ClearView
Video Quality Analyzers
8K • 4K • HD • SD • IP

Video Clarity
Tools for Video Analysis
ClearView is highly advanced test & measurement analyzer for audio and video quality, subjective viewing, recording and comparatively playing up to two 8K ultra high definition uncompressed sequences*. The product line provides a wide choice of quality analysis features and measurements that effectively quantify the human subjective experience.

With the convergence of voice, TV and data there is a need for multiple resolutions and processing methods to all screens - TV, PC and mobile. Therefore, the requirements of digital content distribution have increased dramatically. Evolving compression schemes from MPEG-2 to MPEG-4 and now JPEG 2000, HEVC and VC-9 have increased the need for tools that can properly analyze and track results.

Digital media can be reproduced at any resolution, assuming that one has the storage space and the bandwidth (the number of bits per second that can be sent through a given medium, such as fiber optic cable or the air). At some point, the level of resolution achieved by digitizing a signal will become so good that it is indistinguishable, given the limitations of our perception, from the source.

The most decisive task for product developers and media delivery networks is to create a product or service that can fit as many programs as possible into the available bit rates at the highest quality possible and to avoid low quality.

To this end, human perceptual video and audio quality analysis must be done.

Two ways exist to do this analysis:
- Perform in-depth analysis on problematic/difficult streams and judge the perceived video or audio quality
- Perform long-duration tests searching for drops/ degradation in quality over hours, days or even weeks long test runs

In depth video quality analysis is a subjective notion. The most precise way to measure quality is to collect human observers and to ask them to judge the quality. This is an expensive and potentially inconsistent approach as human observers need to be judged to make sure that they can be trusted - i.e. their sight is good, they are not too tired or they are not color blind, etc. In the end, a mean opinion score (MOS) is computed for each test. Details for setting up a subjective test can be found in Recommendation ITU-R BT.500-12 - Methodology for the subjective assessment of the quality of television pictures.

A number of algorithms have also been developed to estimate perceived quality in a precise way. The results of these algorithms are then correlated against correctly produced subjective data under ITU-R BT.500.12. The result is a perceptual measure of subjective quality.

The algorithms are divided into three general types:
- Full reference algorithms compare the processed and reference sequences
- No reference algorithms analyze only the processed
- Reduced reference algorithms extract specific information from the reference stream and use it when analyzing the processed stream

The ClearView Analyzer product line features four full reference scoring methods or scales:
- MOVIE: MOtion-based Video Integrity Evaluation index which is able to provide one of the most accurate perceptual video quality measurements
- MS-SSIM/DMOS: Multi-Scale Structural Similarity Image Quality Assessment on both MS-SSIM and DMOS scales, where DMOS is the difference between the mean opinion scores of the reference and processed video
- JND: The number of human observers that must be gathered to end up with at least one person who believes that the processed video is at least as good as the reference (just noticeable differences)
- PEAQ: Perceptual Evaluation of Audio Quality with two scales produced from a computerized model of the human ear, BS.1387 and BS.1118
- aFreq: Audio performance metric for finding gross errors versus each reference audio channel. aFreq includes an audio-video offset measurement or lip sync value for a selected channel in program.

The ClearView Analyzer product line includes four no-reference scoring methods:
- aPEAK: True-peak audio measurement per channel according to ITU-R BS.1770-3
- LKFS: Audio loudness measurement per program according to ITU-R BS.1770-3
- Spatial: Calculates the activity power of a video frame, a higher number indicates more changes in the frame
- Temporal: Calculates the changes between successive video frames, a zero indicates a frozen frame

*Sequences in ClearView are video, audio, VANC & timecode of any duration.
The best way to subjectively analyze and compare two different sequences is to look at them on the same video display. Using two different displays, even of the same type, requires vigilant calibration.

- Therefore, ClearView has many viewing modes that show two sequences using its built-in, full resolution video output or in a separate playback window on the desktop*.
- In side-by-side and split-mirror modes the sequences can be panned as only half of the image is showing.
- In seamless split mode part of the image is from the reference and the rest of the image is from a processed version of the video content.
- ClearView allows the split point to be moved interactively.

ClearView can also output the two sequences to two different displays. This is done using the multiple output viewing mode command.

**Side-By-Side Viewing**

**Split Mirror Viewing**

**Seamless Split Viewing**

Video sequences can be further analyzed as follows:
- Zooming into any picture area up to 16x
- Panning within the picture during zoom or split screen
- Identifying pixel values via mouse click
- Playing individual fields

Using the included command line interface play lists can be created to allow any view mode to be executed in a series.

ClearView A-B: An easy way to view pixel intensity differences between two images.
- Below a straight subtraction shows one pixel level intensity which may not be possible with some displays.
- Therefore, ClearView systems include A minus B with a Threshold and Addback command allowing users to see differences that are greater or less than a specific pixel intensity threshold as a selectable color.
- This also allows edge differences to stand out.

**A minus B with Threshold = 20 View Mode**

**Colors green A>B; yellow B>A**

These views are all simultaneously fed to the ClearView graphical user interface and to each of ClearView's full resolution video outputs or, selectably, to a separate desktop window.

*The separate desktop playback window is a feature offered in ClearView starting with version 8.4.*
**ClearView - Objective & Perceptual Measurements**

**PSNR**: The most widely used metrics are PSNR (Peak Signal-to-Noise Ratio) or MSE (Mean Squared Error). Both measure the mean error between input and output. PSNR expresses its result as a ratio of the peak signal expressed in dB. PSNR and MSE, while not performing a human perceptual video quality prediction, do serve an important role. PSNR is the objective metric included in all ClearView systems. It measures the absolute difference between two signals, which is completely quantifiable. This is very important in QA and device performance testing where the perceived quality has already been measured in the laboratory environment and what is needed is a PASS/FAIL indicator.

**Video Perceptual Quality Measurements**

**MOVIE**: The ClearView 8.2 version system provides a new video quality measurement, MOVIE, the MOtion-based Video Integrity Evaluation index which is able to provide an improved perceptual video quality prediction as an addition to others offered in ClearView systems up to this point. Additionally, MOVIE provides an incrementally accurate correlation to standards-based human subjective quality assessments versus other measurements by implementing an advanced method of defining and measuring spatial and temporal motion distortion in a localized multiscale framework. Therefore, MOVIE provides a leap forward by defining the time-space element and its effects on human perception of video quality as it applies to a full-reference measurement method. In ClearView the selections for Temporal MOVIE or Spatial MOVIE indices are included and overall MOVIE is a product calculation.

**MS-SSIM and DMOS**: The structural similarity approach provides an alternative and complementary way to accurately measure human perceptual video quality. It is based on a top-down assumption that the HVS is highly adapted for extracting structural information from a scene, and therefore a measure of structural similarity is an excellent approximation of perceived image quality. The idea is that the eye can recognize a shape even if part of it is missing. It has been shown that a simple implementation of structural similarity (SSIM) outperforms other perceptual image quality metrics. However, the SSIM index achieves the best performance when applied at an appropriate scale (i.e. viewer distance/screen height). Therefore, multi-scale structure similarity (MS-SSIM) has been defined. In MS-SSIM, the picture is evaluated at various resolutions and the result is an average of these calibrated steps and MS-SSIM out-performs simple SSIM even when the SSIM is correctly calibrated to the environment and data set.

ClearView includes the algorithm developed by the University of Texas known as MS-SSIM and provides it on both DMOS (Differential Mean Opinion Score) and MS-SSIM scales. The measurements may be performed on luma (Y) and a combined score is provided for color difference channels (Cb, Cr).

**ClearView System Option - Sarnoff JND**: A well accepted perceptual video quality index method which simulates the functionality of the human visual system (HVS) components.

The method involves video/audio alignment, low pass filtering (to simulate the eye – video only), calculating the differences that affect the human eye/ear, blockiness, blurriness, noise, lack of dynamic range, loss of high frequencies, classifying the types of distortions, and generating a perceived quality number per frame. ClearView analyzers are optionally licensed with the algorithm developed by Sarnoff Corporation known as Picture Quality Ratio (PQR) and place it on the JND (Just Noticeable Differences) scale.
Audio Performance Measurements - Included In All ClearView Models

Audio Frequency Metric - aFREQ - A comparison of audio versus a reference to find gross audio errors.
- Audio Alignment (lip-sync), a millisecond accurate measurement, is included in aFREQ.

Audio Peak Metric and Loudness Measurement - aPEAK measures the true-peak amplitude and gives a value for each frame and separate value for each channel. Within the aPEAK there is a Selection for LKFS, Loudness Quoted relative to Full Scale. LKFS metric gives a measurement that will take the peak loudness over a one second period over all audio channels in a given program and Respond with one value over that period. The values returned are based on a logarithmic scale with 0 Being the maximum value and -60 being close to silence.
- The LKFS measurement in ClearView follows recommendation ITU-R BS.1770-3 exactly.

Audio Perceptual Quality Measurement - Option

The ITU-R PEAQ (Perceptual Evaluation of Audio Quality) model is an “electronic ear” which performs an objective measurement of perceived quality of wide band (up to 20 kHz) audio signals using a computerized model of the human ear. This well accepted perceptual audio quality measurement method was developed jointly by experts from eight leading research laboratories and is an international ITU-R standard. It is ITU-R Recommendation BS.1387, “Method for objective measurement of perceived audio quality”.

The PEAQ model processes two audio signals to be compared (namely the original reference signal and the test version to be evaluated) and calculates a quality score similar to the mean opinion score that would be obtained from a formal subjective test. In this sense, the PEAQ model is considered as an “average listener”.

ITU-R PEAQ Model

The perceptual rating generated by the PEAQ model represents the overall severity of the impairments in the test signal as compared to the reference. The ClearView system provides the user with two rating scales as shown on the right.

The ClearView analyzer features a full implementation of the ITU-R PEAQ model which has been certified by the Communications Research Centre Canada, one of the laboratories that developed the ITU-R PEAQ method.

The PEAQ measurement is an option for all ClearView system models. Option item CV-PEAQ.
Equipment Manufacturers want to accelerate the development of their processing algorithms, network path along with transmission and receiving products. ClearView allows developers to measure the performance of the network and resulting quality with their devices to quantitatively or subjectively judge them, get detailed test results and instantly reviewable video recordings.

ClearView
- Imports many compressed or uncompressed file formats (video and audio file types listed on page 10)
- Records video and audio using standard baseband inputs like HD/SD/3G SDI, HDMI, Component, Composite or S-Video as well as digital or analog audio on XLR and embedded SDI
- Captures live from an IP network and demultiplexes the targeted stream for decoding and testing

Regardless of whether the sequence is imported as a file or recorded, a file is stored as YUV 4:2:2 or RGB 4:4:4.

ClearView can then:
- Automatically align the two sequences spatially and temporally
- Provide a subjective comparison of the two sequences using any of the viewing modes previously shown
- Score the video and audio quality on a perceptual scale using the MOVIE, DMOS, JND and PEAQ methods
- Objectively measure using PSNR

The perceptual scores and objective measurements is saved to a log file, which contains all of the information about the sequences. The log file can be imported into Excel so as to be combined with other data and it can be dropped onto the ClearView GUI (shown on page 8) to restore the test session.

Ways to use ClearView:
1) Capture a sequence via HDSDI, 10 Gig IP or Gig IP to ClearView or output from ClearView to the processing unit. Simultaneously record the transmitted output from a hardware decoder or from an IP network directly.

2) Send a repeatable sequence to the network or processing unit, record the output from an IP network or a hardware decoder via SDI or HDMI and compare this to a pre-recorded or a simultaneously recorded live reference video. After recording and automatic alignment, ClearView generates pass/fail to a log file or command-line script. This can then be followed by instantly recallable playback review of network or device under test failures shown compared to the source video in various view modes as described on page 3.

Reference video - pre-recorded or live feed

Processed sequence from network and/or device under test
Content originators and entertainment service providers want to determine the optimal parameters to fit as many channels or streams into the delivery network as possible and reach an acceptable quality level. They also want to check the quality of the material after it has been compressed and packaged in a transport or program stream. To do this the ClearView analyzer will play a reference sequence to the processing unit and simultaneously record the decoder output or take a direct IP feed and decode internally for its uncompressed measurement operation.

ClearView then provides automatic source video versus processed video alignment methods, multiple comparison measurements and viewing modes.

ClearView
- Plays an uncompressed sequence through SD/HD/3G/Quad 4K SDI, HDMI or 10 Gig IP outputs to the processing unit
- Records, simultaneously, from the IP network or from a decoder via SD/HD/3G/Quad 4K SDI, HDMI or 10 Gig IP inputs
- Aligns spatially & temporally via single or multi-frame method or a frame for frame Exhaustive Alignment routine
- Judges the quality using MOVIE, DMOS, JND, and PEAQ
- Produces log files with the results (log files are text that can be examined as is or automatically exported to Excel)
- Drag and drop logs for recalling any test along with its synchronized side by side audio/video comparison

Another application for manufacturers, broadcasters or any entertainment service provider is using RTM to monitor quality and record performance faults in on-air or IP network quality of service from a long duration test. The RTM system can detect content specific, continuous or intermittent effects on audio or video quality.

RTM and RTM 4K - full reference audio/video quality monitor with error segment recording*
- Inputs source “reference” and downstream “processed” A/V through HDSDI up to 4K or via IP up to 1080i
- Measures the audio and video quality as PSNR or DMOS in real-time on live sources
- Measures the audio and video delay (lip-sync) in real-time
- Measures the audio loudness according to ITU-R BS.1770-3
- Measures each VANC line’s data line integrity with each line individually selectable
- Continuously reports min, max and average A/V quality and A/V delay to log files
- Records the failed portions of the A/V sequences, and alarms via audio beep tone if any of the above have fallen below a user set degradation threshold
- RTM is optionally combined with ClearView in the same system to provide both test applications

*See RTM data sheet for full feature description
Subjective Viewing Modes Now On Desktop or Broadcast Output
- In addition to playback on HDMI & HDSI outputs, a separate desktop function is here
- Play sequences to a separate window on the desktop or to an external video monitor
- Apply side-by-side or any subjective viewing modes to assess quality at full resolution
- Use all interactive play modes, zoom, pan, and pixel value tools on either output type

Perceptual Quality Metrics
- MOVIE: MOTion-based Video Integrity Evaluation index with separately selectable Temporal MOVIE and Spatial MOVIE indices
- MS-SSIM: Provided on DMOS and MS-SSIM scales
- Samoff JND*: On the Just Noticeable Differences scale
- PEAQ*: ITU-R BS.1387 method on BS.1387 or BS.1116 scales for audio quality

Objective Metrics
- PSNR: Peak Signal to Noise differences in video
- aFREQ: Audio Frequency conformance measurement to find gross errors in audio performance versus a reference, provides lip-sync measurement in milliseconds

No Reference (Reduced Reference) Metrics
- aPEAK: True-peak audio measurement per channel according to ITU-R BS.1770-3
- LKFS: Audio loudness measurement per program according to ITU-R BS.1770-3
- Spatial: Calculates the activity power of a frame within the frame
- Temporal: Calculates the changes between successive frames

* JND and PEAQ metric licenses are options on all ClearView models, items CV-JND and CV-PEAQ.
There are several ways to record live A/V sequences into ClearView. All ClearView systems provide a combination of broadcast video/audio inputs as well as IP input capabilities. Broadcast video input interfaces are HDSDI, HDMI or new 10 Gigabit Ethernet, all with embedded audio. IP inputs are Gigabit Ethernet with automatic decoding of compressed video streams. All interfaces provide several options for capturing one or two live inputs as outlined below.

**Broadcast Inputs**

ClearView systems hold several options for uncompressed video with audio source recording. The Broadcast record tab allows a selection of single input, dual input or input/output modes and the configuration menu options are tailored to the input interfaces installed in your ClearView model.

This includes uncompressed 10 Gig IP transport cages, HDSDI or HDMI inputs.

ClearView systems automatically detect the input format for record operations. Sequences are stored as unmodified, fully uncompressed video and audio with support for Dolby® audio then saved for instant recall and playback operations from a user designated ClearView library file folder and sequence name.

**IP Input - Ethernet Stream Decoding and Recording**

Record 1 IP Input - A single input mode that records a video sequence as sensed at the IP multicast address and port specified within the IP configuration menu as pictured to the right. **IP Input,** if MPEG, decodes up to 1080i (excludes 4K, 8K).

Record 2 Inputs - Dual IP or IP with Broadcast input records sequences from two separate inputs or mix of inputs. Each input selection is provided with individual menus to set up Broadcast or IP input parameters. Each IP menu contains transformation settings for scale, crop, de-interlace, rate change and position for matching of source content to the IP network delivered video sequence format for testing.

Record While Playing - In this mode the Broadcast output selection will play a sequence loaded into Viewport A for input to an IP network processor or device under test with an IP output. The ClearView IP Input can then simultaneously decode and capture the processed IP stream as uncompressed video.

**From ClearView**

The ClearView Output tab has new features with version 8.5 providing an ability to internally copy sequences with burned in frame numbers to facilitate frame tracking. Sequences containing Dolby audio can now be automatically trimmed to correct packet boundaries in order to eliminate the potential for audio artifacts or discontinuities while playing sequences in a loop. The ClearView Output tab also continues to provide the unique ability to copy a sequence to a new length or a combination of two sequences set into any View Mode so that selected picture comparisons can then be exported as YUV, AVI or QuickTime formats for external review by most of today’s computer desktop graphics outputs.
ClearView Importer is a comprehensive solution for importing files into ClearView. It is an additional application provided with ClearView Software allowing identification of source file types and full control of file import parameters to store uncompressed sequences that are automatically inserted into a ClearView test routine.

ClearView Importer GUI

ClearView Importer Highlights
- Wide range of supported video and audio formats
- Fast audio and video decoding speed
- Detailed file import source information
- MPTS import with program stream selector- decoder
- Easy source length import modification
- Detailed per pixel source cropping
- Image quality, size and positioning adjustment
- Up to 16 channels of audio decoding
- Command Line and GUI user interface

User confirmable file adjustments:
- Import HDR video in BT.2020 (PQ) or BT.2100 (HLG)
- Import IctCp native color format or record it from HDSDI
- Decoded or imported frame size, rate
- First/last frames to import
- 3:2 pull down insertion or removal
- Bit depth conversion (8 to 10 or 10 to 8)
- Crop source with input values or interactive box
- Scale video resolution up or down to x, y / w, h
- Variable image and canvas resolution
- Truncate to legal broadcast values (yes/no)
- Import audio and closed caption data

Imported File Formats (partial list):
- Accol YUV CCIR 601 8-bit
- ARI Raw Bayer Pattern
- Avid AVR, DS HD/SD, DV (*.gen), DNxHD
- Avid Meridian, Y’CbCr, OMFI (*.omf), *.omfl
- AVR, JIF, JPEG, Meridian, RGB, Y’CbCr
- Cineon (*.cin), CineWave
- DPX RGB 8, RGB 10, Y’CbCr 4:2:2
- DV (*.dv, *.dif), Digital Negative (*.dng)
- DVS Direct File Format (*.dvs)
- DVSD, DV25, DV50, MPEG-I, mJPEG, DigiSuite
- H.261, H.263, H.264, H.265, HDV
- Headerless/Raw (*.hdr, *.yuv, *.rgb, *.raw)
- HiCon SLB32 RGB format (*.slb)
- Image (*.gif, *.jpg, *.png), Jaleo Direct Format (*.js)
- JPEG, JPEG2000, Media 100 Mjpeg
- Microsoft Avi (*.avi), BMP, DIB Files (*.dps)
- MJPEG, MPEG 1 4:2:0 (*.mpg, *.mpeg)
- MPEG-2 Elem. Stream, (4:2:0/4:2:2), MPEG2 (*.m2v)
- MPEG-2 Program Stream, (4:2:0/4:2:2)
- MPEG-2/4 in Transport Stream, (4:2:0/4:2:2)
- MPEG-2/4 in MPTS (4:2:0, 4:2:2), MPEG4 (*.m4v)
- MPEG-4 AVC Elementary Stream 4:2:0/4:2:2, (*.h264)
- MPEG-H HEVC/H.265 4:2:0 Main Profile (*.h265)
- MXF Format (DCC, DV, DVCPro50, MPEG, IMX, OP1a)
- Newtek Video Toaster (*.rtv)
- Phantom Support (*.cine), PhotoShop FilmStrip (*.flm)
- Photo CD PCD, Photoshop PSD, Portable anymap PNM
- Portable Bitmap Format PBm DPS
- Portable graymap PGM
- Portable pixmap PPM
- Profile GXF Format/SMPTE-360 (*.gxf)
- QuickTime Movies (*.mov)
- QuickTime formats w/proper codec, ProRes, etc...
- RealVideo (*.ra, *.rm, *.ram), Red Camera Stream (*.r3d)
- Run-Length encoding (rle)
- Sony XDCam, SGI Movie Format (*.mv), SGI RGB
- Silicon Image Bayer (*.siv), Sun Raster (*.ras)
- Targa TGA, ICB, DVA, Vista, Targa 3000, TIFF, TIF
- v210 Y’CbCr 10 Bit, VC-1 Pro, Viewstore (*.vst)
- vcap, vcap10, Windows Media (*.asf, *.wmf, *.wmv)
- Y’CbCr 8/10, Y’CbCr, RGB, YCrCb 8/RGBA

Audio Import Formats:
- Dolby Digital Plus Professional Decoder (included in v8.5)
- MPEG-2 Layer 1 (*.mp1)
- MPEG-2 Layer 3 (*.mp3)
- Waveform Audio (*.wav)
- Adaptive Multi-rate (*.amr)
- Audio Interchange File Format (*.aiFF)
- Windows Media Audio (*.wma)
- Advanced Audio Coding (*.aac)

Exported File Formats:
- QuickTime with up to 16 audio channels
- Microsoft AVI (*.avi), BMP
- Headerless/Raw (*.yuv, *.rgb, *.raw)
### ClearView Product Feature Matrix

<table>
<thead>
<tr>
<th>Features</th>
<th>ClearView Extreme 8K</th>
<th>ClearView Extreme 4K</th>
<th>CV-Extreme w/RTM 4K</th>
<th>CV-Extreme IP + SDI 4K</th>
<th>ClearView Shuttle 4K</th>
<th>ClearView QA</th>
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<tbody>
<tr>
<td>PSNR, aFreq, aPeak, Lip-sync metrics</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>Perceptual Video and Audio Metrics</td>
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<td>3840X2160p60</td>
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<td>Max Simultaneous Play &amp; Record Rate</td>
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<td>Real-Time Measurement Input Rate</td>
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<td>54 or 108 of 7680X4320p60 Hz YUV10</td>
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<td>Waveform Monitor/Vectorscope - WFM</td>
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<td>Y'PbPr, S-Video, Composite Input</td>
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<td>Y'PbPr, S-Video, Composite Output</td>
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<td>Timecode record and play</td>
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<td>USB Ports - 3.0, 2.0</td>
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<td>Giga-Bit Ethernet Ports</td>
<td>2</td>
<td>2</td>
<td>3 (1 via USB)</td>
<td>2</td>
<td>2</td>
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</tr>
<tr>
<td>Chassis and Rack Mount Type</td>
<td>3RU Kit</td>
<td>3RU Kit</td>
<td>3RU Kit</td>
<td>3RU Kit</td>
<td>2RU Ears</td>
<td>2RU Ears</td>
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</table>

**WFM - Waveform Monitor / Vectorscope**

ClearView systems include WFM, a comprehensive signal tool for input and playback specification display.

**Waveform Monitor** - Displays the levels of the Y, Cb and Cr from the left of the picture to the right of the picture with all the lines summed into one graph.

**Vectorscope** - Depicts a traditional Cb by Cr X-Y display with overlaid reference grade. Color accurate grade automatically switch between SD, HD and UHD color spaces.

**Chromacity Scope** - Provides a visual representation of the color in a video across all the colors of visible light. For a particular Y'CbCr range (BT.2020, Rec.709, C12R-601) a triangle can be super imposed.

**Histogram** - Provides an overview of the tonal range of each color in the picture.

**Picture View** - Shows the video signal, to confirm the source is correct and to display time code location.

**Data View** - Allows access to the raw pixel values being monitored on the HDMI or SDI input.

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**Signal Compare** - Used to freeze a complete frame of video (two fields in interlaced), every second line (field) or at a 50/50 dissolve to compare two signals or cameras.

**Time Code** - Reads multiple timecode types simultaneously and displays them in the lower third data area.

**Audio** - Up to 16 channels of audio are supported for metering.

* WFM is included in new systems shipped with v8.4 starting in April 2016
## ClearView Extreme 4K and 8K Systems

### ClearView Extreme 4K: Model #s CV-S8084-4K-5 or -12 or -24
- **A/V Interfaces:** CV-SDI-IO-4K2 (2)
- **Accessories:** 3 RU rack kit, keyboard, mouse, mirror boot drive, manual, A/V cable kits (2)
- **Play/Record Duration Examples (12 TB):**
  - Video Standard: "3840x2160@60p, 10-bit, 4:2:2, 67 min.
  - Model Option: CV-S8084-RTM, or RTM-5

### ClearView Extreme 8K: Model #s CV-S8088-8K-16 or -32
- **A/V Interfaces:** CV-SDI-IO-8 (2)
- **Accessories:** 3 RU rack kit, keyboard, mouse, mirror boot drive, manual, sync generator w/BNC cables
- **Play/Record Duration Examples (16 TB):**
  - Video Standard: "3840x2160@60p, 10-bit, 4:2:2, 215 min.

### ClearView Extreme 4K and 8K Systems with RTM 4K
- **A/V Interfaces:** See base models above.
- **Accessories:** See base models above.

## ClearView Shuttle 4K and IP Systems

### ClearView Shuttle 4K: Model # CV-S2044 or CV-S2044-5
- **A/V Interface:** CV-SDI-IO-4K2 (1)
- **Accessories:** Hard travel case, keyboard, mouse, OS recovery disk, printed manual, kit, rack ears
- **Play/Record Duration Example for 5 TB:**
  - "3840x160@60p, 10-bit, 4:2:2, 67 min.

### ClearView Shuttle IP: Model # CV-S2043-IP or CV-S2043-IP-5
- **A/V Interface:** CV-IP-IO-HD (1)
- **Accessories:** Hard travel case, keyboard, mouse, OS recovery disk, manual, kit, rack ears
- **Play/Record Duration Example for 5 TB:**
  - Video Standard: "1920x1080@60p, 10-bit, 4:2:2, 269 min.

## ClearView QA: HD and SD Test Systems

### ClearView QA: Model # CV-S2041-QA
- **A/V Interface:** CV-SDI-IO-LHI (1)
- **Accessories:** Hard travel case, keyboard, mouse, OS recovery disk, printed manual, kit, rack ears
- **Play/Record Duration Examples:**
  - Video Standard: "1280x720@60p, 8-bit, 4:2:2, 405 min.

### ClearView QA with Dual HDSDI: Model # CV-S2042-QA
- **A/V Interface:** CV-SDI-IO-CVD22 (1)
- **Accessories:** Hard travel case, keyboard, mouse, OS recovery disk, printed manual, kit, rack ears
- **Play/Record Duration Examples:**
  - Video Standard: "1280x720@60p, 8-bit, 4:2:2, 360 min.

## ClearView Product A/V Interface Specifications

### CV-SDI-IO-8:
- The two interfaces applied on all CV-S8088-8K models include:
  - 16 BNC video connections
  - 1 sync generator, with cables

### CV-SDI-IO-4K2:
- CV-Extreme-4K applies two, CV-Shuttle-4K applies one with:
  - Quad SMB to BNC cable
  - Analog breakout cable
  - Mini HDMI to HDMI cable

### CV-IP-IO-HD:
- Requires one or two SFPs to be purchased separately and applied for I/O function

### CV-IP-IO-LHI:
- Includes:
  - Analog breakout cable
  - 2 Mini HDMI to HDMI cables

### CV-SDI-IO-CVD22:
- Includes:
  - 5 SMB to BNC cables (6)

## Product Specifications

### ClearView Extreme 4K: Model # CV-S8084-4K-5
- **Storage on 4K Models:** 5, 12, or 24 TB
- **Power:** 100 - 240VAC, 47-63Hz, Autodetect 700 Watts Max
- **GUI Output:** HDMI, DVI and VGA
- **Physical Specifications:**
  - Dim. of 4K: 17” W x 5.25” H x 20.15” D
  - Dim. of 8K: 17” W x 5.25” H x 31.5” D
- **Weight:** 4K: 40 lbs, 18 kg; 8K: 50 lbs, 22.7 Kg
- **Options:**
  - CV-JND - JND metric
  - CV-PEAQ - PEAO metric

## ClearView Extreme 8K: Model # CV-S8088-8K-16
- **Storage on 8K Models:** 16 TB or 32 TB
- **Power:** 100 - 240VAC, 47-63Hz, Autodetect, 700 Watts Max
- **GUI Output:** HDMI, DVI and VGA
- **Physical Specifications:**
  - Dim. of 4K: 17” W x 5.25” H x 51.4” D
  - Dim. of 8K: 17” W x 5.25” H x 90.8” D
- **Weight:** 4K: 40 lbs, 18 kg; 8K: 50 lbs, 22.7 Kg
- **Options:**
  - CV-JND - JND metric
  - CV-PEAQ - PEAO metric

### ClearView Extreme QA:
- **Storage:** 2.5 TB or 5.0 TB
- **Power:** 100 - 240VAC, 47-63Hz
- **Options:**
  - CV-WFM: Waveform/Vectorscope
  - CV-Fileimporter: ClearView File Importer
  - CV-MOS: MOS/MS-SSIM metric
  - CV-MOVIE: MOVIE metric
  - CV-JND: Samoff JND metric
  - CV-PEAQ: PEAO metric

### ClearView Extreme QA with Dual HDSDI
- **Storage:**
  - HD: 2.5 TB or 5.0 TB
  - SD: 2.5 TB or 5.0TB

### ClearView Shuttle 4K and IP Systems
- **Storage:** 2.5 TB or 5.0 TB
- **Power:** 100 - 240VAC, 47-63Hz
- **Options:**
  - CV-PEAQ: PEAO metric

### ClearView QA: HD and SD Test Systems
- **Storage:** 2.5 TB
- **Power:** 100 - 240VAC, 47-63Hz
- **Options:**
  - CV-PEAQ: PEAO metric

### ClearView Shuttle 4K: Model # CV-S2044 or CV-S2044-5
- **Storage:** 2.5 TB
- **Power:** 100 - 240VAC, 47-63Hz
- **Options:**
  - CV-PEAQ: PEAO metric

### ClearView QA: Model # CV-S2041-QA
- **Storage:** 2.5 TB
- **Power:** 100 - 240VAC, 47-63Hz
- **Options:**
  - CV-PEAQ: PEAO metric

### ClearView QA with Dual HDSDI: Model # CV-S2042-QA
- **Storage:** 2.5 TB
- **Power:** 100 - 240VAC, 47-63Hz
- **Options:**
  - CV-PEAQ: PEAO metric