MultiScopeLite

Video Measurement and Calibration Tools

Users Guide

RHMG Software Tools Library

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1.0 Introduction

The **RHMG** *MultiScopeLite* software application provides a fast and accurate way to measure, interpret and display video signals from a variety of video capture sources in real-time. It's easy to install, configure and use immediately.

The scope suite offers support in both Standard Definition (SD) and High Definition (HD) whose video signals can be sourced from a number of consumer and professional capture cards including PCI(e) based cards, USB Camera devices, Ethernet cameras and Firewire cards in both 400 and 800 specifications.

This software program is an ideal toolset for live real time video testing, troubleshooting, calibration and digital video R&D project integration (*note:* for software development projects we do offer an SDK library with the same video scopes and property settings as individual components. See our web site under the Products menu...*RHMG Software...SDK*). Video sources can be either analog (composite, S-video, YPrPb component) or digital (SDI, HDMI, Firewire 1394A or B, USB or Ethernet).

The display interface includes an integrated high resolution video monitor* configurable in 4:3 or 16:9 aspect. In addition, a selectable suite of up to four video scopes can be arranged in the order you like. There are a total of video 5 scopes in which to choose, of which only four are enabled at any one time.

> 1   Waveform Monitor
> 2   Vectorscope
> 3   RGB Parade
> 4   YUV Parade and…
> 5   Histogram

*VERY IMPORTANT
The LCD display monitor must be set to a minimum resolution of 1920 x 1080, or the user interface will be truncated on the right with no possible access to the controls.

This user guide contains an interface description, software setup and recommended system configuration to ensure successful use of this software product.

Explanations of what these various video instruments do and how they work is not part of this user guide. Users of this software interface should already be aware and be informed regarding the purpose and theory of these classic video measuring tools.

* **Note:** *the integrated video monitor must be setup properly for brightness, contrast, hue and gamma for accurate video representation. Calibration of the computer LCD monitor itself is the way to do this. Follow the manufacturer's guide for display card you are using. Alternatively use a product called Spyder by DataColor to get trustworthy results.*

2.0   Interface Description

Everything needed to setup the software program for live video streaming is neatly packed in a single user interface as shown in **Figure 1.0**. The interface presents one of three configurable layouts in which to choose.

Figure 1.0   Typical Video Scope layout

All of the video instrument tool displays are placed along the bottom of the interface screen. The video monitor or preview screen is placed in the top middle of the interface in this above example.

On the right side of the preview window is the **Scope Controls** interface. Here you can select which scope you wish to use, in which order (left to right), its unique operating conditions and color space in which to display. The *Display* tab provides the means to select which scope display appears in which display box. If there is no need for a video scope, you do have the option to not display it. Using the individual display tabs (*WFM, VST, RGB, YUV, HST*), you can choose the color space, display calibration scale and render detail you wish for that video scope.

On the left of the preview video window are the **Controls** for setting up the capture device and its operating properties. Any installed capture device with WDM support such as a Directshow driver will be detected and seen by the **Control** interface if the device driver has been properly

installed. If there is no detection, the *MultiScopeLite* application will not recognize the video device and no properties will be shown. Should this occur, it simply means the device driver is not a compliant driver and the video capture device cannot be used with this software.

Any video capture device must first be installed and confirmed working using the original manufacturers install software on DVD or from its web site, before booting up the *MultiScopeLite* application. To do this, just use the user application that came with the video device itself and test its operation.

Lastly, the user interface provides a read only DOS style console window just below the scope controls dialog. This window reports system status and error conditions. View often to see status.

3.0   Setting up the *MultiScopeLite* Application

Once your video capture device has been installed, (PCI based, USB cam, Ethernet cam, etc.), use the *Get Device* button to force the recognition and registration of your video device as shown in the Control Dialog of **Figure 3.0**. You may have multiple video sources installed on the same computer, so select the video source you want to use. The drop down boxes reveal supported properties like video input, video subtype, analog video standard, video size, etc for that installed video capture device.

Note: when using some video devices, its device driver interface may come up first, like that from Black Magic Design, see **Figure 2.0** below. Choose the operating settings from this interface first before selecting the properties *MultiScopeLite* provides.
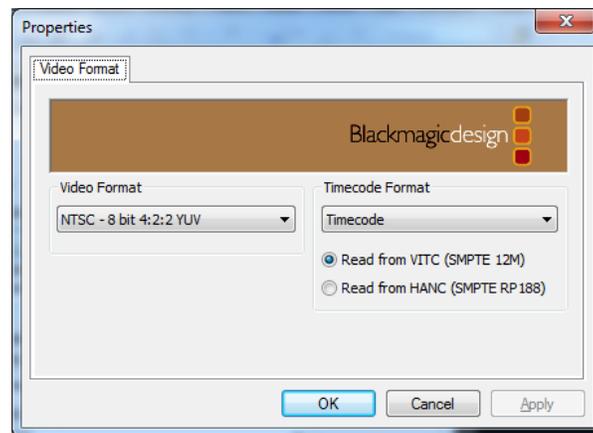
Figure 2.0   Black Magic Design Device Setup Dialog

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Continue the setup by choosing the settings video capture device driver provides and has enabled in the interface. Next setup the video size (frame resolution), video subtype, and video standard if applicable. When a video source is selected, only those unique properties associated with that device will be shown in the various drop down or edit boxes. Press *Preview…Start* when completing the setup. The integrated video monitor will begin streaming video from the selected video device. Press *Preview…Stop* to turn off the video stream to the monitor.
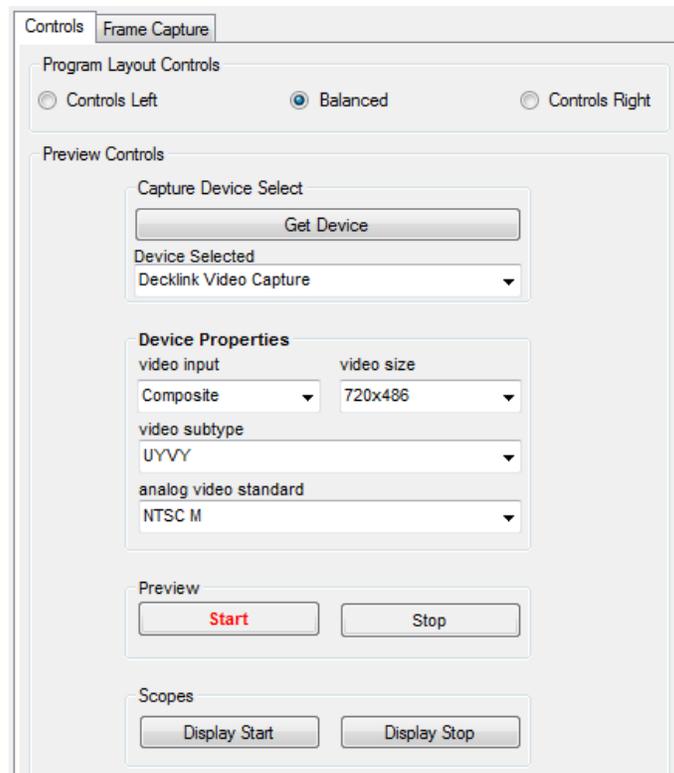
Figure 3.0   Control dialog

Next setup the working environment you want in terms of the number and type of scopes you wish to enable and view from the **Scope Control** dialog as shown in *Figure 4.0*. You can change the settings and configure them on the fly, though it is not recommended when video is being captured.

The *Displays* tab, controls which scope tool goes to which scope tool display, or reset them all to the default setting.
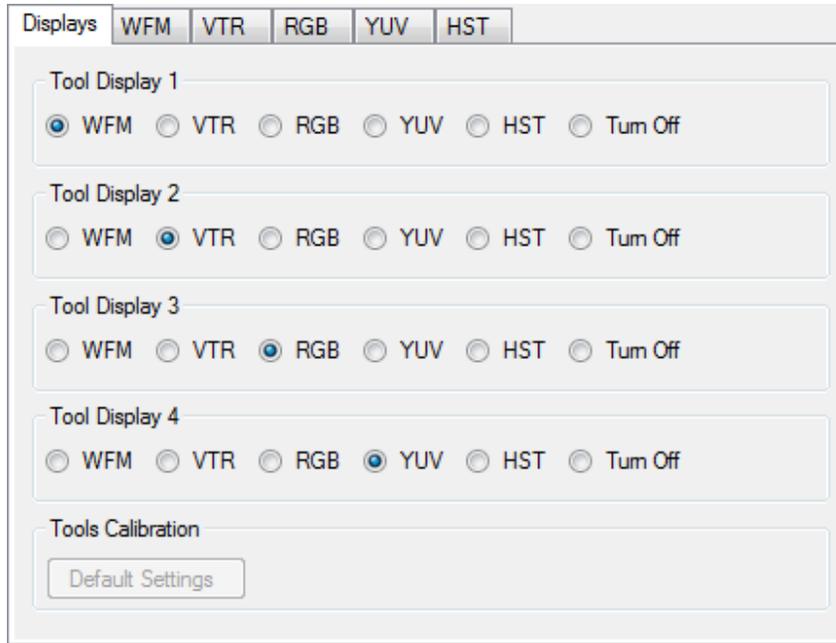
Figure 4.0   Video Scope enable and display order dialog

Figure 4.0 above shows an array of selection buttons that will arrange the order in which the video scopes will show from left to right. In the above example the *Waveform Monitor* will be in the left most position, followed by the *Vectorscope* in the next position, finishing with the *YUV parade* in the left most position. The *Histogram* scope has not been enabled in this layout case.
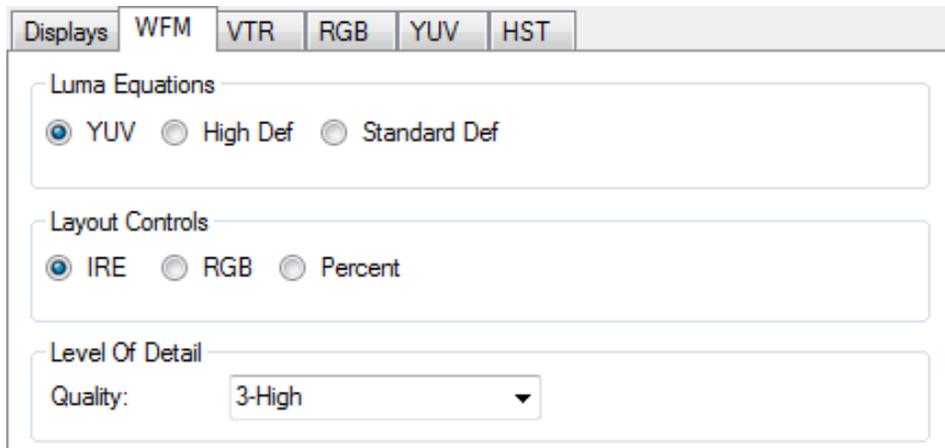
Figure 5.0   Waveform Monitor Scope operational configuration dialog

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Changing the LUMA equations for example as shown above in *Figure 5.0*, affects the color space equation for the display in question, though in the YUV parade only chrominance components are being displayed.   There are three color space equations; YUV, Standard Definition and High Definition, with the equations listed in *Appendix A*.

The Layout Controls section (Graticule Scaling) determines the scaling for the displayed data as some scopes display the specific data. The selection buttons control which measurement system is used, as the data can be displayed as classical IRE, raw RGB or in percent. The Vectorscope has some extra options in that the user can choose to have the data displayed in either dots or lines, in either classic green scope trace or in actual hue/color measured within the video frames.

The RGB parade has the option to keep the display in just RGB data or luminance and the RGB data.
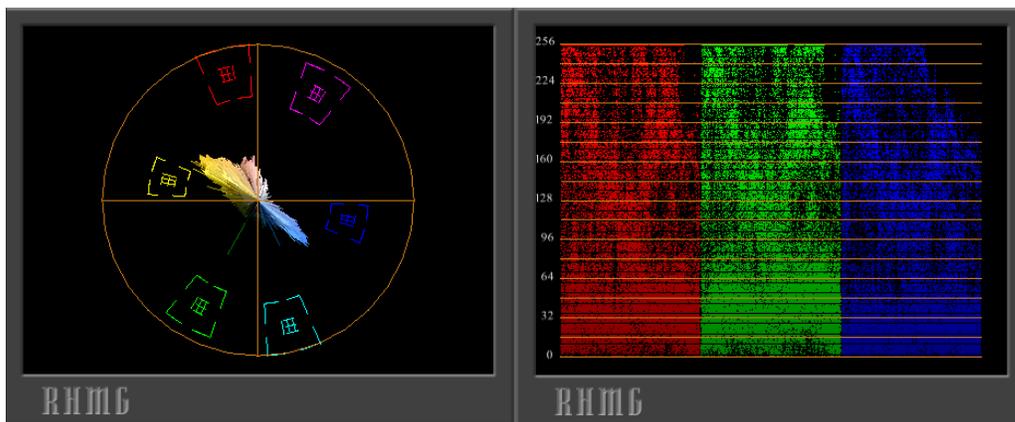
Figure 5.0   Sample Scopes

The *Level of Detail* setting or LOD, is to control the quality of the scope output render vs the display update speed.   The higher the detailed rendering the more processing time will be required to render the data to the scope tool. The settings go from *Perfect* (all vertical lines are processed) to *Very Low* (decimated or skipped lines). The *Perfect* setting will give the most detailed rendering of the data in the scope, but at the same time requires more time to render, The *Very Low* Setting will run the fastest on the very large resolutions, but will have the poorest representation on the data being displayed.

When the video scope setup is complete, press "Scopes Display…*Start*" button, to enable the video scopes to display its unique video data. Changing the properties of the various scopes can occur while video is being streamed though not recommended.

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The **Console** area is read-only display box. It provides the user instant feedback on the program's status, settings, and errors while the system is running. If there are problems that are encountered, the program can fix the error for some supported cases, but will report any and all encountered run time actions.

4.0   Minimum Software Requirements

Windows XP Pro 32bit
.NET Framework 3.5 and Framework 3.5 client must be installed**
CPU: Pentium 4
RAM: 1 GB, DVD ROM player
Screen resolution: 1920 x 1080 or better.

5.0   Recommended System Requirements

Windows XP 32 bit, Windows 7, 32 or 64 bit (avoid using Vista, it may work)
.NET Framework 3.5 and Framework 3.5 Client must be installed**.
CPU: Intel Core 2 Duo or better (faster machines will offer faster renders and higher details)
RAM: 2 GB or more and DVD ROM player
LCD Screen resolution setting: 1920 x 1080 or better.

**Note: the install program should automatically take you to the Microsoft site to download the applicable .NET frameworks required if it is not already installed on your computer. If it does not do the auto install, you must install these frameworks manually yourself (see links below) before running *MultiScopeLite*. Installing .NET Framework 4 will not work.

http://www.microsoft.com/en-us/download/details.aspx?id=21   for Framework 3.0

http://www.microsoft.com/en-us/download/details.aspx?id=5007   for Framework 3.5 Client

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6.0   Software Installation

To Install

1) Run the Setup program
2) go through the setup dialogs
3) Run the MultiScopeLite application
4) Click the "Try" button to run the trial version of the program
   or click "Order" to register and buy the full version.

In any case, the there is only one version of the software. The setup process for both Trial and the full version is the same.

After ordering is complete, you'll receive an e-mail from us containing the user name you entered into the order form at the time of purchase along with the unlock code to unlock the *MultiScopeLite* software to remove the trial restrictions. Once entered into the splash screen, the video software is now registered and ready to go. To do this, just start up the program one more time via its desktop icon and click the "Register" button. Fill in the two text boxes on the register splash screen with the user name and unlock code as per-mail information and enter. That's it.

7.0   Support and Contact information

Rumble House Media Group supports this product for 30days from date of purchase. If you have any questions please call us toll free at 877-397-3971 or email us at <u>support@homedvd.ca</u> and we will provide a technical response or solution to your enquires in a timely fashion.

There is a blog roll for your comments regarding *MultiscopeLite* on the product page itself at: <u>http://www.homedvd.ca/products/rhmg-software/multiscopelite/</u>

8.0   License

There is a single user floating license attached to this software program. Full product license code is provided at time of purchase to unlock full version. Fully operational trial versions are enabled for only noted number of days as shown on the product web page.

Appendix A

Colour space conversion equations used with MultiScopeLite

Standard RGB toYUV colour space

Y = (+0.257*R) + (+0.504*G) + (+0.098*B) + 16;
Cb (U) = (-0.148 * R) + (-0.291*G) + (+0.439*B) + 128
Cr (V) = (+0.439 * R) + (-0.368*G) + (-0.071*B) + 128

Standard Definition colour space RGB toYUV - ITU-R BT.601

Y = ((65.738/256) * R) + ((129.057/256) * G) + ((25.064/256) * B) + 16;
U = ((-37.945/256) * R) + ((-74.494/256) * G) + ((+112.439/256) * B) + 128
V = ((+112.439/256) * R) + ((-94.154/256) * G) + ((-18.285/256) * B) + 128

or   Standard Definition (601) colour space RGB to YCbCr (YUV) - Errata*

Y = ((76.245/256)*R) + ((149.685/256)*G) + ((29.07/256)*B) + 16;
U = ((-43.366/256) * R) + ((-85.136/256)*G) + ((+128.502/256)*B) + 128
V = ((+128.502/256) * R) + ((-107.604/256)*G) + ((-20.898/256)*B) + 128

High Definition (709) colour space RGB to YCrCb (YUV) – Errata*

Y = ((46.742/256)*R) + ((157.243/256)*G) + ((15.874/256)*B) + 16;
Cb = ((-25.765/256) * R) + ((-86.674/256)*G) + ((+112.439/256)*B) + 128
Cr = ((+112.439/256) * R) + ((-102.129/256)*G) + ((-10.310/256)*B) + 128

References
Charles Poynton – Digital Video and HDTV Algorithms and Interfaces – Errata
FOURCC – RGB to YUV conversion   *http://www.fourcc.org/fccyvrgb.php*

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