

# *Focus*

## *Virtual Studio*

# *Video & Audio*

## *Settings*

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VS 1.63

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# 1 Introduction

This document describes the video and audio settings for the signals connected to the Virtual Studio in its main application *HotActions*. Since the input/output of the video and audio data in the Virtual Studio is based on the *FD300* board, the setting is possible only when the *FD300Drivers* software is installed in the operating system. To work with HD SDI video signals, the Virtual Studio also require the installation of the appropriate software for *Aja XENA 2Ke: AJA\_Windows\_Software-4.2.0\_x86.msi*.

Before setting signals in the *HotActions* application, configure the *FD300* board in the *FD300 Configuration* application: specify the parameters of the audio playback on the audio device selected for this in the operating system (see Section 2.1). If the input video signals and the output of the resulting image in the Studio (digital SDI or analog signals) are provided by the *FD300* board, configure their parameters in the *FD300 Configuration* program: specify the format, enable using *Direct Show* filters, specify the output video signal type and the genlock mode. These settings are described in Section 2.

The current version of the document covers the *VSHotActions 1.63* and *FD300 Drivers ver. 5.01.350* software.

## 2 Configuration of *FD300* Boards for Working in Studio

Before working with video and audio signals in the *HotActions* application of the Virtual Studio, configure the operation parameters in the *FD300 Configuration* application (if on the *FD300* board). The audio playback settings are performed for the audio signal output board (Section 2.1). The appropriate settings for video signals, digital (SDI) and analog, are described in Section 2.2.

### 2.1 Audio Settings

Working with audio in the Virtual Studio is performed, as a rule on the output board, that is, on the board with the largest logical index **L** in the **Boards'Indexes** list in the *FDConfig* window.

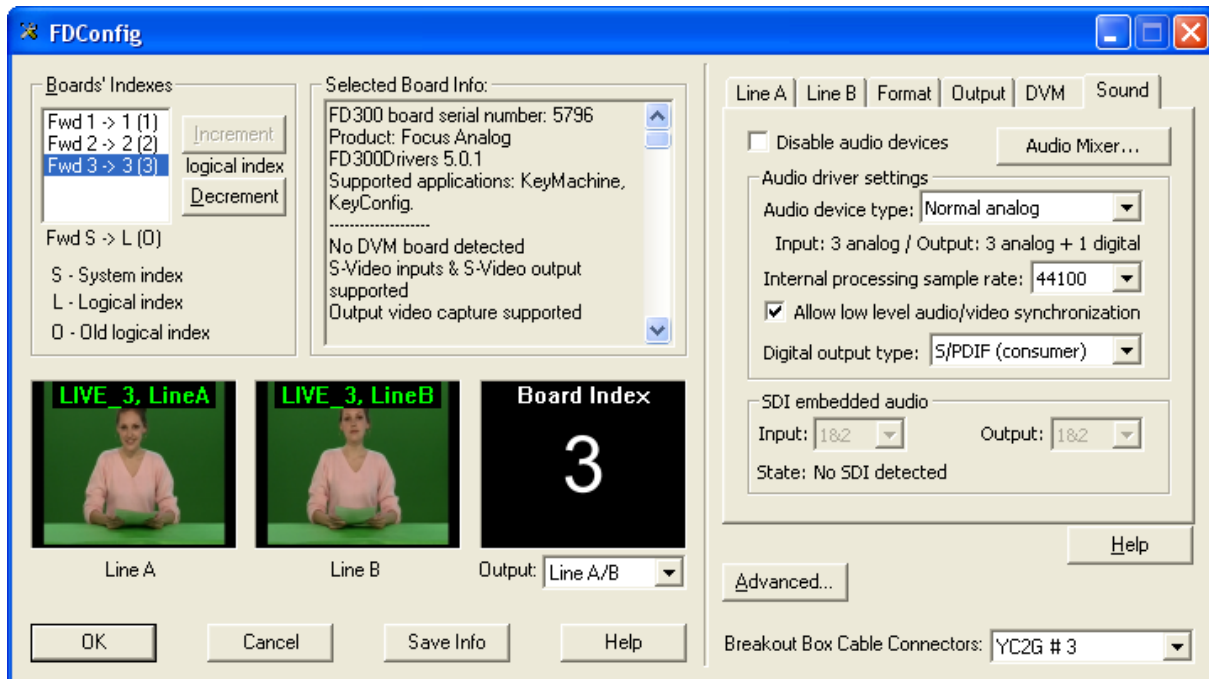




Figure 1. Setting audio on the output board in the *FDConfiguration* application.

One of the output devices of the board is selected as the device used in the operating system by default to play audio. To do so, select **Settings > Control Panel > Sounds and Audio Devices** from the **Start** menu. The *Sound and Audio Devices Properties* dialog box opens. Select one of the output audio devices of the output board from the **Default device** drop-down list in the **Sound playback** area of the **Audio** tab. As a rule, selected is the first one (e.g., *FD300 Output 1 B3*).

The **Disable audio devices** option in the **Sound** tab of the *FDConfig* window must be unchecked for the output board. Select the number and type of the input and output audio devices on the board from the **Audio device type** drop-down list in the same tab. The **Internal processing sample rate** parameter determines the audio sample rate (Section 4); the **Allow low level audio/video synchronization** option enables low-level audio and video synchronization. The **Digital output type** drop-down list is used to select a type of the audio signal on the digital output (if enabled). For more details about the audio setting parameters, see section 3 of *FDConfiguration\_User's Guide*.

When the parameter settings for working with audio signals connected to the board are complete, further adjustment is possible in the *FD300 Sound Control* application. The application is discussed in *FD300 SoundControl\_User's Guide*. To open the routing dialog box *Sound Configure* in the Virtual

Studio (*HotActions* application), click  or  or select the appropriate command from the **Tools** menu. For a detailed description of the dialog box, see Section 4 of this document or *Sound Configure\_User's Guide*.

## 2.2 Video Settings

### 2.2.1 Setting Input Video Signals

When working with video signals on *FD300* boards, select a TV Standard for the video signals that come to the board (PAL, NTSC, or others) from the **TV Standard** drop-down list in the **Format** tab for each of the boards, indicated in the **Boards'Indexes** field of the *FDConfig* window as **Fwd 1**, **Fwd2** and so on. The **Image Size** drop-down list in the same tab is used to select the effective horizontal resolution – **FullFull** (720 pixels) or **HalfFull** (360 pixels).

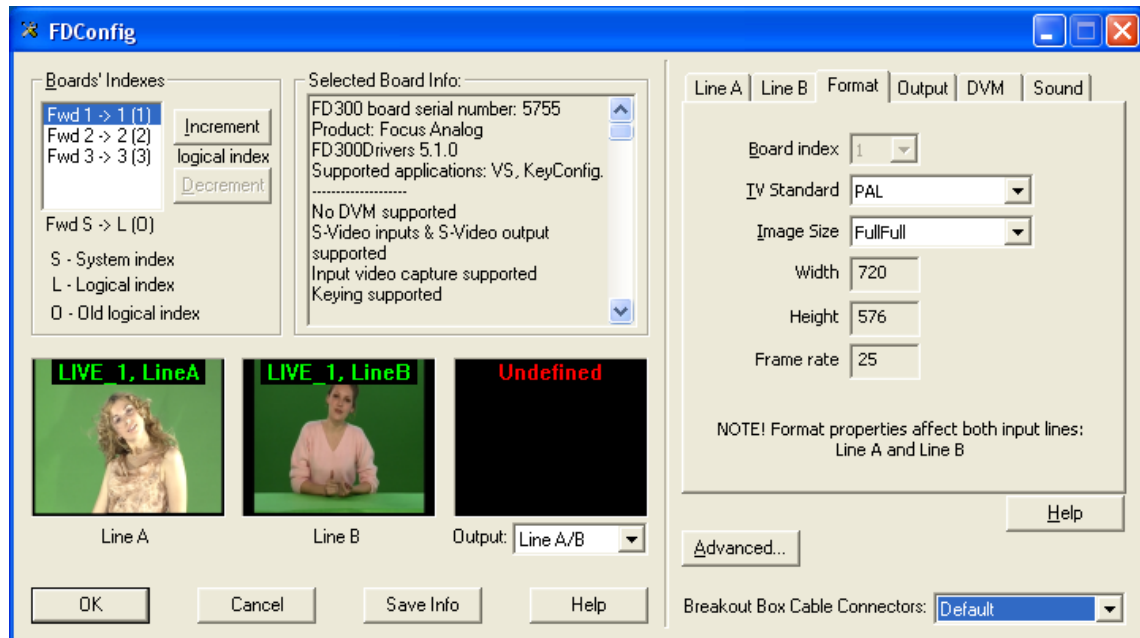


Figure 2. Setting parameters of video signals connected to *FD300* boards.

Working with the connected video signals in the Virtual Studio (*HotActions* application) is performed using a *Direct Show* filter. So, enable the **A/V Capture Filter** option (for each board with connected video signals) in the **Use Direct Show filters** area of the **Advanced Settings** dialog box (Figure 3). To open the dialog box, click the **Advanced** button in the *FDConfig* window.

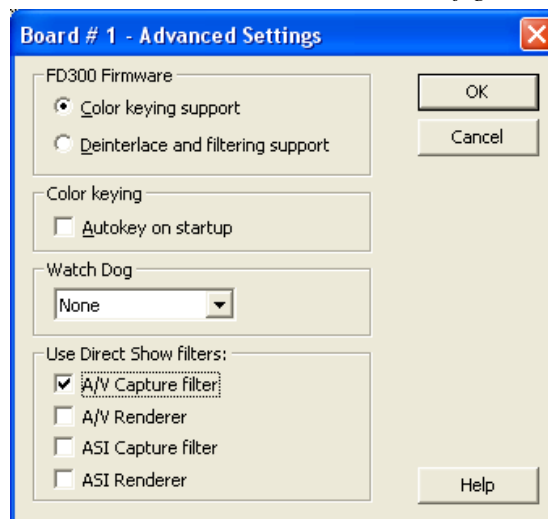


Figure 3. Setting the video signal output from the *FD300* board using a *Direct Show* filter.

### 2.2.2 Setting Output Video Signal Mode

To output the resulting video, the Virtual Studio uses the board with the largest logical index **L** in the **Boards'Indexes** list in the *FDConfig* window. The output video parameters are specified for it in the **Output** tab.

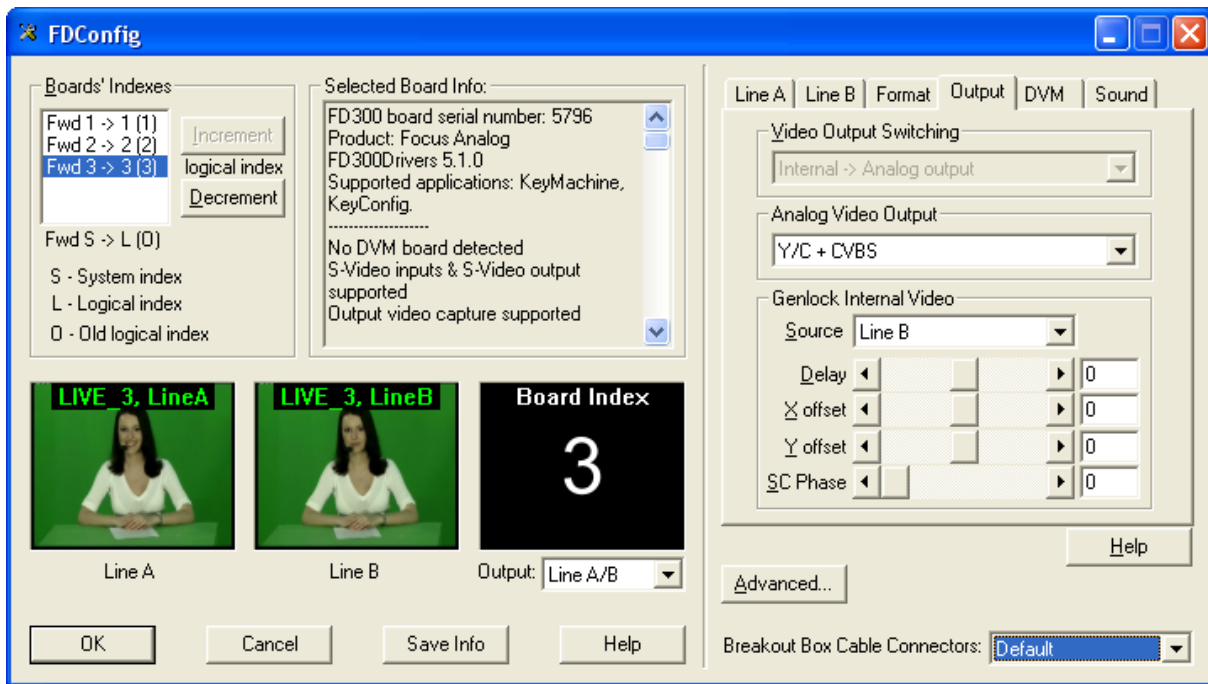


Figure 4. Setting the Studio output video signal in the *FDConfig* window.

The **Video Output Switching** drop-down list is used to select an output mode for the data that come to the output encoder. This may be video data from the **Internal** video mixer or from the external **Digital bus**.

- **Internal -> Analog output** – coming to the analog output are the mixer data; the external bus data are not used.
- **Internal -> Analog output + Digital bus** – coming to the analog output are the mixer data. The same data are fed to the digital bus operating in the transmission mode; the device connected to the bus must operate in the reception mode. May be used to provide an SDI output.
- **Digital bus -> Analog output** – coming to the analog output are the external digital bus data; the internal mixer data are not used.

The **Analog Video Output** drop-down list is used to select a combination of analog video signals that are to be fed to the board output.

Connecting the video signal receivers is performed via a switching device connected to the board. This may be a cable set or *Breakout Box* (see description in section 12 Appendix of *HotActions\_User's Guide*). For such connections, the devices have four connectors: CSYNC/CVBS, Y/GREEN/LUMA, U/BLUE/CVBS, V/RED/CHROMA. Table 1 describes the video signals from the **Analog Video Output** drop-down list (Figure 4) and gives the correspondence between the signals and the connectors of the switching device connected to the output board *FD300*. The Table contains the following symbols:

- CVBS – composite signal;
- Luma, Chroma – components of Y/C (S-video) signal;
- Y, U, V – components of YUV component signal;
- R, G, B – components of RGB component signal;
- Sync – sync pulse signal;
- s – presence of sync pulse in the corresponding component;
- ns – absence of sync pulse in the corresponding component.

Video Signals	Switching Device Connectors			
	RED V/Chroma	BLUE U/CVBS	GREEN Y/Luma	CVBS CSYNC
<b>CVBS x 3</b> Three composite signals	CVBS		CVBS	CVBS
<b>Y/C+CVBS</b> Y/C signal (Luma/Chroma) and composite signal	Chroma		Luma	CVBS
<b>YUV+CVBS</b> Component signal YUV and composite signal	V	U	sY	CVBS
<b>YUV+Sync</b> Component signal YUV with a sync pulse in a separate channel	V	U	Y	Sync
<b>nsRGB+Sync</b> Component signal RGB with a sync pulse in a separate channel	R	B	G	Sync
<b>YUV+sKey</b> Displayed are fill and key. Fill signal in the YUV component signal format without Y synchronization Key signal in the composite signal format	V Fill	U Fill	Y Fill	sKey Key
<b>ns(Key onY)UV+sY</b> Displayed are fill and key. Fill signal in the YUV component signal format, Y synchronized Key signal in the composite signal format without sync pulse	V Fill	U Fill	Key Key	sY Fill
<b>nsRGB+Key</b> Displayed are fill and key. Fill signal in the RGB component signal format without G synchronization Key signal in the composite signal format	R Fill	B Fill	G Fill	sKey Key
<b>ColorBarY/C+CVBS</b> Displayed is the color-bar pattern. Y/C (Luma/Chroma) signal and composite signal	Chroma		Luma	CVBS
<b>ColorBar YUV+CVBS</b> Displayed is the color-bar pattern. Component signal YUV and composite signal	V	U	sY	CVBS
<b>ColorBar nsRGB+Sync</b> Displayed is the color-bar pattern. Component signal RGB with a sync pulse in a separate channel	R	B	G	Sync
<b>Double SDI</b> Used only for SDI option when displaying fill and key	incorrect signal on the analog output			

Table 1. Combinations of analog video signals that are to be fed to the board output.

The **Analog Video Output** drop-down list contains all the possible configurations for the current Studio configuration.

The **Source** drop-down list in the **Genlock Internal Video** area of the **Output** tab in the *FDConfig* window (Figure 4) is used to select a Genlock mode for the video output board:

- **Master** – the output video signal formed by the board internal clock generator is not synchronized to an external video signal;
- **Line A** – the output video signal is synchronized to the video signal selected in the **Input** drop-down list of the **Line A** tab;
- **Line B** – the output video signal is synchronized to the video signal selected in the **Input** drop-down list of the **Line B** tab.

The **Delay** slider is used to set the video delay value (in milliseconds) to compensate a delay when the signal passes through the cable. The default value is **0**.





The **X offset** and **Y offset** sliders are used to set the horizontal and vertical offset of the video image relative to the sync signal. The default values are **0**.

**Sc Phase** – delay of the color subcarrier phase of the sync signal. Used to synchronize the composite signal. The default value is **0**.

Other settings for the *FD300* boards that are performed in the *FDConfig* window are described in *FDConfiguration\_FD300 Board Settings\_User's Guide*.

### 3 Setting Video Signals in the *HotActions* Application

#### 3.1 Setting Input Video Signals

To set the input video signals in the Virtual Studio main application *HotActions*, open the *Video Configure* dialog box. To do so, click the **Live Video Configure**  button on the *General*  toolbar or the  button on the *Live Action*  toolbar, or select the **Video Configure...** command in the **Tools** menu, or press F9 on the keyboard.

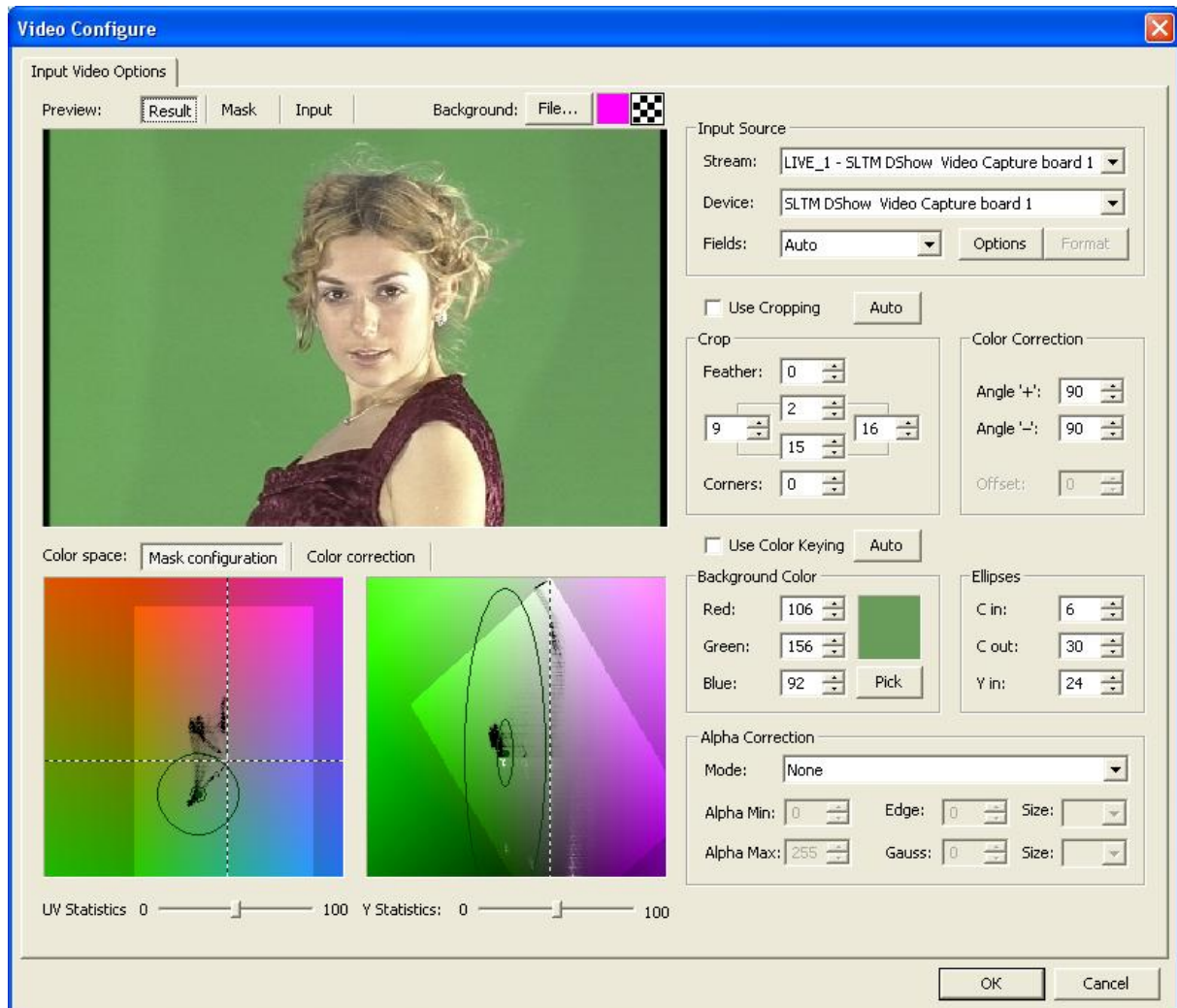


Figure 5. Dialog box for setting the input video signals in *HotActions*.

The **Stream** drop-down list in the **Input Source** area contains the names of the video streams that can be created in the application: LIVE\_1, LIVE\_2, and so on. Initially, the streams has no connected video signals – <none> indication. Select a video stream from the **Stream** drop-down list and assign to it an input device from the **Device** drop-down list. Now the assigned device is indicated next to the stream name (Figure 6). When further creating the video stream in the application using a command (see section 7.1 of *Using the Script Commands\_User's Guide*), you can work in the Virtual Studio with the video signal of the connected device.

There are two items in the **Device** drop-down list for the input channels of each *FD300* board installed in the system: *SLTM DShow Video Capture board* and *SLTM DShow Video Line B Capture board*.

For *Aja XENA* boards (HD stream input devices), there are also two input channels in the drop-down list: *Aja Capture Filter board channel 1* and *Aja Capture Filter board channel 2*.

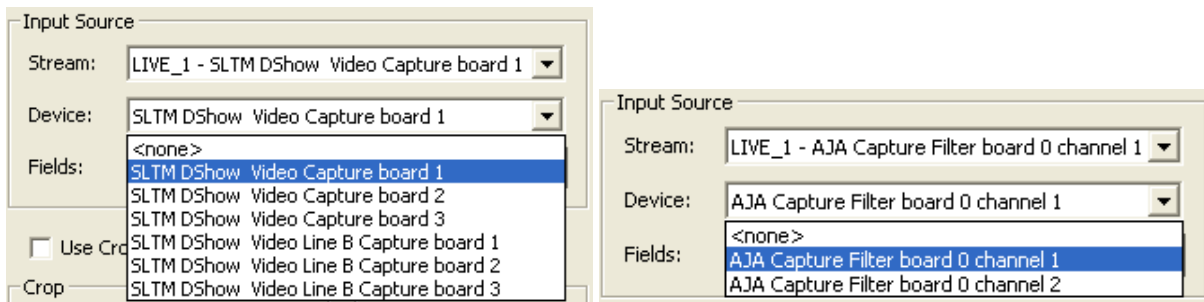


Figure 6. Drop-down list of input devices for the connected video signals in *HotActions*.

The **Fields** drop-down list is used to select a field order for the specified video signal:

**Auto** – according to the data that come from the decoder;

**None (Progressive)** – progressive scan mode (selected when working with a video signal source that operates in the progressive scan mode);

**Upper field first;**

**Lower field first.**

Clicking the **Options** button in the **Input Source** area opens the **Properties** dialog box (Figure 7) used to specify the input video parameters, since some of them are changeable. For example, it is possible to select a connector index of a video source (connected to the switching device of the selected *FD300* board) from the **Input** drop-down list in the **Input** tab. For more details about the switching devices and connector indexes, see section 12 Appendix of *HotActions\_User's Guide*.

The sliders in the **Input** tab of the dialog box are used to adjust the input video parameters: **Hue**, **Saturation**, **Brightness**, **Contrast**, **Y gain**, **U gain**, **V gain**, **Y/C Delay**. For component signals, adjusted are only **Y gain**, **U gain**, **V gain**, the other settings being used for composite and Y/C video signals. Click **Default** to restore the defaults.

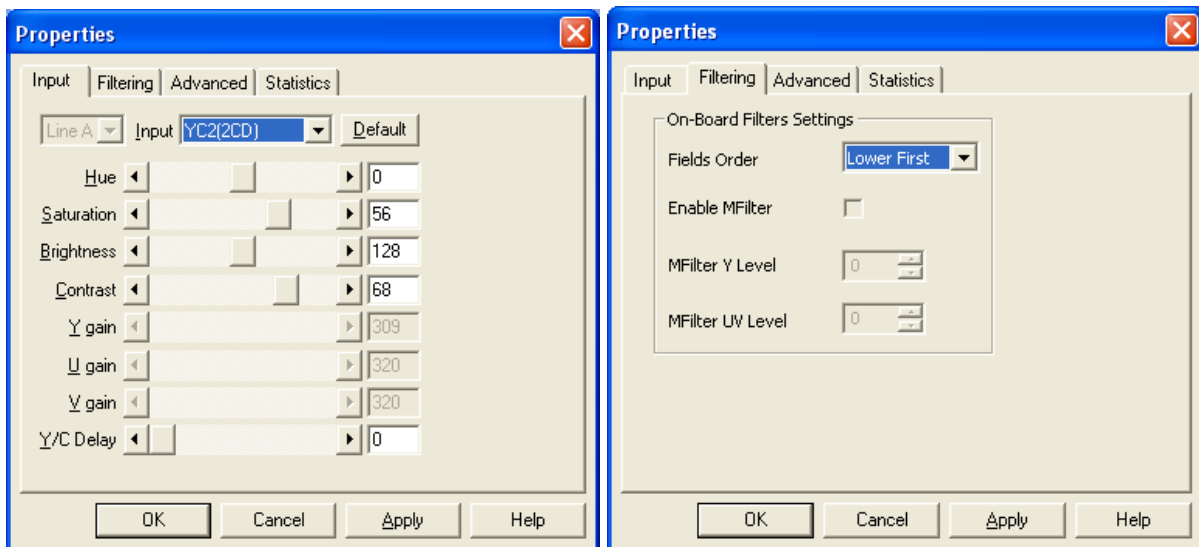


Figure 7. Parameters of the input video signal received from the *FD300* board in the **Input** and **Filtering** tabs of the **Properties** dialog box.

The **Filtering** tab parameters are available only if the **Deinterlace and filtering support** option was previously enabled in the **Advanced Settings** dialog box (Figure 3). Then, you can select a field order from the **Fields Order** drop-down list:

**Lower First** – lower field first;

**Upper First** – upper field first;

**Deinterlace** – progressive scan mode (all the lines of each frame are drawn in sequence).

The **Enable MFilter** option enables the median filter for filtering video.

The **MFilter Y Level** and **MFilter UV Level** spin boxes are used to control the filtering degree by the luminance and chrominance components respectively (possible values from 0 to 31).

The **Image Format** drop-down list in the **Advanced** tab (Figure 8) is used to select the input video format. If selected is UYVY, you can flip the image by enabling the **UYVY Vertical Flip** option.

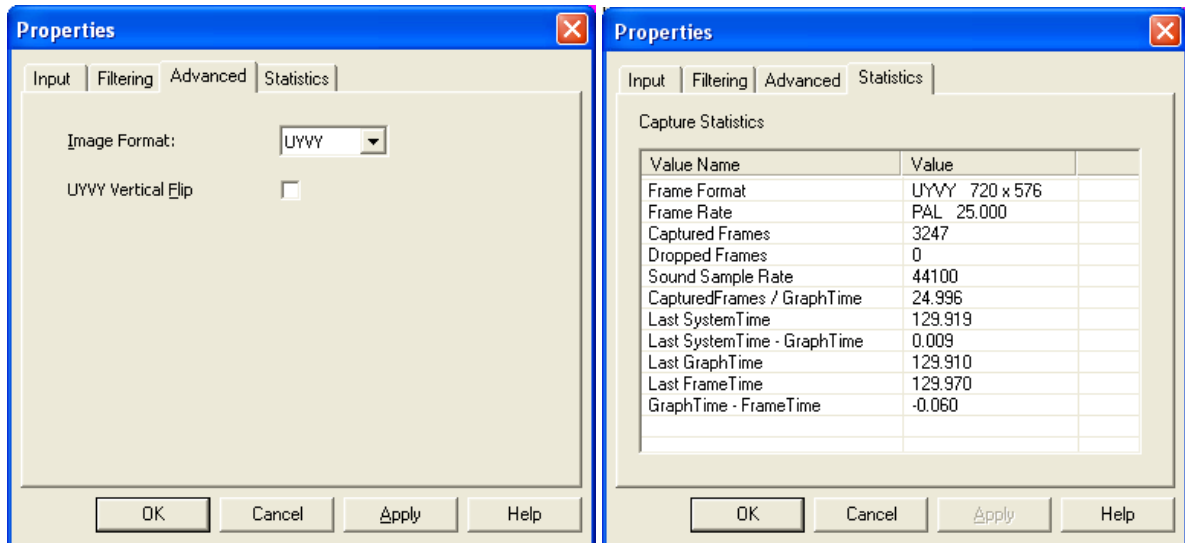


Figure 8. Parameters of the input video signal received from the *FD300* board in the **Advanced** and **Statistics** tabs of the **Properties** dialog box.

The **Statistics** tab contains some other input parameters: **Frame Format**, **Frame Rate**, **Captured Frames**, **Dropped Frames**, **Sound Sample Rate**, and others.

When selected in the **Device** drop-down list is an HD input channel of the *XENA Aja* board (Figure 6), clicking the **Options** button opens a dialog box that contains the input device properties. Clicking the **Format** button opens the **Properties** dialog box (Figure 9) that contains the video format properties of the *XENA Aja* input video channel:

**Video Format** – resolution, scan mode, and frame rate;

**Video Source** – signal type (**Digital** or **Analog**);

**Four CC** – encoding format.

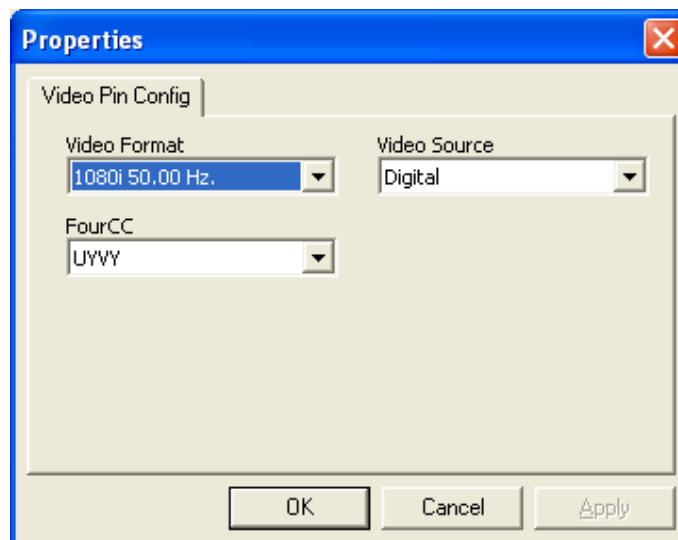




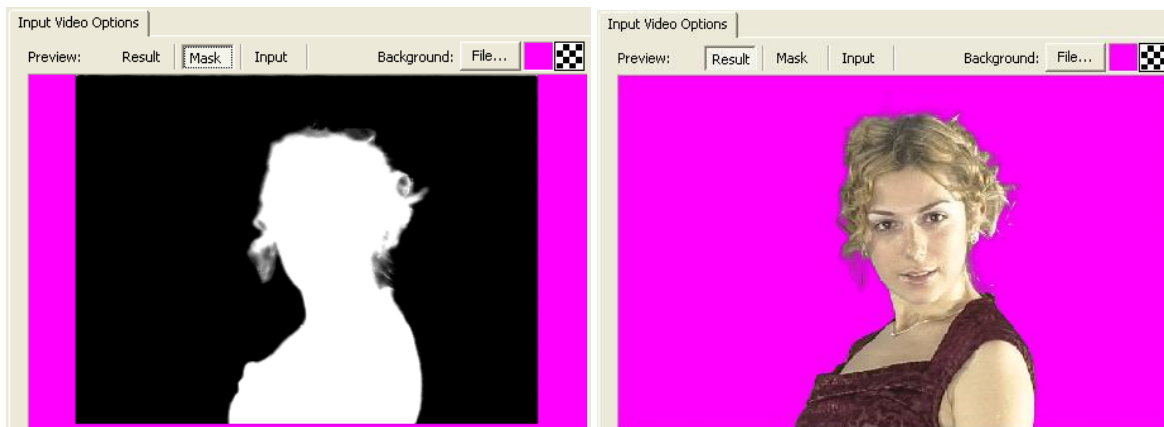
Figure 9. Dialog box for selecting parameters of video signal input via the *XENA Aja* board channel.

### 3.2 Creating Rear Projection of Input Video Image

Select an input device (from the **Device** drop-down list) for the video stream and specify its parameters in the **Properties** dialog box (Figure 7 – Figure 9), and you can see the received image in the **Preview** window. The **Preview** area contains three tabs: **Result**, **Mask**, and **Input**. In the **Input** tab, the image is displayed as is, as it comes from the connected video source. Displayed in the other tabs (**Mask** and **Result**) are the created rear projections of the image: colors that will be displayed as

is, are separated, and the others are substituted with pixels completely or partially transparent. To configure the rear projection, use controls in the right part of the dialog box. If the image rear projection is not formed (**Use Color Keying** check box is unchecked), the **Preview** window in all the tabs displays the image as is.

When creating the rear projection, you form a black-and-white frame image that is mask. Pixels substituted with transparent pixels are displayed black (so-called background), and those unsubstituted that will remain unchanged are displayed white (actor). The mask is displayed in the **Preview** window of the **Mask** tab. (Figure 10). The **Result** tab window displays a resultant image, which is the result of adjusting the rear projection. For the background, you can specify a graphics image. To do so, click the **File...** button under **Background** and select the file you want in the **Open** dialog box. Clicking the  button opens a color selection dialog box, and clicking the  button specifies a checkerboard pattern for the background.

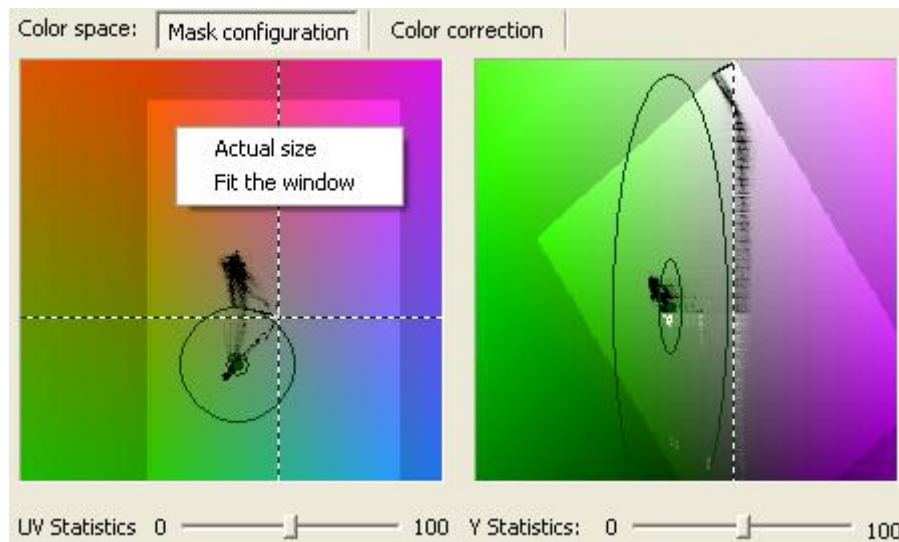


**Figure 10. Initial mixing mask of the actor, which is a result of creating the rear projection, and the actor on a single-color background.**

The **Crop** area, which is on the right of the **Preview** window is used to specify the frame cropping values (non-display areas): top, bottom, left, and right cropping values respectively as the spin boxes are in the area. The **Feather** spin box is used to set the smoothness of transition from non-display areas of the screen to displayed areas. The **Corners** spin box is used to set the corner cropping. Clicking **Auto** enables the cropping self-adjustment. Checking  **Use Cropping** enables the area settings; unchecking the checkbox disables all the frame croppings.

To set the chromakey (rear projection) parameters, use the areas in the lower part of the window. To use the simplest way to set the parameters, automatic, click the **Auto** button next to the **Use Color Keying** check box. Checking the  **Use Color Keying** check box enables all the chromakey settings. The result is now displayed in the **Mask** and **Result** tabs of the **Preview** area (Figure 10).

The chromakey array is adjusted in a color space (RGB or YUV). The **Color Space** area of the dialog box contains the cross section and longitudinal section windows of the YUV space (Figure 11). All the changes in the substituted and non-substituted colors in the frame are displayed in the section planes in the **Mask Configuration** tab.



**Figure 11. YUV color space sections in the Video Configure dialog box.**

Geometric figures highlighted in lighter colors outline the sections created in the RGB color space. Areas outside the figures do not exist in the RGB color space.

To open the context menu, place the cursor over the color section plane and right-click. Use the menu commands to scale the image. To zoom the image in the two windows, click over the window and use the scroll wheel.

When adjusting the chromakey, there are used three areas in the color space:

1. colors that will be substituted with completely transparent pixels. The virtual scenery objects will be seen in the frame behind the pixels instead of the colors. Therefore, the substituted colors of the frame are referred to as background colors.
2. colors that will not be substituted in the frame. Such colors are referred to as the actor colors.
3. color transition from the actor colors to the background colors. Such color pixels will be substituted in the frame for pixels with partial transparency.


The borders of the areas are shaped like ellipses with a common center. The ellipses are elongated along the brightness axis (Y). They form an internal area (background colors) and external (actor colors). Between the internal and external areas, there are colors of the transition from the background color to the actor colors. The common center (a point in the color space) is specified by the **Red, Green, Blue** parameter values in the **Background Color** area. The center point can also be specified in the color selection dialog box. To open the dialog box, click the color button in the **Background Color** area. Or click **Pick** and mark the necessary color point in one of the **Preview** or **Color space** windows. The point specifies the center coordinates of the color area that will be removed from the frame – the background colors. That is such color pixels will be substituted for transparent pixels. The substituted colors area is ellipsoid-shaped, the ellipsoid being elongated along the brightness axis (Figure 11). The brightness axis in the YUV space is **Y**, therefore it is convenient to perform subsequent setting operations in the YUV coordinates.

The **C In**, **C Out**, **Y in** spin boxes in the **Ellipses** area are used to specify the area sizes for the colors that will be substituted in the frame with transparency (background and color transition) and colors that will be displayed in the frame (actor).

**C In** – radius (in UV) of the area (in the YUV color space) of the colors that will be substituted in the frame with transparent pixels : background colors.

**C Out** –radius (in UV) of the area (in the YUV color space) that bounds the colors of the background (that will be substituted with transparent pixels) and the colors of the color transition area. Besides the colors substituted for complete transparency, the frame will contain the color transition that is pixels substituted for pixels partially transparent. The **C Out** parameter marks the border of the area in the YUV color space outside which all the colors will remain in the frame as is, that is its pixels will not be substituted for completely or partially transparent pixels.

**Y in** –half-height Y (half-axis size) of the area (in the YUV color space) of the colors that will be substituted in the frame with transparent pixels: background colors. The Y out parameter is calculated automatically, and the Y out area is displayed along with the Y in area in the corresponding window.

The sizes of the color areas can be changed not only by changing the **C In, C Out, Y in** parameter values, but also by dragging their borders with the cursor in the windows of the **Mask Configuration** tab in the **Color Space** area. When placing the cursor over the area border, it changes to , then you can drag the border with the left mouse button pressed.

Sometimes, when adjusting chromakey, color blending areas may occur on the edges actor-background (noises), which can be removed by mask filtering (Figure 10).

If select **Simple** from the **Mode** drop-down list in the **Alpha Correction** area, the spatial filtering parameters of the mask in the frame are available.


The **Alpha Min** and **Alpha Max** parameters are used to restore the mask contrast thus removing noises in the frame. If a pixel opacity value is less than **Alpha Min**, the pixel will be displayed in the frame as completely transparent (opacity value 0). If the opacity value exceeds **Alpha Max**, the pixel will be displayed completely opaque (opacity value 255). Values in the range between **Alpha Min** and **Alpha Max** are linearly interpolated. Visually, this looks like shrinkage of the actor's silhouette.

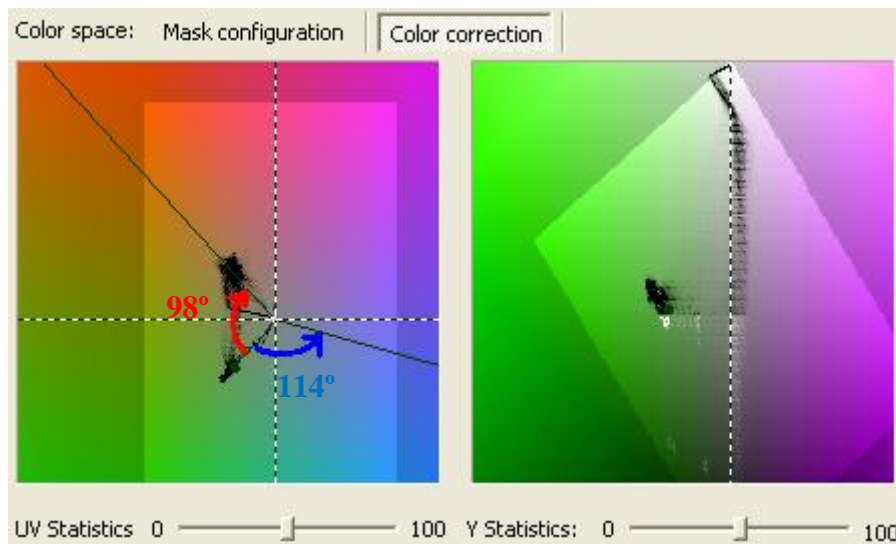
The **Edge** parameter is used to adjust cropping the edges of the actor mask (meaning by “actor mask” colors that will be displayed in the frame as is), the border line being the mean value of the pixels in the area whose size is specified in the **Size** spin box on the right.

The **Gauss** parameter is used to adjust the actor mask blur by Gauss filtering. The blur degree is calculated as the mean value in the area whose size is specified in the **Size** spin box on the right.

The **Color Correction** area is used to adjust the color correction. To perform color correction, specify the colors (in the actor-background color blending areas) that are to be corrected, that is substituted for other colors, not for transparency now. Most often, color correction is necessary to remove actor-background color blending in color transition areas in the frame: reflections, thin objects, object edges. Therefore color correction is performed after the areas of colors that will be substituted for transparency and of colors that will remain unchanged have been already specified (that is after the **Red, Green, Blue, C In, C Out, Y in** parameters have been specified).

Since we are going to specify colors that will be substituted for other colors, all the correction operations are performed now only in the UV color plane.

The correction is adjusted using the **Angle “+”** and **Angle “-”** parameters – rotation angles of two respective rays that part from the ray coming from the origin of coordinates through the background center, which is specified by the **Red, Green, Blue** parameters. The ray specified by the **Angle “+”** angle (produced by counterclockwise rotation from the origin-background ray) selects the area where all the colors will be modified to the ray colors. Likewise, the ray specified by the **Angle “-”** angle (produced by clockwise rotation from the origin-background ray) selects the area where all the colors will be modified to the ray colors. All the changes are reflected in the window of the **Color correction** tab in the **Color space** area. It is also possible to correct the actor colors by rotating the rays directly in the window with the cursor. When placing the cursor over a ray, it changes to , then you can rotate the ray with the left mouse button pressed.



**Figure 12. Setting color correction parameters of the video image.**

For example, for the correction of green colors in the frame, specifying **Angle "+"** as 114 means modifying some of the colors to blue (the color correction ray rotates to the blue area), and specifying **Angle "-"** as 98 means modifying the other part of the green colors to red (the color correction ray rotates to the red area).

To completely switch off color correction, set **Angle "+"**, **Angle "-"** to **0**. The larger the angle values specified, the vaster the area of corrected colors.

The black points on the color planes (Figure 11, Figure 12) mark clusters of the statistically most numerous color pixels that are in the frame. The degree of a pixel transparency on the color planes reflects the number of pixels of the marked color in the frame. The more opaque (blacker) is a pixel of a certain color on the color plane, the more pixels of the marked color are in the frame. By sliding the **UV Statistics** and **Y Statistics** controls that are under the UY and Y color planes, you can display the color distribution statistics in the frame more readable (when the slider positions are close to **100**) or hide it completely (the sliders are set to **0**).

### 3.3 Setting Output Video Image

The output video settings of the resulting image in the *HotActions* application are specified in the **Render Options** dialog box. To open the dialog box, press F11 on the keyboard or use the **Render** command of the **Options** menu in the *Render Output* window.

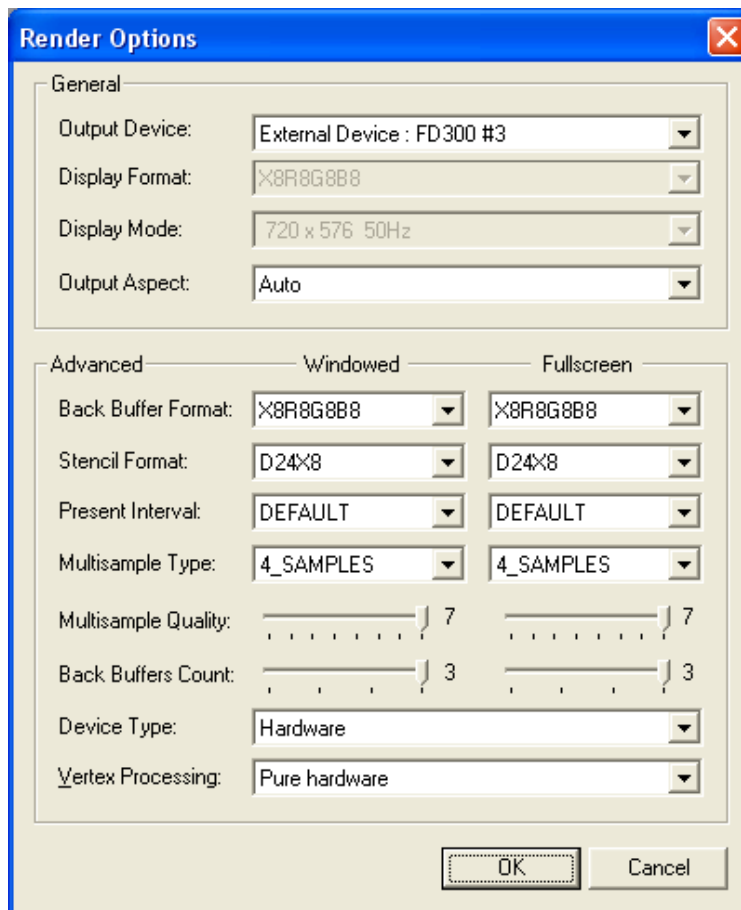


Figure 13. Dialog box for setting the resulting output image of the Studio.

The **General** area of the dialog box is used to specify the general parameters of the resulting output image.

The **Output Device** drop-down list is used to select an output device to render the resulting video image of the Studio. The list may contain:

*Display 1: ...* (the name of the monitor connected to it) –the Studio operation result will be rendered by the video adapter;

*Display 2: DVM62* - rendering via the connected device *DVM62* for the subsequent conversion of the video signal to HD-SDI format (described in section 11 of *HotActions\_User's Guide*) or by the monitor connected to the second output of the video adapter;

*External Device: FD300 #1, External Device: FD300 #2, External Device: FD300 #3* (according to the number of *FD300* boards installed in the system) – the image will be rendered by the selected *FD300* board; the board number must match the logical index **L** of the output board in the *FDConfiguration* application (Section 2.2.2, Figure 4). As a rule, it is the largest number.

**Display Format** – amount of bits allocated for each color component **R...**, **G...**, and **B...** from the 32.

**Display mode** – image format and the refresh rate.

**Output aspect** – image proportions (pixel aspect ratio) – *Auto* (matches the monitor settings), *4:3*, *16:9* or *Square pixels* (1:1).

The **Advanced** area contains parameters for fine tuning the image output: in the window mode (*Windowed*) and full-screen mode (*Fullscreen*).

**Back Buffer Format** – image encoding format in an amount of bits for each color component (RGB);

**Stencil Format** – amount of bits from the 32 allocated for the Z order (D24) and used to store an object number in the scene (X8);

**Present Interval** – frame refresh ratio. At the *DEFAULT* value, the ratio is equal to the monitor horizontal scan rate as well as at *ONE*. The *ONE* mode differs from *DEFAULT* in greater precision and larger amount of resources used. In the *IMMEDIATE* mode, the frame is rendered on the monitor irrespective of its horizontal scan rate, the output time being equal to the full rendering time.

**Multisample Type** – smoothing mode when rendering. When selected *NONMASKABLE*, *4\_SAMPLES*, or *8\_SAMPLES*, the smoothing degree can be specified by the **Multisample Quality** slider below. The recommended value is 7 in the *4\_SAMPLES* mode.

**Back Buffers Count** – number of half-frames buffered before rendering.

The **Device Type** drop-down list is used to select a device that will be used for image rendering. *Hardware* – video card graphics accelerator, *Reference* – the image will be rendered in one of *DirectX* modes (that is the motherboard CPU will be used).

**Vertex Processing** – geometric transformation means selection:



*Software* – transformations are performed by the CPU. Recommended when working with graphics processors of not very high performance and/or with scenes with a large number of dynamic objects (e.g. using morphing).

*Hardware* and *Pure hardware* – transformations are performed by the graphics processor of the video card, but when selected *Pure hardware*, the data transition of the transformation results is impossible, which allows to optimize the process in the best way. Recommended when working with scenes with a large number of static objects.

*Mixed* – transformation means selection is performed as software based, from the above described.

## 4 Routing Audio via Expansion Board *FD300*

The *FD300* board has three stereo inputs and three stereo outputs (or six mono inputs and six mono outputs accordingly). The cable set or breakout box (connected to the board with a dedicated cable) have special connectors for the external audio sources and output signals from the *FD300* board (see section 12 of *HotActions\_User's Guide*).

To adjust the audio routing modes in the Studio for the connected sources, use the *Sound Configure* dialog box (Figure 14). To open the dialog box, click the  or  button on the *HotActions* main window toolbar or use the **Tools** menu. The dialog box provides routing audio from any input to any output with customizable delays and volumes.

A drop-down list in the **Options** area (Figure 14, 1) is used to select a board to be adjusted. The number of items in the drop-down list matches the *FD300* boards installed in the system (Figure 1).

Another drop-down list in the **Options** area (Figure 14, 2) is used to specify a minimum volume for all the volume sliders in the dialog box (Figure 14, 8, 9). Enabling the **Show Meters** option (Figure 14, 3) allows you to easily monitor any signal changes in every input and output with the signal level indicators.

The **Curr. Ratio**: parameter indicates the current sampling rate (in Hz). The sampling rate of the input signals matches the output signals. To change the parameter value, launch the *FD300Configuration* application (previously close *HotActions*) and select the required sampling rate from the **Internal processing sample rate** drop-down list in the **Sound** tab (Section 2.1, Figure 14).

All mono inputs of the board are paired to stereo inputs by default (there is a **Lock** option available for each pair, see Figure 14, 4). To change the volume level for the resulting input stereo signal, either volume slider of the pair can be used. The second and third inputs also have the **Mic. Boost** option (Figure 14, 5) for additional signal boosting.

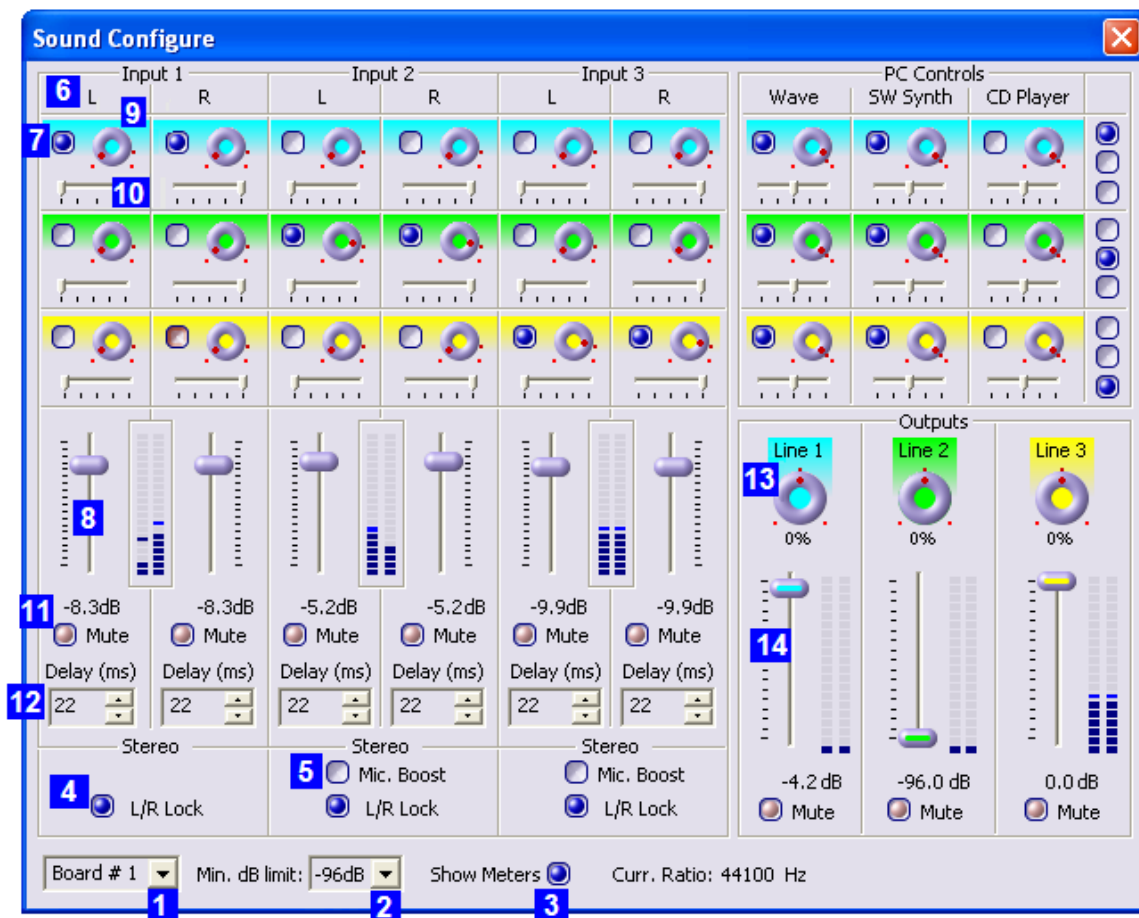


Figure 14. *Sound Configure* dialog box.

Each audio channel of the board is controlled independently within its group, e.g. the **Input1L** area (Figure 14, 6) is used to adjust the first mono input (left channel of the first stereo input).

Among the options of the area is routing the mono input to one of the stereo outputs. For example, checking the upper check box in the **Input1L** area (Figure 14, 7) enables routing this mono input to the first stereo output. The volume slider (Figure 14, 8) allows you to specify the volume level of the signal routed to the enabled stereo output. When placing the cursor over a routing knob (Figure 14, 9), the tooltip displays the output where the signal is routed if the corresponding check box on the left is checked.

By default, the upper check boxes in the mono input areas enable routing to the **Line 1** stereo output; the middle check boxes – to the **Line 2** stereo output, and likewise do the lower ones. The matches are marked with the same color.

By default, the left channel of the first stereo input (**Input1L**) is completely routed to the left channel of the enabled stereo output, and the right channel of the first stereo input (**Input1R**) – to the right channel of the enabled stereo output. Accordingly, the balance slider of the stereo input left channel is set by default to maximum left (Figure 14, 10), and the balance slider of the stereo input right channel is set by default to maximum right.

The **Mute** option (Figure 14, 11) allows you to completely disable the corresponding input from routing (Figure 14, 11).

The **Delay** spin box is used to specify a delay for each mono input in the range from 1 frame to 1 second (in milliseconds) (Figure 14, 12).

Each stereo output has a balance knob (Figure 14, 13), volume slider (Figure 14, 14), and a **Mute** check box that allows you to desable the output.