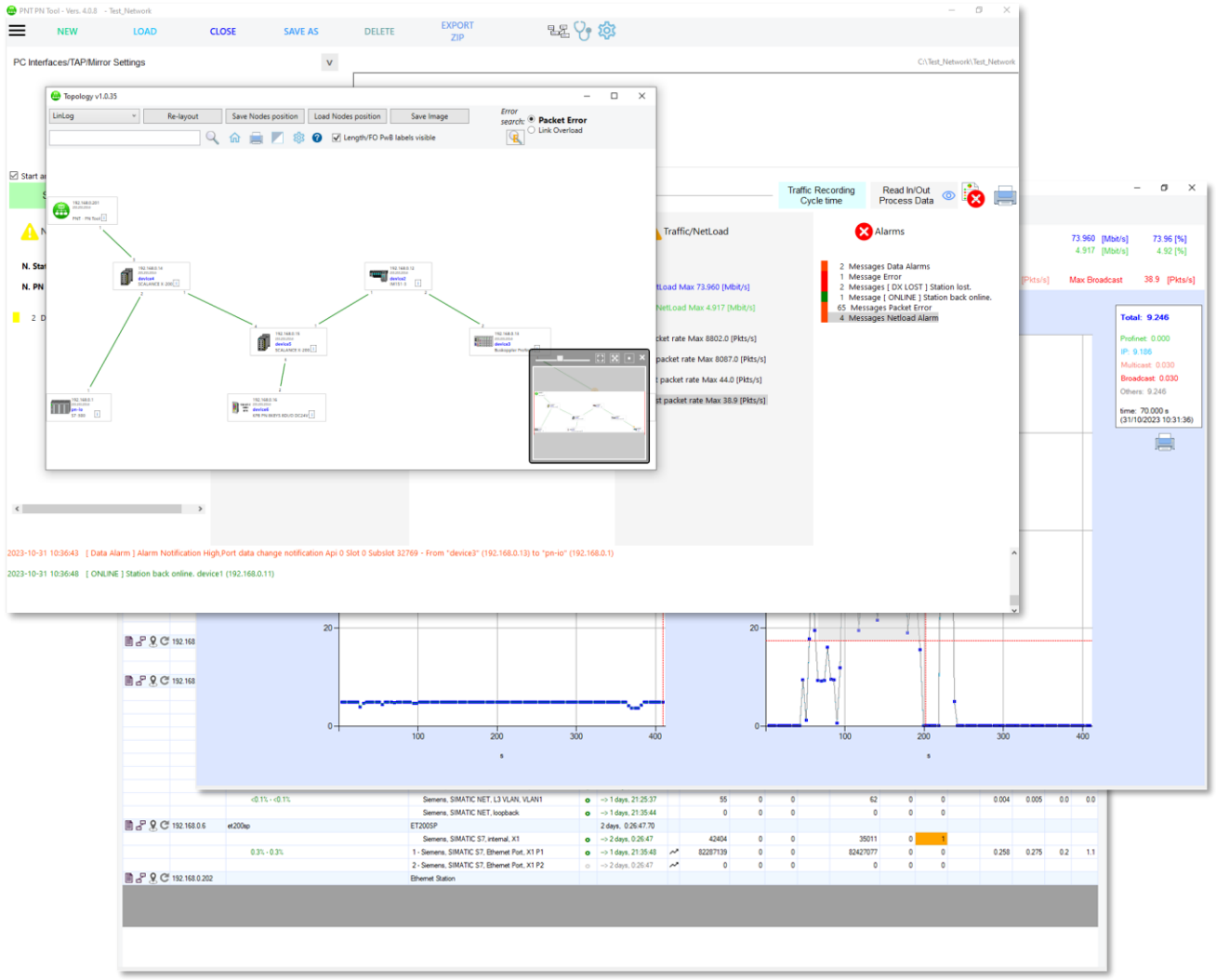
PNT - PN Tool

PROFINET Network Analysis Tool

User Manual



Version (Manual)

V. 4.0.0

Summary

Quick overview

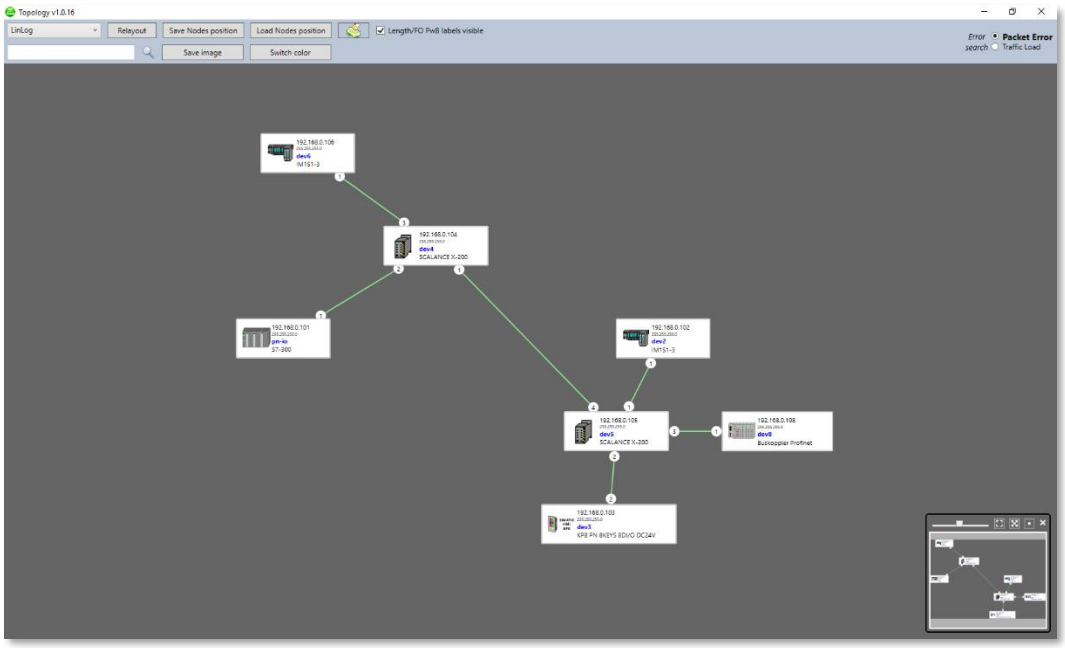
PNT - PN Tool is the program for the analysis and monitoring of PROFINET networks.

Thanks to the many years of experience in the field during the troubleshooting and validation of over 500 PROFINET networks, the PNT - PN Tool **includes in one program all the features** required to analyze the behavior of PROFINET networks.

PNT - PN tool has a simple and intuitive interface and **uses the network card of your PC**.

Connecting the network card of the PC to **any available port** of a PROFINET device/switch you can, for instance:

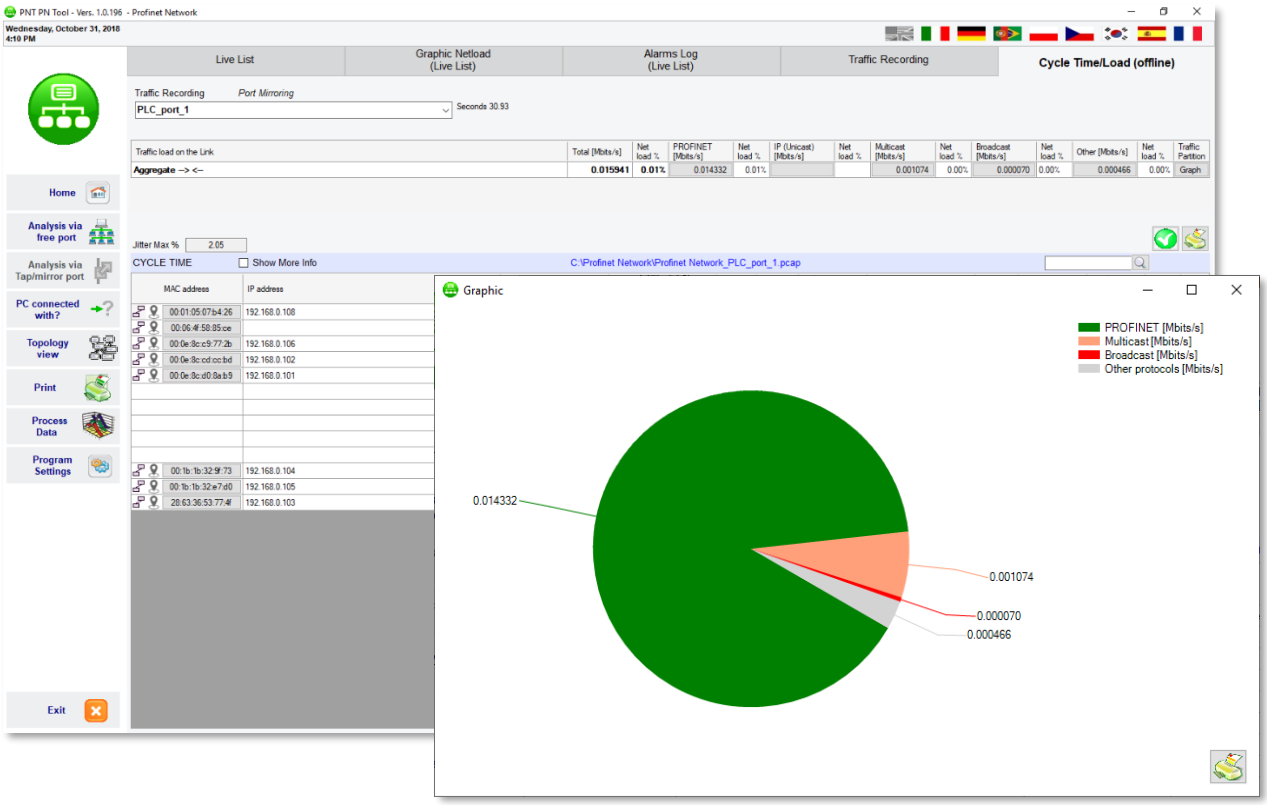
- Get **detailed information** on all connected devices (model and serial number, PROFINET diagnostics)
- Obtain the **number of errors** in transmission and reception (useful for detecting bad cables/interfaces)
- Calculate the **traffic load** on all links (ideal for identifying critical links with too much traffic)
- View the **network topology** (interactive graphic or tabular views)
- Evaluate the impact of the **multicast and broadcast** traffic on the network
- **Assign** name and IP address, identify devices, access the web interfaces of the switches/devices
- **Reset** the device to factory settings
- **Acyclic Communication** Read and Write record



PNT - PN Tool: Topology

In addition, by connecting the PC network card to a free port of a managed switch with port mirror functionality (or to a TAP), you can:

- Show, with the **Live List functionality**, the operating status of the PROFINET devices (Run, Stop, Error), cycle time and missing devices
- Check, during live list the diagnostic messages and events launched by the PROFINET devices
- Save in a **log file** the diagnostic events such as alarms and loss of devices
- **Record** network traffic (PROFINET and others) on the link
- **Show the number of lost packets** using the mirror port of a managed PN switch or a TAP
- Calculate the actual **update times and jitter** (for jitter a TAP with timestamp is required)
- **Continuously monitor the network** (Easy Mode – Network Monitoring).



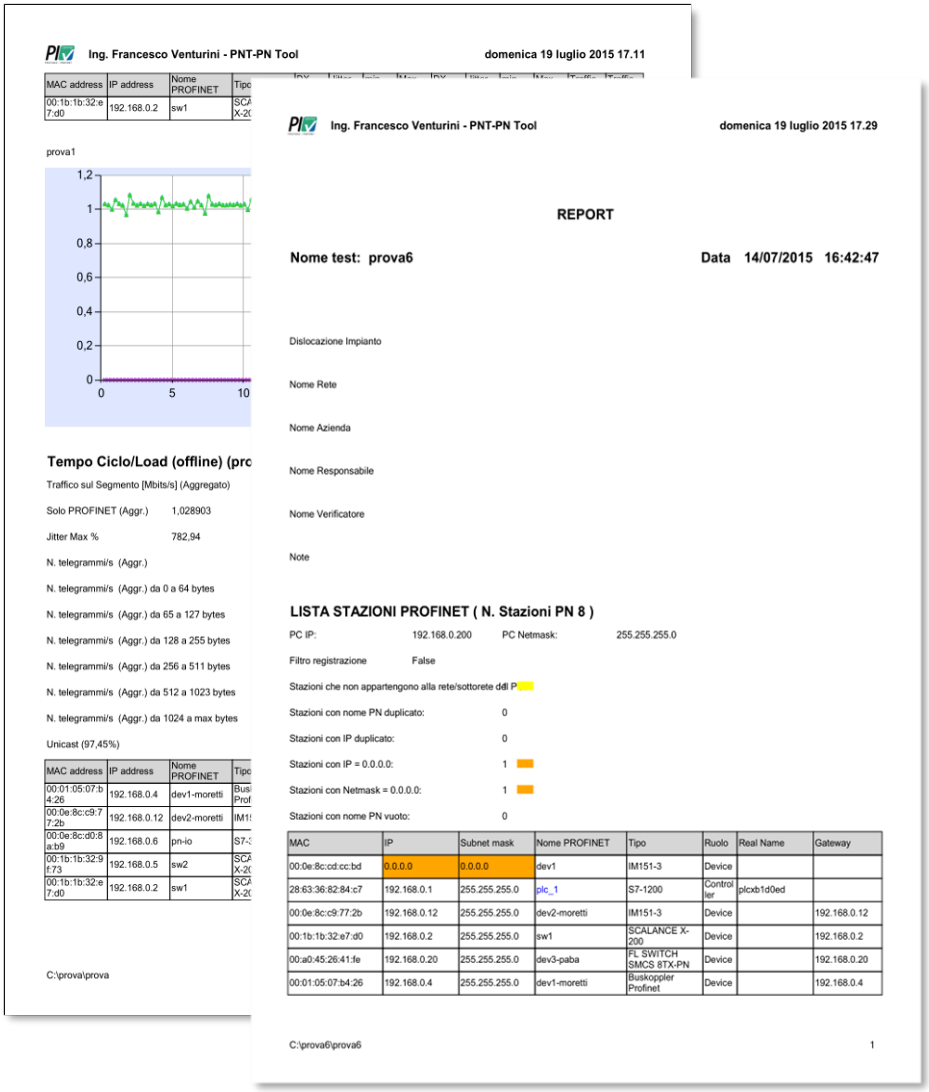
PNT - PN Tool: Network traffic analysis

PNT - PN Tool includes:

- **Wizard** functionality; in order to automatically analyze the network
- **Compare** functionality; to compare the last analysis with previous analysis for the verification of "running error", changes of topology, or replacement of devices
- Generation of **validation reports** in different languages
- Printing reports with **customizable logo**
- **ProfiGraphPN**; for inspecting in graphical form the process data of the PROFINET devices without using the development tool of the PLC. ProfiGraphPN is also a data logger; it enables long time recording of slow process values thanks to a programmable sample time from 0.1s up to 60s (max. sample frequency 10 Hz, min. sample frequency 0.01666 Hz).

PNT - PN Tool is used successfully in automotive plants, manufacturing, food & beverage, and in process industry to ensure conformance to the PROFINET installation rules.

The tool **provides a report to assess the conformity of your network** with the guidelines of the PROFIBUS & PROFINET International consortium (PI).



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MAC address	IP address	Nome PROFINET	Tipo
00:1b:1b:32:e7:d0	192.168.0.2	sw1	SCA X-2(

prova1

Tempo Ciclo/Load (offline) (prc

Traffico sul Segmento [Mbits/s] (Aggregato)

Solo PROFINET (Aggr.) 1,028903

Jitter Max % 782,94

N. telegrammi/s (Aggr.)

N. telegrammi/s (Aggr.) da 0 a 64 bytes

N. telegrammi/s (Aggr.) da 65 a 127 bytes

N. telegrammi/s (Aggr.) da 128 a 255 bytes

N. telegrammi/s (Aggr.) da 256 a 511 bytes

N. telegrammi/s (Aggr.) da 512 a 1023 bytes

N. telegrammi/s (Aggr.) da 1024 a max bytes

Unicast (97,45%)

MAC address	IP address	Nome PROFINET	Tipo
00:01:05:07:b4:26	192.168.0.4	dev1-moretti	Busi Prof
00:0e:8c:c9:77:2b	192.168.0.12	dev2-moretti	IM15
00:0e:8c:d0:8a:b9	192.168.0.6	pn-io	S7-1
00:1b:1b:32:9f:73	192.168.0.5	sw2	SCA X-2(
00:1b:1b:32:e7:d0	192.168.0.2	sw1	SCA X-2(

C:\prova\prova

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REPORT

Nome test: prova6 **Data 14/07/2015 16:42:47**

Dislocazione Impianto

Nome Rete

Nome Azienda

Nome Responsabile

Nome Verificatore

Note

LISTA STAZIONI PROFINET (N. Stazioni PN 8)

PC IP: 192.168.0.200 PC Netmask: 255.255.255.0

Filtro registrazione False

Stazioni che non appartengono alla rete/sottorete dell P

Stazioni con nome PN duplicato: 0

Stazioni con IP duplicato: 0

Stazioni con IP = 0.0.0.0: 1

Stazioni con Netmask = 0.0.0.0: 1

Stazioni con nome PN vuoto: 0

MAC	IP	Subnet mask	Nome PROFINET	Tipo	Ruolo	Real Name	Gateway
00:0e:8c:cd:cc:bd	0.0.0.0	0.0.0.0	dev1	IM151-3	Device		
28:63:36:82:84:c7	192.168.0.1	255.255.255.0	plc_1	S7-1200	Controller	plcxb1d0ed	
00:0e:8c:c9:77:2b	192.168.0.12	255.255.255.0	dev2-moretti	IM151-3	Device		192.168.0.12
00:1b:1b:32:e7:d0	192.168.0.2	255.255.255.0	sw1	SCALANCE X-200	Device		192.168.0.2
00:a0:45:26:41:fe	192.168.0.20	255.255.255.0	dev3-paba	FL SWITCH SMCS 8TX-PN	Device		192.168.0.20
00:01:05:07:b4:26	192.168.0.4	255.255.255.0	dev1-moretti	Buskoppler Profinet	Device		192.168.0.4

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PNT - PN Tool Report

Getting started

WARNING

Any alterations to the software by Viruses, Malware, etc. or device problems such as PN Device Firmware bugs, software bugs, etc. can cause unsafe system operation.

Check all the safety systems before using the software.

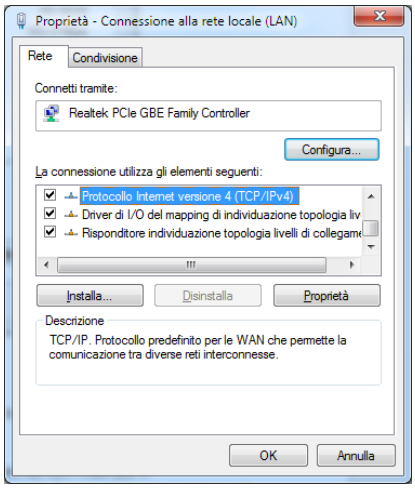
Check if all your PROFINET devices or controllers are PROFINET certified.

It is recommended to stop production before using the software for the first time in the plant.

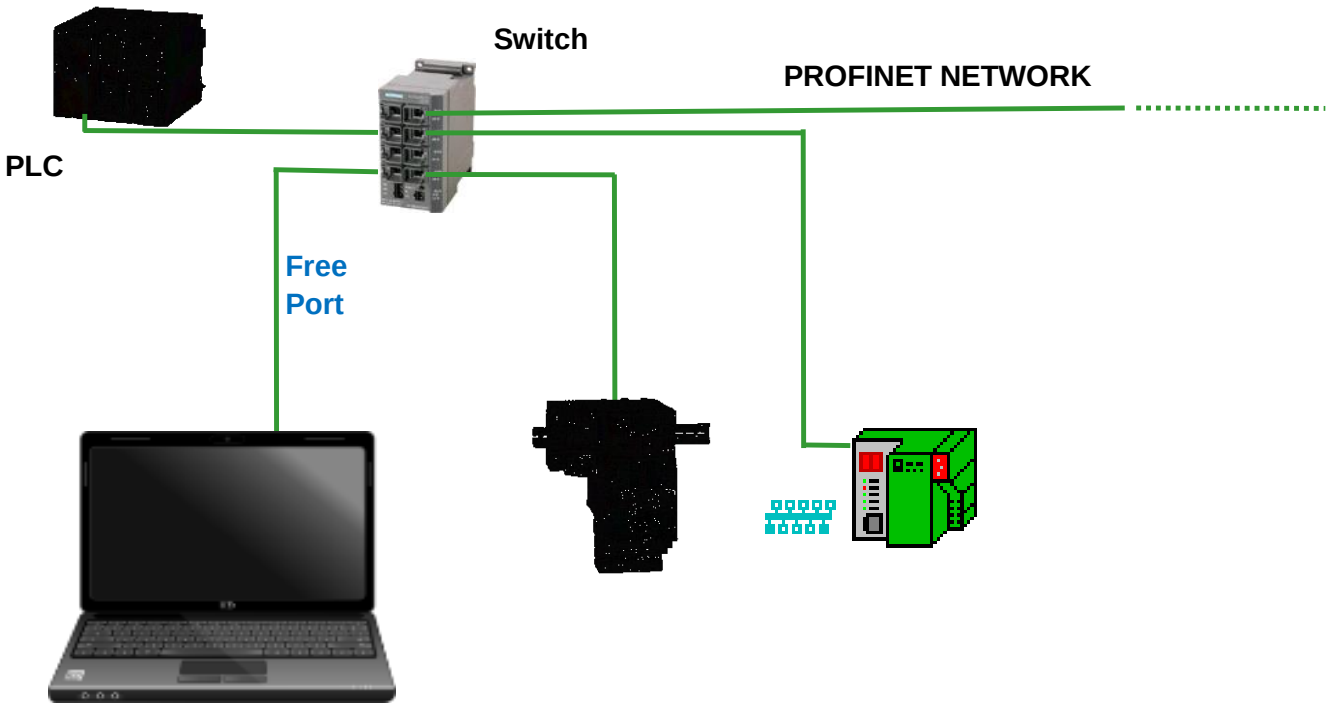
Installing the software and setting the PC address

1. Run PNT_Setup.exe and install the software

2. Assign a free IP address and the correct subnet mask to the PC using the network settings of the operating system



3. Connect your PC to a free port of a switch (or a PROFINET device) with an Ethernet cable

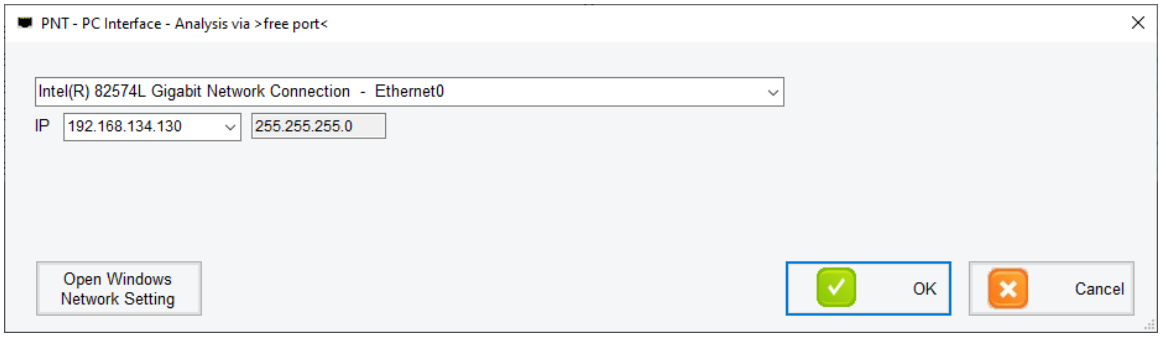


Connection example

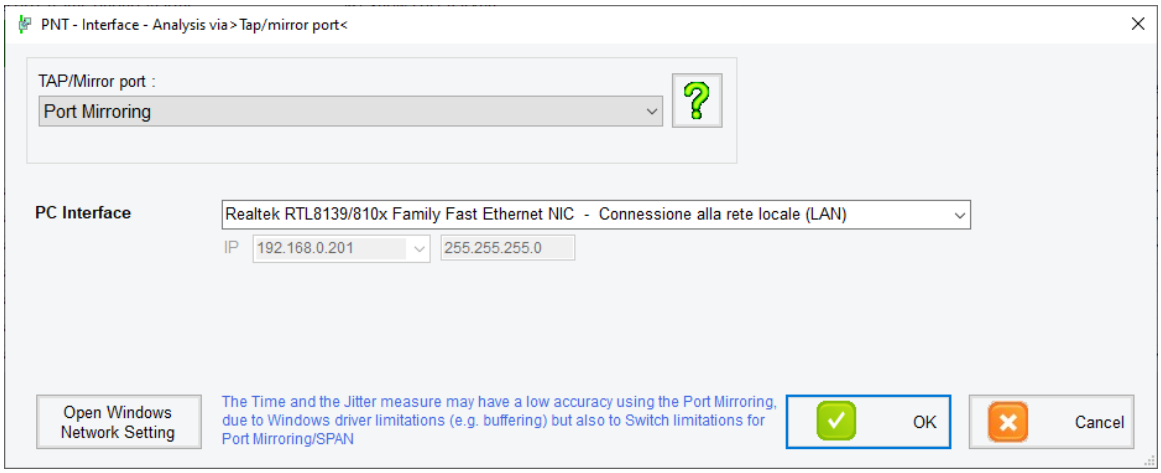
4. Insert the USB license key

5. Start the program PNT - PN Tool

6. Select your PC Interface



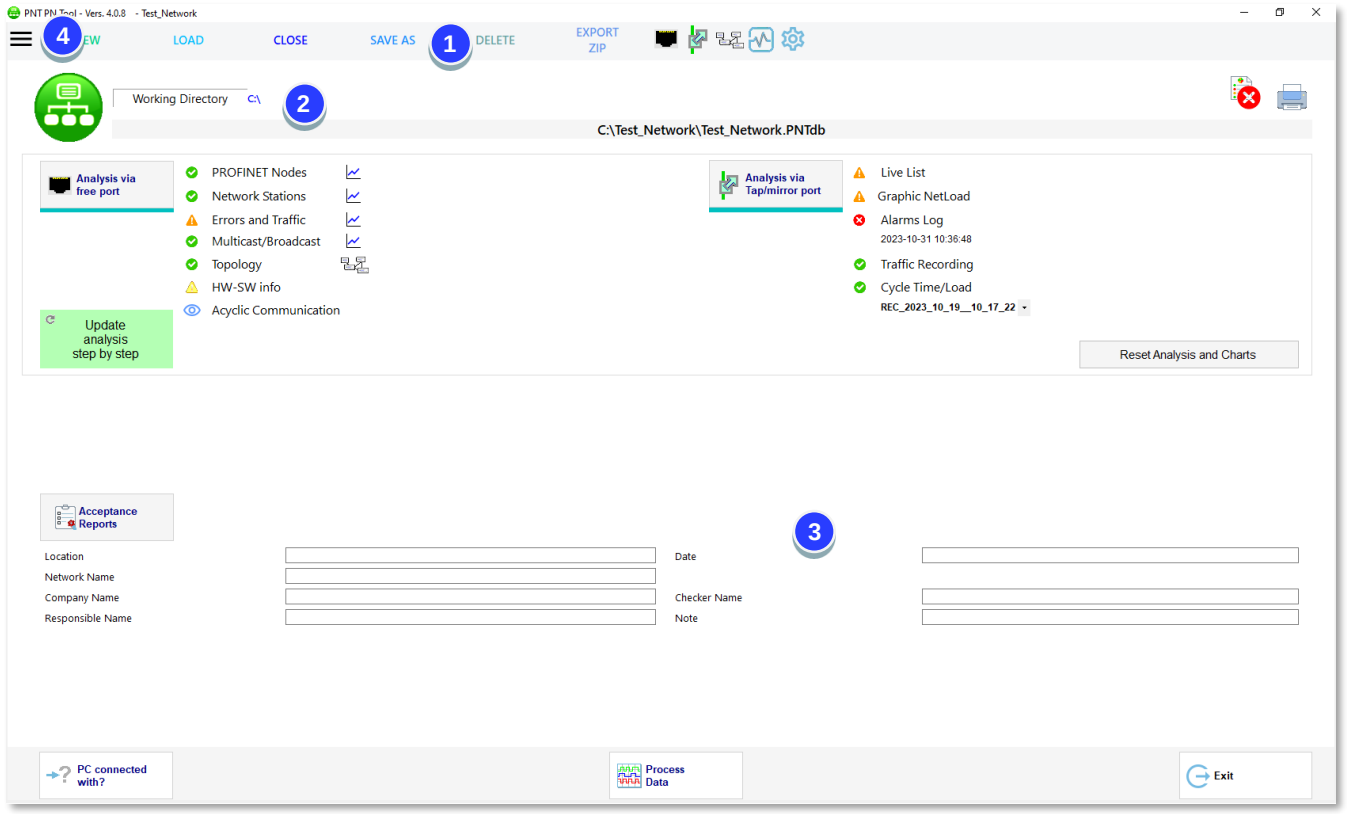
7. Select again the PC Interface connected to the Mirror Port of a switch or, if you are you using a TAP, the TAP interface.



Managing Projects

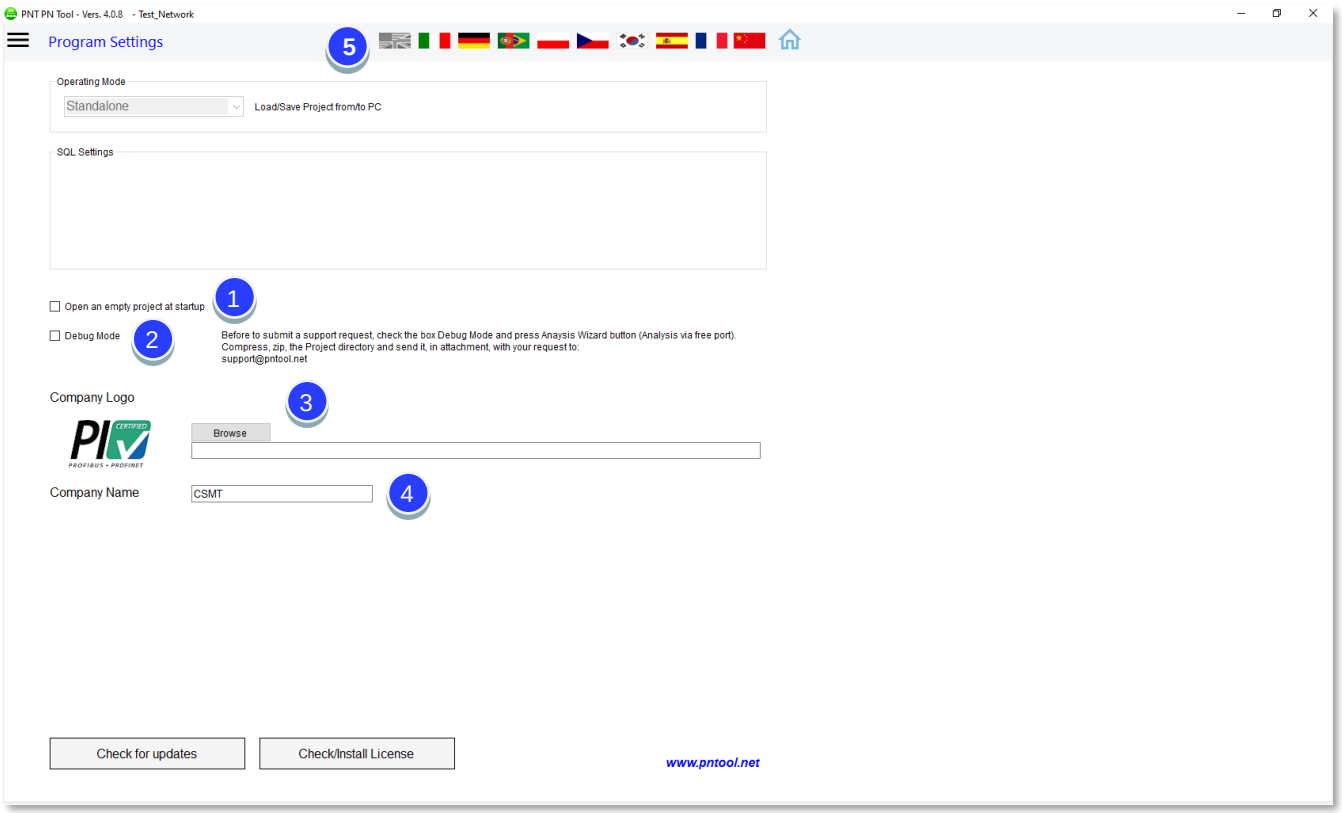
The Home page

The project management window allows the user to create, open and close projects.



	Function	Description
1	**Managing project file buttons**	Create new project, load existing project, close project, save as (clone) project, delete project from disk, export JSON file
2	**Working directory**	Shows the working directory for the PNT tool
3	**Analysis Data information/details**	User can add description of the project details, including the name of involved people and location of the network under test.
4	**Menu button**	Menu button can be used to navigate to other parts of the project

The Program setting page

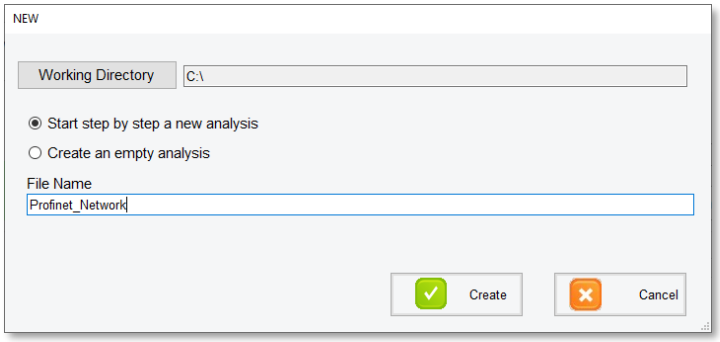


	Function	Description
1	**Open an empty project at startup**	If enabled, it will create at the next startup a new analysis project named PNT_no_name.
2	**Debug Mode**	If enabled, a file with debugging info for developers will be created during the wizard analysis.
3	**Logo**	This logo will appear in the top left page of the report. Browsing for new logo is possible here
4	**Company Name**	This name will appear in the report. A new company name can be inserted here.
5	**Language selection buttons**	Allow user to change the PNT interface and report language

Create a new project

The first step is to create a new project.

1. Press “**New**”



2. Press **“Working Directory”** and select the directory where you want to save the files or create a new one.

3. Select “Start step by step a new analysis” if you want to start the wizard, or “Create an empty analysis” if you want to start the different analysis manually

4. Type the file name and press **“Create”**

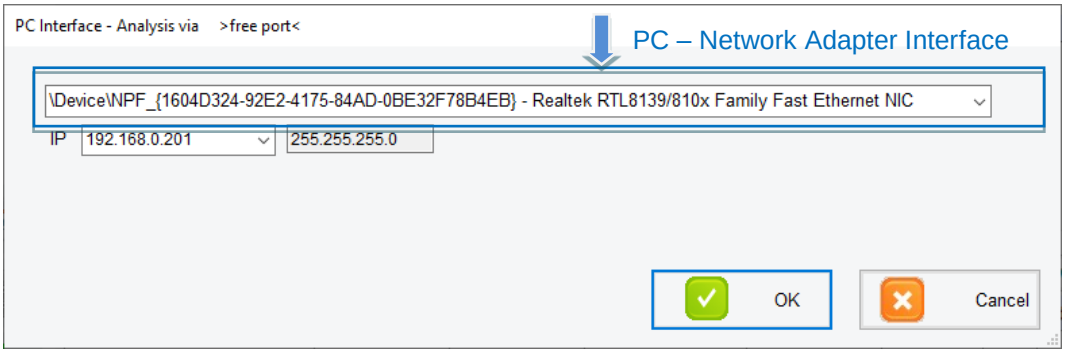
Exploring the network

Analysis via free port (Active Analysis)

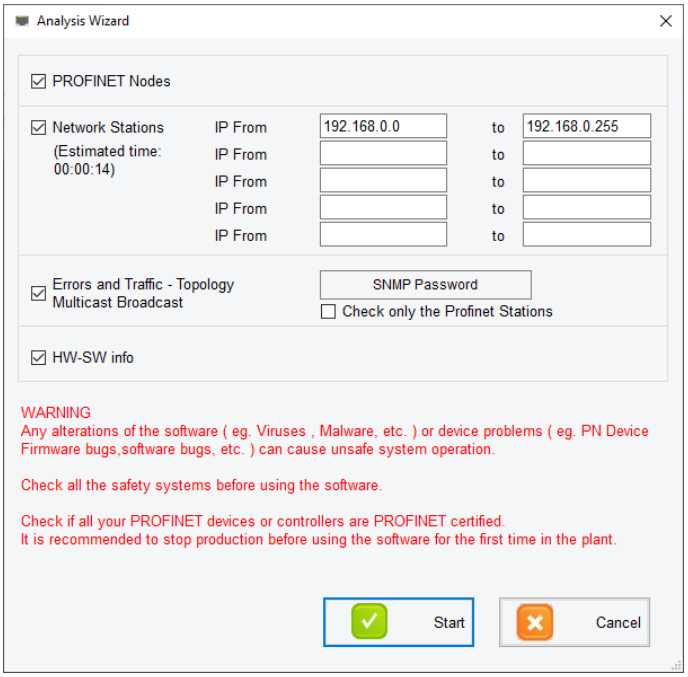
The analysis of diagnostic data and statistics in the PROFINET devices require active polling of these components:
• Statistics in switches
• Neighborhood information for determining the topology
• Status information (error memory, firmware revision level, etc.) [1]

The "**Analysis via free port**" option explores the network simply by connecting the PC network card to any free Ethernet port of the network.

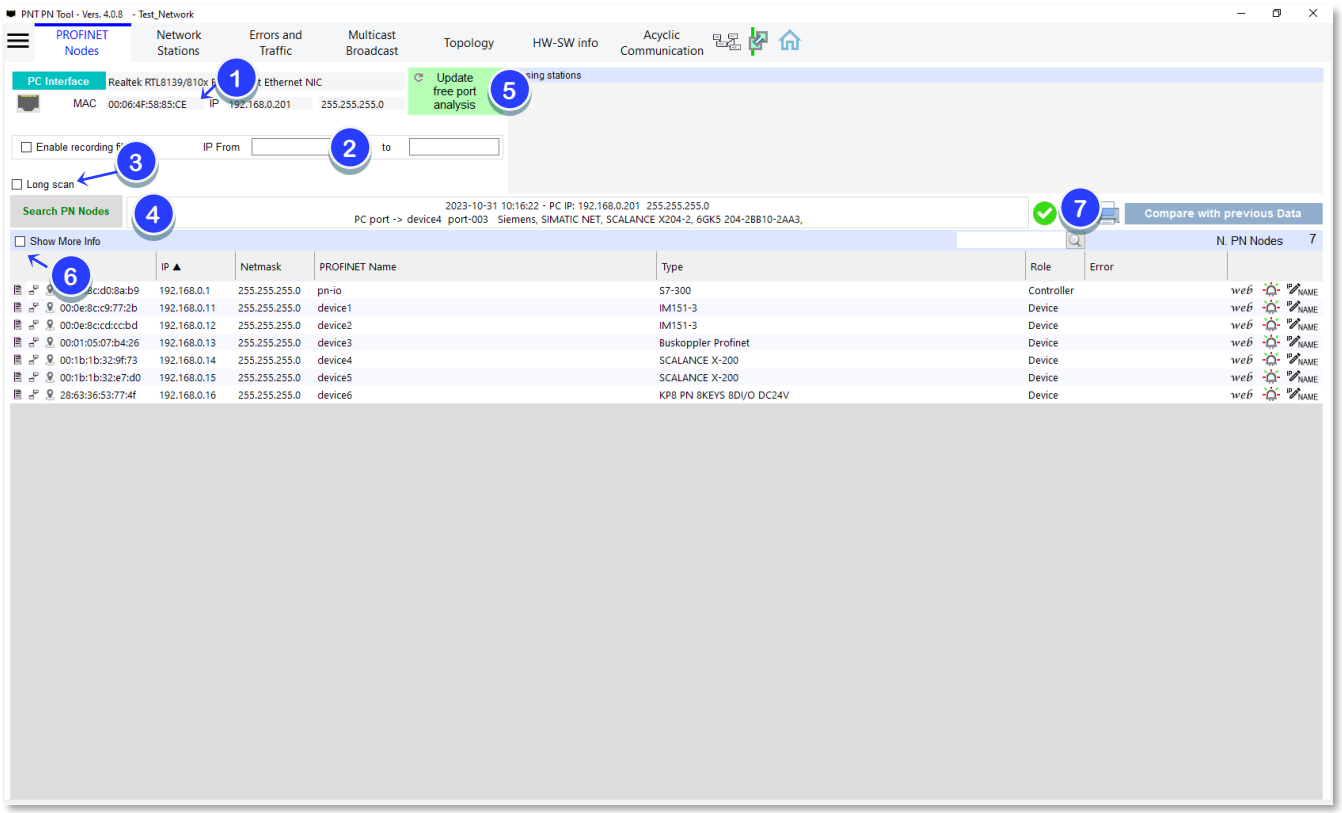
PC Interface Setting – Analysis via free port



The procedure can be executed step by step or by using the **Analysis Wizard**.



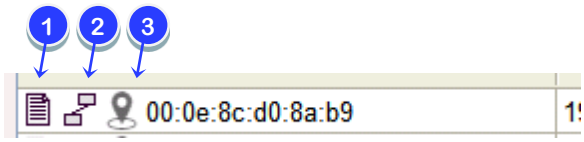
The **PROFINET Nodes** page

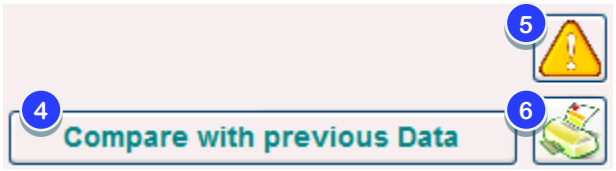


	Function	Description
1	**PC interface**	Select the PC interface connected to PROFINET Network
2	**Recording filter**	Allows analysis of a subnet of the entire network
3	**Long Scan**	Two pass scan. Useful for a large network
4	**Search PN Nodes**	Start the search for PROFINET Controllers and Devices
5	**Analysis Wizard**	Start PROFINET network analysis. Search for PN nodes, read topology, read error and traffic, read hardware and software information
6	**Show More Info**	Show Role, Gateway, Vendor ID, Device ID
7	**Results button**	The icon shows the result of the single test. Pressing the button, a window will display a brief report with the results of the single analysis.

Common buttons

The buttons below are used in more pages.





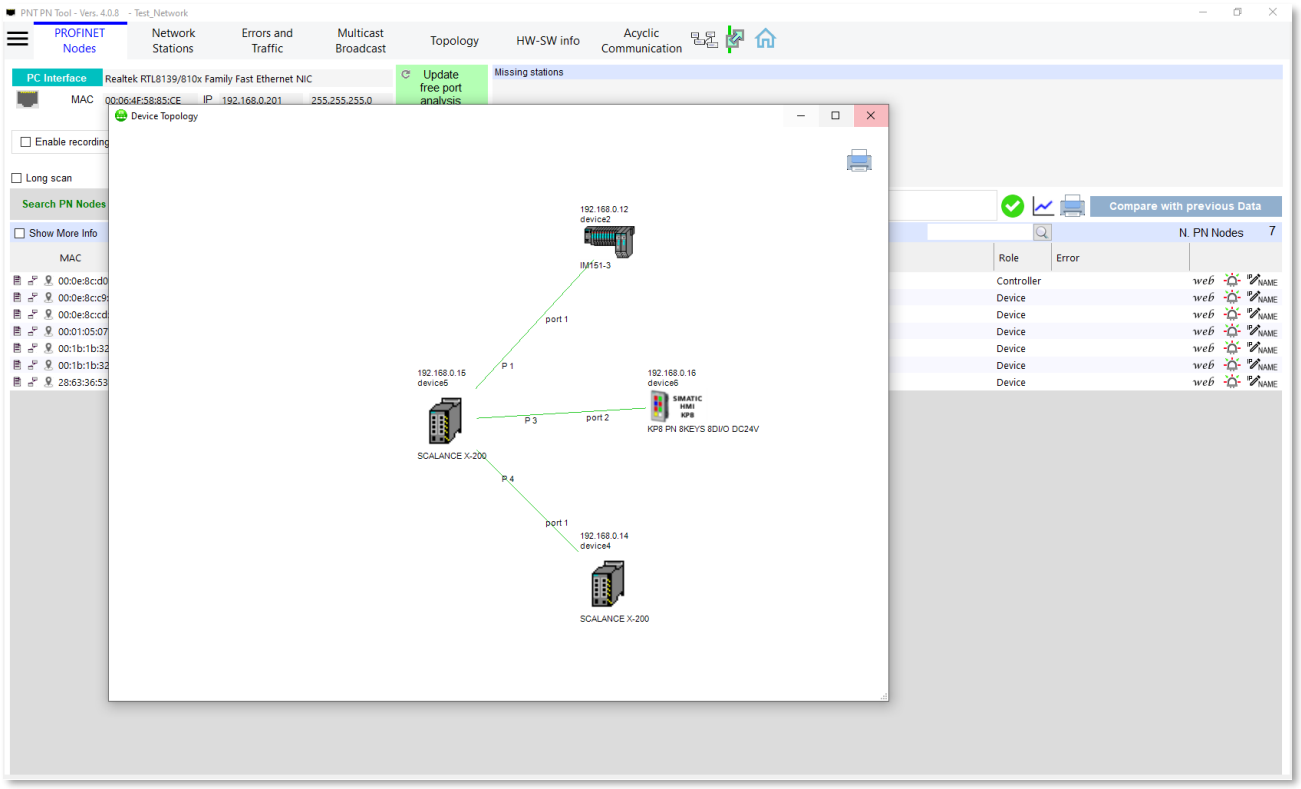
	Function	Description
1	**Device Overview**	Go to the Device Overview window.
2	**Device Connections**	Show the detailed topology of the device.
3	**Device Position**	Open the full Topology View centered on the device.
4	**Compare with previous Data**	Compare the last analysis with the previous analysis.
5	**Results button**	The icon shows the result of the single test.
6	**Print button**	Print the current data table

Sort Columns

You can sort the data in a table by clicking the header of a column.

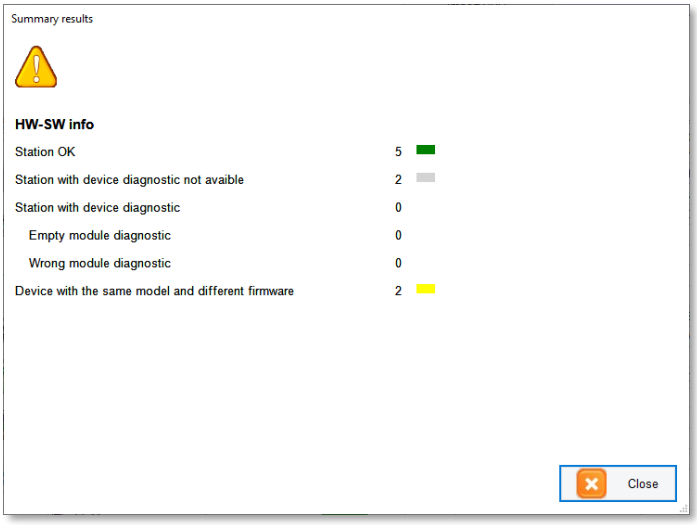
Right click on device

With the right click on the device you can show the detailed topology of the device.

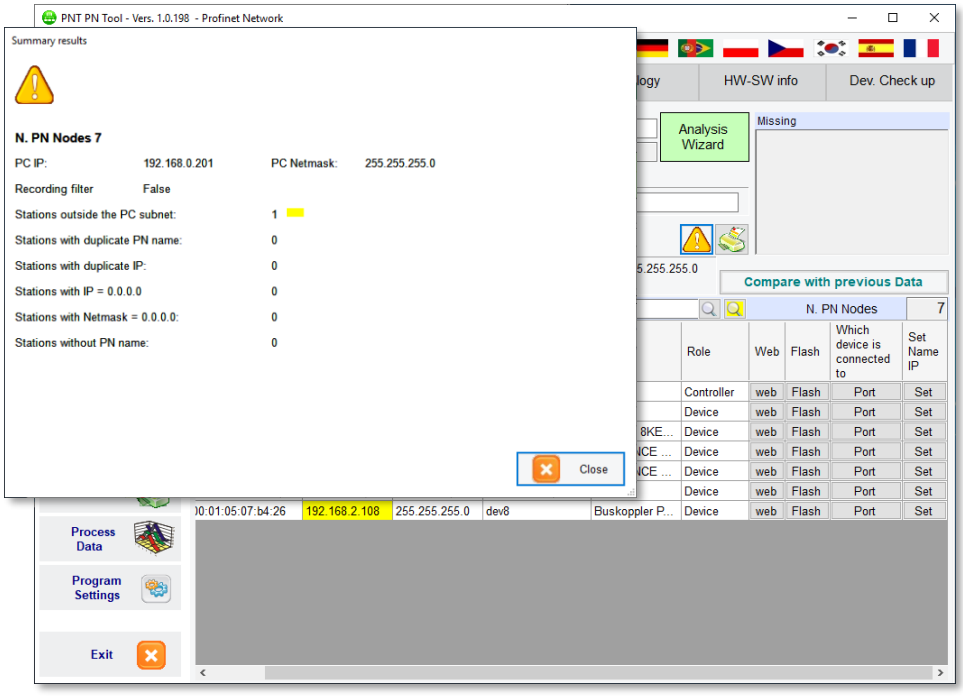


Results of the scan crosscheck

By pressing the WARNING button, a window will display a brief report with the results of the single analysis.



In the example below you can see the number of stations that do not belong to the PC network/subnet (“Station outside the PC subnet”). Stations and PC that don’t belong to the same network cannot exchange IP telegrams.



The background colour of the stations outside the PC subnet is highlighted in yellow. The topology and the telegram errors of these stations cannot be determined.

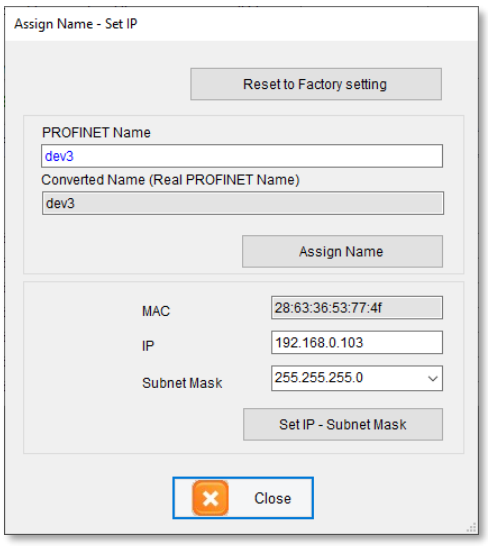
Actions on a single device

If the PLC or the device have a web server included, pressing the button “web” will launch the default browser and open the start page of the PLC/Device.

By pressing the “Flash” Button, one or more LED of the selected device will blink for 6 seconds. Usefull for identification of the device in the plant.

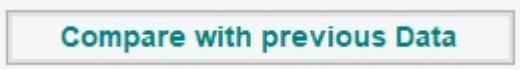
Changing the device name, the IP address or resetting to factory default

By pressing the “IP Name” Button it is possible to change the device name/ the IP address or reset to factory default for a PROFINET Device



You can type the PROFINET name using space or special characters. In the next field you can see the **Converted Name**, this is the real PROFINET Name that will be stored inside the device,

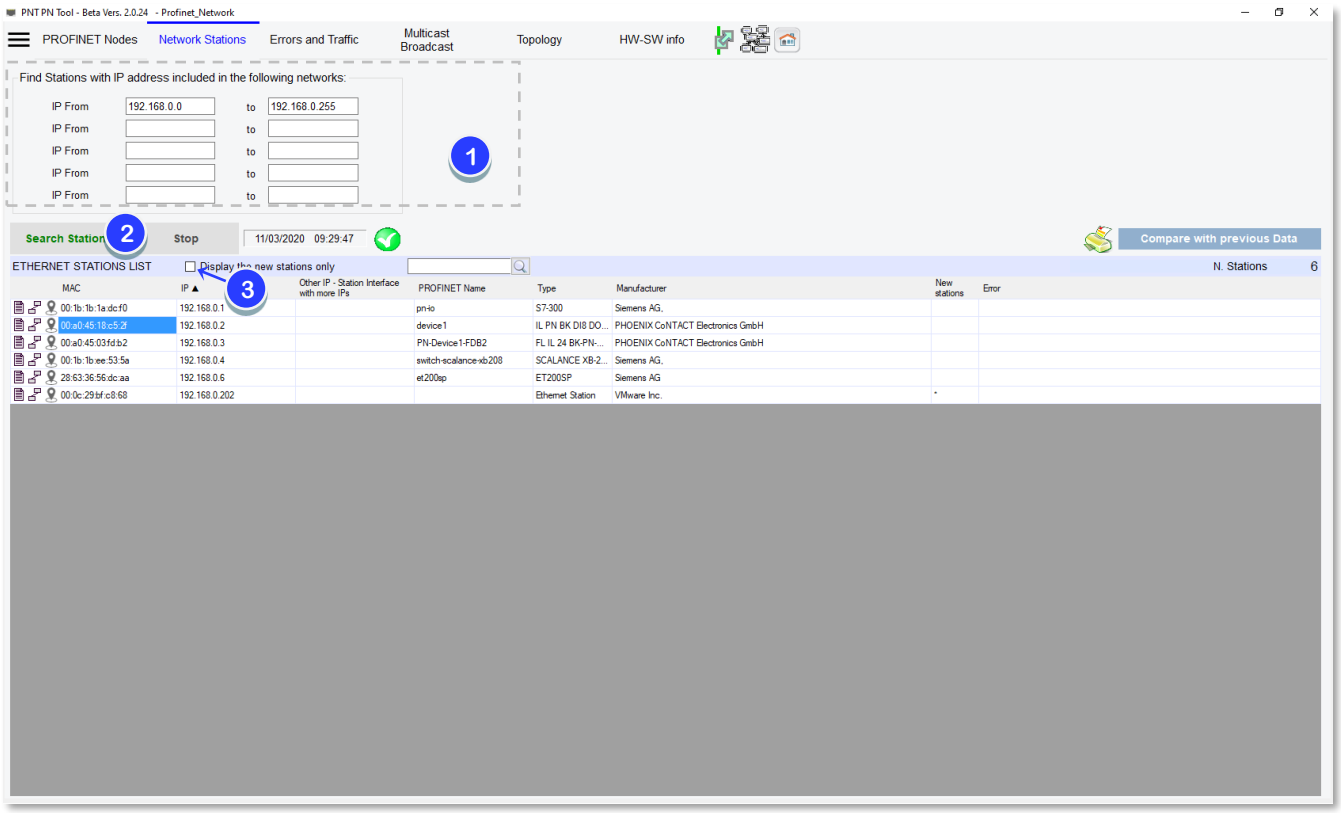
Compare with previous Data



Compare functionality is used to compare the last analysis with previous analysis. For example if you are inside the “**Topology**” page, you can check if the topology has been changed or inside the “**Error** and **Traffic**” page if the number of errors or discarded packets are increased.

The Network station page.

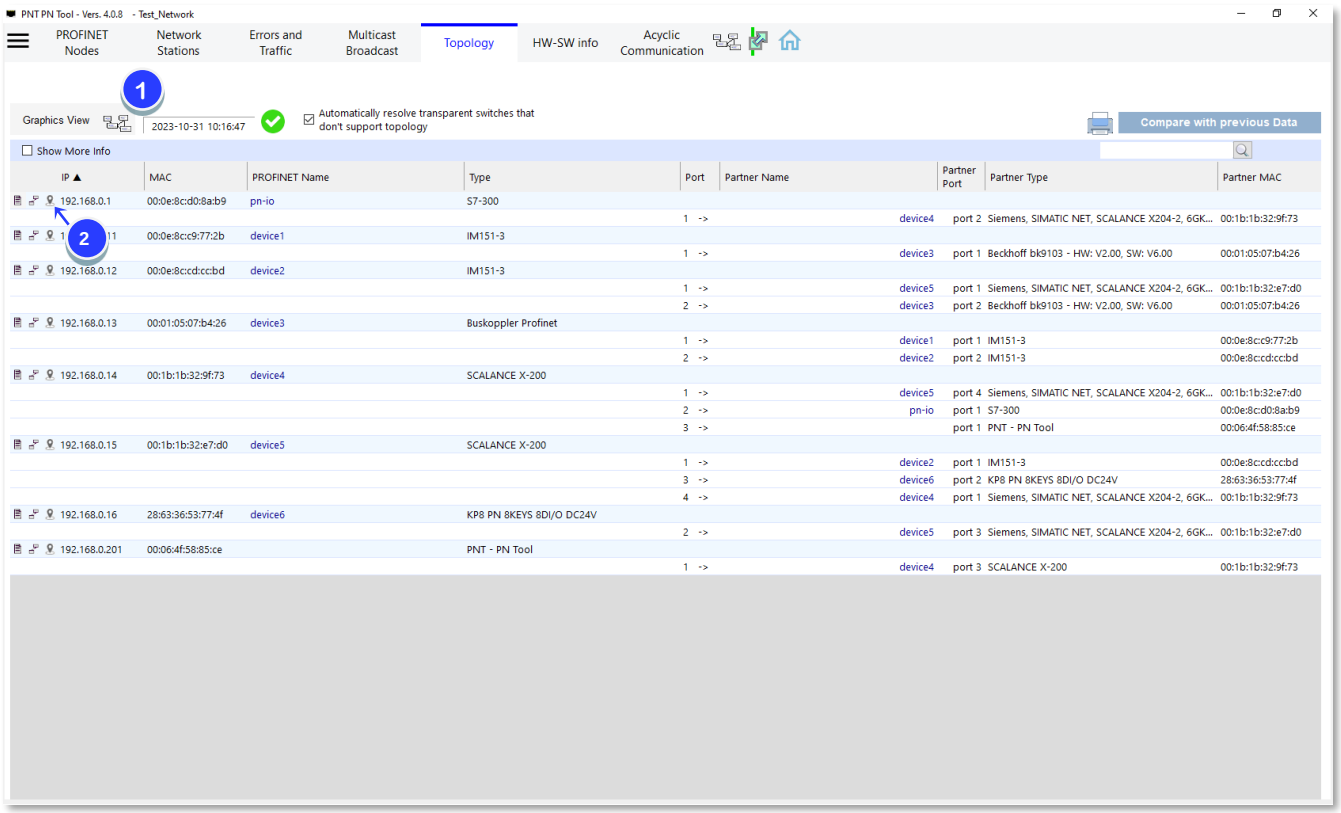
Allows the user to find all the stations with IP protocol (including PROFINET stations) in the specified subnet.



	Function	Description
1	**Networks Fields**	Insert here the networks to scan
2	**Search Station**	Start the search for the Ethernet stations with an IP address
3	**Display the new station only**	Show only the stations not listed in the “PROFINET Node” Table

1. From the top menu bar press **“Network Stations”**
2. Fill the search ranges
3. Press “**Search Stations**”

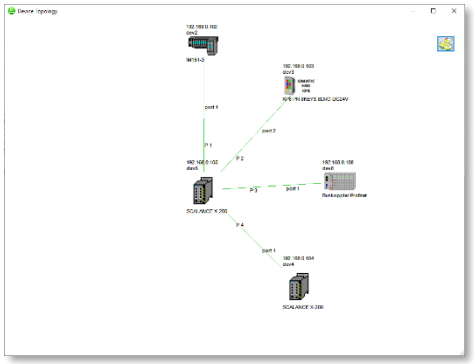
The **Topology** page



	Function	Description
1	**Graphics View**	Show the full network topology
2	**Button Drawing Topology**	Show the topology of the single station

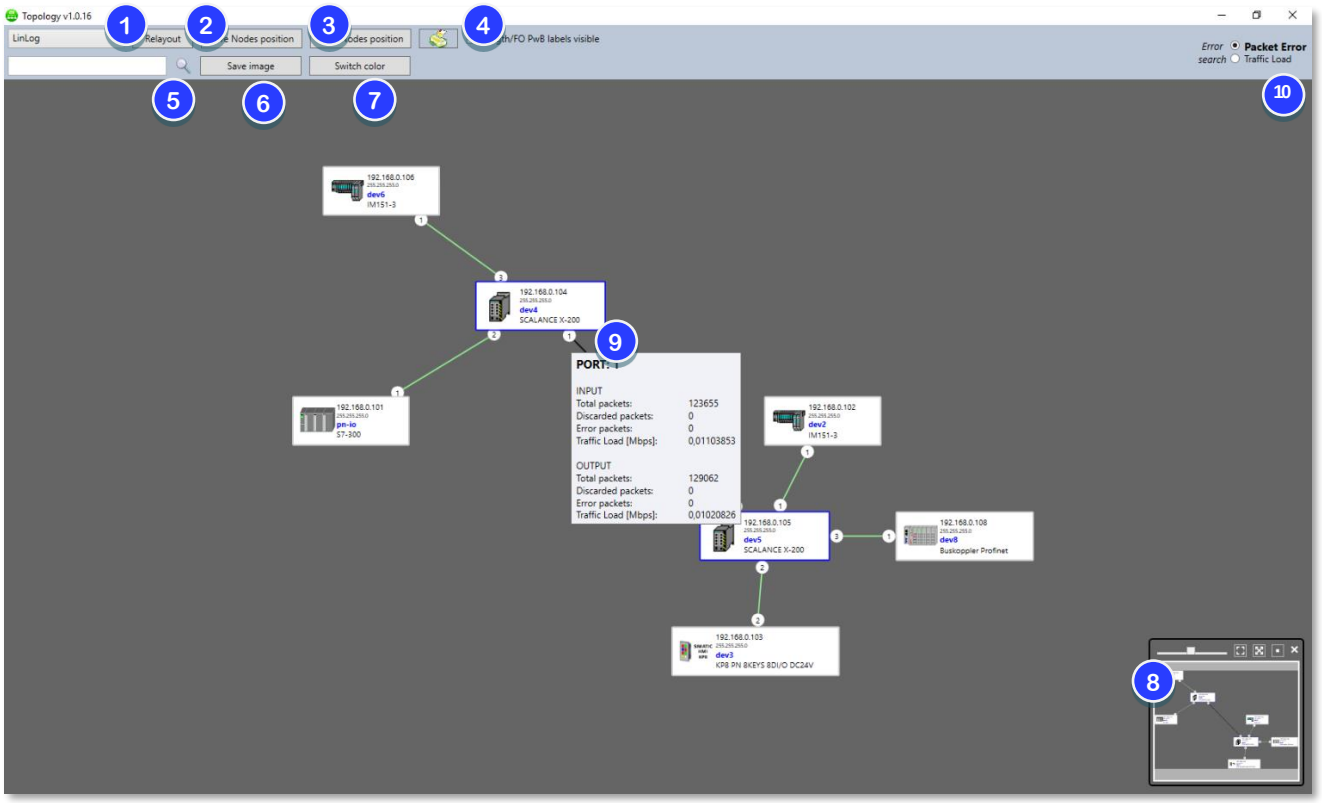
1. Press “**Graphics View**” for the full network Topology
2. Press “**Button Drawing Topology**”  to see the Graphic Topology of the device

The “one hop” topology view



3. Double Click on the device to open a new window with the topology view of the clicked device

The Graphic view of the topology

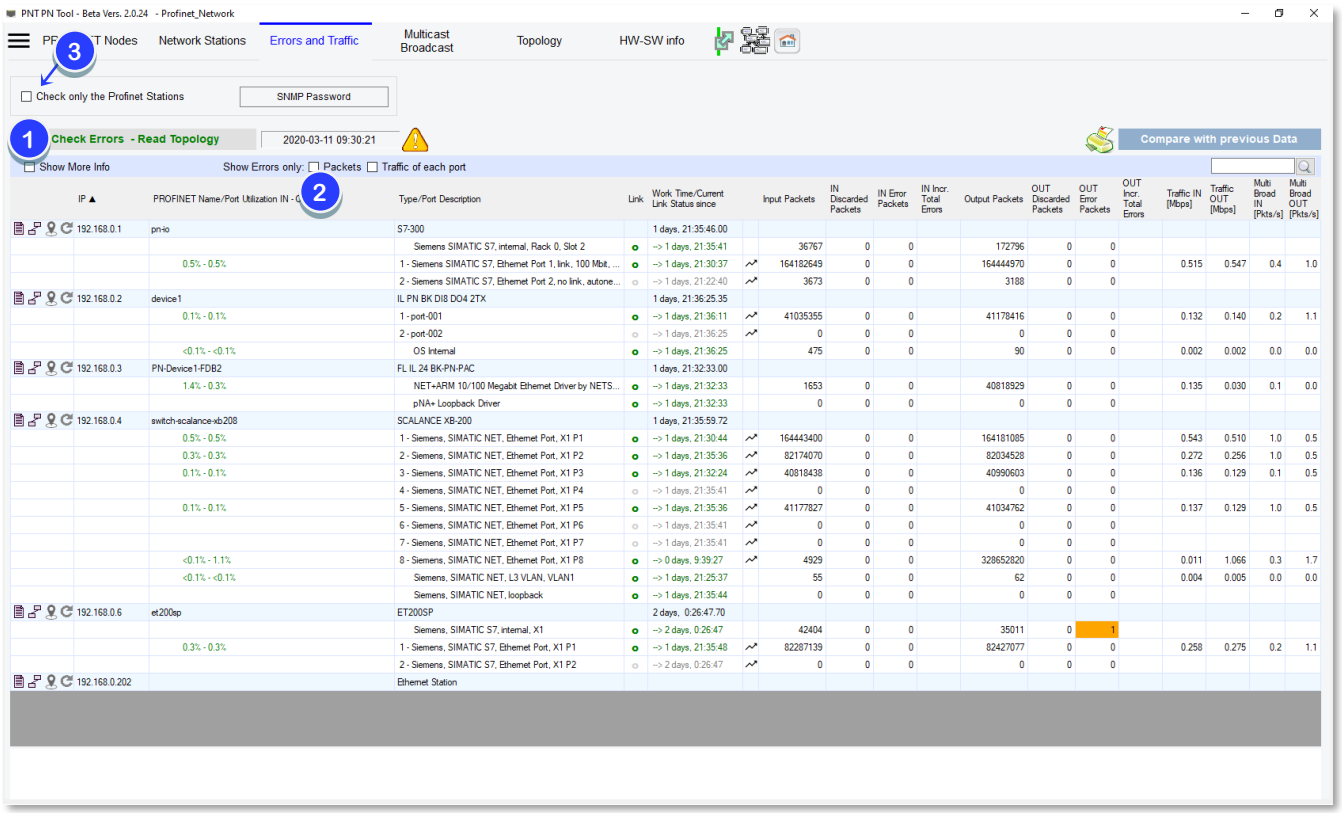


	Function	Description
1	**Re-layout**	Recalculate the position and redraw the nodes
2	**Save Nodes position**	Save the default position of the nodes
3	**Load Nodes position**	Load the default position of the nodes
4	**Print**	Print the full graph or the screen view
5	**Search**	Search the device by the IP or by the Name
6	**Save Image**	Save the full graph or the screen view (PNG,JPEG,BMP)
7	**Switch Colour**	Change the background colour
8	**Overview window**	Overview window with zoom and fill and center buttons
9	**Port/Cable Statistic**	Placing the mouse over the port number or the cable will show packets statistics and Netload
10	**Error search and positioning**	In case of an error, it is possible to search for the error and if found zoom on it

Keyboard and Mouse Commands

- Selection of more devices by mouse click. (CTRL+Left Mouse Button)
- Selection of more devices by window. (AltGr+Left Mouse Button or CTRL+ALT+Left Mouse Button)
- Deselection. (ESC key)
- Zoom window. (ALT+Left Mouse Button or Mouse Wheel)

The **Errors and Traffic** page



	Function	Description
1	**Check Errors – Read Topology**	Read the communication statistics of the PROFINET devices and the topology
2	**Show Error only**	Show only the devices with errors in the input or output telegrams and or the Netload too high
3	**Compatibility Mode**	If you discover some devices that work only in compatibly mode, please send the information to support, the compatibility list will be updated

1. From the top buttons bar press **“Errors and Traffic”**
2. Press “**Check Errors – Read Topology**”

If some information is missing, the program displays the label "n.a." = not available.

The **Multicast Broadcast** page

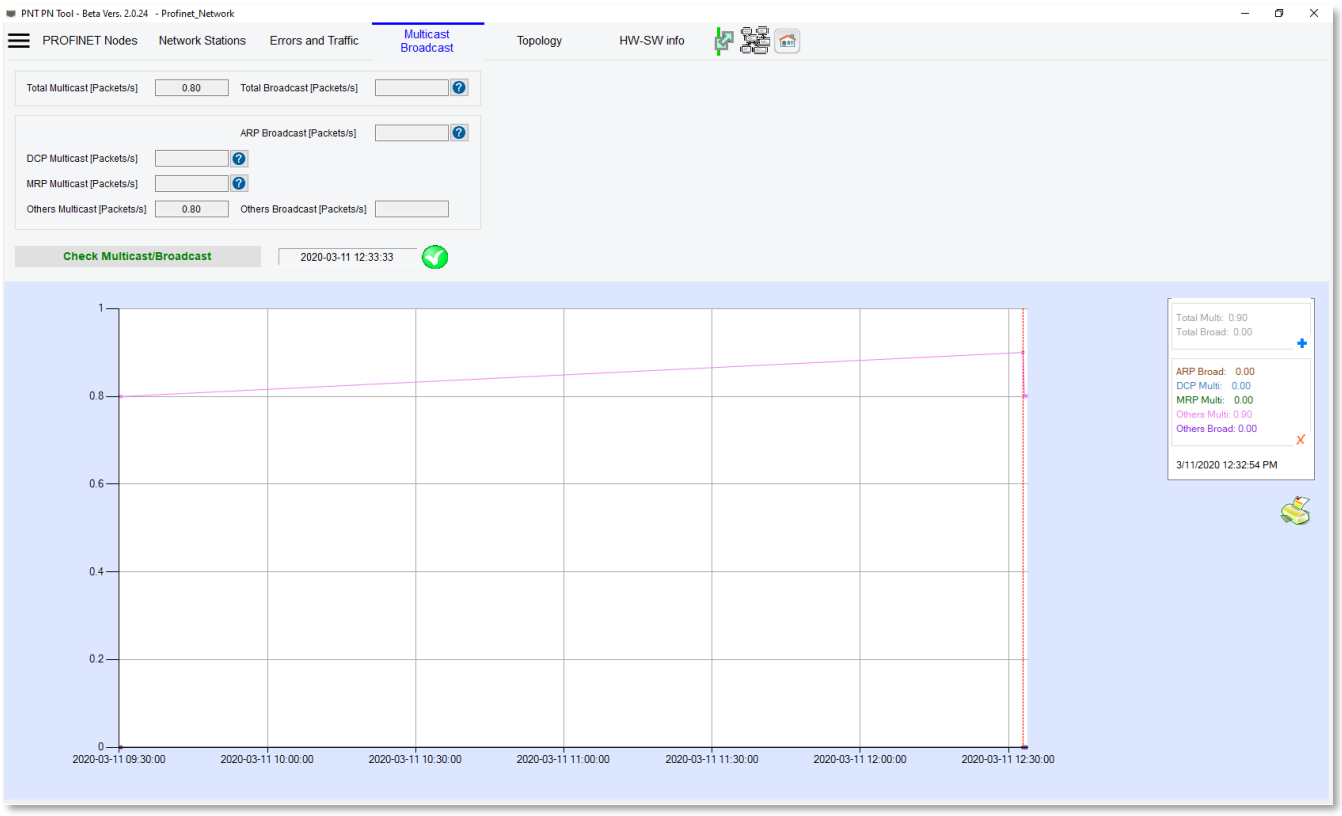
Under certain circumstances, broadcast and multicast network loads can occur during commissioning and operation of a network. These network loads are Ethernet packets transmitted to all network nodes of a switched network (broadcast domain). Typical use cases are, for example, search requests for network nodes. Search requests can be executed for different reasons and by different nodes.
Typical examples include:

• ARP broadcast, e.g. an IP scan of entire AP address ranges for the purpose of de-termining the existing network nodes (performed, e.g. by engineering systems, ser-vice tools, diagnostic tools, IT systems).

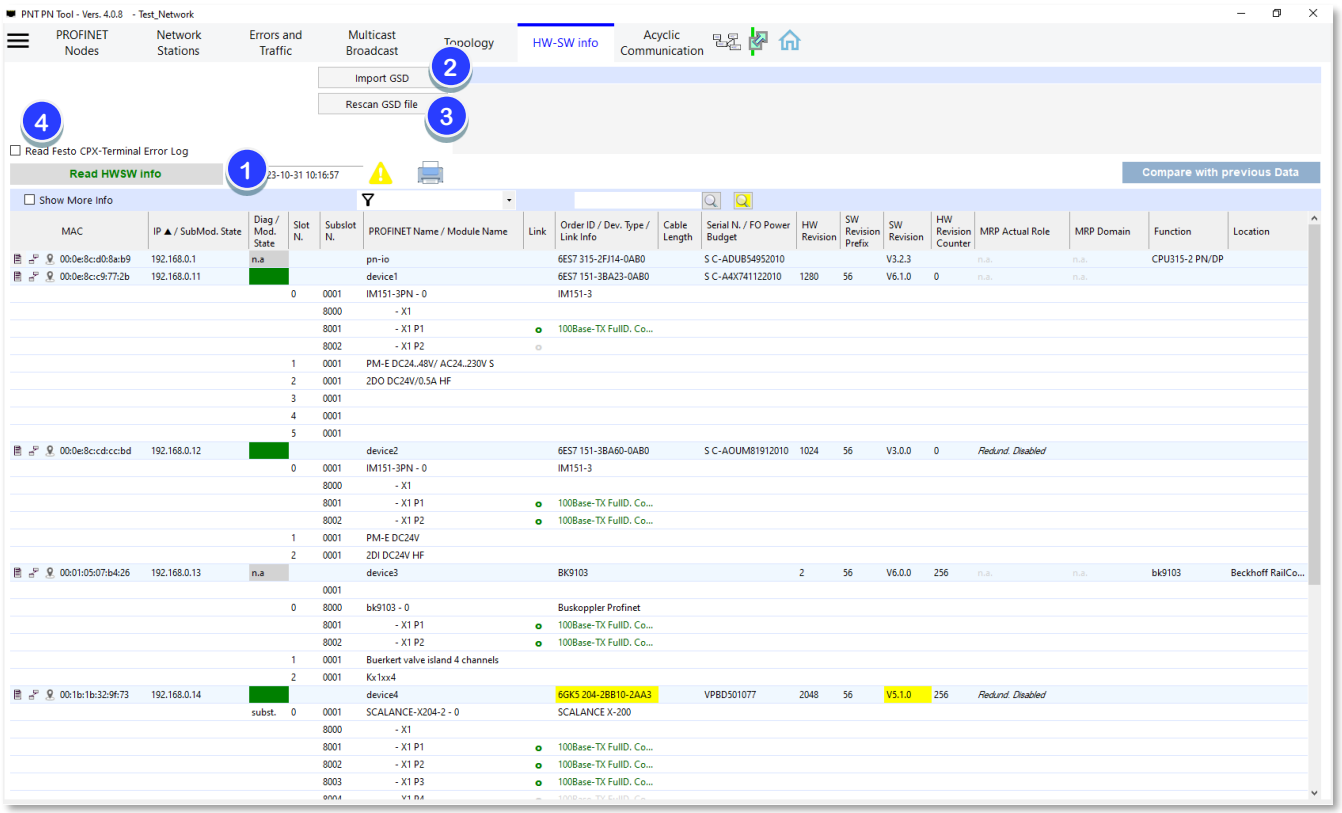
• DCP multicast, performed e.g. at the startup of a PROFINET controller to search for the planned PROFINET devices.

• MRP multicast, test packets for verifying the 'data flow', e.g. with ring redundancy.

The above search requests have one thing in common: all devices in a broadcast domain first must receive and evaluate the corresponding Ethernet packets, irrespective of their location or the topology and regardless whether they are supposed to respond or not. For all devices in the network this results in an additional communication load which may be quite important, depending on the request frequency. Therefore, additional loads generated by broadcast or multicast requests should be minimized. [1]



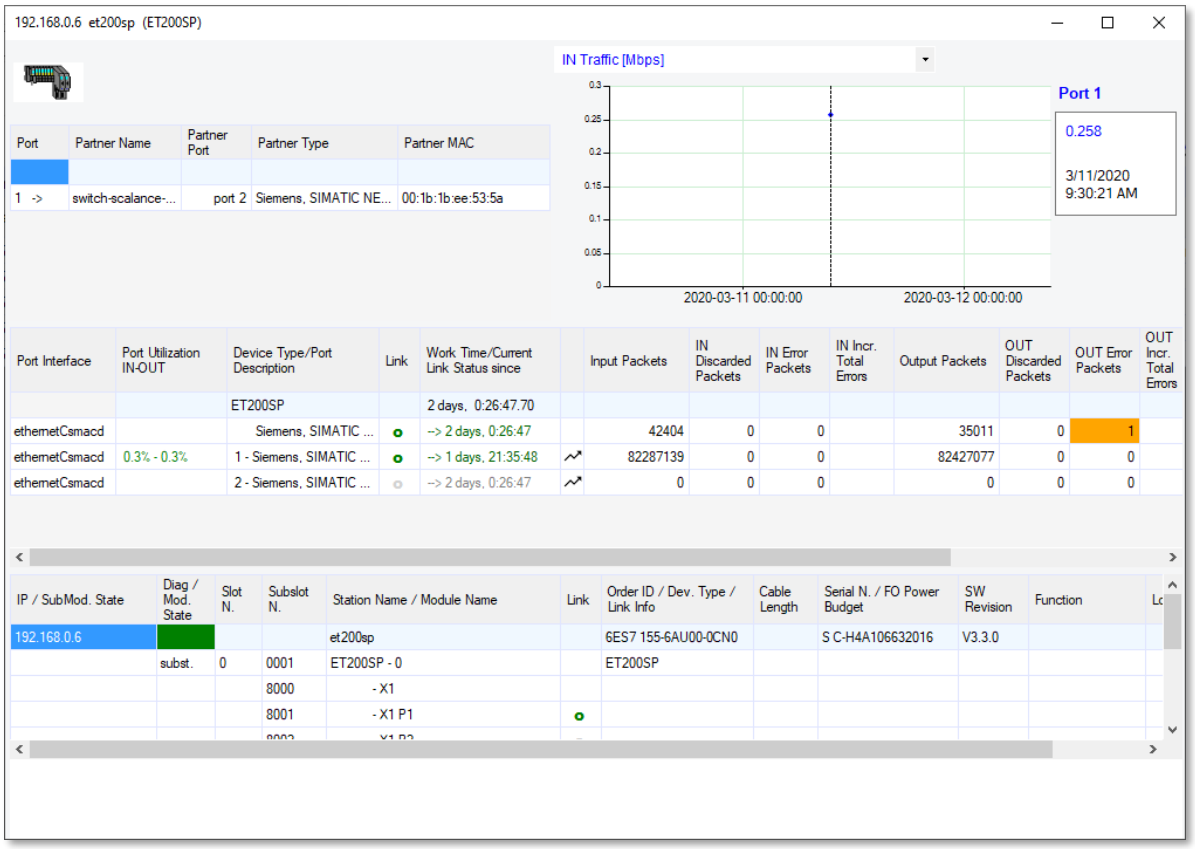
The **HW-SW info** page



	Function	Description
1	**Read HW/SW info**	Read hardware and software information
2	**Import GSD**	Copy the GSD file in the GSD directory of the program
3	**Rescan GSD file**	Rescan all the GSD files included in the GSD directory
4	**Festo Error Log**	Read, during scan, additional information (Error Log) for the Festo device (model CPX-Terminal)

1. From the top menu bar press **"HW-SW Info"**
2. Press "**Import GSD**" if you have to import the GSD file
3. Press "**Read HW-SW Info**"

The **Device Overview** window



You can see all the information of the selected device, included the traffic and the error charts.

Live List and Traffic Analysis

Analysis via switch mirror port or TAP (Passive Analysis)

For passive diagnosis the data streams transmitted in a network must be collected and analyzed in an appropriate segment with no impact on the communication. There are two options:

1) Port mirroring (PC interface connected to a mirror port of a managed switch)
2) Test Access Point (network TAP connected in series in the segment)

With Port mirroring the switch mirrors the data streams of a selected port to a monitoring port. This allows analysis of the data streams on the monitored port using the PC connected to the mirror port,

The switch that is used must support port mirroring. Both the transmitted and received data of the monitored port are copied to the mirror port. The mirror port's data rate thus limits the data volume that can be analyzed. The total volume of incoming and outgoing data must not exceed the data rate of the monitoring port.

A TAP (abbreviation of “Test Access Point”) is used to take out the data stream to be analyzed without the limitations regarding the data rate and change of packet contents known from the port mirroring method.

A TAP allows reading out data streams without the limitations in terms of the data rate and change of packet contents implied by the port mirroring method.
It is, however, required to open the network link to be able to insert or remove the TAP.
Only the data stream passing through the TAP can be analyzed. [1]

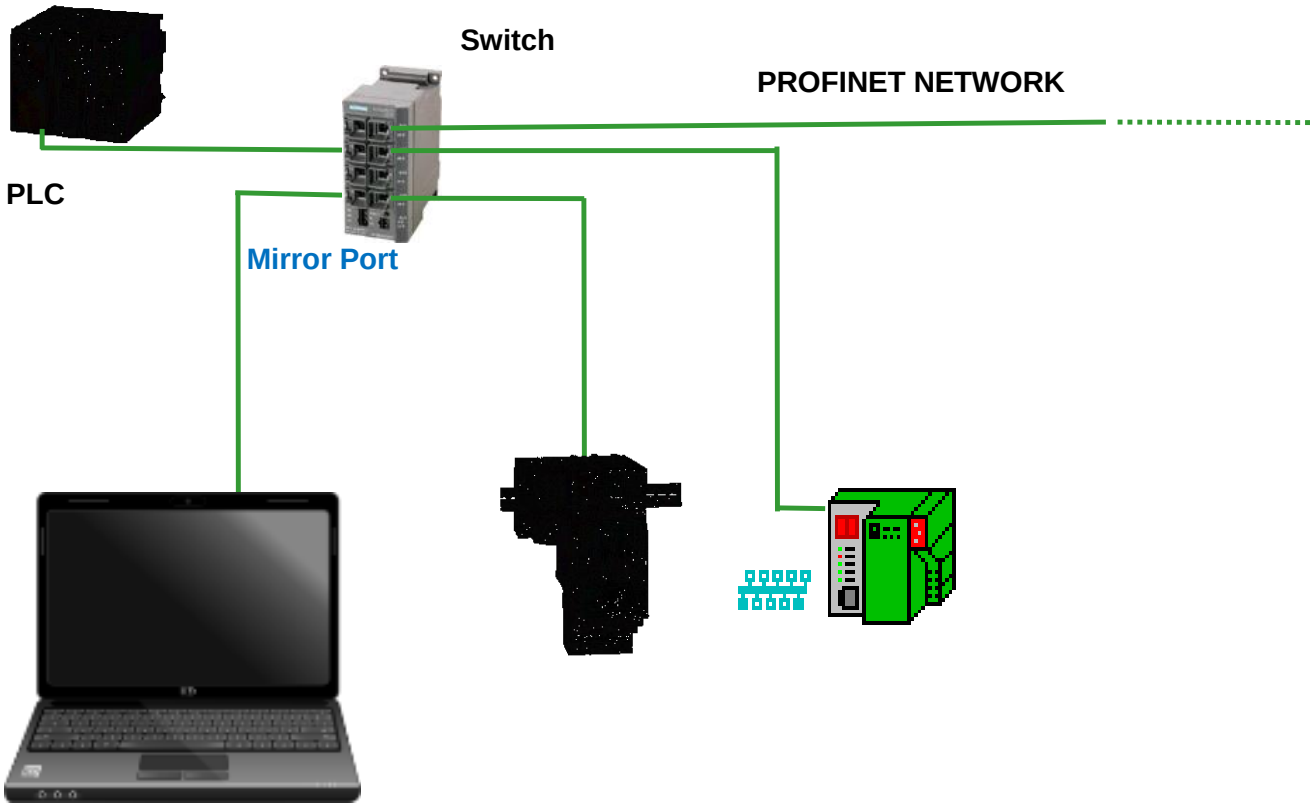
Mirror port/Supported TAPs - Comparison table:

	PNT Functionality								
	Live List	Traffic Recording	Trigger	Recording Filter	Jitter	Lost Packets	CRC Errors	Alignment Error Packet size Err.	Number of PN lines that can be analysed
Mirror port	v	v	v	v	v(1)	v			1
ETAP 1000	v	v	v	v	v(1)	v			1
Kunbus TAP Curious	v	v	v	v	v	v	v	v	2
Kunbus TAP 2100	v	v	v	v	v	v	v	v	2
ProfiShark 100M	v	v	v	v	v	v			1
ProfiTap	v	v	v	v	v(2)				1
ProfiTap Statistic	v	v	v	v	v(1)(2)				1

(1) The measure could have a low accuracy
(2) Not reliable in environment with high electromagnetic interference

Port mirroring

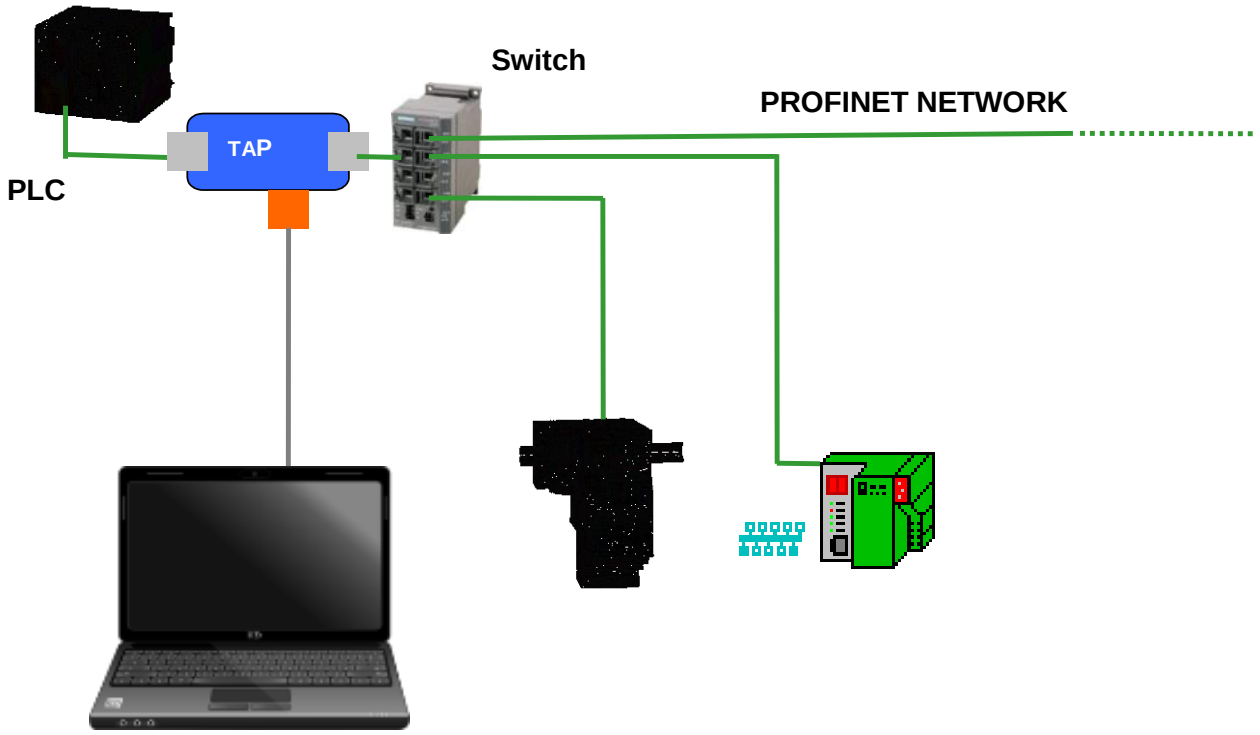
Connect the PC to a free port of a switch. Enable the traffic mirroring (Refer to the switch manual).
Select the PC interface that is connected to the switch. At this point you can start the measurements.



Mirror Port connection example

Network TAP connected in series in the segment

Select the PC interface connected to the TAP
Connect the TAP in series to the PLC segment. At this point you can start the measurements.

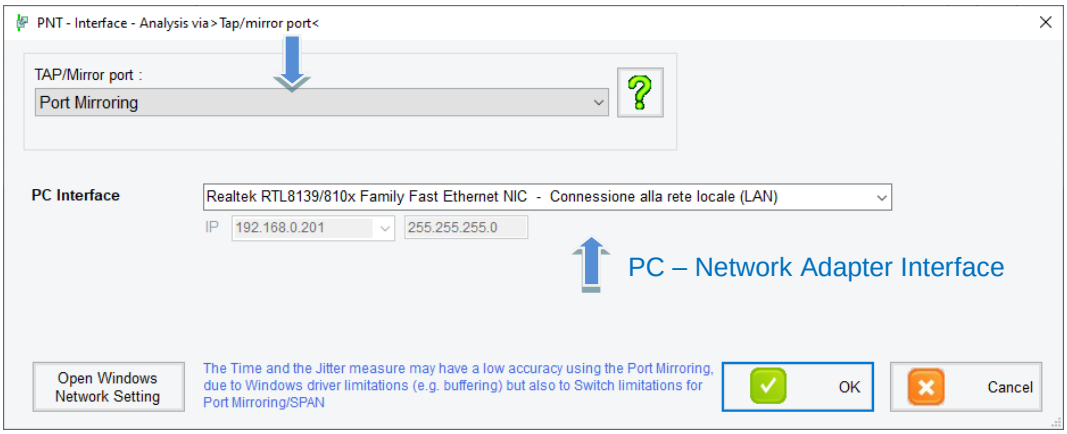


TAP connection example

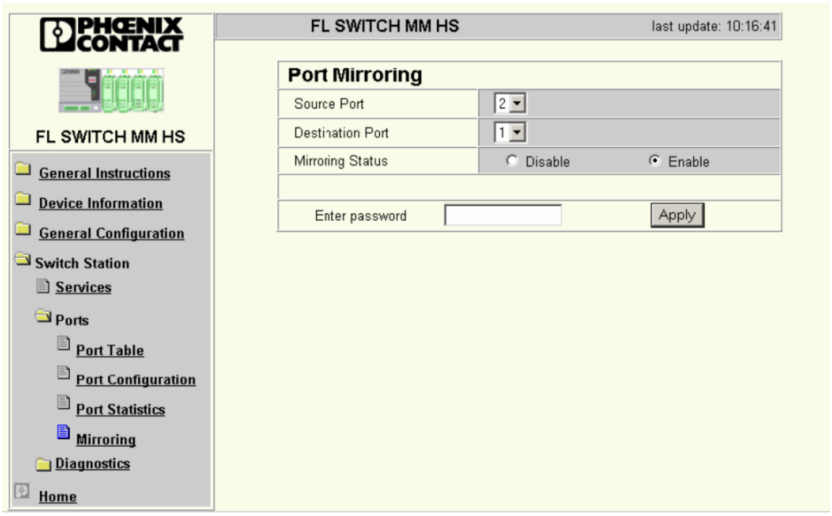
In the next pages some examples with different switches and TAPs.

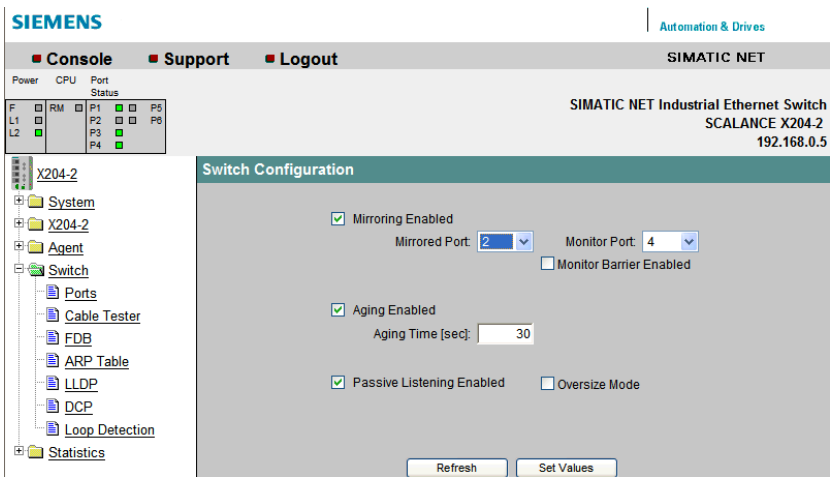
Managed switch - Port Mirroring:

Interface Setting - Analysis via Tap/mirror port



Port Configuration, web page examples





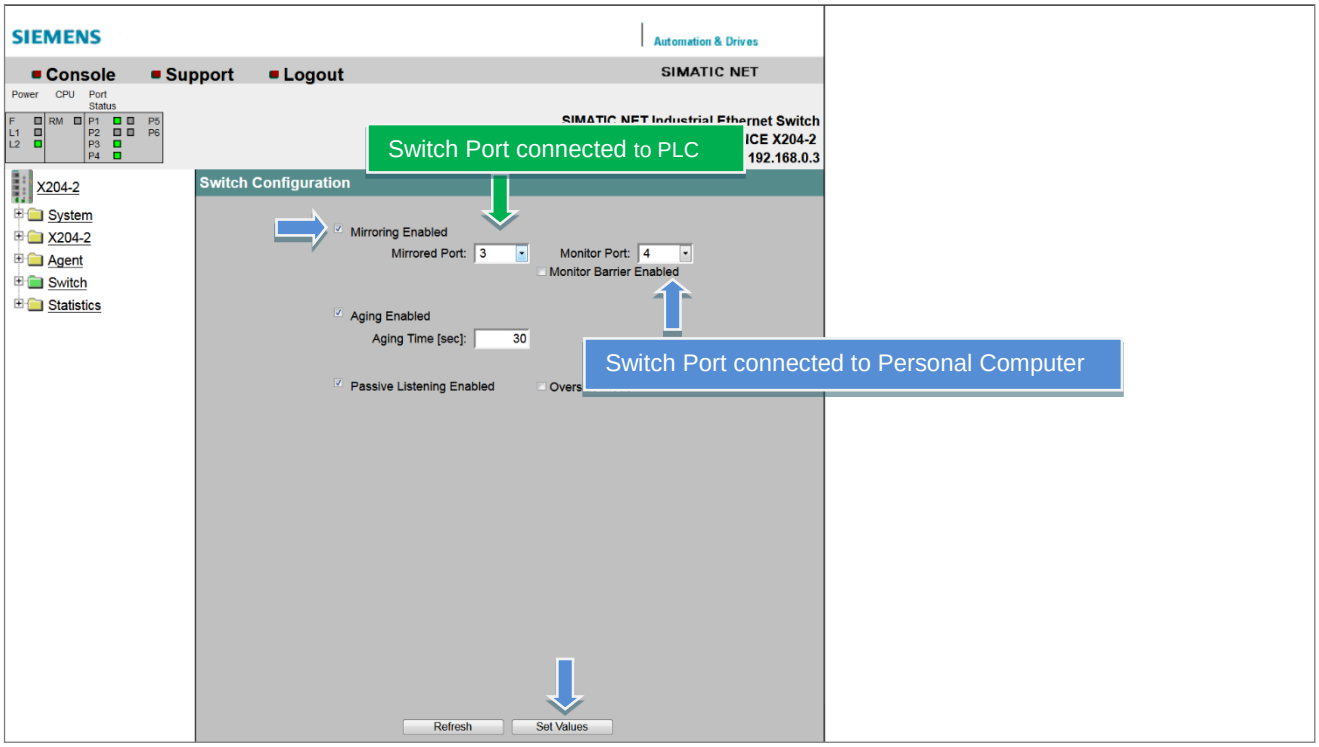
WARNING! AFTER COMPLETING THE MEASUREMENTS REMEMBER TO DISABLE THE MIRRORING.

Port Mirroring Configuration – Siemens SCALANCE X-200 series

Example:

PLC connected to port 3 of the switch.
Personal Computer connected to port 4 of the switch.

1. Press Switch
2. Select the ports
3. Check the box Mirroring Enable
4. Press Set Value



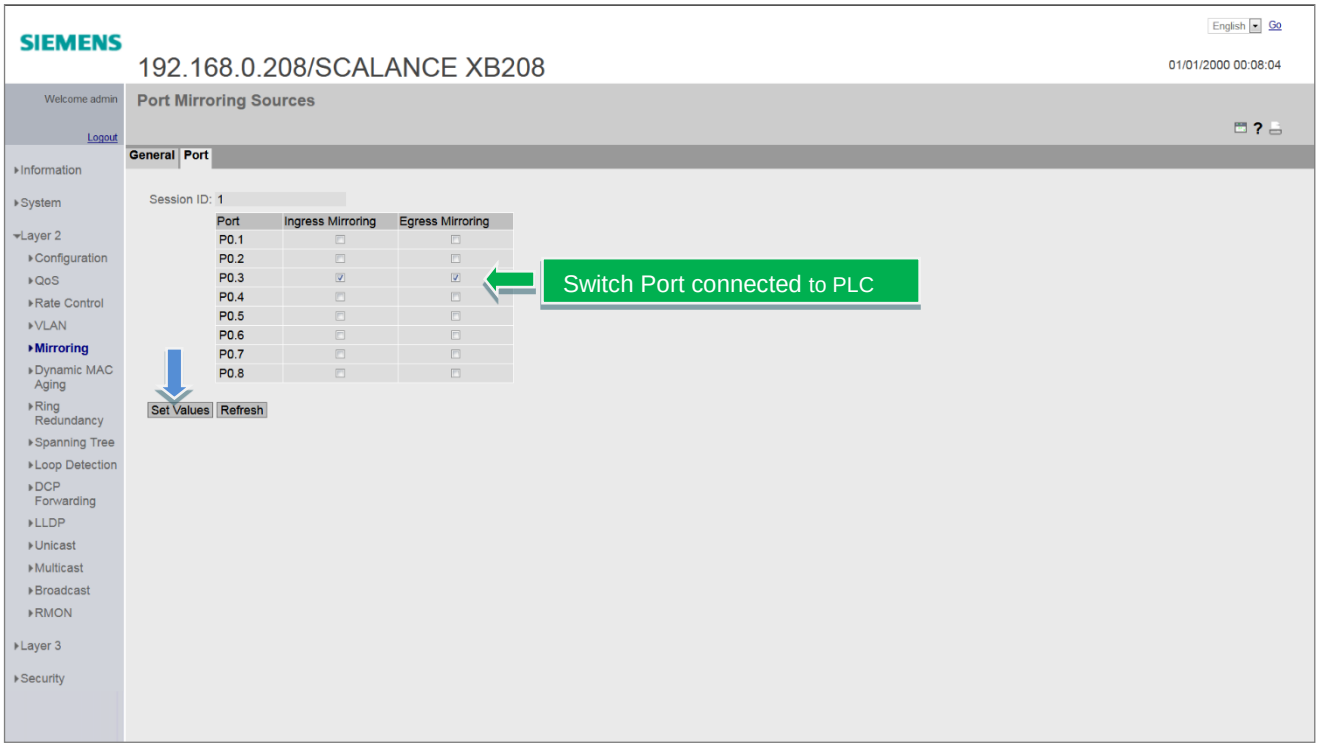
WARNING! AFTER COMPLETING THE MEASUREMENTS REMEMBER TO DISABLE THE MIRRORING.

Port Mirroring Configuration – Siemens SCALANCE XB-200 and XC-200 series

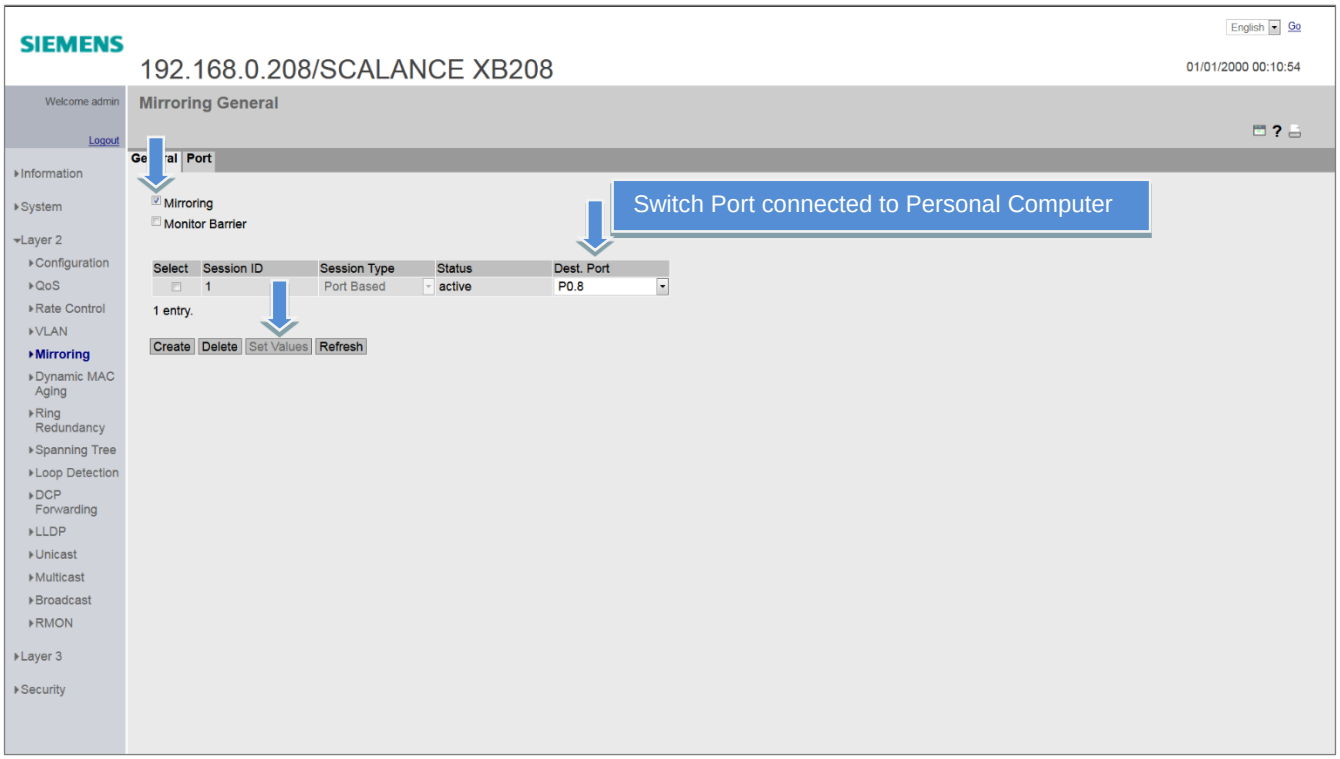
Example:

PLC connected to port 3 of the switch.
Personal Computer connected to port 8 of the switch.

1. Go Layer 2 > Mirroring > Port
2. Check the box Ingress and the Egress Mirroring of the switch port connected to PLC
3. Press Set Value



4. Go Layer 2 > Mirroring > General
5. Select the Dest. Port (number of the switch port connected to Personal Computer)
6. Check the box Mirroring and uncheck the box Monitor Barrier
7. Press Set Value



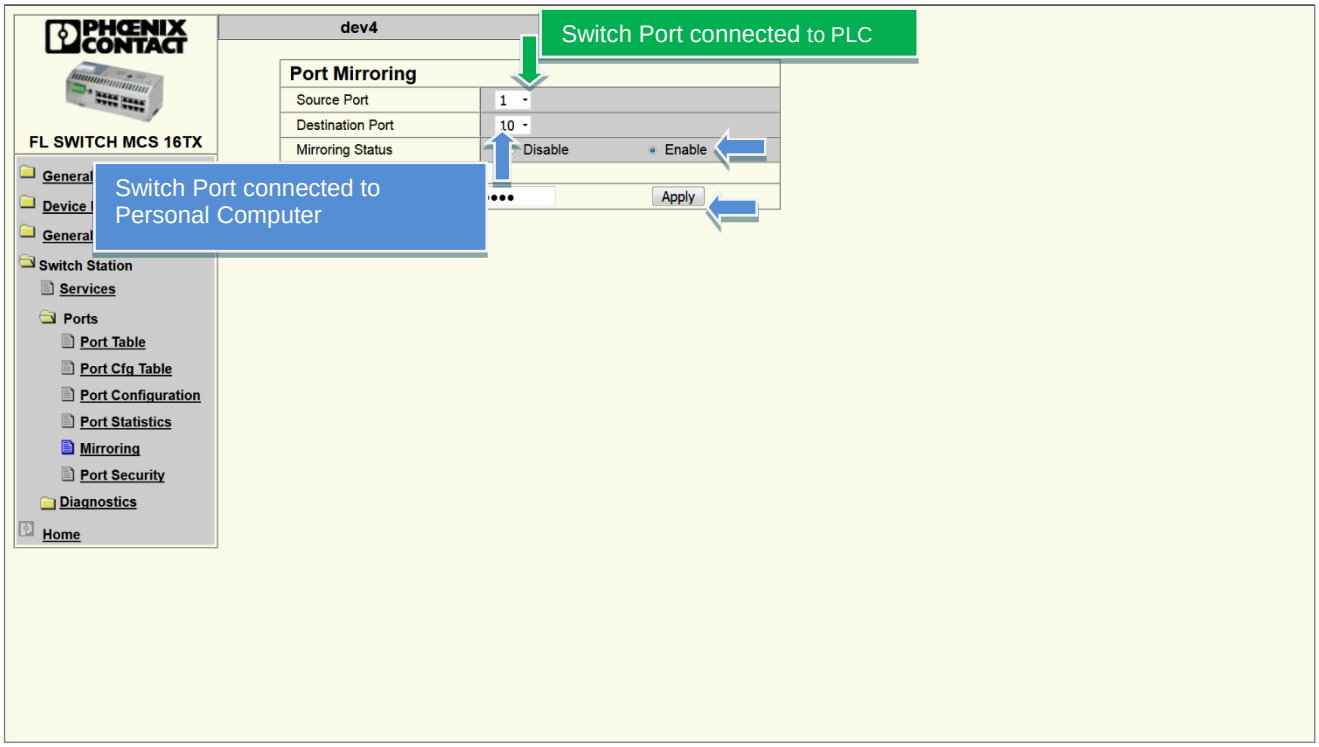
WARNING! AFTER COMPLETING THE MEASUREMENTS REMEMBER TO DISABLE THE MIRRORING.

Port Mirroring Configuration – Phoenix Contact FL SWITCH MCS 16 TX

Example:

PLC connected to port 1 of the switch.
Personal Computer connected to port 10 of the switch.

1. Go Switch Station > Ports > Mirroring
2. Select the ports
3. Check the box Mirroring Status > Enable
4. Insert the password and press Apply



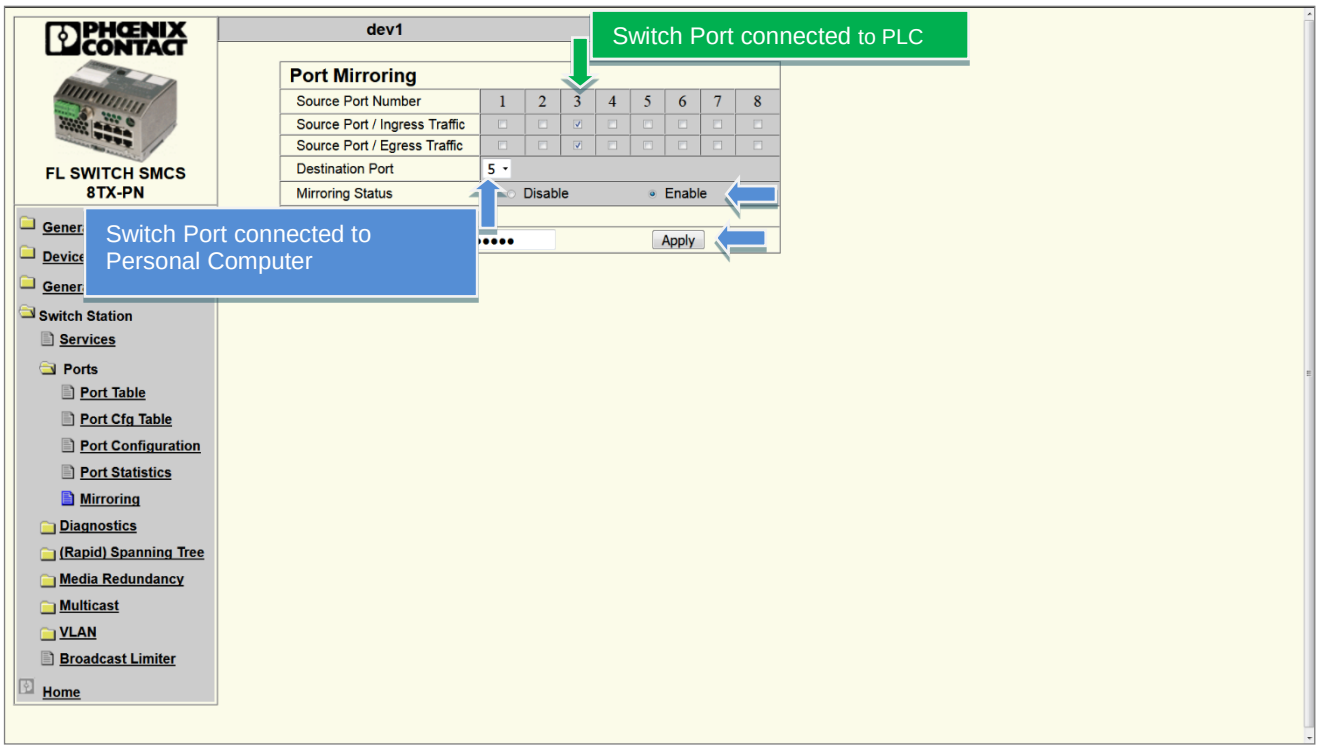
WARNING! AFTER COMPLETING THE MEASUREMENTS REMEMBER TO DISABLE THE MIRRORING.

Port Mirroring Configuration – Phoenix Contact FL SWITCH MCS 16 TX

Example:

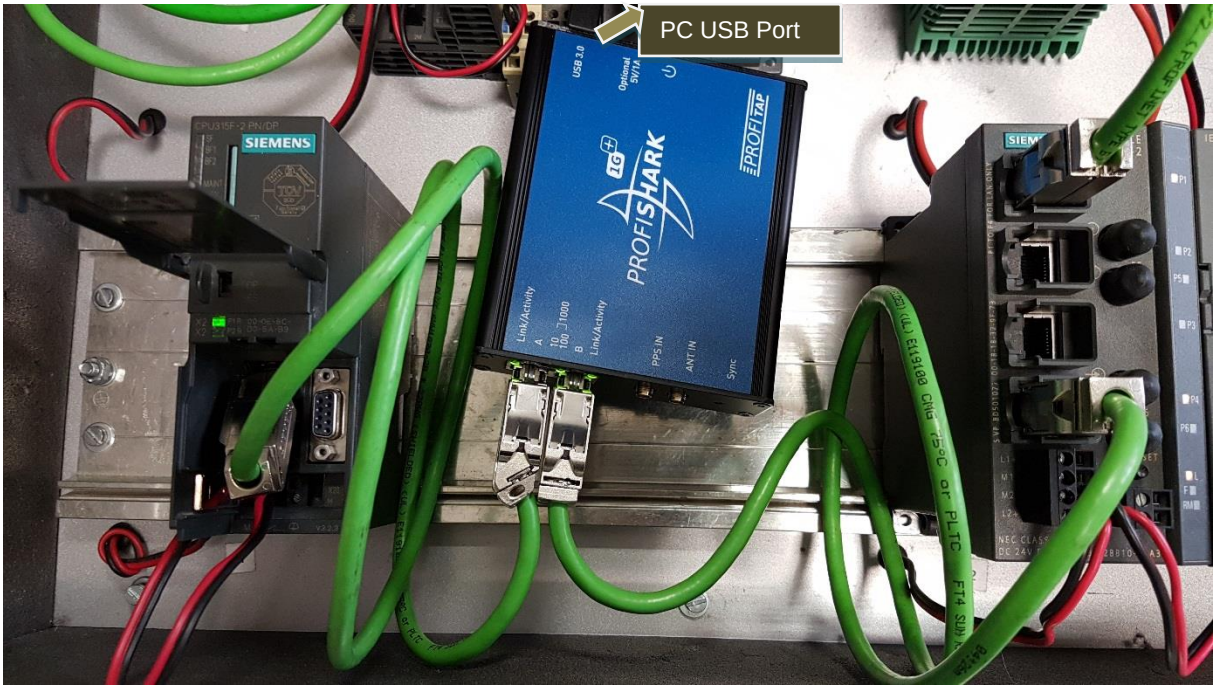
PLC connected to port 3 of the switch.
Personal Computer connected to port 5 of the switch.

1. Go Switch Station > Ports > Mirroring
2. Check the box Source Port/Ingress Traffic and Source Port/Egress Traffic of the switch port connected to PLC
3. Check the box Mirroring Status > Enable
4. Insert the password and press Apply

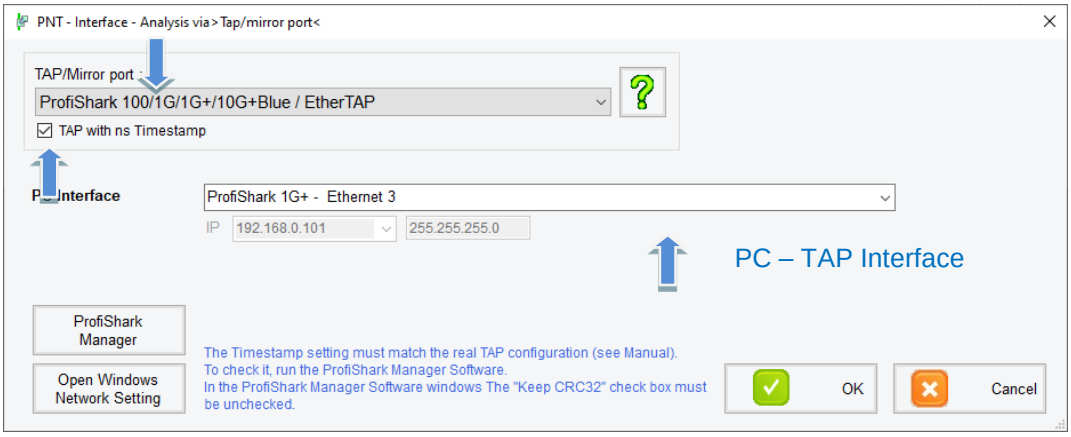


WARNING! AFTER COMPLETING THE MEASUREMENTS REMEMBER TO DISABLE THE MIRRORING.

ProfiShark Blue Version - Connection to PLC that works with one PROFINET port:

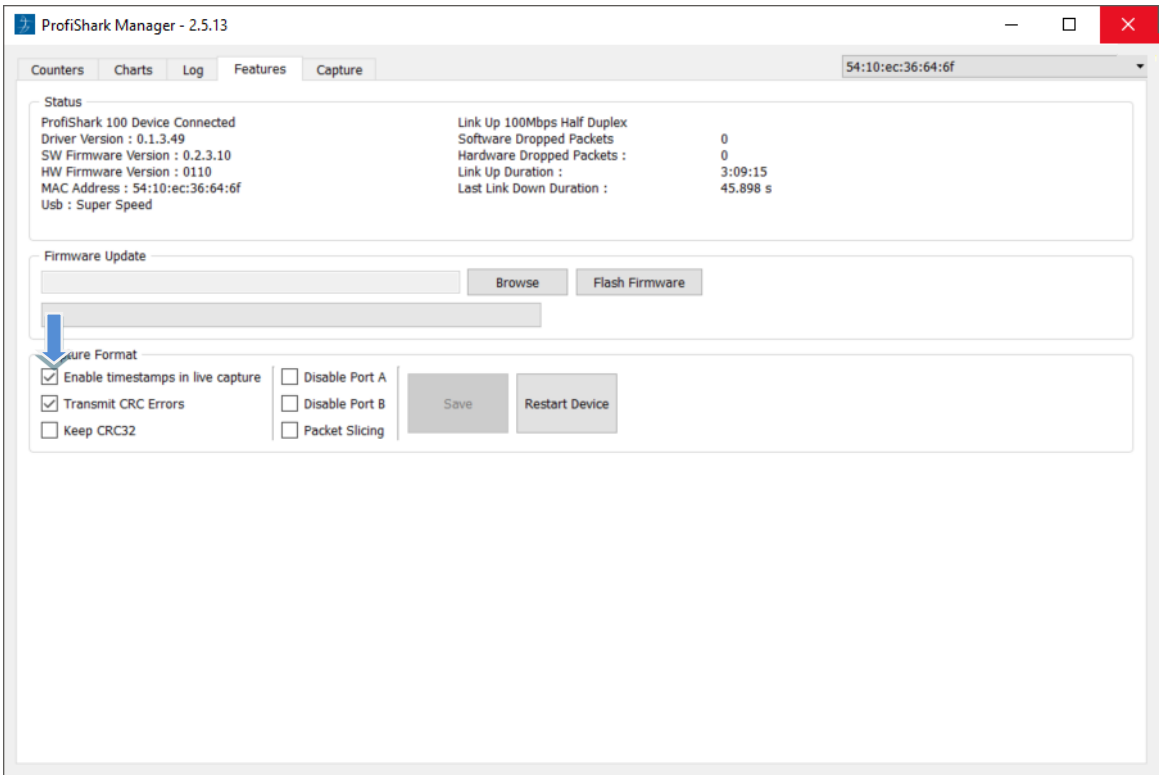


Interface Setting - Analysis via Tap/mirror port

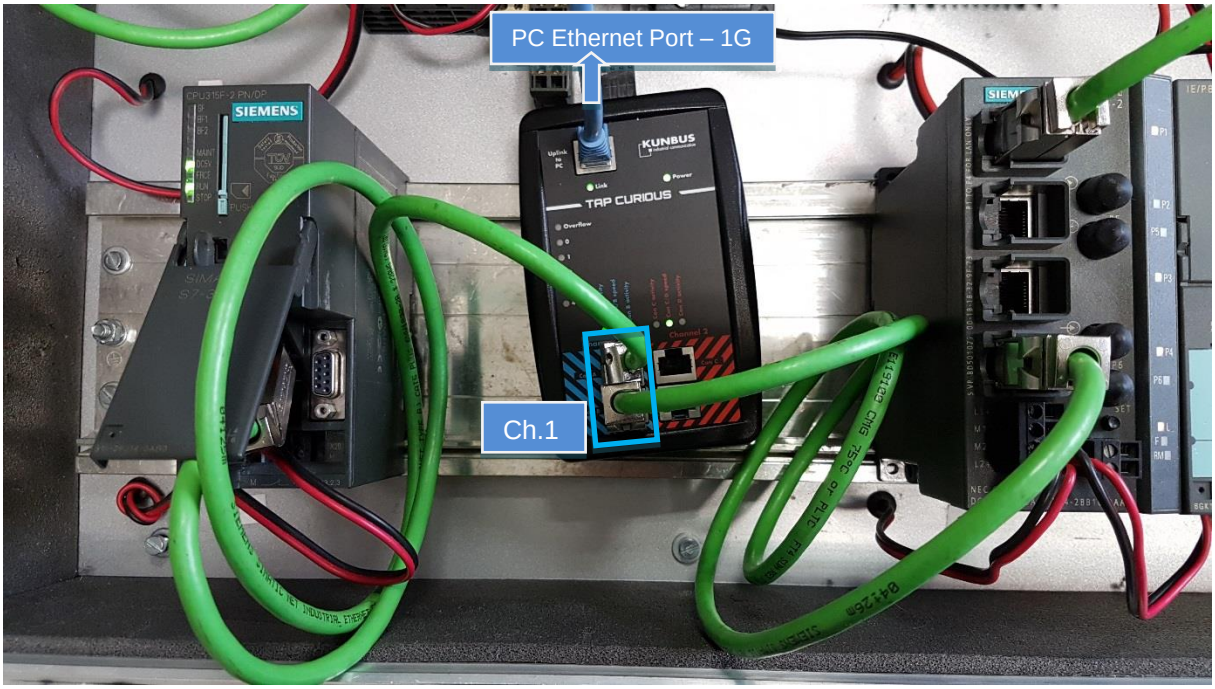


Info: If you don't see the ProfiShark interface, restart your PC. If the interface is still missing, click "Open Windows Network Settings" and assign an IP address to the ProfiShark interface, then reboot.

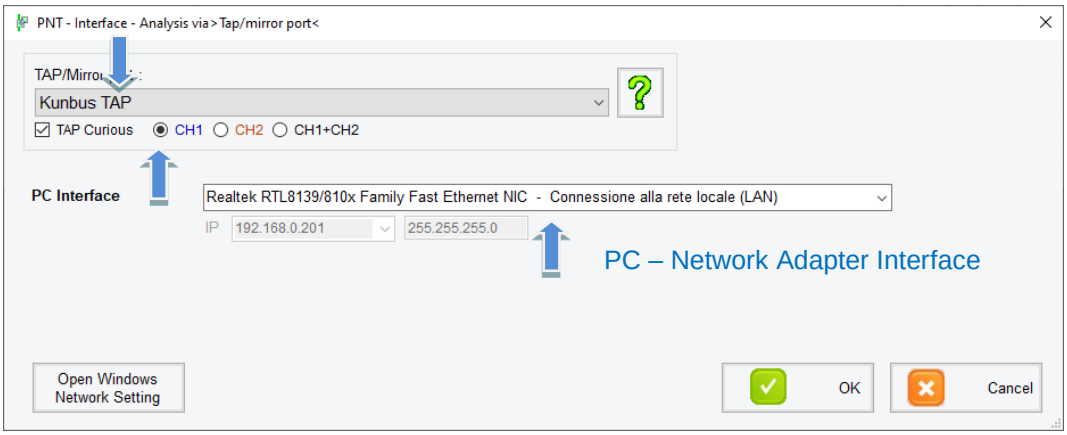
ProfiShark Blue Version – ProfiShark Manager, Timestamp setting:



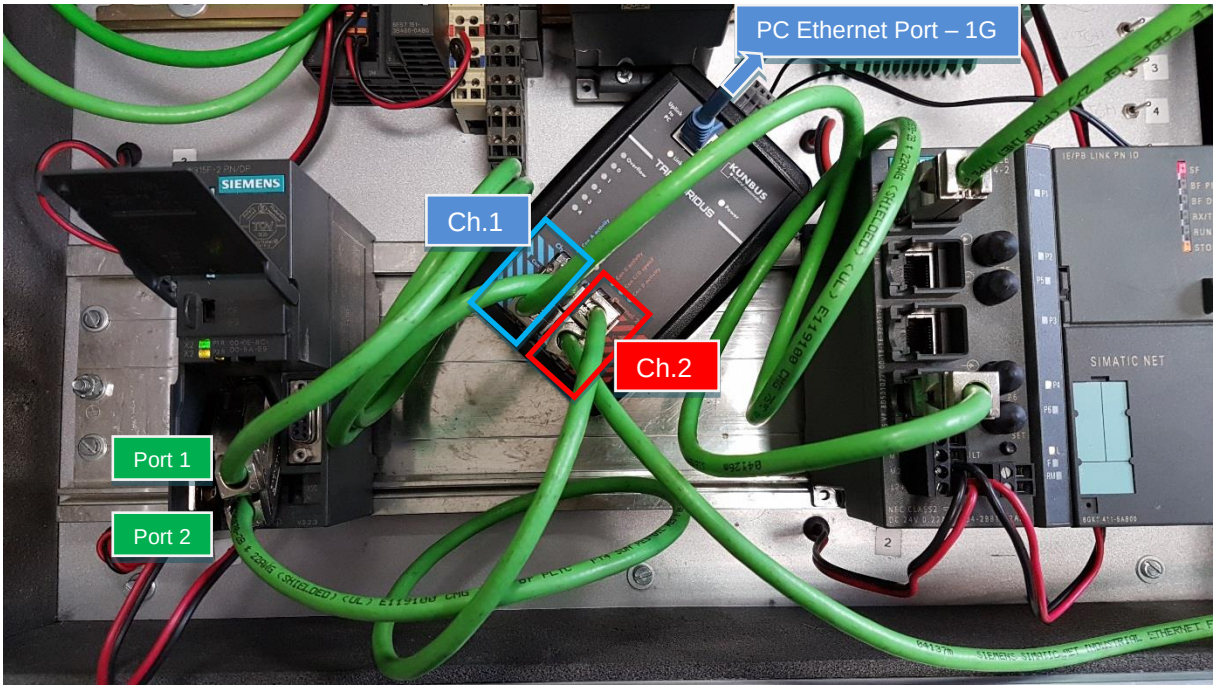
Kunbus TAP CURIOUS - Connection to PLC that works with one PROFINET port:



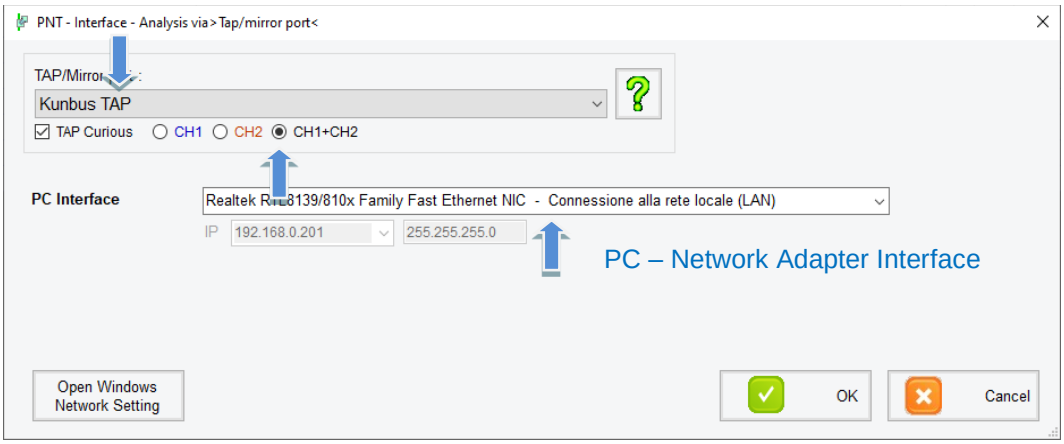
Interface Setting - Analysis via Tap/mirror port



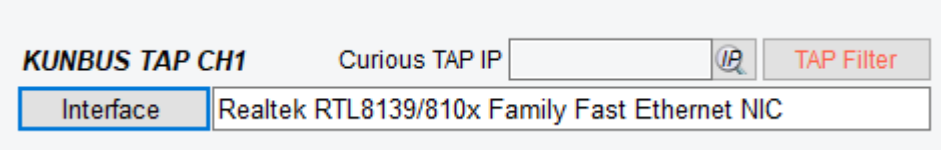
Kunbus TAP CURIOUS - Connection to PLC that works with two PROFINET ports:



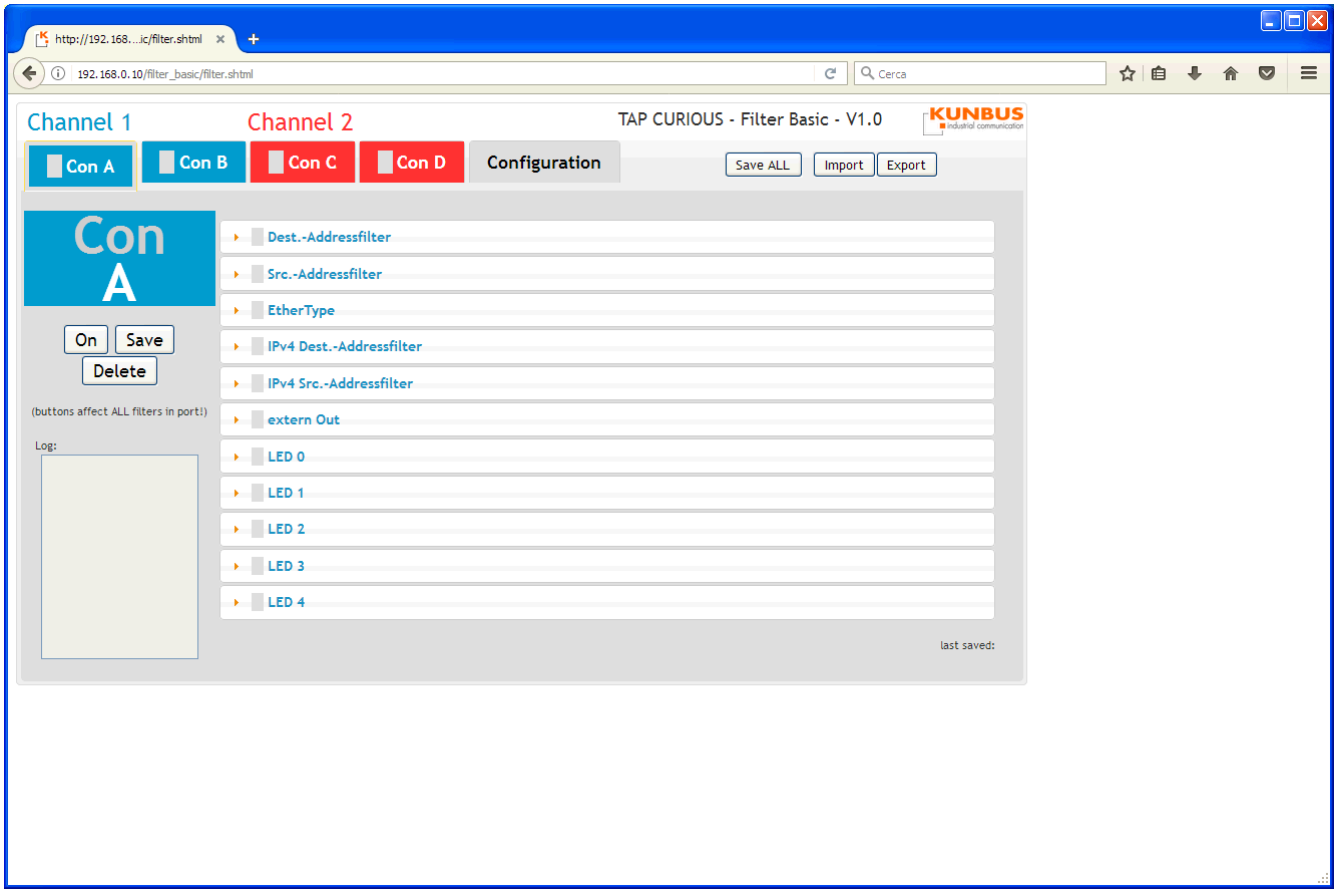
Interface Setting - Analysis via Tap/mirror port



Kunbus TAP CURIOUS - IP Address discovery example:

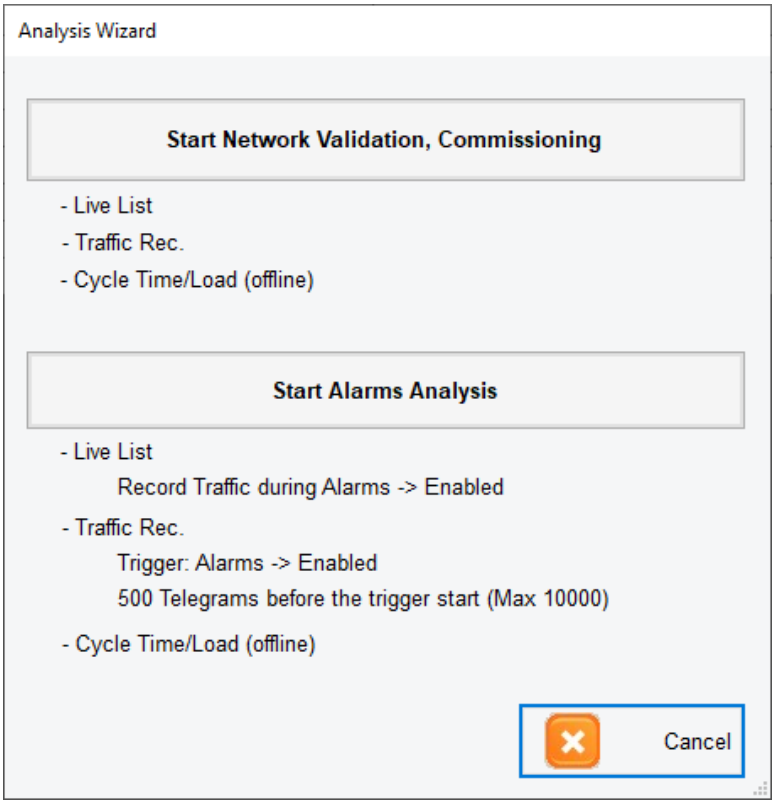


1. Press the  button
2. Disconnect the Ethernet cable from the “Uplink to PC” port of the TAP
3. Press OK
4. Reconnect the Ethernet cable to the “Uplink to PC” port of the TAP
5. If you need to check or modify the TAP filters, press the “TAP Filters” button to open the TAP CURIOUS web page

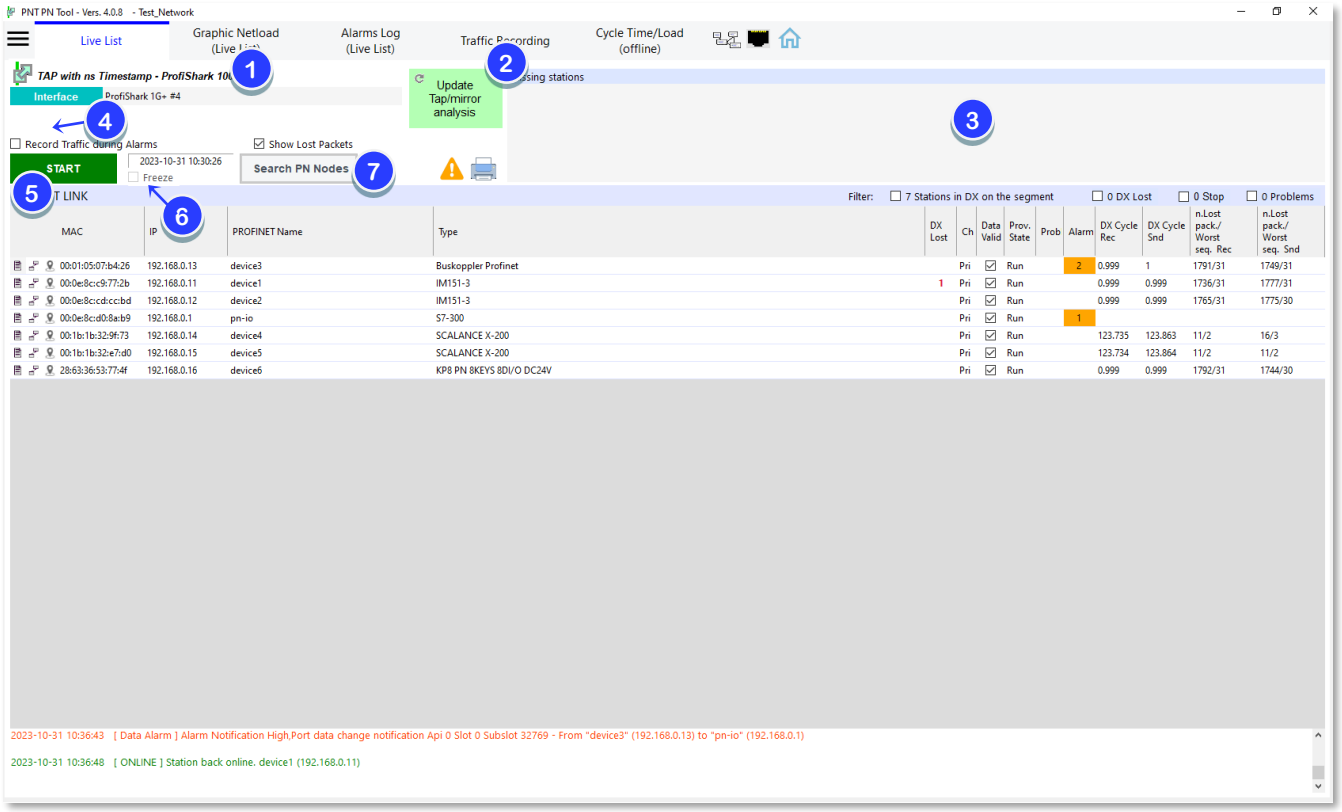


Analysis Wizard

The “Analysis via TAP/Mirror port” can be executed step by step or using the Analysis Wizard.



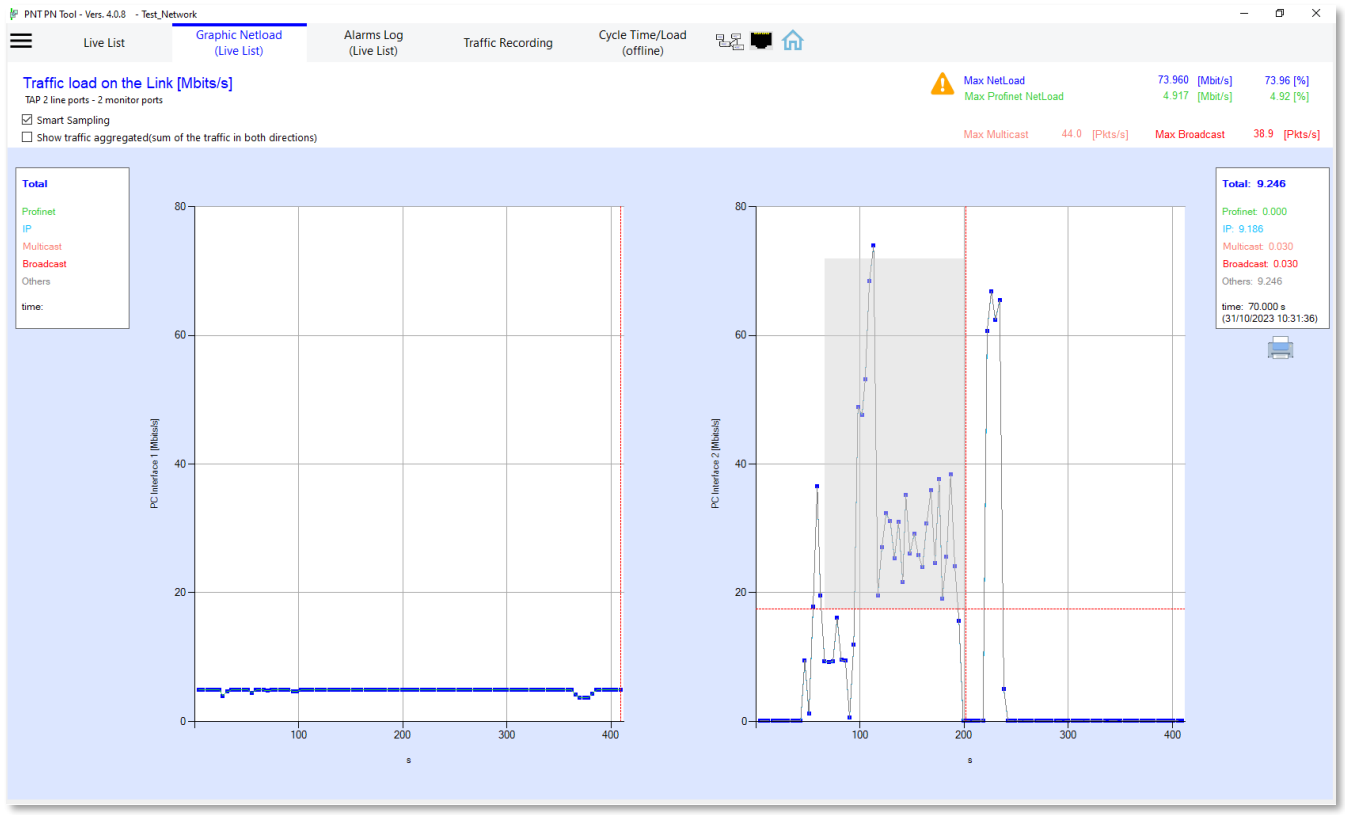
Live List



	Function	Description
1	**PC interface**	Select the PC interface connected to the switch mirror port or to the TAP
2	**Analysis Wizard**	
3	**Missing stations**	Display the missing stations that the controller is looking for
4	**Record packets during alarm**	If checked will save 1000 packets before the alarm and 1000 packets after the alarm for offline analysis
5	**Start**	Start Live List
6	**Freeze**	Freeze the visualization, the acquisition continues to run in the background
7	**Search PN Nodes**	Start searching for PROFINET controllers and devices. Only needed if some PN devices are not in the list, because they were connected after the scanning of the PN Devices

1. From the left menu bar press **“Analysis via TAP/mirror port”**
2. Select the PC interface connected to a mirror port or the PC interface connected to the TAP
3. Select Mirror port or the type of the TAP used
4. Press “**Start**”

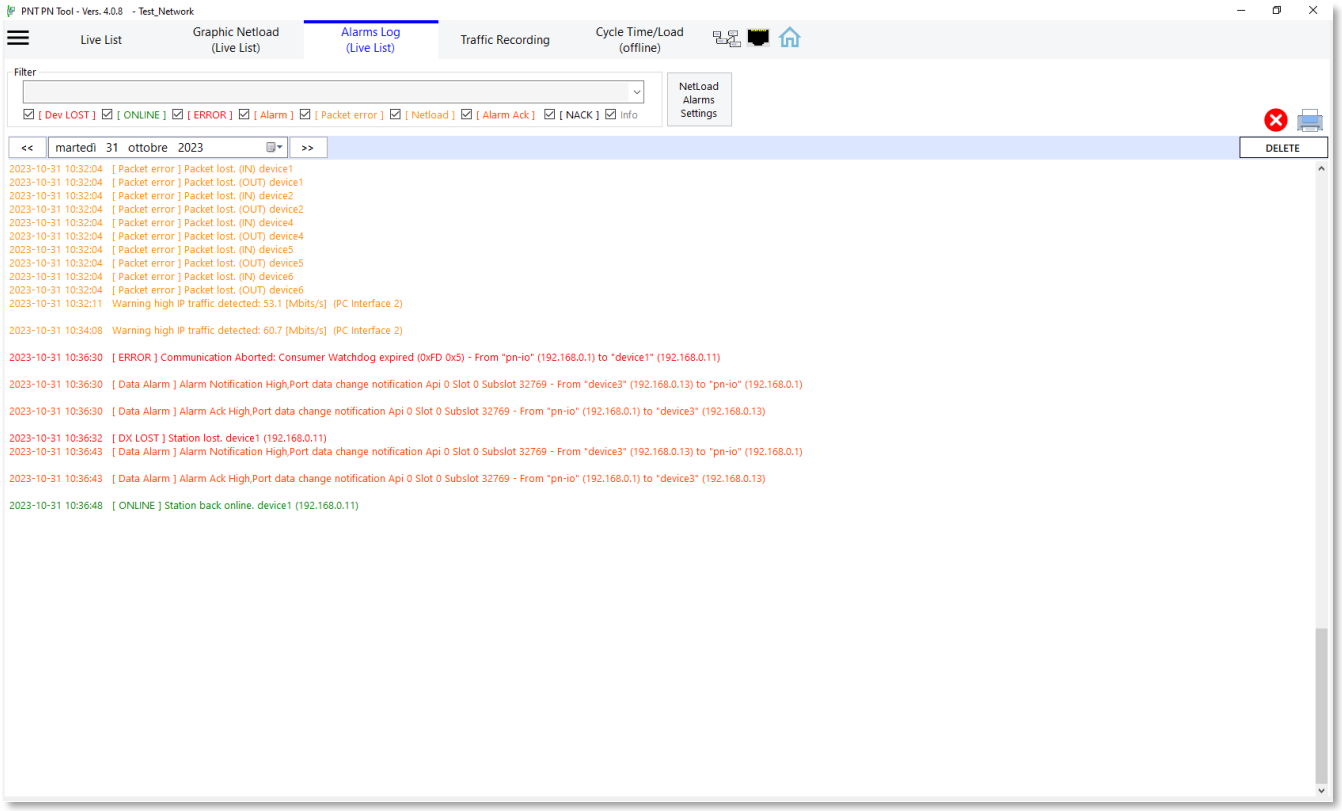
Graphic Netload (Live List)



Hold down the left mouse button to select the part of the Graph to zoom in.

Alarms Log (Live List)

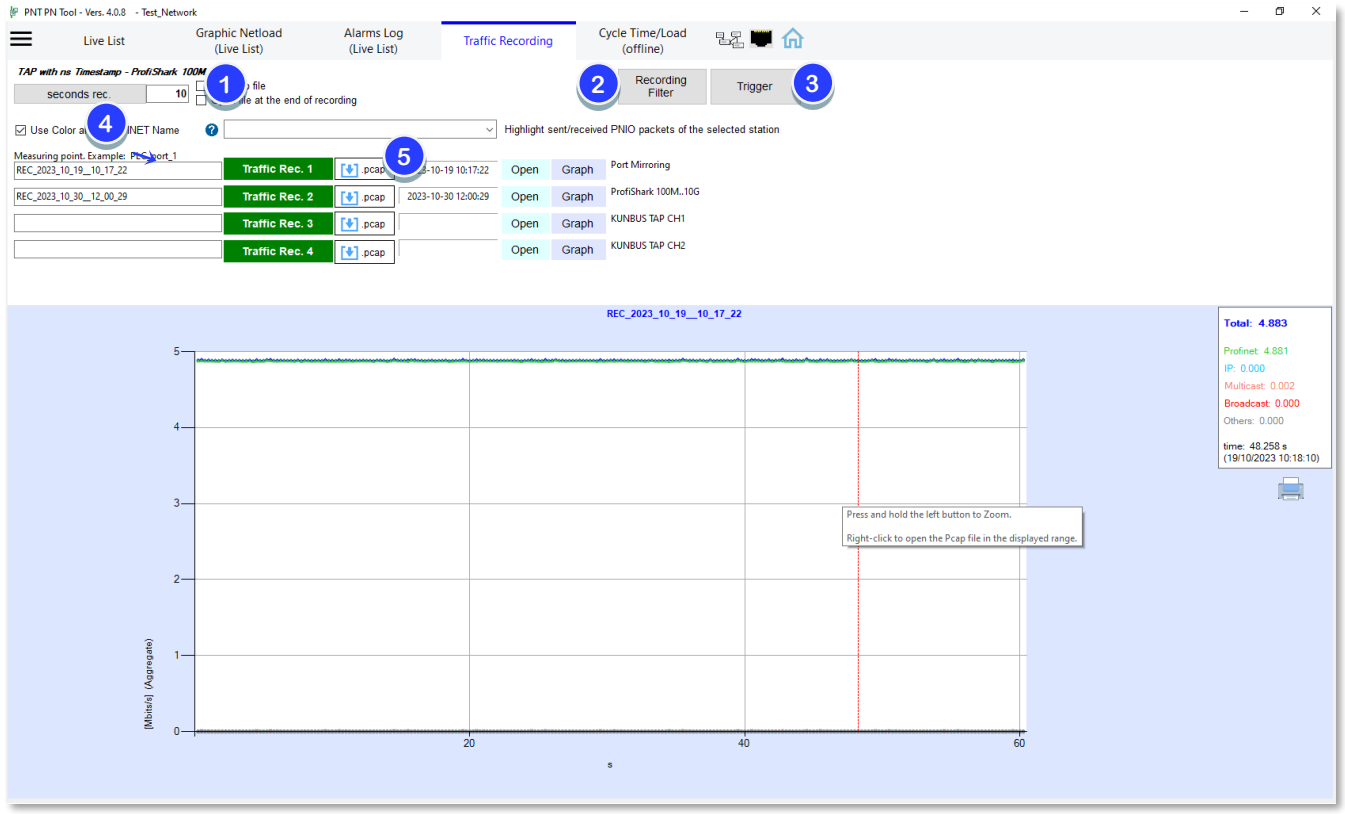
During the **Live List** all the events such as Lost in Data Exchange, Returned in Data Exchange, Alarms, Communication/Device Error and Packet Errors are recorded in a Log file.



Press “the calendar” to analyse previously saved Log files.

Traffic Recording

The traffic data of the segment can be recorded and analysed offline.

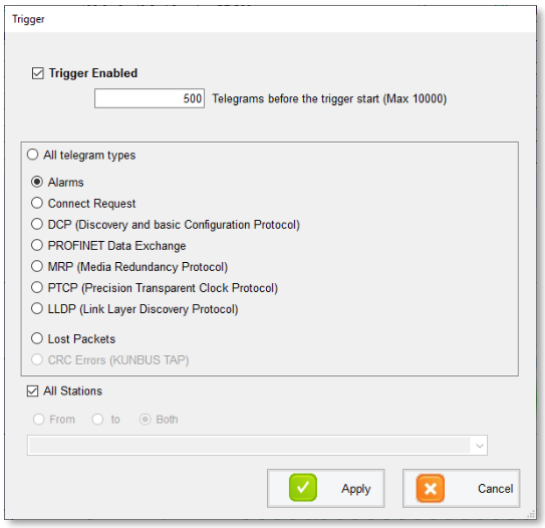


	Function	Description
1	**Seconds Rec.**	Set up the recording time
2	**Recording Filter**	Open the recording filter setup window
3	**Trigger**	Open the trigger setup window
4	**Use Colour and PROFINET Name**	Highlight the input and output device packets with different colours, show the PROFINET name instead of the MAC address
5	**Import .pcap**	Import a .pcap file into the project

Right-click on the graph to open the Pcap file in the displayed range.

Trigger

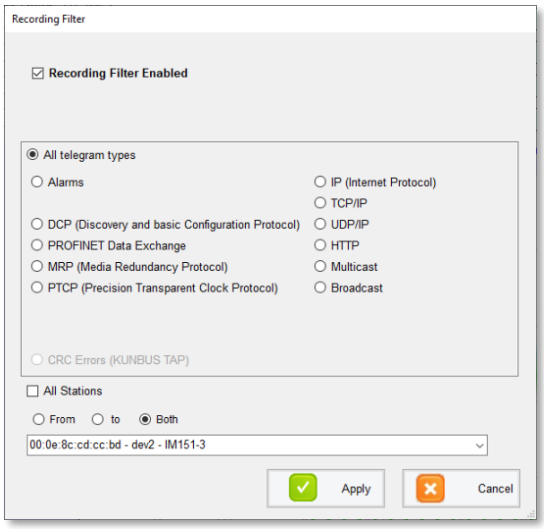
1. From the top menu bar press **“Traffic Recording”**
2. if you need, select the recording time and the trigger



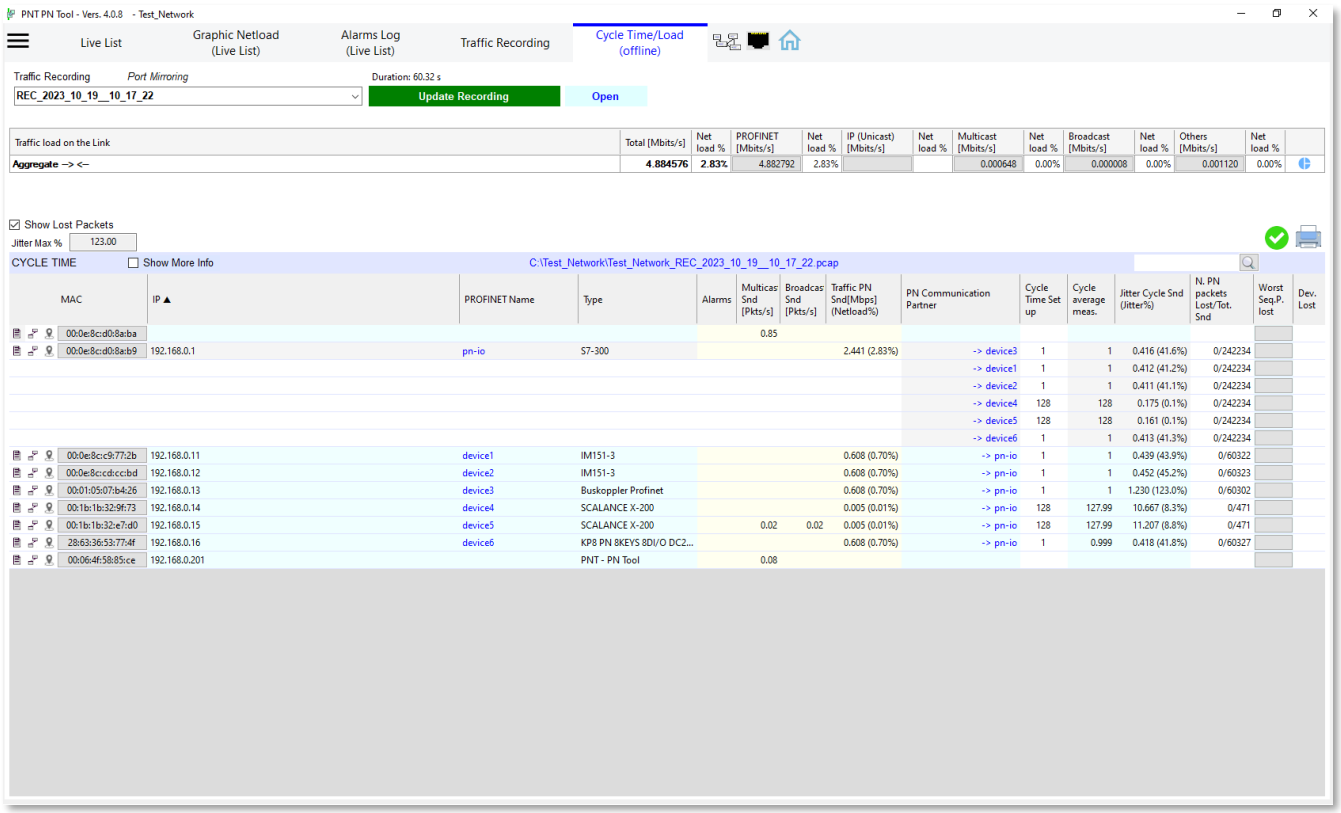
3. Press “**Traffic Rec. 1**” to start the first recording.
4. Selecting “**Use colour and PROFINET Name**” and the device name, allows you to highlight the input and output device telegrams with different colour.

Recording Filter

If you want to filter the packets, for example if you want to capture only the alarms packets, you can setup the recording filter. This allows you to reduce the number of packets saved on the disk and to check for alarms over a long period of time.

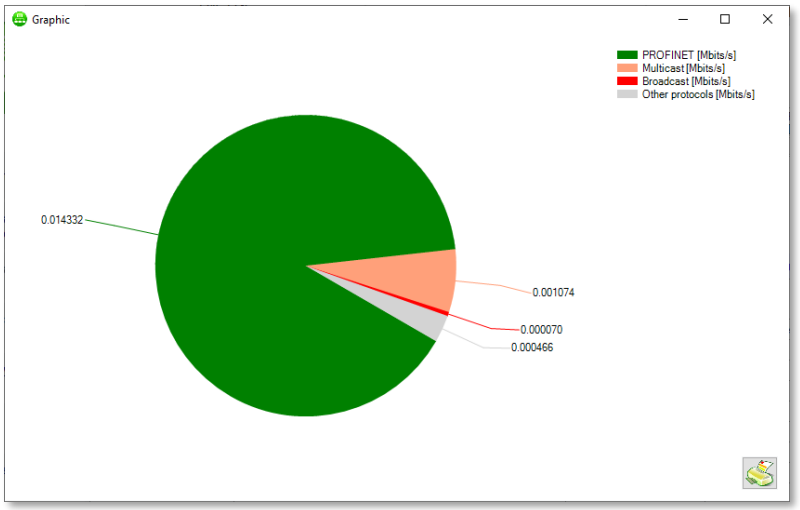


Cycle Time/Load (offline)



This function performs an offline analysis of the traffic recordings.
You can check if some packets have been lost and the worst sequence.

1. From the top menu bar press **"Cycle Time/Load (offline)"**
2. Select the traffic recording that you wish to analyze
3. Press **"Graph"** to see the traffic load graph on the link.

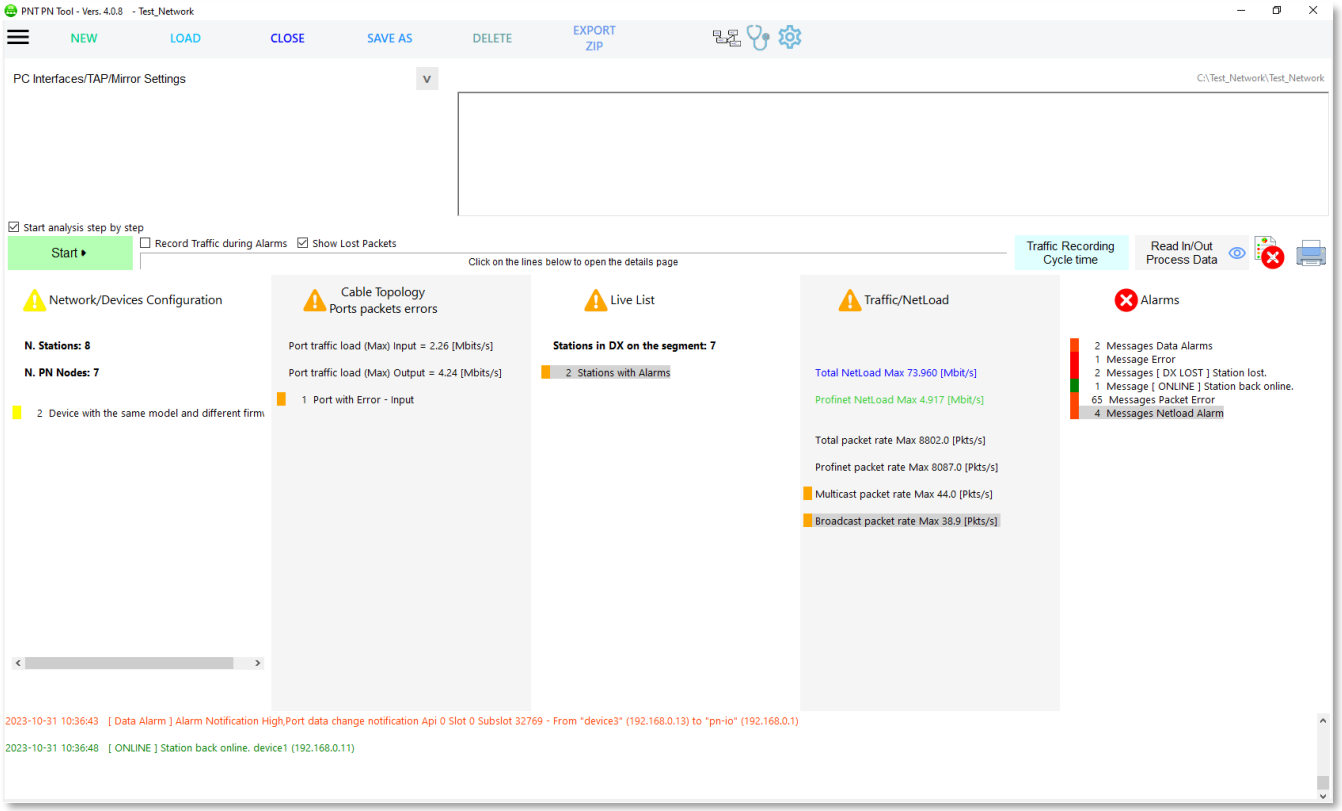


Easy Mode – Network Monitoring

In this mode you can continuously monitor the network via a TAP or mirrored port.
A dashboard will allow you to check the status of your network.

Simply by clicking on the lines of the panel you can view the details of the analysis.

If the PC is equipped with only one interface, consider using a USB to Ethernet Adapter for analysis via a free port and the PC interface for analysis via TAP.
In this way you will be able to update the Device List, Topology, Port packet errors and to read the process data while monitoring the Network.



Acceptance Reports

The acceptance is divided into 4 reports. These reports refer to “PROFINET Commissioning Guideline” [1]

Installation Acceptance – Visual Inspection

The visual inspection should always be performed prior to all other checks. The visual inspection allows you to provide evidence that the installation has been implemented in compliance with the corresponding installation guidelines. This helps to detect in this phase faults like: [1]

• mechanically damaged PROFINET cables

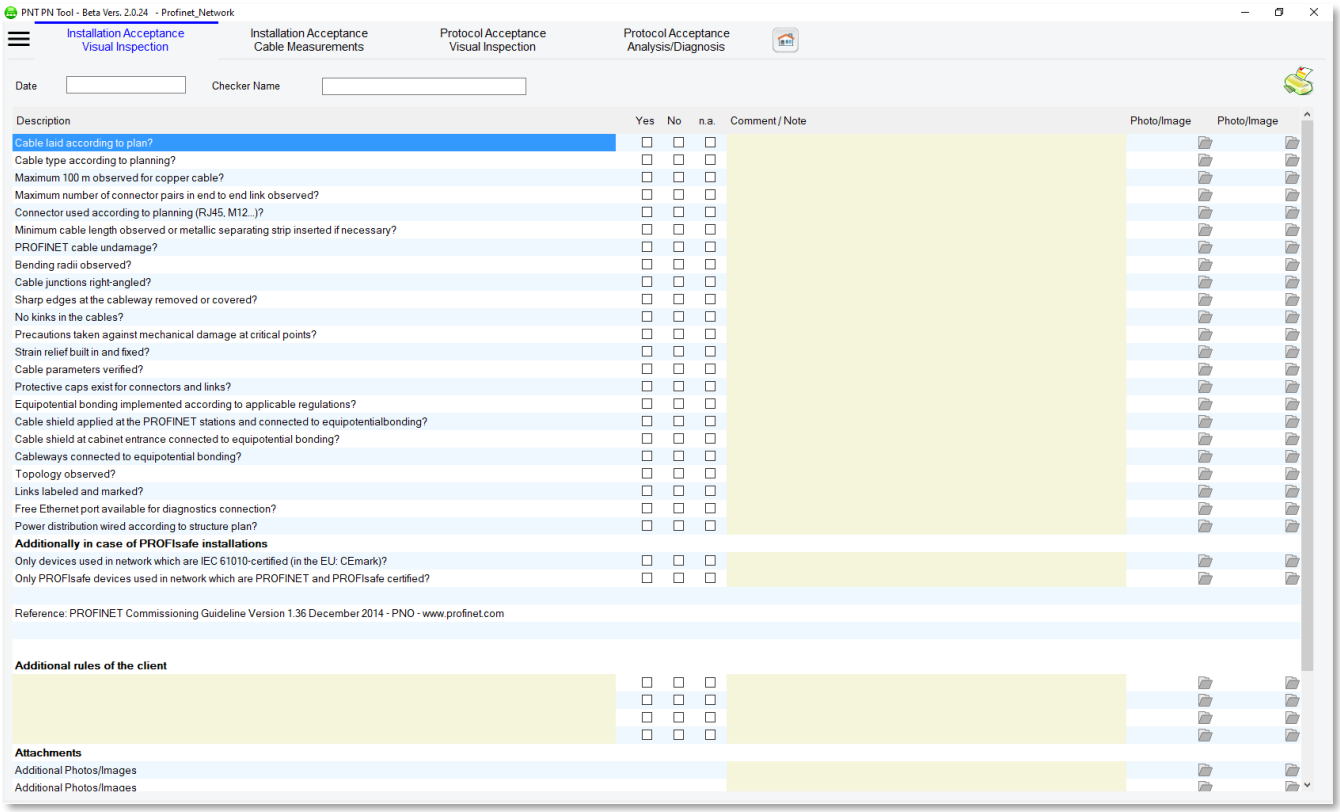
• cables that are bent tighter than the specified minimum bend radius

• disregarded minimum spacing

• defective connectors

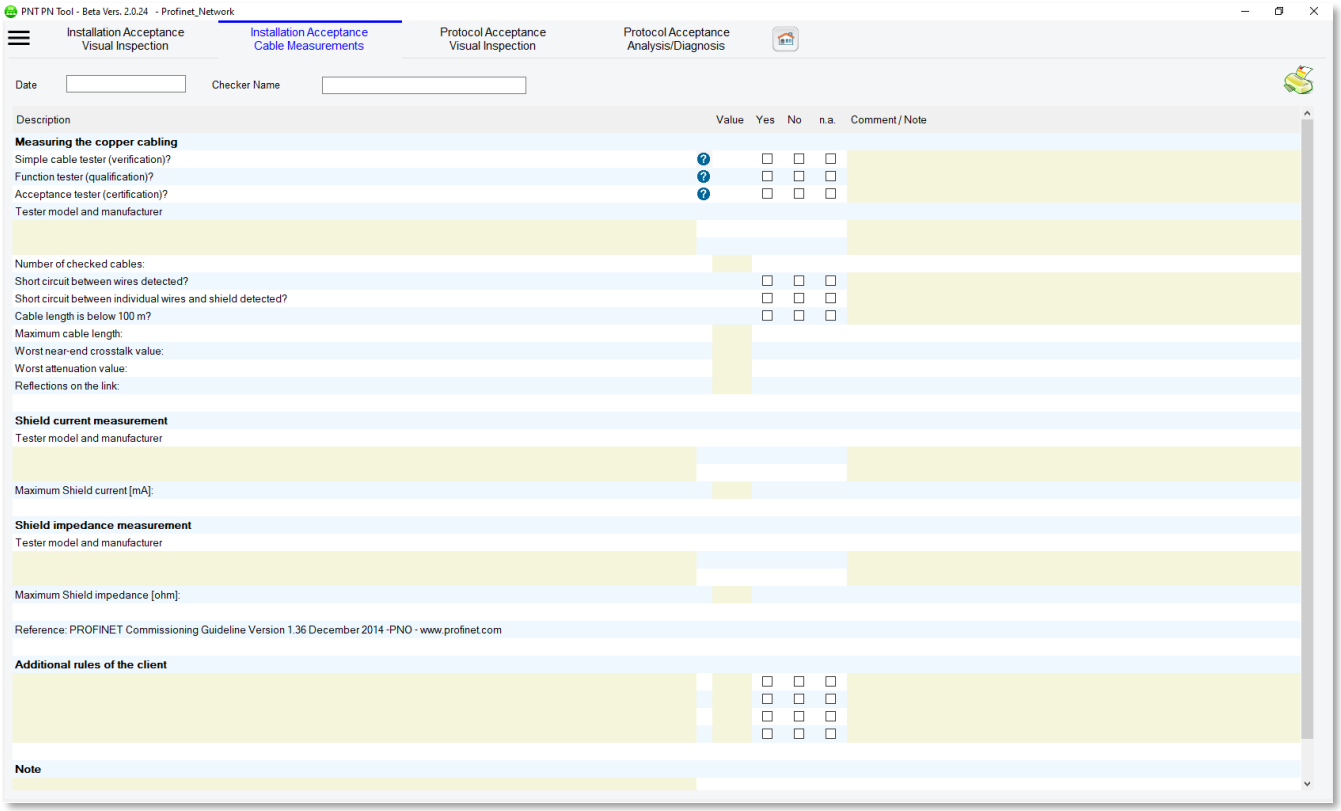
• missing labels on connectors and cables

• and possible other faults.



Installation Acceptance – Cable Measurements

In the test of the copper cabling the network cables are checked using the appropriate measuring instruments. The various testers that are available provide different functionality. [1]



Simple cable tester (verification)
A simple cable tester is an electrical cable test, i.e., a test for proper connection or short-circuits and impermissible split pairs.
The testers do not verify the cable parameters nor do they check whether data packages are transmitted or not. Testers of this kind can be used in the installation phase to check the cabling for proper connection / short circuits and the connectors for correct pin assignment. [1]

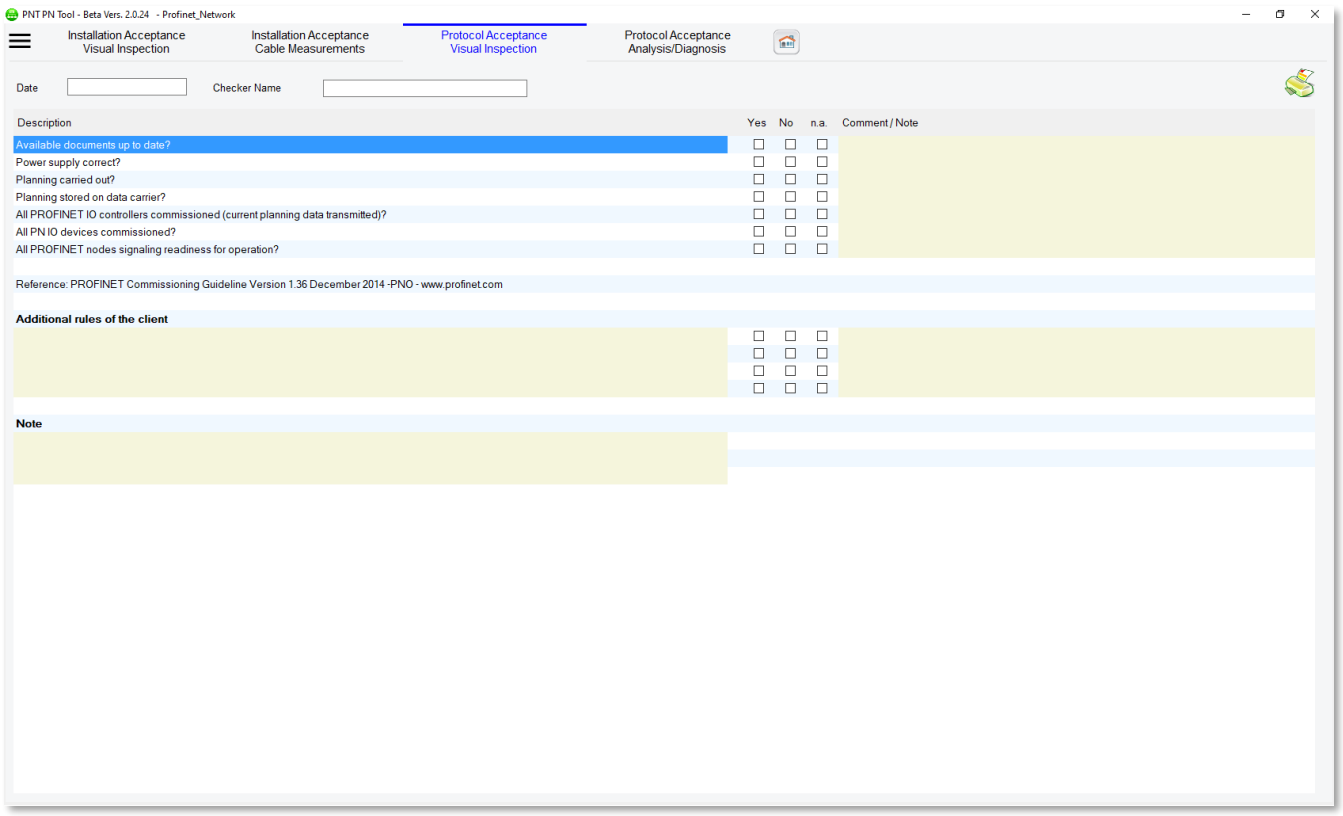
Function tester (qualification)
A function tester verifies the cabling route under consideration of the aspects of actual Ethernet data transmission.
This measuring device transmits predefined data packages via the cable. A remote unit acts as the counterpart that responds to these packages.
Alternatively, there are devices that directly verify the transmission parameters relevant for Fast Ethernet transmission at the time level and can indicate the error location in case of time-outs.
Depending on its type the function tester can also identify other active devices like switches or network nodes on the network using the corresponding diagnostic network protocols.
In this case you can derive from the delivered measuring data whether Ethernet data packages can be properly transmitted via the route or not. [1]

Acceptance tester (certification)

In special cases it is necessary to perform not only a simple functional test using a function tester, but also a detailed measurement of the cabling parameters (e.g., cable length, attenuation, crosstalk, etc.).
Such a measurement allows the determination and documentation of various cable parameters.
These measurements are especially helpful if problems should occur after a long operating period, allowing the documented values from the acceptance test to be used as reference values. [1]

Protocol Acceptance – Visual Inspection

After completion of the installation tests the required documentation should be available. Before starting to commission the system, make sure that the installation has been per-formed in compliance with the PROFINET guidelines. If you discover any installation faults or the documents are incomplete the installer should be contacted.
This helps to minimize the number of potential error sources in the PROFINET commissioning phase. [1]

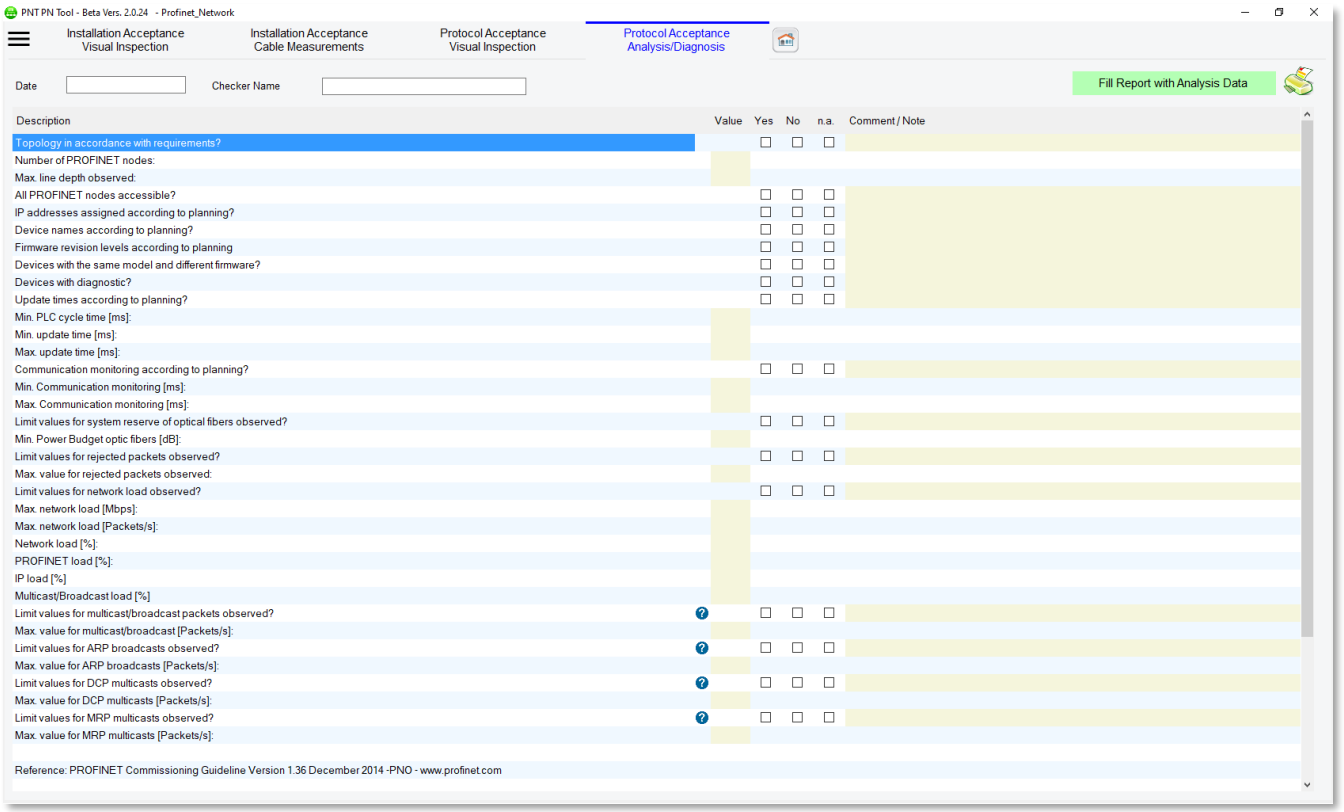


Protocol Acceptance – Analysis/Diagnosis

Compared to the diagnostic functions implemented in the devices themselves, analysis tools can provide additional advanced diagnostic options. [1]

Possible diagnostic functions are:

- Determination of the network load
- Determination of the network load composition (ratio of real-time and non real-time communication, etc.)
- Analysis of the PROFINET communication cycle with a high time resolution
- Data traffic statistics
- Recording of data traffic
- Recording and evaluation of communication problems
- Configuration and status analysis



Press the “Fill Report with Analysis Data” button to fill the report with the data from the “Analysis via Free Port” and the “Analysis via Tap/mirror port”, some data are to be completed manually

Inspect PROFINET Process Data

There are three ways to read the process data.

1) Using a free port connection to ask via acyclic communication the process data values. (Active mode)
2) Using the Mirror port or a TAP connected to the network. (Passive mode)
3) Reading the process data from a pcap files that you have recorded. (Offline mode)

PROFINET Process Data via a free port

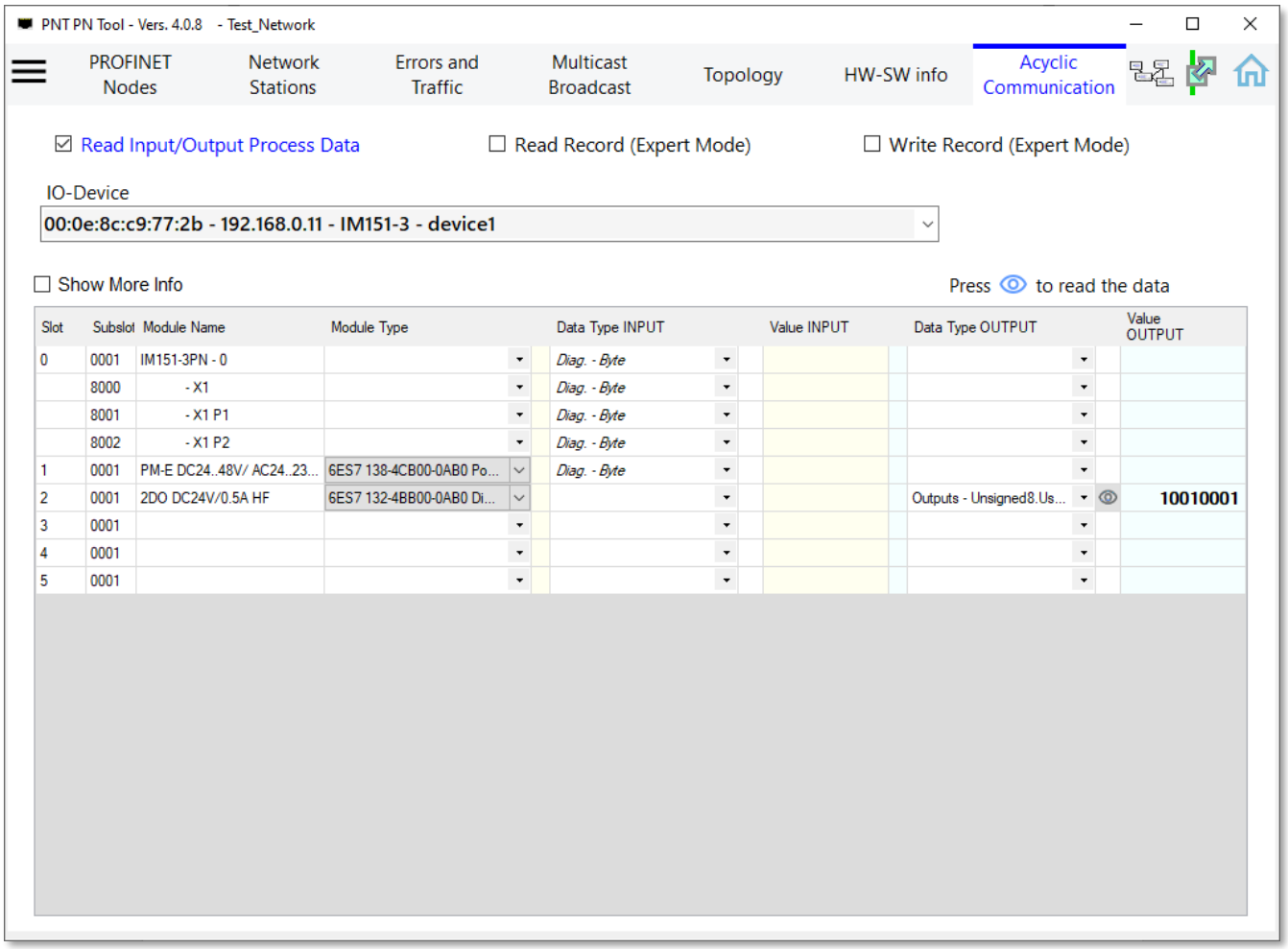
The GSD file of the devices are required

Reading a single process data value

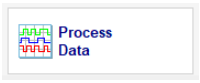
Press the button 

and select Acyclic Communication

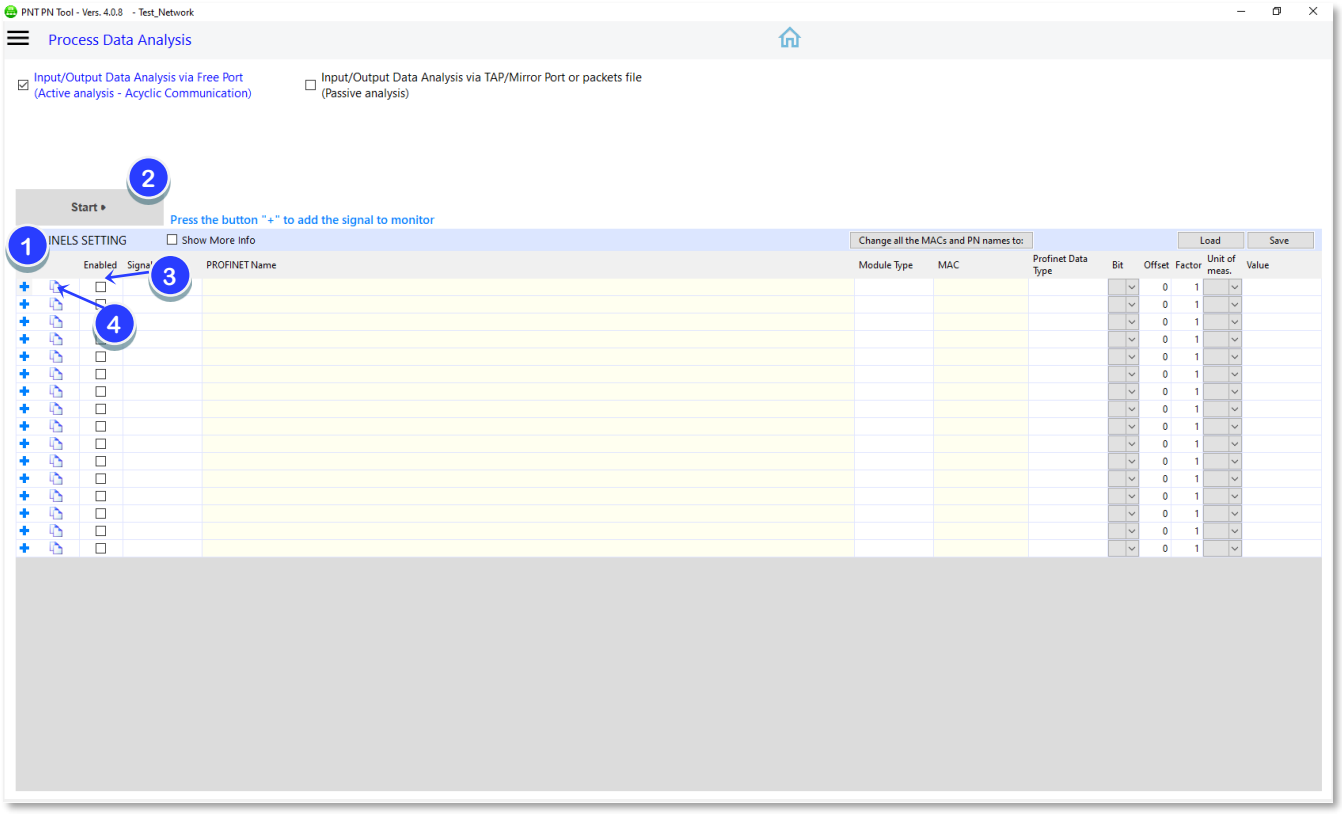
Check Read Input/Output Process Data, Select the device and press the Icon with the eye to read the value



Reading multiple process data

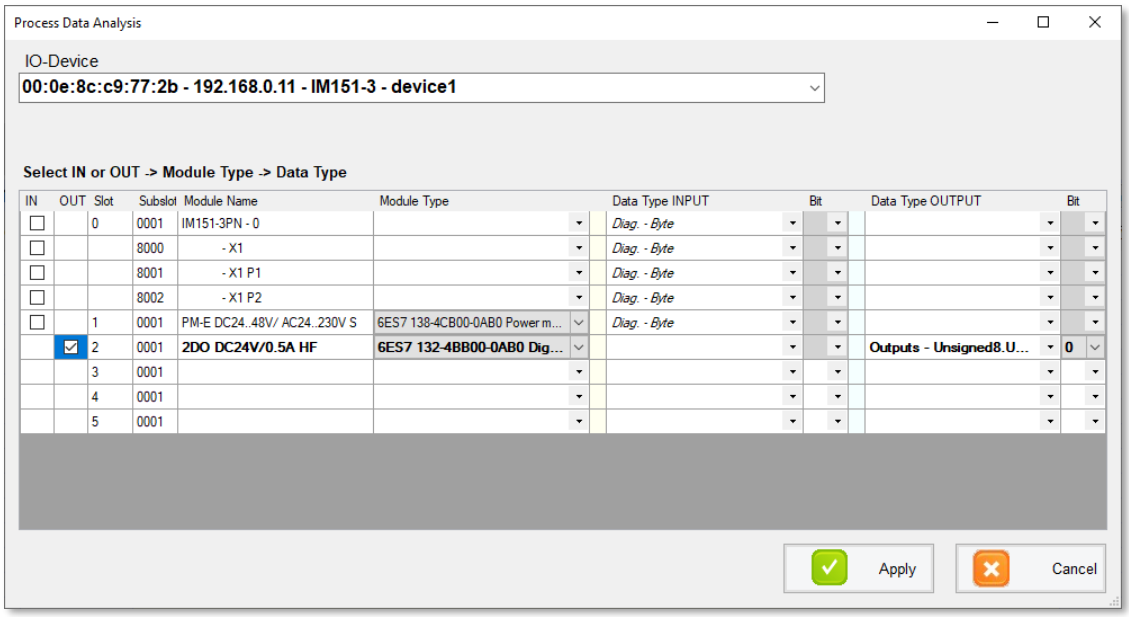
Press the button 

and select “Input/Output Data Analysis via Free Port (Active analysis – Acyclic Communication)”



	Function	Description
1	**+ Button**	Add the signal to monitor
2	**Start**	Start reading the Process
3	**Enable**	Enable/Disable the channel
4	**Button Copy**	Press Copy to select the line. Press Paste button if you want to replicate the selected line

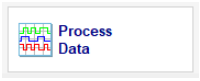
1. Press the button "+" to add the signal to monitor



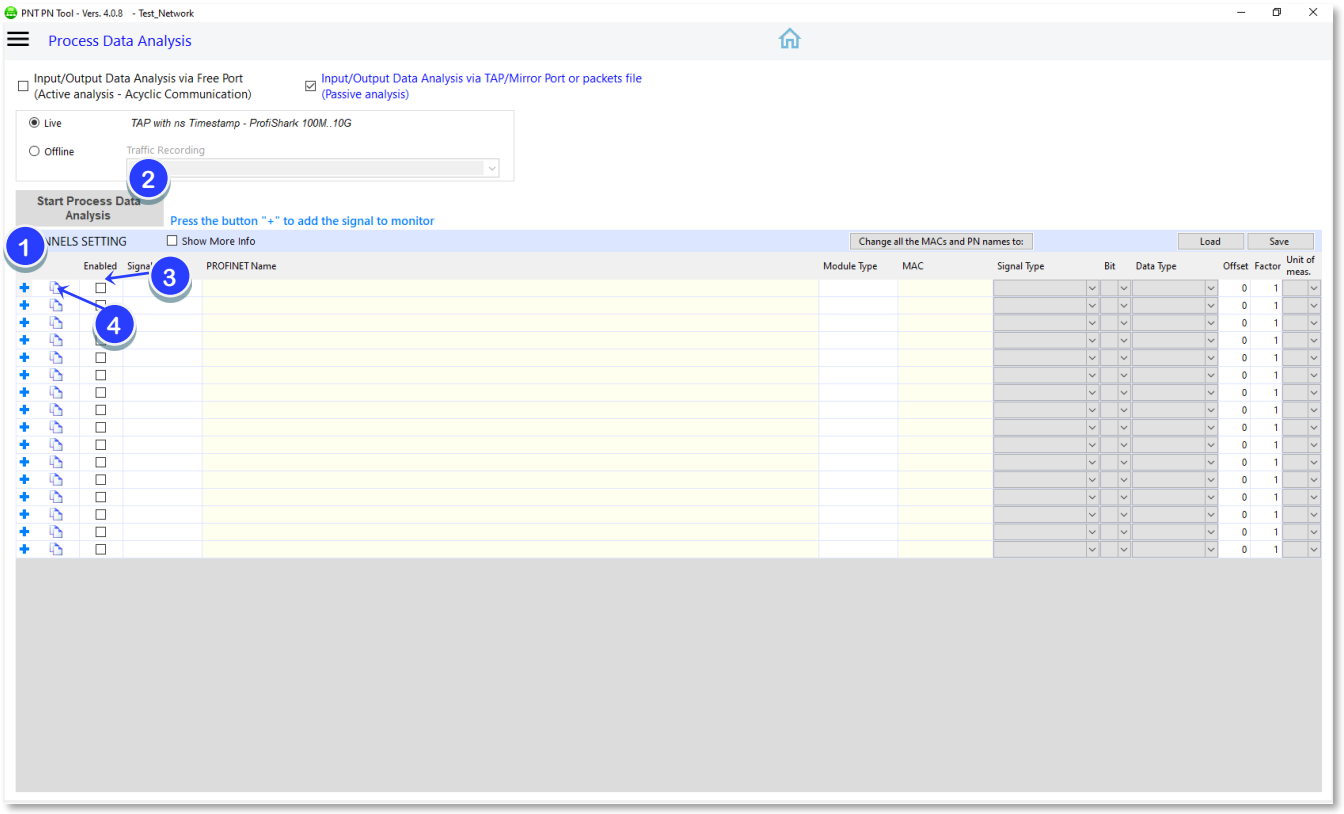
2. Select the IO_Device
3. Select IN or OUT
4. Check the Module Type
5. Select the data to inspect
6. For digital signal select the Bit
7. Repeat for all the signal that you want to monitor

8. Press the button "Start"

PROFINET Process Data via TAP/Mirror port

Press the button 

and select “Input/Output Data Analysis via TAP/Mirror Port or packets file (Passive analysis)” and check “Live”

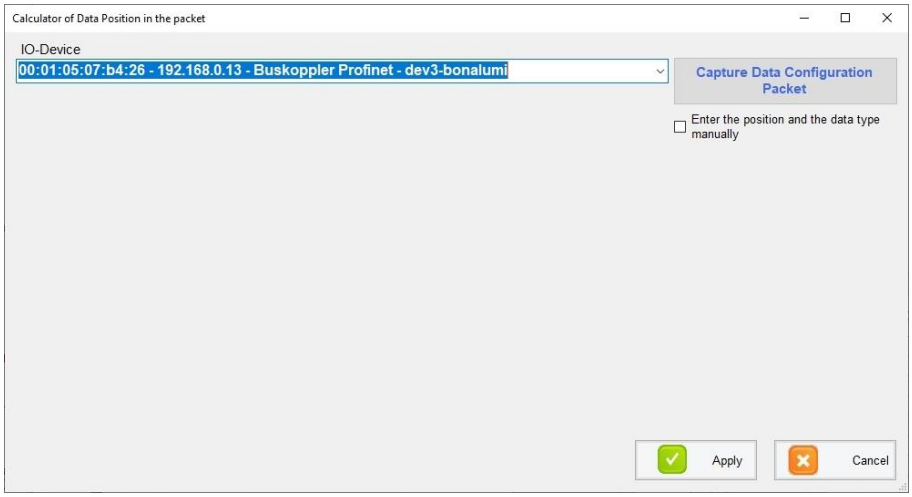


	Function	Description
1	**+ Button**	Add the signal to monitor
2	**Start Process Data Analysis**	Launch ProfiGraphPN
3	**Enable**	Enable/Disable the channel
4	**Button Copy**	Press Copy to select the line. Press Paste button if you want to replicate the selected line

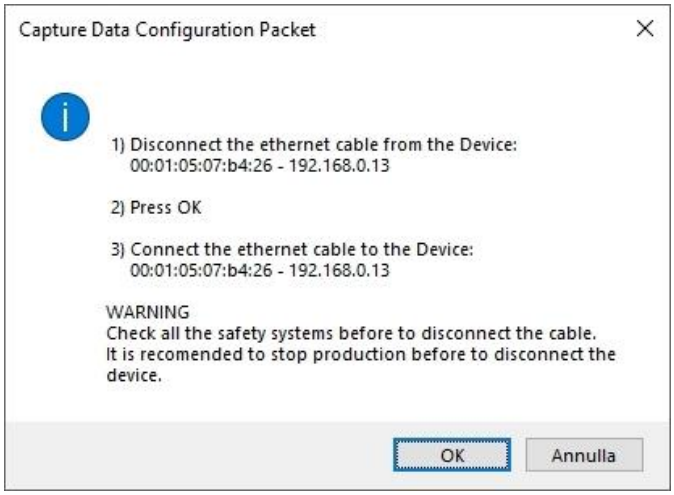
To simplify the procedure, the GSD files of the devices and the capture of the Data Configuration Packet are needed, otherwise it is necessary to know the initial position of the data within the data field of the PROFINET packet.

1. Press the button “**+**” to add the signal to monitor

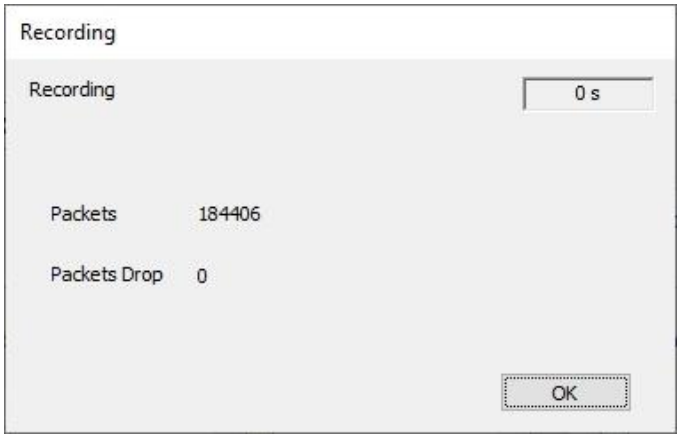
2. Select the device



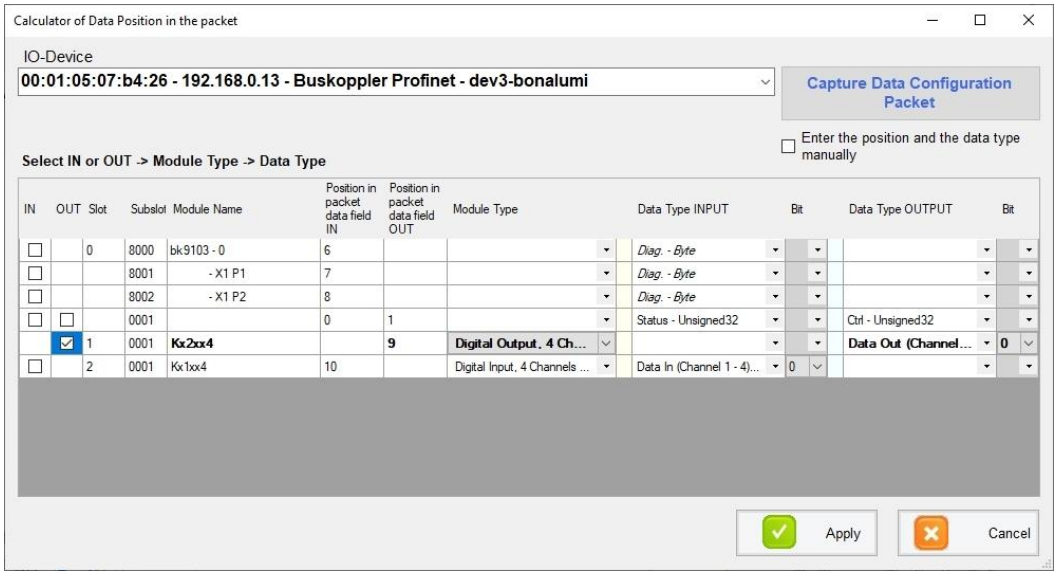
3. Press the button Capture Data Configuration Packet and follow the instruction



4. When the PNT has captured the configuration packet press ok

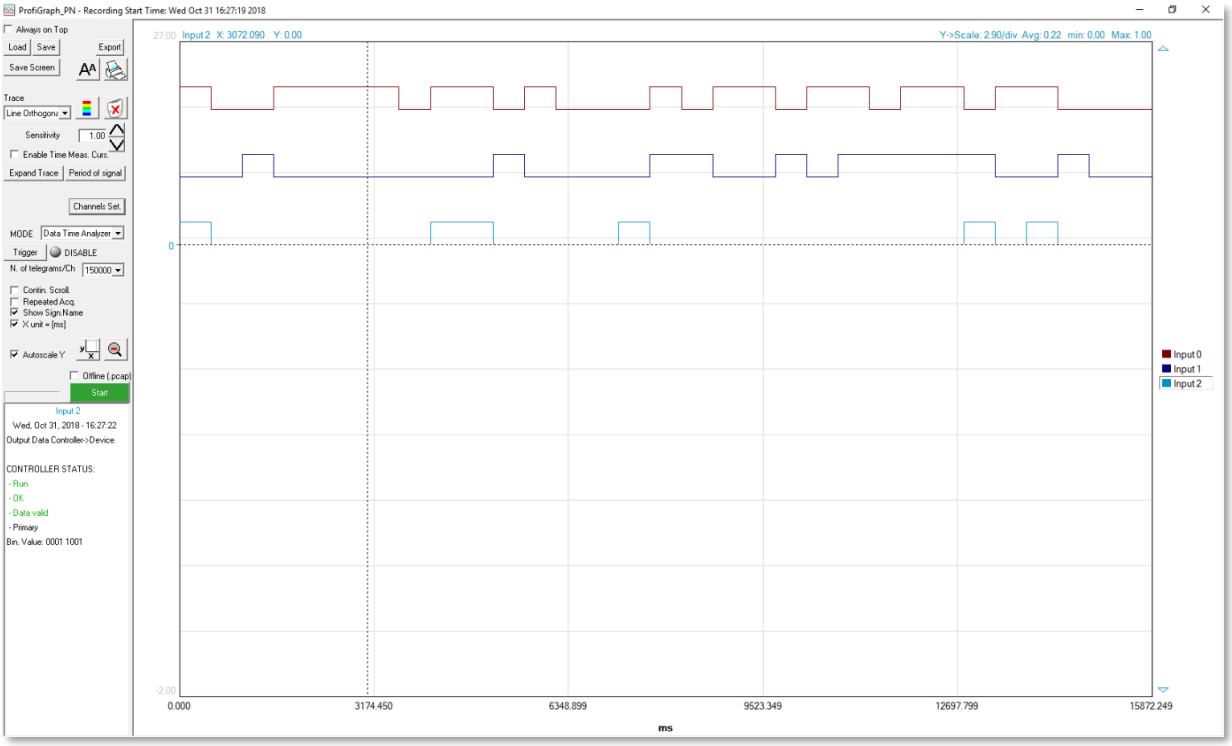


5. Now, you will see the slot and subslot



6. Select IN or OUT
7. Check the Module Type
8. Select the data to inspect
9. For digital signal select the Bit
10. Press Apply
11. You can add up to 16 measurements. **Press the button "Save" to save the configuration. You can use it for other analysis or to use in PROFINET Process Data via packet file (.pcap).**

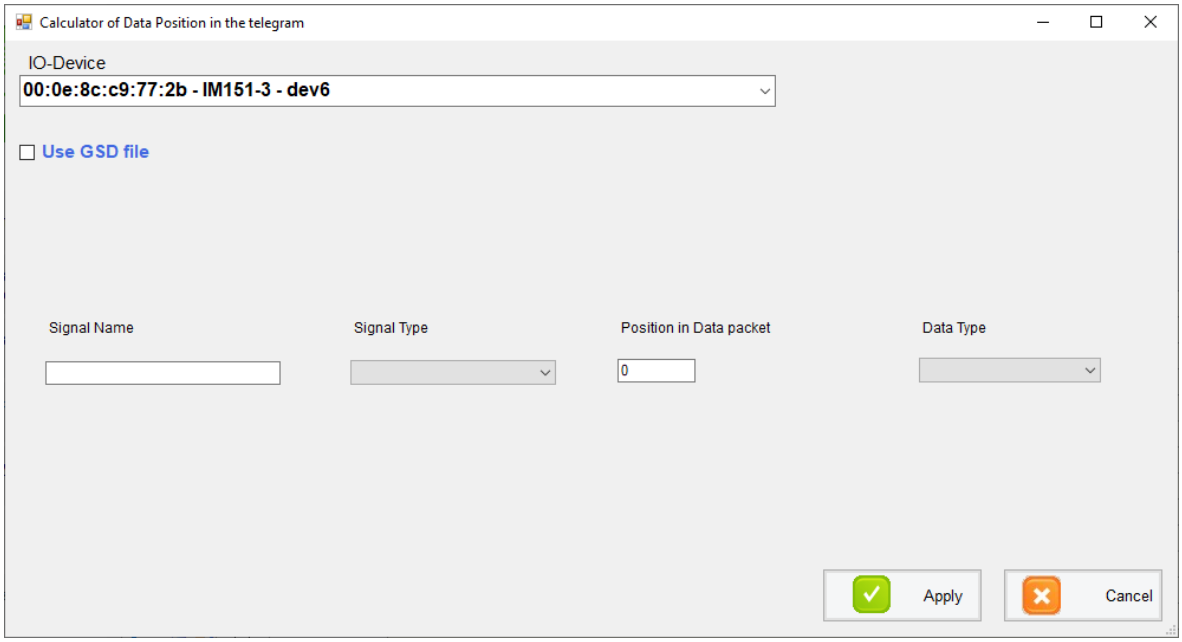
12. Press “Start Process Data Analysis” to launch ProfiGraphPN



13. Press Start to monitor the signal

Enter the position and the data type manually

1. Press the button "+" to add the signal to monitor
2. Select the device



3. Fill in the requested information:

- **Signal Name**

Can be used to better describe the visualized channel.

- **Signal Type**

Type of the signal in the device. Possible Signal Types are:

Digital Input
Digital Output
Analogue/Generic Input
Analogue/Generic Output

- **Position in Data packet (Start Byte)**

Selects, inside the PROFINET data message, the start position of the data that is to be visualized.

- **Data Type**

Selects the numeric format which has to be used. Possible data types are:

Int8
Int16
Int32
Unsign.8 (bin.B)
Unsign.16 (bin.W)
Unsign.32
Float
Int16_intel
Int32_intel
Unsign.16_intel
Unsign.32_intel
Float_Intel

The Unsign.8 (bin.B) and Unsign.16 (bin.W) show the binary value of the data in the Info Panel. Useful for Status Byte or Status Word.

- **(Off+DataValue*Factor)**

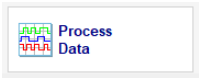
A formula can be used in order to scale the data value.

- **Unit**

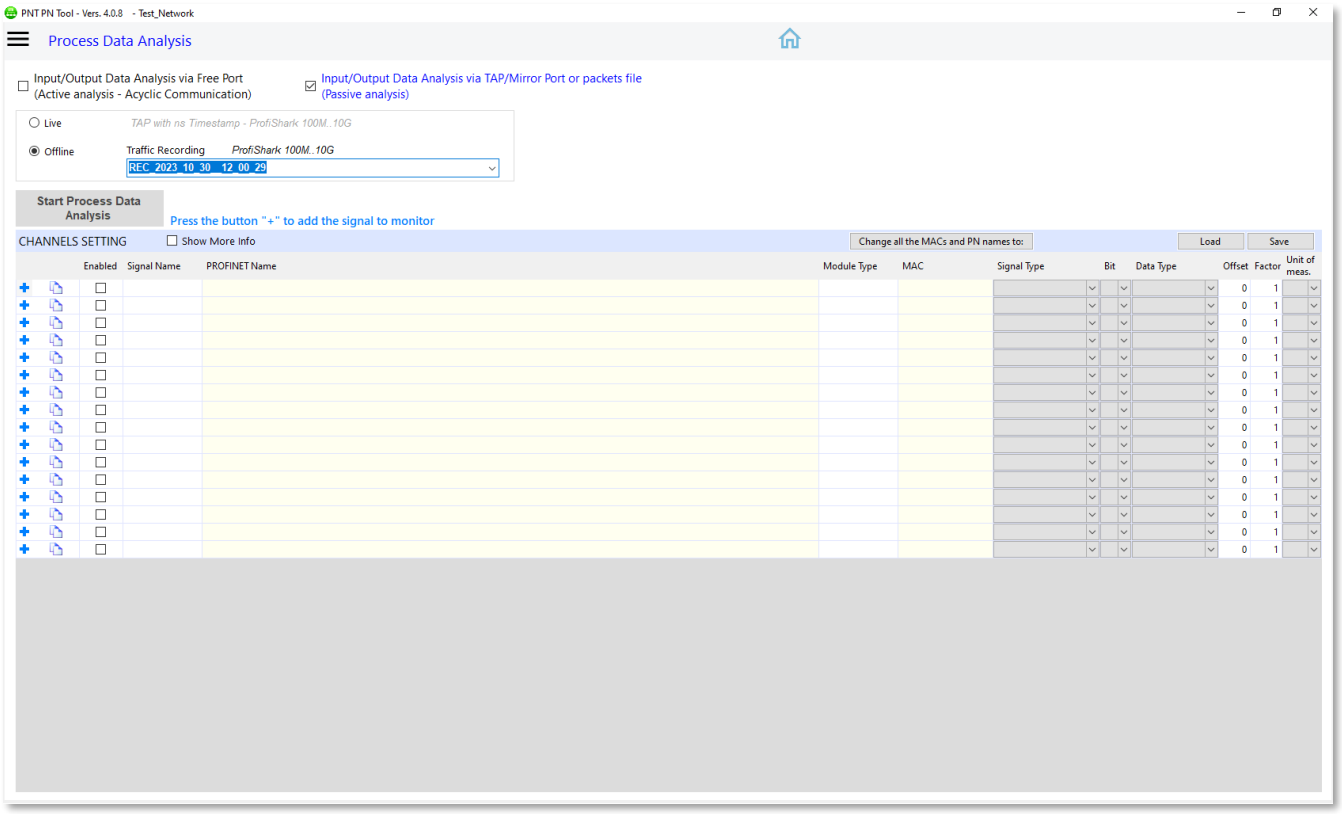
It can be used to better indicate the unit of the visualized data.

4. Press Apply

PROFINET Process Data via packet file (.pcap)

Press the button 

and select “Input/Output Data Analysis via TAP/Mirror Port or packets file (Passive analysis)” and check “Offline”



1. Select the Traffic recording
2. Press the button **"Load"** to load the saved configuration (page 60, point 11) or press the button “**+**” to add the signal to monitor and follow the same procedure like in PROFINET Process Data via TAP/Mirror Port.

ProfiGraphPN

With ProfiGraphPN you can inspect in graphical way the data exchanged between PROFINET devices and the controller.

Number of Channels: 16
Packets/Channel: 150000

Trigger: Set level, positive slope, negative slope, Transition faster than Interval Width, Trig.1 and (Trig.2 Inside Interval), Trig.1 and (Trig.2 Outside Interval), Trig.1 or Trig.2.

Continuous Viewing: Continuous Scrolling mode
Inside ProfiGraphPN you can select the Data Acquisition Mode or the Data Logger Mode.

In Data Acquisition Mode every packet is captured.
In Data Logger Mode the signal is sampled.

The Data Logger Mode enables long time recording of slow process values thanks to a programmable sample time from 0.1s up to 60s (max. sample frequency 10 Hz, min. sample frequency 0.01666 Hz).

Data Acquisition

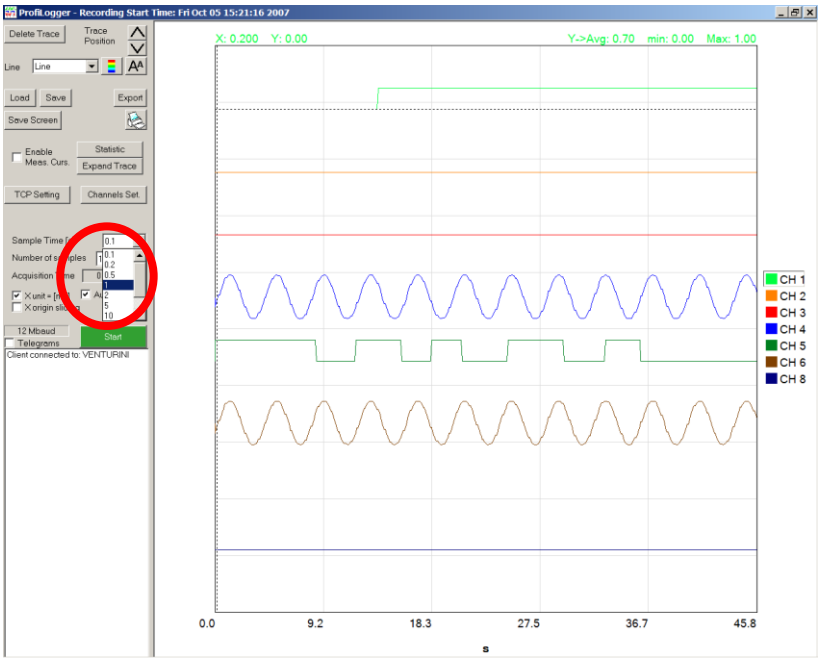
Select 

if you want to have a Continuous Scrolling of the data.
Useful for “N. of telegram/Ch” > 5000.

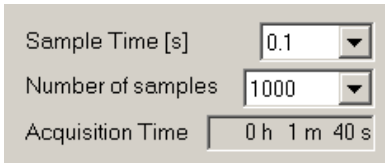
Press **Start**.

Data Logger

Select **Mode Data Logger**



Select the Sample Time.
Select the Number of samples.



The program will calculate the Acquisition Time.

Expand Trace

Shows the selected trace in full screen mode.

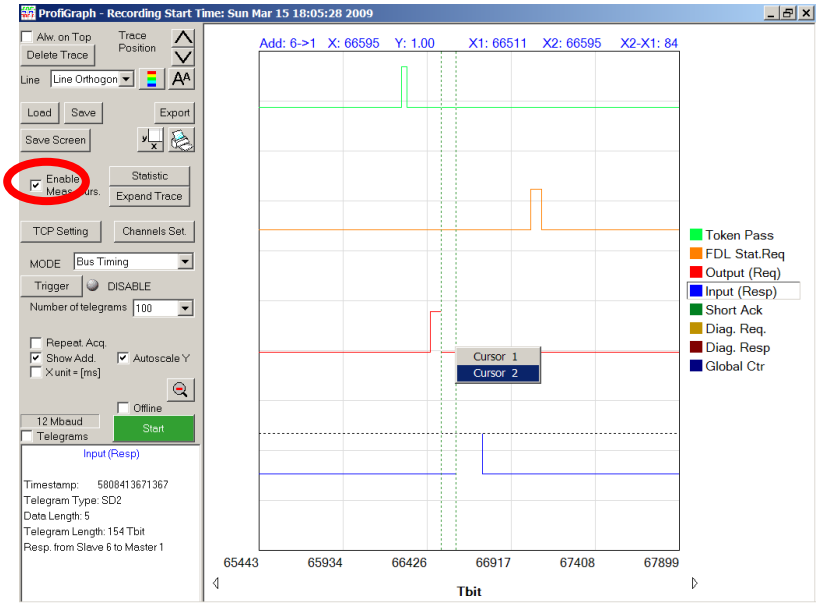
Export Data

The data can be exported into compatible text file (.csv format).

Keyboard Shortcuts

F1	Help
Up Arrow	Move up the selected trace
Down Arrow	Move down the selected trace

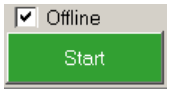
Measurement of time interval



Select **Enable Meas. Curs.** Inside the graphic area, press the **right button** of the mouse and place the first and the second cursor.
The measurement is shown at the top-right corner of the graph.

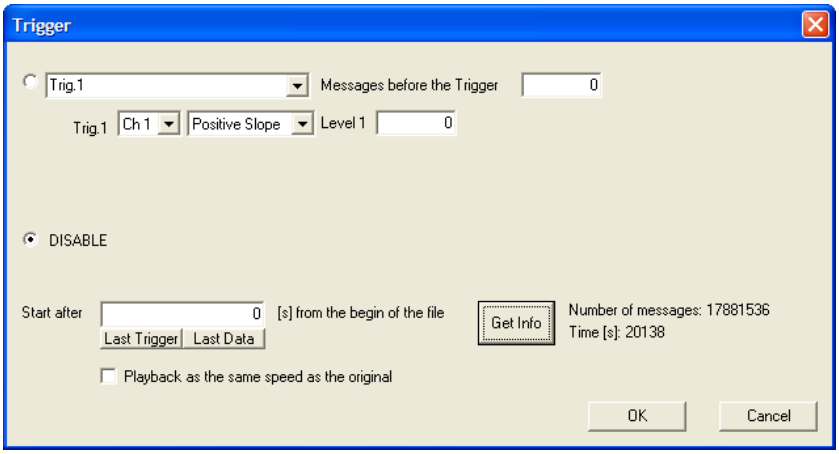
Offline Mode (.pcap files)

It can be used to analyze a ProfiTrace message file (.pcap).

Select 

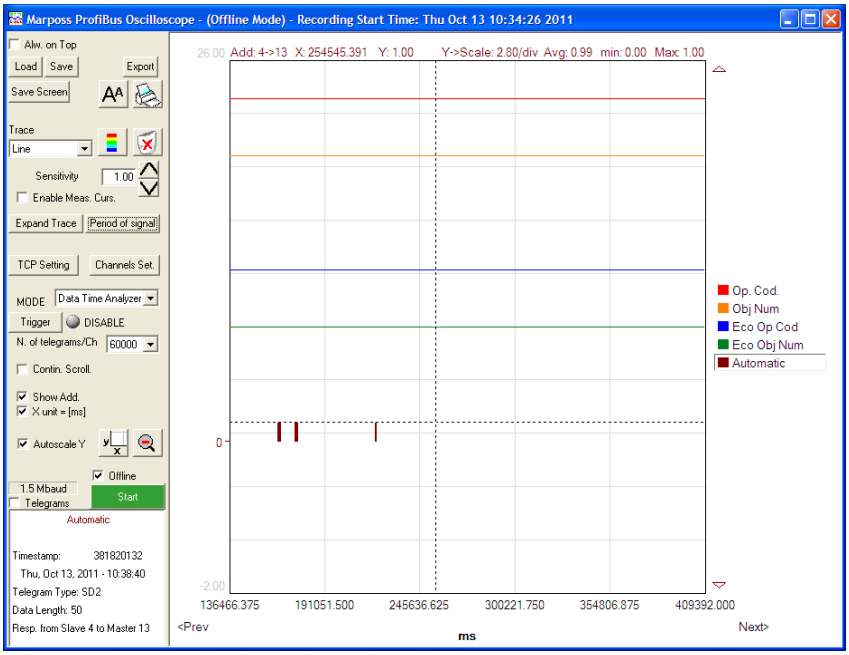
and press Start. Choose the file.

Select the trigger.



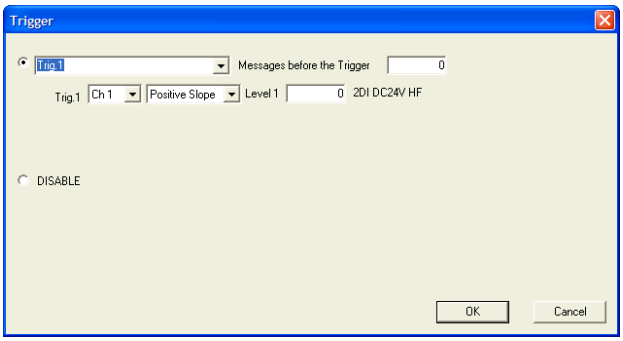
Select if you want to start from begin of the file (Start from 0 [s]) or after a time.

"Get Info" gives you information about the acquisition length, in seconds, and the number of messages.



Press "Next>" and "<Prev" to move inside the ".pcap" file.

Trigger



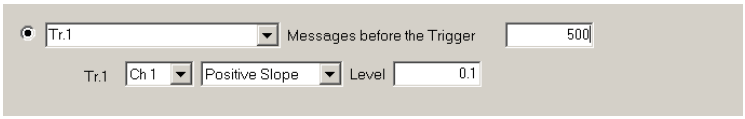
Possible Trigger Types are:

Trig.1
Trig.1 and (Trig.2 Inside Interval)
Trig.1 and (Trig.2 Outside Interval)
Trig.1 or Trig.2
Transition faster than Interval Width
DISABLE

- **Trig.1**

In this mode you have only one trigger. You must select the trigger source. Select the comparison that is to be checked Positive slope, Negative slope, Equal (=), Greater than (>), Less than (<) and the trigger level.

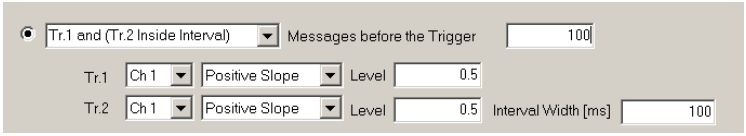
Example:



- **Trig.1 and (Trig.2 Inside Interval)**

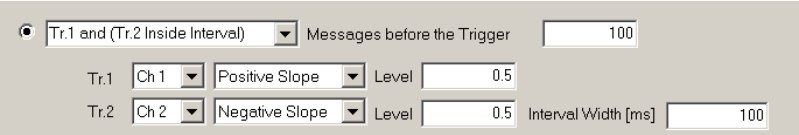
In this mode you have two triggers, the main trigger and the second trigger. You must select for both the trigger source, the positive or negative slope and the trigger level. You must choose also the Interval Width.

Example:



The trigger is generated if after a positive edge on channel 1 occurs another positive edge on channel 1 within the selected interval of 100 ms.

Example:

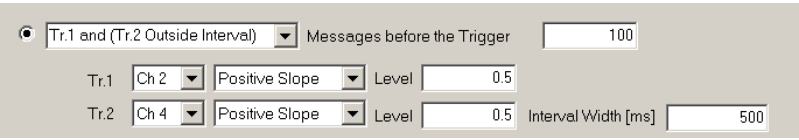


The trigger is generated if after a positive edge on channel 1 occurs a negative edge on channel 2 within the selected interval of 100 ms.

- **Trig.1 and (Trig.2 Outside Interval)**

In this mode you have two triggers, the main trigger and the second trigger. You must select for both, the trigger source, the positive or negative slope and the trigger level. You must choose also the Interval Width.

Example:

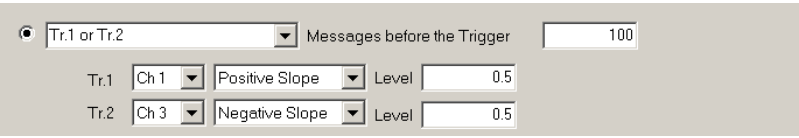


The trigger is generated if after a positive edge on channel 2 occurs outside the selected interval of 500 ms a positive edge on channel 4, or never occurs. The trigger is reset after a positive edge on channel 2 occurs and a positive edge on channel 4 within the selected interval of 500 ms.

- **Trig.1 or Trig.2**

In this mode you have two triggers. You must select for both the trigger source. Select the comparison that is to be checked Positive slope, Negative slope, Equal (=), Greater than (>), Less than (<) and the trigger level.

Example:

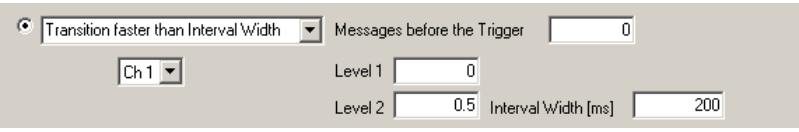


The trigger is generated if a positive edge on channel 1 or a negative edge on channel 3 occurs.

- **Transition faster than Interval Width**

You must select for the trigger source, the start level, the end level and the time.

Example:

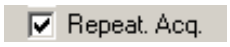


The trigger is generated if a positive transition, from 0.0 to 0.5, faster than 200 ms occurs.

- **Disable**

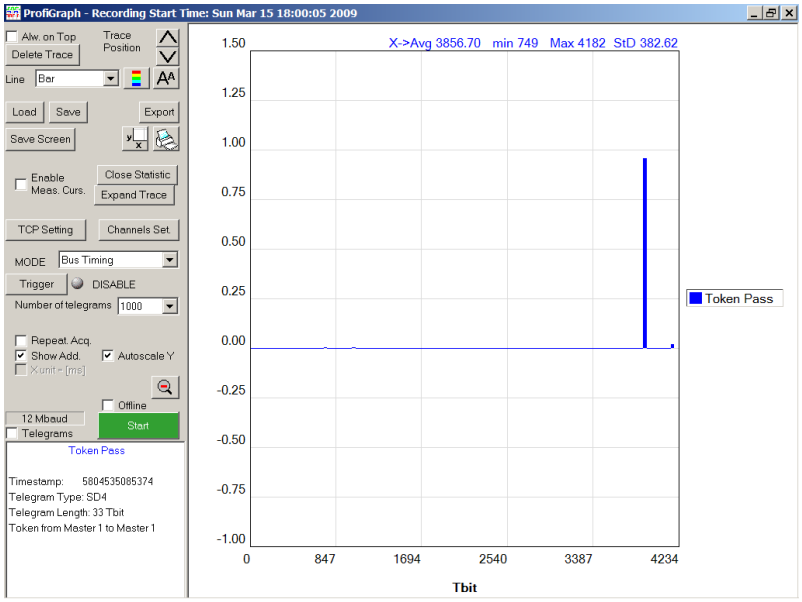
In this mode the trigger is disable.

Retriggering

If 

is selected, ProfiGraph waits for the trigger signal before restarting the acquisition.

Statistical information of the signal



It gives you useful statistical information about the period of digital signals: it can display time distribution, mean, standard deviation, minimum and maximum values of any trace.

Save the Screen

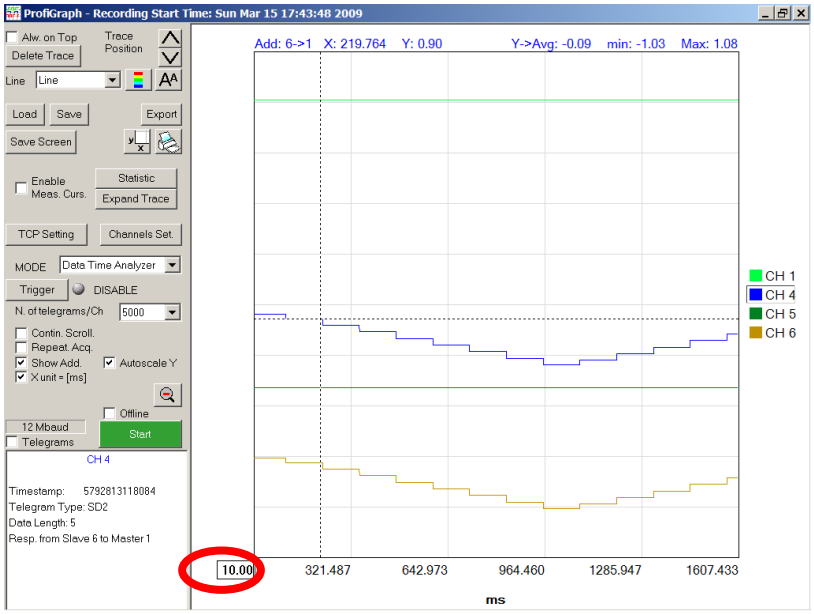
Saves the graphical screen in bitmap format (.bmp)**.**

Select a trace

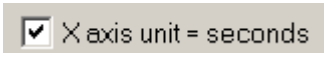
Before removing or changing a trace, you must select it.
Press the left button over the trace name.

Scale

Press the **Scale** button or click over the scale label, insert the new limit and click outside of the edit box.



Time unit



Select this checkbox = seconds
Unselect this checkbox = Tbits

Zoom IN

Inside the graphic area, press and hold the left button of the mouse for to draw the zoom window.
Use the arrow button for scrolling.

 Scroll left

 Scroll right

Zoom OUT

Press the Zoom Undo button

Technical specifications:

Network specification:

- Analysis of PROFINET networks of **any** size
- Maximum number of devices that can be analyzed with a single acquisition: **2500 devices**
- Network TAP (Test Access Point) supported (optional):
  - Kunbus TAP CURIOUS, Kunbus TAP 2100, ProfiShark 100M Blue, Dualcomm ETAP-1000, ProfiTap, ProfiTap Statistic

System requirements:

- Supported operating systems: Windows 7, Windows 8, Windows 8.1, Windows 10, Windows 11
- Minimum requirements: PC with Windows 7 and 1 GB RAM
- Visual C++ Redistributable x86 2015-2022

Reference:

[1] PROFINET Commissioning Guideline Version 1.44 September 2019 -PNO - www.profinet.com

Technical Support:

If you have any technical questions or issues. Just send your support request to:

support@pntool.net

Before you submit a request, please press the button “Check for Update”, “Program setting” page, to control if a new release is available.