Multiscan

RASCAN-4 PC Software

ver. 5.00.1.2

USER'S GUIDE

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Chapter 1. GENERAL INFORMATION

Read the operating instructions carefully before operating the **MultiScan** Software.

1.1. Overview

MultiScan universal program is intended for:

- receiving the image in the surface of survey for detection and identification of hidden objects (scanning);
- analysis of received images;
- image processing using built-in filters;
- creation of animated image of investigated object, allowing to estimate the internal nature of the object.

MultiScan can acquire images when operates in co-operation with different devices having corresponding interface. Depending on the type of device used, the you can get the image using different number of frequencies and channels: for example, five frequencies and two channels – crossed and parallel. According to his need operator can supply the received image of investigated surface with comments and description containing information as follows: test conditions, date, etc. The maximum information volume is 256 symbols.

System requirements

- PC Pentium IV processor
- 256MB RAM
- CDROM
- SVGA 800x600 or high, 65536 colors or high
- Windows 2000/XP/Vista

1.2. Install MultiScan

To use **MultiScan**, you must have installed the files from the **MultiScan** CD-ROM disk onto your hard drive. You cannot run **MultiScan** from your CD-ROM drive.

To install MultiScan:

1. Insert the **MultiScan** CD-ROM disk into your CD-ROM drive. The **MultiScan** Setup dialog box appears. If the Setup does not start

automatically, choose the Run command from the Start Menu. Type **x:\setup.exe** (where **x:** is the CD-ROM drive indicator) and click OK.
2. Follow the Setup instruction on the screen.
3. When the Setup is complete, the program is ready for operation.
4. Restart the computer.

1.3. Uninstall MultiScan

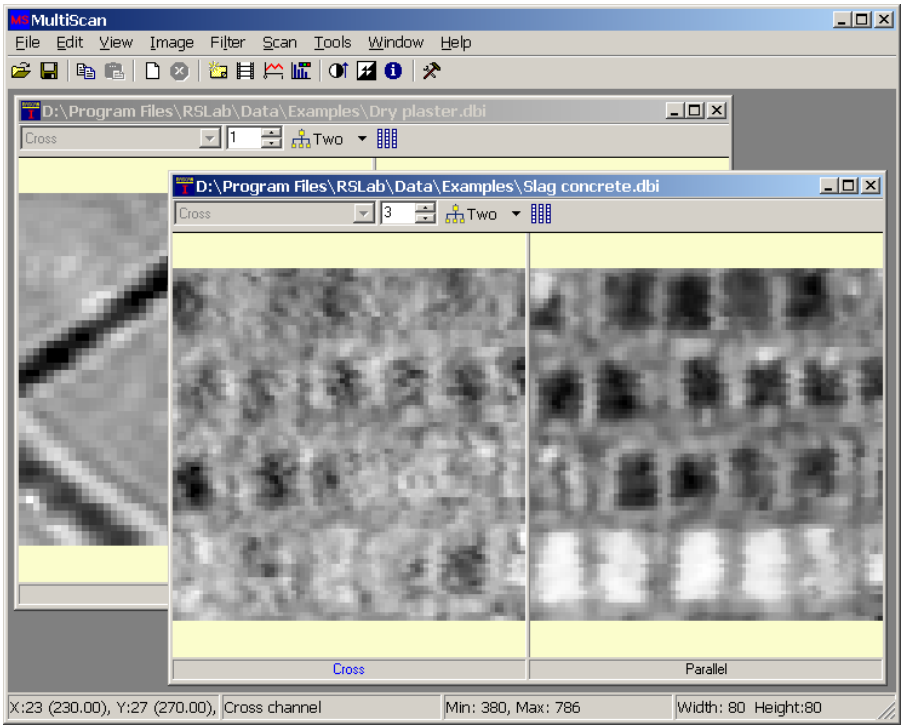
You can remove all of the **MultiScan** components you installed, except the data files you have created.

To uninstall MultiScan:

1. Click the Start Menu and choose Setting->Control Panel.
2. Double-click the Add/Remove Programs Control Panel.
3. Select **Rascan Suite**, click Add/Remove, and click OK to confirm removal.
4. Follow the Setup instruction on the screen.

Chapter 2. USER'S INTERFACE

MultiScan program has the multiwindow interface allowing to process several images simultaneously.



MultiScan program screen

There is command menu in the upper part of the screen, activated when clicking the mouse upon the menu name or when pressing **Alt** button and then underlined letter in the menu name, for example: press **Alt, F** to choose menu **File**. In the drop-down window choose the required command by clicking with mouse button or pressing the underlined letter. If there is an arrow near the menu command pointed to the right, then this command has its own sub-menu. Menu commands available in this situation are bright, non-available commands are faded. Menu command chosen in sequence we'll separate further with "**>**" symbol. For example, **File>Open** means choose command **Open** in the menu **File.**

2.1. Menu

The menu commands are listed in the table.

Command	Description
"File" menu	
Open (Ctrl+O)	This command displays the **"Open"** dialog window which allows to choose the file(s) to be loaded in the **MultiScan** program. User can choose data files with DBI or BIT (old format) extensions.
Close	This command closes the file in active window. If file was changed you have to confirm saving these changes.
Save (Ctrl+S)	This command saves file in the active window.
Save as	This command displays the dialog window **"Save File As"** where user can save the file with arbitrary name in any folder.
Save as AVI file	This command is available when "Animation" window is active. After creation of animation user can save the results in AVI format.
Save as bitmap	This command allows to save the current active image as bitmap file. Following types of files are supported: BMP, GIF, JPG, PNG, TIF.
Save as table	This command allows to save the current active image as ASCII table in file with TXT extension.
Import	This command allows to choose the bitmap file and transform it in DBI format for future processing in **MultiScan** program. Following types of files are supported: BMP, GIF, JPG, PNG, TIF.
Recent files	This command shows the list of last files the user worked with. The maximum list volume is set in the **"General"** card of **"Tool>Option"** dialog window. This volume could not be more than 9 files.
Exit	This command finishes program's operation.
"Edit" menu	
Copy (Ctrl+C)	This command allows to copy file from active window to the clipboard in DBI format. In addition, the image from active channel in the form of bitmap file is copied in the clipboard. In future this image can be used by any Windows program.
Paste (Ctrl+V)	This command creates the new file with the image based upon the file contained in the clipboard in DBI format.
"View" menu	
Toolbar	This command makes toolbar visible/invisible.
Status bar	This command makes visible/invisible the status bar with supplemental information.

Command	Description
Description window	This command makes visible/invisible the file description window containing the description of file placed in the active window.
Animation	This command allows to make frequency animation. The command is available from active window with images.
Graphics	This command allows to draw the graphic for the image chosen along horizontal or vertical direction.
Histogram	This command allows to view histogram for the chosen image.
Refresh (F5)	This command redraws the contents of all program windows.
"Image" menu	
Rotate	This command allows to rotate the image clockwise/anticlockwise at an angle of 90°.
Flip image	This command allows to mirror the image relatively the horizontal/ vertical axis.
Merge	This command allows to merge images along horizontal/vertical line. When merging along vertical line the images should have the same horizontal dimensions. When merging along horizontal line the images should have the same vertical dimensions.
Inversion (Ctrl+I)	This command switches on/off the color inversion when black color becomes white and white color becomes black. Command's action spreads on all windows with images.
Information	This command displays a dialog box with the image parameters. The command is available when window with images is active.
"Filter" menu	
Contrast	This filter allows to change the range of displayed image brightness.
Noise	This filter allows to delete noise of different nature using square masks.
Custom	This filter lets you design your own filter effect.
Smooth	This filter allows to make image's linear and non-linear smoothing along lines or columns.
Threshold	This filter makes threshold image processing.
"Scan" menu	
Start scan (F6	This command loads device's driver and activates driver's card **"Scan".** The scanning features you can see in the device's User's Manual. This command is available if driver was not loaded earlier.
Stop scan (F7)	This command cancels the scanning process. The device's driver stays active.

Command	Description
"Tools" menu	
Test (Ctrl+T)	This command loads the device's driver and activates the driver's card **"Test"**. The test features you can see in the device's User's Manual. This command is available if driver was not loaded earlier.
Options	This command displays the dialog window with **MultiScan** program settings.
"Window" menu	
Cascade	This command forces the program to arrange all windows so the user can see the name of each window.
Tile horizontaly	This command forces the program to arrange all windows top-down.
Tile verticaly	This command forces the program to arrange all windows from left to right.
Next	This command moves you to the next window.
Previous	This command moves you to the previous window.
Close	This command closes the current active window.
Close all windows	This command closes all windows.
"Help" menu	
Contents	This command activates the information service system of **MultiScan** program and displays its contents.
Index	This command activates the information service system of **MultiScan** program and displays its "Index" section.
About	This command displays "About **MultiScan**" section with about property and copyright, program version and user's support service information.

2.2. Toolbar

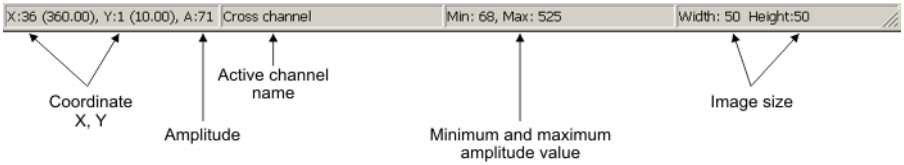
The toolbar contains icons for the most used menu commands. The brief descriptions of these icons are listed in the table.

Icon	Corresponding menu command
	**File>Open** (Open file with image)
	**File>Save** (Save file with image)

Icon	Corresponding menu command
	Edit>Copy (Copy image to Clipboard)
	Edit>Paste (Paste image from Clipboard)
	Scan>Start scan (Start active unit driver in Scan mode)
	Scan>End scan (Interrupt scan process)
	View>Description window (On/Off description window)
	View>Animation (Call animation creation window)
	View>Graphic (Call graphic window)
	View>Histogram (Call histogram window)
	Filters>Contrast (Call image contrast filter)
	Image>Inversion (Invert image colors)
	Image>Information (Call active image information)
	Tools>Test (Start active unit driver in Test mode)

2.3. Status bar

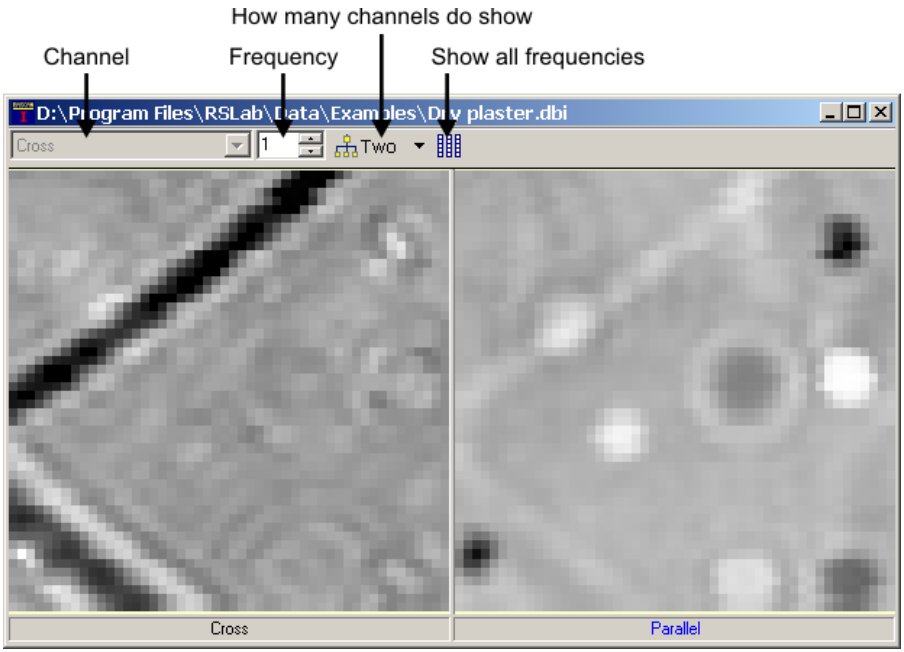
The status bar is in the lower part of the screen. The status bar fields are described in the table.



Field	Description
X, Y coordinates	Two numbers in the beginning of the status line point out the current coordinates of the mouse pointer in image active window when drugging the pointer. The coordinates are given in pixels and in millimeters (within parentheses).
Amplitude	Displays the signal amplitude in the point where mouse pointer is located.
Active channel name	The image can contain information about the same object received from several channels. When viewing the image user should know what channel is active since all processing and analysis operations are made with active channel only. To do the channel active, click with mouse left button at the image corresponding to this channel.
Minimum and maximum amplitude value	During image review the range of all image points is stretched along the whole amplitude of grey color, from black to white. It's made for better image perception. This field shows true amplitude range for user to be able to estimate the contrast of objects in the image.
Image size	Determines width and height of the active image in pixels.

2.4. Image window

When multi-window interface is used, each image has its own window.



MultiScan program image window

Channel

In **MultiScan** program there are several displaying modes. You can choose one displaying channel or several channels displaying simultaneously. When you choose one displayed channel you should determine the channel to be displayed. If this field is inactive, several channels would be displayed simultaneously.

Frequency

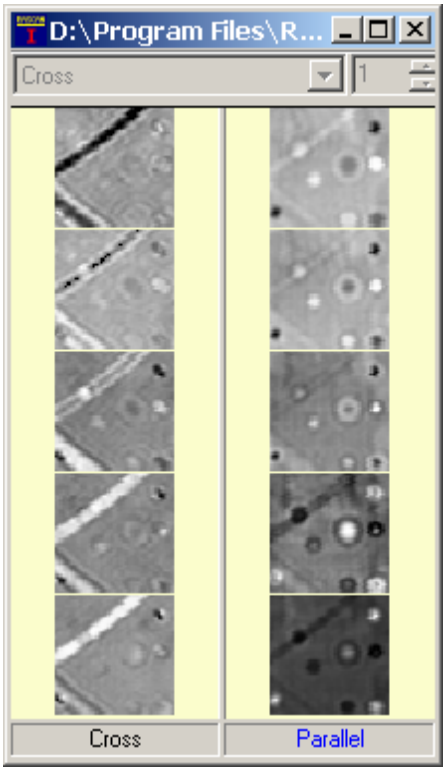
Chooses the frequency number to be displayed.

How many channels do show

Chooses the number of channels to be displayed simultaneously.

All frequencies

The displaying mode when all frequencies of the chosen channels are displayed at once switches on and off.



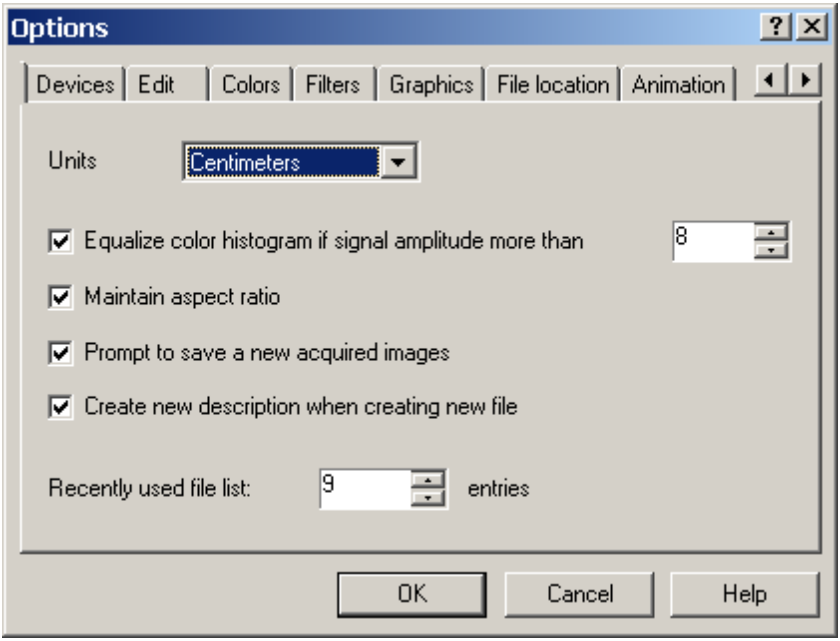
All frequencies display mode

In the lower part of the image window there is a line with channels' names.

Chapter 3. PROGRAM SETTINGS

After **MultiScan** program start (especially, for the first time) we recommend to check program settings. To select the settings, choose the **Tools>Options** menu command.

3.1. "General" card



"General" card of program options window

Units

You can set the default measuring units. You can switch between pixels and centimeters.

Equalize color histogram if signal amplitude more than …

Specifies the peak-to-peak signal amplitude which starts the enlarging the image to full color range.

Maintain aspect ratio

In this state when images are viewed the geometric dimensions of scanned zone are kept unchanged taking into consideration the step value along axes.

Prompt to save a new acquired images

Switches on the compulsory confirmation of file saving if this file is not saved or contains any changes.

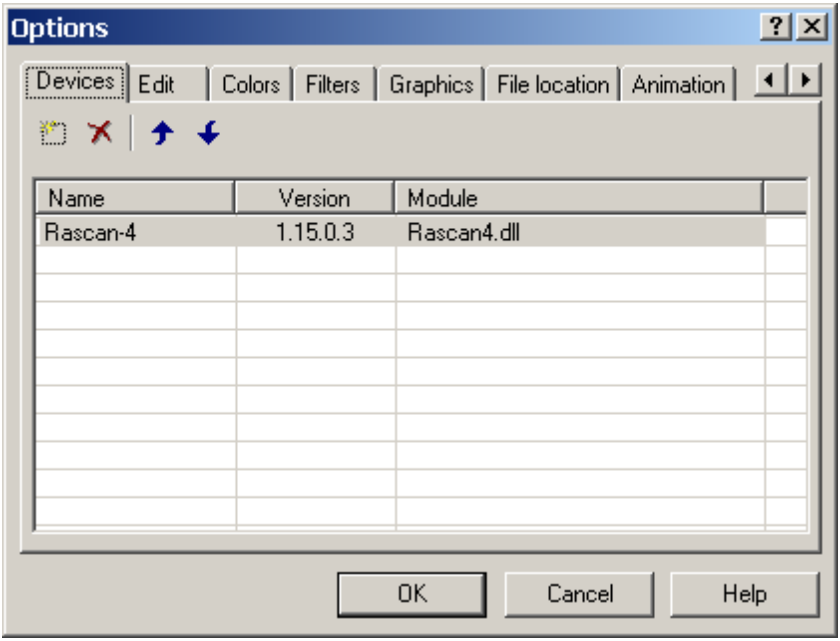
Create new description when creating new file

When this option is enabled, the empty description is added to the new file. If this option is disabled, the new file gets description from the previous one.

Recent file list contains

Specifies the number of file list used recently by the user. Ensures quick access to these files.

3.2. "Devices" card



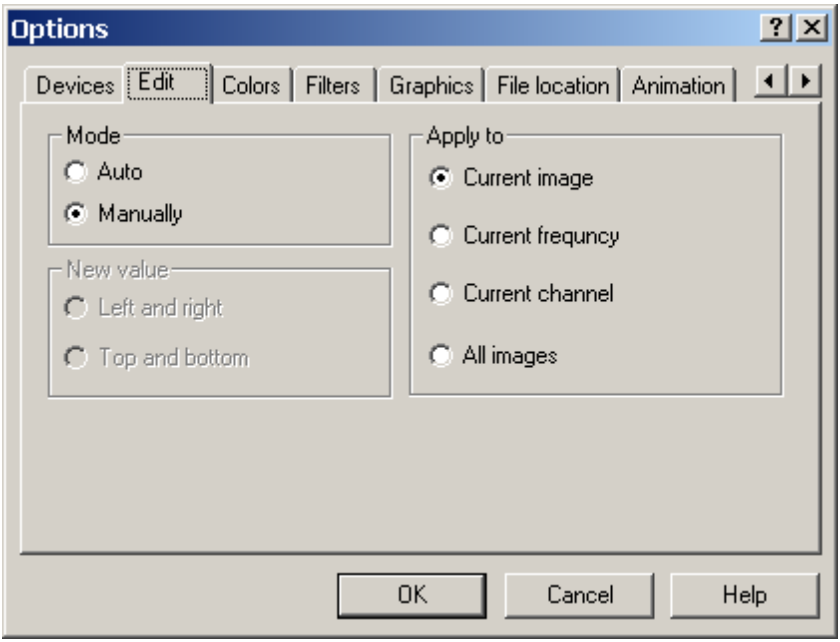
"Devices" card of program options window

The devices' registered drivers are listed on this card.

	***"Add new"*** button allows to register the new device. The new device would be placed at the end of the list.
	***"Delete"*** button allows to delete the device from the list.
	***"Move device up"*** button to move the device one position up in the list.
	***"Move device down"*** button to move the device one position down in the list.

MultiScan program can operate with different types of devices. Before you'll be able to use the device you should register it. The program uses the first device in the list as default. To change the list order you should use ***"Move device up"*** and ***"Move device down"*** buttons.

3.3. "Edit" card



"Edit" card of program options window

You can change the intensity value of any point of the acquired image. The edit mode is available with a double click at the point you would like to edit.

Here you can set the default values used during image points edition.

Mode

Auto

The new value of intensity is calculated automatically as simple average of two adjoining points (left and right or top and bottom).

Manually

The new value of intensity is set by the user.

New value

When the new value is chosen automatically you can choose as initial points two adjoining points from left and from right, or from top and from bottom. If the edited point is located at the boarder of the image so the new intensity value is equal to intensity in the adjoining point (along chosen direction) from outside inwards.

When the new value is chosen manually you can choose the new intensity value in dialog window in “New value” section.

Apply to

Specifies the application field of point editing procedure.

Current image

Changes point on the current image only.

Current frequency

Changes points in the position chosen to all channels in current frequency.

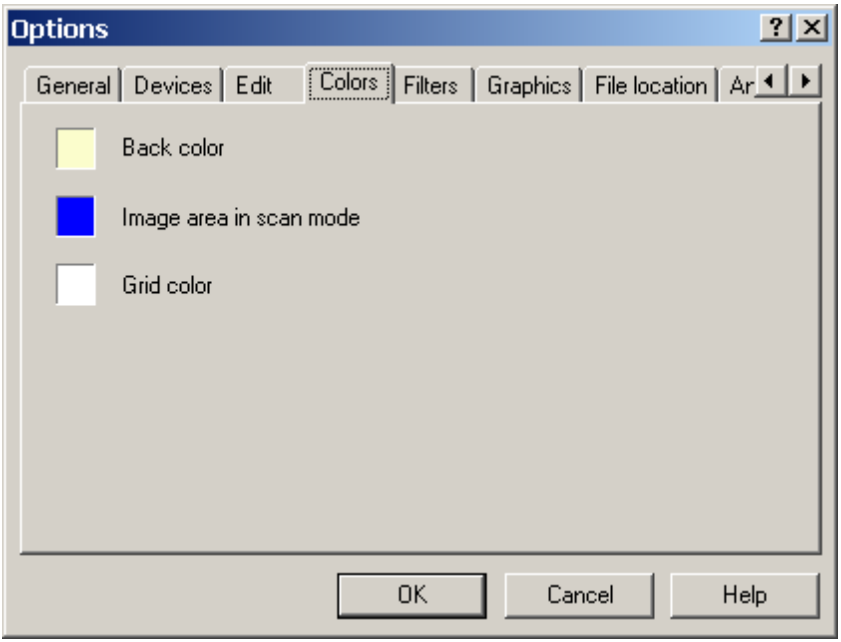
Current channel

Changes points in the position chosen to all frequencies in the channel chosen.

All images

Changes points in the position chosen to all frequencies in all channels.

3.4. "Colors" card



"Colors" card of program options window

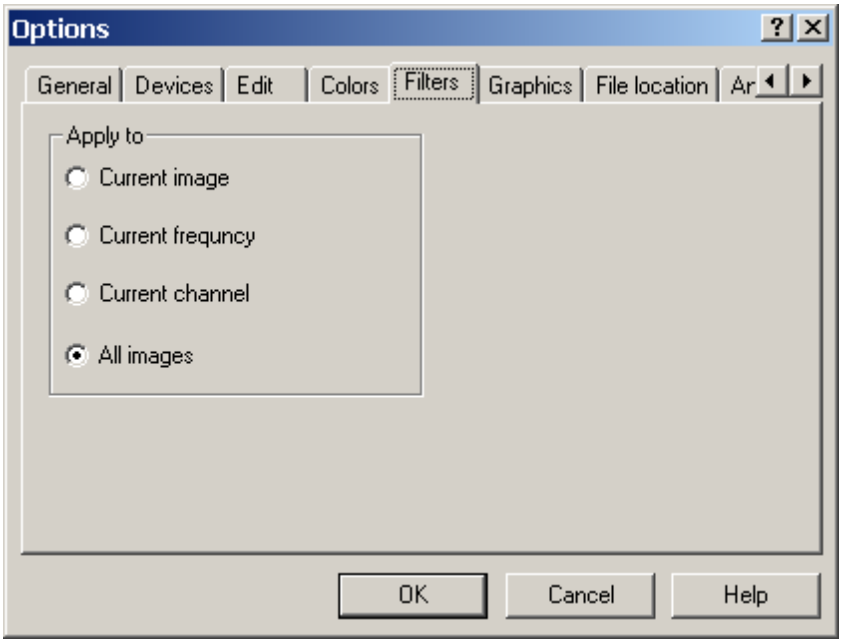
You can set the colors of the image window. The color can be changed with a double click on the color box.

Back color
Background color of window.

Image area in scan mode
Color of working field background during scan mode.

Grid color
Grid color during scan mode.

3.5. "Filters" card



"Filters" card of program options window

Specifies filters operational field.

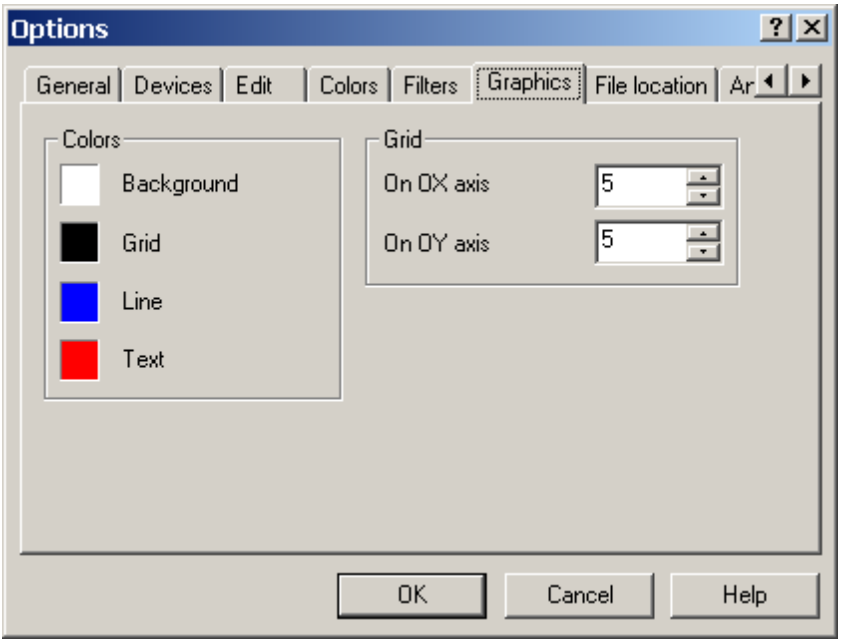
Current image
A filter is applied for current image only.

Current frequency
A filter is applied for images at the current frequency to all channels.

Current channel
A filter is applied for images in the current channel at all frequencies.

All images
A filter is applied for all images in all channels at all frequencies

3.6. "Graphics" card



"Graphics" card of program options window

You can set graphics window options.

Colors

You can set the colors of:

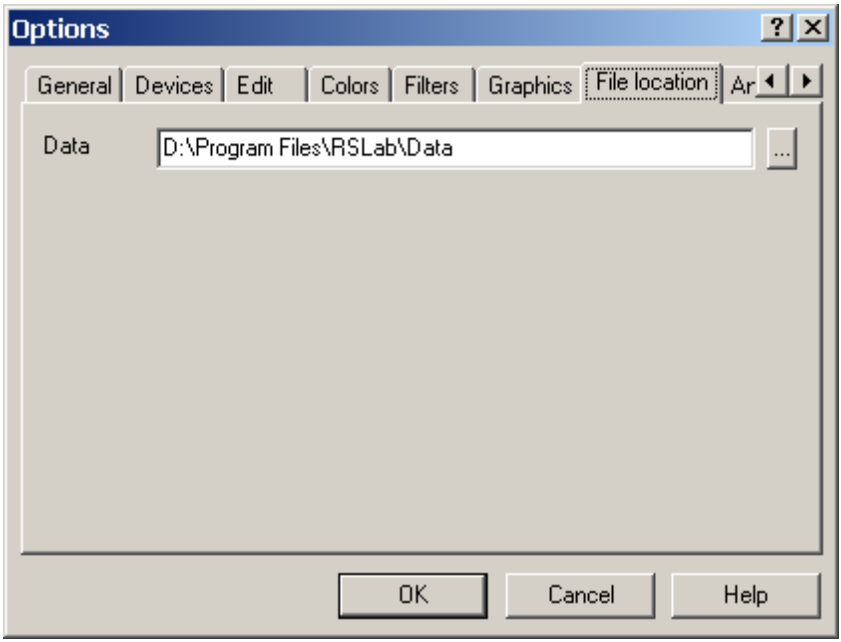
- background;
- grid;
- line;
- text.

The color can be changed with a double click on the color box.

Grid

You can set the the grid dimensions along the chart axes. If the grid dimension of the grid along the axis is equal to 1, there is no grid along this axis.

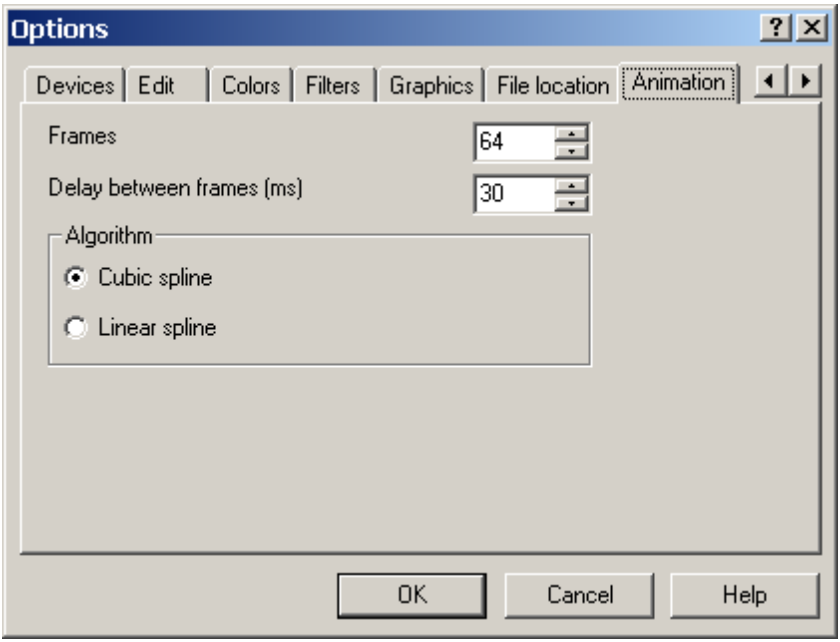
3.7. "File location" card



"File location" card of program options window

You can select the default folder for data files. You can write this path manually in the corresponding line, or press the button "..." located at the right hand and choose the required folder.

3.8. "Animation" card



"Animation" card of program options window

Frames

This option allows you to set the number of frames when animation is created.

Delay between frames

This option allows you to set the delay between frames when animation playback is in progress allowing to compensate the computer's processing speed.

Algorithm

This option lets you select one of the available algorithms for animation line creation.

Cubic spline

The interpolation is made using cubic spline.

Linear spline

The interpolation is made using linear spline.

Chapter 4. IMAGE OPERATION

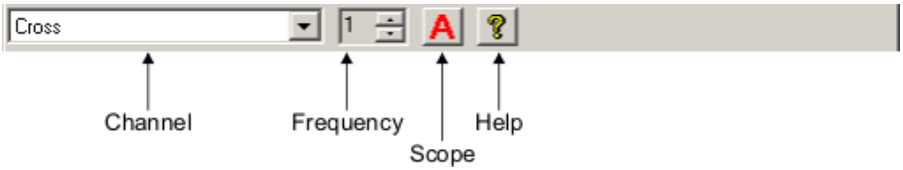
4.1. Image acquiring

To acquire the image of scanned surface, choose command **Scan>Start scan**, and, if it is necessary, choose the operational mode. For more details, see User's Manual of the used device.

4.2. Image processing

4.2.1. Filtration

The **MultiScan** program uses a number of filters for image processing. The filters' parameters are set in the corresponding dialog windows. All dialog windows have common controls



Filters' common controls

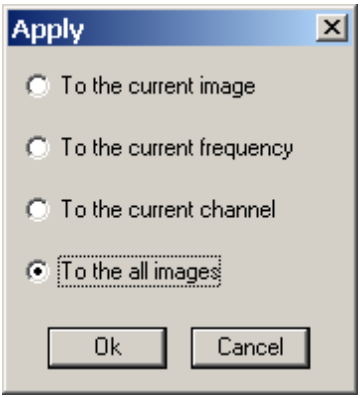
Channel
Specities the current displaying channel in the dialog window.

Frequency
Specities the current displaying frequency in the dialog window.

Scope
Specities the filter's operational field. The filter can be used when processing:

- current image;
- current frequency;
- current channel;
- all images.

Filter's operational field can be set in the **"Apply"** dialog window.



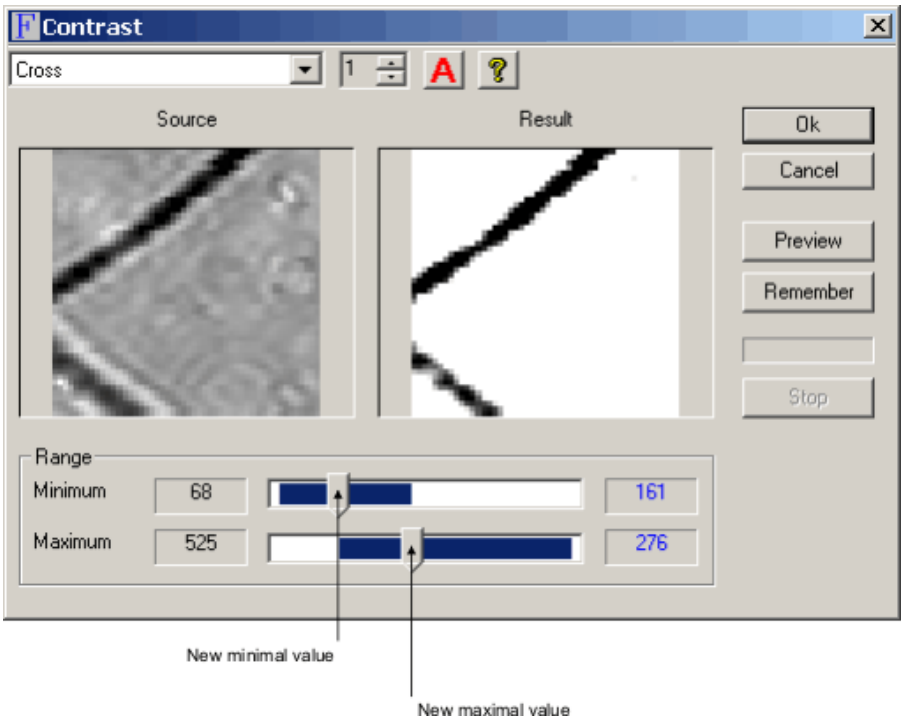
"Apply" dialog window

Also, each filter's control dialog window has its control:

Button	Action
Ok	Finishes filter's operation. The filter processing result is displayed in the new window of **MultiScan** program.
Cancel	Interrupts filter's operation without saving of filter processing result.
Preview	Starts creation process of the new filtered image.
Remember	Memorizes filter processing result for the current channel and frequency.
Stop	Interrupts new image calculating process. The button becomes active only after pressing the button "Preview". When calculating process is finished, the button becomes inactive.

To use this filter you should mark the image (click it with mouse left button) the filter should apply to and in **Filters** menu choose the required filter.

4.2.1.1. Contrast

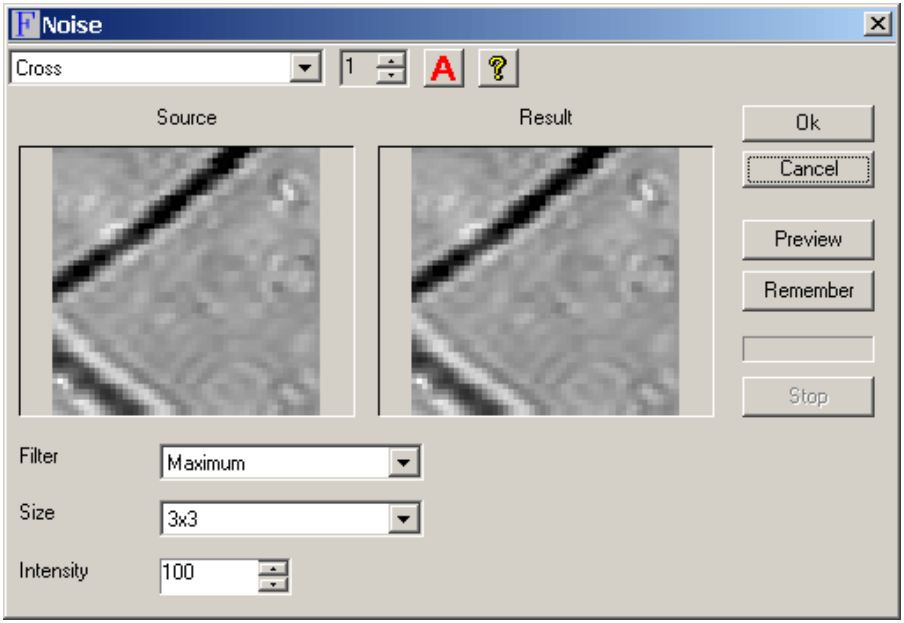


"Contrast" filter dialog window

This command allows to change the interval of displayed image's intensity values according to the following algorithm:

- Values that less than new minimum A_{min}, are replaced with A_{min};
- Values that more than new maximum A_{max}, are replaced with A_{max}.

4.2.1.2. Noise



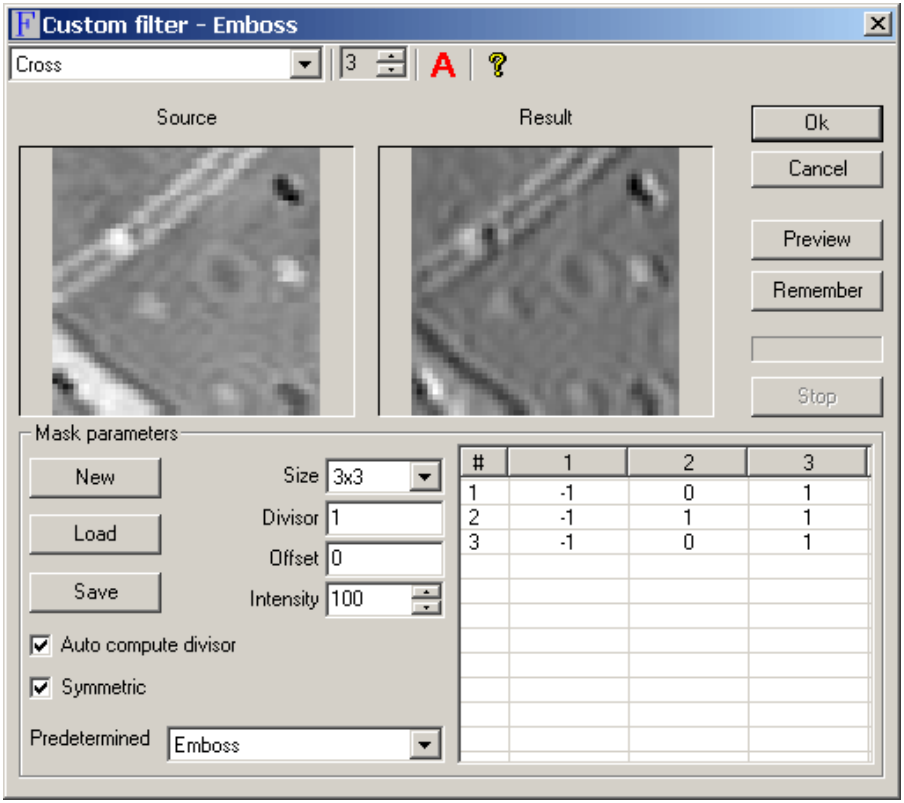
“Noise” filter dialog window

Using matrix filters when processing the image, one can reduce noise of different nature.

Controls

Filter	Determines used filter type. The following filters are possible: - Average, - Minimum, - Median, - Maximum.
Size	Determines filter’s size. The following matrixes are possible: 3x3, 5x5, 7x7, 9x9, 11x11, 13x13, 15x15.
Intensity	New value if intensity can be calculated according to the following formula: C(i,j) = (1-k)*A(i,j) + k*B(i,j), where A(i,j) – value of intensity of the initial image, B(i,j) - value of intensity of filtered image, k – filter’s strength in percent.

4.2.1.3. Custom filter



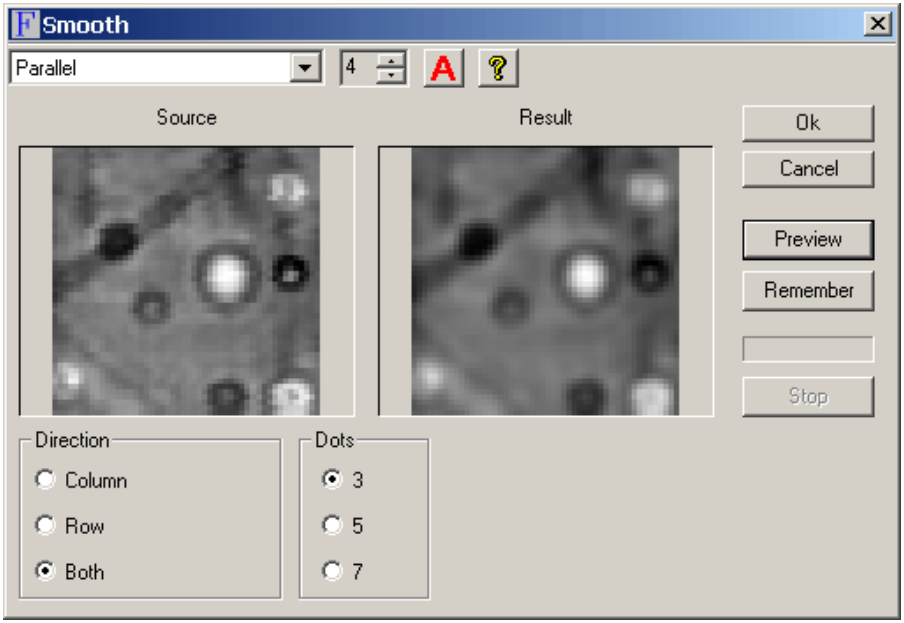
"Custom" filter dialog window

The custom filter (mask) lets you design your own filter effect. With the custom filter (mask), you can change the brightness values of each pixel in the image according to a predefined mathematical operation known as convolution. Each pixel is reassigned a value based on the values of surrounding pixels. You can save the custom filters (mask) you create and use them with other images.

Controls

New	Use the New button to create new custom filter (mask) by size defined in the Size box.
Load	Use the Load button to load custom filter (mask).
Save	Use the Save button to save custom filter (mask).
Size	Defines the filter (mask) size, which will be created after click the New button. The maximum filter size is 9x9.
Divisor	A divisor value. After multiplies each matrix element will be divided into this value.
Offset	An offset value. This is the value that will be added to the final pixel values just before the effect is applied.
Intensity	The new pixel value is defined as C (i, j) = (1-k) *A (i, j) + k*B (i, j), where A (i, j) - the pixel value of the source image, B (i, j) - the pixel value of the image after filtration, k - force of the filter in percentage.
Auto compute divisor	Enable this check box to ensure that color values remain within the range of 0 to 255. If the sum of elements of a matrix is equal to null, the divider is equal 1.
Symmetric	Enable this check box to keep the values entered in the matrix symmetrical. For example, if you enter a value in the top left field with this check box enabled, that same value will appear in the other three corner fields.
Predetermined	Multiscan includes some predefinition filters. You can select any from them and apply its to the image.

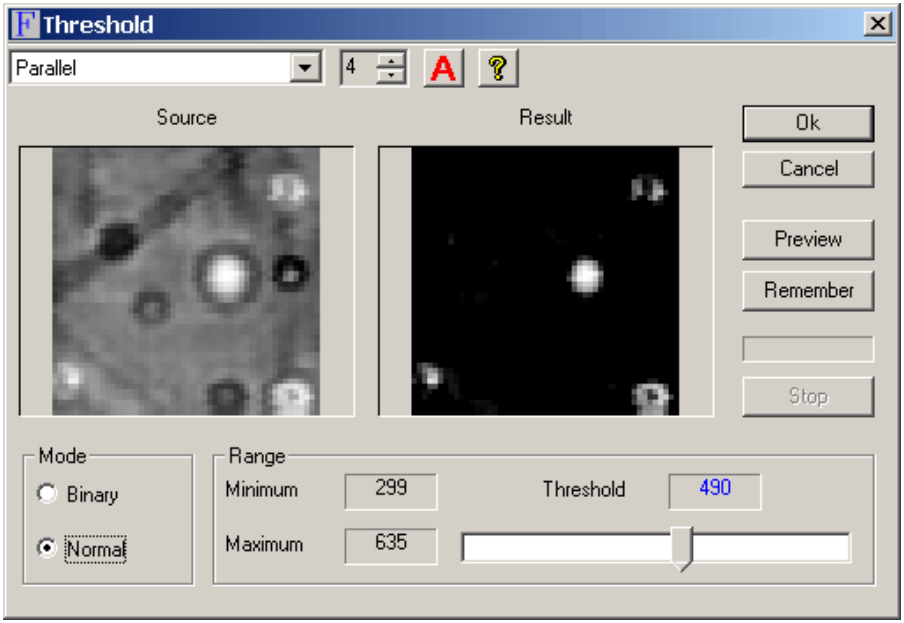
4.2.1.4. Smooth



"Smooth" filter dialog window

The filter allows doing linear (3 and 5 point algorithm) and non-linear (7 point algorithm) image smoothing along chosen direction (along lines and columns).

4.2.1.5. Threshold



"Threshold" filter dialog window

The filter allows doing the binary threshold processing:

- Values that less than threshold are replaced with 0;
- Values that more than threshold are replaced with 1.

or usual threshold processing:

- Values that less than threshold are replaced with 0;
- Value that more than threshold remain without change.

4.2.2. Animation

MultiScan program gets image of investigated surface at several frequencies. It was made since when scanning at single frequency due to the phase correlation there can be situation when the object would not differ from the background and would be invisible. The frequencies are selected in a way that the object would be visible at least on one of the images. The animation mode is intended to offer operator the possibility to review all images simultaneously. The animation mode configuration is described in the

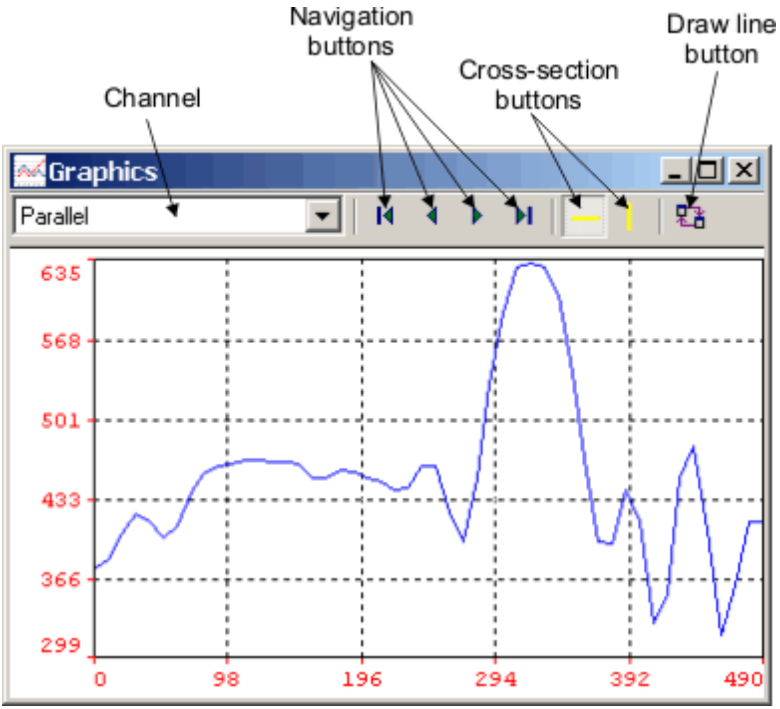
"Program settings" chapter of this Manual. To enable this mode choose the menu command **View>Animation.**

Animation creation dialog window

To create animation you should first choose the point upon the image and click twice with mouse button (this point would be considered as background) and then press the button Start ( ). To cancel the viewing press the button Stop ( ). When animation is prepared the intermediate images are based upon interpolation of true images.

4.2.3. Graphics

For more detailed image analysis the program has the following feature. You can formulate the relation between image brightness and longitudinal or transversal coordinate. When you choose the menu command **View>Graphics** the following dialog window opens for graphics creation:



Graphics creation dialog window

The window has the following controls:

Channel control

Use to select view channel.

Navigation buttons

Use the navigation buttons to move along the image.

Cross-section buttons

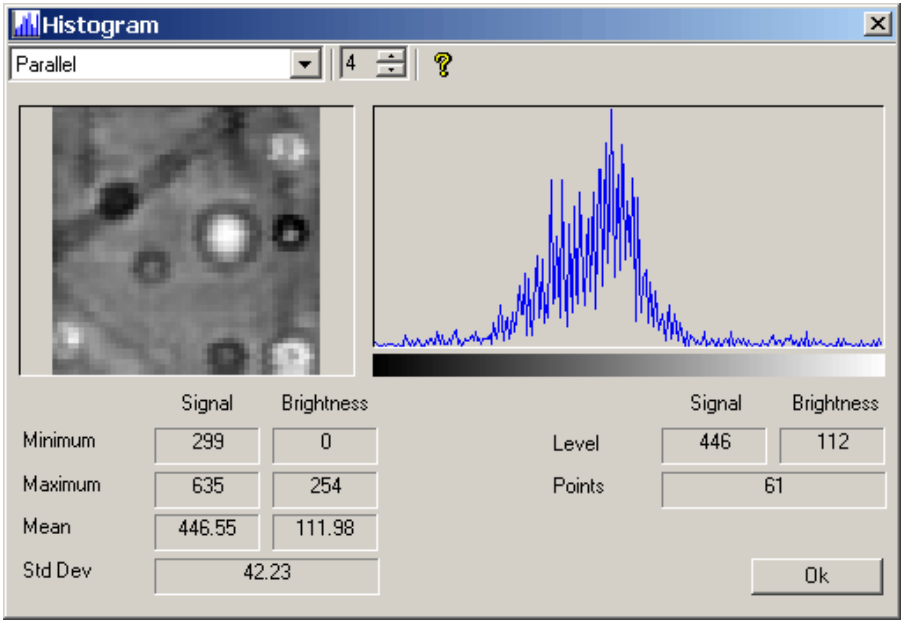
Use these buttons to select the cross-section direction for drawing the graphics. The cross-section direction may be either horizontal or vertical.

Draw line button

Use this button to turn on/off a marker of the current viewed line on the source image.

4.2.4. Histogram

A histogram illustrates how pixels in an image are distributed by graphing the number of pixels at each color intensity level. This can show you whether the image contains enough detail in the shadows, mid tones, and highlights to make a good correction. When you choose the menu command **View>Histogram** the following dialog window opens:



Histogram dialog window

Statistical information

Minimum	Represents the minimum intensity value.
Maximum	Represents the maximum intensity value (brightness).
Mean	Represents the average intensity value (brightness).
Std Dev (Standard deviation)	Represents how widely intensity values (brightness) vary.

Moving the mouse cursor in the histogram window you can see quantity of points belonging given level of a signal (brightness).

Level	The level of signal (brightness)
Points	The total number of pixels with a given level of signal (brightness).