ClearView®

Video Quality Analyzers

8K • 4K • HD • SD • IP

Video Clarity

Tools for Video Analysis

ClearView Product Introduction

ClearView is a highly advanced test & measurement analyzer providing source and processed video recording, file importing, IP stream input decoding, 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.

The emergence of new and diverse media consumption devices creates a need for varied resolutions and processing methods to all screens - TV, PC, and mobile. Therefore, the requirements of digital content distribution have increased dramatically. Evolving and potentially concatenating compression technologies from JPEG 2000 or XS through MPEG H.264, HEVC, VVC, or AV1/2 create an intense 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 while avoiding low quality.

To this end, some form of human perceptual video and audio quality analysis must be done with two requirements in mind.
- In-depth assessment of video content having differing complexity characteristics with multiple digital processing attributes and possibly varied distribution methodologies
- Long-duration tests searching for signal drops and to track degradation in quality over hours, days, or even weeks

For most entities, creating a proper and comprehensive human subjective study of video quality would be a difficult and expensive endeavor. It generally requires setting up a controlled environment and collecting human observers who are able to consistently evaluate picture quality for a varied set of video content. Fortunately a number of algorithms with specific metric characteristics have been developed to estimate human perceived quality with a very high correlation to correctly produced human subjective study data which follow either the ITU-R BT.500.13 or the ITU-T P.913 recommendations.

Quality metrics fall into three general methodologies:
- A full-reference quality method compares the processed and reference sequences
- Reduced-reference methods extract specific information from the reference video and use it when analyzing the processed version
- No-reference methods analyze only the processed video sequence with no knowledge of the reference

ClearView provides several full-reference quality metrics and a number of no-reference quality metrics.

ClearView Full-Reference Quality Metrics:

VMAF: Video Multimethod Assessment Fusion 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 metric versions 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.

***Sequences may be comprised of video with or without audio, VANC, and timecode of any duration.**

ClearView Quality Metric Descriptions

HDR Video Quality Assessment Extensions to VMAF and MS-SSIM: The HDRMAX human perceptual vision model is specifically designed to give existing metrics an extended function for assessing both high dynamic range and standard dynamic range video. By applying a new and original non-linearity operation, which generally expands the brightness ranges at the ends of the local dynamic luma scale while suppressing the middle ranges, HDRMAX implements an extended feature set. In addition, the Visual Information Fidelity features and and Detail Loss Metric features are extracted from these processed luma values to work in conjunction with features already embedded in the existing metric's functions to bring ClearView a significant new video quality measurement. An HDRMAX video quality calculation may now be applied to 10-bit video in the VMAF and MS-SSIM/DMOS metrics within the ClearView video quality analyzer.

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 is important for device performance or network path testing when a PASS/FAIL indicator is needed and as a complement or alternative to perceptual metrics when picture processing performance is near or above the limit of human perception.

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 video processing techniques versus camera original content.

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

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.
- The processed audio/video offset (lip-sync) is also calculated to the millisecond as part of the aFREQ metric.

ClearView No-Reference Quality Metrics:
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 no-reference IQA model not requiring previous distorted image exposure nor any training on human opinion scores. The NIQE quality index performs better than PSNR and the non-multi-scale structural similarity (SSIM) index.

CAMBI: Contrast-aware Multiscale Banding Index operates as a no-reference banding detector in ClearView similarly to other included no-reference quality indices. CAMBI, designed by Netflix, may be operated as full-reference with an added log entry for CAMBI difference scores between source and downstream versions. To create a banding visibility score, CAMBI extracts multiple pixel-level maps at multiple scales, for temporally sub-sampled frames of previously encoded video, and subsequently combines these maps into a single index using properties of the human Contrast Sensitivity Function.

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 defines 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.

Spatial: Calculates the complexity of video within a frame, a higher number indicates more changes in each frame.
Temporal: Calculates the changes between successive video frames, a zero indicates a frozen frame.

ClearView Subjective Viewing Modes

The best way to visually assess 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 to show any half of each image.
- In seamless split mode a line is drawn between the two sequences being compared that can be move left to right or up and down to compare different parts of each.
- Each view mode's split points can be moved interactively during play or pause modes.
- 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:

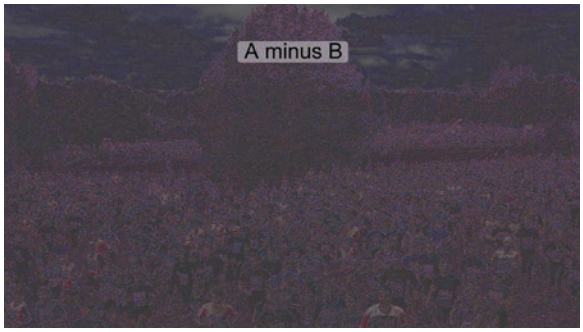
- Zooming into any picture area up to 16x
- Panning within the picture during zoom or split screen
- Identifying luma and chroma pixel values via mouse click
- Playing odd or even fields sequentially to find processor cadence differences to original video

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.

ClearView Application Examples

Equipment Manufacturers want to accelerate the development of their processing algorithms along with comprehensively testing encoder and receiver-decoder products. ClearView allows developers to measure the performance of their devices for image and sound quality quantitatively and visually judge picture quality by providing 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

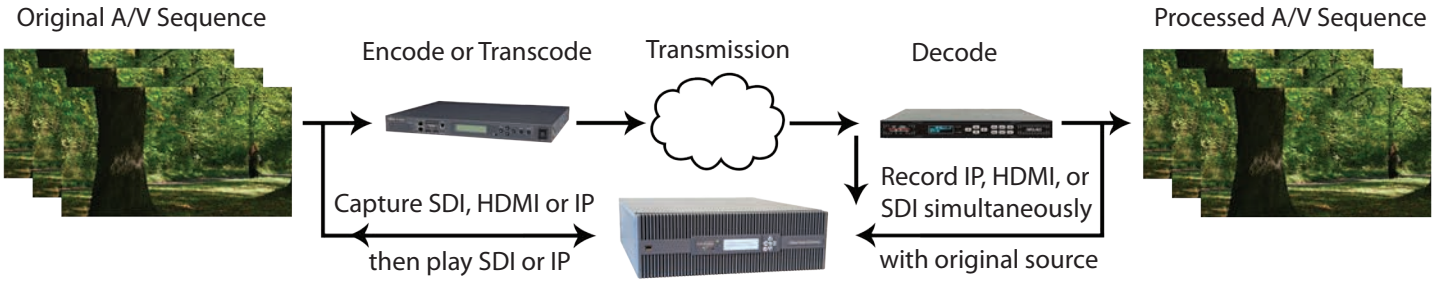
Whether the sequence is imported as a file or recorded, content is stored as uncompressed YCbCr 4:2:2 or RGB 4:4:4.

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 VMAF, MS-SSIM/DMOS, ΔE_{ITP}, JND, PSNR, and NIQE
- Apply the aFreq audio performance metric on up to sixteen audio channels

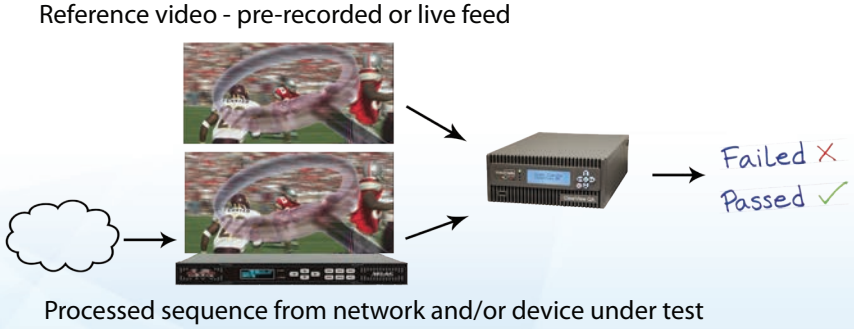
All test measurement scores are saved to a text log file. The log file test data is automatically compiled and graphed with other score data by using the included Metric Log Grapher tool and log files can be dropped onto the ClearView GUI to restore the test session with both video sequences recalled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

ClearView workflow examples:

1) Capture a sequence via 12G-SDI, HDMI, ST 2110 IP, or MPEG IP network to ClearView then output from ClearView to an encoding process. Simultaneously record the transmitted output from a 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 three.

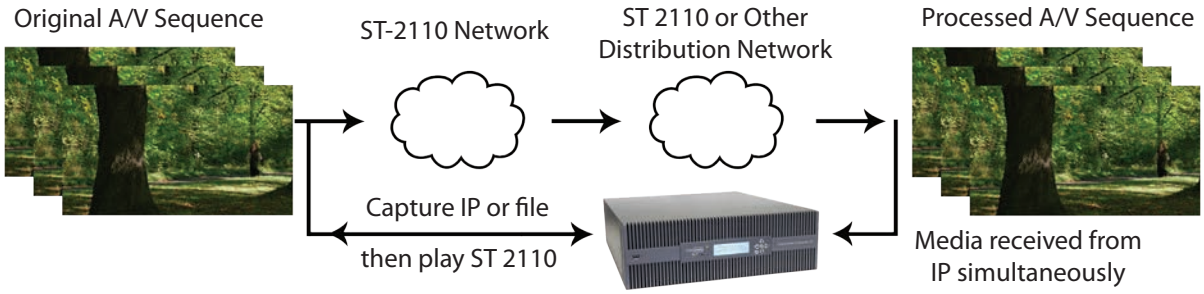


ClearView & RTM Application Examples

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...

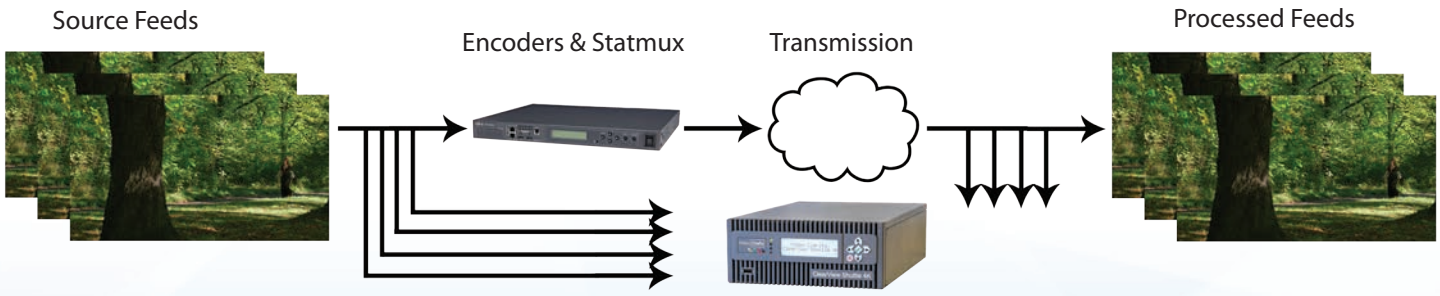
- Plays an uncompressed sequence through IP network as ST 2110 media
- Records simultaneously from uncompressed ST 2110 network or decodes processed video from an MPEG IP feed
- Aligns spatially & temporally via single or multi-frame method or a frame for frame Exhaustive Alignment routine
- Scores the 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
- Recalls any test along with its synchronized side-by-side audio/video comparison from a drag-n-drop of its test log file as shown on page three



A ClearView system option for use by manufacturers, broadcasters, or any media service provider is RTM. The RTM application monitors picture and sound quality and records performance faults automatically via user set thresholds for each test. It 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*

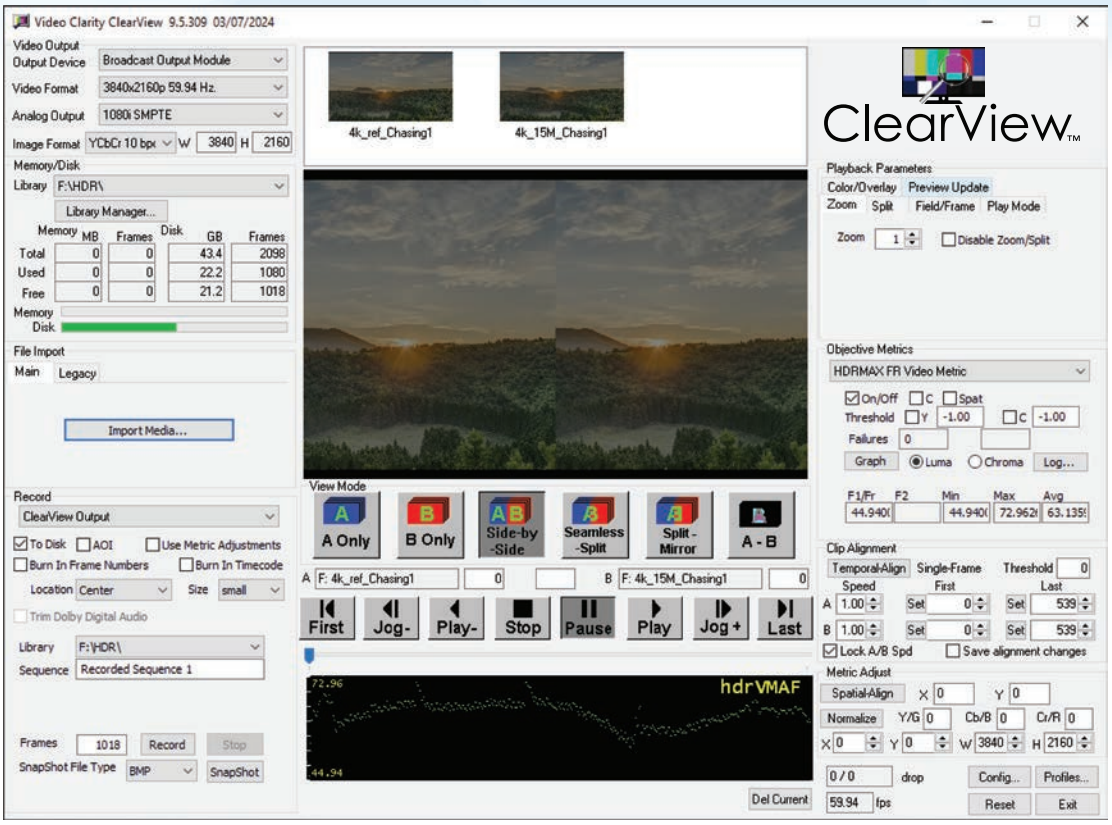
- Inputs source “reference” and downstream “processed” A/V through 12G-SDI, HDMI, ST 2110 or MPEG IP
- Measures the video quality as PSNR or MS-SSIM on the DMOS scale in real-time from live inputs
- Measures the audio quality and audio/video offset (lip-sync) at the same time down to the millisecond
- 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



***RTM Software is optionally provided with ClearView in the same system. See the RTM, RTM-4K, RTM Software, and RTM Manager product brochures for full feature descriptions.**

ClearView Functional Highlights

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 create a newly matched source to the processed video for quality metric scoring

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

Quality Metrics And Performance Measurements

- 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
- HDRMAX: Advanced HDR perceptual quality assessment using VMAF or MS-SSIM
- CAMBI: Video banding detection and visibility metric on its native scale
- ΔE_{ITP}: To assess the potential visibility of color differences giving a JND score
- 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, providing 0 to 100 scale
- Spatial & Temporal: Complexity of each frame & 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
- Decode all media file types
- Demux MPTS, scale or crop
- Decode audio with video or maintain Dolby® Digital with video sequences for playback

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
- Ping, repeat, or loop video
- Apply user generated LUTs
- Select luma or chroma only
- Overlay sequence name

Zoom Into Video Up To 16x
- Pan through motion or stills via mouse click and drag
- Apply A minus B with zoom and color addback with threshold to highlight picture differences

Pixel Value Tool reports image intensity for both A and B videos of each picture component at the mouse click location

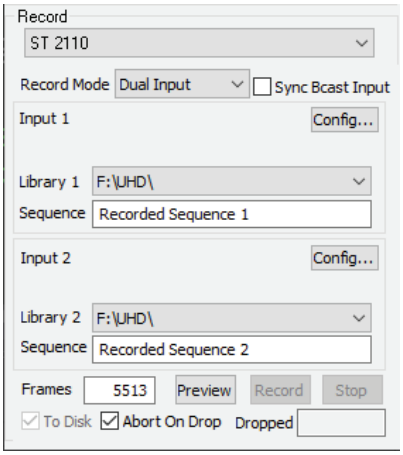
Test Score Analysis

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

ClearView Recording Operations

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 systems 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, HDMI, or SMPTE ST 2110 Network Inputs



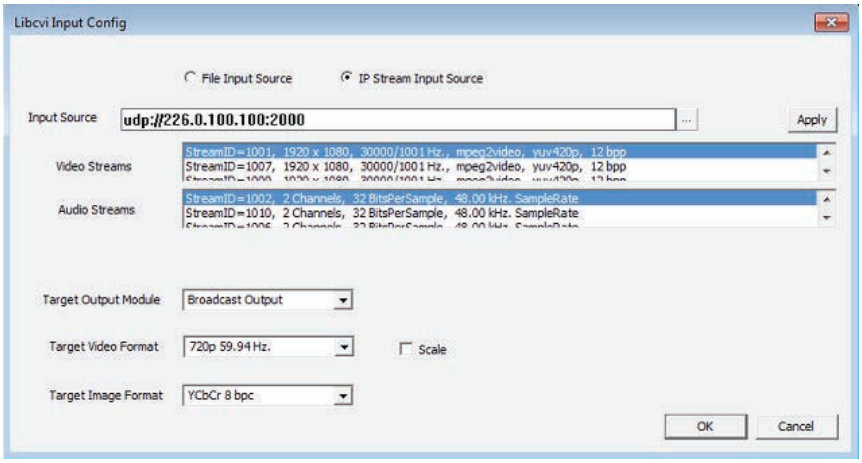
ClearView systems hold several options for uncompressed video with audio source recording. Record section drop menu allows a a selection of single input, dual input or simultaneous output/input modes and the configuration menu options are tailored to the input interfaces installed in your ClearView model.

The functions control either the SDI, ST 2110 IP, 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 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 decodes and records a video sequence as sensed at the IP multicast address and port specified within the IP configuration menu as pictured below.

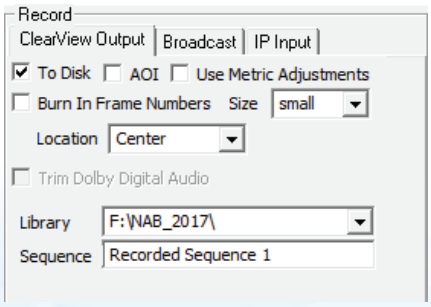


Record 2 Inputs - Select two IP streams whether from MPEG IP compressed media or in combination with ST 2110 network of uncompressed media. Compressed media is automatically decoded and inputs may be a mix of the two networks to record sequences from two points in a delivery chain. Each input selection 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 an video encoder or any 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 4K video resolutions with up to sixteen channels of audio.

From ClearView

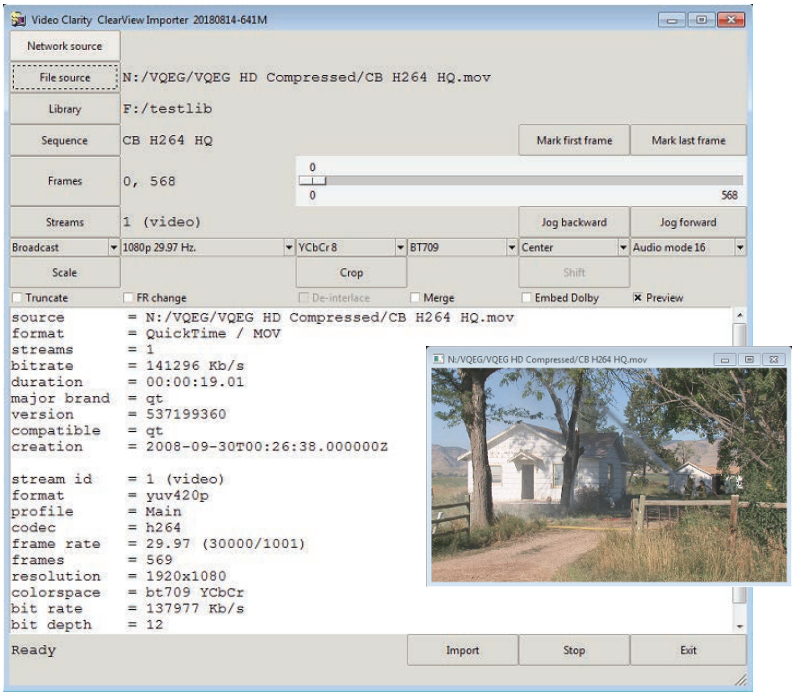
The ClearView Output tab has several features which provide an ability to internally copy sequences, optionally with burned in frame numbers to facilitate frame tracking. Sequences containing Dolby audio can be automatically trimmed to match packet boundaries in order to eliminate the potential for audio 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 uncompressed video sequence for external review by most of today's computer desktop players.



ClearView File Import Operations

ClearView Importer is a comprehensive tool for importing many media file types. The application is provided with ClearView systems* and 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 controllable file adjustments:

- Import HDR video in BT.2020 (PQ) or BT.2100 (HLG)
- Import ICtCp native color format or record it from SDI
- 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

Import 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 (partial list):

Dolby® Digital Plus Professional Input Decoder
-Including AC-3 and Enhanced AC-3
MPEG Audio Layers 1, 2, 3 (*.mp1), *.mp2), (*.mp3)
Waveform Audio (*.wav)
Adaptive Multi-rate (*.amr)
Audio Interchange File Format (*.aiff)
Windows Media Audio (*.wma)
Advanced Audio Coding (*.aac)

Export File Formats:

BMP, Headerless/Raw (*.yuv, *.rgb, *.raw)
Microsoft AVI (*.avi), MXF (v210)
QuickTime (.mov) with up to 16 audio channels

***ClearView Importer is an option in the ClearView QA system.**

ClearView Systems Capability Comparison

Product and Feature Matrix

Features \ Products	CV-Extreme 8K Formats	CV-Extreme 4K Formats	CV-Extreme w/RTM 4K	CV-Extreme 4K w/25G IP	ClearView Shuttle 4K	ClearView QA
PSNR, NIQE, aFreq, aPeak Metrics	Included	Included	Included	Included	Included	Included
Full Ref. Perceptual Video Metrics	Included	Included	Included	Included	Included	All optional
Subjective Viewing Modes	Included	Included	Included	Included	Included	Included
Subjective Side-By-Side Max Play Rate	8192x4320p30	4096x2160p60	4096x2160p60	4096x2160p60	4096x2160p60	2048x1080p60
Max Video Rec. Rate w-16 Ch. Audio	8192x4320p60	4096x2160p60	4096x2160p60	4096x2160p60	4096x2160p60	2048x1080p60
Max Video Play Rate w-16 Ch. Audio	8192x4320p60	4096x2160p60	4096x2160p60	4096x2160p60	4096x2160p60	2048x1080p60
Max Simultaneous Play & Record Rate	4096x2160p60	4096x2160p60	4096x2160p60	4096x2160p60	4096x2160p60	2048x1080p60
Real-Time Measurement Input Rate	Option	Option	2160p 50/60	Option	Option	Option
Disk Storage Capacity Examples - In Minutes of Uncompressed Video	35 or 70 of 7680x4320p 60Hz YUV10	140 or 280 of 3840x2160p 60Hz YUV10	140 or 280 of 3840x2160p 60Hz YUV10	140 or 280 of 3840x2160p 60Hz YUV10	95 min of 3840x2160p 60Hz YUV10	500 min of 1080i 60Hz YUV8
Automatic Metric Log Graphing Tools	Included	Included	Included	Included	Included	Included
Waveform Monitor/Vectorscope - WFM	Option	Option	Option	For SDI Only	Option	Option
CV-Importer - with Dolby Decoder	Included	Included	Included	Included	Included	Option
12G-SDI Input at 8 or 10-bit	Included	Included	Included	Included	Included	3G-SDI Only
Y'PbPr, S-Video, Composite Input	Ext. Option	Ext. Option	Ext. Option	Ext. Option	Ext. Option	Ext. Option
HDMI Video In at 8, 10, or DV Format	2160p60,4:2:2	2160p60,4:2:2	2160p60,4:2:2	2160p60,4:2:2	Ext. Option	Ext. Option
12G-SDI Output, incl. 8 or 10-bit	Included	Included	Included	Included	Included	3G-SDI Only
Y'PbPr, S-Video, Composite Output	Ext. Option	Ext. Option	Ext. Option	Ext. Option	Ext. Option	Included
HDMI Video Out at 8, 10, or as DV	2160p60,4:2:2	2160p60,4:2:2	2160p60,4:2:2	2160p60,4:2:2	2160p60,4:2:2	1080p60,4:2:2
MPEG via IP - Decode Input Functions	2160p60 (2)	2160p60 (2)	2160p60 (2)	2160p60 (2)	2160p60 (1)	Option
Timecode and VANC record and play	Included	Included	Included	Included	Included	Included
USB Interfaces - 2.0, 3.2, Type C	5, 3, 1	5, 3, 1	5, 3, 1	5, 3, 1	2, 4, 1	2, 4, 1
Ethernet - 10G, 2.5G, and 1G Ports	2, 1, 0	2 ,1, 0	2, 1, 0	2, 1, 1	0, 1, 1	0, 1, 1
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 option for video input and output 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 option is compatible with most ClearView system configurations.**

Video Clarity
Tools for Video Analysis

ClearView Systems Specifications

ClearView Extreme: 8K/4K System

Storage: 12 or 24 TB
Power: 100 - 240VAC, 47-63Hz, Autodetect, 600 Watts Max
Desktop Outputs: HDMI, DisplayPort

Physical Specifications:
Dimensions: 20.15" L x 17" W x 5.25" H
51.4 cm x 43 cm x 13.5 cm
Weight: 31 lbs, 14.1 Kg

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

Ethernet: 10G SFP+, 2.5G RJ45

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

ClearView Extreme 8K/4K Models: CV-S8085-8K-12 or -24

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

Play/Record Duration Examples (12 TB):

Video Standard	Duration
7680x4320@60p, 10-bit, 4:2:2	35 min.
3840x2160@60p, 10-bit, 4:2:2	140 min.

ClearView Extreme: Uncompressed Interface Options

Applicable Option Modules:
- CV-IP-IO-UHD, CV-HDMI-I-4, and additional CV-SDI-IO-12G may apply
- Add two modules per 8K/4K system

Play/Record Duration Examples (24 TB):

7680x4320@60p, 10-bit, 4:2:2	70 min.
3840x2160@60p, 10-bit, 4:2:2	280 min.
1920x1080@60p, 10-bit, 4:2:2	1130 min.

ClearView Shuttle: 4K System

Storage: 8.0 TB
Power: 100 - 240VAC, 47-63Hz, Autodetect, 300 Watts Max
Desktop Outputs: HDMI, DisplayPort

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

ClearView Shuttle 4K Model: CV-S2045-8

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

Play/Record Duration Examples:

Video Standard	Duration
1920x1080@60p, 10-bit, 4:2:2	425 min.
3840x2160@60p, 10-bit, 4:2:2	105 min.

All video and audio quality metrics are included in ClearView Shuttle 4K with the following exceptions.

Optional Items: CV-JND: JND video quality metric, CV-RTM-3G: RTM Software, CVVP-4K-1L: Venue Player Software, CV-WFM: Waveform/Vectorscope

ClearView QA: HD and SD Test System

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

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

ClearView QA Model: CV-S2043-QA

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

Play/Record Duration Examples:

Video Standard	Duration
1280x720@60p, 8-bit, 4:2:2	563 min.
1920x1080@60i, 8-bit, 4:2:2	500 min.

Video and audio quality metrics included in ClearView QA are PSNR, NIQE, aFreq, aPeak with LKFS, Temporal, and Spatial metrics.

Optional items: CV-Importer: ClearView Importer for files and IP input decoding function, CV-DMOS: DMOS/MS-SSIM video quality metric, CV-VMAF: VMAF video quality metric, CV-JND: JND metric, CV-CAMBI: Banding detection and measurement metric, CV-WFM: Waveform/Vectorscope, CV-RTM-3G: RTM Software

ClearView Systems Video Interface Module Specifications

CV-SDI-IO-12G:
8K and 4K systems apply one interface module with
- Five HD-BNC to BNC cables
- HDMI cable included, AES cable for "Multi IO" port is optional
- Add up to two optional modules

Digital Video: 4 HD-BNC input/output programmable - 12G-SDI, 3G-SDI, or SD-SDI
- Supports 8 or 10-bits per pixel - 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
HDMI 2.0: 1 output, up to 4096x2160p60Hz 4:2:2 10-bits per component, Type A HDMI
- 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) on 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, LTC input on BNC

CV-IP-IO-UHD module option:
25G IP media interface module requires one SFP28, purchased separately, for ST 2110 input and output operations, apply a second SFP for ST 2022-7 redundancy (Option for 4K and 8K Extreme)

Video I/O: 25 Gigabit Ethernet applying SMPTE ST 2110-20 and 2022-7 media transport
- Up to 2 4K, UHD, or HD video/audio sequences input or simultaneous one in / one out
- Up to 2 4K, UHD, or HD video/audio sequences output with ClearView application
Note: Multiple input and output functions for UHD formats are product model dependent
Media Transport Interface: 2 x SFP28 Cages - SFPs not included
Reference Input: Integrated hardware for network PTP according to ST 2059-2
VANC and Timecode: SMPTE ST 2110-40 record and play

Digital Video Formats:
720p 60, 59.94, 50Hz; 1080i 60, 59.94, 50 Hz
1080p 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz
2160p 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz
Digital Audio I/O: 16 channels input and output
- Formats - 24bit, 48KHz PCM, or Dolby Digital Plus
- According to ST 2110-30 and ST 2110-31

CV-HDMI-I-4 Module Option:
Multiple format capture interface with four programmable inputs

Digital Video: Two HDMI 2.0 or 1.4 , up to two SD, HD, or 4K/UHD simultaneous inputs
-Input image formats up to 4096x2160p60 YCbCr 4:2:2 10-bit on Type A HDMI
Digital Audio: 8 channels per program input **HDR Metadata:** CTA-861.3, CTA-861-G

Digital Video Formats: As in CV-SDI-IO-12G up to 4K
Digital Audio Formats: 16 and 24-bit, embedded HDMI audio, 48 KHz, synchronous per HDMI input

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

Digital Video: 2 SMB/BNC input, 2 SMB/BNC 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 8 ch. on BNC
HDMI (1.4): 1 output on HDMI mini connectors (mini cables supplied)
Analog Video: 3 BNC out - Component (Y, Pr, Pb) or Composite or S-Video
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

ClearView Systems Back Panels

ClearView Extreme 8K/4K System Back Panel

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

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