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Contents: This white paper describes what you can do to optimize execution time of systems in automatic mode when creating visual inspection systems with NeuroCheck 6.2. Emphasis is on the configuration of the windows for visualization in automatic mode.

Note: This document is not part of the official product documentation of NeuroCheck software.



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1. Introduction

NeuroCheck is a universal image processing software for automated visual inspection in industrial manufacturing environments. All image processing algorithms are therefore optimized with regard to precision and reliability, and also to use as little computational time as possible.

Besides the runtime necessary for executing the image processing algorithms, during execution in automatic mode the time needed for visualizing the inspection results on the integrated NeuroCheck automatic screen has to be taken into account.

This white paper gives valuable hints as to the possibilities that will help minimize the time needed for visualizing the NeuroCheck automatic screen. There are information and tricks what you need to pay attention to and what parameters to change to build a high-speed inspection system.

This white paper presumes that you have already optimized the other variables for the runtime performance. Especially:

- The latest NeuroCheck version or latest service pack is required.
- You have optimized the parameters of the image processing algorithms toward fast execution times (e.g. "Filter Image", "Template Matching"...).
- You have minimized delay time for handshakes with the control system.
- You have switched off diagnostic measures that influence system performance in a negative way such as log files, saving of error images etc.



2. Hints for measuring execution time

The hints in this white paper are based upon tests run on various systems in the NeuroCheck test lab. This is made up of several computers with various processors, graphics adapters and operating systems.

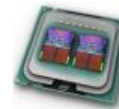
This white paper does deliberately not state data in ms since the absolute execution time depends strongly on the above mentioned factors. We can also not guarantee the effectiveness of the hints and recommendations made here when it comes to your application. If necessary, do the measurements on your planned system.

To do a runtime measurement yourself and to determine how much time the system is currently requiring to visualize Control Panel and Process View, it is useful to compare the execution time of the currently configured visualization and the minimal alternative. For this, switch off Process View and use a minimal Control Panel (e.g. Industrial Compact). The difference in time corresponds to your theoretical time savings for visualization in automatic mode.

3. Use suitable hardware

Multi-Core CPUs

Only use computers with modern multi-core CPUs. NeuroCheck utilizes this technology by carrying out parts of calculations, communication with peripherals and visualization in parallel.



RAM

Make sure you have sufficient RAM. Recommendation: 32-Bit systems should be able to make complete use of 4 GB. 64-Bit systems need at least 8 GB, more is better.



Graphics adapters

When using Process View with elaborate visualization, the graphics adapter is essential for performance. Older on-board graphics adapters are particularly bad. Please use a modern motherboard or a plug-in card, e.g. based on PCI Express. A graphics adapter from the low or medium cost range is sufficient.



4. Optimize Control Panel and Process View

4.1. Basic rules

You should know a few basic rules about visualization windows when you have to optimize runtime:

- Time consuming is only the visualization of windows whose content is displayed anew.
 - Information: Static windows do not delay process runtime.
- The time needed for visualizing all windows whose content changes adds up.
 - Review the necessity of each window in both designers.
- Runtime often depends on the window size.
 - Basic rule: the bigger the window, the more time is needed.
 - For windows with lists please take care to enlarge the window until horizontal and vertical scroll bars disappear, because their display consumes much time.
- A graphically appealing design does not necessarily entail slow performance.
 - Attractive static background images do not need time.
 - For special visual effects of some windows, a slow-down is only noticeable for on-board graphics adapters.
- Most window types will be displayed anew as soon as the contents of the window have changed based on the check routine execution.
 - This means that the time need for a window changes depending on the check routine structure.

4.2. Control Panel


















Whether you use one of the included software standard Control Panels or you want to create one yourself, depends on your ideas in visualization. The included standard Control Panels are good performers and suffice completely. From the large available selection, the fastest are those not using Thumbnail Strips for visualization.

If you still wish to create your own Control Panels, you should do without the window type "Thumbnail Strip" since this takes a lot of time.

4.3. Process View

4.3.1. Performance

Performance depends largely on the window type. Here is a classification by categories:

High saving potential by avoiding this window type	High saving potential by optimizing window settings	Saving potential by reducing window size	Small or no saving potential
 Trace Messages	 Check Function Image ^{*1)}	 Result Status	 Check Function Text
 System Log	 Check Function List ^{*2)}	 Result Rate Tachometer	 Text Label
	 Measurement History ^{*3)}	 Execution Time	 Group Frame
	 Thumbnail Strip ^{*4)}	 Counter	 Static Image
	 File Viewer ^{*5)}	 LED	
		 Chart	

Notes:

- *1.)The Check Function Image window has a "Fast display" mode that you can set in the properties table in the Process View Designer. Depending on the settings you can save up to 90% time.
- *2.)With the Check Function List window you must make sure to enlarge the window so the table fits completely into the window in automatic mode. If horizontal or vertical scroll bars are displayed, the process is considerably delayed.
- *3.)There is a large saving potential for Measurement History window the less curves and points have to be visualized. It's advantageous to leave the line width at 1.
- *4.)As mentioned in the previous chapter, consider whether you want to visualize the images via Thumbnail Strip window. If yes, then please keep in mind: the higher the number of images in the Thumbnail Strip, the more your process will slow down.
- *5.)Keep two things in mind when using the File Viewer window: First, retrieving the file from a network drive will slow down the process. Second, in the properties table in the Process View Designer you can define the update mode for this window.

4.3.2. User- and GDI-Objects

Windows in the process view require a certain number of user and GDI objects in order to be displayed correctly. Windows limits the number of these objects to 10,000 pieces for each process, which can lead to a flawed presentation in case of extensive process visualizations. Due to this problem, it is recommended to pay attention to which elements are really needed for the visualization and which are only "nice-to-have". The absence or incorrect representation of a process view can lead to significant misunderstandings and thus to problems during production. The number of user and GDI objects that a process uses can be viewed in the Windows Task Manager. If you are on a Windows 7 System open the "View" menu, select the "Select column ..." menu item and select the options "USER" and "GDI objects". You can then use the "Processes" tab to see how many objects the NeuroCheck62.exe process needs. On Windows 10, you can monitor the number of objects in the "Details" tab. By right-clicking on the column heading and selecting "Select Columns" you can also display the USER and GDI objects there. In addition, you can use Table 1 to get a feel for the number of user or GDI objects of each window type.

Possible symptoms of NeuroCheck when reaching or exceeding the limits:

- The process view can not be loaded and will not be displayed
- The process view is displayed but contents of the screen layout are missing
- Some contents of the screen layouts are not updated during operation
- The cycle time is increased
- NeuroCheck reacts slowly to user input

Solutions:

- Reduce the total number of windows used in the process views until you no longer exceed the limit of 9,500 user and GDI objects. In this case, the process visualizations of all test programs used in automatic mode should be considered, as these are cached by default and therefore not rejected during a test program change. NeuroCheck itself needs the remaining approximately 500 objects.
- Activate the option "Defensive memory management" in the NeuroCheck software settings. Attention: Enabling this option may result in longer load times for a test program switch because the process visualizations are no longer cached.

Attention: We strongly advise against using the Windows Registry to manually set the number of objects. In certain constellations this might lead to an irreparable total failure (bluescreen) of the operating system, which can only be restored with considerable expenditure of time.

Note: The following table was created with NeuroCheck 6.2 under Windows 7 64-bit.

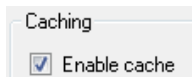
Table 1: User- and GDI-objects in the process view

	Process view window	User objects	GDI objects
	Text Label	1	2
	Group Frame	2	0
	Static Image	1	10
	File Viewer	20	2
	Check Function Image	12	7
	Check Function List	14	11
	Check Function Text	9	5
	Result Status	9	5
	LED	1	3
	Custom Data Visualization	9	2
	Thumbnail Strip	6	0
	System Log	15	9
	Trace Message	13	14
	Execution Time	13	8
	Counter	11	4
	Result Rate Tachometer	10	7
	Chart	9	5
	Measurement History	10	7
	Date/Time	11	4
	Data Register Viewer	12	5
	Digital I/O or Fieldbus Status	46	66
	Hard disk usage	21	5
	Memory usage	31	5
	Per Screen Layout	6	0

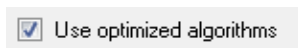
5. Optimizing software settings

- (1) Before you start an optimization, make sure that variables influencing execution time have been eliminated (see chapter 1).
- (2) Please refer to System → Software Settings → Advanced and make sure that the settings are still as follows:

- Caching:

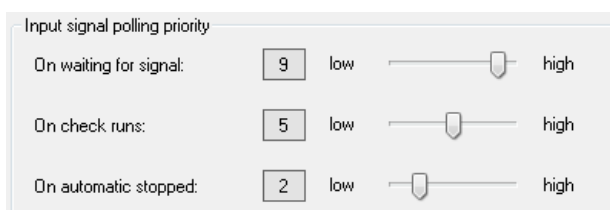


- Performance:



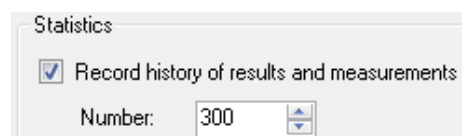
(NeuroCheck 6.0 only)

- Time Response:



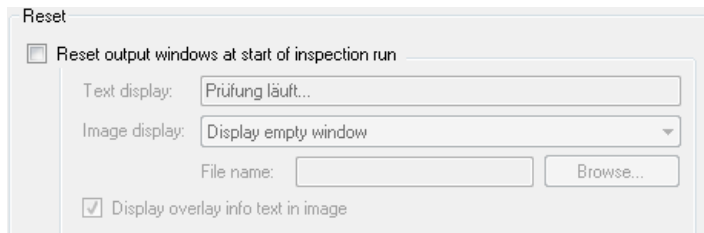
- (3) Please look up Software Settings → Automatic Mode → Statistics:

This setting is only needed for the window type "Measurement History". If you do not need this window, remove the check mark in front of "Record history of results and measurements".



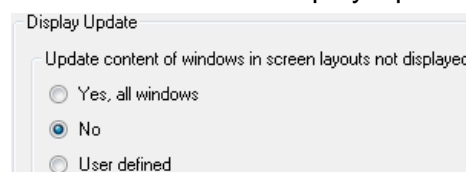
- (4) Please look up Software Settings → Automatic Mode → Process View → Reset:

This setting needs additional process runtime when activated. If you can do without resetting the output window upon the start of the inspection cycle, do not set the check mark.



- (5) Please look up Software Settings → Automatic Mode → Process View → Display Update:

This setting only applies if you use more than one screen layout in your Process View. If you can do without updating the contents of the windows in the background screen layout, set the option to "No" in order to get a faster process. On selecting "User defined" you can activate certain window types on demand.



6. Conclusion

If you incorporate all the hints in this document, your NeuroCheck automatic screen should be at an optimum according to your preferences. If you have any more questions, do not hesitate to contact the NeuroCheck team at support@neurocheck.com.