

MultiScopeCompact 3D

Video Measurement, Analysis and Calibration Tools

Users Guide

RHMG Software Tools Library

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1.0 Introduction – Now with 3D Scope Support

The **RHMG MultiScopeCompact** video software application provides a fast and accurate way to measure, help interpret, calibrate, analyze and display 8bpp video signals from a variety of 3rd party video capture sources in real-time. It's easy to install, configure and use immediately.

NOTE: MS Compact has always been built as an engineering model and does not have the visual and user finesse of a true final product. Our priority has been functionality over visuals. Over time market productizing will be addressed.

The 'MSCompact' line of video tools has been designed with flexibility and economy in mind, all packed into a small LCD screen footprint. A major design feature is the adaptation of a plug-in model. This simply means the user can select from any of our many A/V scopes mounted within the MSCompact interface that have been purchased and unlocked.

Though the user interface supports only two visible scope spots (or sockets), the user can access, select and enable any available unlocked scopes needed for the immediate job at hand.

See *Figure 1.0* below to view the updated MSCompact user interface supporting both the classic and new 3D video scopes.

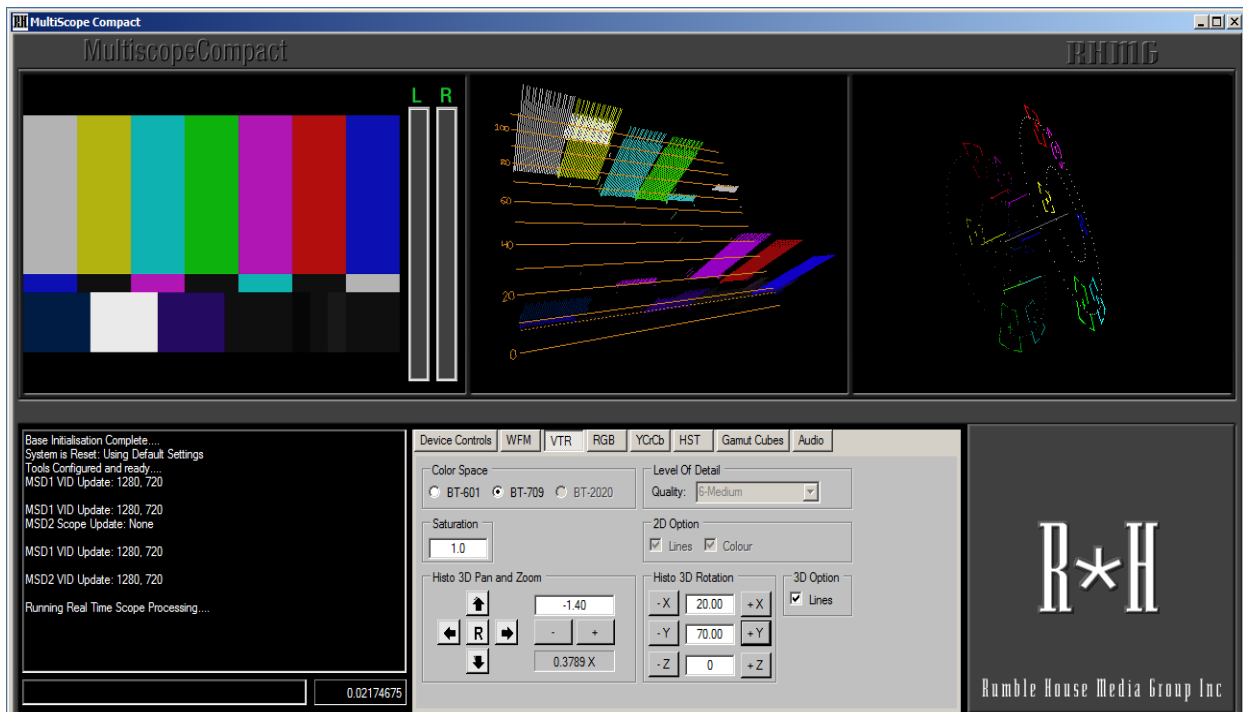


Figure 1.0 MSCompact User Interface with sample 3D Plug ins

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This video software application supports both Standard Definition (SD ITU-R BT.601) and High Definition (HD ITU-R BT.709) video color spaces (in either 2D or 3D format) that can be sourced from a good number of consumer and professional capture cards and devices including PCI(e) based cards; Thunderbolt, BlackMagic Decklink devices, USB camera devices and Firewire cards in both 400 and 800 specifications.

Ethernet based cameras are supported but require a separate IP based Hosting Unit. An IP base unit does not offer 3D plugin operation. There is no support for IP cameras in a standard hosting interface.

MSCompact is an ideal toolset for testing, analyzing, troubleshooting, calibrating and monitoring live real time audio-video streams – there is no support for image capture or image ingest of still images.

SDK Tools - For engineering projects involving custom development and integration of digital video systems, we offer a comprehensive video API library with the same video and audio scope functions we have used to build *MultiScopeCompact*. See our web site <http://www.rumblehouse.com/products/> to review our SDK product bundles.

The *MSCompact* main user interface hosts an integrated high resolution video monitor configurable in 4:3 or 16:9 aspect, a basic audio PPM, two audio or video scope plug-ins that can be arranged in any order you like and a scope operating setup interface. Right now there are a total of 14 plug-in style scopes in which to choose, of which only two can be enabled at any one time in the base or ‘hosting’ unit.

- 1 Waveform Monitor (WFM)
- 2 Vectorscope w/fleshtone axis 100% saturation
- 3 RGB Parade, multi function, blend
- 4 YCrCb Parade
- 5 Histogram, RGB, Luma
- 6 Dual PPM Audio Meter
- 7 Stereo Audio Phase Meter
- 8 Stereo Audio Analog dual channel Waveform scope
- 9 3D YcrCb Cube with full Gamut presentation
- 10 3D-Histo Vectorscope
- 11 3D-Histo Waveform Monitor
- 12 3D-Histo YCrCb Parade
- 13 3D-Histo RGB Parade
- 14 3D RGB Cube - Demo

Scope plugins will come in three bundles to purchase:

- 1 5x 2D scopes and 3x audio scopes - basic scope bundle
- 2 5x 3D scopes – advanced upgrade path to 2D scopes
- 3 All 13 scopes in one bundle, plus bonus RGB cube

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There are no compound scopes yet available where two scope functions are used within one plug-in. We are considering those combinations for future releases. Let us know what may work for you if this is important.

***IMPORTANT**

1 The LCD display monitor must be set to a minimum resolution of 1280 x 720, or parts of the user interface may be truncated on the right with no possible access to the controls. The user interface is not re-sizable.

2 There are two hosting interfaces available for use. One type of host for USB, PCI, Thunderbolt and Firewire type video sources and the second type of host is for supporting Ethernet cameras. Make sure you purchase the right hosting unit for your video application.

3 Ethernet base units do not support any 3D scope plugins.

This user guide contains a user interface description, software installation guide, scope descriptions, software setup procedure and recommended system configuration to ensure successful use of this software product.

Explanations of the operating principles these various video and audio instruments is not part of this user guide. Users of this software interface should already be aware of and be informed regarding the purpose and theory of these classic audio-video industrial tools.

***Note:** *if important, the LCD monitor used to view this application must be setup properly for brightness, saturation, contrast, hue and gamma for accurate video monitor representation. Calibration of the computer LCD monitor must be done to ensure this. There are two options. Either, follow the manufacturer's guide for the display card you are using or use a product called Spyder by DataColor to get accurate results.*

MultiscopeCompact is a Windows application which supports only 8 bits per pixel video streams at this time. Attempting to use 10bpp or more pixel bit depth video will only cause the system to fail, by either hanging or crashing the application.

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2.0 Hosting or Base Interface Unit Description

The *MSCompact* video product is made up of two parts, a plug-in base hosting unit (*Figure 2.0 below*) and custom A/V scope plug-ins. The basic hosting unit supports a high resolution video monitor, a set of basic built-in stereo PPM meters, a system health reporting display, tabbed scope configuration dialogs, and a dual scope plugin socket location for any one or more video or audio scopes.

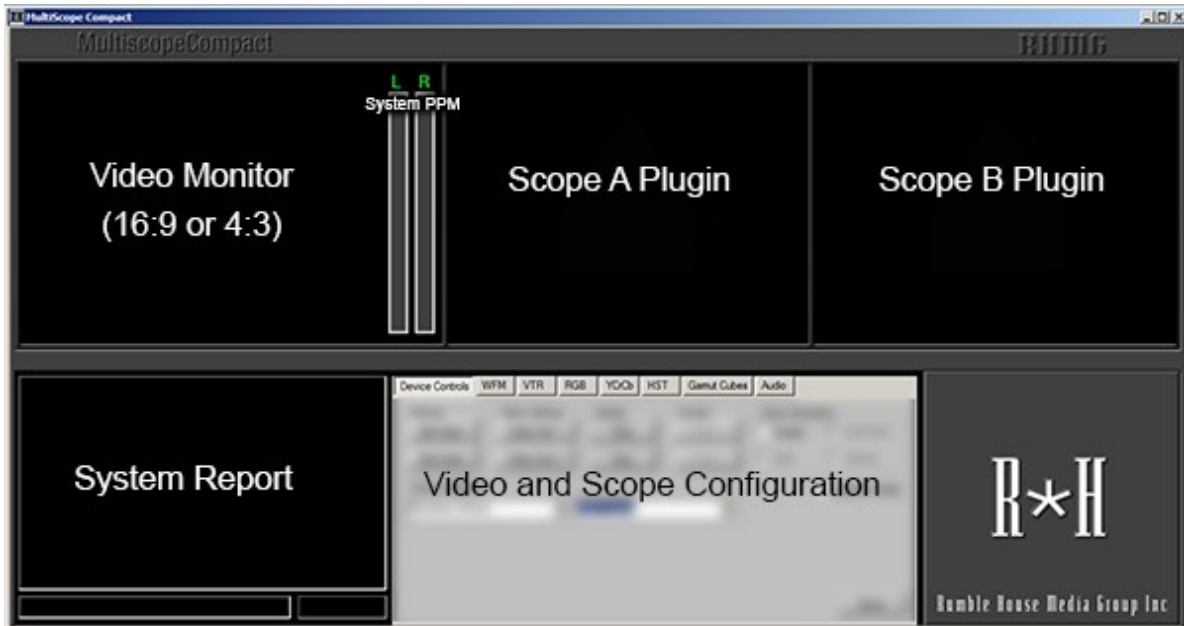


Figure 2.0 MSCompact Basic Hosting Interface

2.1 Tabbed System Setup

In the lower center half of the base unit interface there are a series of scope setup and configuration tabs. (*IP Cam support is not available in a standard hosting unit*).

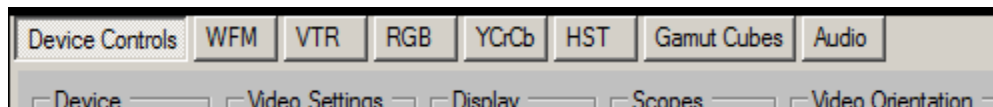


Figure 3.0 Scope Configuration Tabs

The first tab, labeled '*Device Controls*' is activated by default when the application is first launched. It serves to select and configure an A/V source and to select one or two scopes for operation. Subsequent tabs configure the selected scopes for operation.

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2.2 *Video Color Monitor*

The integrated video monitor, located in the upper left of the hosting interface can be set for either 4:3 or a 16:9 video frame format depending on the aspect ratio of the source video being streamed. Video in a 16:9 aspect will frame the video with black bars on the top and bottom of the video box. Full 4:3 aspect will fill the video box with no bars in any orientation.

The video display box will show any supported video resolution of the source up to 2048x536 pixels from what we have tested to date. Lower resolution videos may show up stretched to fill the video box or may show its smaller native size and maintain proper aspect.

2.3 *System Console - Reporting Interface*

We have included a small DOS type box in the lower left of the hosting interface. It is used to report the status of the interface while *MSCompact* is running and input control commands. It will be useful to use when reporting any issues with the software if you were to report problems to us. The interface can capture many types of operational errors and flags them here.

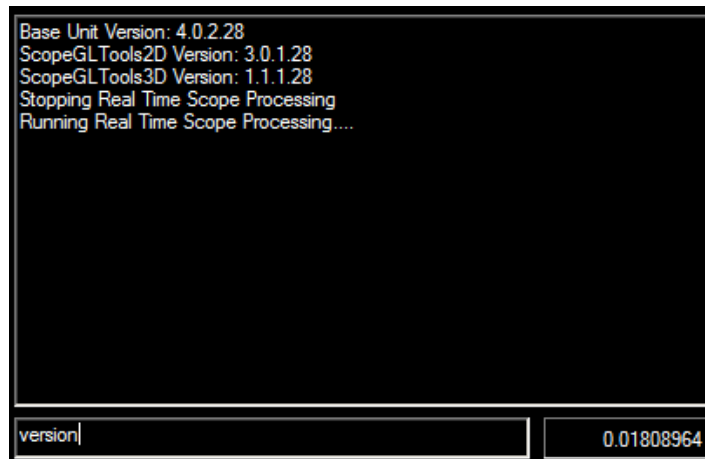


Figure 4.0 **DOS style Status System Reporting Screen**

When discovering an error in operation or the system has crashed, the console captures and report specific system error messages. You can do a simple PRINT SCREEN and save the DOS box message as a JPEG. Append the image to your email message when talking to us about problems.

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The console also accepts user commands that are written in the edit box just below the main console screen.

Commands

Clear the console: enter *cls* or *clear* <return>

Clear registry: enter *rebirth* <return> deletes both scope settings and registry files

Delete files: enter *rm config* <return> deletes just scope settings file

Delete files: enter *rm registry* <return> deletes just the registry (reg codes) file

Report application version: enter *version* <return>

Note: *The following is the procedure to clear registration information from the operating system that was entered during the application install procedure. This to allow for fresh installs or new releases with no residual files present, run this code sequence.*

Using the console window in the application (DOS look alike) you will clear the application registry so that a fresh install is possible with no errors.

Steps:

1 Clear console: type *cls* or *clear* <return> blanks out the console screen

2 - type : *rm config* <return>
<the console will then report the config file has been successfully deleted.>

then....

3- type : *rm registry* <return>
<the console will then report the registry has been successfully deleted.>

and... the console will now report : "Registry codes required to continue program operation">

4 - or delete both files at once type: *rebirth* <return>

At this point a Windows dialog box will appear over top the application itself and will ask for new registration codes, which means the *MultiScopeCompact* application is looking to be re-registered.

Exit the application and uninstall the application to be removed via Windows as usual. This *rebirth* ing process ensures that any re-installation of the application or a newer version will be error free.

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2.4 Dual Scope Plug-in Screens: A and B

There are two scope spaces (or sockets) in the main user interface for your choice of audio or video scopes that we offer for you to use (see **Figure 2.0** above). The *Devices Control* tab provides the selection and properties setup of the scopes you want to run. If you have more scopes that have been purchased and unlocked, a drop down list is available to show all available scopes in which to choose (*not all scopes shown in the drop down list are activated, just those purchased will run*). You can place any scope in any of the two positions available. Even run the same scope in both locations if you want.

2.5 Ancillary Controls

Depending on video sources connected there may appear to be initial video orientation inversions. The user frame labeled '*Video Orientation*', is there to correct video that appears to be incorrectly positioned. Check the '*Enable*' check box first to change orientation.

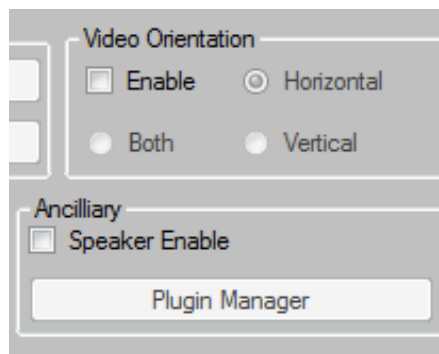


Figure 5.0 Ancillary System Functions

The '*Speaker Enable*' check box is to connect or disconnect the system speaker when audio is being captured. Depending on speaker loudness and sensitivity of any microphone attached while streaming real-time A/V, there may be enough sound level to cause feedback or due to delays in processing cause the audio to repeat itself in a doubling or delayed fashion.

The *Plugin Manager* or '*Get Plugins*' button enables the registration and activation of any plug-ins you may have purchased so you can begin to use them. To register plug-ins see *Section 8.0*.

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3.0 Scope Plugin Properties and Descriptions

Many of our video scopes share common properties as part of its mode of operation. Here are the main common operational properties:

3.1 *Color Space Equations*

There are three color spaces we have implemented; Standard YUV, Standard Definition (ITU-R BT.601) and High Definition (ITU-R BT.709), with the associated equations listed in *Appendix A*. Support for ITU-R BT.2020 (4K resolution, 10bpp and 12bpp video), is planned for a future release.

Each color space influences the scope display outcome depending on the color representation required. Video sources that output in or out of gamut video for example, will be processed based on the rules specified by the relevant color equations.

3.2 *Level Of Detail Control*

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 (thus lower frame rate) will be required to render the data to the scope display. The settings go from 'Perfect' (all vertical lines are processed) to 'Very Low' (heavily decimated or skipped lines). The 'Perfect' setting will give the most detailed and accurate rendering of the data in the scope, but at the same time requires more time to render and thus may run at a slower frame rate. The 'Very Low' setting will run the fastest even on the very large frame resolutions, but will have the poorest representation on the data being displayed.

3.3 *Graticule and Scaling*

Some scopes require the option of scaling to different standards. The scale selection radio buttons offers several standard reticle scales. The processed data can be displayed in classical IRE, raw RGB (0 to 255) or in percent (0% to 100%).

It should be noted that the processed data itself is not scaled or changed in any way to fit the selected scale. The data presented remains the same, just the scaling reticle information changes.

3.4 *Lines and Dots*

Some scopes need the option to either render results as dots or as lines. Choosing either one may result in clearer understanding of the rendered results.

3.5 *Color or Classic Traces*

Traditionally, test equipment scopes have always output traces in classic green, based on the excitation of the CRT phosphor of the analog scopes at the time. Now being digital, we can represent traces in color, notably colors that show the actual RGB color being process and/or rendered.

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3.6 Chroma Overlay

Rather than rendering out just the luma (Y) component of a video signal for certain scopes, it may be of value to some users to see the chroma (CrCb) component as well rather than being discarded. So we have included an overlay option for some of our scopes.

4.0 Audio Video Scope Descriptions

In this section, there will be an in depth description of all of the audio-video scopes available for *MSCompact*. ie: a section on the classic video scopes, audio scopes and 3D Histo and Color Gamut cube scopes.

4.1 Classic RGB Parade Scope

The RGB parade scope is a very practical way to color grade video (color saturation, white balance, black levels-pedestals, greyscale). It provides the means to present video in its basic color form. The amount of energy in each of the prime colors in its color space is a strong indicator of where to seek proper level adjustment to achieve a well balanced picture.

The RGB Parade scope splits the video stream frames into individual RGB components in the form of RGB columns. Content presentation and behavior is identical to the classic Waveform Monitor (WFM) in terms on how the video data is read per frame. The difference is the classic WFM presents just the luma component of the video stream whereas the RGB parade presents just the color part of the video stream. Luma is stripped away.

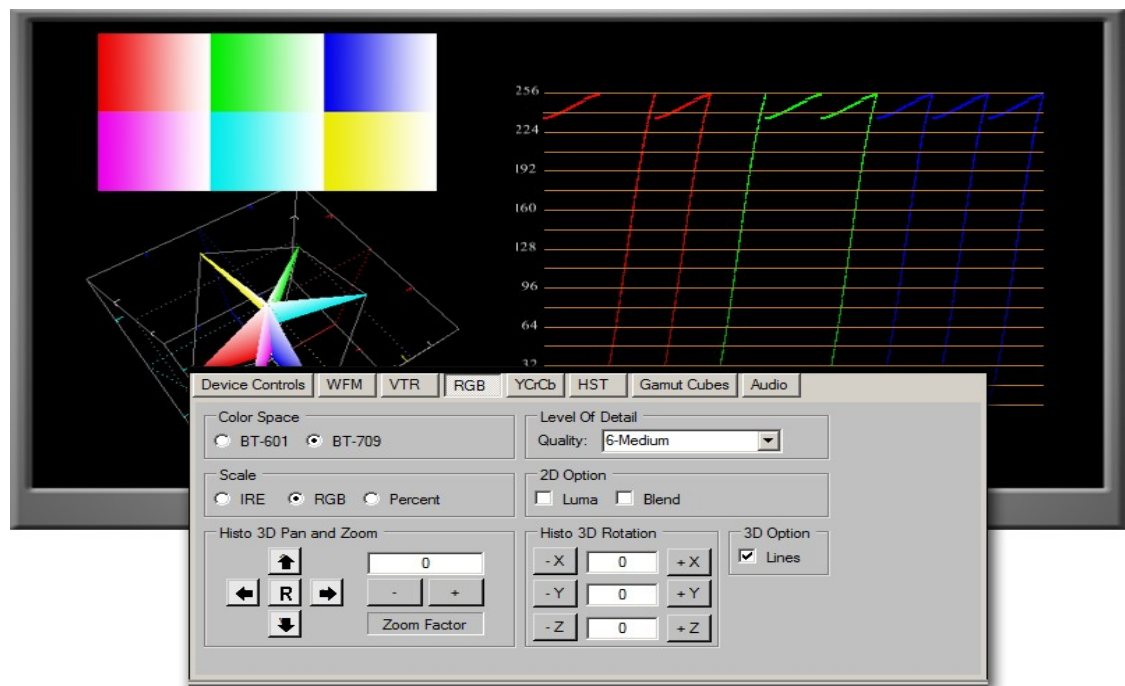


Figure 6.0 RGB Parade with Gradient Color Swatches – 240wh, 235chroma

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RGB parade running in regular 2D operation has a Blend and Luma check box.

Running in Blended mode shows each colour channel is over laid on each other. If aligned perfectly in gain, pedestal and gamma, gray scale traces should result, showing a properly white balanced picture.

Operating in the *Standard* triple column RGB scope mode, the **Luma** and **Blend** check boxes must be left unchecked. If a fourth channel, *Luma*, is required, check the **Luma** checkbox. For an RGB overlay of each colour is required, then check the **Blend** check box. The **Luma** checkbox will have no meaning when running in blended mode.

The 3D histogram controls shown on the lower half of the control interface do not operate in standard 2D RGB mode and has no effect on the operation of this scope.

4.2 Vectorscope

A vectorscope presents video data in terms of color saturation (vector length) vs hue (vector angle) for the color space set.

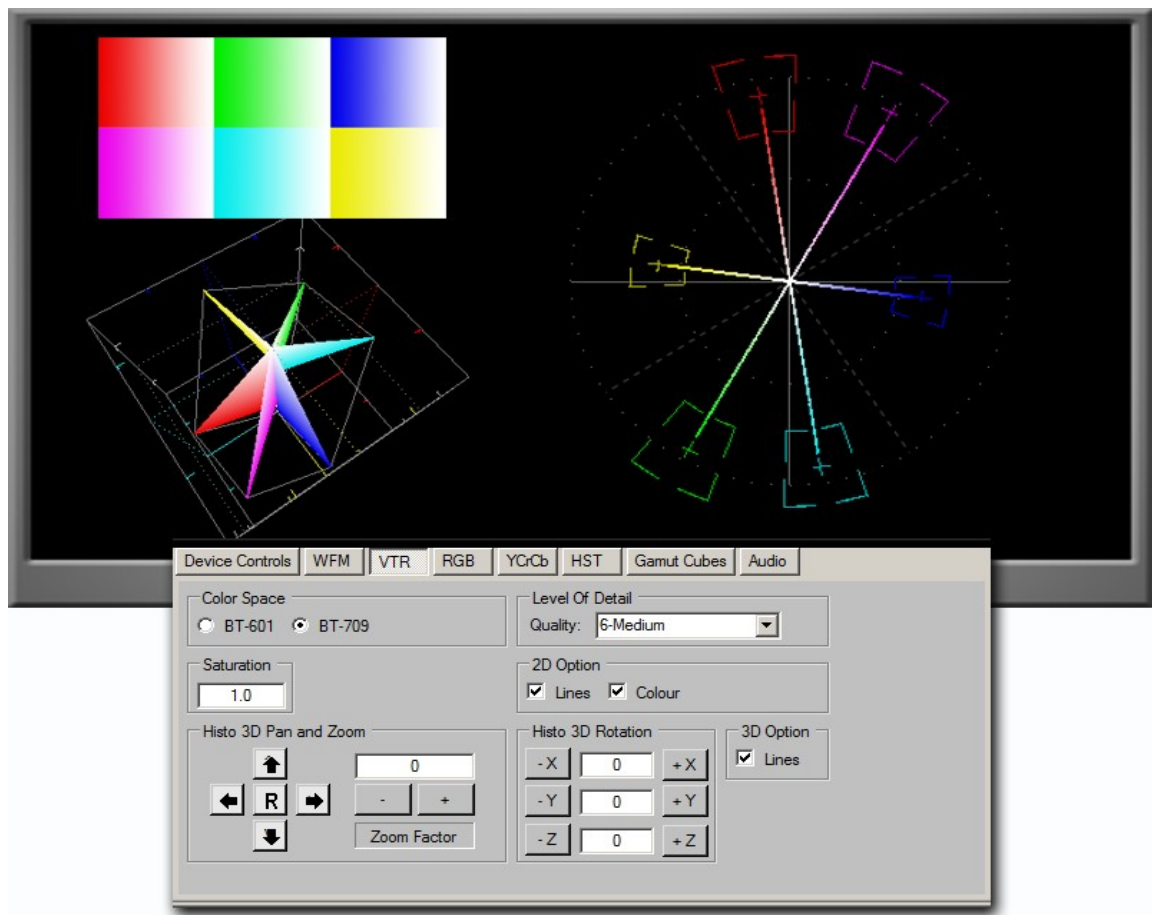


Figure 7.0 Vectorscope and Control Panel Property Settings

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The *MSCompact* vectorscope provides targets at the 100% saturation point for both HD and SD color spaces. There are no 75% (191*) nor 91% (235*) targets marked in either 601 and 709 color spaces. (* 8 bits per pixel)

Processed data can be presented in either dots or lines, in full relational hue/color or in classic green.

This scope also offers full quadrant I/Q lines denoted by either dotted or solid lines at the standard 33 degree offset angle.

The I/Q angle drawn in the positive left side of the vectorscope face is the angle that can be used as a means to *align flesh tones* for any post production work.

A **Gain** or *Saturation* control is available for video systems using calibration charts. Gain settings can be adjusted from unity (1.0) to 4.0x and down to .5, in 1/10 steps.

Controls for the 3D histogram version of the vectorscope shown in the lower half of the control interface are not operational for this scope and are ignored.

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4.3 Classic Waveform Monitor

The classic waveform monitor is used to present the overall exposure of the video stream, regardless of the color component. It is a plot of luma values in video frame over time.

It is a very useful tool to examine the brightness, contrast, black/white levels and gamma of a video stream and to provide the video engineer feedback in adjusting the video for best presentation.

A basic waveform monitor extracts and presents only the luma component of a video stream. The video frames are read left to right, top to bottom pixel by pixel. Each pixel is converted to YCrCb where only the Y component is used in the presentation plot. Each Y component is processed against an appropriate color space equation and plotted into a luma calibrated map.

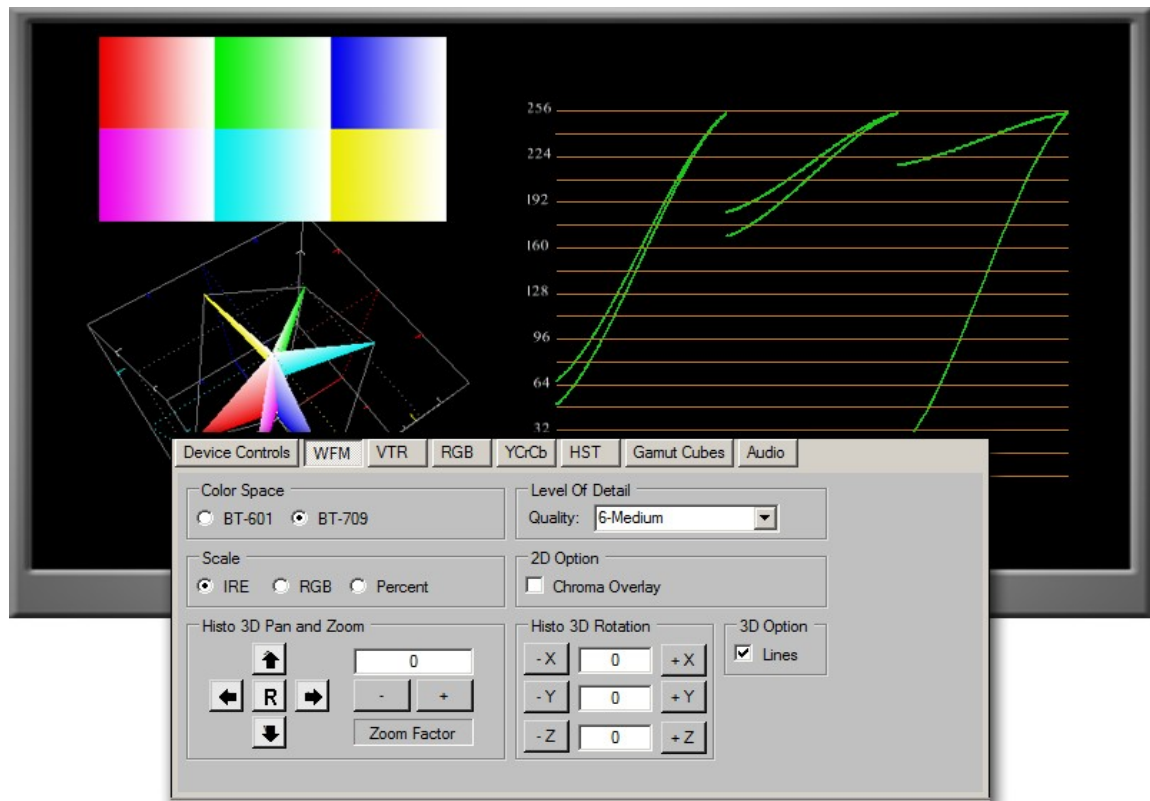


Figure 8.0 Waveform Monitor and Property Settings

A chroma overlay is optional where the CrCb that was discarded can be now used and overlaid on top of the luma plotted signal. Chroma overlay is only available in classic 2D operation.

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4.4 YCrCb Parade Scope

The YCrCb is a digital color coding system used in many video capture and compression products. It's mainly used in scope form to visually examine a video stream for signal strengths in luminance and color difference chrominance.

It represents colors in terms of one luminance component/luma (Y), and two chrominance components/chroma(Cb and Cr).

YCrCb levels are heavily influenced by the co-efficients of the used color space.

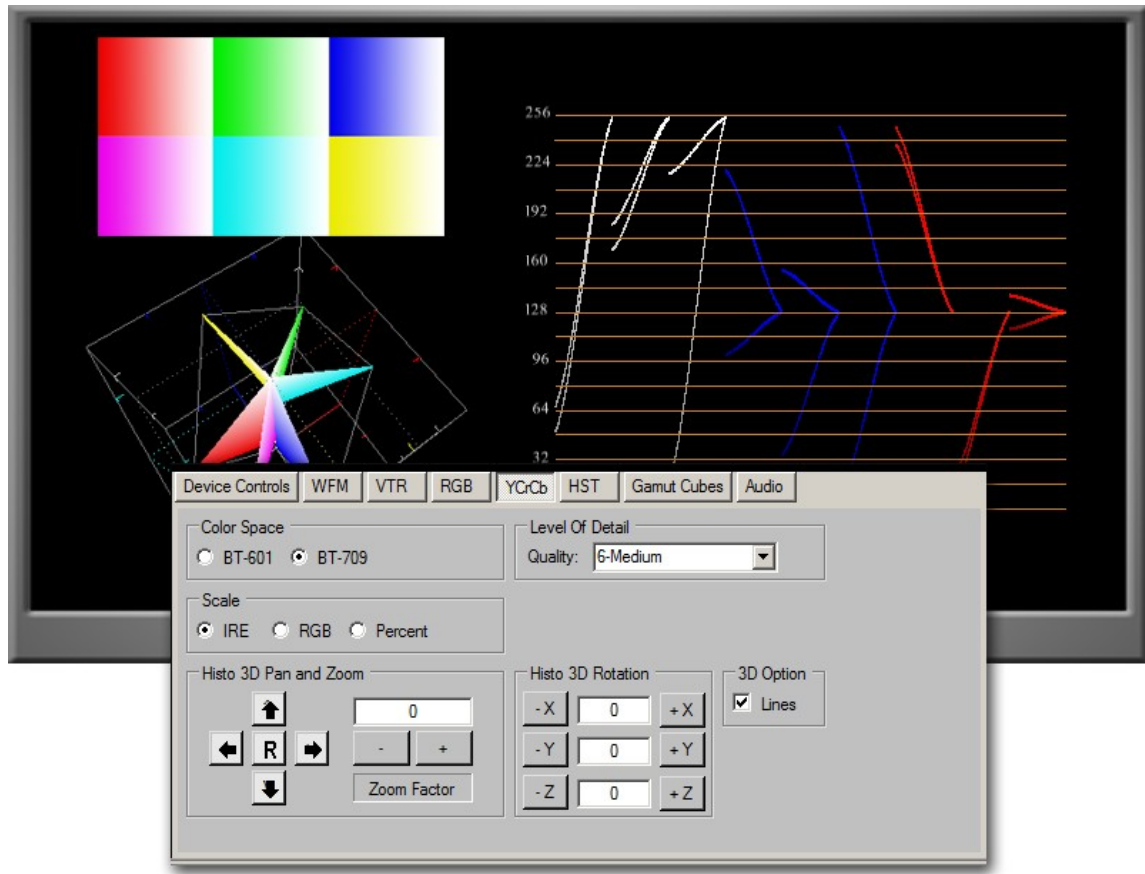


Figure 9.0 YCrCb Parade scope and controls

The bottom half of the control interface is not used for this scope, however is used for the 3D histo YCrCb scope version.

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4.5 Histogram

A histogram is a statistical tool. It presents continuously collected and processed data in the form of binning and occurrences of that data. The individual binning accumulation is shown as vertical bars.

A video histogram splits the video data into its RGB constituent parts and is binned as to occurrences of the same colors. As an added feature, we have included a luma histogram channel in parallel showing the distributed luma power in the video flow.

Numbers shown to the right of the channel shows the bin with the maximum value found, followed by the bin with the minimum value found – no reporting of those values.

eg: a red channel will show all red occurrences of different shades of red. In 8 bit video systems there will be 256 bins, each storing the number occurrences of the same shades value in each corresponding bin. If a picture has just one pure color for example, like 255 red, the red histogram channel will show one spike in the 255 bin. All other bins will be zero as there is no other shades of red to report. All frame data is collected, never discarded. The bin recording the most occurrences will be scaled at 100% and subsequent bins scaled down accordingly for display purposes. Bin numbering starts at 0 to 255, left to right.

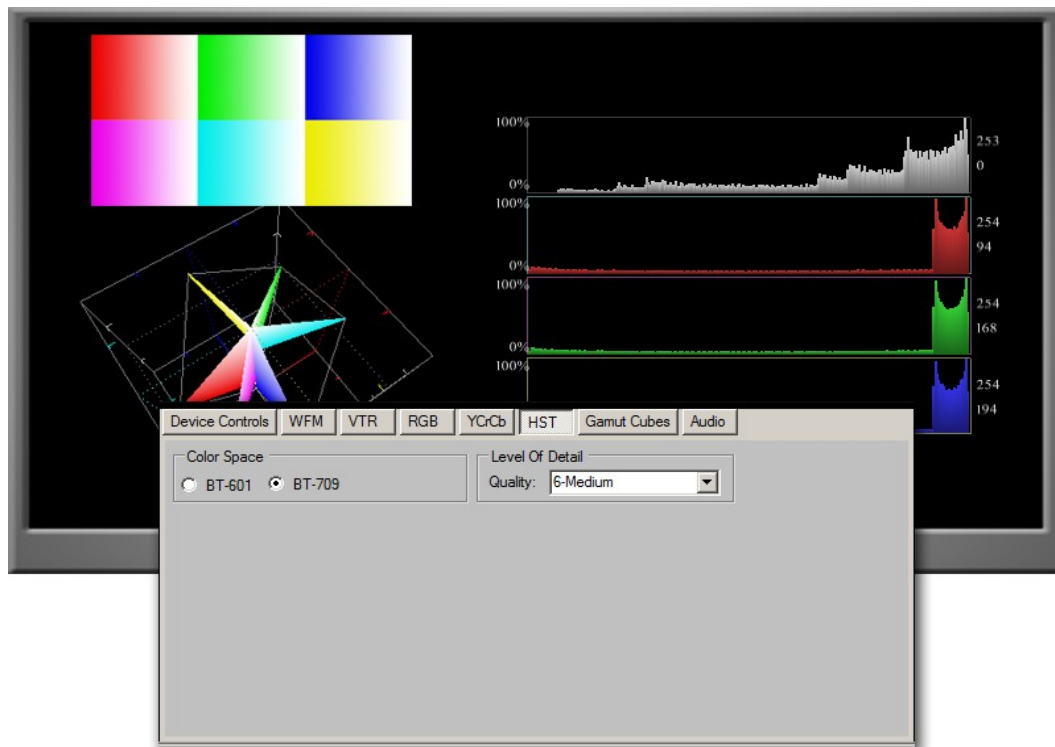


Figure 10.0 RGB Histogram

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4.6 3D YCrCb Gamut Cube

This scope was specifically developed to display the gamut of colors output from a video source in real-time in 3D cube form. Its main purpose is to show in or out of gamut conditions against different color spaces. Any color errors found can be corrected at source and verified. The external cube shape, vertices and connecting lines are defined using a maximum theoretical limit of defined color values in addition to serving as a reference for the odder shaped inner cube. The inner cubes' shape, boundary limits and relative position within the larger cube are defined exactly by the color space selected.

One use of this scope is in a multi-camera event situation where all the cameras must be made equal in saturation, hue, gamma, brightness, contrast and gamut. Applications such as VMix for example where multiple cameras covering an event must be similarly calibrated to ensure seamless video performance when switching between cameras.

Rotational and scaling controls provide the means to adjust the cube planes for best observation of in and out of gamut operations.

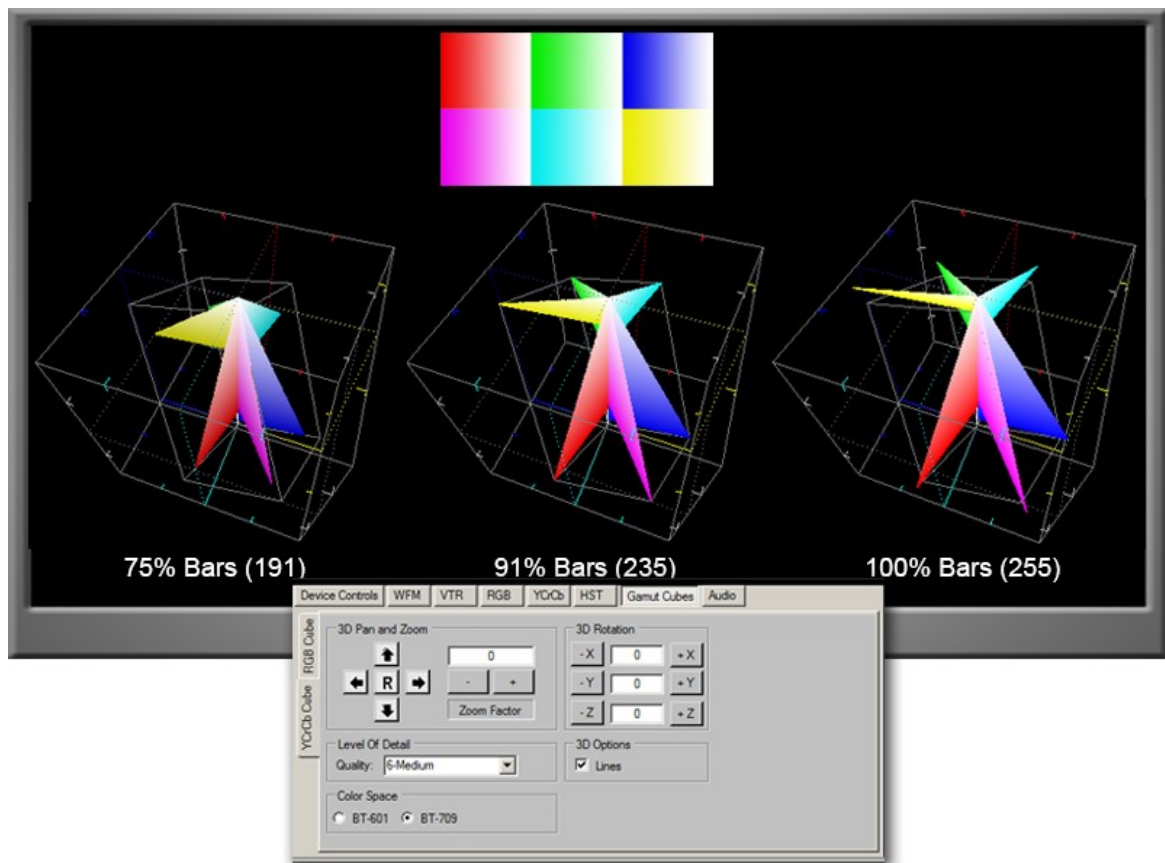


Figure 11.0 YCrCb 3D Gamut Color Cube in 709 Weighted Space

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A Brief Description of the YcrCB Gamut Cube

Figure 12.0, shown below is a sample rendering of the color gamut cube. The larger external cube is designed to be a three dimensional classic cube whose purpose is to differentiate the shape and position of the actual color space driven inner cube. The inner cube vertices and its location in relative space is an exact rendering of the color space model we wish to calibrate against when looking at real-time video streams.

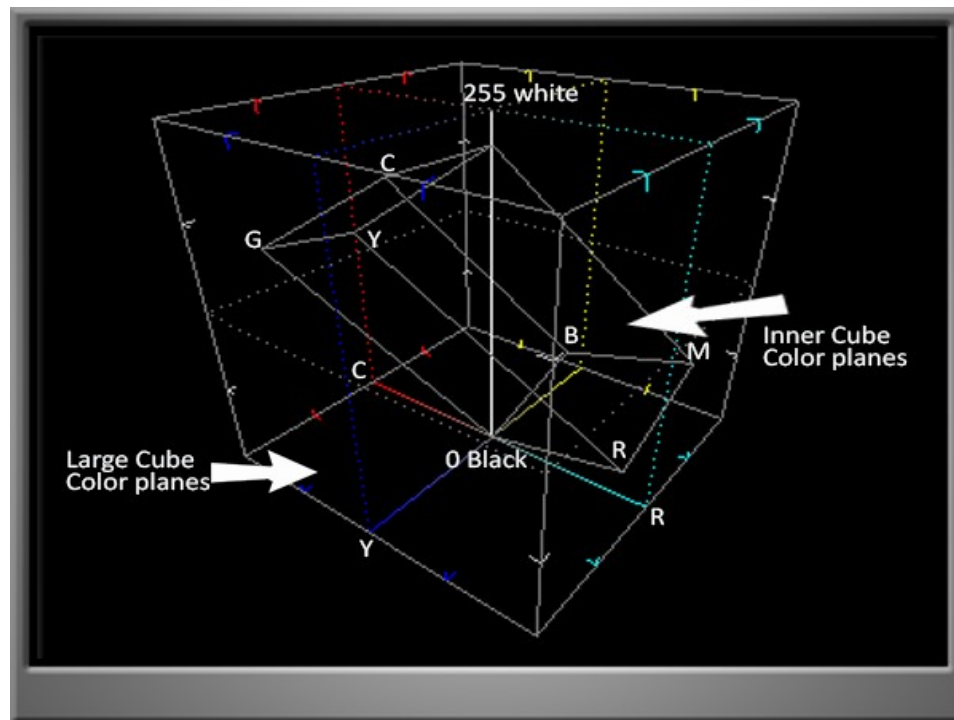


Figure 12.0 Gamut Cube Description

The outer cubes primes, secondaries and shades color faces are indicated by color corner chevrons running along its edges. The bottom and top faces are blended shades of the joining colors – going to white or black, depending on the face. The actual colors rendered will be shown in reverse to that expected when looking at the inner cube faces (see Figure 12.0 for details). They are backwards. It was done to ensure clarity is maintained when the cube is rotated. Color boundaries do wash when in operation in dot mode.

The center line running top to bottom is the black to white line producing a gray scale along the way - 0 to 240 white.

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4.7 3D-Histo Vectorscope

This scope is a 3D version of the vectorscope, where the chrominance data is presented in more detail in terms of real color distribution and strength thus helping to define more accurately the purity of the video signal stream.

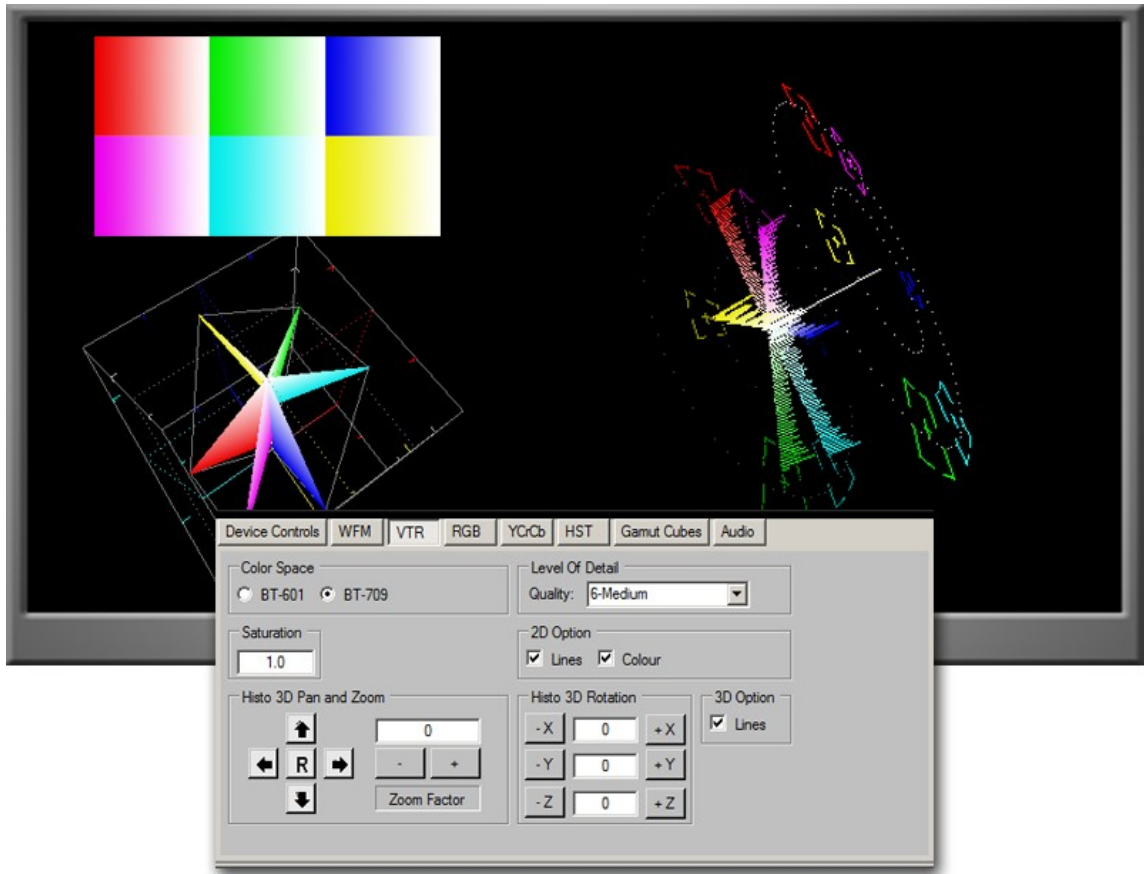


Figure 13.0 3D Histo Vectorscope and Control Interface

The lower half of the control interface offers control over cube X Y position in the display space and the 3D rotational state of the cube (R in Pan/Zoom joy stick is Reset to 0). The cube can also be scaled by a factor of 2 in zoom in and zoom out factors to allow clearer presentation of 3D data if need be.

Cube rotational controls have full angular range (0 to 360 degrees) control in all 3 axis. Applying any over riding data entry into the corresponding control edit boxes cannot be done at this time. Incremental data changes per click on all control buttons is fixed. This interface does not offer an auto increment feature when a button is held down. Each positional data change must be done manually on a per click basis.

Zoom factor is plus/minus 2 in 0.1 increments

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4.8 3D-Histo Waveform Monitor

This scope is a 3D version of the waveform monitor, where the luminance data is presented as a histogram plot, thus providing more detail of the video signal in terms of its levels distribution. A color overlay shows the real distribution of the luma signals' true color content.

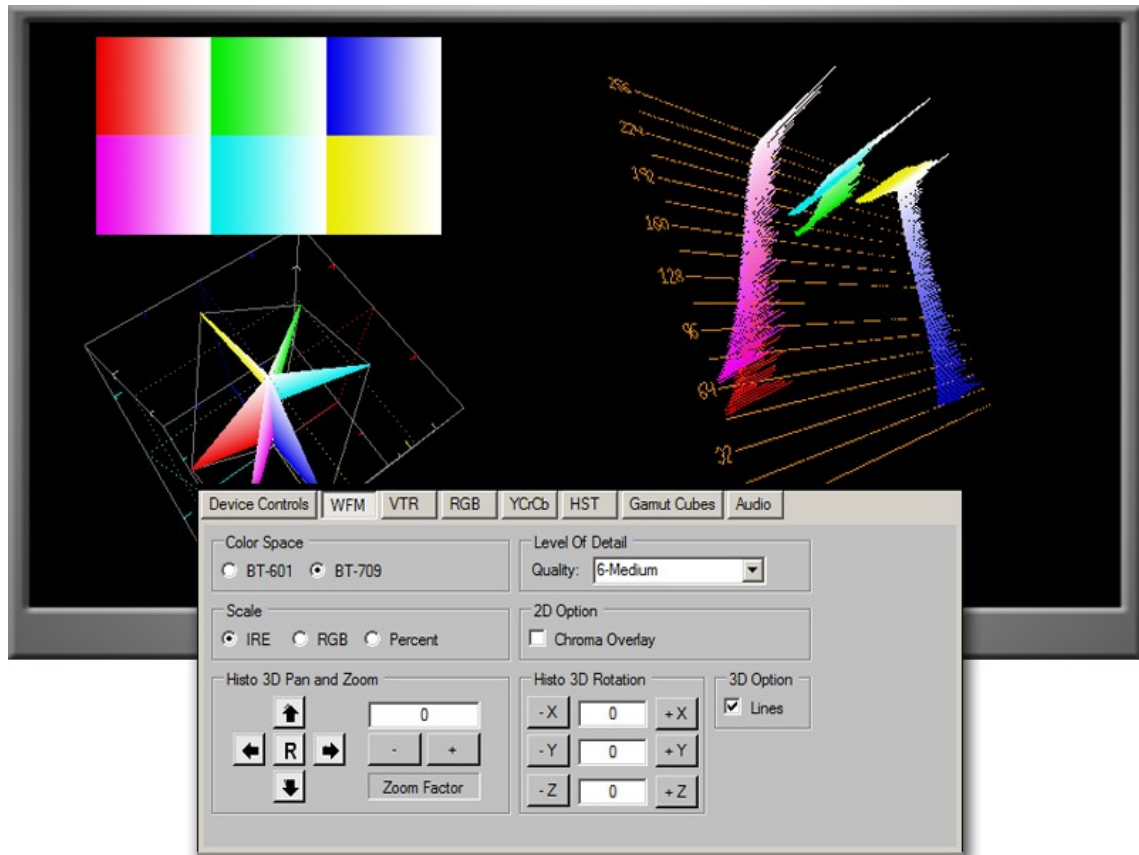


Figure 14.0 3D Histo Waveform Monitor and Control Interface

The lower half of the control interface offers control over cube X Y position in the display space and the 3D rotational state of the cube. The cube can also be scaled by a factor of 2 in zoom in and zoom out factors to allow clearer presentation of 3D data if need be. Plane rotational controls have limits of 90 degrees in the Y and Z axis in either direction and 0 to 90 degrees in the X direction.

Applying any over riding data entry into the corresponding control edit boxes cannot be done at this time. Incremental data changes per click on all control buttons is fixed. This interface does not offer an auto increment feature when a button is held down. Each positional data change must be done manually on a per click basis.

Zoom factor is plus\minus 2 in 0.1 increments

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4.9 3D-Histo RGB Parade

This scope is a 3D version of the RGB parade scope, where the RGB data is presented in more detail in terms of its colors and levels distribution. There is no color mixing or overlay for this scope.

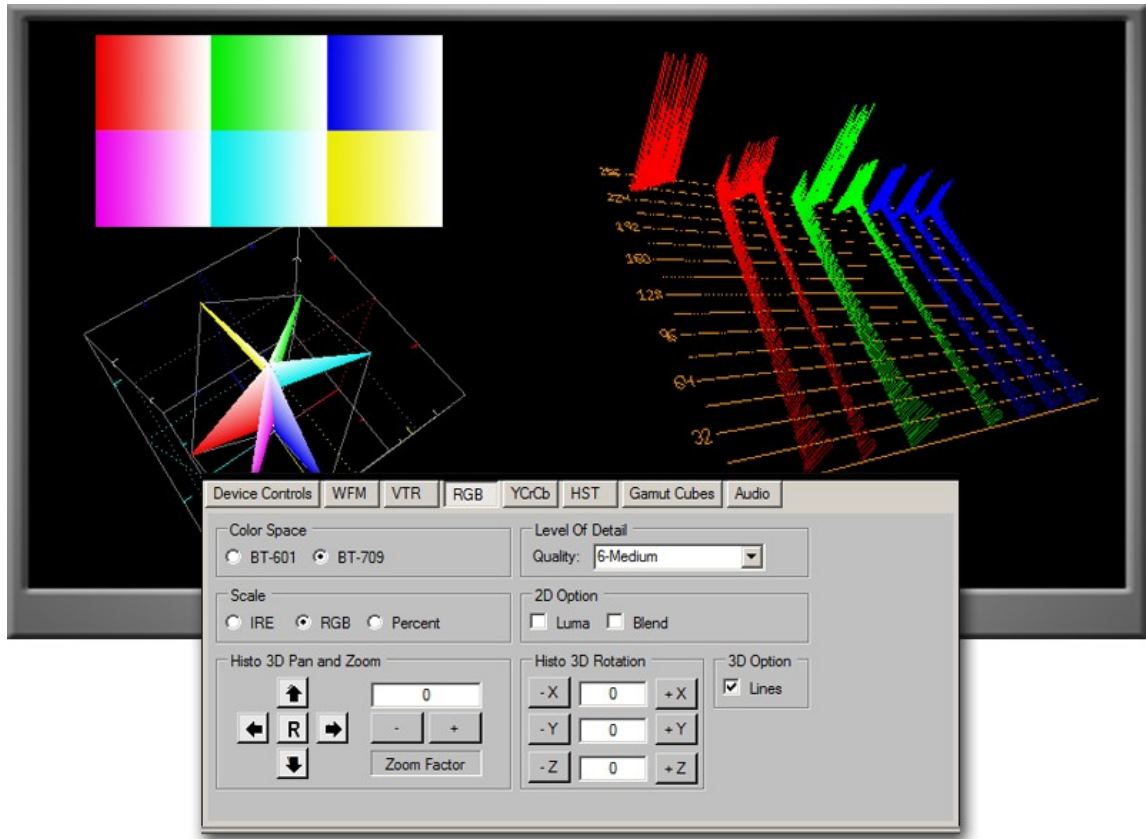


Figure 15.0 3D Histo RGB Parade and Control Interface

The lower half of the control interface offers control over cube X Y position in the display space and the 3D rotational state of the cube. The cube can also be scaled by a factor of 2 in zoom in and zoom out factors to allow clearer presentation of 3D data if need be.

Plane rotational controls have limits of 90 degrees in the Y and Z axis in either direction and 0 to 90 degrees in the X direction.

Applying any over riding data entry into the corresponding control edit boxes cannot be done at this time. Incremental data changes per click on all control buttons is fixed. This interface does not offer an auto increment feature when a button is held down. Each positional data change must be done manually on a per click basis.

Zoom factor is plus\minus 2 in 0.1 increments

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4.10 3D-Histo YcrCb Parade

This scope is a 3D version of the YCrCb parade scope, where the Y, Cr and Cb data is presented in more detail in terms of its levels distribution. There is no color mixing or overlay for this scope.

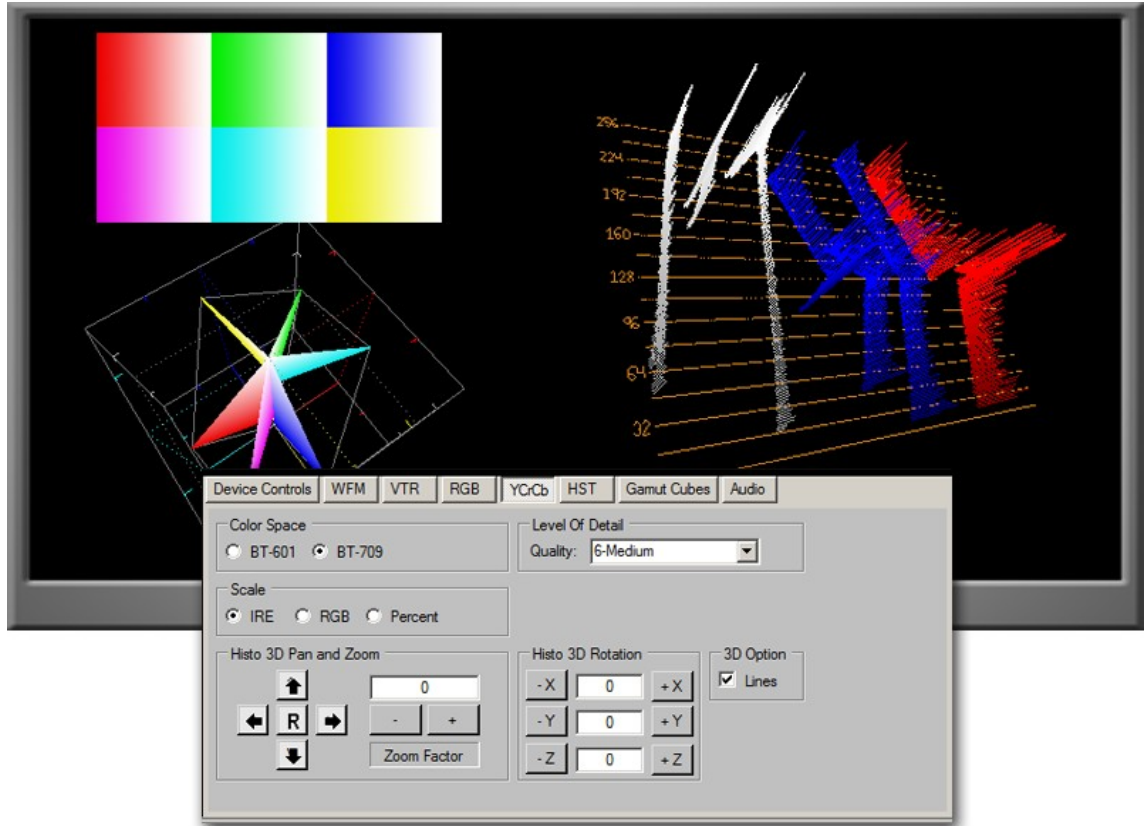


Figure 16.0 3D Histo YCrCB Parade and Control Interface

The lower half of the control interface offers control over cube X Y position in the display space and the 3D rotational state of the cube. The cube can also be scaled by a factor of 2 in zoom in and zoom out factors to allow clearer presentation of 3D data if need be.

Plane rotational controls have limits of 90 degrees in the Y and Z axis in either direction and 0 to 90 degrees in the X direction.

Applying any over riding data entry into the corresponding control edit boxes cannot be done at this time. Incremental data changes per click on all control buttons is fixed. This interface does not offer an auto increment feature when a button is held down. Each positional data change must be done manually on a per click basis.

Zoom factor is plus\minus 2 in 0.1 increments

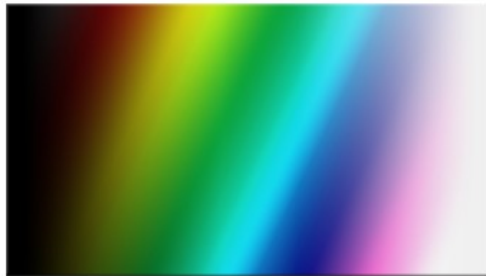
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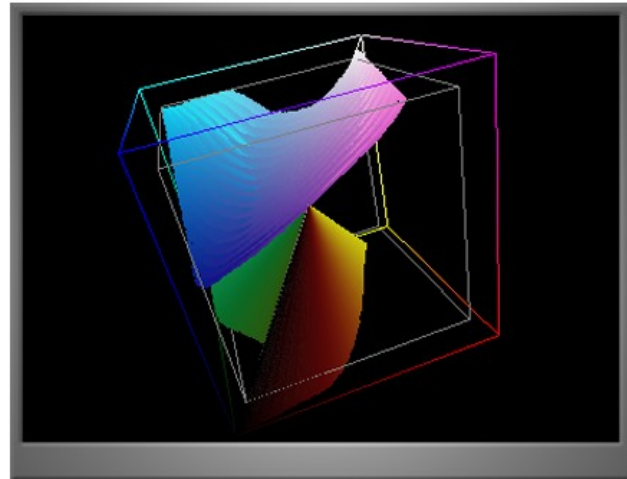
4.11 RGB Cube – Demo

The RGB cube is supplied free of charge for experimentation purposes. It is not annotated for scale and value. It is linear from 0 to 255 in all directions. You will have to interpolate if necessary for your application. The cube rotational and scaling controls are fully functional as defined in previous 3D scope descriptions.

The corner vertices are color coded for reference and set to represent full saturation of 255 of the prime, complementary colors white and black vertices. There is a diagonal axis representing a white to black track and a center indicator value of RGB 128. The inner cube wire frame is offset by a minimum black value of 16 all around and 235 maximum RGB values. Be sure to add a black RGB value of 16 for any test images created to ensure proper offsets.



Full Color 235 limited gamut, 0blk 240wh



Full 8bit RGB Cube with 235 RGB limits

Figure 17.0 Demo RGB Color Cube

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4.12 Audio Scope Setups

Generally, audio scopes have no user interface as of this version of design. The scopes are fixed in operation with no user controls at this time. Look for updates in the audio product line as we continue to add and improve *MSCompact*.

4.13 Audio Scopes

Our audio scope library currently consists of three plug-ins; a PPM, a dual trace oscilloscope and a stereo phase meter.

Supported audio properties:

Quantization	Sampling rate	Mode
8 bit, 16bit	11, 22, 44.1, 48kbits/sec	Stereo and mono

4.13.1 Peak Programme Meter or PPM

Our PPM is calibrated in 6db steps from 0dbFS to -48dbFS (*Figure 18.0*). A full range of -96db is processed but only a range of -48dbFS is displayed. The audio streams processed are those associated with the input video stream; though an independent microphone input with no associated video will also work.

An audio buffer is read for its peak value (then converted to db) and is output to the display. Peaks greater than the last output get updated as a new peak. Lower peaks detected are ignored for a set time. Slow or no peak responses are removed from the display by a fixed decremented value until new peaks are detected and output. No signal for a period of time will see the PPM indicator fall to minimum output.

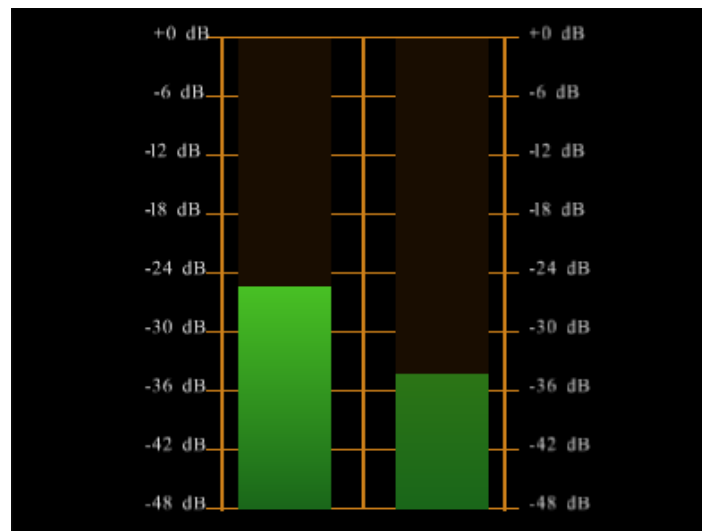


Figure 18.0 Peak Programme Meter

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4.13.2 Audio Phase Meter

The audio phase meter is a tool used to see the phase difference between the left and right channels. The meter traces can render in either dots (default) or lines. The trace color rendered shows something about its correlation between the channels. Green traces show a strong correlation (around 1); red traces show strong uncorrelated signals (around -1) and yellow traces covering anything between -1 and 1.

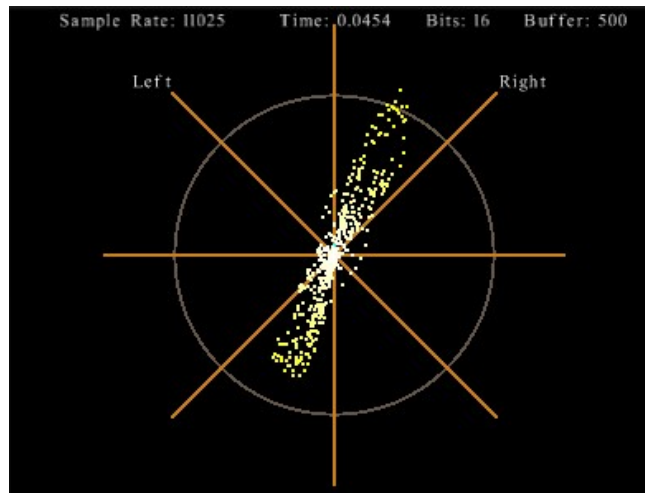


Figure 19.0 Stereo Audio Phase Meter

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4.13.3 Audio Waveform Scope

The audio oscilloscope plug-in provides for stereo output as shown in *Figure 20.0* with the colours green and orange representing left and right channels. The display shows a fixed audio buffer size.

Annotations for the detected audio sample rate, buffer time span, bit quantization and audio buffer size are shown just below on the top of the scope frame.

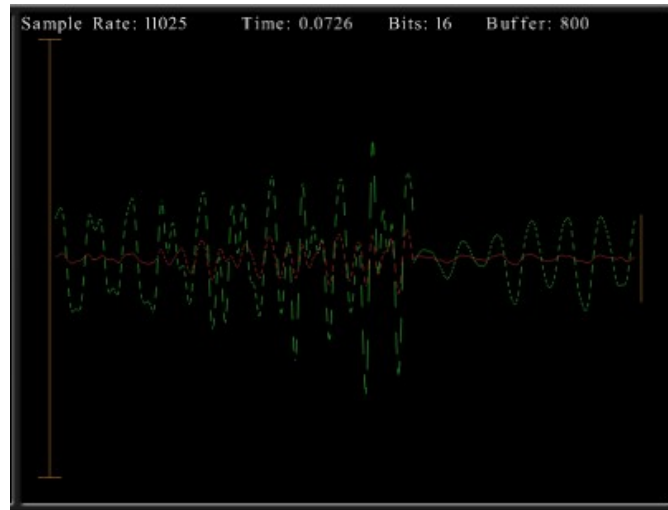


Figure 20.0. Stereo waveform Oscilloscope

Meters to be decide:

- Classic VU Meters
- Audio Spectragram (FFT)

Dual function or compound scopes will be considered but will need your feedback as to what would be useful.

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5.0 Ethernet Cameras (not hosted on this platform)

If a network camera is to be attached to *MSCompact*, it is assumed the camera has already been operationally setup via its own configuration interface enacted via its IP address to a standard browser like Firefox or MS Explorer. Video frame size, compression standard, bit rate and network protocols etc., have already been defined, setup and confirmed off-line as operational. *MSCompact* can support H.264 and MJPEG video streams.

MSCompact Ethernet can only operate Ethernet cameras that support RTSP over TCP for now. Video frame sizes can exceed the 1920 horizontal size. Maximum frame resolution has not been fully tested.

We do not yet support the more custom GigE cameras.

Operating the IP camera in either a LAN, WAN or internet environment will work with *MSCompact*. Make sure you have the IP specific hosting unit. Standard host does not support IP cameras.

As a POE camera, ensure a compatible DC supply is attached and the camera shows some life it is ready for use. Configure the camera using the supplied IP address, and password by the manufacturer. Camera Authorization should be disabled and be reflected in the URI string. Connect the network camera using a standard Ethernet CAT5 cable either directly from a network switch that may be close by or remotely before your router. If in the latter case ensure the router and ports have been setup properly.

Once connected, open *MSCompact* application and go to the IP Camera tab. Enter in the camera IP URI. *MSCompact* will connect itself to the camera. A recognized URI must be used to access the camera by *MSCompact*. See the manufacturers Users Guide or their software development documentation for this string and syntax.

As an example: `rtsp://admin:password@192.168.x.x:554/h264/channel/101`

****admin:password syntax may not be required**

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6.0 Trial Software and Installation

Our trial software is provided free of charge for evaluation purposes. The trial *Compact* host interface includes three fully functional and feature enabled scopes; a *Waveform Monitor*, a *Histogram* and our demo *RGB cube* – see Figure 21.0 below. Access to any other scopes and features, are not available for use in this **Trial** version.

Caution: There will be pop up ‘nag’ screens that will appear randomly while the **Trial** software is running.

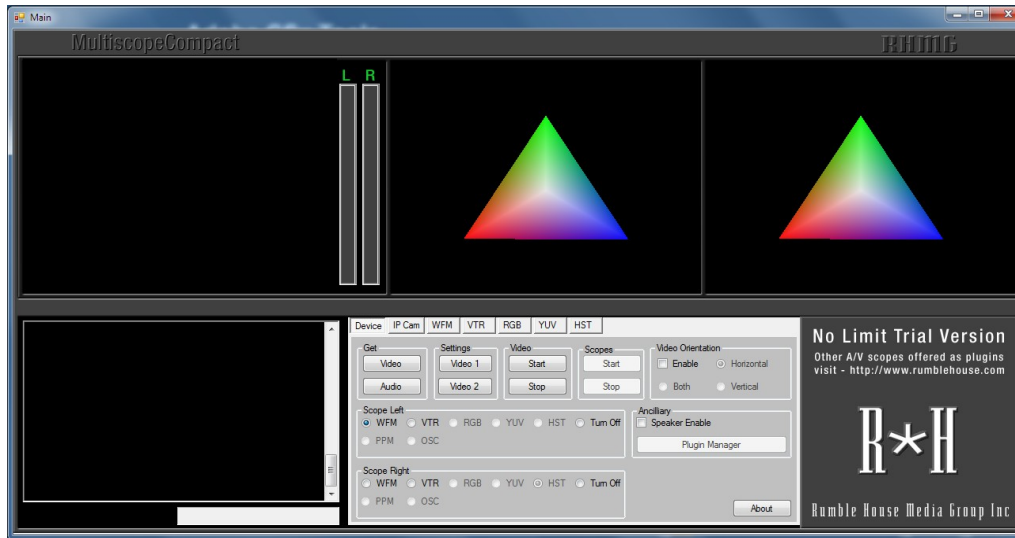


Figure 21 MSCompact Trial User Interface upon first launch

The trial has no registration or activation features to run in its limited operating mode and will run forever without an expiry date. To acquire a fully featured, plug-in accessible and non ‘nag’ version of *MSCompact*, a system package must be purchased, downloaded and be unlocked separately.

<http://www.rumblehouse.com/products/multiscopecompact/>

A hosting unit and at least one scope bundle from our scope library is the minimum configuration for *MSCompact* to run as a working video instrument.

Trial Installation

Download the **Trial** software after filling out the short download form from our product web page. Use the shown download link from the pop up dialog to get the *MSC_Card402Trial_Setup.msi* file. Create a folder for the **Trial** download if you wish on an available hard drive or use the default setup properties and dbl click on the install *.exe file. The software will be installed and a desktop icon showing the *Rumble House Logo (RH)* will appear on the desktop. Click on the icon and the application interface will appear in a few seconds depending on your system performance. Please be patient. There may be a number of Windows system alert screens appearing prior to and after actual install, skip them or answer them accordingly.

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Once the **Trial** is running there is no requirement to register the software or unlock it in anyway. The hosting unit and the two default plug-ins will already be enabled for use. There is no timeout for this **Trial** version. It will always available for use, with the constant message screens indicating purchase options.

A purchased and fully licensed base unit and at least one licensed plug-in bundle will provide uninterrupted fully programmable use in addition to accessing to any additional plug-ins if desired.

Once launched, the *MSCompact* **Trial** video application will begin to run right away with a default video source if it finds one. Audio capture functions that are associated with video capture devices can be enabled. The onboard basic audio PPM shown just to the right of the video monitor is always enabled. There are no other audio meters available for use on the **Trial**.

If there are multiple video sources available on your computer, *MSCompact* will find them and list them if they meet Microsoft DirectShow driver standards and be accessible for evaluation. Choose the one video source you want from the drop down list, click it and run it.

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7.0 Release Software Purchasing Information

To purchase a fully functional hosting unit or any plug-ins, go to our product purchasing web page located at....

<http://www.rumblehouse.com/products/multiscopecompact>

Note: *it is recommended to uninstall the Trial application before installing a full release version. After standard uninstall run there could be issues with a fresh install. If so, see Section 2.3 to clear the registry before an error free fresh install can take place.*

Payment is made using Paypal 'Add to Cart' services right from our web site. When reaching the official Paypal page, whether you have an account already setup or a new user, select the proper choice for user payment and select the method of payment you wish. You can use a credit card, direct bank withdrawal or your Paypal cash account.

To start using *MSCompact* as a working tool, a hosting unit and at least one plug-in bundle must be purchased, licensed and activated. After payment, license number(s) will be issued to you via email, so please have a real email address when registering your product. You will need these forwarded unlock numbers to activate the base unit and any one or more plug-ins you have purchased.

After purchase, a URL or link will be provided to download the base unit software. Copy the setup executable file that was downloaded to a folder location that works for you. There are no download links for the plug-in software, just product activation codes.

8.0 Installing, Configuring and Running *MSCompact* Release Software

(applies to both standard and IP camera hosting units)

8.1 Preliminary Setups and Installation

Before installing the *MSCompact* software, ensure that the A\V capture devices\cards that are planned to be used, its associated drivers, *.Net Frameworks environments are all pre-installed. Test these video products independently using its own OEM user software that comes with the hardware. This way you will know the devices and its functions are working prior to using *MSCompact*.

If the Microsoft .NET Framework version required is not already installed on your computer, the *MSCompact* installation process will do it for you automatically. A hint as to Framework problems is no video will be displayed. It will be black.

Should Frameworks not install, use these links and install manually:

<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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These links are for version 3.5 as a minimum. Frameworks version 4.x.x is not recommended but can work. Thank Microsoft.

Installs into Windows 10 may cause issues. Some users report no problems with Windows 10. It's best to stay with Win7 or Win8 for now to ensure proper operation for now.

Now install the *MSCompact* release software you received from the download link we sent you. The application installation executable will be noted as *MSC_Card402Full_Setup.msi*. Double click the *.msi and run it. Use the install default drive and folder location as recommended. You may see Windows alerts as the install progresses, ignore these or answer them if applicable and continue with the install.

Once the install process is complete a large icon showing black and white **RH** letters will appear on your desktop. Double click the icon too startup the video application. Wait a few seconds for the program to activate. The interface shown is the Hosting Unit interface like that in *Figure 22.0* below.

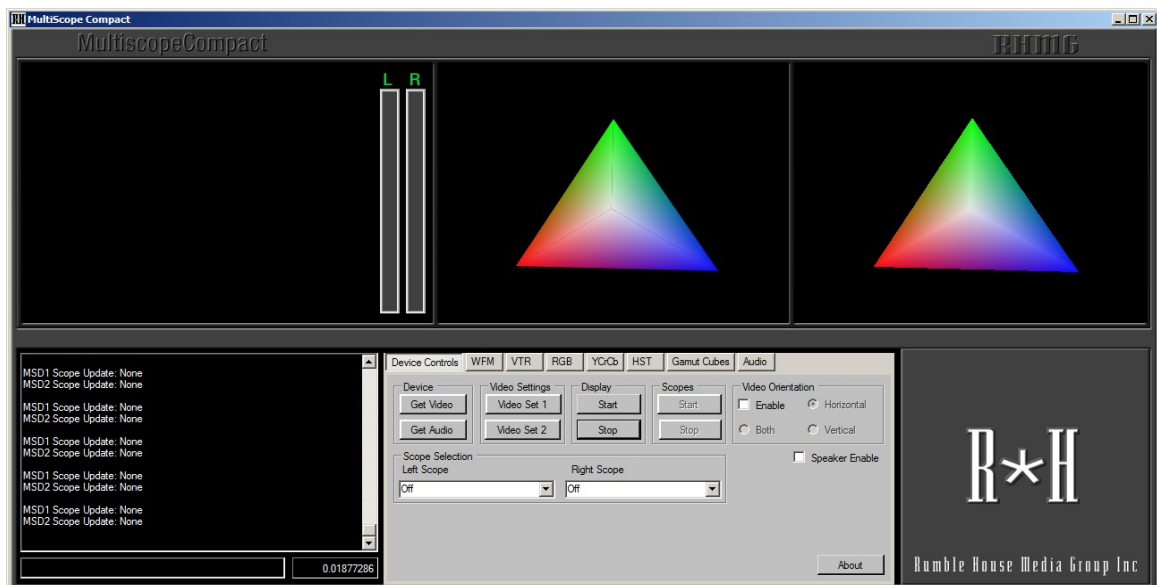


Figure 22.0 Bootup Basic Hosting Unit Interface

Initially the scope locations will be empty of any working scopes and will show colourful moving 3D triangles, indicating empty video scope socket(s). If the application is running with just the video monitor screen and no scopes being enabled or activated, the triangles will rotate. Default video capture may be running in the video monitor. A dialog will pop up indicating master reg number. Send this number to us...

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8.2 Hosting Unit Activation

Upon completion of purchase of your hosting unit, you would have received an email from us indicating acknowledgment of your purchase, a download link for the hosting unit and information outlining the install process. Of which I will summarize as follows.

Install the hosting unit on your PC and follow the default settings as indicated. There is no need to reboot your computer to run the hosting unit for the first time.

Run the hosting unit by double clicking on the desk top RH icon created from the install process. A blank hosting unit interface (as shown in *Figure 22.0 above*) will appear along with a pop up dialog (*Figure 23.0*) requesting registration information.

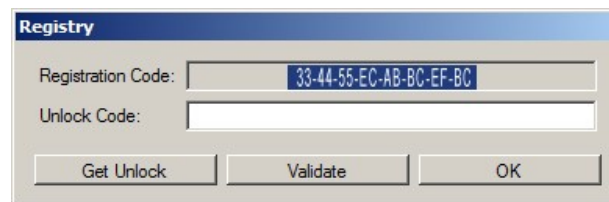
A screenshot of a Windows-style dialog box titled "Registry". It contains two text input fields. The first field, labeled "Registration Code:", contains the text "33-44-55-EC-AB-BC-EF-BC". The second field, labeled "Unlock Code:", is empty. At the bottom of the dialog, there are three buttons: "Get Unlock", "Validate", and "OK".

Figure 23.0

A registration key will have been generated shown in 'Registration' label field. The unlock field will be empty. There are three buttons on this interface, 'Get Unlock', 'Validate' and 'Ok'. You can use the *Ok* button to exit here if you wish and come back later to register the hosting unit.

To get your unlock code, first copy (CNTL C) the registration code to the clipboard and then click on the 'Get Unlock' button. This will take you to the *Rumblehouse Media Group Inc* product registration web page. Fill out the form and PASTE (CTNL V) the registration number into the *Registration* field on the form. Click on the 'Register' button when the form has been completed. You will receive an acknowledgement of registration, a detailed READ ME web page and a message indicating we will be sending you an unlock code for the hosting unit to your email address shortly.

When you get the unlock code from us, run the hosting unit application again. The small pop up registration dialog will also appear again. Copy and paste the unlock code from our email into the 'unlock' field of the unlock dialog box and click 'Validate'. If successful, the unlock dialog will go away and you will get a validation message indicating successful activation of the hosting unit. Click 'ok' to complete the unlock process.

Future launches of the hosting unit will not show the unlock dialog again.

You will now have to register and unlock your plug-ins. See next Section.

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8.3 *Plug-in Activation*

Unlocking your plug-ins is similar in process to registering and unlocking the host unit. In order to purchase and register your plug-ins successfully, you will need the system registration code you originally got from us when installing the host unit (not the unlock code). You will need this get to the plug-in purchase page.

You cannot order plug-ins without a hosting unit that you bought for your working computer platform.

Unlock codes are not transferrable.

After selecting your plug-in bundle and purchasing them through Paypal, you will get a return email from us acknowledging your purchase. Please make sure your email address is valid or your registration information will be lost.

In short order you will get back from us an email with your unlock codes for the number of scopes you purchased.

Run the *MSCompact* application again and click on the '*Plugin Manager*' button on the '*Device Control*' tab interface – right side. A pop up dialog will appear similar to that seen during the host unit registration (*Figure 24.0*).

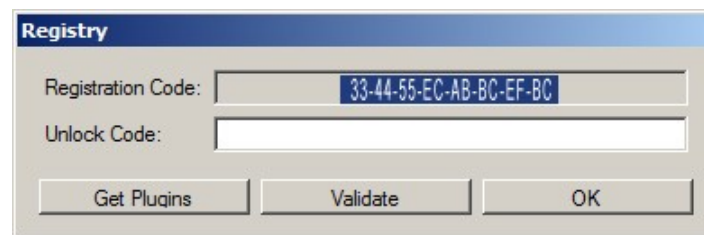


Figure 24.0 Plugin Manager Dialog

You will see your original registration code from the hosting unit in the Registration field and a blank unlock code field along with three buttons. Enter in the unlock code you got from our email and click '*Validate*'. A message box will appear if validation is successful. Enter in the next unlock code if necessary and validate it. Carry on this process until all of your purchased plug-ins has been validated. When completing all of your entries, just click the 'ok' button to exit the unlocking dialog box. Now all of your plug-ins is ready for use.

If you plan on purchasing other plug-in bundles in the future, just follow this procedure again.

MSCompact is now ready for use.

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8.4 Video Devices and Scope Control Tab

When the application software has been successfully installed and launched, an empty base unit interface will appear showing a tabbed setup and configuration dialog screen as shown below in *Figure 25.0*.

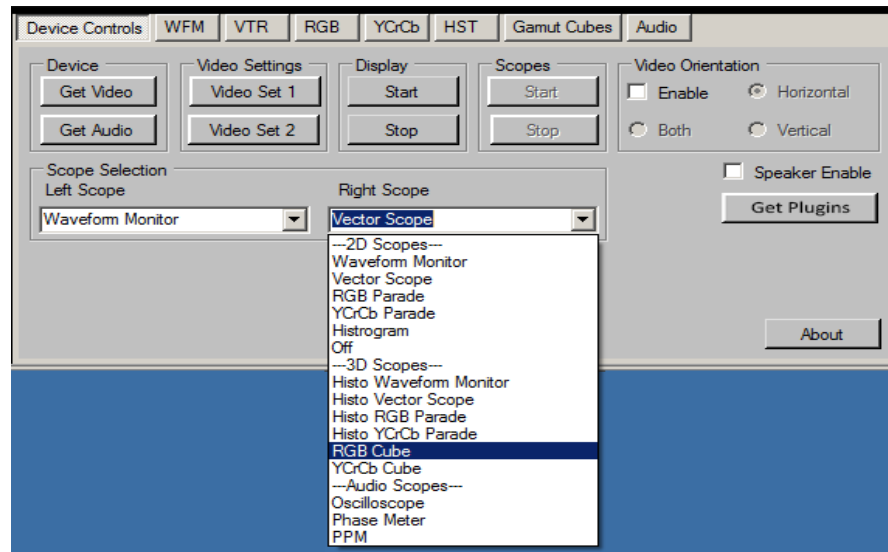


Figure 25.0 Video and Scope Setup Screens

The prime tab for interface control is the '*Devices Control*' tab. It controls which video devices are selected, access to capture device functions, video display orientation, plug-in controls and A/V scope selection and activation.

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1 Selecting an A/V Source

To choose an A/V source connected to your computer (*PCIx, USB, Thunderbolt, Firewire, etc*), click on the ‘*Get Video*’ button (upper left frame). Any video drivers seen by *MSCompact* will be listed here – *Figure 25.1* below. Select the one device you want and click OK.

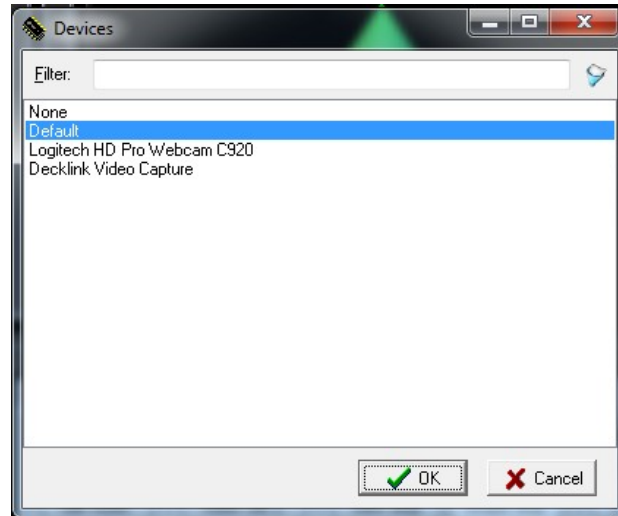


Figure 25.1 Typical Video Device Found Dialog

Similarly for selecting audio sources, choose the ‘*Get Audio*’ button. Typically an audio source will be associated with a video source with the same name. If no audio is needed or you just want to turn it off, then just select ‘*None*’

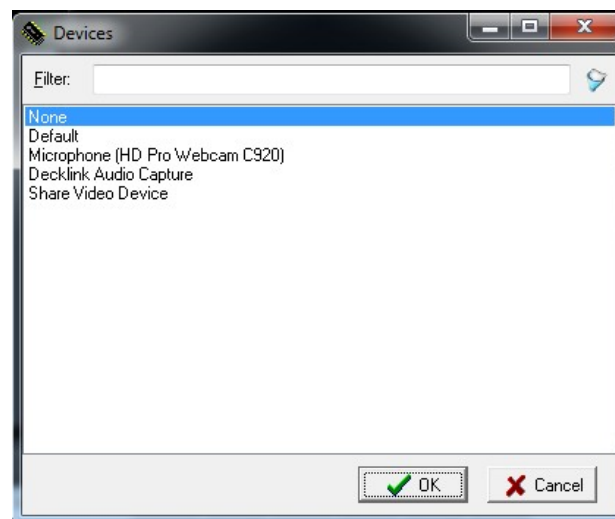


Figure 25.2 Audio Source Selection

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2 Configuring an A/V Source

Once the video and audio sources have been selected, you must configure those sources. That means, setting the video resolution and frame rate of the video is to run. This will tell *MSCompact* what streaming information it needs to work. There are two buttons set aside for this action as shown in *Figure 16.3* ‘Settings Video1’ and ‘Settings Video2’.

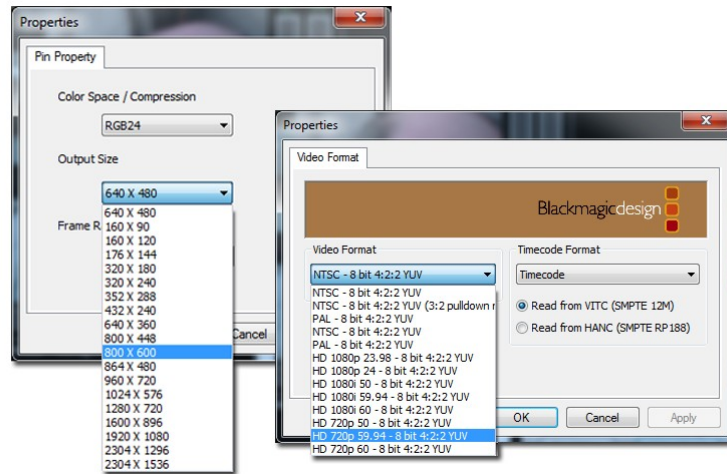


Figure 25.3 Video Source Configuration Dialogs

There can be many forms of this video configuration dialog and is very manufacturer dependent. *Figure 25.3* above shows just two of what are many examples of a video setup. Select the video frame resolution and frame rate in which to operate and click OK.

Note: just because the dialog shows many settings, it doesn't mean it supports them all. If you select a combination that doesn't seem to work, the application may hang or crash. You must shut down the application and start up again. Worst case, you may have to reboot the computer. Not all driver dialogs are accurate. Choosing standard known parameters are safe bets.

Capture devices from BlackMagicDesigns for example, require an additional setup of the capture card/device itself through the operating system Control Panel. Set this up first before running *MSCompact*.

There is no rule as to which button (*Video Settings1* or *Video Settings2*) will activate the video configuration dialogs. The remaining button will usually open up a ProcAmp dialog, which sets up the camera for standard functions like brightness, contrast, gamma etc. ProcAmp functions are not always supplied by the capture hardware vendor and will not produce a setup dialog. Showing a working ProcAmp dialog is very driver dependent. *Figure 25.4*, below shows what a typical ProcAmp screens look like.

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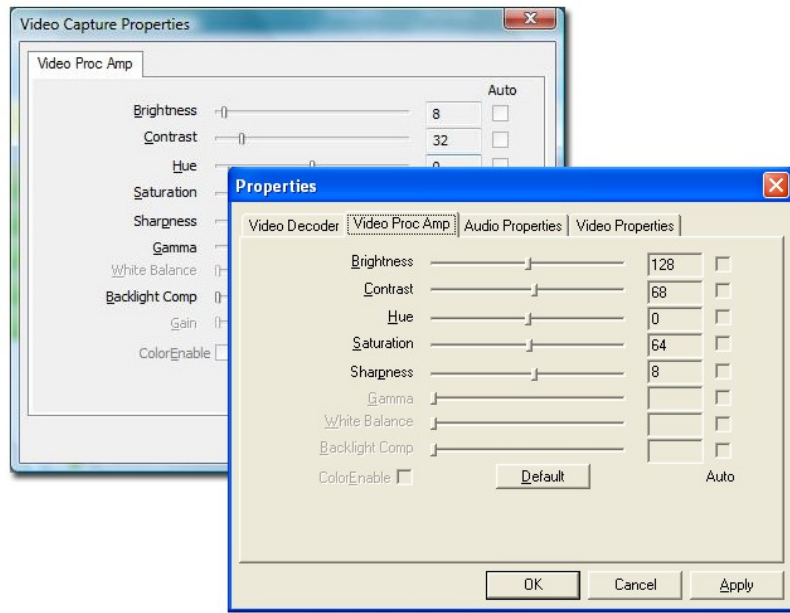


Figure 25.4 Typical ProcAmp setup screens

3 *Controlling Video Start and Play operation*

After the video and audio sources have been selected, clicking on the ‘*Video Start*’ button will activate *MSCompact* to begin the A/V capture process. The video monitor will resize itself to the video frame resolution selected and show live video from its camera source in addition to the built-in audio PPM meters responding to audio input. The scopes themselves will not be running at this point, just live A/V capture.

To stop the A/V stream, click on the ‘*Scopes Stop*’ button followed by the ‘*Display Video Stop*’ button.

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4 Selecting and Controlling A/V Scopes

MSCompact supports up to 14 different A/V scopes at this time – 5 standard 2D scopes, 6 3D style scopes and 3 audio scopes. The ‘*Device Controls*’ tab provides two drop down lists (*Scopes Selection*) describing those scopes in which to choose. Each drop down list corresponds to the left or right scope window in which to run the selected scope. The ‘*Right*’ list includes the audio scopes. The ‘*Left*’ scope window does not support audio.

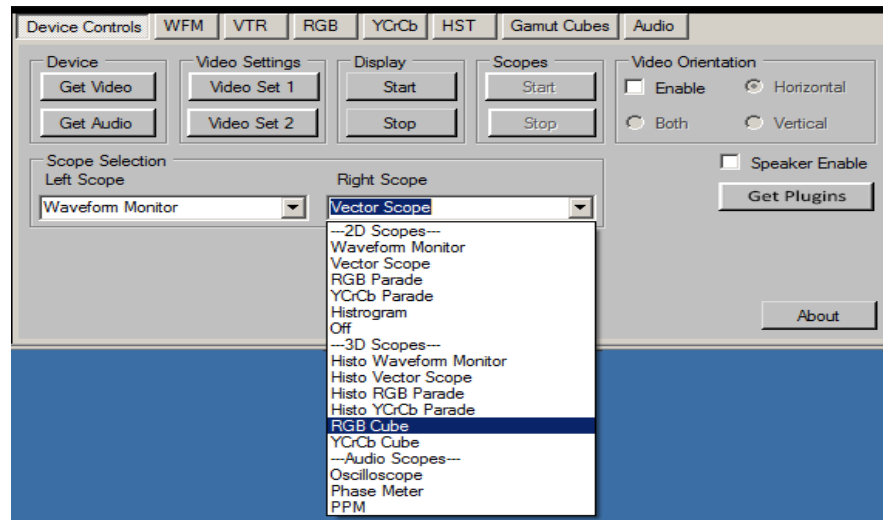


Figure 25.5 Scope selection interface

The drop down list box show all AV scopes available at this time whether purchased or not. The list items will not be updated, be hidden or be disabled regardless of the number of plugins purchased.

Activating the A/V scopes can only be possible if the A/V stream has been started and running. If you have selected a scope to operate in either one or both A/V sockets (*via Figure 25.5*) then just click on the ‘*Scope Start*’ button to activate the scopes selected.

Assuming you have already setup the operating environment for the scopes in question, using its unique tab location, the scope(s) selected will now run in real time showing its respective audio - video representation. Changing the video source input signal like gain, brightness, contrast etc, will be reflected on the scopes display measuring those parameters.

To stop the scopes from operating, just click on the ‘*Scopes Stop*’ button in the main ‘*Device Controls*’ tab. You may have to click the ‘*Stop*’ button twice to stop the scope processes.

Changing scopes will require you to stop the scopes and stop the display before selecting a new scope.

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Once you have activated your scope(s), you can have access to the applicable scope properties tab and change some operating parameters in real-time. Some features will be locked out (grayed). To gain access to grayed controls you must stop the scope ('*Scopes Stop*') operation first and start again - '*Scopes Start*'.

9.0 System Requirements

9.1 *Minimum Configuration*

- Windows 7, 32bit (do not use XP Pro 32bit)
- .NET Framework 3.5 and Framework 3.5 client must be installed**
- CPU: Pentium 4 multicore
- RAM: 8 GB, DVD ROM player
- LCD screen resolution: 1280 x 720 or better.

9.2 *Recommended Configuration*

- Win7 or Win8, 32bit or 64 bit (avoid using Vista)
- .NET Framework 3.5 and Framework 3.5 Client must be installed**.
- CPU: Intel i3, i5, i7 (faster machines will offer faster renders and higher details)
- RAM: 16 GB or more and DVD ROM player
- LCD screen resolution setting: 1280 x 720 or better.

For some customers, there are no problems with running MultiScope in Windows 10. However, most do have problems. If you encounter this issue when running the Trial, don't expect it to work when you get a purchased version. If you want to run MSComapct for your application, for now, install this program to Windows 7 machines only.

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12.0 Support and Warranty

We provide support for pre-sales questions. The **Trial** software is offered to confirm that the application software meets end users requirements in both hardware and software compatibility prior to any purchasing considerations.

If the **Trial** does not meet expectations or meet your application requirements or it just won't run on your computer please do not purchase *MSCompact* as there will be **no refunds** after purchase.

Post sales support is always available. We make every effort to answer your questions and to consider your feedback on issues relating to the software.

We can return answers using email, but it would be preferred to use the *Comments* section on the product page. Answers will be more forthcoming with the added benefit of sharing the discussion dialog for others in the MultiScope community.

Product upgrades will be offered at reduced or at no cost depending on degree of revision changes for current registered users of *MSCompact*.

******* IMPORTANT *******

Purchased software is not returnable for refund under any circumstances.

Be sure the trial software you have downloaded has been fully assessed in meeting your project requirements prior to purchasing the fully operational software version.

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13.0 My Standard EULA License Terms

Definition: references in this document to the term *Compact software* or *software* or *license* or *MSCompact* is one and the same.

The *Compact* License issued for use, is restricted to the purchaser and/or End User of a unique released license number that we have generated for that purchaser and/or End User on the one computer that will be used for this software. One license number has been issued for one computer only and one license number for each associated plugin that may have been purchased.

Software transfers to other computers are allowed but a new license number must be requested and the software must be uninstalled on any previous computer. << this is trusting that you do the right thing>>. The same rules apply for multiple purchases of *MSCompact* licenses: one license for one computer.

All software purchased or used from RHMGM is at the End Users risk, this includes accepting to download and use the trial or a purchased version of *MSCompact* on end users, users and/or purchasers computers. All users, End Users, purchasers will assume all of the risk associated with this software in any operational environment.

Any damage or system failure when using this software on End Users, users, purchasers computers will hold RHMGM (Rumble House Media Group Inc) harmless regarding any and all issues related to this software and its use.

Further, the purchaser, user, end user, acknowledges whether they have read this EULA notice or not, the same terms and conditions for use applies and are in force. There is no remedy for ignorance.

If these conditions of use are not favourable to you or you have objections to the outlined terms of use, please do not use or purchase this software.

‘nuff said

Appendix A

Colour space conversion equations used with *MultiScopeCompact*

Standard RGB to YUV colour space

$$\begin{aligned}Y &= (+0.257 * R) + (+0.504 * G) + (+0.098 * B) + 16; \\Cb (U) &= (-0.148 * R) + (-0.291 * G) + (+0.439 * B) + 128 \\Cr (V) &= (+0.439 * R) + (-0.368 * G) + (-0.071 * B) + 128\end{aligned}$$

Standard Definition colour space RGB to YUV - ITU-R BT.601

$$\begin{aligned}Y &= ((65.738/256) * R) + ((129.057/256) * G) + ((25.064/256) * B) + 16; \\U &= ((-37.945/256) * R) + ((-74.494/256) * G) + ((+112.439/256) * B) + 128 \\V &= ((+112.439/256) * R) + ((-94.154/256) * G) + ((-18.285/256) * B) + 128\end{aligned}$$

or Standard Definition ITU-R BT.601 colour space RGB to YCbCr - Errata*

for full range luma 0 - 225 and chroma 0 – 255

$$\begin{aligned}Y &= ((76.245/256) * R) + ((149.685/256) * G) + ((29.07/256) * B) + 16; \\U &= ((-43.366/256) * R) + ((-85.136/256) * G) + ((+128.502/256) * B) + 128 \\V &= ((+128.502/256) * R) + ((-107.604/256) * G) + ((-20.898/256) * B) + 128\end{aligned}$$

Simplified BT.601 (for range = luma 16-240 and chroma 16-235)

To be verified and published

High Definition ITU-R BT.709 colour space RGB to YCrCb – Errata*

for full range luma 0 - 225 and chroma 0 – 255

$$\begin{aligned}Y &= ((46.742/256) * R) + ((157.243/256) * G) + ((15.874/256) * B) + 16 \\Cb &= ((-25.765/256) * R) + ((-86.674/256) * G) + ((+112.439/256) * B) + 128 \\Cr &= ((+112.439/256) * R) + ((-102.129/256) * G) + ((-10.310/256) * B) + 128\end{aligned}$$

Simplified BT.709 (for range = luma 16-240 and chroma 16-235)

$$\begin{aligned}Y &= .2126 * R + .7152 * G + .0722 * B \\Cb &= -.1172 * R - .3942 * G + .5114 * B + 128 \\Cr &= .5114 * R - .4645 * G - .0469 * B + 128\end{aligned}$$

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Ultra High Definition (2020) colour space RGB to YCrCb

To be verified and published

References

Charles Poynton – Digital Video and HDTV Algorithms and Interfaces – Errata

FOURCC – RGB to YUV conversion <http://www.fourcc.org/fccyvrgb.php>

Jose