

Integrating Profibus PA instruments in PES

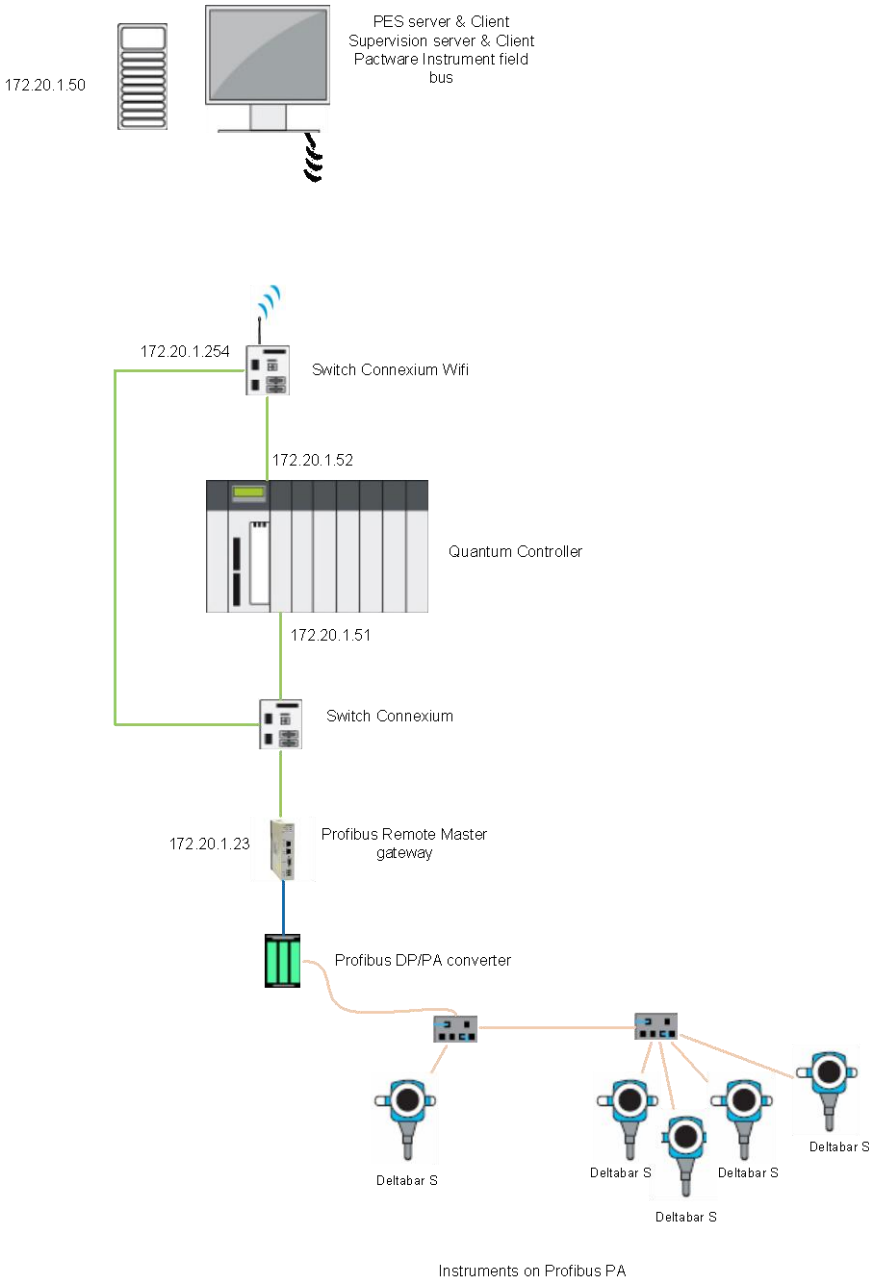
Table of contents

- Introduction..... 2
- Demo platform 2
- PES Topology configuration..... 4
 - Quantum Controller configuration:..... 4
 - Controller communication settings..... 5
 - PRM configuration..... 5
 - General settings node 7
 - Profibus Settings node 9
 - Input variables and Output variable nodes:..... 10
 - Optimizing the PRM IO scanning line 10
- PES Application configuration 12
 - PRM configuration..... 12
 - \$EMPortQ configuration: 12
 - \$PRMmgtQ configuration: 12
 - Connection between \$EMPortQ and \$PRMmgtQ..... 13
 - Profibus PA instrument configuration..... 13
 - \$GenericDevice configuration:..... 13
 - \$PA_Measure_UL:..... 14
 - \$AnalogInput 14
- PES project configuration 15
 - Control project configuration..... 15
 - Process section refinement..... 15
 - Executable configuration..... 16
 - Supervision project configuration 16

Introduction

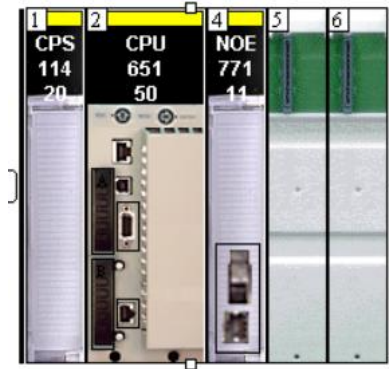
The purpose of this article is to provide guidance on how to integrate Profibus PA instruments inside PES, using PRM gateway. This article is based on a real demo platform executed in the TVDA lab in Carros with a quantum PLC and Endress Hauser instruments. We will go through the different steps to build the PES application in PES v4.0 SP1.

Demo platform description



In this demo platform, we are using:

- one PC hosting PES server and clients for the System Engineering and maintenance, PES real time supervision server and client for operation and Pactware to manage the instrumentation Asset Management.
- One Quantum controller with the following configuration

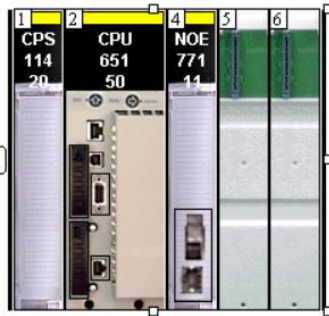


- One Profibus Remote Master connected to the NOE77111 module of the Quantum through its Ethernet port and to the Profibus DP/PA converter module through its Profibus DP port.
- 5 Profibus PA instruments DeltaBar S on profibus PA

PES Topology configuration

The purpose of this chapter is not to concentrate on the controller or PES server configuration, but really to focus on the instrument integration through the PRM configuration.

Quantum Controller configuration:

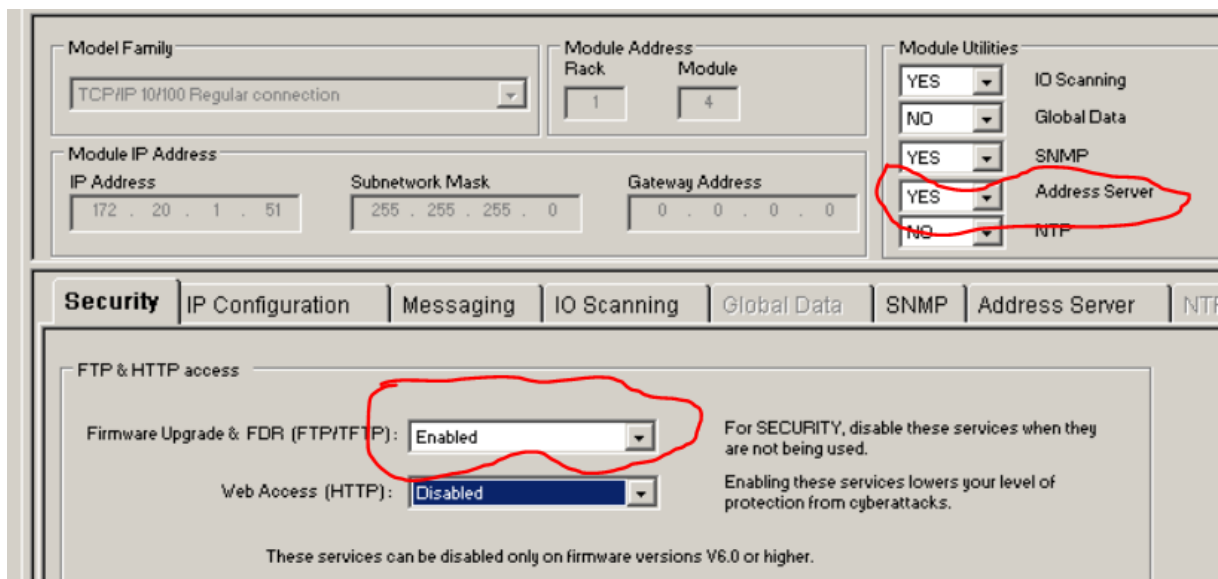


CPU 65150 Ethernet port IP: 172.20.1.52

NOE77111 Ethernet port IP: 172.20.1.51

For the NOE77111 module, we are enabling FDR configuration for the PRM.

For that purpose we are activating Address server option + FTP on the communication network linked to the NOE Ethernet port.



In the address server tab we configure the PRM IP settings:

Client / Server address table					
	MAC address	Name	IP address	Netmask	Gateway
1		TCSEGPA23F14F028	172.20.123	255.255.255.0	172.20.151
2					
3					

The PRM name is based on fix name part: TCSEGPA23F14F + a number which correspond to the rotary switches selection.

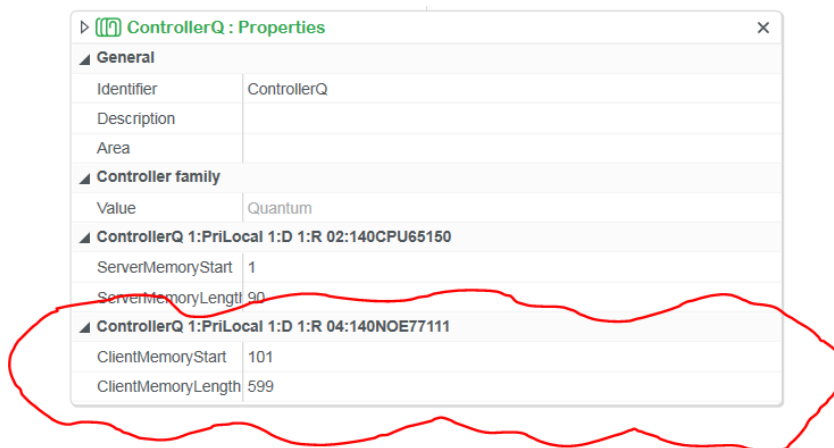
IP address is the IP address that we want to give to the PRM. Netmask is the range of IP address that can be seen by the PRM and gateway is the NOE IP address.

We now have finished with controller configuration, but need to adjust some communication settings.

Controller communication settings

In PES v4.0 SP1 the communication between the Controller and PRM is done through IO scanning.

We need to allocate some memory space for the IO scanning line in the controller properties

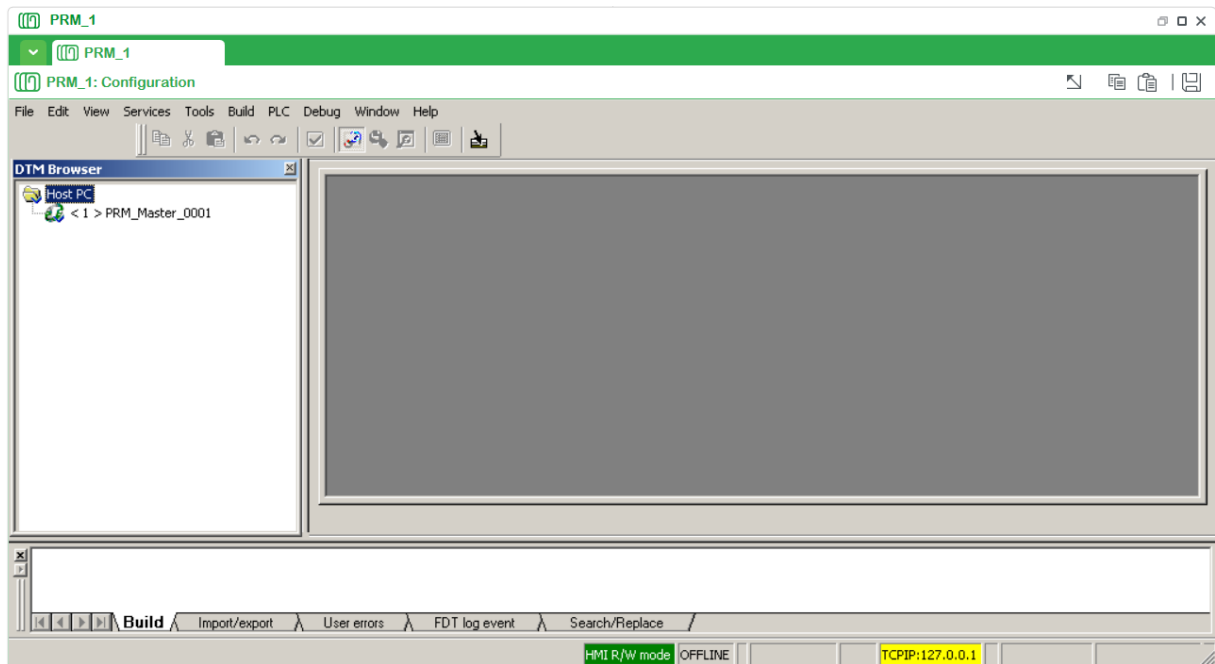


In our case we are attributing 599 words starting at %MW101

PRM configuration

As a pre-requisite all the needed DTM (instruments and actuators) have to be installed inside the PES VM.

Inside the topology manager we are declaring one PRM remote Master. Once it is created we can configure the PRM.

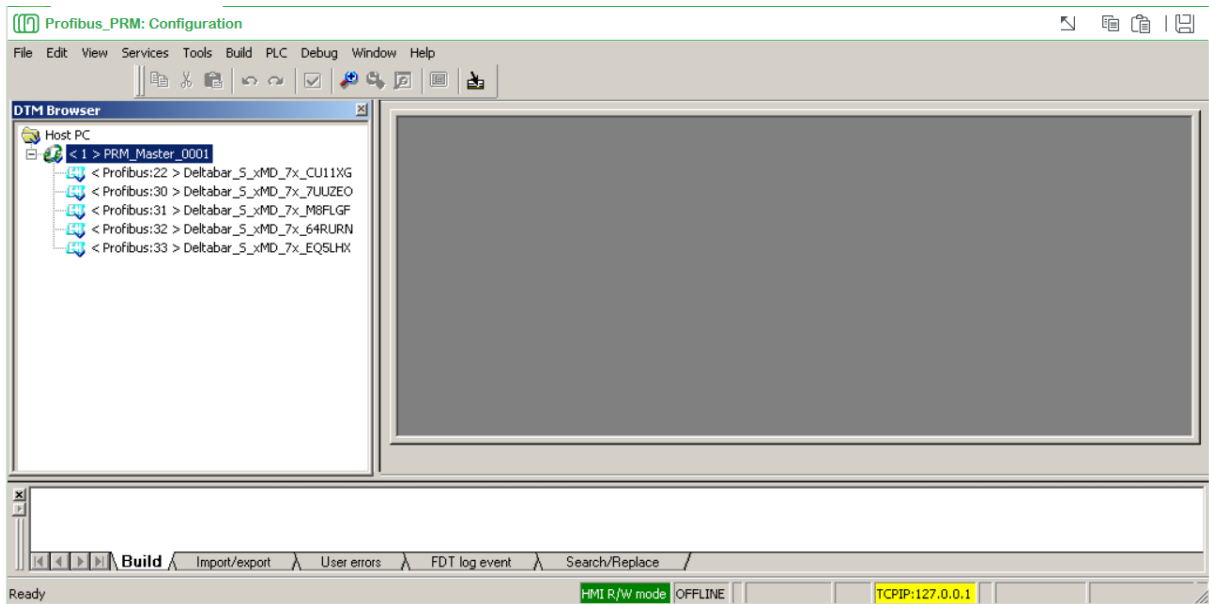


On the left part of the configuration window, there is a tree describing the Profibus configuration. When opened for the first, the PRM Master node is empty, no slaves are declared.

We now need to declare our instruments (PA slaves). In order to declare the PA devices two ways are possible:

- If you are connected to the PRM and if your instruments are already connected to the PRM, you can right click on the PRM, **connect** and select **fieldbus discovery**. The PRM will detect all the slaves connected and propose corresponding DTMs for each device.
- If you are offline you can manually declare each instrument. For that purpose, right click on the PRM_Master node and select add. The DTM and GSD list appear and you can select from that list your device.

In the demo platform there are 5 instruments Deltabar S from Endress Hauser. The result after instantiation is the following



We now need to configure the PRM and instruments settings. We are first double clicking on the PRM node; it is opening the PRM DTM inside which we will configure the PRM and some settings for the devices.

General settings node

On the **General Settings** node from the DTM we configure all the PRM characteristics:

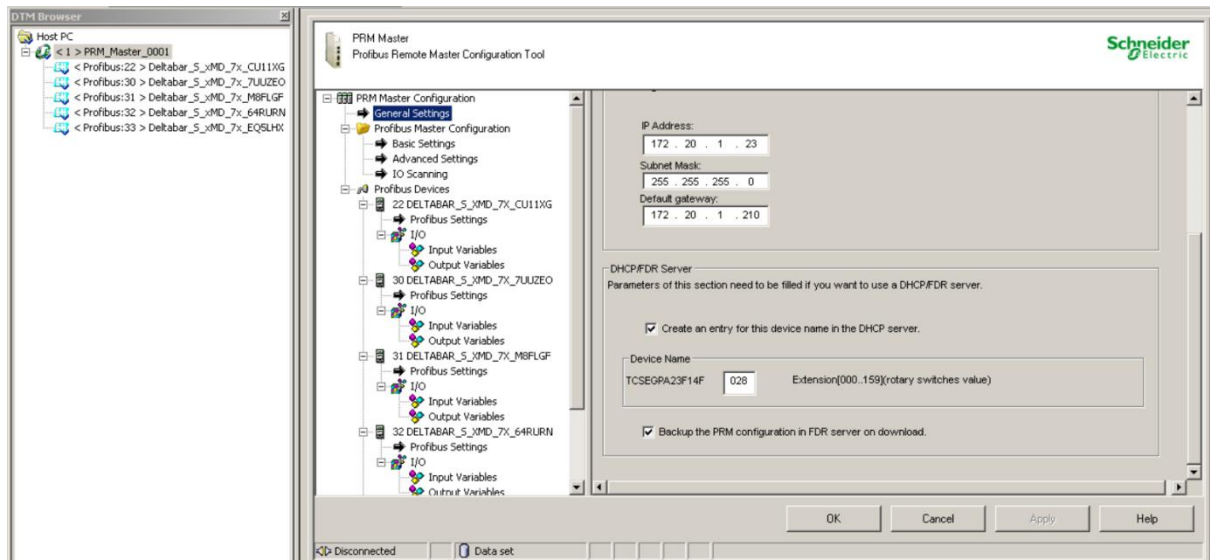
MAC address: 0.80.f4.ff.0.e2

IP address: 172.20.1.23

Mask: 255.255.255.0

Default gateway: 172.20.1.210 (*NOE address*)

We then select the DHCP server option, 28 for the rotary switches (configured physically at the rear of the PRM on rotary switches) and FDR server. These options will allow us to have the PRM configuration stored inside the NOE and when the PRM is switching on it will take its IP + configuration from the NOE module.



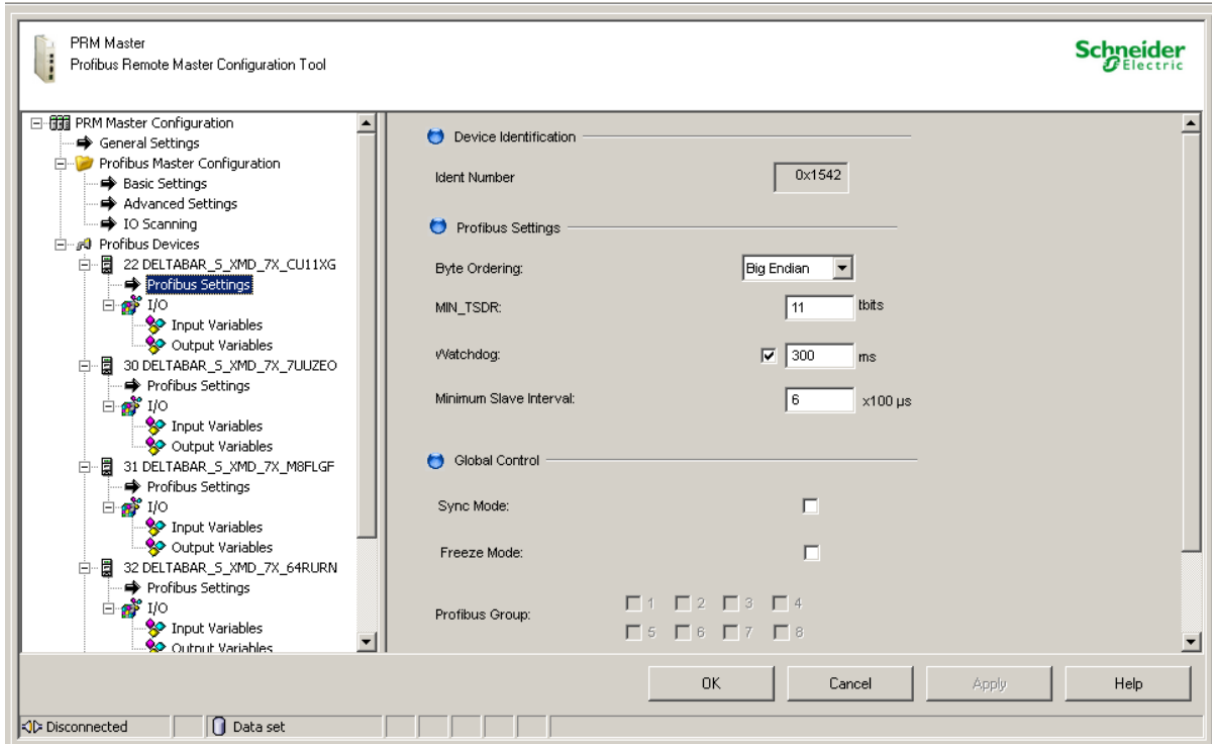
Under the Profibus **Master Configuration** node, the **Basic Settings** node allows to configure the Profibus DP speed. In our case we have no Profibus DP slaves, only one Profibus PA slaves. The profibus PA network speed is 31.25 kbits/s. We can configure the Baud rate to that speed even if it is not an obligation, because the Profibus DP/PA convertor will manage the speed difference to feed the PRM.

The benefit of setting the Profibus DP speed to the PA speed will be to have automatic evaluation of the instruments acquisition cycle by the Profibus Remote Master.

For instance, if we go on the **Advanced Settings** node, we can see that the Recommended Profibus cycle is 218ms. It means that each instruments will provide its cyclic values to the PRM approximately every 218ms (a bit less, if not cyclic because the recommended value integrate some bandwidth for non cyclic values)

On the **IO Scanning** node we can take note of the Modbus rate Recommended value: 272 ms. This value is giving a recommendation of the IO scanning line refreshment time. In PES v4.0 SP1 the IO scanning line will be configured inside the project editor, but we can take note of this value to later configure the proper rate for the IO scanning line.

Profibus Settings node

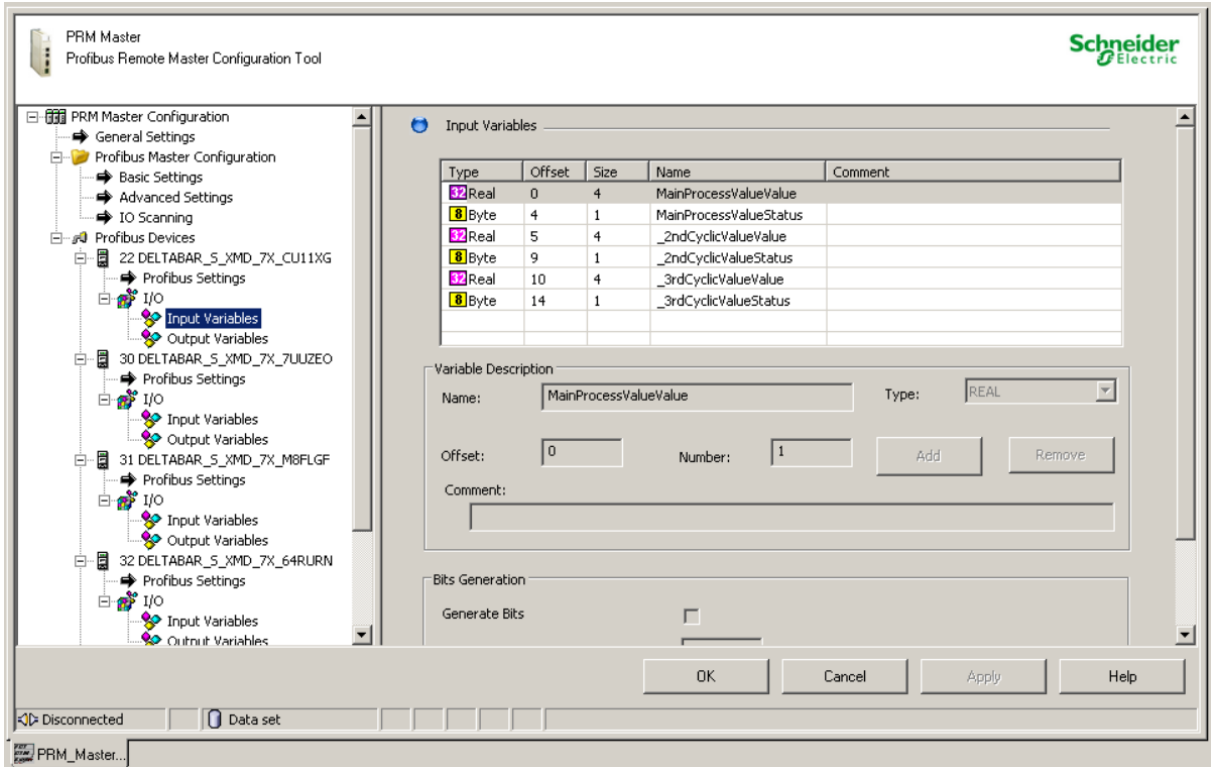


Every devices previously declared under the PRM are appearing in the Profibus Devices list.

Each device configuration includes a Profibus Settings node

In this node, we keep the default values which are provided by the Instrument maker. We need to adjust the watchdog values in order to be aligned with the acquisition cyclic rate (218 ms recommended value). We set the watchdog value to 300ms.

Input variables and Output variable nodes:

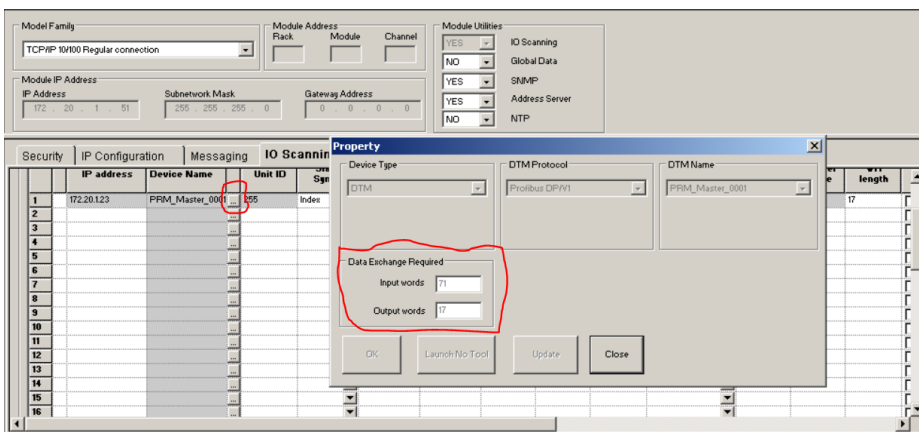


In the **Input Variables** and **Output Variables** nodes we take note of the Data volumes exchanged by this instrument (in bytes). It will be useful when we will configure the instrument inside the Application manager.

In our case this instruments is consuming 15 input bytes and 5 output bytes.

Optimizing the PRM IO scanning line

We need now to optimize the IO scanning line. In order to display it, click on **Tools -> Project Browser**. Select the **Ethernet_1** network and click on the **IO Scanning** tab



On the IO scanning line click on the 3 points buttons and take note of the input and output words. You will have to replace the IO scanning line parameters with them as shown below.

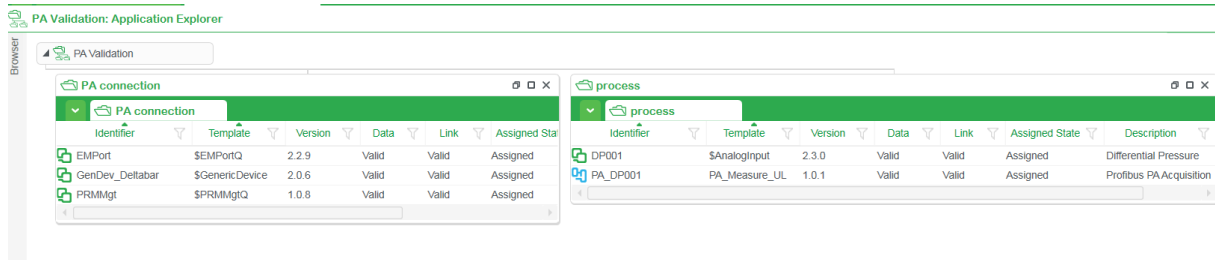
The screenshot shows the configuration page for IO Scanning. At the top, there are sections for 'Model Family' (TCP/IP 10/100 Regular connection), 'Module Address' (Rack, Module, Channel), and 'Module Utilities' (IO Scanning, Global Data, SNMP, Address Server, NTP). Below these are fields for 'Module IP Address' (IP Address: 172.20.1.51, Subnetwork Mask: 255.255.255.0, Gateway Address: 0.0.0.0). A navigation bar includes 'Security', 'IP Configuration', 'Messaging', 'IO Scanning', 'Global Data', 'SNMP', 'Address Server', 'NTP', and 'Bandwidth'. The 'IO Scanning' section has a 'Health Block (%d/%d)' field set to %d/%d1 and a 'Repetitive rate step' of 16. Below is a table of scanned peripherals:

	IP address	Device Name	Unit ID	Slave Syntax	Health Timeout (ms)	Repetitive rate (ms)	RD Master Object	RD Ref Slave	RD length	Last value (Input)	VR Master Object	VR Ref Slave	VR length
1	172.20.1.23	PRM_Master_0001	255	Index	2500	112	:%Mw1	0	71	Set to 0	:%Mw101	4096	17
2													
3													

It is finished for the PRM configuration. The last action is to save and connect the PRM on the same network as the NOE.

PES Application configuration

Below is the general view of our application



PRM configuration

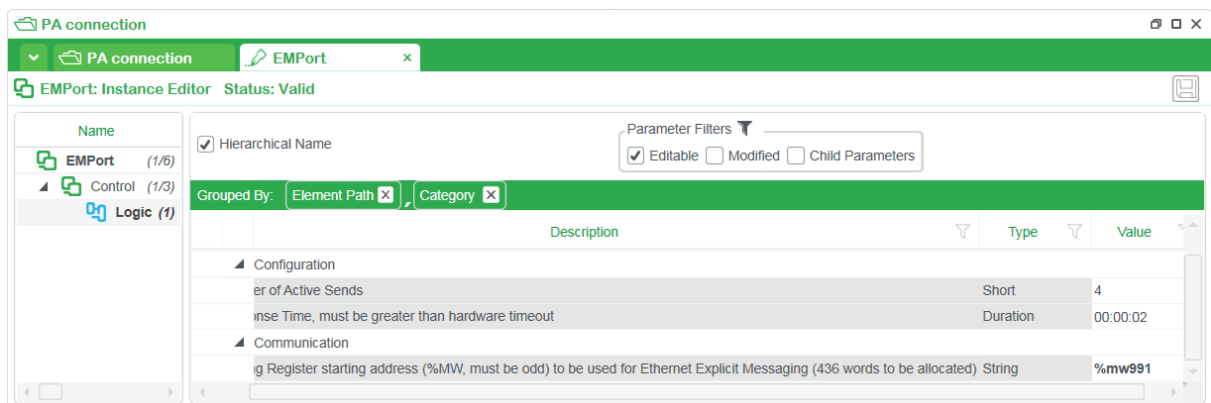
In order to configure the PRM, we need to instantiate two blocks from the GPL library:

- \$EMPortQ: manage the Ethernet port inside the Quantum Controller
- \$PRMMgtQ: manage the PRM inside the Quantum Controller

\$EMPortQ configuration:

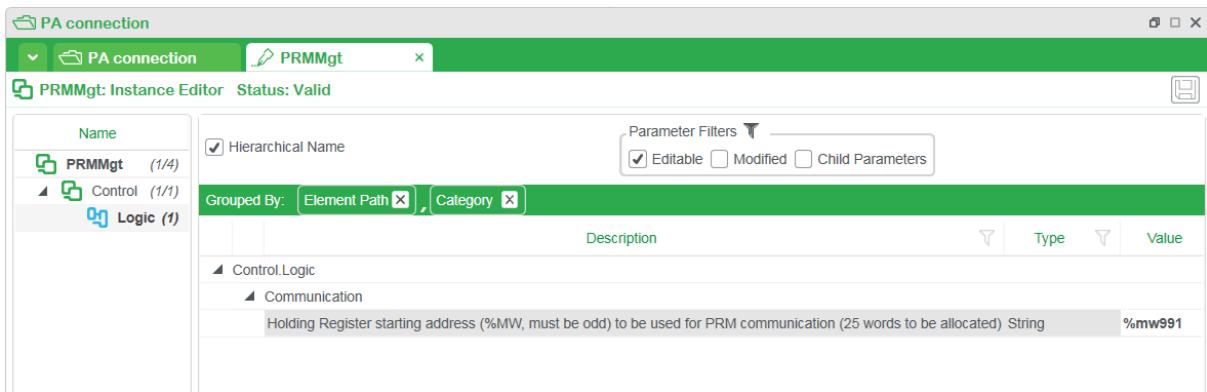
In the Communication Holding Register we are setting an address which is the starting address of 436 words used by the port.

In this case we are setting %MW991



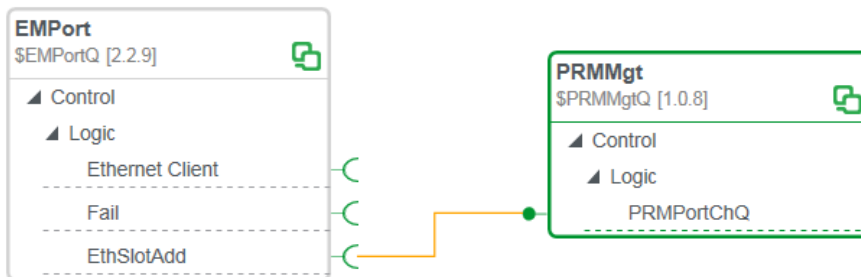
\$PRMMgtQ configuration:

In the Communication Holding Register we are setting the same address as the port Communication Holding Register: %MW991



Connection between \$EMPortQ and \$PRMMgtQ

In order to establish the communication between the controller and the PRM through the designated Controller port, we open the link editor between the \$PRMMgtQ instance and \$EMPortQ and create a link



Profibus PA instrument configuration

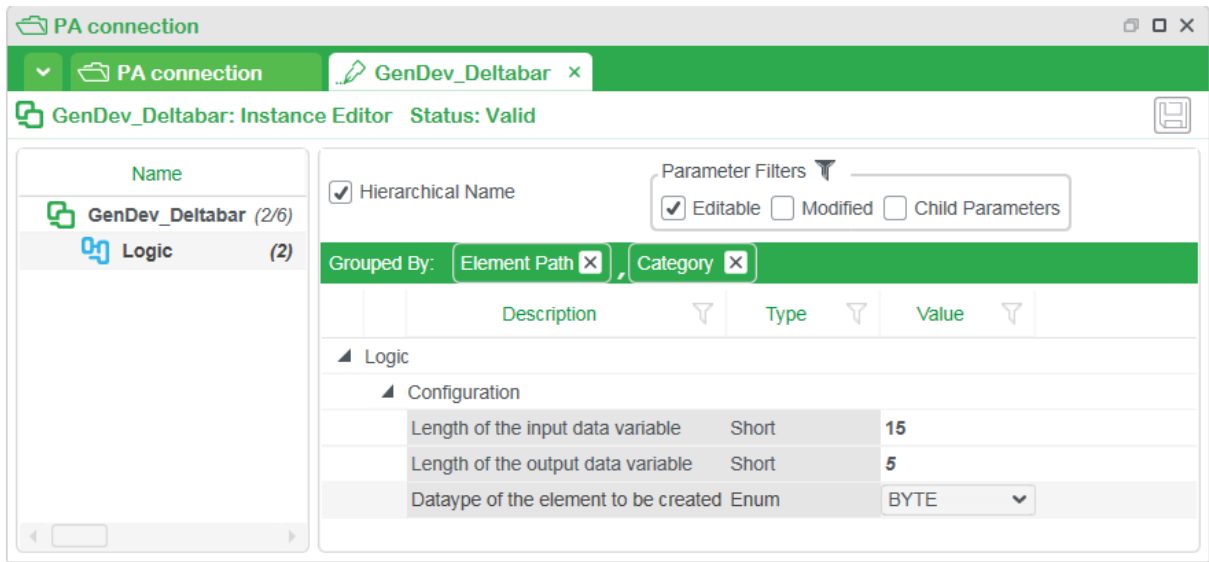
To be able to acquire the instrument data from the PRM communication IO scanning line, we instantiate the **\$GenericDevice** block from the GPL library. The purpose of this block is to reproduce the Data mapping of the PA Data Inputs.

\$GenericDevice configuration:

In the **Topology Editor->PRM configuration->PRM DTM** from the previous chapter, we already took note of the Data volume per instrument type: [lien](#)

As a reminder we identified 15 Input bytes and 5 Output bytes.

These are the values we are filling inside the instance configuration



\$PA_Measure_UL:

I have created a dedicated block to convert the bytes into real and extract the measure PA status into comprehensive boolean. This block is called \$PA_Measure_UL . We have to instantiate one block per cyclic value. For instance in the Deltabar instrument, 3 cyclic values and their status are available.

\$AnalogInput

In order to display the Instrument measure we are using the \$AnalogInput block from GPL library.

PES project configuration

We have created one Quantum controller project and one Supervision project

Control project configuration

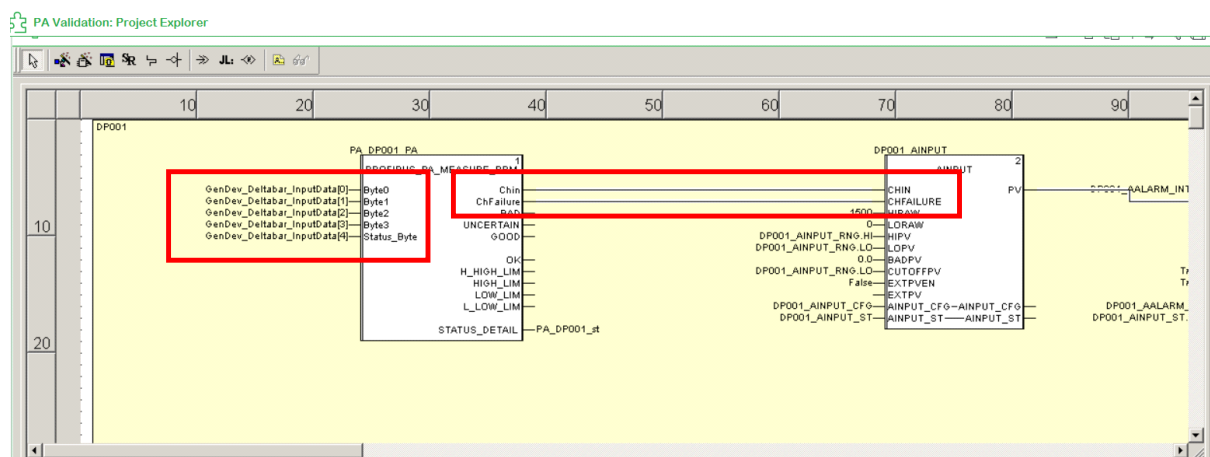
In our case we have created two sections. The first one called PRMManagement and the second one Process.

In the section PRMManagement we are assigning the **\$EMPortQ**, **\$PRMmgtQ** and **\$GenericDevice** control facets instances

In the section Process, we are assigning the **\$AnalogInput** and **PA_Measure_UL** control facets instances.

Process section refinement

We are opening the **Process** section in refinement mode



The **\$GenDevice** instance has created two structures:

- An input array of 15 bytes (specified in **\$GenDevice** configuration)
- An output array of 5 bytes (specified in **\$GenDevice** configuration)

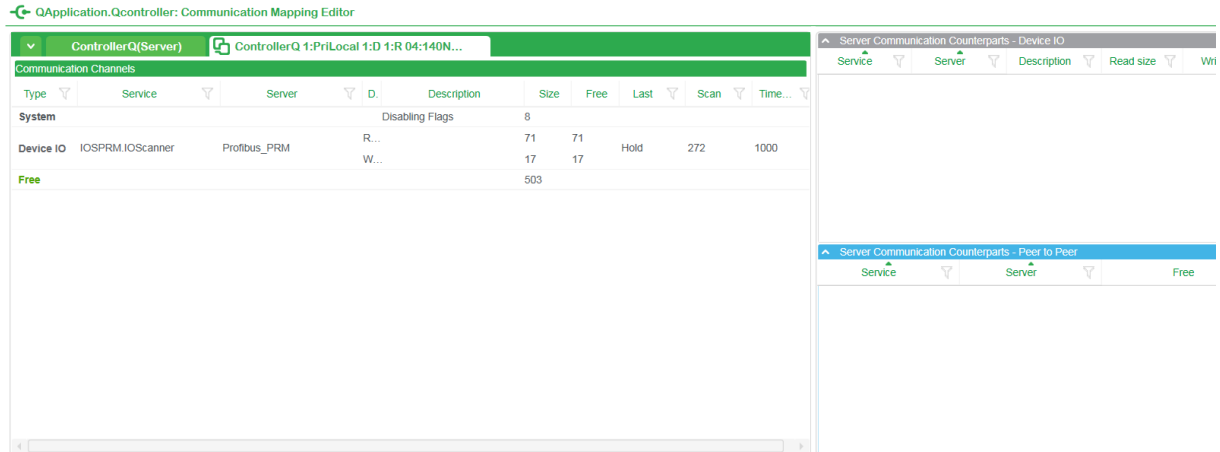
In our case we want to display the main measure from the instrument. This measure is coded on the 4 first bytes and the measure status on the 5th. We are connecting the 4 first bytes to the DFB input Byte 0 to 3 and the Status byte to the Input **Status_byte**

We are connecting in addition the **Profibus_PA_Measure_UL** DFB and the **AINPUT** DFB to transfer the measure and status.

Executable configuration

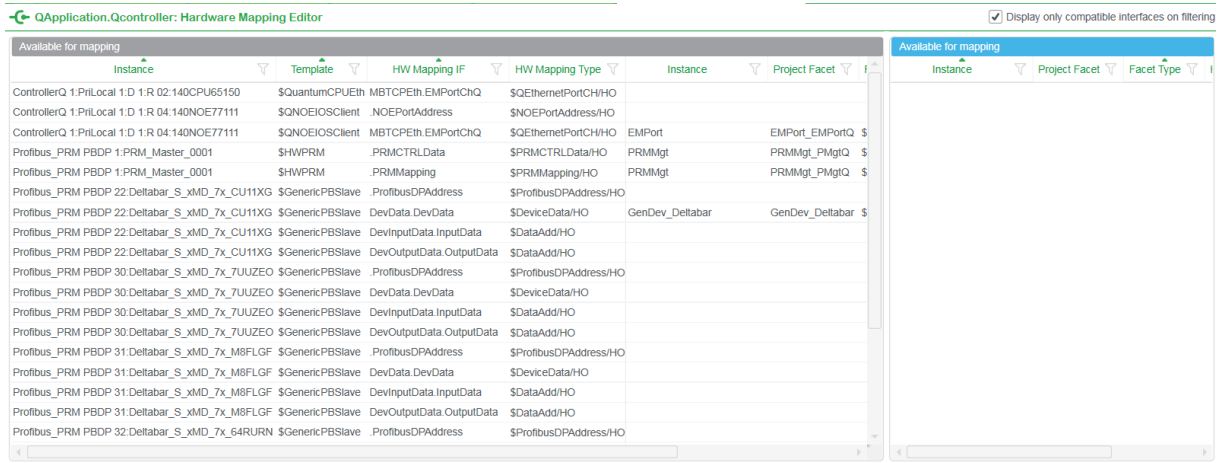
In the executable we map the service on the Quantum controller we have configured previously.

On the communication mapping we drag and drop the PRM to communication channels and configure the scan rate that was recommended by the PRM in the topological editor: 272 ms



In the Hardware mapping editor we connect the Port to the NOE and PRM to the hardware PRM

Instrument Deltabar is also connected to the proper instrument position of the PRM: In this case Profibus address 22.



Then we just have to build the project and deploy

Supervision project configuration

There is nothing specific for the supervision.

We just need to assign the Analoginput facets, create a page to display the genie and that is all.

Deployment and test

The PES system is ready we just have to deploy the application inside controller and PRM. Install the Supervision application in the Supervision server and client.