

**ESI
VLS-2000
Video Line Scaler**

Operating Manual

Version 1.2
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1. INTRODUCTION

The ESI VLS-2000 extends the capabilities of high definition projectors, monitors, and other high-resolution display devices. It provides the ability to view a wide range of video sources at the full capabilities of the display. The VLS-2000 contains sophisticated video processing electronics, which will de-interlace, re-scale, sharpen, and reformat as necessary to provide the clearest, smoothest viewing regardless of the video source.

The VLS-2000 has a sophisticated set of features, which together allow any display system to operate with multiple video sources, originating from DVD, Film, Video, or Still Cameras. The VLS-2000 automatically selects the proper enhancements to perform, optimizing the video stream to provide the best possible viewing experience within the capabilities of the display system. Some of the features provided are:

- **Video De-interlacing** – Conversion of slow, 30 frames per second image (Interlaced), to a fast 60 frames per second image (Progressive). This eliminates flickering and doubles the amount of detail the eyes see each frame.
- **Film Reconstruction** – Studio conversion of Film to Video requires movies to be re-timed from 24 frames per second to 30 frames per second. The VLS-2000 analyses the video and recognizes the source as film, which allows it to perfectly reconstruct the original film frames.
- **Line Doubling, Tripling, Quadrupling, and Scaling** – Regardless of the format of the display device, the VLS-2000 allows conversion of the video source to a format which is optimized for the display device. A video source with less video lines than the display can be expanded, with new lines added, calculated from surrounding lines with algorithms that minimize annoying artifacts.
- **Image Sharpening** – Special filters use information from surrounding lines and other frames to reconstruct the original image, regardless of the limitations of TV transmission and recording. All the information present in the signal is extracted, and used to help sharpen the displayed image.
- **Format Conversion** – Regardless of whether the original source was a video camera (4:3 format) or motion picture (16:9 format), the picture will be converted to appear correctly on the display system. A TV movie will show up centered in the middle of a movie screen, while a Hollywood movie will appear in the shape that the director intended it to be watched.
- **Picture Adjustment** – Besides the standard Brightness, Contrast, Color, and Tint, the VLS-2000 allows black level, noise filtering, and detail to be adjusted on an input-by-input basis. These are automatically saved and restored when that input is selected. This allows switching from DVD to cable TV to any other source, without having to adjust the projector.

2. INSTALLATION AND SETUP

2.1 Connections

Figure 2 shows the rear panel layout of the VLS-2000. Input connections are grouped on the left side of the panel. The Output connector is to the right of the Inputs, and the Power connection is at the far right.

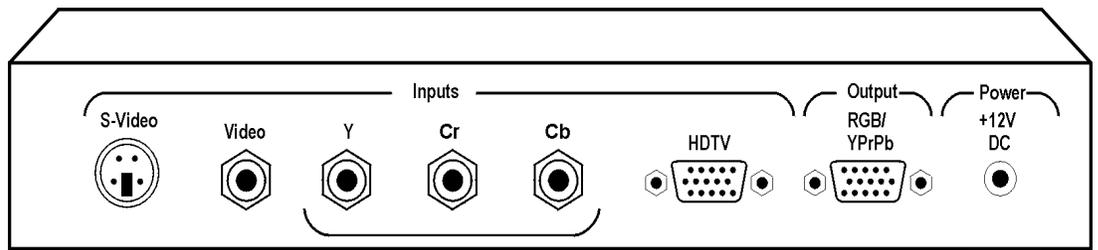


Figure 2 : VLS-2000 Rear Panel Layout

2.1.1 SVideo Input

Connect an S-Video source to this input, using a standard S-Video cable. If the source equipment has both S-Video and Video connectors, S-Video is preferable to maintain the highest possible video quality.

2.1.2 Video Input

Connect a composite video source to this input, using a video quality Phono style cable. If the source equipment has both S-Video and Video connectors, S-Video is preferable to maintain the highest possible video quality.

2.1.3 YCrCb Input

Connect a Component Video source to this input, using three video quality Phono style cables. The video source should be labeled to match these three connectors. Do not connect RGB video sources to this input. YCrCb provides the highest possible video quality and should be used whenever the source equipment provides it.

2.1.4 HDTV Input

Connect a direct video source to this input. This signal is a pass-thru when selected, allowing high definition sources to be switched to the projector input. No processing is performed on this input, so the format, whether YprPb, or RGB, should match the requirements of the Display System. This will allow the use of high definition sources which need no video processing. It also allows multiple VLS-2000 units to be chained together to expand the number of available sources.

2.1.5 RGB/YPrPb Output

Connect this to the Display System. This could be a Projector, High Definition TV, or Monitor. The VLS-2000 may be configured to connect to RGB or YPrPb Display Systems, with any sync requirement (HV, Sync-On-Y, Sync-On-Green, Tri-Level, or Composite). For connection to equipment with Phono or BNC connectors, breakout cables are available. Consult your dealer.

2.1.6 Power Input

The VLS-2000 is provided with a universal AC power supply. This will automatically sense line voltage from 90 Volts AC to 264 Volts AC, at line frequency from 47 Hz to 63 Hz. This allows connections anywhere in the world. Plug the small power plug from the power supply into the Power input jack, and connect the black line cord from the power supply to the wall outlet.

2.2 Output Setup

It is important to set up the VLS-2000 output prior to turning on your display system. Some projectors and monitors can be damaged if run for any length of time with the wrong scan rates or improper sync signals. Section 3 of this manual shows how to set up operating parameters. There are four output settings which need to be set up for your display device

2.2.1 Output:

This must be set up to match your display device. If it has input connections labeled “R”, “G”, and “B”, or a 15 pin plug labeled “RGB”, set this setting to **RGB**. If your connections are labeled “Y”, “Pr”, and “Pb”, set this to **YPrPb**.

2.2.2 Scaling

This must be set to match the resolution of your projector. Typically, it would be set to the maximum resolution of your projector. **640x480**, **800x600**, and **1024x768** are common settings for projectors and monitors designed for computer use. **480p**, **720p**, and **960p** are common resolutions for High definition TVs and projectors, and **1365x1k** is a common size for new D-ILA projectors.

2.2.3 Screen

This should match the shape of your screen and/or projector, measured as a ratio of width to height. Set it to 4:3 for computer or TV shaped screens, and to 16:9 for wide screens intended for movie viewing. This setting allows the VLS-2000 to perform any necessary scaling to make any size image fit your display.

2.2.4 Sync

The sync type must be determined by looking at your display device manual. Generally, devices which connect with a 15 pin VGA style cable, or 5 separate cables labeled R, G, B, H, and V will use the **H-V Pos** or **H-V Neg** setting. Three wire connections to RGB monitors will need the **RGsB** setting. Three wire connections to Component input monitors will need the **YsPrPb** setting. Some newer High Definition monitors require Tr-Level sync require the **TriLevel** setting, and if you

have a 4 wire system, with only one composite sync wire, the **Composit** setting may be required.

3. OPERATION

3.1 Normal Operating Mode

Figure 3 shows the overall menu structure. In *Normal Operating Mode* (Top 4 blocks in Figure 3.1), the buttons allow the choice of any one of the four inputs connected to the VLS-2000. When the VLS-2000 is powered up, it automatically selects the input which was selected when the unit was last powered off. Press SELECT or UP to view a different input. The same buttons are available on the remote control as on the front panel.

Press the MENU button to enter *Setup Mode* (Bottom 4 blocks in Figure 3.1), which will allow changing any control function associated with that input. Press the MENU button again to return to *Regular Operating Mode*.

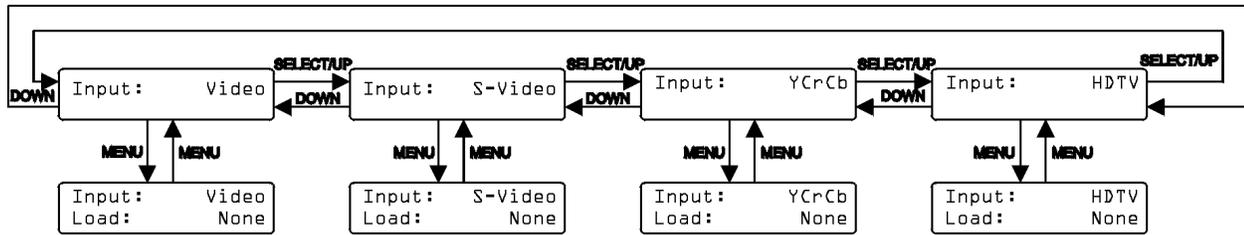


Table 3.1 Basic Menu Structure

3.2 Setup Mode

To change any control function associated with an input, first select the input, and then press MENU. This enters *Setup Mode* for that input. A second line will appear on the display which allows a control function of that input to be changed. Pressing SELECT will choose the next control function, and UP and DOWN will change the value of the control function being displayed.

When any change is made to any of the control functions, the result appears immediately on the Display System. Once the changes have been completed, the changed values may be saved into any one of 3 available *Presets*. This is accomplished by pressing SELECT until the *Save* control function appears. Use UP to select *Preset1*, *Preset2*, or *Preset3*. Press SELECT again to save the control information in the chosen Preset. To return to factory settings, use the *Load* control function to load the *Factory* Preset, and then use *Save* to write these settings into the Preset you want restored.

Figure 3-2 shows the layout of the Setup Menu. Each input (Video, S-Video, and YCrCb) has 3 available independent presets. This gives a total of 9 independent control function sets, which are remembered even if the unit is powered off. The VLS-2000 remembers the last preset loaded or saved for each input and automatically reloads it when that input is chosen. This allows the maximum flexibility in setting up different control functions for different types of video material. At a minimum, each used input needs to have at least one setup saved. The control functions are listed below.

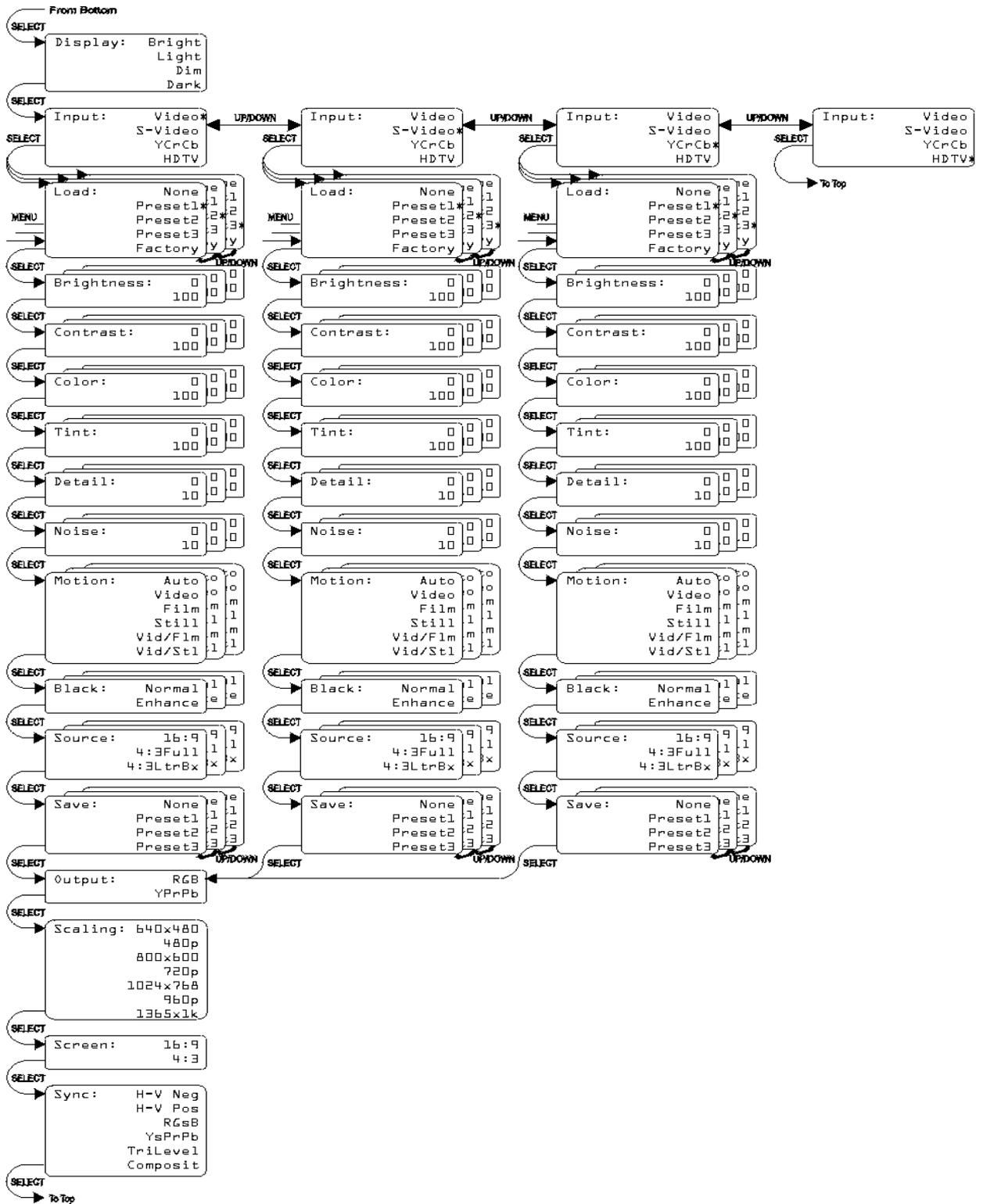


Figure 3.2 – Setup Menu Structure

3.2.1 Input

This chooses the VLS-2000 input to display on the display device. The **Video** setting displays the device connected to the connector labeled “Video”. The **S-Video** setting displays the device connected to the connector labeled “S-Video”. The **YCrCb** setting displays the device connected to the connectors labeled “Y”, “Pr”, and “Pb”. The **HDTV** setting connects the display device to the HDTV connector. No processing is performed on this signal in the HDTV setting.

3.2.2 Load

This allows recall of previously stored settings for Brightness, Contrast, Color, Tint, Detail, Noise, Motion, Black, and Source. There are three separate presets for each of the three inputs (No settings are necessary for the HDTV pass-thru). To recall a preset, use the UP and DOWN buttons to choose **Preset1**, **Preset2**, or **Preset3**. Pressing SELECT again will cause the preset to be loaded from memory. “*Loading Preset*” will appear on the display to acknowledge the action. To load the factory values, select the **Factory** settings. On power up, Preset1 for each input is automatically loaded.

3.2.3 Brightness

Brightness is used to set the background dark areas of the display. Set this to get black areas of the screen to appear correctly. This will display on a scale of 0 to 100. If you hold in the UP or DOWN buttons, this will ramp quickly.

3.2.4 Contrast

Contrast is set to get the brightest areas of the picture to appear with sharp detail, without blooming or distortion of white areas, and without losing the distinction of off-white areas near white areas.

3.2.5 Color

This setting sets the color saturation level. This is set to get the proper amount of color into the video picture.

3.2.6 Tint

This sets the tint of the picture. It shifts colors slightly to get the best match to the original image. This is typically set by feel by setting the value which yields the most natural skin tones. Brightness, Contrast, Color, and Tint can be set up to better accuracy by using commercially available test patterns on DVD, such as “Video Essentials”, available at most DVD movie outlets.

3.2.7 Detail

This setting sets up the level of fine image-detail processing the VLS-2000 performs, on a scale of 0 to 10. The nominal setting is 5, but edges can be sharpened with higher numbers, or softened with lower numbers.

3.2.8 Noise

This setting controls the amount of noise filtering performed by the VLS-2000, on a scale of 0 to 10. The 5 setting provides nominal filtering. For broadcast or cable sources, more filtering may be preferable, while high quality sources, such as DVD or Laser disc may be better viewed at lower settings.

3.2.9 Motion

This setting controls the type of motion processing performed by the VLS-2000. This should be set to **Auto** except for some limited cases. The VLS-2000 has sophisticated processing hardware which, in automatic mode, continuously analyzes the content of the video signal and optimizes the processing to provide the best viewing experience. The Auto mode switches between three different types of processing (Video, Film, and Still). The additional settings on this control simply limit the switching of algorithms.

If set to **Video**, the information from successive interlaced frames is combined with motion processing to compensate for the movement of objects in the picture during the frames. This setting is used for video originating from video cameras, which capture images at 60 frames per second, then transmitting the information $\frac{1}{2}$ frame at a time. Most home and TV network originated video is of this type.

If set to **Film**, the information from successive frames is reconstructed to exactly match the original movie film frames. This reconstruction is made possible by advanced logic in the VLS-2000 which detects and reverses the "3:2 pulldown" process used to convert movie film timing to video timing.

If set to **Still**, the information from successive frames is combined and sharpened with no motion estimation. This gives the sharpest possible picture, but will result in visible artifacts on moving objects.

If set to **Vid/Film**, the automatic switching logic is prohibited from switching to Still mode. This should only be used for known Film sources, and eliminates the occasional switch into and out of static mode during still portions of the film.

If set to **Vid/Stl**, the transition to Film mode is prohibited. This may be used for the output of digital cameras or home video cameras, but otherwise, needlessly prohibits the best possible motion processing from activating if a Film source is detected.

3.2.10 Black

This setting enhances the black level for home theater viewing. Use the **Enhance** setting to eliminate any remaining dark grey on the edges of black scenes. **Normal** is used if this enhancement has already been performed at the input source (i.e. the DVD source has already had Black Level Enhancement set)

3.2.11 Source

This tells the VLS-2000 what type of video source material is being presented to the device input. Combined with the Screen setup, the VLS automatically calculates the best image transformations to perform to get the largest possible image in the correct aspect ratio on the display. Source should be set to either **16:9**, **4:3Full**, or **4:3LtrBx**, depending on the format of the supplied input. Figure 3-3 shows the 6 possible combinations of input Source and output Screen, with the image processing that will be performed.

Some examples of setup combinations are given to show the flexibility provided by the VLS-2000, when connected to a 4:3 format projector or monitor:

Showing a cable TV broadcast, set Source to **4:3Full** to display the video on the entire screen.

Showing an anamorphic DVD movie on a 4:3 monitor, set the DVD output to 16:9 and let the VLS-2000 do the scaling to letterbox format by setting source to **16:9**.

Showing an anamorphic DVD movie on a 4:3 computer type projector, set the DVD output to 16:9 and let the VLS-2000 do the scaling to letterbox format by setting source to **16:9**. Display the image on a wide screen, with the black areas above and below the boundaries of the screen.

Showing a cable TV movie which has been formatted and broadcast in letterbox format, select **4:3LtrBx** or **4:3Full** to display as a letterbox image.

Some examples of setup combinations are given when connected to a 16:9 format projector or monitor:

Showing an anamorphic DVD movie, set the DVD output to 16:9 and set Source to **16:9**.

Showing a cable TV video broadcast, set Source to **4:3Full** to display the video centered on the screen with black areas left and right.

Showing a cable TV movie which has been formatted and broadcast in letterbox format, select **4:3LtrBx** to re-scale the image to fill the entire 16:9 screen.

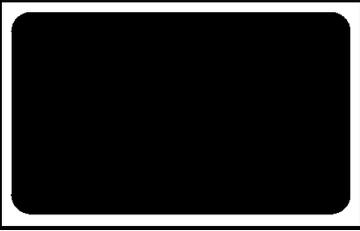
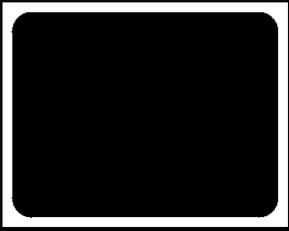
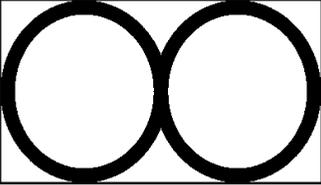
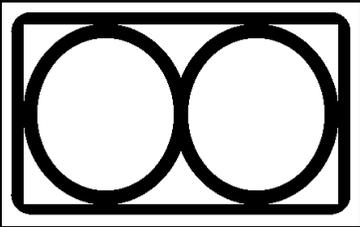
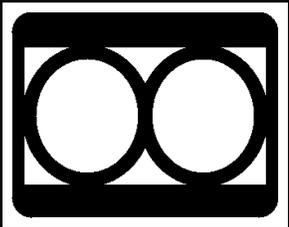
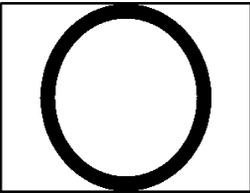
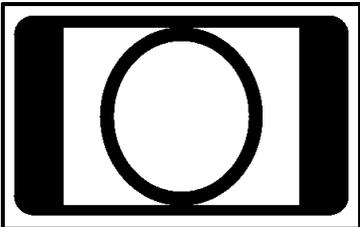
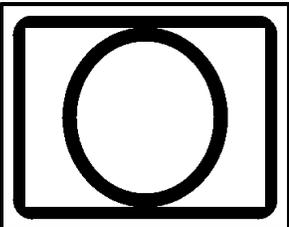
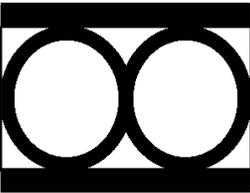
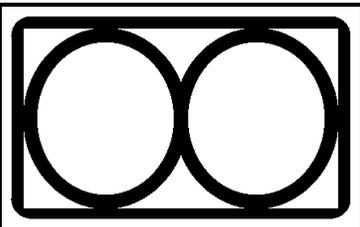
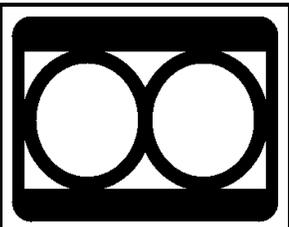
<p>Output Screen</p>	 <p>16:9 Screen</p>	 <p>4:3 Screen</p>
<p>Input Source</p>  <p>16:9 Film or Anamorphic Source</p>	 <p>No scaling performed. Image is displayed without change.</p>	 <p>16:9 image is Vertically scaled down to fit in 4:3 format, centered vertically on the screen, with black areas added top and bottom.</p>
 <p>4:3 Full TV, Computer or Video Source</p>	 <p>4:3 image is Horizontally scaled down to fit in 4:3 format, centered on the screen, with black areas added right and left.</p>	 <p>No scaling performed. Image is displayed without change.</p>
 <p>4:3 Letterbox Film Source Formatted for TV</p>	 <p>16:9 portion of image is stretched vertically to fill the entire screen.</p>	 <p>No scaling performed. Image is displayed without change</p>

Figure 3-3 – Input Source to Output Screen Translation

3.2.12 Save

This allows saving a group of control settings for Brightness, Contrast, Color, Tint, Detail, Noise, Motion, Black, and Source. As an example, Input 1 might be connected to cable TV. For movies, the settings might be slightly different than those used for sports events. In that case the settings for movies would be stored in Preset1, and the settings for sports events stored in Preset2. These could be simply recalled with the Load function when that source is again viewed. There are three separate presets for each of the three inputs (No settings are necessary for the HDTV pass-thru). To save a preset, use the UP and DOWN buttons to choose **Preset1**, **Preset2**, or **Preset3**. Pressing SELECT again will cause the preset to be saved to memory. “*Storing Preset*” will appear on the display to acknowledge the action. To reset the factory values, go to Load and select the factory settings, then Save these values into the desired Preset. Control values saved will be retained even if power is lost to the unit. Your most used settings should be saved to Preset1, since this is what is loaded when the unit is first powered up.

4. TECHNICAL SPECIFICATIONS

4.1 Video Inputs

Composite	1 V pp
S-Video	Y – 700 mv pp C – 286 mv pp
Component (YCrCb)	Y – 1 V pp Cr – 700 mv pp Cb – 700 mv pp
HDTV	D15F (Progressive)

Note: All inputs are NTSC or PAL interlaced video except HDTV

4.2 Video Outputs

15 Pin female DB15 connector (VGA style).

Progressive scan, 59.94 hz frame rate (50 hz PAL).

Settable line rate for all major computer or TV standards

H-V Mode	RGB - 700 mv pp Separate H and V TTL Sync, 4 V pp Selectable Positive or Negative Sync Polarity
RGsB mode	RG - 700 mv pp G – 1V pp, with embedded composite sync
YsPrPb mode	PrPb - 700 mv pp Y – 1V pp, with embedded composite sync
Tri-Level mode	PrPb - 700 mv pp, with Tri-Level sync Y – 1V pp, with Tri-Level sync
Composite mode	Composite sync on H and V, 4 V pp

4.3 Controls

Brightness, Contrast, Color, Tint

Detail Enhancement, Noise Filtering, Motion Processing, Black Level

Output Type (RGB or YprPb)

Output Scaling (640x480, 480p, 800x600, 720p, 1024x768, 960p, 1365x1024)

Output Screen Aspect Ratio (16:9, 4:3)

Output Sync Type (H-V, Sync on G, Sync on Y, Tri-level, Composite)

4.4 Input Stage

High quality adaptive Luma comb filtering

Multi line Chroma Comb filter.

Low noise YCrCb input stage.

4.5 Video Processing Stage

Automatic Film (3:2 pull-down) detection and reconstruction processing.

Automatic Video detection and adaptive motion processing.

Automatic Still Video / Computer graphics detection and enhancement.

Format conversion for all combinations of input and output aspect ratios.

Scaling and re-timing to all common display resolutions.

4.6 Output Stage

High quality 10-bit DAC.

Fully programmable Sync for any Display System.

4.7 Power

93-247 Volts, 47-63Hz (Universal External Switching Power Supply)

12 Volts DC, 1.5 Amperes at power input jack.