ClearView
A/V Analyzers

Video Clarity
Tools for Video Analysis
ClearView is a state-of-the-art test & measurement analyzer for A/V quality, subjective viewing, recording and playing high definition and standard definition uncompressed sequences*. The product line consists of the widest choice of product capabilities and model platforms available.

With the convergence of voice, TV and data there is a drive toward 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 AVC and now HEVC and mJPEG 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 broadcasters is to create a product or service that can fit as many programs as possible into the available bandwidth before the quality becomes objectionable.

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 A/V quality
- Perform long-duration tests searching for drops/degradation in A/V quality over a 24/48 hour test run

In depth A/V 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 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 3 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 includes three full reference scoring methods or scales:
- DMOS: 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

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

ClearView provides various tools for assessing perceptual quality and performance of video and audio. To start, we will explore the various subjective tools (page 3) and then move to the perceptual and performance tools (page 4 and 5).

* A sequence can include audio, video and data of any duration.
One of the easiest ways to subjectively analyze two different sequences is to look at them on the same display. Using two different displays, even of the same type, requires vigilant calibration. Therefore, ClearView has many viewing modes that show the two sequences. In side-by-side and split-mirror modes the sequences can be panned as only half of the image is showing. In seamless split part of the image is from the reference and the rest of the image is from processed (the combined image forms a full screen). ClearView allows the split point to be arbitrary (not just the middle/center).

ClearView can, of course, send the two sequences to two different displays. This is done using the multiple output viewing mode command. Further, this can be perfectly synchronized for 3D playback.

Side-By-Side Viewing

Using the ClearView GUI, the command line interface (CLI), or play lists, two sequences can be displayed in a variety of ways:
- Side-by-Side (or over-under)
- Seamless Split
- Split Mirror (butterfly)
- A minus B (with threshold and color addback)
- Full Screen (each sequence to a different display or one at a time to the same display)

Sequences can be further analyzed as follows:
- Playing individual fields
- Zooming up to 16x
- Panning and scanning
- Identifying pixel values via mouse click

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. ClearView includes A minus B with Threshold and Addback allowing users to see differences that are greater than a threshold as a color. Edge differences also stand out in this mode.

A minus B with Threshold = 20 Viewing Modes

Colors green A>B; yellow B>A

These views are simultaneously fed to the ClearView user interface and to each of ClearView’s full resolution video outputs providing a versatile subjective viewing solution.
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 vision 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 Monitoring where the perceived quality has already been measured in the laboratory environment and what is needed is a PASS/FAIL indicator. A PSNR value of 35dB is generally considered good.

Video Perceptual Quality Measurements

Sarnoff JND: A well accepted perceptual video quality index method which simulates the functionality of the human visual system (HVS) components. The method involves the following:
- 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
- Generating a perceived quality number

ClearView analyzers provide a full implementation of the algorithm developed by Sarnoff Corporation known as Picture Quality Ratio (PQR) and place it on the JND (Just Noticeable Differences) scale.

DMOS utilizing MS-SSIM: The structural similarity approach provides an alternative and complementary way to most accurately measure human perceptual video quality assessment. 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 state-of-the-art perceptual image quality metrics. However, the SSIM index achieves the best performance when applied at an appropriate scale (i.e. viewer distance/screen height). Calibrating the parameters, such as viewing distance and picture resolution, creates the most challenges of this approach. To rectify this, 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. It has been shown that MS-SSIM out-performs simple SSIM even when the SSIM is correctly calibrated to the environment and data set.

ClearView uses the algorithm developed by the University of Texas known as MS-SSIM and places it on the DMOS (Differential Mean Opinion Score) scale. DMOS measurements may be performed on luma (Y) and a combined score is provided for color difference channels (Cb, Cr). MS-SSIM scale may also be chosen for the on-screen score graph seen on the ClearView GUI when measuring DMOS. Both DMOS and MS-SSIM scale measurements are entered in ClearView test logs on a per frame basis when a DMOS measurement is created.

Video Clarity is continually working on new algorithms and adding tools to its ClearView analyzer product line in order to provide the most up to date solutions for Equipment Manufacturers, Content Providers and Broadcasters.
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”.

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 included with all fully licensed ClearView system models delivered with ClearView 7.0 or later versions. It is an optional upgrade for ClearView systems delivered under previous ClearView versions or new ClearView QA systems.

Audio Performance Measurements

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 K-weighted 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 is based on recommendation ITU-R BS.1770-3
Equipment Manufacturers want to accelerate the development of their processing algorithms. ClearView allows developers to compare performance of algorithms, quantitatively or subjectively judge them, and get detailed reports.

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 comparison of the two sequences
  - Subjectively using any of the viewing modes previously shown
  - Score the video and audio quality on a perceptual scale using the DMOS, JND and PEAQ methods
  - Objectively measure using PSNR

The perceptual scores and objective measurements can be 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 10) to restore the test session.

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

2) Send a known sequence via SDI to the processing unit, record the output from a hardware decoder and compare this to a pre-recorded result - generating pass fail to a ClearView log file or CLI script.
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.

ClearView then provides multiple comparison measurements of the processor output to the original content.

ClearView
- Plays an uncompressed sequence through HD/SD/3G SDI, HDMI or analog outputs to the processing unit
- Records, simultaneously, from the IP network or from a decoder through HD/SD/3G SDI, HDMI or analog inputs
- Aligns spatially & temporally
- Judges the quality using 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 - a full reference A/V quality monitor *
- Inputs source “reference” and downstream “processed” AV signals through HDSDI, IP or File
- Measures the audio and video quality 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, sends an SNMP trap or alarm 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
Perceptual Quality Metrics
- Sarnoff JND: Complex HVS metric found to be 92%* accurate when compared to subjective scoring
- University of Texas’ MS-SSIM using the DMOS scale: Top down HVS metric found to be 94%* accurate
- PEAQ: ITU-R BS.1387 method for objective measurement of perceived 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
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Subjective Viewing Modes
- Numerous side-by-side, over-under viewing modes to assess quality
- Field/Frame modes, Zoom, Pan, Pixel Value tools and more

* Data from the University of Texas
There are several ways to record live AV sequences into ClearView. All ClearView systems now provide a combination of digital video/audio inputs as well as IP input capabilities. Digital input interfaces are HDSDI with embedded audio with an option for HDMI and analog video with audio. IP inputs provide several options for capturing one or two IP streams as outlined below. ClearView also provides the very useful ability to record a side by side sequence from the system’s output into a file for export to standard file formats.

**Broadcast Inputs**

ClearView systems hold several options for HDSDI, HDMI or analog 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.

ClearView systems automatically detect the input format and correct the system output format during record operations. Sequences are formatted and saved for instant recall and playback operations from a user designated ClearView library file folder and sequence name.

**IP Inputs**

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.

Record 2 IP Inputs - Dual IP program input mode records sequences from two separate multicast addresses and ports as specified within the dual IP input selection which provides two configuration menus. Each configuration menu contains transformation settings for scale, crop, de-interlace, rate change and position for matching of source content to a network delivered sequence targeted for testing.

Record While Playing - In this mode the broadcast output will play a sequence loaded into Viewport A for processing by the IP network processor or device under test with IP output. The ClearView IP input can then simultaneously record from an IP stream.

**From ClearView**

The ClearView Output tab provides the unique ability to record any sequence or combination of two sequences that are set into any View Mode. As an example a side by side view of two synchronized sequences, each with an identifying overlay window is created as a single file in a ClearView library. This AV sequence can then be exported in YUV, AVI or QuickTime format for delivery and playback review by most of today’s computer desktop graphics outputs. This mode also allows a snapshot recording so that representative stills can be inserted as reference material to presentations.
ClearView File Importer is the latest addition for importing files into ClearView. It is a stand-alone application provided with ClearView systems allowing complete control and thumbnail viewing of imported sequences that are automatically formatted into a ClearView library for use within a ClearView test routine.

ClearView File Importer Highlights
- Wide range of supported video and audio formats
- MPTS demultiplexer - decoder
- Easy source length import modification
- Detailed per pixel source cropping
- Image quality, size and positioning adjustment
- Up to 8 channels of audio decoding
- Fast AV decoding speed
- Detailed file import source information
- Variety of video and image formats for output media
- Command Line and GUI user interface

User configurable file adjustments:
- 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
- Color space convert YUV to/from RGB
- Import audio
- Variable image and canvas resolution
- Truncate to legal broadcast values (yes/no)

Imported File Formats
Accom YUV CCIR 601 8-bit
ARI Raw Bayer Pattern
Avid AVR, DS HD/SD, DV (*.gen)
Avid Meridian, Y’CbCr, OMFI (*.omf, *.omfi)
AVR, JFIF, JPEG, Meridian, RGB, Y’CbCr
Cineon (*.cin), CineWave
Digital Negative (*.dng), DPIX (DPX), DV (*.dv, *.dif)
DVS Direct File Format (*.dvs)
DVSD, DV25, DV50, MPEG-I, mJPEG, DigiSuite
H.261, H.263, H.264, HDV
Headerless/Raw (*.hdr, *.yuv, *.rgb, *.raw)
HiCon SLB32 RFB 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, *.mpeg2)
MPEG 2 Program Stream, 4:2:4:2:2
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)
MXF Format (DV, DVCPro50, MPEG, IMX)
Newtek Video Toaster (*.rtv)
Phantom Support (*.cine), Photoshop FilmStrip (*.flm)
Photo CD, Photoshop PSD, Portable anmap PN
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 (rl)
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, Viewstore (*.vrs)
Windows Media (*.asf, *.wmf, *.wmv)
Y’CbCr 8/10, Y’CbCr, RGB, YCrCb 8/RGBA

ClearView File Importer GUI

Audio Import Formats
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 8 audio channels
Microsoft AVI (*.avi), BMP
Headerless/Raw (*.yuv, *.rgb, *.raw)
# ClearView Product Comparison

## Product Matrix

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<th>ClearView Extreme 4K</th>
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<th>ClearView Extreme X2</th>
<th>ClearView + RTM</th>
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<td>X</td>
<td>X</td>
<td>X</td>
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<td><strong>Perceptual Metrics JND/DMOS/PEAQ</strong></td>
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<td>Option</td>
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<td><strong>Video w/ 8-chs of Audio Record</strong></td>
<td>4, 1080p</td>
<td>DP-4K model</td>
<td>1080p</td>
<td>1080p</td>
<td>2, 1080p</td>
<td>1080p</td>
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<tr>
<td><strong>Video w/ 8-chs of Audio Playout</strong></td>
<td>4, 1080p</td>
<td>DP-4K model</td>
<td>1080p</td>
<td>1080p</td>
<td>2, 1080p</td>
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<td><strong>Simultaneous Playout &amp; Record</strong></td>
<td>up to 1080p</td>
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<td><strong>Display Port / DVI (RGB) Output Rate</strong></td>
<td>120Hz</td>
<td>85 min of 1080i 60Hz YUV</td>
<td>173 min of 1080i 60Hz YUV</td>
<td>518 min of 1080i 60Hz YUV</td>
<td>173 min of 1080i 60Hz YUV</td>
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<td><strong>Disk Storage Capacity Example</strong></td>
<td>89 min of 3840X2160p 60Hz YUV</td>
<td>60 min of 3840X2160p 60Hz YUV</td>
<td>85 min of 1080i 60Hz YUV</td>
<td>173 min of 1080i 60Hz YUV</td>
<td>518 min of 1080i 60Hz YUV</td>
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<td>2RU</td>
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### ClearView
- Records two live inputs, imports compressed and uncompressed files
- Stores input items as YUV 4:2:2 or RGB 4:4:4 files
- Automatically aligns reference and comparator file spatially and temporally
- Performs video perceptual measurements using JND and DMOS scales
- Performs audio perceptual measurements using PEAQ with BS.1387 or BS.1116 scales
- Facilitates subjective testing by allowing the user to view and hear the sequences in many ways
- Provides audio conformance (aFreq), lip-sync, true-peak, loudness and full VANC data integrity measurements on recorded or imported files
- Includes many of the EBU and VQEG test sequences used for encoding research

### RTM*
- Measures the audio and video quality in real-time
- Performs either DMOS or PSNR calculation in real-time
- Measures the A/V offset/delay (lip-sync)
- Measures audio loudness according to ITU-R BS.1770-3
- Measures the VANC data accuracy by line
- Alarms and records the A/V sequences if any of the above are below the defined threshold
- Creates time based logs for recorded failures and continuous min, max, average log at user set interval

*See RTM data sheet for full feature description
### ClearView Product Models and Specifications

#### ClearView Shuttle Systems

**ClearView Shuttle Dual: Model # CV-S2042**
- **A/V Interface:** CV-SDI-IO-CVD22 (1)
- **Accessories:** Hard travel case, keyboard, mouse, OS recovery disk, printed manual, BNC kit, rack ears

**ClearView Shuttle Dual: Model # CV-S2042**
- **A/V Interface:** CV-SDI-IO-CVD22 (1)
- **Accessories:** Hard travel case, keyboard, mouse, OS recovery disk, printed manual, BNC kit, rack ears

**ClearView Extreme DP/4K: Model # CV-S8084-DP**
- **A/V Interfaces:** CV-DP/DVI-O (1)
- **Accessories:** 3 RU rack kit, keyboard, mouse, OS recovery disk, disk, manual, A/V cable kits (2)

**ClearView Extreme DP/4K: Model # CV-S8084-DP**
- **A/V Interfaces:** CV-DP/DVI-O (1)
- **Accessories:** 3 RU rack kit, keyboard, mouse, OS recovery disk, disk, manual, A/V cable kits (2)

**ClearView Extreme 4K: Model # CV-S8084-4K**
- **A/V Interfaces:** CV-SDI-IO-4K (2)
- **Accessories:** 3 RU rack kit, keyboard, mouse, OS recovery disk, disk, manual, A/V cable kits (2)

**ClearView Extreme 4K: Model # CV-S8084-4K**
- **A/V Interfaces:** CV-SDI-IO-4K (2)
- **Accessories:** 3 RU rack kit, keyboard, mouse, OS recovery disk, disk, manual, A/V cable kits (2)

**ClearView QA**
- **Storage:** 600 GB
- **Power:** 100 - 240VAC, 47-63Hz, Autodetect, 300 Watts Max
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**ClearView Shuttle + RTM**
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**ClearView Extreme X2: Model # CV-S8083-X2**
- **A/V Interfaces:** CV-SDI-IO-X2 (1)
- **Accessories:** 3 RU rack kit, keyboard, mouse, mirror boot drive, manual, A/V cable kits (2)

**ClearView Extreme X2: Model # CV-S8083-X2**
- **A/V Interfaces:** CV-SDI-IO-X2 (1)
- **Accessories:** 3 RU rack kit, keyboard, mouse, mirror boot drive, manual, A/V cable kits (2)

**ClearView Extreme DP: Model # CV-S8084-DP**
- **RGB 24 or 30 bpp DP or DVI Player**
- **A/V Interface:** CV-DP/DVI-O (1)

**ClearView Extreme DP: Model # CV-S8084-DP**
- **RGB 24 or 30 bpp DP or DVI Player**
- **A/V Interface:** CV-DP/DVI-O (1)

**ClearView Extreme DP/4K: Model # CV-S8084-DP**
- **Play/Record Duration Examples:**
  - Video Standard: CV-1920x1080@60p, 8-bit, 4:2:2 Duration 194 min.
  - CV-3840x2160@60p, 8-bit, 4:2:2 Duration 173 min.

**ClearView Extreme DP/4K: Model # CV-S8084-DP**
- **Play/Record Duration Examples:**
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**CV-SDI-IO-4K**
- **Physical Specifications:**
  - Dimensions: 8.6” W x 3.5” H x 13.75” D
  - Weight: 11.5 lbs, 5.4 Kg

**CV-SDI-IO-4K**
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**CV-SDI-IO-CVD22**
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  - Weight: 40 lbs, 18 Kg

**CV-SDI-IO-CVD22**
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**ClearView Product A/V Interface Specifications**

| CV-SDI-IO-4K | Digital Video: 4 BNC input/output programmable - 3G HD-SDI or SD-SDI compliant  
- Supports 8 or 10 bits for SMPTE 295, 292, 296, 424, 425a/b and 4K QuadHD  
Digital Embedded Audio: 8 channels - SDI embedded input and output  
Digital AES/EBU Audio: 8 channels on 4 BNC input, 8 channels on 4 BNC output  
HDMI 1.4: 1 output on HDMI mini connector with 8 channel digital audio (cable supplied)  
Analog Video: 3 BNC, 3 BNC out - Component (Y, Pr, Pb), Composite or S-Video  
Reference Input: 1 BNC - Tri-level HD sync (Analog A/V breakdown cable supplied) | Digital Video Formats:  
525i @ 59.94Hz, 625i @ 50Hz  
720p @ 60, 59.94, 50 Hz  
1080i @ 59.94, 50 & 1080p, 50, 30, 29.97, 25, 24, 23.98 Hz  
3840X2160p @ 60, 59.94*, 50*, 30*, 29.97*, 25, 24, 23.98 Hz  
1 High 4K frame rate play/rec. only available in **CV-S8084-4K**  
Digital Audio Format: 24-bit, 48kHz PCM, Synchronous |
| --- | --- |
| **CV-SDI-IO-CVD22** | Digital Video: 2 BNC input, 2 BNC output - 3G HD-SDI or SD-SDI compliant  
- Supports 8 or 10 bits for SMPTE 295, 292, 296, 424, 425a/b  
Digital Embedded Audio: 8 channels - SDI embedded inputs and outputs  
Digital AES/EBU Audio: 8 channels on 4 BNC input, 8 channels on 4 BNC output  
HDMI 1.4: 1 output on HDMI mini connector with 8 channel digital audio (cable supplied)  
Analog Video: 3 BNC, 3 BNC out - Component (Y, Pr, Pb), Composite or S-Video  
Reference Input: 1 BNC - Tri-level sync (Analog A/V breakdown cable supplied) | Digital Video Formats:  
525i @ 59.94Hz, 625i @ 50Hz  
720p @ 60, 59.94, 50 Hz  
1080i @ 59.94, 50 & 1080p, 50, 30, 29.97, 25, 24 & 23.98 Hz  
1080p @ 60, 59.94 & 50 Hz  
Digital Audio Format: 24bit, 48kHz PCM, Synchronous |