Operation Instruction Manual

netANALYZER Software

Data Acquisition and Analysis

Hilscher Gesellschaft für Systemautomation mbH

www.hilscher.com

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Table of Contents

1 Introduction

1.1 About the Operation Instruction Manual

This operation instruction manual contains descriptions for installation and use of the analysis software **netANALYZER**.

Notes about software installation are provided in the user manual **Installation guide, Software installation for netANALYZER devices**.

1.1.1 List of Revisions

Index	Date	Software	Chapter	Revisions
1	15-03-15	netANALYZER Rev. 1.5.x.x	All	created
2	17-01-10	netANALYZER Rev. 1.0501.x.x		Sections about content of the product DVD, about installation and about the Wireshark plugin removed. For software installation instructions see separate manual.
3	17-02-23	netANALYZER Rev. 1.0501.x.x	2.2	Terminology: “frame” instead of “telegram”; “product DVD”. Section *System Requirements*: Internet to downoad product DVD.

Table 1: List of Revisions

1.1.2 Conventions in this Manual

Notes, operation instructions and results of operation steps are marked as follows:

Notes

Important: <important note you must follow to avoid malfunction>

Note: <general note>

<note, where to find further information>

Operation Instructions

1. <instruction>
2. <instruction>

or

➢ <instruction>

Results

<result>

Safety Messages

The labeling of safety messages is explained in the chapter *Safety*.

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Copyright

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1.4 Hilscher Software License Agreement

When you install the Hilscher software you are asked to read the Hilscher Software License Agreement and explain your acceptance to it.

2 Description and Requirements

2.1 Introduction about the netANALYZER Software

By use of the netANALYZER software **netANALYZER** the modes listed hereafter can be used:

Capture Data Mode

In the **Capture Data** mode, the data are recorded to the hard disk of the PC.

For further information refer to the User Manual **netANALYZER Devices** in section *3.1 Recording and analyzing Data Traffic*.

For data capturing two operating modes are provides:

- **Ethernet Mode** (Standard Capturing)

In the **Ethernet Mode** standard Ethernet frames are captured.

- **Transparent Mode**

In the **Transparent Mode** standard Ethernet frames are captured, which include the preamble and the SFD (=Start of Frame Delimiter).

For further information refer to section *Transparent Mode* beginning from page 54.

Timing Analysis Mode

In the **Timing Analysis** mode, no frame data are stored, only the time stamp of individual frames are analyzed. No data recording is performed.

For further information refer to section *Timing Analysis* beginning from page 55.

Netload Analysis

In the **Netload Analysis** mode, the netload of the frames is analyzed over the time. The data recording is performed in the background. The frame data are captured on the hard disk and can be used for further analysis in Wireshark.

For further information refer to section *Netload Analysis* beginning from page *67*.

2.2 System Requirements

In order to download the product DVD, you need an Internet access.

2.2.1 Hardware Requirements

PC or Notebook with the following specification:

- Intel compatible CPU, approx. 2 GHz or faster
- 1 GB RAM or more
- SVGA 1024x768 16bit colors or better
- 20 MB free hard drive space for the **netANALYZER** software
- At least 1 GB free hard disk memory (NTFS partitions) for data capturing
- Approx. 73 MB free hard disk memory for the **Wireshark** software

2.3 Software Requirements

- Operating System:
  - Windows® XP Professional, SP3, (32-bit and 64-bit Version),
  - Windows® Vista, (32-bit and 64-bit Version),
  - Windows® 7, (32-bit and 64-bit Version),
  - Windows® 8, (32-bit and 64-bit Version).
- The program Microsoft .NET Framework Version 2.0 must be installed. The program can be downloaded from the Internet address: http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=16614
- ~~In orde~~r to show the displayed data, a network monitoring program such as Wireshark must be installed that supports the WinPcap format. (Wireshark is "free software"), and can be downloaded from the Internet address: http://www.wireshark.org/. A special Hilscher Dissector is integrated in Wireshark.
- The **netANALYZER** software V 1.0501.x.x must be installed. This includes the **netANALYZER** software, the Analyzer driver and the Analyzer firmware “Ethernet-Analyzer”.

Only for analyzer device NANL-B500G-RE:

- The **Remote Access Client** must be installed.
- The program **Ethernet Device Configuration** must be installed.

3 Getting Started

3.1 Overview Settings an Analysis Methods

No	Step	Short Description	Detailed Information, see the Documentation / Chapter / Section	Page
1	**Settings**			
1.1	Starting netANALYZER Software and selecting Device	Start the netANALYZER software and select the netANALYZER device for data capturing and analysis. If you have two or more netANALYZER devices connected to your PC, you can open the netANALYZER software (beginning with the version 1.4.x.x) for several devices multiple times in parallel.	*netANALYZER Software* *Starting the netANALYZER Software multiple Times*	18 18
1.2	Selecting Ports and Analysis Method for Data Capturing	In the netANALYZER main window, you must set the **Ports** to be used for the capturing and which **Analysis Methods** are to be used. Furthermore you can read here the data about the captured frames, the found errors, the bus load and for the capturing time, you can open the window to convert a binary format files into the WinPcap format and read the status bar reports on the status of the application, the firmware or the driver and the GPIOs (external inputs/outputs).	*netANALYZER Main Window*	23
1.3	Defining Number, Name and Allocation for Binary Files (*.hea)	In the **File Settings** window you can determine the number of binary files to be stored, define, that the capturing data are to be stored to the ring buffer, define the systematic name of the *.hea files and where the binary files will be stored.	*Performing File Settings*	27
1.4	GPIO and Trigger Configuration	In the **GPIO Settings** window you assign a GPIO event to every GPIO (external input/output) and define, how the capturing shall be started or stopped and a delay time.	*GPIO Settings*	29
1.5	Setting the Transmission Rate for Port 0 to Port 3 manually	Via **PHY Settings** you can manually set the data transmission rate per port.	*PHY Settings*	35
1.6	Analysis Configuration	In the **Analysis Configuration** you define for the Timing Analysis, whether you will use the **Extended Software Filter Settings** and whether the graph of the analysis data will be displayed as a **Histogram** or as a **History** or as a combined Histogram and History graph. The Netload Analysis always used the extended software filters.	*Analysis Configuration*	46
2	**Filter Settings**			
2.1	Hardware Filter Settings	Selecting analysis data using pre-defined filter masks or defining own filter masks.	*Filter Settings for the Hardware Filters*	31
2.2	Extended Software Filter Settings	Selecting analysis data using pre-defined filters or defining own filters.	*Extended Software Filter Settings*	36
3	**Data Capturing**			
3.1	Starting Data Capturing	Start the capturing process of the received Ethernet frames.	*Starting Data Capturing*	48
3.2	Converting binary Files into WinPcap Format	Convert binary files **.hea* into WinPcap format **.pcap*.	*Converting Binary Files into WinPcap Format*	49
3.3	Displaying Analysis Data	Display analysis data of the Ethernet Frames using e. g. Wireshark.	*See help of the used network monitoring program*	-
4	**Timing Analysis**			
4.1	Presettings	Enter title, select port, configure axis and histogram	*Timing Analysis*	55

No	Step	Short Description	Detailed Information, see the Documentation / Chapter / Section	Page
		settings.		
4.2	Data Evaluation	Measuring value and histogram evaluation.	*Extended Software Filter Settings*	36
5	**Netload Analysis**			
5.1	Analyzing captured Ethernet frames	Analyzing the netload of the captured frames over the time and capturing the frame data.	*Netload Analysis*	67

Table 2: Overview Settings, Filter Settings and Analysis Methods

4 Software Installation and Configuration

4.1 Display and Settings in Wireshark

4.1.1 netANALYZER Info Block in extended .pcap File Format

In the extended .pcap file format according to the link-layer type with wireshark 1.7.1 the compatible "netANALYZER frame info block" with the additional information is in the 4 bytes ahead of the Ethernet frame.

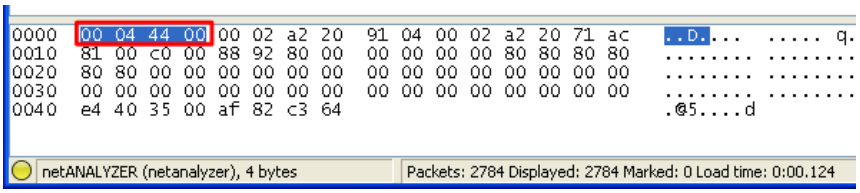


Figure 1: Wireshark 1.7.1: netANALYZER Info Block in the extended .pcap File Format

Beginning with version 1.4.x.x, the netANALYZER software converts the recorded data in either

- the .pcap file format with the info block behind the Ethernet frame or
- into the **extended link-layer type .pcap file format** with the info block ahead of the Ethernet frame.

For additional information refer to section *Converting Binary Files into WinPcap Format* page 49.

The extended .pcap file format generated by the netANALYZER software beginning from V1.4.x.x, can only be opened in Wireshark versions beginning from V1.7.1. When using earlier versions of Wireshark, the error message "link-layer type is not supported" is displayed.

For troubleshooting, you must either install the latest version of Wireshark or convert the .pcap file to the .pcap- file format with the info block behind the Ethernet frame. The .pcap file format with the info block behind the Ethernet frame, however, will no longer be supported by future versions of Wireshark.

Real Frame Length

Important: The 4 bytes additional information of the "netANALYZER Frame Info Block" ahead of the Ethernet frame are not included in the real frame length.

In the example in *Figure 1* 72 bytes have been captured, the real frame length in this example is 68 bytes, however.

4.1.2 Display Port Number in Wireshark Packet List

To display the port information in the protocol tree of Wireshark directly in the packet list of Wireshark, you can insert a new column to the packet list of Wireshark. Therefore proceed as follows:

➢ Select in Wireshark **Edit > Preferences**.

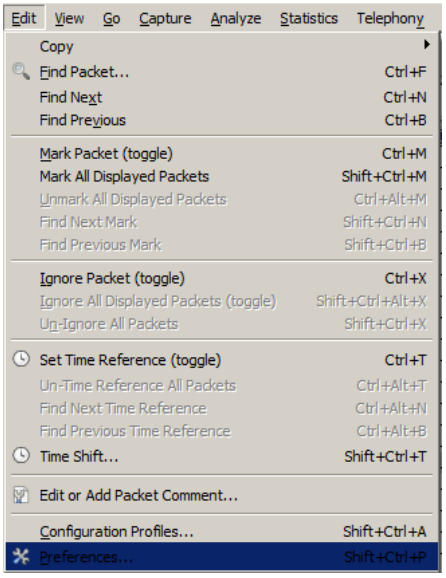


Figure 2: Wireshark: Edit > Preferences

➢ Select in the **Preferences** dialog at the left side **User Interfaces > Columns**.

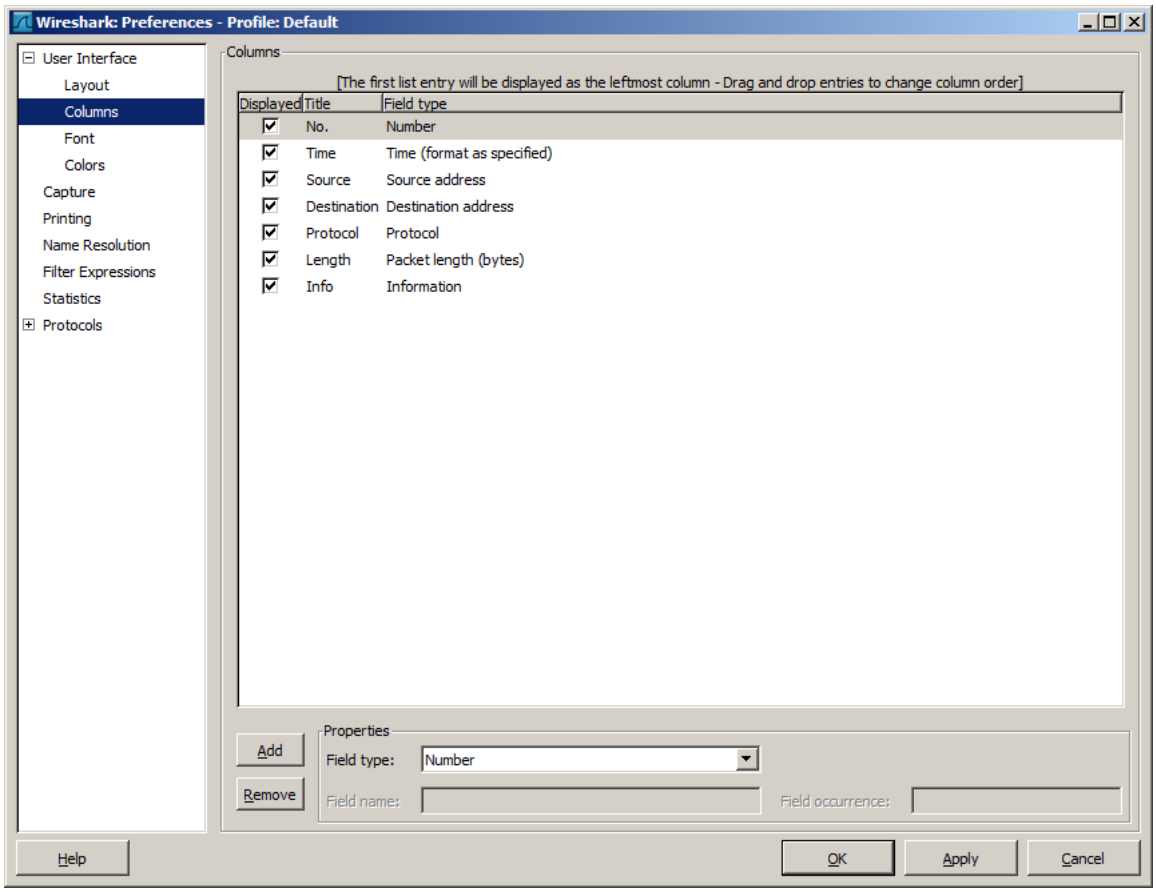


Figure 3: Wireshark: Preferences > User Interface > Columns

- Select under **Field Type** (1) „Custom“.
- Enter for the **Field name** (2) „netanalyzer.port“.
- Click to **Add**.
- The new line „New Column“ is displayed.

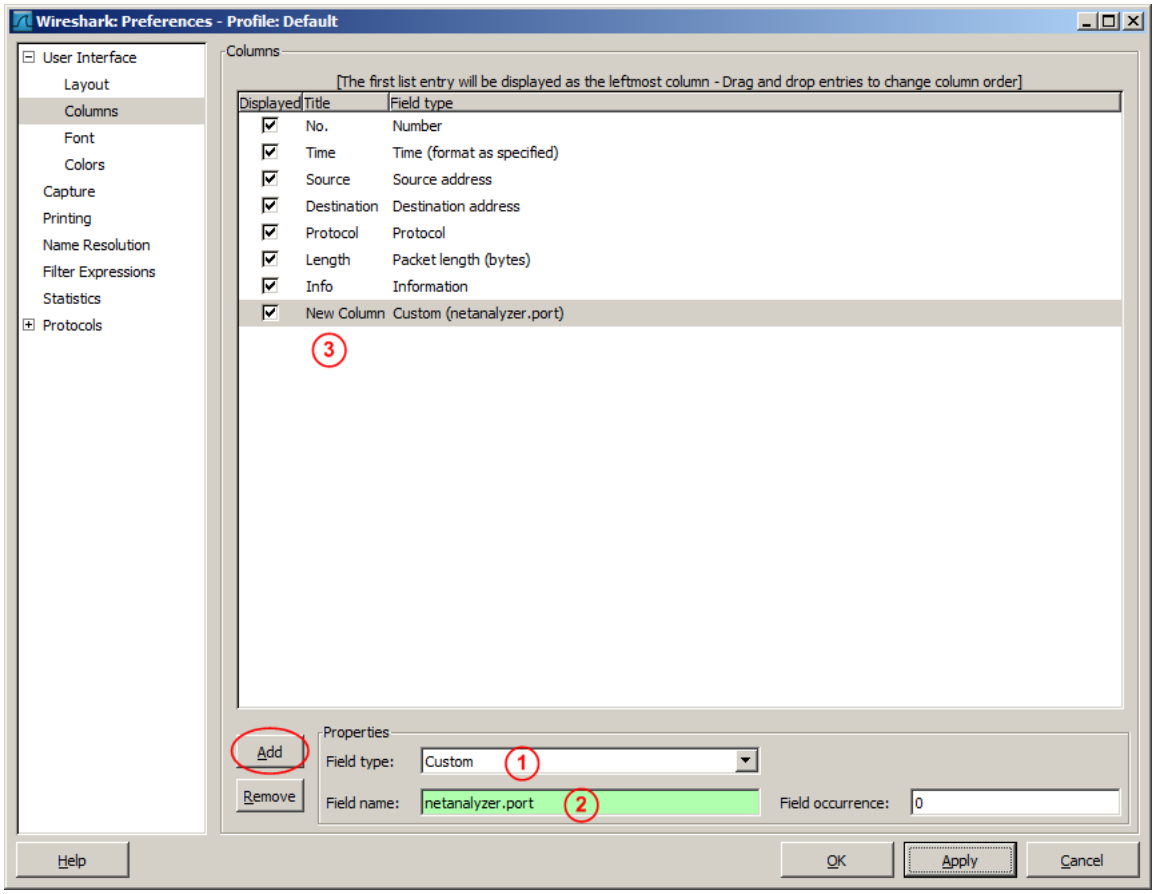


Figure 4: Wireshark: Preferences > User Interface > Columns > Add

- Enter at **Title** (3) the heading name “Port”.
- Move the line to the requested position.

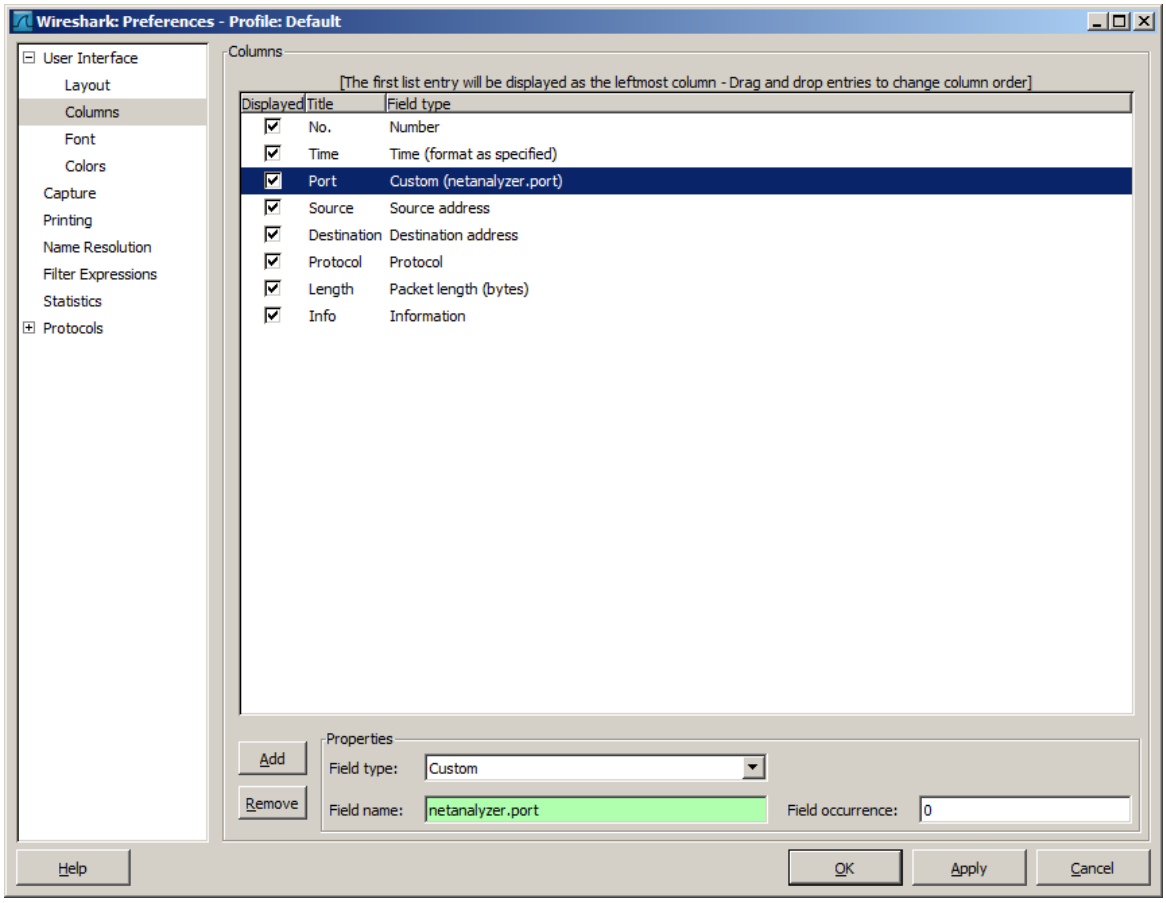


Figure 5: Wireshark: Preferences > User Interface > Columns

➢ Close the window via **OK**.

↬ In the packet list of Wireshark the number of the port now is displayed as an addition column.

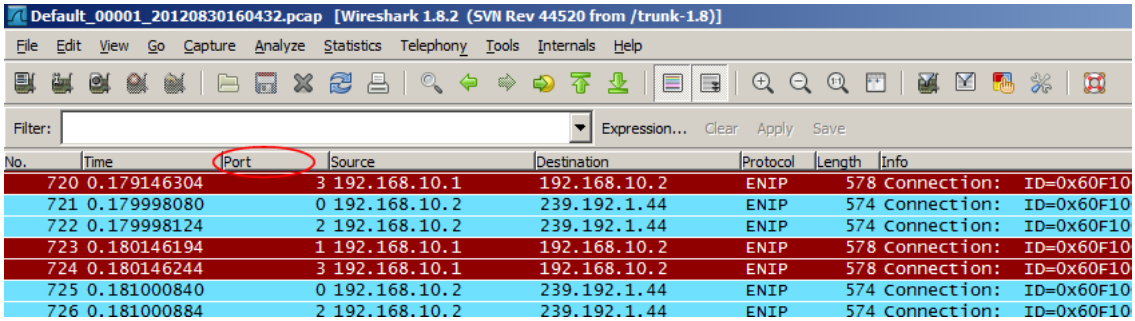


Figure 6: Wireshark: Port Number in the Packet List

5 netANALYZER Software

The **netANALYZER** software is a Windows® application that indicates the status information about the hardware and the received data packets. In addition, here the operator must define the filing paths for capturing the analysis data and initiate the conversion of the stored binary files (**.hea*) to the WinPcap format (**.pcap*).

5.1 Starting the netANALYZER Software

5.1.1 Starting and closing the netANALYZER Software

- Starting the **netANALYZER** Software:

➢ Select via the Windows® start menu **Start** > **Programs** > **Hilscher GmbH** > **Hilscher netANALYZER**.

- Closing the **netANALYZER** Software:

➢ Select via the **netANALYZER** Software menu **File > Close**.

5.1.2 Starting the netANALYZER Software multiple Times

Beginning with the netANALYZER software version 1.4.x.x the netANALYZER user interface includes multi-instance capability and can be opened multiple times in parallel. If you have two or more netANALYZER devices connected to your PC you will be able to run the netANALYZER software for each device at the same time.

Note: All settings such as HEA file settings, filter settings, etc. are stored for each netANALYZER device under a separate registry value. This allows keeping all device specific settings when using multiple netANALYZER devices in parallel.

5.1.3 Verification for Hardware and Device Driver

During initializing of the **netANALYZER** software the netANALYZER hardware is checked and the netANALYZER / netSCOPE Device Driver version is verified.

- If the hardware is not installed, the window **Select netANALYZER Device** is displayed without a device. If you click to **Proceed without device**, the error message **Incompatible driver version** is displayed. Via **OK** the **netANALYZER** main window is displayed, with the status bar message „Error in driver“.

- If the netANALYZER / netSCOPE Device Driver or the **netANALYZER** software is not up to date and compatible, the following error message is displayed: **Incompatible driver version. Please check driver version and installation**.

➢ Install the current **netANALYZER** software and the current netANALYZER / netSCOPE Device Driver.

5.1.4 Starting netANALYZER Software without Hardware Installation

If you have not installed any netANALYZER hardware in your PC, you can start netANALYZER software anyway, for example, to convert binary files to the WinPcap format or to create extended software filters.

Procedure:

➢ Open the netANALYZER software via **Start** > **Programs** > **Hilscher GmbH** > **Hilscher netANALYZER**.

➢ The **Select netANALYZER Device** window without a device.

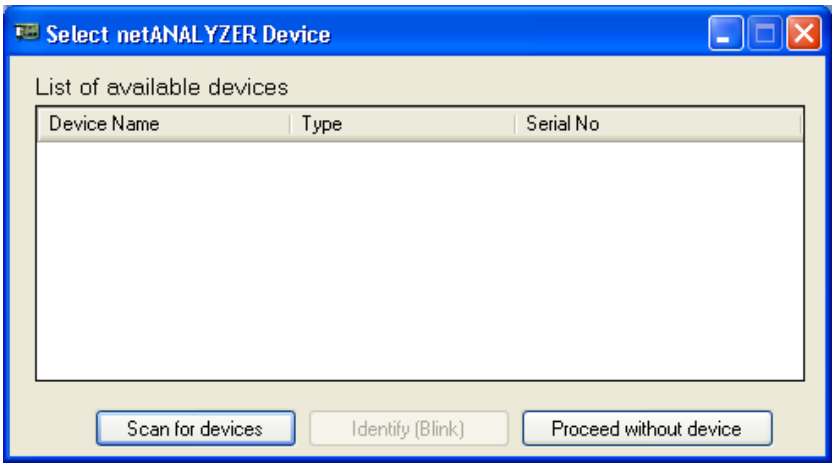


Figure 7: Proceed without Device

➢ Click on **Proceed without device**.

➢ The error message **Missing or incorrect driver** appears:

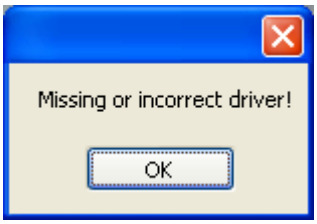


Figure 8: Missing or incorrect Driver

➢ Click on **OK**.

➢ The **netANALYZER** main window is displayed, with the status bar message „Error in driver“.

About **Settings** and **Convert** you can access to all dialogs important for the conversion or the presettings. The Filter Settings dialog can not be opened.

5.1.5 Selecting netANALYZER Device

Beginning with the netANALYZER software version 1.4.x.x after the error free start of the software the **Select netANALYZER Device** window is displayed, with the list of available netANALYZER devices.

To select a device:

Note: The netANALYZER device must be connected via an Ethernet connection to the PC or notebook.

➢ Open **Start** > **Programs** > **Hilscher GmbH** > **Hilscher netANALYZER**.

➢ The window **Select netANALYZER Device** is displayed. The found netANALYZER devices are listed in the window.

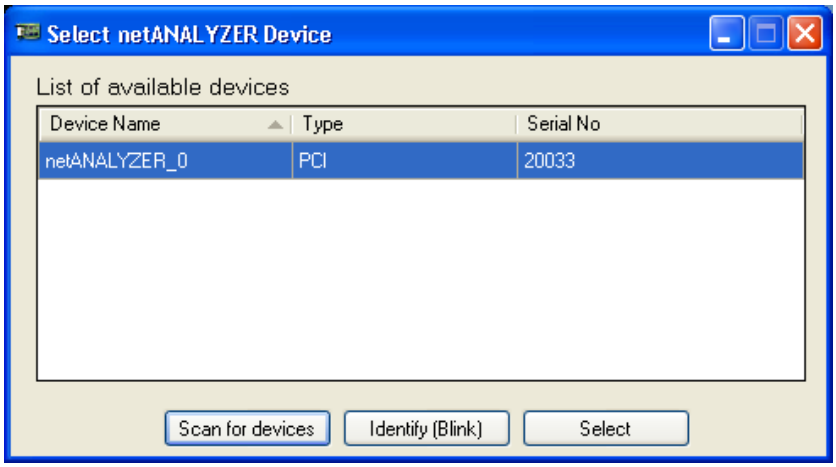


Figure 9: Select netANALYZER Device (Example NANL-C500-RE)

Figure 10: Select netANALYZER Device (Example NANL-B500G-RE)

Control	Explanation	Range of Value / Value
Device Name	Name of the found netANALYZER device	netANALYZER_0, netANALYZER_1 …
Type	Type of netANALYZER device found	PCI, GbE
Serial No	Serial number of the found netANALYZER device	
Scan for devices	Starting device search: The **List of available devices** shows the detected analyzer devices: PCI: netANALYZER PC card PCI RTE NANL-C500-RE GbE: netANALYZER portable device RTE Gigabit NANL-B500G-RE	

Control	Explanation	Range of Value / Value
Identify (Blink)	Starting device detection: The LEDs **STA0** and **STA1** on the selected device are flashing for approximately 10 seconds in green.	
Select	Select netANALYZER device for the current analysis. Already selected devices appear grayed out and can not be chosen again at the same time.	

Table 3: Description Select netANALYZER Device

- Select a netANALYZER device.
- Click on **Select**.

→ The netANALYZER main window is displayed.

5.1.6 Scanning for changed netANALYZER Hardware Installation

When the hardware installation has been changed, you must restart the netANALYZER software, and scan for new devices.

➢ Therefore open **Start** > **Programs** > **Hilscher GmbH** > **Hilscher netANALYZER**.

➢ The window **Select netANALYZER Device** is displayed:

➢ Click to **Scan for devices**.

➢ The found netANALYZER devices are listed.

Note: Already selected devices appear grayed out and can not be chosen again at the same time.

➢ Select a netANALYZER device.

➢ Click on **Select**.

➢ The progress bar **Scanning for Devices*** displays the scanning progress in percent (when several netANALYZER devices are connected to the PC). [**for future use*]

➢ In the **Select netANALYZER Device** window the found devices are displayed.

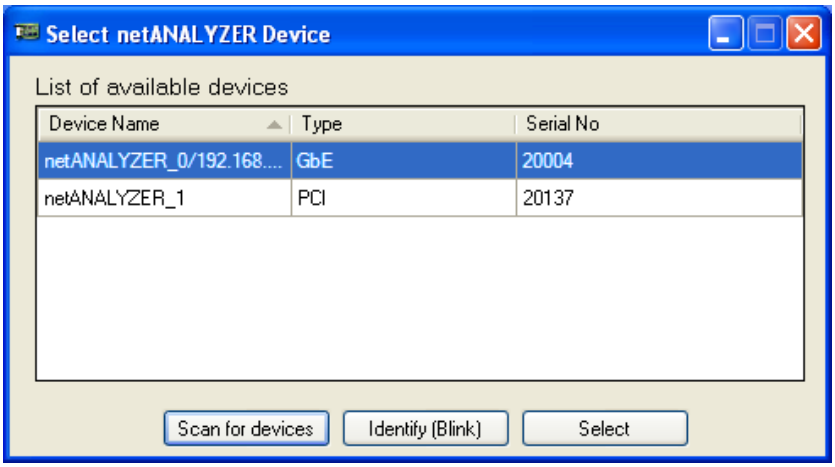


Figure 11: Select netANALYZER Device after Device Scan

➢ The netANALYZER main window is displayed.

5.2 netANALYZER Main Window

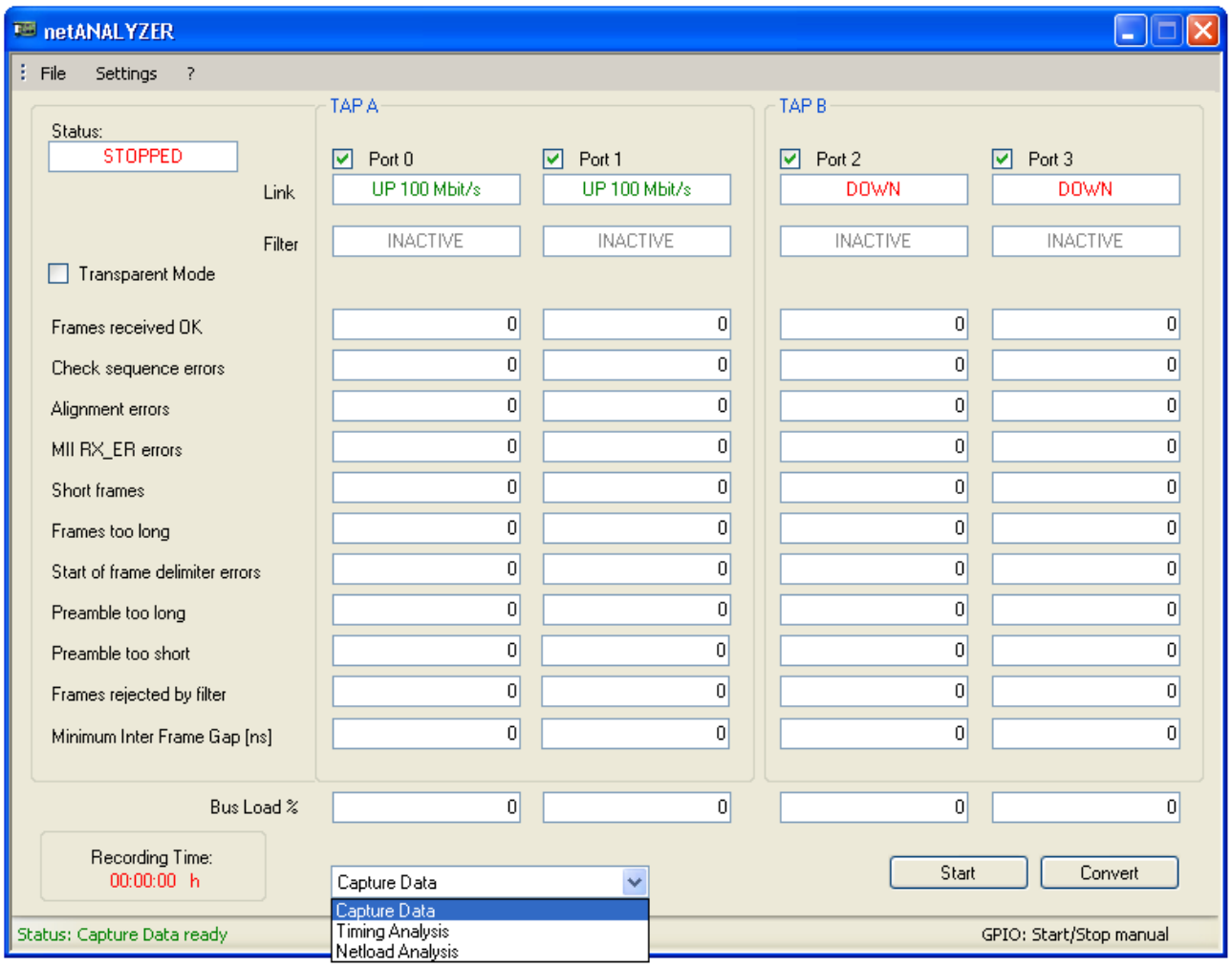


Figure 12: netANALYZER Main Window

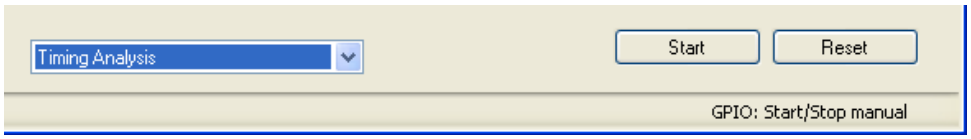
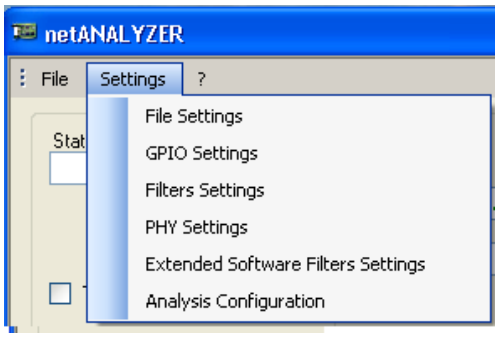


Figure 13: netANALYZER Main Window – Selection Timing Analysis

In the netANALYZER main window, you can for example

- set the **Ports** to be used for the capturing and
- which **Analysis Methods** are to be used,
- you can read here the data about the receive frames, the found errors, the bus load and for the capturing time,
- you can open the window to convert a binary format files into the WinPcap format and
- read the status bar reports on the status of the application, the firmware or the driver and of the GPIOs (external inputs/outputs).

Parameter	Meaning	Range of Value / Value
Settings Menu	 About the **Settings** menu you can open the windows for the settings and configuration. Further information you find in the subsequent sections.	
Status	Defines the operating status of the firmware	RUN / STOPPED
TAP A (Port 0, Port 1), TAP B (Port 2, Port 3)	Capturing for this port on/off. Deactivated ports are greyed out.	Selected/ unselected
Link	Indicates for each Port 0 to Port 3 the status of the link connected to the port and the speed information. "fix" indicates, that the speed has been set manually. For further information refer to section *Link Speed Information* on page 26.	UP / DOWN, 10, 100 MBit/s, fix 10, 100 MBit/s
Filter	Indicates for each Port 0 to Port 3 the status of the filter. If the syntax "ACTIVE" is displayed in red, the filter would be used but not stored so that the filter would be lost after a restart of the software.	ACTIVE, INACTIVE
Transparent Mode	If checked, any Ethernet frame data, including the preamble and SFD are displayed or captured. For further information refer to section *Transparent Mode* on page 54.	checked / unchecked, Default: unchecked
Frames received OK	Number of frames without error received	0 to 2 ^32 -1
Check sequence errors	Number of Sequence errors occurred	0 to 2 ^32 -1
Alignment Errors	Number of alignment errors by collision, frame is not Byte-Align	0 to 2 ^32 -1
MII RX_ER errors	Number of MII RX_ER errors	0 to 2 ^32 -1
Short frames	Number of short frames	0 to 2 ^32 -1
Frames too long	Number of frames too long	0 to 2 ^32 -1
Start of frame delimiter errors	Number of SFD errors	0 to 2 ^32 -1
Preamble too long	Preamble is too long	0 to 2 ^32 -1
Preamble too short	Preamble is too short	0 to 2 ^32 -1
Frames rejected by filter	Number of frames rejected by the filter	0 to 2 ^32 -1
Minimum Inter Frame Gap [ns]	Minimum measurable gap between two frames on the line	0 to 327670 ns
Bus Load %	Busload in percentage **Note**: For the analyzer card NANL-C500-RE TAP B the PHY transmission rate can not be evaluated. For this reason, here the busload signal 10 Mbit/s is faulty. But if in the PHY configuration dialog* the setting is changed to 10 Mbit/s manually (*see section *PHY Settings* on page 35), the busload signal can be displayed correctly. This is not true for the analyzer device NANL-B500G-RE. Here everything automatically is displayed correctly.	0 – 100%
Recording Time	Recording Time, in „hours.minutes.seconds“	00.00.00 h

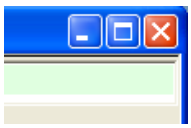
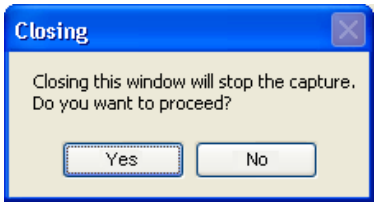
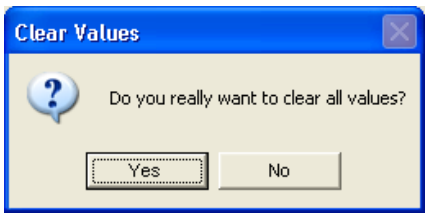
Parameter	Meaning	Range of Value / Value
Analysis Mode	Selection list **Capture Data**, **Timing Analysis** or **Netload Analysis**. For the selection **Timing Analysis** the Timing analysis window is displayed and for the selection **Netload Analysis** the Netload Analysis window is displayed. For further information refer to the sections *Data Capturing* page 48, *Timing Analysis* page 55 and *Netload Analysis* page 67.	Capture Data, Timing Analysis, Netload Analysis
Closing the Analysis Window 	The respective analysis window is closed automatically if you select an other analysis mode in the netANALYZER main window. If you select  to close the analysis window, the query **Closing this window will Stop the capture. Do you want to proceed?** will be displayed. To cancel the analysis and the data capturing, click to **Yes**. 	
Start / Stop	For the selection ‚Capturing': Starting and stopping Data Capturing, see section *Starting Data Capturing* on page 48. For the selection ‚Timing Analysis' or ‚Netload Analysis': Starting and stopping Analysis.	
Convert **Reset**	For the selection ‚Capturing' or ‚Netload Analysis': Converting Binary Files into WinPcap Format, see section *Converting Binary Files into WinPcap Format* on page 49. Set storage path for the binary and Pcap files in the **Path of .hea file and .pcap files** window. For the selection ‚Timing Analysis': Resets the analysis data within the four windows.  The query **Do you really want to clear all values?** Is displayed. To reset the values, answer the query by yes.	
Status Bar	In the status bar of the main window of the netANALYZER software different status messages are displayed for the status of the application, for the firmware or for the driver or for the status of the GPIOs (external inputs/outputs) and for the used filter. **Status**: Indicates the Status of the application, of the firmware or of the driver: **GPIO:** Indicates the status of the GPIOs (external inputs/outputs). To read detailed explanations to the single status bar messages refer to section *Status Bar Messages* on page 73.	Status or GPIO messages

Table 4: Main Window: Parameters and Status Bar

5.3 Link Speed Information

Under **Link** for Port 0, Port 1, Port 2 and Port 3 the link speed information is displayed, which corresponds to the device specific speed settings from the firmware. "fix" indicates, that the speed has been set manually.

Example:

TAP A	Port 0	DOWN: Link down not fixed to speed,
	Port 1	DOWN fix 10 Mbit/s: Link down fixed to 10 Mbit/s,
TAP B	Port 2	UP10 Mbit/s: link up with10 Mbit/s,
	Port 3	UP100 Mbit/s: link up with 100 Mbit/s

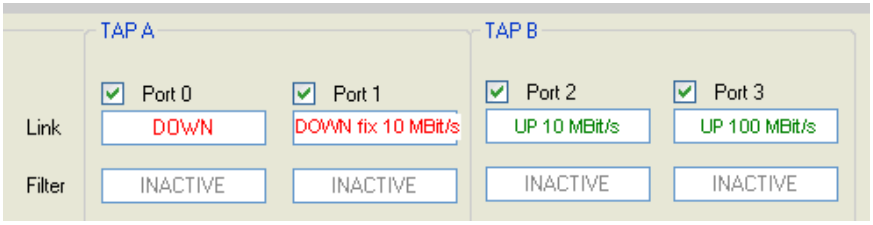


Figure 14: Example - Link Speed Information

Note: On the analyzer card NANL-C500-RE Rev. 4 and earlier the speed for Port 2 and Port 3 can not be determined.

5.4 Performing File Settings

Default Paths for .hea Files

The netANALYZER software installation prepares the path:

"My Documents\netANALYZER\hea"

This is the default path for .hea files. After the first usage of the netANALYZER software, the last used path is the default path.

File Settings

➢ Select **Settings >File Settings**.

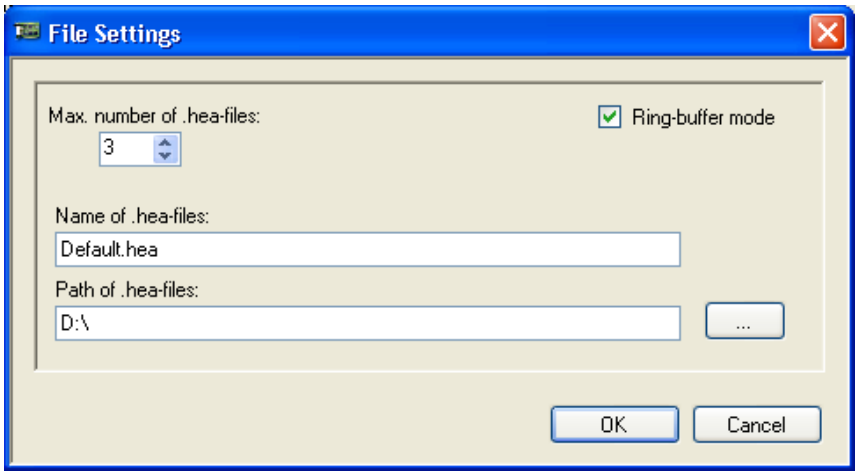


Figure 15: File Settings

Control	Explanation	Range of Value / Value
Max. number of .hea files	Maximum number **.hea* files, which is to be saved before the capturing is stopped. The maximum file size for per **.hea* file is 1GB. **Note:** Check the storage capacity of your hard disk before increasing the **Max. number of .hea-files** to prevent the creating file error. For more refer to section *Important Error Codes, Causes and Troubleshooting* on page 76. **Note when using the Ring Buffer:** If the ring buffer shall be used and the number of **. hea* files shall be **n**, due to the overflow properties of the ring buffer, the value set under **Max. number of .hea-files** must be defined by **n +1** each.	1 … 100
Ring-buffer mode	If checked, the capturing data are stored to the ring buffer. If unchecked the capturing data are stored to a stack buffer (stack buffer mode) and the data capturing is be finished automatically if all .hea files are filled completely. Refer also to error code 0xC07700000 description (end of capture file reached) in section *Important Error Codes, Causes and Troubleshooting* on page 76. **Note:** The use of the ring buffer is only useful for values for **Max. number of .hea-files** ≥ 2. **Overflow of the Ring Buffer:** In the ring buffer, the **. hea* files according to the preset number **Max. number of .hea-files** are filled sequentially. If the last file is filled, the file filled first will be overwritten next. **Example:** If under **Max. number of .hea-files** a value of 3 has been set, only two **. hea* files are effectively backed up.	checked / unchecked, Default: checked

Control	Explanation	Range of Value / Value
Name of .hea files	Name for **.hea* files. **Note:** The total number of characters of the file storage path AND the file name is at its maximum 112 characters long, inclusively the number of characters of the file name extension „_n“ or „_nn“. Example: The length of the file name is 112 characters minus 52 characters for the path minus 2 characters for the file ending "_n" = 58 characters or 57 characters if the file ending "_nn" requires 3 characters.	1 … (112 – number characters path – number ending „_n“ or „_nn“)
Path of .hea files	Path to be defined by the operator, under which the netANALYZER / netSCOPE Device Driver shall save the binary file (**.hea*). Upon netANALYZER software the default path is prepared as *"My Documents\netANALYZER\hea".* This is the default path for .hea files. After the first usage of the netANALYZER software, the last used path is the default path. **Important!** The binary files (**. hea*) may only be stored on NTFS partitions and not on FAT32 partitions.	1 … (112 - number characters file name)

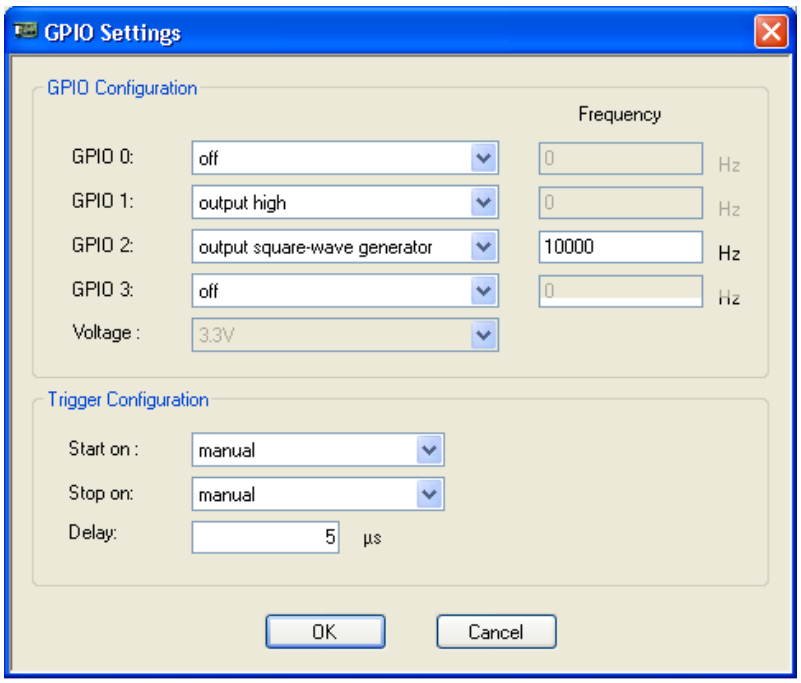
Table 5: Description File Settings

- Determine in the window **File Settings** under **Max Number of .hea files** the number of binary files to be stored.
- Check **Ring-buffer mode** to define, that the capturing data are to be stored to the ring buffer.
- Under **Name of .hea files** define the systematic name of the **.hea* files.
- Under the **Path of .hea files** determine where the binary files will be stored.
- Click to the **OK** button to close the window **File Settings**.

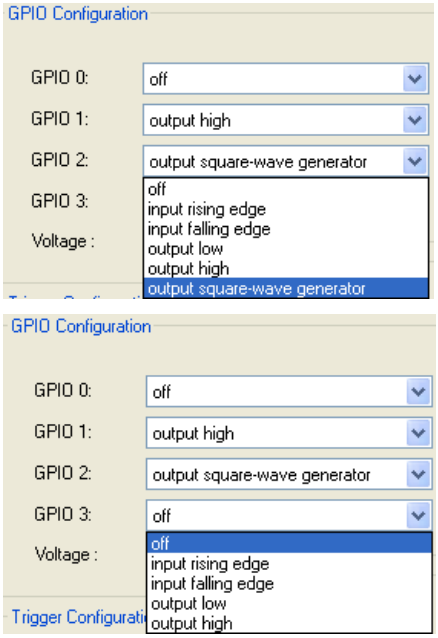
5.5 GPIO Settings

➢ Select **Settings >GPIO Settings**.

Example GPIO Configuration

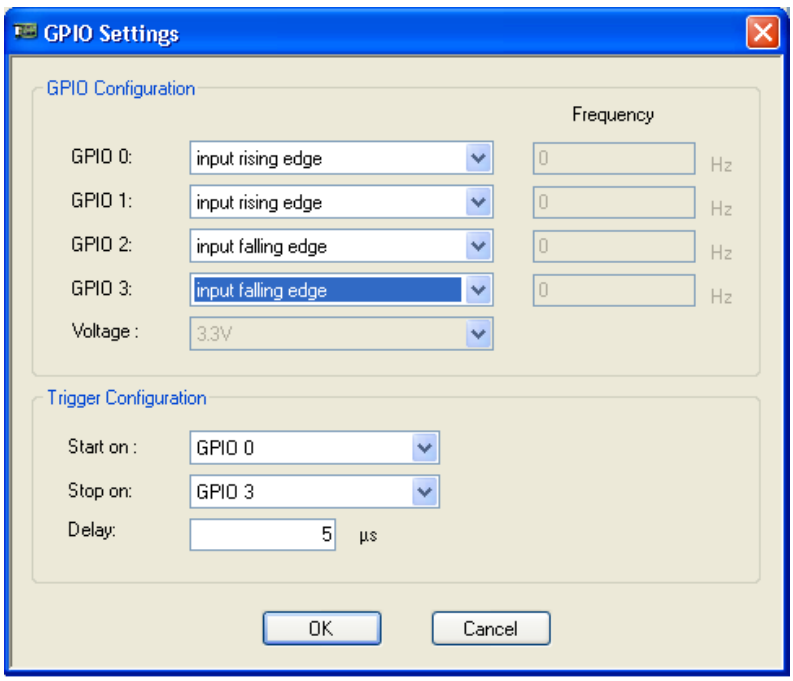


Selection Options GPIO Configuration

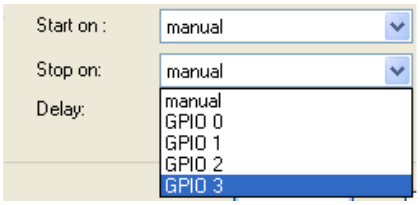


Note! The GPIO event **output square-wave generator** (with the **Frequency** field) is only available once at a time. If **output square-wave generator** is selected for one GPIO this event cannot be selected for any other GPIO at the same time (the hardware has internally only one signal generator).

Example Trigger Configuration



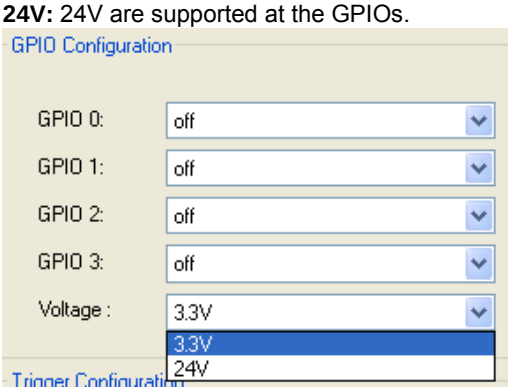
Selection Options Trigger Configuration



Note! A Trigger on a GPIO event is only possible for GPIOs which are in **input rising edge** or **input falling edge** mode.

Figure 16: GPIO Settings

Note: If for the start or the end of the capturing process a GPIO event is selected, that will not be checked (e. g. “OFF”), the data capturing process will not start.

<table>
<tr><th>Control</th><th>Explanation</th><th>Range of Value / Value</th></tr>
<tr><td>GPIO Configuration / GPIO 0, GPIO 1, GPIO 2, GPIO 3</td><td>Selection list, which GPIO event shall be assigned to which GPIO (external input/output) and is displayed as a pseudo frame in Wireshark.
<table>
<tr><th>GPIO Event</th><th>Meaning</th></tr>
<tr><td>off</td><td>no event</td></tr>
<tr><td>input rising edge</td><td></td></tr>
<tr><td>input falling edge</td><td></td></tr>
<tr><td>output low</td><td>= output 0V,
The GPIO is switched during the capturing period of as output 0V. Otherwise it is set as an input. One connection option is an external pull-up resistor.
For information on voltage and maximum current, refer to user manual netANLAZYER Devices to chapter 11 Technical data.</td></tr>
<tr><td>output high</td><td>= output 3.3 V</td></tr>
<tr><td>output square-wave generator</td><td>The GPIO event output square-wave generator (with the Frequency field) is only available once at a time. If output square-wave generator is selected for one GPIO (external output), this event cannot be selected for any other GPIO at the same time. The hardware has internally only one signal generator.</td></tr>
</table></td><td>off,
input rising edge,
input falling edge,
output low,
output high,
output square-wave generator</td></tr>
<tr><td>Voltage</td><td>3.3V: 3.3V are supported at the GPIOs.
24V: 24V are supported at the GPIOs.
 

If the Voltage setting is changed, the IO State LED indicates the different GPIO states: 24V out-put (red), 3.3V output (yellow), 3.3V input (green) and 24V input (off).
See also user manual netANLAZYER Devices to section 9.2 LEDs NANL-B500G-RE.</td><td>3,3V; 24V,
Default:
NANL-C500-RE:
3,3 V;
NANL-B500G-RE:
3,3V; 24V</td></tr>
<tr><td>Frequency</td><td>The Frequency field of the appropriate GPIO is only enabled if output square-wave generator was selected. Then the frequency of the output signal of the selected GPIO can be entered here.</td><td>1 Hz … 100 000 Hz</td></tr>
<tr><td>Trigger Configuration /
Start on, Stop on</td><td>Selection list for the start and the end of the capturing of the GPIO.
Manual: The capturing process is started and stopped manually, via the netANALYZER user interface.
Note: A Trigger on a GPIO event is only possible for GPIOs (external inputs) which are in input rising edge or input falling edge mode.</td><td>manual,
GPIO 0,
GPIO 1,
GPIO 2,
GPIO 3</td></tr>
<tr><td>Delay</td><td>Time after the stop event during which still data are captured.</td><td>0 … 40.000.000 µs;
Default 0µs</td></tr>
</table>

Table 6: Descriptions to the GPIO Settings

- Define under **GPIO Configuration** which GPIO event shall be assigned to which GPIO.
- Define under **Trigger Configuration** the GPIO event for the start and the end of the data capturing and the delay time.
- For NANL-B500G-RE select under **Voltage 3.3V** or **24 V**.

5.6 Filter Settings for the Hardware Filters

The hardware filters[1] works as upstream filters pre-located to the software filters. To reduce the amount of data or to select analysis data more specific, one or two filter masks can be defined. Already defined filters can be saved and reloaded.

The filter mask checks the first 512 Bytes of the frame, consisting of the destination MAC address (Byte 0 to 5), the source MAC address (6 to 11 Bytes), the Ether-type (Byte 12 and 13) in the first two Bytes for the frame data.

Note: All predefined filters are provided with a write protection. I. e., the filter masks defined under **Enable Filter A** or **Enable Filter B** can not be changed and the values for „Mask“ and „Value“ in the filter mask can not be edited.

Opening Filter Settings:

Note: In order to access to the **Filter Settings** menu, the netANALYZER hardware installation in your PC is required. If you start the netANALYZER software via **Proceed without device**, you can not open the **Filter Settings** menu.

➢ Select **Settings >Filter Settings**.

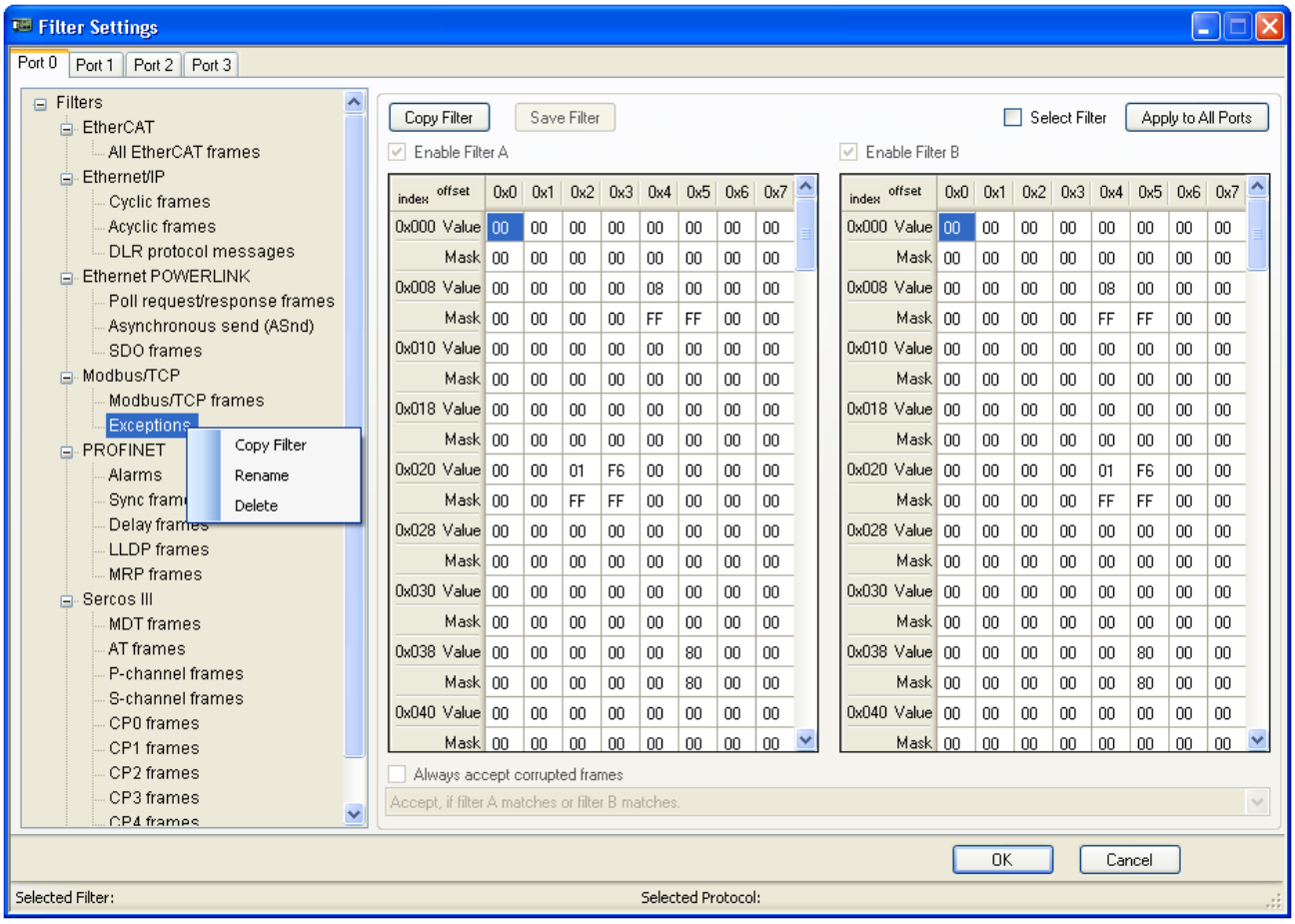


Figure 17: Filter Settings

1 This corresponds to the ‘Capture Filter’ in Wireshark. Refer also to section *Filter Principles* on page 36.

Control	Explanation	Range of Value / Value
Port	Filter settings page per Port	Port 0, Port 1, Port 2, Port 3
Filters	Selection list as tree structure with predefined filters for different Ethernet protocols. To add a newly defined filter the tree structure can be enlarged. E. g. via right click on **Modbus/TCP > Exceptions** the menu **Copy Filter**, **Rename**, **Delete** is opened to copy, rename or delete a filter.	Predefined filters an newly defined filters
Copy Filter	Copies the filter selected under the **Filters** and adds this one as copy below.	
Save Filter	Saves the newly defined filter.	
Select Filter for this Port	Defines the under **Filters** selected filter for this port.	
Apply to All Ports	The selected filter is applied to all ports.	
Enable Filter A **Enable Filter B**	Definable filter masks: „Filter A“ or „Filter B“ or „Filter A and Filter B“. All predefined filters are provided with a write protection.	checked: Filter A, Filter B, Filter A and Filter B
Filter Matrix	Matrix for entering byte- and mask values.	1-512 byte
Offset	Byte Offset for each 8 Byte of a frame, which are indexed by the Byte Index.	0x0 to 0x7
Index	Byte Index, which defines 64 x each 8 Byte of a frame.	0x000 to 0x1F8
Value	Assessed value under restriction of the mask. Entry in hexadecimal notation	0 … FF hex
Mask	Mask Value = 0: Value of the value-Bit is not included. Value = 1: Value of the value-Bit is included. Entry in hexadecimal notation	0 … FF hex
Always accept corrupted Frames	Faulty Frames should always be displayed, even if they would be filtered out otherwise.	
Selection List **Filter Configu-ration**	Selection list of the possible combinations of the following filter options: 1. Accept / reject value 2. Filter A and / or filter B 3. Value must be true or should not apply 4. And or link of the values (In the case of multiple filters) Depending on what filter/s are selected, the list box offers different options.	
Selected Filter:	Under **Filters** selected filter	
Selected Protocol:	Under **Filters** selected protocol	

Table 7: Filter Settings – Window Filter Settings

5.6.1 Selection List Filter Configuration

The selection list filter configuration offers the following options:

Filter A	Filter B	Configuration:
X	X	Accept, if filter A matches and filter B matches.
X	X	Accept, if filter A doesn't match and filter B matches.
X	X	Accept, if filter A matches and filter B doesn't match.
X	X	Accept, if filter A doesn't match and filter B doesn't match.
X	X	Accept, if filter A matches or filter B matches.
X	X	Accept, if filter A doesn't match or filter B matches.
X	X	Accept, if filter A matches or filter B doesn't match.
X	X	Accept, if filter A doesn't match or filter B doesn't match.
X	X	Reject, if filter A matches and filter B matches.
X	X	Reject, if filter A doesn't match and filter B matches.
X	X	Reject, if filter A matches and filter B doesn't match.
X	X	Reject, if filter A doesn't match and filter B doesn't match.
X	X	Reject, if filter A matches or filter B matches.
X	X	Reject, if filter A doesn't match or filter B matches.
X	X	Reject, if filter A matches or filter B doesn't match.
X	X	Reject, if filter A doesn't match or filter B doesn't match.
X		Accept, if filter A matches.
X		Accept, if filter A doesn't match.
X		Reject, if filter A matches.
X		Reject, if filter A doesn't match.
	X	Accept, if filter B matches.
	X	Accept, if filter B doesn't match.
	X	Reject, if filter B matches.
	X	Reject, if filter B doesn't match.

Table 8: Combinations of the Selection List Filter Configuration

5.6.2 Defining, saving, loading Filter Settings

To define, to save or to load filter settings for one or several filters, proceed as follows:

1. Enable checkbox Enable Filter A or Enable Filter B or Enable Filter A and Enable Filter B.
2. Enter the value to be assessed under restriction of the mask in the line **Value**.

Entry in hexadecimal notation, value ranges from 00 to FF.

3. Enter the desired mask in the line **Mask**.

Value = 0: Value of the value-Bit is not included.

Value = 1: Value of the value-Bit is included.

Value in Mask	Value used for the Filter
FF	The value FF effects, that the value in ‚Value' is used for the Filter.
00	The value 00 effects, that the value in ‚Value' is not used for the Filter.
0F	The value 0F effects that lower 4 Bits of the value in ‚Value' are used for the Filter.
F0	The value F0 effects, that upper 4 Bits of the value in ‚Value' are used for the Filter.

Table 9: Value used for the Filter

Entry in hexadecimal notation, value range from 00 to FF.

Example:

	Destination MAC Address						Source MAC Address						Data Type		User Data	
Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value	00	15	CF	DD	DA	BE	00	00	00	00	00	00	00	00	00	00
Mask	FF	FF	FF	00	00	00	00	00	00	00	00	00	00	00	00	00

Table 10: Example Defining Filter Settings

The filter shown in the example filters for frames beginning with 00,15, CF.

4. Enable **Always check accept corrupted frames**.

↳ Faulty Frames are always displayed, even if they would be filtered out otherwise.

5. Select in the selection list filter configuration a combination of the filter options.

Depending on what filter/s are selected, the list box offers different options.

6. Save the current filter via **Save Filter**.

5.7 PHY Settings

Via **PHY Settings** for Port 0 to Port 3 the data transmission rate can be set manually to a defined value. Then every Ethernet frame is captured from the beginning on. With the setting **Auto** no data capturing is provided during auto negotiation.

Note: For a good portion of all applications the **Auto** setting for **PHY Configuration** is comfortable. A typical application when the transmission rate must be defined manually to 100 Mbit/s, is given e. g. with the PROFINET / Fast-Startup.

Proceeding, how to set the transmission rate:

➢ Select **Settings > PHY Settings**.

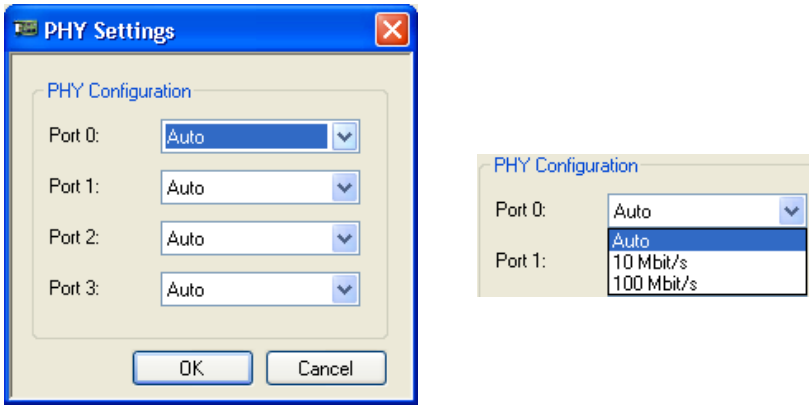


Figure 18: PHY Settings

Control	Explanation	Range of Value / Value
PHY Configuration / Port 0 to Port 3	For Port 0 to Port 3 the transmission rat can be set manually per port.	Auto, 10 Mbit/s, 100 Mbit/s, Default: Auto

Table 11: GPIO Settings

➢ Under **PHY Configuration > Port 0** to **Port 3** each set the transmission rate.

5.8 Extended Software Filter Settings

By use of the **Extended Software Filters** including an identification function, Ethernet fames are prefiltered for the software analysis. The extended software filters are extremely flexible in terms of filter capabilities. For the netload analysis, described in section *Netload Analysis* beginning on page 67, the extended software filters are required to measure the netload of various protocols transmitted via Ethernet. The extended software filters can be combined with the hardware filters described in section *Filter Settings for the Hardware Filters* beginning on page 31. The extended software filters are user configurable and can be stored on the hard disk of the PC. For the netload analysis various pre-defined filters can be loaded.

5.8.1 Filter Principles

The extended software filters work as downstream filters subsequent to the hardware filters and can be enabled or disabled. When filtering the software goes on the filter tree along and makes the decisions given there as filter entries. Thereby the Ethernet frames are examined towards the criteria of the filter entries and the sought frames are identified. Possible types of filter entries are:

- Byte Match"
- Port Match“
- Frame Length“
- Value Match“

For filter trees with multiple sub-trees the filter is running in parallel over the sub-trees. By this, depending on the chosen connections, such as "or" or "and", frames can be assigned simultaneously to multiple categories.

5.8.2 Creating Filter Entries and Identification

1. Creating Filter Entries

➢ Open the **Extended Software Filters** window via the netANALYZER main window >**Settings** > **Extended Software Filter Settings**.

Via the associated **Add Filter Entry** dialogs filters can be defined, which will filter by specific byte values (Byte Match), netANALYZER ports or GPIOs (Port Match), a particular frame length (Frame Length) and certain values (Value Match).

2. Adding Identification Entry

➢ Access to the window via **Add Identification Entry**.

➢ Enter in the filed **Identify this Frame a** an identification description for the frame.

For further information refer to the sections :
- *Extended Software Filters*, page 37,
- *Add Filter Entry*, page 40,
- *Add Identification Entry*, page 45.

5.8.3 Extended Software Filters

Software Filters

Upon netANALYZER installation software filter examples are installed to:

"My Documents\netANALYZER\Software Filter"

This is the default path when a filter shall be loaded or saved in the **Extended Software Filter** dialog. After the first usage of the netANALYZER software, the last used path is the default path.

Extended Software Filters

In the **Extended Software Filters** window, the filter entries can be created in the form of a filter tree. About **Add Filter Entry** and **Add Identification Entry** entries can be added or removed via **Remove Entry**.

- Open the **Extended Software Filters** window via the netANALYZER main window >**Settings** > **Extended Software Filter Settings**.

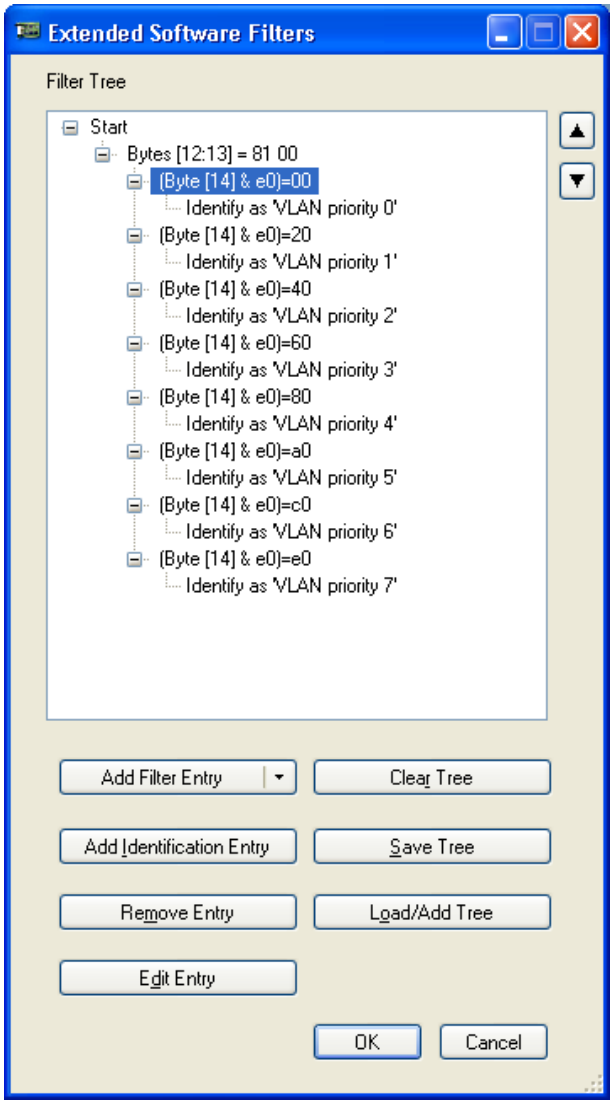


Figure 19: Example Extended Software Filters

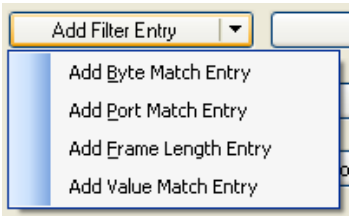
Element	Descriptions
Filter Tree	The **Filter Tree** window contains the filter entries for decision making in the form of a filter tree. Each entry contains the filter condition ("Decision Entry") and an identification entry ("End of the Decision"). **Note:** Via double click on a filter entry or via **Edit Entry** the **Edit Filter** window opens and the filter entry settings can be edited.
	Arrow buttons to move a filter entry to a new position within the filter tree. For more refer to section *Moving Filter Entry* on page 39.
Add Filter Entry	Via **Add Filter Entry** the filter options can be selected: - **Add Byte Match Entry** - **Add Port Match Entry** - **Add Frame Length Entry** - **Add Value Match Entry** For more refer to section *Add Filter Entry* on page 40. 
Add Identification Entry	Via **Add Identification Entry** a dialog is opened with the field **Identify this Frame as** where an identification description must be entered. For more refer to section *Add Identification Entry* on page 45.
Remove Entry	Via **Remove Entry** entries can be removed.
Edit Entry	Via **Edit Entry** entries can be edited.
Clear Tree	Via **Clear Tree** the complete filter tree is deleted, only the **Start** entry remains.
Save Tree	With **Save Tree** the complete filter tree can be stored as XML file on the hard disk. Upon netANALYZER software the default path is prepared as: *"My Documents\netANALYZER\Software Filter"*. This is the default path for the XML software filter files. After the first usage of the netANALYZER software, the last used path is the default path.
Load/Add Tree	With **Load/Add Tree** a previously saved file can be selected, which will be added in the filter tree at the current cursor position. Thus, different subfilter trees with specific filter functions are stored on the hard disk that can be merged together to form a complex complete filter. Upon netANALYZER installation software filter examples are installed to: *"My Documents\netANALYZER\Software Filter"*. This is the default path for the XML software filter files. After the first usage of the netANALYZER software, the last used path is the default path.
Ok	**OK** accepts the changes and the **Extended Software Filters** window closes.
Cancel	About Cancel the changes are discarded and the **Extended Software Filters** window closes.

Table 12: Explanations Window Extended Software Filters

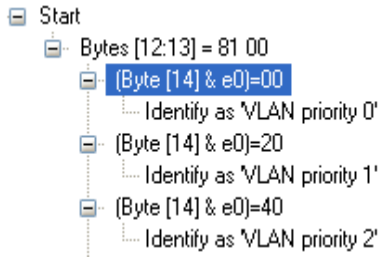
5.8.4 Moving Filter Entry

In the **Extended Software Filters** window, a filter entry can be moved by use of the arrow buttons ▲ or ▼ to a new position within the filter tree.

Example

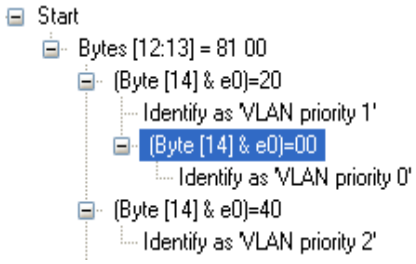
Moving a filter entry *downwards*:

1. Click on the filter entry.



2. Click on ▼.

↳ The filter entry is moved to a position below the next filter entry. Its position within the tree hierarchy is one level subordinated to that before (further to the right).



3. Click on the filter entry once more.

4. Click on ▼ once more.

↳ The filter entry is moved to a position below the Identify entry and is at the same level as in the beginning.

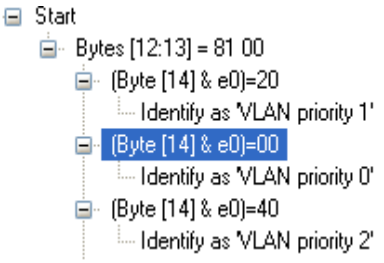


Table 13: Example Moving a Filter Entry downwards

5.8.5 Add Filter Entry

5.8.5.1 „Byte Match“

In the window **Edit Filter „Byte Match“** filters can be defined which will filter by specific byte values.

➢ To access to the window select **Add Filter Entry** > **Add Byte Match Entry**.

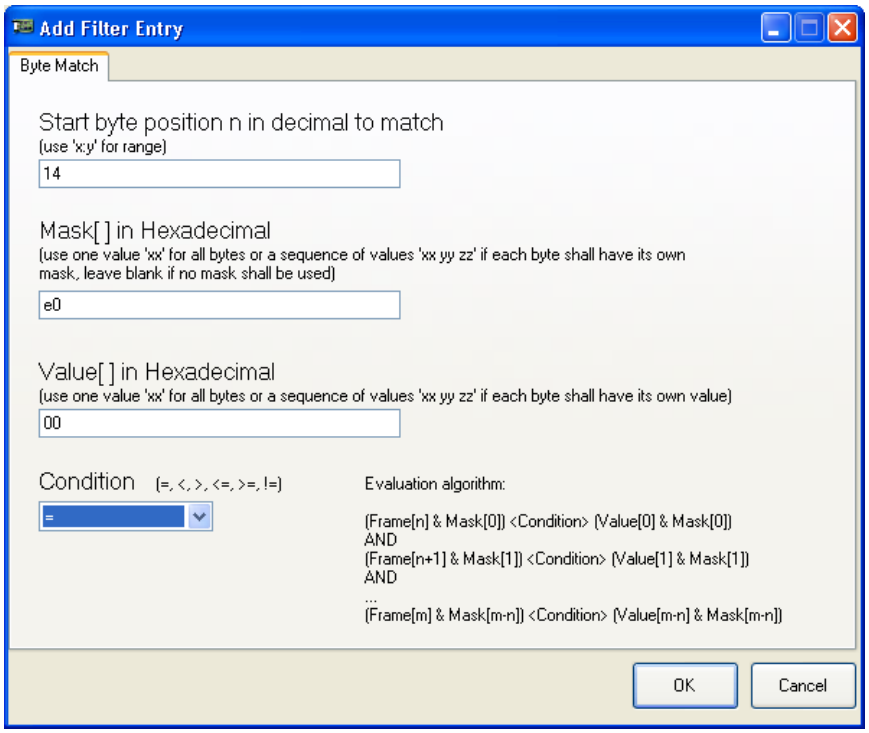


Figure 20: Example Edit Filter „Byte Match“

Element	Descriptions
Start byte position n in decimal to match (use ’x:y’ for range)	➢ Enter the byte position n in decimal notation. **Note:** The counting starts at zero! Example: '14' = Byte position 14.
Mask[] in Hexadecimal (use one value ’xx’ for all bytes or a sequence of values ’xx yy zz’ if each byte shall have its own mask, leave blank if no mask shall be used)	➢ Enter the mask in hexadecimal notation. Example: The Byte in the Byte position 14 gets masked with the value 'e0'.
Value[] in Hexadecimal (use one value ’xx’ for all bytes or a sequence of values ’xx yy zz’ if each byte shall have its own value)	➢ Enter the value in hexadecimal notation. Example: value = 00
Condition (=, <, >, <=, >=, !=)	➢ Select a mathematical operand as condition. Example: Condition '=', i. e., the Byte at the chosen position must match with the value indicated.

Table 14: Explanations Edit Filter „Byte Match“

5.8.5.2 Example how to count the Byte Position

The Byte position for ‚a2' of the 00:02:**a2**:21:2b:5b destination MAC address shall be indicated in decimal.

If the captured .pcap file is converted to the extended pcap file format (compare section *Converting Binary Files into WinPcap Format* on page 49), in wireshark (from version 1.7.1) the „netANALYZER frame Info Block" appears in the first 4 Bytes before the Ethernet-Frame.

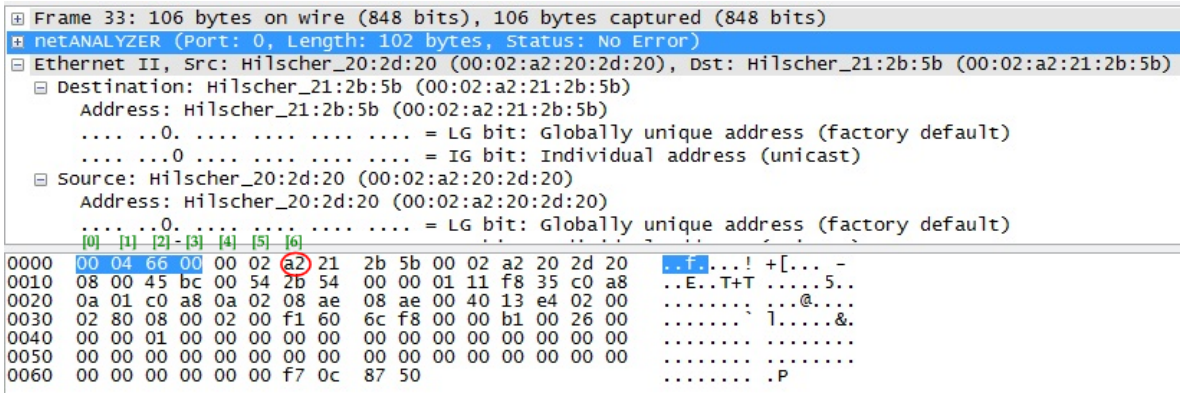


Figure 21: Wireshark 1.7.1: Example „netANALYZER frame Info-Block" displayed

Note: The counting starts at zero! In wireshark you must take into consideration the 4 bytes of the „netANALYZER frame Info-Block".

The read offset for the byte position ‚a2' is ([0] [1] [2] [3] [4] [5] [6]) offset = 6.

Offset 0 = 00 (netANALYZER frame Info Block)
Offset 1 = 04 (netANALYZER frame Info Block)
Offset 2 = 66 (netANALYZER frame Info Block)
Offset 3 = 00 (netANALYZER frame Info Block)
Offset 4 = 00 (destination MAC address)
Offset 5 = 02 (destination MAC address)
Offset 6 = a2 (destination MAC address)

From the offset 6 you have to substract the value 4. For the byte position ‚a2' under **Byte position(s) in decimal to match** enter „2".

Or: If you do not check **Convert to extended .pcap file including additional frame information** for the conversion, the „netANALYZER frame Info-Block" won't be added. Then you directly can read the offset for the byte position ‚a2', with ([0] [1] [2]) offset = 2.

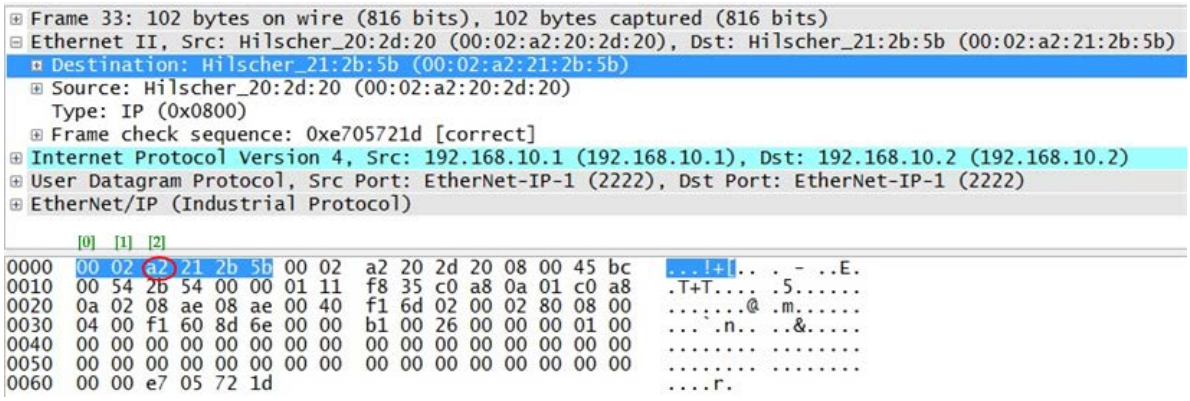


Figure 22: Wireshark 1.7.1: Example „netANALYZER frame Info-Block" not displayed

Offset 0 = 00 (destination MAC address)
Offset 1 = 02 (destination MAC address)
Offset 2 = a2 (destination MAC address)

5.8.5.3 „Port Match“

In the window **Edit Filter „Port Match“** filters can be defined which will filter by specific netANALYZER ports or GPIOs.

➢ To access to the window select **Add Filter Entry** > **Add Port Match Entry**.

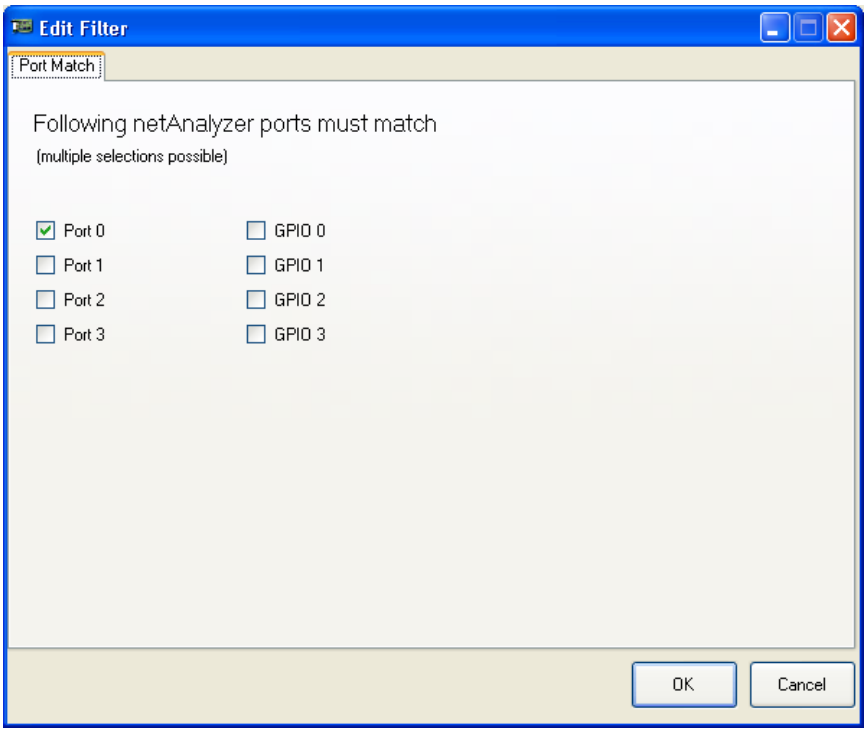


Figure 23: Example Edit Filter „Port Match“

Element	Descriptions
Following netANALYZER ports must match (multiple selections possible)	➢ Check ports or GPIOs which must match.

Table 15: Explanations Edit Filter „Port Match“

5.8.5.4 „Frame Length“

In the window **Edit Filter „Frame Length“** filters can be defined which will filter by a specific frame length.

➢ To access to the window select **Add Filter Entry** > **Add Frame Length Entry**.

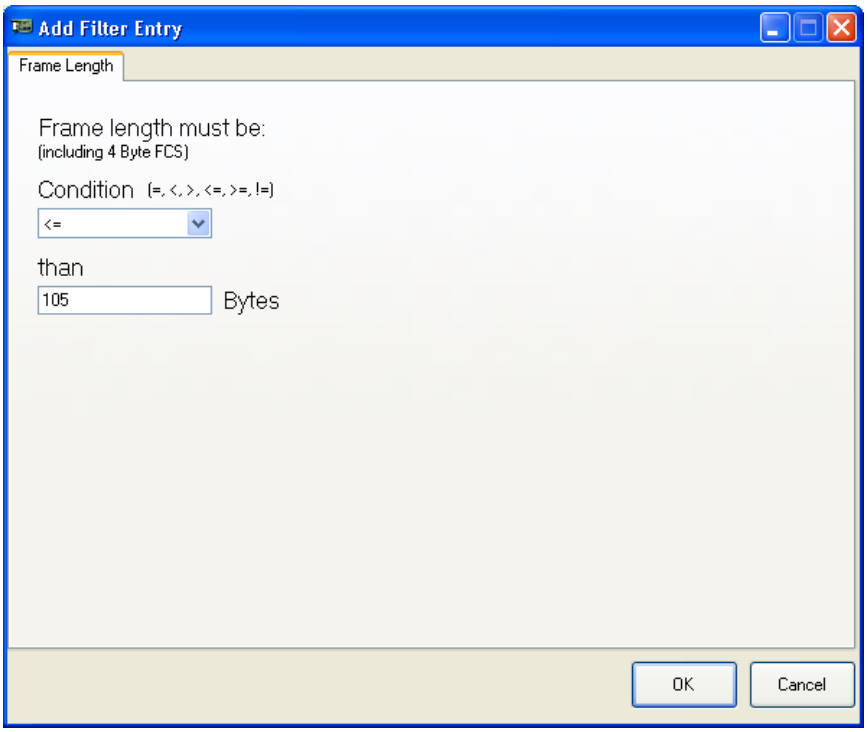


Figure 24: Example Edit Filter „Frame Length“

Element	Descriptions
Frame length must be (including 4 Byte FCS)	FCS = Frame Check Sequence (Ethernet check sum) (Check sum at the frame end for error detection) **Note:** The frame length corresponds to the byte count of the Ethernet frame. The four bytes of the „netANALYZER frame Info Block“ are not included.
Condition (=, <, >, <=, >=, !=)	➢ Select a mathematical operand as condition.
than Bytes	➢ Enter a value for the frame length into the **Bytes** field. For the value 105 specified in *Figure 24*, the condition '<=' matches on Ethernet frames if the frames are shorter or equal to 105 bytes.

Table 16: Explanations Edit Filter „Frame Length“

5.8.5.5 „Value Match“

In the window **Edit Filter „Value Match“** filters can be defined which will filter by specific values.

➢ To access to the window select **Add Filter Entry** > **Add Value Match Entry**.

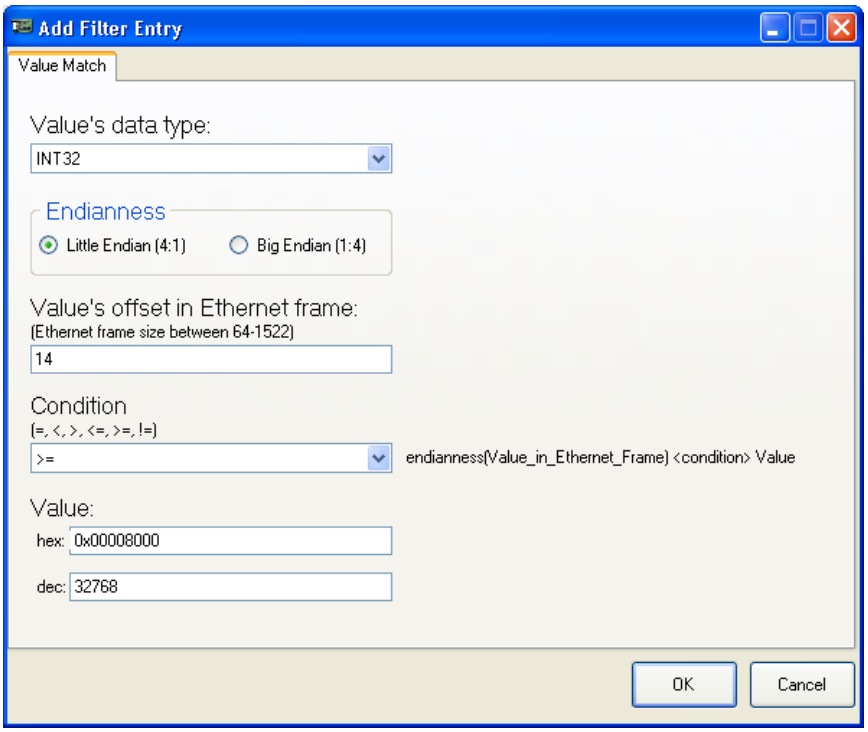


Figure 25: Example Edit Filter „Value Match“

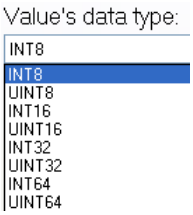
Element	Descriptions
Value’s data type:	Under **Value’s Data Type** the following data types can be selected: INT8, UINT8, INT16, INT16, INT32, UINT32, INT64, UINT64  ➢ Select value’s data type.
Endianness: Little Endian (4:1), Big Endian (1: 4)	The byte sequence option **Endianness** is necessary for any data type except of CHAR.
Value’s offset in Ethernet frame: (Ethernet frame size between 64-1522)	➢ Enter offset for the value in the Ethernet frame.
Condition (=, <, >, <=, >=, !=)	➢ Select a mathematical operand as condition.
Value	➢ Enter a value to match.

Table 17: Explanations Edit Filter „Value Match“

5.8.6 Add Identification Entry

The dialog **Add Identification Entry** allows to enter an identification description. This description is used in the netload analysis, when an appropriate frame was identified.

➢ Access to the window via **Add Identification Entry**.

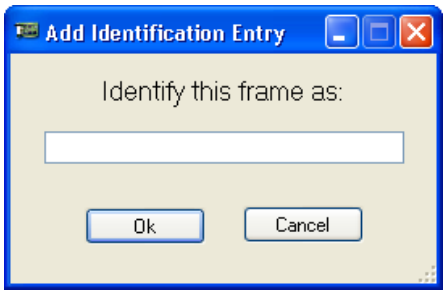


Figure 26: Dialog Add Identification Entry

Element	Description
Identify this Frame as	➢ Enter in the filed **Identify this Frame a** an identification description for the frame.

Table 18: Explanations Dialog Add Identification Entry

5.9 Analysis Configuration

In the window **Analysis Configuration** can be determined:

- whether or not the extended software filters are to be used (the Netload Analysis always used the extended software filters), and
- whether at the timing analysis a histogram, a history or a combination of both should be displayed as a graph.
- Further, an upper limit can be determined on the amount of data, which can be captured.

➢ Open the window via **Settings > Analysis Configuration**.

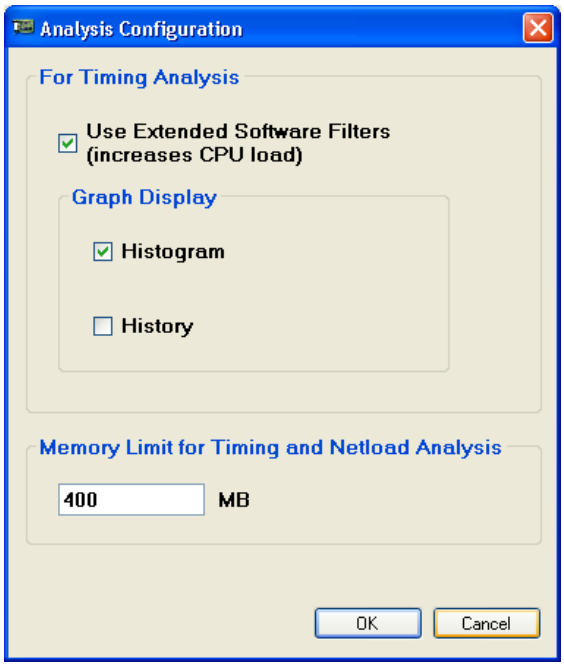


Figure 27: Analysis Configuration

Element	Description
Use Extended Software Filters (increases CPU load)	If **Use Extended Software Filters** is checked, the extended software filters are also used in the Timing Analysis. The Netload Analysis always uses the extended software filters!
Graph Display **Histogram** **History**	For the timing analysis at least one graph type must be selected. Otherwise the error message **Select at least one graph type** appears. ➢ Check **Histogram** or check **History** alternatively or additionally.
Memory Limit for Timing and Netload Analysis	The netANALYZER analysis data are stored in the RAM of the PC. **Memory Limit for Timing and Netload Analysis** sets an upper limit for the maximum exportable data, such as 1 GB. If the specified maximum storage space is completely used, the message will be displayed: *NOTICE, memory is full. Old values are discarded.*

Table 19: Analysis Configuration Options

Important! If the amount of data recorded exceeds the fixed upper memory limit, only the data from recording span according to the memory limit can be backed up. Old values will be discarded.

5.10 About Hilscher netANALYZER

In the **About Hilscher netANALYZER** window you will find information about the copyright for netANALYZER and to the versions of the netANALYZER software, the netANALYZER firmware, the netANALYZER / netSCOPE Device Driver and the netANALYZER Toolkit.

➢ Access to the **About Hilscher netANALYZER** window via **Settings > Info**.

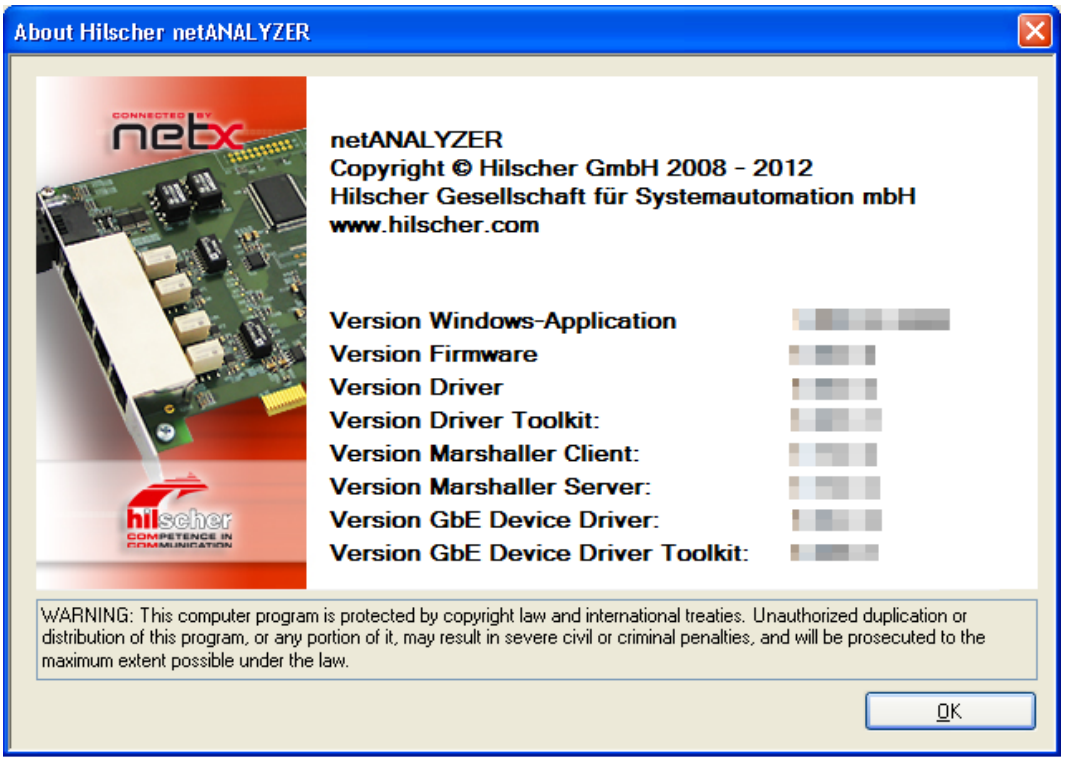


Figure 28: About Hilscher netANALYZER

Element	Description
Version Windows-Application	Version of the netANALYZER Software
Version Firmware	Version of the netANALYZER Firmware
Version Driver	Version of the netANALYZER / netSCOPE Device Driver
Version Driver Toolkit	Version of the netANALYZER Toolkit
Version Marshaller Client	Version of the Marshaller Client
Version Marshaller Server	Version of the Marshaller Server
Version GbE device driver	Version of the device driver of the netANALYZER portable Device RTE Gigabit
Version GbE device driver toolkit	Version of the device driver toolkit of the netANALYZER portable Device RTE Gigabit

Table 20: Description on About Hilscher netANALYZER

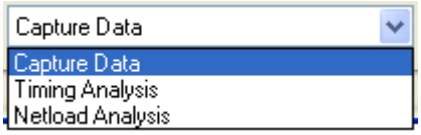
6 netANALYZER Analysis Methods

6.1 Data Capturing

6.1.1 Starting Capturing

1. Select Capture Data Mode

➢ In the **netANALYZER** window select **Capture Data**.



2. Activating or deactivating Ring Buffer.

➢ In the **netANALYZER** window select **Settings > File Settings** and in the **File Settings** window check **Ring-buffer mode**.

➢ The capturing data are stored to the ring buffer.

Or

➢ Do not check **Ring-buffer mode**.

➢ The capturing data are stored to a stack buffer (stack buffer mode) and data capturing is finished automatically, when all .hea files are filled completely.

3. Activating the Ports for the Data Capturing.

➢ In the **netANALYZER** window check the capturing ports required.

4. Starting Data Capturing

➢ In the **netANALYZER** window click on **Start**.

➢ The capturing process of the received Ethernet frames starts.

During the capturing process all elements in the window **netANALYZER** are disabled.

5. Stopping Data Capturing

➢ In the **netANALYZER** window click on **Stop**.

6.1.2 Converting Binary Files into WinPcap Format

➢ Click in the window **netANALYZER** to **Convert**.

➢ In the window **Path of .hea file and .pcap files** are displayed:

- Under **.hea File > All filtered .hea files for this name or capture:** the filtered **.hea* files.
- Under **.pcap files > .pcap files that will be generated:** the **.pcap* files to be converted.

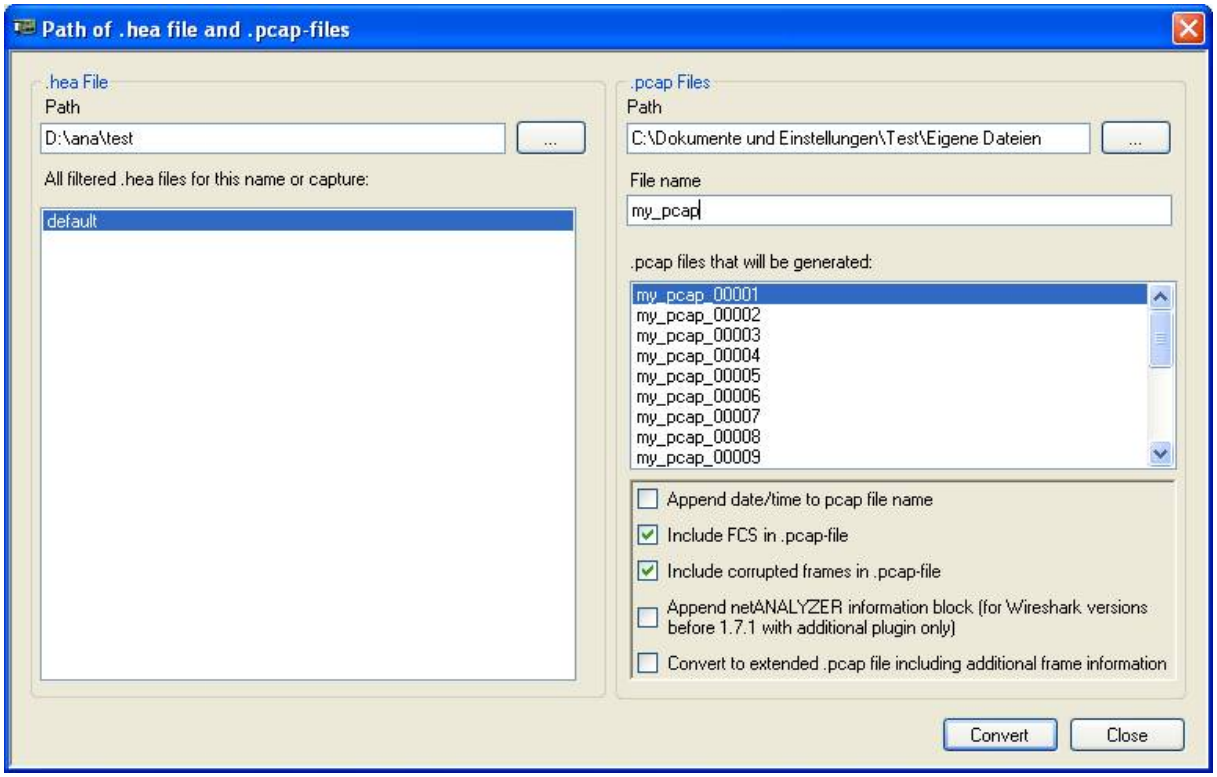


Figure 29: Path of .hea file and .pcap files

Control	Explanation
.hea File	
Path	Path to be selected by the operator, from which the netANALYZER must read the binary file (*. hea) for conversion. By default, here the last in the window **File Settings** defined path is displayed, where the netANALYZER / netSCOPE Device Driver has saved the binary file (**.hea*). This path can be changed here, to gain access to elsewhere stored capturing data. **Note:** If the path defined in the window **File Settings** is changed here, the new path is displayed also in the window **File Settings** and the data captured at the next capturing will be saved under this new path.
...	Selection of the source directory of the .hea files
All filtered .hea files for this name or capture	Edited list of .hea files in the selected directory

Table 21: Description Path of .hea file and .pcap files - .hea File

.hea File

1. To possibly change the path for the conversion:

➢ Under **.hea File > Path** click to ... .

➢ In the window **Search Folder** define the file location.

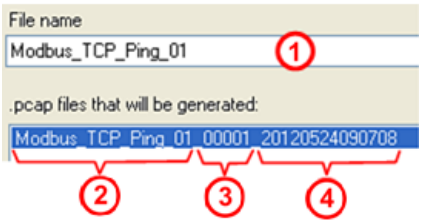
Control	Explanation
.pcap files	
Path	Path to be defined by the operator, under which the **netANALYZER** software shall save the WinPcap file (**.pcap*).
...	Selection of the destination directory of the .pcap files
File name	Systematic file name for the **.pcap* files. The **netANALYZER** software still assigns for every file in addition an ongoing number in the file name.
.pcap files that will be generated Example for the building name:	Preview of the .pcap files that will be generated  1 or 2 selected file name 3 consecutive numerical code 4 time information, consisting of: yyyymmddhhmmss (start of the capturing of the hea-file, only if **Append date/time to pcap file name** is checked).
Append date/time to pcap file name	Date and time are added to the file name or not.
Include FCS in .pcap-files	Checkbox whether the Ethernet check sum must be with the PCAP file or not. (Some Wireshark-dissectors do not support FCS.) **Note:** If **Convert to extended .pcap file including additional frame information** is checked, **Include FCS in .pcap-file** is grayed-out, as in this case the FCS will be converted to the .pcap file. FCS = Frame Check Sequence (Ethernet check sum at the frame end for error detection) Can not be selected if **Convert to extended .pcap file including additional frame information** is checked, but is enabled.
Include corrupted frames in .pcap file	If this option is activated, also incorrect frames will be transferred into the .pcap file. If the option is deactivated only correct Ethernet frames will be saved to the .pcap file.
Append netANALYZER information block (for Wireshark versions before 1.7.1 with additional plugin only)	For Wireshark versions before V1.7.1 the option requires to install the netANALYZER Wireshark plugin. Inserts the netANALYZER info block behind the Ethernet frame into the .pcap file. Thereby additional information for every frame are available, as the receiving time, the receiving port or error information. **Note:** The .pcap file format with the info block behind the Ethernet frame is not supported any more by Wireshark versions beginning from V1.7.1. Can not be selected if **Convert to extended .pcap file including additional frame information** is checked, but is enabled.
Convert to extended .pcap file including additional frame information	Beginning with version 1.4.x.x, an extended pcap file format can be generated. Here the "netANALYZER frame info block" is in the 4 bytes ahead of the Ethernet frame. Thereby additional information for every frame are available, as the receiving time, the receiving port or error information. **Note:** The extended .pcap file format generated by the netANALYZER software V1.4.x.x can be opened in Wireshark versions beginning from V1.7.1.
Convert	Conversion of binary files into WinPcap format.
Close	Close the window without starting a conversion.

Table 22: Description Path of .hea file and .pcap files - .pcap files

.pcap files

2. To change the path to store .pcap files:

➢ Under **.pcap files > Path** click to ...

➢ In the window **Search Folder** define the file location, where to store WinPcap files.

➢ Data are saved in multiple .pcap-files, 50 MB each.

3. Via **Convert** convert the binary files to the WinPcap format.

➪ In the window **Conversion** the conversion process details are displayed.

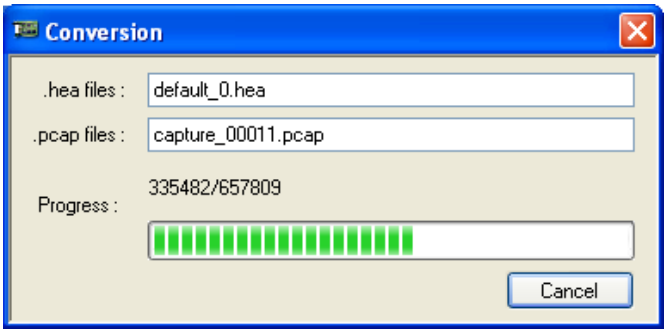


Figure 30: Conversion

Control	Explanation
.hea files	Display of the name of the currently created binary file
.pcap files	Display of the name of the currently converted WinPcap file
Progress	Progress bar for the conversion in Kbyte

Table 23: Description Conversion

4. After the conversion was completed successfully, the window **Path of .hea file and .pcap files** closes automatically.

6.1.3 Input Signal as pseudo Frame

For GPIO events a special pseudo Ethernet frame is generated by the firmware. This allows Wireshark with a special dissector to display GPIO events within the frame list.

Note: A special MAC address is used, of the Hilscher range 00:02:A2:FF:FF:FF. This address must never be assigned to a real address.

Format of the Pseudo Frames (Length: 17 Bytes):

6 Bytes Destination MAC Address	6 Bytes Source MAC Address	Ethertype	ID	GPIO Number	Edge (pos/neg)
00:02:A2:FF:FF:FF	00:02:A2:FF:FF:FF	0x88FF	0x00	0x00 … 0x03	0x00 … 0x01

Table 24: Format of the Pseudo Frames

6.1.4 Determining Cycle Time and Forwarding Time (Capture Data Mode)

The parameters cycle time and forwarding time at the capturing-mode can be determined by the use of Wireshark from the captured and to the pcap format converted analysis data. The procedure, how to determine the parameters, varies with the different types of communication.

Cycle Time (Example PROFINET IRT)

The cycle time is the time difference between the time stamps of two consecutive frames of a cyclically occurring frame type (such as the Sync-frame).

1. Open in Wireshark the *.pcap file of the captured and into in the pcap format converted analysis data. (see section *Starting Data Capturing* on page 48 and section *Converting Binary Files into WinPcap Format* on page 49).
2. Take in Wireshark the time difference between the time stamps of two successive frames of a cyclically occurring frame type.

Forwarding Time (Example PROFINET IRT)

The forwarding time is the time difference between the time stamps of a cyclically occurring frame after and of a cyclically occurring frame before a device (e. g. Sync-frame).

1. Open in Wireshark the *.pcap file of the analysis data, captured after or before a device and converted into in the pcap format. (see section *Starting Data Capturing* on page 48 and section *Converting Binary Files into WinPcap Format* on page 49).
2. Take in Wireshark the time difference between the time stamps of a cyclically occurring frame after and of a cyclically occurring frame before a device.

6.1.5 Transparent Mode

The **Transparent Mode** is used with the data capturing to register any Ethernet frame data, i. e., any bits transmitted including the frame data, preamble and SFD (=Start of Frame Delimiter).

Note: The usage of the **Transparent Mode** only makes sense with a 100 Mbit connection.

The figure below shows the basic principle of an Ethernet frame in the in the **Ethernet Mode** or in the **Transparent Mode**.

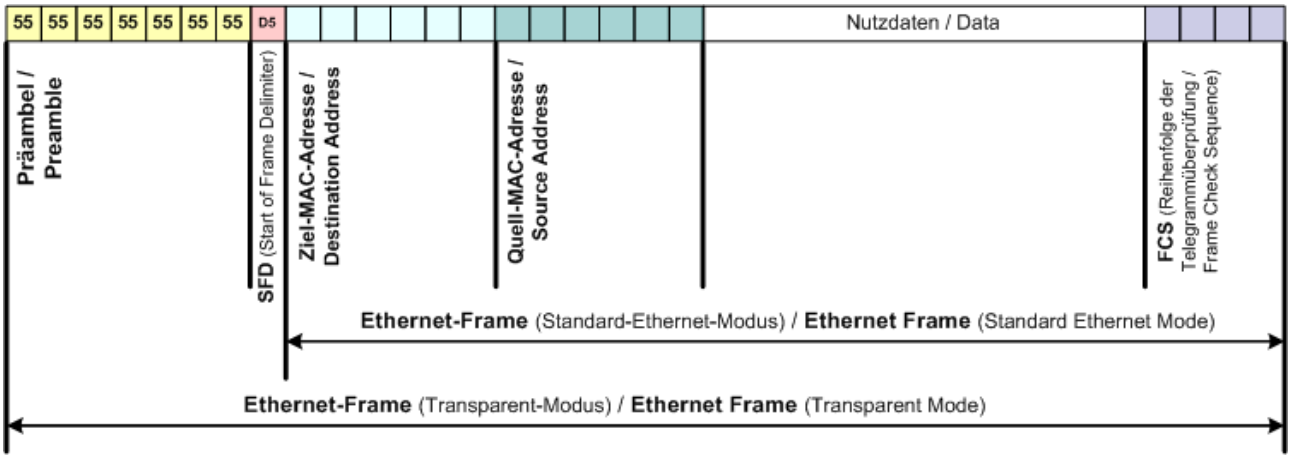


Figure 31: Basic Principle of an Ethernet Frame in the Ethernet Mode or in the Transparent Mode

As during the Ethernet Mode the preamble and the SFD (=Start of Frame Delimiter) are not included to the Ethernet frame, these parts are captured in the Transparent Mode.

```
0000  01 80 c2 00 00 0e 00 14  22 40 4f e4 88 cc 02 07   ........ "@o.....
0010  04 00 14 22 40 4f e4 04  09 07 70 6f 72 74 2d 30   ..."@o.. ..port-0
0020  30 31 06 02 00 14 08 41  42 72 6f 61 64 63 6f 6d   01.....A Broadcom
0030  20 4e 65 74 58 74 72 65  6d 65 20 35 37 78 78 20    NetXtre me 57xx
0040  47 69 67 61 62 69 74 20  43 6f 6e 74 72 6f 6c 6c   Gigabit  Controll
0050  65 72 20 2d 20 50 61 6b  65 74 70 6c 61 6e 65 72   er - Pak etplaner
0060  2d 4d 69 6e 69 70 6f 72  74 0a 0a 53 49 4d 41 54   -Minipor t..SIMAT
0070  49 43 20 50 43 0c 23 53  49 45 4d 45 4e 53 20 41   IC PC.#S IEMENS A
0080  47 20 53 49 4d 41 54 49  43 20 50 43 20 2b 20 65   G SIMATI C PC + e
0090  6e 67 69 6e 65 65 72 69  6e 67 0e 04 00 80 00 80   ngineeri ng......
00a0  10 14 05 01 c0 a8 0a 25  02 00 00 00 01 08 2b 06   .......% ......+.
00b0  01 04 01 81 c0 6e fe 08  00 0e cf 02 00 00 00 00   .....n.. ........
00c0  fe 0a 00 0e cf 05 00 14  22 40 4f e4 fe 09 00 12   ........ "@o.....
00d0  0f 01 02 00 00 00 10 00  00 5a bb b9 68           ........ .Z..h
```

Figure 32: Ethernet frame in Wireshark in the standard Ethernet Mode

```
0000  55 55 55 55 55 55 55 d5  01 80 c2 00 00 0e 00 14   UUUUUUU. ........
0010  22 40 4f e4 88 cc 02 07  04 00 14 22 40 4f e4 04   "@o..... ..."@o..
0020  09 07 70 6f 72 74 2d 30  30 31 06 02 00 14 08 41   ..port-0 01.....A
0030  42 72 6f 61 64 63 6f 6d  20 4e 65 74 58 74 72 65   Broadcom  NetXtre
0040  6d 65 20 35 37 78 78 20  47 69 67 61 62 69 74 20   me 57xx  Gigabit
0050  43 6f 6e 74 72 6f 6c 6c  65 72 20 2d 20 50 61 6b   Controll er - Pak
0060  65 74 70 6c 61 6e 65 72  2d 4d 69 6e 69 70 6f 72   etplaner -Minipor
0070  74 0a 0a 53 49 4d 41 54  49 43 20 50 43 0c 23 53   t..SIMAT IC PC.#S
0080  49 45 4d 45 4e 53 20 41  47 20 53 49 4d 41 54 49   IEMENS A G SIMATI
0090  43 20 50 43 20 2b 20 65  6e 67 69 6e 65 65 72 69   C PC + e ngineeri
00a0  6e 67 0e 04 00 80 00 80  10 14 05 01 c0 a8 0a 25   ng...... .......%
00b0  02 00 00 00 01 08 2b 06  01 04 01 81 c0 6e fe 08   ......+. .....n..
00c0  00 0e cf 02 00 00 00 00  fe 0a 00 0e cf 05 00 14   ........ ........
00d0  22 40 4f e4 fe 09 00 12  0f 01 02 00 00 00 10 00   "@o..... ........
00e0  00 5a bb b9 68                                     .Z..h
```

Figure 33: Ethernet frame in Wireshark in the Transparent Mode

6.2 Timing Analysis

6.2.1 Starting Timing Analysis

1. Opening the Histogram Graph.

➢ In the **netANALYZER** window select **Settings > Analysis Configuration > Graph Display** and check **Histogram**.

Or

2. Opening combined Histogram and History Graph.

➢ In the **netANALYZER** window select **Settings > Analysis Configuration > Graph Display** and check both **Histogram** and **History**.

3. Activating the Ports for the Timing Analysis.

➢ In the **netANALYZER** window check the analysis ports required.

4. Select Timing Analysis Mode.

➢ In the **netANALYZER** window select **Timing Analysis**.

↬ The window **Timing Analysis** with four analysis windows is displayed.

5. Starting Timing Analysis.

➢ In the **netANALYZER** window click on **Start**.

↬ The analysis process of the received Ethernet frames starts.

6. Stopping Timing Analysis.

➢ In the **netANALYZER** window click on **Stop**.

6.2.2 The Timing Analysis Window

On the subsequent pages the *Figure 34* and *Figure 35* show two examples about the Timing Analysis window.

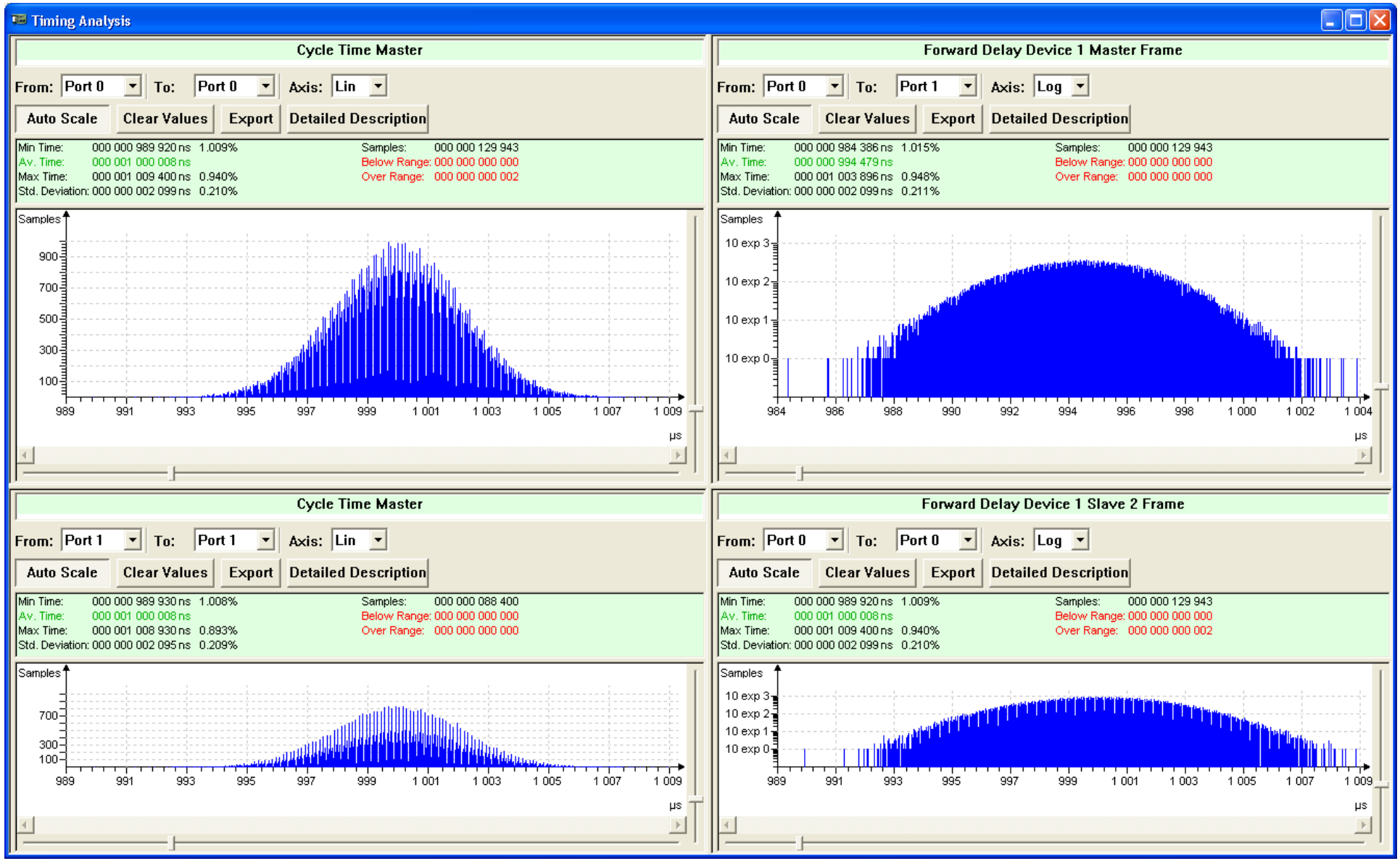


Figure 34: Timing Analysis with Histogram Graph (Example)

Figure 35: Timing Analysis with combined Histogram and History Graphs (Example)

6.2.3 Timing Analysis Window Detail Description

One analysis window in detail consists of the following components:

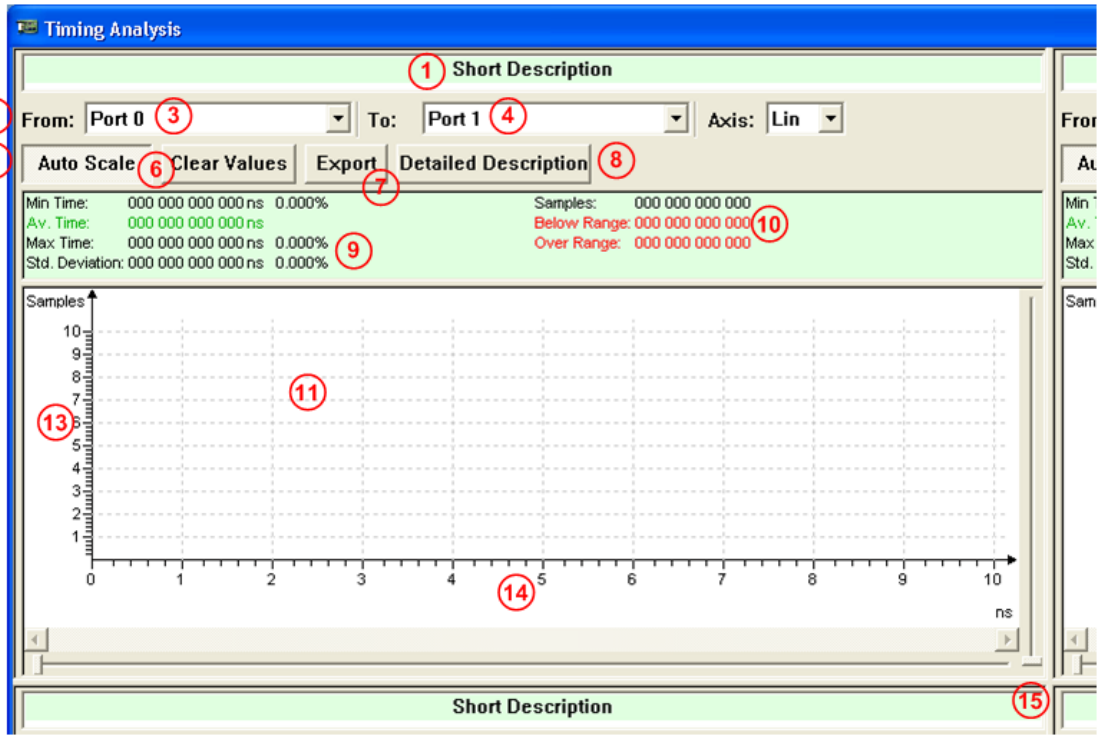


Figure 36: Timing Analysis Window with Histogram Graph

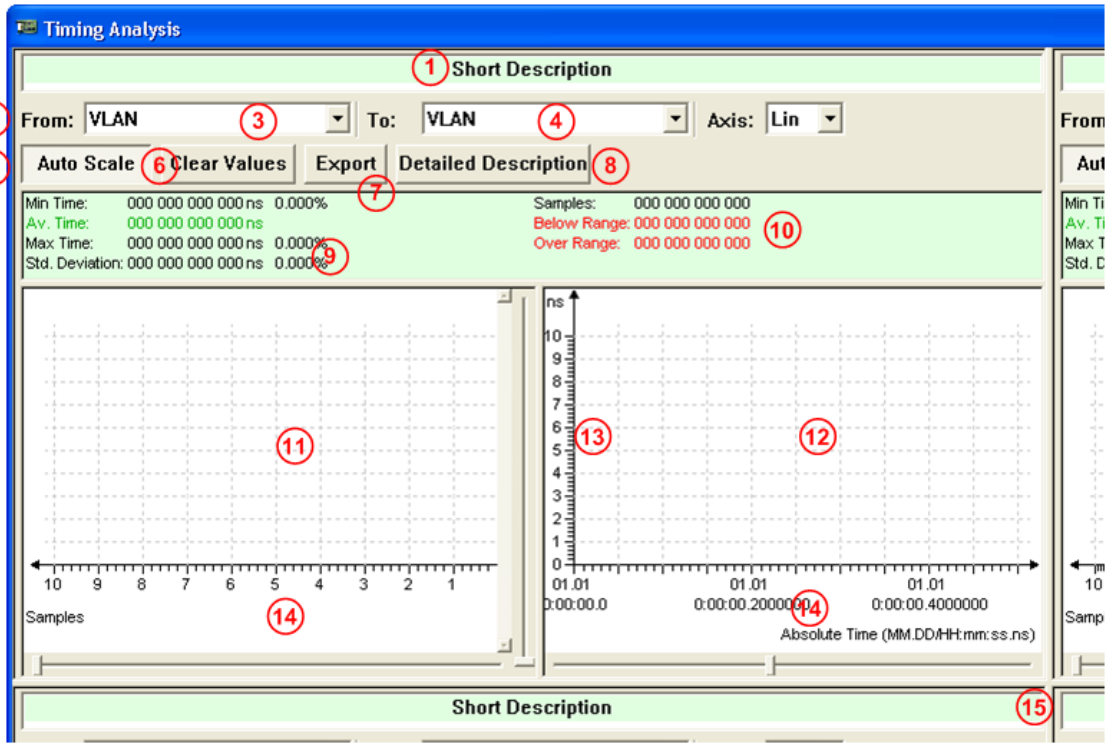
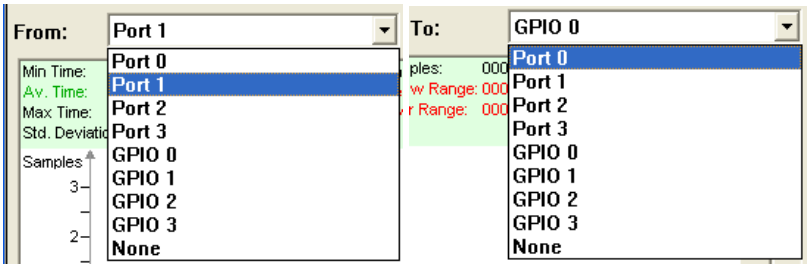
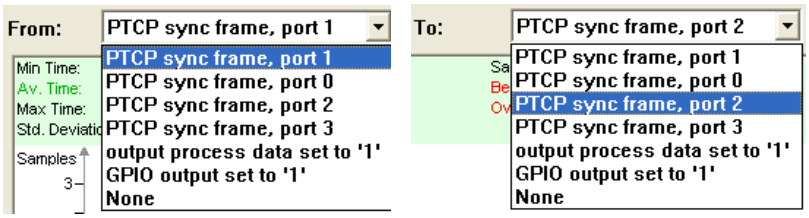
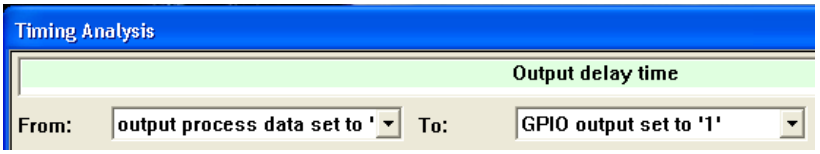
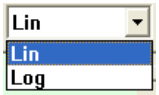
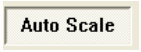


Figure 37: Timing Analysis Window with combined Histogram and History Graphs

Control	Explanation	Range of Value / Value
① **Short Description**	Here the user can enter an arbitrary short description for his histogram.	Text
Port or Event Selection ② (From) ③ (To)	Defines the analysis ports or events. The timing analysis is always carried out for frames or events between start port or start event **From** and stop port or stop event **To**.  Choice options: Port 0-3, GPIO 0-3, "None" Via “None” the appropriate timing analysis graph is disabled.	Port 0, Port 1, Port 2, Port 3, GPIO 0, GPIO 1, GPIO 2, GPIO 3, None
	When using the Extended Software Filters, under **From** / **To** the events can be selected, which were defined via the extended software filters. This requires that the Extended Software Filters will be created or loaded via **Settings > Extended Software Filter Settings**, and enabled via **Settings> Configuration Analysis**.  *Example: „Forwarding time, sync telegram“, Selection of the Events*  *Example: „Forwarding time, sync telegram“*  *Example: „Output delay time“*	Alternatively: the events defined via the Extended Software Filters, None
④ **Axis**	 Selection for the linear or logarithmic scaling of the histogram sample axis. The time axis only can be displayed in linear mode.	
⑤ **Auto Scale**	Serves to switch between the automatic and manual scaling of the x-axis and the y-axis.  Click **Auto Scale**, to disable Auto Scale.  Click **Auto Scale** once more, to enable Auto Scale.	
⑥ **Clear Values**	The message is displayed: "Warning! All captured data in this window will be lost. Do you want to proceed?" Deletes all values recorded till now for the current histogram and starts with the analysis once more.	
⑦ **Export**	Saves the detailed description, the measured values and the histogram data into a CSV file.	

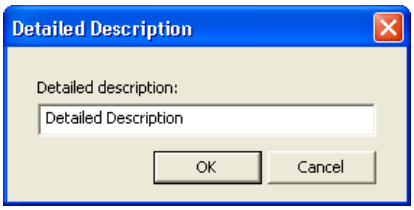
Control	Explanation	Range of Value / Value
Detailed Description ⑧	**Detailed Description** opens a text window, where a detailed description to the timing analysis window can be entered.  This description is saved in the CVS file, when **"Export"** is pressed.	Text
Measured Value Display ⑨ (left side)	At the left side the following values are displayed: - the minimum and maximum measured time (Min Time, Max Time), - the arithmetic mean value of the measured time (Av Time) and - the standard deviation of the measured time (Std. Deviation). The minimum and maximum measured time both are displayed in absolute value and as percent deviation from the arithmetic mean value of the measured time. The standard deviation is displayed in absolute value and in percent. $S = \sqrt{S^2} := \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2}$ S: Standard deviation n: Number of samples X: Value of the sample X_average: Arithmetic Mean	Min Time, Av Time, Max Time, Std. Deviation
⑩ (right side)	At the right side the following values are displayed: - the number of measured values (Samples), as well as - the number of measured values below and above the display area of the histogram (Below Range, Over Range). The display area can be found via the zoom and pan sliders for the scaling of the X-axis or the Y-axis.	Samples, Below Range, Over Range
⑪ **Histogram:** (Frames / Time or Time / Frames)	The history graph shows the distribution function of all measurements as **Frames / Time Diagram** respectively for the timing analysis with Histogram and History as **Time / Frames Diagram**.	
⑫ **History:** (Time / Absolute Time)	The history graph shows the distribution function of all measurements as **Time / Absolute Time Diagram**.	
Scaling ⑬ **X-Axis** ⑭ **Y-Axis**	Zoom and pan sliders for the scaling of the X-axis or the Y-axis.	
⑮ **Divider**	The size of the individual windows can be varied about the divider. Therefore right-click to the divider and move with the pressed right mouse button on the desired position.  *Divider*  *moving Divider*	

Table 25: Description Timing Analysis Window

6.2.4 Scaling in the Timing Analysis Window

You can expand or compress the graphical representation of both time axes. This is important especially for the X time axis within the history window. Therefore you must click on **Auto Scale** to deactivate it.

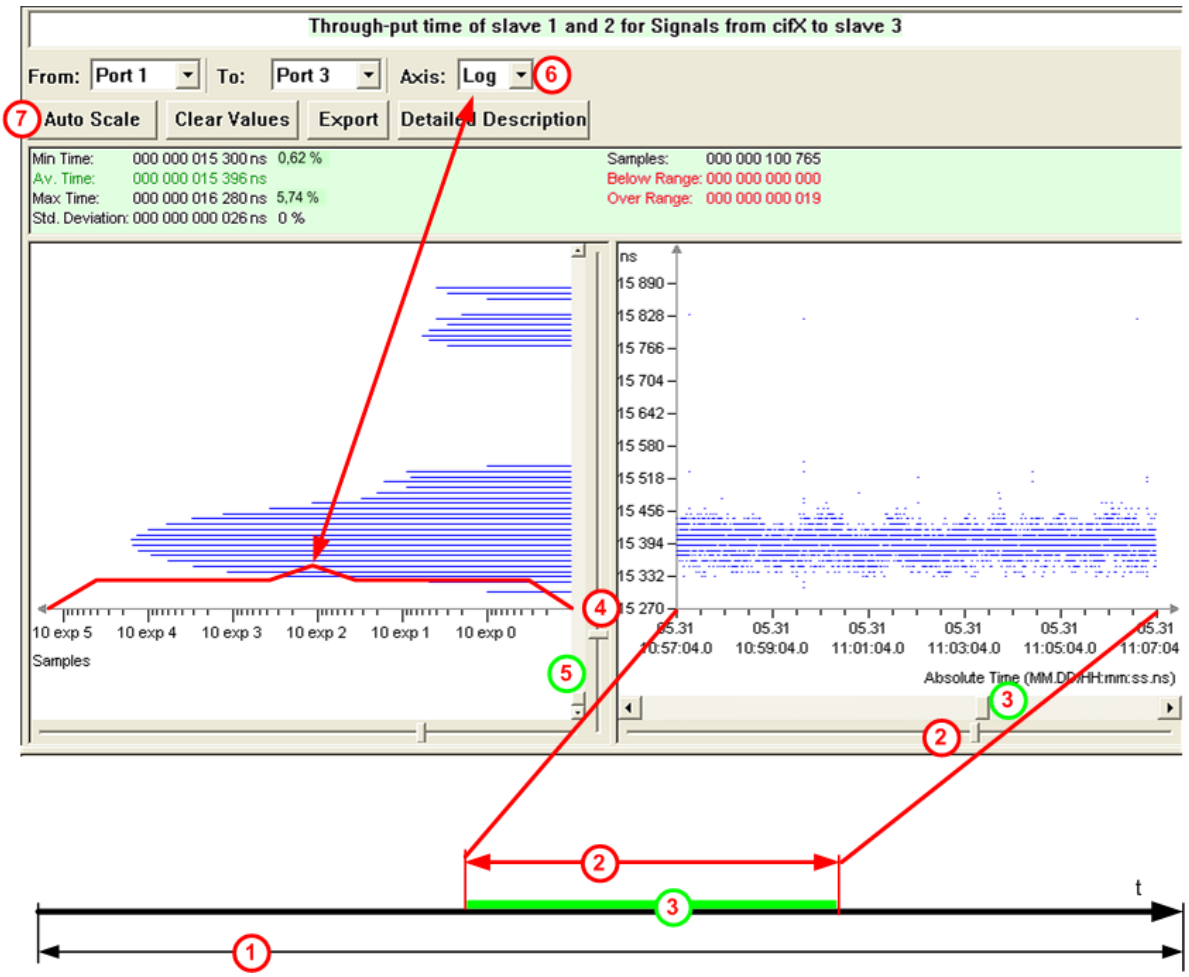


Figure 38: Timing Analysis, change Scaling

The time bar (1) in *Figure 38* displays the entire measuring time period.

The slider (2) allows to change the width of the displayed time period.

The slider (3) allows to change the position of the displayed time period relative to the entire measuring time period.

This applies for the Y time axis accordingly: The width of the displayed time period is adjusted with slider (4) and the position on the time bar with slider (5). The measured events can very easily move outside of the displayed area. By clicking at **Auto Scale** (7) the display area is moved over the events again.

Within the histogram, the sample axis can be switched between linear and logarithmic scaling by selecting **Axis** (6) and vice versa. The time axis only can be displayed in linear mode.

All three axes in *Figure 38* can be adjusted with **Auto Scale** (7) in such a manner, that all measuring events are located within the display area.

6.2.5 Zooming in the Timing Analysis Window

In Timing Analysis window you can zoom in any area in the history or the histogram graph.

- ➢ Therefore disable **Auto Scale** and drag the required area in the window.
- ➢ The desired area appears as a shaded field and is zoomed in upon dropping.

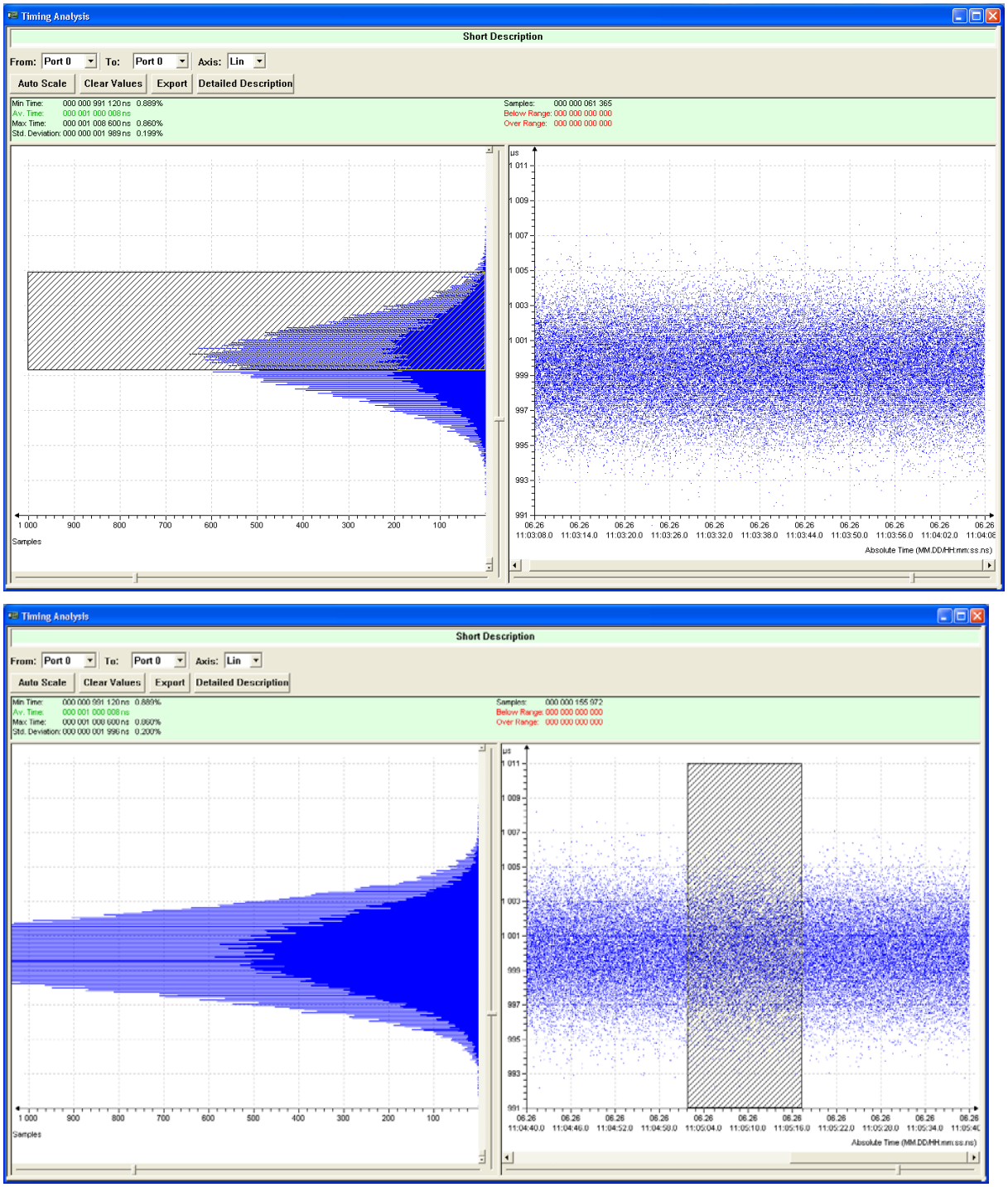


Figure 39: ‚Drag and Zoom' in the Timing Analysis Window, top Histogram Graph, below History Graph

6.2.6 Examples for the Possibilities of the Timing Analysis

Note: Normally certain cyclical frames form the base for the timing analysis, so e.g. the Sync telegram (Sync frame) at PROFINET or MDT0 at sercos. It is of importance that only these frames are brought to the timing analysis. Therefore before the start of the analysis a corresponding filter must be set, which prefilters possible acyclic or additional cyclical Ethernet frames and exclusively lets through the frame to be analyzed.

6.2.6.1 Cycle Time Measurement

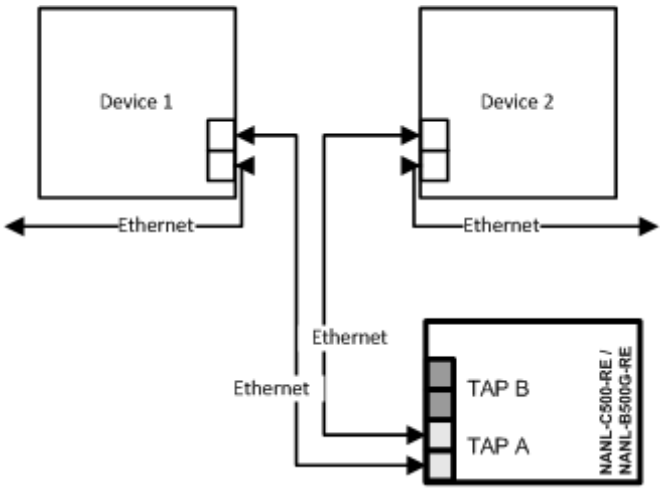


Figure 40: Application Case1 – Example Cycle Time Measurement

For the cycle time measurement, it is sufficient to insert one TAP of the analyzer card NANL-C500-RE or the analyzer device NANL-B500G-RE into transmission distance. Here the differences between two successive frame times are formed, and gives the cycle time as a result. In the port selection as start and as destination port correspondingly the same port must be selected.

6.2.6.2 Forwarding Time Measurement

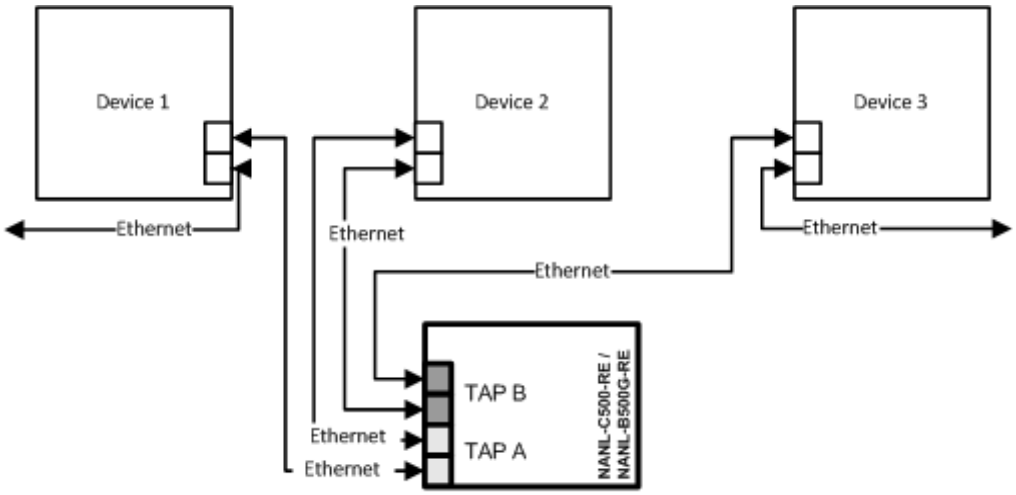


Figure 41: Application Case2 - Example Forwarding Time Measurement

For the forwarding time measurement the analyzer card NANL-C500-RE or the analyzer device NANL-B500G-RE must be inserted before and behind the device to be examined. Here the time difference between the Ethenet frame coming in on the one side of the device is measured up to the next frame on the other side of the device. The port selection correspondingly must be carried out from a port of the first TAP to a port of the second TAP: Difference of port 0/1 to port 2/3 or for measurement to the opposite direction port 2/3 to port 0/1.

6.2.6.3 Stack Operating-Time Measurement

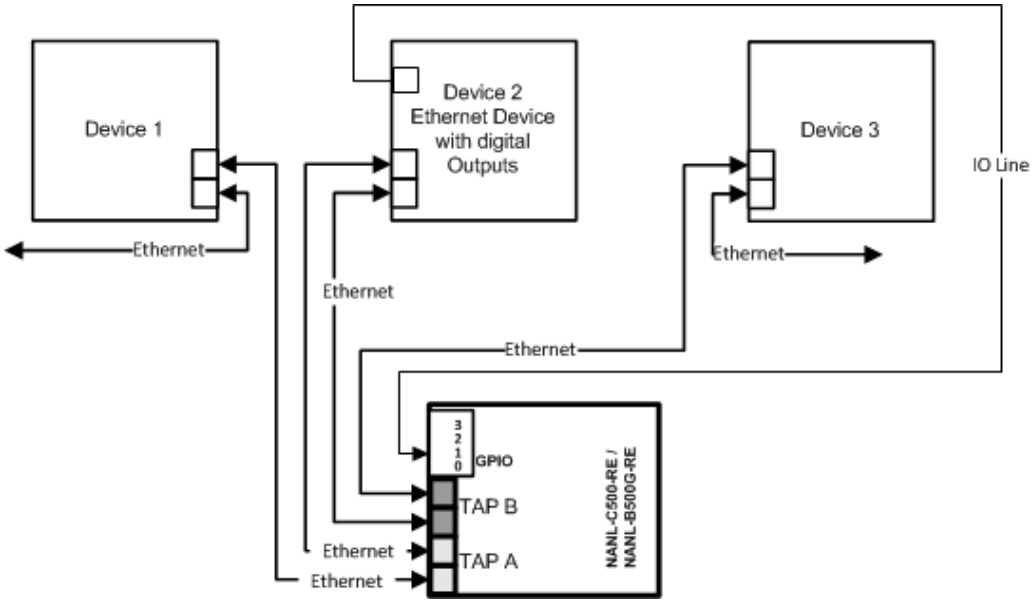


Figure 42: Application Case 4 – Recording of the Runtime in the Device – Example Stack Operating-Time Measurement

For stack operating-time measurement the difference between a port of the Ethernet channel and a GPIO can be formed. Here, e. g. a cyclical process data frame on port x becomes supervised as well as the appearance of a digital switching event on GPIO y after this frame was processed in the software stack.

6.2.6.4 Response-Time Measurement

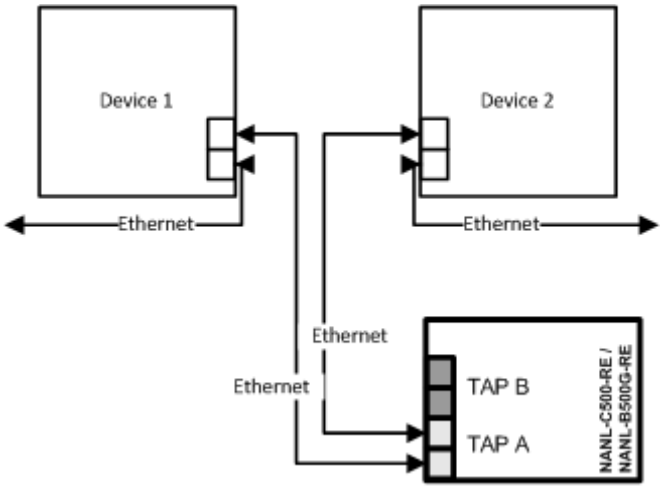


Figure 43: Application Case 1 – Example Response-Time Measurement

For response-time measurement the difference in time between two different ports on the same TAP is measured. Here, for example, the incoming frame on port 0 is recorded, and the outgoing response frame on port 1.

Note: Because of the auto-crossover function of most of the RTE systems, the assignment of port 0 and 1 or port 2 and 3 can change between different test runs.

One effect of the port interchanging is, that for wrongly selected ports the response time is measured incorrectly, because the measurement values are taken from the wrong ports.

6.2.7 Determining Cycle Time and Forwarding Time

The parameters cycle time or forwarding time can be found out at the data capturing mode (Capture Data) in the **netANALYZER** timing analysis window.

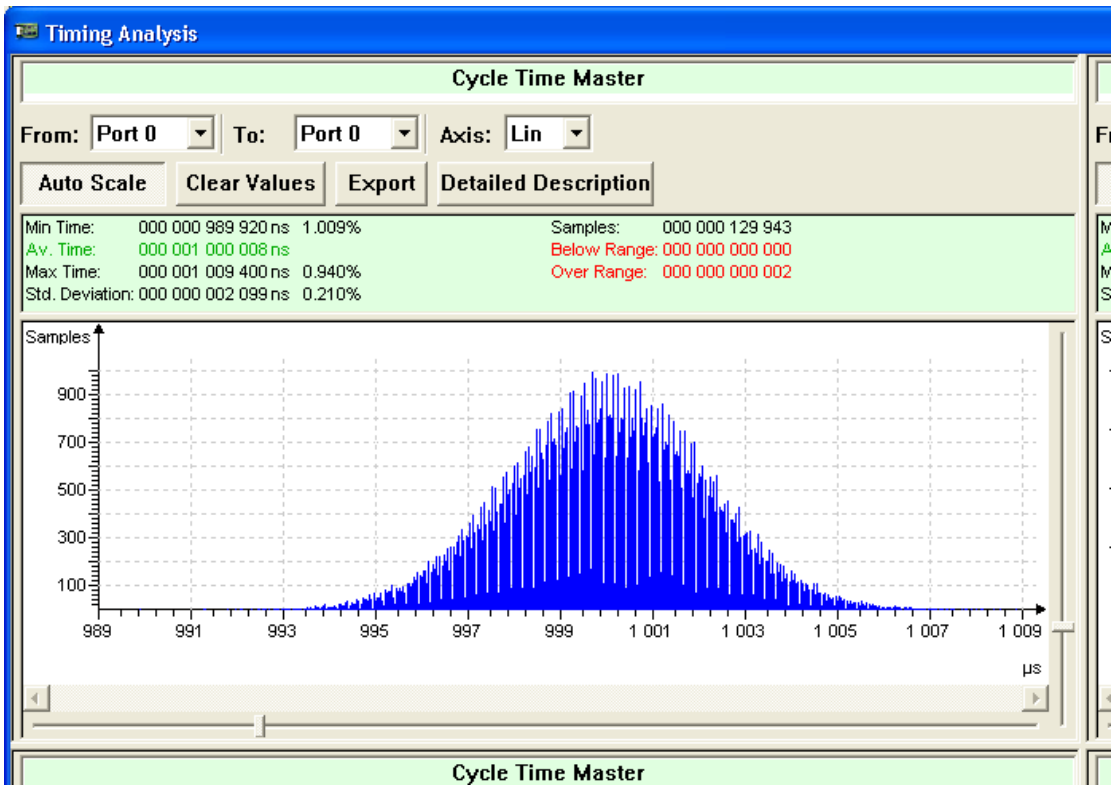


Figure 44: Timing Analysis Window

Cycle Time

- To find out the cycle time, select at **Start Port** and at **Stop Port** each the same port.

Forwarding Time

- To find out the forwarding time, select at **Start Port** and at **Stop Port** each the port in front of or after the device, for which the forwarding time shall be found out.

6.3 Netload Analysis

The **Netload Analysis** is used to measure the netload of different protocols transferred over the Ethernet line. To identify various frame types the **Extended Software Filters** are required (see also section *Extended Software Filters* on page 37).

A number of frames per time overview of the network is provided as textual and graphical statistics display, including export of the measured data to CSV. The identified frame types are counted in a statistics window and displayed graphically in a network load diagram, one colored line for every frame type over the capture time, as shown in the example in *Figure 45: Netload Analysis with Extended Software Filters VLAN_priorities* on page 68.

For analytical purposes the Netload Analysis data are captured. For more refer to section *Capturing the Netload Analysis Data* on 72.

6.3.1 Starting Netload Analysis

1. Loading and activating the Extended Software Filters

➢ Load via **Settings > Extended Software Filter Settings** > **Load/Add Tree** a file for the extended software filters.

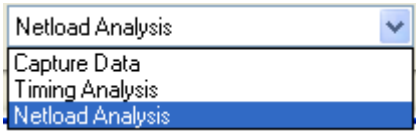
➢ Select **Settings > Analysis Configuration > Graph Display** and check **Use Extended Software Filters**.

2. Activating the Ports for the Netload Analysis.

➢ In the **netANALYZER** window check the analysis ports required.

3. Select Netload Analysis Mode.

➢ In the **netANALYZER** window select **Netload Analysis**.



↬ The window **Netload Analysis** is displayed.

4. Starting Netload Analysis.

➢ In the **netANALYZER** window click on **Start**.

↬ The analysis process of the received Ethernet frames starts.

5. Stopping Netload Analysis.

➢ In the **netANALYZER** window click on **Stop**.

6.3.2 The Netload Analysis Window

The **Netload Analysis** window consists of two parts.

- In the upper part under **Frame Statistics** a textual display of the collected statistical information is displayed. Here for every defined filter information like overall frame count and current average load are displayed. Each entry can individually be selected to be displayed in the graph. The color of each displayed parameter can be selected (by right clicking on the filter name).
- The lower part of the window under **History** shows a graphical history of the measured net loads. Each of the selected entries is represented by a line with the same color as the entry in the textual display. The x-axis displays the absolute time (including the date, when the capture runs longer than 1 day), the y-axis displays the average frame load in 1/s. The update interval of the graph is 1 second, which means every second a new value is displayed. The graph is completely zoom- and pan-able in x- and y-axis by sliders.
- All displayed information (textual and graphical) can be exported to a CSV data file at any time during the analysis process.

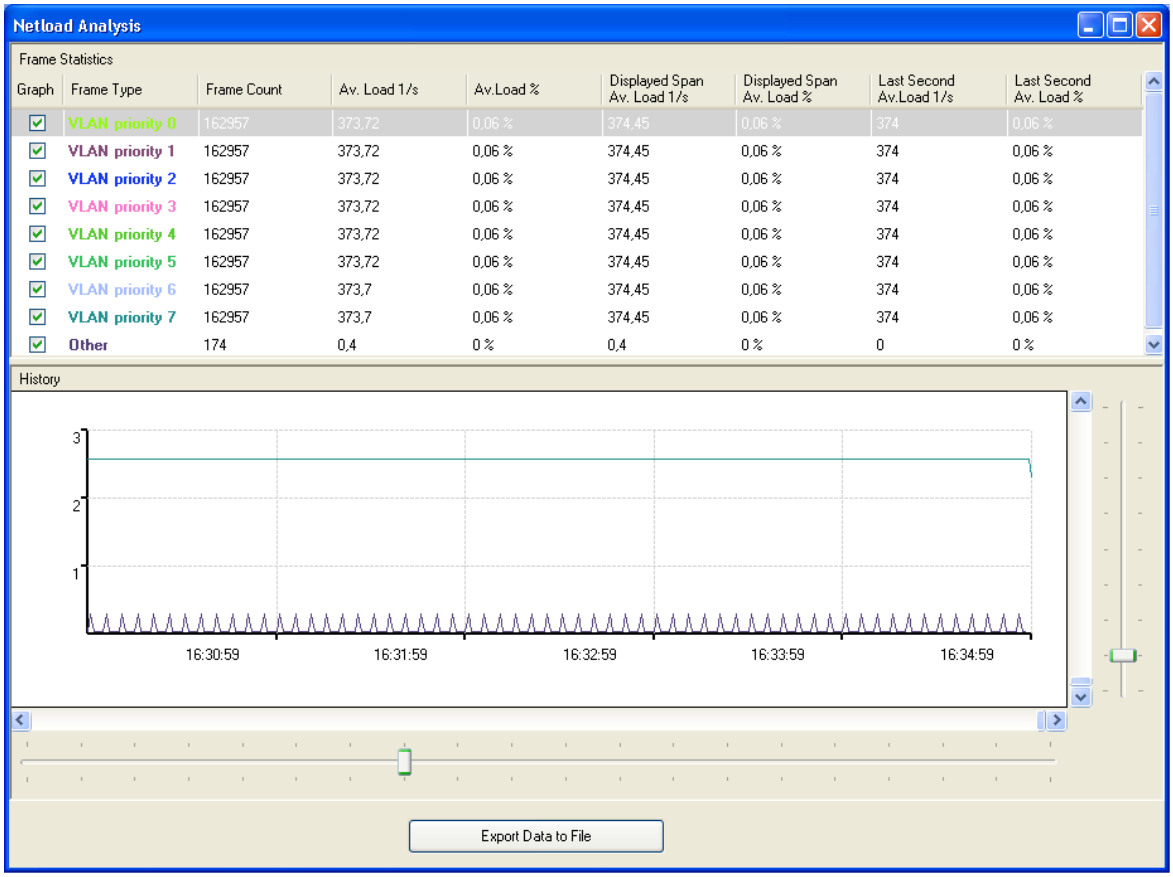


Figure 45: Netload Analysis with Extended Software Filters VLAN_priorities

Control	Explanation	Range of Value / Value
Frame Statistics		
Graph	Check the filter entry if the filtered frames shall be displayed as a graph in the history.	checked, unchecked

Control	Explanation	Range of Value / Value
Frame Type	Types of Ethenet frames for which an identification entry has been created in the extended software filter settings. The frame type "Other" is always displayed. Among this, all the other frames are indicated.	Text
Frame Count	Total frame count of a filter entry per second. The measured distance is 1 second.	Frames in 1/s
Av. Load 1/s	Current average frame-load in 1/s	Frames in 1/s
Av. Load %	Current average frame-load as a percentage of max. transmitted bandwidth (100 % = 100 Mbit/s)	Frames in %
Displayed Span Av. Load 1/s	Current average frame-load during the indicated period of time in 1/s	Frames in 1/s
Displayed Span Av. Load %	Current average frame-load during the time period displayed as a percentage of max. transmitted bandwidth (100% = 100 Mbit/s)	Frames in %
Last Second Av. Load 1/s	Current average frame-load during the last second in 1/s	Frames in 1/s
Last Second Av. Load %	Current average frame-load during the last second in percentage of maximum. transmitted bandwidth (100% = 100 Mbit/s)	Frames in %
History		
Y-axis	Average frame-load in 1/s, Update interval = 1 second.	Frames in 1/s
X-axis	Absolute time (including indication of the date if the recording is longer than 1 day).	absolute Time
Sliders	Panning and zooming the graphic in the X and Y directions.	
CSV Export		
Export Data to File	Refer to section *CSV Export* on page 71.	CSV file

Table 26: Description Netload Analysis Window

6.3.2.1 Color, Line Style and Line Width of the Graph

The color, line style and line width of a filter entry's graph can be changed individually.

➢ To change the graph's style, click in the **Netload Analysis** window under **Frame Statistics** with the right mouse button to the corresponding filter entry.

➢ The configuration window for the color, line style and line width appears.

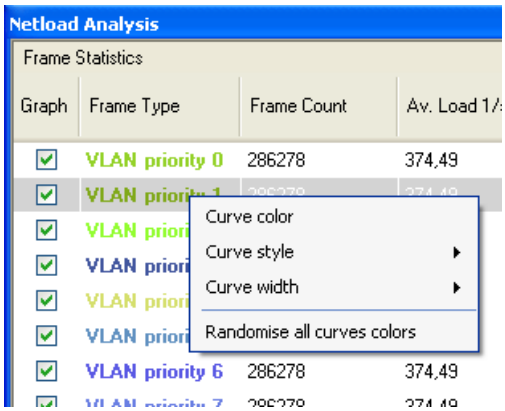


Figure 46: Color, Line Style and Line Width of the Graph

- About **Curve color**, the color of a filter entry and the associated graph are defined.

- About **Curve style**, the line style of a filter entry and the associated graph are defined.
- About **Curve width**, the line width of a filter entry and the associated graph are defined.
- About **Randomize all curves colors**, the colors of all filter entries are assigned at random again. In order to achieve a suitable color distribution trigger that option if necessary several times.

6.3.2.2 Linear, logarithmic or percentage Display the of Netload

The netload graph can be shown in linear, logarithmic or percentages* display (* 100% = 100 Mbit/s).

➢ Therefore click in the **Netload Analysis** window under **Frame Statistics** with the right mouse button to the corresponding graph.

➢ The configuration window for the display mode appears.

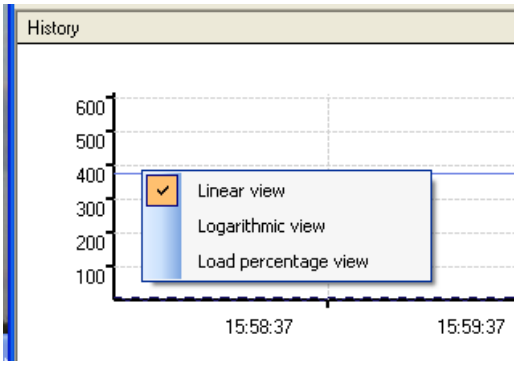


Figure 47: Linear, logarithmic or percentage Display of the Netload

➢ Select and check the desired display mode.

6.3.2.3 Tooltip Display for Frame Types

In the graphic display on each graph the frame type can be displayed as the name of the filter or of the filtered frame.

➢ Therefore move the mouse over the respective graph.

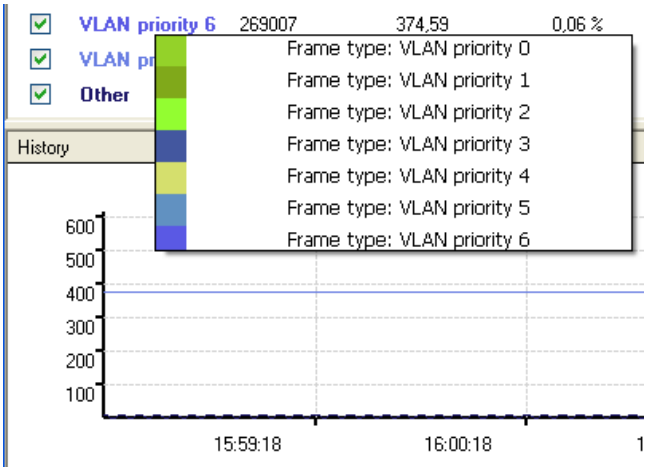


Figure 48: Tooltip Display for Frame Types

6.3.2.4 CSV Export

The CSV export can include all analysis data since the beginning of the capturing time, or only a portion of it.

➢ In order to export all or a part of the analysis data into a CSV file, click in the **Netload Analysis** window to **Export Data to File**.

➪ The **Export to CSV File** query appears.

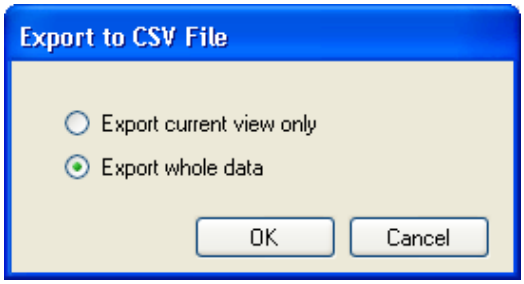


Figure 49: Query CSV Export

Element	Explanation
Export current view only	Only the currently displayed data are exported.
Export whole data	All the data since the beginning of the capturing session are exported.

Table 27: CSV Export Options

➢ Select **Export current view only**, to export all the currently displayed data.

➢ Select **Export whole data**, to export all data since the beginning of the capturing session.

➢ Click on **OK** and select the location for the CSV file.

➪ The exported CSV file is saved. It contains all data for all filter entries.

Structure of the CSV export file

- The upper part of the open CSV file containing the frame statistics data from the **Netload Analysis** window.
- The lower part of the CSV file contains the list of all values of the total number of frames measured every second. The total number of frames includes all frames of all frame types with an identification entry in the extended software filter settings, as well as those listed under "Other" frames.

	A	B	C	D	E	F	G	H	I
1	Graph	Frame Type	Frame Count	Average Load	Average Load(%)	Displayed Average Load	Displayed Average Load(%)	Last second Average Load	Last second Average Load(%)
2									
3	1	VLAN priority 0	303924	374,1319372	0,06%	374,34	0,06%	375	0,06%
4	1	VLAN priority 1	303924	374,1319372	0,06%	374,34	0,06%	375	0,06%
5	1	VLAN priority 2	303924	374,1319372	0,06%	374,34	0,06%	375	0,06%
6	1	VLAN priority 3	303924	374,1319372	0,06%	374,34	0,06%	375	0,06%
7	1	VLAN priority 4	303924	374,1319372	0,06%	374,34	0,06%	375	0,06%
8	1	VLAN priority 5	303924	374,1319372	0,06%	374,34	0,06%	375	0,06%
9	1	VLAN priority 6	303924	374,1319372	0,06%	374,34	0,06%	375	0,06%
10	1	VLAN priority 7	303924	374,1319372	0,06%	374,34	0,06%	375	0,06%
11	1	Other	324	0,398845592	0%	0,4	0%	1	0%
12									
13	Frame Type	Date Time	Count						
14									
15	VLAN priority 0	15:51:21 04.04.2012	374						
16	VLAN priority 0	15:51:22 04.04.2012	376						
17	VLAN priority 0	15:51:23 04.04.2012	374						
18	VLAN priority 0	15:51:24 04.04.2012	376						
19	VLAN priority 0	15:51:25 04.04.2012	374						
20	VLAN priority 0	15:51:26 04.04.2012	376						
21	VLAN priority 0	15:51:27 04.04.2012	374						
22	VLAN priority 0	15:51:28 04.04.2012	376						
23	VLAN priority 0	15:51:29 04.04.2012	374						

Figure 50: Example CSV Export of Measuring Data during the Netload Analysis

6.3.3 Capturing the Netload Analysis Data

For analytical purposes the Netload Analysis data are captured.

➢ To access the captured netload analysis data, click in the window **netANALYZER** > **Stop** and then **Convert**.

➢ Save the data in the window **Path of .hea file and .pcap files** as *.pcap files as described in section *Converting Binary Files into WinPcap Format* on page 49.

7 Troubleshooting, Status Messages and Error Codes

7.1 Notes about Troubleshooting

netANALYZER Software

For possible error messages during software start refer to section *Verification for Hardware and Device Driver* on page 18.

7.2 Status Bar Messages

The following table lists all status messages, which can be displayed in the status bar.

Significance of the color of the text status messages:
Black: Info message
Red: Error message
Green: Function enabled

Status Bar Description	Message Type	Description
GPIO Message		
GPIO: Start/Stop manual	Info message	Manually starting and stopping of the capturing process
GPIO: Start on event	Function enabled	The start of the capturing process, is triggered by a GPIO event.
GPIO: Stop on event	Function enabled	The stop of the capturing process, is triggered by a GPIO event.
GPIO: Start/Stop on event	Function enabled	The start and stop of the capturing process, are triggered by an event.
Status Message		
Start of the Software		
Status: Error in driver	Error message	The hardware is not installed or not compatible.
Status: Proceeding without device	Info message	The application has been started without netANALYZER device found. For testing this, remove the netANALYZER device from the PC or disable it from the Device Manager.
Status: Application ready	Info message	The application has been launched and everything is OK.
Status: Error in registry	Error message	Error reading/writing registry values. The necessary entries in the registry were faulty or absent.
Status: dll or driver not available	Error message	netANALYZER_API.dll or driver not found.
Status: Error set port configuration!	Error message	Error when calling the driver function for setting port configuration.
Data Capturing		
Status: Capture Data ready	Function enabled	The application is ready for the capturing data mode.
Status: Capture in progress	Function enabled	The application is in the capturing data mode.
Status: Capture stopped manually	Info message	The capturing data process was manually stopped.
Status: Capture stopped automatically	Info message	The capturing data process was automatically stopped by the application.
Status: Error creating file!	Error message	Failed to create the capture file.
Timing Analysis		
Status: Timing Analysis ready	Function enabled	The application is ready for the Timing Analysis mode.
Status: Timing Analysis not ready	Error message	The Timing Analysis mode has been selected but the Timing Analysis window could not be shown.
Status: Timing Analysis in	Function enabled	The application is in the Timing Analysis mode.

Status Bar Description	Message Type	Description
progress		
Status: Timing Analysis stopped manually	Info message	The Timing Analysis process was manually stopped.
Net Load Analysis		
Status: Net Load Analysis ready	Function enabled	The application is ready for the Net Load Analysis mode.
Status: Net Load Analysis in progress	Function enabled	The application is in the Net Load Analysis mode.
Status: Net Load Analysis stopped manually	Info message	The Net Load Analysis process was manually stopped.
Further Messages		
Status: Error, can't open directory	Error message	Access to the specified directory was denied. (Example: it does not exist)
Status: Successfully loaded settings	Info message	All settings could be loaded successfully. (The non-existing directory in the „can't open directory error“ has been successfully created.)
Status: preparing start of Firmware	Info message	Starting the capturing or data analysis process.
Status: preparing stop of Firmware	Info message	Stopping the capturing or data analysis process.
Status: File not found	Error message	The specified file could not be found.
Status: Can't open file	Error message	The specified file could not be opened.
Status: Converting data	Info message	The conversion of captured data was proceeded.
Status: Capture stopped from GPIO	Info message	The conversion of captured data was stopped by a GPIO event.
Status: Conversion completed	Info message	The conversion of the captured data was completed
Status: Mode not available	Error message	The selected mode could not be initialized correctly.
Status: Mode available	Info message	The selected mode has been initialized.
Status: Error: "XXXX"	Error message	An error has been occurred, the error code of which is XXXX.
Status: Error	Error message	An error has been occurred. The error code could not be represented yet.

Table 28: Status Bar Messages

7.3 Overview Error Codes

Error Codes		Type	Range
netANALYZER / netSCOPE Device Driver Errors	Generic Errors	Warnings	0x00000000 … 0x80200009
	Toolkit Errors	Warnings	0x80210001 … 0x8021000E
	Driver Errors	Warnings	0x80220001 … 0x80220012
	Transport Errors*	Warnings	0x80230001 … 0x80230014
	Transport Header State Errors*	Warnings	0x80230024 … 0x80230026
*only for NANL-B500G-RE	Marshaller Target Errors*	Errors	0xC0230001
Capturing Errors		Errors	0x00000000 … 0xC0770001

Table 29: Overview Error Codes and Ranges

The Error Codes are described in the **Driver Manual netANALYZER API, Windows XP/Vista/7/8, V1.x** in the chapter **5 Error List**. The manual file *netANALYZER API Windows DRV XX EN.pdf* is on the product DVD.

7.4 Important Error Codes, Causes and Troubleshooting

Value	Error Code (Definition)	Description	Possible Causes	Troubleshooting
Generic Errors (for NANL-C500-RE and NANL-B500G-RE)				
0x80200003	NETANA_OUT _OF_MEMORY	Out of memory	The available storage capacity of central memory is full.	Upgrade the storage capacity of the central memory.
				Close all other open applications on the PC.
				Diminish the value under **Memory Limit for Timing and Netload Analysis** in the **netANALYZER Configuration** dialog, see section *Analysis Configuration* on page 46.
Driver Errors (for NANL-C500-RE and NANL-B500G-RE)				
0x80220002	NETANA_ DRIVER_NOT_ RUNNING	netANALYZER / netSCOPE Device Driver is not running	The netANALYZER / netSCOPE Device Driver is not installed.	Install the netANALYZER / netSCOPE Device Driver.
			The netANALYZER / netSCOPE Device Driver is installed, but the netANALYZER hardware is not installed in the PC or not connected.	The netANALYZER hardware installed in the PC and connect.
			The netANALYZER device is disabled in the device manager.	Enable the netANALYZER device in Device Manager.
0x80220003	NETANA_ DEVICE_NOT_ FOUND	Device with the given name does not exist	The netANALYZER device was removed from the PC during operation of the netANALYZER software.	Update the netANALYZER Software device list, see section *Scanning for changed netANALYZER Hardware Installation* on page 22.
0x80220004	NETANA_ DEVICE_STILL _OPEN	Device is still in use by another application	The netANALYZER device was already open in another instance of the netANALYZER software.	Close the netANALYZER device in the other instance of the netANALYZER software or select another device.
0x80220007	NETANA_FILE _OPEN_ ERROR	Error opening file	Error during the attempt to open the .hea-file to convert it. The read access to the drive has been denied by Windows 7, there are no reading permissions.	Ask for reading rights to the directory or ask the administrator of your PC to move the .hea file to another directory.
0x80220009	NETANA_FILE _CREATION _FAILED	Error creating file	At the start of the capturing session, the error message **Error creating file** appears, that means, that the .hea file can not be created.	Reduce the maximum number of .hea-files before you start the capturing session (see section *Performing File Settings* on page 27. The netANALYZER software reserves for each .hea file a storage area of 1GB. Alternatively, expand the storage capacity of the hard disk.
0x8022000A	NETANA_FILE _WRITE_ FAILED	Error writing file	An error occurs in the file during the current capturing session. For example, the USB connection to the external drive is disconnected or the network drive fails.	Do not interrupt the USB connection during capturing. Re-establish the network drive and start a new capturing session.

Value	Error Code (Definition)	Description	Possible Causes	Troubleshooting
Transport Errors (only forNANL-B500G-RE)				
0x8023000B	NETANA_ TRANSPORT_ RECV_ TIMEOUT	Timeout while receiving data	The device is no longer accessible over the network connection.	Check the network connection to the device. Is the Ethernet cable connected correctly? By help of the Ethernet Device Configuration program check if the IP settings of the device are correct.
0x8023000C	NETANA_ TRANSPORT_ SEND_ TIMEOUT	Timeout when sending data	The device is no longer accessible over the network connection.	Check the network connection to the device. Is the Ethernet cable connected correctly? By help of the Ethernet Device Configuration program check if the IP settings of the device are correct.
0x8023000D	NETANA_ TRANSPORT_ CONNECT	Could not communicate with the device / no answer	The device is no longer accessible over the network connection.	Check the network connection to the device. Is the Ethernet cable connected correctly? By help of the Ethernet Device Configuration program check if the IP settings of the device are correct.
0x8023000E	NETANA_ TRANSPORT_ ABORTED	transfer was canceled due to keep-alive timeout or separation of the interface	The device is no longer accessible over the network connection.	Check the network connection to the device. Is the Ethernet cable connected correctly? By help of the Ethernet Device Configuration program check if the IP settings of the device are correct.
0x8023000F	NETANA_ TRANSPORT_ INVALID_ RESPONSE	The packet was rejected Reply	The response packet was rejected due to invalid packet data.	Check if the first two digits of the version information of "Version Marshaller Client“ and “Version Marshaller Server“ are the same. If they are different perform an update of the hardware and the driver to the newest version.
Transport Header State Errors (only forNANL-B500G-RE)				
0x80230025	NETANA_ TRANSPORT_ UNSUPPORTE D_FUNCTION	Function is not supported	The function request is incompatible or unsupported.	Check if the first two digits of the version information of "Version Marshaller Client“ and “Version Marshaller Server“ are the same. If they are different perform an update of the hardware and the driver to the newest version.
0x80230026	NETANA_ TRANSPORT_ TIMEOUT	Timeout when transmitting	The device is no longer accessible over the network connection.	Check the network connection to the device. Is the Ethernet cable connected correctly? By help of the Ethernet Device Configuration program check if the IP settings of the device are correct.
Marshaller Target Errors (for NANL-C500-RE and NANL-B500G-RE)				
0xC0230001	NETANA_ CAPTURE_ ERROR_ON_ TARGET	Capturing error on the target device	The data load of the capturing is too high.	Check if the PC works with 1 Gb/s. The LINK-1000/LINK100-LED (reverse side of the device) must light up green. Or reduce the load of the data to be captured, e.g. by the use of hardware filters (see section *5.6* on page 31).

Value	Error Code (Definition)	Description	Possible Causes	Troubleshooting
Capturing Errors (for NANL-C500-RE and NANL-B500G-RE)				
0xC0660004	NETANA_ CAPTURE_ ERROR_NO_ DMACHANNEL	No free DMA channel available. Probably host is too slow	The data load of the capturing is too high.	Check whether the hard disk of the PC is fast enough to save the captured data. The theoretical maximum load is 50 MB/s. Reduce the load of the data to be captured, e.g. by the use of hardware filters (see section *Filter Settings for the Hardware Filters* on page 31).
0xC0660005	NETANA_ CAPTURE_ ERROR_URX_ OVERFLOW	XC buffer overflow (URX overflow)	Occurs because a non IEEE802.3 conform traffic is captured (e.g. too short frames, too small IFG).	Record only IEEE802.3-compliant Ethernet frame traffic.
0xC066000B	NETANA_ CAPTURE_ER ROR_NO_HOS TBUFFER	No free DMA buffer available.	Host is too slow to handle data efficiently.	Check whether the hard disk of the PC is fast enough to save the captured data. The theoretical maximum load is 50 MB/s. Reduce the load of the data to be captured, e.g. by the use of hardware filters (see section *Filter Settings for the Hardware Filters* on page 31).
0xC066000C	NETANA_ CAPTURE_ ERROR_NO_IN TRAMBUFFER	Internal capture buffer overflow	No free INTRAM Firmware is out of memory resources and is unable to buffer more data. This may also be caused by a slow file system or a slow application	Check whether the hard disk of the PC is fast enough to save the captured data. The theoretical maximum load is 50 MB/s. Reduce the load of the data to be captured, e.g. by the use of hardware filters (see section *Filter Settings for the Hardware Filters* on page 31).
0xC066000D	NETANA_ CAPTURE_ ERROR_FIFO_ FULL	Firmware is out of FIFO resources and is unable to buffer more data.	This may also be caused by a slow file system or a slow application	Optimize your application or use a faster PC.
0xC0770000	NETANA_ CAPTURE_ ERROR_ DRIVER_FILE_ FULL	End of capture file reached. Driver has stopped capturing.	The error is triggered when the ringbuffer mode is not activated and the end of capture file is reached.	No error

Table 30: Important Error Codes, possible Causes and Troubleshooting

8 Annex

8.1 List of Figures

8.2 List of Tables

8.3 Glossary

CSV

Comma Separated Value

DHCP

Dynamic Host Configuration Protocol

This is a protocol simplifying the configuration of IP networks by automatically assigning IP addresses.

DMA

Direct Memory Access

FCS

Frame Check Sequence (Check sum at the frame end for error detection)

GPIO

General Purpose Input/Output

hea

File extension of the binary files with the capture information content (default.hea) created by the Hilscher **netANALYZER** software

NANL-C500-RE

netANALYZER PC Card with PCI Interface for Real-Time Ethernet and all 100BASE-T Ethernet Networks

NANL-B500G-RE

netANALYZER portable Device with Gigabit Ethernet PC Interface for Real-Time Ethernet and all 10/100BASE-T Ethernet Networks

netANALYZER

netANALYZER software (Windows® Application)

.NET Framework Version 2.0

Microsoft .NET Framework Version 2.0

http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=16614

nff

netANALYZER filter file

SFD

Start-of-Frame-Delimiter: Bits subsequent to the preamble at the start of an Ethernet frame.

PHY

Physical Interface

TAP

Test Access Point

Wireshark

„Network Monitoring Program Wireshark“

http://www.wireshark.org

WinPcap

„The Library WinPcap“

http://www.winpcap.org/

8.4 Contacts

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