Connection Guide

IF2030/PNET

Interface module

1 General

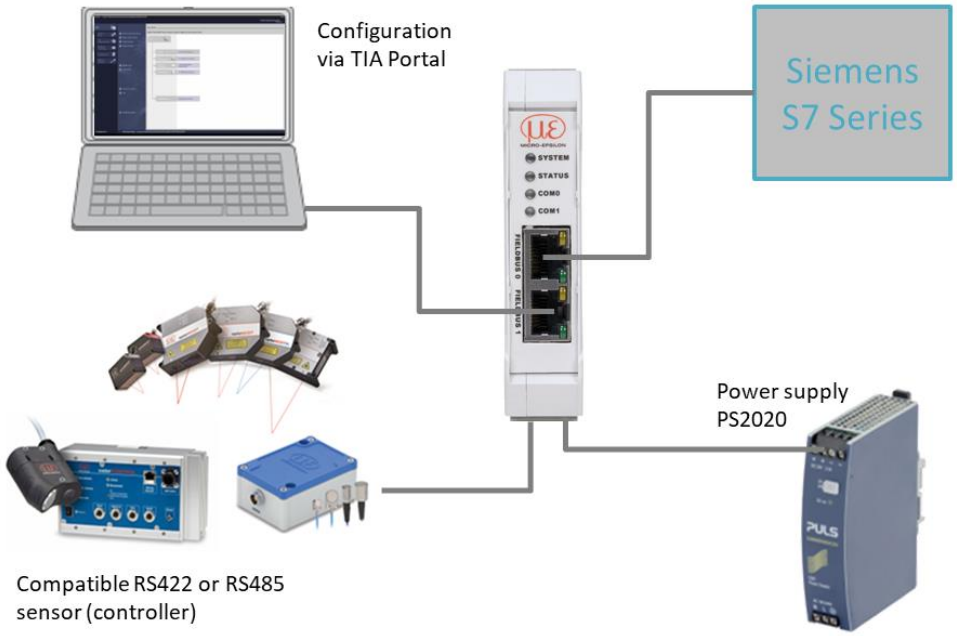
This document describes how to connect IF2030/PNET to SIMATIC S7 controllers. IF2030/PNET is an interface module to connect Micro-Epsilon sensors (controller) equipped with either an RS422 or RS485 interface to PROFINET. This is how these devices can be integrated into Siemens PLC environments. This guide refers to the STEP 7 V.14 programming software which is part of the TIA Portal framework. Other versions may differ in the design of the graphical user interface and their range of features.

2 System design

Please prepare the following equipment to connect an IF2030/PNET-compatible sensor (controller) with a Siemens PLC environment:

- CPU module of the Siemens SIMATIC S7 series
- Micro-Epsilon sensor (controller) with RS422 or RS485 interface, incl. corresponding connection cable
- IF2030/PNET interface module, incl. GSDML file (download from the Micro-Epsilon website or data storage device included in the scope of supply)
- Computer with installed STEP 7 software (TIA Portal)
- 2x Ethernet cables
- Power supply PS2020 (optional)

Please note that the connectable Micro-Epsilon sensors (controllers) are stored in the IF2030/PNET firmware. The figure below schematically shows you how to connect the previously mentioned components.

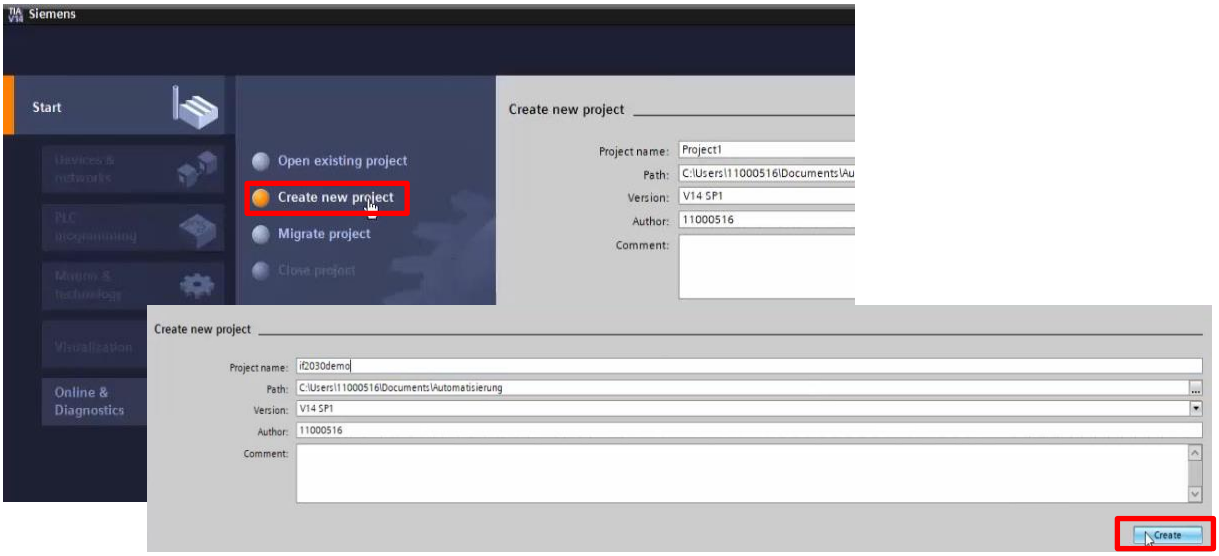


3 Basic settings and configuration

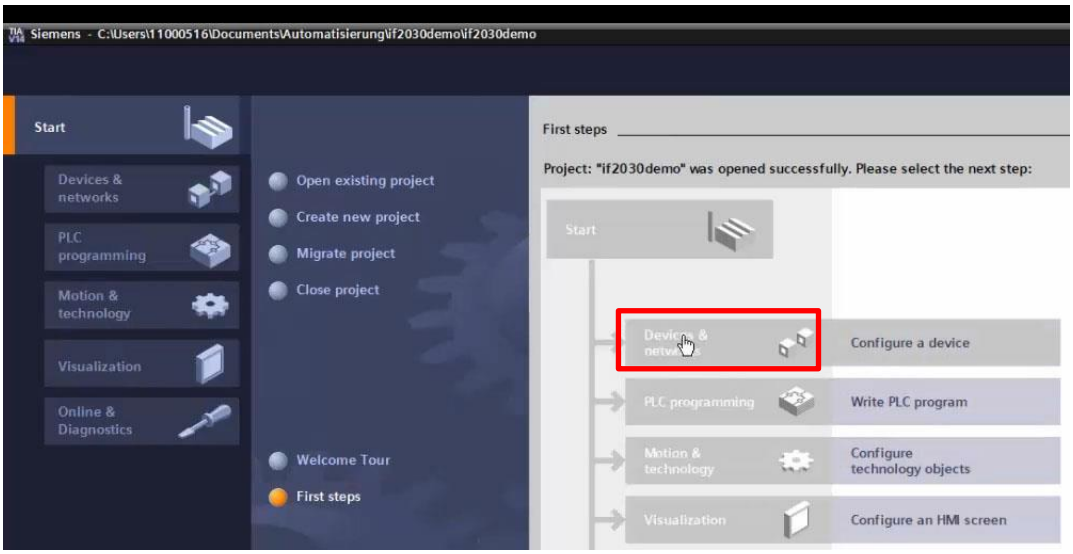
3.1 Importing IF2030/PNET into the software

1. Start the TIA (Totally Integrated Automation) Portal. Therefore, either double-click the `TIA Portal icon` on your desktop or call up the framework via the `Start Menu`.

2. Click the button `Create new project` which is at the top left of the `Start portal` view. Enter a project name and confirm by clicking the `Create` button.

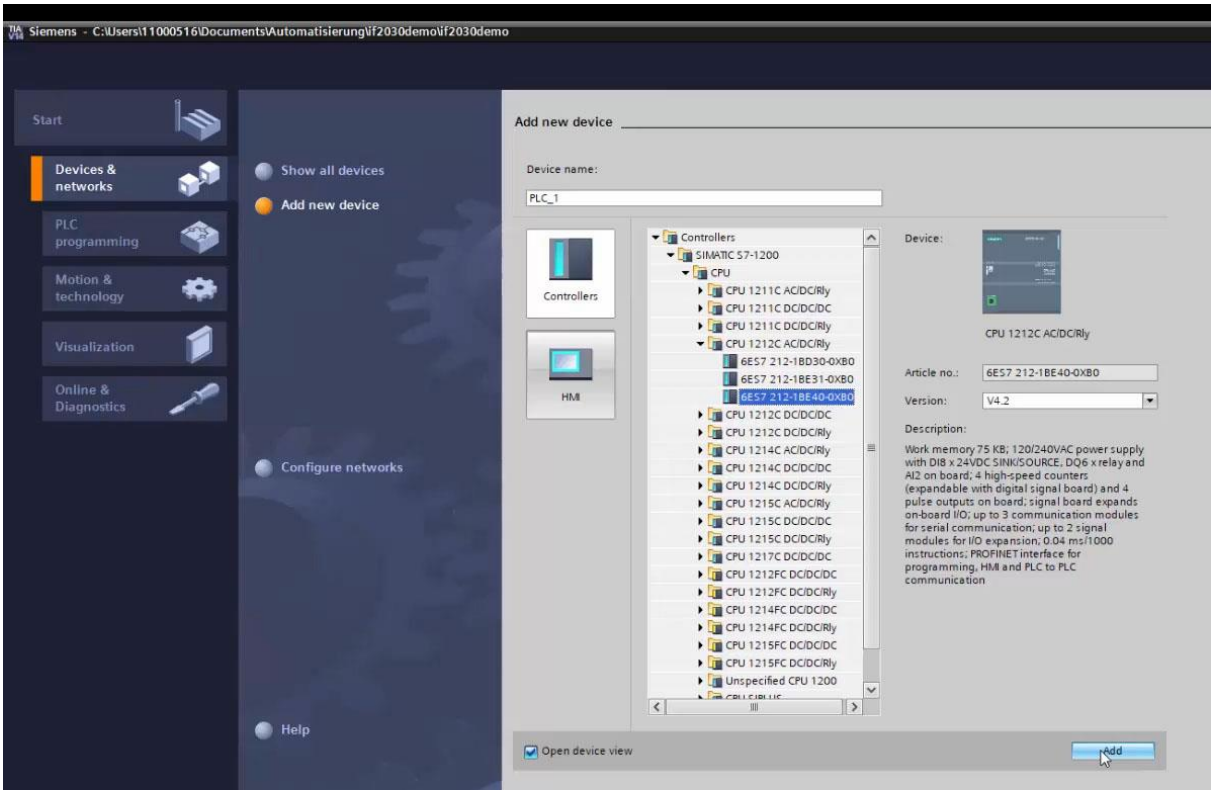


3. Switch to the `Devices & networks` portal.



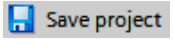
4. Click `Add new device`. Select the S7 CPU series you are using in the device list and click the Add button. Make sure that the checkbox `Open device view` on the bottom left of the window is activated.

Hint: Identify your CPU module based on the order number on the S7 device, its packaging, or the delivery note. Also select the correct firmware `Version`.

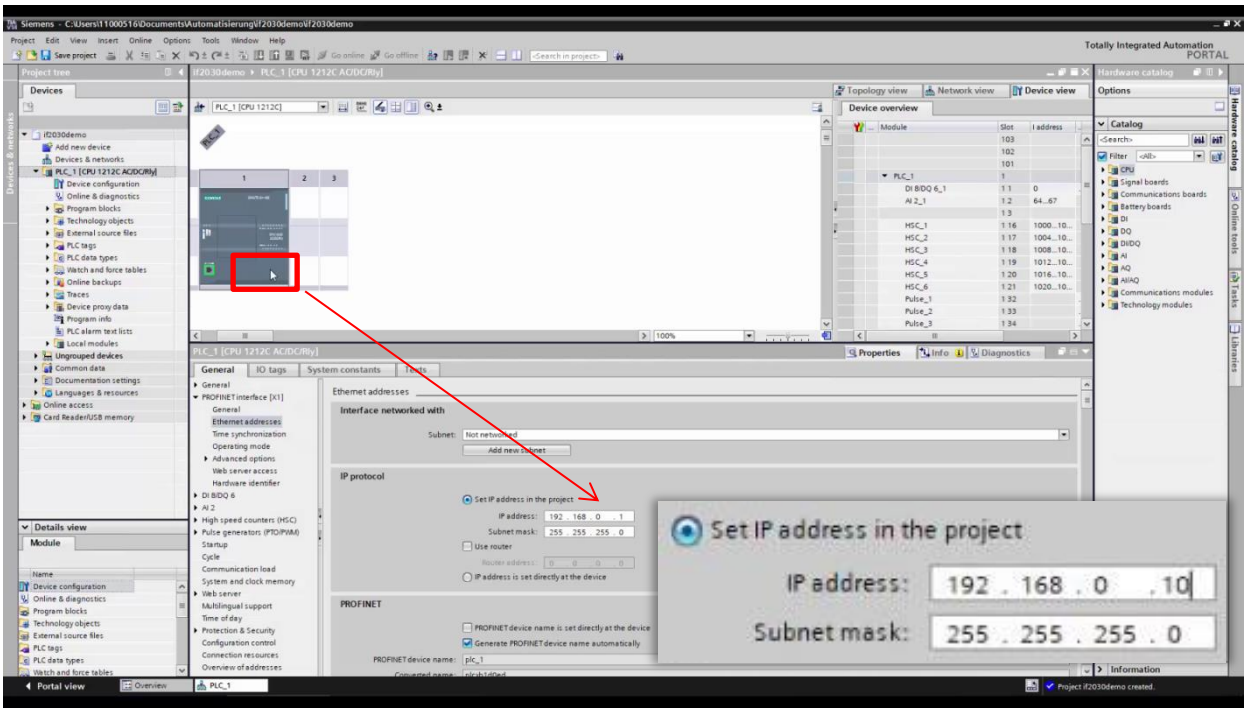


Note: Here, you can also change the default `Device name` PLC_1. However, this is not mandatory.

5. The software switches automatically to the `Project view` and displays the `Working window` (center of screen) in the `Device view`. Below, you can find the `Inspector window` which shows the parameterization options of the selected PLC in the `Properties` register.

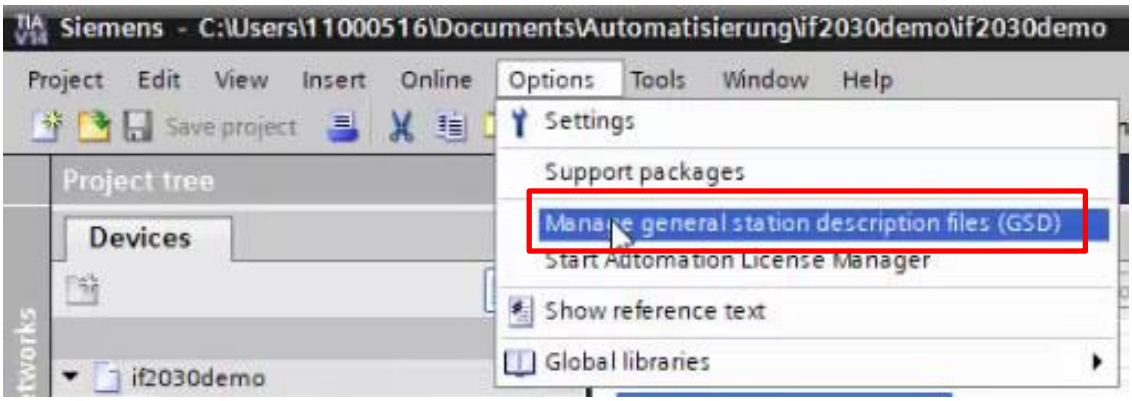
Note: The TIA Portal automatically assigns the IP address and subnet mask. You can manually adjust these data here (`General` → `PROFINET interface` → `Ethernet addresses`) if necessary and save them by clicking the Save project button 

(top left corner in the `Toolbar`).

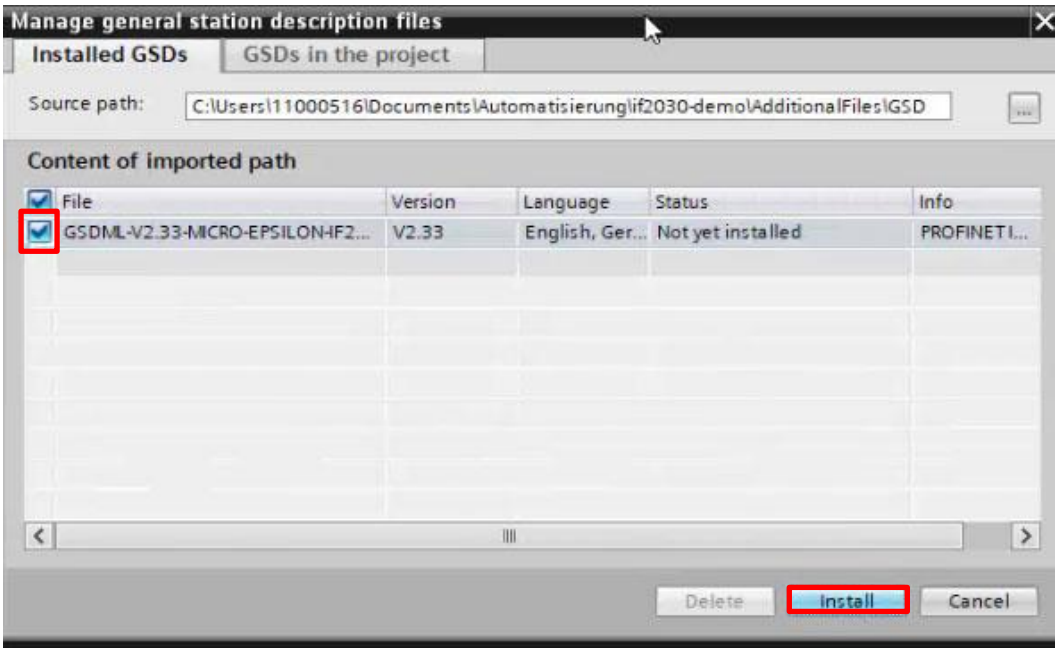


6. Import the GSDML file. In general, it contains information about a PROFINET device (properties such as supported sensors and parameters of IF2030/PNET) and is provided by Micro-Epsilon. This file is necessary for the PROFINET controller and must be integrated into the corresponding configuration software.

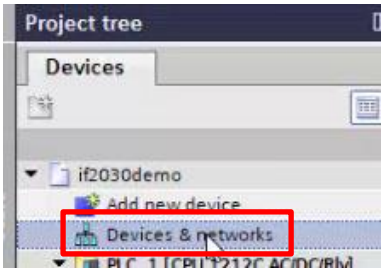
Navigate in the `Main menu` to `Options` → `Manage general station description files (GSD)`.



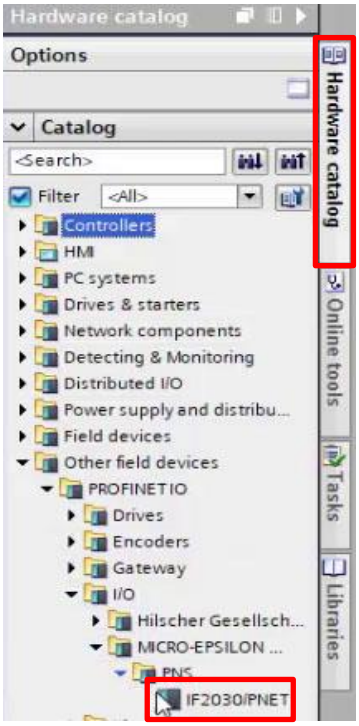
7. Select the path for the file „*GSDML-Vx-MICRO-EPSILON-IF2030.xml*“ in the open `Dialog box` and click the `Install` button.



8. After successful installation, switch to the `Project view` again by clicking `Devices & networks` in the `Project tree` on the left side of the screen.



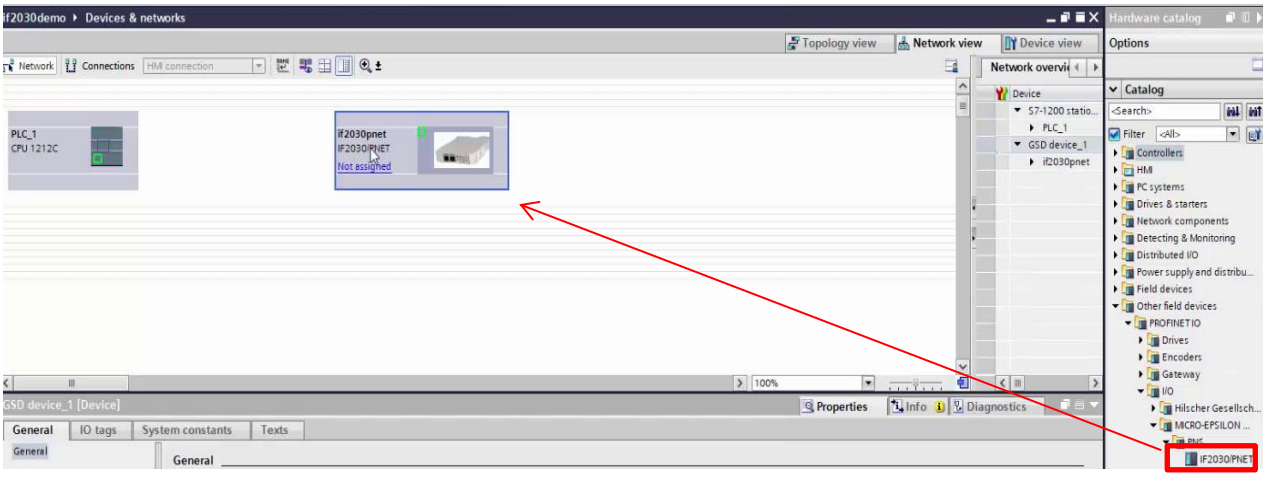
9. Make sure that IF2030/PNET has been integrated correctly. Use the `Hardware catalog` (within the `Task window`) next to the `Working window` for this purpose. The catalog shows all hardware components which can be configured with the current STEP 7 version.



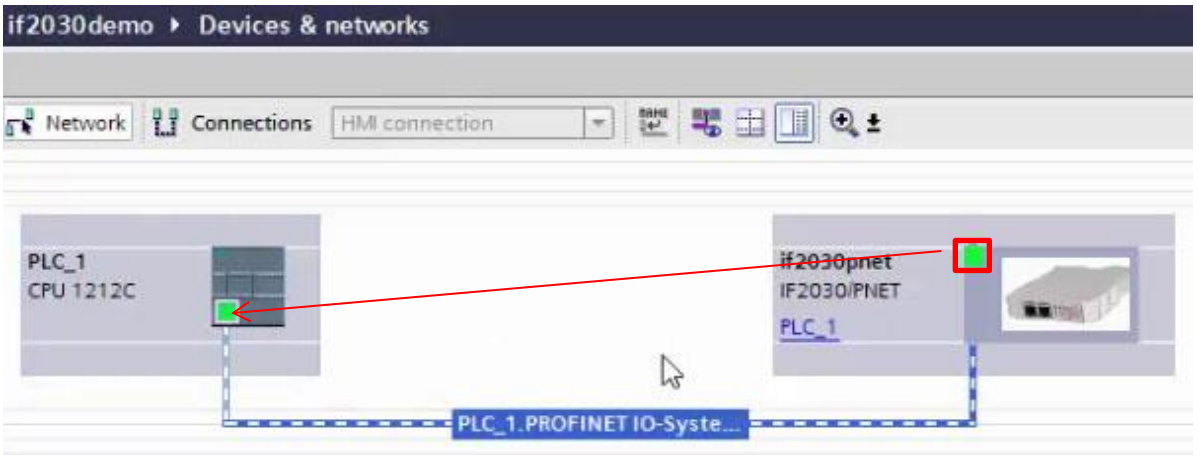
Follow this path: `Other field devices` → `PROFINET IO` → `I/O` → `MICRO-EPSILON MESSTECHNIK GmbH` → `PNS` → `IF2030/PNET`.

3.2 Unique integration of IF2030/PNET into the PROFINET network

10. Switch to the `Network view` of the `Working window` and add IF2030/PNET from the `Hardware catalog` by drag and drop.

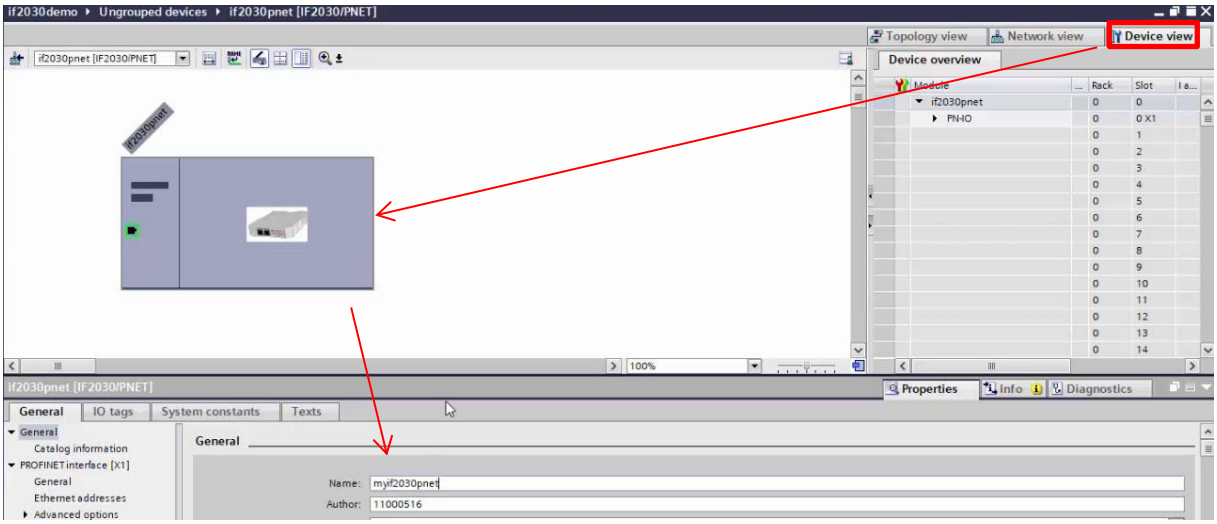


11. Connect the green Ethernet socket of IF2030/PNET with the one of the PLC by clicking one of the green boxes with the left mouse button. Hold the button and draw the resulting line to the other green box in order to create a PROFINET subsystem.

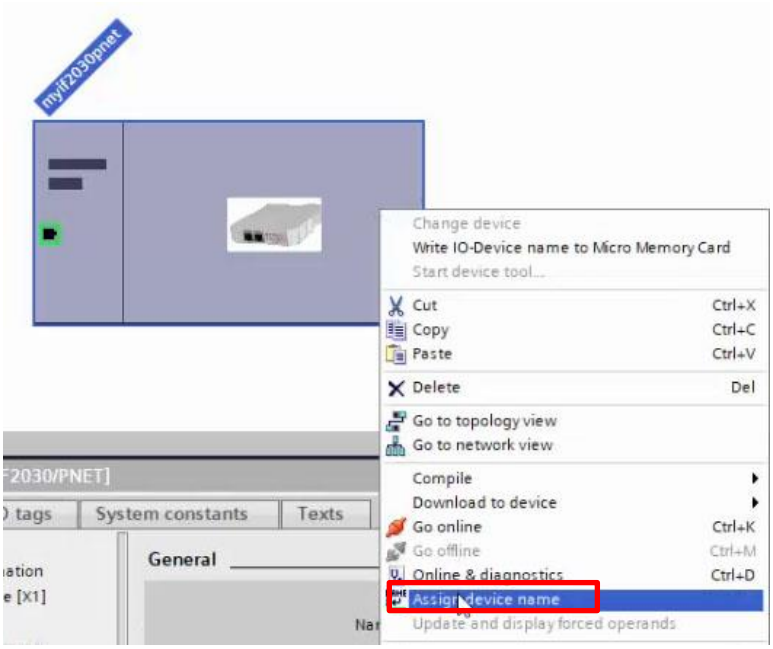


12. Switch to `Device view`, double-click your IF2030/PNET and assign a (device) Name in the `Inspector window` (tab `Properties` → `General`). This name is used for identification in the PROFINET network and as address. Therefore, it must be unique throughout the system!

Note: This is one of several possibilities to change the device name.

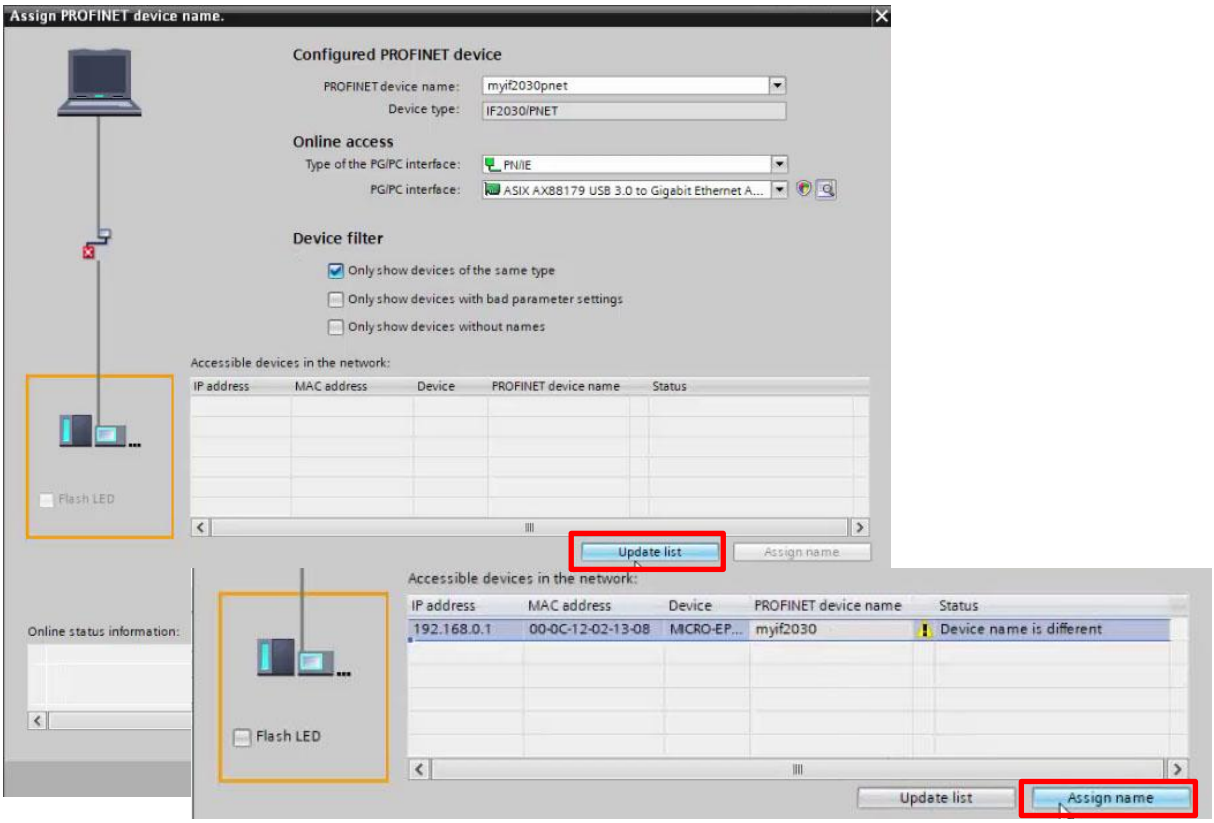


13. The change of name has to be communicated to the PROFINET network. Right-click IF2030/PNET to reach the function `Assign device name` in the displayed `Shortcut menu`.



14. Click the `Update list` button in the open `Dialog box` in order to display all possible devices in the PROFINET network corresponding to the profile. Select the line containing the IF2030/PNET, which should be given a new name, in the appearing list (`Status` "*Device name is different*"). Finally, click the `Assign name` button.

Hint: If you activate the `Flash LED` checkbox in the orange highlighted area you can verify which device you are currently addressing. This is especially helpful in larger networks.



3.3 Defining inputs and outputs of IF2030/PNET

15. Add modules to IF2030/PNET. In the `Hardware catalog` on the right-hand side, first select the appropriate input module for the payload. Drag it to the first free `Slot` in the `Device overview`. Then select the output module "*Basic configuration*" and place it in the next free spot.

Note: IF2030/PNET determines the amount of cyclic data to be transmitted itself and selects a suitable module. The module must match the one selected in TIA. The determination results from the logic described below.

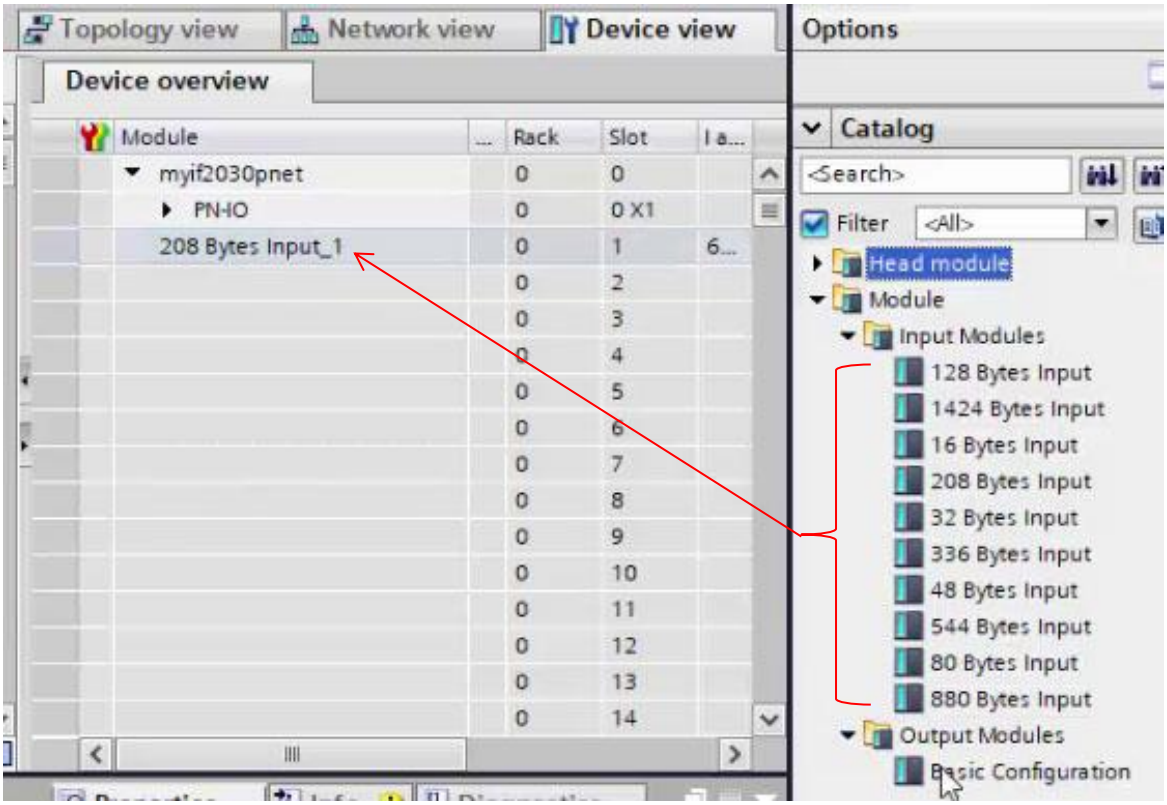
15.1 Determination of payload data: If a value `!= 0` is entered in the `Datasize` object (hex address 0x2022), this value is used as data quantity per sensor for selecting the module. Otherwise the following applies for (►Operating Instructions **4.2.2**)

- **ME Bus** / **RS485** sensors: IF2030/PNET asks the first sensor at boot time for the amount of payload data and multiplies it by the number of sensors.
- **MEO** / **RS422** device: IF2030/PNET cannot determine the amount of data, which is why the 128 Bytes input module is selected by default.

15.2 Debug header: If the `Cyclic Status Information` is activated in the settings at boot time, additional 8 Bytes are added to the determined demand. The debug header can be addressed directly via the hex address 0x2028.

15.3 Module selection: From the number of available modules (16, 32, 48, 80, 128, 208, 336, 544, 880, 1424 Bytes) the smallest possible one is selected, which can fulfill the demand. To give you some examples:

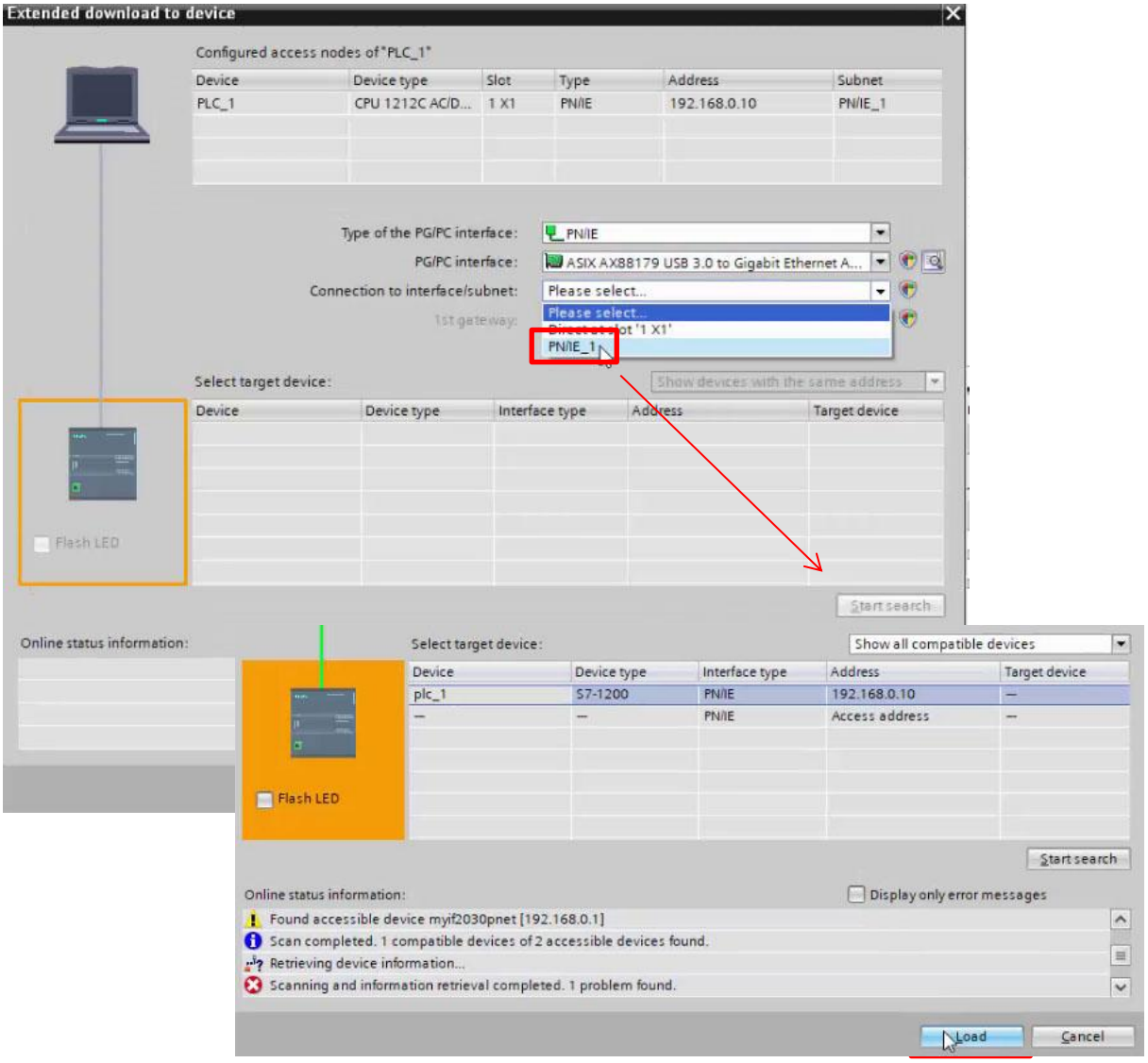
- RS422 sensor → `128 Bytes Input`
- RS422 sensor, DebugHeader (0x2028) active → `208 Bytes Input`
- RS422 sensor, Datasize (0x2022) = 42 → `48 Bytes Input`
- RS485 sensor with frame length 66 Bytes → `80 Bytes Input`
- 4x RS485 sensors with frame length 23 Bytes → `128 Bytes Input`



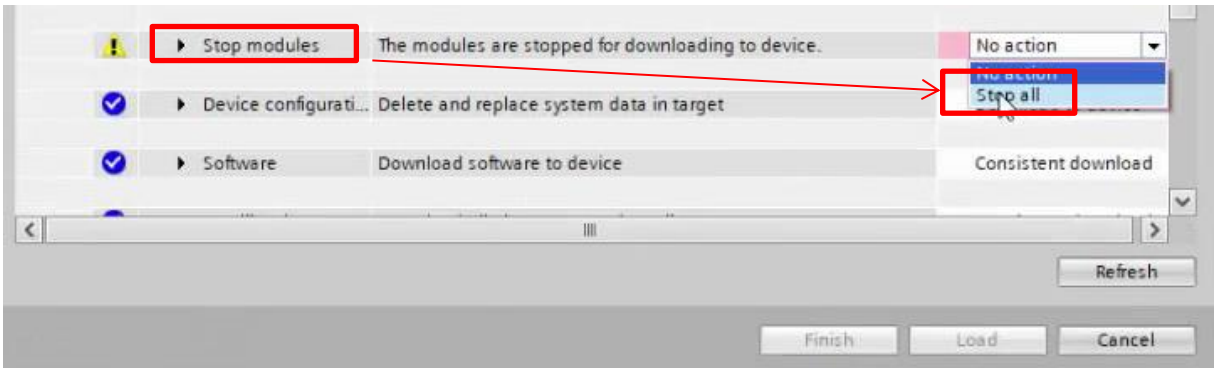
3.4 Loading the configuration into the PLC

16. Click the `Download to device` symbol button in the `Toolbar`. Alternatively, right-click the image of your S7 in the `Network view` and select the function in the `Shortcut menu`.

17. In the open `Dialog box`, select the option "*PN/IE_1*" (the previously created PROFINET subsystem) in `Connection to interface/subnet`. Click the `Start search` button afterwards. Next, select your target PLC in the displayed list. Clicking the `Load` button transfers the hardware configuration.



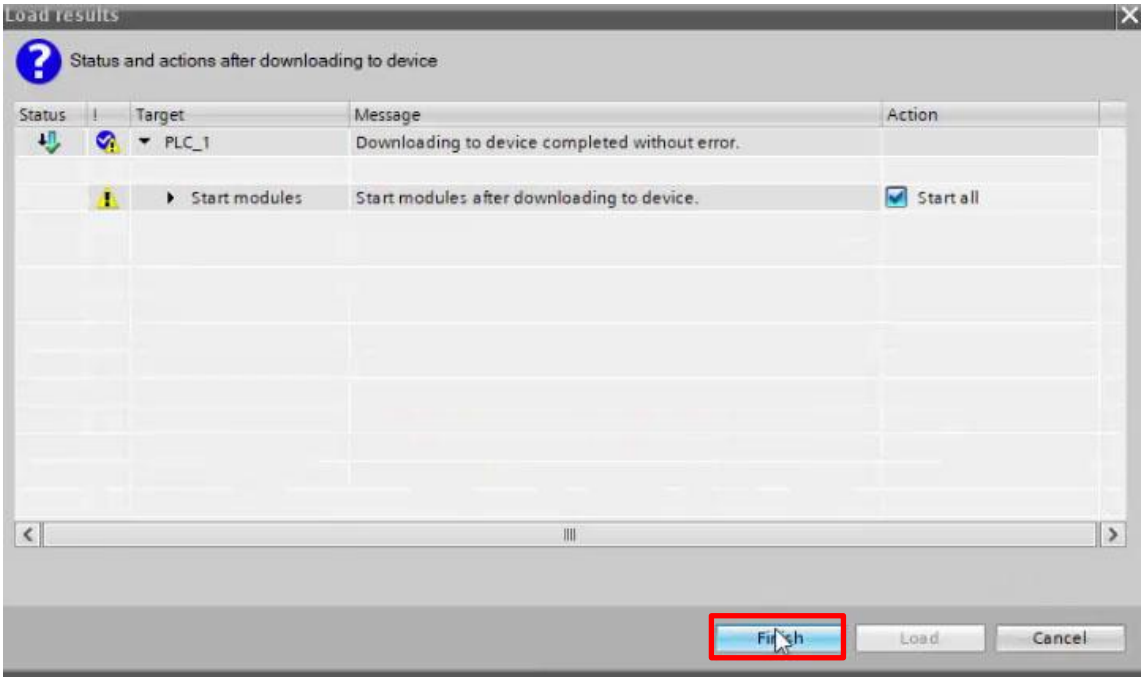
18. The "*Load preview*" `Dialog box` opens. Select the "*Stop all*" option in `Stop modules`. The device configuration can only be loaded when the CPU is in the operating state "*STOP*"!



Note: Depending on whether you created a new project or opened an existing one, it might be necessary to overwrite the so-called additional information. The latter is recommended to ensure an up-to-date data pool. This can be done by scrolling downwards within the same dialog and checking the `Overwrite all` box at `Additional information`.

Click the `Load` button. The PLC is thereby introduced to its environment for the first time. The loading process is indicated visually by a red flashing LED of the S7 device.

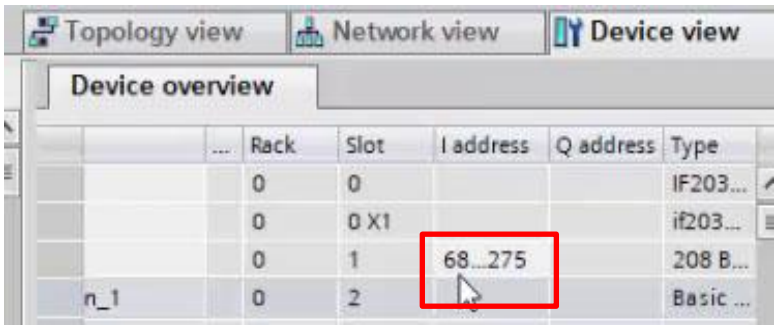
19. The results of the loading process are displayed in the following `Dialog box`. If the process was completed successful, start your S7. Activate the `Start all` checkbox, if necessary, and click the `Finish` button.



If no error occurs, the S7 changes to the operating state "*RUN*" which is indicated by the green RUN-LED.

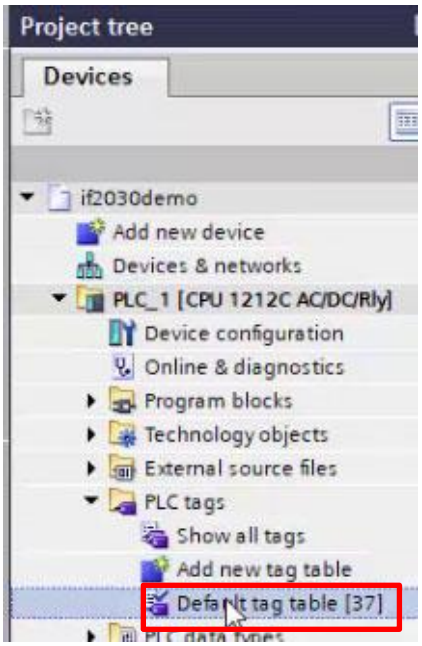
4 Accessing input and output data

1. Switch to the `Device view` and take a look at the `Device overview` of IF2030/PNET. Memorize the start address of the input module as an example.



Depending on the module, the address space (memory address bytes) is visible in the `I address` or the `Q address` columns. These addresses are automatically assigned to the respective module depending on the slot.

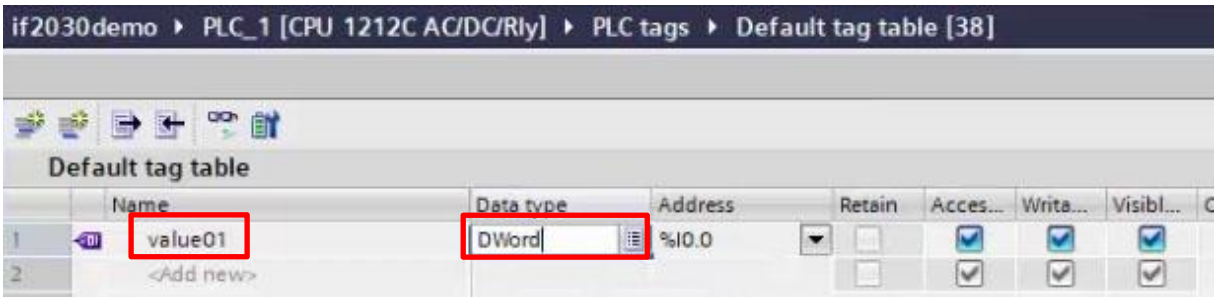
2. Go to the `Project tree`. Follow this path in your PLC: `PLC tags` → `Default tag table`. The latter opens in the `Working window` by double-clicking.



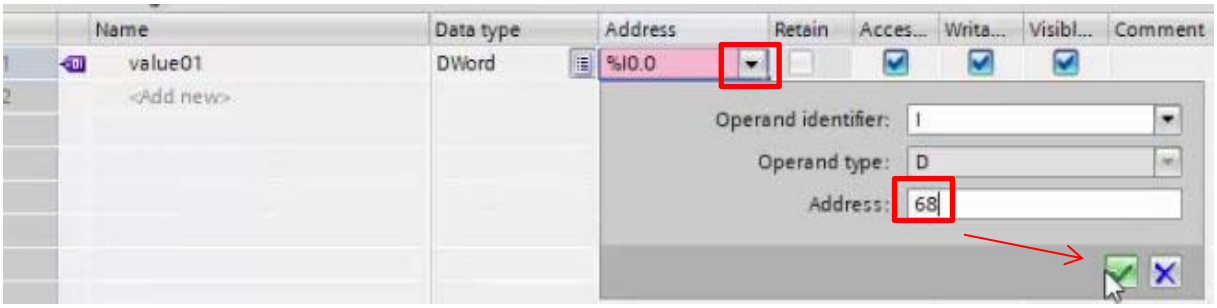
3. You can now define variables in the `Tag` register to read out the desired memory locations. Each PLC tag is assigned a name, a data type, and an address.

Proceed as follows to read out the content of the input module at its start address:

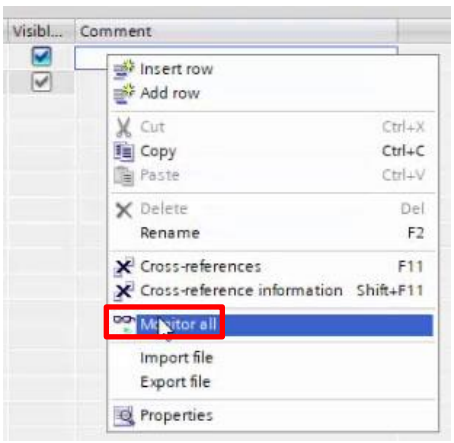
3.1 Assign a (tag) `Name` and select the `Data type` "*DWord*".



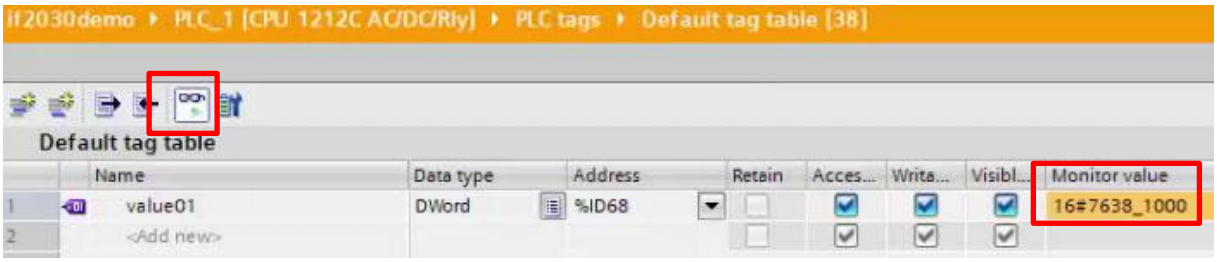
3.2 Open the extended view of the `address` definition. This facilitates the correct specification of operand and memory space. Enter the start address from point 1 and confirm the entry by clicking the symbol button with the `green check mark`.



4. You can monitor the values of the PLC tags in online mode directly via the `Default tag table`. Click either the `Monitor all` symbol button in the `Toolbar` or select this function by right-clicking within the tag table.



This leads to the online mode and the column `Monitor value` is displayed in the table. Clicking the symbol button once again quits the monitor mode.



Below is an example to help you interpret the values correctly. One RS422 device outputs two values. Depending on whether the debug header was activated in your IF2030/PNET, the value of the corresponding PLC variable is composed as follows:

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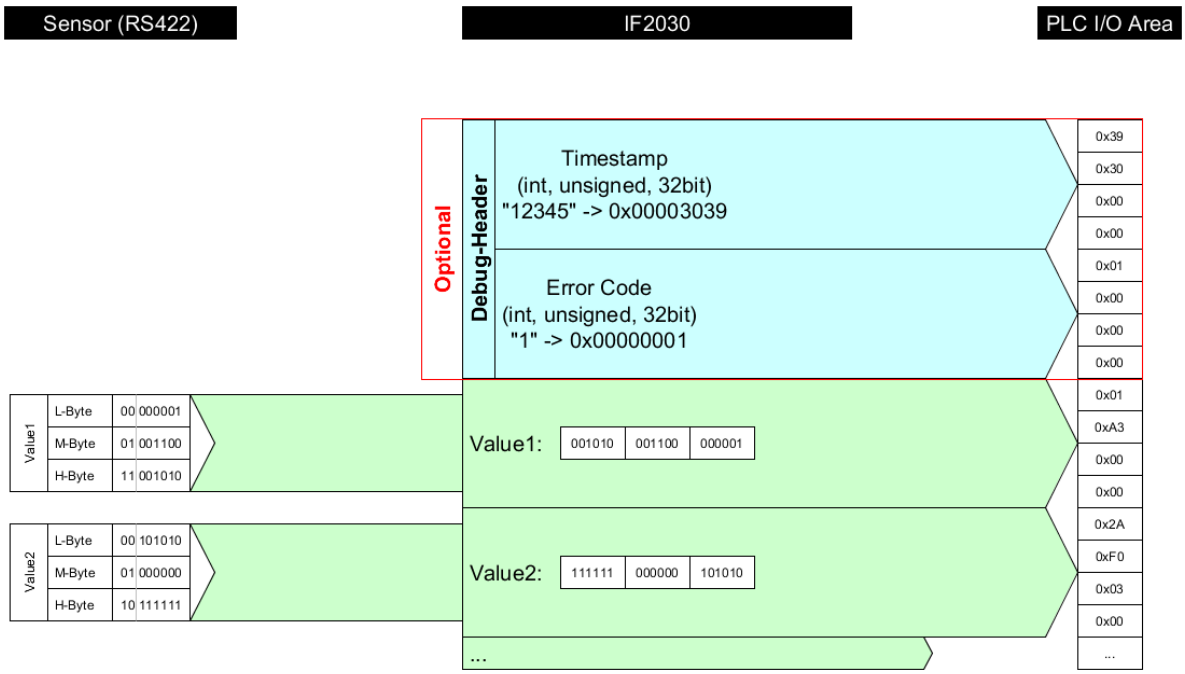
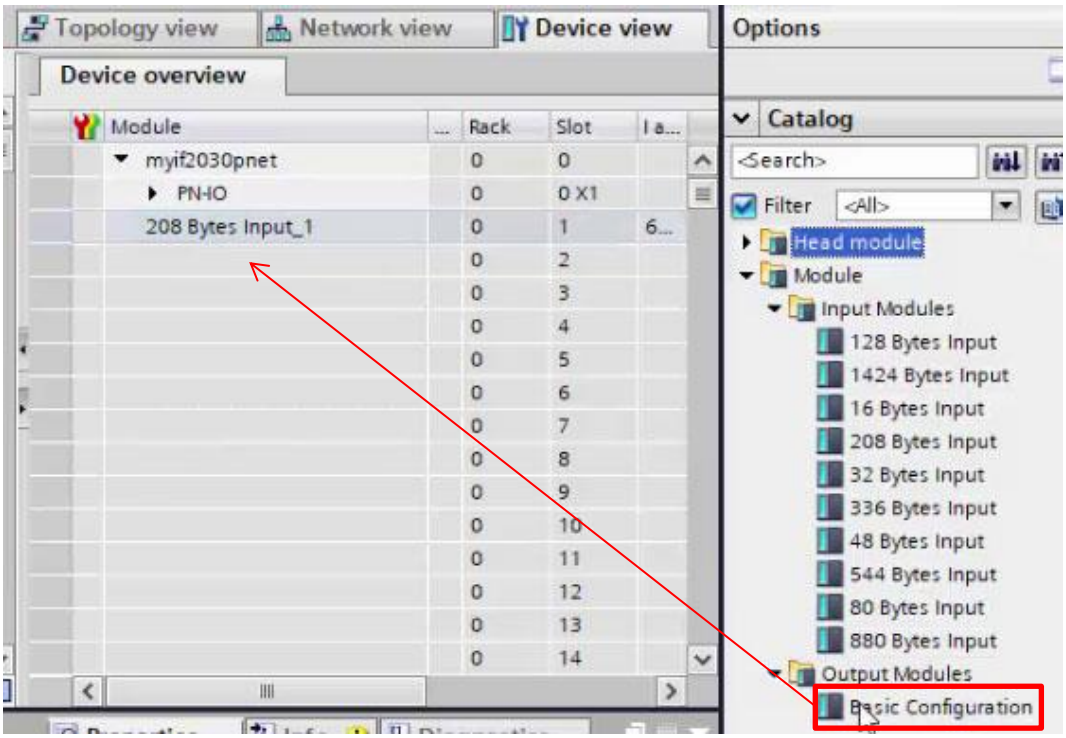


For further examples and information on the interpretation and conversion of sensor values, please refer to ►Operating Instructions **A 4**.

5 Using the output module “Basic configuration”

A special output module is available for making basic settings via the TIA portal interface. Proceed as follows to configure IF2030/PNET using a few basic parameters.

1. Select the output module “*Basic configuration*” and place it in the next free `Slot` in the `Device overview` – cf. basic settings (section 3).

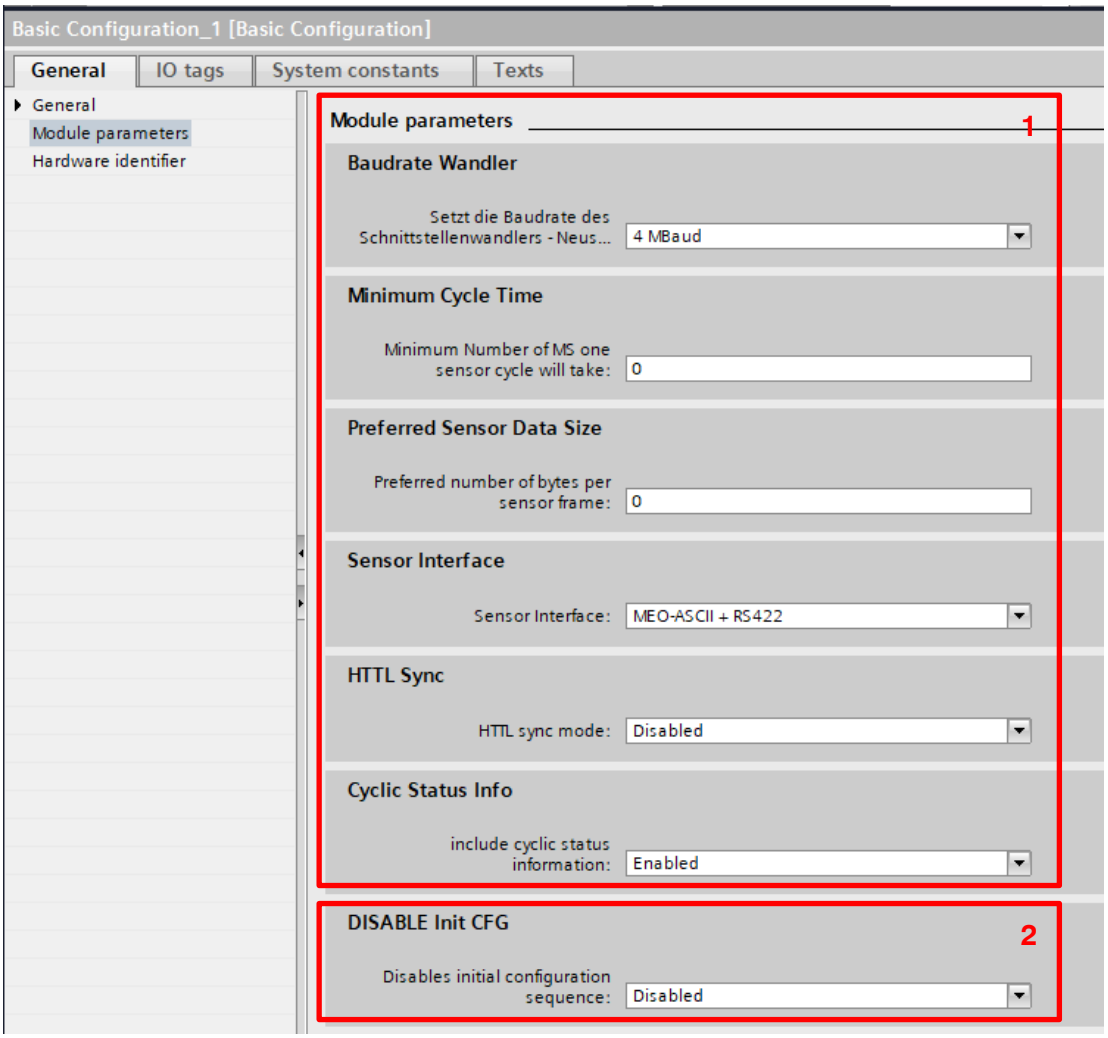


Note: The "*Basic configuration*" module must always be located one slot below the input module!

2. Double-click the module in the `Device view`. Switch to the `Inspector window` and navigate to tab `Properties` → `General` → `Module parameters`.

3. Make all desired settings ("*Baud rate*" to "*Status information*") and finally activate the "*Initial configuration*" (seventh configuration option). Ensure that you specify the sensor interfaces correctly (►Operating Instructions **4.2.2**):

- ME-Bus + RS485
- MEO-ASCII + RS422



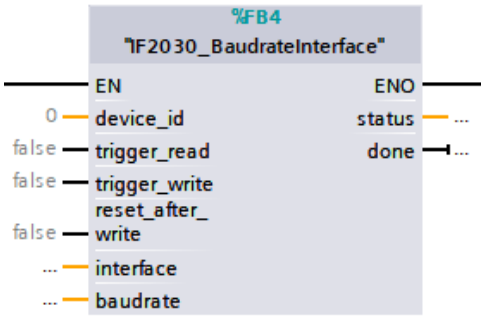
4. Save your changes by clicking the `Save project` button Save project. Now you can load the settings into the CPU. If this is not the case, select your S7 device in the working window, and click the `Download to device` symbol button in the `Toolbar`.

5. The loading procedure is described in section 3 of this document. Return to the `Module parameters` view of the `Inspector window` after this process. Deactivate the "*Initial configuration*" there, save and reload afterwards.

Restart the IF2030/PNET for the changes to take effect!

Note: This step is required due to the selected/used mechanism to establish a GUI for parameterizing IF2030/PNET while preventing the configuration from being sent again (repeatedly) to the CPU in the further course.

6 Configuring IF2030/PNET via function blocks



You can also configure your IF2030/PNET via S7 with some function blocks. These cover core functions (extended scope compared to the output module from section 5) that can be used for all compatible Micro-Epsilon sensors.

These blocks are unencrypted so that you can view the code ("*Structured Control Language*") and use it as template for your own programs. The function blocks are provided together with the GSDML file. Below, you will find an overview of the configuration examples including the register addresses in Hex format. The corresponding object directory can be found in ►Operating Instructions **5.4**.

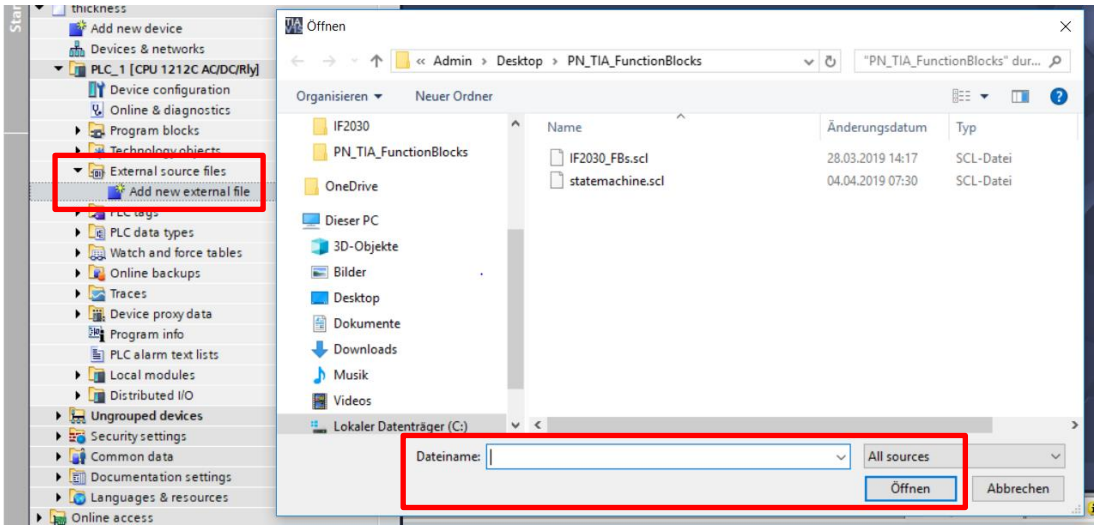
- *IF2030_BaudrateInterface*: R/W Sensor interface (0x2023) and baud rate (0x2020)
- *IF2030_CycletimeDatasize*: R/W Cycle time (0x2021) and data size (0x2022)
- *IF2030_HTTL-Debug*: R/W Switching between HTL/TTL (0x2027) and activation of the debug header (0x2028)
- *IF2030_MEB_floatparam*: R/W Sensor parameters of type Float (0x2510)
- *IF2030_MEB_intparam*: R/W Sensor parameters of type Int (0x2530)
- *IF2030_MEB_uintparam*: R/W Sensor parameters of type UInt (0x2530)
- *IF2030_Reset*: W Delete IF2030/PNET configuration (0x2024) or sensor configuration (0x2025) and restart (0x2026)
- *IF2030_SelectSensor*: R/W Sensor selection (0x2000) and R Sensor list (0x2001)

Note: The `device_id` of the connected device (Micro-Epsilon sensor or controller) must be passed to each function block. A *trigger* on `TRUE` for a program cycle triggers the desired *action* (*read has priority* over write), the *end* of which is signaled by `done = TRUE`. A `status != 0` indicates an *error* while sending or receiving data. If `reset_after_write = TRUE`, IF2030/PNET is restarted after successful configuration so that the *changes made become effective immediately*.

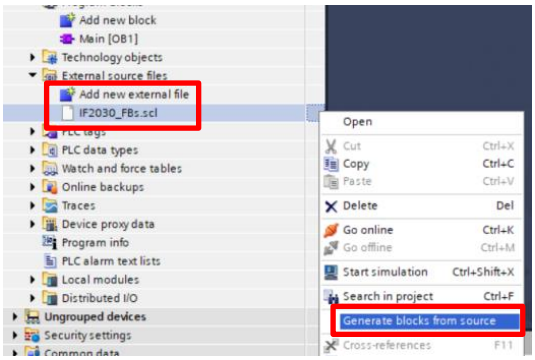
6.1 Importing function blocks

1. Go to the `Project tree`. Follow this path in your PLC: `External source files` → `Add new external file`. Double-click the latter to open a `Dialog box`.

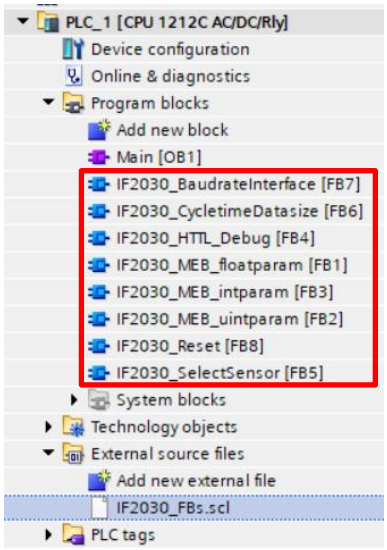
2. Select the path for the source file "*IF2030_FBs.scl*" and click the `Open` button.



3. When stored correctly, your source file is available in the `External source files` folder (`Project tree`). Now transfer the function blocks from the source file to the Program blocks folder. Therefore, right-click the source file to open the `Shortcut menu` and select the `Generate blocks from source` command. Confirm the message which may appear informing that existing blocks will be overwritten.



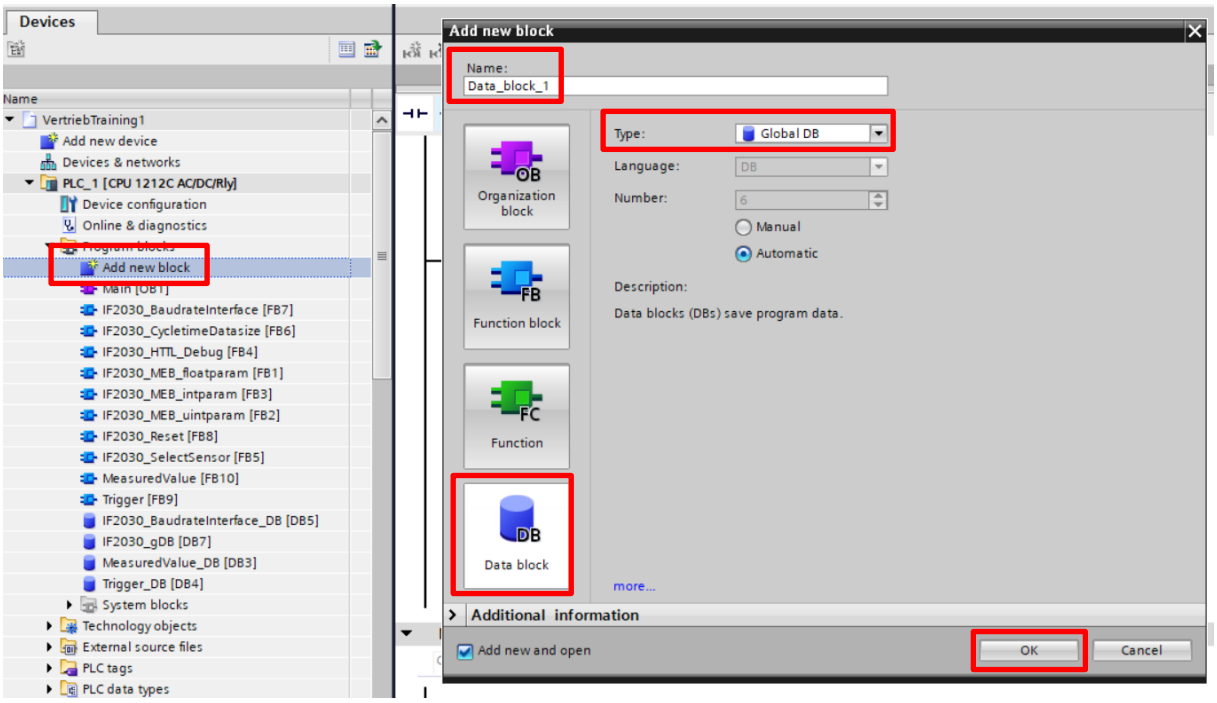
4. The generated function blocks are now available in the `Program blocks` folder. You will see the result of the generation in the `Inspector window` in the `Info` → `Compile` tab. Please note that these messages refer to the source file!



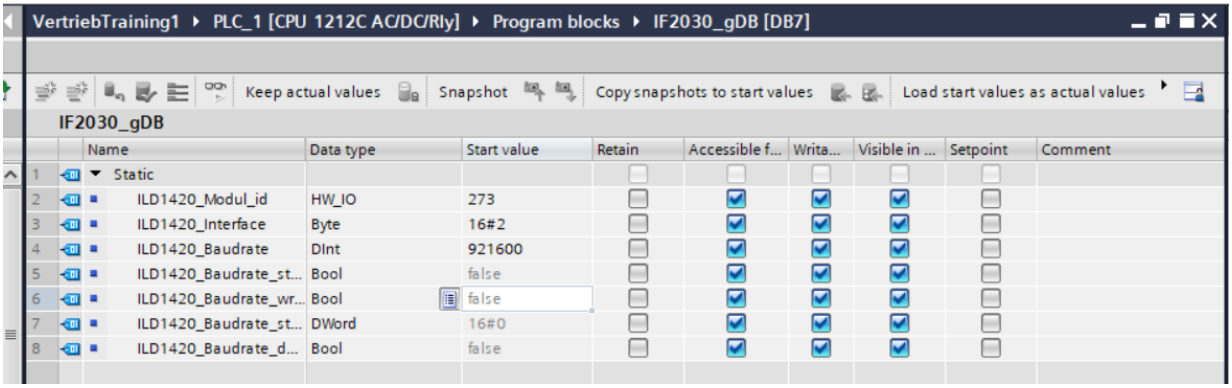
6.2 Executing function blocks

5. Select the `Program blocks` folder of your CPU in the `Project tree` and then click `Add new block` to create a global data block.

Select the `Data block` option in the following `Dialog box` and change the block name, if necessary. Select "*Global-DB*" as type. Activate the checkbox `Add new and open`, if this is not the case automatically. Now confirm by clicking the `OK` button.



6. The data block is displayed automatically. Now create the necessary variables, depending on the function module. The start value is the value with which the data block is loaded in the main memory of the CPU. Then click the `Save project` button (top left corner in the `Toolbar`).

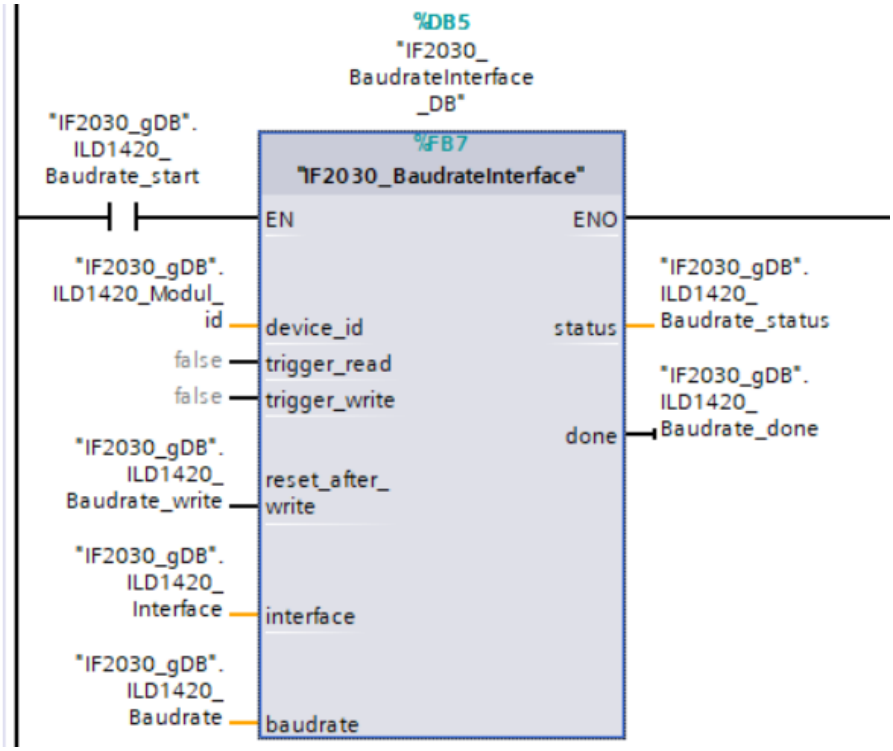


Note: Make sure you use the correct data types! You have to link the global variables correctly with those of the function blocks.

7. To allow for a function block to be processed, it must be called in the program. Open the organization block "*Main [OB1]*" with a double click. Now mark your function block and drag it into the program of the previously opened organization block.

Note: The call does not necessarily have to be made via the main program OB1, which is always processed by the CPU by default.

8. Now interconnect your data and function block. Drag and drop the required variables from your data block to the connections of the function block to be called using the mouse. Alternatively, you can also enter the variables manually.



Hint: You can display the data block and the organization block "*Main [OB1]*" next to each other by clicking the `Split editor space vertically` symbol button in the `Toolbar`.

9. Save your project as usual. To compile all blocks, click the `Program blocks` folder in the `Project tree` and select the `Compile` symbol button in the `Toolbar`.

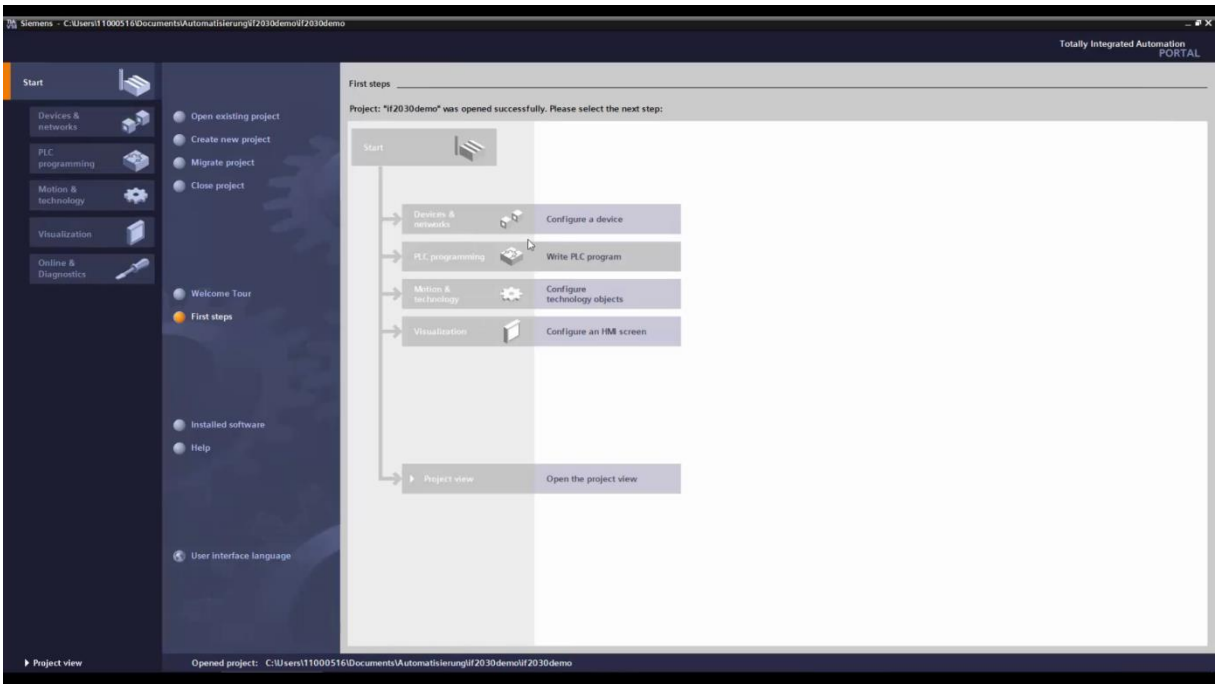
Note: The `Inspector window` (→ `Info` → `Compile`) then displays which blocks were successfully compiled.

After successful compilation, the entire control can be loaded with the created program including the hardware configuration, as already described, via the `Load to device` symbol button.

7 Appendix

7.1 Portal view

In general, a portal provides all functions and tools required for the respective task range in the corresponding Portal view. After the start-up, STEP 7 displays the **`Start portal`**. Starting from here, you can reach the following portals:

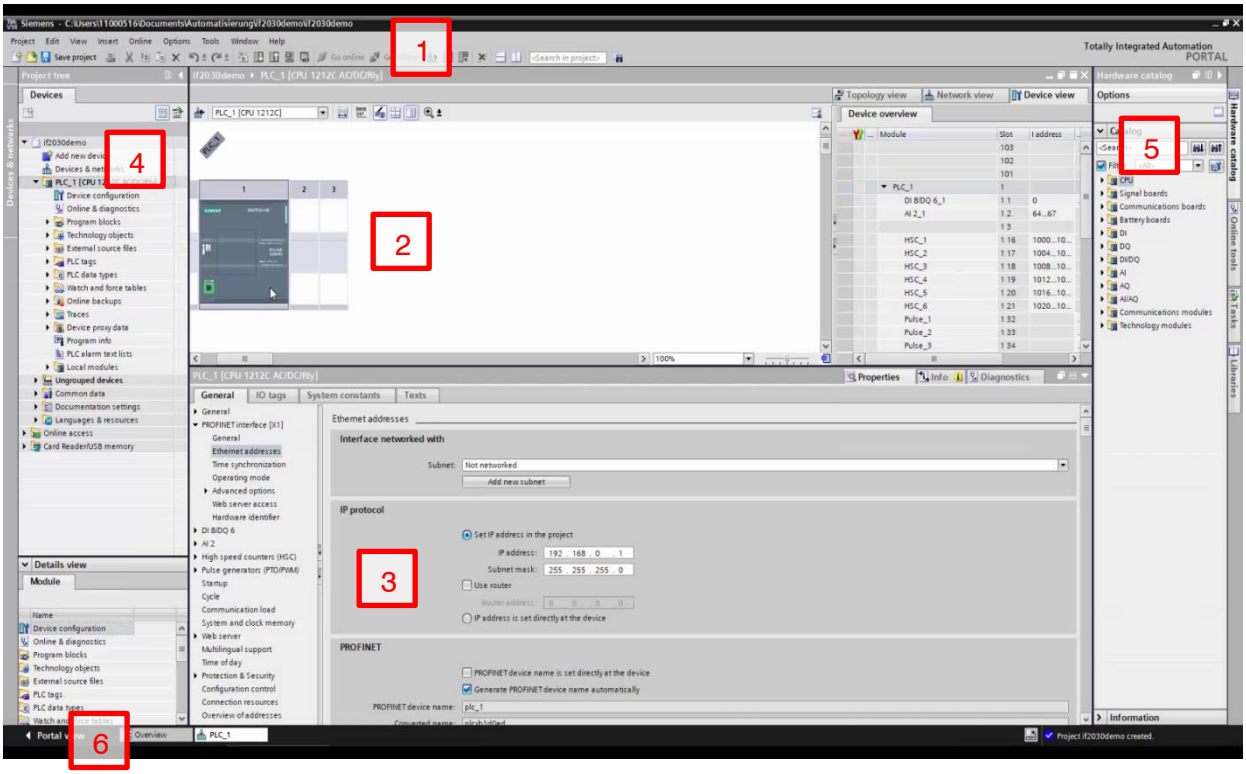


- **`Devices & networks`**: for configuring the hardware of the programmable controller (incl. selection, positioning, and property assignment of hardware components) and defining connections to network multiple devices
- `PLC programming`: for generating the PLC station's user program with different tools
- `Motion & technology`: for creating technology objects
- `Visualization`: for generating operator controls and monitoring interfaces for HMI stations
- `Online & diagnostics`: for testing programs and detecting faults in the automation system

Moreover, you can **`Create a new project`**, `Open` an existing one, or perform a `Migration` via the `Start portal`. For an introduction to STEP 7, carefully read the `Welcome Tour` and `First steps`. Navigate to `Installed software` to get an overview of further SIMATIC applications that are currently available on the programming device. You can call `Help` in every portal. Use the `User interface language` function to change the operating language of STEP 7.

5.2 Project view and associated windows

The **`Project view`** (in portal `Devices & networks`) consists of various processing windows that show all elements of a project in a structured manner. Different window contents are displayed depending on the currently used editor.



1 *Main menu, Toolbar, and Shortcut menu*

The **`Main menu`** with all menu commands is beneath the title bar. The currently marked object determines the commands which can be selected (non-selectable ones are greyed out). The same functionality is available via the **`Shortcut menu`**: By right clicking an object, a window with the currently selectable menu commands opens. Underneath the `Main menu` is the **`Toolbar`** that graphically represents the “main functions”. Both `Main menu` and `Toolbar` are available at all times.

2 *Working window*

The **`Working window`**, whose contents depend on the currently used editor, is in the center of the screen. Here you can, for instance, configure the hardware of the automation system. The objects (stations and modules) are both diagrammed and tabulated.

3 *Inspector window*

The **Inspector window** underneath the working window serves multiple purposes: it shows the properties of an object marked in the Working window, records the sequence of actions, and displays the diagnostics of all connected devices. During configuration you set the object properties (e.g. addresses and symbol names of inputs and outputs, tag data types, or block attributes).

4 *Project tree*

The content of the **Project tree** window remains stable in all editors. It is hierarchically structured and contains the entire project data and required editors: folders for the PLC, HMI, and PC stations included in the project, with further subfolders for, e.g., **PLC tags** or watch tables. Double-click an object with project data to start the associated editor automatically.

5 *Task window*

Right next to the Working window is the **Task window** with the so-called task cards and further objects that are intended for processing in the Working window. Again, the window's contents depend on the currently active editor (e.g. the **Hardware catalog** with available components during hardware configuration).

6 *Editor and Status bar*

The bottom of the Project view offers different functions. On the left you can change to the Portal view. In the middle you can find the tabs of the open windows. You can quickly switch between different window contents by simply clicking a tab (i.e. they are displayed at the top level of the Working window). The Status bar is on the right and indicates the current status of project execution.

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