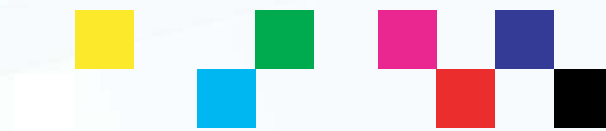# ClearView™
Video Quality Analyzers
8K · 4K · HD · SD · IP

Video Clarity

Tools for Video Analysis

ClearView is a highly advanced test & measurement analyzer providing source and processed video recording, file importing, automatic alignment, and a variety of quality metric assessments for any content resolution or frame rate. Comparative playback modes are a unique feature applied up to 8K ultra high definition uncompressed sequences*. This combination of quality analysis features allow users to 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 HEVC, JPEG-XS, and AV1 have increased the need for tools that can properly analyze and track results.

Today's digital media can be produced and delivered at very high resolutions and frame rates assuming that one has the storage space and the required throughput via the chosen delivery network such as satellite, internet, cable, cellular, or over-the-air broadcast. Each method presents unique characteristics and limitations. Therefore, the most challenging task for product developers, content originators, and media delivery networks is to create a product or service that can fit as many programs as possible into the available bandwidth at the highest quality and to avoid low quality.

To this end, human perceptual video and audio quality analysis must be done. Two ways exist to do this:
- 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.500-13 - methodology for the subjective assessment of the quality of television pictures.

*Sequences in ClearView are video, audio, VANC, and timecode of any duration.

A number of algorithms have been developed to estimate human perceived quality in a precise way via correlation against correctly produced subjective data under either the ITU-R BT.500.13 or ITU-T P.913 recommendations.

The algorithms are divided into three general types:
- Full-reference algorithms compare the processed and reference sequences
- No-reference algorithms analyze only the processed video sequence with no knowledge of the reference
- Reduced-reference algorithms extract specific information from the reference video and use it when analyzing the processed version

ClearView full-reference scoring methods:
- ΔE_{ITP}: Provides an objective assessment of whether a difference between two colors may be visible between two versions of a given program
- VMAF: Video Multimethod Assessment Fusion is tailored for quality assessment of streaming video services
- 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)
- PSNR: Peak Signal-to-Noise Ratio, the ratio between the maximum possible power of a signal and the power of distorting noise affecting the fidelity of its representation
- 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

ClearView no-reference scoring methods:
- NIQE: Natural Image Quality Evaluator, a completely blind, distortion free, no reference, image quality assessment index
- aPEAK: True-peak audio measurement per channel according to ITU-R BS.1770-4
- LKFS: Audio loudness measurement per program according to ITU-R BS.1770-4
- 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

The best way to subjectively analyze an original source versus its processed version is to look at them on one video display. Using two different displays, even of the same type, requires vigilant calibration.

- Therefore, ClearView applies comparison viewing modes to its video outputs that play two uncompressed sequences on one video display. These modes can also be played to a window on the desktop.
- In side-by-side and split-mirror modes the sequences can be panned left or right 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.
- Each view mode's split points can be moved interactively.

Split mode is selectable as horizontal or vertical and view mode can be set for playback to two different displays.

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 luma and chroma pixel values via mouse click
- Playing individual fields at a time to easily find processor cadence differences to original video

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

ClearView A minus 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.
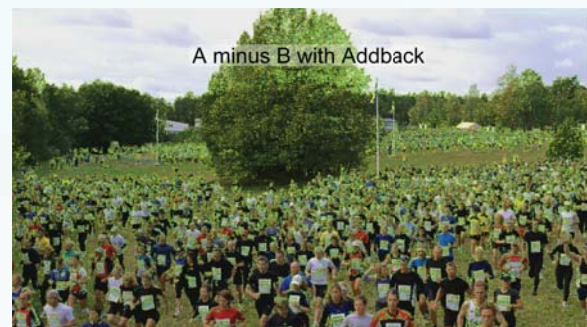- Therefore, ClearView systems include A minus B with a Threshold and Addback command allowing users to see differences that are greater or less than a specific pixel intensity threshold as a selectable color.
- This also allows edge differences to stand out.

A minus B with Threshold = 20 View Mode
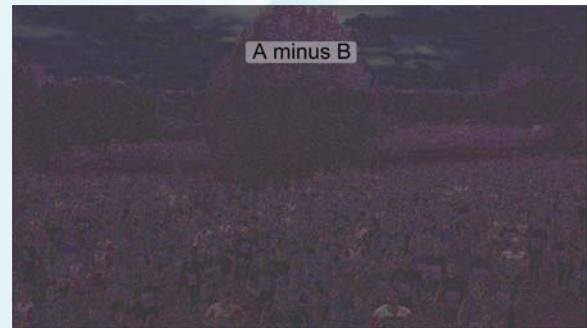

Colors green A>B; yellow B>A

These views are all completely interactive for play, jog, pause, zoom or picture scroll using desktop controls and mouse movements while being fed to the ClearView system's full resolution video outputs or, selectively, to a separate desktop window.

PSNR: One of the most widely used metrics is PSNR (Peak Signal-to-Noise Ratio). It measures the mean error between input and output expressed as a ratio of the peak signal in dB. PSNR, while not performing a human perceptual video quality prediction, does serve an important role as one of the objective metrics included in all ClearView systems. PSNR provides the absolute difference between two signals and is important for device performance or network path testing where a PASS/FAIL indicator is needed.

NIQE: Natural Image Quality Evaluator is a completely blind, distortion free, no reference, image quality assessment index. This quality evaluator by University of Texas LIVE is of a natural scene statistic (NSS) based modeling framework for an opinion unaware (OU) and distortion unaware (DU) no-reference (NR) image quality assessment (IQA). The result is a first of a kind NSS-driven blind OU-DU IQA model which does not require exposure to distorted images a priori, nor any training on human opinion scores. The new NR OU-DU IQA quality index performs better than peak signal-to-noise-ratio (PSNR) and the non-multi-scale structural similarity (SSIM) index delivering equal performance to top performing NR OA-DA IQA approaches.

VMAF: This full-reference metric is designed by Netflix and implemented on its native scale in ClearView according to the latest published VMAF version. VMAF closely approximates human perception of video quality and is consistent across content types whether for natural videos or animated content. VMAF is particularly tuned to assess quality of video streaming by taking various source content characteristics into account and by focusing on compression and picture scaling artifacts as the dominant degradation components in delivered versions of streamed content.

MS-SSIM, SSIM and DMOS: In Multi-Scale Structural Similarity Image Metric (MS-SSIM), the picture is evaluated at various resolutions and the result is an average of these calibrated steps. MS-SSIM out-performs simple SSIM even when the SSIM is correctly calibrated to the environment and data set. ClearView includes MS-SSIM and SSIM, developed by the University of Texas, and provides both on their native scales with MS-SSIM also mapped to a linear DMOS (Differential Mean Opinion Score). The measurements may be performed on luma and a combined score is provided for color channels.
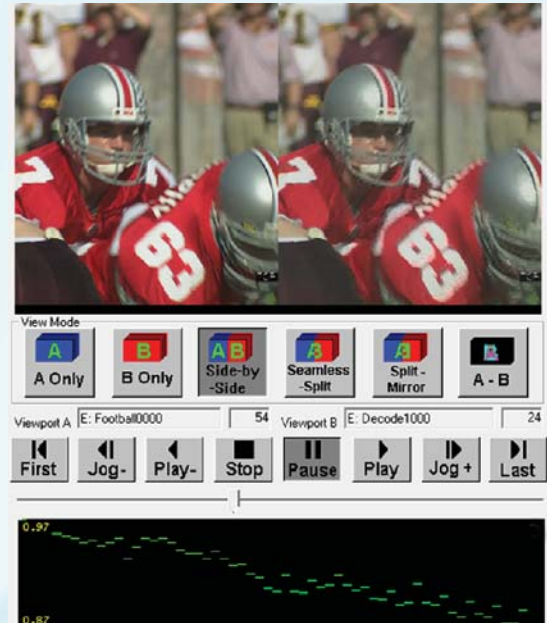
ΔE$_{ITP}$: Following ITU Recommendation BT.2124, ΔE$_{ITP}$ is useful to assess the potential visibility of color differences in HDR television images and signals. The metric returns a just noticeable difference (JND) score that provides an assessment of the differences introduced by signal processing techniques versus camera original content.

Sarnoff JND: A ClearView option, the Sarnoff JND Vision Model is a highly accurate predictor of perceptual quality in video. It includes the Picture Quality Ratio (PQR) algorithm and is quantified in units of JND (Just Noticeable Difference).

Audio Performance Measurements - Included In All ClearView Models

aFREQ - Audio Frequency Metric - Gives a comparison of audio versus a reference to find gross audio errors and provide a general performance comparison of source audio channels to processed audio channels.
- Audio/Video Alignment (lip-sync) is a millisecond accurate measurement included in aFREQ.

aPEAK - Audio Peak Metric and Loudness Measurement - Measures the true-peak amplitude, providing a value for each frame and a separate value for each channel. Within the aPEAK measurement there is a selection for **LKFS**, Loudness, K-weighted, relative to Full Scale. LKFS provides a measurement that takes peak loudness over a one second period over all audio channels in a given program and responds 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 follows recommendation ITU-R BS.1770-4.

Equipment Manufacturers want to accelerate the development of their processing algorithms, and network path along with transmission and receiving products. ClearView allows developers to measure the performance of resulting quality with their devices to quantitatively or subjectively judge them, provides detailed test results, and instantly reviewable video recordings.

ClearView
- Imports many compressed or uncompressed media file types partially listed on page nine
- Records video and audio using baseband inputs such as 12G-SDI, IP for SMPTE ST 2110, or HDMI along with up to sixteen channels of digital audio and ancillary data
- From an MPEG IP stream it demultiplexes, decodes, and records the targeted stream for testing

Whether the sequence is imported as a file or recorded, content is stored as uncompressed YUV 4:2:2 or RGB 4:4:4.
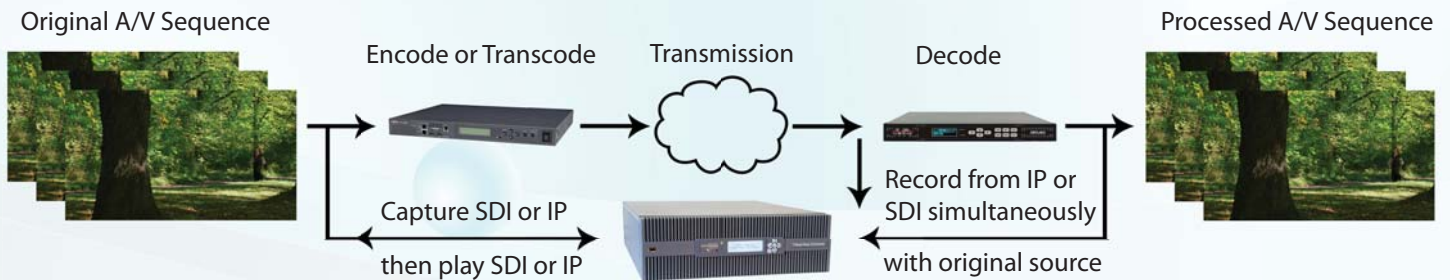
ClearView can then:
- Automatically align the two sequences spatially and temporally using a choice of methods
- Provide a subjective comparison of the two sequences using any of the viewing modes previously shown
- Score the video quality using objective methods ΔE_{ITP}, VMAF, MS-SSIM/DMOS, NIQE, JND or PSNR
- Apply the aFreq audio performance metric on up to sixteen audio channels

All test measurement scores are saved to a text log file. The log file test data is automatically compiled and graphed with other score data by using the included Metric Log Grapher tool and log files can be dropped onto the ClearView GUI to restore the test session with both video sequences recalled for review.

ClearView workflow examples:
1) Capture a sequence via 12G-SDI or IP network to ClearView then output from ClearView to the processing unit. Simultaneously record the transmitted output from a hardware decoder or from an IP network directly.

Original A/V Sequence

Encode or Transcode   Transmission   Decode   Processed A/V Sequence

Capture SDI or IP
then play SDI or IP

Record from IP or
SDI simultaneously
with original source

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 three.

Reference video - pre-recorded or live feed

Failed ✗
Passed ✓

Processed sequence from network and/or device under test
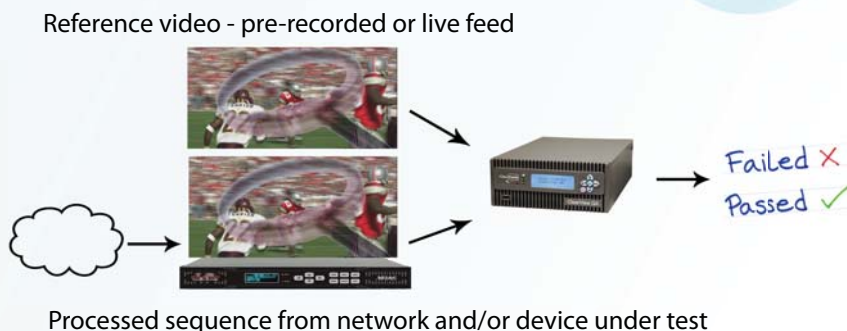
Content originators and entertainment service providers want to determine the optimal parameters to fit as many channels or streams into the delivery network as possible and reach an acceptable quality level. They also want to check the quality of the material after it has been compressed and/or transmitted through a distribution network. ClearView provides both uncompresssed 12G-SDI or ST 2110 input and output support as well as compressed IP network input decoding for its uncompressed quality measurement operation.

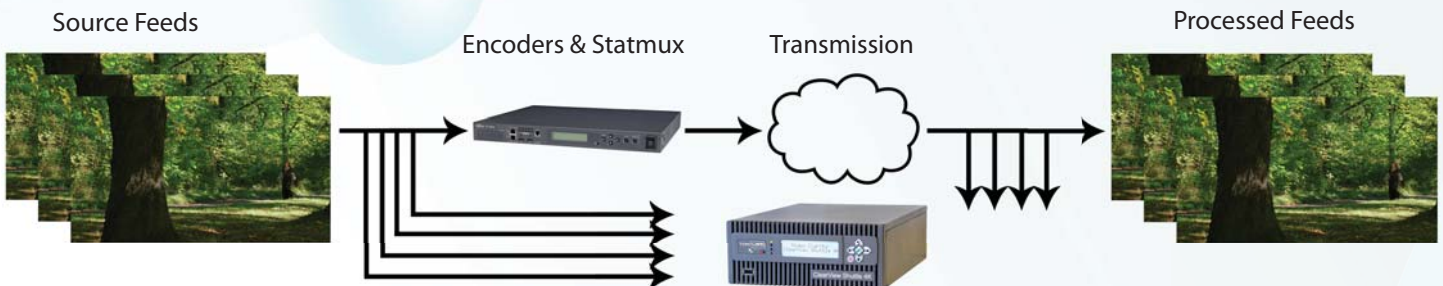In this example the ClearView system...
- Plays an uncompressed sequence through IP network as ST 2110 media
- Records simultaneously from uncompressed ST 2110 network or decodes processed video from an MPEG IP feed
- Aligns spatially & temporally via single or multi-frame method or a frame for frame Exhaustive Alignment routine
- Scores the video quality using VMAF, MS-SSIM/DMOS, JND, NIQE, PSNR, and audio quality with the aFreq metric
- Produces delimited text log files where results can be examined as is or graphed automatically with Metric Log Grapher
- Drag and drop the log file for recalling any test along with its synchronized side-by-side audio/video comparison as shown on page three

Original A/V Sequence • ST-2110 Network • ST 2110 or Other Distribution Network • Processed A/V Sequence

Capture IP or file then play ST 2110

Media received from IP simultaneously
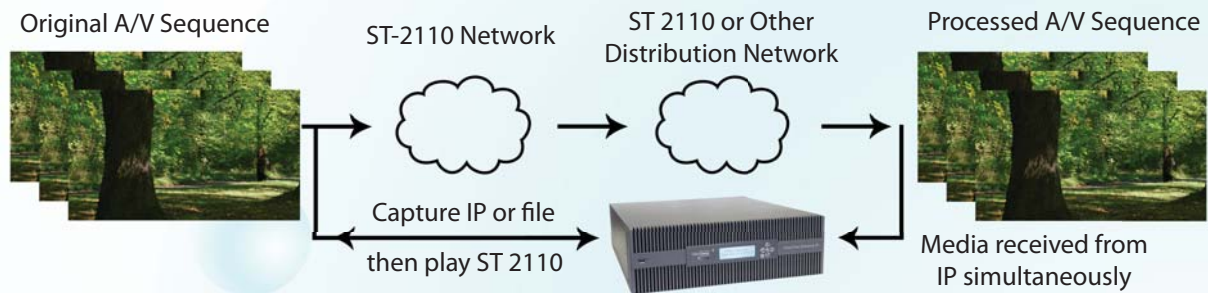
Another application for use by manufacturers, broadcasters, or any entertainment service provider is RTM. RTM monitors picture and sound quality and records performance faults automatically via user set thresholds for each test. The RTM application detects all content specific, continuous or intermittent effects on audio or video quality.
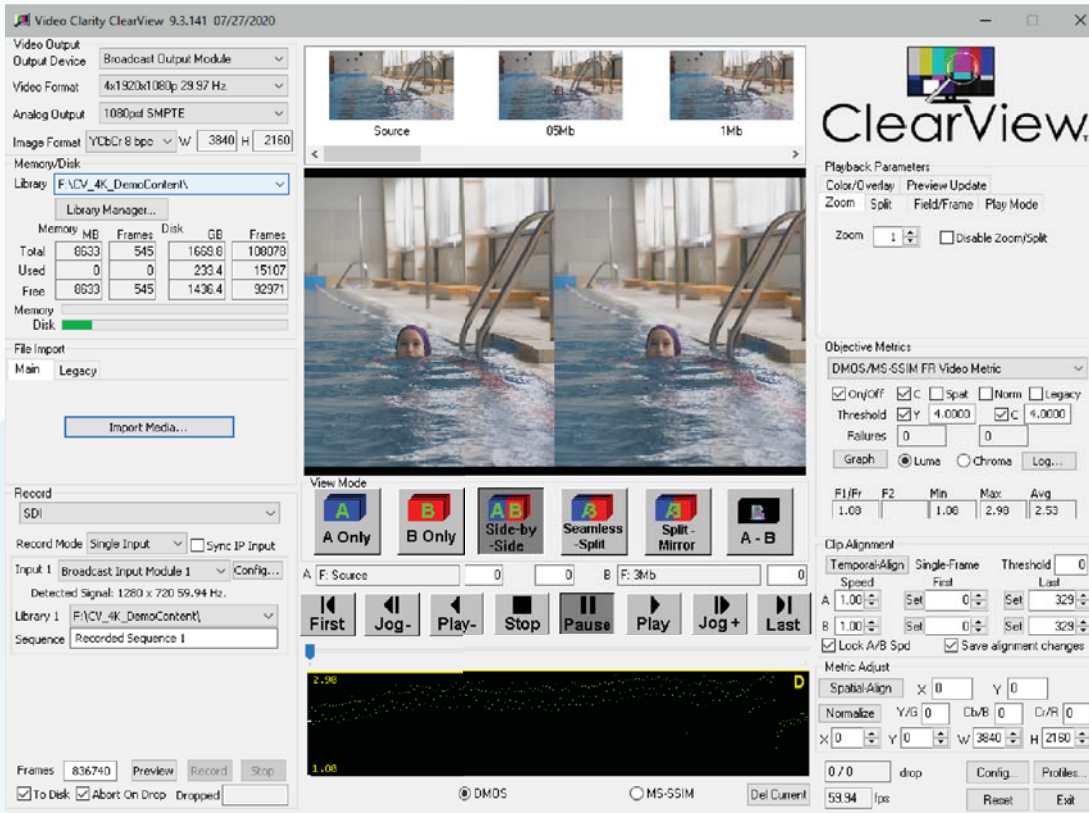
RTM and RTM 4K - full reference audio/video quality monitoring with error segment recording*
- Inputs source "reference" and downstream "processed" A/V through 12G-SDI or IP up to 4K*
- Measures the video quality as PSNR or MS-SSIM on the DMOS scale in real-time from live inputs
- Measures the audio quality and audio/video offset (lip-sync) at the same time down to the millisecond
- Measures the audio loudness according to ITU-R BS.1770-4
- Measures each VANC line or IP media ancillary data for integrity with each data item individually selectable
- Continuously reports min, max, and average A/V quality and A/V offset to text logs and to the RTM Manager
- Records the failed portions of the A/V sequences and alerts the user via GUI or RTM Manager if any of the tests applied have fallen below a user-set degradation threshold

Source Feeds • Encoders & Statmux • Transmission • Processed Feeds

*RTM software is optionally provided with ClearView in the same system. See the RTM and RTM Manager product brochures for full feature descriptions.

ClearView Graphical User Interface

Automatic Alignment Of Source And Processed Videos
- ClearView systems have the unique ability to apply several alignment methods
- Either "single frame", "intelligent" multi-frame, or "exhaustive" alignment are selectable
- Exhaustive alignment is applied when unpredictable amounts of dropped or frozen frames occur in the processed video for which ClearView will provide a count and then eliminate from a test score by providing a newly matched source to the processed video

Subjective Viewing Modes On Desktop Or A Selection Of Outputs
- Play sequences to a separate window on the desktop or out to a video monitor
- Outputs are system dependent and include 12G-SDI, HDMI, and ST 2110 on IP
- Apply side-by-side and all subjective viewing modes to assess quality

Quality Metrics And Performance Measurements
- ΔE$_{ITP}$: To assess the potential visibility of color differences giving a JND score
- VMAF: High accuracy quality assessment optimized for streaming with 0-100 scale
- MS-SSIM: Emmy winning metric provided on linear DMOS and native MS-SSIM scales
- NIQE: Natural Image Quality Evaluator, a blind image quality assessment index
- Sarnoff JND: PQR metric on the Just Noticeable Differences scale (optional item)
- PSNR: Peak signal-to-noise ratio, in decibels, between two video images
- Spatial: Calculates the activity power of a frame within the frame
- Temporal: Calculates the changes between successive frames
- aFREQ: Audio Frequency conformance measurement to find gross errors in audio performance versus a reference, provides lip-sync measurement in milliseconds
- aPEAK: True-peak audio measurement per channel according to ITU-R BS.1770-4
- LKFS: Audio loudness measurement per program according to ITU-R BS.1770-4

Control
ClearView GUI
Play list commands
Batch commands
- Full Command Line Interface

Operation
Record From Baseband Inputs
- 12G-SDI, 3G-SDI, HDMI, IP
Record From MPEG IP Network
- Both source and test stream
- With real-time demux/decode
Import Files
- Demux MPTS, scale or crop
- Decode all media file types
Play to 12G-SDI, HDMI, or IP
- As side-by-side, split mirror, etc.
- View A minus B picture value
- Addback colors to A-B values
- Apply threshold to A-B views
- Play field 1/2 only, or alternate
- Zoom into picture up to 16x
- Pan throughout picture zoom
- Read via mouse click RGB or YCbCr pixel values
Apply Metrics & Measurements
- New VMAF or ΔE$_{ITP}$
- MS-SSIM with DMOS scale
- NIQE (No-reference quality)
- Sarnoff JND (option)
- APEAK true-peak amplitude
- LKFS loudness test
- AFREQ audio impairment test
- Lip-sync +/- measurement
- PSNR
- Spatial (Activity)
- Temporal (Change)

Test Score Analysis
Log files contain the quality scores and information about each test's setup
- Metric Log Grapher creates multiple test comparisons
- Drag & drop log files back to ClearView to recall previous tests and comparison views

There are several ways to record live A/V sequences into ClearView. All ClearView systems provide a combination of uncompressed SDI or IP network video/audio inputs as well as compressed IP input capabilities. Video interfaces are 12G-SDI, 3G-SDI, or IP as 25G Ethernet. All sytems include Gigabit Ethernet for compressed IP input with automatic decoding of MPEG video streams. All interfaces provide one or two live input recording as outlined below.

SDI or SMPTE ST 2110 Network Inputs

ClearView systems hold several options for uncompressed video with audio source recording. Record section tabs allow a selection of single input, dual input or simultaneous output/input modes and the configuration menu options are tailored to the input interfaces installed in your ClearView model.

The functions control either the SDI, or SMPTE ST 2110 IP network 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 created ClearView library showing a thumbnail view of recorded sequences.
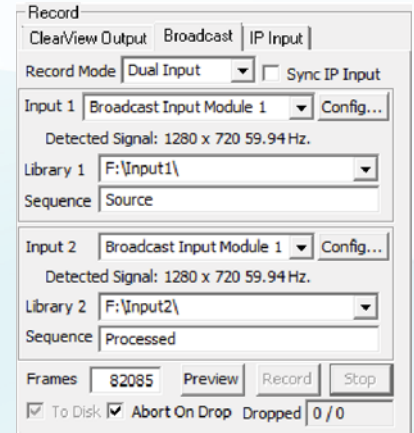
IP Input - Ethernet Stream Recording From MPEG IP Networks

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 one UHD video feed.*

Record 2 Inputs - Select two IP streams whether from MPEG IP compressed media or in combination with ST 2110 network of uncompressed media. Compressed media is automatically decoded and inputs may be a mix of the two networks to record sequences from two points in a delivery chain. Each input selection provides individual menus to set up MPEG IP input parameters.
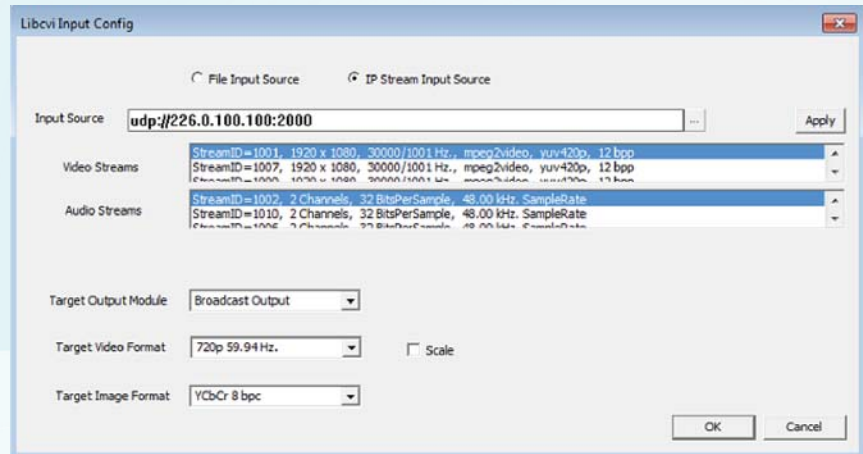
Record While Playing - In this mode the ST 2110 IP or SDI output selection will play a sequence loaded into Viewport A for input to a IP network processor or device under test with an IP output. The ClearView IP input can then simultaneously decode and capture the processed MPEG IP stream as uncompressed video up to UHD resolutions with up to sixteen channels of audio.

From ClearView

The ClearView Output tab has several features which provide an ability to internally copy sequences, optionally with burned in frame numbers to facilitate frame tracking. Sequences containing Dolby audio can be automatically trimmed to match 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 recorded and exported as a single sequence in YUV, AVI, or QuickTime formats for external review by most of today's computer desktop players.

Video Clarity
Tools for Video Analysis
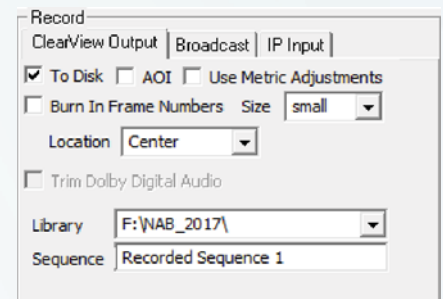
ClearView Importer is a comprehensive tool for importing many media file types. The application is provided with ClearView systems* or software allowing identification of source file types and full control of file importing parameters to store uncompressed sequences that are automatically inserted into a ClearView library for use within a ClearView test routine.

ClearView Importer GUI
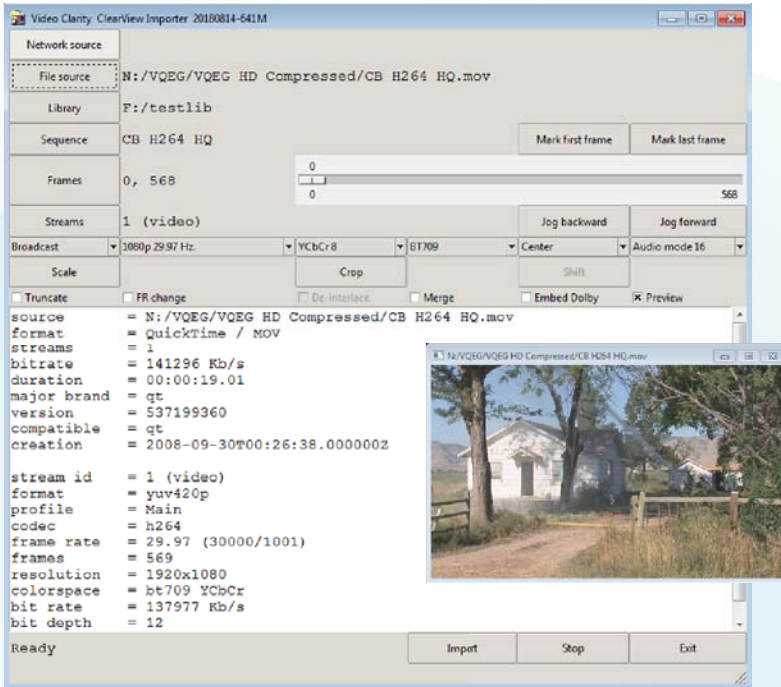
ClearView Importer Highlights

- Wide range of supported video and audio formats
- Fast audio and video decoding speed
- Detailed file import source information with video window
- 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
- Native bit depth import of 8, 10 or 12 bit video
- Crop source with input values
- 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):
Accom YUV CCIR 601 8-bit
ARI Raw Bayer Pattern
Avid AVR, DS HD/SD, DV (*.gen), DNxHD
Avid Meridian, Y'CbCr, OMFI (*.omf, *.omfi)
AV1, AVC, AVC-HD, AVR, AVS
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
GXF Format/SMPTE-360 (*.gxf)
H.261, H.263, H.264, H.265, HDV
Headerless/Raw (*.hdr, *.yuv, *.rgb, *.raw)
HiCon SLB32 RFB format (*.slb)
Image (*.gif, *.jpg, *.png), Jaleo (*.js), JFIF, JPED
JPEG, JPEG2000, LXF, Meridian, 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), MPEG-4 (*.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 (DCP, 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
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, VDA, VST, Targa 3000, TIFF, TIF
v210 Y'CbCr 10 Bit, VC-1 Pro, VP8, VP9, Viewstore (*.vsr)
vcap, vcap10, Windows Media (*.asf, *.wmf, *.wmv)
Y'CbCr 8/10, Y'CbCr, RGB, YCrCb 8/RGBA

Audio Import Formats:
Dolby® Digital Plus Professional Input Decoder
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:
BMP, Headerless/Raw (*.yuv, *.rgb, *.raw)
Microsoft AVI (*.avi), MXF (v210)
QuickTime with up to 16 audio channels

*ClearView Importer is an option in ClearView QA models.

Video Clarity — Tools for Video Analysis

Product and Feature Matrix

Features / Products	ClearView Extreme 8K	ClearView Extreme 4K	CV-Extreme w/RTM 4K	CV-Extreme 4K w/10G IP	ClearView Shuttle 4K	ClearView QA
PSNR, NIQE, aFreq, aPeak Metrics	X	X	X	X	X	X
Full Ref. Perceptual Video Metrics	X	X	X	X	X	All optional
Subjective Viewing Modes	X	X	X	X	X	X
Subjective Side-By-Side Max Play Rate	7680x4320p30	3840x2160p60	3840x2160p60	3840x2160p60	3840x2160p30	1920x1080p60
Max Video Rec. Rate w-16 Ch. Audio	7680x4320p60	3840x2160p60	3840x2160p60	3840x2160p60	3840x2160p60	1920x1080p60
Max Video Play Rate w-16 Ch. Audio	7680x4320p60	3840x2160p60	3840x2160p60	3840x2160p60	3840x2160p60	1920x1080p60
Max Simultaneous Play & Record Rate	3840x2160p60	3840x2160p60	3840x2160p60	3840x2160p60	1920x1080p60	1920x1080p60
Real-Time Measurement Input Rate	Option	Option	2160p 50/60	Option	Option	Option
Disk Storage Capacity Examples - In Minutes	40 or 81 of 7680x4320p 60Hz YUV10	108,215,431 3840x2160p 60Hz YUV10	108,215,431 3840x2160p 60Hz YUV10	108,215,431 3840x2160p 60Hz YUV10	54 min of 3840x2160p 60Hz YUV10	575 min of 1080i 60Hz YUV8
Automatic Metric Log Graphing Tools	X	X	X	X	X	X
Waveform Monitor/Vectorscope - WFM	Option	Option	Option		Option	Option
CV-Importer - with Dolby Decoder	X	X	X	X	X	Option
12G-SDI Input, including 8, 10, 12 bit	X	X	X	X	X	3G 8 or 10 bit
Y'PbPr, S-Video, Composite Input	Ext. Option	Ext. Option	Ext. Option	Ext. Option	Ext. Option	See Models
HDMI AV Input (Recording YUV 4:2:2)	Ext. Option	Ext. Option	Ext. Option	Ext. Option	Ext. Option	See Models
12G-SDI Output, incl. 8, 10, or 12 bit	X	X	X	Option	X	3G 8 or 10 bit
Y'PbPr, S-Video, Composite Output	Ext. Option	Ext. Option	Ext. Option	Ext. Option	Ext. Option	See Models
HDMI Video Output - Max Rate	2160p60,4:2:2	2160p60,4:2:2	2160p60,4:2:2	2160p60,4:2:2	1080p60,4:2:2	1080p60,4:2:2
IP on GNIC Max Decode Input Rate	2160p60 (1)	2160p60 (1)	2160p60 (1)	2160p60 (1)	1080i60 (2)	Option
Timecode record and play	X	X	X	X	X	X
USB - 2.0, 3.1 Gen1, 3.1 Gen2, Type C	1, 2, 3, 1	1, 2, 3, 1	1, 2, 3, 1	1, 2, 3, 1	1, 4, 0, 0	1, 4, 0, 0
Ethernet - 10G Ports, Gigabit Ports	1, 1	1, 1	1, 1	1, 1	0, 2	0, 2
Rack Mount Type Included	3RU Kit	3RU Kit	3RU Kit	3RU Kit	2RU Ears	2RU Ears

WFM - Waveform Monitor / Vectorscope*

ClearView systems may 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 graticule. Color accurate graticules automatically switch between SD, HD and UHD color spaces.

Chromaticity 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, CCIR-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.

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 an option for most all ClearView system configurations.

ClearView Extreme 8K and 4K Systems

Storage on 8K Models: 12 or 24 TB
Storage on 4K Models: 8, 16, or 32 TB
Power: 100 - 240VAC, 47-63Hz, Autodetect, 600 Watts Max
Desktop Outputs: HDMI, or DP (2)

Physical Specifications:
Dimensions: 17" W x 5.25" H x 20.15" D (8K and 4K) 43 cm x 13.5 cm x 51.4 cm
Weight of 8K: 36 lbs, 16.4 Kg
Weight of 4K: 31 lbs, 14.1 Kg

Temperature:
Operating: 0 - +40 Celsius
Storage: -20 - +50 Celsius
Rel Humid: 5-95%, noncondens
Ethernet: 10G NIC (1), GNIC (1)

Additional Options:
-CV-JND - JND metric
-CV-WFM - W-form/V-scope
-CVVP-4K-1L - Venue Player

ClearView Extreme 8K: SDI Models CV-S8085-8K-12 or -24

A/V Interfaces: CV-SDI-IO-12G (1)
Accessories: 3RU rack kit, keyboard, mouse, mirror boot drive, printed system guide, A/V cable kits (1)

Play/Record Duration Examples (12 TB):

Video Standard	Duration
7680x4320@60p, 10-bit, 4:2:2	40 min.
3840x2160@60p, 10-bit, 4:2:2	162 min.

ClearView Extreme 4K: SDI Models CV-S8085-4K-8, -16 or -32

A/V Interfaces: CV-SDI-IO-12G (1)
Accessories: 3RU rack kit, keyboard, mouse, mirror boot drive, printed system guide, A/V cable kits (1)

Play/Record Duration Examples (8 TB):

Video Standard	Duration
3840x2160@60p, 10-bit, 4:2:2	108 min.
1920x1080@60p, 10-bit, 4:2:2	431 min.

ClearView Extreme: Input and Output Options

Optional A/V Interfaces, Add One:
- CV-IP-IO-HD - 10G IP for 2110/2022-6
- CV-DP-O-4 - DP output module
-See A/V Interface descriptions below

Play/Record Duration Examples (24 TB):

Video Standard	Duration
7680x4320@60p, 10-bit, 4:2:2	81 min.
3840x2160@60p, 10-bit, 4:2:2	323 min.
1920x1080@60p, 10-bit, 4:2:2	1293 min.

ClearView Extreme: RTM 4K Option

RTM 4K Option: CV-RTM-4K
- One RTM license for RTM 4K function
- RTM 4K application may be added to all Extreme 8K and 4K models

Play/Record Duration Examples (16 TB):

Video Standard	Duration
3840x2160@60p, 10-bit, 4:2:2	215 min.
1920x1080@60p, 10-bit, 4:2:2	862 min.

ClearView Shuttle 4K Systems

Storage: 4.0 TB
Power: 100 - 240VAC, 47-63Hz, Autodetect, 300 Watts Max
Desktop Outputs: DVI, DP, or HDMI

Physical Specifications:
Dimensions: 8.6" W x 3.5" H x 13.75" D
22.0 cm x 9.0 cm x 35.0 cm
Weight: 11.5 lbs, 5.4 Kg

Temperature:
Operating: 0 - +40 Celsius
Storage: -20 - +50 Celsius
Rel Humid: 5-95%, noncondens

Additional Options:
-CV-JND - JND metric
-CV-RTM-3G - RTM 3G and IP
-CVVP-4K-1L - Venue Player

ClearView Shuttle 4K: Models CV-S2045

A/V Interface: CV-SDI-IO-12G (1)
Accessories: Hard travel case, keyboard, mouse, OS recovery disk, printed guide, cable kit, rack ears

Play/Record Duration Example:
3840x2160@60p, 10-bit, 4:2:2   54 min.
Waveform-Vectorscope Option: CV-WFM
- Up to 4K test of video input and output

ClearView Shuttle IP: Models CV-S2043-IP

A/V Interface: CV-IP-IO-HD (1)
Accessories: Hard travel case, keyboard, mouse, OS recovery disk, printed system guide, rack ears

Play/Record Duration Example:

Video Standard	Duration
1920x1080@60p, 10-bit, 4:2:2	215 min.

SFPs not included.

ClearView QA: HD and SD Test Systems

Storage: 4.0 TB
Power: 100 - 240 VAC, 47-63 Hz, Autodetect, 300 Watts Max
Desktop Outputs: DVI, DP, or HDMI

Physical Specifications:
Dimensions: 8.6" W x 3.5" H x 13.75" D
22.0 cm x 9.0 cm x 35.0 cm
Weight: 11.5 lbs, 5.4 Kg

Temperature:
Operating: 0 - +40 Celsius
Storage: -20 - +50 Celsius
Relative Humidity: 5-95%, noncondensing

Video and audio quality metrics included in ClearView QA models are PSNR, NIQE, aFreq, aPeak with LKFS, Temporal, and Spatial.
Optional items: CV-Importer: ClearView File Importer, CV-DMOS: DMOS/MS-SSIM video quality metric, CV-VMAF: VMAF video quality metric, CV-JND: Sarnoff JND video quality metric, CV-WFM: Waveform/Vectorscope, CV-RTM-3G: RTM application license (for 2043 model only)

ClearView QA: Model # CV-S2041-QA

A/V Interface: CV-SDI-IO-3G (1)
Accessories: Hard travel case, keyboard, mouse, OS recovery disk, printed guide, cable kit, rack ears

Play/Record Duration Examples:

Video Standard	Duration
1280x720@60p, 8-bit, 4:2:2	647 min.
1920x1080@60i, 8-bit, 4:2:2	575 min.

ClearView QA with Dual 3G-SDI: Model # CV-S2043-QA

A/V Interface: CV-SDI-IO-3G (1)
Accessories: Hard travel case, keyboard, mouse, OS recovery disk, printed guide, BNC kit, rack ears

Play/Record Duration Examples:

Video Standard	Duration
1280x720@60p, 8-bit, 4:2:2	647 min.
1920x1080@60i, 8-bit, 4:2:2	575 min.

ClearView Product A/V Interface Specifications

CV-SDI-IO-12G:
8K and 4K SDI systems apply one interface module with
- Five HD-BNC to BNC cables
- HDMI cable
- LTC, AES cable is optional

Digital Video: 4 HD-BNC input/output programmable - 12G-SDI, 3G-SDI, or SD-SDI
- Supports 8, 10, 12 bits - SMPTE 259, 292, 296, 424, 425a/b, 2082, 4K as 2SI
- 8K products provide up to 7680x4320p60 as Quad or 2SI on four 12G-SDI
Digital Embedded Audio: 16 channels - SDI embedded input and output
Digital AES/EBU Audio: 8 chnls on 4 BNC input, and 4 BNC output is optional
HDMI 2.0: 1 output, up to 4096x2160p60Hz 4:2:2 on standard HDMI connector
- HDR Infoframe metadata compatible with HDMI 2.0a/b - CTA-861.3, CTA-861-G
Reference Input: Black (1V), Composite (2 or 4V), or Tri-Level Sync (1V) via 1 HD-BNC

Digital Video Formats: 525i 59.94Hz, 625i 50Hz, 720p 60, 59.94, 50Hz, 1080i 60, 59.94 & 50Hz, 1080p 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz, 2160p 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz 4320p 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz via Quad
Digital Audio Format: 24bit, 48KHz PCM, or DD+
Timecode: -SMPTE-12M on SDI included
                      -LTC input on BNC via optional breakout cable

CV-IP-IO-HD:
Optional 10G IP media interface module requires one or two SFPs purchased separately and applied for I/O function

Video I/O: 10 Gigabit Ethernet applying SMPTE ST 2110, or 2022-6 media transport
- Up to 2 HD or SD video/audio programs output with ClearView playback function
- Up to 2 HD or SD video/audio programs input or simultaneous one in / one out
HDMI 1.4 programmable - 1 output, standard size HDMI connector
Media Transport Interface: 2 x SFP+ Cages - SFPs not included
Reference Input: ST 2110-10 PTP slave or composite sync on BNC

Digital Video Formats: 525i 59.94Hz, 625i 50Hz, 720p 60, 59.94, 50Hz, 1080i 60, 59.94 & 50 Hz, 1080p 60, 59.94, 50, 30, 29.97, 25, 24 & 23.98Hz
Digital Audio I/O: 16 channel, 24bit, 48KHz PCM, or DD+
VANC: SMPTE ST 2110-40 record and playback
Timecode: ST 2110-40 or LTC analog on shared BNC

CV-DP-O-4:
Optional DisplayPort module

Digital Video: 4 DP 1.4 outputs per system, up two outputs addressable via ClearView
- Supports RGB 4:4:4 10 bit uncompressed video formats on one or two outputs

Digital Video Formats:
Programmable via ClearView up to 4096x2160 120p

CV-SDI-IO-LHI*:
Includes: Analog breakout cable, Mini to HDMI cables (2)
CV-SDI-IO-3G:
Includes: SMB to BNC cables (4), Quad BNC cable, Mini to HDMI cable, analog breakout cable

Digital Video: 1* BNC or 2 SMB input, 1* BNC or 2 SMB output - 3G-SDI compliant
- Supports 8 or 10 bits as SMPTE 259, 292, 296, 424, 425 (Level A or B)
Digital Audio: 16 ch. SDI embedded or AES/EBU with 2 ch. on 1 XLR* or 8 ch. on BNC
HDMI (1.3*, 1.4): 1 input*, 1 output on HDMI mini connectors (mini cables supplied)
Analog Video: 3 BNC in*, 3 BNC out - Component (Y, Pr, Pb) or Composite or S-Video
Analog Audio*: 2 channels on 2 XLR (Analog A/V cable breakout supplied, LHI only)
Reference Input: 1 BNC via analog breakout cable - Tri-level HD sync or black burst

Digital Video Formats: 525i 59.94Hz, 625i 50Hz, 720p 60, 59.94, 50Hz, 1080i 60, 59.94 & 50Hz, 1080p 60, 59.94, 50, 30, 29.97, 25, 24 & 23.98Hz
Digital Audio Format:
24bit, 48KHz PCM, or DD+
Timecode: SMPTE-12M on SDI or LTC on breakout cable
*Items with an asterisk apply to LHI interface only

Video Clarity
Tools for Video Analysis

ClearView Extreme 8K System Back Panel with Optional Display Port Output Interface

ClearView Extreme 4K System Back Panel with Optional 10G IP Media Interface

ClearView Shuttle 4K System with 12G-SDI & HDMI 2.0 Output

ClearView Shuttle IP System with 10G IP Media Interface

ClearView QA HD/SD System with 3G-SDI/HDMI Input & Output

ClearView QA HD/SD System with Dual 3G-SDI Input & Output

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