# *Virtual Set 2000*

*Environment Builder*
*for Virtual Studio Sets Control*

# Video and Sound Settings Guide

Revision 1.07


Darim Vision Co., Ltd.

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Our company warrants this product against defects in materials and workmanship for a period of one year from the date of purchase. During the warranty period, products determined by us to be defective in form or function will be repaired or replaced at our option, at no charge. This warranty does not apply if the product has been damaged by accident, abuse, misuse, or as a result of service or modification other than by us.

This warranty is in lieu of any other warranty expressed or implied. In no event shall we be held liable for incidental or consequential damages, such as lost revenue or lost business opportunities arising from the purchase of this product.

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# 1 Introduction

This document describes adjustment parameters for working with video and sound for *VS2000* using *HotActions*.

The given version of the document (1.07) corresponds to ***VS2000 HotActions 1.35*** software version and ***FD300 Support for VS2000 Software ver. 2.01*** drivers.

# 2 *Live Video* panel for settings of input and output video

**Live Video** panel of *Options* dialog (Figure 1) is used for adjustments of input and output video for *HotActions*.

Group **Output** provides adjustment parameters for output video. These are described in chapter 3 of this document.

Group **Inputs** allows selection of an input board from the drop-down list (**LIVE_1** is the first input board, **LIVE_2** - the second etc.) as well as the ability to set the video source for each input channel of the selected board. Other adjustment parameters available include those for keying (chroma key). See chapter 4 for a description of Group Inputs.

Different combinations of Inputs and Outputs can be saved as **Presets.** The next section, Chapter 2**,** details the use of Presets.

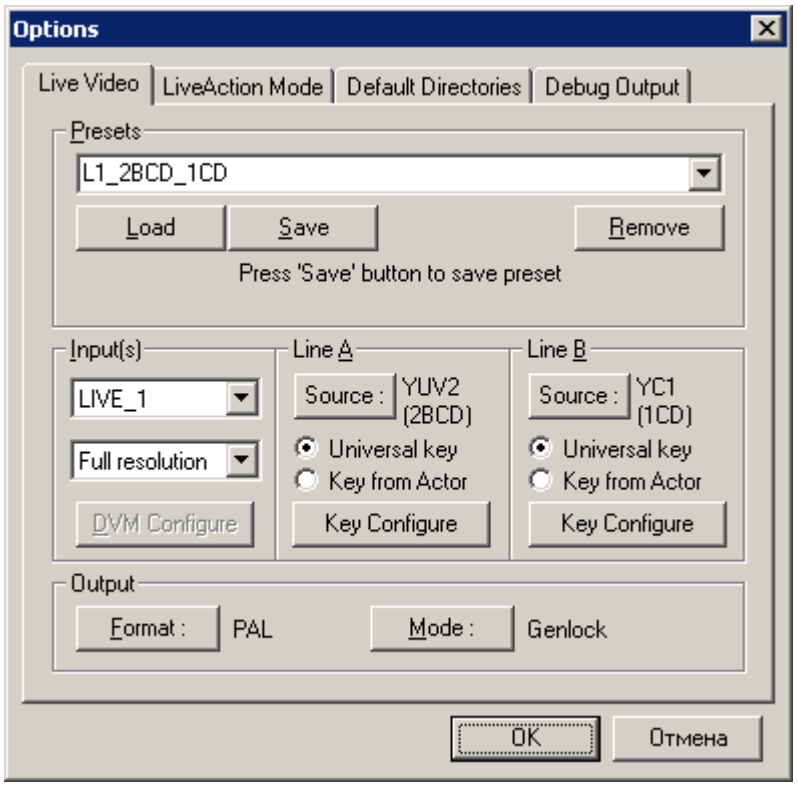



**Figure 1. *Live Video* panel of *Options* dialog**

## 2.1 Presets: How to create and save parameter configurations

The **Presets** group on the *Options* dialog of the Live Video panel (Figure 1) allows you to save (**Save**) and to restore (**Load**) established configuration inputs for each board defined as a video source in the **Input** group as well as parameters for keying (rear-projection) for its channels.

When you change any parameters from **Input** group the editable name of item in the drop-down list of **Presets** group is cleared allowing you to save the altered settings under a different name. To save your current adjustments first type a new name (the name should not contain spaces) or choose one from existing list if you wish to permanently alter a particular Preset.. By clicking **Save** the configuration for this board is saved with the given name.

If you have not saved the configuration, *HotActions* will save it at the end of the work session with a name like «**AutoSaveN**», where **N** (1, 2 etc.) corresponds to the number of the input board **LIVE_N**.

To load any configuration, it is necessary to choose its name in the drop-down list of **Presets** group and press **Load** button. When *HotActions* starts, it loads in the last saved configuration.

If your system has more than one input board, be careful to choose the one you need for this particular work session from the **Input** group.

When assigning a name to a Preset, it is convenient to use names containing the information about board and video inputs used.

For example, **LIVE_2_1BCD_2B** may mean a configuration of the second input board (**LIVE_2**) when its **Line A** with the component signal (YUV) connected to **INPUT CHANNEL 1** group of the switching panel as **B** (**Y**) **C** (**U**) **D** (**V**). And for **Line B** it is chosen composite signal connected to a **INPUT CHANNEL 2** group of the switching panel.

# 3 Output video settings

## 3.1 Output parameters group

**Output** group on the Options dialog of the **Live Video** panel (see Figure 1) has two available settings – Format and Mode. The **Format** button is used to specify the working video standard of video for both video input sources and the video output used by *VS2000*. Pressing **Format:** shows *Format Properties* dialog (section 3.2) for choosing desired standard of video. Also, if you correctly specify an index of the output board (and it is connected to *DVM* board) you will be able to adjust parameters of *DVM* work.

The **Mode** button defines the current mode of operation of the output board is selected. To change this mode and to adjust other parameters of output video, access the *Output Mode Configure* dialog (described in section 3.4) by clicking the **Mode** button.

☝ *In* Output Mode Configure dialog *you can set combinations of output signals (component YUV or RGB, S-Video, composite and other) to produce desired output for selected board.*

## 3.2 *Format Properties* dialog. Format panel

*Format Properties* dialog appears after pressing **Format** button of **Live Video** panel (*Options* dialog, see Figure 1). The Format Properties dialog has two panels – Format and DVM.

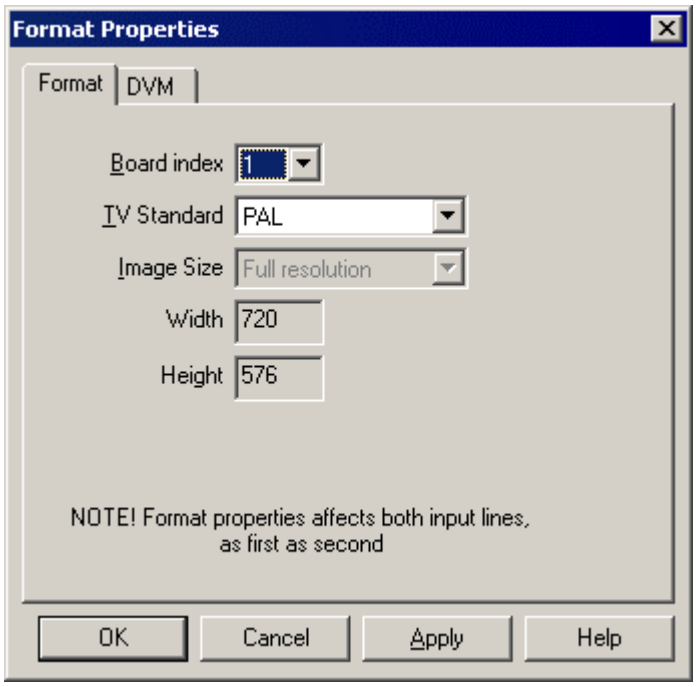



**Figure 2. *Format* panel of *Format Properties* dialog**

Two drop-down lists are available on the Format panel – Board Indexes and TV Standard. The **TV Standard** drop-down list to defines the television format, PAL or NTSC (in some configurations SECAM-PAL is also available).

☝ *Setting the standard for output video assigns the same standard for input video.*

**Board index** on **Format** panel (Figure 2) should contain correct number for the output board. This value is fixed by the given hardware-software configuration of system. As a rule, the correct output board number will be the default. Usually the only time the board index parameter is changed is only when a new Windows user is introduced after a logon. In this case, it is necessary to find out what is the correct number of the output board.

☝ *It is not recommended to change* ***Board Index*** *without instructions of technical support service. Especially if correct number of the output board is already known.*

**Image Size** is automatically defined by the TV Standard. Typically the default is Full Resolution. The Width and Height settings will vary with the selected TV Standard.

## 3.3 *Format Properties* dialog. DVM panel

In all configurations of *VS2000* hardware, the *DVM* module is used. The *DVM* is used for conversion of digital video. There are three sections in the **DVM** panel (Figure 3) – Video Conversion, Output and DVI Input. For some hardware configurations adjustments of *DVM* require the use of special software which functions similarly to the **DVM** panel.

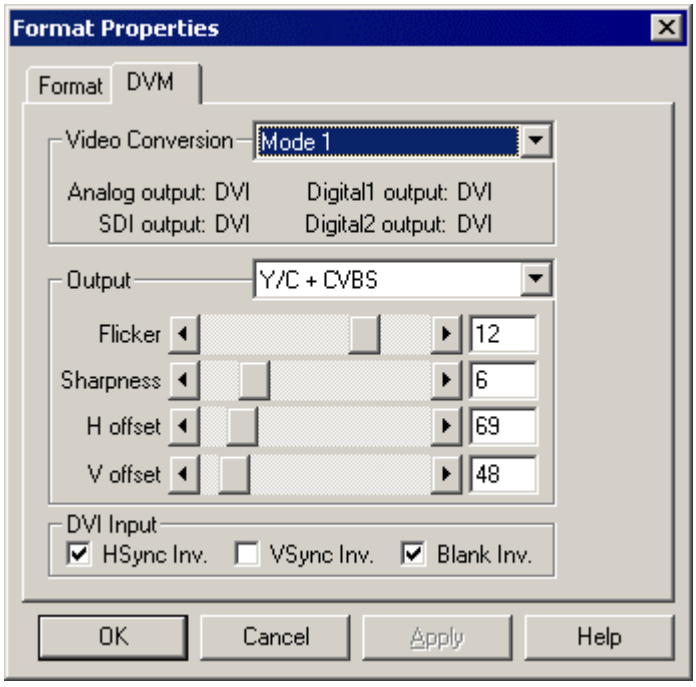



**Figure 3.** ***DVM*** **panel of** ***Format Properties*** **dialog**

In the **Video Conversion** drop-down list of **DVM** panel (Figure 3) you can set the mode of conversion for video (**Mode 1**, **Mode 2** and up to **Mode 7**). Abbreviated information concerning the output for each chosen mode is displayed directly beneath the Video Conversion drop-down list. The name of the output (**Analog output**, **SDI output** and etc**)** is followed by the name of its input signal (**SDI**, **Digital1**, **Digital2**, or a line «**-----**» if no signal is outputted).

☝ *If your system does not use SDI input /outputs it is necessary to choose* ***Mode 1****!*

The **Output** drop-down list (Figure 3) is used for setting the type of output analog signals, which may be accessible in some configurations of *VS2000* for preview.

☝ *Parameters* ***Flicker****,* ***Sharpness****,* ***H offset*** *and* ***V offset*** *of* ***Output*** *group directly influence the signal from the output board.*

Parameters such as **Flicker** (managing for the blink suppression filter) and **Sharpness** are selected experimentally.

**H offset** and **V offset** - shifts horizontally and vertically, accordingly. Correct values should be set when monitors are connected to *VS2000*. Typically, there is no need to change these offsets once the monitors are properly connected unless the model of the graphic accelerator or the version of its driver is updated.

In **DVI Input** group polarity of synchronization signals for digital input is set: horizontal (**HSync Inv.**), vertical (**VSync Inv.**) and a flat back signal (**Blank Inv.**). These parameters adjust the recognition of pulses of a graphic accelerator by *DVM* module; we recommend that you do not alter these default settings.

## 3.4 *Output Mode Configure* dialog

*Output Mode Configure* dialog is shown (Figure 4) by clicking **Mode** button in the Live Video panel in the Options dialog.

The **Analog Video Output** drop-down list (Figure 4) serves for setting the types of output analog signals (if there are two signals like **YUV + CVBS** one of them may be used for additional monitoring).

Drop-down **Mode** list offers various modes of operation for the board and all parameters of this panel and names of groups under **Mode** list are changed correspondingly with each mode selection. Some modes of operation may be inaccessible in certain configurations of *VS2000*.

Features of these modes and their adjustments are described in following sections. We shall note that the **Reset Mode** button sets the default value of the chosen mode for the **Video Output Switching** list and (if it is required for correct operation in a given mode) other default values for parameters are automatically selected as well.

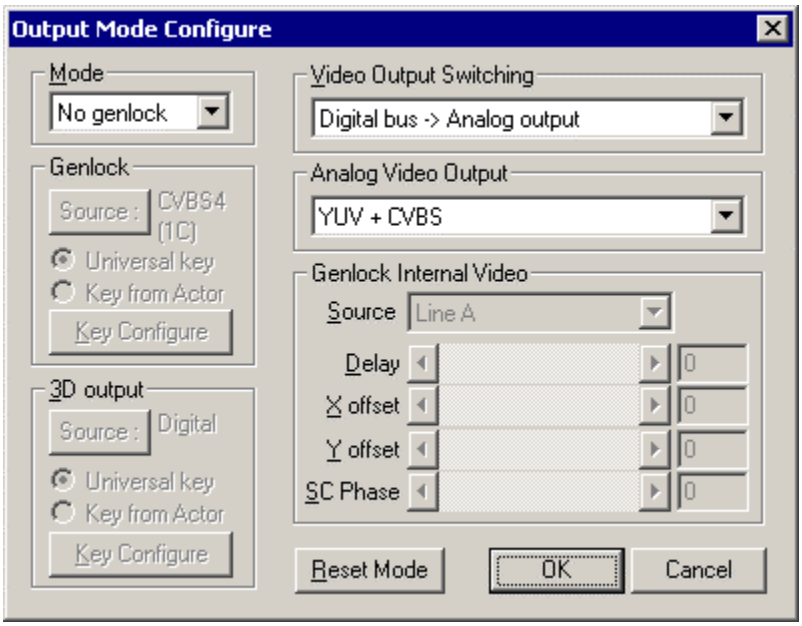



**Figure 4. *Output Mode Configure* dialog with mode *No genlock* selected**

### 3.4.1 *Analog Video Output* dialogue for the type of output signal

In **Analog Video Output** drop-down list it is possible to choose types of output signals for three connectors of the **Output** group in the switching panel.

After the «+», the type of the additional signal (it may be used for additional monitoring) is shown. In the description of the main output **CVBS** means composite signal and **Sync** the synchronal one. The following basic combinations are available:

| | |
|---|---|
| **Y/C + CVBS** | S-Video signal «+» composite signal. |
| **YUV + CVBS** | component signal with synchronization by Y «+» composite signal. |
| **YUV + Sync** | a component signal with synchronization by Y «+»synchronous signal. |
| **nsRGB + Sync** | a component signal in RGB format (without synchronization) "+"synchronous signal. |

The names of three more additional modes are the same as described above but prefixed with **ColorBar**. These modes always produce the test image of color bars.

☝ *If ONLY modes with color bars (which names begin with **ColorBar**) are accessible you should contact technical support service.*

The described list of modes is always available for all given configurations of *VS2000*. Combinations with **Key** should be used only in **3D Titler** mode (see 3.4.7).

### 3.4.2 Video Output Switching

☝ *It is not recommended to manually switch modes in **Video Output Switching**. It occurs automatically when the mode in the **Mode** list is changed.*

**Video Output Switching** allows setting, which data will move to the output coder. It may be either data from internal video mixer (**Internal**) or input from the external digital bus (**Digital bus**).

- **Internal -> Analog encoder** means that analog output uses data from the mixer; external digital bus is not used.
- **Internal -> Analog encoder + Digital bus** means that analog output uses data from the mixer. Also the same data goes to the digital bus, thus the device connected to this bus, if there is one, should receive the same data. It may be used for the SDI output.
- **Digital bus -> Analog encoder** means that analog output coder gets data from the external digital bus; and the data of internal mixer is not used. This setting should be used only for regular work in **No Genlock** mode (see below).

### 3.4.3 Genlock Internal Video – synchronization of the output signal

Parameters of **Genlock Internal Video** group allow you to adjust synchronization of data in internal video mixer (**Internal**).

☝ *Parameters of **Genlock Internal Video** group become inaccessible if in the **Video Output Switching** the selection **Digital bus -> Analog encoder** (Figure 4 is used). This happens because this mode has no synchronization at all.*

It is possible to choose a source for synchronization from the **Source** dropdown list:

- **Master** for internal synchronization, usually used if there is no external synchronization signal;
- **Line A** for synchronization with the video source connected to the first channel of the board;
- **Line B** for synchronization with the video source connected to the second channel of the board.

☝ *While working with HotActions version 1.7 synchronization to the first channel (**Line A**) is recommended because **Line B** is used to get the data for the internal video mixer (**Internal**) from digital bus (**Digital**).*

**Delay** – performs delay of input synchronous signal.

**SC Phase** – fine tuning of the phase for color component of composite signal.

**X offset** and **Y offset** – shifting of the output image relatively to input synchronous signal. By changing these parameters it is possible to get the higher quality synchronization.

### 3.4.4 *No genlock* mode

**No Genlock** mode (Figure 4) is usually used for the minimal hardware configuration of *VS2000* studio. This mode prevents any genlock for output signal.

If the No Genlock mode is selected in the **Video Output Switching** then you must select **Digital bus->Analog encoder** (this value is also set if you press **Reset Mode**).

As well as in other modes, in **Analog Video Output** drop-down list it is possible to choose types of output signals. Parameters of other groups are inaccessible, since the are not useful in the given mode.

Another consideration of the **No Genlock** mode from other modes is the output board can also use input video for use in *HotActions*. Adjustment of input video is performed using **Input** group of **Live Video** panel (*Options* dialog Figure 1) as for usual input board.

☝ *It is recommended to restart HotActions after switching to (or out of)* ***No Genlock*** *mode (or when parameter in* ***Video Output Switching*** *is changed to* ***Digital bus -> Analog encoder****).*

### 3.4.5 *Genlock* mode

**Genlock** mode (Figure 5), as a rule, is used as basic mode for working with *HotActions*.

In this mode video data from the graphic accelerator (the result of 3D-scene rendering) enters the board through the external digital bus (note that in **No Genlock** mode other digital bus is used). Therefore source **Digital** should be chosen in **3D output** group. This default setting is restored by **Reset Mode** button as well as **Internal -> Analog encoder** in the Video Output Switching drop-down list and **Line A** as a source of synchronization (**Source**) in group **Genlock Internal Video**.

The signal used for synchronization can be chosen in *Select Video Source* dialog (described in section 4.1), which appears by clicking **Source** button of **Genlock** group.

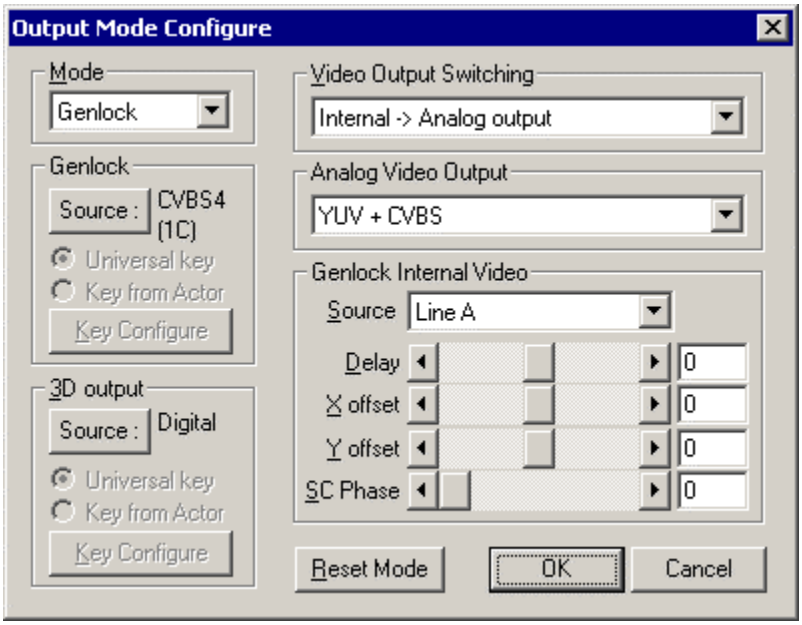



**Figure 5.** ***Output Mode Configure*** **dialog for** ***Genlock*** **mode**

### 3.4.6 *Overlay* and *Virtual Actor* modes

**Overlay** mode (Figure 6, at the right) is the mode when input video selected and adjusted in **Live Actor** group, is placed in front of video specified in **3D output** group. By default Digital is the Source for **3D output** group ..

This default setting is restored by **Reset Mode** button as well as **Internal -> Analog encoder** and **Line A** as a source of synchronization (**Source**) in group **Genlock Internal Video**.

The **Live Actor** group of parameters is identical to the group of parameters for any channel of the input board; procedures for their adjustment (see chapter 4) are similar to Overlay: button **Source** shows *Select Video Source* (section 4.1.) and **Key Configure** button shows **KeyConfigPro** dialog for keying settings (found in chapter 5).

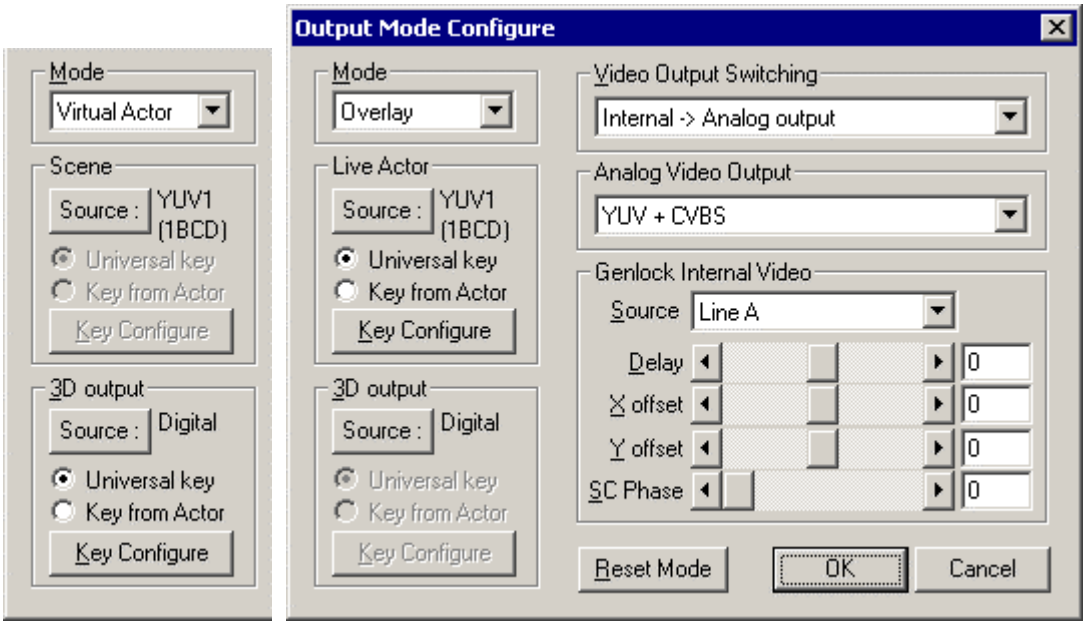



**Figure 6. *Output Mode Configure* dialog. *Overlay* mode (at the right) and part of the dialog in *Virtual Actor* mode (at the left)**

**Virtual Actor** mode is very much like the **Overlay** mode but differs in that layers of video exchange places. The input video adjusted in **Scene** group becomes background for video chosen in **3D output**.

The left part of *Output Mode Configure* dialog in **Virtual Actor** mode is shown in Figure 6, at the left. As a rule special 3D-scenes with homogeneous color background (typically the color magenta) are developed for use in this mode.

### 3.4.7 *3D Titler* mode

**3D Titler** (Figure 7) is the special mode allowing additional outputting of the alpha-channel (**Key**) as a result of keying of the input video specified in **3D output** group. The 3D Titler mode is intended for use together with an external video mixer. The mechanism used by the 3D Titler coincides with that used by the **Virtual Actor** mode.

☝ *Note, to activate **3D Titler** mode it is necessary to select output type with the alpha-channel (see below) in **Analog Video Outpu**. Only combinations with the word **Key** should be used in **3D Title, for example YUV+Key.**.*

**YUV + sKey** the component YUV signal without any synchronization «+» **Key** with synchronization.

**ns(Key on Y)UV + sY**

the component signal with synchronization on **Y** which goes to special output connector (section 3.4.1) while connector for **Y** outputs **Key** without any synchronization.

**nsRGB + Key** the component RGB signal without any synchronization «+» **Key** with synchronization.

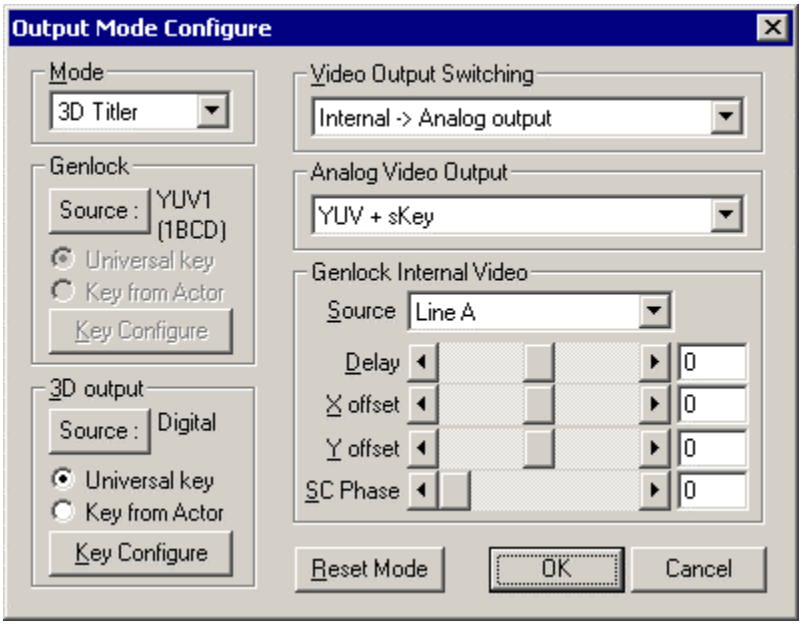



**Figure 7. *Output Mode Configure* dialog for *3D Titler* mode**

# 4 Input video settings

This section describes routines for working with the input video directly from the main *VS2000* application *HotActions*.

For the best quality image we strongly recommend you to use:

- a homogeneous background of one color (we suggest dark blue or green);
- a uniform illumination whenever possible to prevent the occurrence of shadows in the background;
- it is recommended to disable all automatic adjustments of the camera to avoid any intervention by the camera in the process of color replacement;
- the clothes of the actor should contain as little as possible of the background colors so that he does not appear partly translucent after the keying process.

**Input(s)** group of the **Live Video** panel of *Options* dialog (Figure 1) allows adjusting boards and their channels separately.

- Use **Input(s)** list to choose a board for adjustment. The number of values on this list (**LIVE_1**, **LIVE_2** etc) is established automatically by the number of boards in the system and represents independent video streams.

☝ *If your configuration includes several boards in the **Input(s)** list, you may have to determine which board is appropriate to a particular situation by practical experimentation. For this purpose it is necessary to choose any number from the list and set the correct input and its format. Then try to get the image from camera. If there is no image, the number is chosen incorrectly. Please note that the format of input video is set by format of output video.*

- For each input video on the **Input(s)** list it is possible to set the effective resolution to either **Full Resolution** (720 pixels) or **Half Resolution** (352 pixels).
- **DVM Configure** button is used only in a configuration of *VS2000* with SDI.
- For the first and second channel of the chosen board (groups **Line A** and **Line B**) the special *Select Video Source* (section 4.1.) dialogs help to adjust input from the switching panel. The *KeyConfigPro* dialog for adjustments of keying is described in detail in chapter 5.

## 4.1 *Select Video Source* dialog

*Select Video Source* dialog contains the primary settings for the external video equipment connection. For purposes of example, let's consider the camera is connected to the first channel of the board (**Line A** on **Live Video** panel of *Options* dialog (Figure 1). Button **Source** on **Live Video** panel of *Options* dialog opens *Select Video Source* dialog.

The type of the input is selected in **Input** pull-down list of dialog (Figure 8). For example if the camera is connected to the 1CD input of the switching panel by S-Video cable it is necessary to choose **YC1 (1CD)**.

If the component video input (YUV or RGB) is selected, then three regulators (**Y gain**, **U gain** and **V gain**) are accessible. They allow adjusting brightness and chromaticity of the image.

If composite or S-Video video is chosen, then input adjustments of hue, saturations, brightness and contrast become accessible. In **Half resolution** mode **X offset** slider allows shifting of the image horizontally.

The results of any changes are immediately displayed in the window of dialog. Once parameters are set, press OK button. When you choose new type of the input in **Input,** the parameters are reset to their default settings**.** (as if button **Default** had been pressed).


**Figure 8.** ***Select Video Source*** **dialog**

# 5 *KeyConfigPro* dialog for keying adjustment

For each channel of each input board a keying (chroma key or the rear-projection) is adjusted separately.

In the appropriate group (**Line A** or **Line B**) on **Live Video** panel of *Options* dialog (Figure 1) you can perform keying adjustments by either the **Universal key** or **Key from Actor** dialogs. Pressing button **Key Configure** displays the *KeyConfigPro* dialog with its parameters.

**Universal key** (Figure 10) provides definition of colors for the background by ellipses in three-dimensional color space. This method works best with a high quality background and illumination.

**Key from Actor** (Figure 12) requires the construction of a mask after manual selecting of the background's and the actor's colors. This methods is more flexible but is more tedious and demands more time.

In stationary conditions saving results of settings as ***Presets*** (**Presets** group of **Live Video** panel, Figure 1) considerably reduces preparation time. When using a ***Preset*** it is best to disable all automatic adjustments of the camera to prevent the camera interfering in the process of color replacement.

There are toolbar buttons of automatic parameters adjustment  for **Universal key** and  for **Key from Actor**. Pay attention to the small button at the right of some parameters. In the pressed state of the button it is red () that means, that the parameter is fixed and will not vary with automatic adjustments of keying. Otherwise the button is green (), and automatic adjustments may change the value.

Features of **Universal key** and **Key from Actor** adjustments are discussed in following chapters 6 and 7. By the end of this chapter the common elements for all variables of *KeyConfigPro* dialog (such as same toolbar buttons, the frame for input video and the stages of keying construction, a status bar and etc) are described.

## 5.1 Frame from input video displayed on panels keying stages

The frame of input video is displayed in a window on the panels for most keying stages. The image in the input video frame is updated as adjustments are made to different parameters in the various keying stages. The following panels display the input video frame:

**Input** – captured frame (as on Figure 10).

**Color corrected** – result of color-correction. Color correction is used for removing the mixed color of a background from the image of the actor. The color will be removed in places on the image where light reflected from the background. It is important when constructing a mask parameter adjustments are picked up correctly. If the adjustment is correct the area of a background on this panel will be grey.

**Mask** is initial transparency mask (Figure 9 at the left). Black color means absolutely translucent background, white – opaque «actor» while gradations of grey present degree of mixing of input video and scenery.

**Filtered Mask** – result of application of the algorithms influencing degree of mixing of input video and scenery. In particular, the of masks spatial filtration (**Spatial filter**), and color corrections of the actor (**Alpha correction**),are described in section 5.4.

**Decoration** – a background with which the input video is mixed by you through experimentation. This may be pure color if button  is pressed, or a picture from a file if  is pressed.

**Result** – result of mixing of the frame of input video (panel **Input**) with background (panel **Decoration**) with use of the filtered mask (**Filtered Mask**). An example is shown at Figure 9 at the right.

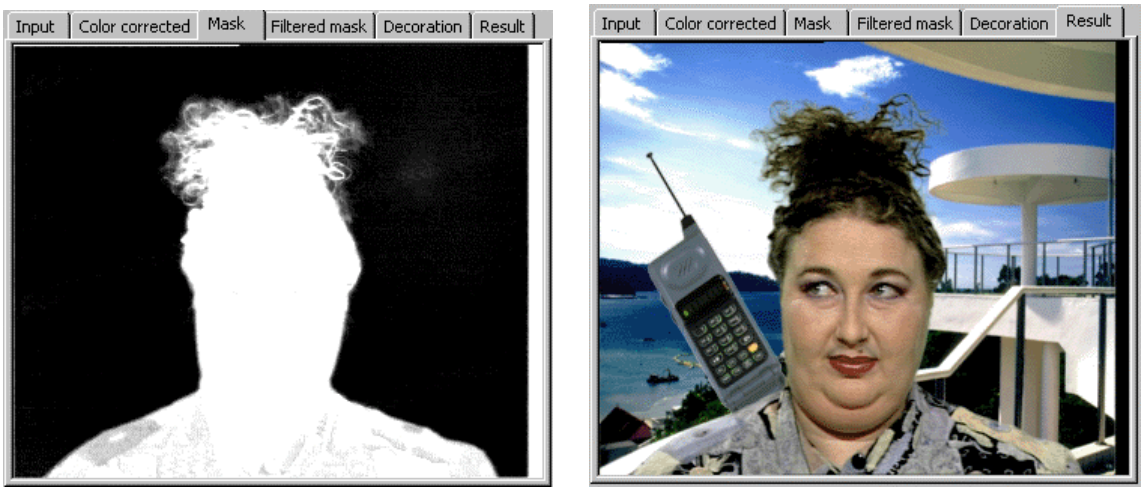



**Figure 9. An initial mask and result of keying**

The scale of the image can be increased or reduced with the help of toolbar buttons (section 5.3) or **Zoom** menu commands (chapter 7.3).

## 5.2 Status bar


At the bottom of *KeyConfigPro* dialog the status bar is located. There the information about the pixel on the image under the cursor's position is displayed. Coordinates of pixel are shown in the most right section. In others sections there is information about this pixel at different stages of keying. The information on color is given as Y, U, and V after following prefixes:

**in** **Input**, initial color on the captured frame image.

**cc** **Color corrected**, corrected color.

**a** **Mask**, value of actor's opacity weight (α) in initial mask (in range from 0 to 255).

**fa** **Filtered mask**, value of actor's opacity weight (α) after filtration (in range from 0 to 255).

**d** **Decoration**, color of the corresponding pixel on the decoration panel.

**r** **Result**, color of the corresponding pixel in the resulting image.

**x, y** coordinates of image's pixel under the cursor.

## 5.3 Toolbar

The buttons of *KeyConfigPro* dialog's toolbar are listed below for each type of keying – **Universal key** (chapter 6) and **Key from Actor** (chapter 7). Additional buttons are described in the appropriate sections.

Captures the frame image to the **Input** panel while other panels show stages of keying.

Loads parameters and the keying table into the board; it may take up to ten seconds.

Opens *Crop parameters* dialog, for cropping edges of the input video. Actually the size of the image remains the same but cropped edges are made translucent. Usually it is the simplest way to get rid of black strips on borders of the video.

Shows/hides cropped borders determined using *Crop parameters* dialog (see the previous paragraph), on images of the frame.

If this button is pressed the pure color is used as decoration (**Decoration** panel). By pressing the button again *Select Decoration Color* dialog is shown.

If this button is pressed the image from the file is used as decoration (**Decoration** panel). By pressing the button again standard *Open* dialog is shown to browse for file (tga, png, dib, bmp or jpg).

Zoom in the image on panels.

Zoom out the image on panels.

Close the dialog with saving all parameters.

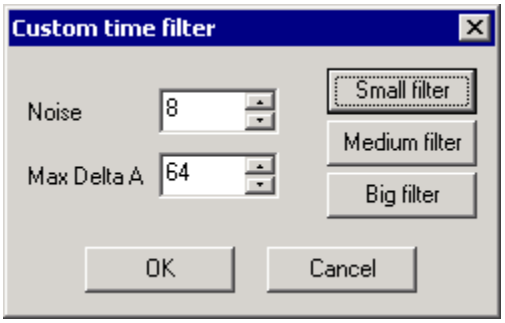
## 5.4 *Spatial filter* and *Alpha correction* groups

The algorithms adjusted in these groups of *KeyConfigPro* dialog; work for all types of keying. As a rule, adjustment of their parameters is controlled by images on panels **Result** and **Filtered Mask**. You can also use *Render Output* window of *HotActions* if any project with live video is loaded (don't forget to load parameters to the board by pressing  ).

In **Spatial filter** group shown at Figure 12 (**Filtration** group for **Universal key** algorithm, Figure 10) common masking adjustments are available.

The degree of horizontal spatial filtration is set in **Horizontal** list and the vertical degree in **Vertical** list. **None** turns off the filtration in the given direction. Icons in the list give comparative information about number of pixels taken into filtration. The degree of desired filtration is determined by quality of a background, uniformity of its illumination, quality of a signal from the camera etc. In bad conditions, to get better quality, it is recommended to use filters of the maximal length. Note that the small button on the right in its pressed status (  ) fixes the choice of the filter.

The degree of interframe time filtration of the mask is set in **Time** list. **None** disconnects filtration. **Custom** allows setting any parameter in *Custom time filter* dialog (see figure on the right). To call this dialog just presses the  button to the right of the list.




In this dialog two thresholds for the differences between weights of actor's color (α) from sequential frames are set. A Max Delta A value below the one set in **Noise** is considered as noise and will be suppressed. If the difference is higher than the value in **Max Delta A** correction is not made. Intermediate values cause small changes. Buttons of dialog, whose names coincide with names from **Time** list (**Small**, **Medium**, **Big**), set the pre-defined values for the given filtration.

**Alpha correction** group (Figure 10) corrects the values of actor's color weight (α, opacity) to increase the sharpness of actor-background border. Note certain settings may cut off thin objects. Parameters **Min** and **Max** range from **0** up to **255**. The difference between **Max** and **Min** should not be less than **128**. If value of a mask in the given point is less than **Min** the point will be completely transparent (**0**). If it is more than **Max** it is completely opaque (**255**); values a between **Min** and **Max** are linearly interpolated. These result in geometrical reduction of the mask in actor's area. On the diagram **Min** is at the left, and the **Max** at the upper right. By placing the cursor above either and then dragging, it is possible to change these values.

As a rule, for increased sharpness the value of **Min** should be increased slightly (e.g. shifted to the right).

# 6 Universal Key (*KeyConfigPro* dialog)

This variant of keying construction in *KeyConfigPro dialog* (Figure 10), is displayed upon pressing button **Key Configure**, when in group **Line A** or **Line B** of the **Live Video** panel (Figure 10) in the dialog *Options* is chosen **Universal key**.

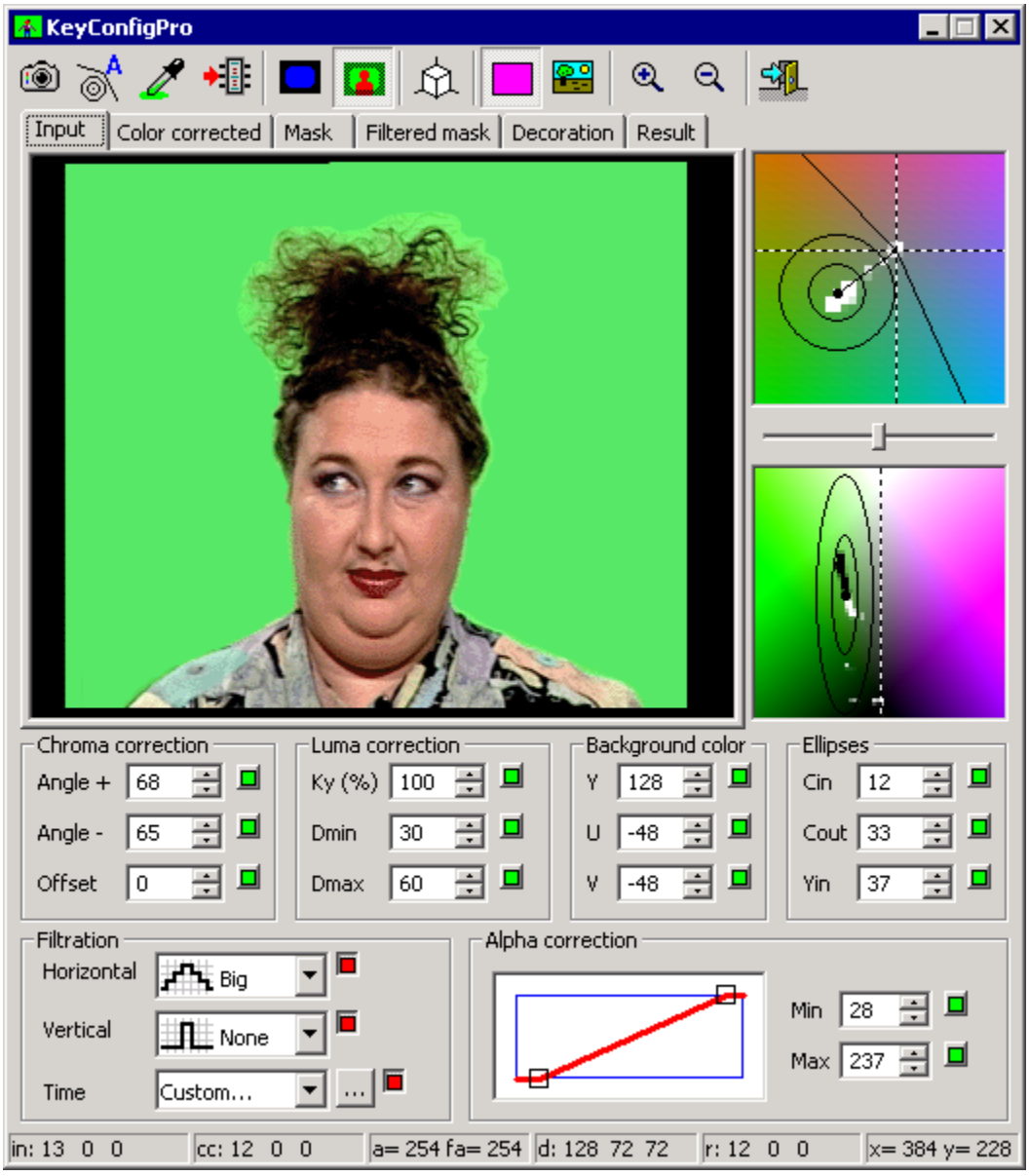



**Figure 10.** ***KeyConfigPro*** **dialog for** ***Universal Key*** **algorithm**

The mechanics for construction of an initial mask (parameters of groups the **Background color** and **Ellipses**) are described in chapter 6.1. Then if necessary adjust color correction (item 6.3, groups **Chroma correction** and **Luma correction**). A spatial filtration of a mask in group the **Spatial filter** and correction of values of weight of color of the actor in **Alpha correction** for elimination of regional effects are outlined above in section 5.4.

In section 5 other elements of dialog are described. Except for the Tool Bar described in section 5.3 the following buttons are available on keying panels.

Automatically adjusts keying parameters, analyzing the frame that is shown on panel **Input**. To grasp the new frame it is possible, having pressed the button  .

After pressing this button it is necessary to transfer the cursor to panel **Input** and to click above a point of a background. Parameters of group **Background color** thus are set. see section 6.1 is lower.

Shows/removes dialog of 3-measured statistics of distribution of colors in the seized frame (Figure 11).

## 6.1 Construction of a mask. Ellipsoids in color space

Division between colors of a background and the colors for the actor, is carried out in color space **YUV** with the help of two ellipsoids with the common center. Colors for external ellipsoid (colors of «actor») will be opaque in the input video. In space between ellipsoids, the transparency of colors, or a degree of mixing with scenery, smoothly changes from opacity at external up to a transparency at internal ellipsoid, which defines colors of a background, i.e. colors of input video, which will be absolutely transparent. The common center should be in area of the most typical colors of a background so that internal ellipsoid covered area of change of colors of a background owing to non-uniformity of illumination and noise. Coordinates of the center are in group **Background color**: **Y** – value of brightness, **U** and **V** – color components.

Parameters of group **Ellipses** determine the sizes of ellipsoids. In the left part of dialog two sections of color space **UVY,** which are taking place through the common center of ellipsoids are displayed. In the top window value of brightness **Y** is fixed, the dotted line shows projections of axes **U** and **V**. Ellipsoids in this section are defined by circles with radiuses **Cin** (internal) and **Cout** (external). In the bottom window is shown the section, which is the space through axis **Y** and color of a background displayed, the dotted line shows a projection of an axis of brightness **Y**. Parameter **Yin** – half height of internal ellipsoid (half height of external it is calculated as **Yin*Cout/Cin**).

When moving the cursor to a circle, either the top or bottom edge of an ellipse or the common center of ellipsoids; the cursor will take the form of a hand  . Then with a mouse click it is possible to moving the ellipse, as well as change parameters of ellipsoids including their center. The edge of an ellipse in the bottom window can be pulled only upwards or downwards, changing thus **Yin**; the center of ellipsoids can be moved to any side.

Pressing the right button of the mouse above a color plane displays the local menu, which commands scale changes of display.

Initial mixing mask and the result from mixing with the chosen decoration are shown on panels **Mask** and **Result** (Figure 9). When adjustments are correct, the background colors for the mask should be black, and colors of «actor» – white. Shades grey means mixing in colors from the background can occur. This can happen, for example, if light from the background is reflected on the actor. If definition of colors for the background with the help of ellipsoids is already close to optimum, background mixing in the mask can be eliminated with the help of color correction (see 6.3).

## 6.2 3D Statistics of distribution of colors in the frame

If you press the button of the mouse as the cursor hovers above the image of the frame on panels, a window with sections of color space (see 6.1) for the pixel under the cursor is displayed. (see Figure 11) On the planes of sections of color space is a gradation grey depicting the distribution of colors in the video frame. When there are more dark colors in the gradation, there is more pixels in the frame with the same color as that of the pixel under the cursor. With the help of a regulator  between windows it is possible to change contrast of display of statistics.

The button on the tools panel of dialog *KeyConfigPro* shows/removes the *3d statistics* dialog (Figure 11) in which also are shown ellipsoids and statistics of colors in the frame.

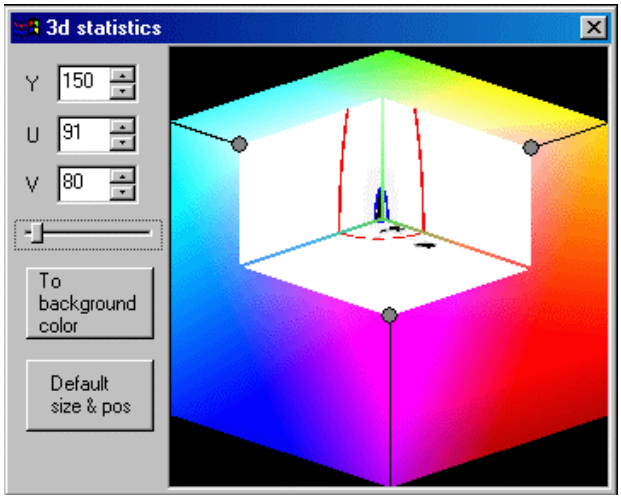
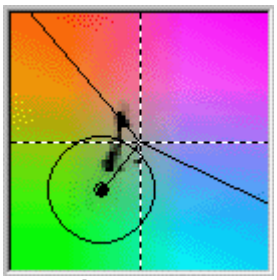



**Figure 11. Statistics of distribution of colors in 3D-space**

In dialog *3d statistics* parameters **Y**, **U** and **V** are coordinates of an internal point of the «cut out» parallelepiped. These values also can be changed by moving grey points on the edge of the color cube. The regulator changes contrast of display of statistics. **To background color** sets in fields **Y**, **U** and **V** values of the center of ellipsoids, i.e. parameters of group Background color dialog *KeyConfigPro* (see 6.1). Button **Default size & pos** sets the size and position of dialog *3d statistics* by default.

## 6.3 Color correction

Parameter groups **Chroma correction** and **Luma correction** contain parameters for color correction. Color correction is required to remove colors from the background that are mixed in with the actor. Mixing can happen during transitions – light reflected from a background may fall on the actor. To adjust color correction the parameters for construction of the mask (the center and the ellipsoids sizes) must be correctly determined.



For execution of color correction, the color space is divided into two parts of two half-planes, which are perpendicular with planes **UV**. The line of crossing of these half-planes is in a plane, which passes through the center of ellipsoids and axis **Y**. On plane **UV** (figure at the left) dividing beams leave a point which is on a straight line passing through the center of ellipsoids and the crossing of the dotted axes. From this straight line the angles of the beams can be edited in the **Chroma correction** -**Angle** – (clockwise) and **Angle +** (counter clockwise), Beams also can be turned by pressing the mouse button when the cursor takes the form of a hand. By changing parameter **Offset** it is possible to displace a point at the beginning of the beams from crossing axes (from axis **Y** in space), i.e. from grey colors. For example, with a little displacing at the beginning of beams further from the center of ellipsoids; it is possible to restore natural color of light hair on actors. In the above figure with the **Offset = 0**, and values of angles are approximately 100 degrees.

All colors, which are in the area within the center of ellipsoids, i.e. relative to color of a background, are replaced by the nearest colors in the area on border of sector. Colors in other areas remain constant, i.e. not exposed to color correction. If on the actor there are colors, which should be kept, but they have got in color correction area, it is still possible to change the color correction parameters for the sector. It is even possible to completely switch off color correction, by setting the values of **Angle -** and **Angle +** to equal **0**.

Chroma correction algorithm only changes the colors inside the color correction sector. Brightness of colors inside the color correction sector is changed by the **Luma** correction parameters. Parameter **Ky (%)** determines amount of correction of brightness. Value **0** cancels correction of brightness. Value **100%** changes all colors with brightness lower than the brightness of the background to the color black, while all colors with brightness are higher than brightness of a background become white.

The recommended value is about **30%**.

Parameters **Dmin** and **Dmax** limit correction of brightness by reducing the influence of noise. If the difference of value of brightness of the current color from brightness of the center of ellipsoids, i.e. the center of colors of a background, does not exceed size **Dmin** correction of brightness is not made. If difference of brightness lays within limits from **Dmin** up to **Dmax**, correction of brightness is proportionally increased up to specified in parameter **Ky (%)** values. It is recommended to set value **Dmin** a little bit more than the size of a variation and noise of colors of a background, i.e. about equal to value **Yin**. Value **Dmax** should exceed **Dmin** by approximately 2-3 times.

## 6.4 Recommendations for *Color Correction*

The sizes of internal ellipsoid **Cin** should, as a minimum exceed noise level on the appropriate axes. As a rule, the noise level on brightness is higher, than noise level on color, therefore value **Yin**, exceeds value **Cin**.

For changes to the general brightness of the image, the majority of cameras colors of the image ( including as little change colors of the background as possible), it is desirable to increase the sizes of internal ellipsoid a bit. To reduce change of color of the background by the chamber it is desirable to disconnect all automatic adjustments in the chamber, such as balance white, auto-focus and others.

External ellipsoid should not include axis **Y**, as grey colors (all colors from black up to white),since as a rule they are present on any actor. Small difference of parameters **Cin** and **Cout** for an actor–background combination can result in wavy edges of the actor in creation of sharp transition. It is desirable, that the distance from color of a background (the center of ellipsoids) up to axis **Y** exceed noise level at a minimum three times.

☝ *After adjustment of all parameters you always can check the result in the window of dialog, by choosing button **Result** (see Figure 9, on the right).*

To load parameters of keying in the device it is necessary to press the button  of the tools panels of dialog.

# 7 Key from Actor (*KeyConfigPro* dialog)

This variant of keying construction and, accordingly, dialog *KeyConfigPro* (Figure 12), is caused by pressing button **Key Configure**, if in group **Line A** or **Line B** of panels **Live Video** (Figure 1) of the *Options* dialog is chosen **Key from Actor**.

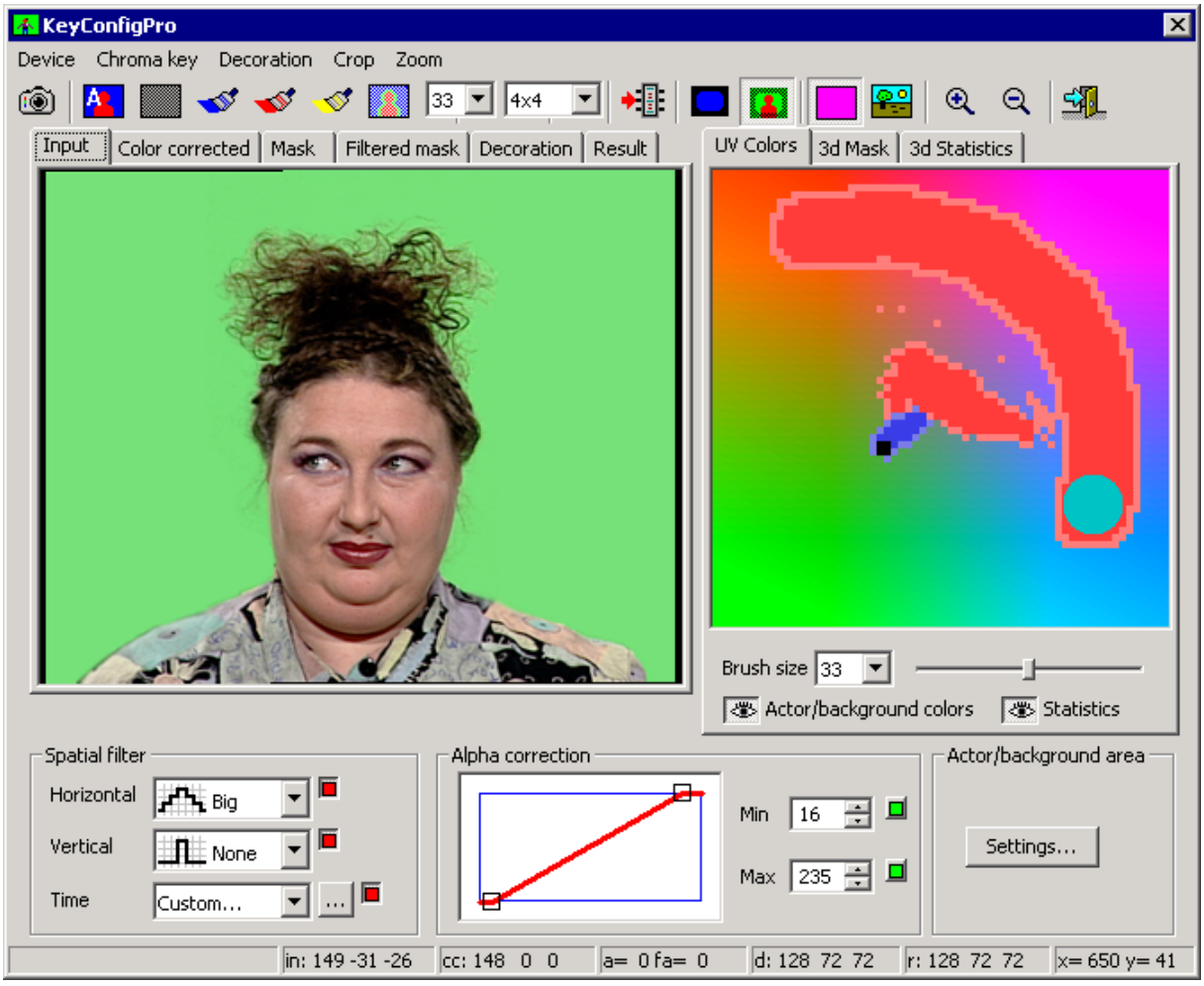



**Figure 12. *KeyConfigPro* dialog for *Key from Actor* algorithm**

## 7.1 Mask building on the video frame

Construction of a mask occurs by the assignment of colors to a background and to the actor on the image of the seized frame of video on **Input** panel. To specify colors of a background, it is necessary to press the button with a dark blue brush . Then transfer the cursor to an area of a background on the image of the frame and, press the left button of the mouse, to paint on background in the frame (Figure 13). When the button of the mouse is released, background dark blue color will appear. If in the frame there are areas in the background that were accidentally painted over or should not be included in the background, the brush size can be chosen from the drop-down list on the palette of tools to the right of yellow (last) brush. The chosen colors, as a background can be erased, by pressing the right button of the mouse; for example, when accidentally including portions of the actor.

To exit from the mode of definition of colors of a background, it is necessary to use the wring out the dark blue brush , by clicking on it or by pressing a different button with the brush.


**Figure 13. Indications of background colors (at the left) and actor (at the right) in the *KeyConfigPro* dialog**

In addition to definition of color of a background it is necessary to press button with a red brush to paint over colors of the actor (Figure 13). After that with the help of a yellow brush it is possible to carry out color correction, details of this procedure are discussed in section 7.2.

It is easy to define, what colors are painted over, and what colors are not present. To do this it is recommended to press the include button, this will result in the tinting of pixels on the frame on panel **Input**. Pixels with color of the background will be tinted dark blue, while colors of the actor will be tinted red. Areas needing color correction will be tinted green. Grey color is mixed with the others pixels. For example, in Figure 13 the frame on the left the indication of colors of the actor has only begun, the first stroke of brush has not started the splitting into colors of the background and the actor. At this stage of the process, pressing the button resets adjustments of keying. In all colors, except for a trace of a brush grey color is mixed, compare about Figure 12, where all buttons to the image of a brush are depressed. On the right side of Figure 13 the indication of colors of the actor is now beginning with a trace of red from the brush. The majority of the actor remains, however colors of a background already were adjusted, and pixels with these colors are tinted dark blue.

After shooting of actual video new colors can appear, which were not defined as colors of the actor. This can make the actor look transparent. Whenever possible, if new colors occur in the video they should be painted over beforehand. To add colors for the actor, grab a new frame by pressing the button ). Also it is possible to press button with a red brush to choose all colors in window **UV Colors** at a great distance from a background, then new colors will be less transparent, and that will considerably improve their perception. On Figure 12 for this purpose «arch» from the left top corner is carried out; pay attention, that green colors of a background are at the left below (they are tinted dark blue). After painting colors it is possible to wring out the button to clean color illumination of the painted over colors.

On panel **Mask** it is possible to see result of construction of a mixing mask.

## 7.2 Color correction and mask filtration

After construction of a mixing mask, in places of transition between actor/background on the actor there can be colors of the background. As a rule, it is best to check on the image in the **Result** panel. If background is on the actor, this can be corrected by color correction. In Figure 14 is an example of a transition between actor/background before and after color correction is executed.

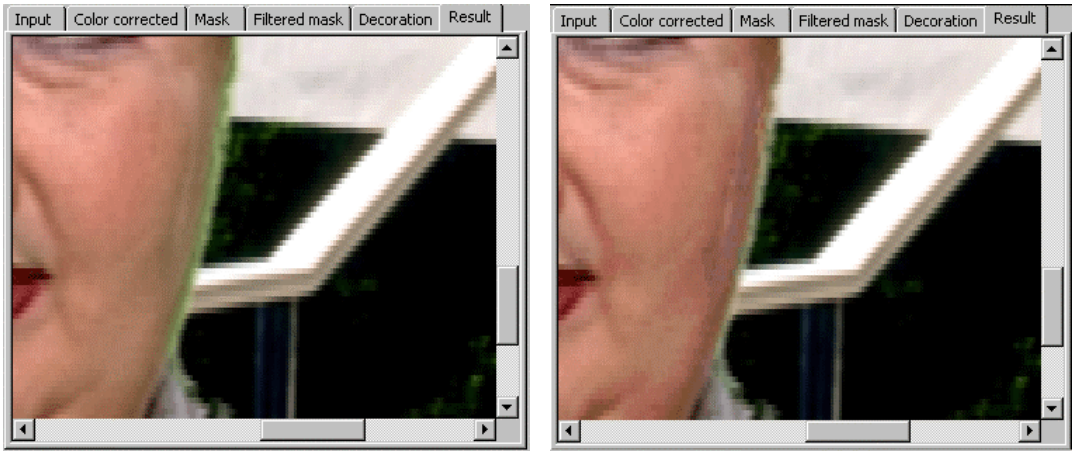



**Figure 14. Edge of the actor image up to (at the left) and after (on the right) of color correction**

For color correction execution it is first necessary to choose convenient scale of display of the frame and to reduce the size of brush (see 7.3) in order to have finer control of the brush. Then press button with the yellow brush and paint over colors of a background on the actor (Figure 15). If on the actor background illumination is still visible, operation can be repeated several times for achievement of optimum result.

Sometimes the result is a too strong color correction of the actor, resulting in leaks of the background in the places on the actor far from the transition edge between the actor and the background. In this case it is possible to erase on the image part of pixels with colors that have undergone color correction (Figure 15), by pressing the right button of the mouse.

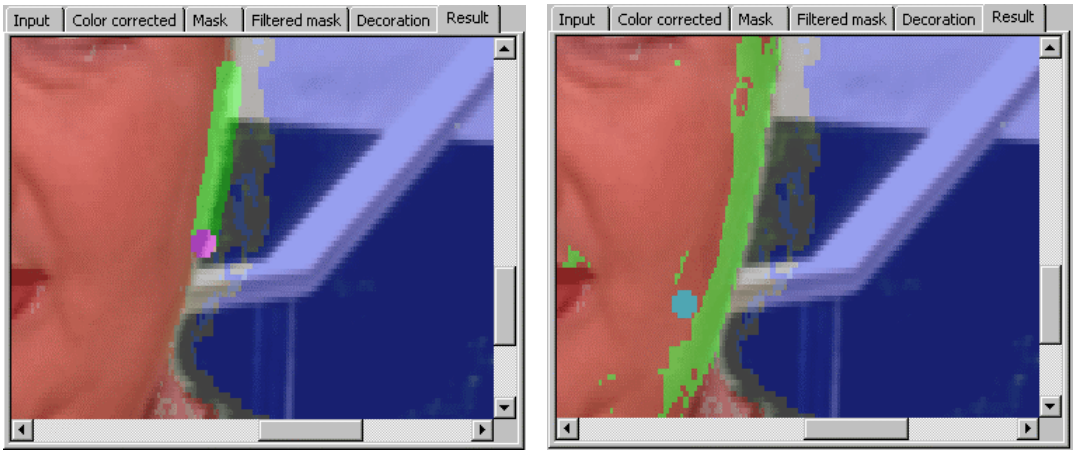



**Figure 15. «Painting» transition (at the left) and restoration of actor colors after superfluous color correction**

For perception of a more precise and pure transition edge of actor/background it is possible to filter a mask, using parameters of groups **Spatial filter** and **Alpha correction**. These are described in section 5.4.

## 7.3 The tools panel and menus

In section 5 parts of elements of the *KeyConfigPro* dialog are already described. In particular, images of the input frame at all stages of keying construction (see 5.1), groups **Mask filter** and **Alpha correction** (5.4).

The *KeyConfigPro* dialog contains menus: **Device, Chroma Key, Decoration, Crop** and **Zoom**. Buttons on the tools panel duplicates the majority of commands. The several of the buttons were described in section 5.3.

In menu **Device** are two commands: **Capture input image** ( ) and **Load parameters into device** ( ). Commands of menu **Decoration** include switch scenery. Commands of menu **Crop** control transparency of edges of the frame. Menu **Zoom** allows changing scale of the image.

Buttons describe below on the tools panel are duplicated by commands of menu **Chroma Key**; names of commands are shown in the beginning of the description of the button.

**Auto create keying**. Automatically adjusts parameters of keying by analyzing the frame that is shown on **Input** panel. Any previous adjustments are reset. Note that with appropriate commands of **Chroma Key** menu it is possible to automatically choose only colors of the actor or only colors of a background (see below).

**Clear key table**. Resets all adjustments of keying in order to try keying adjustment anew. If it is necessary to correct results of adjustment it is possible to remove adjustments instead of full dump a part of colors on panel **UV Colors** (see 7.4) by a few and/or to remove or add colors from the frame manually (see 7.1).

**Select background colors**. Allows specifying colors of a background (if it is pressed) on the image of the frame on the **Input** panel. For this purpose it is necessary to press the left button of the mouse and to paint with brush over the background in the frame (Figure 13).

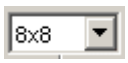
For more detail you should read section 7.1.

**Select actor colors**. Allows the user to specify colors of the actor, see 7.1.

**Select corrected colors**. Allows execution of color correction. Details – in section 7.2.

**Show/hide selected colors**. Switches on and switches off display of the painted over colors. Details are described in section 7.2.


Allows defining the size of a brush by painting over the image with the pressed left mouse button. The size is in number of pixels.




The size of area in 3-measured color space **YUV** around of color of the pixel frame, chosen (painted over) on the image. Each color painted over on the image chooses itself and the neighbors in this color area.

Buttons of the tools panel do NOT duplicate the following commands of **Chroma Key** menu.

**Auto select background colors**

Automatically chooses colors of a background. The previous adjustments of colors of a background are reset.

**Auto select actor colors**

Automatically paints over color of the actor. The previous adjustments of colors of the actor are reset.

**Auto adjust keying parameters**

Automatically adjusts parameters of groups **Spatial filter** and **Alpha correction**, described in section 5.4.

**Select colors...** Opens the *Add colors* dialog (Figure 16).

With the help of dialog *Add colors* it is possible to add colors to the actor (**Actor's color**), to background (**Background's color**) or to make color correction (**Corrected color**). In the drop-down list it is possible to choose the size of area in 3-measured color space around of color with coordinates of parameters **Y** (from 0 up to 255), **U** and **V** (from –128 up to +128). Buttons **Black** and **White** set values appropriate to black and white colors. Pressing on **Add** adds area over which it is possible to change adjustments and pressing on **Add** again stops the addition process. Button **OK** closes dialog and saves any changes made to the keying table.

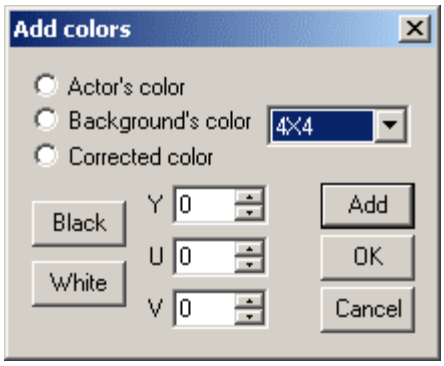



**Figure 16.** ***Add colors*** **dialog**

## 7.4 UV Colors and colors statistics

On panel **UV Colors** the section of color space is shown at constant brightness, i.e. a plane of coordinates **UV**. The projection of the color under the cursor hovering on the image in the input frame (exact value of all coordinates is displayed in status bar, see item 5.2). In 3D **Statistics** gradation grey displays distribution of colors to in the captured video frame.. The more dark color shown, the more pixels are in the frame with the same color. With the help of a regulator  it is possible to change contrast of display of statistics.

An **Actor/background color operates** display of colors of a background (dark blue), the actor (red) and corrected colors (green). Thus if one of buttons with a brush is pressed, it is possible to edit the appropriate colors, painting over or erasing (at the pressed right button of the mouse) areas on plane **UV**. For example, to add the colors of the actor absent in the frame it is described in 7.1. Or to erase color correction, to adjust it anew. Parameter **Brush size** sets the size of a brush for these purposes.

On panels **3D Mask** and **3D Statistics** parameters **Y, U** and **V** are coordinates of an internal point of the cut out parallelepiped. These values also can be changed, moving grey points on the edge of a color cube. **Actor/background colors** on the panel **3D Mask** as well as in **UV Colors** operates display of colors and switch **Mask** display of distribution of values of a mask with the help of gradation grey. The regulator changes contrast of display of statistics on the panel **3D Statistics**

## 7.5 The expanded adjustments of algorithm

Change to parameters in group **Actor/background area** is not recommended. Their adjustment demands a detailed understanding of the color algorithm and the careful analysis of colors of input video.

Regulators **Expansion of background colors area** and **Expansion of actor colors area** automatically allow expansion of the actor area and background color area. Recommended values of parameters is 6%.

**Suppression of actor near background** sets area around of a background in which allocation of color of the actor is ignored, i.e. even the painted over actor in these places will be always transparent. An increase of a level of noise value of this parameter should be increased accordingly. Recommended value of the given parameter is 25%.

**Autokey actor/background transition** sets width of transition between the actor and a background at automatic adjustment of keying parameters. Recommended value is 16 pixels.

# 8 Sound settings for *FD300*

*FD300* has three stereo inputs and three stereo output (correspondingly six mono inputs and six mono outputs) and its switching panel has special connectors for sound equipment.

To set sound setting in VS2000 access the *Sound Configure* (Figure 17) dialog by clicking on  toolbar button of the main window of *HotActions*. This dialog provides cross input-output mixing with customizable delays and volumes.

Drop-down list (Figure 17, #1) of **Options** group helps you to select the board for adjustment. The number of items of this drop-down list corresponds to the number of boards.

Other group of parameters **Options**, Figure 17,#2 allow you to set minimal volume for all volume sliders of the dialog (Figure 17, 7,#2). If you set **Show Meters** (Figure 17,#3) any changes of the signals will be shown by color indicators.

All mono inputs are paired to stereo by default by **Lock** option for each pair as shown at Figure 17,#4. Any volume slider of the pair could change volume for the resulting stereo input. Second and third inputs have **Mic. Boost** (Figure 17,#5) options for additional signal boosting.

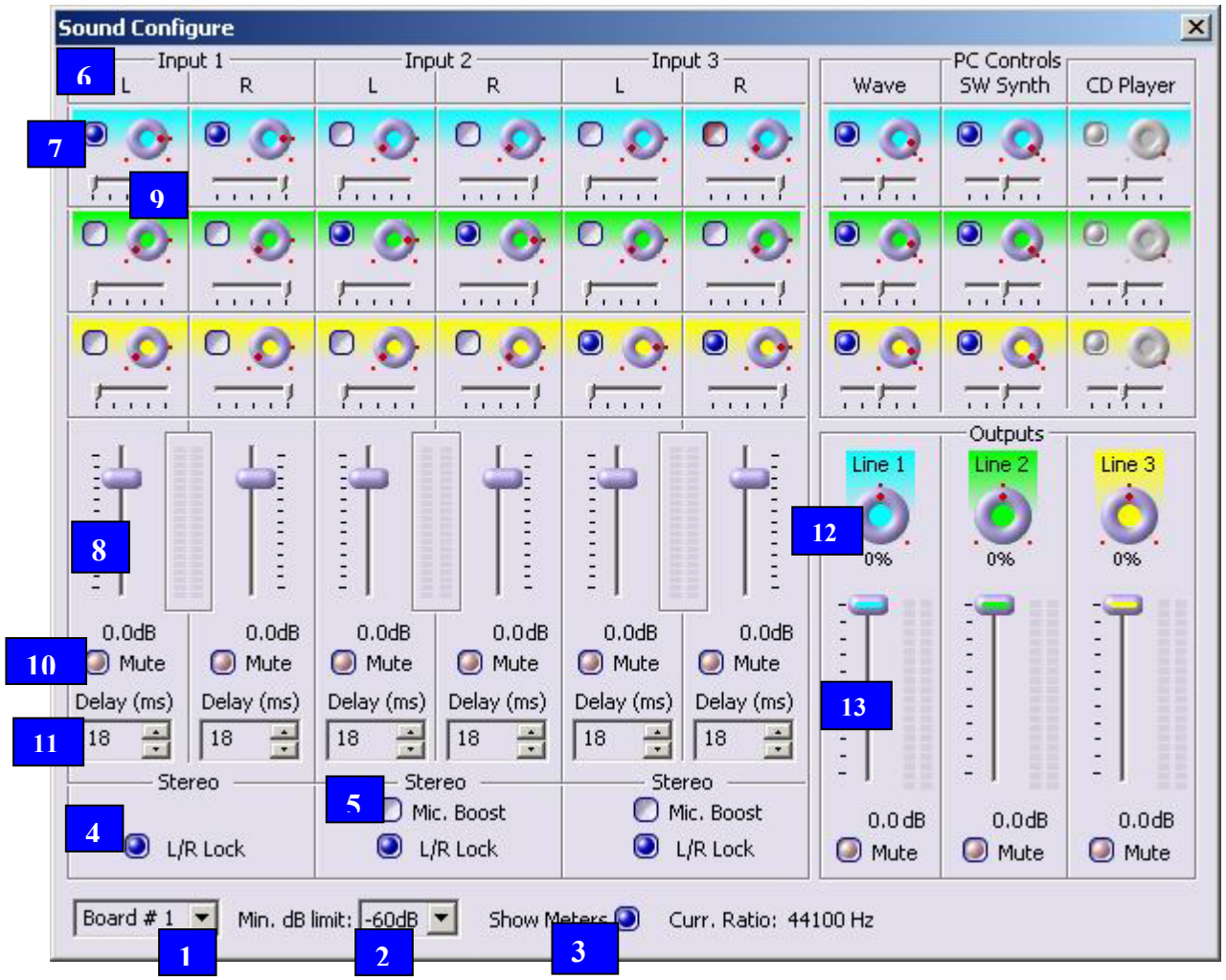



**Figure 17. *Sound Configure* dialog**

Each sound channels of the board is controlled independently within its group; for example **Input1L** shown at Figure 17,#6 servers for the first mono input as well as for left channel of first stereo input.

Each channel has special checkboxes in its group for output for example. If you checked **Input1L** (Figure 17, #7) then mixing of this mono input to the first stereo output is switched on. These checkboxes have tool tips

with info about which output has this signal. The volume slider (such as Figure 17,#8) allows setting the level of signal.

By default all mono inputs go to the channels of corresponding stereo output. For example from the first mono input (**Input1L**) and the second mono input (**Input1R**) go to the first stereo output (**Line1**) and for your convenience their groups have the same color. The balance for the right and the left (Figure 17,#9) channels are set correspondingly.

**Mute** (Figure 17,#10) completely excludes this input from output mixing. You can set delay for any input in range from 0 to 999 ms in **Delay** edit box (Figure 17, #11).

Each stereo output has the slider for balance (Figure 17,#12) and volume (Figure 17,#13) settings while **Mute** checkbox completely turns off the output.

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