Integration Tutorial ME01

Mitsubishi Electric MELSEC System Q and PROFIBUS for Water & Wastewater Industry

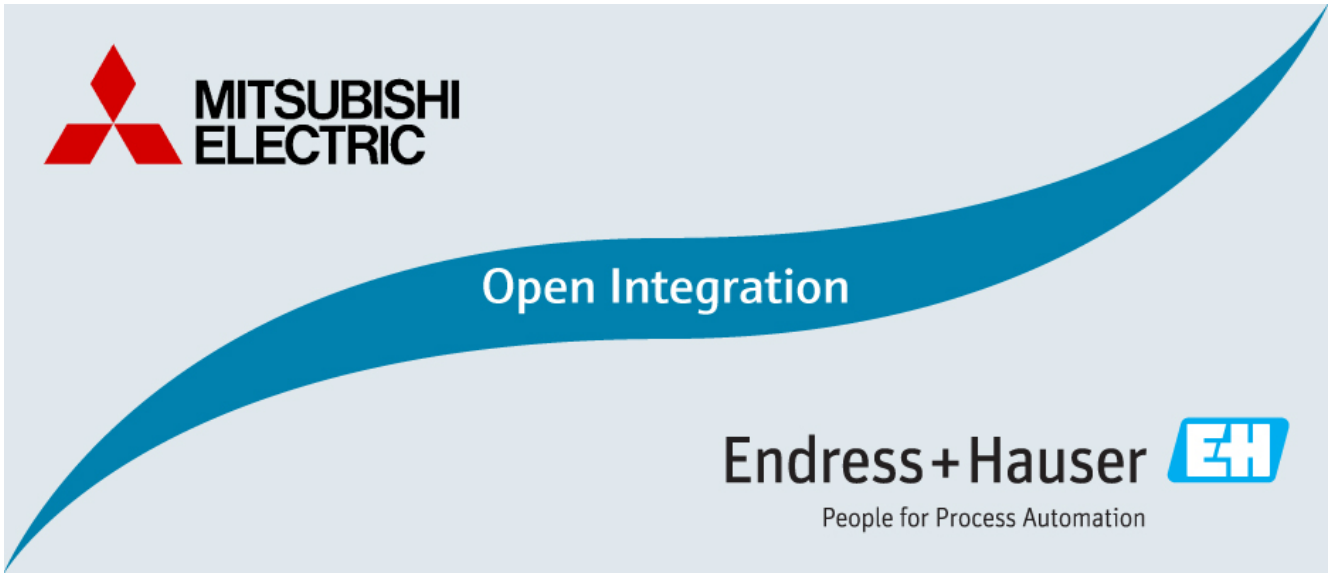


Table of Contents

1 Document Information

1.1 Purpose and Scope

This document provides a step by step description on how to integrate Endress+Hauser PROFIBUS devices with the Mitsubishi Electric MELSEC Q System. All content of this document is jointly developed, reviewed and approved by Mitsubishi Electric and Endress+Hauser as a common deliverable of Open Integration.

1.2 Document History

This is version 1.00.00 of this document. Version history:

Version	Released	Description
1.00.00	2015-03	Initial version

1.3 Related Documents

Please refer to related documents as listed below:

Document	Description
SD01431S/04/EN/02.15	Reference Topology ME01
SD01433S/04/EN/02.15	Integration Test Summary ME01
SD01434S/04/EN/02.15	List of Tested Devices and Versions ME01

2 Pre-Requisites

Readers of this document should be familiar with related documents as listed in chapter 1.3 and basics on how to work with the Mitsubishi MELSEC Q System and PROFIBUS in general. Please refer to recommended literature as listed in chapter 2.1.

2.1 Recommended Literature

2.1.1 Mitsubishi Electric

Document	Description
sh080483eng	QCPU User's Manual (Hardware Design)
sh080782eng	MELSEC Q Structured Programming Manual
sh080788eng	GX Works2 Beginners Manual

2.1.2 Endress+Hauser

Document	Description
BA00065S	FieldCare Project Tutorial
BA00070S	Fieldgate SFG500 Installation and Commissioning

2.1.3 Other

2.1.3.1 Pepperl+Fuchs

Document	Description
tdoct0835g_eng.pdf	POWERHUB Segment Coupler Manual

2.2 Operable Control System

This document assumes an operable Mitsubishi MELSEC Q System as defined by Reference Topology ME01. Please refer to the manuals listed in chapter 2.1.1 for an explanation on how to use hard- and software provided by Mitsubishi Electric.

2.3 Operable Asset Management System

This document assumes an operable Endress+Hauser PAM System as defined by Reference Topology ME01. Please refer to manuals listed in chapter 2.1.2 for installing of hardware and software provided by Endress+Hauser.

2.4 Operable Field Network Infrastructure

This document assumes an operable PROFIBUS DP / PA field network infrastructure as defined by Reference Topology ME01. Please refer to manuals listed in chapter 2.1.3 for installing of hardware and software provided by other parties.

2.5 Operable Field Devices

This document assumes an operable selection of Endress+Hauser PROFIBUS DP and PROFIBUS PA devices connected via the field network infrastructure, as defined by Reference Topology ME01. Each field device is adequately powered and prepared with unique tag and PROFIBUS address. If required, please refer to individual device manuals for further advice.

3 Basic Integration

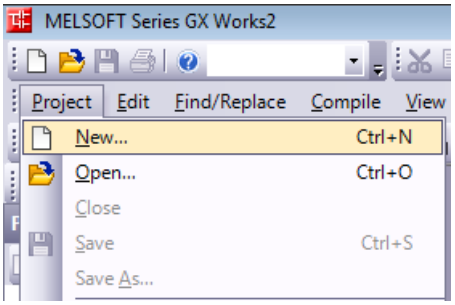
This chapter describes the main workflow for integration of a PROFIBUS network and field devices into the Mitsubishi Electric Melsec Q system by means of GSD. As a result, the cyclic PROFIBUS communication is running and process values with status information are available within the control strategy of the system for further processing.

3.1 System Configuration

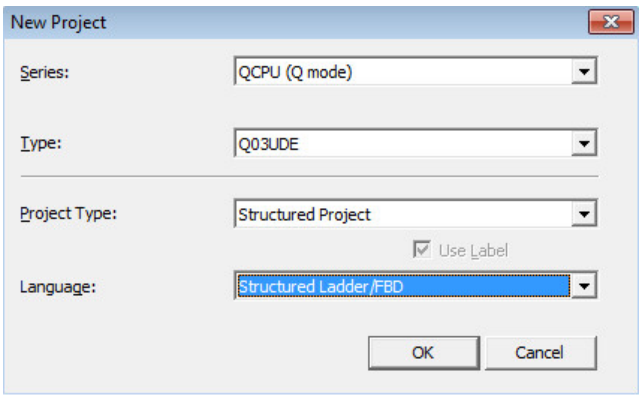
3.1.1 New project

- Start the software GX Works.

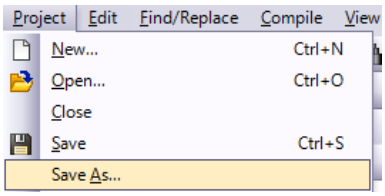
- Create a new project with the menu "Project → New".



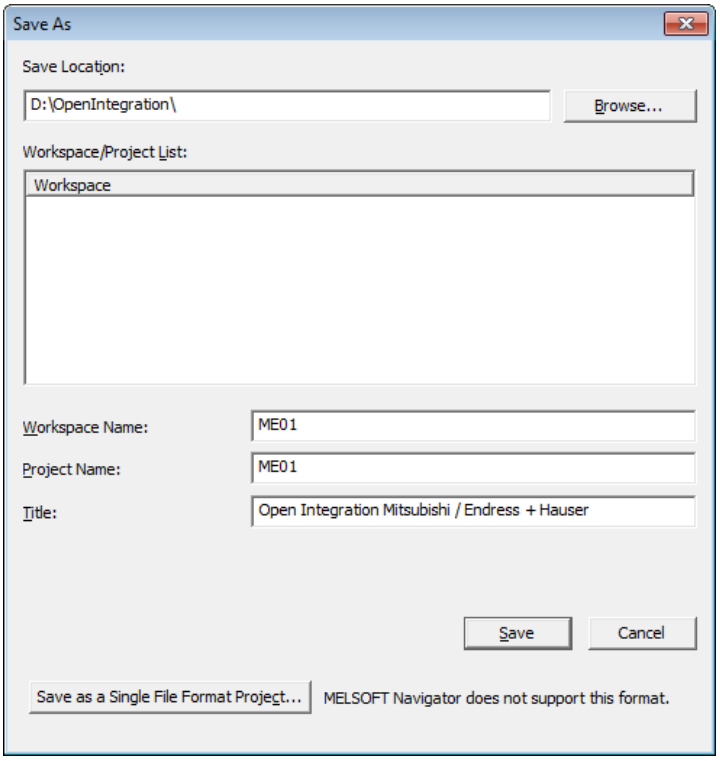
- Configure the controller and the programming language.



- Save the project with the menu “Project → SaveAs”.

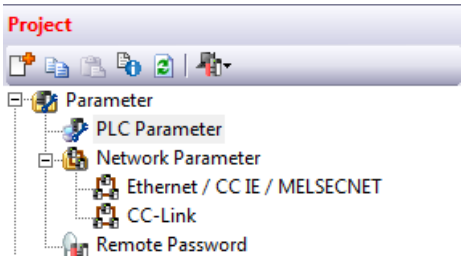


- Fulfill all required fields (Save Location/Workspace Name/Project Name/Title) and click on the button “Save”.



3.1.2 PLC Parameters

- In the project view, double-click on the menu “Parameter →PLC Parameter”.

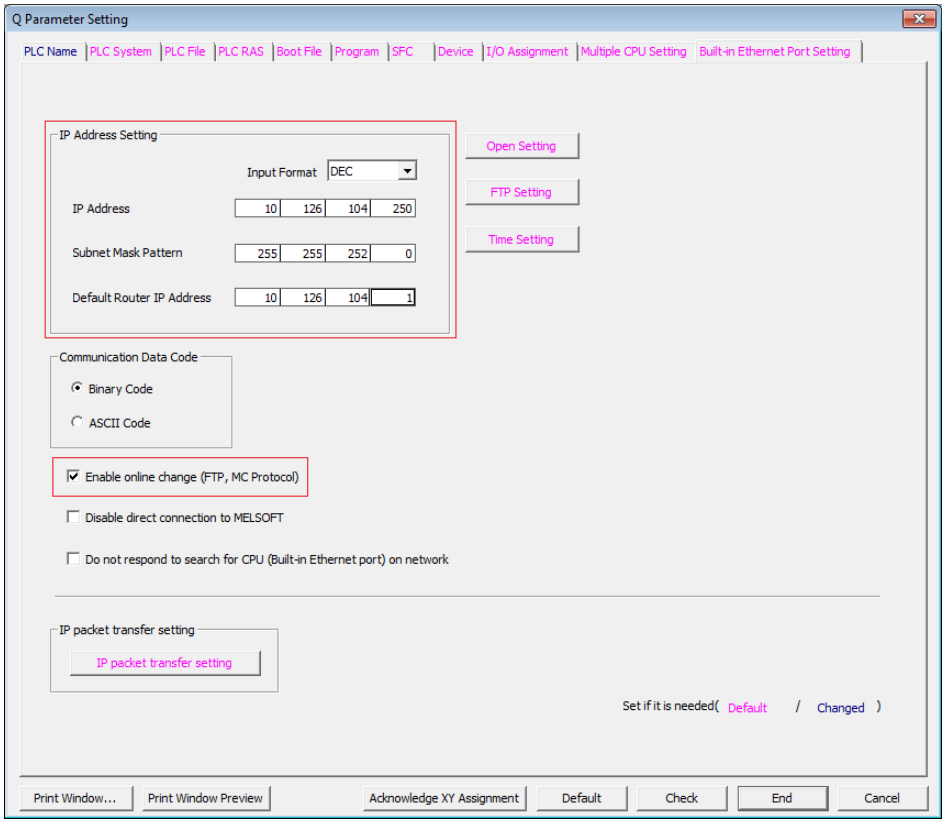


3.1.2.1 PLC Name

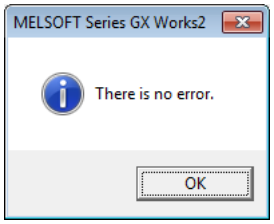
- Select the tab “PLC Name”, and then configure the field “Label” and optionally the field “Comment”.

3.1.2.2 PLC IP address

- Select the tab “Built-in Ethernet Port Setting”.
  - Configure the menu “IP address setting” **according to the connected network.**
    In this example:
    - The PLC IP address is 10.126.104.250
    - The Subnet Mask is 255.255.252.0
    - The default Router IP address is 10.126.104.1
  - Select the checkbox “Enable online change (FTP, MC Protocol)”.

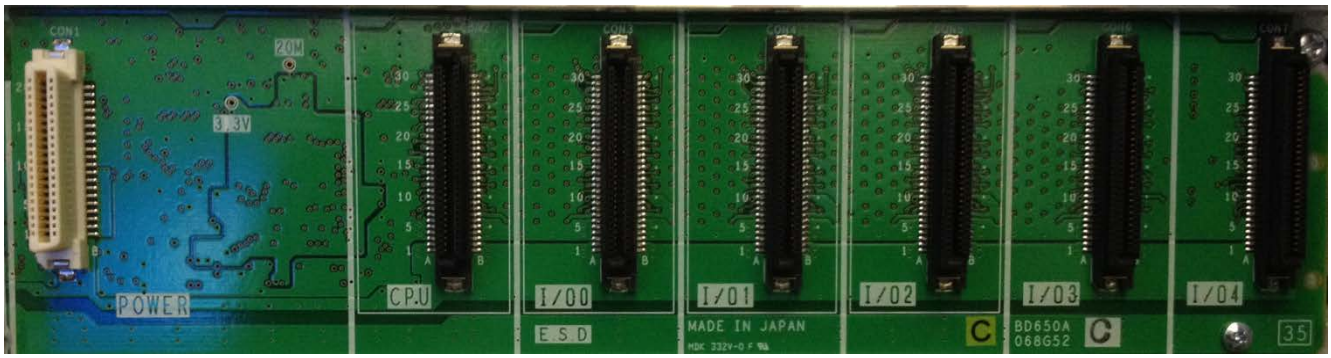


o Click on the button “Check”.



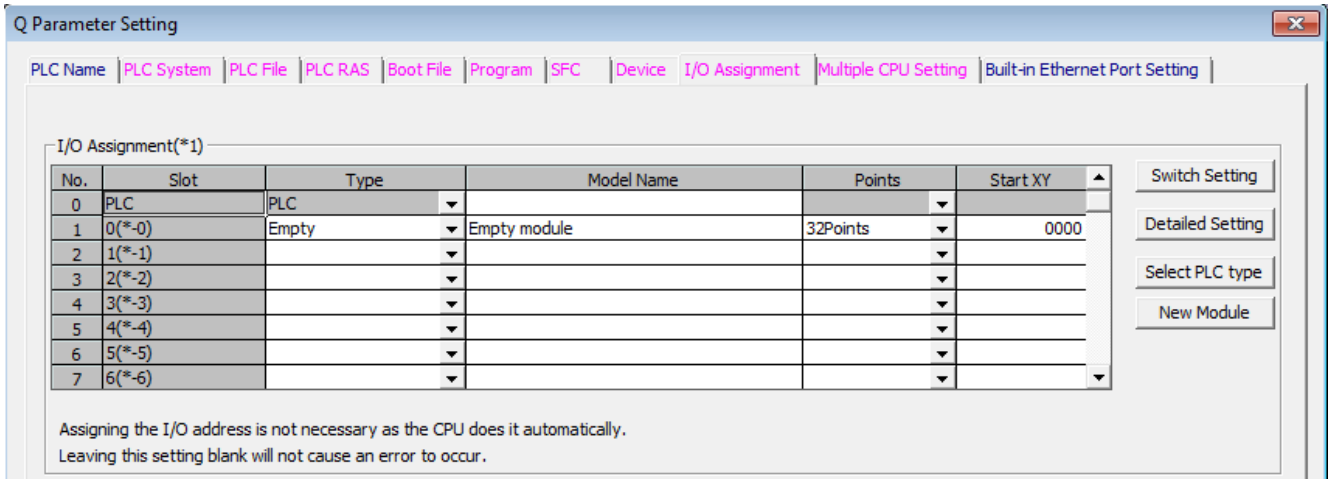
3.1.2.3 PLC Hardware Configuration

The PLC slots have to be configured according to the physical setup of modules. In our example we configure this configuration:



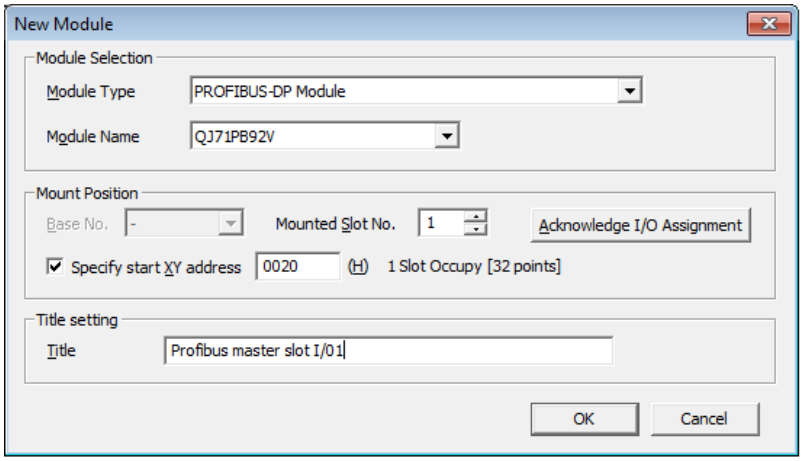
Power Supply	PLC	**Slot 0**	**Slot 1**	**Slot 2**	**Slot 3**	**Slot 4**
Q63P	Q03UDE	Empty, Reserved for CC Link IE Field	PROFIBUS module QJ71PB92V	Empty	Empty	Empty

- In the “Q Parameter Setting” window, select the tab “I/O Assignment”.

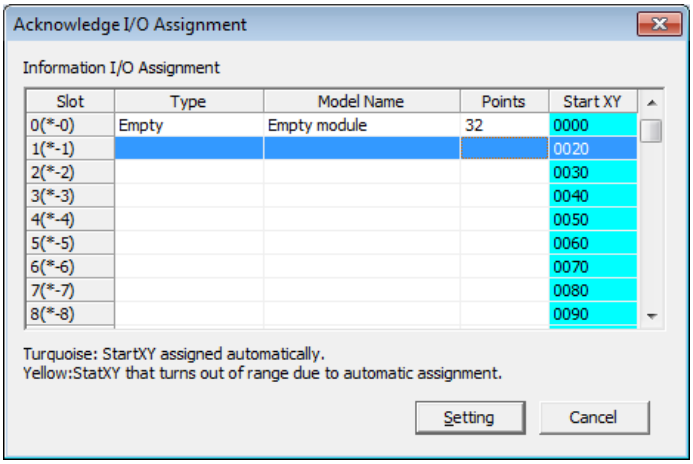


- **Slot 0**: Select an empty module as a place holder for a CC Link IE Field module which may be added later:
  - Enter the name “Empty module” for the “Model Name”.
  - As place holder for a CC-link IE Field card:
    - Configure 32Points
    - Enter the Start XY address 0000.

- **Slot I**: Configuration of a PROFIBUS-DP module
  - Click on the button “New Module”.
    - Select the module Type “PROFIBUS-DP Module”, then the module name “QJ71PB92V”.
    - Enter a title in the field “Title”, which will be indicated in the Project view.

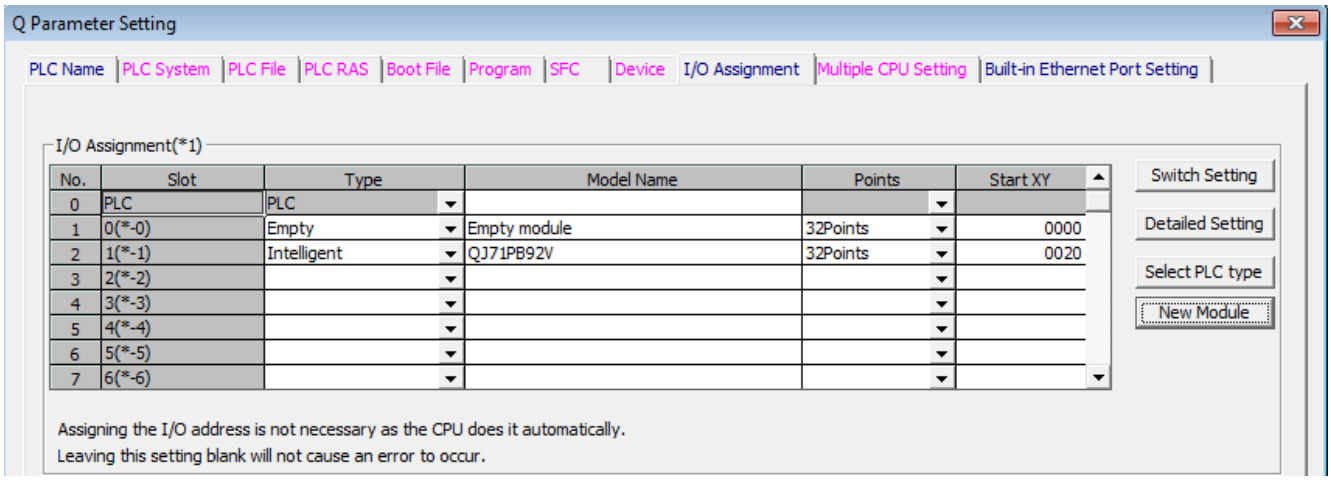


    - Click on the button “Acknowledge I/O Assignment”.
      - Select the Slot 1 (Start XY Address 0020)
      - Click on the button “Setting”.



  - Check settings in the “Mount Position” part:
    - Mounted Slot No. : 1
    - Start XY address : 0020
  - Click on the button “OK”.

- Overview of the configuration:



- Click on the button “End” to close the window.

3.1.3 Connection Destination Configuration

There are two options to download the hardware configuration and the software in the PLC: via USB or Ethernet.

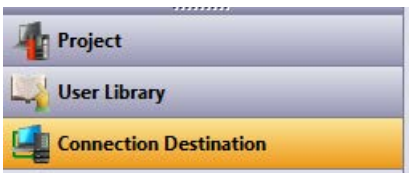
The first download will have to be done with the USB interface because of the IP addresses which are still not set in the PLC.

In this example, the PLC IP address is at first downloaded via USB. Then, it is the Ethernet connection which is used to download the other parts of the project configuration.

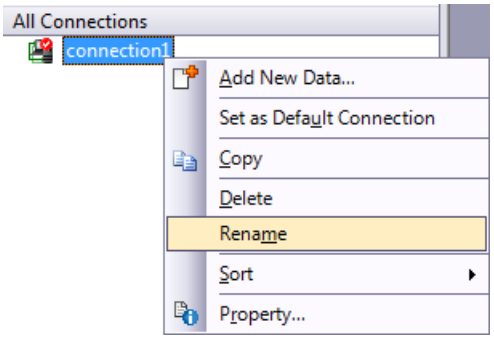
3.1.3.1 Connection via USB interface

- Connect the USB cable from the PLC USB port to the engineering station one.

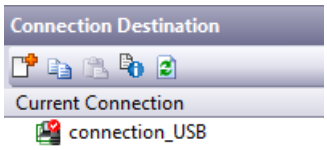
- In the Navigation menu, click on the button “Connection Destination”.



- In the Connection Destination view:
  - Right-click on the connection “connection1” and select the field “Rename”.

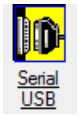


  - Enter the connection name “connection_USB”.

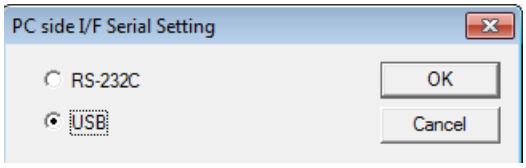


  - Double-click on the “connection_USB” connection in order to open the “Transfer Setup” window.

- In the window “Transfer Setup connection_USB, double-click on the PC side I/F icon “Serial USB” text.

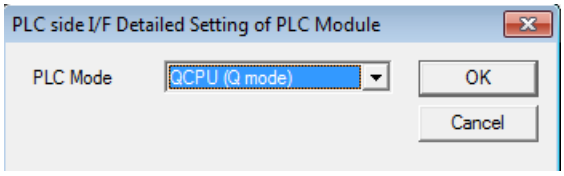


  - Select the USB device and click on the button “OK”.



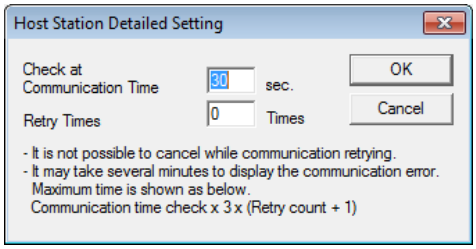
- Double-click on the PLC side I/F icon “PLC Module” text.

  - Select the PLC Mode “QCPU (Q mode)” and click on the button “OK”.

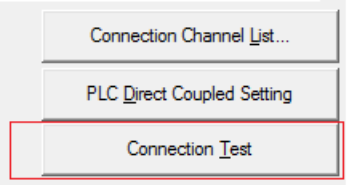


- Double-click on the option text “No specification” in the menu “Other Station Setting” and click on the button “OK”.

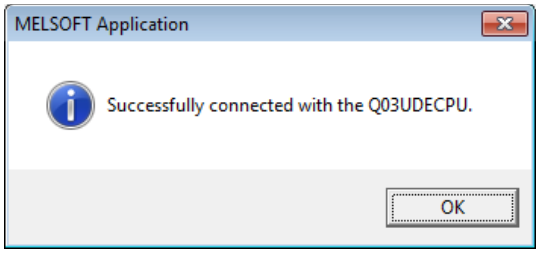
  - Verify default settings



- Check the connection between PC and PLC by using the button “Connection Test”.

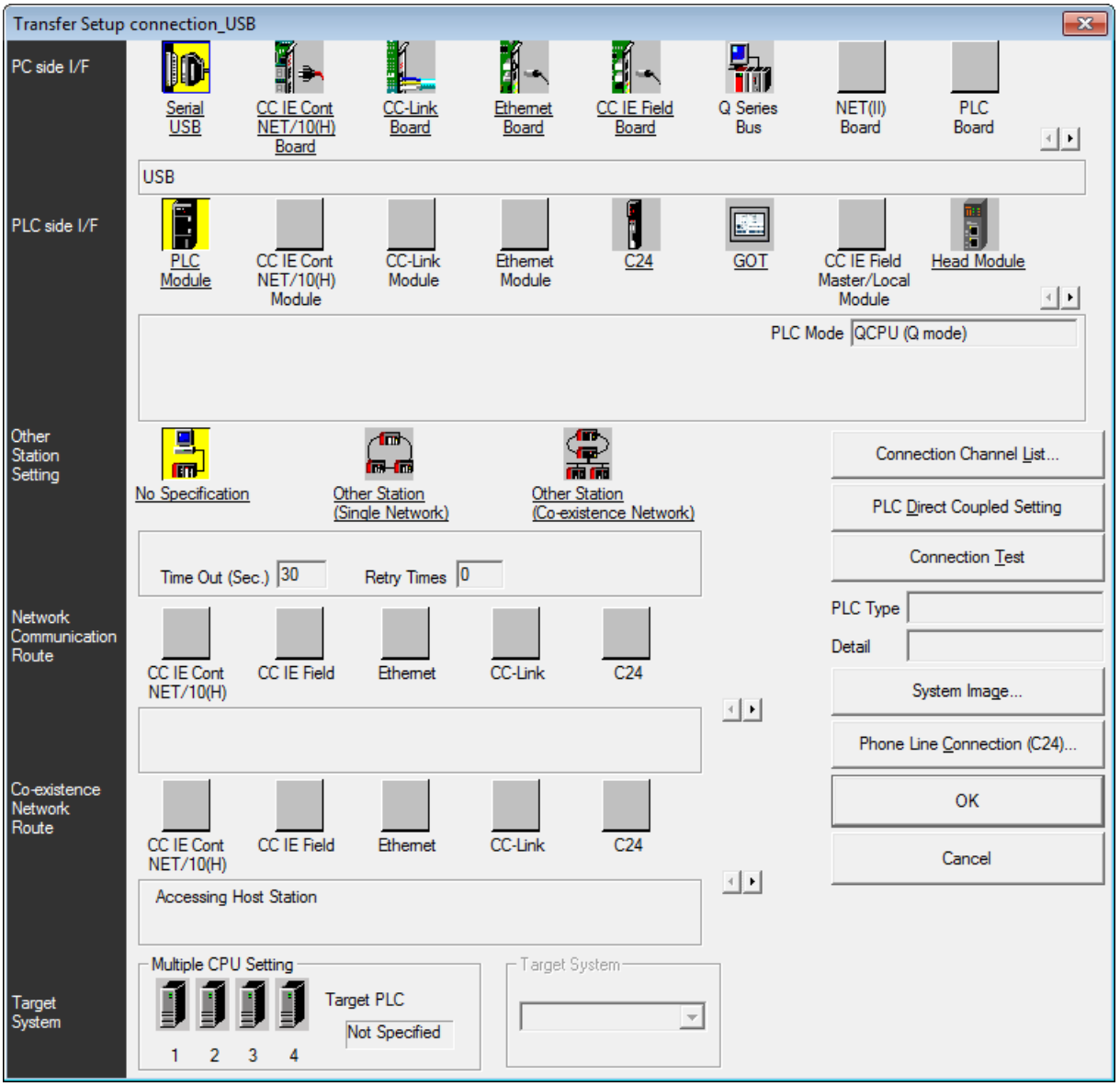


  - If successful, following message is displayed.



  - Click on the button “OK”.

- This is the configured “Transfer Setup connection_USB” window.



- Click on the button “OK” to close the window “Transfer Setup connection_USB”.

3.1.3.2 IP settings configuration download via USB

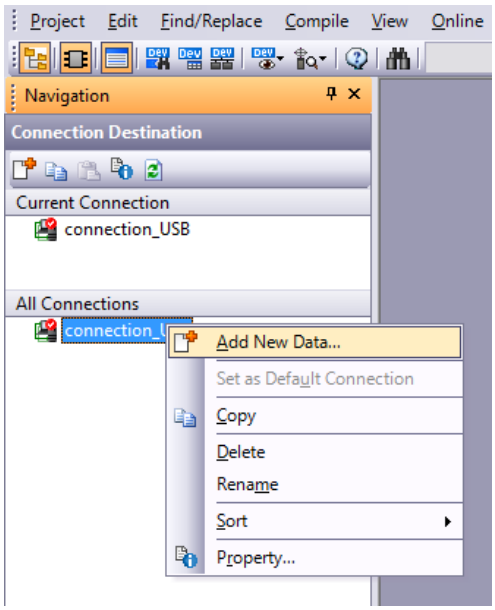
- Download the IP configuration in the PLC.
  →Refer to part **3.4.2** and **3.4.3** to proceed.

Notes :

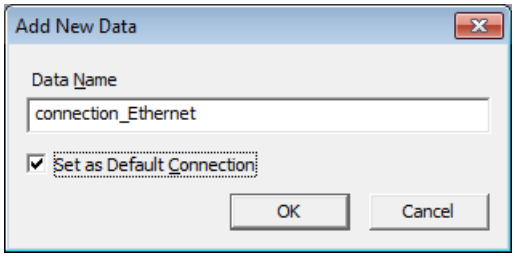
- Just the part "PLC Module" is downloaded in this step.

3.1.3.3 Connection via Ethernet board

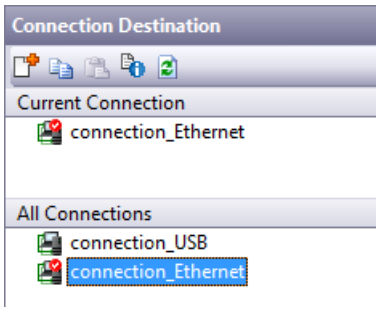
- Connect the Ethernet cable from the PLC port/HUB to the engineering network one.
- In the Navigation menu, click on the button "Connection Destination".
- Create a new connection configuration:
  - Right-click on the connection "connection_USB" and select the option "Add New Data".



  - Enter the name of the new connection, ie "connection_Ethernet" and cross the checkbox "Set as Default Connection".

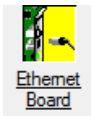


- The new connection is displayed in the fields “Current Connection” and “All Connections”.

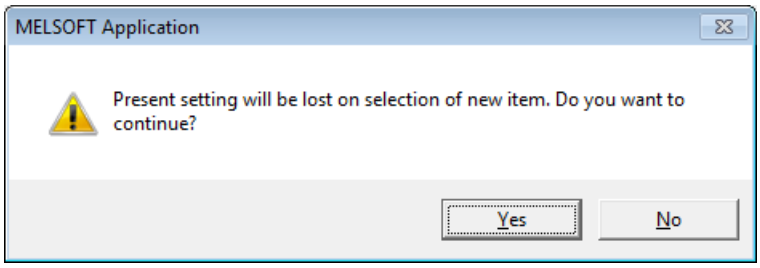


- Double-click on the “connection_Ethernet” connection in order to open the “Transfer Setup” window.

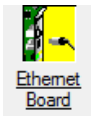
- In the window “Transfer Setup connection_Ethernet”, double-click on the PC side I/F icon “Ethernet Board” text.



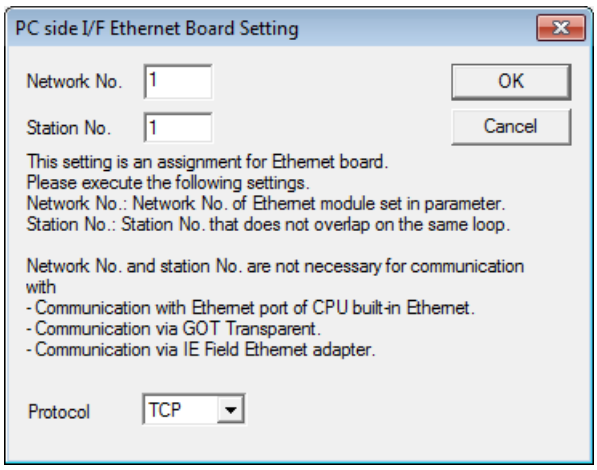
- MELSOFT Application message is displayed.
- Click on the button “Yes”.



- Double-click again on the PC side I/F icon “Ethernet Board” text.



- Verify that the TCP protocol is selected:

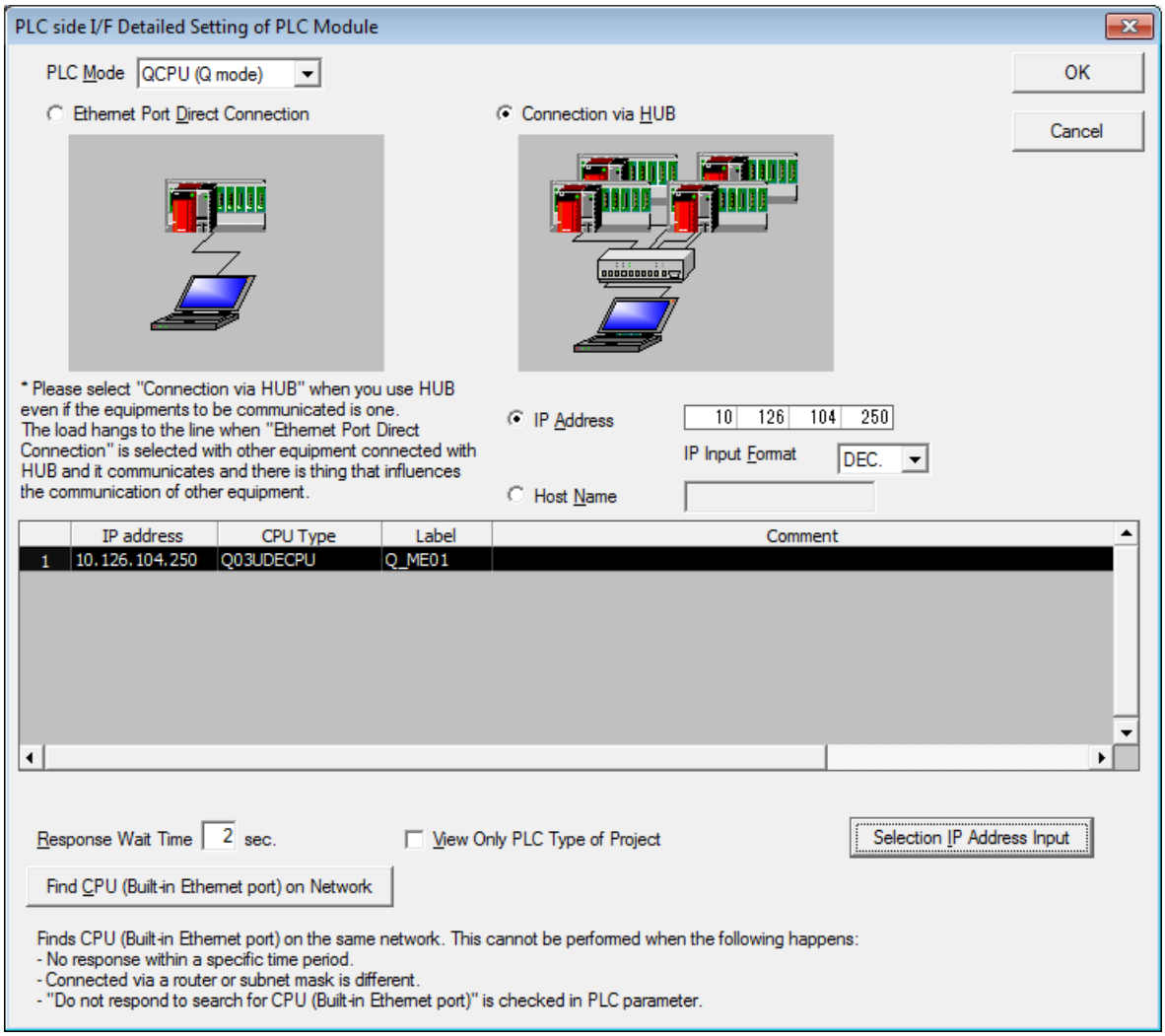


- Click on the button “OK”.

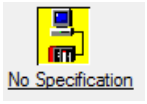
- Double-click on the PLC side icon “PLC Module” text.

  - Select the PLC Mode “QCPU (Q mode)”.
  - Select the appropriate Ethernet connection: “Connection via HUB” in this example.
    - Click on the button “Find CPU (Built-in Ethernet port) on Network” to see the defined IP address.
    - Select the IP address 10.126.104.250 by clicking on the button “Selection IP address Input”.

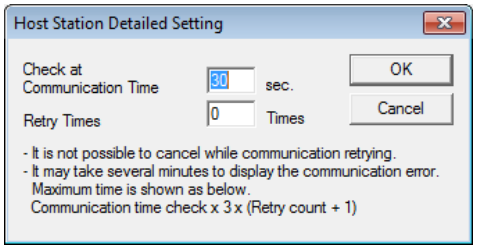
      That is the defined PLC IP address in this example, which is defined in the Project view, menu “Parameters → PLC parameters → Built-in Ethernet Port Setting”.
  - Click on the button “OK” to close this window.



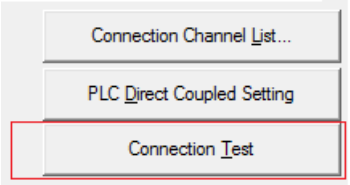
- Double-click on the option text “No specification” in the menu “Other Station Setting”.



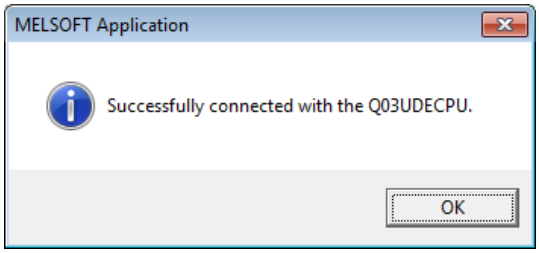
  - Verify default settings and click on the button “OK”.



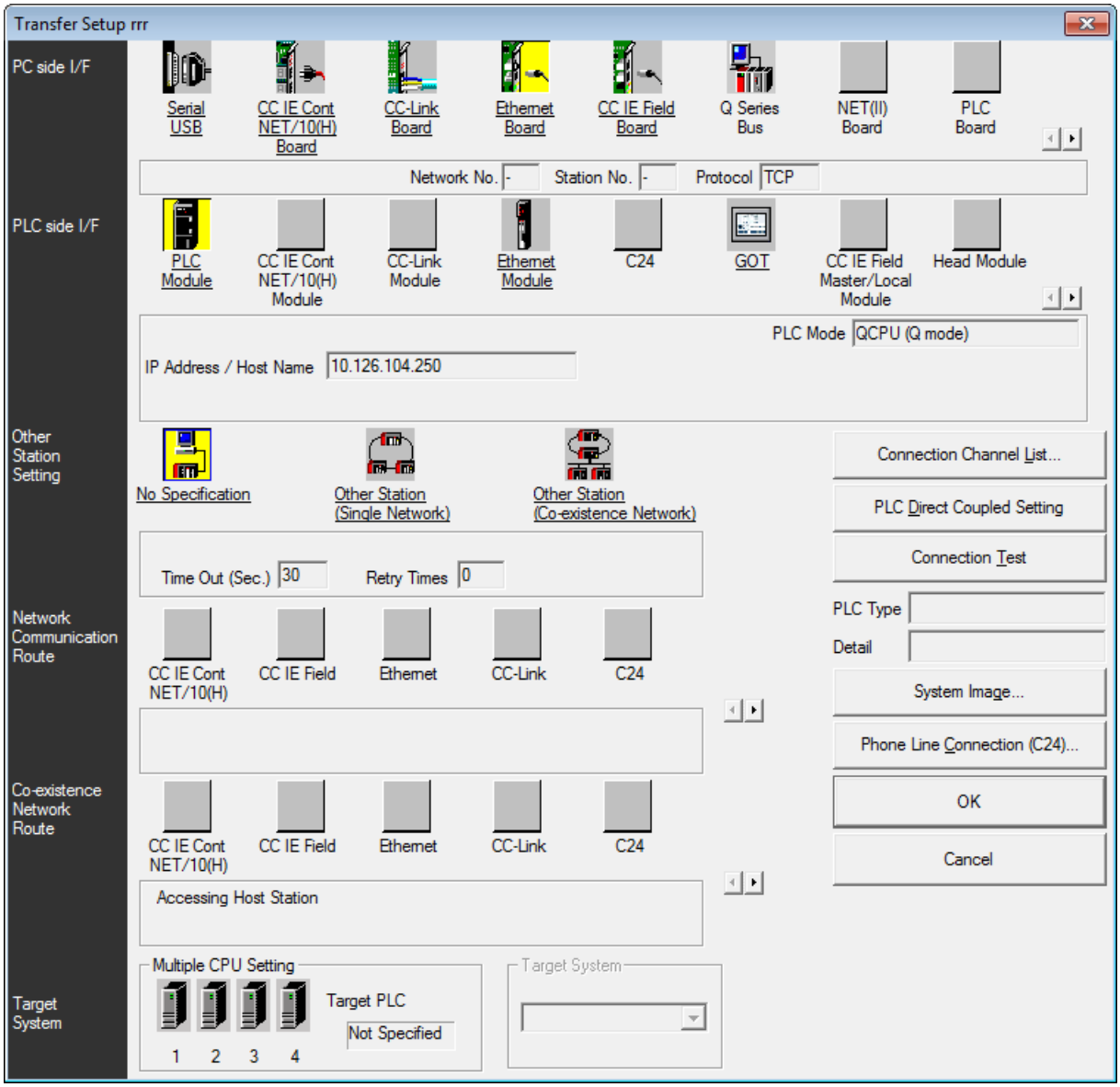
- Check the connection between PC and PLC by using the button “Connection Test”.



  - If successful, following message is displayed.
  - Click on the button “OK”.



- This is the configured “Transfer Setup connection_Ethernet” window.



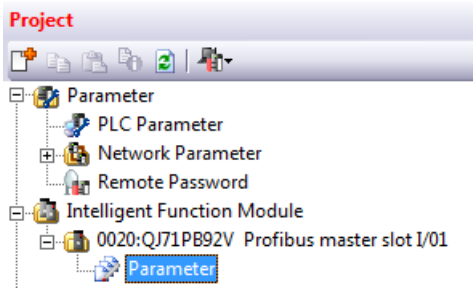
- Click on the button “OK” to close the window “Transfer Setup connection_Ethernet”.

3.2 Field Network Configuration

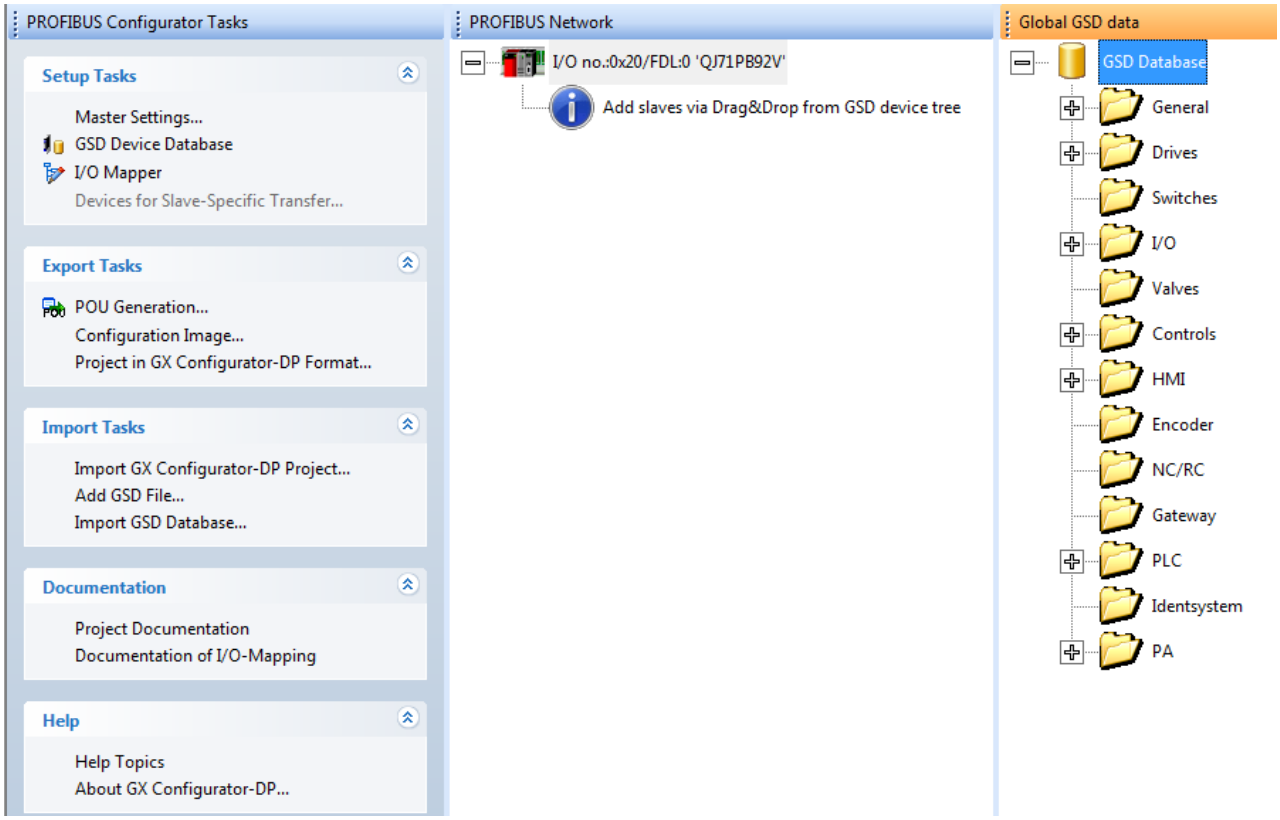
In this part it is explained how to configure the PROFIBUS master interface and how to import a GSD file in the GSD database.

The following example is based on an Endress+Hauser Promag 400 DP flowmeter. The principle is the same for all other devices.

- In the Project view, double-click on the PROFIBUS module menu “0020:QJ71PB92V→Parameter”.

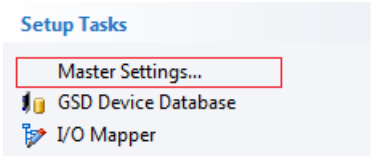


- The tab 0020:QJ71PB92V is opened:

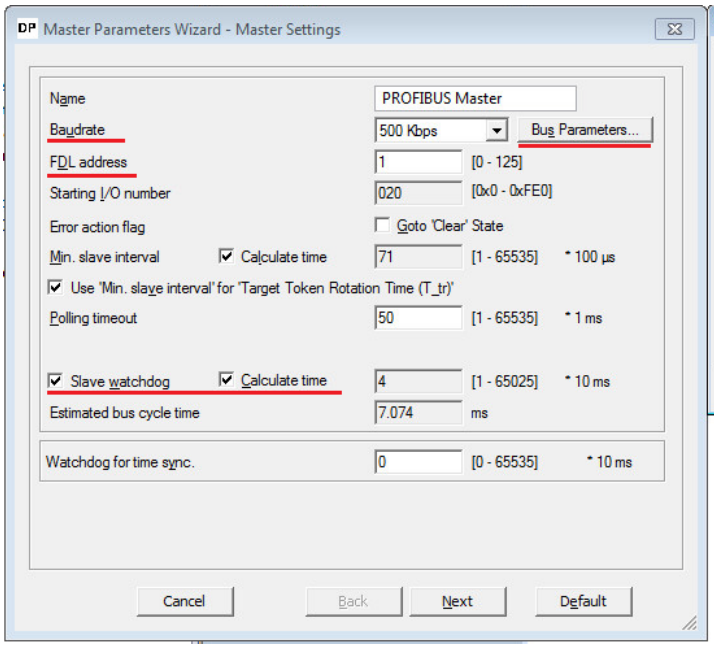


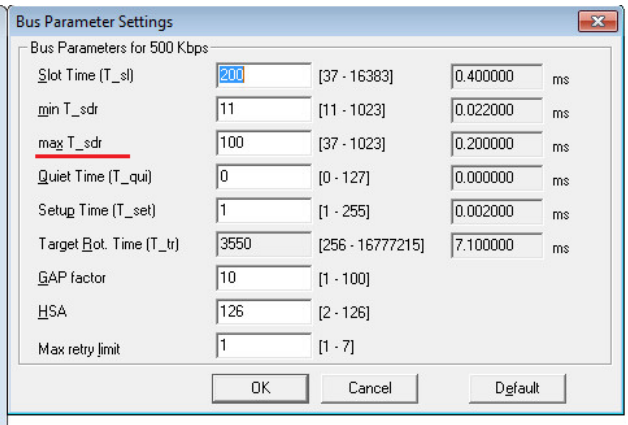
3.2.1 PROFIBUS DP master configuration

- Select the menu “PROFIBUS Configurator Tasks →Setup Tasks→Master Settings…”.

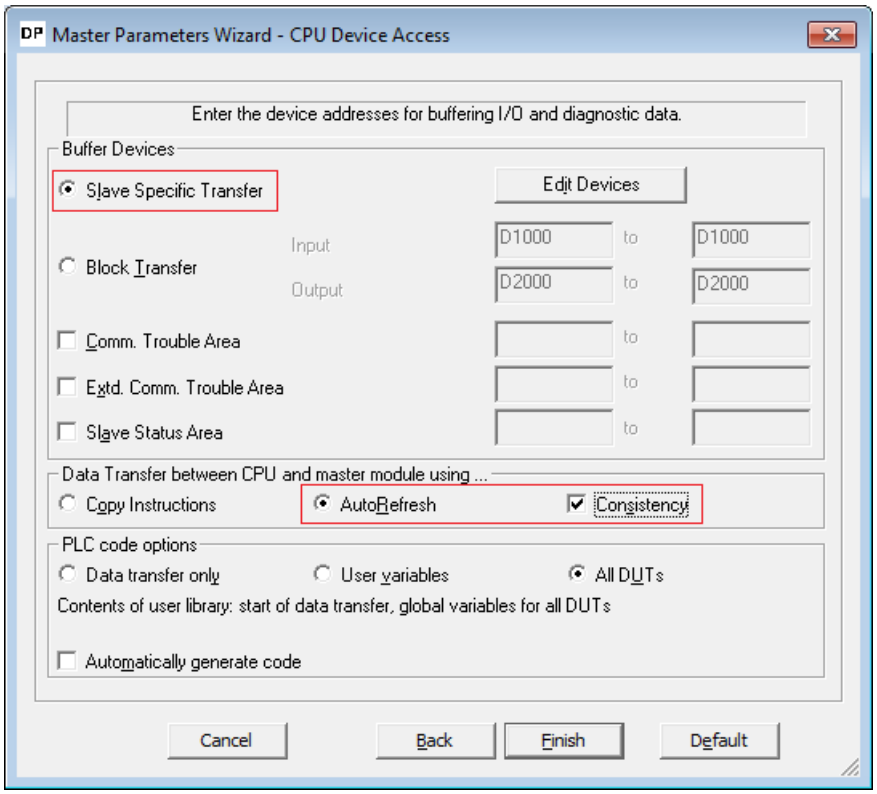


- In the window “Master Parameters Wizard-Master Settings”:
  - Set the Baud rate to 500 kbps(specific for this example).
    - Available Baud rates: 9.6k/19.2k/93.75k/187.5k/500k/1.5M/3M/6M/12M.
  - Set the FDL address to 1 (specific for this example).
  - Select the parameter “Slave watchdog” and “Calculated time”.
    - The watchdog time can be configured manually if needed. Unselect the parameter “Calculated time” and indicate the value in the corresponding field.
  - Click on the button “Bus Parameters”:
    - The window “Bus Parameter Settings” is displayed.
    - All timing parameters are calculated automatically according to the configured devices.
    - Click on the button “OK”.
  - Click on the button “Next”.





- Check the following settings in the window “Master Parameters Wizard – CPU Device Access”:



  - Select the option “Slave Specific Transfer”.
  - “AutoRefresh” and “Consistency” are selected.
  - Input address is set to D1000.
  - Output address is set to D2000.

- Click on the button “Finish”.

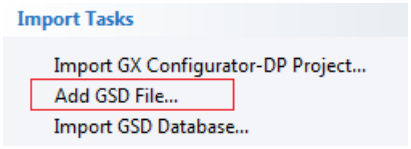
Notes:

- The Baud rate has to correspond to this used by all slaves. If the Baud rate doesn’t match with one slave, an error will be indicated but only during the compilation of the configuration.
- The settings “Bus Parameters “as watchdog or timing parameters depends on the complete PROFIBUS network configuration.

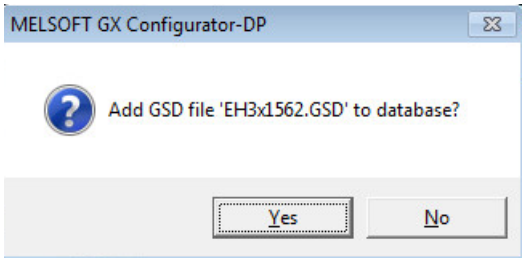
3.2.2 GSD file

3.2.2.1 GSD file import

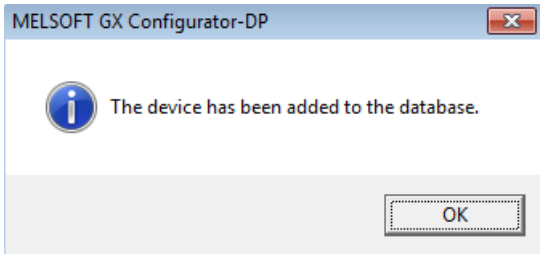
- Select the menu “PROFIBUS Configurator Tasks →Import Tasks→Add GSD File”.



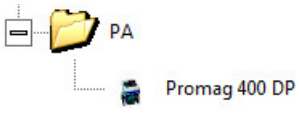
- The browser is opened:
  - Indicate the path of the stored GSD file EH3x1562 (specific to the Promag 400 DP device).
  - Confirm the import request by clicking on the button “Yes”.

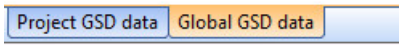


  - If successfully imported, following message is displayed:



The GSD file is now imported in the “Global GSD database” (orange tab).





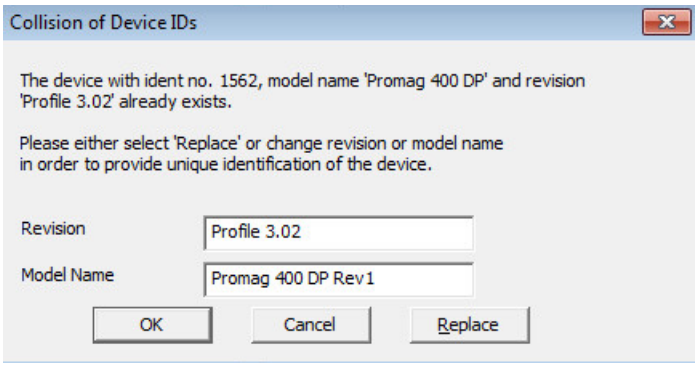
Notes:

- The GSD file is imported automatically in the “Project GSD database” when a new slave is added in the PROFIBUS network.

3.2.2.2 GSD revision installation

The GSD database allows the installation of multiple GSD files revisions but the model name will have to be changed.

- Import the GSD revision file following the same steps as in part “GSD File import”.
- The GSD file is not imported but following window is displayed:

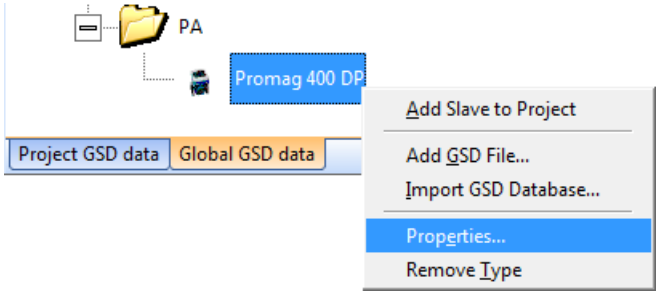


- Change the field “Model Name”.
  For example, give the Model Name “Promag 400 Rev1” and click on the button “OK”.

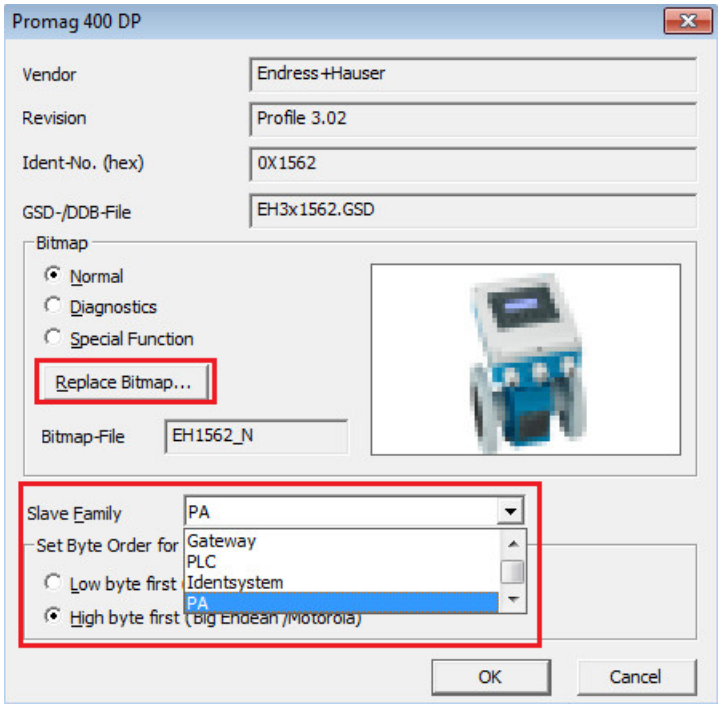
- The GSD file is imported in the GSD Database.

3.2.2.3 GSD slave family structure

- The imported device is symbolized with a bitmap in the “Global GSD database”.
  - Select the tab “Global GSD database”.
  - Right-click and select the field “Properties”.



- Select the desired Slave Family type (PA in this example)



- Select the bitmap case (Normal/Diagnostics/Special Functions) that need to be changed and click on the button "Replace Bitmap" to look for the appropriate bitmap.
- Click on the button "OK" to close the window.

Notes:

- The bitmap change can only be done in the "Global GSD database".

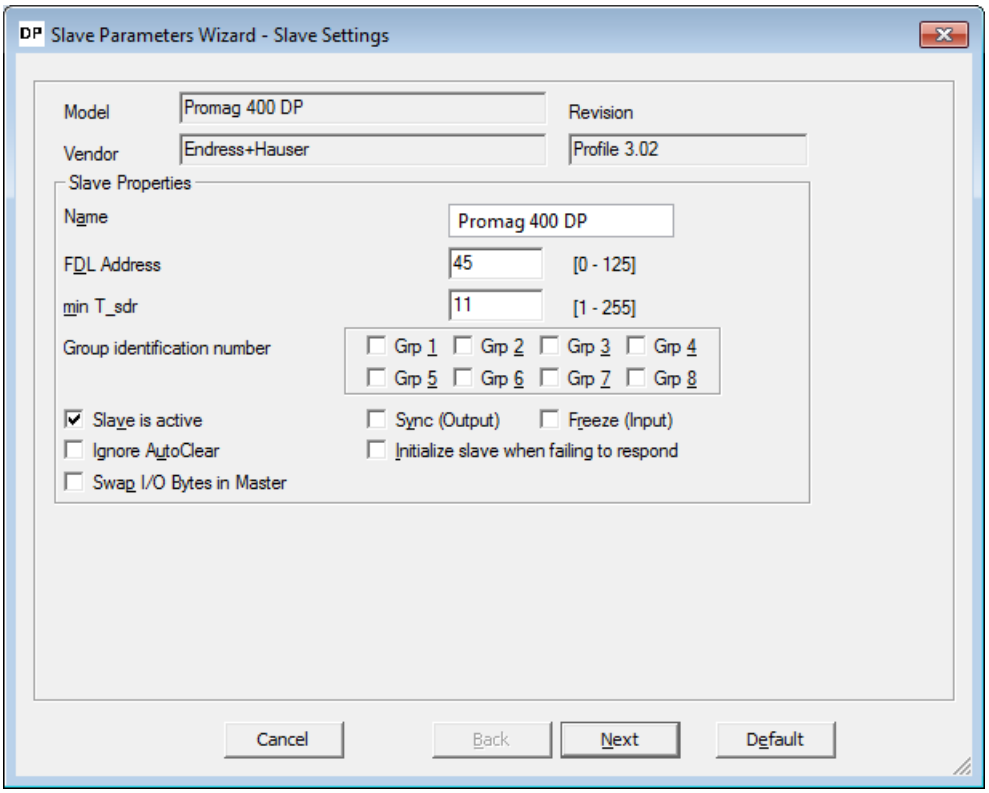
3.2.3 Field Devices Configuration

- In the menu "Global GSD data", select the Promag 400 DP device in the GSD database.
- Drag and drop it in the "PROFIBUS Network" window".

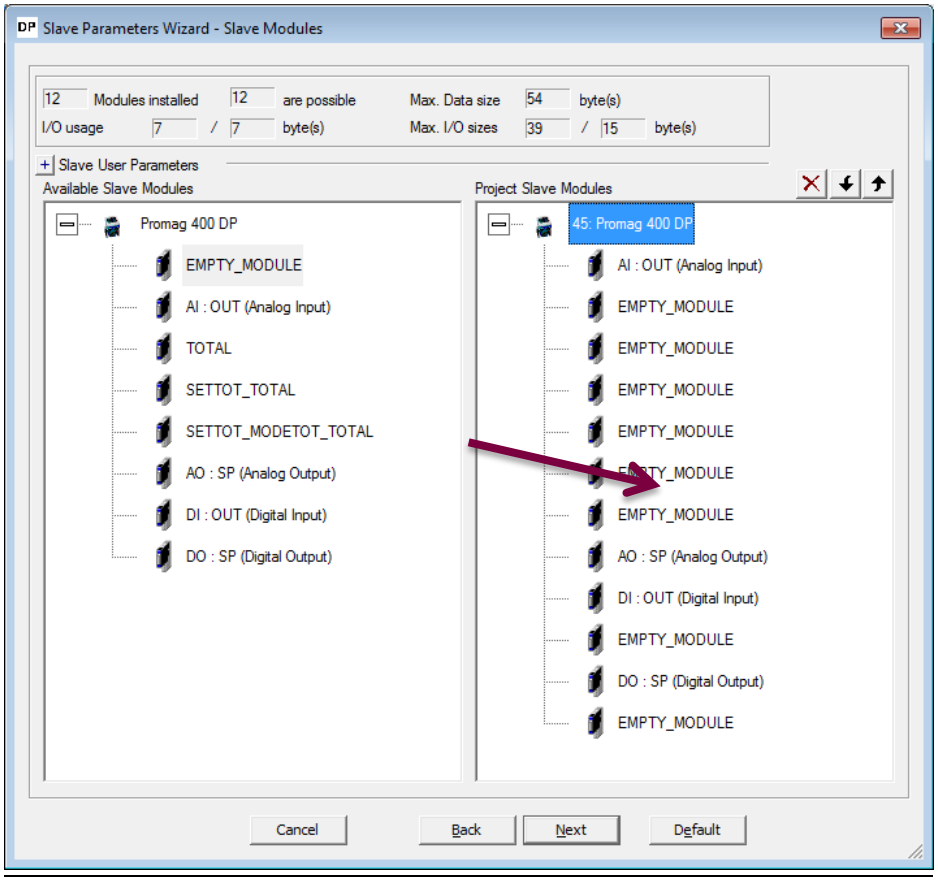
- The slave configuration window is immediately displayed.

In the “Slave Properties” menu:

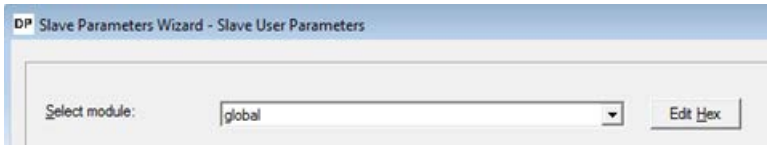
- Specify:
  - The name of the slave: PROMAG 400 DP (specific for this example).
  - The FDL Address : 45 (specific for this example).
  - The parameter “min_T_sdr” is automatically imported.
- Verify that the checkbox “Slave is active” is crossed.
- Click on the button “Next”.



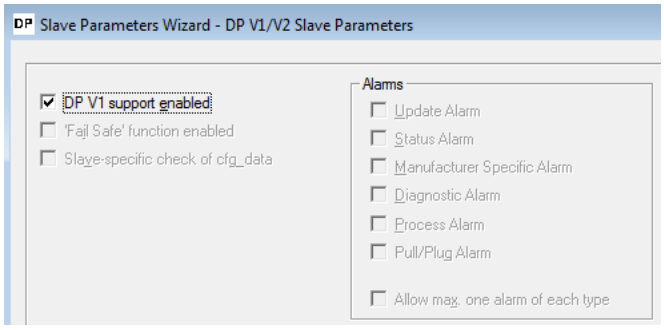
- The next window shows a configuration example of the module(s). Drag and drop following modules from the left to the right window:
  - 1 analog input module in slot 1.
  - 6 empty modules in slots 2,3,4,5,6,7.
  - 1 analog output module in slot 8.
  - 1 digital input module in slot 9.
  - 1 empty module in slot 10.
  - 1 digital output module in slot 11.
  - 1 empty module in slot 12.
  - Click on the button “Next”.



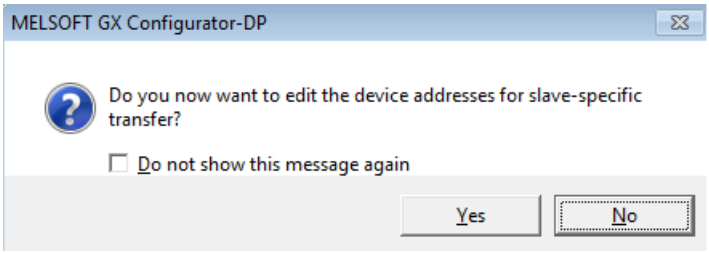
- The window “Slave User Parameters” is displayed:
  - Select the field “global” (specific for this device).
  - Click on the button “Next”.



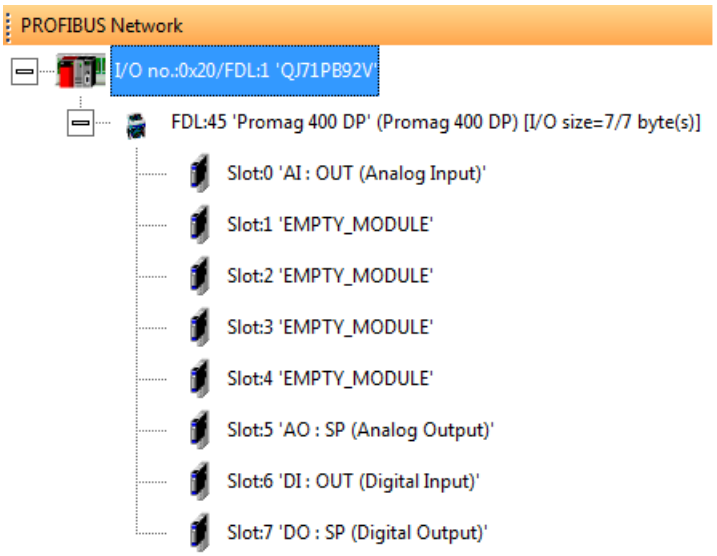
- The window “DPV1/V2 Slave Parameters” is displayed:
  - The checkbox “DP V1 support enabled” is crossed.
  - Click on the button “Finish”.



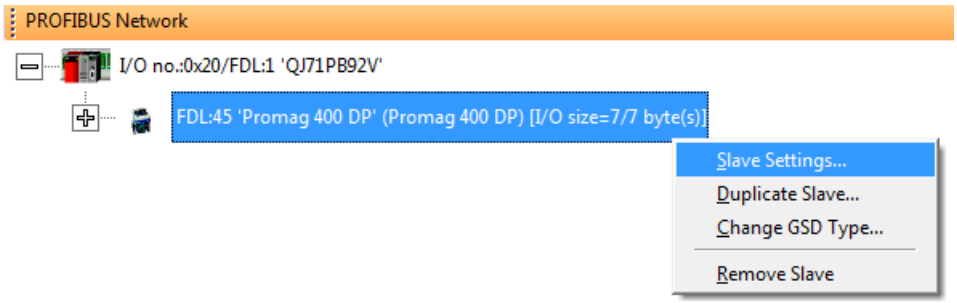
- The following window is displayed. Click on the button “No” (This step will be done after the variables declaration).



- The configured slave is now displayed in the PROFIBUS network.



- All configured slave settings can be updated. Right-click on the slave in the PROFIBUS network view and select the option “Slave Settings”.



Notes :

All information related to the module allocations and slot definitions are described in the GSD file.

- Check the module number definition in the GSD file.

```
Module = "EMPTY_MODULE" 0x00
1
EndModule

Module = "AI : OUT (Analog Input)"  0x42,0x84,0x08,0x05
2
EndModule

Module = "TOTAL " 0x41,0x84,0x85
3
EndModule

Module = "SETTOT_TOTAL " 0xC1,0x80,0x84,0x85
4
EndModule

Module = "SETTOT_MODETOT_TOTAL " 0xC1,0x81,0x84,0x85
5
EndModule

Module = "AO : SP (Analog Output)" 0x82,0x84,0x08,0x05
6
EndModule

Module = "DI : OUT (Digital Input)" 0x91
7
EndModule

Module = "DO : SP (Digital Output)" 0xA1
8
EndModule
```

- Check the module allocation in the GSD file.

```
;***************  Additional keywords for module assignment  **************
SlotDefinition
Slot(1)   = "AI 1 (Analog Input)"       2 1,2
Slot(2)   = "AI 2 (Analog Input)"       2 1,2
Slot(3)   = "AI 3 (Analog Input)"       2 1,2
Slot(4)   = "AI 4 (Analog Input)"       2 1,2
Slot(5)   = "TOT 1 (Totalizer)"         3 1,3,4,5
Slot(6)   = "TOT 2 (Totalizer)"         3 1,3,4,5
Slot(7)   = "TOT 3 (Totalizer)"         3 1,3,4,5
Slot(8)   = "AO 1 (External density)"   6 1,6
Slot(9)   = "DI 1 (Digital Input)"      7 1,7
Slot(10)  = "DI 2 (Digital Input)"      7 1,7
Slot(11)  = "DO 1 (Flow override)"      8 1,8
Slot(12)  = "DO 2 (Start verificat.)"   8 1,8
EndSlotDefinition
```

Allowed modules for each slot

Default module for each slot

Notes:

- A wrong module allocation configuration will not be indicated.
- A wrong configuration can be downloaded in the PLC, but will not be accepted by the field device.

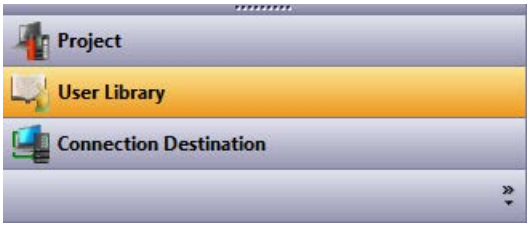
3.3 Mapping of Process Values and Status to Control Strategy

This part describes how to implement the logic which handles PROFIBUS data.

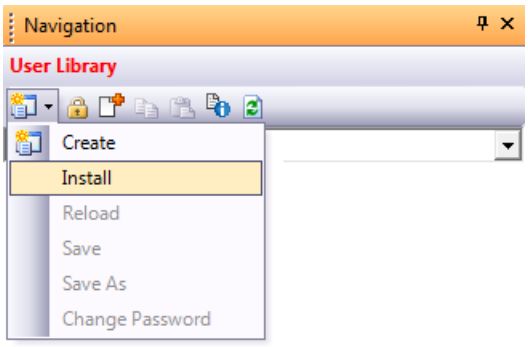
3.3.1 Library import

All pre-defined functions are saved in libraries, which need at first to be installed into the project.

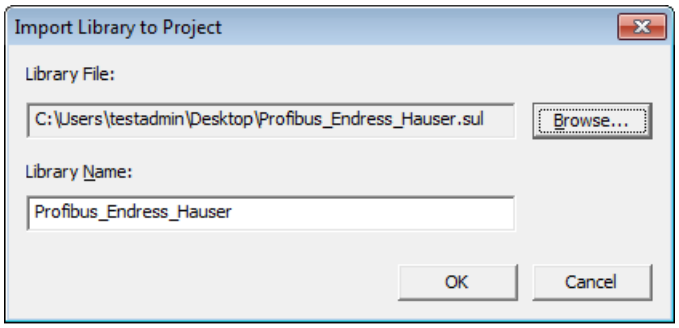
- In the Navigation menu, click on the button “User Library”.



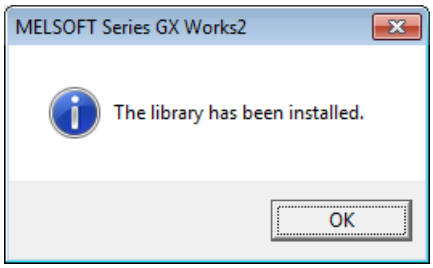
- Select the 1st shortcut in the user library and click on the menu “Install”.



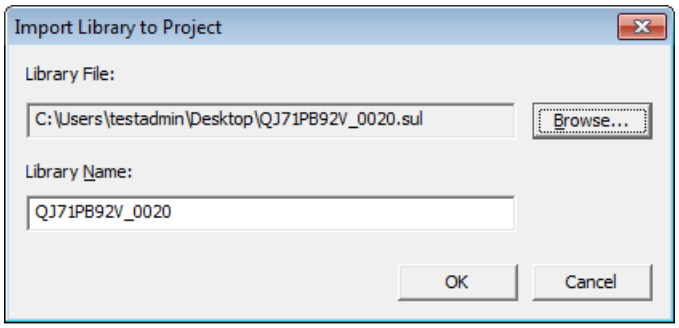
  - Click on the button “Browse” to look for the library “Profibus_Endress_Hauser”.
  - Click on the button “OK”.



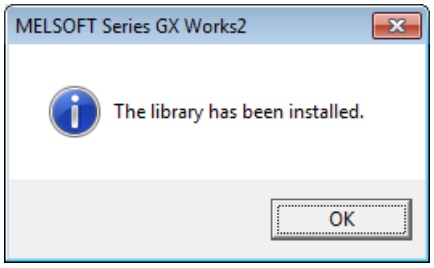
- Message is displayed when the library is installed.



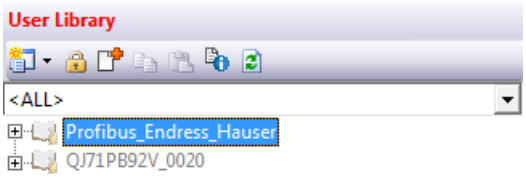
- Select the 1st shortcut in the user library and click on the menu “Install”.
  - Click on the button “Browse” to look for the library “QJ71PB92V_0020”.
  - Click on the button “OK”.



- Message is displayed when the library is installed.



- Both libraries are now part of the project.



3.3.2 Create a program

This part describes how to create a program, insert a function block and assign the corresponding variables.

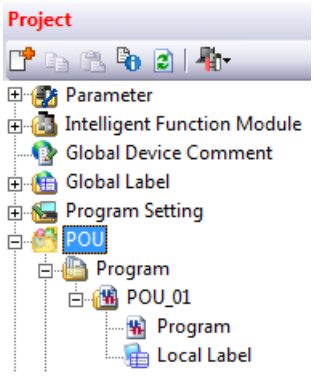
This example describes four function blocks used in the communication between PLC and device:

- Function block reading an analog input called “DP_to_Float_with_Status”.
- Function block reading a digital input called “DP_to_Inputs_1xbyte_Stat_1xbyte”.
- Function writing an analog output called “Float_to_DP”.
- Function writing a digital output called “Outputs_1xbyte_Stat_1xbyte_to_DP”.

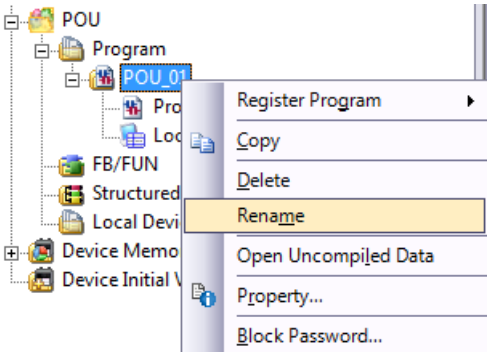
3.3.2.1 Reading functions

3.3.2.1.1 POU Configuration

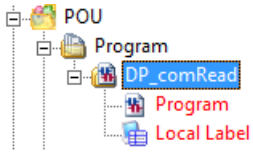
- In the Project view, expand the “POU” part.



- Right-click on the program “POU_1” and select the menu “Rename”



- Enter the new program name “DP_comRead”.

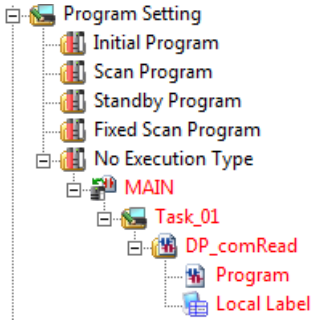


Notes:

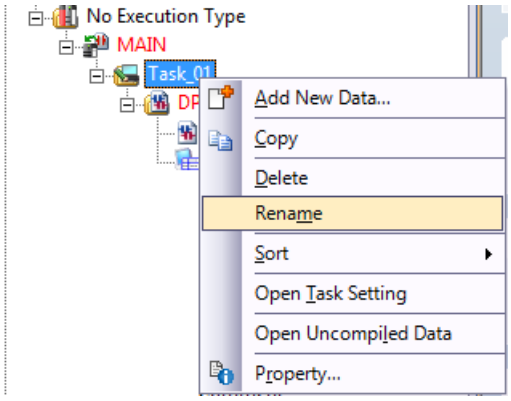
- The new configuration is written in red because it still has not been compiled.

3.3.2.1.2 Program Setting Configuration

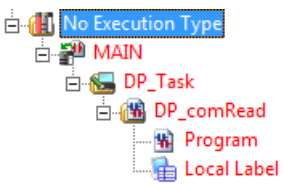
- Expand the menu “Program Setting→No Execution Type”.



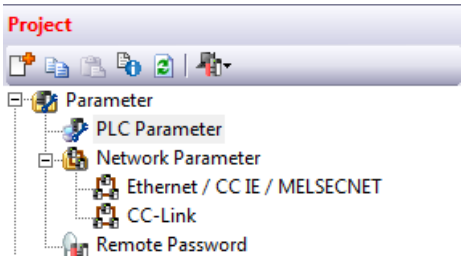
- Right-click on the task “Task_01” and select the menu “Rename”.



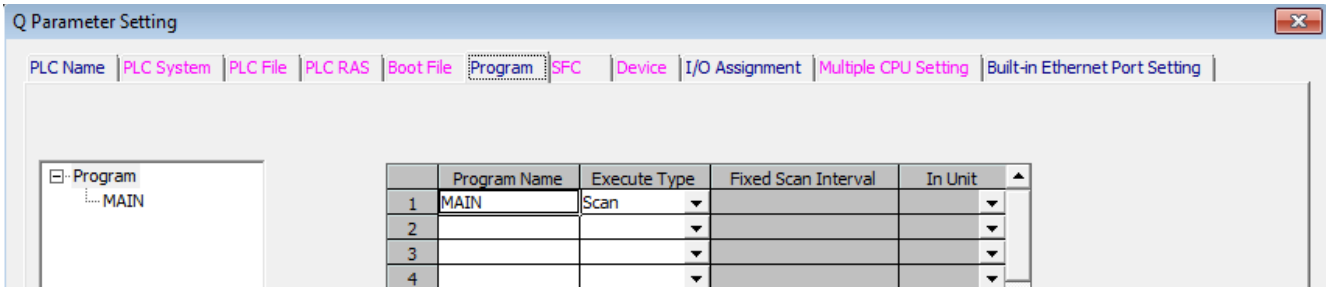
- Enter the new name “DP_Task”.



- In the project view, double-click on the menu “Parameter →PLC Parameter”.



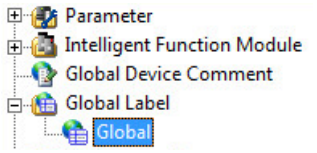
- In the “Q Parameter Setting” window, open the tab “Program”.
  - Select the program “MAIN” and click on the button “Insert”.
  - Select “Scan” in the field “Execute Type”.
  - Click on the button “End”.



3.3.2.1.3 Variables declaration

In the following example, variables have been declared in Global and Local type.

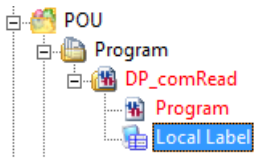
- In the Project view, double-click the menu “Global Label→Global”.



- Declare the required function blocks global variables.
  For each variable, specify the fields Class, Label Name, data Type and Device.

	Class	Label Name	Data Type		Constant	Device	Address
1	VAR_GLOBAL	Promag400_AI1_startAddress	Word[Signed]	...		D1250	%MW0.1250
2	VAR_GLOBAL	Promag400_AI1_status	Bit	...		M3250	%MX0.3250
3	VAR_GLOBAL	Promag400_AI1_value	FLOAT (Single Precision)	...		D3250	%MD0.3250
4	VAR_GLOBAL	Promag400_DI1_startAddress	Word[Signed]	...		D1252	%MW0.1252
5	VAR_GLOBAL	Promag400_DI1_status	Bit	...		M3255	%MX0.3255
6	VAR_GLOBAL	Promag400_DI1_value	Word[Signed]	...		D3256	%MW0.3256

- In the Project view, double click the menu “POU→Program→DP_comRead → LocalLabel”.

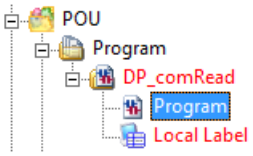


  - Declare the required local variables related to the function blocks:
    - The label Promag400_AI1 corresponds to the function block Analog Input.
    - The label Promag400_DI1 corresponds to the function block Digital Input.

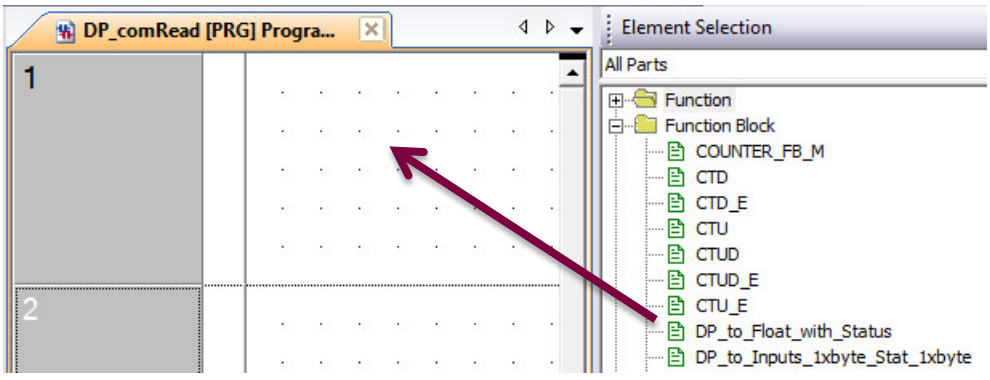
	Class	Label Name	Data Type
1	VAR	Promag400_AI1	DP_to_Float_with_Status
2	VAR	Promag400_DI1	DP_to_Inputs_1xbyte_Stat_1xbyte

3.3.2.1.4 Analog Input function programming

- Double-click on “Program” in the menu “POU→ Program → DP_comRead”. This opens the program page.

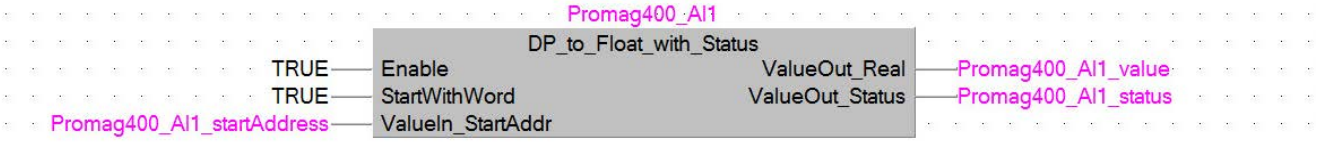


- Drag and drop the analog input function block “DP_to_Float_with_Status” from the “Function Block” library to the program window.



- Rename the function block with the name “Promag400_AI1” (reference to the defined local variable).

- Assign the defined global variables to the function block.

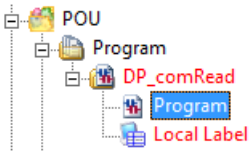


Notes:

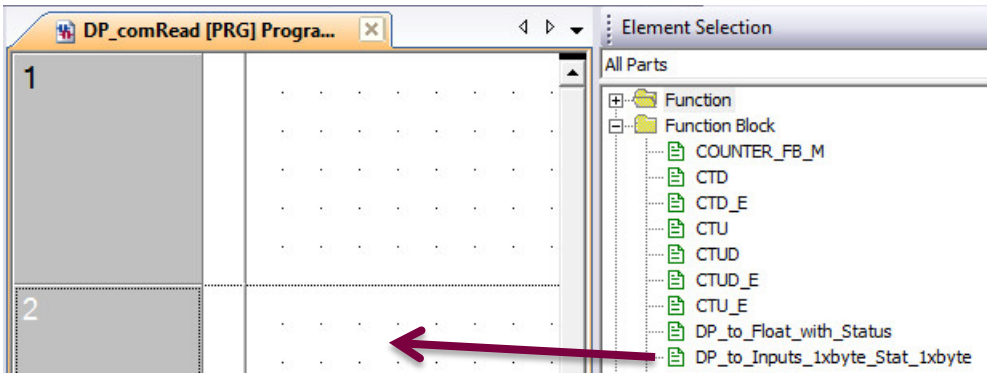
- The function block parameter “StartWithWord” needs to be set to the state “TRUE” because it is the first input module.
- Analog inputs are coded on 5 bytes (4 bytes data + 1 byte status).

3.3.2.1.5 Digital Input function programming

- Double-click on “Program” in the menu “POU→ Program → DP_comRead”. This opens the program page.

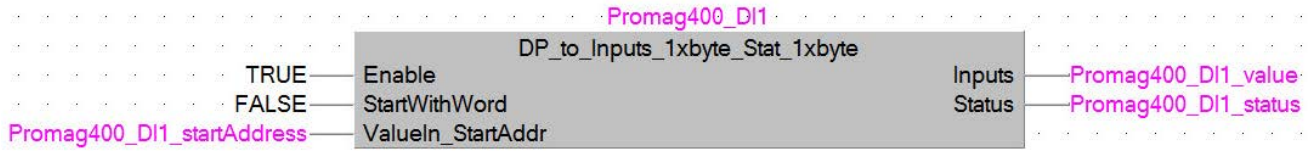


- Drag and drop the analog input function block “DP_to_Inputs_1xbyte_Stat_1xbyte” from the “Function Block” library to the program window.



- Rename the function block with the name “Promag400_DI1” (reference to the defined local variable).

- Assign the defined global variables to the function block.



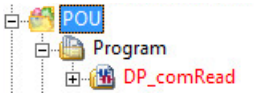
Notes:

- Digital inputs are coded on 2 bytes (1 byte data + 1 byte status).
- The function block parameter “StartWithWord” needs to be set to the state “FALSE” because of the first module which is an analog input (coded on 5 bytes).

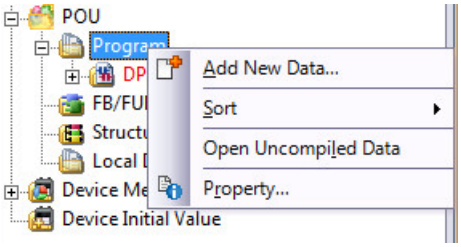
3.3.2.2 Writing functions

3.3.2.2.1 POU Configuration

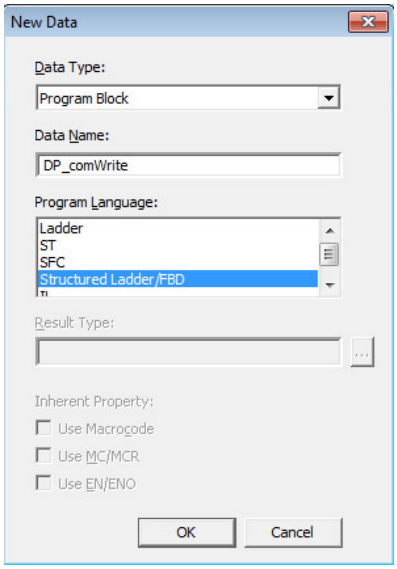
- In the Project view, expand the “POU” part.



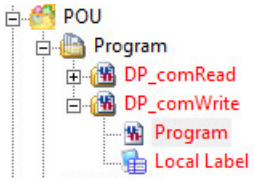
- Right-click on “Program” and select the menu “Add New Data”.



- The following window is displayed.
  - In the field “Data Name”, enter the new program name “DP_comWrite”.
  - Click on the button “OK”.

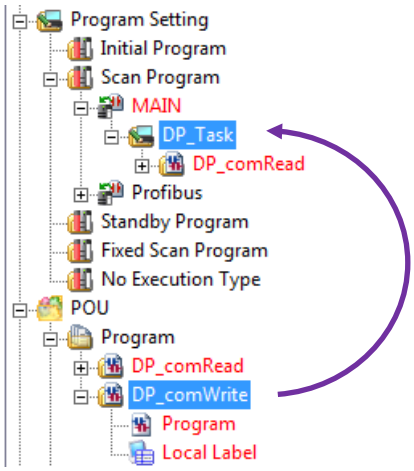


- The new part “DP_comWrite” has been added.

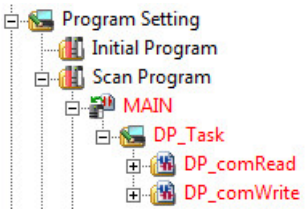


3.3.2.2.2 Program Setting Configuration

- Select the menu “DP_comWrite” in the part “POU→Program”.
- Drag and drop it in the part “Scan Program→MAIN→DP_Task” in order to be registered in the program.



- The new part is added in the “DP_Task”.



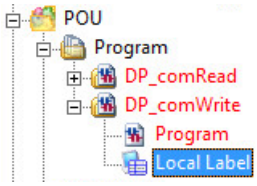
3.3.2.2.3 Variables declaration

In the following example, variables have been declared in Global and Local type.

- In the Project view, double click on the field “Global”.
  - Declare the required function blocks global variables.
    For each variable, specify the fields Class, Label Name, Data Type and Device.

	Class	Label Name	Data Type		Constant	Device	Address
7	VAR_GLOBAL	Promag400_AO1_startAddress	FLOAT (Single Precision)	...		D4000	%MD0.4000
8	VAR_GLOBAL	Promag400_AO1_value	Word[Signed](0..2)	...		D5000	%MW0.5000
9	VAR_GLOBAL	Promag400_DO1_startAddress	Word[Signed]	...		D4002	%MW0.4002
10	VAR_GLOBAL	Promag400_DO1_value	Word[Signed]	...		D5002	%MW0.5002

- In the Project view, select the menu “POU→Program→DP_comWrite → LocalLabel” to declare following local variables.

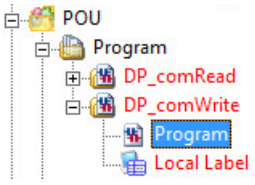


  - Declare the required local variables related to the function blocks:
    - The label Promag400_AO1 corresponds to the function block Analog Output.
    - The label Promag400_DO1 corresponds to the function block Digital Output.

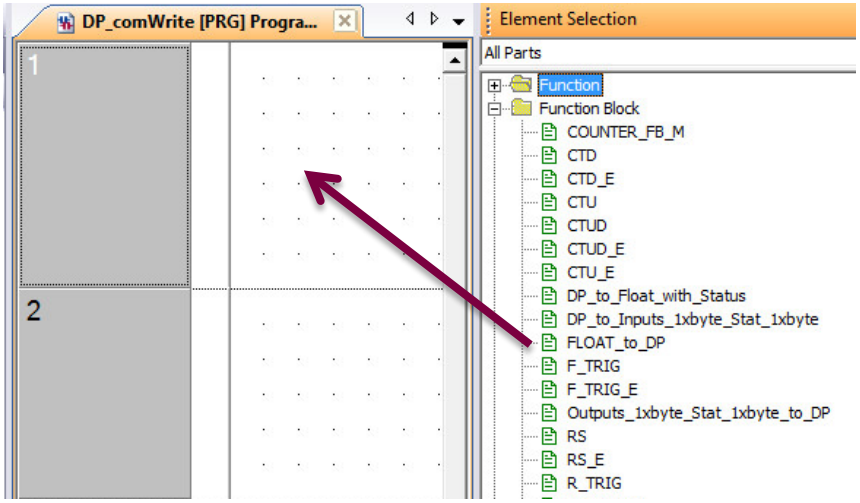
	Class	Label Name	Data Type
1	VAR	Promag400_AO1	FLOAT_to_DP
2	VAR	Promag400_DO1	Outputs_1xbyte_Stat_1xbyte_to_DP

3.3.2.2.4 Analog Output function programming

- Double-click on “Program” in the menu “POU→ Program → DP_comWrite”. This opens the program page.

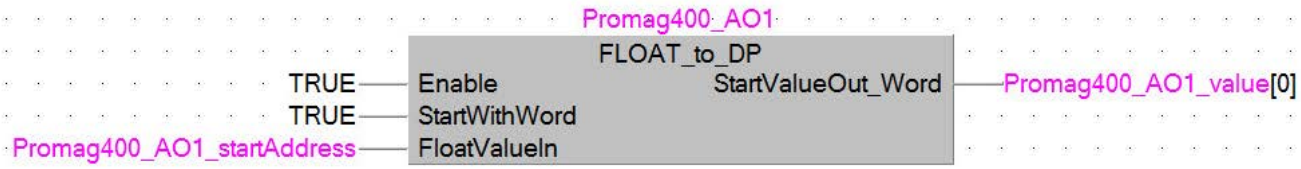


- Drag and drop the analog output function block “Float_to_DP” from the “Function Block” library to the program window.



- Rename the function block with the name “Promag400_AO1” (reference to the defined local variable).

- Assign the defined global variables to the function block.

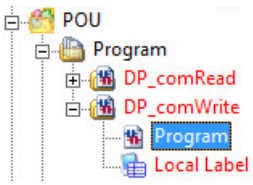


Notes:

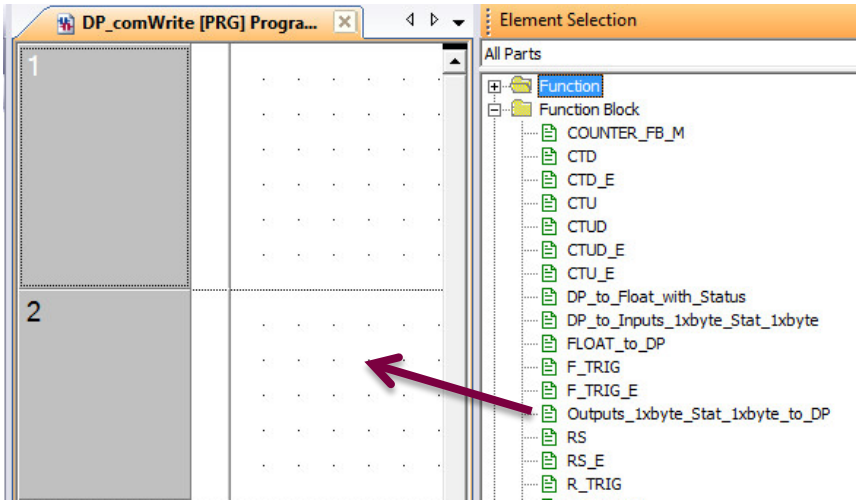
- Analog outputs are coded on 5 bytes (4 bytes data + 1 byte status)
- The index “[0]” needs to be indicated for the variable “Promag400_AO1_value”.
- The function block parameter “StartWithWord” needs to be set to the state “TRUE” because it is the first output module.

3.3.2.2.5 Digital Output function programming

- Double-click on “Program” in the menu “POU→ Program → DP_comWrite”. This opens the program page.

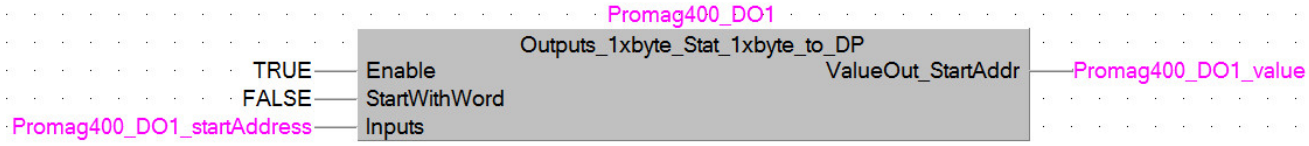


- Drag and drop the analog output function block “Outputs_1xbyte_Stat_1xbyte_to_DP” from the “Function Block” library to the program window.



- Rename the function block with the name “Promag400_DO1” (reference to the defined local variable).

- Assign the defined global variables to the function block.



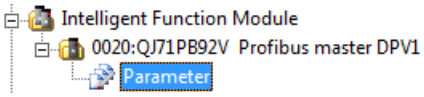
Notes:

- Digital outputs are coded on 2 bytes (1 byte data + 1 byte status)
- The function block parameter “StartWithWord” needs to be set to the state “FALSE” because of the first module which is an analog output (coded on 5 bytes).

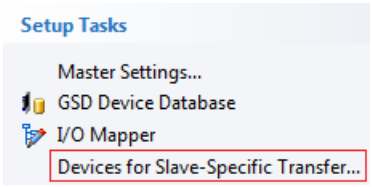
3.3.3 Specific slave buffer device

This part explains how to address the inputs/outputs addresses to the PROFIBUS slave device.

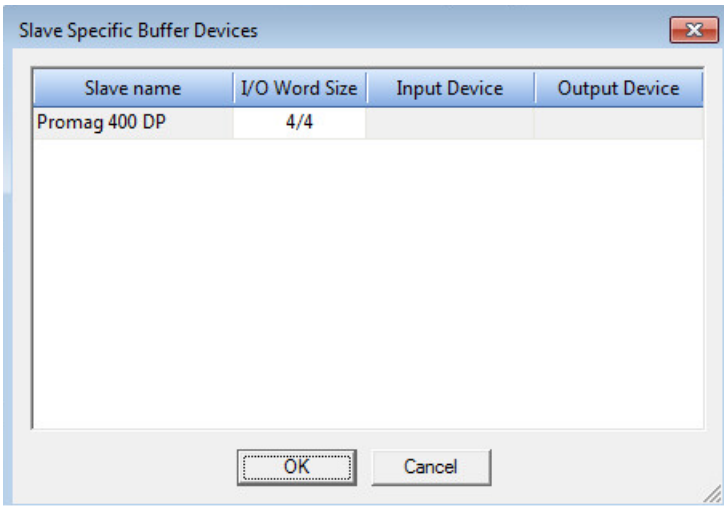
- In the Project view, double-click on the menu “0020:QJ71PB92V →Parameter”.



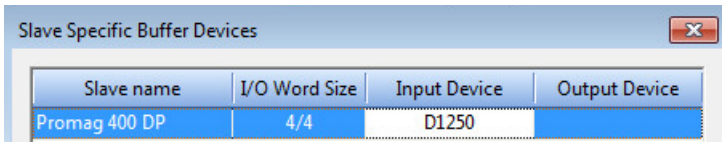
- Select the menu “Setup Tasks→Devices for Slave-Specific Transfer …” .



- Following window is displayed:

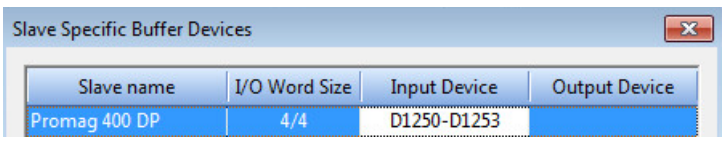


  - Click on the field "Input Device" and set the address D1250.

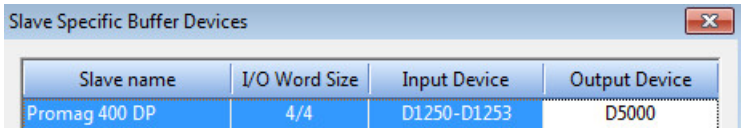


    - In this example, the start address is D1250 which corresponds to the global variable "Promag400_AI1_startAddress" assigned to the first configured input module.

    - The field is automatically updated according to the amount of configured inputs modules (1 Analog Input + 1 Digital Input in this case).

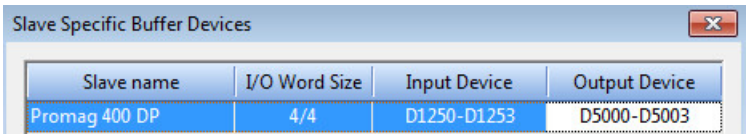


- Click on the field “Output Device” and set the address D5000.



  - In this example, the start address is D5000 which corresponds to the global variable “Promag400_AO1_startAddress” assigned to the first configured output module.

  - The field is automatically updated according to the amount of configured outputs modules (1 Analog Output + 1 Digital Output in this case).



- Click on the button “OK” to close the window.

3.4 Commissioning of the Control Project

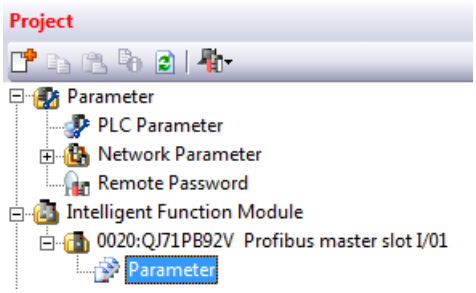
This part describes the POU generation, the program compilation and download.

3.4.1 POU Generation

3.4.1.1 POU Generation steps

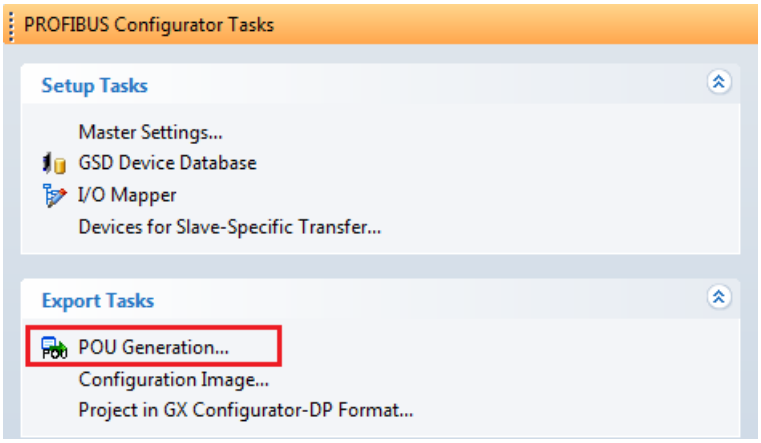
This part must be executed as soon as any changes have been done in the Field Network configuration.

- In the Project view, double-click on the PROFIBUS module menu “0020:QJ71PB92V→Parameter”.

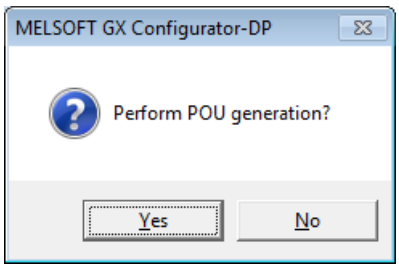


- The tab 0020:QJ71PB92V is opened.

- Select the menu “PROFIBUS Configurator Tasks →Export Tasks→POU Generation”.



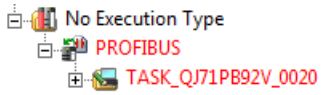
  - The following window is displayed:



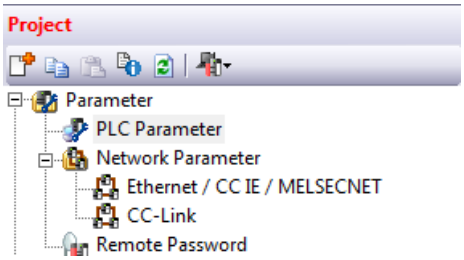
- Click on the button "Yes" to execute the task.
- There is no message when the task is finished. The previous window is just closed.

3.4.1.2 POU generated PROFIBUS task

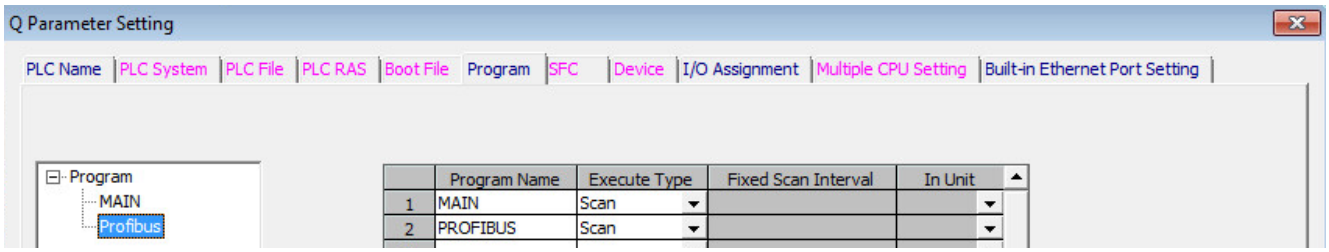
- During the first POU generation, the PROFIBUS tasks of the library "QJ71PB92V_0020" have been assigned automatically in the field "No Execution Type".



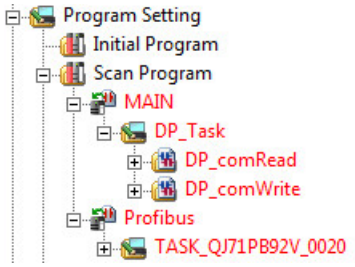
- In the project view, double-click on the menu "Parameter →PLC Parameter".



- In the "Q Parameter Setting" window, open the tab "Program".
  - Select the program "PROFIBUS" and click on the button "Insert".
  - Select "Scan" in the field "Execute Type".
  - Click on the button "End".



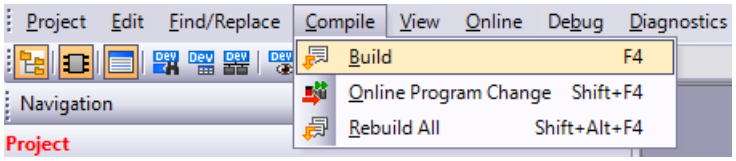
- In the Project view, the part PROFIBUS has been moved to "Scan Program".



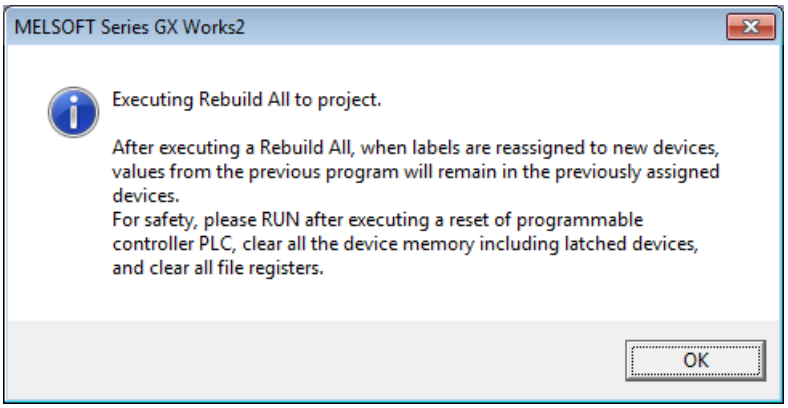
- These steps need to be done once.

3.4.2 Program compilation

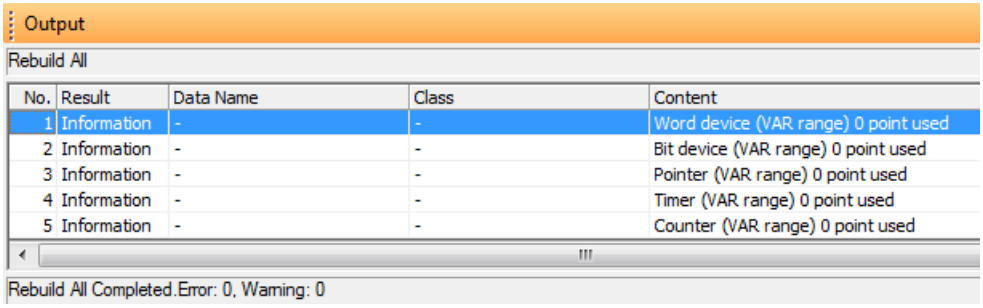
- Select the menu “Compile → Build”.



  - o A “Rebuild All” can be requested to convert and compile all data (programs, structured data, labels, functions, function blocks)
  - o Click on the button “OK” to continue.



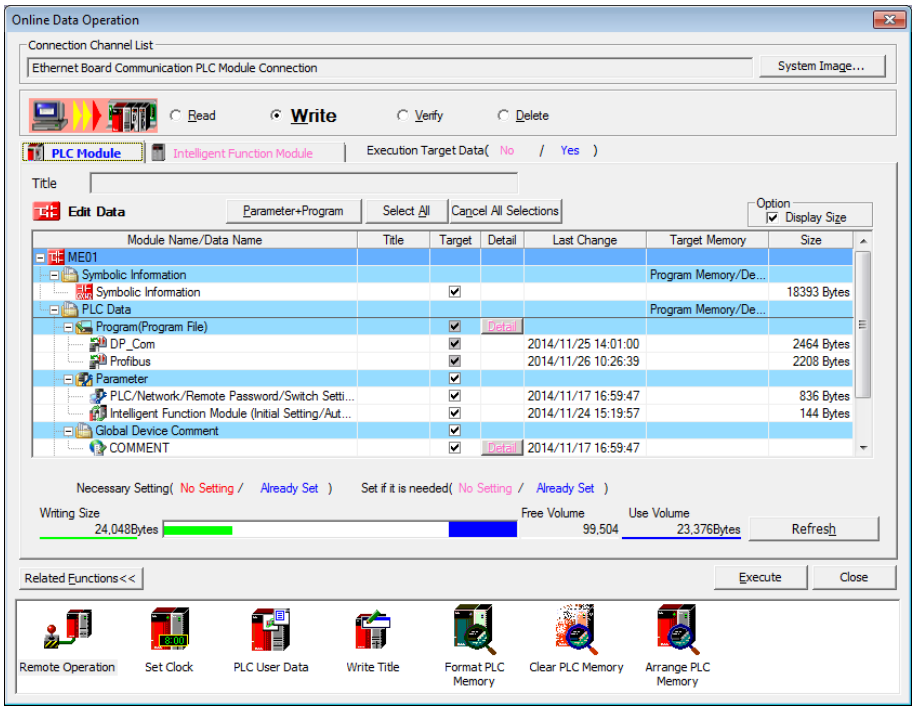
- The compilation results are displayed in the window “Output”.
  In this case, there are 0 Errors and 0 Warnings.



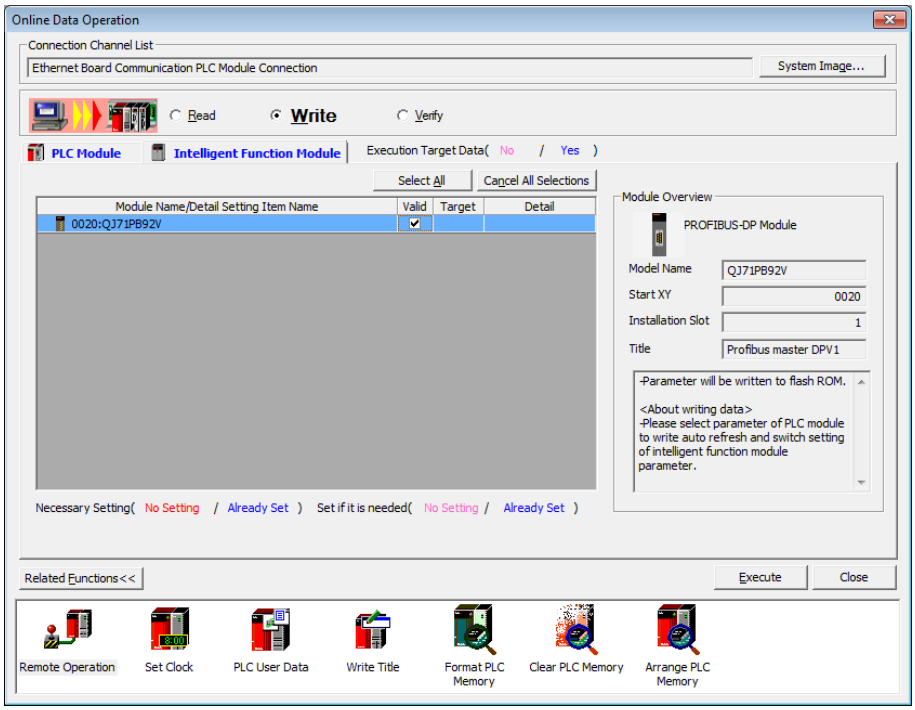
3.4.3 Program Download

- Select the menu “Online → Write to PLC”.

- In the Tab “PLC Module”, click on the button “Select All” to cross check all targets.

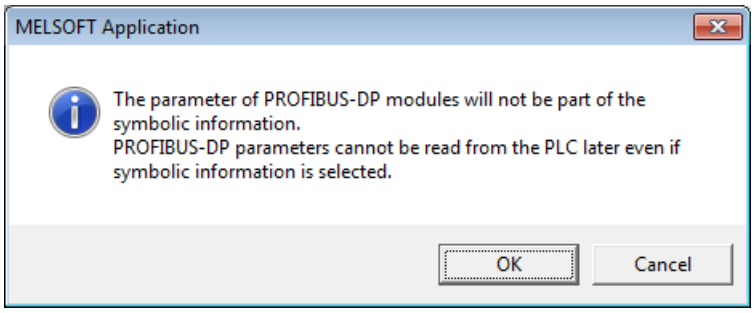


- In the Tab “Intelligent Function Module”, click on the button “Select All” to cross check all targets.

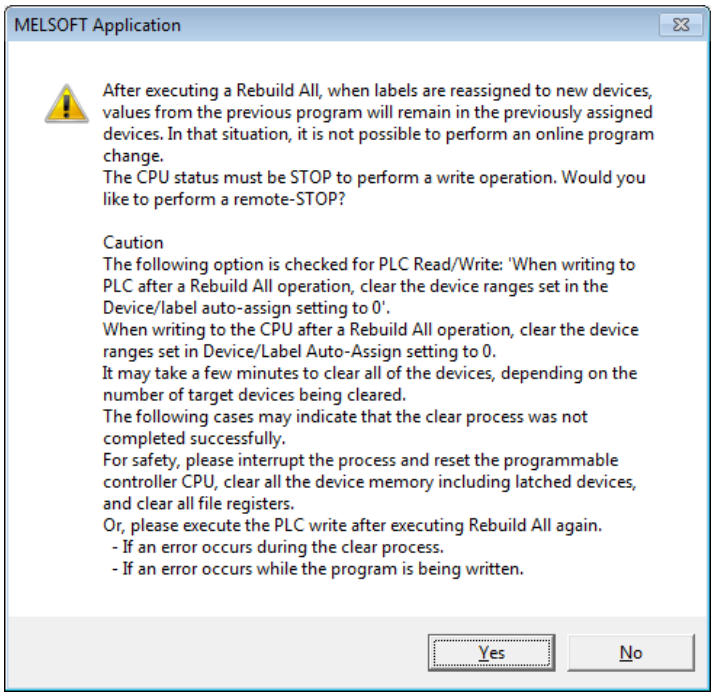


- Click on the button “Execute”.

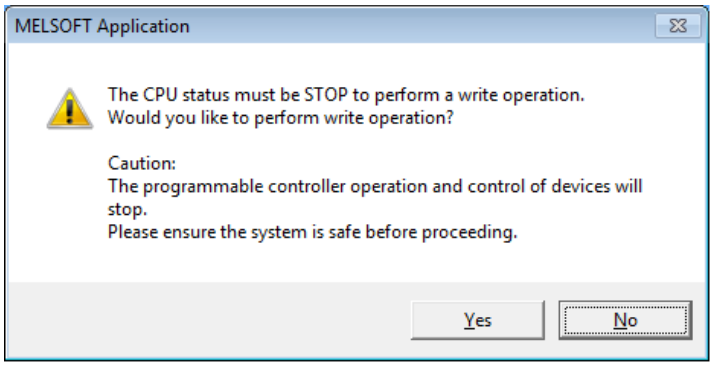
- Following window may be displayed. Click on the button “OK”.



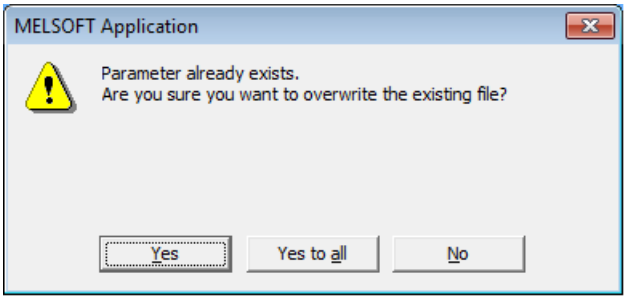
- When a “Rebuild All” has been executed, following window may be displayed. Click on the button “Yes”.



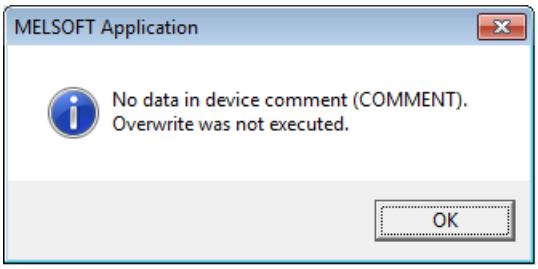
- Warning message is displayed. Click on the button “Yes” to continue.



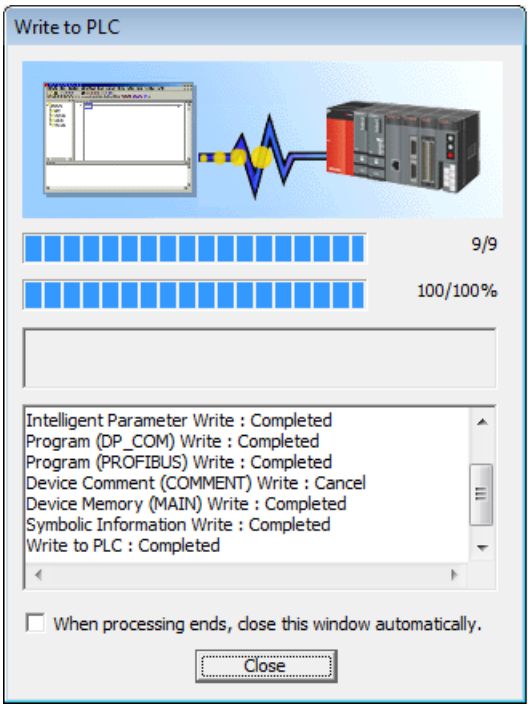
- If some programs have already been downloaded in the PLC, following message is displayed. Click on the button “Yes to all”.



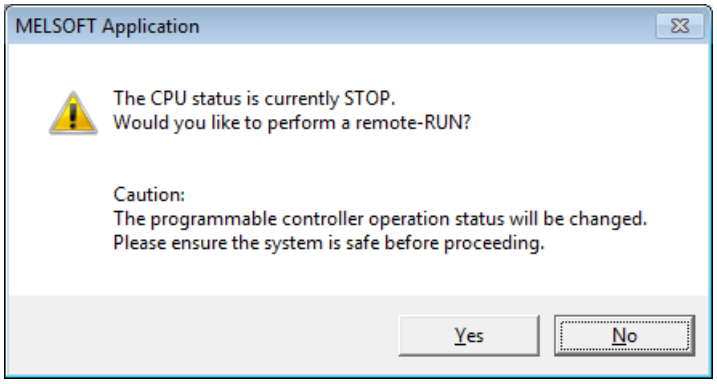
- Following warning is displayed during the download. Click on the button “OK” to continue.



- Status message “Write to PLC: Completed” is displayed when the download is completed. Click on the button “Close”.



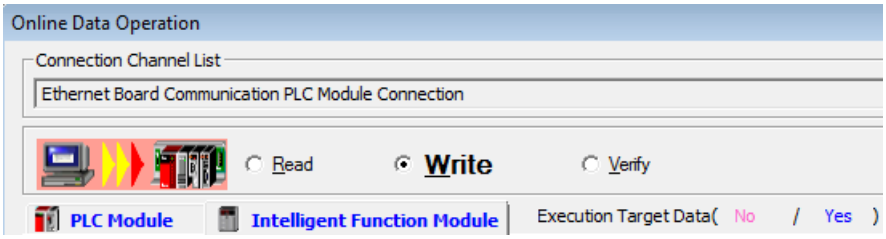
- Click on the button "Yes" to start the CPU.



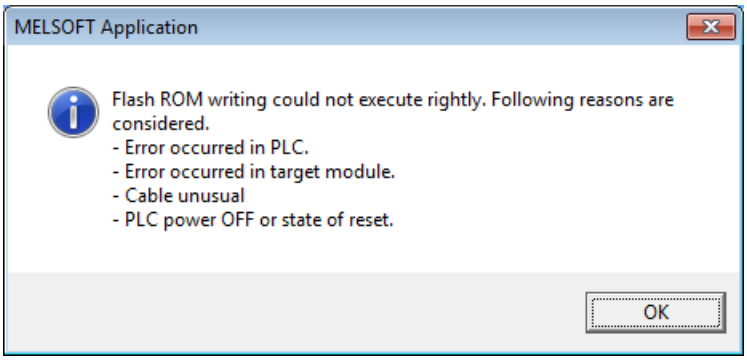
- Click on the button "Close" to close the window "Online Data Operation".

Notes:

- It is possible to download separately the part "PLC Module" and "Intelligent Function Module".



- If an error is occurring during the writing as described on the following window:



1. Download only the part "PLC module".
2. Reset the PLC.
3. Download only the part "Intelligent Function Module".

3.5 Monitoring of Process Values and Status Information

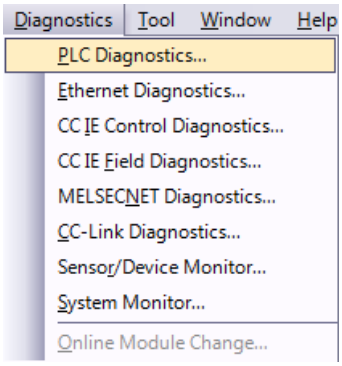
This part describes some tools, which are useful once the PLC is in Run operating mode for checking hardware status or online variables values.

3.5.1 Diagnostics

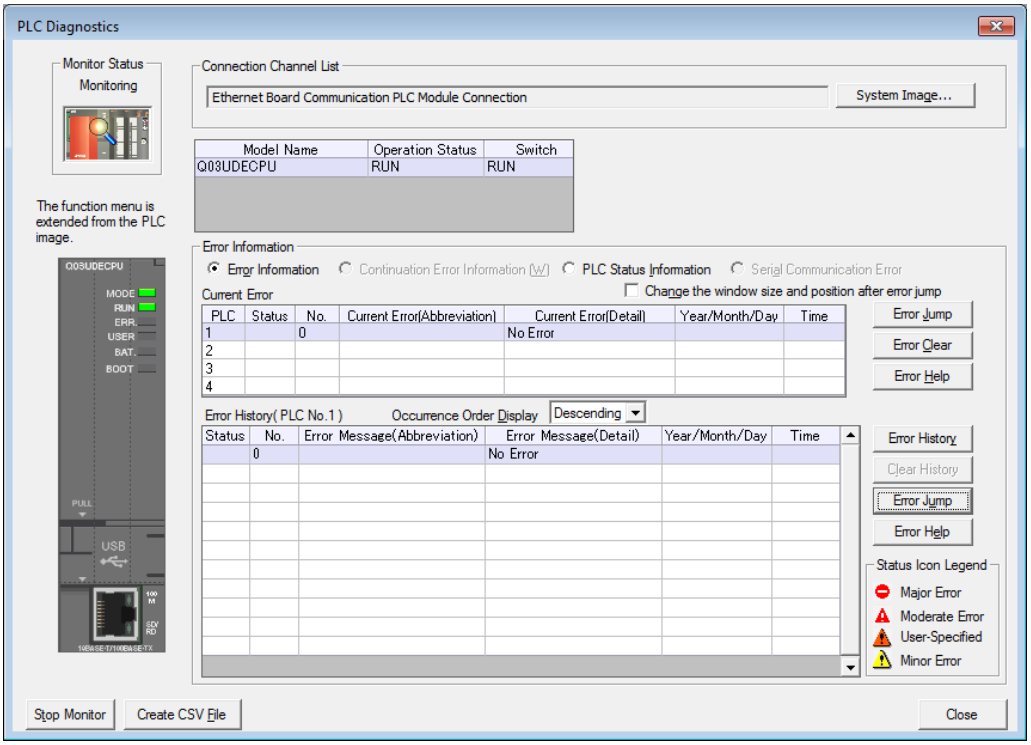
3.5.1.1 PLC diagnostics

The diagnostic function “PLC Diagnostics” displays the PLC status/errors.

- In the Project view, select the menu “Diagnostics → PLC Diagnostics”.



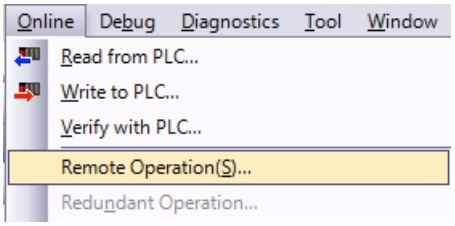
- No errors detected in the following window.



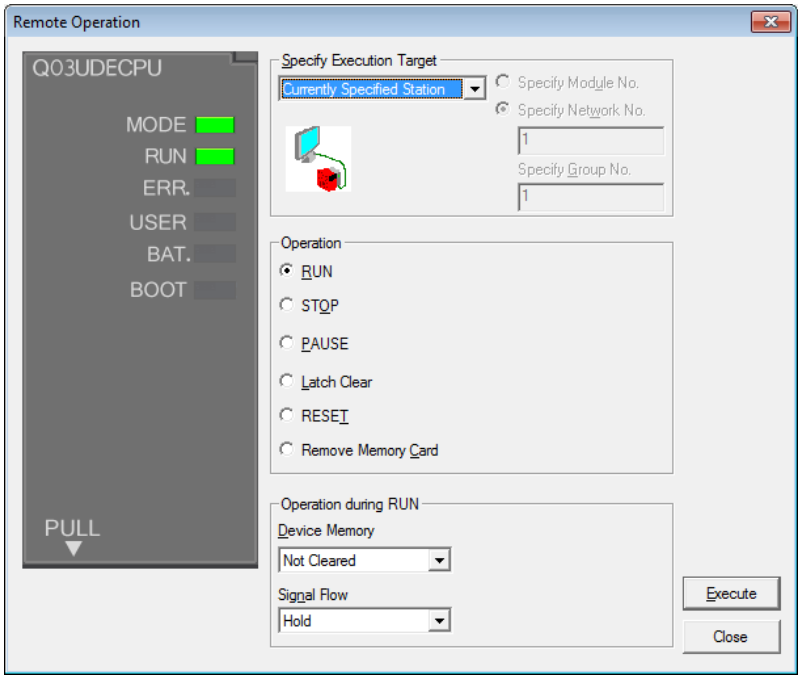
3.5.1.1.1 PLC Remote Operation

The “PLC Remote Operation “window allows the operator to change the PLC operation mode.

- Select the menu “Online → Remote Operation(S)”.



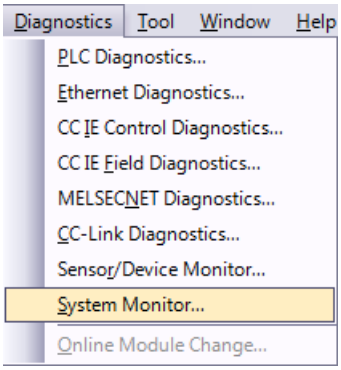
- The “Remote Operation” window is displayed.
  - Select the requested Operation mode and click on the button “Execute”.
  - Click on the button “Close” to close the window.



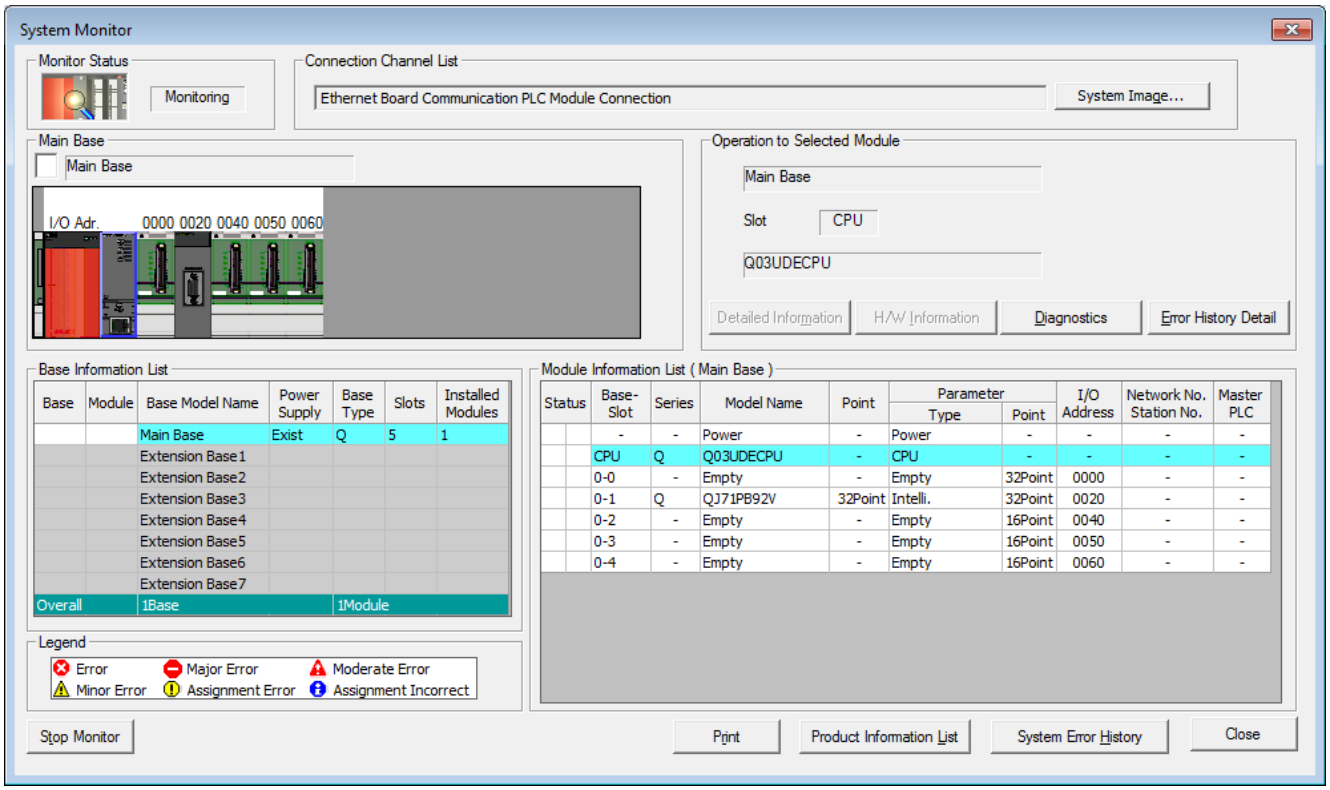
3.5.1.1.2 PLC System monitor

The diagnostic function “System Monitor” gives status of all hardware parts of the Mitsubishi environment.

- Select the menu “Diagnostics → System Monitor”.



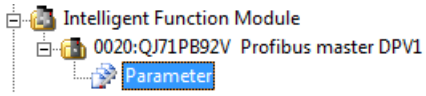
- No errors detected in the configured hardware environment.



3.5.1.2 PROFIBUS slave diagnostics

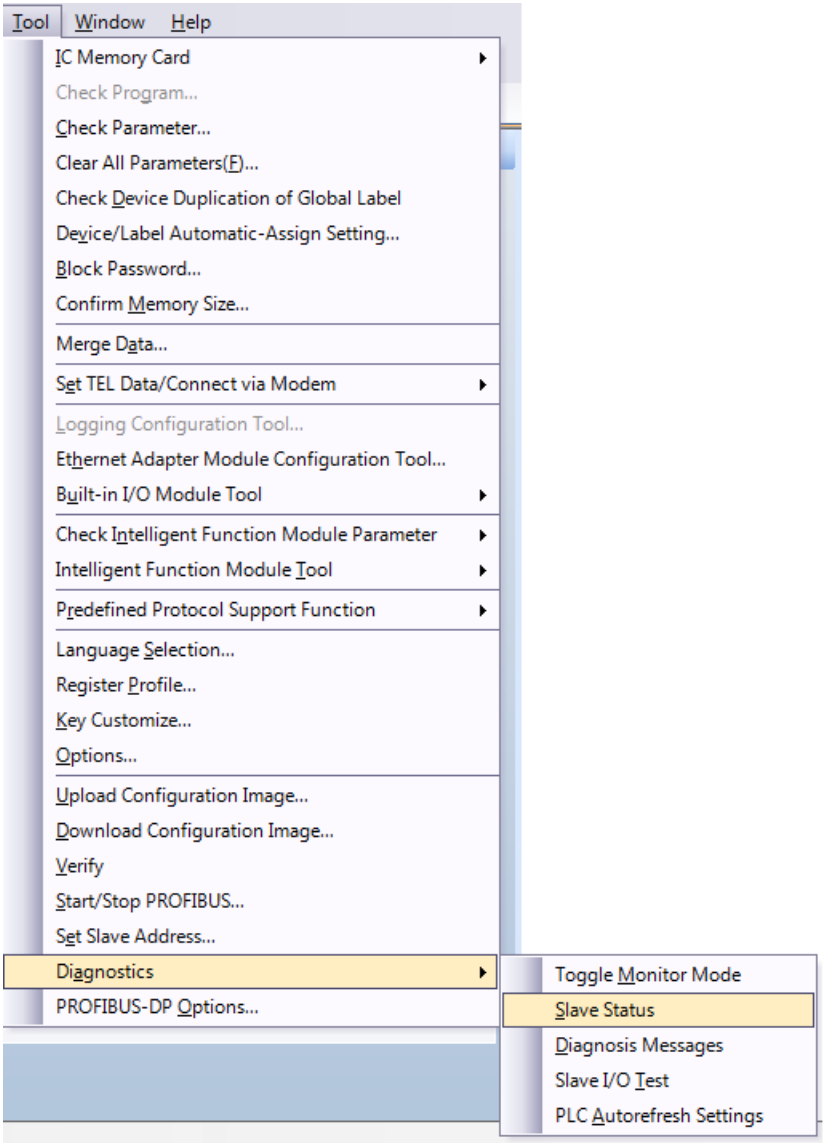
Some functions are available to check status of PROFIBUS devices.

- Double-click on the menu “0020:QJ71PB92V → Parameter”.



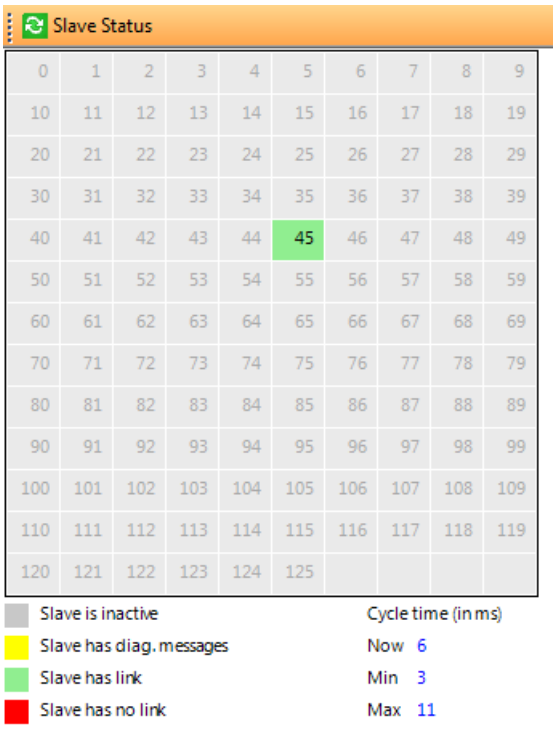
- The Tab “0020:QJ71PB92V” must be opened in order to display the Diagnostics function in tool menu.

- Select the menu “Tool → Diagnostics → Slave Status”.

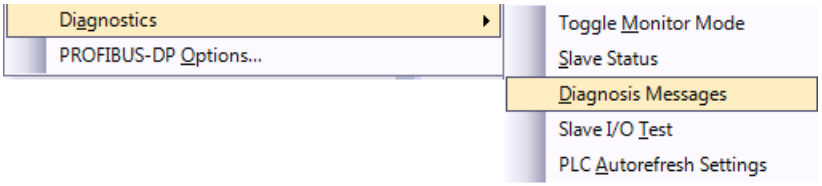


- The window “Slave Status” is displayed.

In this example, the Promag 400 DP has the address 45 and is active.



- If some errors are detected, open the menu "Tool → Diagnostics → Diagnosis Messages" to see the corresponding messages.

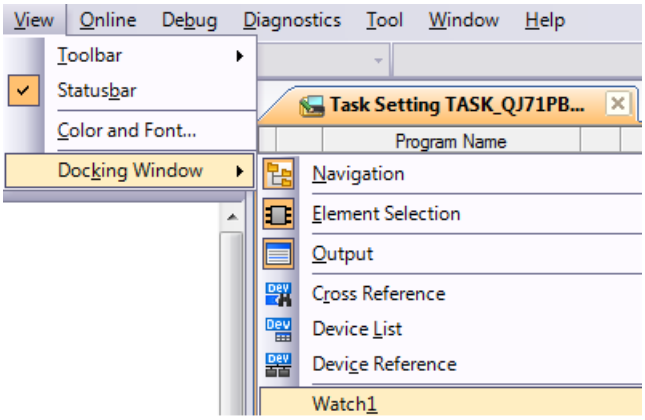


3.5.2 Online monitoring

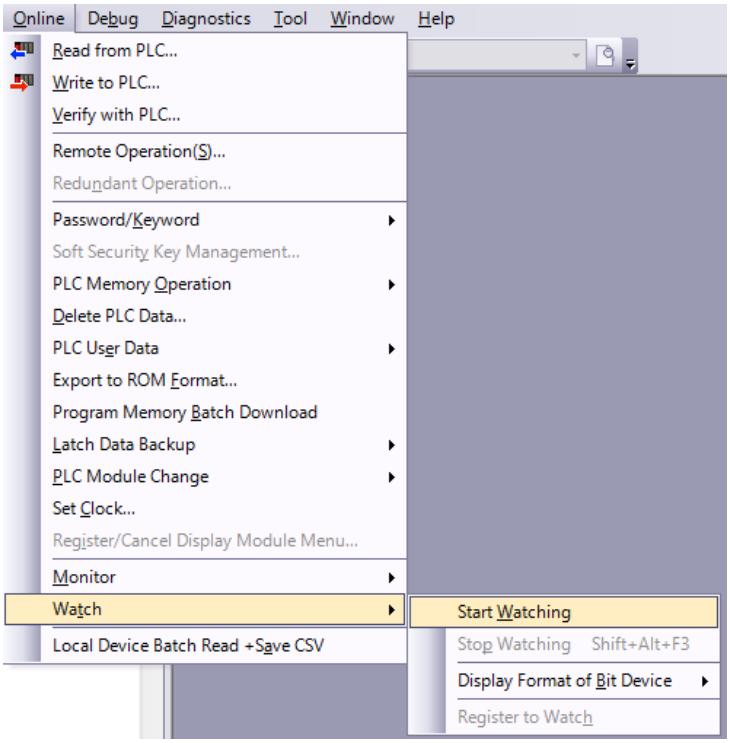
The online monitoring functions as “Watch” or “Monitoring” are used to check variables in online mode.

3.5.2.1.1 Online variable watch function

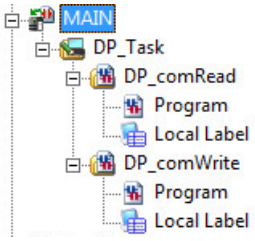
- Select the menu “View → Docking Window → Watch1 to open the Watch window.



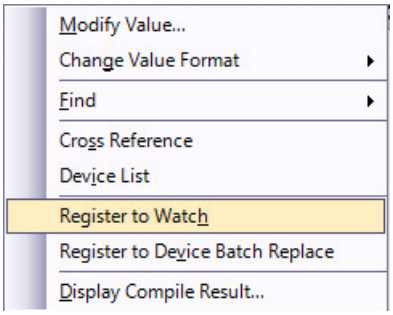
- Select the menu “Online → Watch → Start Watching” to start the function.



- Add and check the declared variables in the Watch1 window.
    - To add a variable in the Watch1 window:
        - Open the pages “DP_comRead→Program”and “DP_comWrite→Program”.



        - Right-click on the desired variables and select the menu “Register to Watch”.



    - Added variables in the Watch window

Watch 1(Monitor Executing)

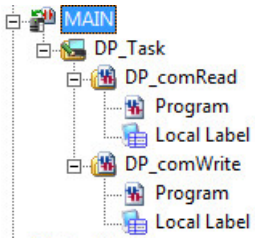
Device/Label	Current Value	Data Type	Class	Device	Address
Promag400_AI1_startAddress	H3047	Word[Signed]	VAR_GLOBAL	D1250	%MW0.1250
Promag400_AI1_value	45304.9023438	FLOAT (Single Precision)	VAR_GLOBAL	D3250	%MD0.3250
Promag400_AI1_status	H01	Bit	VAR_GLOBAL	M3250	%MX0.3250
Promag400_DI1_startAddress	H0180	Word[Signed]	VAR_GLOBAL	D1252	%MW0.1252
Promag400_DI1_value	H0001	Word[Signed]	VAR_GLOBAL	D3256	%MW0.3256
Promag400_DI1_status	H01	Bit	VAR_GLOBAL	M3255	%MX0.3255
Promag400_AO1_startAddress	45.2299995	FLOAT (Single Precision)	VAR_GLOBAL	D4000	%MD0.4000
Promag400_AO1_value		Word[Signed] [3]	VAR_GLOBAL		
[0]	H3442	Word[Signed]		D5000	%MW0.5000
[1]	H85EB	Word[Signed]		D5001	%MW0.5001
[2]	H0080	Word[Signed]		D5002	%MW0.5002
Promag400_DO1_startAddress	H0001	Word[Signed]	VAR_GLOBAL	D4002	%MW0.4002
Promag400_DO1_value	H0180	Word[Signed]	VAR_GLOBAL	D5002	%MW0.5002

- Select the menu “Online → Watch → Stop Watching” to stop the function.

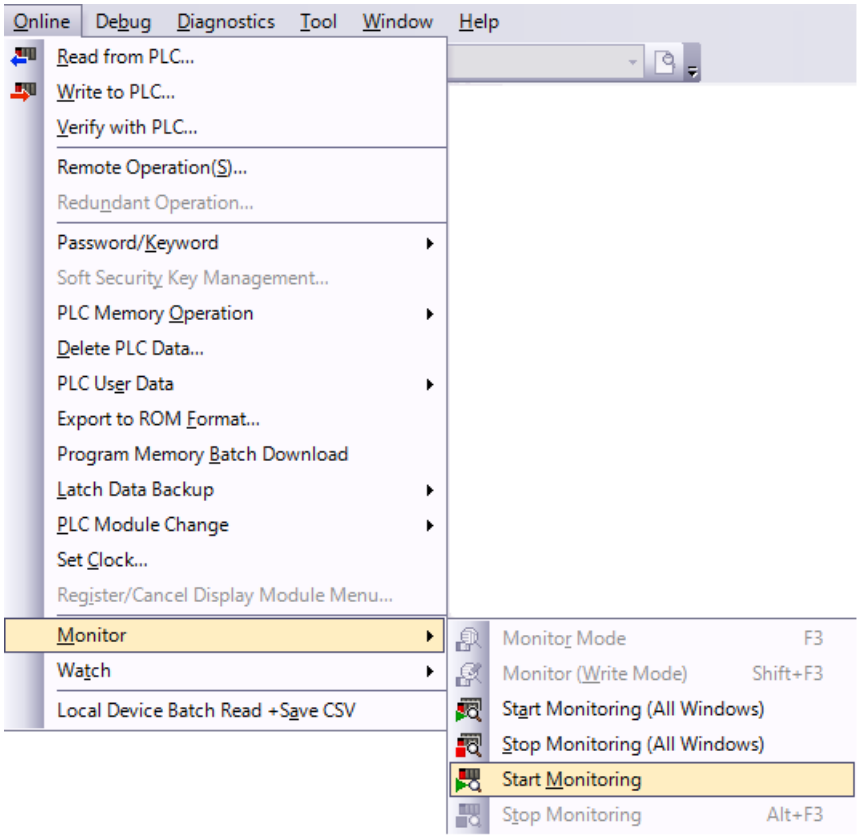
3.5.2.1.2 Monitoring function

The function “Monitoring” displays the online values directly on the corresponding function block.

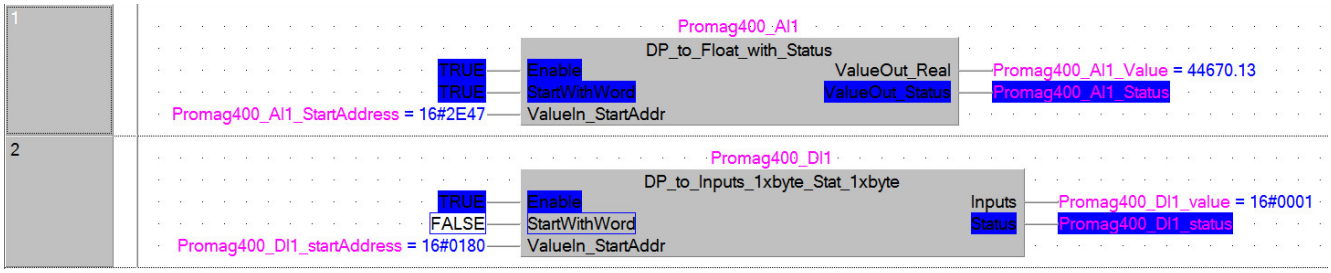
- Select “Program” in the menu “DP_Com → DP_communication_EH → DP_comRead”. This opens the program page of the function block.



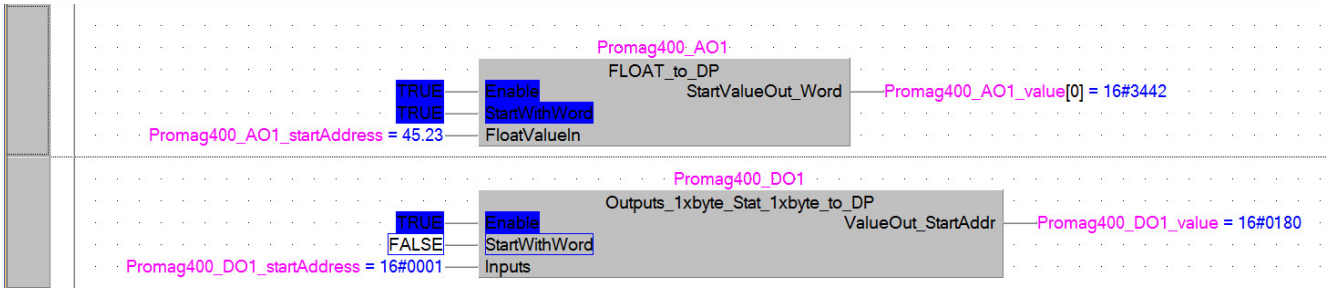
- Select the menu “Online → Monitor → Start Monitoring” to start the function.



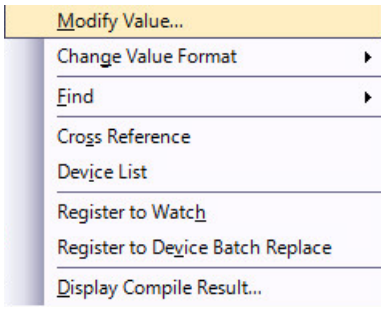
- Online monitoring for the Input function blocks (AI / DI).



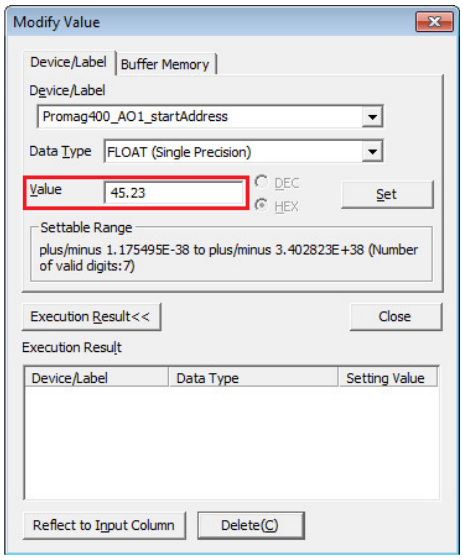
- Online monitoring for the Output function blocks (AO / DO).



  - To edit an output (AO or DO), right-click on the desired start address variable and select the menu "Modify Value".



- Then edit the field “Value” and click on the button “Set”.
  The next window shows the example for the analog output start address variable “Promag400_AO1_startAddress”.



- Select the menu “Online → Monitor → Start Monitoring” to stop the function.

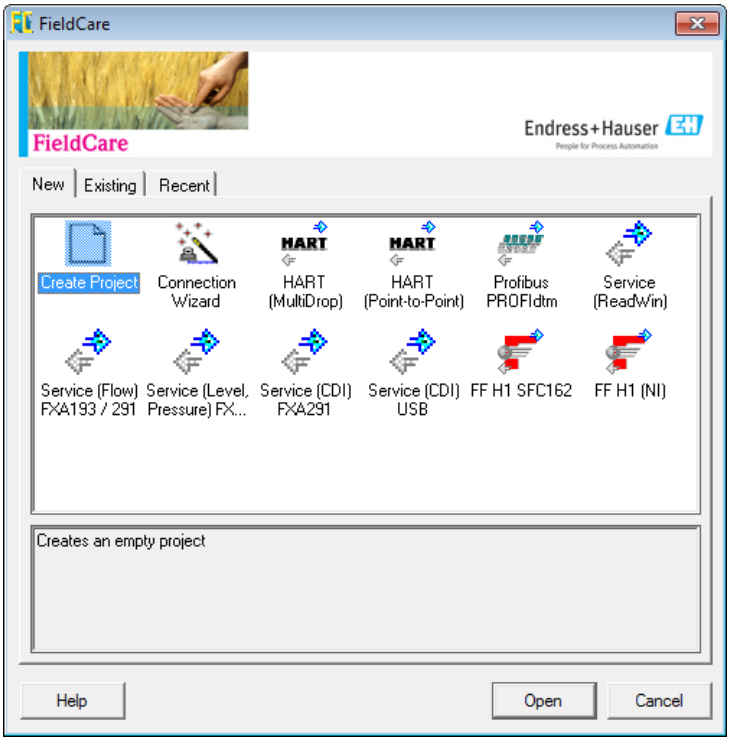
4 Routed Tool Integration

This chapter describes the main workflow for integration of Mitsubishi Electric system components to the Endress+Hauser Plant Asset Management (PAM system) by means of Communication DTMs. As a result, the Endress+Hauser PAM system can access underlying PROFIBUS devices via Mitsubishi Electric Ethernet backbone for device configuration. Please refer to the Integration Test Summary document for known limitations.

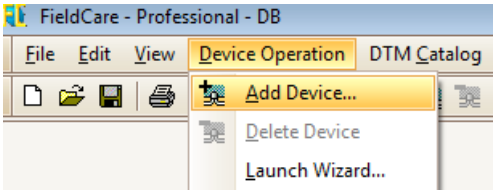
4.1 Mitsubishi MX CommDTM-PBDP configuration

- Start the application FieldCare.

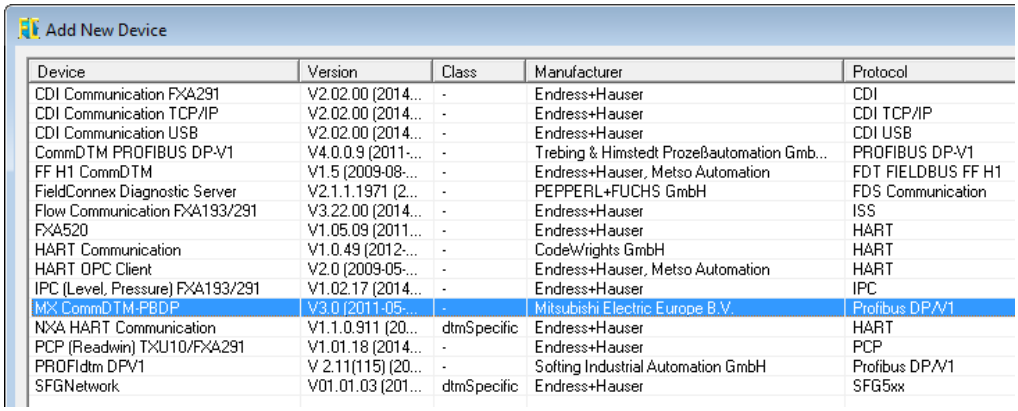
- Create a new project:



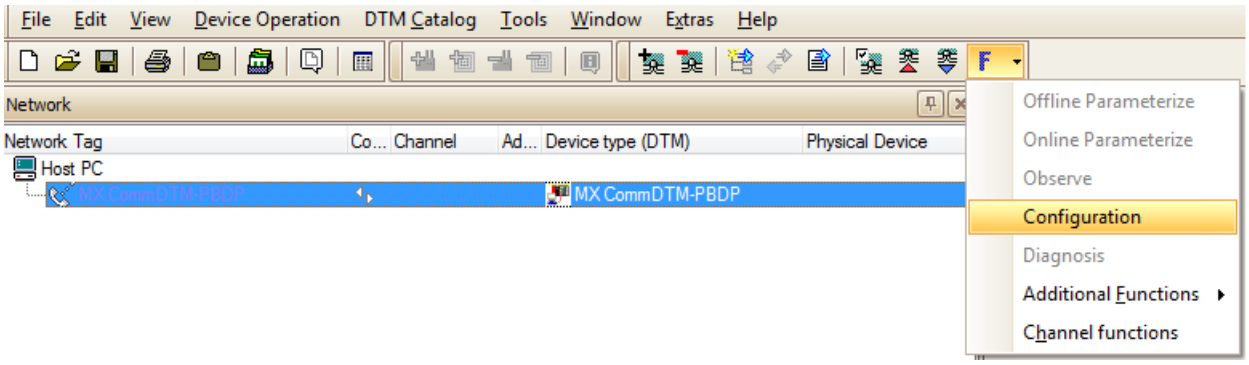
- Select the menu" Device Operation→ Add Device".



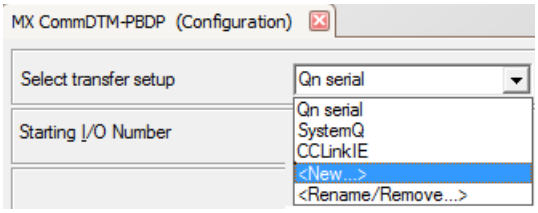
- Select the commDTM “MX CommDTM-PBDP” from Mitsubishi and click on the button “OK”.



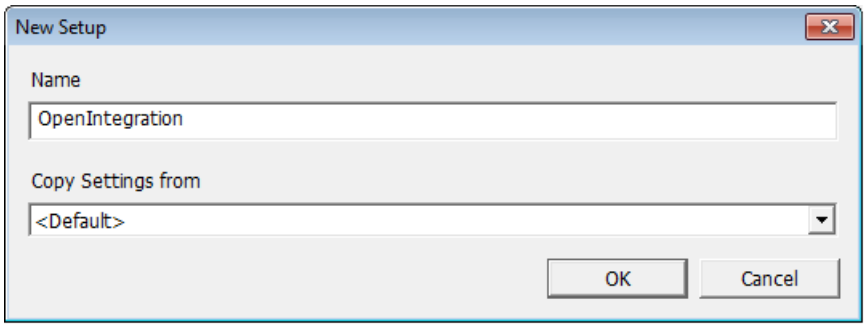
- Select the CommDTM and select the function “F→Configuration“ in the tool bar.



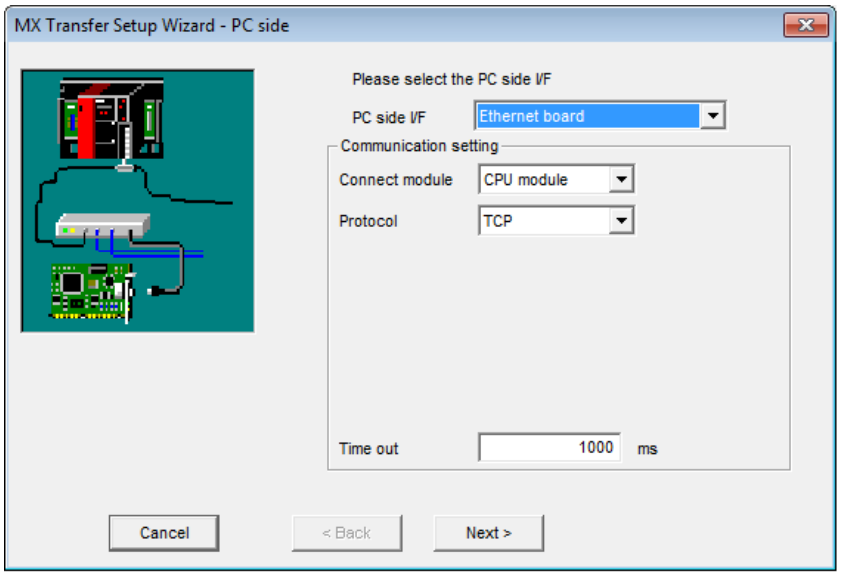
- In the MX CommDTM-PBDP Tab :
  - Select the field “New” in the menu “Select transfer setup”.



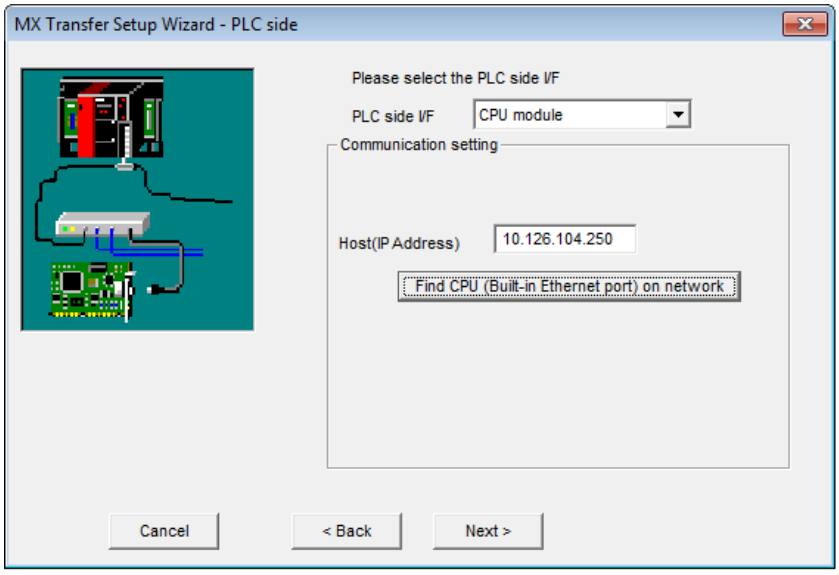
  - Give a new Name to the setup configuration and click on the button “OK”.



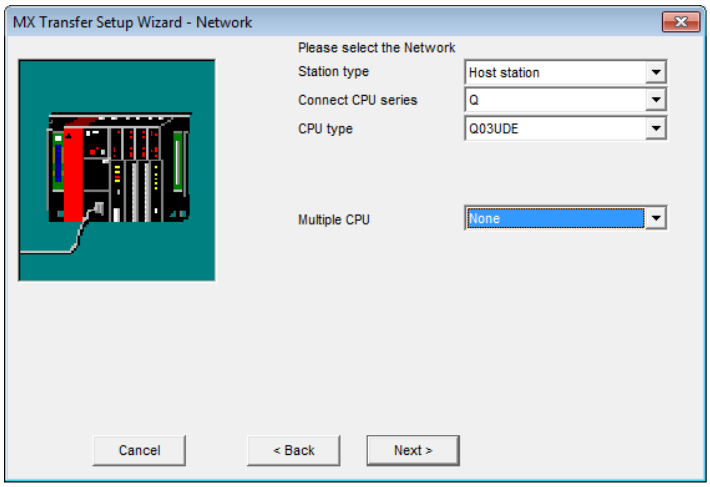
- Configure following settings:
  - PC side I/F : Ethernet board
  - Connected module : CPU module
  - Protocol TCP
  - Click on the button “Next”.



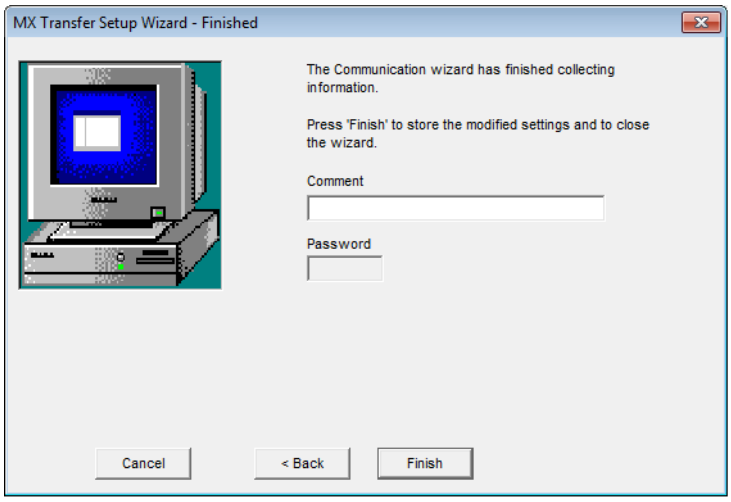
- Configure following settings:
  - Select the PLC side I/F “CPU module”.
  - Set the IP address of the PLC: 10.126.104.250 (specific for this example).
  - Click on the button “Next”.



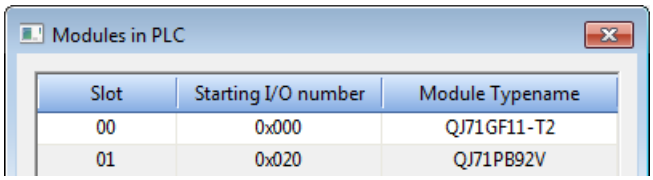
- Configure following settings:
  - Select the station type “Host station”.
  - Select the option Connect CPU series “Q”.
  - Select the CPU type “Q03UDE”.
  - Select the option Multiple CPU “None”.
  - Click on the button “Next”.



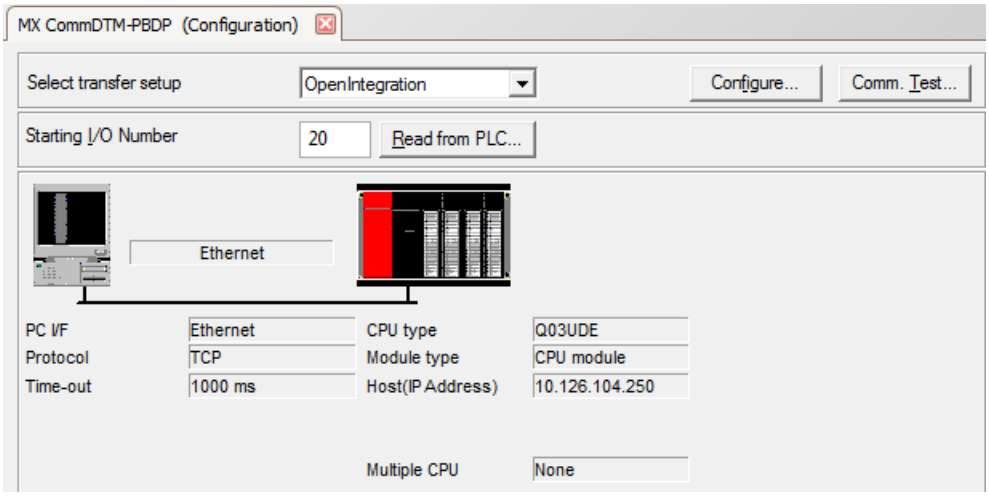
- Click on the button “Finish” to validate the configuration.



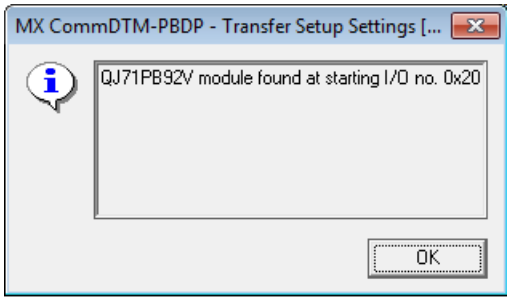
- In the MX CommDTM-PBDP Tab:
  - Click on the button “Read from PLC” and select the PROFIBUS master module QJ71PB92V. This will display the Starting I/O Number “20”.



- Click on the button “Comm. Test” to verify if the connection is established.

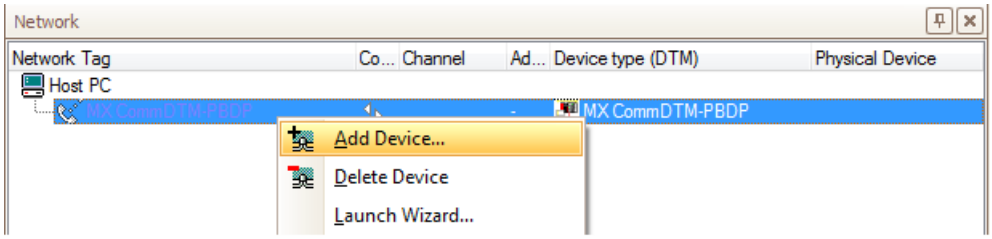


- If successfully, following message is displayed.

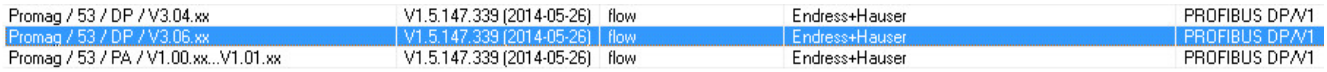


4.2 Device DTM configuration

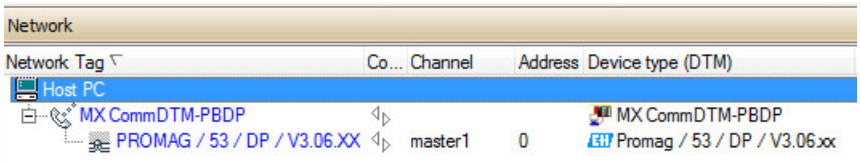
- Right-click on the new inserted CommDTM and select the menu “Add Device”.



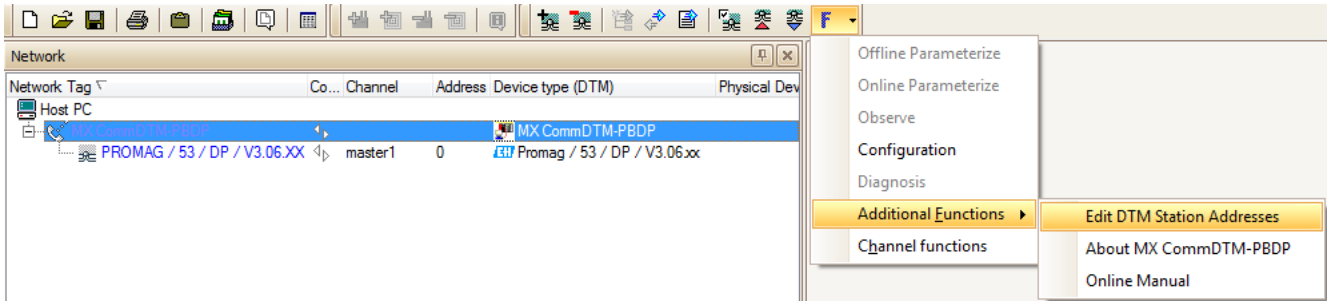
- Select the device you want to connect to, e.g. “Promag/53/DP/V3.06.xx”



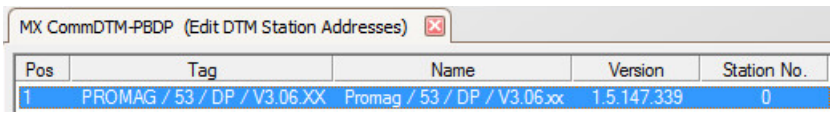
- New device is added in the Network tag.



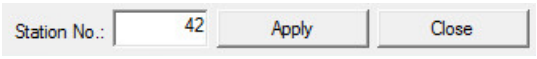
- Select the CommDTM “MX CommDTM-PBDP”:
  - Select the function: “F→Additional Functions→Edit DTM Station Addresses” in the tool bar.



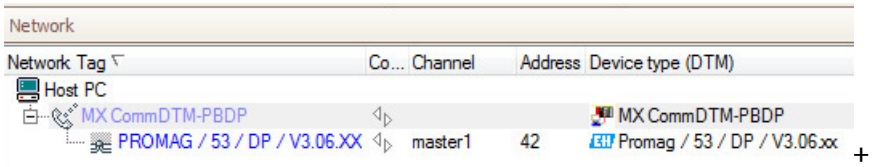
- Select the Promag 53 device.



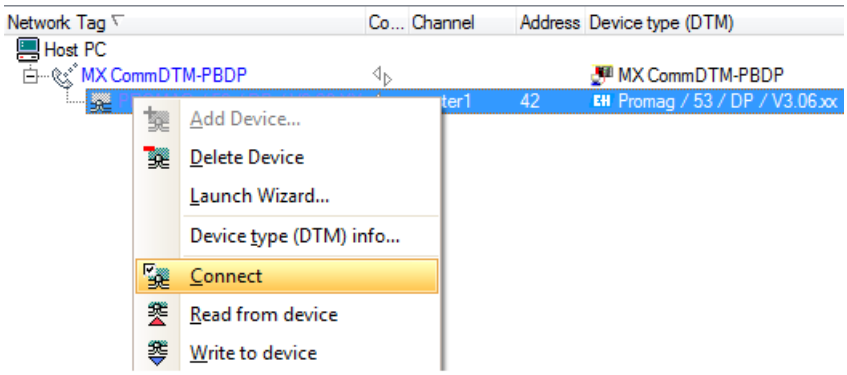
- Update the new FDL address in the field “Station No.”, @42 in this example.
- Click on the button “Apply”.
- Click on the button “Close”.



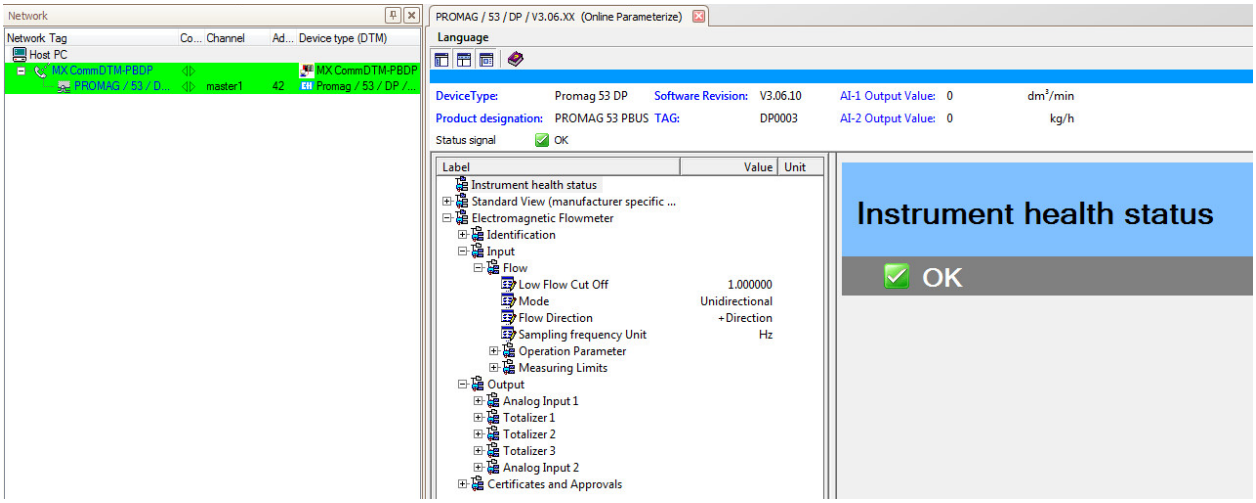
- The new address is updated in the Address field.



- Right click on the device Promag 53 and select the menu “Connect”.



- The Promag 53 is now connected (Online mode).

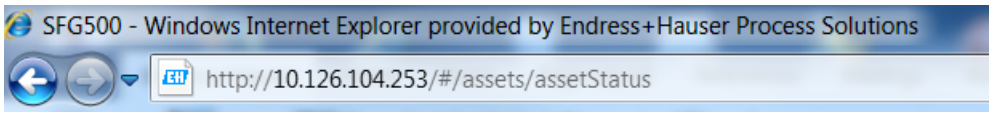


5 Bypassed Tool Integration

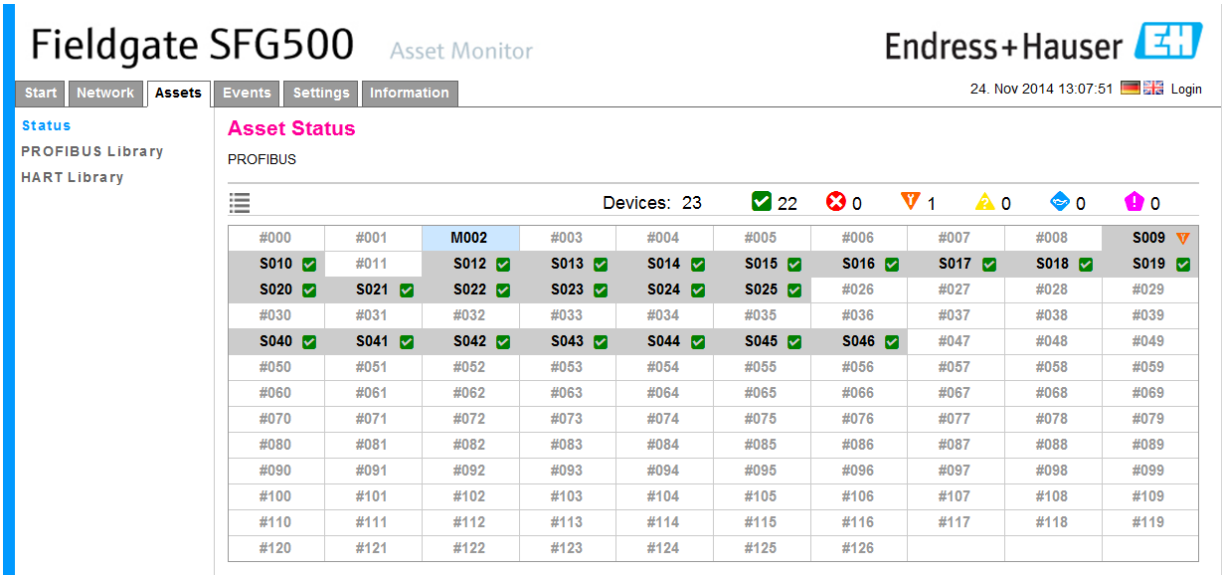
This chapter describes the alternative workflow for commissioning of the Endress+Hauser Plant Asset Management (PAM system) with independent access path via Fieldgate SFG500. As a result, the Endress+Hauser PAM system can access underlying PROFIBUS devices for device configuration and asset health monitoring.

5.1 Fieldgate SFG500 Browser

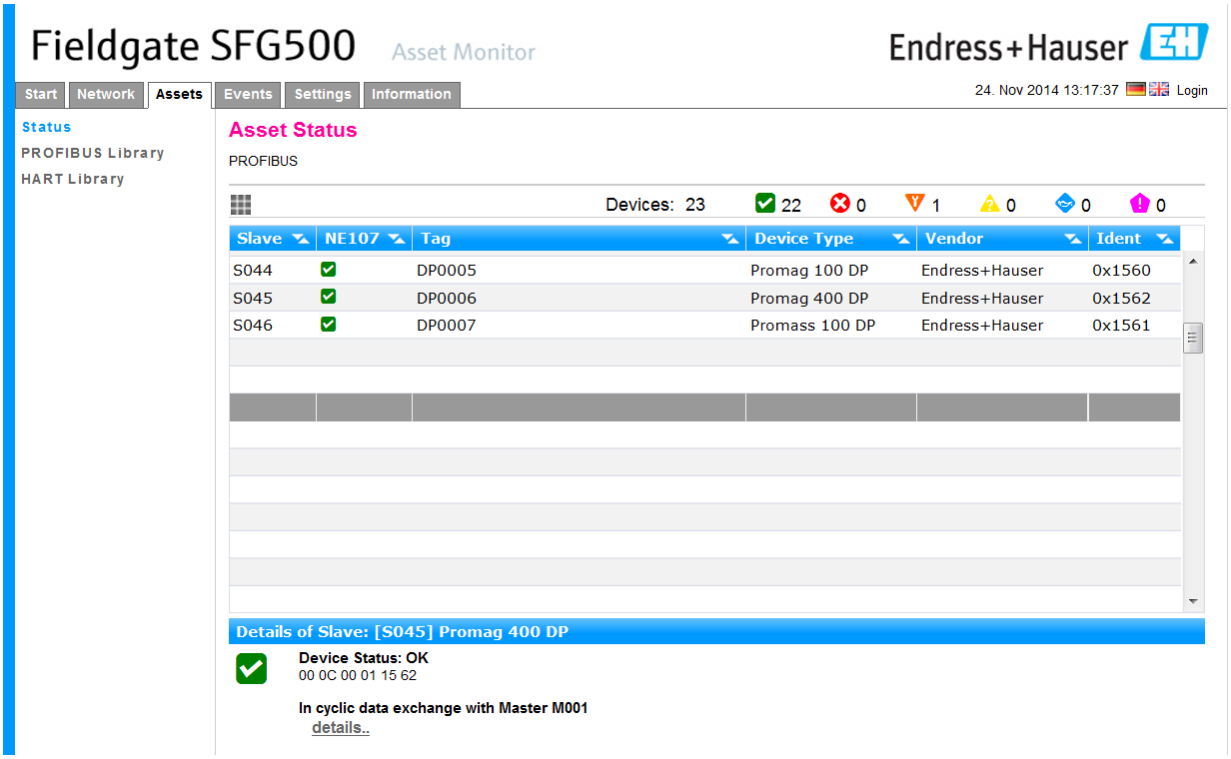
- Check that the SFG500 is connected to the engineering station network.
- Open the browser and enter the IP address of the SFG500, 10.126.104.253 (specific for this example).



- The Fieldgate SFG500 main window is displayed.
  In this view are displayed all detected devices (Masters and slaves).



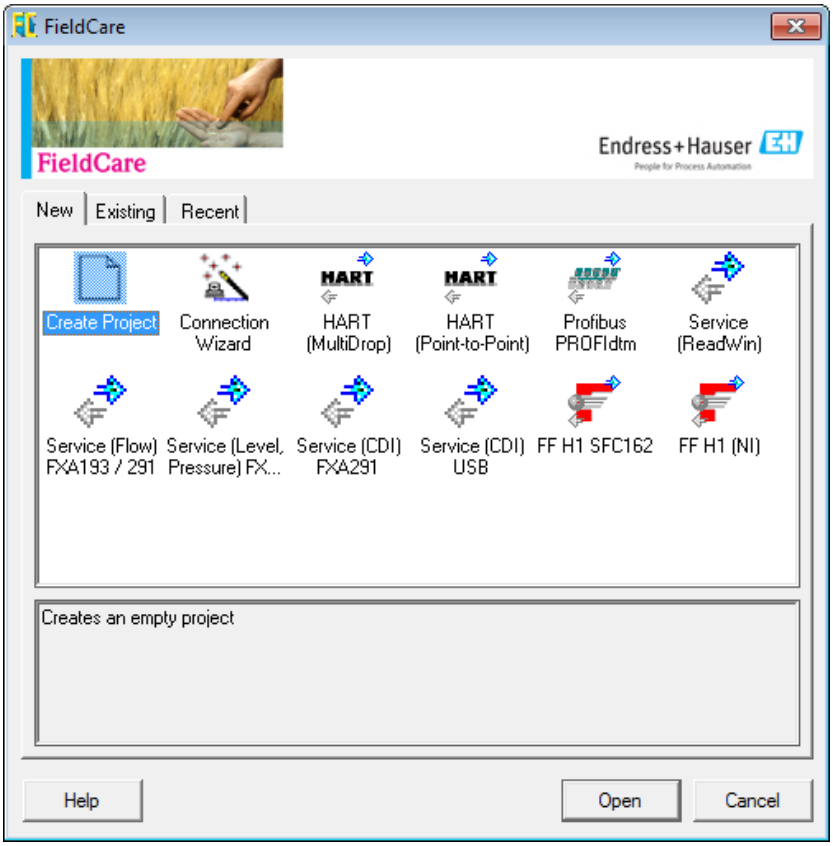
- Click on the shortcut “Show list view” to display the connected device types.
  In this example the Promag 400 DP flowmeter with the FDL address 45 is displayed:



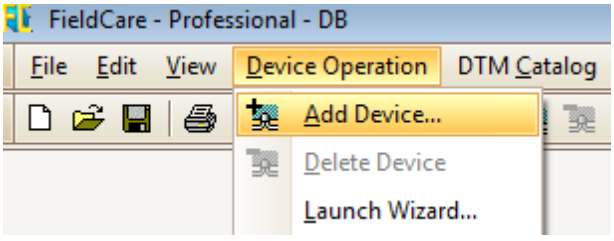
5.2 Endress+Hauser DTM SFG500

- Start the application FieldCare.

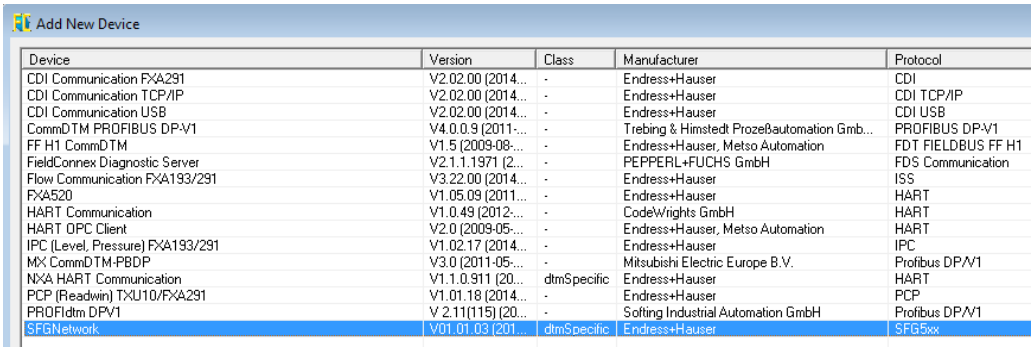
- Create a new project.



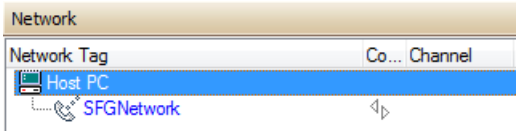
- Select the menu" Device Operation→ Add Device".



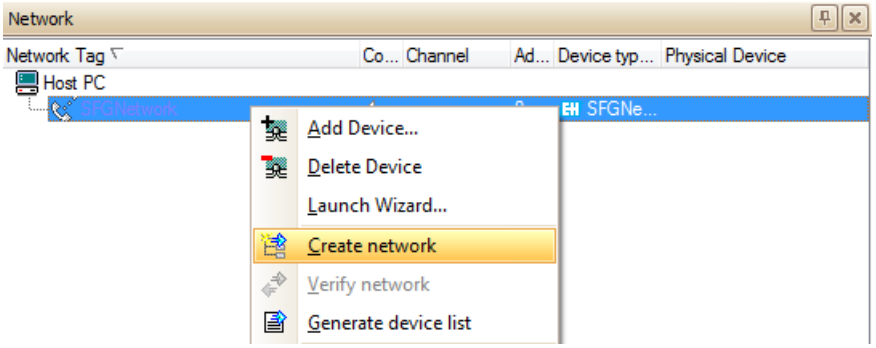
- Add the device “SFGNetwork”.



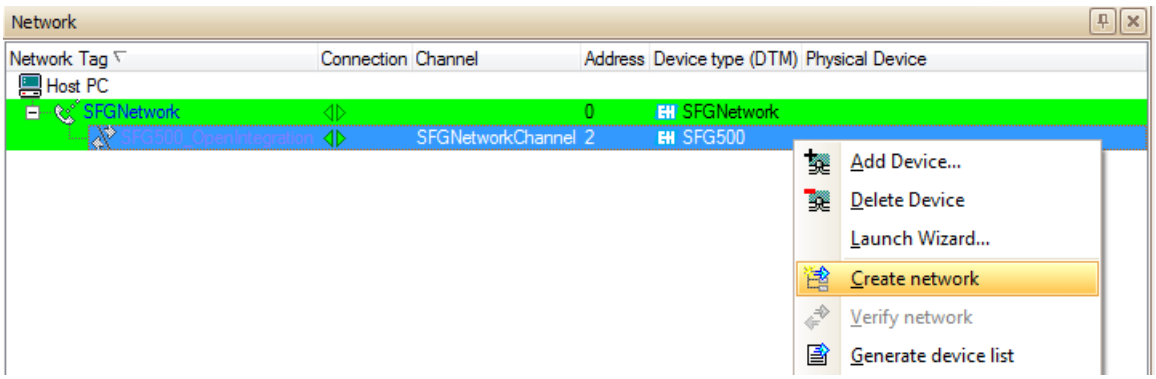
- The new device “SFGNetwork” is then implemented in the Network view.



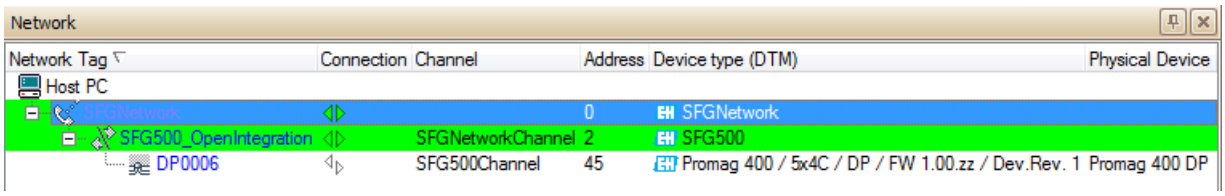
- Right-click on the SFGNetwork device and select the option “Create Network”.



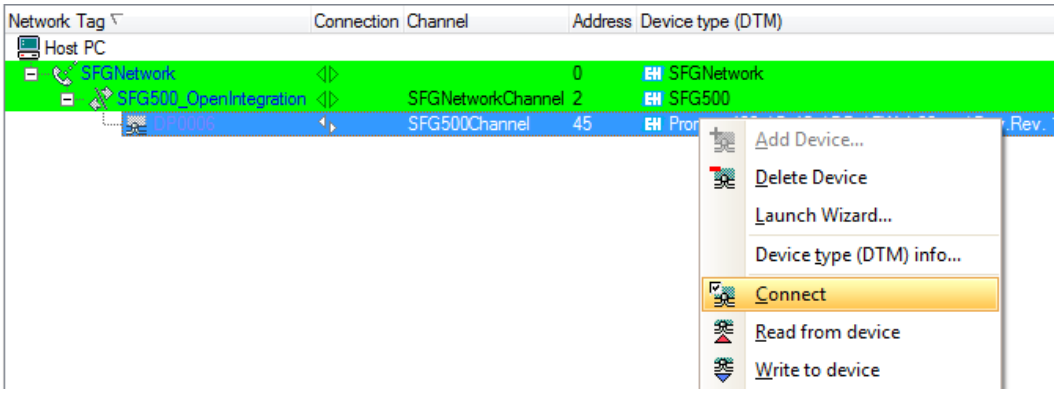
- The Endress+Hauser DTM is then displayed in the Network view. In this example, it is called SFG500_OpenIntegration and has the address 2. Right-click on the DTM and select the option “Create Network”. The DTM is then searching all connected devices.



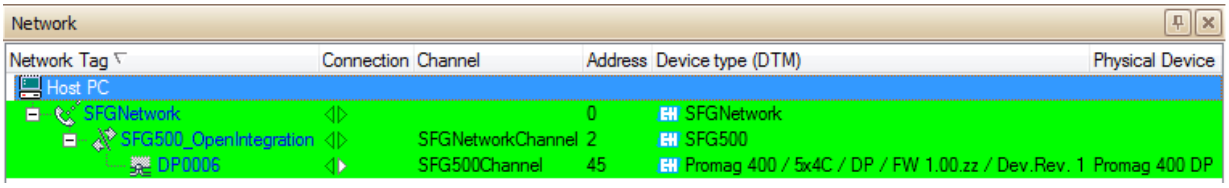
- All found devices are displayed in the Network window.
  In this example, there only is the Promag 400 DP device with the network tag DP0006 and address 45.



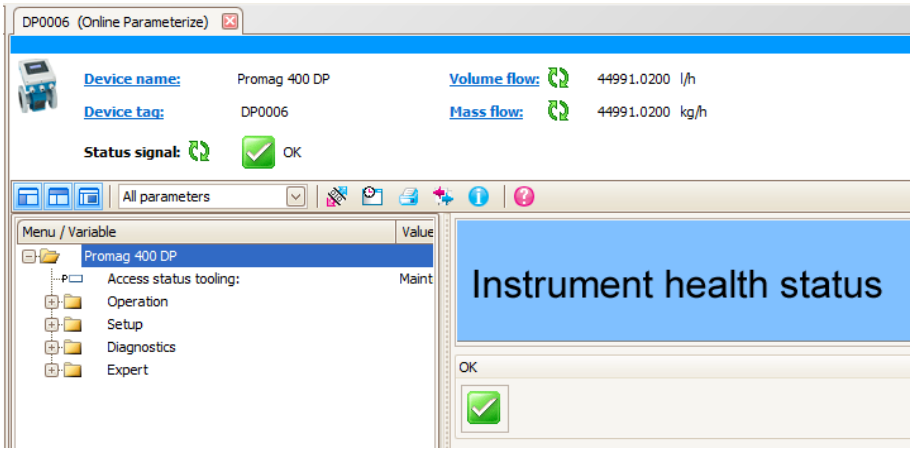
- Right click on the slave device Promag 400 DP and select the menu “Connect”.



- The Promag 400 DP is now connected (Online mode).



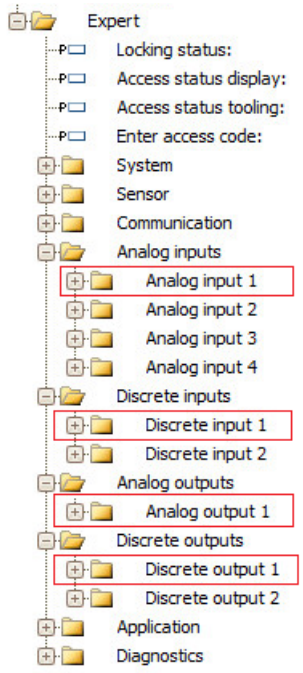
- Select the Promag 400 DP. The online parameters are displayed.
  Device parameters can be changed in this mode.



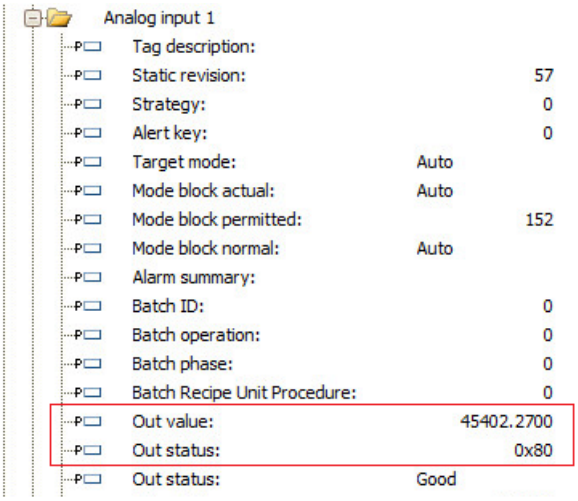
5.3 Data exchange verification

Online variables have been checked on the control system in the part 3.5.2 “Online monitoring”. All these variables can be checked in the device with FieldCare.

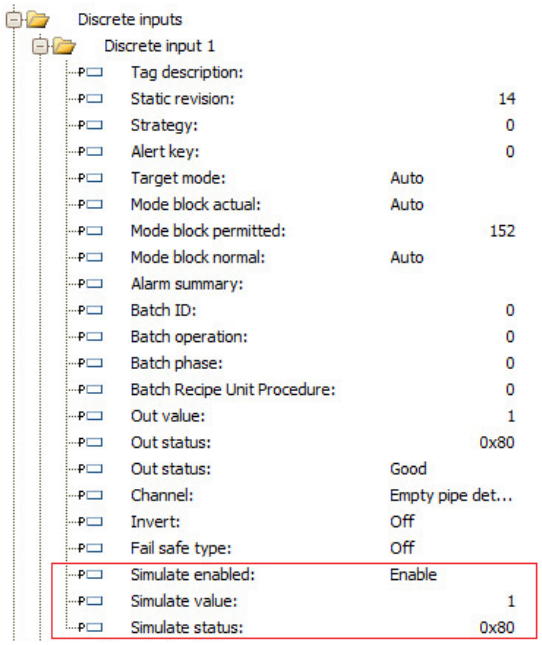
- Expand the Expert mode.



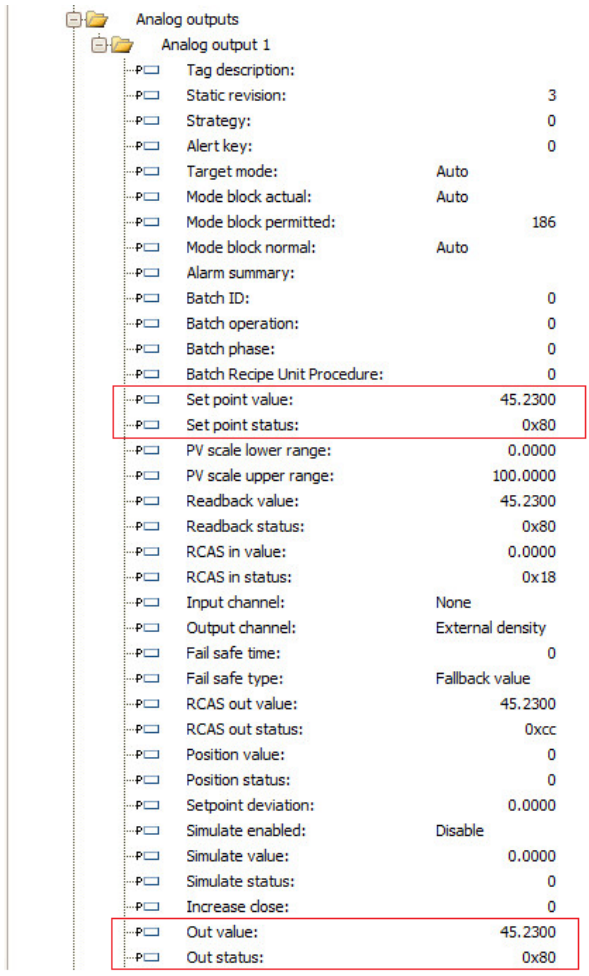
  - Expand the menu “Expert→Analog inputs→Analog input 1”.



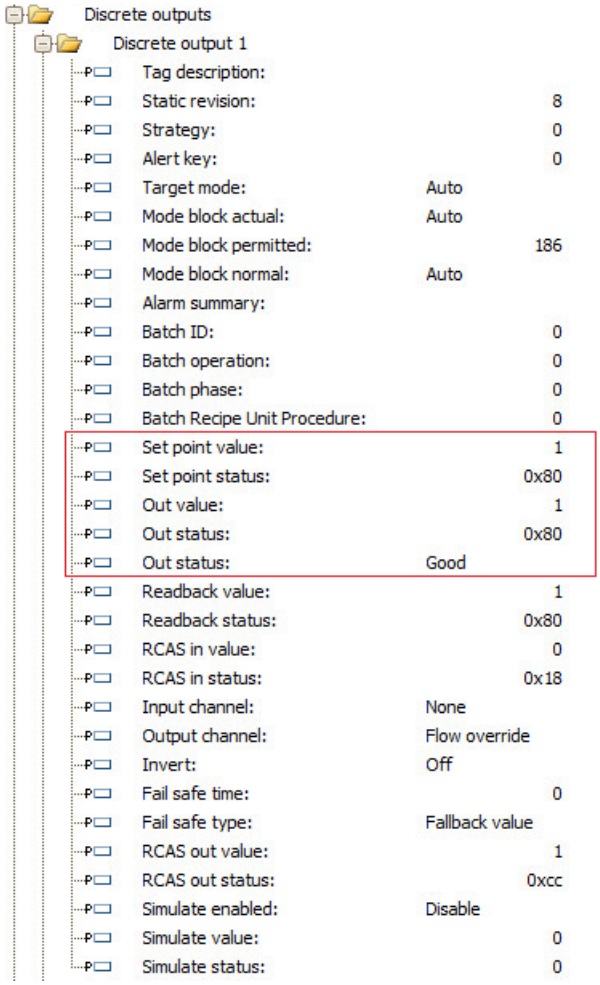
- Expand the menu “Expert→Discrete inputs→ Discrete input 1”.



- Expand the menu “Expert→ Analog outputs→ Analog output 1”.



o Expand the menu “Expert→Discrete outputs→ Discrete output 1”.



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