

**Version 5.1**  
**for Microsoft® Windows®**  
**2000 / XP / Vista / 7**

**Operator**  
**Manual**

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# Introduction

Welcome to NeuroCheck version 5.1, the professional system for industrial image processing under Microsoft Windows 7/Vista/XP. NeuroCheck is one of the leading image processing systems on the market, and we are happy to make all our know-how available to support you.

This manual introduces you to NeuroCheck and shows you how to get comprehensive information for working with NeuroCheck; furthermore, it will help you with problems and contains hints for troubleshooting. It is primarily written for operators and set-up people working with NeuroCheck visual inspection stations. For users who would like to know more about image processing in general, we offer two-day training courses.

The contents of this manual have been checked for compliance with the described hardware and software. Due to the rapid development of hardware and software, differences from procedures described here cannot be excluded, which is why complete compliance cannot be guaranteed. Necessary changes will be made on a regular basis in the following editions.

We are grateful for feedback regarding your experience with this documentation and welcome any suggestions.



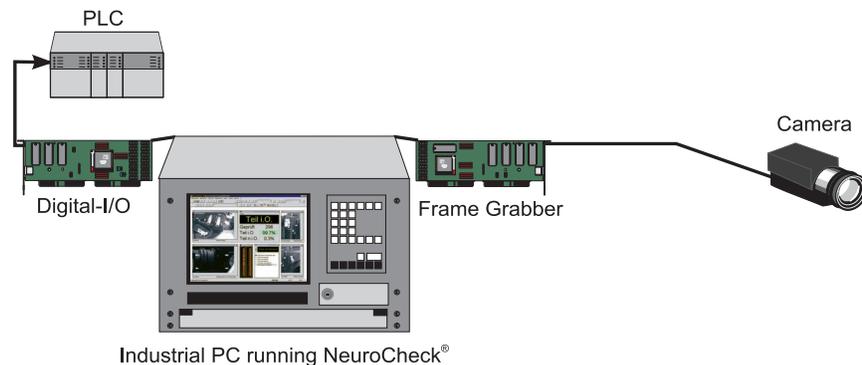
# 1 Working with NeuroCheck

In this section you will learn

- what NeuroCheck is,
- how to start and shut down your system,
- what operating modes are available in NeuroCheck,
- what the user interface looks like and how to work with it,
- how a check routine is made up, how dialogs are accessed, and
- how signals are exchanged with a superior control system.

## 1.1 What is NeuroCheck

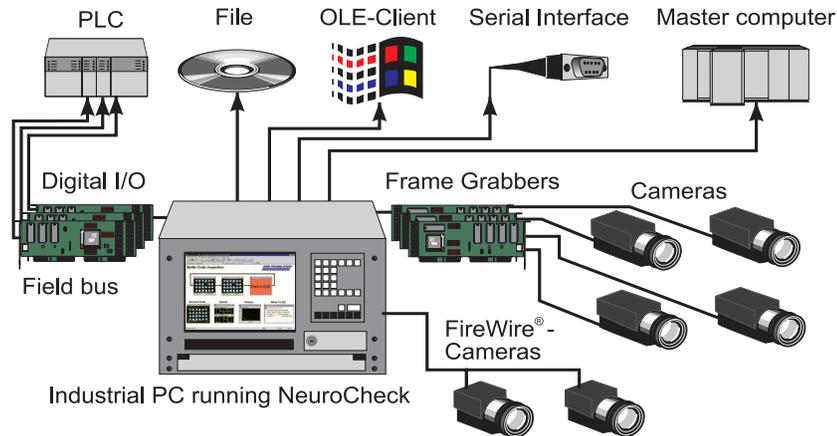
NeuroCheck is a universal image processing system designed for use within automatic production processes and quality management systems. It offers an integrated environment for the interactive configuration of visual inspection applications and their automatic execution on the manufacturing line. The following figure shows the schematic setup of a NeuroCheck inspection system including the necessary hardware components and communication links in a basic configuration.



With its comprehensive set of image processing functions, NeuroCheck can be used in a wide range of application areas. A highly automated check routine configuration and an intuitive graphical user interface help to solve visual inspection problems.

Because of its ability to exchange data with other Windows applications using the Windows clipboard or to create comprehensive inspection records via files and serial data communication, NeuroCheck is ideal for use with highly integrated manufacturing lines and integration into modern quality management systems.

NeuroCheck can be controlled using digital I/O, serial interface, and OLE automation. It is even possible to change check routines via remote control, i.e. to reconfigure the whole inspection system within milliseconds. The following figure shows the setup of a NeuroCheck inspection station including all possible connections.



Even a communication protocol as flexible as that of NeuroCheck cannot take into account the special features of every PLC available on the market. Therefore, NeuroCheck offers a fully documented DLL interface to use customer defined communications protocols (OEM communication), thus fitting seamlessly into today's highly integrated manufacturing processes.

## Extensibility

NeuroCheck can be extended in various ways opening up new dimensions of performance and flexibility:

- Plug-in DLLs contain user-defined image processing functions. The functions are seamlessly integrated into the NeuroCheck environment, i.e. you can use the entire functionality of the NeuroCheck framework, including parameter copying, output to different recipients, visualization of run-time data... For example, you can create your own preprocessing functions, support manufacturer specific communications protocols, and do anything too specialized for a standard software package.
- OEM communication DLLs support any communication hardware with an interface equivalent to the serial driver included with NeuroCheck.
- Via OLE automation you can control NeuroCheck from your own Visual C++ or Visual Basic applications to give your inspection system an individual user interface. The OLE interface consists of approx. 100 functions giving access to all relevant functions and parameters in NeuroCheck.

## File Output

Wherever it is useful, NeuroCheck functions allow for writing result data to files. This includes measurement values as well as images and check results. Interactive configuration of the file format makes it possible to process the data with standard software (e.g. Microsoft Excel). Thus NeuroCheck meets the requirements of modern quality management for comprehensive inspection records.

## 1.2 Start and Close System

### Start System

Switching on the computer automatically starts the check routine in automatic mode. In this mode the system waits for the signal *Start Check* from the superior control system.

### Switch off System

To avoid loss of data, the inspection system may only be switched off after an already started measuring cycle has been finished. Note that the computer may not be switched off directly but must be properly shut down. Terminate NeuroCheck with the **Exit** command from the **Check Routine** menu. Click on the **Start > End** button on the windows task bar. When the message “It is now safe to turn off your computer” appears, you may switch off your computer.

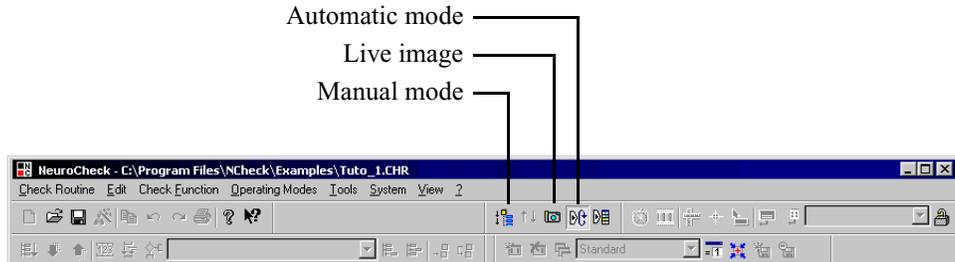


If the computer was not shut down in the prescribed manner (system crash, oversight, electricity failure), the error message “Windows was not shut down correctly” appears when restarting the system. Confirm by pressing a key. The “ScanDisk” program will be run. Afterwards Windows starts and NeuroCheck is started automatically.

If your computer is already equipped with an uninterruptible power source (UPS), you will not notice significant changes when switching your computer on or off. The UPS checks in the background whether the computer is switched off and switches itself off automatically within 3 seconds. The same is true for switching the computer on. The UPS switches itself back on automatically (for additional information about UPS see “Data Integrity for your System” on page 79).

## 1.3 Operating Modes

This section explains the different modes of operation in NeuroCheck.



### 1.3.1 Automatic mode

The item **Automatic** in the **Operating modes** menu or the corresponding icon switches the system into automatic mode. The check routine is carried out automatically with NeuroCheck being remote controlled by PLC or a master computer.

The fundamental settings for automatic mode are valid for the software as a whole, i.e. for all check routines since they refer directly to the configuration of the surrounding production process that will change only infrequently. They are set in the **Remote Control** dialog box which you can access using the corresponding menu item from the **System** menu.



### 1.3.2 Manual mode

After start of the program, NeuroCheck is usually in automatic mode. To switch to manual mode click the depicted button on the tool bar or select **Manual** from the **Operating Modes** menu. In this mode the check routine can be edited and carried out step by step manually.



### 1.3.3 Live Image Mode

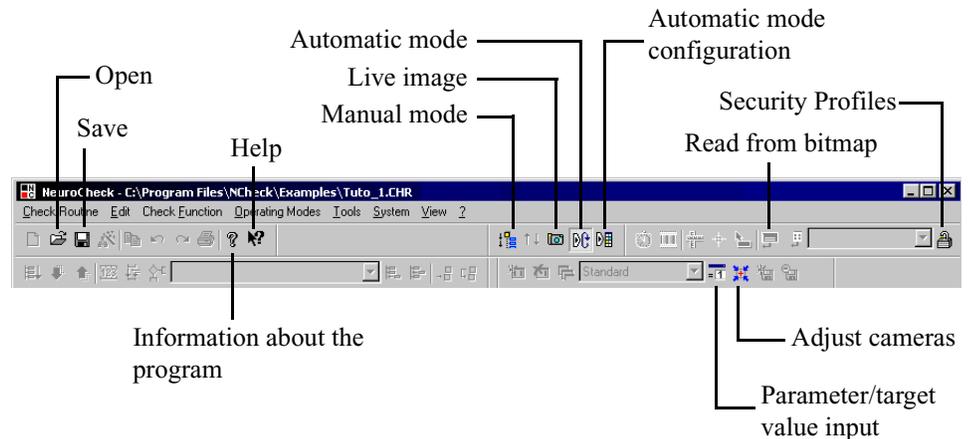
You can reach this mode by clicking the depicted button or by selecting the menu item **Live** from the **Operating Modes** menu. The complete program window is then used to display the current live camera image. If more than one camera is connected, select the desired camera from a list. To focus more easily, the zoom factor can be changed. This mode is primarily used to check and set up focus and exposure of the cameras.

## 1.4 User Interface

The user interface of NeuroCheck was designed to make using a digital image processing system as easy as possible but also to offer all possibilities to the experienced user. It therefore allows you access to all options and function parameters, but does not require the user to set all of them by hand because of its mostly automatic configuration.

True to the Windows 9x/2000/XP philosophy, NeuroCheck supports intuitive use of the right mouse button. Object properties, parameter settings, online help, clipboard, everything can be accessed using the right mouse button. At the same time, most functions offer traditional control elements for an immediate overview of the current configuration.

### 1.4.1 Description of the toolbar.



#### Open

Lets you select a check routine file from a file select box.

#### Save

Saves the active check routine.

#### Information About The Program

Displays the **About** NeuroCheck dialog box with information on the current program version and the system environment.

## Help

Clicking this button on the standard toolbar changes the mouse cursor into a contextual help cursor. Clicking any element on the NeuroCheck user interface will then display a help window with information about the element.

## Manual Mode

Switches to manual mode, the primary mode for check routine editing.

## Live Image

Switches to live mode, using the whole of the NeuroCheck window for live image display.

## Automatic Mode

Switches to automatic mode in which NeuroCheck performs automated visual inspections under remote-control communicating through various channels with external devices, like PLCs and master computers.

## Configuration of Automatic Mode

Switches to automatic screen configuration mode used to configure the layout of the automatic mode screen shown by NeuroCheck when executing the current check routine in automatic mode.

## Read from Bitmap

This command temporarily switches input of all *Transfer image* functions in the check routine to bitmap files instead of camera images. By using this feature applications involving several cameras can be edited without taking care that the right piece is placed in front of each camera.

## Security Profiles

Opens the **Security Profiles** dialog for configuring security levels for this NeuroCheck installation.

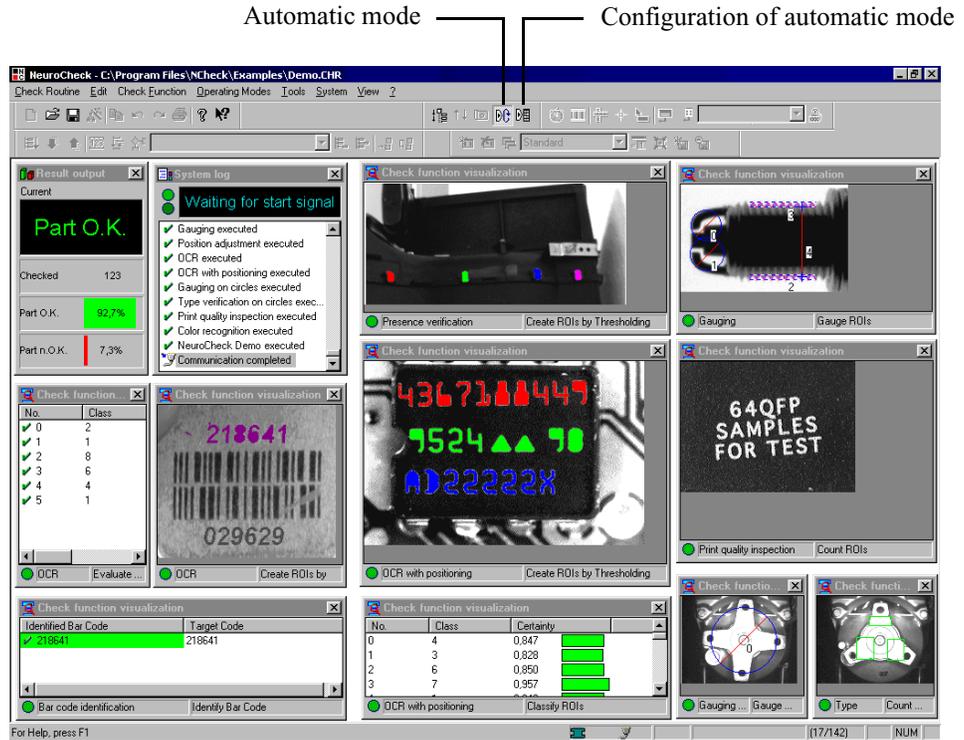
## Adjust Cameras

This function opens the **Adjust Cameras** dialog which allows you to compare reference images to the current camera image for adjusting camera positions.

### **Parameter/Target Value Input**

This command displays the **Parameter/Target Value Input** dialog for setting parameters and target values for selected functions in automatic mode.

## 1.4.2 Automatic Mode Screen



The automatic mode screen displays the processing results of the check routine in various windows.

### Automatic Screen Background

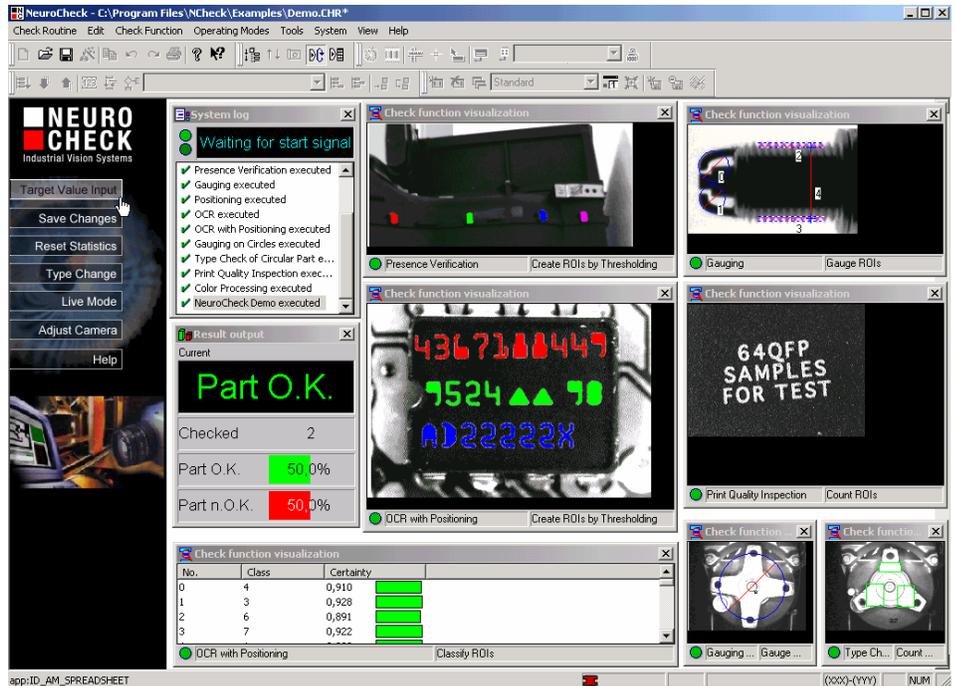
In automatic mode, the output windows for visualization can be moved in the foreground of the automatic screen. For the background, there are three different display types available:

- A simple white background.
- A background image (e.g. a company label) without any further functionality.
- A HTML background (similar to an internet page) with interactive elements like buttons, text links or graphics.

Since the HTML background allows you to control NeuroCheck, we will explain this feature in more detail now.

## Interactive HTML background

In addition to the graphical presentation of text and graphics, a HTML background can contain elements with functionality. This enables you to perform an action by clicking the corresponding element with the mouse. Such an action could be, for instance, the change of the check routine, the reset of the statistics or the activation of the target value dialog (See “Publishing Target Values” on page 82.).

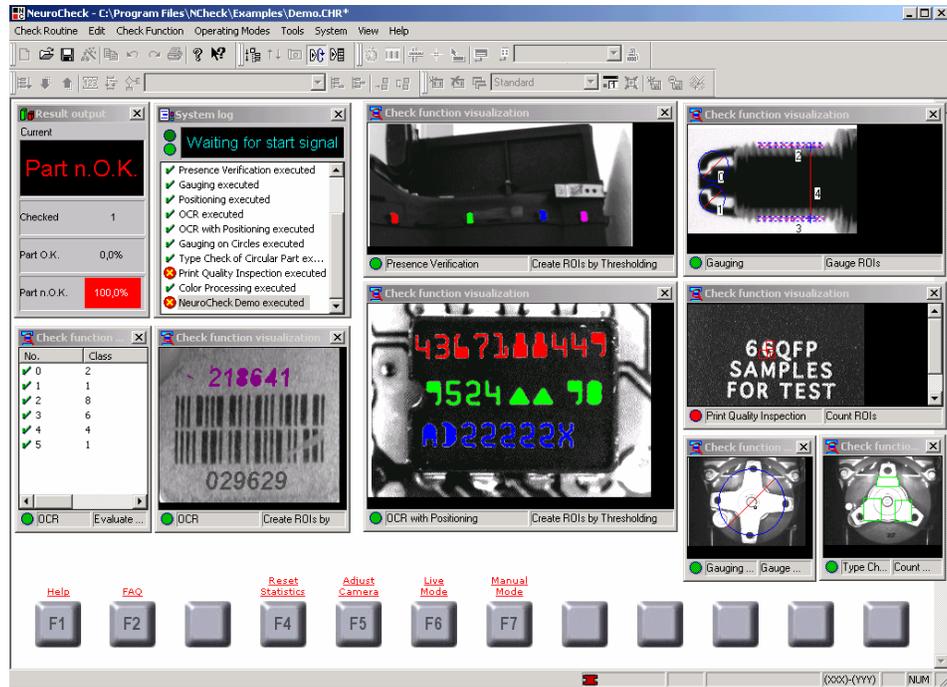


In this example the default NeuroCheck HTML background is used. The buttons on the left side of the screen represent commands which can be activated via mouse click. Note, that the mouse cursor changes when moved over an interactive element, like a button in this case. Text links are normally presented underlined.

The visualization windows can be changed in size and position, so it is possible that some of the interactive elements might be hidden behind these windows.

## Function Keys

Another possibility to send commands to NeuroCheck is the usage of function keys. The keys F1 to F12 on your keyboard are free configurable with several commands in the settings for automatic mode.



Here is another example of a HTML background. The function keys are displayed at the bottom of the screen. The command assigned corresponding to the function key (e.g. F1=Help) is also displayed as a text link above the image of the key. The command „call Help window“ could be activated in three different ways:

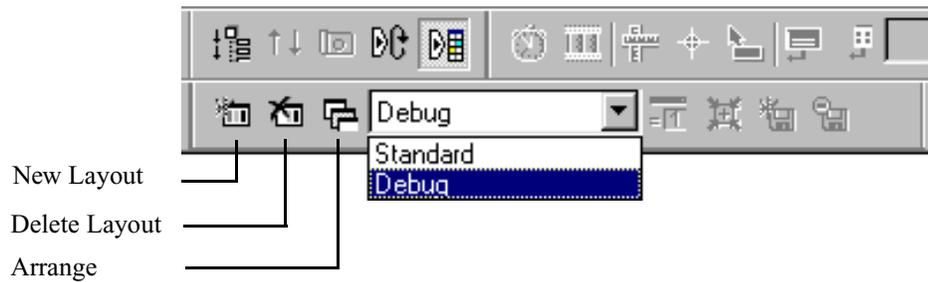
- Press the F1 key on your keyboard.
- Click on the image of the F1 key on the HTML background.
- Click on the text link „Help“ above the image of the F1 key.

All three ways have the same effect, e.g. the help window appears.



## Automatic Screen Configuration Mode

The **Configure Automatic Screen** command from the **Operating Modes** menu or the depicted button enable you to configure the screen display in automatic mode. This display is part of the check routine since it allows customized assignment of output windows to check functions for the output of result values or images. Thus the screen configuration depends on the check functions contained in the check routine.



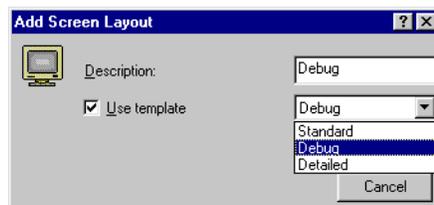
## Screen Layouts

In NeuroCheck you can choose from several screen layouts. However, these must have been configured and saved.

If this is not the case, we recommend to create a screen for debugging besides the standard screen. On this screen, all important check routine functions can be displayed as images. This helps you to check whether the positioning was carried out correctly, whether the thresholded image or the ROIs were created correctly etc. In the communication window, the inputs and outputs are displayed. Using this window, you can check the communication with the control system.

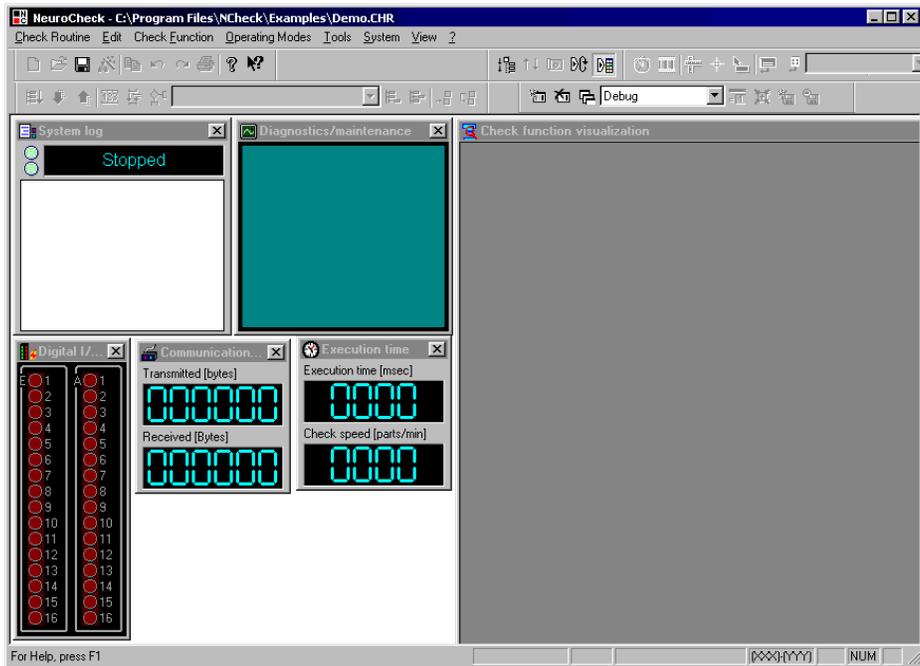


A new layout is created using the depicted icon or by choosing **Screen Layout > New** from the **View** menu.



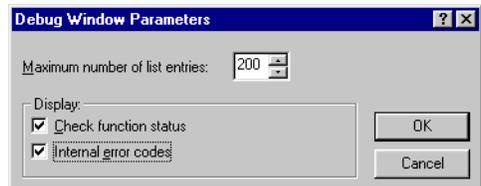
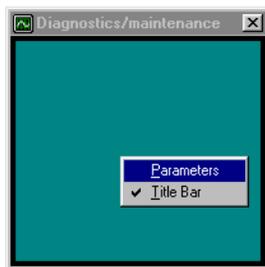
If the check box *Use template* is activated, you can choose standard layouts from a list. You can also create your own screen using the toolbox.

Here you see a screen layout based on the *Debug* template.



The new layout contains: system log, debug, check function visualization, digital I/O and serial communication status windows, and an execution time window.

For the windows to display the desired information, parameters have to be set using the right mouse button.

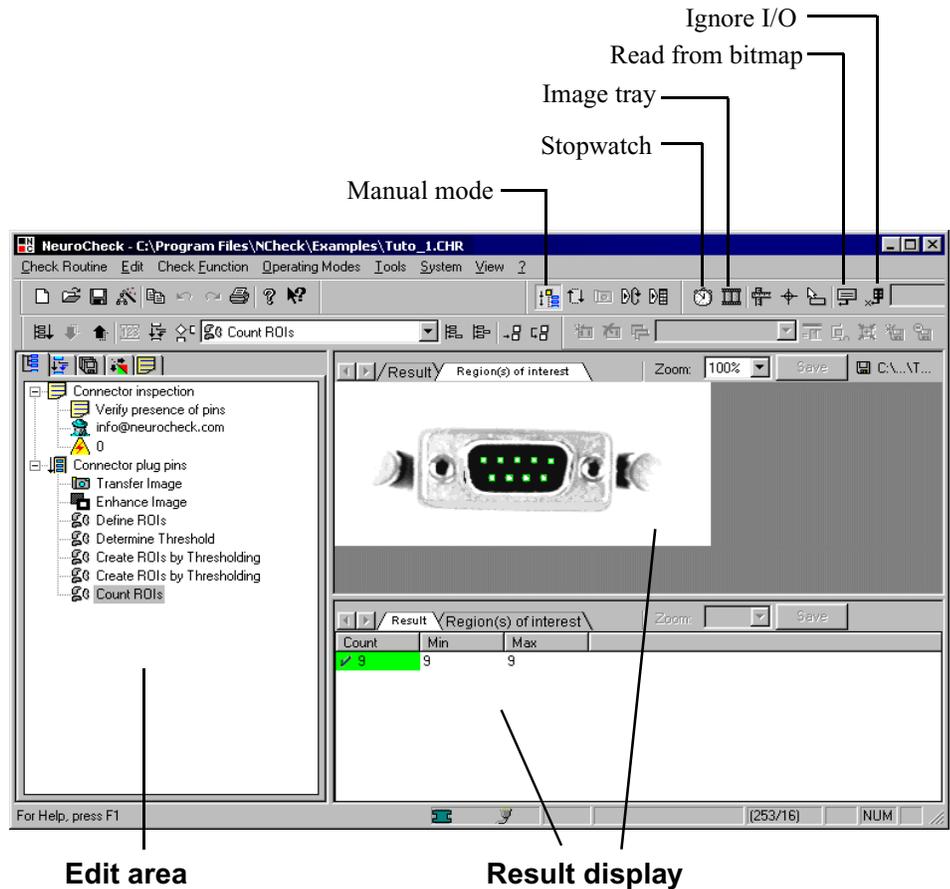


From the context menu of the *Diagnostics/maintenance* window choose *Parameters*. Activate the check boxes *Check function status* and *Internal error codes*. The *Diagnostics/maintenance* window then lists every single check function executed during a check routine. The two check boxes activate additional output, listing error codes of the

functions, which can be very helpful for the NeuroCheck technical support team to find the cause of a problem.

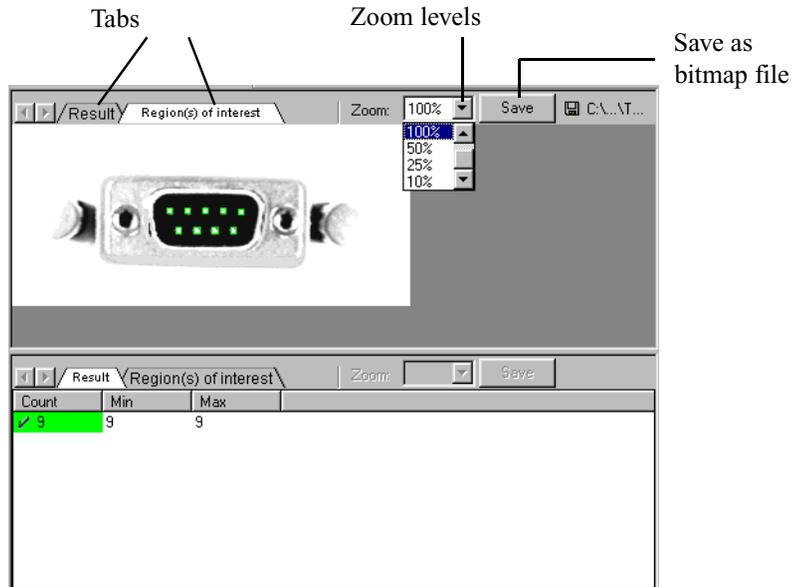
For further information please refer to the help files or the user manual.

### 1.4.3 Manual Mode Interface



Here you see the NeuroCheck window in manual mode. The main window is divided into the edit pane on the left, featuring five tabbed edit pages, and the result image display on the right. The bottom border of the window contains the status bar, which keeps you informed about the current state of the program.

## Result Display



The output pane in the right area of the manual mode screen is used to display results as well as input and output data of the check function just carried out.

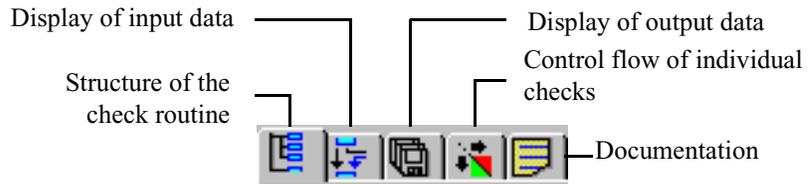
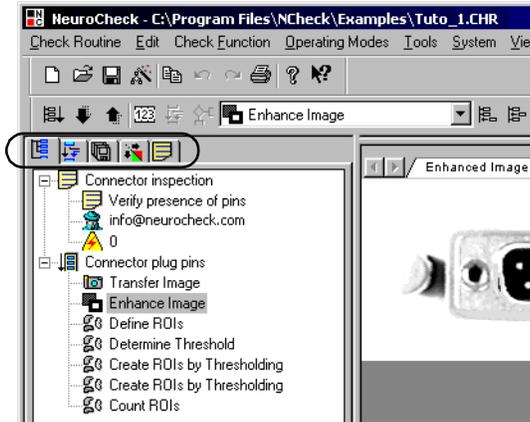
You can switch between the various views of results offered by the check function using the tabs. This way it is easy to see what is currently being displayed and which options are available.

Result display allows for different zoom levels that can be switched using a list box.

Result images can be saved from the window into a bitmap file or copied to the clipboard.

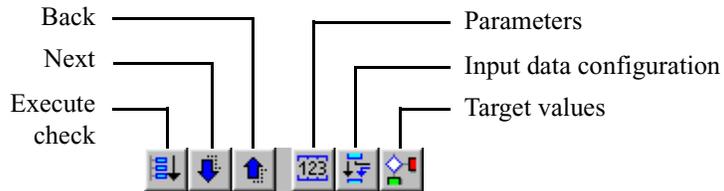
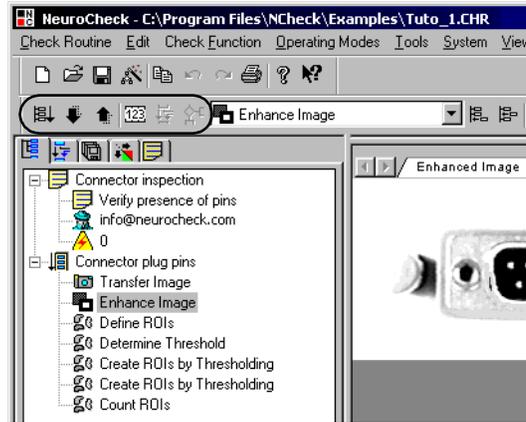
Splitting the result view into two horizontal areas (by pulling down the upper frame) allows for simultaneous viewing of two different result displays.

## Editing Tabs



The main aspects of a check routine (structure, input data, output data, execution of individual checks, documentation) are edited in different tabbed pages in the left window area. Each page offers a complete overview of the check routine, showing you where you are at any time. The structured display of the check routine is the default page in the editing area.

## Edit Bar



The depicted toolbar is located above the editing window by default. Since the tool bars can be arranged individually, it may also be found in a different location e.g. the left side depending on the configuration used.

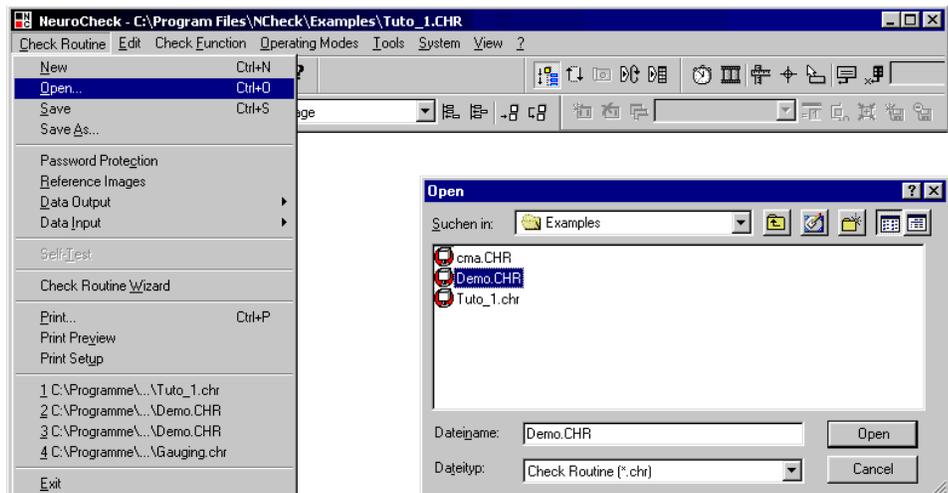
Using the symbols, you can easily execute check functions and step forward and back. The pertaining dialogs for parameter setting, input data configuration and target values can also easily be opened using these icons.

## 1.5 Check Routine

### 1.5.1 Load Check Routine



Usually, the check routine is automatically loaded when NeuroCheck starts. To perform a check routine change manually, click the depicted symbol or choose **Open** from the **Check Routine** menu.



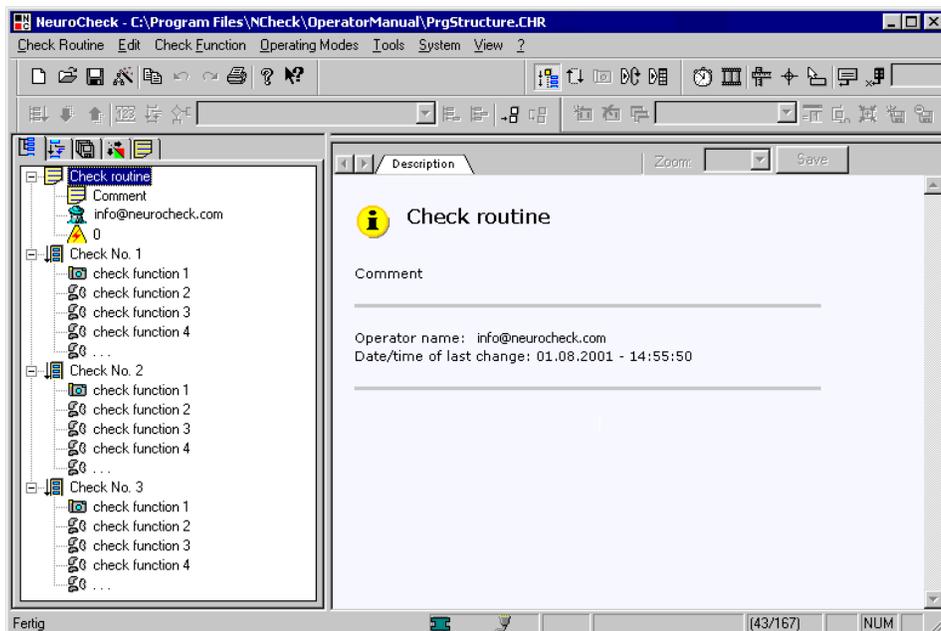
The File Select dialog box is displayed.

Here you can select the desired check routine from the installation directory of NeuroCheck (check routines have the extension \*.CHR, short for “check routine”).

Click **Open** to confirm.

In manual mode NeuroCheck displays the structure of the loaded check routine in the tree view on the left side.

## 1.5.2 Basic Structure of Check Routines



The **Check routine** is the core element of every image processing solution created with NeuroCheck. Its role can be compared to that of a text document in a word processor or a source code in a development environment.

It is displayed in a tree view with the following hierarchy:

The check routine comprises the solution of the entire inspection task. A check routine typically consists of a number of individual checks that take care of different aspects of the inspection task. The individual results can be combined by conditional branching.

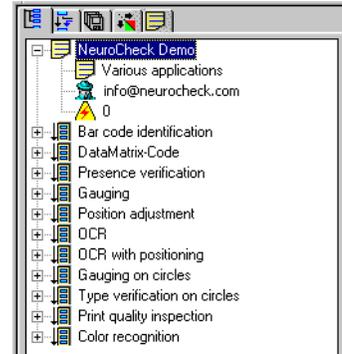
In an **individual check** a single aspect of the entire inspection task is solved, e.g. recognition of writing, gauging of an object or presence verification of a part. Each individual check is made up of a sequence of check functions.

A **check function** is an image processing, classification or system function that can be integrated into an individual check to fulfill a specific processing task.

## Individual Check

Individual checks inspect different aspects of a work piece. A check might measure a bore hole, verify the presence of a component or read a line of characters.

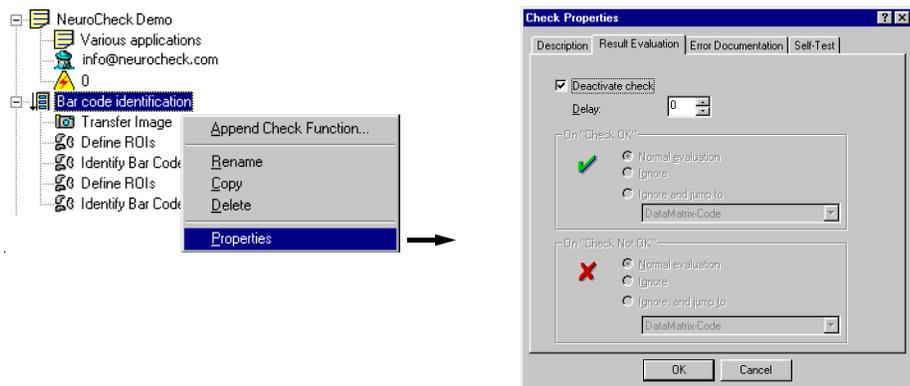
Each individual check consists of several check functions. After all checks for a work piece have been carried out, their results are combined to form the final result of the check routine.



Individual checks are independent of each other, they do not exchange data. Usually checks are executed in the order in which they appear in the check routine. However, it is possible to carry out a check depending on the result of another check. The result of a check - **O.K.** or **n.O.K.** - can be used to decide which check should be carried out next. This makes it possible to carry out type-dependent checks or to use different check methods for the same work piece. Use a simple, quick method first and only if this fails, use a more elaborate one so the average execution time is reduced.

## Deactivate Check

It is also possible to deactivate a check. Right-click the appropriate check and select **Properties** from the context menu.



Select the **Result Evaluation** tab and click the **Deactivate check** box. Confirm with **OK**. This check is now marked with a red arrow and not active for the whole inspection.

## Start and End Actions

Start and end actions are special types of individual checks that can be added at the beginning or end of a check routine. They are always executed at a specific point in time, namely before resp. after all other checks in the check routine. The start actions can for example be used to take several pictures quickly and to buffer them in the image tray for later processing after the test piece has already left the check station. Some controls need a confirmation of the input signal by NeuroCheck. This can be accomplished by inserting a start action into the check routine.

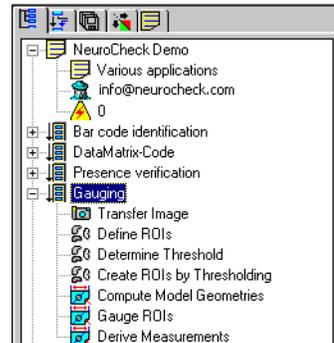
The main purpose of the end actions is to synchronize NeuroCheck with the production process after the end of all checks, e.g. by exchanging certain digital signals. The end actions can also be used as a time delay to rule out undesired multiple measurements.

## Check Functions

Check functions are image processing, communications or system functions that can be inserted into a check to carry out specific tasks. NeuroCheck provides check functions for various tasks, such as filtering entire images, searching and measuring individual objects, reading from or writing to digital I/O connectors etc.

The check functions of a check are executed in sequence. Through a data pool, input and output data is exchanged with a check function getting its input data usually from the preceding check function. This assignment can manually be changed at will.

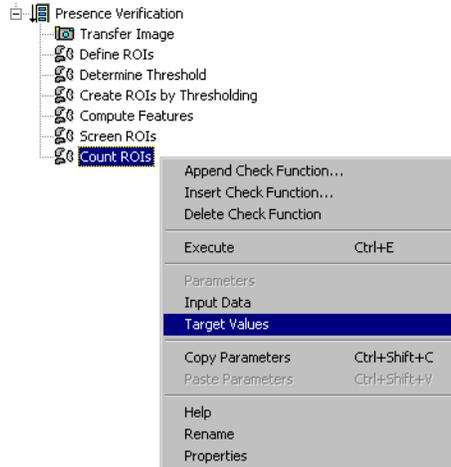
The parameters of all check functions can be set independently of each other. Therefore, each check function contains a dialog for the **Target Values** or for the **Parameters**, which also provide you with appropriate visual support.



## Open Target Value Dialog



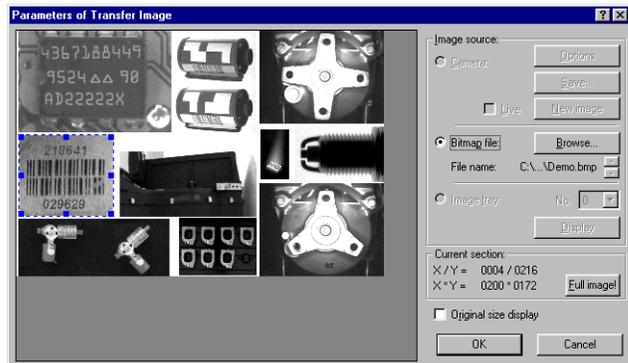
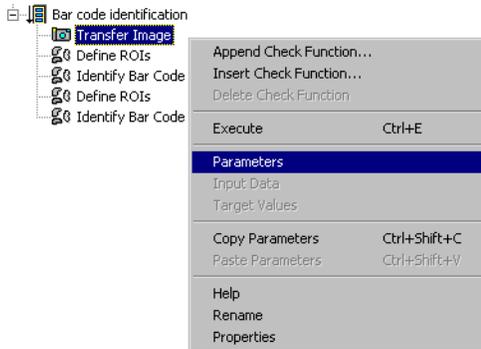
Select the check function by left-clicking it. Select this icon from the toolbar or right-click the context menu and select **Target Values**.



## Open Parameter Dialog



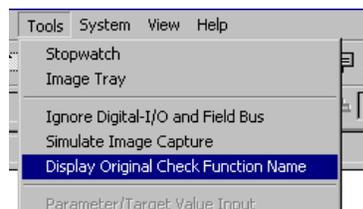
Select the check function by left-clicking it. Select this icon from the toolbar or right-click the context menu and select **Parameters**.



## Check Function Name

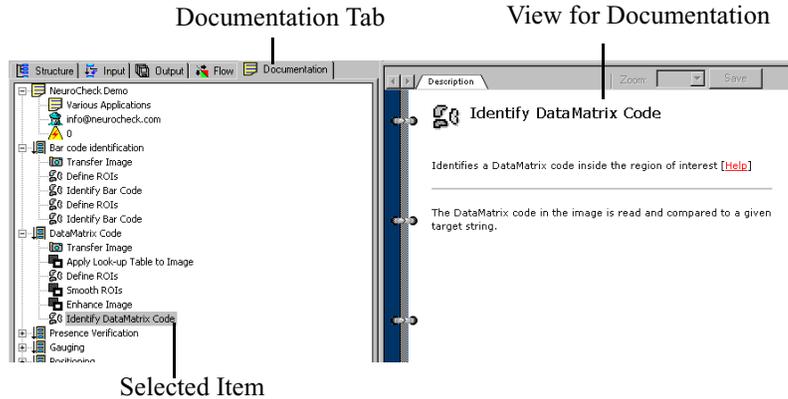
Check functions can be given custom names. For that, right-click on the check function and select **Rename** from the context menu. Enter the new name and confirm by pressing Enter.

To display the default names of the check function, activate the menu entry **Display Original Check Function Name** in menu **Tools**.



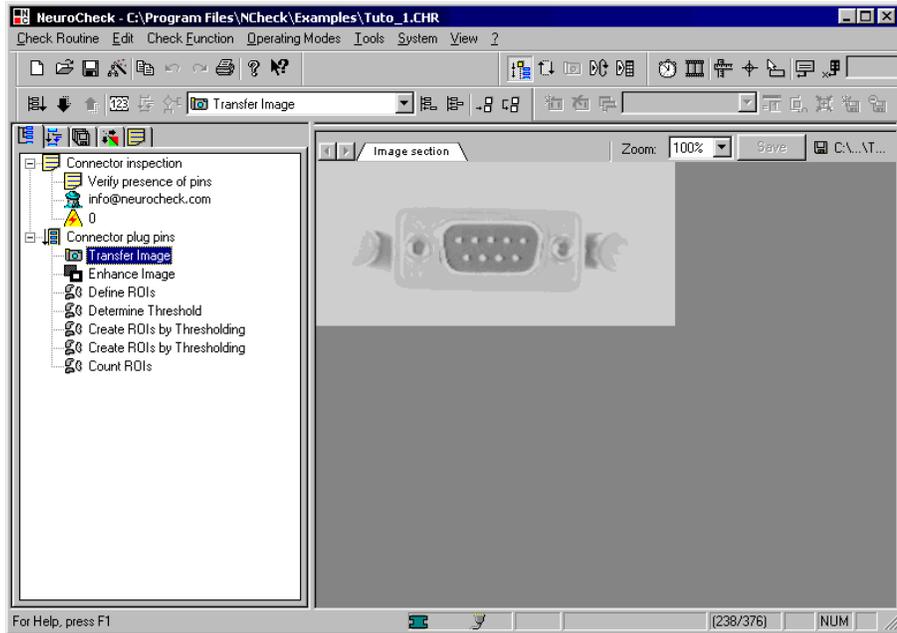
### 1.5.3 Check Routine Documentation

For a better readability of a check routine, you can add a description to the check routine, its individual checks and to each check function. These comments and descriptions are displayed when the documentation view (using tab *Documentation*) is active. The information available for the selected item, will be shown in the right side of the screen.



### 1.5.4 Check Routine Example

For further information about check routines please refer to the appendix (see page 105) where you'll find a complete example of a check routine. The example is described step by step to explain the purpose of each check function and its parameter settings.



The example described deals with a presence verification of contact pins on a plug.

## 1.5.5 Save Check Routine



All changes are saved by clicking the depicted icon or by choosing **Save** from the **Check Routine** menu.



## 1.6 Automatic Start of NeuroCheck

In practice, it is often necessary that the system starts automatically after booting the computer. Therefore NeuroCheck has to be started directly after Windows has started.

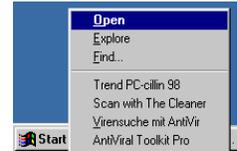
Furthermore, NeuroCheck has to switch into automatic mode upon start and load a specific check routine.

### 1.6.1 Start of NeuroCheck after Booting

To start NeuroCheck automatically after Windows has finished booting, you have to register the program in the *StartUp* folder of Windows. That means that you have to create a shortcut to NeuroCheck in this program folder. For this configuration, it is not necessary that NeuroCheck is running.

First, click with the right mouse button on the Windows *Start* button. A context menu will open. Choose the menu entry **Open**.

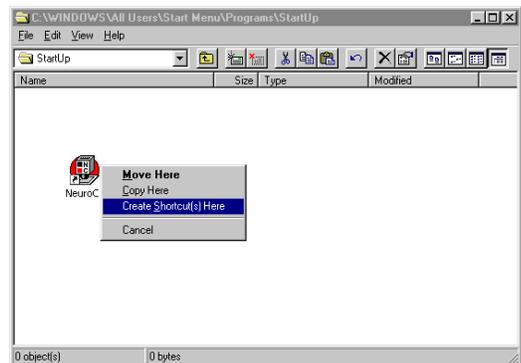
Double click on the folder *programs*.



Now double click on the folder *StartUp*. After the installation of NeuroCheck a shortcut to NeuroCheck is created on the Windows desktop. Move the window of the StartUp folder so that you can see the symbol of NeuroCheck on the desktop.

Right click on the shortcut symbol of NeuroCheck and keep the button pressed. Move the symbol into the StartUp folder window and release the right mouse button. A pop up menu appears. Choose **Create Shortcut(s) here**. Now Windows is configured in a way, that it will start NeuroCheck automatically after the next start of Windows.

You now can close the window of the StartUp folder.

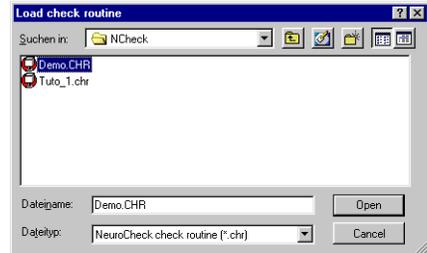
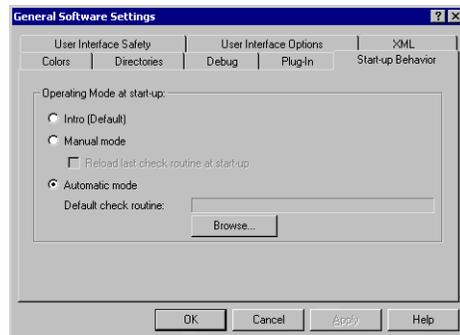


## 1.6.2 Automatic Mode after Starting NeuroCheck

It is possible to configure NeuroCheck so that it will switch into automatic mode directly after program start, using a predefined check routine.



Choose **General Options** from the **System** menu.



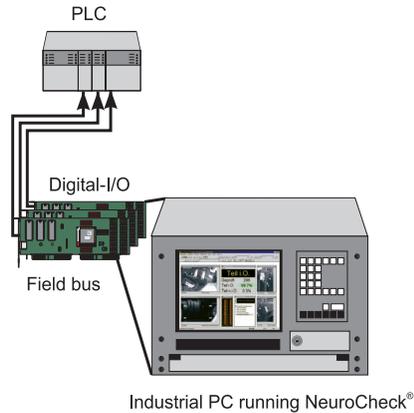
Select the option *Automatic mode after program start* on the *Start-up Behavior* page. Use *Browse* to select the check routine which has to be loaded on program start.

On the next start of NeuroCheck, it will switch directly into automatic mode, load this check routine, and wait for the input signal *Start Check*.

If NeuroCheck is configured for an automatic change of check routines (see page 36), the check routine corresponding to the current product type will be loaded before execution of the inspection run.

The external communication with signals and the automatic check routine change will be explained in detail in the following sections.

## 1.7 Signal Exchange



Several *input and output signals* are available for communication between NeuroCheck and a superior control system. The configuration of these signals is determined by the application and should only be changed by authorized personnel.

### 1.7.1 Output Signals

#### System Running

The signal *System running* is immediately set to high level after loading NeuroCheck. It is continuously present while NeuroCheck is active.

#### System Ready

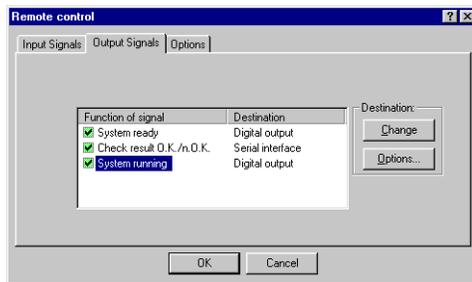
The signal *System ready* is set immediately after the end of an inspection run. NeuroCheck then waits for a start signal.

#### Check Result OK/not OK

This signal is also set after an inspection run has been finished, but it depends on the result generated by the check routine. The output signal remains set until the next *Start check* signal. There are separate signals for **OK** and **not OK** result.



Open the dialog box for the output signals described above by choosing **Remote Control** from the **System** menu. Choose the **Output Signals** page.



The digital output channel can be selected by choosing **Options**.

## 1.7.2 Input Signals

### Start Check

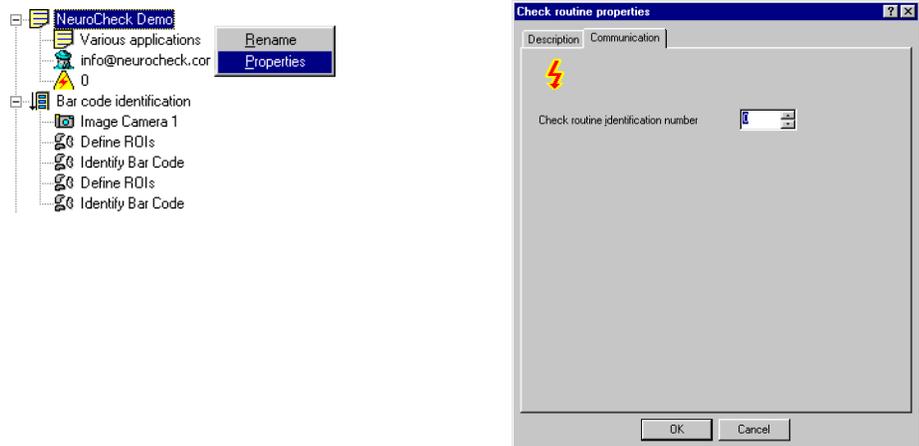
The signal **Start Check** is only recognized by NeuroCheck if the output signal **System ready** is at high level. NeuroCheck reacts to the state of the input signal. If the signal **Start Check** is applied longer than the check routine execution time, the check routine is restarted immediately. If the signal **Start Check** is applied constantly, NeuroCheck executes a permanent check.

### Select Check Routine

If you want to check a different type during production or if production is alternating between different products, NeuroCheck can load a new check routine controlled by a type code that is transmitted by the control system. The check routine change takes approximately 100 ms.

The check routine identification number (short ID) in NeuroCheck is assigned as follows:

Select the check routine (not an individual check!) and choose **Properties** from the **Edit** menu or the context menu opened by right-clicking the check routine.

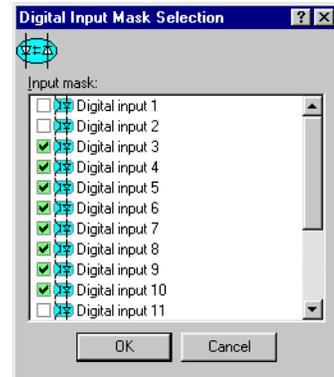
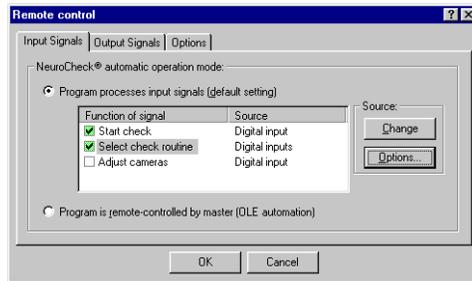


Enter the check routine identification number on the *Communication* page of the dialog box. The number is used to change check routines during automatic mode controlled by an external signal.

If a check routine identification number was assigned in the NeuroCheck check routine, the control system needs to send not only the *Start Check* signal, but also the ID number of the check routine. For this you can use the unassigned inputs of the digital I/O.



Select **Remote Control** from the **System** menu and activate the *Select check routine* check box on the *Input Signals* page.



The digital inputs can be selected by choosing *Options*.

From the list of digital input channels, select the bits to be used for the identification number. A channel is selected by activating the check box in front of the channel name. The selected inputs make up a binary number in the sequence displayed. Thus the input listed at the top represents the least-significant bit, the one on the bottom the most-significant bit. The output designations correspond to those specified in the Device Manager dialog.

### Configuration of the Check Type Selection

As described before, in order to perform an automatic check routine change, a unique identification number has to be assigned to all relevant check routines. In addition, you have to specify which check routines are to be used for this change.

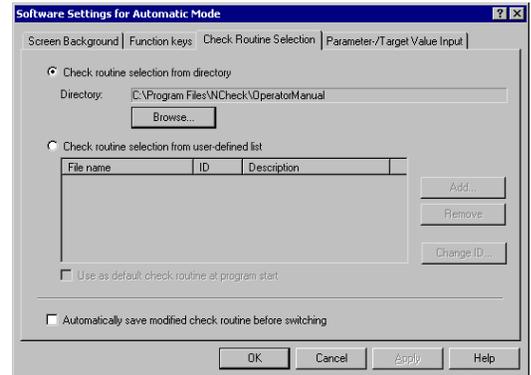


Choose **Settings for Automatic Mode** from menu **System** and switch to tab **Check Routine Selection**

There are two possibilities to configure the automatic check routine change.

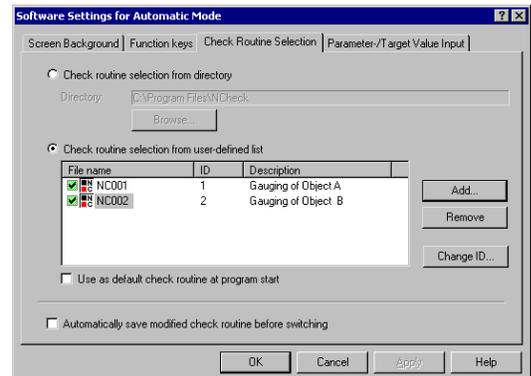
The first possibility is to use a central directory where the check routines with different IDs are stored.

Therefore, activate the option **Check routine selection from directory**. Use **Browse** to select the central directory, in which the possible check routines are located, and close the directory selection dialog with **OK**. Now you can see the selected path where NeuroCheck will search for the check routines.



The second possibility is to specify an individual configured list of check routines for the automatic check routine change. Here, the check routines can be stored in different directories.

For the individual list of check routines, activate the option **Check routine selection from user defined list**. Click **Add** to search for check routines and to add them to the list. After that you can change the check routine ID for these check routines. Ensure that the correct ID is set and the check box is activated for the check routines you want to use.



After you have configured one of the two options, close this dialog with **OK** in order to apply your changes.

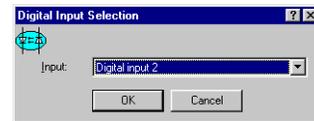
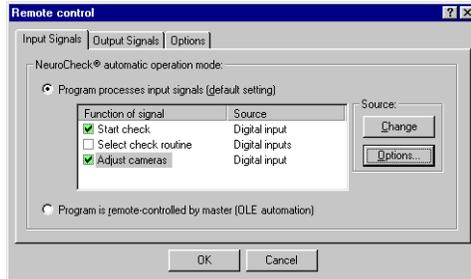
Now the system is ready and you can switch to automatic mode. After receiving the **Start Check** signal and the ID number, NeuroCheck attempts to load and run the check routine with the given identification number from the specified directory or from the individual defined list, depending on the selected option.

## Adjust Cameras

The **Adjust cameras** input signal displays reference images to check the brightness of the image and the camera position in automatic mode. Marks can be set at prominent image spots in the reference images using the **Reference Image** command from the **Check Routine** menu. NeuroCheck stores such images within the check routine to be used for adjusting camera positions in automatic operation (see “Adjust Cameras” on page 48).



To configure the input signal choose **Remote Control** from the **System** menu.



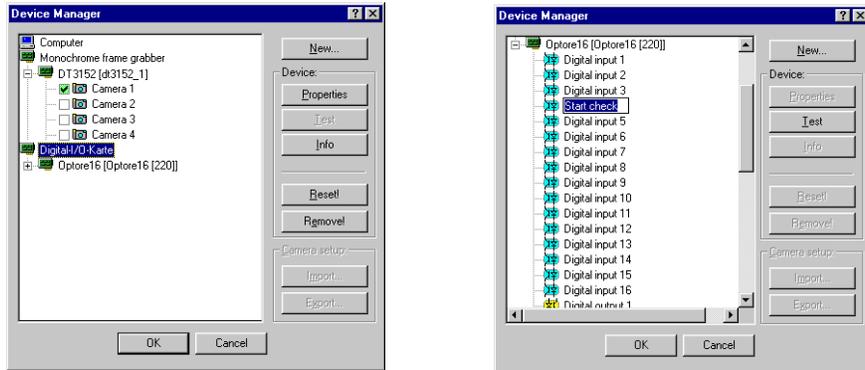
Activate *Adjust cameras*. Select the digital input using *Options*.

## Designate Digital Inputs and Outputs

We recommend to give meaningful names to the inputs and outputs of the bits used depending on their function, e.g. “Start check”.



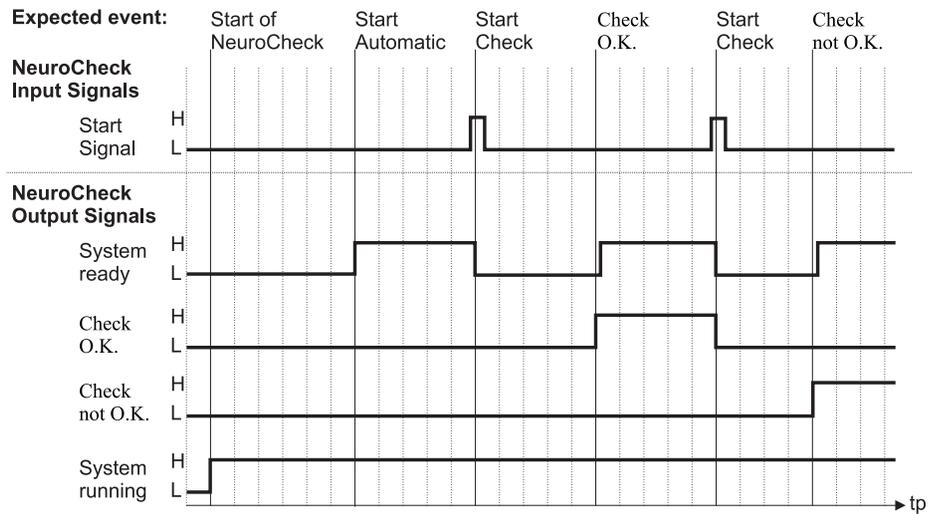
Renaming is done by in-place editing; choose **Device Manager** from the **System** menu.



Click the “+” icon of the **Digital I/O board** for the device manager to display all inputs and outputs. Now click twice (do not double-click) on the input or output that you want to change to enter the desired name.

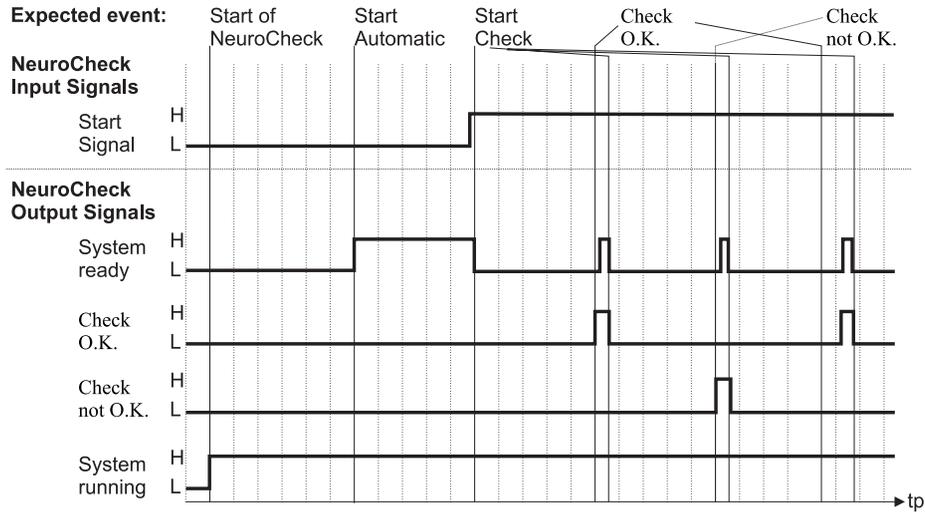
Confirm with **OK**.

### 1.7.3 Signal Flow Chart for Standard Systems



The system is clocked by an external start signal.

### 1.7.4 Signal Flow Chart for High Speed Systems



The start signal is applied constantly and the system triggers itself, thereby achieving the highest possible evaluation speed.

## 2 Process Optimization and Troubleshooting

In this section you'll learn how to optimize your NeuroCheck visual inspection system and how to handle possible problems.

In detail, you'll learn

- how to adjust cameras and check that they are connected correctly;
- how to check whether all hardware components are recognized correctly;
- how to check the communication of NeuroCheck with the superior control system and its correct integration;
- how to change target values in automatic mode easily;
- what information NeuroCheck provides for troubleshooting purposes;
- how to work through a check routine step by step; and
- what you can do when you don't find a solution.

### 2.1 Hardware Check

#### 2.1.1 Peripheral Equipment (Visual Check)

If you encounter problems with your inspection system (e.g. high rate of false alarms), first take a close look at cameras, lenses and lighting equipment.

Check

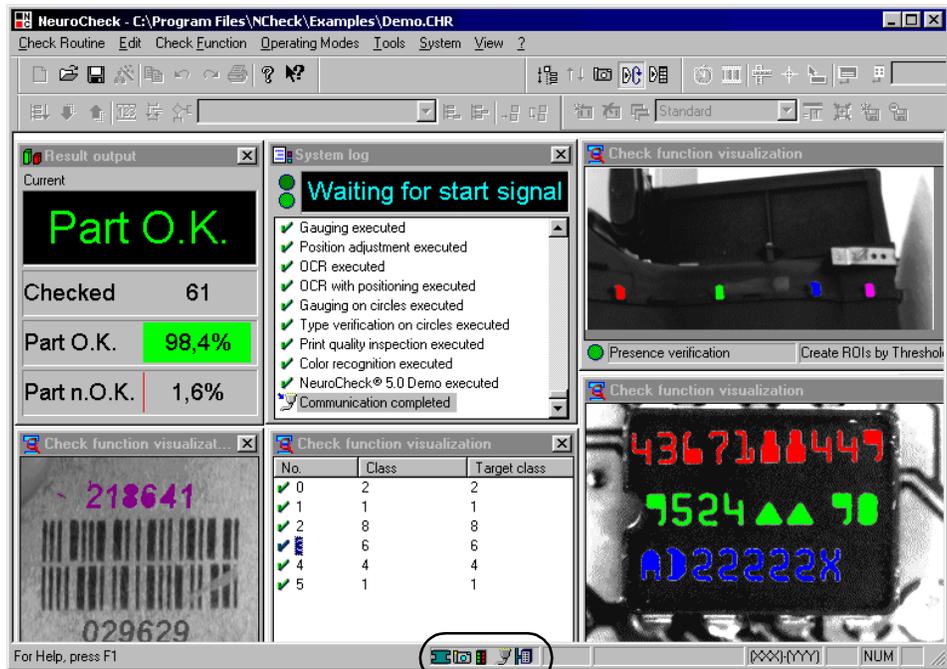
- **Lighting** for function and brightness. This is simple when you have a standard application with permanent lighting. If your inspection system switches different lighting setups, please refer to the specific manual for your system.
  - If brightness decreases considerably, clean or replace the light source.
  - If lighting fails completely, check the mains power supply and the connections before replacing it.
- The **plug-in connections** on the back panels of the cameras.



- **Cameras and lenses** for
  - damages,
  - dirt,
  - blocking objects.

## 2.1.2 Status Bar

The status bar is located at the bottom of the NeuroCheck window.



It tells you whether necessary hardware components such as security key, frame grabber, digital I/O board, serial interface and field bus board are available in the system and have been recognized.



The icons stand for (from left to right): security key, camera icon for frame grabbers, digital I/O board, serial interface and field bus board.

Security key and frame grabber (camera icon) are always required. I/O board, serial interface and field bus may be required, depending on the configuration of your inspection system. For more information please refer to the specific manual for your system.



- If the dongle icon is missing, the security key is not recognized correctly. For further information please refer to „Security Key Test“ on page 45.



- If the camera icon is missing, the frame grabber is either defective or is not correctly integrated. Check, as described below, whether the frame grabber has been configured correctly in the Device Manager (for more information refer to the user manual or contact our technical support).



- The same holds for a missing digital I/O board icon. Either the board is defective or not properly integrated. Check, as described below, whether the digital I/O board is correctly configured in the Device Manager (for more information refer to the user manual or contact our technical support).



- If the depicted icon is missing from the status bar, the serial interface of your computer is defective or not properly recognized. Check, as described in the following, the configuration in the Device Manager (for more information refer to the user manual or contact our technical support).



- If the depicted icon is missing from the status bar, the field bus board of your computer is defective or not properly recognized. Check, as described in the following, the configuration in the Device Manager (for more information refer to the user manual or contact our technical support).

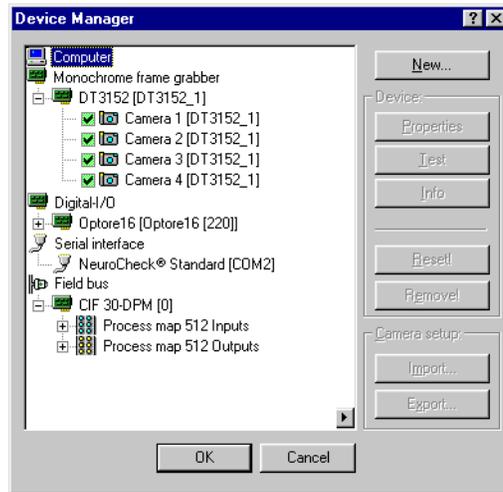


- This icon appears in the status bar when the system was restarted without the security key.

## Device Manager

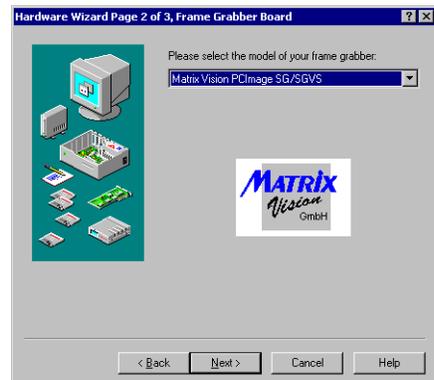
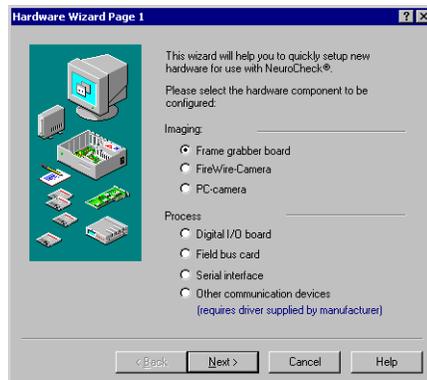
The various hardware components necessary for an image processing system are managed by a central Device Manager that is similar to the familiar hardware management of Microsoft Windows.

To check the configuration in the Device Manager, choose **Device Manager** from the **System** menu.



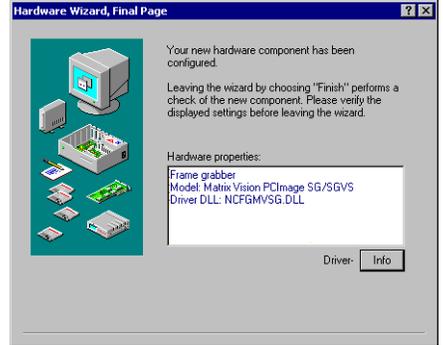
The appropriate boards and interfaces must be present in the device tree.

To add a new component, click **New** in the **Device Manager**. The new component is configured through an easy-to-use hardware wizard.



Select the type of component and click **Next**. In the following dialog select the specific model for your application from a list box.

Clicking *Next* opens the final page of the hardware wizard. Your hardware component is now configured. Click *Finish* to test it and integrate it into your system.



### 2.1.3 Security Key Test

Comprehensive information about the security key can be obtained via the WIBU-KEY control panel extension for checking properties of connected security keys.

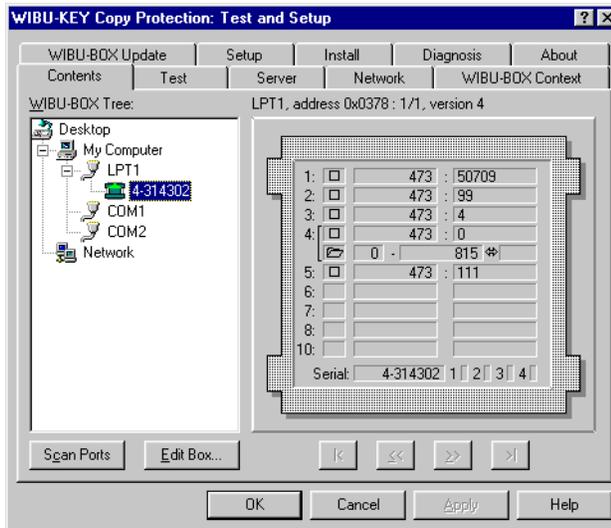


Open the WIBU-KEY control panel by double-clicking the security key icon in the status bar with the left mouse button.



If the security key is not recognized and the corresponding icon not present, click on the depicted icon which is displayed instead in the status bar.

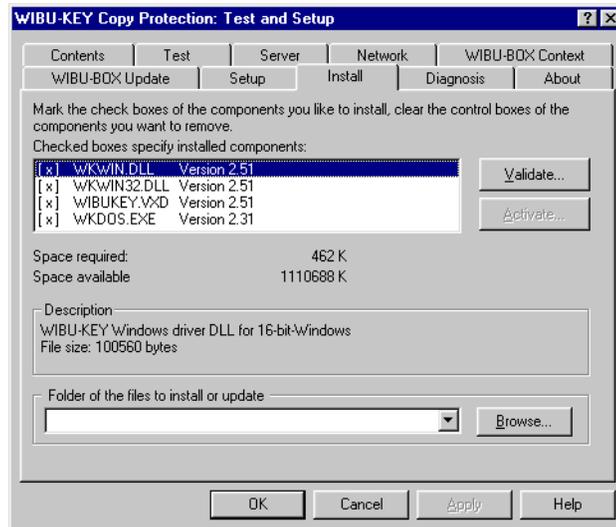
The control panel initially displays the *Contents* page.



This is where all detected security keys are listed in a tree view sorted by connections. Usually there will only be a single security key. If no security key is displayed, there can be several causes:

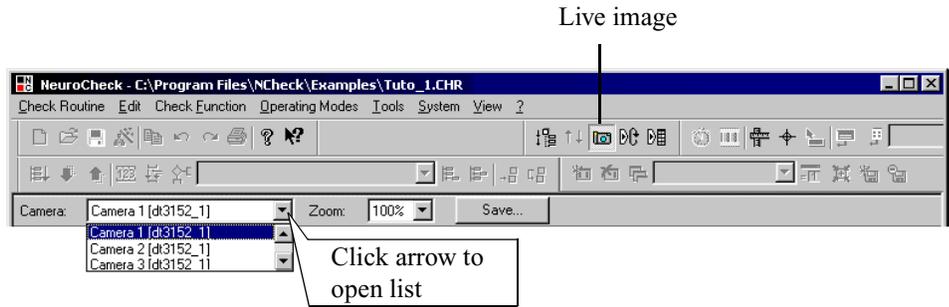
- There is a problem with the driver installation.
- The parallel interface is defective (or blocked by a printer driver; some drivers do not behave correctly in this respect).
- The security key is defective (rare, but possible).

Possible driver problems can be checked on page **Install**.



The *Validate* button causes the control panel extension to check for inconsistencies in the driver installation and to suggest corrective measures.

## 2.1.4 Live Image



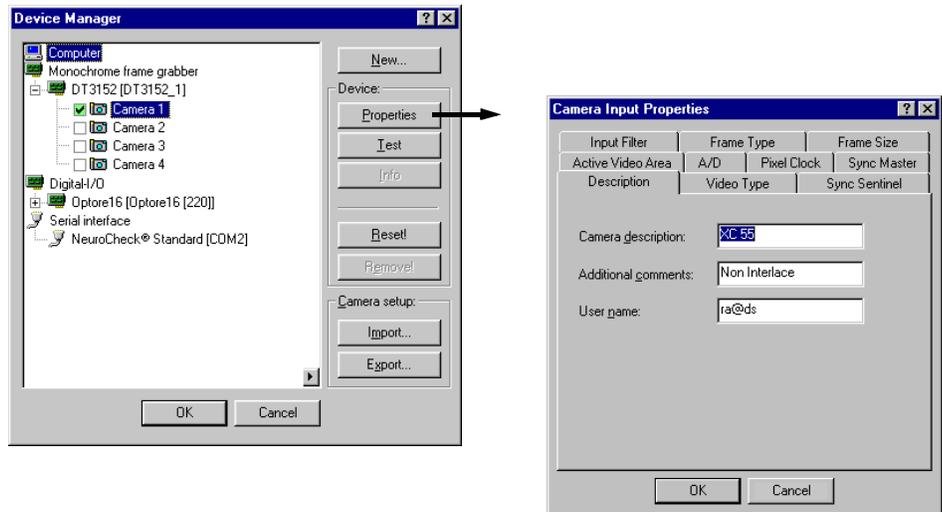
Check whether there is a suitable live image available.

Switch to live image mode by clicking the depicted icon.

If your inspection system includes several cameras, you can select the desired camera from a list.

If you cannot get a live image, even if the frame grabber was recognized correctly, check the camera setup.

Select the desired camera from the device tree after choosing **Device Manager** from the **System** menu.



Then click the *Properties* button. This opens the dialog box for **Camera Properties**.

You can see which camera setup is loaded by checking the *Description* tab. This must correspond to the camera type used in your inspection system. For more information refer to the user manual.

**Error: image capture**

If this message is displayed at the bottom of the NeuroCheck window, the camera could be faulty.

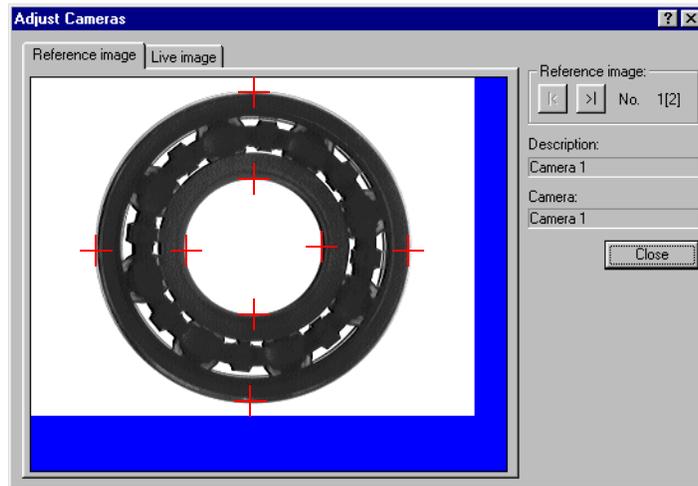
## 2.1.5 Adjust Cameras

Next you should check the position of the camera as well as brightness and focus of the camera image.

The Adjust Cameras function is a useful tool to correct misalignment of the camera or to adjust brightness and focus. However, there must be a reference image available already.

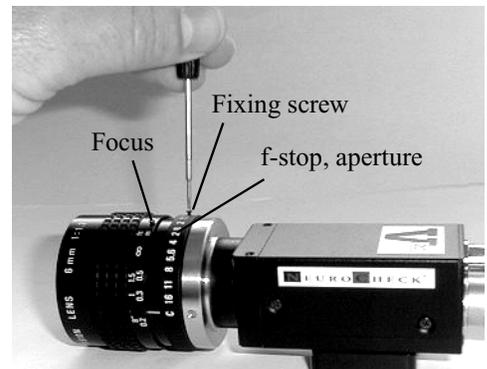


Choose **Adjust Cameras** from the **Tools** menu or click the depicted icon to call the Adjust Cameras function. If the input signal *Adjust cameras* was configured, the function can also be activated by this signal (see “Adjust Cameras” on page 37).



With the help of two tabs you can switch between live image and reference image. Using the marks in the reference image, you can adjust your camera position in live view. You adjust the brightness by changing the f-stop on the lens; here, too, the reference image serves as the model. If the image is out of focus, adjust the focus on the lens.

Both f-stop and focus should be re-locked after the camera has been adjusted.



## 2.1.6 Check Signal Connections

Please make sure that production equipment is stopped when testing the signal connections and that the superior control system is in manual mode.

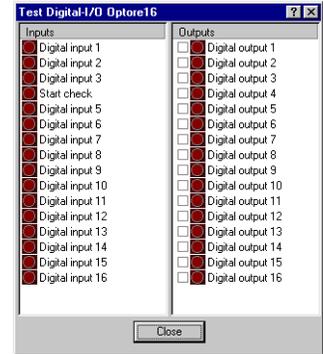
### Digital I/O Board

You can check the inputs and outputs of the digital I/O by choosing **Test > Digital I/O** from the **System** menu.



You can set the outputs by clicking the check boxes in the *Test Digital I/O* dialog box and you can then check at the control system whether the signals arrive.

You can apply inputs from the control system and check whether they are displayed in the dialog box.



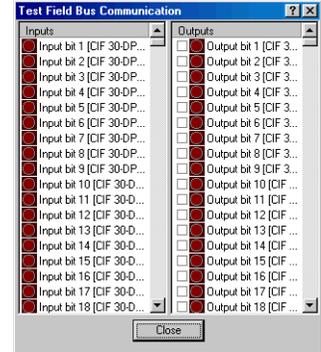
### Field Bus Board

You can check the inputs and outputs of the field bus board by choosing **Test > Field Bus Process Mapping** from the **System** menu.



You can set the outputs by clicking the check boxes in the *Test Field Bus Communication* dialog box and you can then check at the control system whether the signals arrive.

You can send signals from the control system to the inputs and check whether they are displayed in the dialog box.

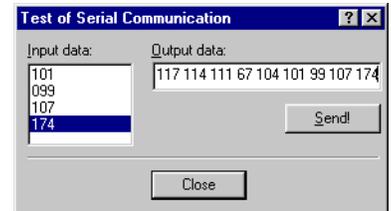


### Serial Communication

You can check the serial interface by choosing **Test > Serial Communication** from the **System** menu.

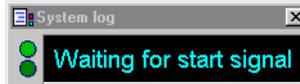


The dialog box *Test of Serial Communication* is displayed.



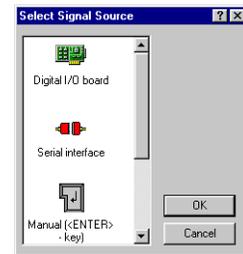
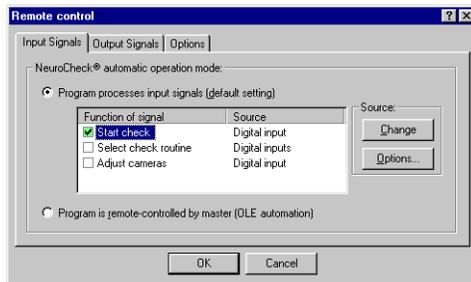
In the *Output data* field you can enter the decimal ASCII codes of characters to be sent by NeuroCheck. Separate the individual character codes by spaces. The *Send* button sends the characters via the serial interface.

The *Input data* field displays the ASCII character codes most recently received by NeuroCheck from the serial interface. Thus you can easily check data transfer in both directions.



If the result of the check of the signal connections yields no faults and NeuroCheck is still waiting for the start signal, you should check whether the correct communication interface is selected as the source for the start signal.

Choose **Remote Control** from the **System** menu.



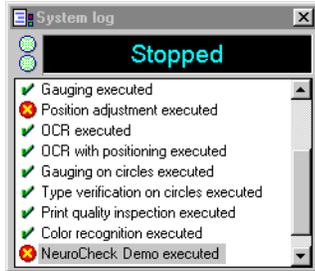
Switch to the **Input Signals** page in the **Remote Control** dialog box and select **Start check**. Click the **Change** button to open the **Select Signal Source** dialog. Check whether the correct signal source is selected.

It must not be set to **Manual<ENTER>** because in that case NeuroCheck will wait for the ENTER key to be pressed to start the check.

If necessary change the settings and confirm with **OK**.

## 2.2 Troubleshooting Tools

### 2.2.1 System Log Window

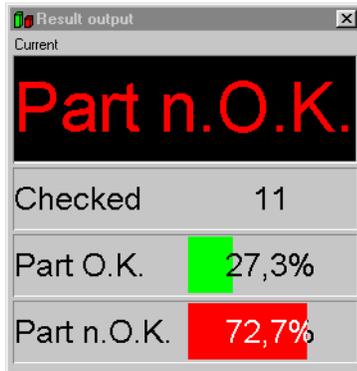


The system log window of the automatic screen gives you a first important hint, which check is reporting an error.

A red circle with a yellow cross marks the failed check, in this case *Position adjustment*.

### 2.2.2 Error Statistics

Furthermore, the NeuroCheck automatic screen offers you the possibility to have the error shares of the individual checks displayed in the result output window. You can also have several result output windows with different output categories displayed simultaneously.



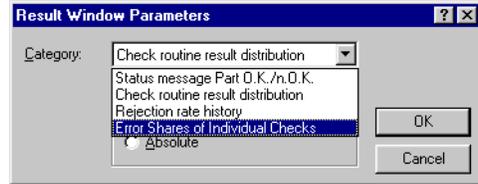
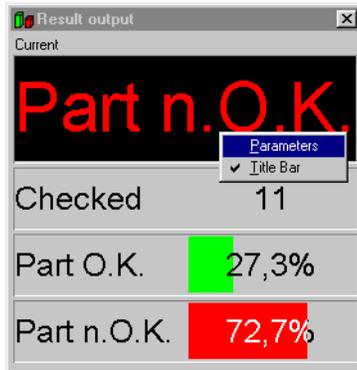
The result output window on the automatic screen looks like this by default. It shows the proportional distribution of the check routine results.

Usually, there is another result output window displaying the error shares of the individual checks.

If this is not the case, you can have the error shares displayed as follows:



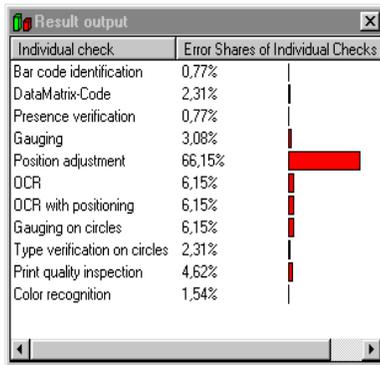
Switch to *Configure Automatic Screen* mode. Click the icon depicted on the left.



Right-click the result output window and choose *Parameters*. In the dialog now displayed, click the arrow to open the list; select *Error shares of individual checks*. Confirm with **OK**.



Switch back to automatic mode by clicking the depicted icon.



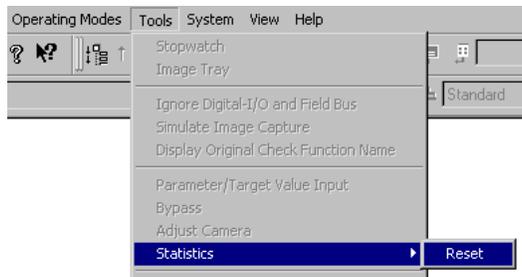
Now the result output window displays the error shares of all individual checks of the check routine.

It's easy to see that in this example the error share of the individual check *Position adjustment* is disproportionately high.

In the following error search, you can concentrate on this particular individual check.

How to step through an individual check in manual mode is described on page 66.

In order to reset the statistics, that means to set the count of inspected parts back to 0, you can choose the command **Reset** in menu **Tools > Statistics**



## 2.2.3 Debugging Screen

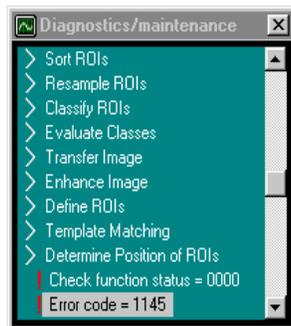
You can also supervise the behavior of a check routine online. Debugging output takes time and uses up system resources, which is why you should avoid it in normal operation. Since a check routine can manage any number of different screen layouts, you can choose a special layout for debugging purposes. If, of course, one has been created at all. How to create a debugging layout is described in section „Screen Layouts“ on page 17.

Change into *Configure Automatic Screen* mode.

Configure automatic screen



Select the debugging screen from the list box.

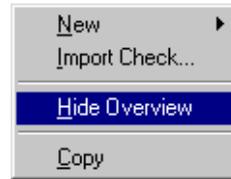
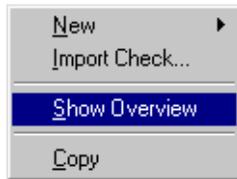


The Diagnostics/maintenance window lists every single check function executed during a check routine. The additional output of error and status codes helps the NeuroCheck support team to find the reason for your problem (see “Configuration of Automatic Mode” on page 12).

## 2.2.4 Check Routine Overview

The check routine overview window can be inserted into the bottom left window area in manual mode. It gives you a quick overview over important configuration properties of a check routine, e.g. the inputs and outputs used, image sources etc.

The window is displayed by right-clicking the empty editing area on the left side and selecting the **Show Overview** command from the context menu. It can be removed by selecting **Hide Overview** from the context menu.



Alternatively, you can use the **Check Routine Overview** command from the **View** menu.



The overview window displays the following properties of the check routine and its individual checks:

### Data Output

The overview window displays icons in each line representing the destinations which are used for output by functions within the individual check.

### Statistics

The overview window displays the number of the check functions in each individual check.

### Digital I/O

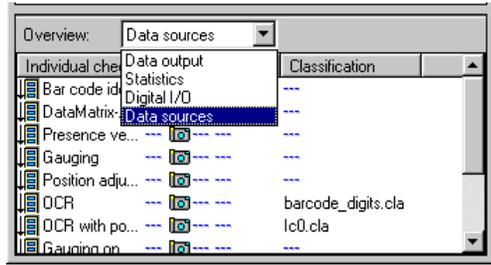
The overview window displays which inputs and outputs are used by the functions **Read Digital Input** and **Set Digital Output** within each individual check.

### Data Sources

The overview window displays the sources for image and classifier data.

Basically it consists of two elements:

- A list box from which you can select the property to be displayed in the overview window.
- A list with one line per individual check displaying the selected properties.



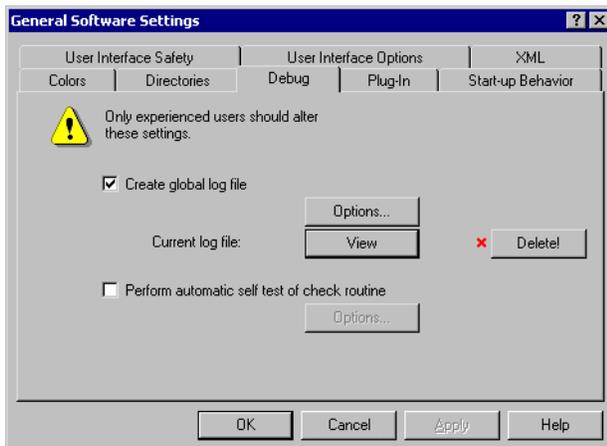
## 2.2.5 Protocol File

The **protocol file** is a very useful tool for solving problems with **NeuroCheck** start-up or automatic operation.

### Information about Automatic Operation



The dialog box is displayed by choosing **General Options** from the **System** menu.



For NeuroCheck to generate troubleshooting information during automatic operation, switch to the *Debug* page of the dialog box **General Software Settings**. Here you can make the appropriate settings.

If the check box *Create global log file* is activated, system log information such as name and activities of the executed check routine, date, time etc. are written into the NCMLOG.TXT file in the NeuroCheck installation directory. This information can help you to locate the cause of problems.

The *View* button opens WordPad with the log file so that you can read the log file without having to leave NeuroCheck.

You can delete the log file by selecting *Delete*.

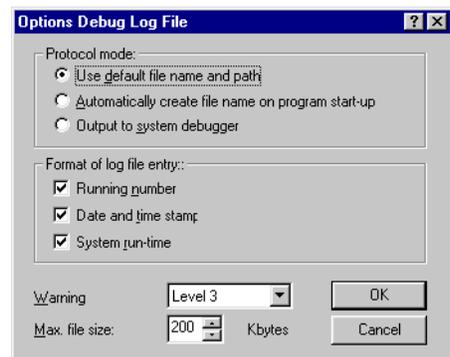


### Important:

Creating log files uses additional computer resources. This increases the execution time required for the visual inspection. Depending on the application, this can be a problem with short cycle times. We recommend to generate log files only when troubleshooting is necessary.

Clicking the *Options* button opens another dialog, in which logging mode and log file format can be selected.

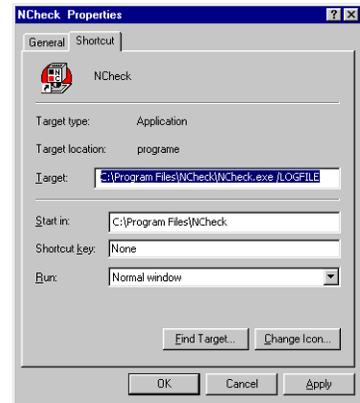
The warning level and the maximum size for the file can also be selected. When the file reaches this size, NeuroCheck overwrites the file again.



### Information about Start-up Behavior

The following function uses the same file as the above mentioned logging of automatic mode.

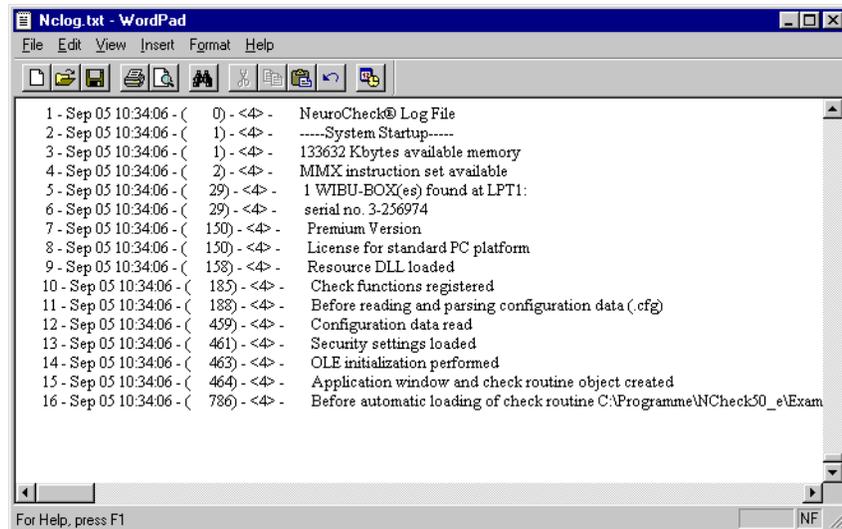
Using the command line option /LOGFILE, the start-up behavior of NeuroCheck can be logged. The protocol file NCMLOG.TXT in the installation directory records not only the current date and time, it also informs you whether the dongle and the correct license level were recognized and whether drivers and plug-in DLLs were loaded correctly.



The command line option can be given in the properties window of the NeuroCheck shortcut on the desktop or in the application folder of the Start menu.

From the context menu (right mouse button) select **Properties**; in the properties window go to the **Shortcut** page; and in the Target field add the command line option /LOGFILE.

NeuroCheck reports the system start-up in the log file.



For more information on this subject refer to the appendix of the NeuroCheck Training Course.

## 2.3 Software Optimization

### 2.3.1 Changing Target Values



parameter/target value input

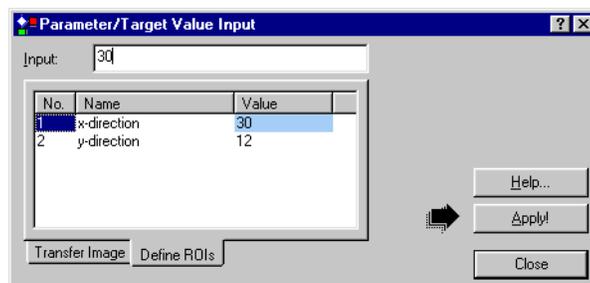
NeuroCheck enables the user to change published target values or to add or change measurements. How to publish target values is described in chapter „Data Integrity for your System“ on page 79.

Changes in the production process can thus be accommodated by optimizing the target values for certain functions without having to change the processing parameters themselves. To facilitate easy changes in such cases target values can be set directly in automatic mode. This is also possible in the runtime version of NeuroCheck.

Such changes should only be made by trained personnel.



By clicking the depicted icon in automatic mode, you can open the dialog for entering parameters and target values.



The parameters that can be set here relate to the check function *Define ROIs* from our example check routine (see appendix). By selecting the appropriate function, e.g. the x-direction of the ROI, the parameter value can be changed in the text field. Clicking the *Apply* button causes the new values to be used.

All check functions whose parameters and target values are published can be accessed using the tabs. Use the two arrows to browse the tab pages.

Please note that the possibility of parameter/target value input here can also depend on the current user profile. If your user profile does not permit changing of target values, the corresponding icon is disabled. For more information see “Security Profiles” on page 80.

## 2.3.2 Error Images

NeuroCheck makes it possible to save error images directly from the running process. The error images can be used to optimize the system and to reduce false alarms by loading them as bitmap files into the check routine.

With these images you can then determine why a check failed and thereby find out whether it is really a false alarm or a problem in the manufacturing process.

### Saving Error Images

A prerequisite for working with error images is that these images are saved. Saving of error images is usually activated by default.



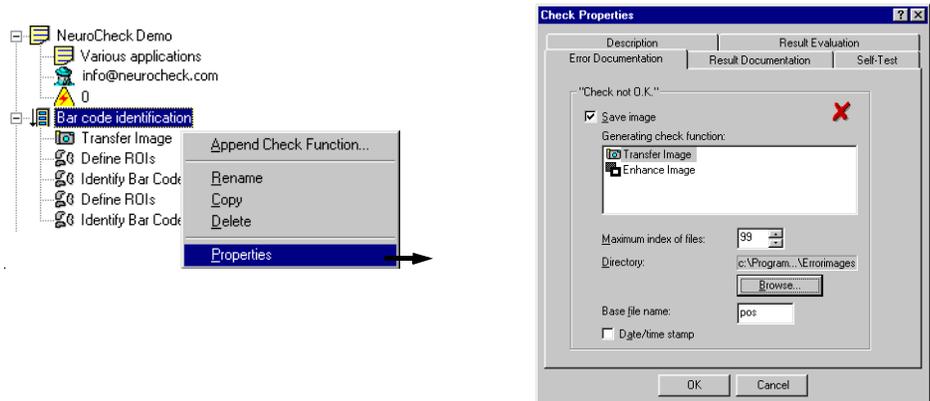
Depending on the application, this can exceed the allowed inspection time, since saving images requires time and thereby extends the overall duration of the inspection. In such cases, we recommend activating the saving of error images only when you want to do troubleshooting or optimization.

To activate the saving of error images, proceed as follows:

Right-click the appropriate check and select **Properties** from the context menu.

Alternatively choose **Properties** from the **Edit** menu.

A dialog box appears.



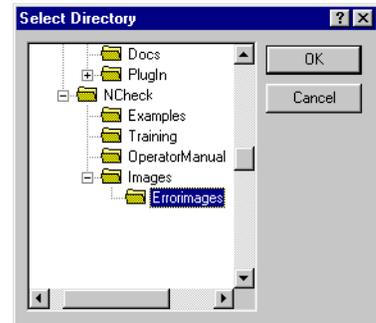
Click the **Error Documentation** page.

Activate the check box **Save Image** and select the check function that generates the image to be saved. Usually this is **Transfer Image**.

In the next field, enter the number of error images to be saved. This cyclical buffer can store up to 999 images. Select a number that suits your requirements (usually no more than 99 images)

Use **Browse** to determine the directory in which to store the error images.

We recommend to create a path Images\Errorimages in the NeuroCheck standard-directory.



## Loading Error Images



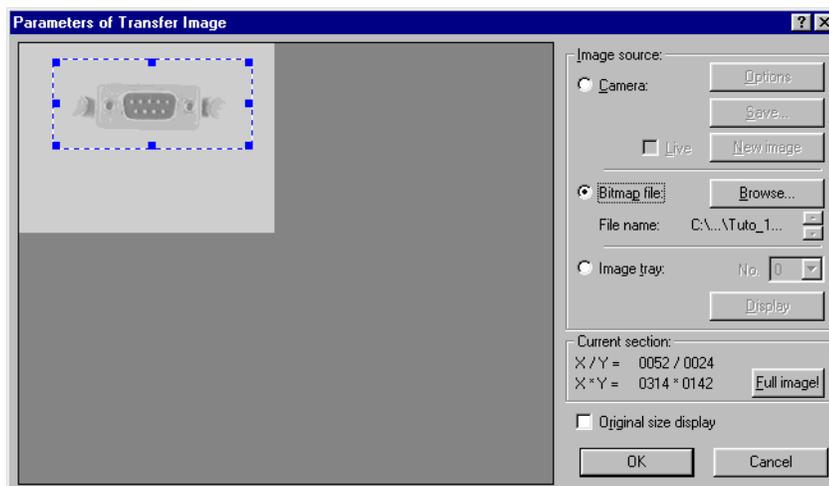
To load error images, switch into manual mode by clicking the depicted icon and open the appropriate individual check by clicking the “+” symbol.



By clicking the depicted icon, NeuroCheck is instructed to ignore all functions that expect signals via digital I/O. That way, inspection applications that are remote controlled via digital I/O can easily be edited without needing the whole manufacturing process including the PLC to create the necessary signals.



Select check function **Transfer Image** by clicking and open the corresponding parameter dialog by selecting the depicted icon.

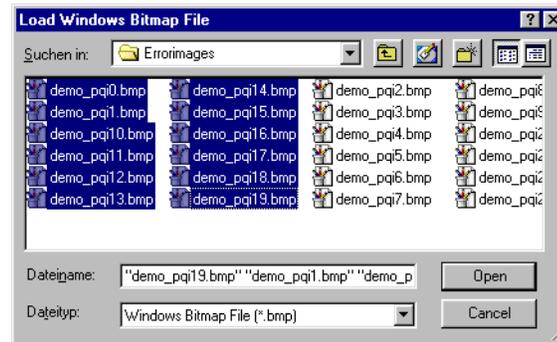


Select **Bitmap file**, then click **Browse**. Select the corresponding bitmap files from the error images folder.

You can select files individually



or in groups.



You can select the error images as a group by left-clicking the first file (in this example: demo\_pqi0 . bmp) and then left-clicking the last file (in this example demo\_pqi19 . bmp) while holding down the Shift key.

Leave the dialog box with **OK**.

If several error images are selected, they are processed cyclically, i.e. every time you click **Execute Check Function**, the next error image is loaded. To make identification of the error images possible, the name and path of the file are displayed above the result output area.



NeuroCheck offers you the possibility to switch the image sources of all functions **Transfer Image** from camera images to bitmap files using the **Simulate Image Capture** command. This way especially applications using several cameras can be easily edited. Execute this command by clicking the depicted icon. Then the bitmap files are loaded whose path was entered last.



Select the first check function and execute it using the depicted icon.



Single-step through the check functions using the icon depicted here.

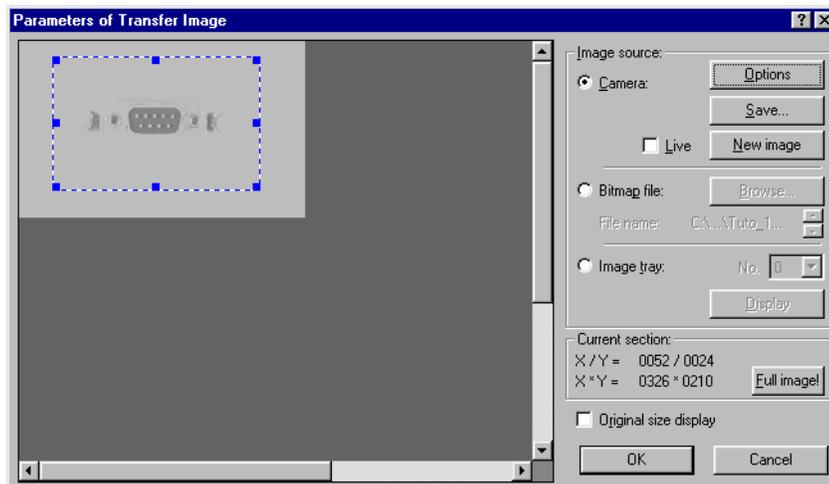
How to step through a check routine manually with the loaded error image, is described in detail in „First step:“ on page 66.

## Back to Automatic Mode

In manual mode you carried out the check routine step by step using the loaded error images. Now you want to switch back to automatic mode. Before doing so, make sure that the image source is switched from *Bitmap File* to *Camera*.



For this select the check function *Transfer image* and open the corresponding parameter dialog using the depicted icon.



Choose *Camera* as image data source and close the dialog with **OK**.



In case you activated the *Simulate Image Capture* command, deactivate it by clicking the corresponding icon again.

This is very important because otherwise the system does not use the live image in automatic mode but an image from a bitmap file.

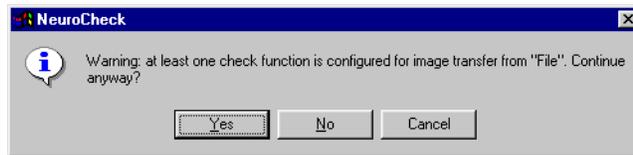


Click the depicted icon to suspend the *Ignore I/O* function.



Now you can switch to automatic mode.

If the following safety hint is displayed, the image source is still set to bitmap file for at least one check function.



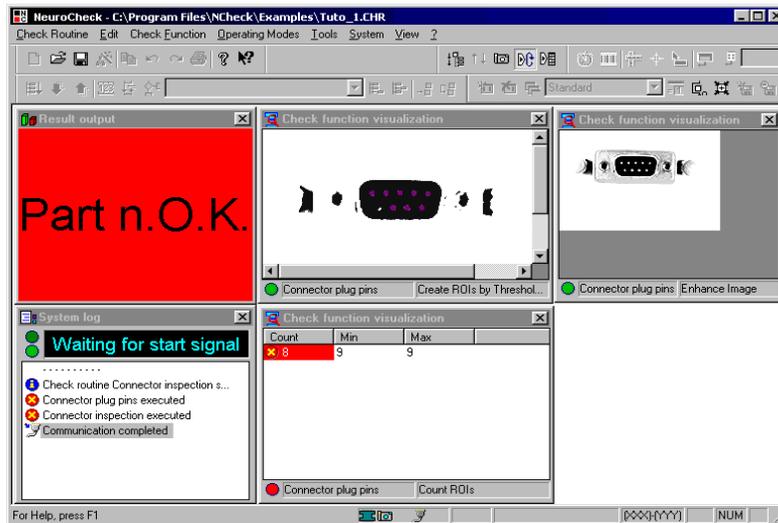
Click *No* and make the changes described above.

Especially for applications that use more than one camera, the overview window is extremely helpful to find the function whose image source is still set to *Bitmap* (see “Check Routine Overview” on page 55).

## 2.3.3 Troubleshooting Using the Check Routine Example

Here we will give an exemplary explanation of troubleshooting using the check routine described on page 29.

Let us assume the connector plug check routine issues the following **not O.K.** message:



A visual inspection of the plug does not yield any faults. It must be a false alarm.

### First step:

**Go through the check routine in manual mode step by step.**



To find the reason for the error, click the depicted icon to switch into manual mode.



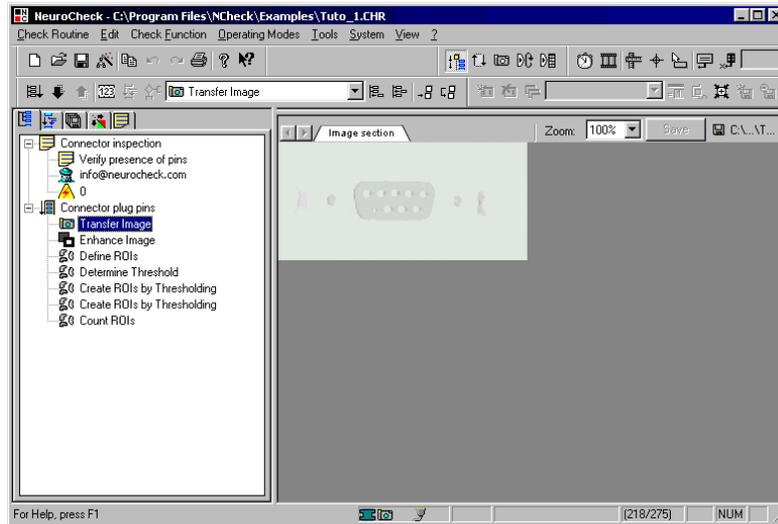
In the check function *Transfer Image* load the error images (as described in the previous chapter). Select the first check function and execute it using the depicted icon.



Single-step through the check functions using the icon depicted here.

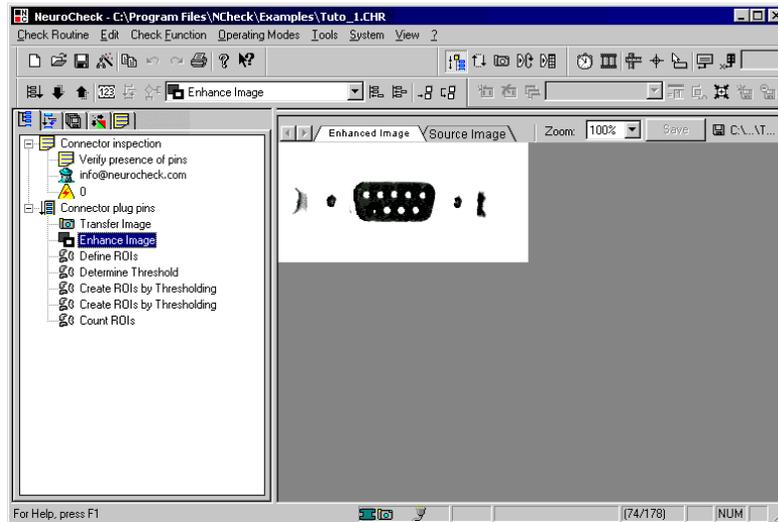
Back to the example:

## Transfer Image



Here you can already see that the input image is very bright and has low contrast. Let's step through the next check functions to understand what is happening.

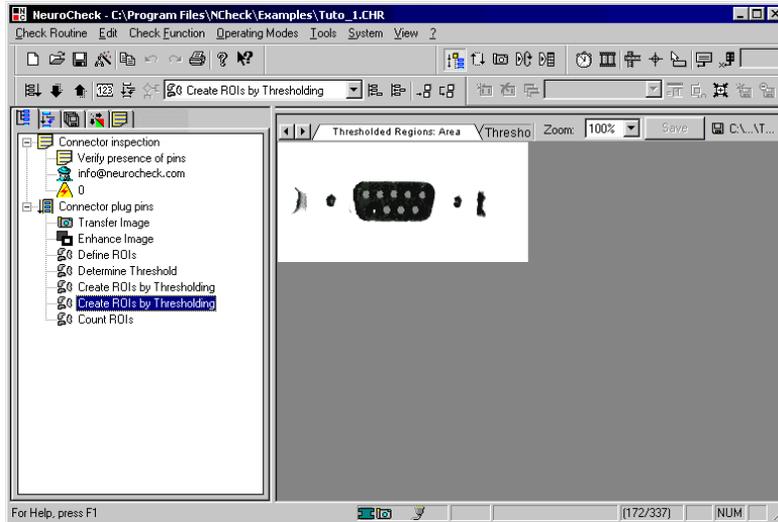
## Enhance Image



Here you can see that the plug pin on the bottom left is only discernible as a small white dot.

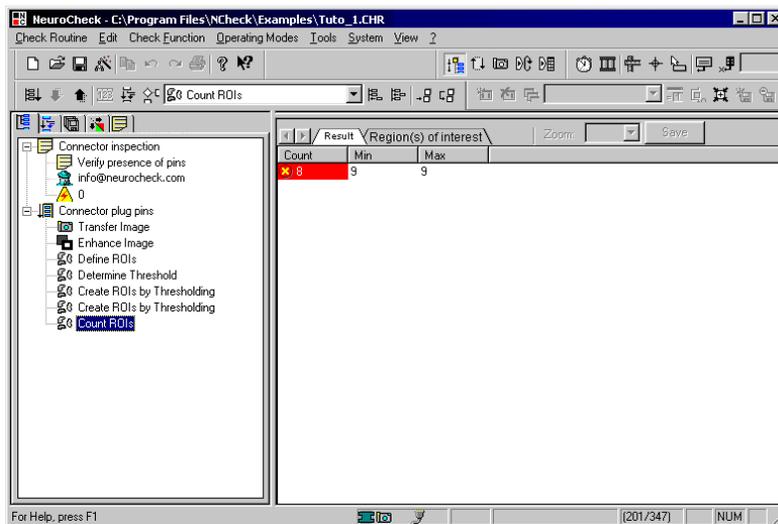
We'll skip the following three check functions since they are not relevant to our search for the error cause.

## Create ROIs by Thresholding



In this check function the white dot is no longer identified as a plug pin and therefore no longer taken into account in the following check function.

## Count ROIs



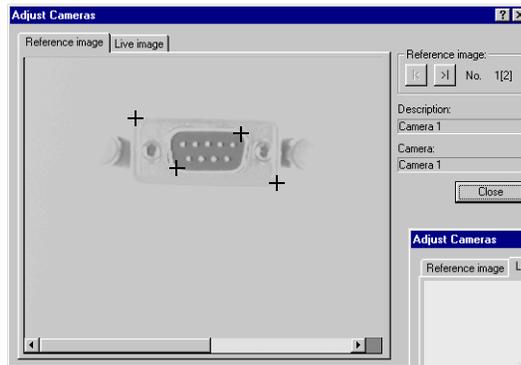
Of course, here a wrong number is then determined.

## Second step: Adjust Cameras Function

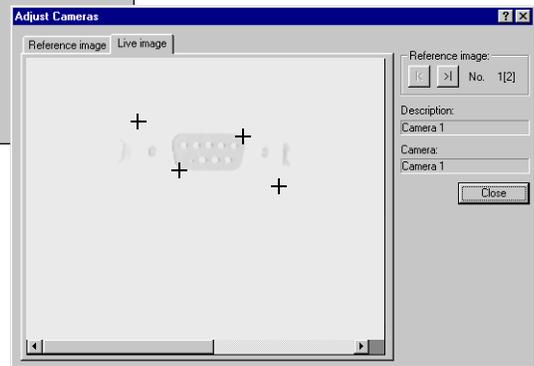
In the next step of the troubleshooting procedure compare the stored reference image with the current live image using the Adjust Cameras function.



Click the depicted icon as previously explained in Adjust Cameras.



Reference image



Live image

The comparison between reference and live image clearly shows that the live image is correctly positioned, but it is far too bright.

In this example the f-stop setting of the camera should be adjusted to solve the problem.



## 2.4 Hotline, Web site

If you cannot find a solution for your problem, NeuroCheck technical support is at your disposal both on the phone and over the Internet.

### NeuroCheck Technical Support:

Phone: +49 (0) 711 22 96 46 31

Fax: +49 (0) 711 22 96 46 59

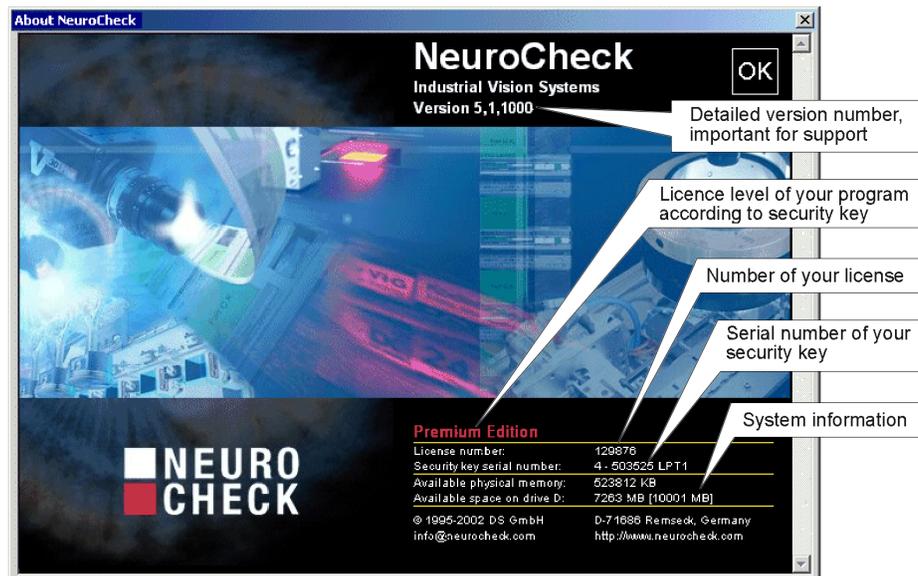
E-mail: [support@neurocheck.com](mailto:support@neurocheck.com)

<http://www.neurocheck.com>

For optimum support, please provide us with the complete version number of your NeuroCheck installation first.



You will find this information by choosing **About** NeuroCheck from the **Help** menu or by clicking the depicted icon.



The more detailed the information you can give us about your problem, the faster and more efficient the support we can give you. For example, creating a **Protocol file** is a very useful tool for solving problems with NeuroCheck start-up or automatic operation (see “Protocol File” on page 57).

If you have stored images pertaining to your problem, please include them with your check routine in your E-mail, preferably packed into a ZIP archive.

## 2.5 Remote Maintenance

We offer remote maintenance as an additional option. This requires the necessary software to be installed on your computer. We can then log on to your system over a phone line and solve your problem in situ. In this way, expensive and time-consuming service can often be avoided.



## 3 Getting Help on NeuroCheck

In this section, you will learn about other sources of helpful information available to you besides this setup manual and how to access them.

### 3.1 Online Help

Even the best user interface cannot answer every question; therefore, a comprehensive online documentation is especially important for an area as specialized as digital image processing. NeuroCheck saves you the time to look for answers in voluminous manuals by providing an online help system that makes the required information instantly available to you.

Online help is automatically installed together with the NeuroCheck program. Updated versions are available for download from <http://www.neurocheck.com>.

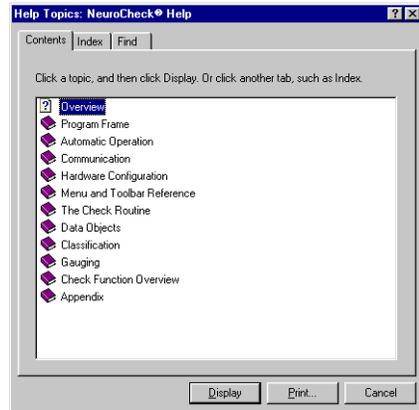
### Accessing Online Help

In NeuroCheck you can access helpful information in various ways.



Choose **Help Topics** from the **Help** menu to access the hierarchical help contents and the searchable index.

From there, you can reach all explanations and function references. You can browse through every chapter of the help system as though it were a book by using the appropriate buttons. Overview pages are another structural level above this reference information and help you to get to the desired information quickly.



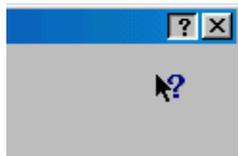
Many times you can obtain the help needed at that moment even more directly.



Help information for each element of the NeuroCheck user interface can be reached by clicking the depicted context help symbol, followed by a click on the user interface element in question.

### Help for Specific Parameters

Probably the most important way to access help information can be found in the dialog boxes, where settings for NeuroCheck as a whole and for individual image processing functions are made. Click on the question mark in the upper right corner of the title bar of the dialog box.

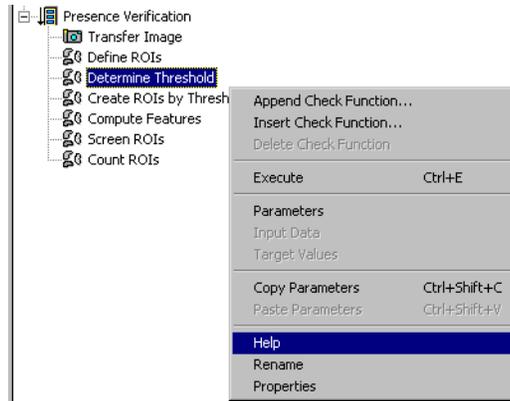


The mouse pointer changes into a context help cursor. With this help cursor, click on the control element for the parameter in question. As a result a small pop-up help window appears with a short explanation for the control element. It will disappear again when you carry out the next action in NeuroCheck, so you can continue to work as usual.

This way you can look up the meaning of each parameter without having to read a full-length explanation of the function in the online help or manual again.

## Function Descriptions

A helpful tool for the understanding of check routines is the function description of check functions. In manual mode, select a check function in the edit area and choose **Info** from the **Check Function** menu. You'll reach the same explanation when you right-click the function in the check routine window and choose **Info** from the context menu.



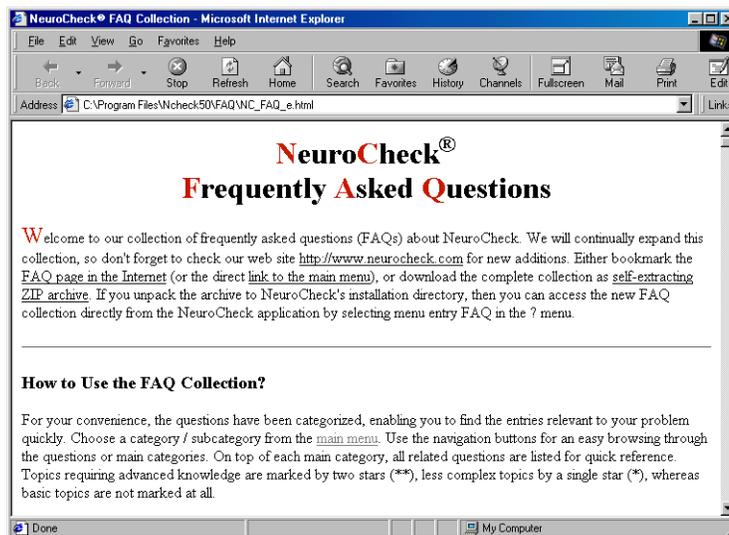
A help window appears with a complete description of the function with all its parameters.

## 3.2 Frequently Asked Questions

To complement the numerous information and help topics in the manual and the online help of NeuroCheck, there is a collection of frequently asked questions (FAQs) from users of NeuroCheck.



You can access this collection by choosing **FAQ** from the **Help** menu.



This collection of questions and answers contains tips and solutions for typical hardware and software problems that can help you in similar cases.

Our Web site (<http://www.neurocheck.com>) provides you with an up-to-date version of the FAQ collection that you can download at any time or read online (NC\_FAQ\_e.html).

## 3.3 Additional Information Sources

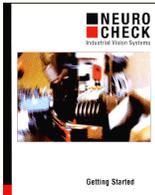
There is even more information about NeuroCheck. This page gives you an overview as well as a short description of each information source to help you choosing the appropriate one. If you are unable to locate the information you are looking for or have special questions, please contact your NeuroCheck dealer or the NeuroCheck GmbH (Web site: <http://www.neurocheck.com>).



### Readme

The Readme file contains helpful hints for installing and making your first steps with NeuroCheck.

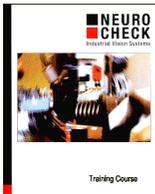
You will find a `Readme.txt` and `Readme.pdf` in the root directory of the NeuroCheck CD-ROM.



### Getting Started

This short manual gives an overview of the functionality of NeuroCheck and its application areas, describes the installation, and contains a tutorial on the configuration of check routines.

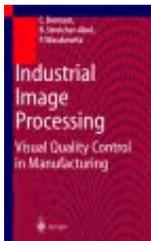
You will find the file `Getstart.pdf` in the `Extra\Documentation` directory on the CD-ROM; you can also download it from our Web site (<http://www.neurocheck.com>). A printed copy is included with every NeuroCheck edition.



### Training Course

The Training Course gives a step by step introduction into configuring check routines for different application areas.

A printed copy is included with the NeuroCheck Professional and Premium Edition.



### Industrial Image Processing

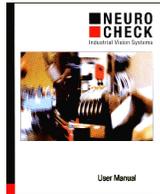
The book “Industrial Image Processing” provides you with a practical introduction into image processing. It focuses on the combination of procedures in an integrated image processing system. Using real life examples and utilizing the NeuroCheck software, it gives an introduction to the automated solution of industrial inspection tasks.

Published by Springer Verlag (Berlin, Heidelberg, New York), ISBN 3-540-66410-6. Also available in German.



## Industrielle Bildverarbeitung

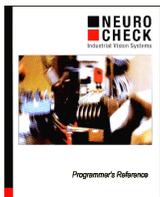
The book on visual quality control; also available in German! ISBN 978-3-642-13096-0



## User-Manual

The user manual gives a detailed description of all NeuroCheck functions.

A printed copy is included with the NeuroCheck Professional and Premium Edition.



## Programmer's Reference

The Programmer's Reference addresses primarily software developers and explains how to extend NeuroCheck with plug-in functions and self-developed communication drivers and how to control it via OLE automation.

You will find the file `ProgRef.pdf` in the `Extra\Documentation` directory on the CD-ROM; alternatively you can download it from our Web site (<http://www.neurocheck.com>). A printed copy is included with the NeuroCheck Premium and Professional Edition.

# 4 Data Integrity for your System

In this section you will learn

- how to protect your inspection system from unauthorized access and how to make it accessible for authorized personnel only,
- what features NeuroCheck provides for saving your data.

## 4.1 System Integrity

NeuroCheck contains several security options.

- With the help of **Password Protection** it is possible to protect the check routine from unauthorized access.
- With its comprehensive **User Profile System**, different access authorizations can be granted. This controls who is authorized to make changes.
- NeuroCheck enables the user to change **published target values** or to add or change measurements.

### 4.1.1 Password Protection

Open the dialog box for password protection by choosing **Password Protection** from the **Check Routine** menu.



It allows you to enter a password for the active check routine or to deactivate password protection. A check routine protected by a password cannot be saved, i.e. the version currently stored on the data carrier is protected against changes.

When password protection is deactivated, the dialog box contains two text fields. The new password is entered in the text field *Password*. For security reasons the characters of the password are displayed as asterisks. Then the password has to be confirmed by entering it again in the text field *Confirmation*. Only after correct confirmation the **OK** button will be enabled.



When password protection is active the dialog box displays only the text field *Password*. By entering the correct password and confirming with **OK**, password protection is deactivated. The **OK** button will be enabled only if the correct password has been entered.



## 4.1.2 Security Profiles

In addition to protecting individual check routines by using the password protection dialog, NeuroCheck offers you the possibility to set up any number of user profiles. The system administrator can set access authorizations for each user profile, thereby disabling certain program functions. This system allows OEMs or production supervisors to protect their installed applications against any unauthorized use.

### Structure of the Security Profile System

For maximum security the system of security profiles is managed through a combination of dongle programming and a password file. The fact itself that a NeuroCheck installation is password-protected is encoded in the dongle, the current passwords and the access authorizations are stored in a password file in the NeuroCheck directory.

### Establishing a Security Profile System

To set up security profiles choose **Security Profiles** from the **System** menu.



The first dialog box appears.



Select **Add** to create the first security profile.

Note that at least one security profile needs to own system administrator rights to make adding, editing or removing security profiles and passwords possible.

Therefore, you will first establish a system administrator profile. Choose any name. The check box **System Administrator** must be active.

For security reasons, the password has to be entered twice (all password dialogs are case insensitive).

On the following pages access authorizations are granted. The system administrator can determine the authorization for each user profile (for details refer to the user manual).

On the last page of the Security Wizard dialog, a system administrator can activate logging of actions carried out under the current security profile. Format and extent of the data to be logged is set in **Options**.

Add more security profiles by selecting **Add**. Make sure that the check box **System Administrator** is only activated for the person responsible and other authorized people. Deactivate the check box for all other users.

## Start-up Procedure of a Protected Installation

When starting NeuroCheck, the stored security profiles and their passwords are read from the dongle. Then the most recently used security profile is activated. This ensures that no one can enter a different security level without having the correct password.

## Removing System Password Protection

Leaving the **Security Profiles** dialog while no security profile is activated in the list view removes password protection. The dongle is reprogrammed. Only a system administrator has the right to do this.



## Switching Security Profiles

The current security profile can be changed by selecting a new profile from the list box in the Extra toolbar.



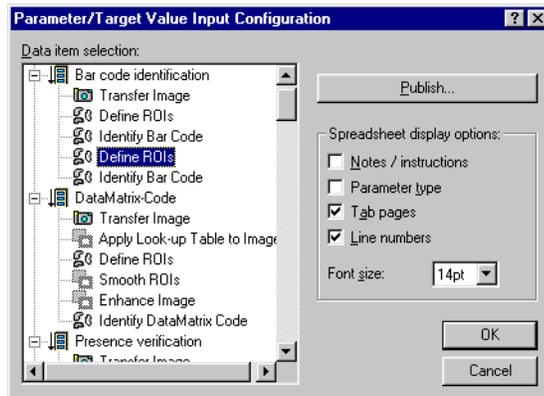
Depending on the access rights of the new security profile this may involve a change of operating mode (for example: if the security profile is switched in manual mode and manual mode has is not allowed for the new profile, NeuroCheck will enter automatic mode). Unless the current user has system administrator rights the **Security Profile Password** dialog asks for the password for the new profile.

### 4.1.3 Publishing Target Values

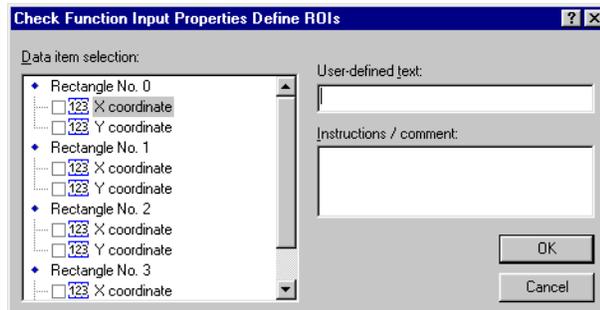
To accommodate changes in production easily, target values must be published for editing in automatic mode. If this was not already done during application development, the system administrator can publish the target values as follows:



To publish target values choose **Data Input > Parameters/Target Value Input Configuration** from the **Check Routine** menu.



Select those check functions in the dialog box **Parameter/Target Value Input Configuration** whose target values are to be accessible in automatic mode and click **Publish**.



Now select those data elements that you want to publish.

In addition you can enter a text and comment. This can be helpful later on for the operator.

**Note:** The above mentioned steps are only possible when publishing the target values has been allowed for the current security profile in the security wizard reached from the **Security Profiles** dialog (see section above).

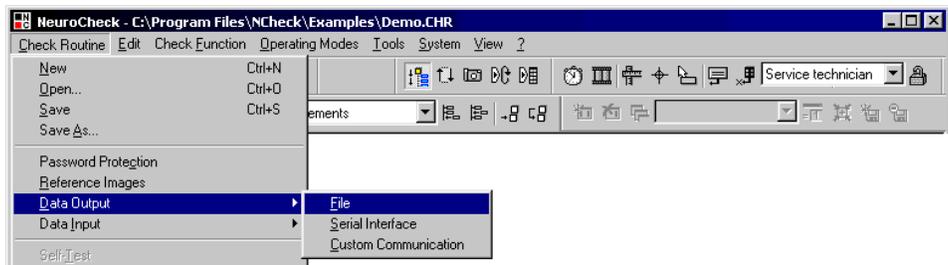
## 4.2 Saving Data

### 4.2.1 File Output

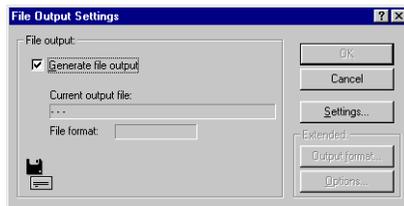
Wherever it is useful, NeuroCheck functions allow for writing result data to files. This includes both measuring data and check results; the output data can be specified for each function separately. Thus NeuroCheck meets the requirements of modern quality management for comprehensive inspection records.



To configure the output of result data into a file, you have to switch to manual mode by clicking the depicted icon.

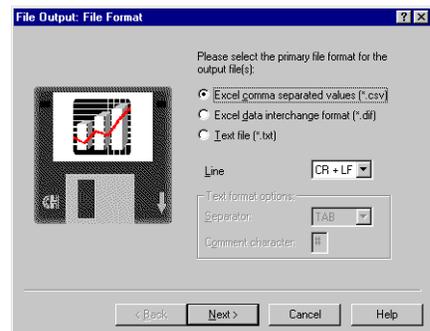


Choose **Data Output > File** from the **Check Routine** menu.



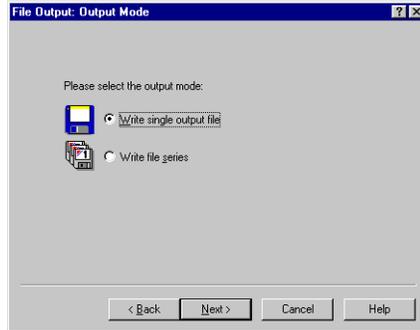
Activate the check box **Generate File Output** in the **File Output Settings** dialog box. Now the other buttons are active.

Click **Settings**.



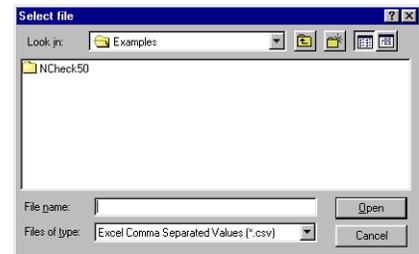
On the first page you select the basic file format. The preselected CSV (comma separated value) format is a standard data exchange format understood by most spread-sheet programs, e.g. Microsoft Excel.

Simply click **Next** here.

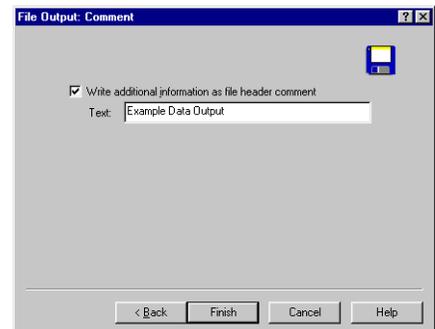


In the output mode dialog you can choose between a single output file or a series of files. The default setting is *Write Single Output File*. Select the desired setting and click *Next*. Click the *Browse* button in the next dialog.

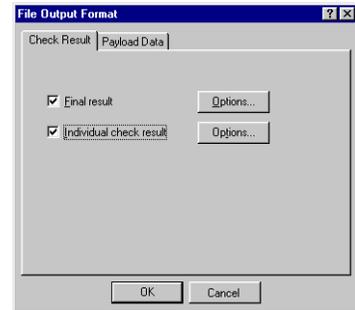
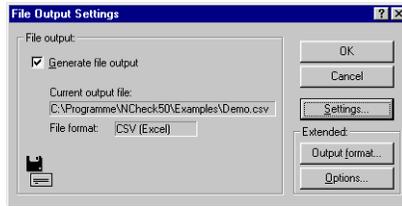
A file selection dialog box appears. Here you can enter the name and path of your output file. The output file can be on any storage medium, also on a network drive. Leave the dialog with *Open*.



Click *Next* to open the dialog for the commentary entry. If you activate the check box *Write additional information as file header comment*, you can enter a commentary into the text field that will be written at the beginning of a file for easier identification.



After leaving the wizard with *Finish*, the **File Output Settings** dialog will display the select file name – possibly abbreviated – and the file format.



Click the **Output format** button to open the dialog box **File Output Format** to set format options.

It contains two tabs to set various aspects of the result value output format:

**Check Result:** This page sets options for the output of check routine and individual check results.

**Payload Data:** This page sets options for the output of the results from individual check functions.

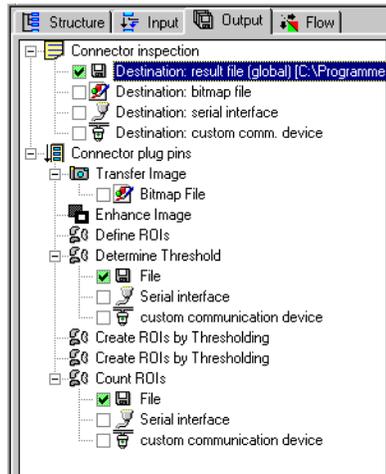
This dialog is opened by clicking **Options** in the **File Output Settings** dialog. It allows you to enter settings for the global control of data output into files, such as whether a record is written for each inspection cycle or only when there is an error, or to limit the file size.



## Data Output of Check Functions



Data output of individual check functions is activated on the **Data Output** editing page. By clicking the depicted tab, you can switch to the appropriate page.

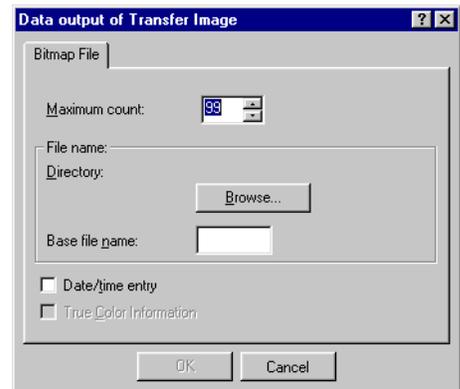


Data output is activated globally by the steps described above. Now you can select the data output for the various check functions by clicking the check boxes.

The output of a bitmap file is also possible. For this select **Destination: bitmap file** globally and then **Bitmap file** at the **Transfer Image** check function.

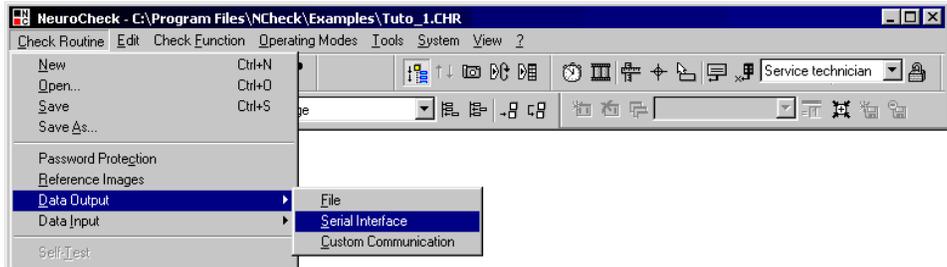
The following dialog box appears:

Enter the desired path with **Browse** and confirm with **OK**.

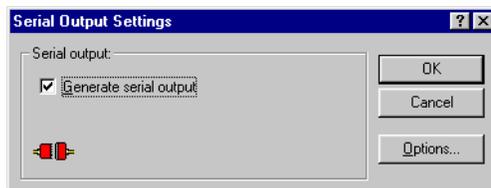


## 4.2.2 Serial Data Communication

Similar to logging inspection data to a file, NeuroCheck allows the output of result data via serial interface using a fully documented protocol with error detection by check sum or CRC-32.



Open the **Serial Output Settings** dialog box by switching to manual mode and choosing **Data Output > Serial Interface** from the **Check Routine** menu.



If **Generate Serial Output** is activated, result values will be sent over the serial interface. A prerequisite is that the serial interface is registered in the device manager (see “Device Manager” on page 43).

Using **Options** you can select additional information to be added to the result values of the check functions during transfer (for further information please refer to the user-manual).

For information about data format, test and configuration of the serial interface see „Serial Communication“ on page 51.

### 4.2.3 Custom Communication Interfaces

The NeuroCheck custom communication interface provides functionality similar to the serial interface. This functionality is implemented by means of a DLL driver typically provided by the supplier of the communication device. For more information on the custom communication interface, please refer to the Programmer's Reference.

### 4.2.4 Disc Image

Using disc imaging (Drive Image), you can store a compressed image of an entire hard disk or of individual partitions on CD-ROM. In case of data loss, the image file can be used to recover and restore data. Thus a disc image is an ideal backup medium to quickly and safely restore data lost because of a damaged hard disk.

## 4.2.5 Uninterruptible Power Source (UPS)



Optionally, an uninterruptible power source can be installed into the system computer to prevent data loss due to power failures.

In case of under voltage or power failure, the UPS supplies power to the system.

During regular power supply operation, internal filters serve as mains overload filter and effectively prevent damage because of power surges. This way the destruction of important data as well as damages to the hardware can be avoided and system lifetime is prolonged.

In case of excess temperatures (more than 105° C), the internal temperature control raises an alarm by activating the red excess temperature LED and giving an acoustic signal.

When the computer is started, the UPS is activated automatically, and when the computer is switched off, the UPS switches itself off within 3 seconds.

### **UPS Management Software**

The installed UPS management software causes a warning to be displayed on the screen in case of power failure; open files are automatically saved. After automatic saving is completed, the UPS switches off.



# 5 Maintenance and Care

## 5.1 Maintenance Instructions

### Every other week

Check for pollution:

- Lens
- Lighting

If required, clean with oil-free pressurized air or special lens cleaning cloth.

### Every four weeks

Check for good fixation (handle carefully, especially with coarse tools!):

- Camera
- Lighting

Afterwards, check correct position with the help of the Adjust Cameras (see “Adjust Cameras” on page 48) function.

### Every other month

Check for pollution:

- Dust filter of PC fan

## 5.2 Service Pack

The service pack is a program that updates the NeuroCheck version on your computer. It fixes bugs and provides new functionality. You can download the service pack free of charge from our web site at any time.

## 5.3 Update

Software can never really be “finished”, there are always new ideas and extensions. Therefore, the latest version of NeuroCheck is always available on our web site. Please note that version 5.1, for example, does not accept a dongle of version 5.0 or earlier. For an update, the dongle has to be re-programmed. Please contact NeuroCheck GmbH or your NeuroCheck dealer for details regarding an update to a newer version.

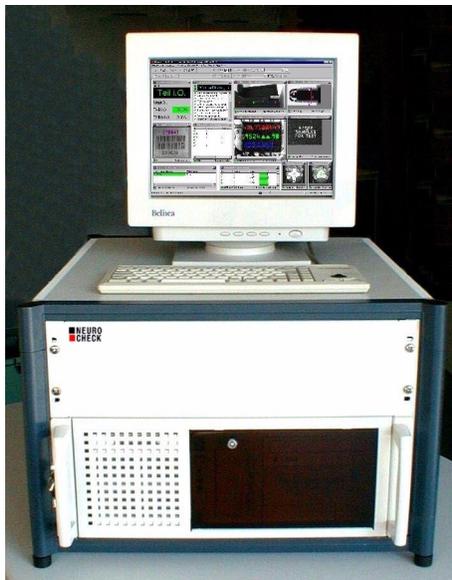
## 5.4 Upgrade

An upgrade from a lower to a higher license level is possible at any time. For example, you can upgrade a Runtime Edition to a Professional or Premium Edition.

## 6 Appendix

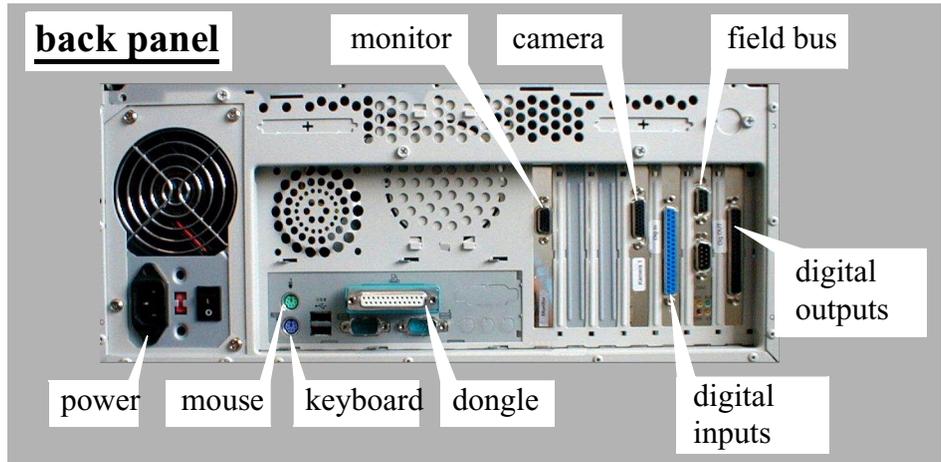
This appendix provides you with information about complete hardware setups as well as individual hardware components, and contains a checklist for troubleshooting as well as an exemplary check routine.

### 6.1 Standard Industrial PC



Standard industrial PC in 19" housing with external monitor.

Housing measurements (W x H x D):  
560 x 370 x 600 mm



Typical back panel of a 19" industrial PC

## 6.2 Compact Industrial PC



Industrial PC in a compact housing (protected according to German IP65 standard) with integrated TFT monitor as stand-alone solution.

Housing measurements (W x H x D): 520 x 480 x 260mm

## 6.3 PC Camera



The PC camera has an integrated processor; thus it is a PC and camera in one. Because of the simple setup with highly integrated standard PC components, it provides a compact and reliable solution for visual inspection tasks.

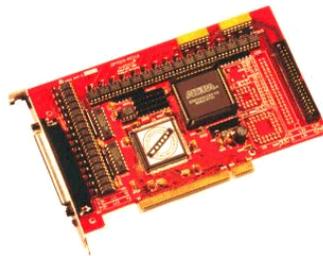
Applications can be developed on a standard PC and easily transferred to the PC camera. It is also possible to develop the application directly on the PC camera.

The PC camera has an interface for peripheral equipment such as monitor (the PC camera can be operated without a monitor), keyboard and mouse. Both parallel port and network connection are provided. A digital I/O is provided with eight electrically decoupled inputs and outputs each to control external processes.

The PC camera contains an integrated network interface card. Both communication and data backup can be realized in a convenient way.

By default the system has a camera resolution of 640 x 480 square pixels. Higher resolutions up to 1280 x 1024 pixels are available upon request.

## 6.4 Digital I/O Board



The digital I/O board offers 16 digital inputs and 16 digital outputs; inputs and outputs are electrically insulated by means of opto-couplers. All opto-coupler inputs and outputs also have TAZ diodes as protection against power surges. The output opto-couplers are

connected to the 37-pin D-sub connector mounted on the slot cover of the board itself. The input opto-couplers are connected to a header connector on the board; from there, a ribbon cable leads to another 37-pin D-sub connector on a separate slot cover.

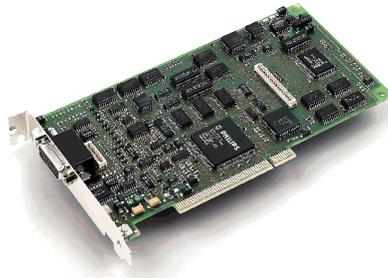
## 6.5 Field Bus



The field bus board is used to connect different stations or work cells on a manufacturing line or in an entire plant.

NeuroCheck is integrated into your manufacturing process via PROFIBUS-DP.

## 6.6 Frame Grabber



The frame grabber is the interface to the video camera. The image is read from the camera and stored until it is read by the image processing program.

NeuroCheck supports simultaneous operation of as many frame grabbers as the number of PC slots allows. Frame grabbers can be of different types and from different manufacturers, e.g. in order to use line-scan cameras, analog area scan and color cameras at the same time.

## 6.7 Cameras



The following camera types are available:

- Video cameras according to CCIR/EIA standard for non-moving parts.
- Triggered progressive scan cameras for parallel image capturing and processing in high-speed systems.
- Line-scan cameras for large or rotating objects.
- Digital area-scan cameras for high-precision measuring.
- Color cameras (PAL/NTSC).
- FireWire-Cameras (IEEE 1394)

All connected cameras can be individually named. These names are used throughout the program; it is therefore not necessary to remember that the camera showing the right side of the spark plug on the fourth cylinder is connected to the second input of the first frame grabber. Instead, the camera is simply given an appropriate name. Furthermore, a separate reference image can be stored for each camera. These reference images are used to adjust the system in automatic mode.

If the frame grabber allows the setting of input parameters, these can be saved in a camera setup file, which can be exchanged among NeuroCheck installations. Camera setup files can be easily documented when they are written out as text files.

## 6.8 Dongle and License Levels

The license level is encoded in the security key (dongle). It is connected to the parallel interface (printer port) of the system computer.



The following editions or license levels of NeuroCheck are available:

### Premium Edition

The Premium Edition provides complete functionality for configuring check routines in manual mode and full hardware access, i.e. several cameras, digital and serial communication. In addition, the Premium Edition offers extensibility by plug-in functions, custom communication interface drivers and OLE automation. The Premium Edition can be protected against unauthorized use (see section „Security Profiles“ on page 80 for details).

### Professional Edition

The Professional Edition is identical with the Premium Edition with the exception that check routines with plug-in functions cannot be configured. The Professional Edition can load and execute check routines with plug-in functions, but it cannot create them.

## **Runtime Edition**

The Runtime Edition is intended for the duplication of completely configured inspection applications. It has complete image processing, hardware access and extension functionality, but restricts operation to automatic mode. No configuration of check routines or system parameters is available in a runtime version. Reconfiguring a check routine requires exchange of the runtime security key against a Professional or Premium security key and restarting the software. To buy a Runtime Edition, you must own at least one Professional or Premium Edition.

## **Demo**

NeuroCheck automatically runs as a demo version when the security key is removed. In this version, no hardware access is possible. There is no communication, remote-control or extension functionality. This version is intended for evaluation purposes only. Regular use of a demo version in an image processing laboratory or in an automated visual inspection system is illegal. Utilization of results obtained by using a demo version in a technical or scientific publication other than a software review violates the copyrights of NeuroCheck GmbH.

## 6.9 Troubleshooting Check List

This section can serve as a check list for troubleshooting. It summarizes chapter „Process Optimization and Troubleshooting“ on page 41 in a shorthand fashion and is intended as an on-site memory aid for setup personnel after studying this entire manual. It is also available electronically as a PDF file on the NeuroCheck installation CD-ROM and can be downloaded from our web site. We recommend having a hardcopy of this check list ready to hand at the visual inspection system.

### Hardware Inspection

#### Visual inspection of cameras, lenses and lighting

Check

- **Lighting** for function and brightness.
- **Connectors** on the back panels of the cameras.
- **Cameras and lenses** for
  - damages,
  - dirt,
  - blocking objects.

#### Status Bar



Check the status bar. You'll find it on the bottom of the NeuroCheck window. It tells you whether the necessary hardware components are available in the system and have been recognized.

The icons indicate:



- Dongle



- Image processing board (frame grabber)



- Digital I/O board



- Serial interface



- Field bus board

Security key and frame grabber (camera icon) are always required. I/O board, serial interface and field bus may be required, depending on the configuration of your inspection system.



### Live Image

Check whether there is a suitable live image available.



### Adjust Cameras

- Adjust camera position using the marks in the reference image.
- Adjust brightness by changing the f-stop setting on the camera lens.
- Set the focus using the focus ring on the lens.
- After adjustment, re-lock f-stop and focus.

## Check signal connections

Please take care that:

- Production equipment is at stand-still during testing,
- Control system is in manual operating mode.

Check inputs and outputs of **digital I/O** and/or **field bus board** by choosing **Test** from the **System** menu and selecting the appropriate board.

- **Set outputs:** click the check boxes in the dialog to set outputs. Check transmission of the signals on the control system.
- **Check inputs:** set inputs from the control system. Check in the dialog box whether they are recognized.

You can check the **serial interface** by choosing **Test > Serial Communication** from the **System** menu.

- In the **Output data** field you can enter characters to be sent by NeuroCheck as decimal ASCII values.
- The **Input data** field displays the ASCII character codes most recently received by NeuroCheck from the serial interface.

## Signal Source

Check whether the signal source for the start signal has been set to the correct communication interface.

Choose **Remote Control** from the **System** menu.

- Select **Start check** on the **Input Signals** page in the **Remote Control** dialog box.

- Click *Change* and check whether the correct signal source is selected.

## Troubleshooting Tools

### System Log Window

In automatic mode, this window displays the following information:



- Green check mark: individual check successful.
- Red circle with yellow cross: individual check failed.

### Error Statistics

The result output window can display the failure share of the various individual checks.



Change into *Configure Automatic Screen* mode.

- Right-click the result output window.
- Choose *Parameters*.
- Select *Error Shares of Individual Checks* from the list.
- Confirm with OK.



Switch back to automatic mode by clicking the depicted icon.

### Debugging Screen

The Diagnostics/maintenance window lists every single check function executed during a check routine.



- Change into *Configure Automatic Screen* mode.
- Select the debugging screen from the list box.

### Check Routine Overview



The check routine overview window can be inserted into the bottom left window area in manual mode.

- Right-click the empty edit area on the left.
- Select **Show Overview** from the context menu (the overview window can be removed with the **Hide Overview** command.).

### Protocol File

The **protocol file** is a very useful tool for solving problems with NeuroCheck start-up or automatic operation.

- Choose **Options** from the **System** menu.
- Switch to the *Debug* page of the dialog box.

- The **View** button opens WordPad with the current log file (see „Protocol File“ on page 57 of the Operator Manual for information about configuring NeuroCheck to create a log file).

## Software-Optimization



### Changing Target Values

To optimize inspection system performance, you can change target values directly in automatic mode. Such changes should only be made by trained personnel.



- Configure NeuroCheck to ignore all functions expecting digital I/O signals.



- Switch to manual mode and display the structure of the individual check in question by clicking the “+” icon.



- Select check function **Transfer Image** by a single left mouse-click and open the corresponding parameter dialog.

- Select **Bitmap file**, then click **Browse**. Select the corresponding bitmap files from the error images folder. Leave the dialog box with OK.



- Select the first check function and execute it using the depicted icon.



- Single-step through the check functions using the icon depicted here.



### Important:

Before switching back to automatic mode:

- change the image data source back from **Bitmap file** to **Camera** and
- switch off the **Ignore Digital I/O** functionality.



### NeuroCheck Technical Support:

Phone: +49 (0) 711 22 96 46 31

Fax: +49 (0) 711 22 96 46 59

E-mail: [support@neurocheck.com](mailto:support@neurocheck.com)

<http://www.neurocheck.com>

## Maintenance Instructions

### Every other week

Check for pollution:

- Lens
- Lighting

If required, clean with oil-free pressurized air or special lens cleaning cloth.

### Every four weeks

Check for good fixation (handle carefully, especially with coarse tools!):

- Camera
- Lighting

Check correct position using the Adjust Cameras function (see “Adjust Cameras” on page 48).

### Every other month

Check for pollution:

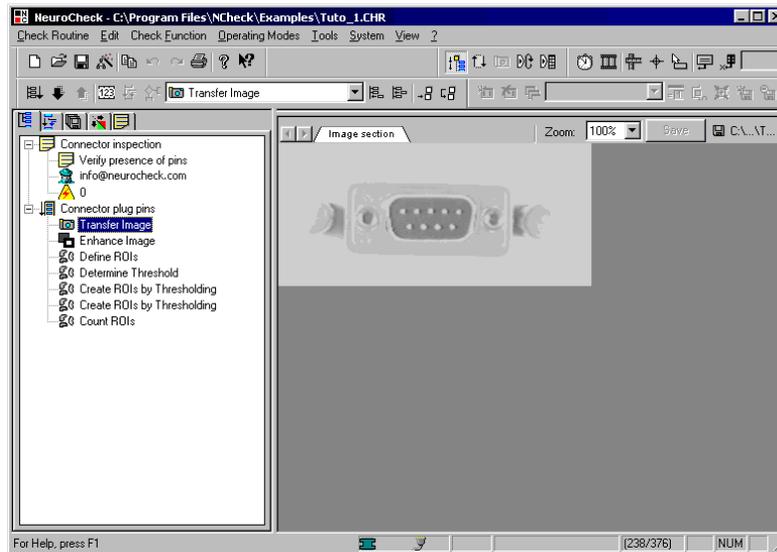
- Dust filter of PC fan

## 6.10 Check Routine Example

Now we want to go through a simple check routine step by step to describe the function of the check functions and the pertaining parameter setting in an exemplary fashion.

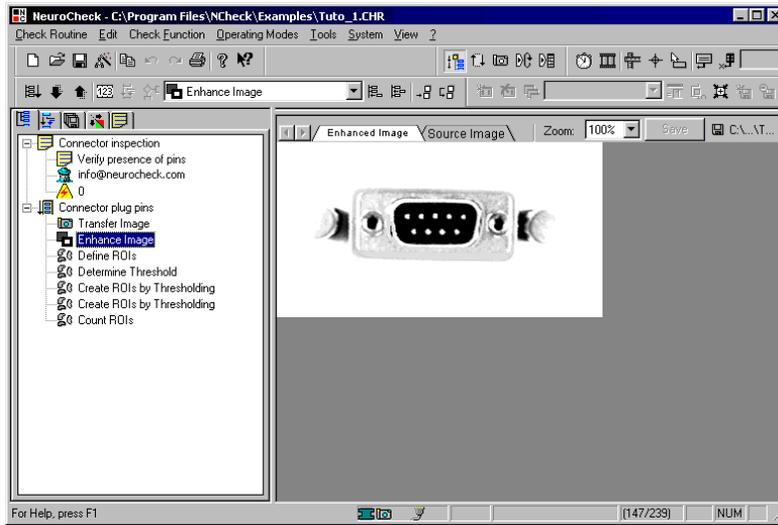
We'll use the inspection of a plug that is tested for the presence of the contact pins.

### Transfer Image

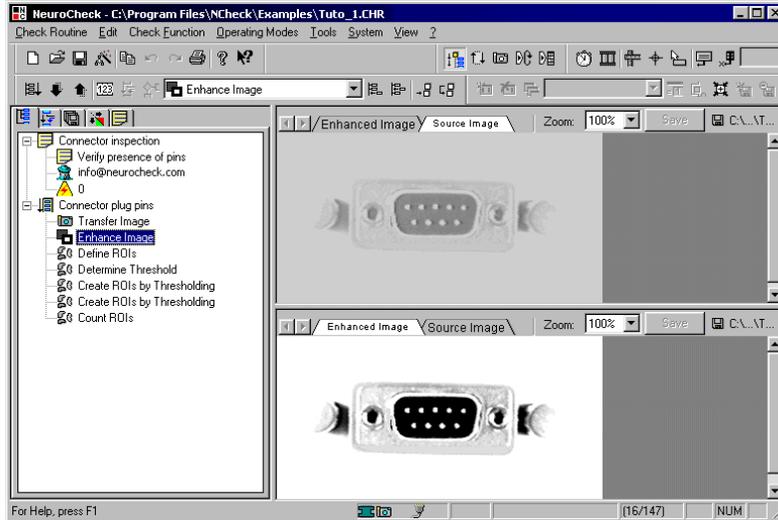


The first check function transfers an image into the memory of the computer. Only there the image can be processed thus this function is a prerequisite for the use of most check functions in NeuroCheck.

## Enhance Image



Since the input image used has but poor contrast, the check function *Enhance Image* is used to improve contrast.



## Display Options

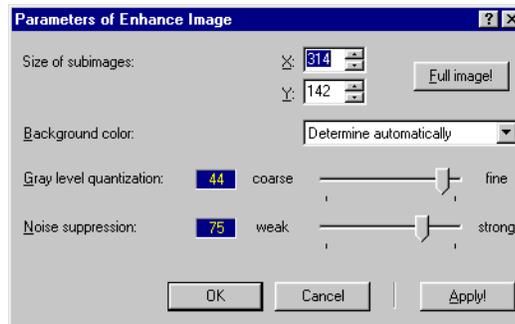
A closer look at the right window pane of the NeuroCheck window will reveal a double frame on top. Keep the left mouse button pressed and pull the frame border down. Now you'll see the original input image on top and the enhanced image on the bottom. Above

each window area is a bar with control elements for setting display options and zoom levels for the window area.

This option is intended to compare between the original input image (poor contrast) and the enhanced image.

## Parameters of Enhance Image

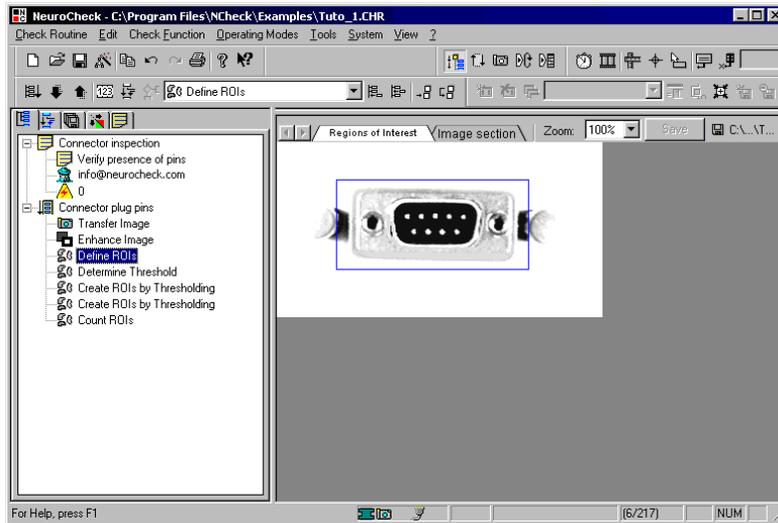
The parameter dialog of the function is opened by choosing **Parameters** from the **Check Function** menu or by clicking the depicted icon when the **Enhance Image** function is selected in the tree view.



The function makes it possible to improve the contrast of different image areas in relation to lighting changes. Since the image in our example is rather uniform, an integration area over the entire image was created by clicking the **Full Image** button.

The enhancement is then carried out evenly over the entire image.

## Define Regions of Interest



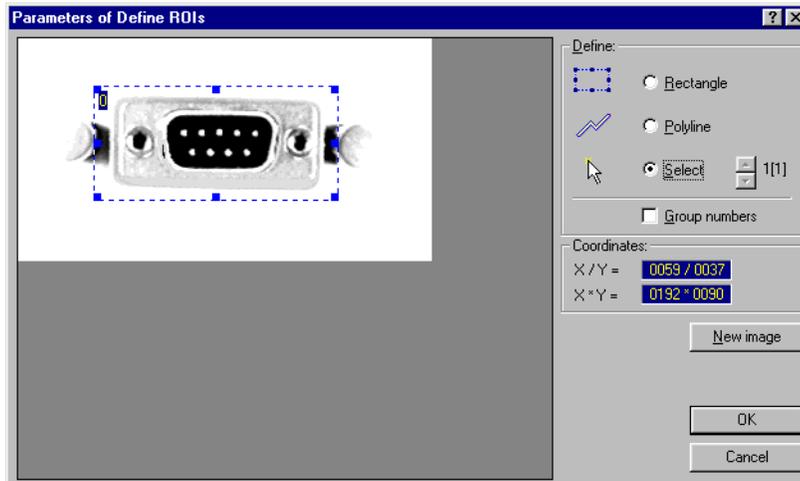
Here the image section to be used for further analysis is determined.

Because of the importance of the ROI concept in NeuroCheck, this is one of the central functions.

### Parameters of Define ROIs



Choose **Parameters** from the **Check Function** menu or click the depicted icon when the **Define ROIs** function is selected.



## The parameter dialog has the following elements

### Graphics Panel

Here you can define the individual regions of interest using the mouse. In select mode you can edit the ROIs using the context menu (right mouse button).

### Rectangle

Activates rectangle mode; in this mode you can define any number of rectangular regions of interest in one operation.

### Polyline

Activates polyline mode; in this mode you can define any number of arbitrarily shaped polygonal regions of interest in one operation.

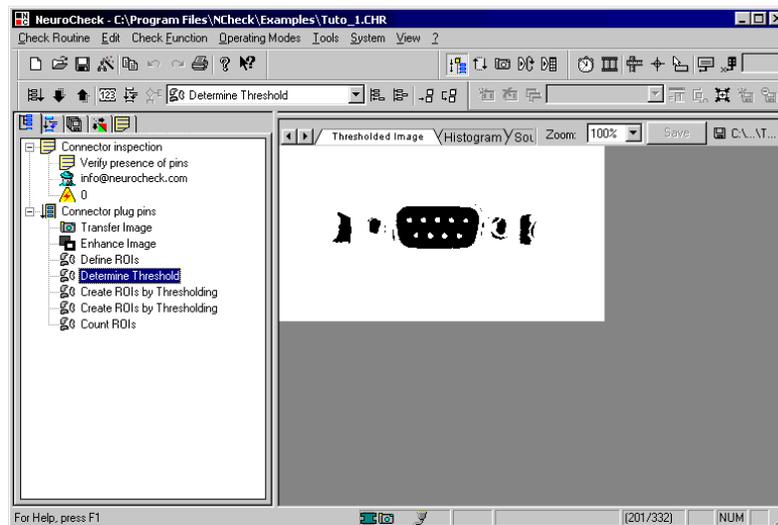
### Select

Activates Select mode; in this mode you can activate defined ROIs using the left mouse button and edit them using the context menu. Selection can also be performed using the spin buttons to the right.

### Group Numbers

This activates the grouping feature of NeuroCheck. In subsequent image analysis functions, individual parameters can then be set for each of the defined ROIs.

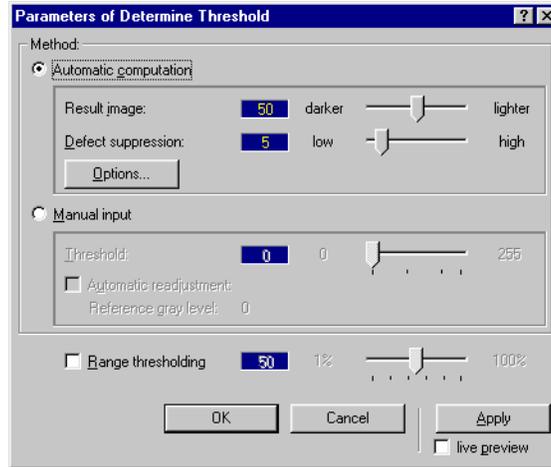
## Determine Threshold



This function sets a threshold for segmenting background areas and objects. This is a prerequisite for using function *Create ROIs by thresholding*.

You'll notice that all intermediate brightness levels are gone from the image. Executing the function removes all gray shades from the image, leaving only black and white areas.

## Parameters of Determine Threshold



In our example, the pins contrast well with the background. Therefore, a simple thresholding operation will suffice to isolate the objects in the image. First, a threshold value must be calculated to be used for this distinction.

### Automatic Computation

Most of the default parameters of this function are well-suited for the task at hand; therefore, only one parameter setting was changed.

This function determines the optimum threshold from the image content within the existing ROIs.

### Manual Input

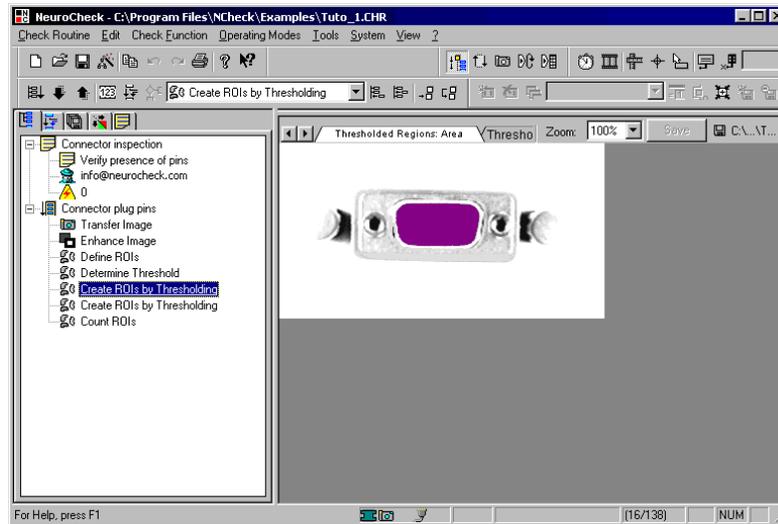
If this option is selected, a global threshold can be entered manually.

### Threshold

Sets the manual threshold.

## Create ROIs by Thresholding

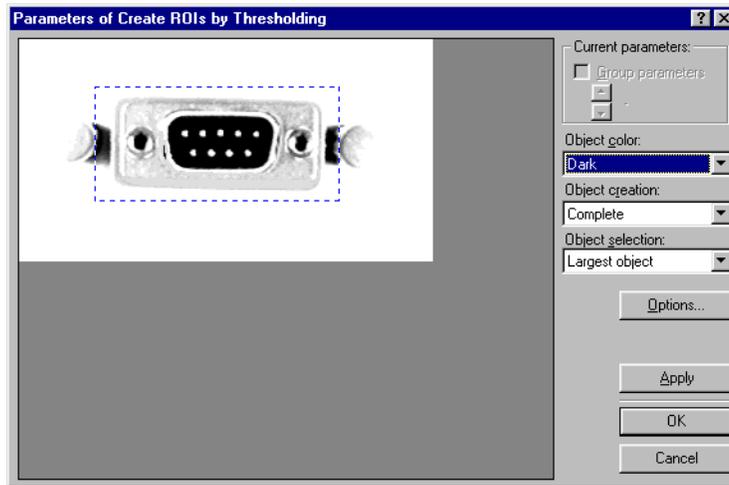
### Looking for the Plug Area



This function creates new regions of interest starting from existing regions of interest by a thresholding process. The existing regions of interest are thresholded and searched for objects. From the detected objects a new list of regions of interest is created, that can be processed further.

We can now isolate the pins as objects from the image scene. To guarantee an exact recognition when the position of the check piece in the image varies, we search for the dark area, in which the pins are located, first.

## Parameters of Create ROIs by Thresholding

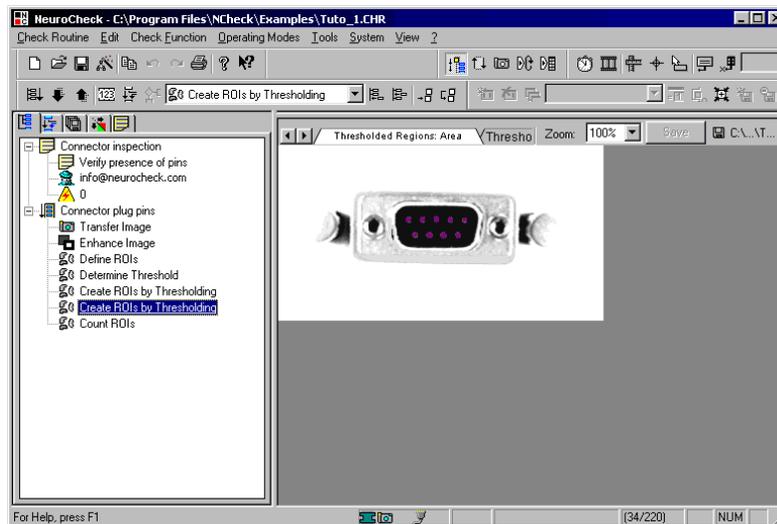


The parameter settings in this dialog have been set in such a way that the largest dark object is created within the given ROI.

Aside from the parameters set here, the object search is influenced by the threshold computed by function *Determine threshold*. An important factor is the required contrast. If the difference between minimal and maximal gray level inside a region of interest is smaller than this value, no object is detected, even if the thresholding would have separated an object from the background. This helps to avoid that a slight disturbance is accepted as an object, which in fact is missing.

## Create ROIs by Thresholding

### Looking for Contact Pins

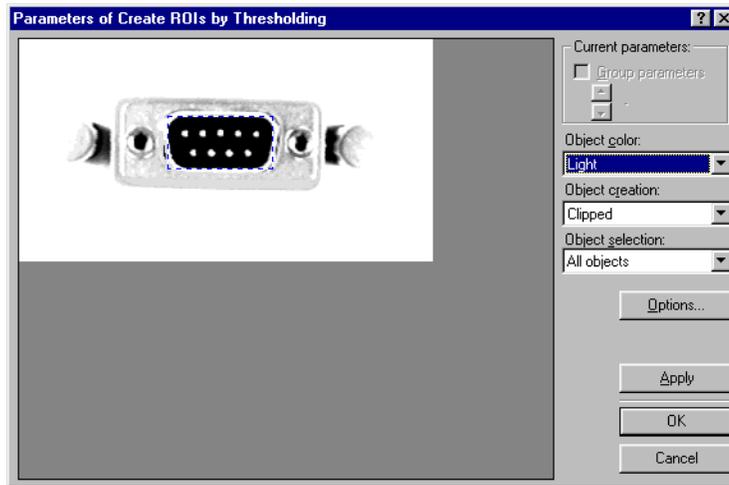


### Objects as Regions of Interest

Here you are introduced to one of the most important features of NeuroCheck which is crucial for the system's flexibility. Every object found or computed by NeuroCheck can be used as a new ROI. This means that NeuroCheck now uses the dark plug area just found as the area in which to look for contact pins. This link is made automatically. Therefore, the function *Create ROIs by Thresholding* is added once more and light objects are looked for next.

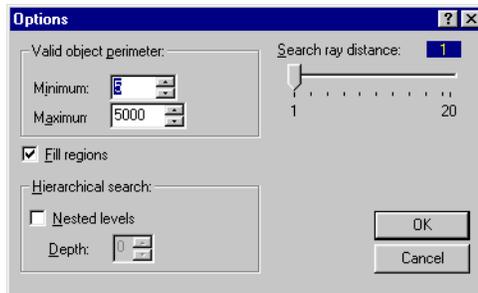
Therefore, the function *Create ROIs by Thresholding* appears twice in immediate sequence.

## Parameters of Create ROIs by Thresholding



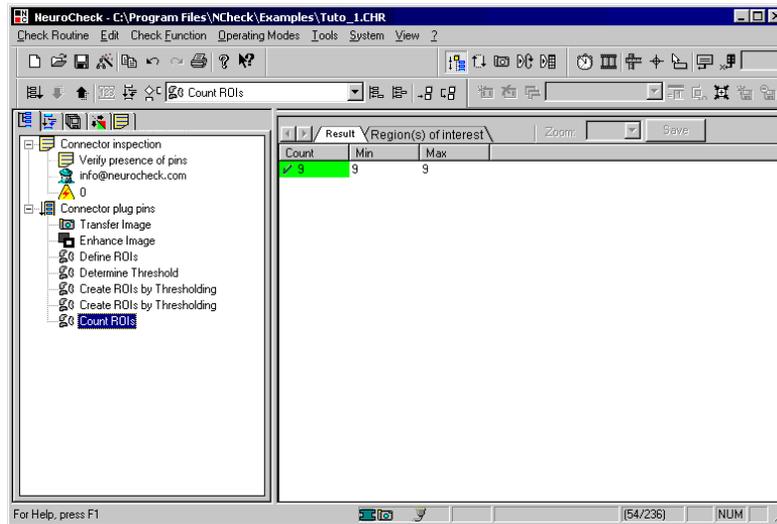
### Search Parameters

*Light* is chosen as *Object Color*. It is important that *Object Generation* is set to *Limited* so that the search is only conducted within the defined ROI. Using *All Objects* for *Object Selection* causes the system to search for all pins.



Click on the *Options* button; the search ray distance is set to 1. The pins are rather small objects that are not located on a precisely horizontal line because of the slight inclination of the plug. If the search ray distance is larger, NeuroCheck could miss some pins.

## Count Regions of Interest

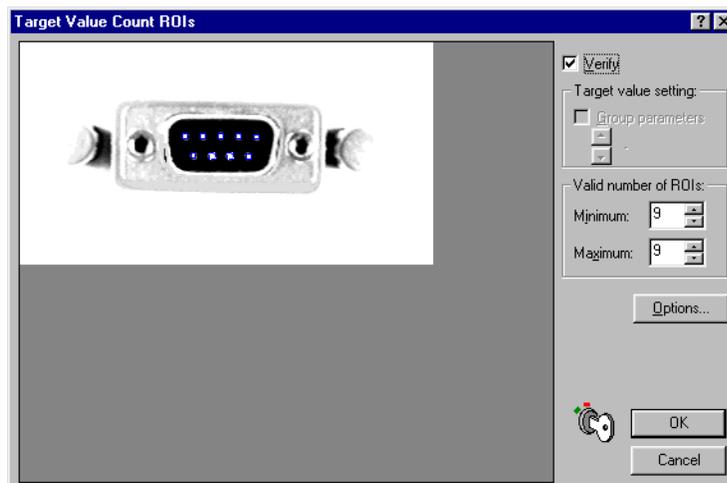


This check function counts the number of regions of interest in its input list and compares it to a prescribed range.

The minimum and maximum target values are entered via a target value dialog.



Open the target value dialog by clicking the depicted symbol or by choosing **Target Values** from the **Check Function** menu.



## The dialog contains the following elements:

### Verify

When this check box is activated the function acts as a decision function, i.e. it compares the number of existing ROIs to the target values. If these do not match, it yields a *not O.K.* result. Otherwise the function simply counts the existing regions.

### Group Parameters

If checked, the range can be adjusted separately for each group of ROIs. It is available only, if group numbers have been activated in function *Define ROIs*. Groups are selected in the graphics panel or using the spin buttons below.

### Minimum

To be valid, the group has to contain at least this number of ROIs;

### Maximum

To be valid, the group has to contain at most this number of ROIs;

In our example the values for minimum and maximum are identical, i.e. the inspection is only valid when all 9 pins are present.

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