Setting the Record Straight

DVStorm vs The Rest - See the Canopus Difference

This document is a technical, clear, and factual comparison pitting the technical merits of the Canopus DVStorm compared with other 'prosumer' DV editing products currently available. Although this document mainly focuses on a comparison with the Matrox RT.X100, these principles can be applied to nearly all the products in the market today. In order to illustrate this point, three key areas of video production have been chosen. They are - The Operating Color Space (YUV against RGB), Visual Signal Clarity (Analogue Input/Output) and Audio Signal Clarity.

September 2002

E&OE. All trademarks or registered trademarks are properties of their respective holders.

Comparison

1. The Operating Color Space (YUV vs RGB)

After reviewing a number of comparisons documented by other manufacturers, there appears to be some confusion as to exactly what editing in the RGB color space and the YUV color space means. To show how RGB and YUV influence Video editing, a clarification on their respective meanings is needed.

Canopus editing products are solely built using a proprietary '*Native to DV*' YUV color space. Whilst a video camera does use RGB CCD's to capture its video footage, in order to store it on DV or Analog tapes, the camera must convert the RGB spectrum to the more manageable YUV. This is '*Native to DV*' as all DV is YUV.

Matrox exclaim that the RT.X100 uses the YUV spectrum to process certain effects and the RGB spectrum to process others such as 3D. The reality is that once the video camera has converted the footage to YUV in order to store it on DV tape, the color information has been reduced by approximately 75%, leaving just 25% of the original color data on the tape. This is presently the only way video images can be stored and managed easily. It is an engineering impossibility to extract the 75% lost or the 12 million colors lost in the RGB to YUV conversion.

When YUV is converted back to RGB, the YUV color space remains. Therefore when other manufacturers claim that they process their 3D transitions in RGB because it has twice the color (chroma), this is not true. They process their 3D transitions in RGB because the video board and graphics chip they use cannot process the YUV data format. The intended message put forward by a number of other manufacturers is that their hardware is for video editing professionals, however the truth is that the hardware processes in RGB the same as a games graphics cards, NOT as native DV.

The Matrox boards for example, convert from an 8-bit YUV format to an 8-bit RGB format, process in RGB and convert back to YUV for output, using the original YUV footage the whole time. An 8-bit YUV format has very different dynamic range and resolution to the 8-bit RGB format. Upon each conversion there are colors lost, the resolution and dynamic ranges are altered. These then give rise to artifacts such as aliasing and banding. In any form of signal processing whether it be audio, visual or color spaces, professionals and engineers agree that it is best to try to keep the original format to maintain quality. Since Canopus view this notion as being fundamentally important, and understand the merit of YUV processing, they are able to produce products that have far superior imaging and processing capabilities. The DVStorm when placed against the Matrox RT.X10 and RT.X100 reflect this yet again.

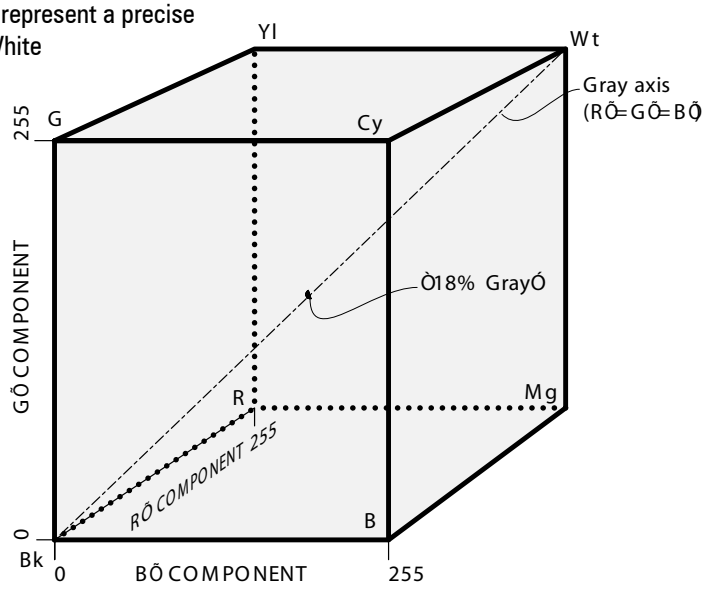
Comparison

What is RGB?

Red, Green and Blue (RGB) represent 3 color light channels, combining these channels of light produces a wide range of colors. Allow us to illustrate:

Figure 1[1] - The RGB Spectrum[1]

The RGB spectrum is a cubed space. Each color component, Red, Green and Blue have 255 steps or levels of intensity. If we take any single point in this space, that point has specific co-ordinates, these co-ordinates represent a precise color i.e. R255, G255, B255 = White (for 8 bit depth).
In an electronic environment such as a computer, all of these colors can be displayed, in total 16 million +.



This color spectrum is the most comprehensive; there are 16 million colors represented in the RGB spectrum. While unfortunately the visual shortcomings of human beings prevent being able to see all of them, never the less they are all colors.

One can easily edit in RGB, however storing such a vast number of colors especially in a dynamic environment such as video becomes almost impossible because of the data's immense size. This is the main reason why YUV was developed; it's smaller, more manageable and can be broadcast easily.

[1] 'Converting between RGB and 4:2:2' Charles Poynton, URL: www.inforamp.net/~poynton

©1998-04-04.

Comparison

What is YUV?

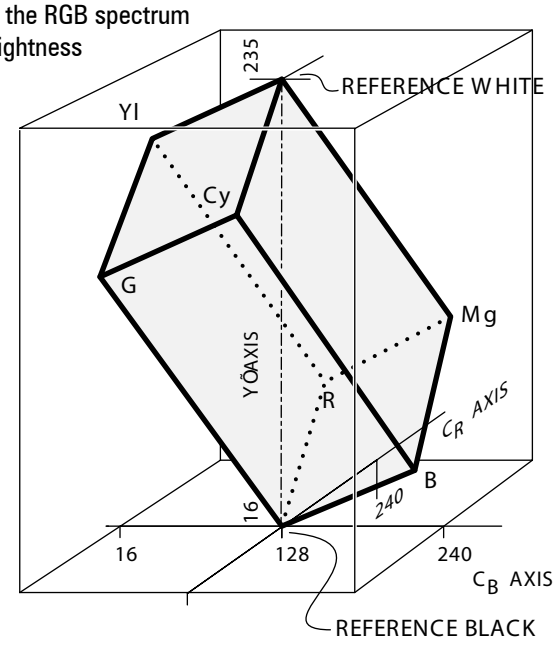
YUV is very different from RGB, instead of three large color channels it deals with one brightness or Luminance channel (Y) and two color or Chrominance channels (U-red & V-blue).

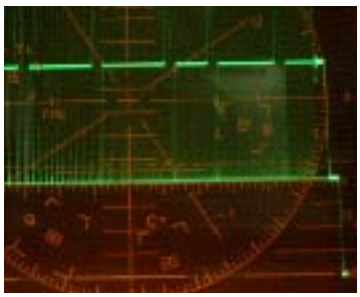
Human vision has poor sensitivity to color detail, it is much more sensitive to light or brightness. As long as brightness differences are maintained, a lot of color detail can be discarded from images thus reducing the size. If done correctly this cannot be noticed. This is the principal behind the conversion of the RGB color spectrum to the YUV spectrum used in all forms of video and broadcasting today.

Figure 2[1] show's that when a brightness channel is introduced and the colors that the visual system cannot detect are removed, what remains is a condensed spectrum called YUV, this spectrum contains only 2.75 million colors and not the 16 million that RGB possesses.

Figure 2[1] - The YUV Spectrum[1]

The YUV spectrum is much smaller than the RGB spectrum (See Fig. 1) with the same amount of brightness information & ~75% less color.





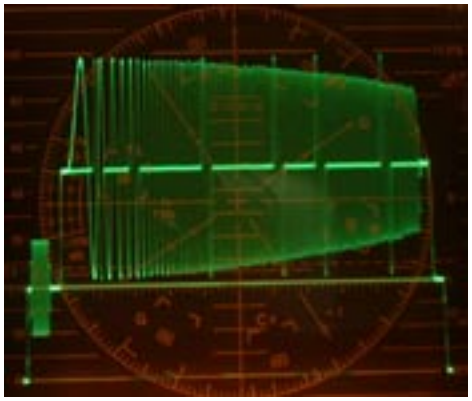
1. Original Test Signal

2. Visual Signal Clarity

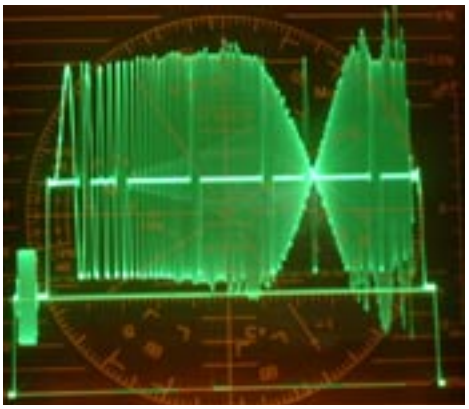
Full Field Color Bar Wave Forms[2]

The original test signal shows a perfect color bar signal representation on a wave form monitor. Once this signal has been passed through a video editing system the signal is distorted, this is the major factor in determining the overall image quality of a video editing system.

Canopus's DVStorm is very close to a pure signal as can be seen in picture 2 above. However the Matrox RT.X100 shows major distortion at the 3.58MHz mark, this severely degrades the out going image. Canopus prides itself on quality fundamentals; it's these fundamentals that can be trusted to produce the highest quality of editing.



2. Canopus DVStorm



3. Matrox RT.X100

[2] This is a standard color bar test through a wave form monitor. It measures the signal produced by the video board. The initial image 'Test Signal' is a direct signal from the signal generator. In this case the generator was set to the standard color bar. The test signal was then passed through the Canopus DV Storm and Matrox's RT.X100 video boards and the image recorded.

Comparison

1. Original Test Signal

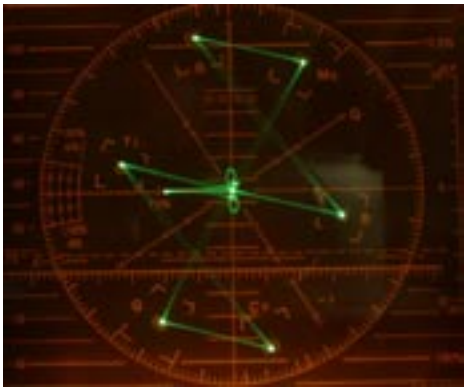
2. Visual Signal Clarity

Vector Wave Form[3]

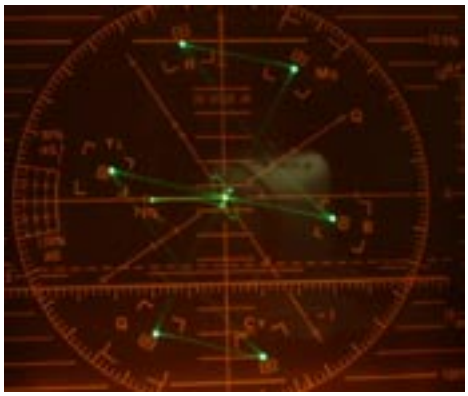
The vector wave form indicates the accuracy of color representation. The accuracy of each part of the color spectrum are indicated by the checkered boxes. The acceptable ranges are within the checkered boxes. Picture 2 shows the extremely high accuracy of color present in the DVStorms capabilities. Picture 3 clearly shows that the RT.X100 is well outside of the acceptable color representation realm.

What this means?

Canopus's color accuracy is true to life, what is captured is exactly what is edited and outputed to tape. The Matrox image shows a color representation very different to that of the original image. Color accuracy and reproduction play a big part in determining the overall quality of the finished product.



2. Canopus DVStorm



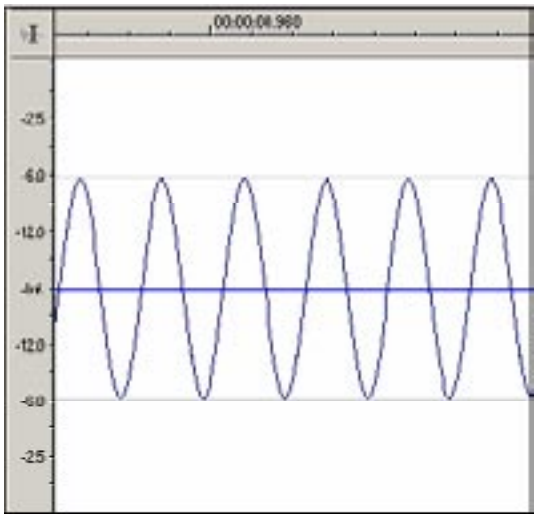
3. Matrox RT.X100

[3] The Vector Wave Form readings were all taken with the same calibration, gain and intensity. This can be verified by the position of the 75% marking on each vector scope image. The first image is an undistorted test image from a color bar signal generator.

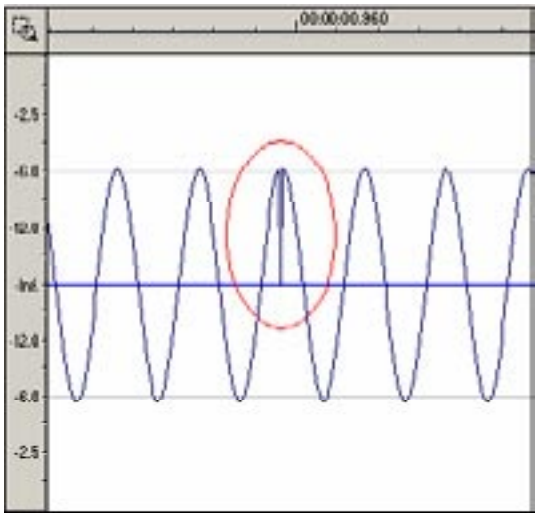
Comparison

3. Audio Signal Clarity

The DVStorm has its own built in audio capture device, whereas the RT.X10 and RT.X100 both require a soundcard to capture audio during analog capture. When capturing analog video/ audio, the RT.X10 or 100 re-sample the captured audio to have synchronization between the audio and video. This re-sampling, because it is done in realtime, will have a strenuous effect on the audio. The below images are audio waveforms of an audio clip captured by the RT.X100. The audio is a 1 kHz test signal.



DVStorm



RT.X100

The above image clearly shows a noise in the test signal, which should show only a sine curve. The noise can be heard as a cracking sound in the background of the audio sample. This test was done using a generic audio card found in many computers.

	S/N ratio	THD(%)
Realtime video filters / Video filter tools		
DVStorm [4] (Sound card independent)	84	0.001
RTX100 w/AC97 audio [5]	32 - 34	0.169 - 0.007
RTX100 w/SoundBlaster Live! [6]	45 - 69	0.036 - 0.001

Note: In the above "S/N ratio" the higher the number the better the quality of sound.

Above are the Signal to Noise Ratio (S/N) and Total Harmonic Distortion (THD) results of the DVStorm and RT.X100.

---

[4] System Configuration 1
CPU – AMD Athlon 1.3GHZ, Motherboard – FIC AD11, 512RAM, Windows 2000. Test signal output from

[5] System Configuration 2
CPU – Intel Pentium 4 1.8GHz, Motherboard ASUS P4B, 512RAM, Onboard Ac97 audio, Windows XP. Test signal output from MEGURO Audio Analyzer MAK-6581.

[6] System Configuration 3
CPU – Intel Pentium 4 1.8GHz, Motherboard ASUS P4B, 512RAM, SoundBlaster Live!, Windows XP. Test signal output from MEGURO Audio Analyzer MAK-6581.

Comparison

Canopus editing products use proprietary high quality sound circuitry located on the video board, producing clear, crisp sound with excellent S/N ratio and superb THD results. The RT.X10 and 100 however, use the soundcard present in the system to capture audio therefore the performance of the soundcard determines the overall audio quality. This produces variable results depending on the system set up. Ultimately, it is clear once again that when it comes to the fundamentals of this discipline, in this case sound editing, the Canopus drive for understanding and perfection result in quality that one can trust.

Conclusions

These images and technical results clearly show that Canopus have a fundamental advantage over their other manufacturers due to their pursuit of accuracy, quality driven ideals and commitment to delivering not only professional products but also professional output.

Higher Quality Base Video

Canopus products process in the Native DV color space, avoiding defects in image quality that result from changes in dynamic range when convertimg and processing in the non-Native DV RGB color space, as used by the competition.

Higher Quality Video Signal Clarity

Canopus products maintain accurate color levels and ranges, keeping the original signal as pure as possible, a difficult task made acheviable. Through distortion of the video signal, competing manufacturers do not let the creativeness of their users govern the overall result of their editing.

Higher Audio Signal Clarity

Canopus's proprietary on board sound capture circuitry is arguably the best on the market. It maintains accurate sound levels with minimal distortion and noise. As demonstrated, Matrox's use of the editing system's sound board for capture creates unpredictability in sound capture and output.

The highest quality possible is the ultimate goal; when it comes to video editing, understanding the fundamentals of how to obtain quality and accuracy is Canopus's foundation. Armed with this knowledge it's easy to see why Canopus is and always will be No.1.

Would you trust your lifetime memories to image degration? Only Canopus editing products offer the finest and cleanest DV editing solutions time after time.

Important:
All information provided in this document is considered to be accurate by Canopus Co. Ltd. based on information available at the time of printing. No responsibility however is assumed by Canopus Co., Ltd. for its use or misuse. Results may differ depending on hardware modifications and software releases. E&OE