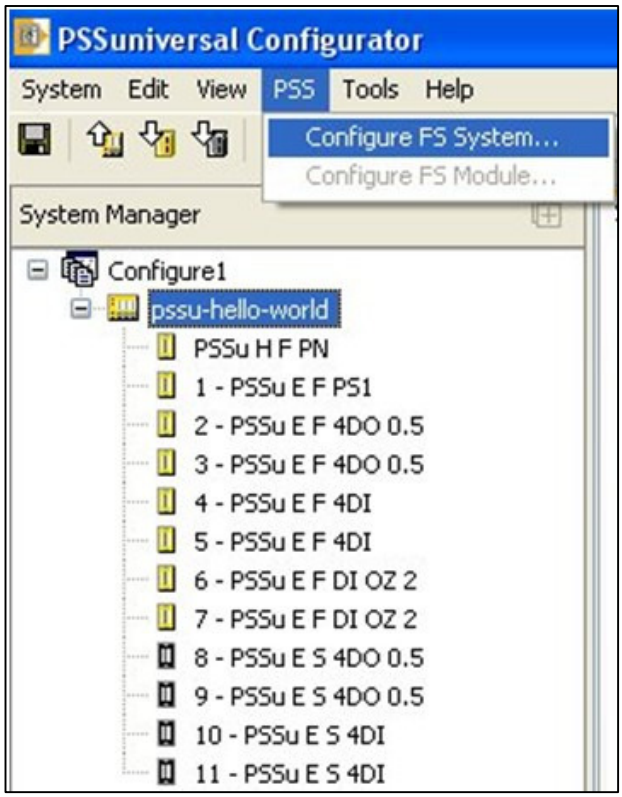


Fig. 37: PSSu Configurator – Start the PSSu Failsafe-configuration

- Enable the dual channel functionality, and get the PSSu clamp information

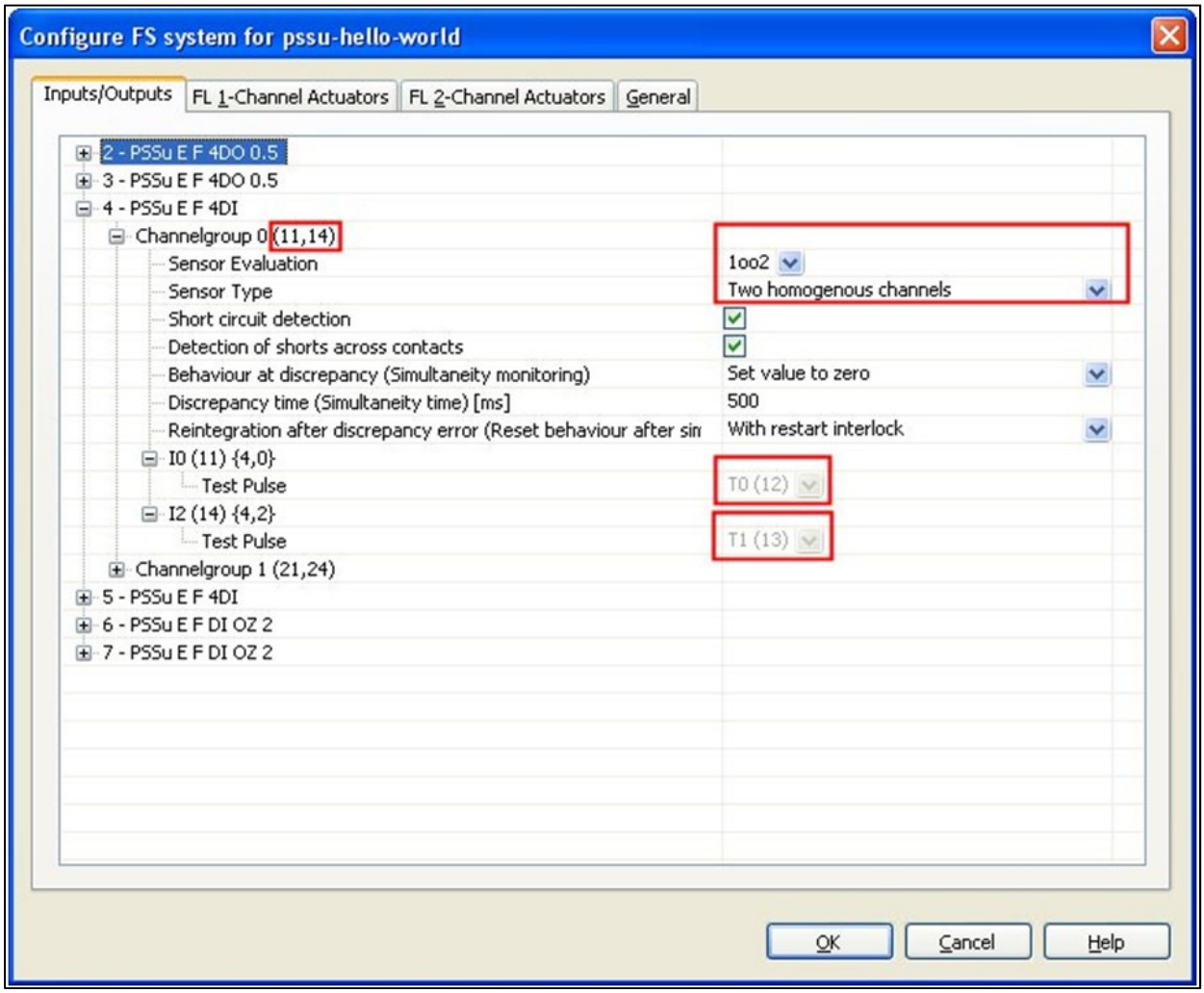


Fig. 38: PSSu Configurator – Enable the dual channel functionality

- Check the wiring especially the used clamps of electrical circuits please.
  “1 out of 2” means, that one get only one Process Image of Inputs flag in PLC-code.

- Troubleshooting note:
  If one want to check the E-Stop configuration and functionality, one have to look at these settings and the FB215 E-STOP parameters in the Failsafe-program too.

7.3. Download configuration to PSSu and Simatic system

- Download the Failsafe configuration data to the PSSu device:

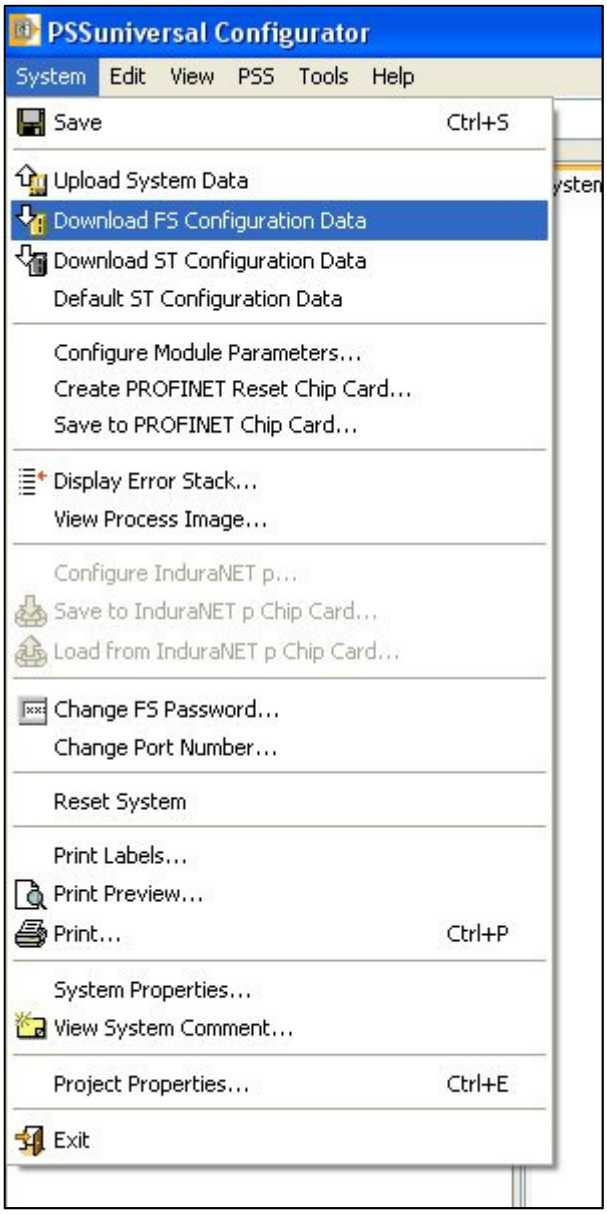


Fig. 39: PSSu Configurator – Download the Failsafe configuration to the PSSu device

- Notes:
  One have to download the Failsafe-part too, if one are using:
  - a PSSu H **F** PN-system with Standard Electronic Modules only.
  - a PSSu H **S** PN-head in the version smaller than 2.0.

- One can change the Default password of the PSSu-System via the menu System: Change the Failsafe-password in the PSSu Configurator.

Fig. 40: PSSu Configurator – Insert the PSSu-Password (default “pssu”)

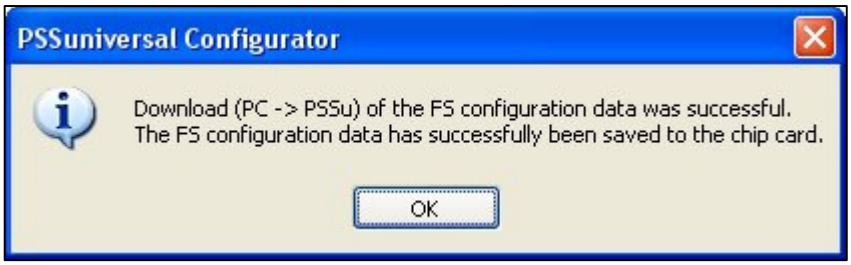


Fig. 41: PSSu Configurator – The download was successfully.

- Download the Standard configuration to the PSSu device

Fig. 42: PSSu Configurator – Download the Standard configuration to the PSSu device too

Fig. 43: PSSu Configurator – Standard download is finished.

- The “Save and Compile”-operation will close hardware configuration work.

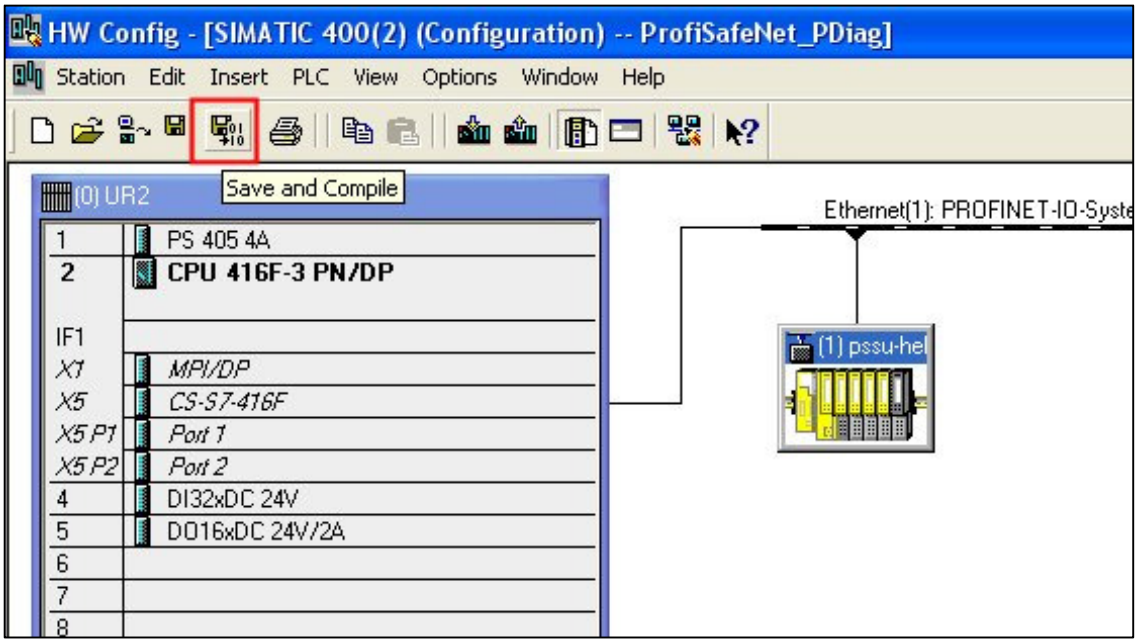


Fig. 44: S7 HW Config – Save and compile S7 hardware configuration

8. Step 7 program

8.1. Create the Organisation blocks

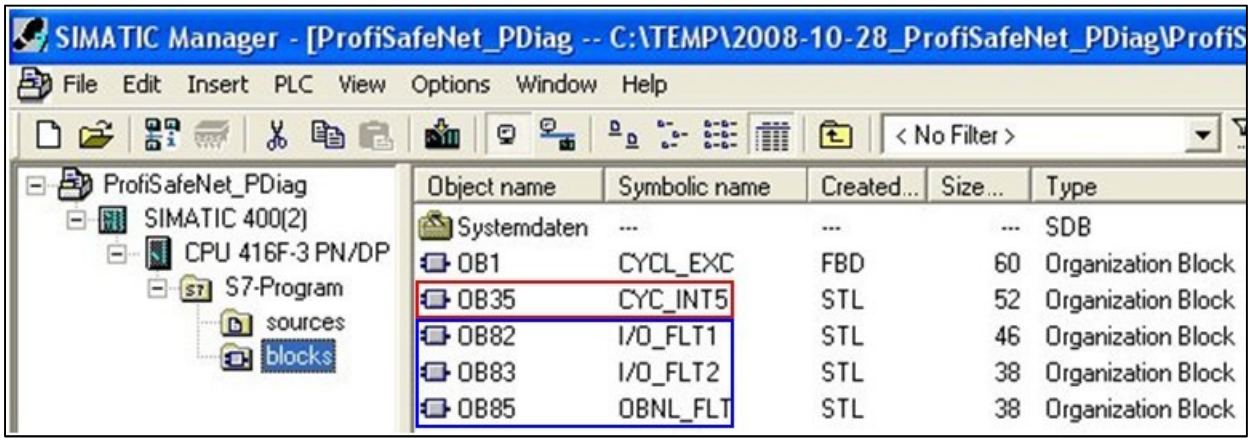


Fig. 45: Simatic Manager – Failsafe OB35 and "Error- OBs"

- Note:
  Without the “Error-OBs” the PLC would change to STOP mode in case of a system error (e.g. physical missing of a configured PSSu device).

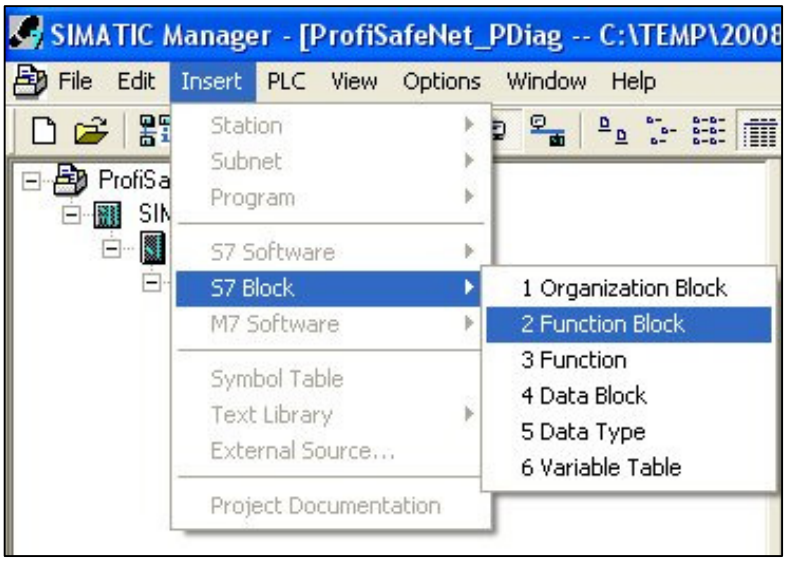


Fig. 46: Simatic Manager – Create a new Function block (Part1)

- Set the properties of Failsafe Function block:

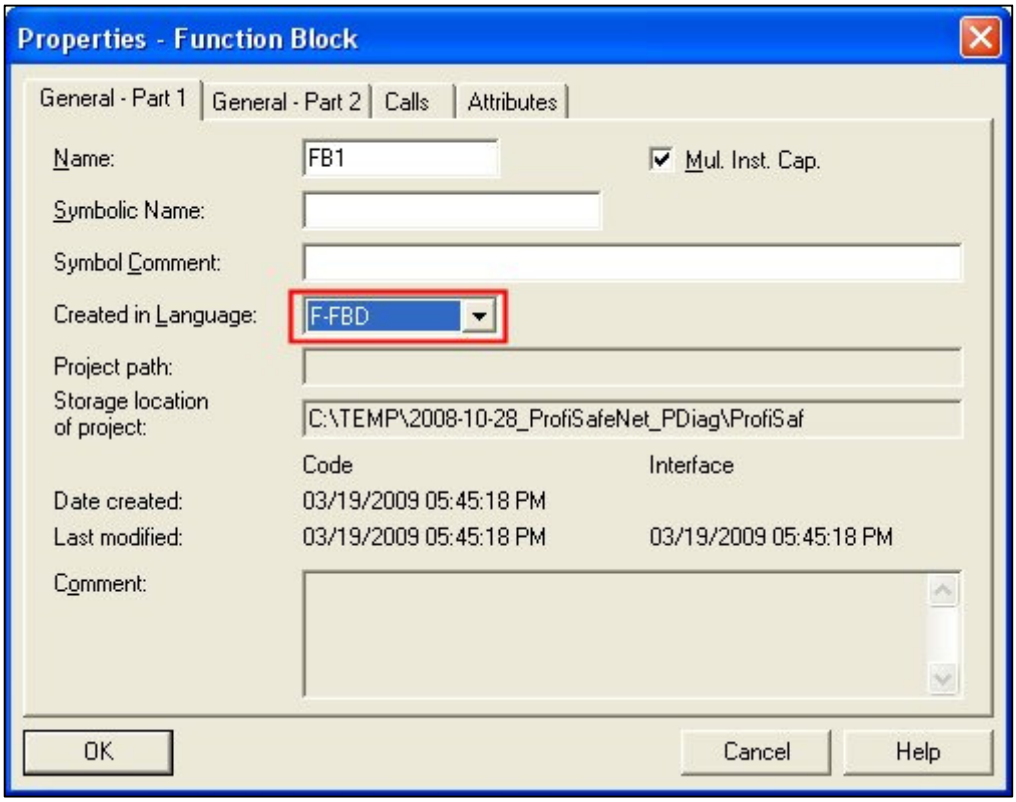


Fig. 47: Simatic Manager – Create a new Function block (Part2)

In this “Application Note” the FB1 will take the functionality like a “Cyclic user Failsafe-Organisation Block”. The FC1 will be the “FS-Master configuration block ” that include the Function block and assigned instance data blocks.

- The cyclic interrupt OB35 will call the Failsafe-program.

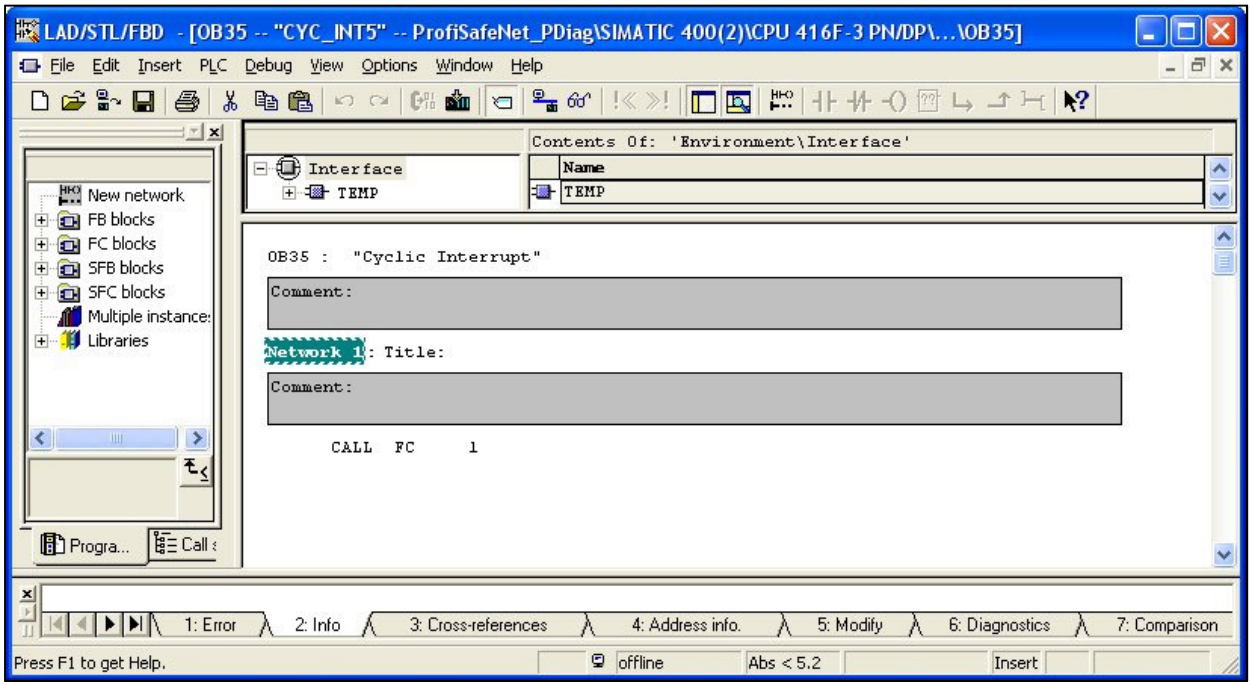


Fig. 48: Simatic Program Editor – Call the Failsafe function block

8.2. Create and open FC1

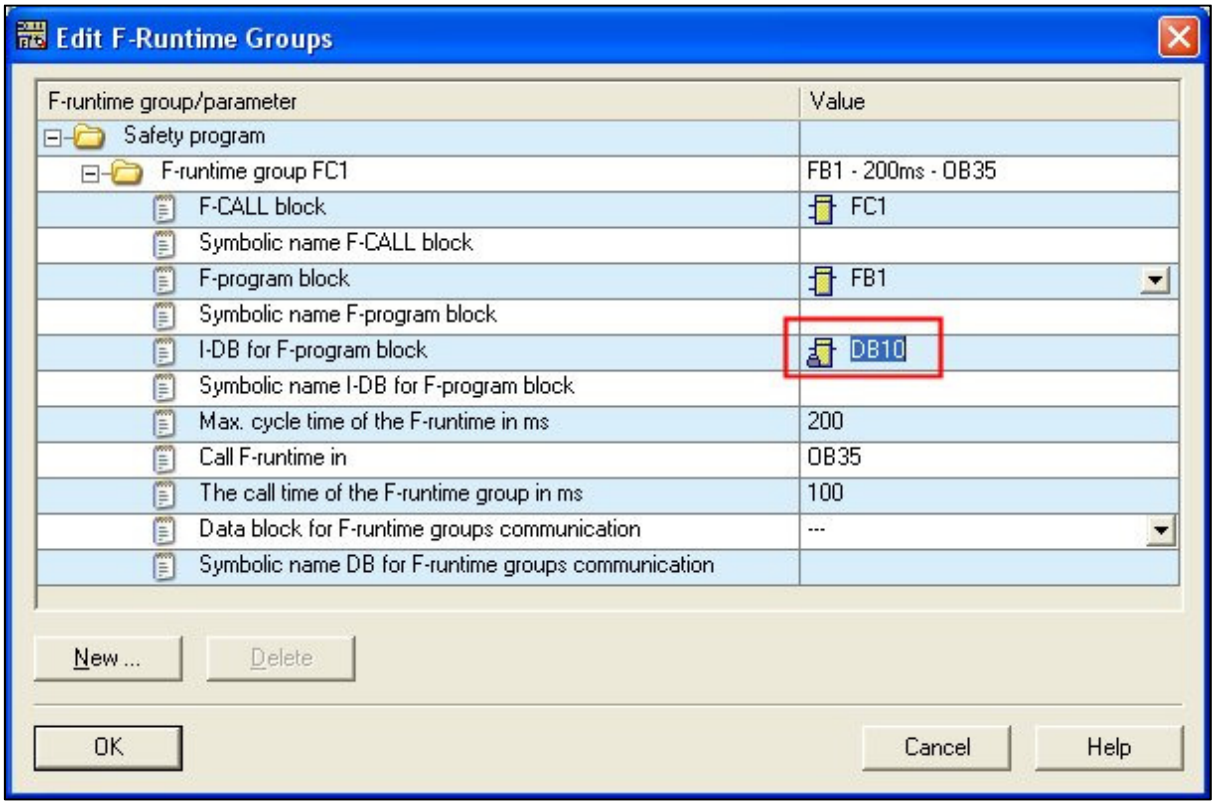


Fig. 49: Simatic Program Editor – Assign the Failsafe program block

- Change the F-program block.

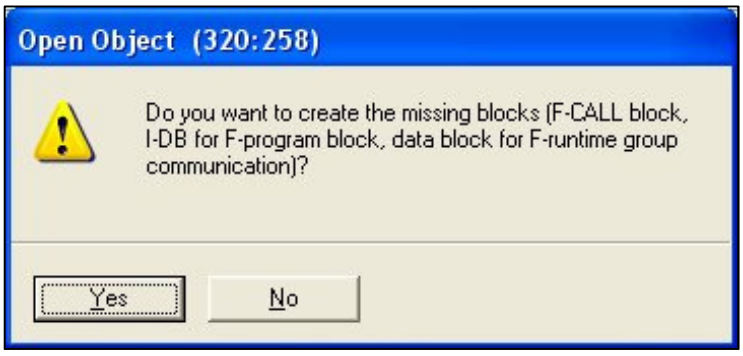


Fig. 50: Simatic Program Editor – Confirm the DB creation

8.3. Insert the E-Stop block to Failsafe-program

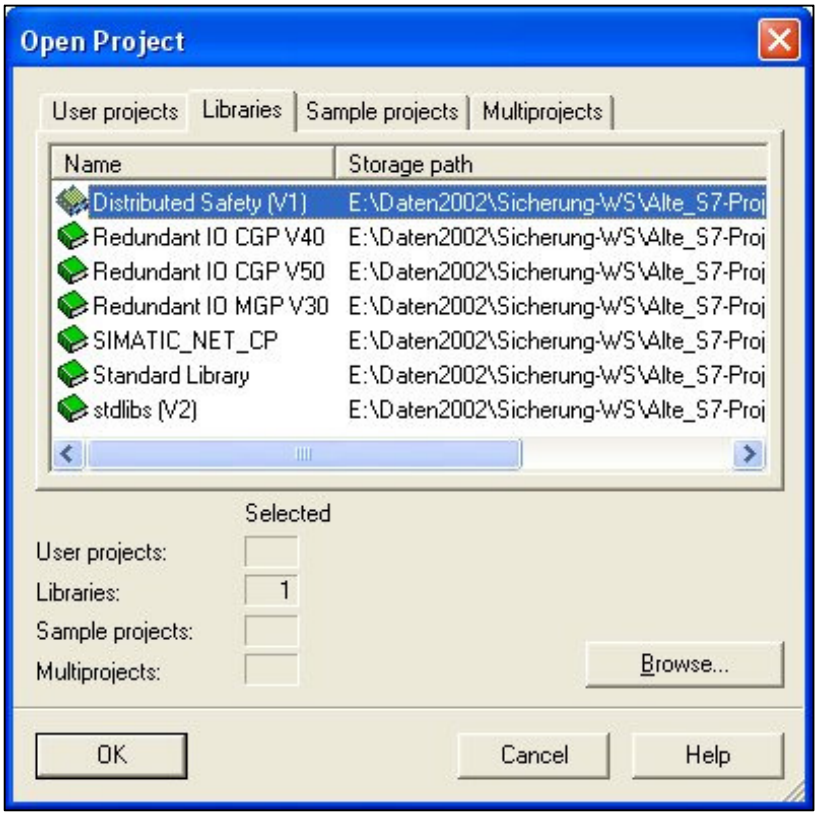


Fig. 51: Simatic Program Editor – Open the Failsafe-library

The E-STOP block is part of the Distributed Safety library.

- Copy the needed Failsafe-blocks to project block directory (e.g. via drag & drop):

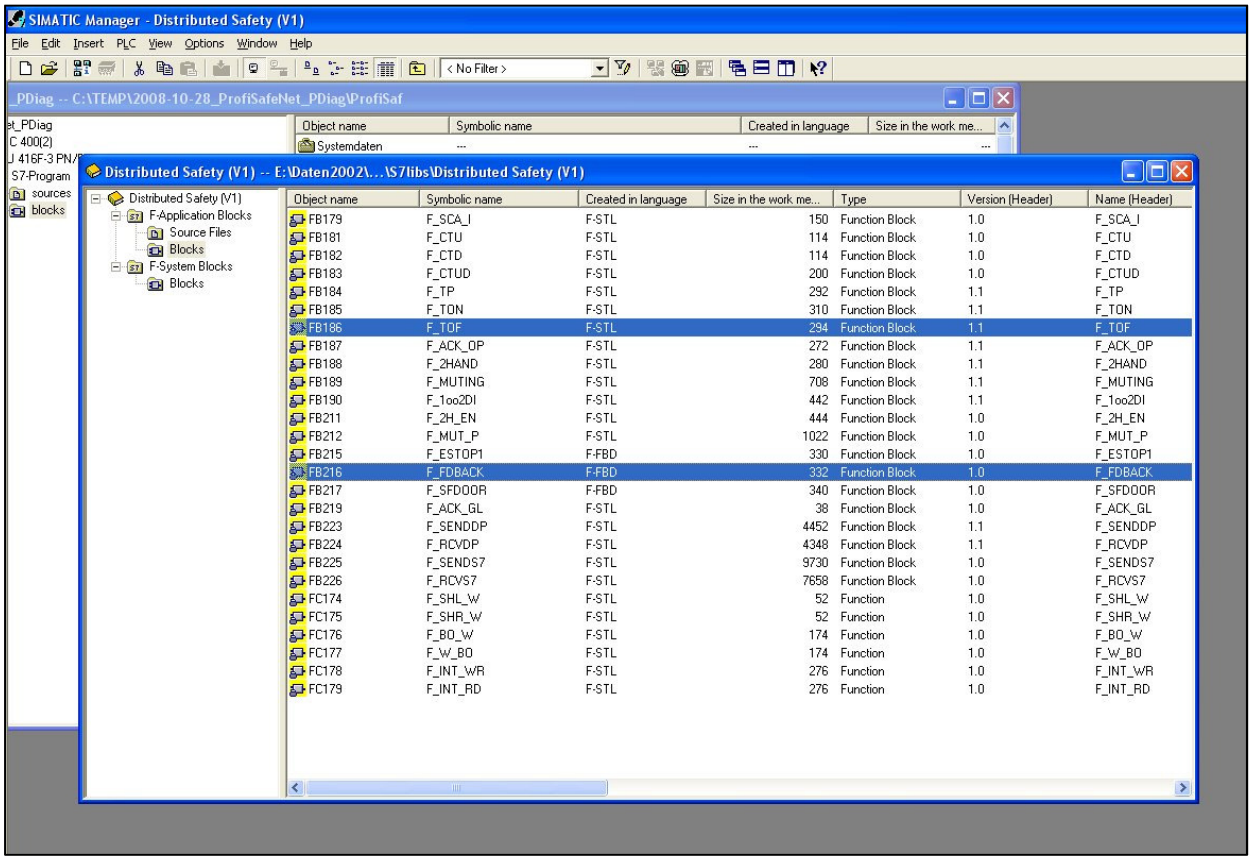


Fig. 52: Simatic Manager – Copy the Failsafe E-Stop blocks to project

8.4. User defined Failsafe-data block memory

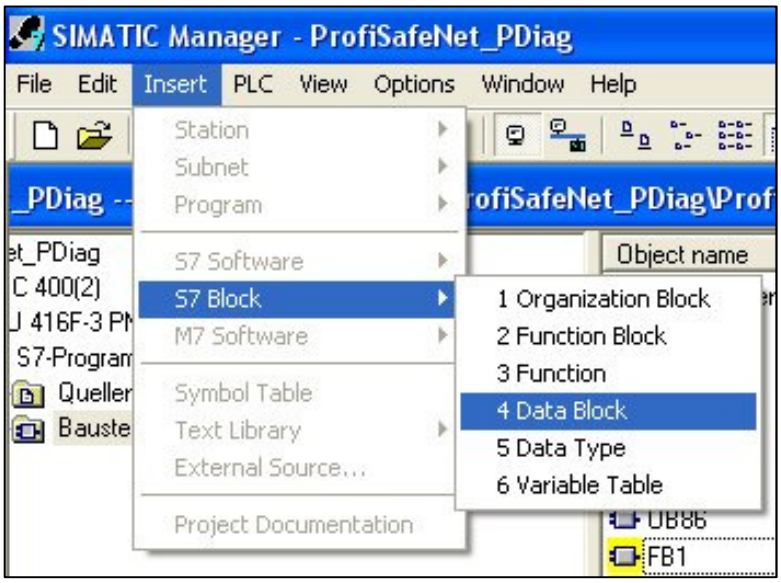


Fig. 53: Simatic Manager – Create a Failsafe user data block (Step1)

- Create a Failsafe user data block

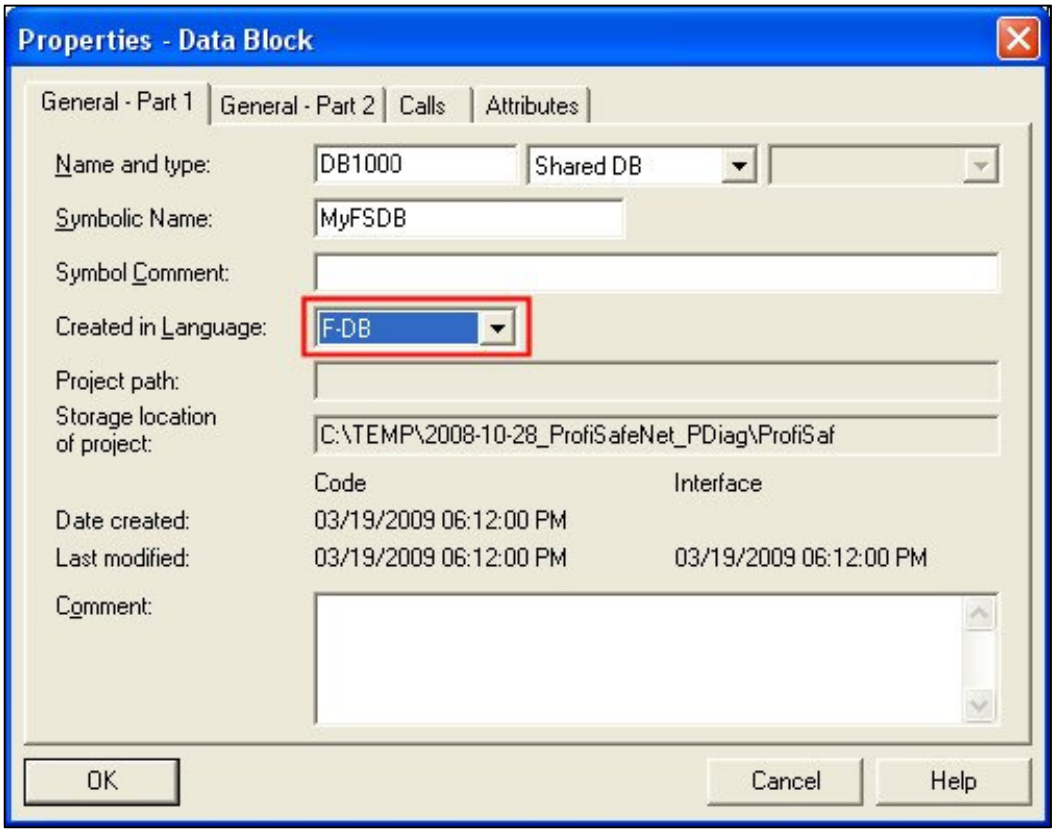


Fig. 54: Simatic Manager – Create a Failsafe user data block (Step2)

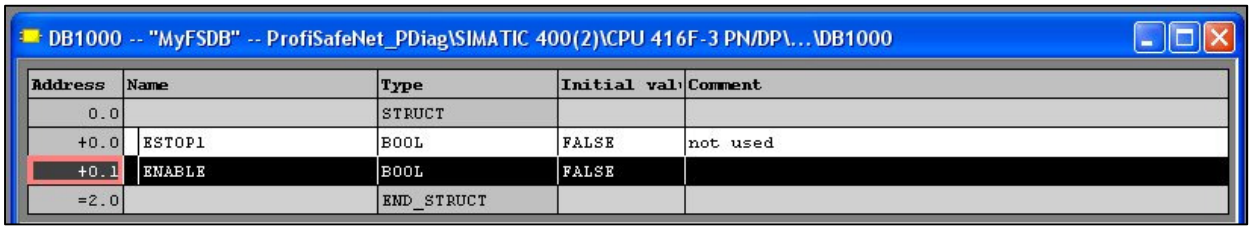


Fig. 55: Simatic Program Editor – Insert a data block bool declaration

The Failsafe data block 1000 “MyFSDB” includes the user bool declation “ENABLE”.

- Create a program code like the figure below and close the FB1 edit mode.

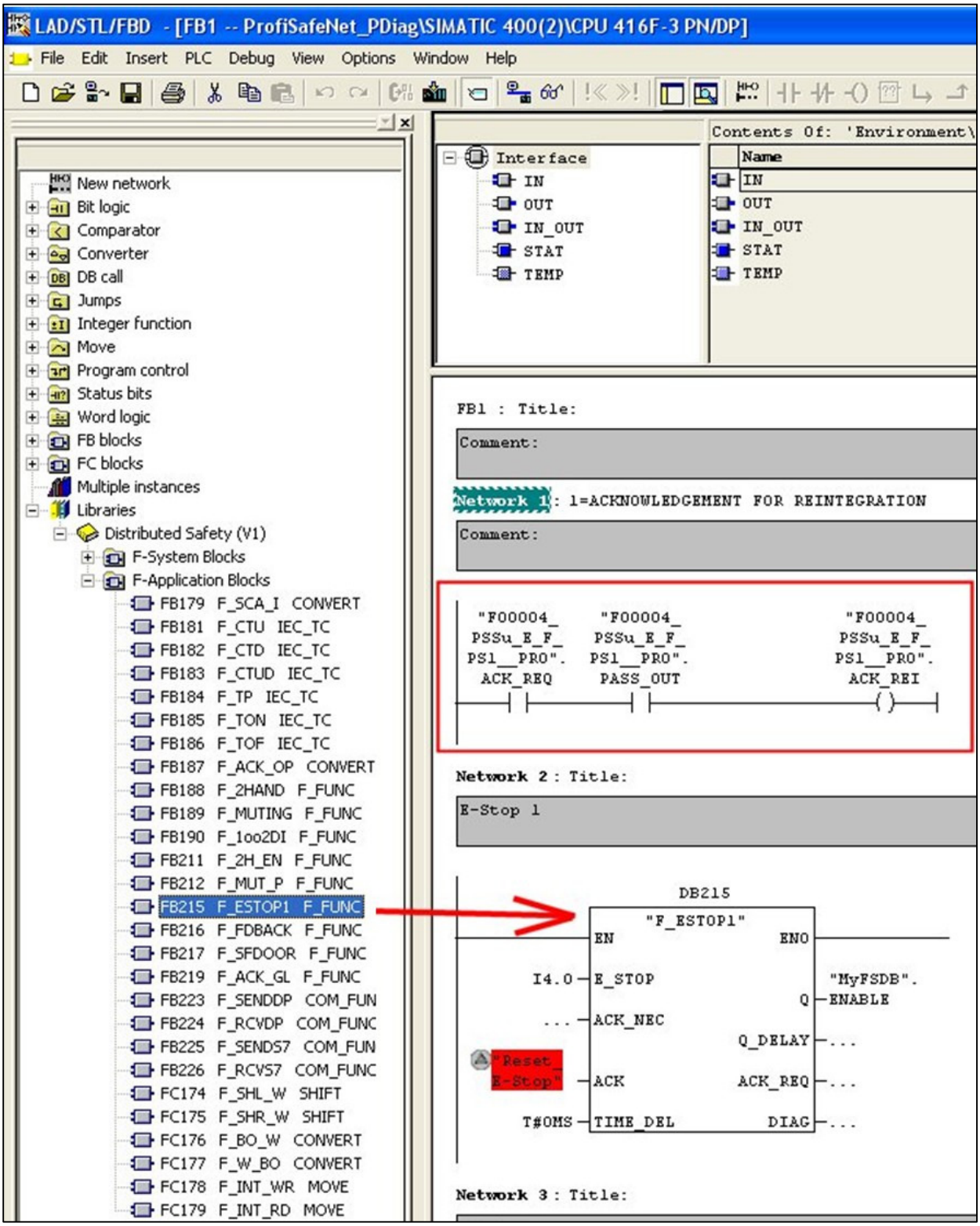


Fig. 56: Simatic Program Editor – Program a E-Stop and the PROFISafe “reintegration”

- Back to the Simatic Manager one have to activate the block directory and ...

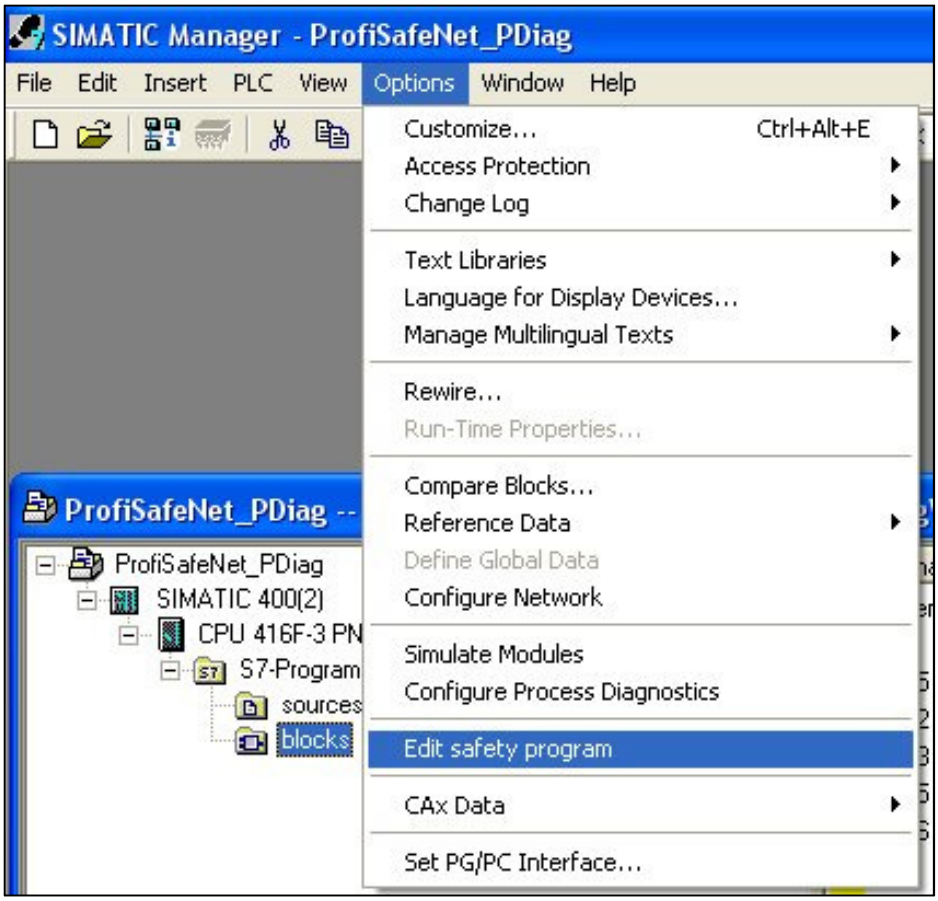


Fig. 57: Simatic Manager – Start safety program menu

- … and start the Safety program dialog to compile (and download) the Failsafe program:

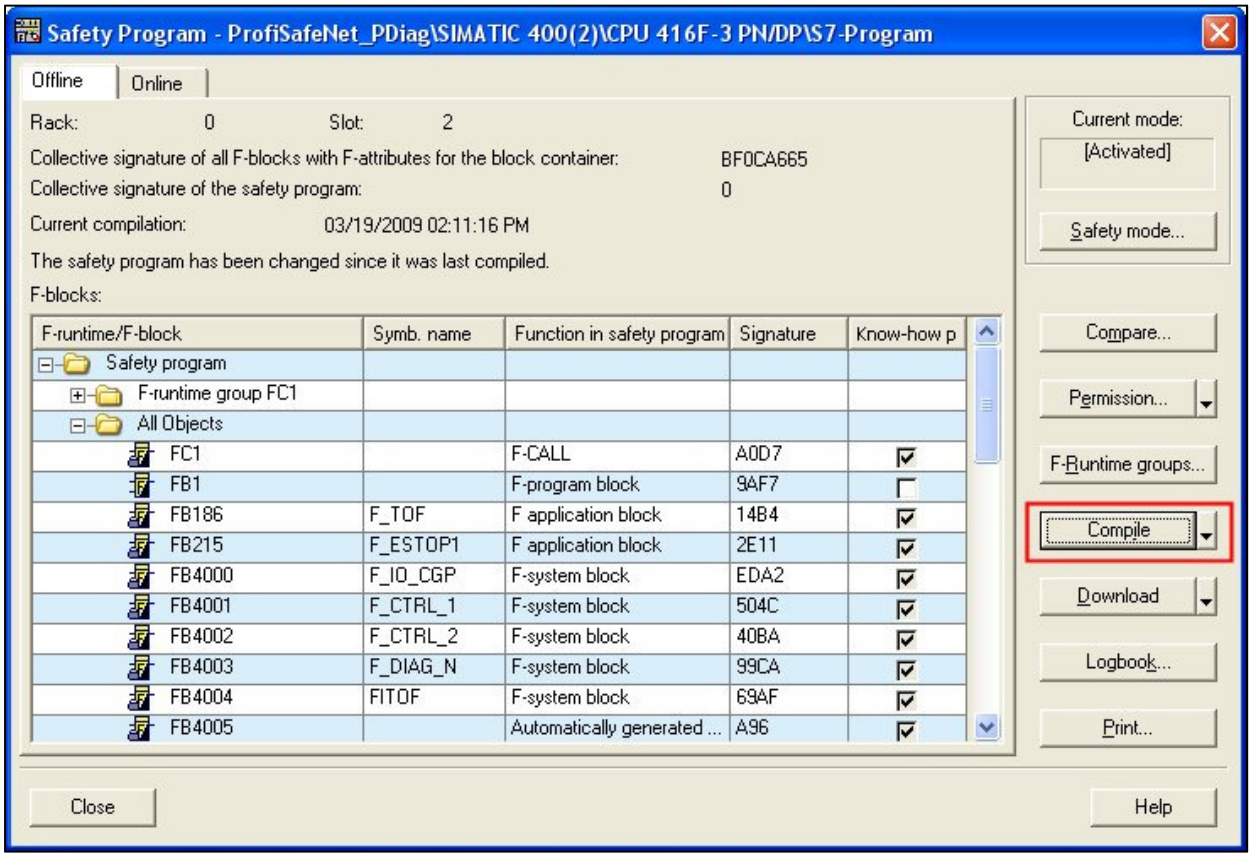


Fig. 58: Simatic SafetyProgram – Compile the Failsafe-program

- The compilation will create further write protected Failsafe Function Blocks an FB Data Block instances of it.

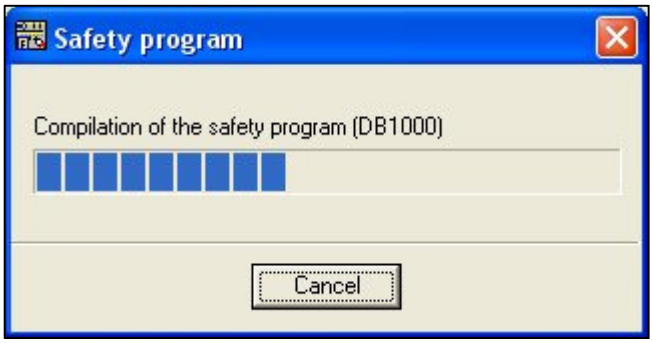


Fig. 59: Simatic SafetyProgram – Compiling the Failsafe-program

- One have to compile Failsafe-program without errors.

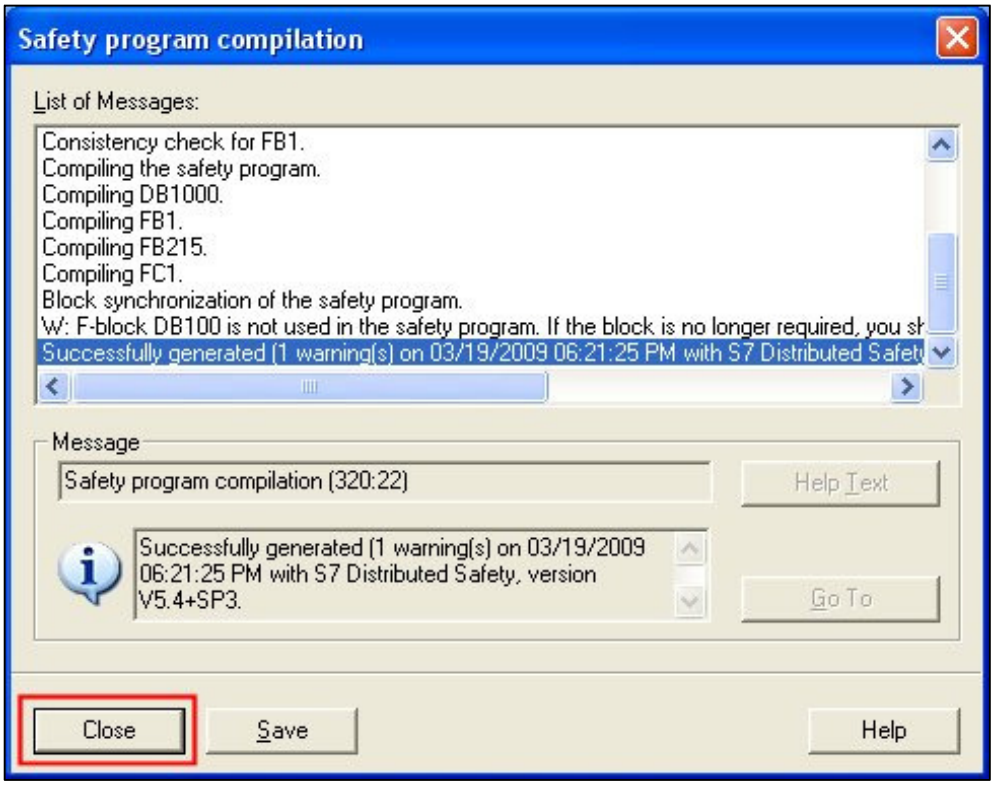


Fig. 60: Simatic SafetyProgram – Compiling Failsafe-program without errors

- Road junction decision: Siemens 416F with memory card or 3xxF-CPU?

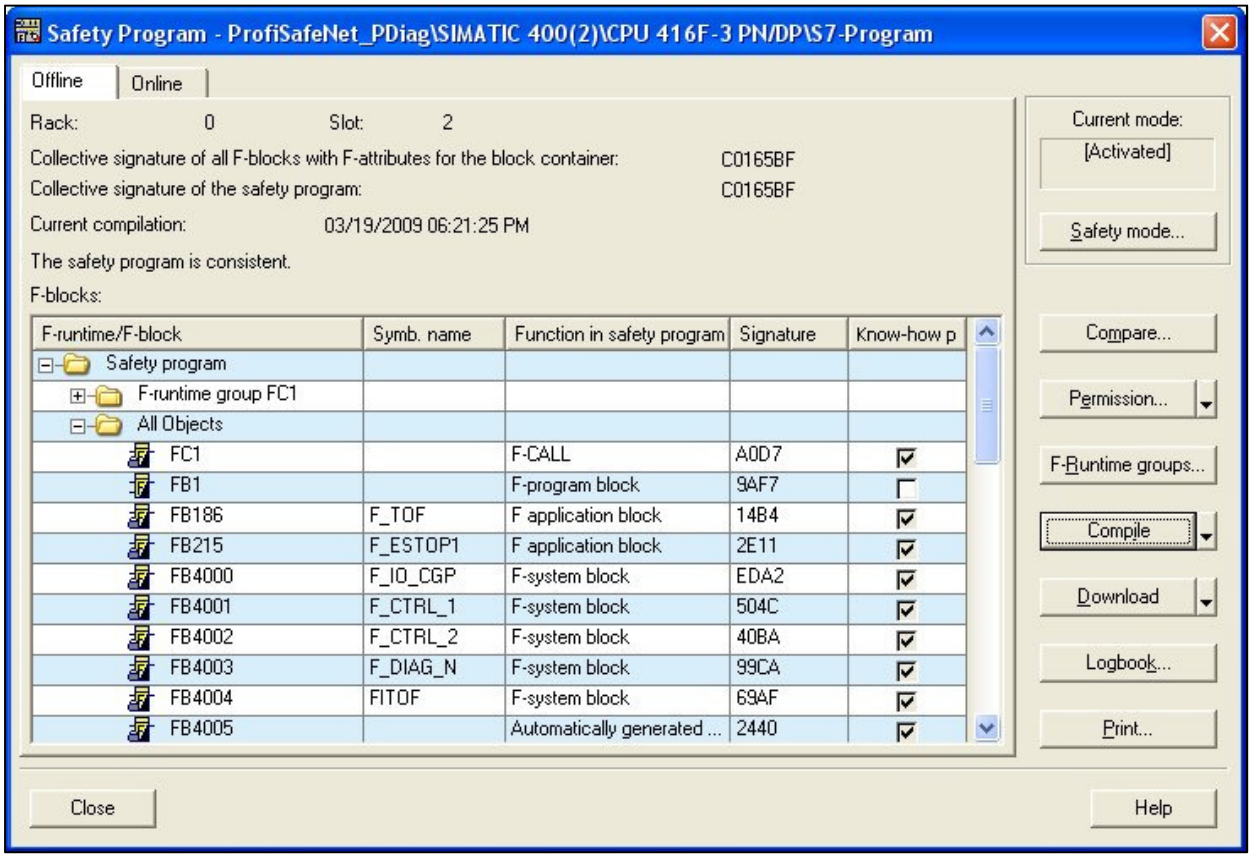


Fig. 61: Simatic SafetyProgram – Road junction decision

If one had modified the Failsafe-program, there is the need to save it to the memory card. Otherwise one would get a error “download of DBxxxx failed”.

- Note: If one are using a S/-F3xx CPU have to use the Download-button of this dialog

Fig. 62: Simatic Manager – Save current project to memory card (View1)

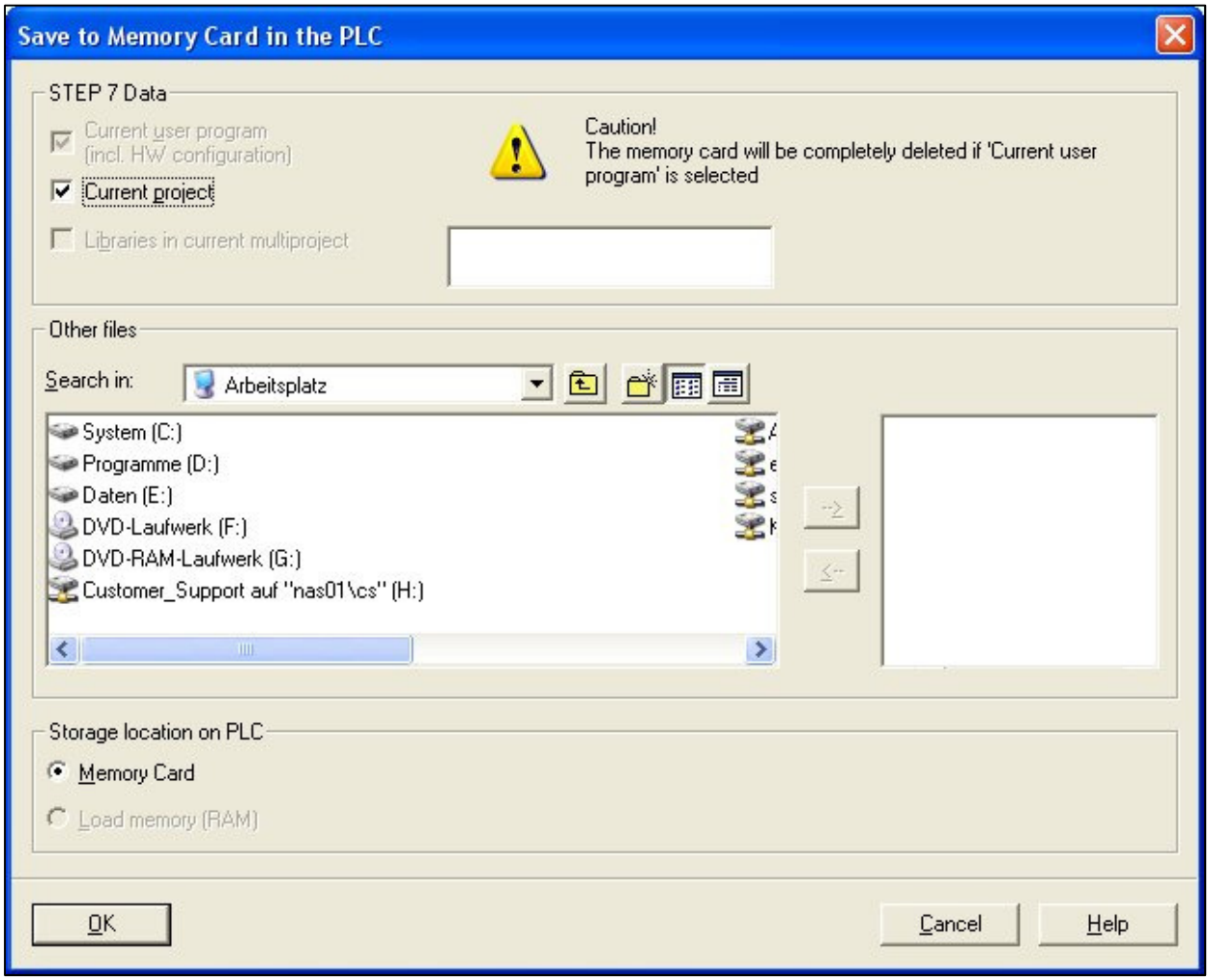


Fig. 63: Simatic Manager – Save current project to memory card (View2)

- Close all blocks and the S7 Hardware-Manager-project. Otherwise one will get errors.

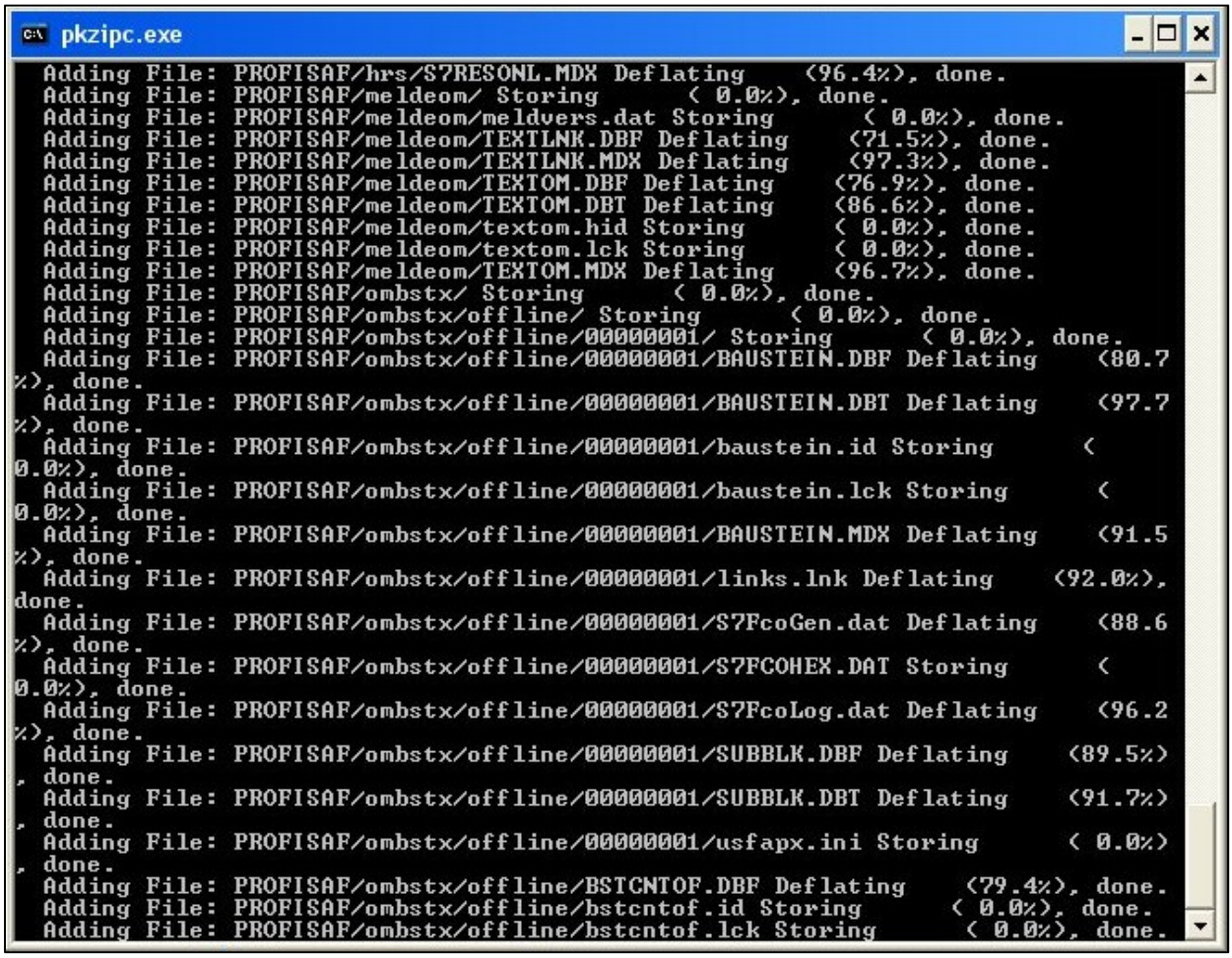


Fig. 64: Simatic Manager – S7-Compressing project data via PKZIP.

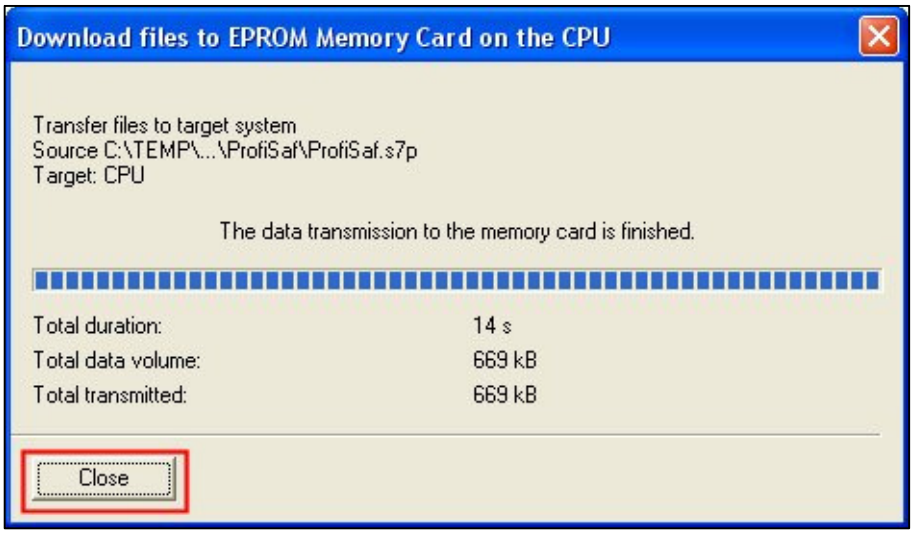


Fig. 65: Simatic Manager – download to memory card is ready

Switch the CPU to “RUN”, open the FB1 and enable the dynamic display (“Powerflow”).

8.5. PSSu Failsafe–Mapping

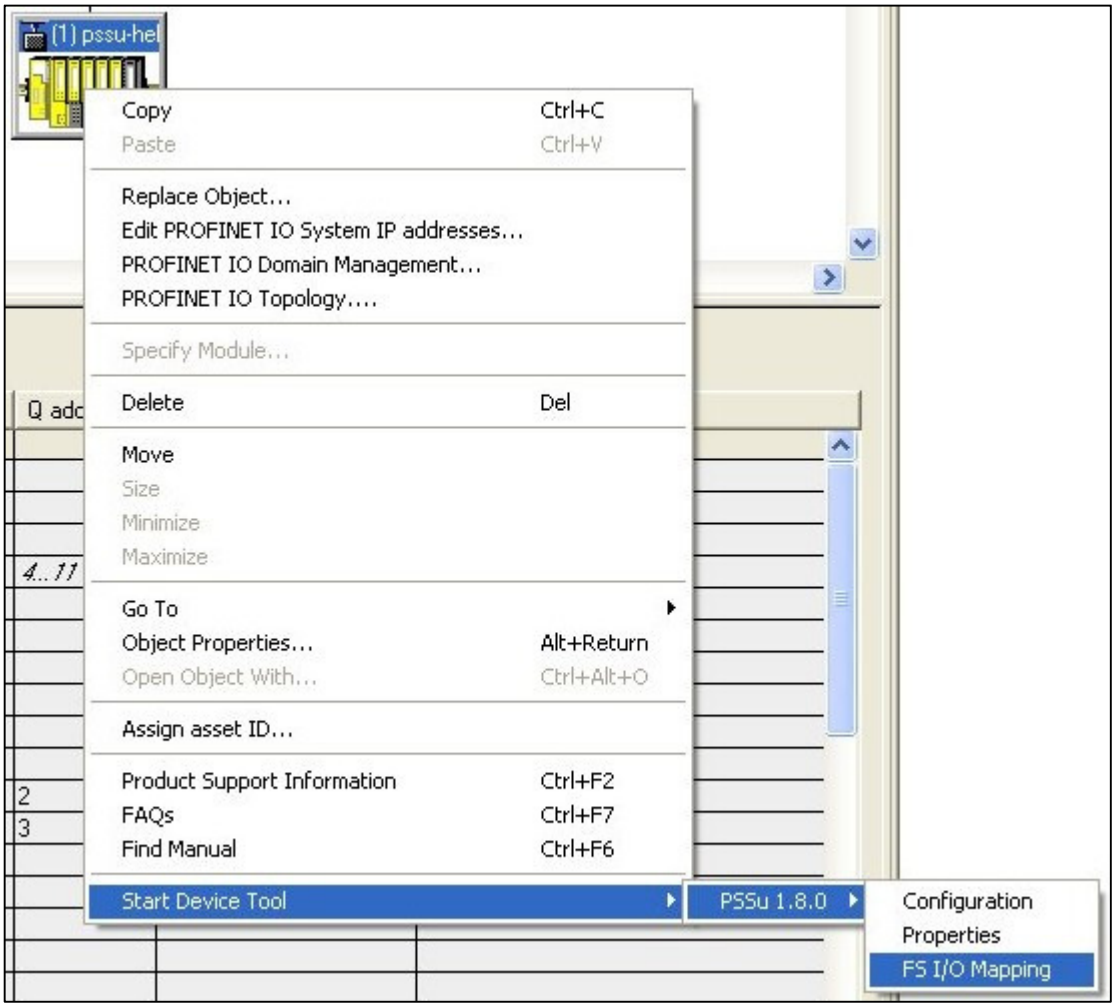


Fig. 66: S7 HW Config – Check the PSSu I/O mapping

- Note:
  If the PSSu system is big, one can get the Failsafe-address of a PSSu Electronic Module Input or Output by using the PSSu Configurator.

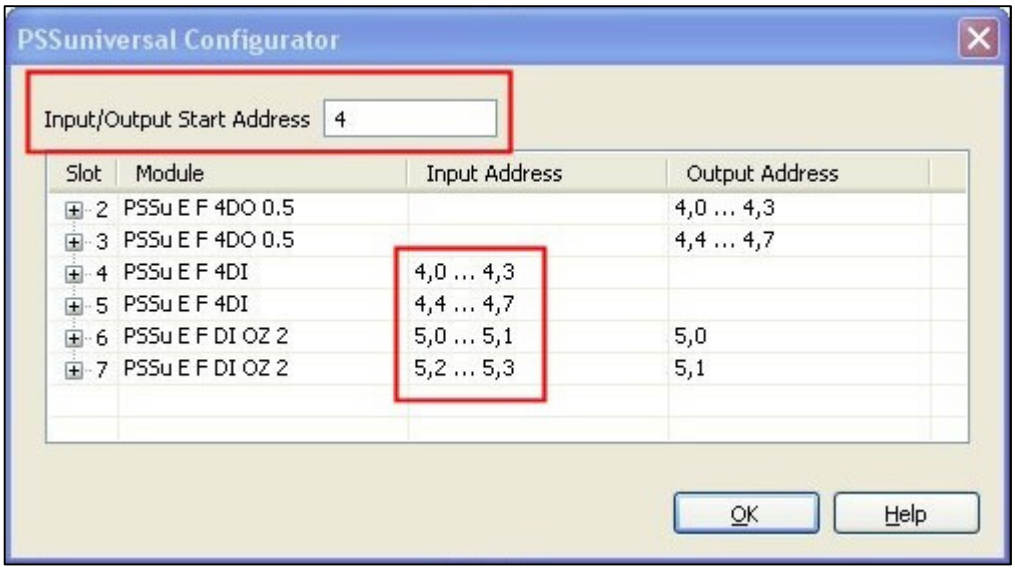


Fig. 67: PSSu Configurator – Input 4.0 will be used for the E-STOP

- Insert the PSSu Failsafe-Start address and the PSSu Configurator will calculate the Failsafe address using this offset.

- E-Stop in initial position:

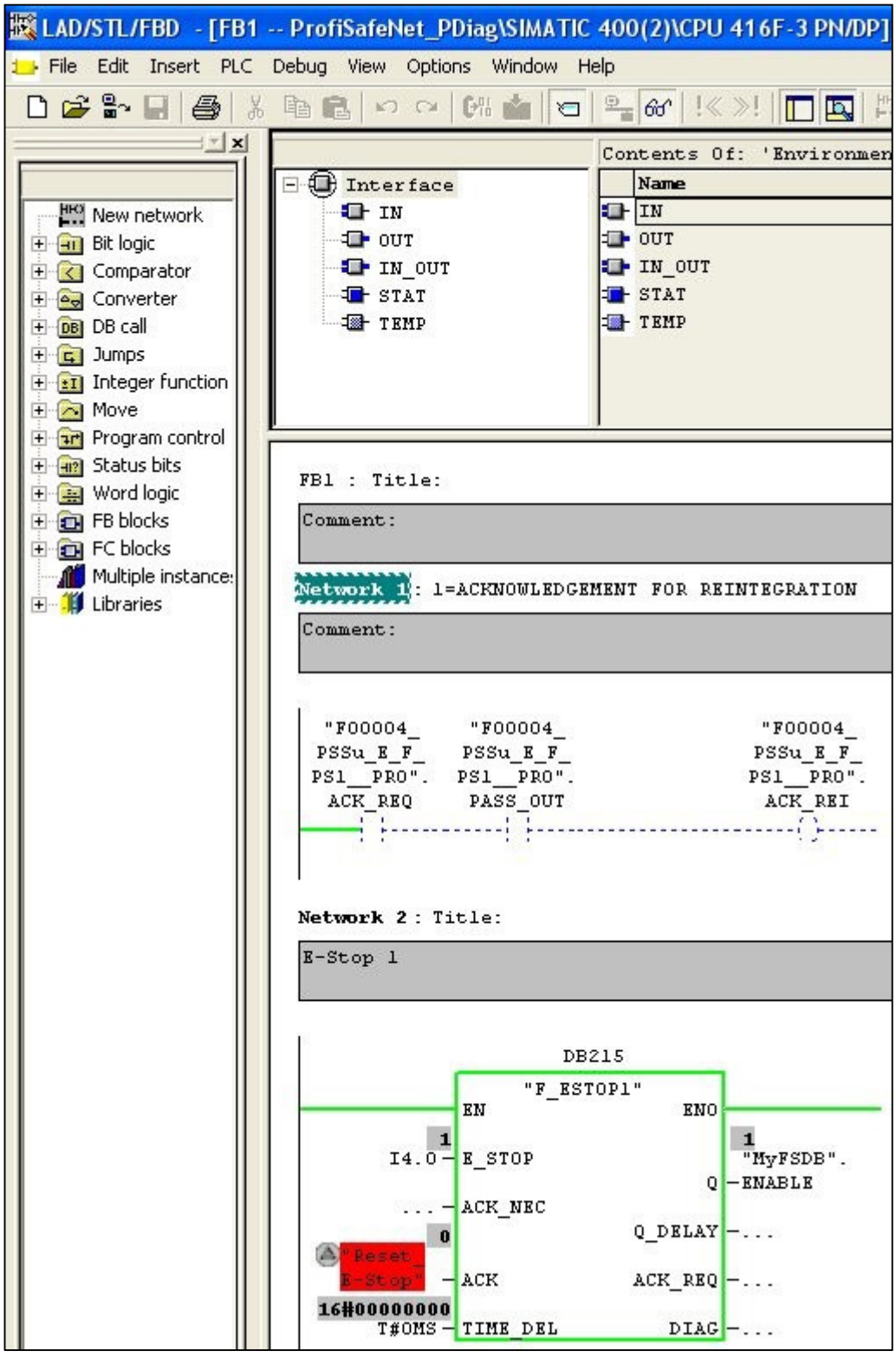


Fig. 68: Simatic Program Editor Online – E-Stop in initial position

- E-Stop-parameter get a reset by the user

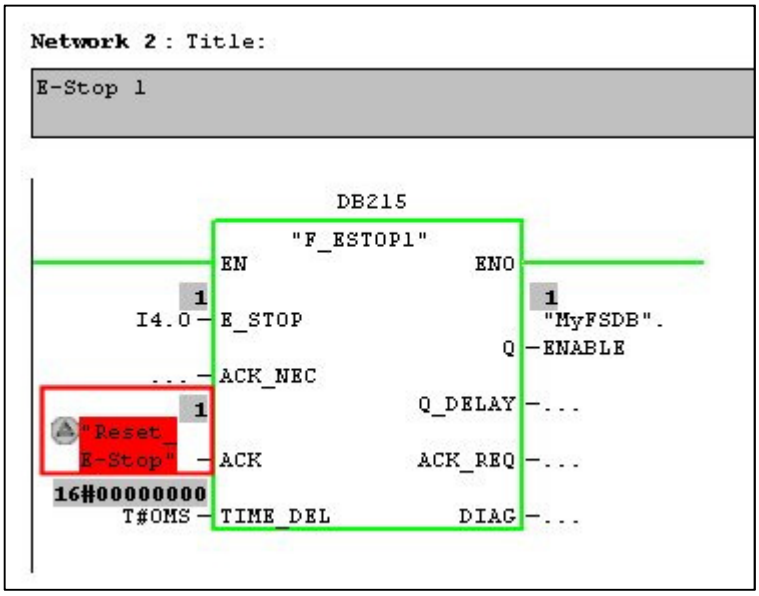


Fig. 69: Simatic Program Editor Online – E-Stop-parameter get a reset by the user

- E-Stop block flag is enabled

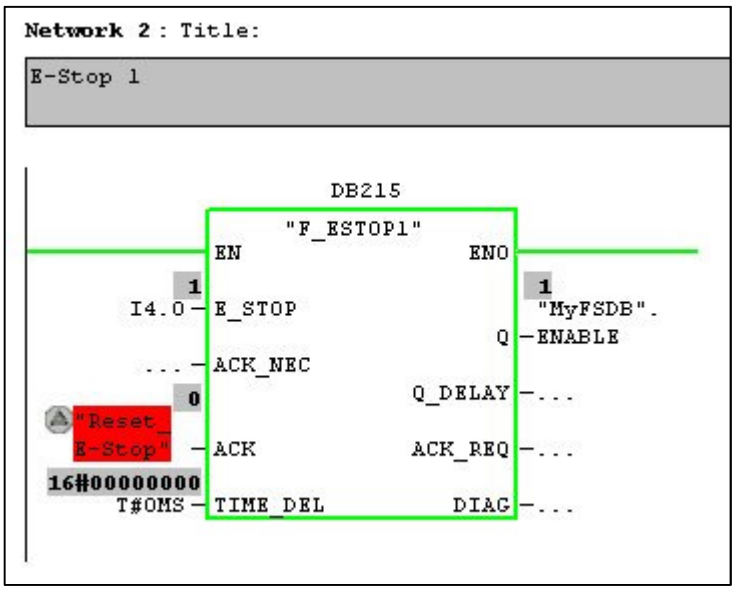


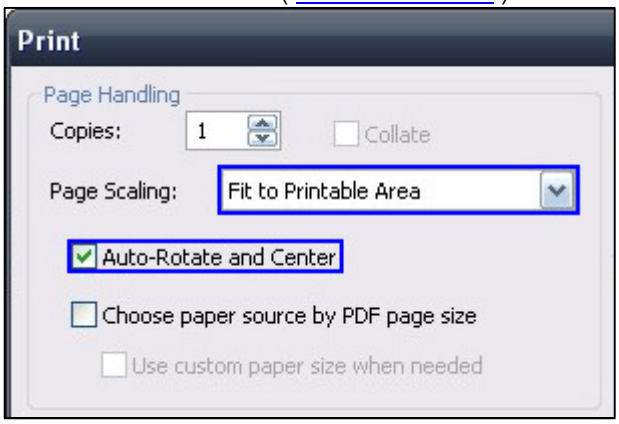
Fig. 70: Simatic Program Editor Online – E-Stop block flag is enabled

Finally one had finished the application task “E-STOP”.

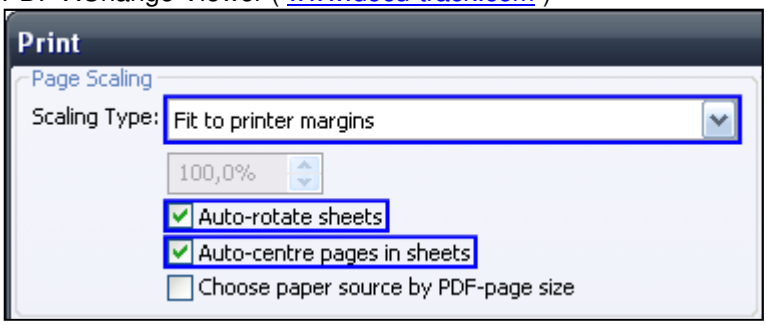
9. Table of figures

Recommended printer settings

Adobe Acrobat Reader (www.adobe.com)



PDF-XChange Viewer (www.docu-track.com)



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