



segFORCE

Quick Start Guide

Examples and configuration when using PLCs

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1 Read First Before Starting

This document is separated into various sections. Depending on what hardware you are using, jump directly to the appropriate chapter that matches your environment. You don't have to read the whole document. However, the appendix is essential as it describes the data addressing for all PLC interfaces.

- Siemens PLC users utilize **PROFINET** start with Chapter 2, SIMATIC PROFINET.
- Allen-Bradley PLC users utilizing **EtherNet/IP** start with Chapter 3, RSLogix 5000 EtherNet/IP.

2 SIMATIC PROFINET

2.1 Prerequisites

- SIMATIC PLC
- PC with Step 7 SIMATIC Manager or TIA Portal installed and ready to use.
- The FMS segFORCE roller with at least two segments and a PROFINET controller.

2.2 Introduction

This document intends to give you a fast way to use our segFORCE in conjunction with a PROFINET PLC. It shows what to do at first to get the data into your PLC. **But we can give you no further support in PLC programming or problems that may occur using the PLC.** In case of difficulties with the PLC configuration or programming, please refer to the Siemens documentation or contact Siemens support. But we are sure this document will help you get the first results.

There are two options to start using the segFORCE in a PLC. Either take one of our example programs or configure and integrate it directly into your PLC project. All options are explained in different chapters. So jump straight to the chapter that explains the option you want to use.

FMS provides two example programs for PROFINET. One is for the Step 7 SIMATIC Manager, and the other is for the TIA Portal.



If you have a PLC of the SIMATIC 300 series, we suggest taking the Step 7 SIMATIC Manager example. But it is also possible to use the TIA Portal as well. In this case, **make sure to increase the input process image size to a minimum of 640 bytes.**



Suppose you have a PLC of the SIMATIC 1200 or 1500 series. In that case, we suggest taking the TIA Portal example. But if you prefer the Step 7 SIMATIC Manager example, you can still use it on such PLCs.

The GSDML for the segFORCE provided by the FMS can be used for all options.

2.3 Use the Step 7 SIMATIC Manager example

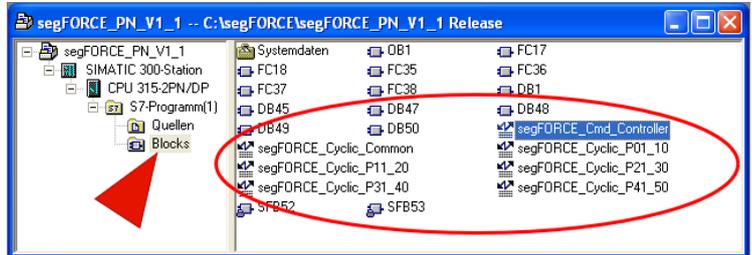
2.3.1 Setting up the project

- Download the example programs contained in the segFORCE_PN_Vx_x Release.zip from our web page. (x is a placeholder for the container file version that includes the example programs)
Link: <https://www.fms-technology.com/en/downloadcenter/profinet>
- Unpack the example project to your preferred directory on your PC on which the **SIMATIC Manager** development software is installed.
The Quick Start Guide uses the directory c:\segFORCE, and all further explanations start from this directory without explicitly mentioning it again.
- Execute the **SIMATIC Manager** program.
- Make sure you have a cleared PLC. Therefore do a factory reset before downloading the example program to the PLC.
- Open the project c:\segFORCE\Step7_PN_Vx_x (x is a placeholder for the example program version).
- Open the Hardware Configuration and change the SIMATIC Controller (PLC) if yours differs from the one the example program is using.
The example program uses the PLC controller CPU 315-2 PN/DP Article no. 6ES7 315-2EH14-0AB0. Please refer to the Siemens documentation if you have difficulty changing the controller.
- Search for all PROFINET devices, and assign the segFORCE the name **segforce**. The PLC gives after that the segFORCE the IP 192.168.10.82. If the IP does not fit your network environment, change the IP before downloading the program to the PLC.
- Download program to the PLC.
- Continue with the next chapter when the example program has been configured and downloaded successfully. Therefore the LEDs DCV5 and RUN must permanently light green, and no other LEDs should be blinking. If that is not the case, fix the problems first.

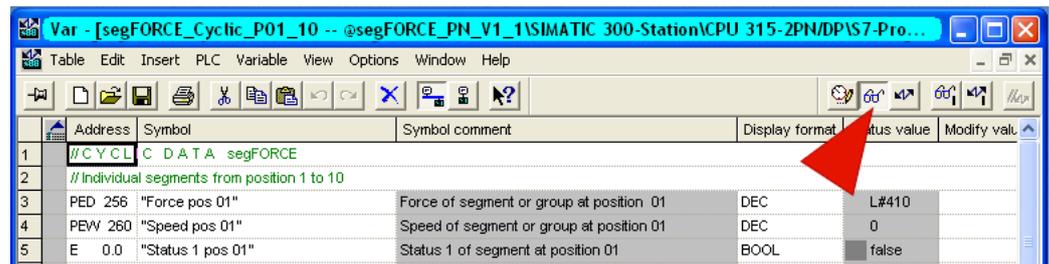


2.3.2 How to use the example program

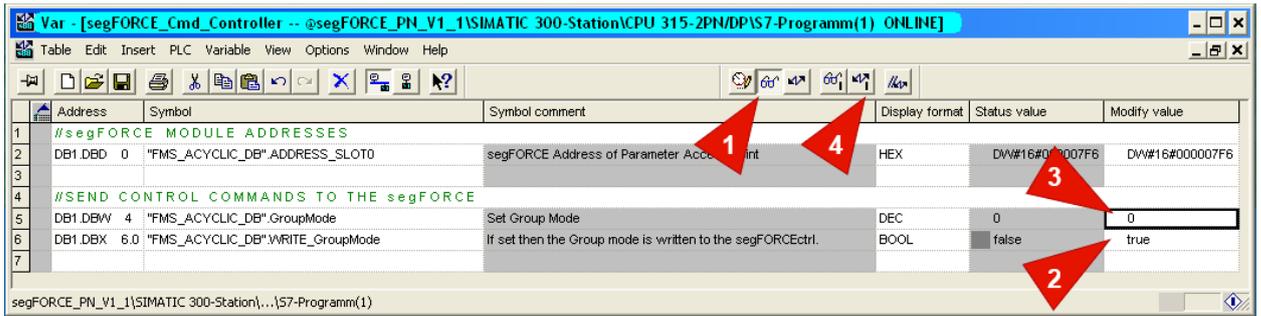
- Execute the SIMATIC Manager.
- Open the Blocks folder.
- The project contains several predefined variable tables for displaying the segment's values.
- Open the appropriate variable table depending on what values you are interested in. There are the following variable tables for cyclic data available:



- segFORCE_Cyclic_Common General information about the entire roller.
- segFORCE_Cyclic_P01_10 Segments at positions 1 to 10
- segFORCE_Cyclic_P11_20 Segments at positions 11 to 20
- segFORCE_Cyclic_P21_30 Segments at positions 21 to 30
- segFORCE_Cyclic_P31_40 Segments at positions 31 to 40
- segFORCE_Cyclic_P41_50 Segments at positions 41 to 50
- Once the variable table is open, click on the icon with the glasses. This will start the monitoring process of the variables, and the values will be displayed continuously. To stop the monitoring click the icon again.



- One more variable table is used to switch between single and group force return values:
 - segFORCE_Cmd_Controller Send commands to the PLC.
- Once the variable table is open,
 - 1 click on the icon with the glasses
 - 2 set the write enable to *true*
 - 3 set the value to 1 to activate group mode
 - 4 click on the icon with the flash to send the command to the PLC



Address	Symbol	Symbol comment	Display format	Status value	Modify value
1	<i>//segFORCE MODULE ADDRESSES</i>				
2	DB1.DBD 0	"FMS_ACYCLIC_DB" ADDRESS_SLOT0	segFORCE Address of Parameter Access Point	HEX	DW#16#000007F6
3					
4	<i>//SEND CONTROL COMMANDS TO THE segFORCE</i>				
5	DB1.DBW 4	"FMS_ACYCLIC_DB" GroupMode	Set Group Mode	DEC	0
6	DB1.DBX 6.0	"FMS_ACYCLIC_DB" WRITE_GroupMode	If set then the Group mode is written to the segFORCEctrl.	BOOL	false
7					true

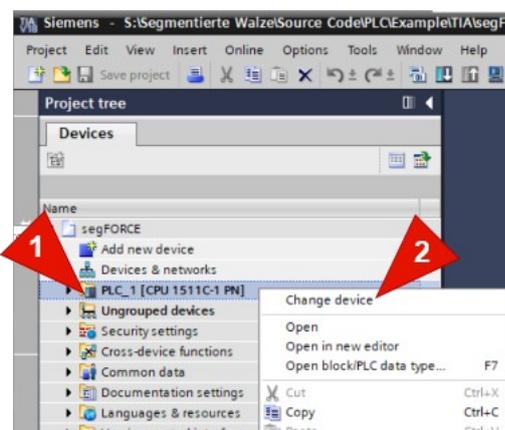


For further information on how the grouping of segments works and how the data are transferred to the PLC, consult the segFORCE Operation Manual.

2.4 Use the TIA Portal example

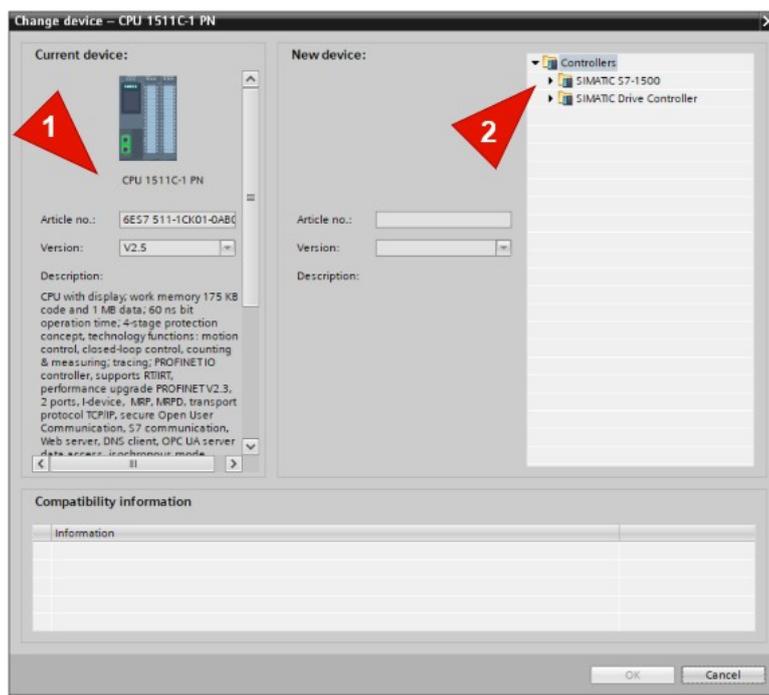
2.4.1 Setting up the TIA project

- Download the example programs contained in the segFORCE_PN_Vx_x Release.zip from our web page. (x is a placeholder for the container file version that includes the example programs)
Link: <https://www.fms-technology.com/en/downloadcenter/profinet>
- Unpack the example project to your preferred directory on your PC on which the **TIA Portal** development software is installed.
The Quick Start Guide uses the directory c:\segFORCE, and all further explanations start from this directory without explicitly mentioning it again.
- Execute the **TIA Portal** program.
- The program normally starts with the portal view. Switch to the project view by clicking the  **Project view** menu at the bottom left.
- Make sure you have a cleared PLC. Therefore do a factory reset before downloading the example program to the PLC. Refer to the chapter 2.6.1 *How to reset a PLC to factory settings*.
- Open the project c:\segFORCE\TIA_PN_Vx_x\segFORCE (x is a placeholder for the example program version).
- The example program uses the PLC CPU 1511C-1 PN. You must change the configuration accordingly if you have a different device of the same SIMATIC series. Right-click on the item **PLC_1 [CPU 1511C-1 PN]**  and click after that on **Change devices** . That action opens the Change device dialog.



But if you have a device from a different SIMATIC series, e.g., 1200, it's best not to use the example program and configure everything from scratch. Hence go to the chapter 2.5 *Use the segFORCE in your project*.

- The change device dialog shows the currently configured device on the left-hand side **1**. On the right, you can select your utilized device **2**.

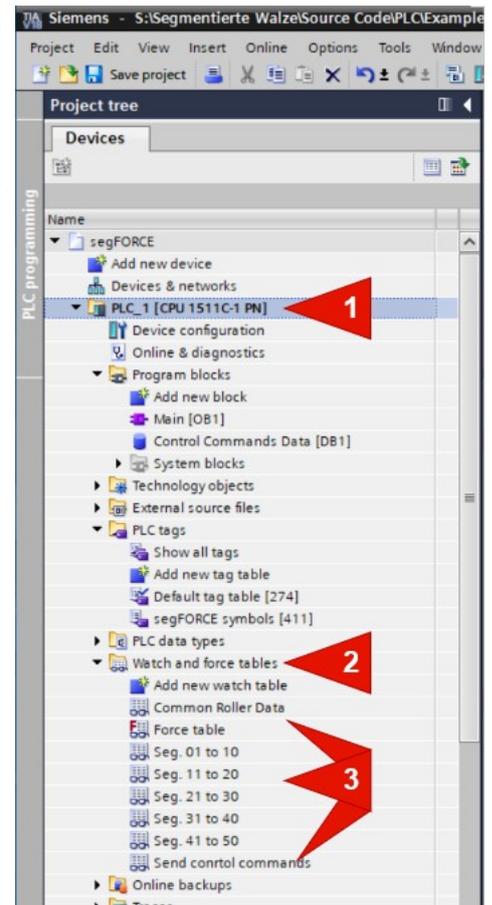


- Search for all PROFINET devices, and assign the segFORCE the name **segforce**. Refer to the chapter *2.6.2 How to assign the PROFINET device name* for a detailed description. The PLC gives after that the segFORCE the IP 192.168.10.82. If the IP does not fit your network environment, change the IP before downloading the program to the PLC.
- Download program to the PLC.
- Continue with the next chapter when the example program has been downloaded successfully and configured. Therefore the left LED must permanently light green, and the other two LEDs must be dark. If that is not the case, fix the problems first.

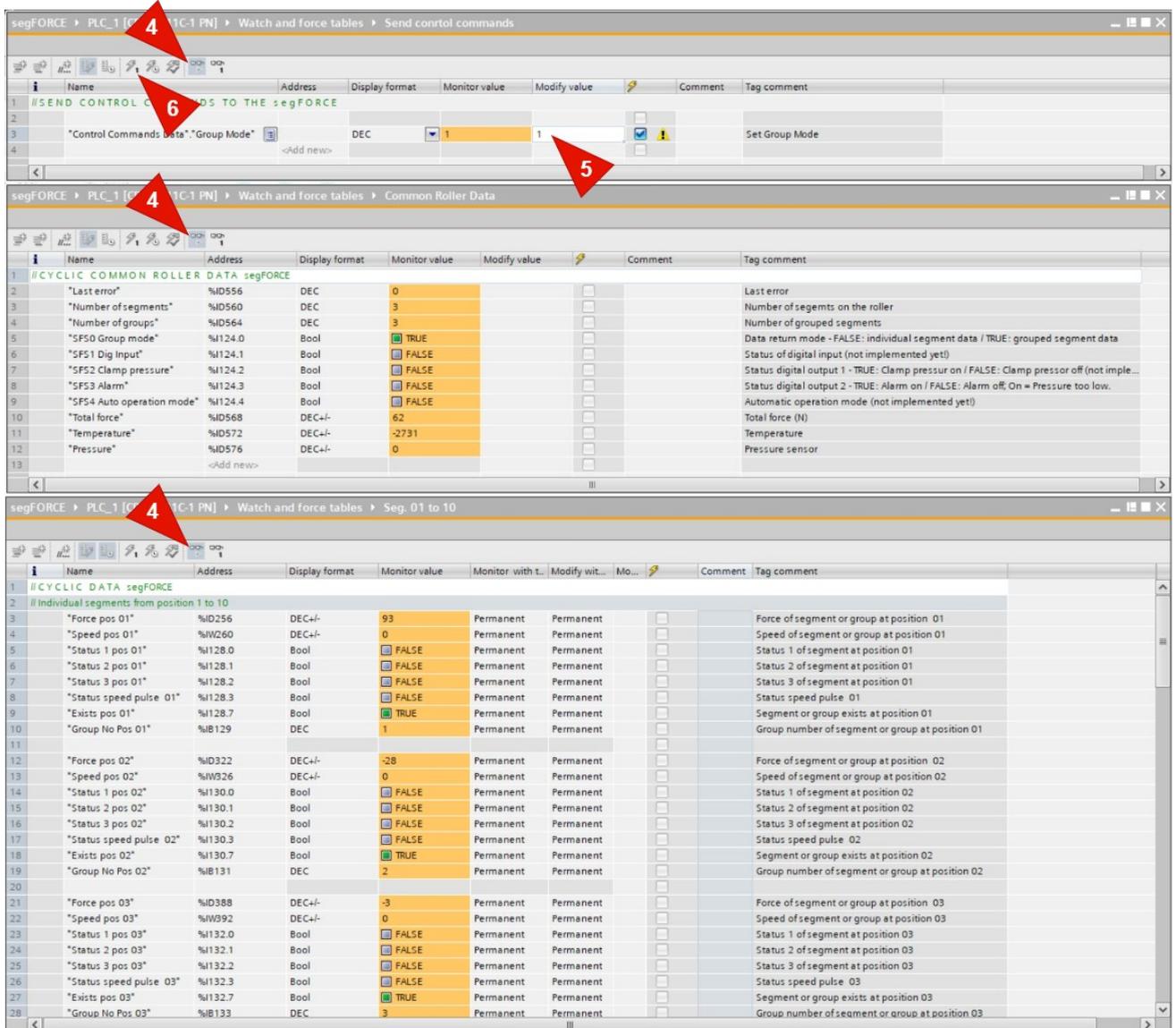


2.4.2 How to use the TIA example program

- Execute the **TIA Portal** program.
- The program normally starts with the portal view. Switch to the project view by clicking the **Project view** menu at the bottom left.
- Open the project ... \TIA_PN_Vx_x\segFORCE
(x is a placeholder for the example program version and TIA portal version).
- Open the folder **Watch and force tables** **2** under the PLC project tree **1**.
- The project contains several predefined tables to display the segment's value and control the roller.
- Open the appropriate watch tables **3** depending on what segment values you are interested in or if you want to control the group mode. There are the following watch tables available:
 - - Common Roller Data General information about the entire roller.
 - - Seg. 01 to 10 Segments at positions 1 to 10
 - - Seg. 11 to 20 Segments at positions 11 to 20
 - - Seg. 21 to 30 Segments at positions 21 to 30
 - - Seg. 31 to 40 Segments at positions 31 to 40
 - - Seg. 41 to 50 Segments at positions 41 to 50
 - - Send control commands Switch between single segment values and group values.
- Once the watch tables are open, click on the icon with the glasses **4**. This will start the monitoring process of the variables, and the values will be displayed continuously. To stop the monitoring click the icon again.



- The watch table **Send control commands** is used to switch between single and group force return values. Once the variable table is open,
 - 4 click on the icon with the glasses
 - 5 set the value to 1 to activate group mode or 0 to get back to the single segment mode
 - 6 click on the icon with the flash to send the command to the PLC



The screenshots illustrate the configuration of the segFORCE watch tables. The first screenshot shows the 'Send control commands' table with a value of 1 in the 'Modify value' column. The second screenshot shows the 'Common Roller Data' table with various parameters like 'Last error', 'Number of segments', and 'SFS0 Group mode'. The third screenshot shows the 'Seg. 01 to 10' table with parameters for individual segments, including force, speed, and status.

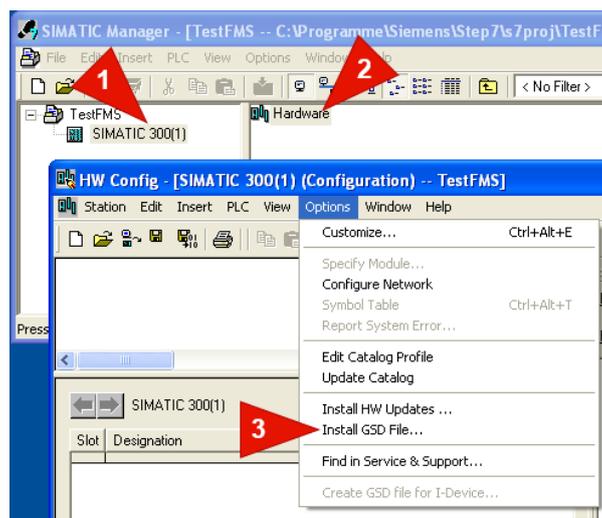


For further information on how the grouping of segments works and how the data are transferred to the PLC, consult the segFORCE Operation Manual.

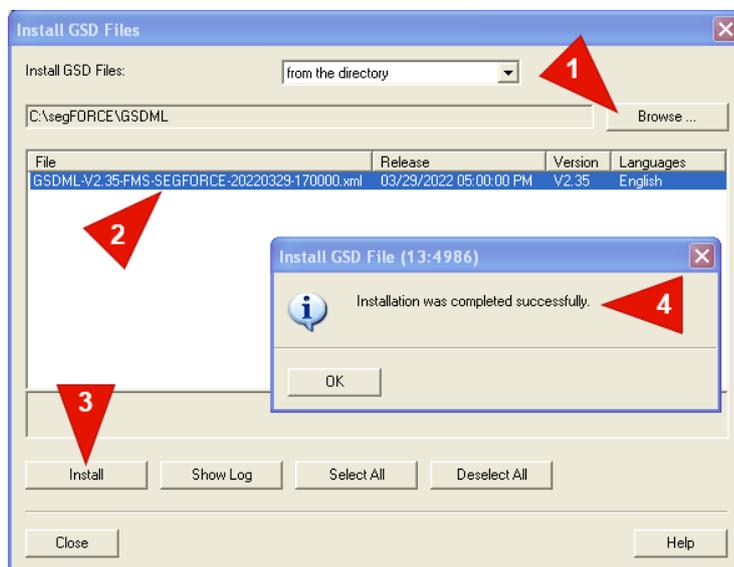
2.5 Use the segFORCE in your project

2.5.1 Step 7 SIMATIC Manager

- Execute the SIMATIC Manager.
- Open your project or create a new one. In case of a new project, insert a new object, e.g., SIMATIC 300 Station.
- Select the SIMATIC 300 Station on the tree or whatever you have named the station **1** and double-click the item Hardware on the window's right side panel **2**. That opens the dialog HW Config.
- On the HW Config dialog, choose the menu **Option -> Install GSD File 3**. That opens the dialog Install GSD Files.

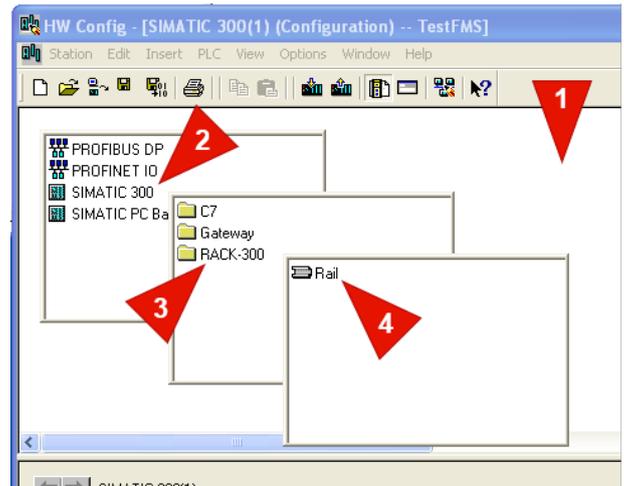


- On the Install GSD Files dialog, click on the Browse button **1**. Choose the directory where the GSDML files are located. In our case, it is c:\segFORCE\GSDML. Return to the previous dialog by clicking on OK. Select the GSDML file from the list that is to be installed **2**. Now click on Install **3** and accept all questions on the follow-up dialogs until you reach the dialog **Installation was completed successfully 4**. Close all dialogs until you are back on the HW Config dialog.

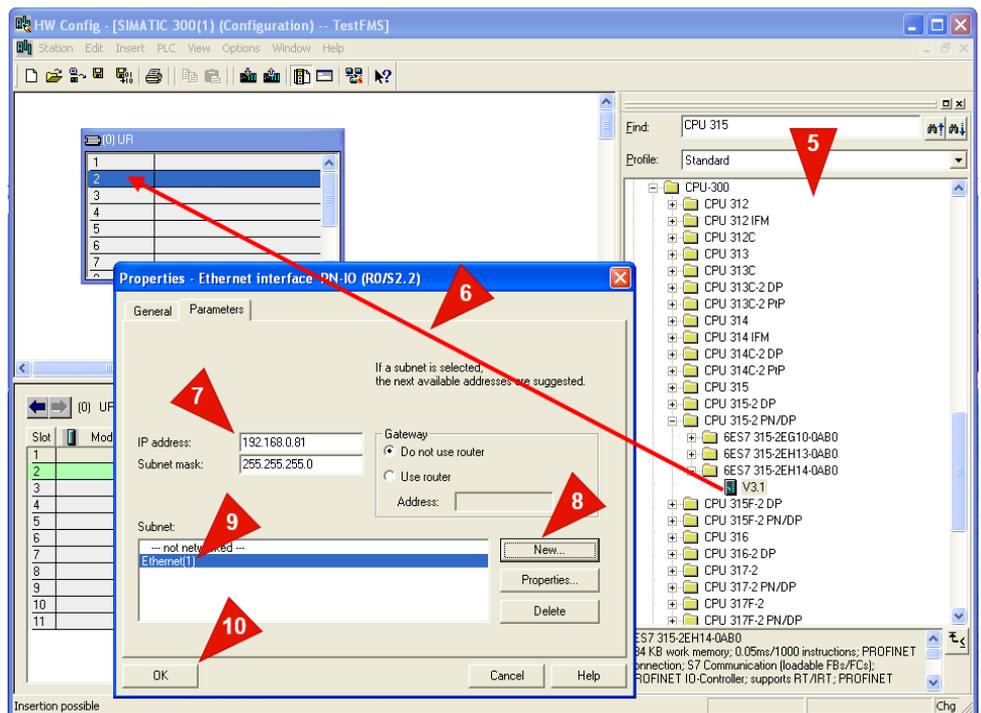


- Now as you are back on the HW Config dialog, the next step is to insert a rack and a CPU. Of course, only if they are not configured already. Otherwise, continue straight on to the next step.

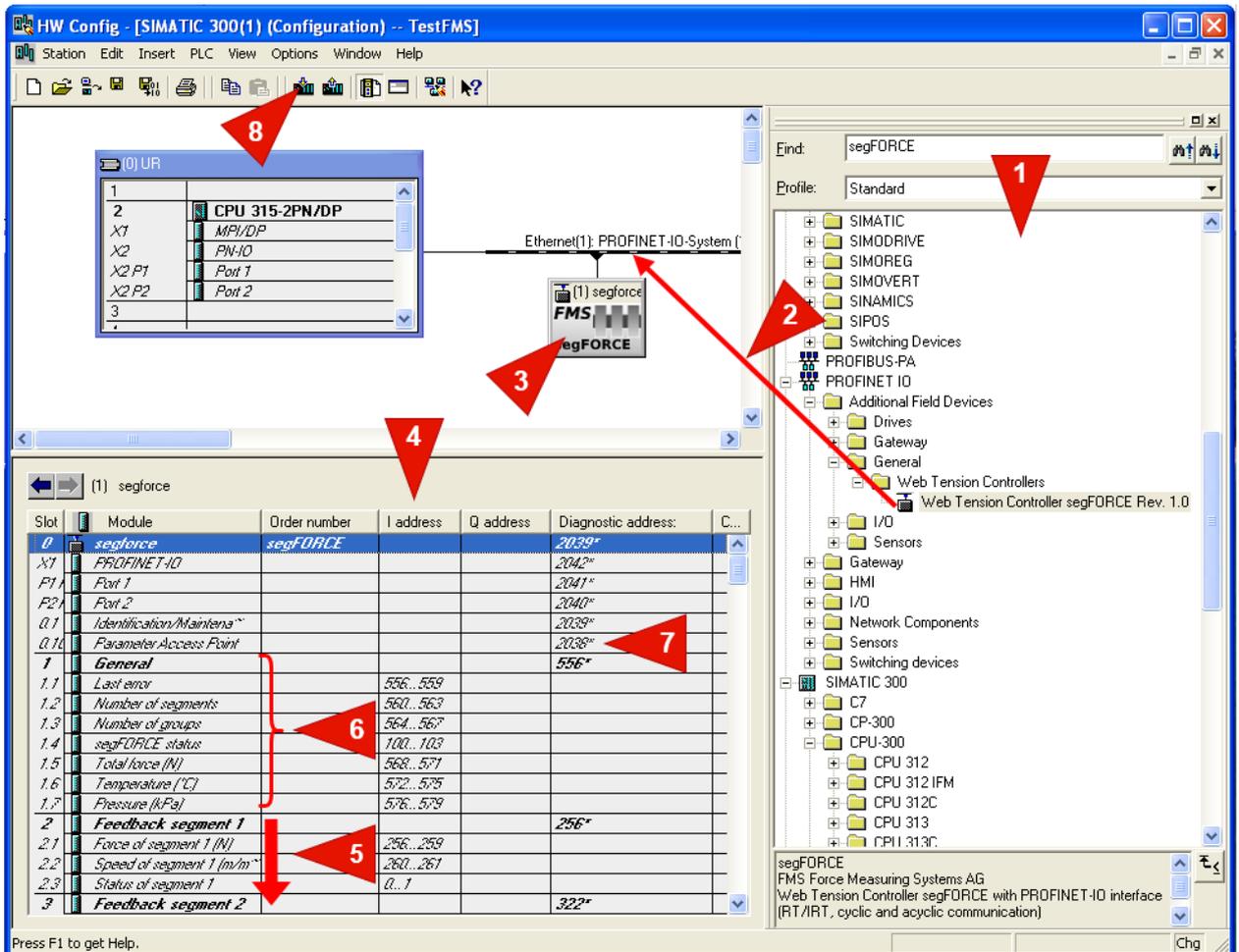
Right-click in the white area below the menu and symbol bar **1** and choose Insert Object. In the popping-up list, choose SIMATIC 300 **2**, then RACK-300 **3**, and finally Rail **4**. A table representing the rack is inserted in the white area.



Find your CPU in the hardware catalog on the right **5** and drag and drop it into slot 2 of the rack **6**. This operation opens the dialog **Properties - Ethernet interface**. Enter a not used IP address into the corresponding field **7** with which the PLC will operate on the network. Click on **New** **8** to add a Subnet if it not already exists, and click on Ok in the popping-up dialog. Back on the properties dialog, select the Subnet **Ethernet** **9**, and click on Ok **10**.



- Add the segFORCE device to the hardware configuration. Make sure the HW Config is open, as already described above once. Find the segFORCE device in the hardware catalog on the right **1** and drag and drop it to the Ethernet PROFINET-IO-System **2**. This operation inserts the segFORCE device into the hardware configuration **3**. The list below **4** always shows the assigned hardware address of all possible 50 segments **5**, although not all must be mounted on the roller. The addresses of the general roller properties can be looked up at the beginning of the list **6**. Another important module is the Parameter Access Point. This address must be used to parameterize the device. For the segFORCE, it is used to switch the Group Mode on or off **7**.

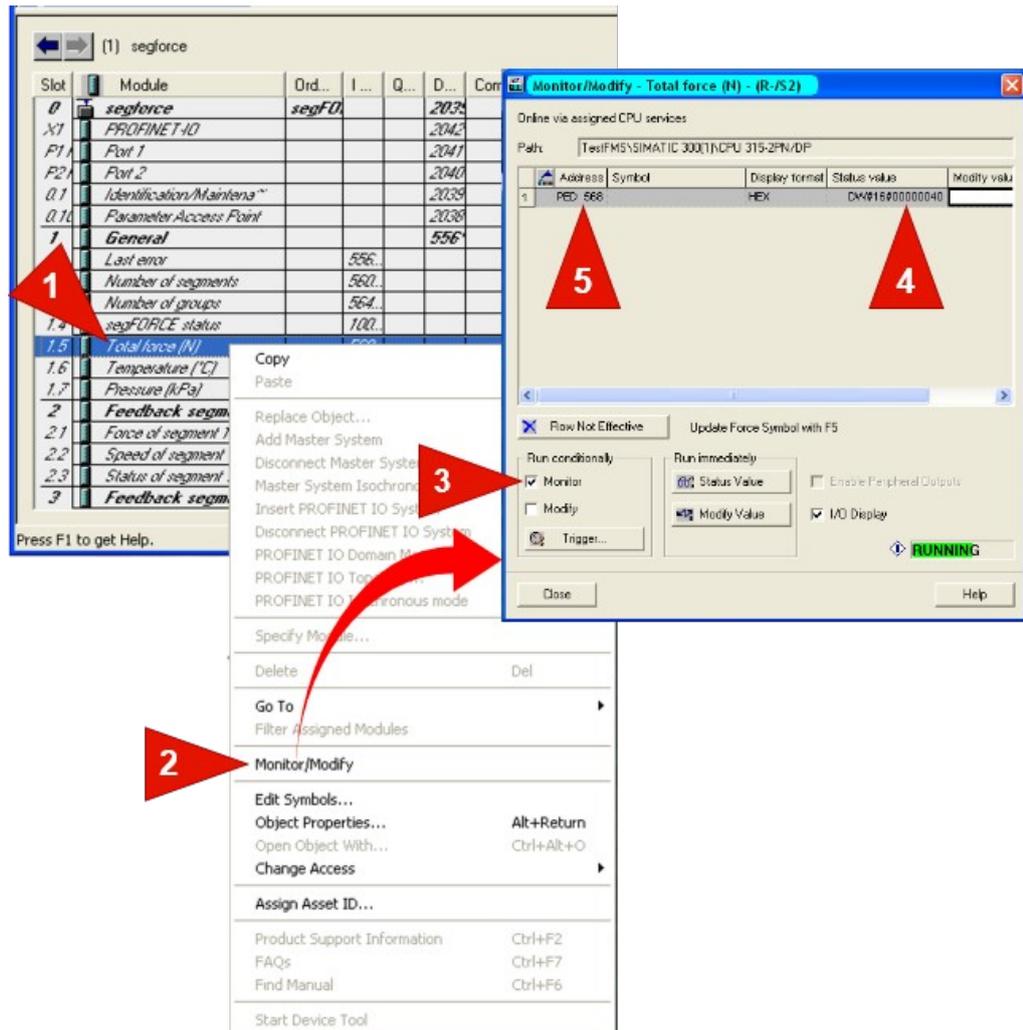


The screenshot shows the SIMATIC HW Config interface for a SIMATIC 300(1) configuration. The hardware catalog on the right lists various modules, with 'segFORCE' selected. The main configuration area shows a rack diagram with a 'segFORCE' module connected to the 'Ethernet(1): PROFINET-IO-System'. The parameter table below provides the following data:

Slot	Module	Order number	I address	Q address	Diagnostic address:	C...
0	segforce	segFORCE			2039*	
X1	PROFINET-IO				2042*	
F1	Port 1				2041*	
F2	Port 2				2040*	
Q.1	Identification/Maintena...				2039*	
Q.16	Parameter Access Point				2038*	
1	General				556*	
1.1	Last error		556..559			
1.2	Number of segments		560..563			
1.3	Number of groups		564..567			
1.4	segFORCE status		100..103			
1.5	Total force (N)		568..571			
1.6	Temperature (°C)		572..575			
1.7	Pressure (kPa)		576..579			
2	Feedback segment 1				256*	
2.1	Force of segment 1 (N)		256..259			
2.2	Speed of segment 1 (m/m...)		260..261			
2.3	Status of segment 1		0..1			
3	Feedback segment 2				322*	

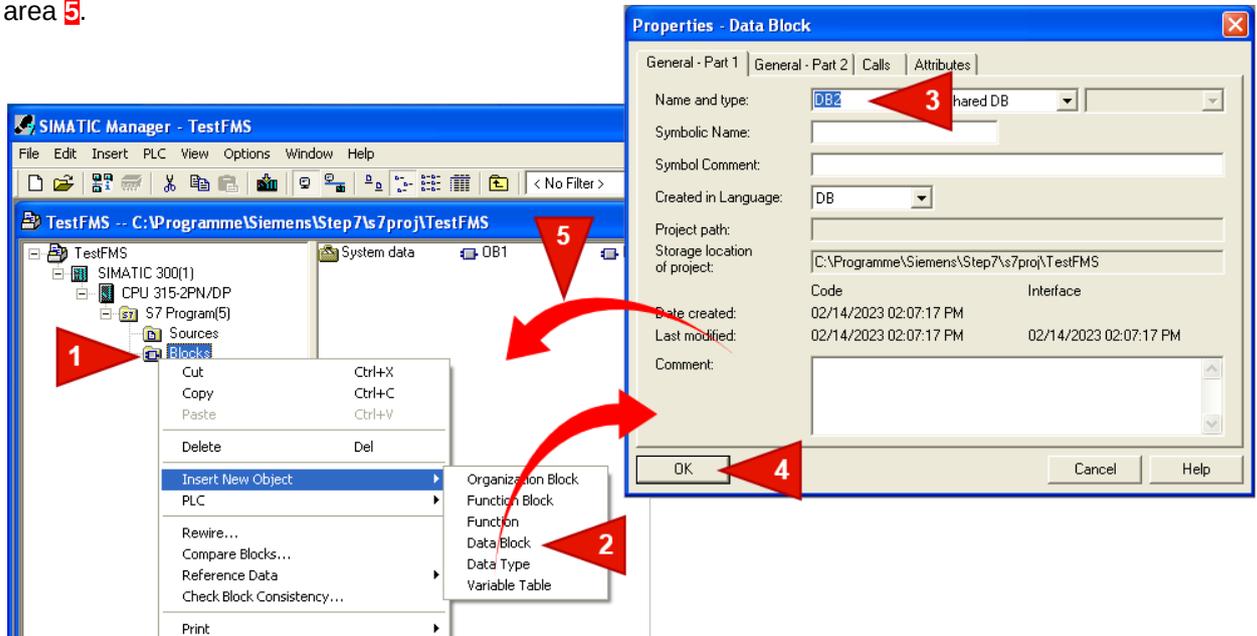
- After all hardware configuration has been made, download it to the PLC **8**. Check if the PLC is satisfied with it. Therefore the LEDs DCV5 and RUN must permanently light green, and no other LEDs should be blinking. If that is not the case, fix the problems first.

- The segFORCE is now ready to use. If you want to test the system, you can read any values of the cyclic data. There is even no program necessary for doing that. In the HW Config window, right-click a parameter (module) of interest, e.g., **Total force (N)** **1**. In the appearing context menu, click on the menu **Monitor/Modify** **2**. That opens the dialog **Monitor/Modify** online. Next, click on the check box **Monitor** **3**. In the table above, the value will be continuously updated **4**. If you push on a segment, you can observe changes in the value. Furthermore, the table shows you how the parameter can be addressed later on in your program **5**.

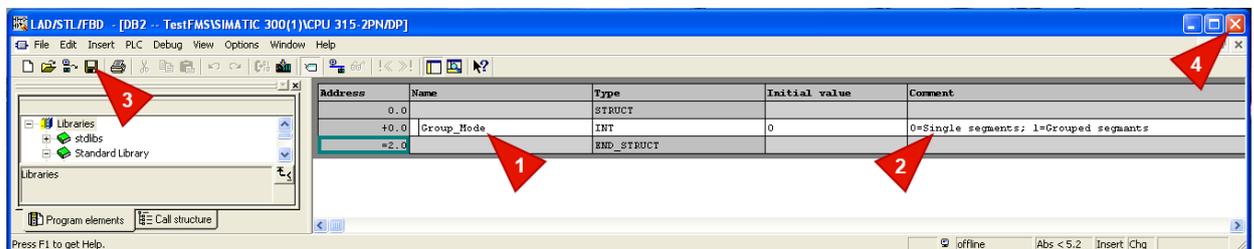


For the following steps, close all dialogs until you are back on the SIMATIC Manager main window.

- The last thing to explain is how to switch the segFORCE group mode. For that purpose, a little program is needed. First, insert a new data block by right-clicking the **Blocks** **1** item under the project tree and choosing the command **Insert New Object -> Data Block** **2**. Enter the name, e.g., **DB2** **3** or another new name, and confirm the dialog with a click on **Ok** **4**. Double-click the newly inserted data block **DB2** in this area **5**.



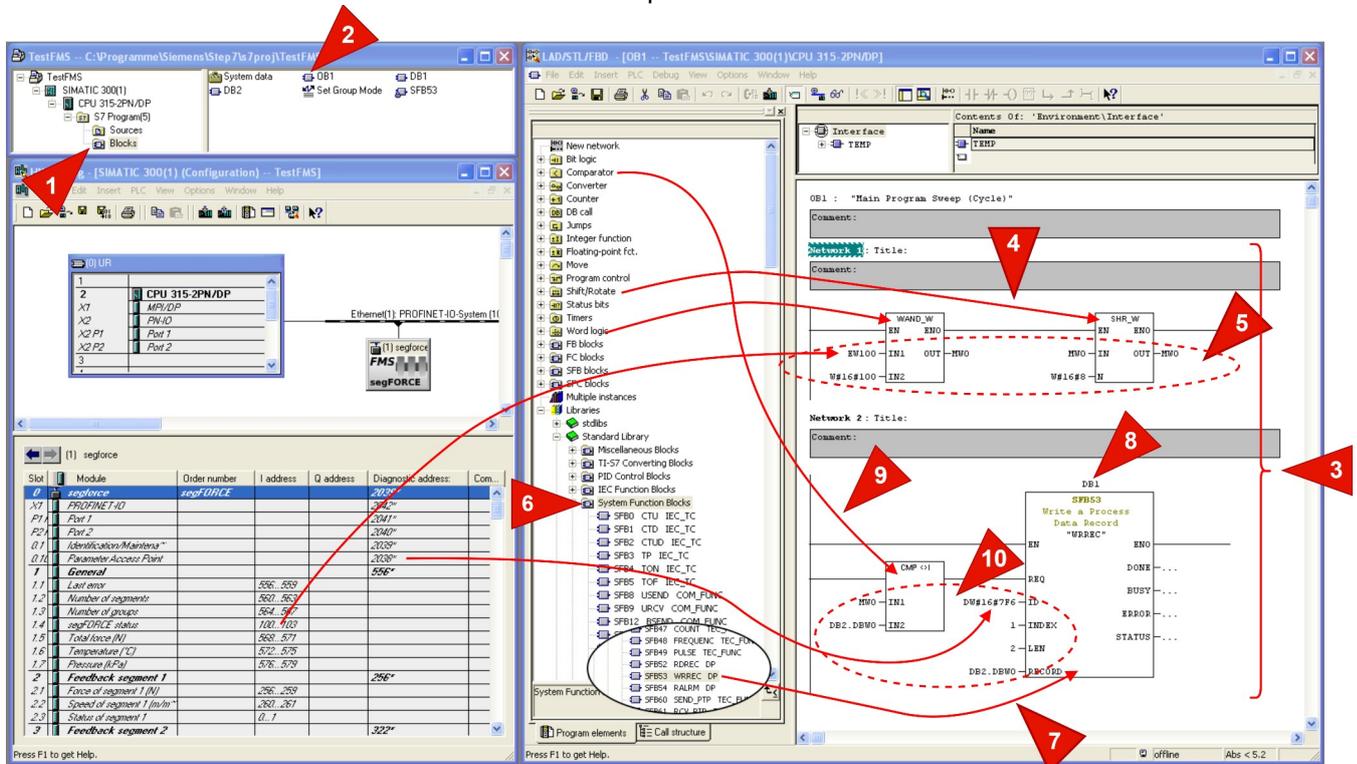
- The last action above **5** opens the data block definition. Enter the parameter name **Group_Mode** **1** and a comment **2**. Save the changes **3** and close the window **4**.



- Next, select the item **Blocks** **1** under the project tree and double-click the object **OB1** **2** on the right window panel. That opens the programming window. In the programming area, insert two networks **3** by hitting Ctrl-r on the keyboard. They are empty in the first place, not as shown in the picture.

Network 1 converts the digital input **Group Mode** to a variable of type WORD. To achieve that, insert the functions WAND_W and SHR_W to network 1 **4**. Edit the four inputs and two outputs as shown in the picture **5**, whereas IN1 points to the physical address of the segFORCE status bits.

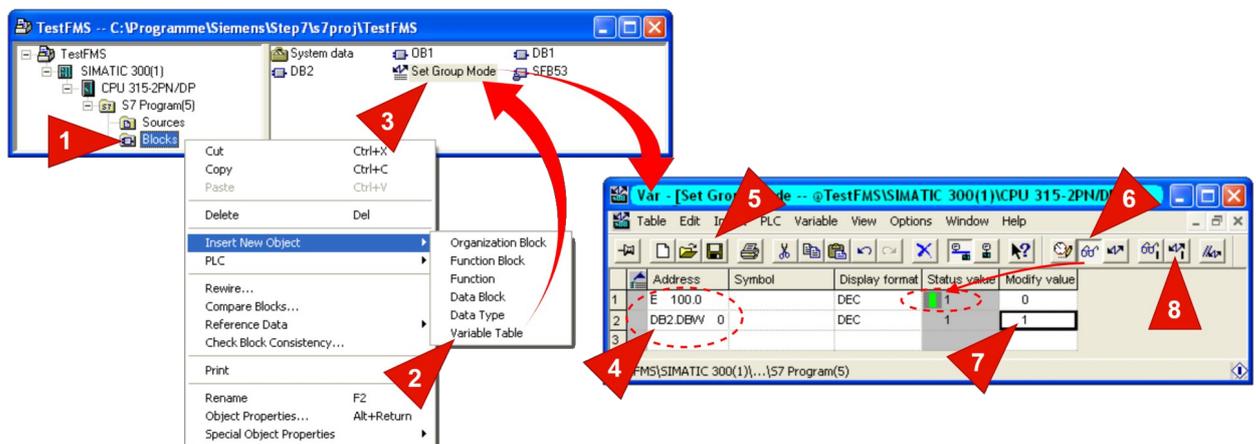
Network 2 sends the group mode value when the demanded group mode differs from the set. To achieve that behavior, select the item **System Function Blocks** on tree **6**. Further down the branch, drag the SFB53 WRREC DP function block **7** to the desired network. Enter the name of a data block not yet used, e.g., DB1 **8**, and confirm the creation if it does not already exist. Insert the comparator CMP<>I into the input REQ **9**. Edit the six inputs as shown in the picture **10**, whereas ID points to the physical address of the Parameter Access Point. The address must be specified in hexadecimal format.



- Download program to the PLC.

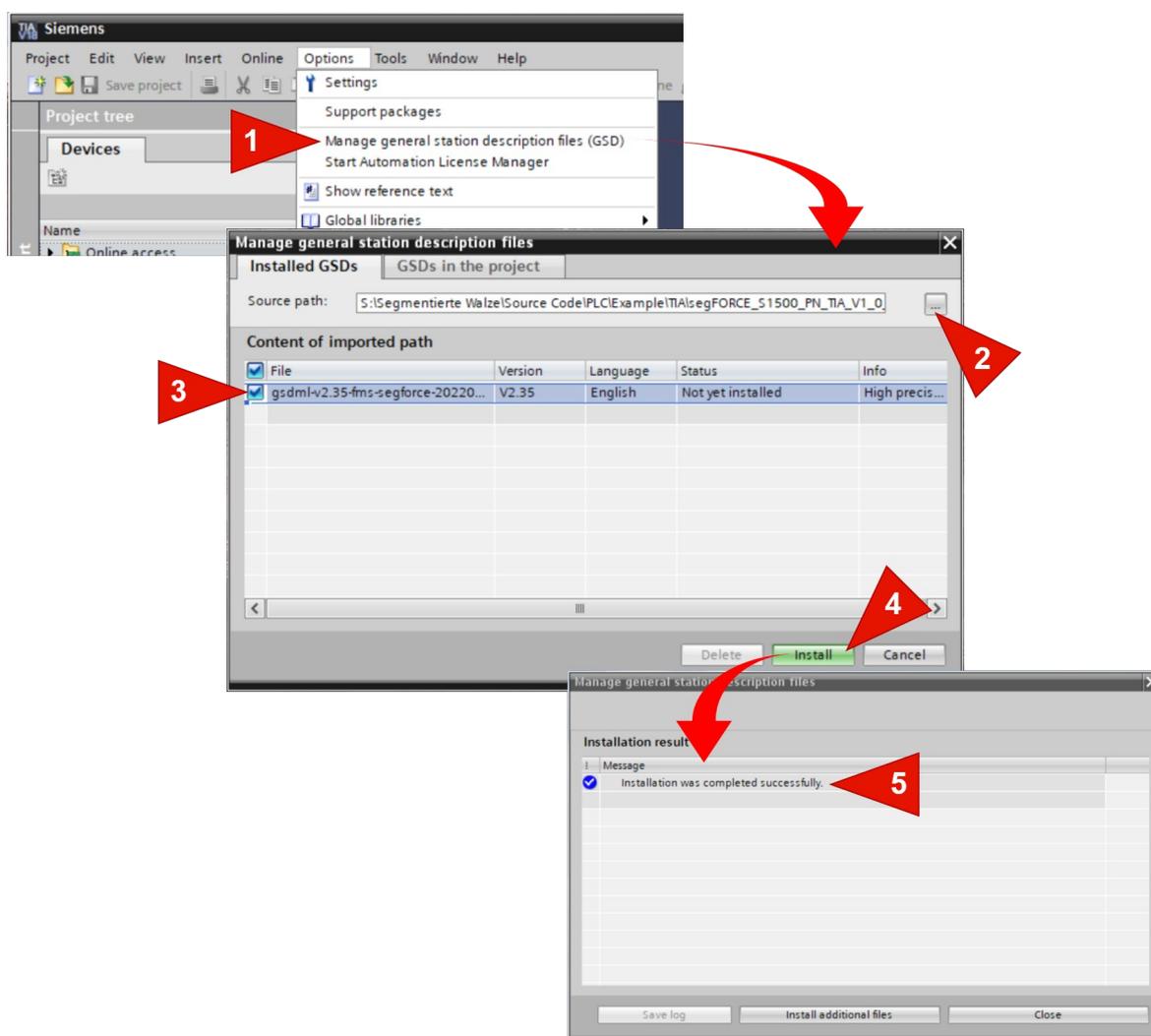
- How to use the program. First, right-click on the tree item **Blocks** **1**, and select the submenu **Insert New Object -> Variable Table** **2**. In the popping-up dialog, enter the Symbolic Name, e.g., **Set Group Mode**, and click on Ok. The variable table is now available in the area on the right of the window. Double-click the item to open the variable table **3**. Enter the two addresses as shown in the picture **4**, or take the ones you have used during the configuration above. They may differ from this description. In the first line, the address E 100.0 indicates the status of the Group Mode bit of the segFORCE. The second line with the address DB2DBW 0 is used to change the Group Mode. Click on Save to save the changes to the table **5**.

Click on the glasses icon to start the variables' monitoring process **6**. Now you can see the actual setting of the Group Mode. If you want to change the Group Mode, enter the desired value into **Modify value** **7**, and click next on the flash icon **8**. That action sends the new value to the PLC, and the **Group Mode** bit must also change accordingly **6** when the communication to the PLC works correctly.

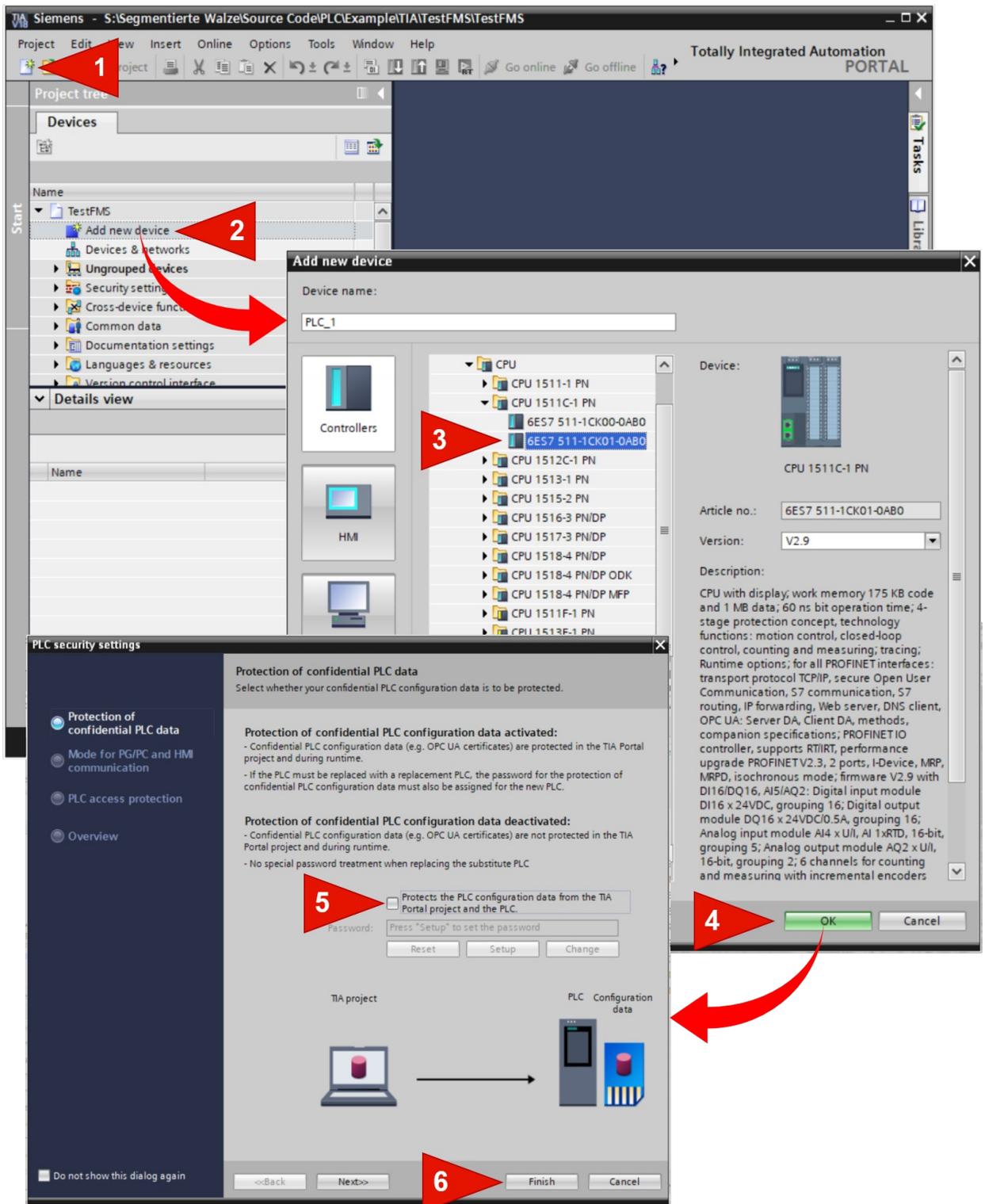


2.5.2 TIA Portal

- Execute the **TIA Portal** program.
- The program normally starts with the portal view. Switch to the project view by clicking the **Project view** menu at the bottom left.
- On the TIA Portal main window, choose the menu **Option -> Manage general station description files (GSD) 1**. That opens the dialog for installing GSD files.
- On the **Manage...** dialog, click on the **Browse** button **2**. Choose the directory where the GSDML files are located. In our case, it is c:\segFORCE\GSDML. Return to the previous dialog by clicking on **Select Folder**. Select the GSDML file from the list that is to be installed by ticking the check box **3**. Now click on **Install 4** and accept all questions on the follow-up dialogs until you reach the dialog **Installation was completed successfully 5**. Close all dialog windows until you are back on the main window.



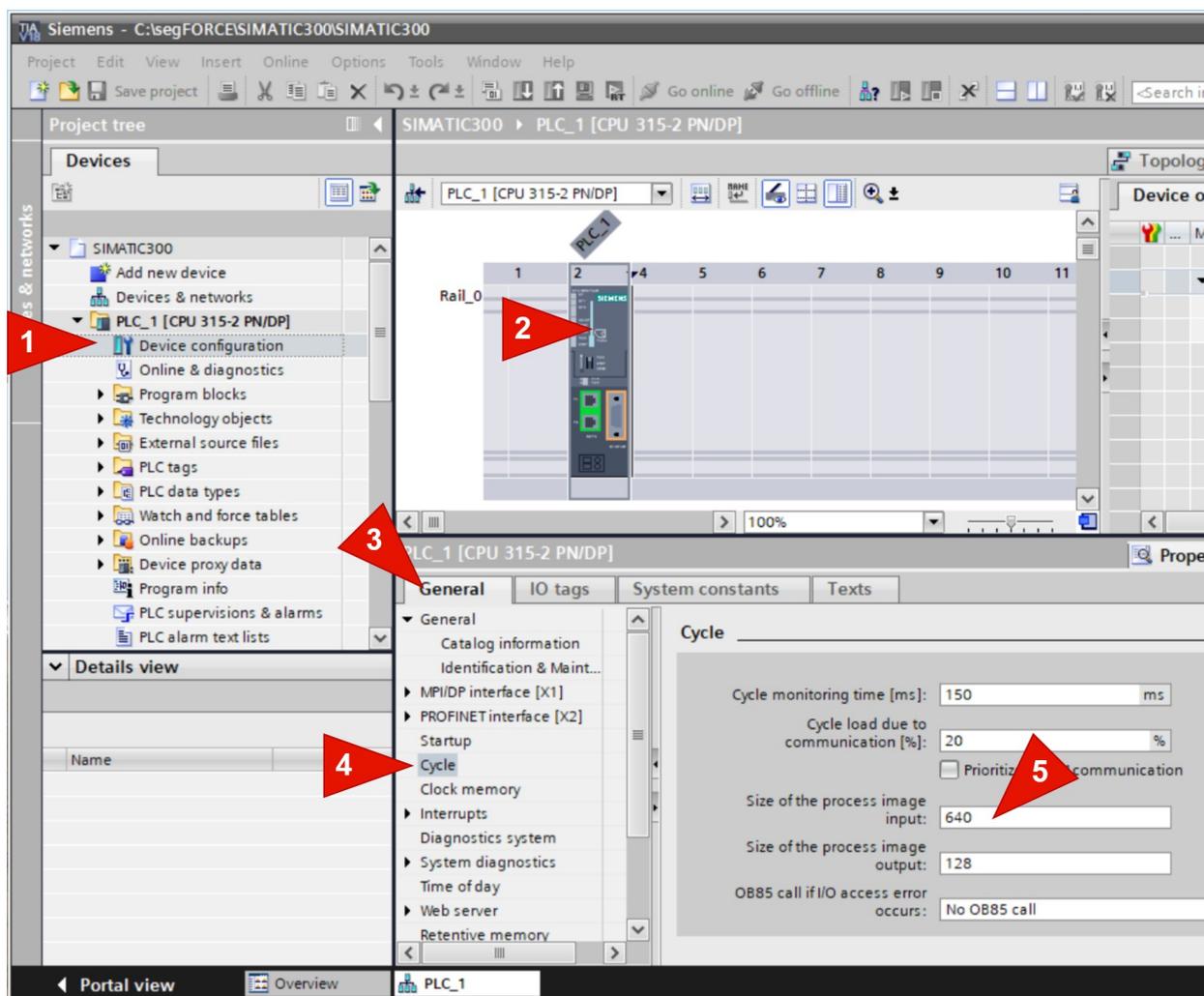
- Open your project or create a new one **1**. In case of a new project, add a new device, e.g., PLC CPU 1511C-1 PN, by double-clicking on **Add new device** **2**. After that, search your CPU **3** and click on **OK** **4**. In the opening dialog **PLC security settings** make sure the check box **Protects the PLC...** is not ticked **5**, and finally, click on **Finish** **6**.



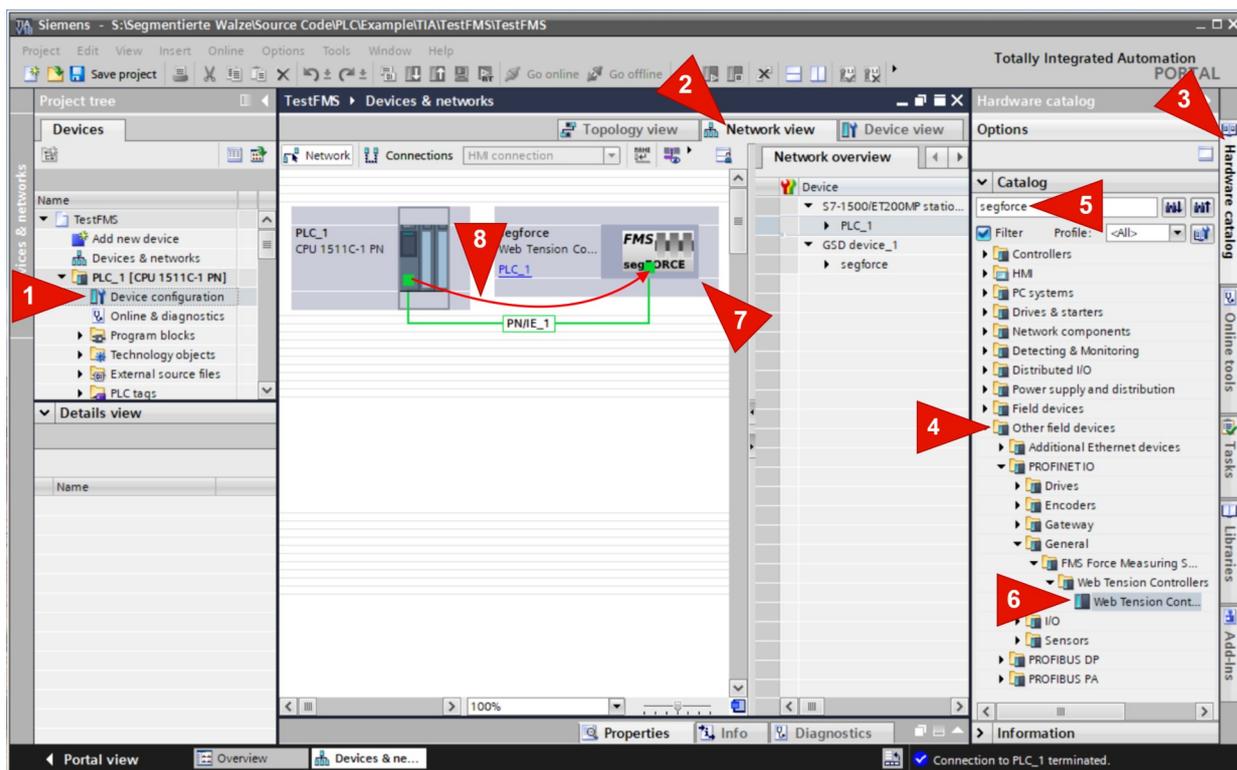


If you have a PLC of the SIMATIC 300 or maybe 400 series added, **make sure to increase the input process image size to a minimum of 640 bytes**. If you don't make that change, not all segFORCE values will be seen. Therefore when reading values from the process image, they return 0 instead of the actual value.

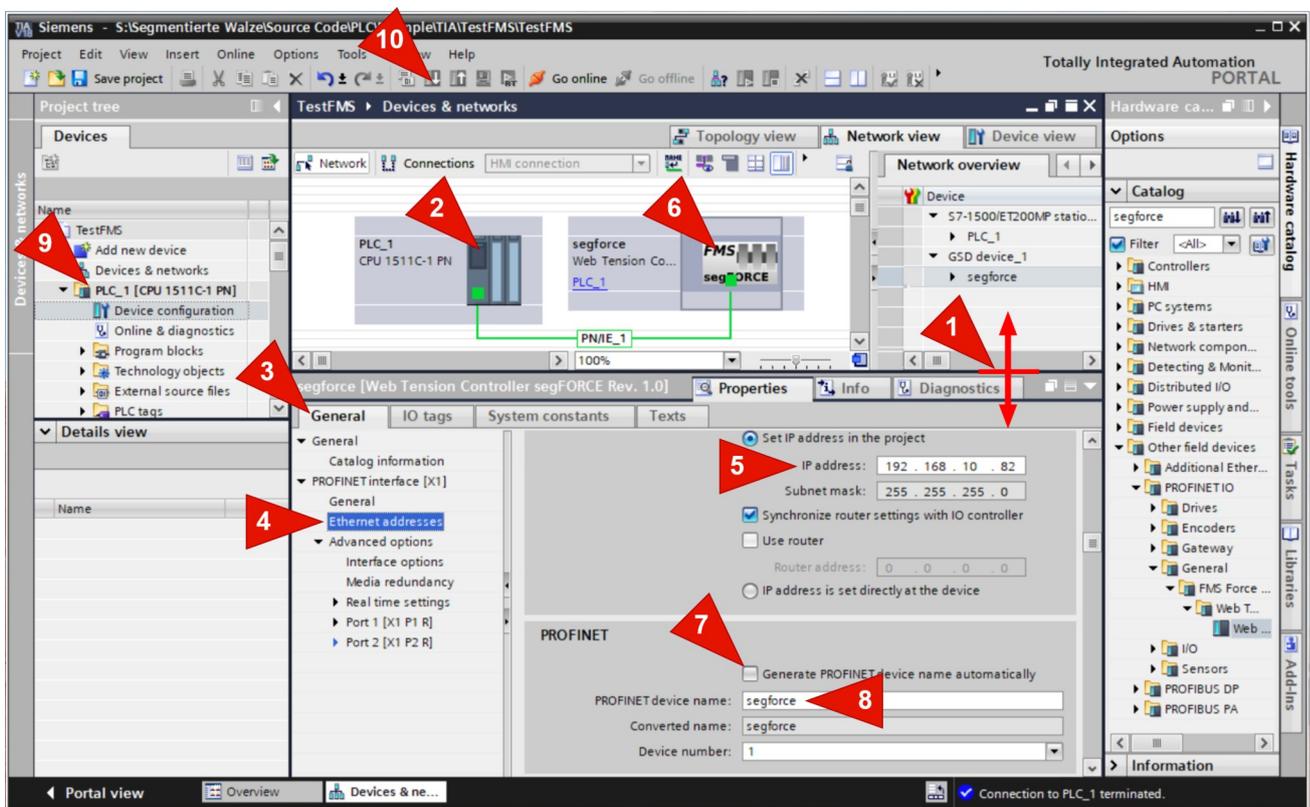
- If you have a SIMATIC 1200 or 1500 series PLC, continue with the next point. But if you have a SIMATIC 300, or maybe the same applies to the 400, double-click on the **Device Configuration** item in the Device Tree **1**. Then double-click the PLC **2**, select the tab **General** **3** and choose the tree item **Cycle** **4**. On the right panel, change the entry filed **Size of the process image input** the value to 640 **5**.



- Add the segFORCE device to the hardware configuration. Double-click in the device tree on the item **Device configuration** **1**. In the right panel, click on the tab **Network view** **2**, and at the right sidebar, on the tab **Hardware catalog** **3**. The catalog tree should be seen, and select **Other field devices** **4** in there. In the search entry field, enter **segforce** **5** and hit the enter key to start the search. After a while, the entry **Web Tension Controller segFORCE Rev. x.x** appears **6**. When double-clicking that item, the segFORCE is added to the hardware configuration **7**. Connect the PLC and the segFORCE by dragging a line **8** between the Ethernet ports. This action draws a green line between the two devices representing the connection.



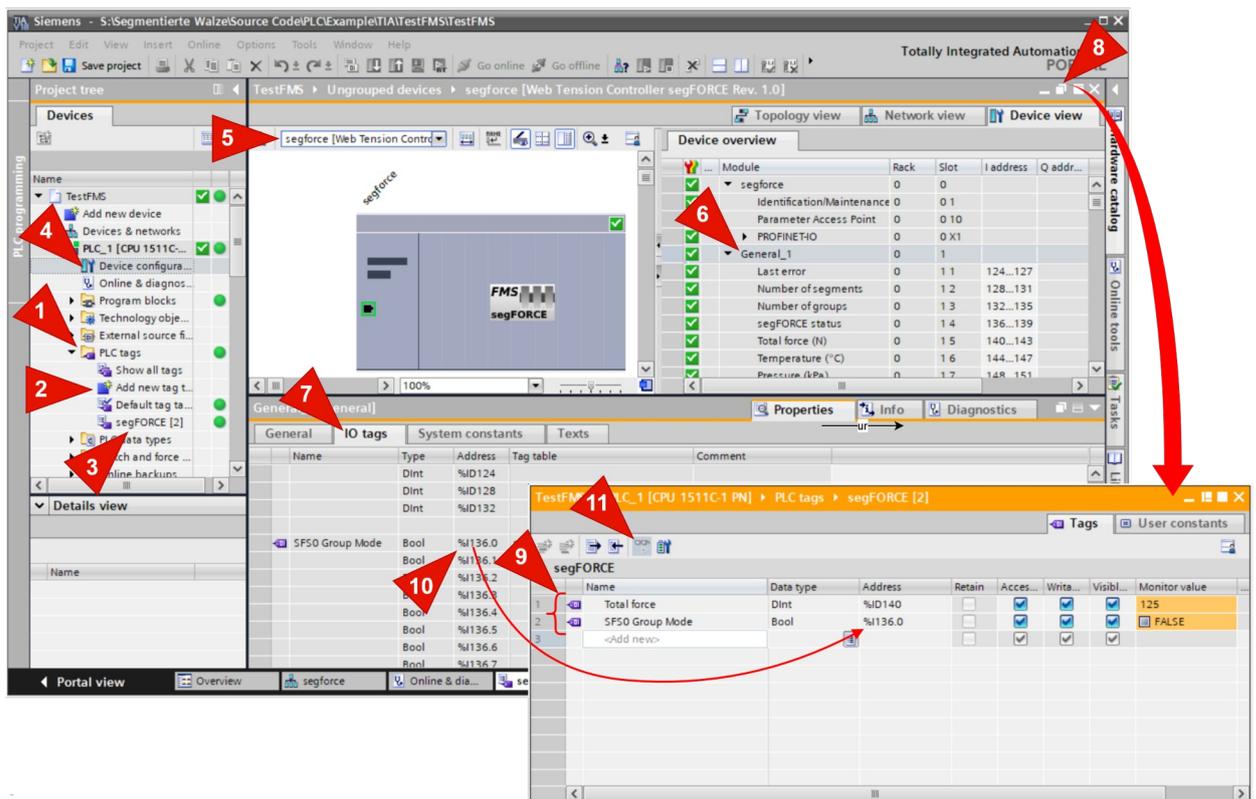
- The next step is to assign the PLC and the segFORCE an unused IP address. In the case of the PLC, that is unnecessary for an existing project because you might already have done that. First, you can stay on the panel above and uncover the lower part of the device configuration by dragging the separator line up **1**. Click on the PLC **2** and then tab General **3**. Select the tree entry Ethernet addresses **4**. Enter the IP address **5** the PLC should get on the panel right of the tree. Next, click on the segFORCE **6** and then tab General **3**. Select the tree entry Ethernet addresses **4**. Enter the IP address the segFORCE should get **5**. As we are already at the right place to set the PROFINET device name, scroll down a bit and ensure the option Generate PROFINET device name automatically is not ticked **7**. Then enter PROFINET device name **segforce** **8**.
- Now it is about time to test the configuration. Download it to the PLC. Click on the entry PLC_1 on the device tree **9** and execute the download by clicking on the download symbol **10**.



- Continue with the next step when the configuration has been downloaded successfully. Therefore the left LED must permanently light green, and the other two must be dark. If that is not the case, fix the problems first.



- The segFORCE is now ready to use. If you want to test the system, you can read any values of the cyclic data. No program is necessary to achieve this, but you must create a PLC tags table. Open the tree branch **PLC tags** **1**, and double-click on the entry **Add new tag table** **2**. A new table named **Tag table_1 [0]** or similar will be added. Rename the table to **segFORCE** **3**. By the way, the value in square brackets behind the name indicates the number of defined tags in the tag table.
- To look up the absolute addresses of the segFORCE values, which you want to insert into the tag table afterward, double-click on the tree entry **Device configuration** **4**. On the panel on the right, the Device view opens. Select the segFORCE from the drop-down list **5**. Next, select the row **General_1** **6** and make sure the tab **IO tags** **7** have been chosen on the lower panel. That uncovers the absolute addresses of the selected module. Now the tag table segFORCE can be opened for editing. Therefore, double-click on the tag table segFORCE **3** to open it. If the tag table covers the device view, click on the symbol float **8** to detach the window from the main application.
- The quick guide shows just two possible values to visualize. But all others can be added in the same manner. Edit rows 1 and 2 as shown in the picture **9**. The absolute address can be found on the table **IO tags** **10**.
- Download the program again to the PLC.
- Click on the glasses symbol to see the values live **11**.

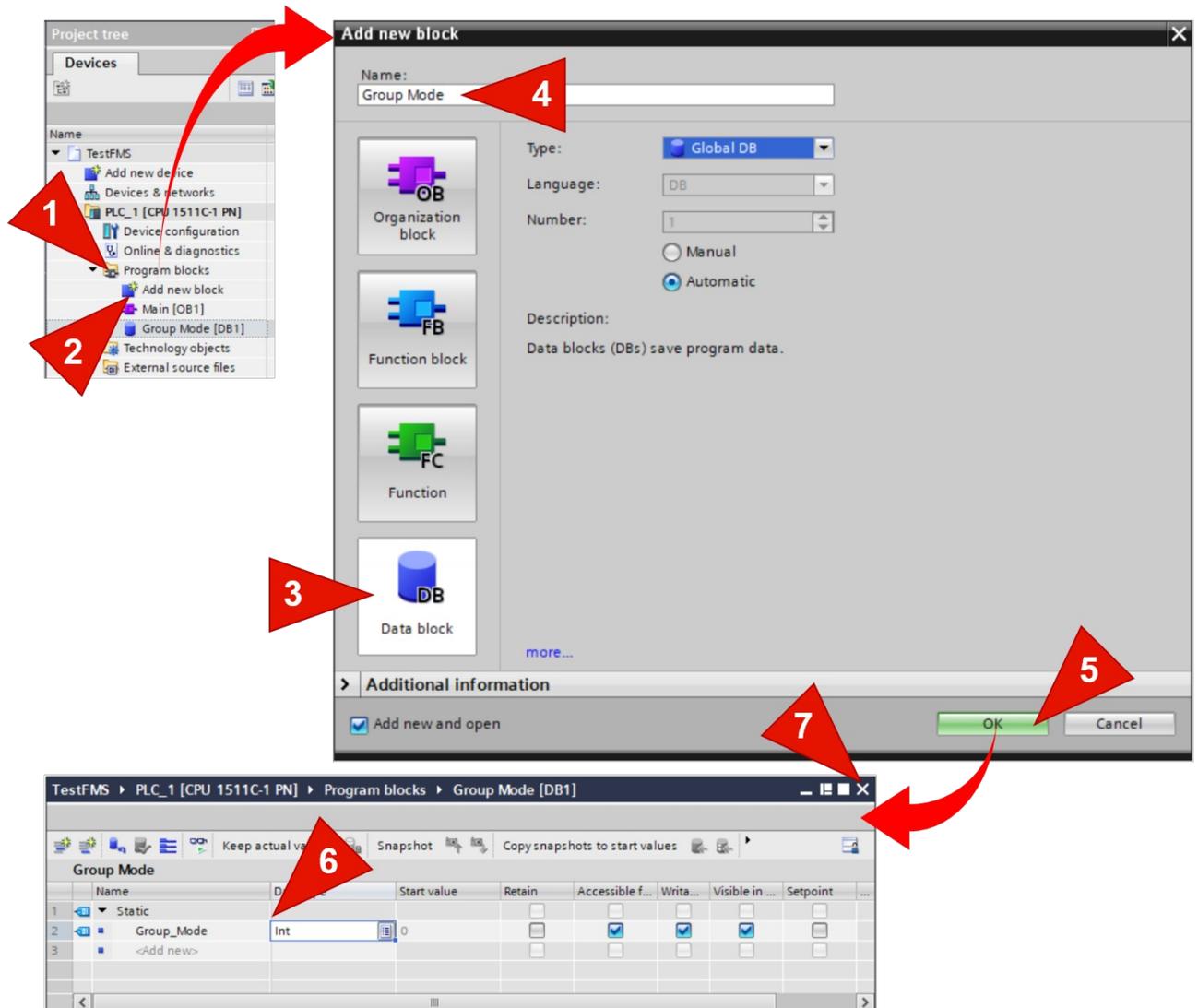


The screenshot shows the Siemens SIMATIC Manager interface. The Project tree on the left shows the 'PLC tags' folder expanded. The Device overview table on the right shows the 'segforce' module selected. The Properties window at the bottom shows the 'IO tags' tab for the 'segFORCE' tag table. The 'IO tags' table lists the following data:

Name	Data type	Address	Tag table	Comment
Total force	Dint	%ID140		
SFSO Group Mode	Bool	%I136.0		

The Properties window also shows a 'Monitor value' column with the value '125' for 'Total force' and 'FALSE' for 'SFSO Group Mode'.

- The last thing to explain is how to switch the segFORCE group mode. For that purpose, a little program is needed. Open the tree branch **Program blocks** **1**, and double-click the tree entry **Add new block** **2**. The dialog **Add new block** pops up. Click on the symbol **Data block** **3**, enter the name **Group Mode** **4**, and confirm the changes with a click on **OK** **5**. That opens the data block for editing. Enter the parameter name **Group_Mode** **6**, the data type **Int**, and close the window **7**.



- Next, open the tree branch **Program blocks** **1**, under the Project tree, and double-click the tree entry **Main [OB1]** **2**. That opens the programming window. In the programming area, insert two networks **3** by hitting Ctrl-r on the keyboard. They are empty in the first place, not as shown in the picture.

Network 1 converts the digital input **Group Mode** to a variable of type WORD. To achieve that, insert the functions AND and SHR to network 1 **4**. Edit the four inputs and two outputs as shown in the picture **5**, whereas IN1 points to the physical address of the segFORCE status bits.

Network 2 sends the group mode value when the demanded group mode differs from the set. To achieve that behavior, open the **Extended instructions -> Distributed I/O** **6**. Drag the WRREC function block **7** to the desired network. Enter the name of a data block not yet used, e.g., WRREC_DB **8**, and confirm the creation by clicking OK. Insert the comparator CMP<> into the input REQ **9**. Edit the six inputs as shown in the picture **10**, whereas ID points to the physical address of the Parameter Access Point. Save the changes **11**.

The screenshot displays the SIMATIC Manager interface for a Siemens PLC. The main window shows the ladder logic programming area with two networks. Network 1 contains an AND block and an SHR block. Network 2 contains a WRREC block and a comparator block. The Properties window at the bottom shows the configuration for the Parameter Access Point.

Name	Type	Address	Tag table
segforce	Dint	%ID124	
General_1	Dint	%ID128	
Feedback segment 1_1	Dint	%ID132	
Feedback segment 2_1	Bool	%I136.0	segFORCE
Feedback segment 3_1	Bool	%I136.1	
Feedback segment 4_1	Bool	%I136.2	
Feedback segment 5_1	Bool	%I136.3	

Name	Type	Hardware identi.	Used by
segforce-Parameter_Access_Point	Hw_SubModule	479	PLC_1

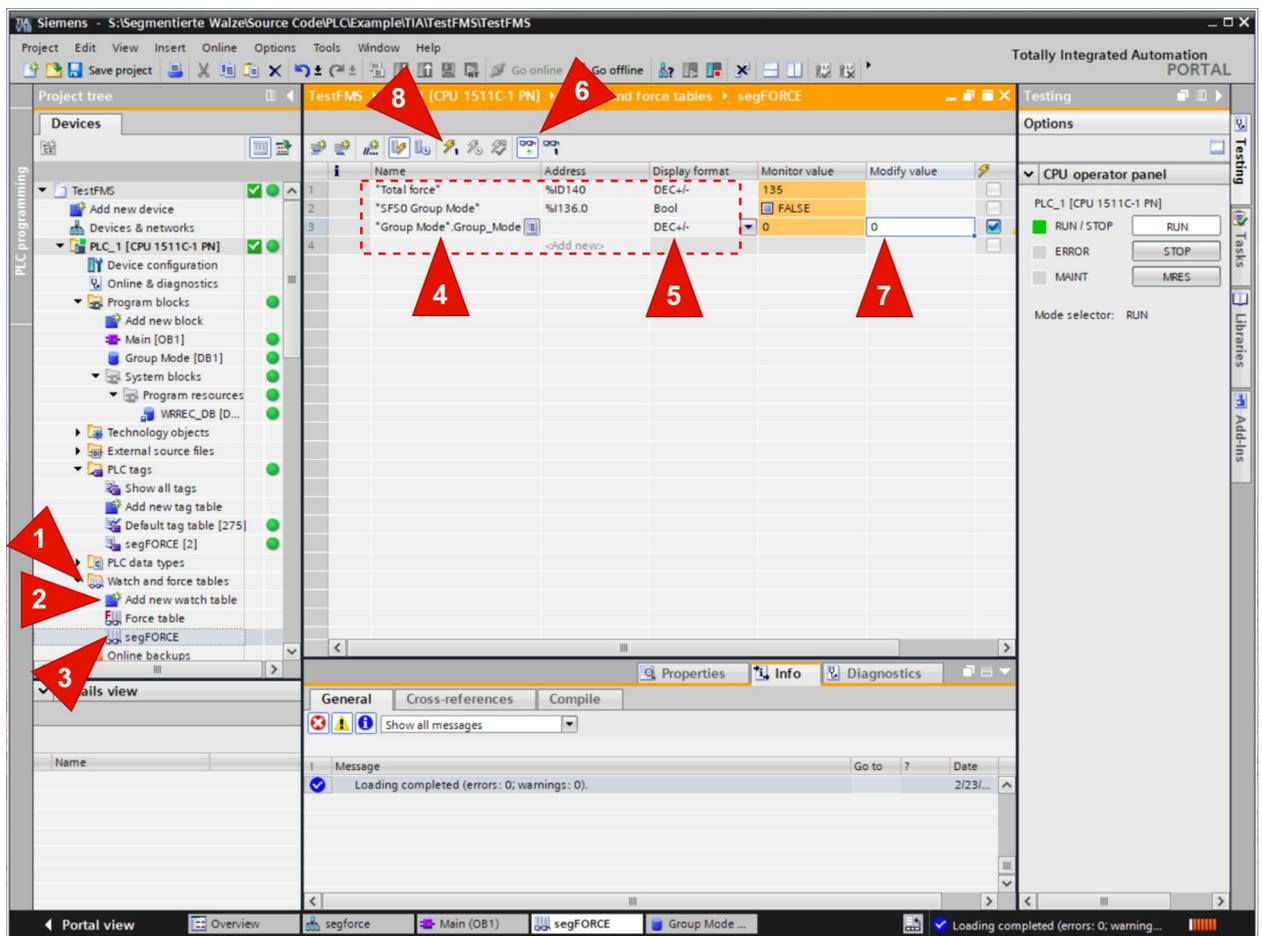
- Download program to the PLC.
- How to use the program. Open the folder **Watch and force tables** **1** under the PLC project tree, and double-click the tree entry **Add new watch table** **2**. A new table named **Watch table_1** or similar will be added. Rename the table to **segFORCE** **3**. After adding the watch table, it should already be open for editing on the right side of the tree window. Even all tags should be available when you fulfilled all steps above. Therefore, edit the table according to the picture. Just enter the name **4**. The addresses will be inserted automatically because of the tag definition. The last thing you have to do is to adapt the Display format **5**.

Once the variable table has been edited,

6 click on the icon with the glasses to see the values live.

7 set the value to 1 to activate group mode or 0 the get back to the single segment mode

8 click on the icon with the flash to send the command to the PLC



The screenshot displays the SIMATIC Manager interface for configuring a segFORCE watch table. The Project tree on the left shows the hierarchy: TestFMS > PLC_1 [CPU 1511C-1 PN] > Watch and force tables > segFORCE. The main table editor shows the following configuration:

Name	Address	Display format	Monitor value	Modify value
*total force	%I140	DEC+/-	135	<input type="checkbox"/>
*SF50 Group Mode	%I136.0	Bool	FALSE	<input type="checkbox"/>
*Group Mode.Group_Mode	<Add new>	DEC+/-	0	<input checked="" type="checkbox"/>

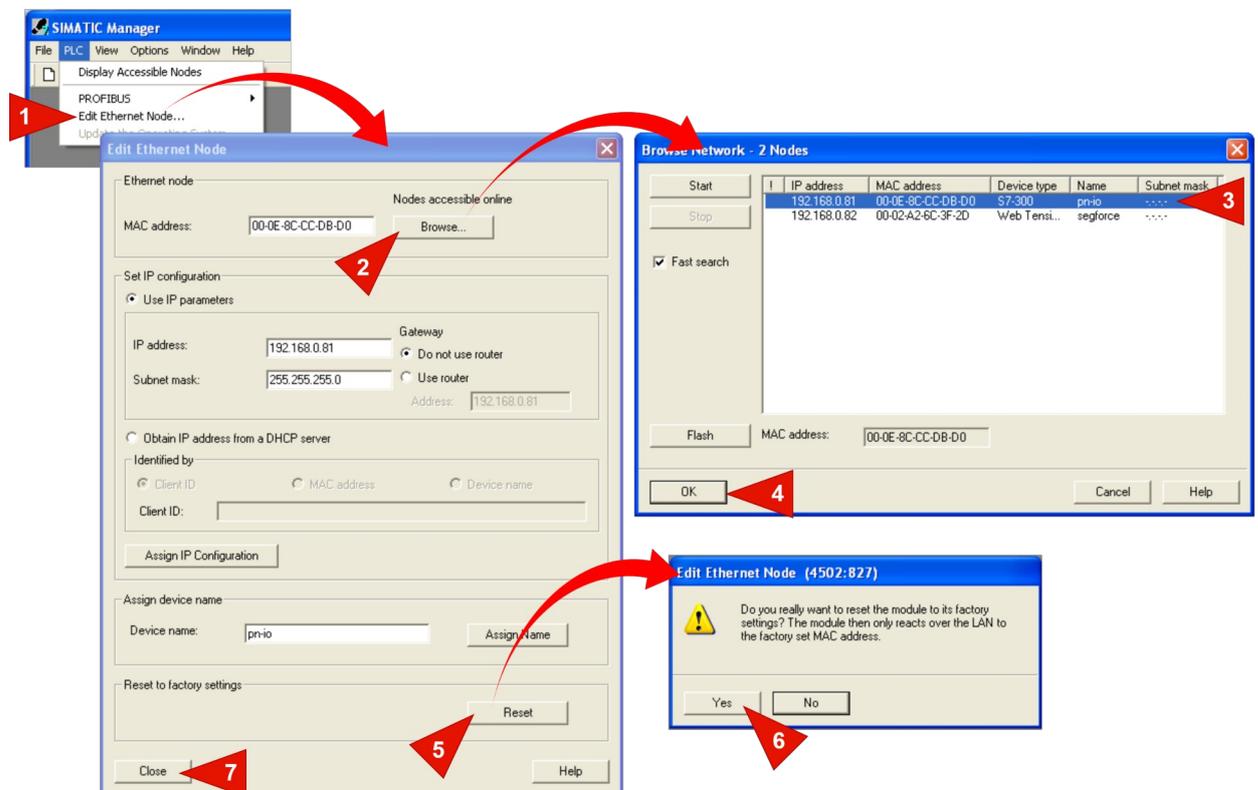
The CPU operator panel on the right shows the mode selector set to RUN. The bottom status bar indicates 'Loading completed (errors: 0; warnings: 0)'.

2.6 PLC Operation Commands

2.6.1 How to reset a PLC to factory settings

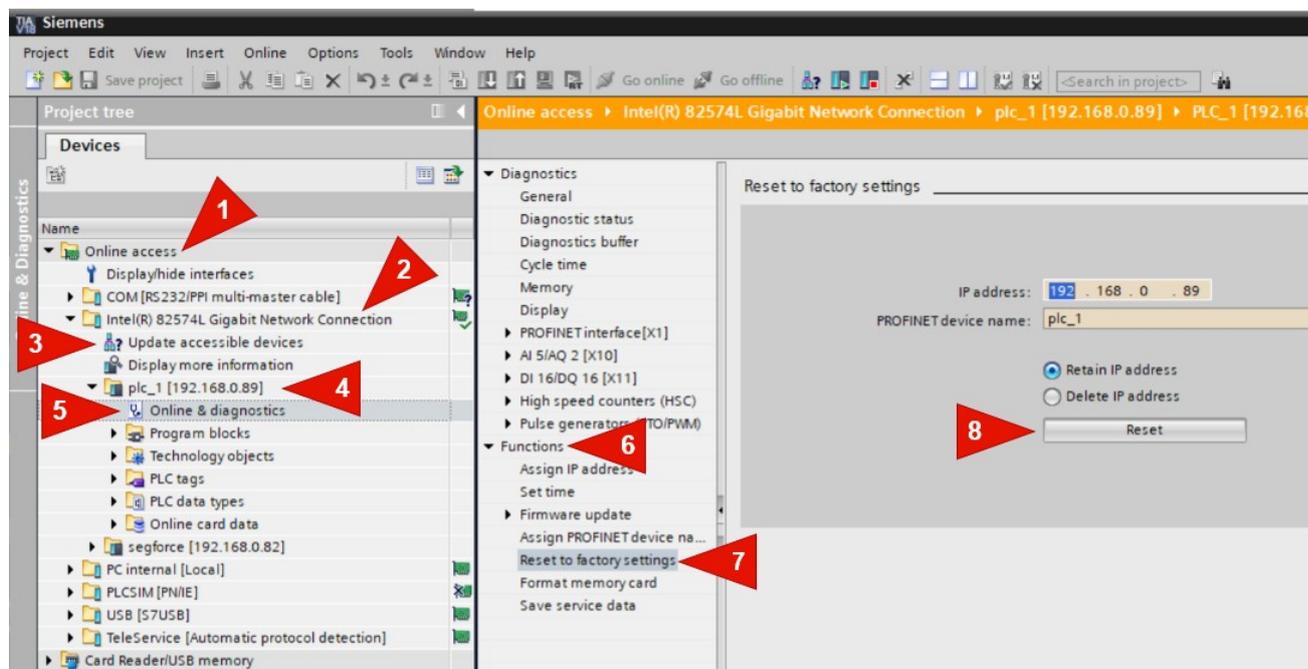
2.6.1.1 Resetting PLC with Step 7 SIMATIC Manager

- Execute the **SIMATIC Manager** program.
- Select the **PLC ->Edit Ethernet Node 1** menu in the main window. A project doesn't need to be open; if so, the PLC menu contains several more entries. Just select the appropriate menu. This action opens the dialog Edit Ethernet Node.
- Click on **Browse 2** which opens the dialog Browse Network. The search for PROFINET devices starts automatically after roughly 3 seconds. Just be patient until the list is filled with the found devices.
- Select the PLC from the list **3**, which should be reset to its factory defaults. If it is not listed, a network problem could be the reason, e.g., the cabling is wrong, a router is in between, or the PLC is not powered on.
- Click **OK 4** to confirm the selection and return to the previous dialog in which the properties of the chosen PLC are filled up in the entry fields.
- Finally, click **Reset 5** and confirm the action on the popped-up dialog with **Yes 6**.
- All work is done, therefore leave the dialog by clicking on **Close 7**.



2.6.1.2 Resetting PLC with TIA Portal

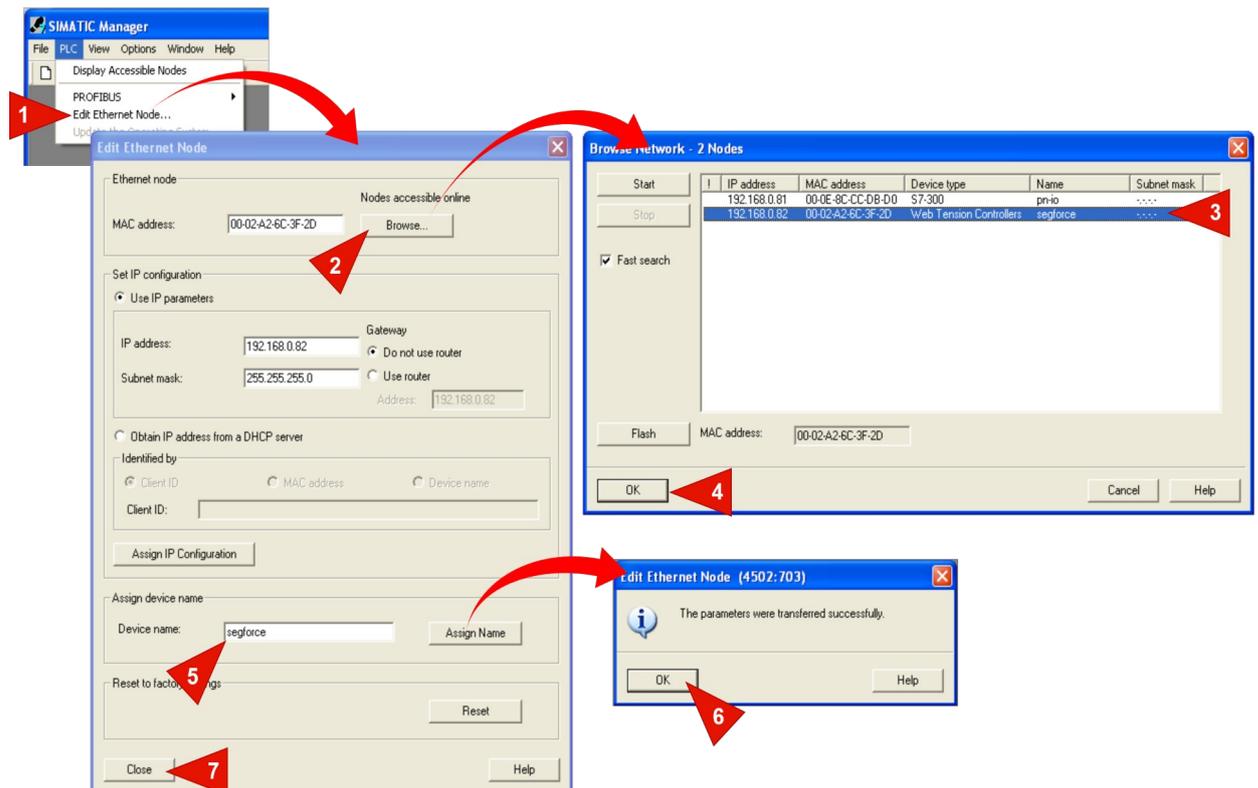
- Execute the **TIA Portal** program.
- The program normally starts with the portal view. Switch to the project view by clicking the **Project view** menu at the bottom left.
- Open the Online access tree **1** and the Ethernet interface card **2**, over which the PC is connected to the network.
- Double-click on the item **Update accessible devices** **3**. After a while, all PROFINET devices on the same network emerge.
- Open the tree of your PLC. The shown IP address may differ from yours **4**.
- Double-click on the item **Online & diagnostics** **5**. That action opens the diagnostics panel right of the tree panel.
- On the diagnostics panel, open the **Functions** tree **6** and select the item **Reset to factory settings** **7**. That action opens the appropriate entry form on the right.
- Finally, click on the button **Reset** **8**. That action takes a moment. You can observe flashing LEDs at the PLC front.



2.6.2 How to assign the PROFINET device name

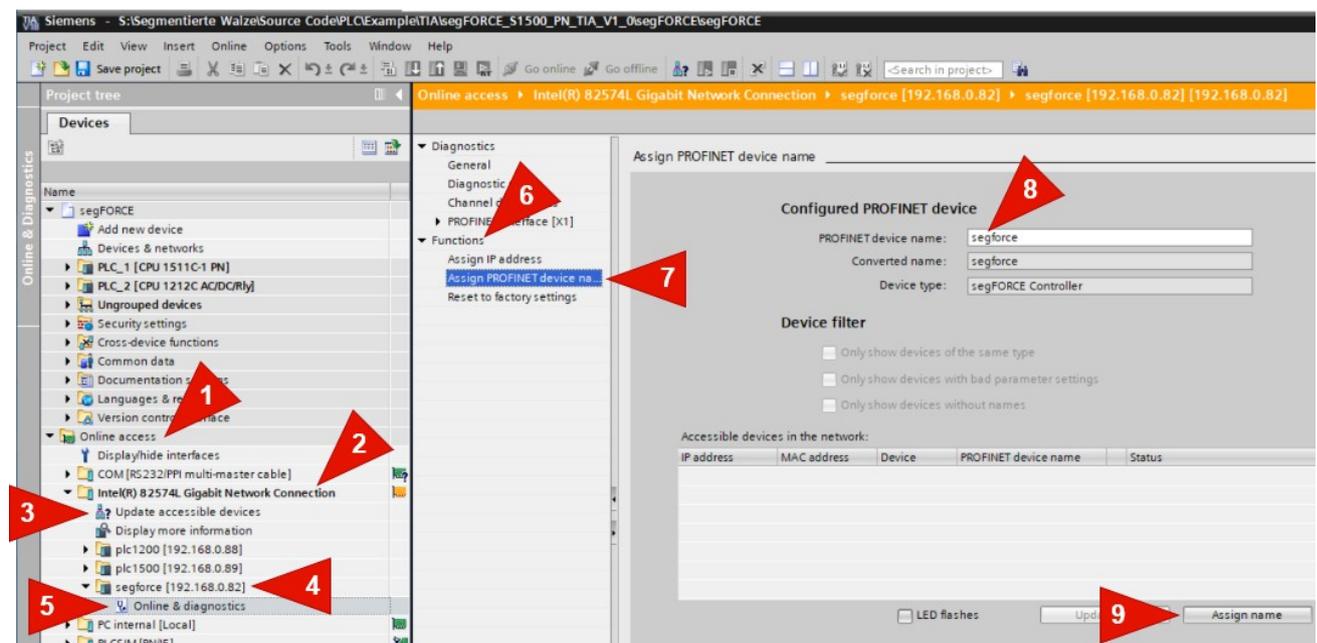
2.6.2.1 Name assignment with Step 7 SIMATIC Manager

- Execute the **SIMATIC Manager** program.
- Select the **PLC ->Edit Ethernet Node 1** menu in the main window. A project doesn't need to be open; if so, the PLC menu contains several more entries. Just select the appropriate menu. This action opens the dialog Edit Ethernet Node.
- Click on **Browse 2** which opens the dialog Browse Network. The search for PROFINET devices starts automatically after roughly 3 seconds. Just be patient until the list is filled with the found devices.
- Select the segFORCE from the list **3** you want to assign the device name to. If it is not listed, a network problem could be why, e.g., the cabling is wrong, a router is in between, or the segFORCE is not powered on.
- Click **OK 4** to confirm the selection and return to the previous dialog in which the properties of the chosen segFORCE are filled up in the entry fields.
- Finally, click **Assign Name 5** and confirm the action on the popped-up dialog with **OK 6**.
- All work is done, therefor leave the dialog by clicking on **Close 7**.



2.6.2.2 Name assignment with TIA Portal

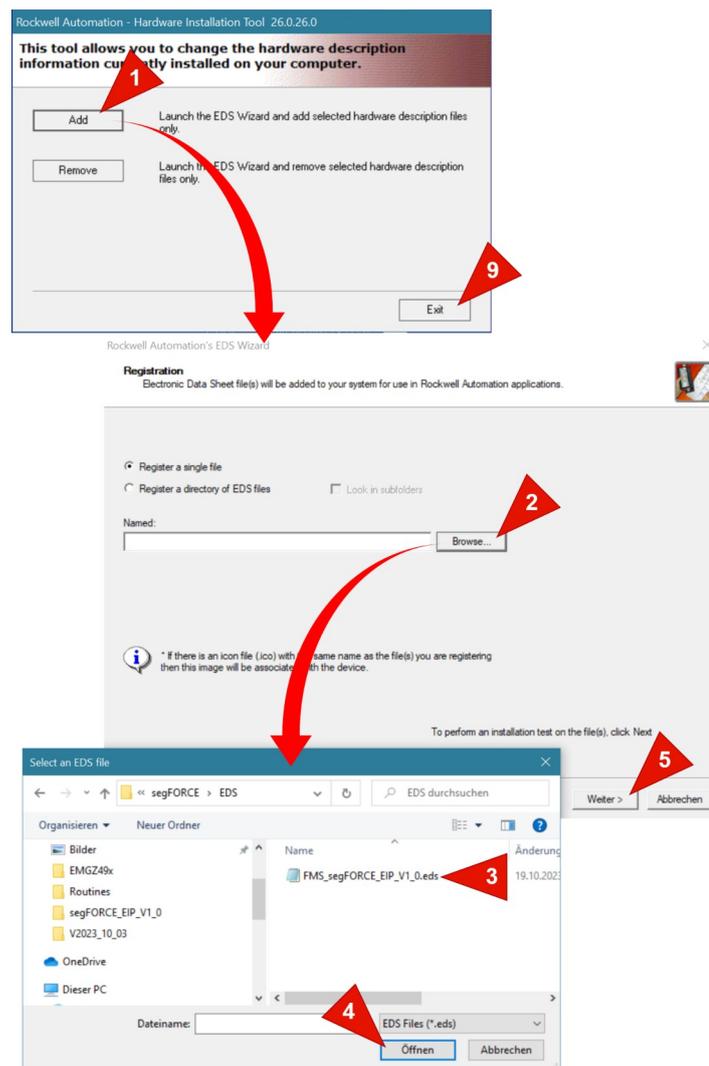
- Execute the **TIA Portal** program.
- The program normally starts with the portal view. Switch to the project view by clicking the **Project view** menu at the bottom left.
- Open the Online access tree **1** and the Ethernet interface card **2**, over which the PC is connected to the network.
- Double-click on the item **Update accessible devices** **3**. After a while, all PROFINET devices on the same network emerge.
- Open the tree of your segFORCE. The shown name and IP address might differ **4**.
- Double-click on the item **Online & diagnostics** **5**. That action opens the diagnostics panel right of the tree panel.
- On the diagnostics panel, open the **Functions** tree **6** and select the item **Assign PROFINET device name** **7**. That action opens the appropriate entry form on the right.
- Type the PROFINET device name **segforce** into the entry field **8**. Note that the name must be all lowercase.
- Finally, click on the button **Assign name** **9**.

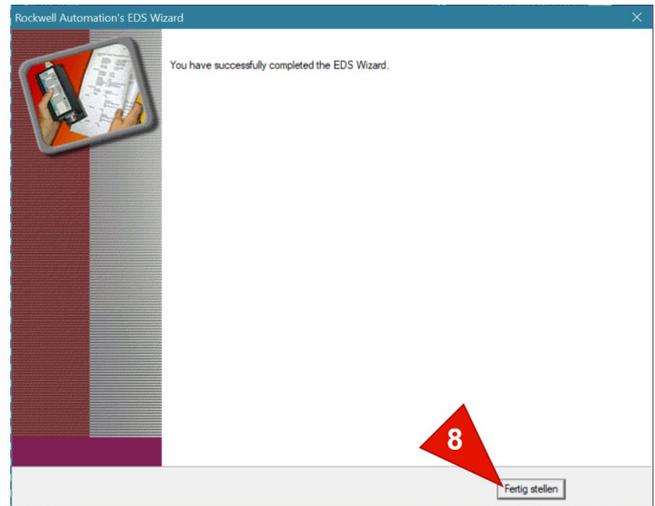
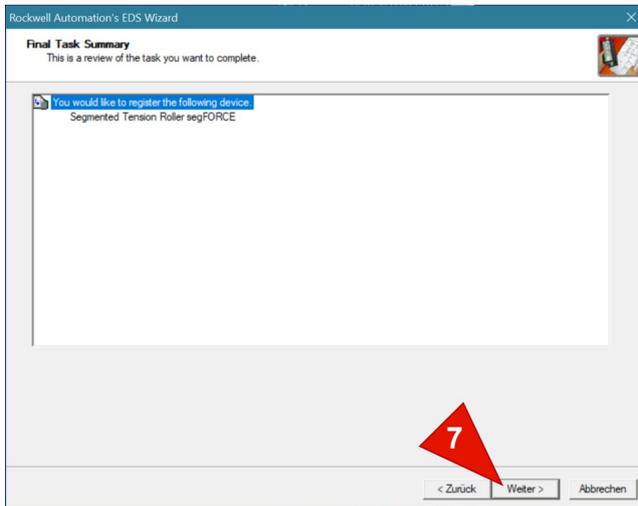
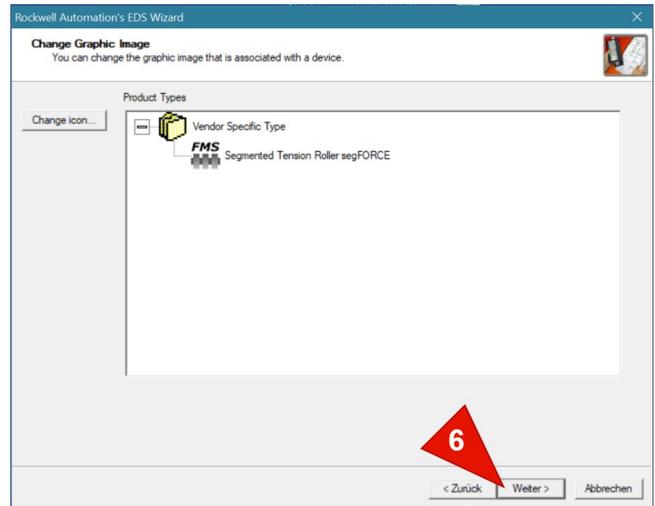
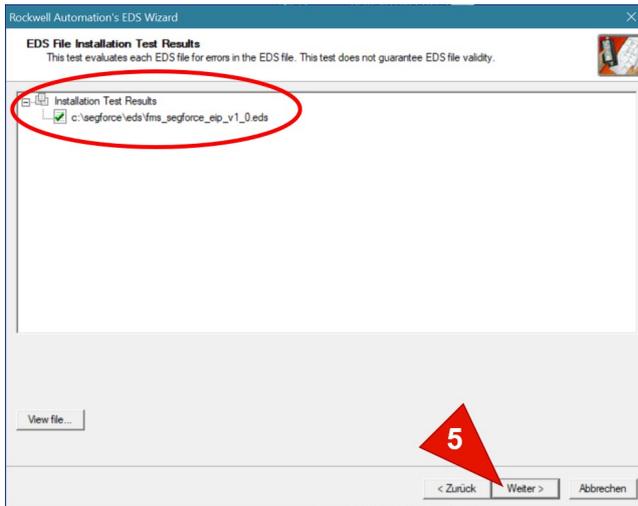


3 RSLogix 5000 EtherNet/IP

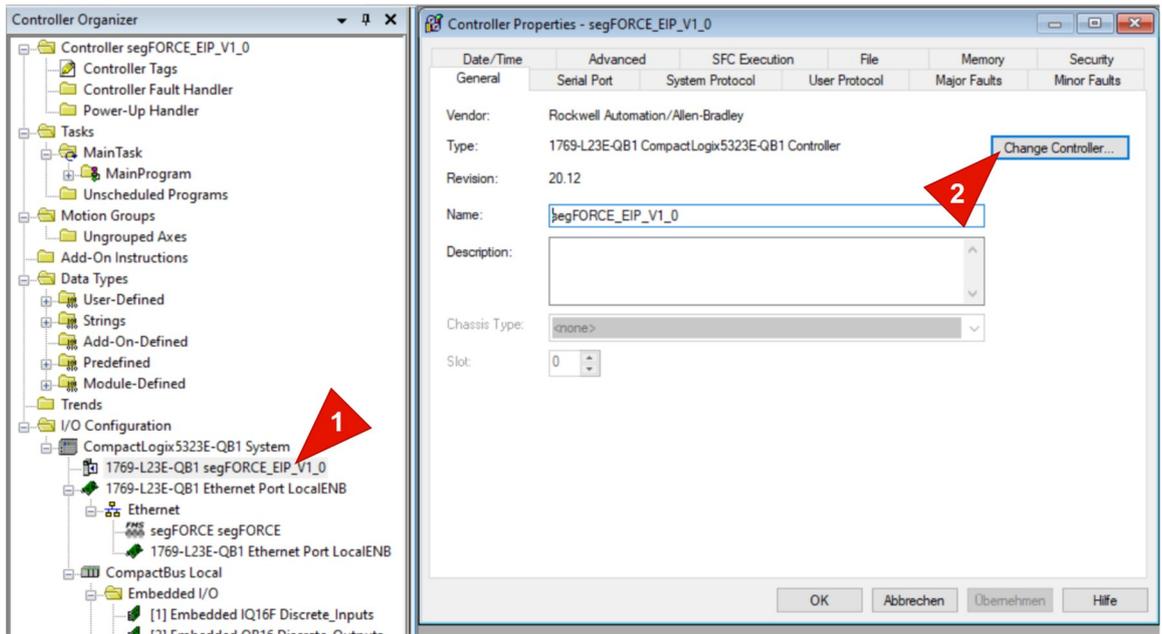
3.1 Setting up the project

- Download the example programs contained in the segFORCE_EIP_Vx_x Release.zip from our web page. (x is a placeholder for the container file version that includes the example programs)
Link: <https://www.fms-technology.com/en/downloadcenter/profinet>
- Unpack the example project, including the EDS file, to your preferred directory on your PC on which the **RSLogix 5000** development software is installed.
The Quick Start Guide uses the directory c:\segFORCE, and all further explanations start from this directory without explicitly mentioning it again.
- Install the EDS for the segFORCE if the newest version does not already exist on your PC. To do so, execute the **Rockwell Automation - Hardware Installation Tool** and follow the screenshots.

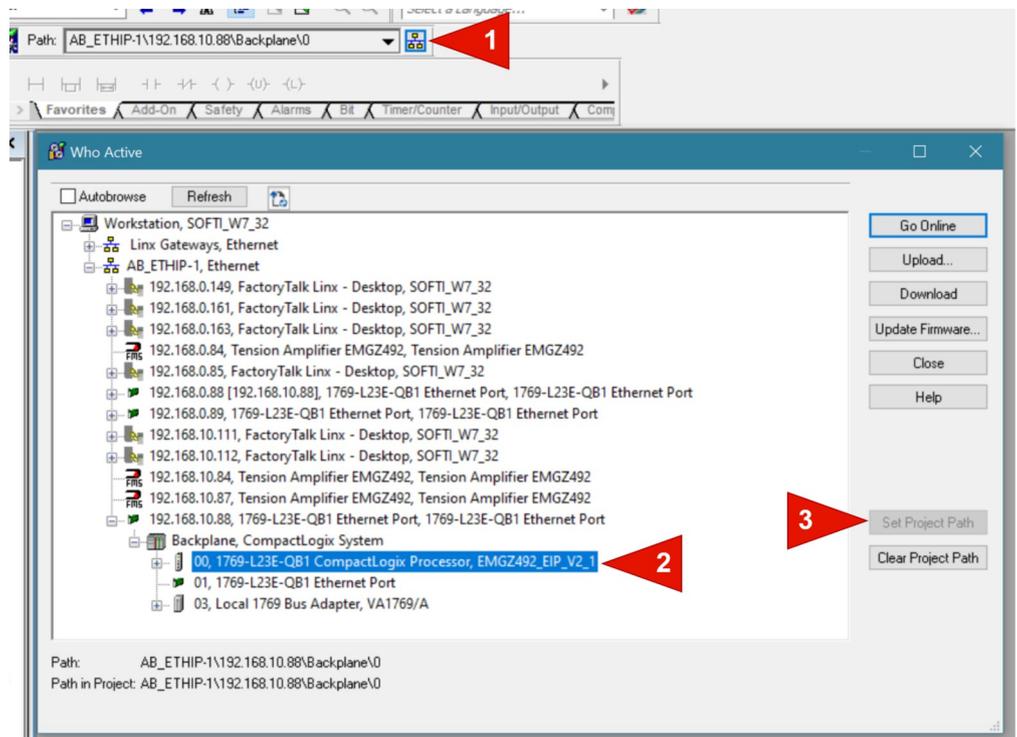




- Execute the **RSLogix 5000** program.
Open the existing project c:\segFORCE\segFORCE_EIP_Vx_x\segFORCE_EIP_Vx_x.ADC (x is a placeholder for the example program version).
- Change the controller that it matches your utilized controller.



- Change the Path to the controller that you would like to use for the example program. If you have difficulty to change the path, use the Allen Bradley documentation for a further description.



- Ensure the IP addresses of the PLC and the segFORCE controller are correctly configured, matching the set IPs of the physical devices. If not, change them accordingly. Follow the screenshots below.

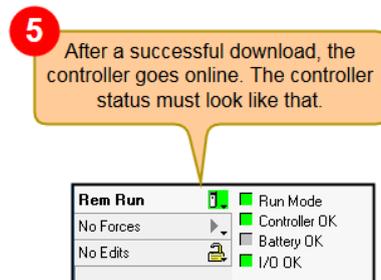
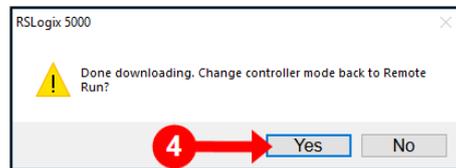
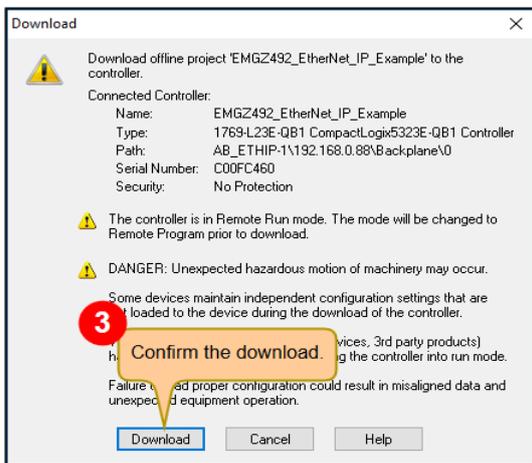
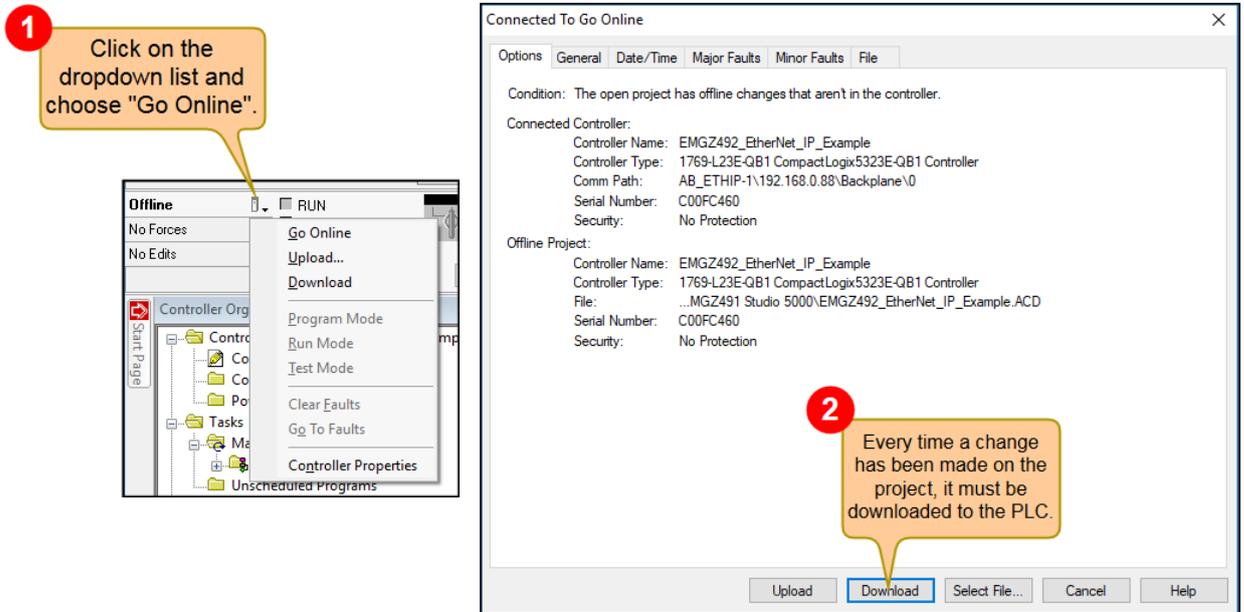
Changes here define how the PLC program addresses or expects the devices over the IPs. To set the physical IPs of devices, use either the **RSLinx** tool or the Hilscher tool **Ethernet Device Configuration**.

The IP configuration of the PLC

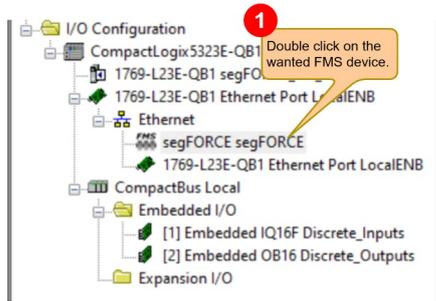
The IP configuration of the segFORCE.

3.2 Using of the example program

- Establish a connection with the PLC.



- Open the Module Properties dialog.



ID	Name	Value	Units	Style	Description
1001	Last Error				
1002	Number of segments				
1003	Number of groups				
1004	segFORCE status				
1005	Total force		N		
1006	Temperature		°C		
1007	Pressure		kPa		
1011	Force pos. 01		N		
1012	Speed pos. 01		m/min		
1013	Status pos. 01				
1021	Force pos. 02		N		
1022	Speed pos. 02		m/min		
1023	Status pos. 02				
1031	Force pos. 03		N		
1032	Speed pos. 03		m/min		

1905	Status pos. 00	0	Decimal
2001	Set Group Mode	0	Decimal

5 To change a parameter click into value field and edit the value.

- To change device configuration parameters, follow points 4 to 6 above. If the **Group Mode** is 0, then the data of individual segments are returned. If the value is 1, then the segment group data are returned. Alternatively, the group mode can also be changed by manually writing 0 or 1 into the tag **Group_Mode**. The PLC program detects if that tag has been changed and triggers the message **msg_Group** over the flag **Trigger_Group_Write.0**. See the picture below.

The screenshot displays the RSLogix 5000 software interface. The top window shows a ladder logic routine named 'MainRoutine' with three rungs. Rung 0 contains a JSR instruction. Rung 1 contains an XOR instruction. Rung 2 contains a MSG instruction. The bottom window shows the 'Controller Tags' table for 'segFORCE_EIP_V1_0(controller)'. Red callouts are placed as follows:

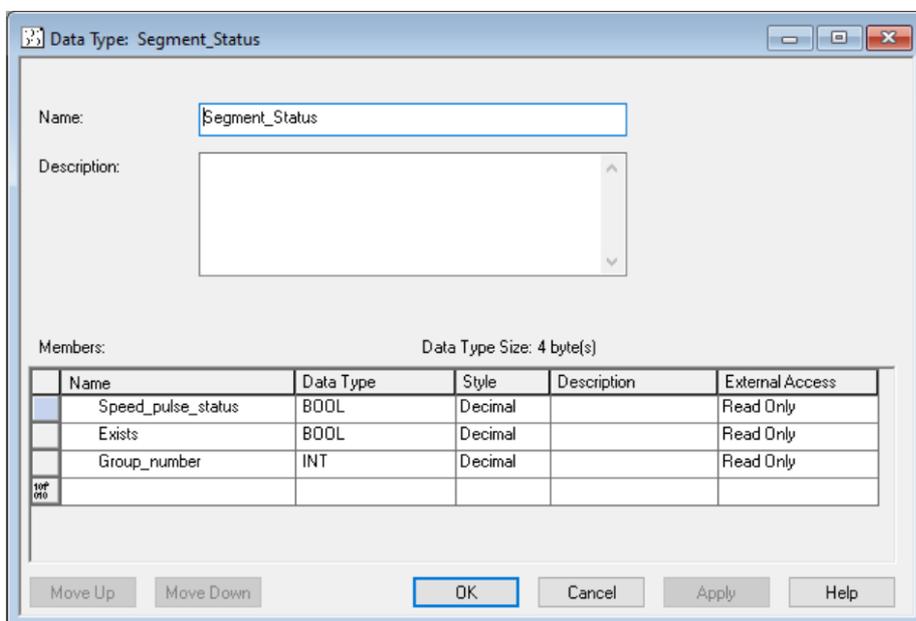
- Callout 1:** Points to the 'Force Mask' column in the tag table.
- Callout 2:** Points to the 'Trigger_Group_Write' tag in the table and its corresponding output in the MSG instruction.
- Callout 3:** Points to the 'Trigger_Group_Write.0' output in the XOR instruction.
- Callout 4:** Points to the 'Trigger_Group_Write' input in the XOR instruction.

Name	Value	Force Mask	Style	Data Type
Group_Mode	0		Decimal	DINT
Local1.C	{...}	{...}		AB:Embedded_IQ16F:C:0
Local1.I	{...}	{...}		AB:Embedded_IQ16F:I:0
Local2.C	{...}	{...}		AB:Embedded_OB16:C:0
Local2.I	{...}	{...}		AB:Embedded_OB16:I:0
Local2.O	{...}	{...}		AB:Embedded_OB16:O:0
msg_Group	{...}	{...}		MESSAGE
segFORCE.I	{...}	{...}		_04C3:segFORCE_119399B7:I:0
Status_of_Segments	{...}	{...}		Segment_Status[50]
Trigger_Group_Write		8	Decimal	DINT

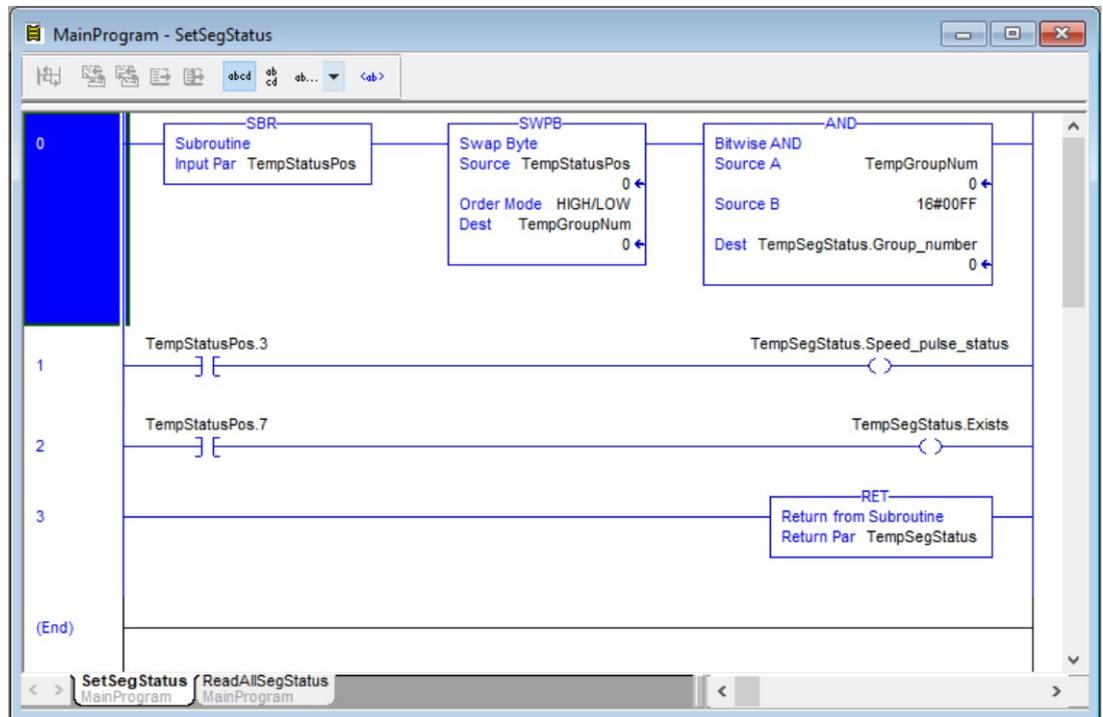
3.3 Decoding the Status of the Segments

Each segment has its status register. The register's datatype is an unsigned integer of 16 bits. The bits 0 to 7 are flags. Bits 8 to 15 hold the group number of the segment. The PLC example program already includes some routines for decoding the status registers. The routines split the register into individual flags and the group number.

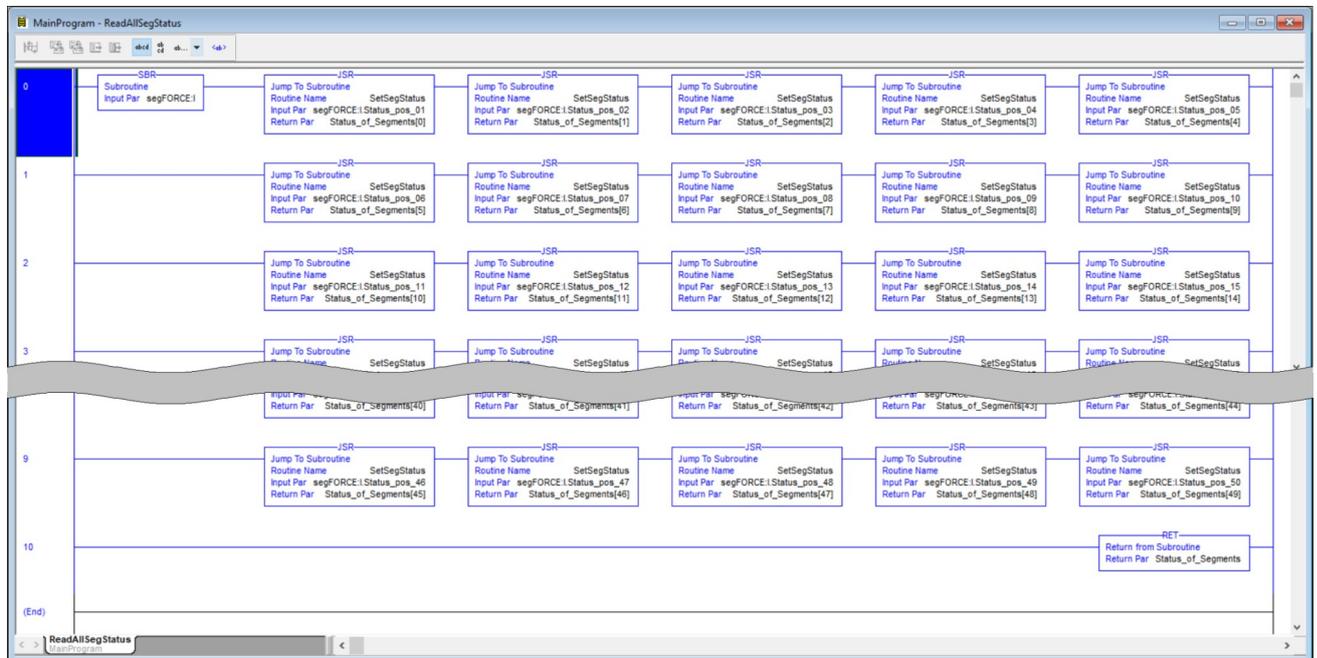
First, we need a *User-Defined* data type that includes the currently supported data in the segment status register. Its name is **Segment_Status**. If you do not want to define it yourself, you can import it from the file Segment_Status.L5X, which is delivered together with the example program and located under directory \segFORCE_EIP_Vx_x\Routines\. The *User-Defined* data type looks as follows.



Next, we need a routine that decodes the status register and writes the individual data entries into the variable of type Segment_Status. The routine's name is **SetSegStatus**. It can be imported with the file SetSegStatus.L5X. The routine looks as follows.



Last, we need a routine that calls the decode routine **SetSegStatus** for all 50 possible segments on the roller. The results are written into the array tagged **Status_of_Segments**. The routine's name is **ReadAllSegStatus** and is called from the **MainRoutine**. It can be imported with the file **ReadAllSegStatus.L5X**. The routine looks as follows.



3.4 Writing Parameters from a PLC Program

This chapter shows how to write parameters from a PLC program. The example code switches between the group and individual segment modes.

In general, for reading and writing parameters, messages must be used.

Message Configuration - msg_Group

Configuration | Communication | Tag

Message Type: CIP Generic

Service Type: Set Attribute Single | Source Element: Group_Mode

Service Code: 10 (Hex) | Class: 87 (Hex) | Source Length: 2 (Bytes)

Instance: 1 | Attribute: 1 (Hex) | Destination Element:

Enable | Enable Waiting | Start | Done | Done Length: 0

Error Code: | Extended Error Code: | Timed Out

OK | Abbrechen | Übernehmen | Hilfe

Extract of the EDS file

```

2525 Param2001 =
2526 0, $ reserved, shall equal 0
2527 6,"20 87 24 01 30 01", $ Link Path Size, Link Path
2528 0x0000, $ Descriptor
2529 0xC7, $ Data Type
2530 2, $ Data Size in bytes
2531 "Set Group Mode", $ name
2532 "", $ units
2533 "", $ help string
2534 0,1,0, $ min, max, default data values
2535 ,,,, $ mult, div, base, offset scaling
2536 ,,,, $ mult, div, base, offset links
2537 ; $ decimal places
    
```

4 Appendix

4.1 PLC Interfaces



The PLC interfaces always uses metric units, although imperial units might be configured for the Web Interface. The reason for that behavior is that the PLC must also handle a unit system change in their program. Therefore it is much easier and less error prom to keep the Fieldbus interface consistent on what a PLC can count on.

4.1.1 Cyclic Data Traffic

The cyclic data traffic reads the data of typically measured values of the segFORCE in a defined time rate and updates it in the PLC. The PLC defines the cycle time for their protocol, e.g., PROFINET, EtherNet/IP, Modbus/TCP, etc. The table below shows the available data and how they must be interpreted.

The interface is designed such that a PLC always gets the data of a fully equipped segment-roller, therefore 50 segments, even if it has not been fully build-out. Measured values of not equipped segments return zero and the segment status bit *Seg. or Group exists* is false.

Consecutive segments can be grouped into one virtual segment. The number of segments that can be grouped depends on the number of individual available segments.

The actual segment values are returned in the data structure from segment ID 1 to ID 50, either individually or grouped. What kind of values will be returned depends on the **Group mode** setting. By default, the **Group mode** is set to individual segments. Therefore the bit **Group mode** is set to false. The **Group mode** can be switched over the command interface.

Fieldbus - Cyclic Data read-only																			
PROFINET – Slot: 1																			
EtherNet/IP – Class: 0x82 / Instance: 1																			
Roller																			
Subslot	Parm. ID	Attribute	Seg. Pos.	Type Parameter	Unit	Valid range and number format	Description												
1	1001	1	-	INT32 Last Error			0 No Error 1 Command allowed, accepted, and is running. <i>Not implemented yet.</i> 2 The Command is not allowed because the segFORCE controller is in automatic mode <i>Not implemented yet.</i> 3 The command is not allowed when another command already runs. <i>Not implemented yet.</i>												
2	1002	2	-	UNIT32 Number of segments		1 to 50	This parameter shows the number of # segments mounted on the roller.												
3	1003	3	-	UNIT32 Number of groups		0 to 50	This parameter shows the number of # configured groups.												
4	1004	4	-	UINT32 segFORCE status			<table border="0" style="width: 100%;"> <tr> <td style="padding-left: 20px;">Bit 0: Group mode</td> <td style="padding-left: 20px;">True Returns grouped segment data. False Returns individual segment data.</td> </tr> <tr> <td style="padding-left: 20px;">Bit 1: Digital Input</td> <td style="padding-left: 20px;">True <i>Not implemented yet.</i> False</td> </tr> <tr> <td style="padding-left: 20px;">Bit 2: Status digital output 1</td> <td style="padding-left: 20px;">True Clamp pressure on False Clamp pressure off The purpose of the output is to control the pressure valve. <i>Not implemented yet.</i></td> </tr> <tr> <td style="padding-left: 20px;">Bit 3: Status digital output 2</td> <td style="padding-left: 20px;">True Alarm on False Alarm off</td> </tr> <tr> <td style="padding-left: 20px;">Bit 4: Automatic Operation Mode</td> <td style="padding-left: 20px;">True Automatic operation active False Manual operation active <i>Not implemented yet.</i></td> </tr> <tr> <td style="padding-left: 20px;">Bit 5 to Bit 31</td> <td style="padding-left: 20px;"><i>Reserved for future use.</i></td> </tr> </table>	Bit 0: Group mode	True Returns grouped segment data. False Returns individual segment data.	Bit 1: Digital Input	True <i>Not implemented yet.</i> False	Bit 2: Status digital output 1	True Clamp pressure on False Clamp pressure off The purpose of the output is to control the pressure valve. <i>Not implemented yet.</i>	Bit 3: Status digital output 2	True Alarm on False Alarm off	Bit 4: Automatic Operation Mode	True Automatic operation active False Manual operation active <i>Not implemented yet.</i>	Bit 5 to Bit 31	<i>Reserved for future use.</i>
Bit 0: Group mode	True Returns grouped segment data. False Returns individual segment data.																		
Bit 1: Digital Input	True <i>Not implemented yet.</i> False																		
Bit 2: Status digital output 1	True Clamp pressure on False Clamp pressure off The purpose of the output is to control the pressure valve. <i>Not implemented yet.</i>																		
Bit 3: Status digital output 2	True Alarm on False Alarm off																		
Bit 4: Automatic Operation Mode	True Automatic operation active False Manual operation active <i>Not implemented yet.</i>																		
Bit 5 to Bit 31	<i>Reserved for future use.</i>																		
5	1005	5		INT32 Total force	N	-200'000'000 200'000'000 #.###	The total force value shows the summed to force of all segments on the roller.												
6	1006	6		INT32 Temperature	°C	-1000 to 2000 #. #	Temperature at segFORCE												
7	1007	7		INT32 Pressure	kPa	0 to 100'000'000 #	Pressure sensor												

4.1.2 Acyclic Data Traffic

A PLC can exchange acyclic data with the segFORCE. These data are used to control the behavior of the segFORCE. The table below shows all available commands. This is the flag **Group Mode** to control the returned data in the cyclic data traffic. The commands can be read and written. Note that writing the same value again is allowed, which executes the command again.

Detailed command description

The group mode flag determines which data is returned via the cyclic data block of the Fieldbus Interface. This can be either the individual or grouped segment data structure. The Fieldbus Interface stacks are limited in their maximum transfer size, particularly the PROFINET stack, which is limited to 170 sub-slots. Therefore, individual and grouped segments cannot be returned in one data block. The PLC must distinguish between these two structures and handle the data accordingly.



Group mode is not saved permanently.

The status of the group mode is not saved permanently. After restarting the system, the group mode assumes its default value. Then the data block will return the values of individual segments.

Fieldbus - Acyclic Data Traffic					
PROFINET – Slot: 0					
EtherNet/IP – Class: 0x87 / Instance: 1					
Roller					
Subslot / Index	Parm. ID	Attribute	Type Command	Unit	Valid Values Description
10/1	2001	1	WORD Set Group Mode		0 The cyclic data block returns individual segment data. 1 The cyclic data block returns grouped segment data.

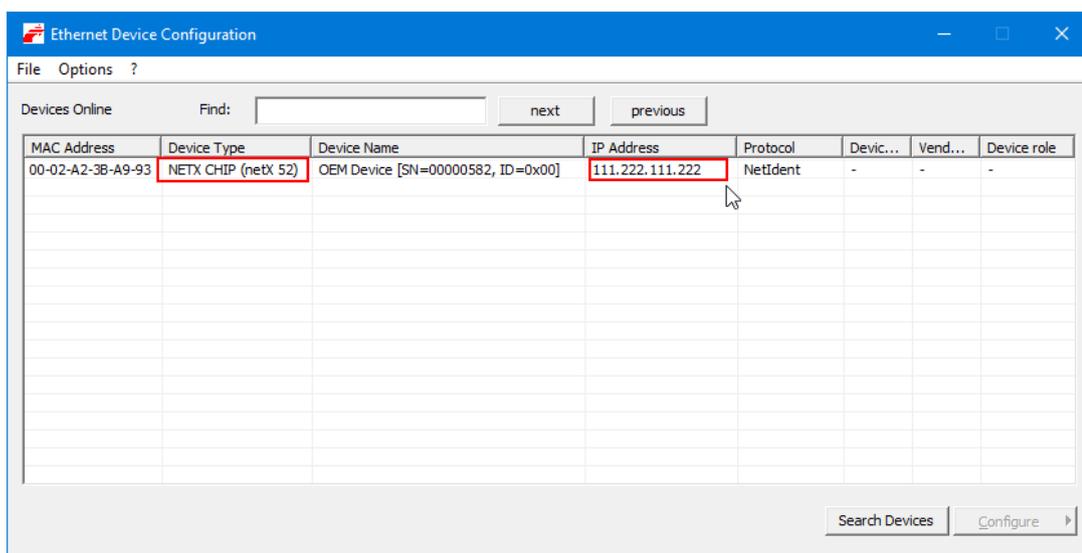
4.2 Find Out the Device's IP

In case you don't know the IP of a PROFINET or EtherNet/IP device because you entered the wrong IP by accident or there is not an IP assigned at all yet, then you can use the Hilscher tool **Ethernet Device Configuration**. Follow the steps below to use the tool.

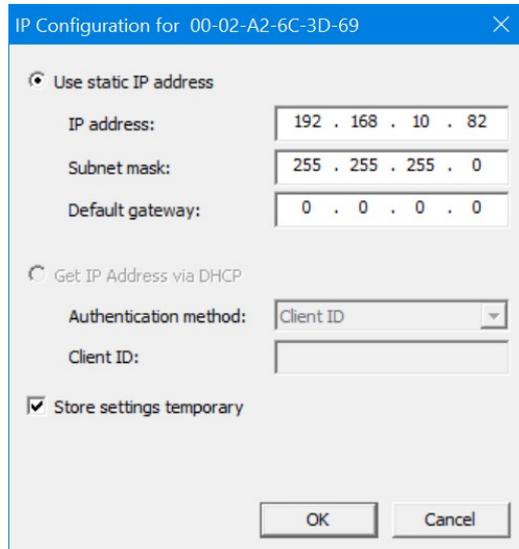
1. Download the Ethernet Device Configuration tool from the FMS website.
On the page, scroll down until you see the title **Ethernet Device Configuration** and click on EthernetDeviceConfiguration.zip.

<https://www.fms-technology.com/en/downloadcenter/profinet>

2. Unzip the contains of the EthernetDeviceConfiguration.zip archive to a temporary directory.
3. Installing the tool by double-clicking on the file **EthernetDeviceConfiguration Vx.x.x.x Setup.msi** and follow the instructions.
4. Start the tool and changing the language to your preferences.
5. Ensure that the PC and the device are connected to the Ethernet Network and powered up.
Click on button **Search Devices**. The tool finds all devices on the network that uses a Fieldbus protocol. Usually, you should only see a few devices. The device we are looking for has the Device Type NETX CHIP (netX 52) or segFORCE Controller, depending on the device's used protocol. If you are not sure which device should be selected, unplug all other devices, and repeat the search.
6. Select the line that shows the wanted device. In our example, the device has the wrong configured IP 111.222.111.222.



7. Click on button **Configure** and choose **Set IP Address...**
In the called dialog, enter the correct IP Address and Subnet mask.

PROFINET

IP Configuration for 00-02-A2-6C-3D-69

Use static IP address

IP address: 192 . 168 . 10 . 82

Subnet mask: 255 . 255 . 255 . 0

Default gateway: 0 . 0 . 0 . 0

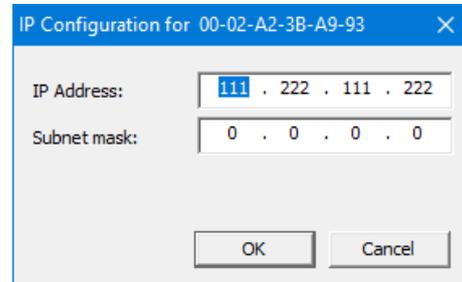
Get IP Address via DHCP

Authentication method: Client ID

Client ID:

Store settings temporary

OK Cancel

EtherNet/IP

IP Configuration for 00-02-A2-3B-A9-93

IP Address: 111 . 222 . 111 . 222

Subnet mask: 0 . 0 . 0 . 0

OK Cancel