STREAMBOX CHROMA

HD/2K/UHD/4K Half-Rack Encoder and Decoder

User Manual

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1 About Streambox Chroma

The Streambox® Chroma Encoder/Decoder is a rack-mountable Audio/Video Encoder and Decoder solution for secure, low-latency video transport that is required for studio and post-production workflows, video backhaul, or multi-campus video distribution. The Encoder and Decoder applications run on a Linux operating system and support AES 128-bit encryption (and optionally AES 256-bit encryption with restrictions), LDMP multipath transport, and ACT-L5 and -L3 Advanced Profile compression, all together providing a secure, high quality video transport with low latency and wide color fidelity.

With optional hardware and software upgrades, Chroma can utilize such features as 4:4:4 chroma subsampling, 12-bit Color depth, multiple SDR and HDR color spaces including Rec.709, Rec.2020, DCI-P3, XYZ and RGB, and 2K/4K video, with support for HDR and HFR video, as well as up to 16 channels of PCM audio. Additionally, multiple video stream channels are supported, either from a single input or multiple inputs, or receiving multiple streams with simultaneous, synchronized output.

Codecs

Chroma utilizes two proprietary video codecs, ACT-L5 and ACT-L3. Chroma hardware offers Streambox ACT-L5 codec, an advanced video compression technology optimized for interlaced and progressive video and display systems, allows the streaming of much higher color fidelity than is available on other platforms. Streambox's legacy ACT-L3 codec ensures compatibility with other legacy Streambox products including Standard Definition (SD) products. Both codecs provide higher quality in 4K, UHD, 2K, HD and SD, at a much lower data rate than MPEG and H.264 compression. Both codecs are adaptable to user-selectable data rate requirements with constant bit rate and variable bit rate modes.

The robust family of Streambox video transport solutions features innovative error correction and bandwidth shaping technologies which manage, control, and mitigate packet loss and correct irregularities common to video delivery over packet-based networks.

2 Solution Features

ACT-L5 Codec for Superior Video, Color Quality, and Delivery

✔ Standard Definition, High Definition, 2K, UHD, 4K DCI, and even 3D (synchronized two-channel HD video) are supported
✔ High-quality, 12-bit RGB 4:4:4, or 8/10-bit 4:2:2 video over public and private IP networks
✔ Ingests video in RGB or YUV encodings with support for color space conversion, including HDR workflows.
✔ Low Delay Multi-path Protocol (LDMP) reliable video transport
✔ 0.2 to 2 second end-to-end latency over IP networks
✔ Scalable bitrates from 2 up to 120 Mbps with near lossless quality
✔ Adaptive bitrate encoding / decoding
✔ Up to 4-channel synchronized video (option)

Security for Protection of Content

✔ A protective shield around the transport of valuable media content
✔ One-to-one or one-to-many encrypted collaboration via private network or Streambox Cloud Services
✔ Optimized ACT-L5 codec adds security
✔ End-to-end AES 128-bit video encryption
✔ AES 256-bit encryption is available with added restrictions (optional)
✔ Encryption with no increase in stream latency
✔ Playout on proprietary software and hardware Media Players

Simplified Workflows and Playout

✔ Workflow support from capture to playback with either a hardware Decoder or software media player
✔ Integration with Streambox Cloud Service and StreamOn Server for video routing of live streams
✔ Supports file-based streaming from Streambox Enterprise Server or Cloud Services to Decoder or media player
✔ Stream high quality live video over local networks, Internet connections, and MPLS networks
✔ Securely share video streams with 3rd-party providers or stakeholders with Streambox Sessions

Upgrade Options

✔ 16-channel audio support
✔ AES 256-bit encryption
✔ 12-Bit, 4:4:4 RGB Color
✔ 2 and 4-Channel synchronized video
✔ Dolby Vision/HDR10+ metadata streaming
✔ Extended service and support

3 Specifications

Hardware

● Size: 0.5 Rack Unit: W: 8.5in x 10in L x 1.7in H
● Weight: 2 kg (4.4 lbs)
● Power: 100-240 VAC, 150W external adapter (model A17-150P1A)
● 2x 1000Mbps RJ-45 Ethernet ports
● HDMI Monitor Output (for terminal access)
● USB Connections (for terminal access)
● Encoder/Decoder half-duplex (standard). Encoder-only, Decoder-only, and Encoder/Decoder full-duplex models available

Video Interface

● Video IN/OUT: BNC connections for 12G, 6G, 3G or HD-SDI (support varies with model), 12-bit 4K with up to 16-ch embedded SDI audio
● Color: RGB, YUV 4:4:4* in 2K/4K modes, 4:2:2 and 4:2:0 Rec.709 in all modes
● Bit Depth: 12, 10, 8
● Options to add HDMI Video in/out
● HDMI 2.0a with Rec.2020, HDR-10 Metadata support on Decoder (optional)
● Reference Output: BNC Tri-sync (Decoder-mode HD only)
● Upgradable to 2 and 4 stream decoding.

Audio Interface

● SDI Embedded Audio IN/OUT
● Audio Codec: Up to 8-ch PCM and AAC, CELP, GSM; sampling frequency up to 48 KHz, 5.1 surround sound; upgradable to 16-ch.

Supported Encoder Video Inputs

SD	NTSC 480i @ 29.97fps PAL 525i @ 25fps
HD[1]	720p 50,59.94,60fps 1080i 50,59.94,60fps 1080psf 23.98,24fps 1080p 23.98,24,25,30fps
2K (UHD and 4K only)	2K DCI 2048x1080 23.98,24,25,30fps
4K (4K only)	UHD 3840x2160 and DCI 4096x2160 23.98,24,25,30fps

Supported Decoder Video Outputs

SD	NTSC 480i @ 29.97fps PAL 525i @ 25fps
HD[2]	720p 50,59.94,60fps 1080i 50,59.94,60fps 1080psf 23.98,24fps 1080p 23.98,24,25,30fps
2K (UHD and 4K only)	2K DCI 2048x1080 23.98,24,25,30fps
4K (4K only)	UHD 3840x2160 and DCI 4096x2160 23.98,24,25,30fps

[1] Can force input to an HD standard of your choice, upconverting from SD if necessary

[2] Can force output to an HD standard of your choice, upconverting from SD if necessary

4 Hardware

Streambox Chroma is available in 3 main models: HD, UHD, and 4K, with some additional upgraded versions such as the 12G-SDI version, available. Furthermore, each of the 3 models is available in an Encoder version and a Decoder-only version. The Encoder versions can be switched into Decoder mode, in a half-duplex fashion: the unit can be an Encoder or a Decoder, but not both at the same time.

Front Panel



Rear Panel of 12G-SDI (UHD/4K Models)



5 Encoder Web Administration

The Streambox Encoder is equipped with a web management feature. This allows the Encoder to be easily controlled using a web browser on any computer with network access to the unit. (Requires a common TCP 80 connection.) The web interface uses advanced html which allows dynamic updates of the web interface so that information is updated without having to refresh the page. The web interface can be accessed by entering the IP address of the Streambox Encoder into a web browser.

5.1 Login Page

When first connecting to the web interface of the Streambox ACT-L5 Encoder or Decoder you are prompted for the Username and Password to access the interface. This username and password is specific to the web interface and is not shared by the console or RDP interfaces. The login and password are case- sensitive. The default credentials are:

Username: **administrator**
Password: **demo**



Figure 1 Encoder Web UI Login Page

5.2 Title Bar

The title bar contains the Streambox logo, product information, and important information about the Streambox stream. The product information will indicate whether the unit is in Encoder or Decoder mode.



5.3 Info Page

The Info page is the main interface for Streambox Chroma Encoder and provides an instant view of the current video and network settings.

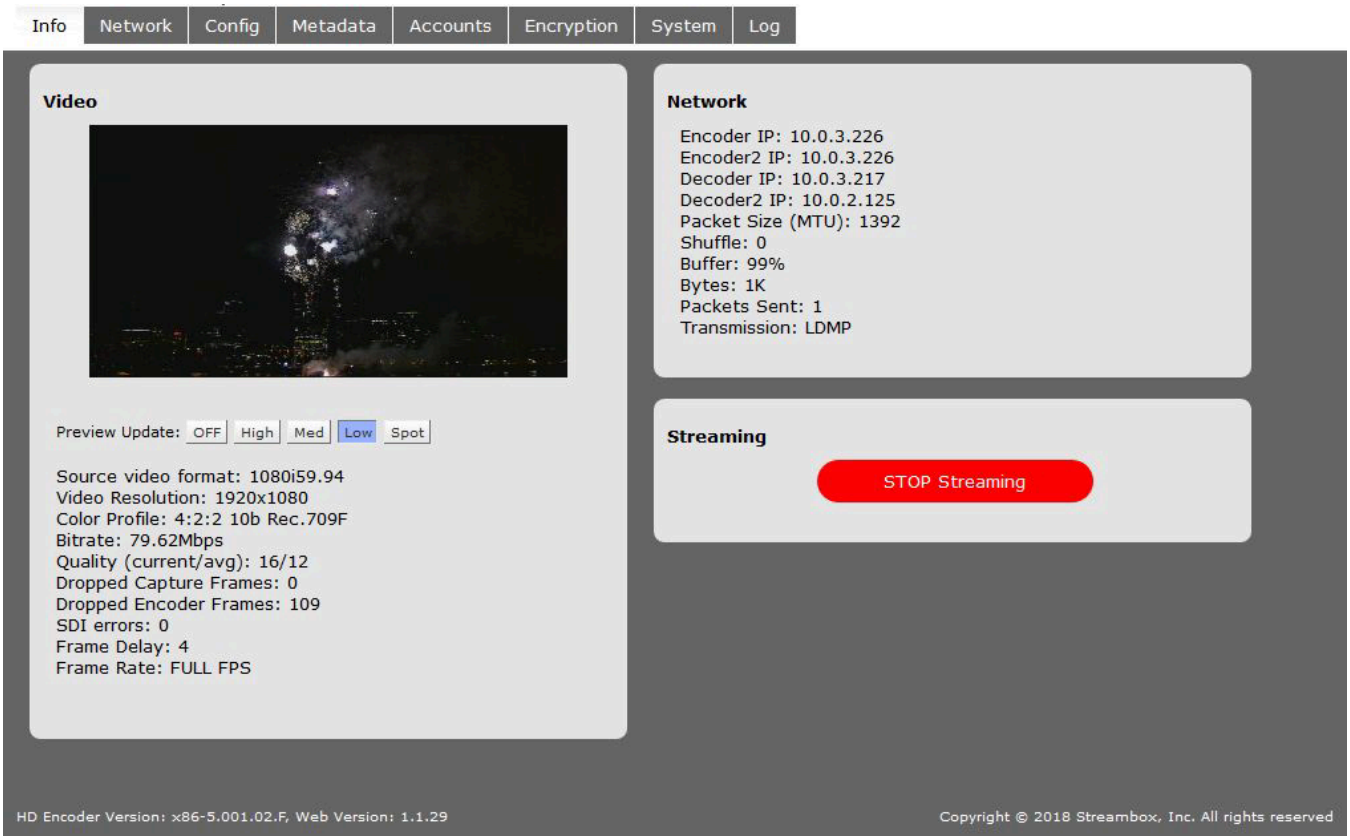


Figure 2: Encoder Web UI Info Page

Video

The video section shows a scaled down preview of the video input to assist in verifying the video input signal.

- **Preview Update:** With these buttons, you can select the frequency with which the picture will be updated. *Spot* will load a single frame about every 30 seconds, while *Low*, *Med,* and *High* will load frames at respective speeds; Preview Update provides feedback of what is being streamed and does not represent the full quality of the video stream.

- **Source Video Format:** displays the resolution, progressive/interlaced, and the framerate of the source video, as detected by the Encoder.
- **Video Resolution:** the video stream's intended resolution, which may be a fraction of the source resolution.
- **Color Profile:** the color capture profile
- **Bitrate**: the total overall transfer rate of the ACT-L5 stream, including all video, audio, FEC, and ancillary data
- **Quality:** the current and average compression quality metric for the encoded frames; 0 is highest quality (no compression) and 300 is the lowest quality (highest compression)
- **Dropped Capture Frames:** number of video frames dropped by the capture process; typically due to a problem with video input (cumulative)
- **Dropped Encoder Frames:** number of video frames dropped by the Encoder software engine; typically due to the "prefer quality over framerate" setting or a problem with the Encoder settings (cumulative)
-

NOTE: Even with perfect stream conditions, it's normal for the encoder to drop several dozen or hundred packets at the beginning of an LDMP stream. If the number increases in surges or continuously over the course of the stream, that indicates a problem. If every frame is dropped, that usually indicates a failed LDMP connection.

- **Frame Delay:** The number of frames buffered in the capture process
- **Frame Rate:** The frame rate setting of the encoded stream

Network

- **Encoder IP**: IP address that the Encoder is using to send data from (source address). If the Encoder is set with 2 or more network connections, one is selected based on connection availability at startup. If an undesired network connection is selected, it's possible to set a "skip" command so the Encoder won't select it in the future. (Contact Support for information about the skip command.)
- **Decoder IP:** IP address that the Encoder is using to send data to (destination address)
- **Packet Size (MTU):** IP Packet size (default = 1392)
- **Shuffle:** Forward Error Correction Shuffle setting - Should only be used if the stream is experiencing packet loss in distinct bursts
- **Buffer:** the amount of network buffer available. This will vary based on the complexity of the video and limitations in the network connection. A negative value indicates a failed network connection.
- **Bytes:** size of the buffer in bytes
- **Packets Sent:** number of total packets sent since last restart
- **Transmission:** Indicates LDMP or UDP network mode.

Streaming

This region includes a start/stop button for the stream.

5.4 Network Page

The network page allows access to the network settings such as bitrate, latency, and Decoder IP.

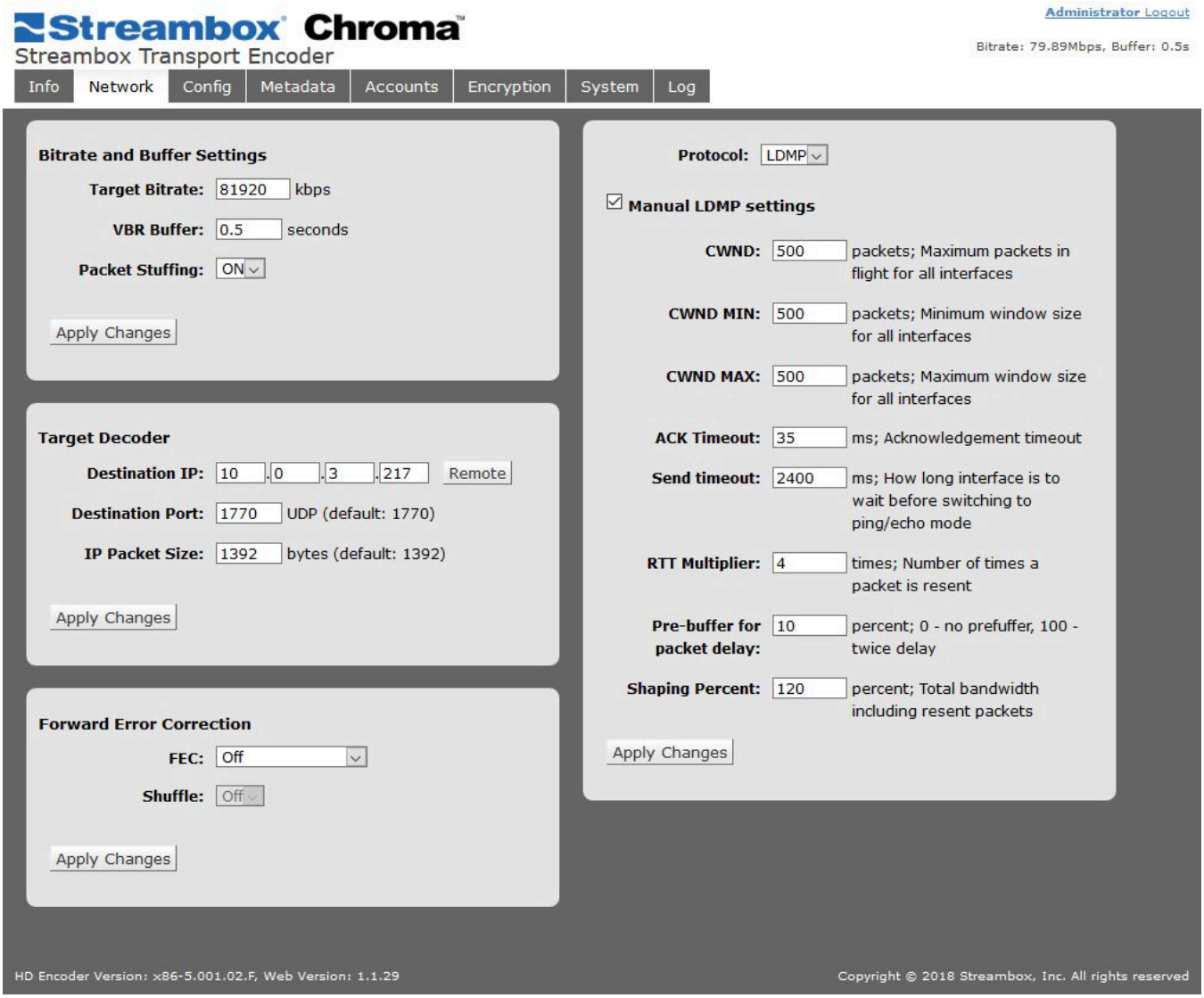


Figure 3 Encoder Web UI Network Page

For basic functionality of the system upon initial setup, two settings need to be set: the Decoder IP address and target bitrate.

Bitrate and Buffer Settings

- **Target Bitrate:** sets the total transfer rate that will not be exceeded when streaming
- **VBR Buffer:** Variable bitrate buffer in seconds; amount of time in seconds that the Encoder has to process the video before it is to be transported to the Decoder; values 0.1s to 5s; A lower setting decreases latency while a higher setting often improves video quality
- **Packet Stuffing:** fills the outgoing stream with blank data as needed to maintain an output bitrate at the Target Bitrate. This setting is useful for checking that the full amount of data can get through if needed.

Target Decoder

- **Destination IP:** target IP address for the Decoder to which the video stream will be sent. Unicast and multicast addresses are supported. 224.1.1.1 is an example of a Multicast IP address
- **Destination Port:** IP port number for outbound ACT-L5 UDP stream (default: 1770)
- **IP Packet Size:** the size of the IP packet (default: 1392)

Forward Error Correction

Forward Error Correction, known as FEC, recovers packets lost in the transmission due to variable network conditions. This setting refers to the amount of redundant packets sent to compensate for variable network conditions.

FEC:

FEC is denoted as either “x% - y packets” for Parity type FEC, and “R-S x% (a/b)” for the Reed-Solomon type FEC. Reed-Solomon (R-S) type is more efficient than Parity type, and so R-S is recommended. In both cases, the Encoder adds additional packets which can be transformed by mathematical deduction into missing packets at the receiving end. Each shows a percentage of packets added (and so the available bitrate for video/audio is reduced in proportion); higher packet loss demands higher values of FEC if FEC is the only error correction method used. FEC does increase latency because of additional packets sent.

FEC should be used in UDP mode if using unreliable networks (which is to say everything outside of local wired networks, and satellite networks which have their own error correct), and may also, optionally, be used as a supplement to LDMP’s built-in error correction if using LDMP mode.

Shuffle: Rearranges the FEC packet sequence for ‘burst’ error protection. The following formula is used to calculate the recommended setting for the Decoder when shuffle is enabled: buffer/jitter size in packets = FEC packets X shuffle size

Protocol

Streambox offers two types of Transport Protocol for streaming, UDP and LDMP. Both use the UDP network protocol. LDMP is a Streambox-proprietary protocol which uses 2-way UDP streaming.

LDMP settings:

● **CWND** sets the maximum Congestion Window, the number of packets sent but not yet acknowledged, for all interfaces combined.
● **CWND MIN** sets the minimum congestion window for each individual interface. When using a single network connection, this value should be the same as the **CWND** value above; when using two connections, this value should be half the **CWND**.
● **CWND MAX** sets the maximum congestion window for each individual interface. When using a single network connection, this value should be the same as the **CWND** value above.
● **ACK Timeout** (Acknowledgement Timeout) is the number of milliseconds the Encoder will wait for confirmation that a packet arrived before it tries to resend. This setting affects allowed latency of the stream because interfaces (USB modems for example) that are too slow and don't meet this requirement will not be used. This is how LDMP is able to guarantee latency. *If your total bandwidth seems very low, then try raising this number.*
● **Send Timeout** is the number of milliseconds without response from a Decoder (or other receiver) after which the Encoder will consider the connection dead.
● **RTT Multiplier** tells the Decoder how much predictive jitter buffer to create for out of order packets. Increasing this value will increase reliability and latency when multiple interfaces are used.
● **Pre-Buffer for Packet Delay** (elsewhere called **Jitter2 Percentage**) tells the Decoder how large to set the **Jitter2** buffer to compensate for bursting or delayed packets. Setting this value higher will increase reliability and latency when network bandwidth fluctuates.
● **Shaping Percent** is a percentage of the Target Bitrate, representing the maximum amount of data (including both video stream packets and packets re-sent by the Encoder) that the Encoder is allowed to send.

5.6 Config Page

This section will cover quality settings for Streambox Encoder stream.

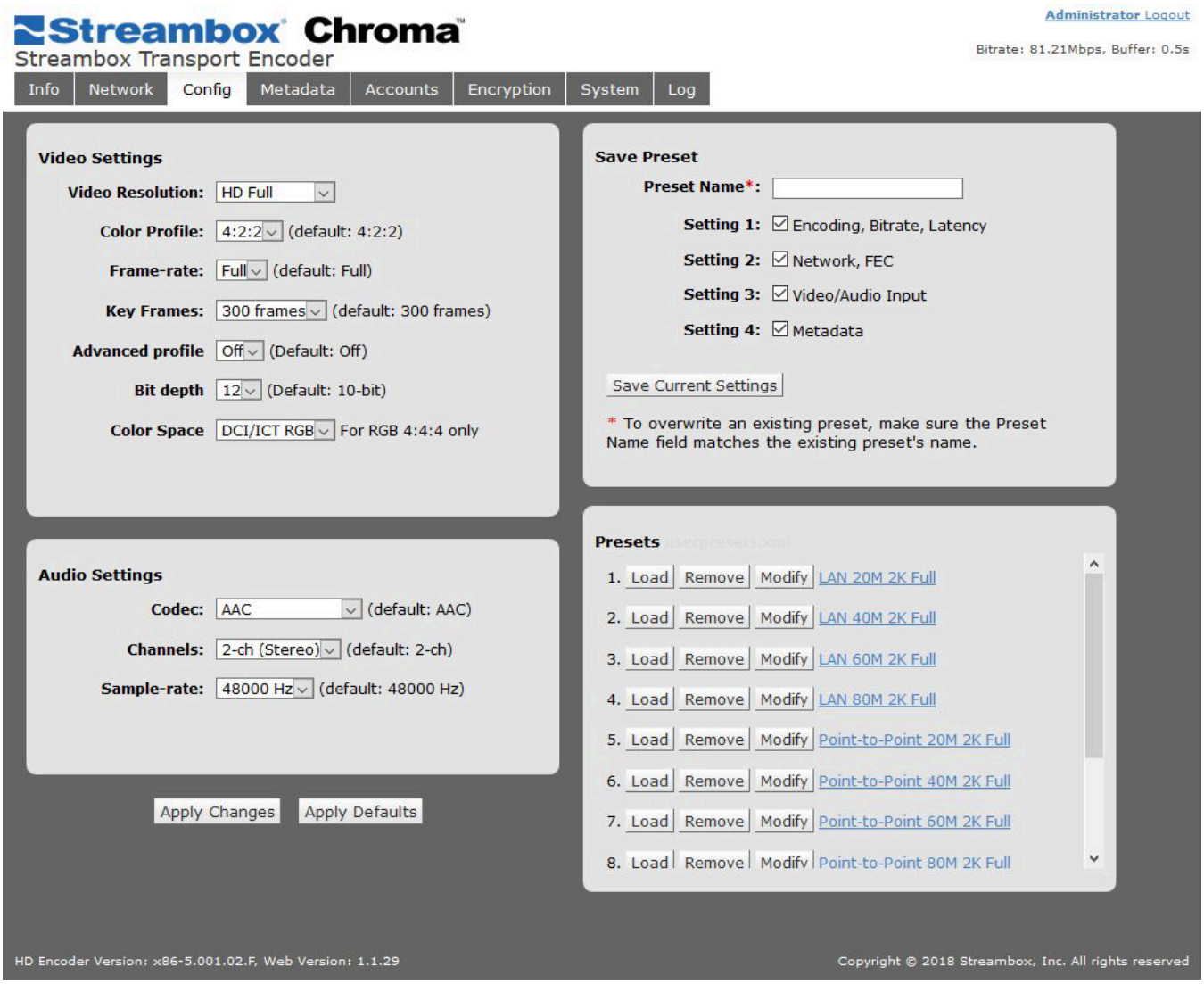


Figure 5 Encoder Web UI Config Page

Video Settings

- **Video Resolution:** Sets the capture resolution of the encoded video. The dropdown list will be commensurate with the incoming video resolution; e.g., if the incoming video is HD, then the list will include possible resolutions for HD (as opposed SD, UHD, 4K, etc.).
- **Color Profile:** The video color profile specifies the detail level at which the Streambox Encoder captures color data. This is also known as chroma subsampling.
- **Frame-rate:** The frame rate at which the ACT-L3 or ACT-L5 encodes video may be adjusted below full frame rate.
- **Key Frames:** The keyframe frequency value determines the **maximum** amount of frames to be encoded before key frame creation is forced. (Default: 1080i – 300, 720p – 240). Lower values require higher bandwidth as it will force keyframes to send more frequently.

- **Advanced Profile (AP):** This feature allows improved quality for low delay application. Instead of sending a single big i-frame/keyframe, the encoder draws the keyframe in a left-to-right pattern, producing slightly lower delay and more graceful image recovery. This is more useful for lower bitrates, below 12 Mbps.
- **Bit Depth:** The number of bits used for color in the pixels. Possible values are 8, 10, and 12. (12-bit is ACT-L5 only). For similar quality, a 10-bit setting requires an additional 25% bitrate over 8-bit, and 12-bit requires 50% more than 8-bit.
- **Color Space:** Select the color gamut for the stream.

Audio Settings

The Audio Settings allows changes to be made to the stream's audio parameters. Do not make changes to this menu during live broadcasts as it will interrupt the audio feed.

- **Codec:** Selects the audio codec to use for audio transport. The codecs and their per-channel bitrates are listed below:
    - **PCM (768Kbps):** This uncompressed audio mode offers the highest quality at a cost of the highest bandwidth.
    - **AAC (256Kbps):** The AAC audio codec is the highest quality compressed audio available.
    - **GSM (77Kbps):** The GSM audio codec delivers medium quality audio for lower bandwidth usage. Using GSM audio will allow for lower latency over the stream. This codec only supports mono audio (single channel). If the source video has 2 or more input channels, and GSM or CELP are used, the channels will be merged.
    - **AAC Low Bitrate (64Kbps)**: The AAC low bitrate audio codec delivers lower quality audio for half the bandwidth usage of the AAC setting.
    - **CELP (24Kbps):** This codec only supports mono audio (single channel).
    - **GSM Low Bitrate (20Kbps)**: The GSM low bitrate audio codec delivers lower quality audio for lower bandwidth usage. This codec only supports mono audio (single channel).
    - **CELP Low Bitrate (12Kbps)**: The CELP low bitrate audio codec delivers lower quality audio for the lowest bandwidth usage, and is best used for voice-only transmissions. This codec only supports mono audio (single channel).
- **Channels:** Selects the number of audio channels to encode. Set to 1 channel when using CELP or GSM. Select 6 channels for 5.1 Audio. The unit supports up to 8 channels by default, but it can be extended to 16 channels with an add-on feature license.
- **Sample-rate:** Selects the audio capture sample rate.

To save your settings, press '**Apply Changes**'. If you want to go back to some original settings, press '**Apply Defaults**'.

Save Preset

Presets allow the user to recall frequently used stream configuration settings quickly and easily. Presets can be helpful for engineers in configuring a unit, thus requiring less training for non-technical users.

When the desired settings for Video quality, Networkquality , and other stream qualities are set, the user can save a preset. To do so, enter a name for the preset. Select the desired settings using their corresponding checkboxes; presets can include all or some of the 4 settings listed. Click “Save Preset.”
Presets can be loaded in the section below.

Note: Presets do not save the Destination IP; that information can be saved on the network page.

5.7 Metadata

The Metadata tab is where the user can enter metadata related to their stream. This metadata is viewable via any Streambox Media Player or Decoder, or the web interface of Streambox Cloud Services or Enterprise Server.

Figure 7 Encoder Web UI Metadata Page

Streambox recommends enabling Metadata even if blank or not in use.
When streaming to Streambox Cloud, it’s recommended that the Reporter field be filled in.
Note that DRM is the same as “Group” as seen in other Streambox products. This field is necessary for use with Streambox servers, such as Streambox Cloud Services. It is changed in the System tab.

5.8 Accounts Page

This page shows user accounts for Web UI users.

Figure 8 Encoder Web UI Account Page

Use the **Add User** button to add additional users. There are 3 types of users:

- Administrator: All-access
- Operator: Can access all features and make changes, but cannot create or delete users.
- Guest: Can view all status and settings but cannot make changes.

Login Page Select the “Enable login data autocompleting” box for the Login form to auto-complete usernames based on the initial entry by a user.

5.9 Encryption Page

Figure 9 Encryption Page (disabled/enabled) Streambox Chroma offers the optional feature Stream Encryption, using 128, 192, or 256-bit AES encryption. This page allows you to start the Activation process (if you've paid for an activation key) and, following activation, enable or disable encryption. Check the box to enable encryption, and a field will appear in which to enter your Crypto-Key. This key is not given by Streambox, but rather is the shared-secret phrase that sender and receiver must use. We recommend that you use both letters and numbers in your crypto-key.

5.10 System Page

The system page allows system functions to be performed on the unit and it displays the serial number, version and firmware. Here you can also switch between ACT-L3 and ACT-L5 codecs.

Figure 10 System Page

Codec: The current codec is highlighted green, and also indicated by the Version number, which will begin with a 3 for ACT-L3, and version 5 for ACT-L5. Encoder and decoder must match codecs in order for a successful stream.

Stop Encoder: Stop the video stream

Restart Encoder: restarts the Encoder software application; it takes only a fraction of a second but will interrupt a stream.

Switch to Decoder: Stop the Encoder software and switch to Decoder mode.

Advanced Mode: Open the Legacy web UI which has additional settings and diagnostics

Features: Open the Features page to view current activations or add additional features.

DRM: Digital rights management (DRM) is the account designation assigned by Streambox. It is also called Group or Network 1 in other Streambox products. This metadata field is necessary for streaming to Streambox Cloud or Streambox Enterprise Server. When using the Sessions feature of Streambox Cloud, you enter the Session code, starting with $, here. Click the "Apply DRM" button to save changes.

5.11 Features Page

Figure 11 Features Page

The Features tab appears on the Navbar when opened from the System tab. It displays which features are enabled on the Chroma, and can also indicate expiration dates for features that have a time limit.

System Info This section displays some hardware specifications of the Chroma, including Serial Number, CPU specs, memory, and info about the video card.

Activation

This section displays the **Hardware ID** of the Chroma, which will be needed by Streambox Support to create activation codes to enable optional add-on features. **Activated Package** identifies the core functionality that has been enabled on the machine. **Enter an Activation Code** has an entry field for entering the 9+ digit codes generated by Streambox to add features or feature expiration dates.
Below those items is a key for understanding the features chart

Features

This chart lists the available features for the hardware, and indicates which ones are activated. Consult the key in the Activation section of this same page. Not all Chroma hardware can support all listed features.

5.12 Log Page

The log page is where the user can preview and download the Decoder application log. This tool is used to assist in troubleshooting possible issues.
Figure 12 Log Page
REFRESH: Update the current display manually with the most recent lines of the log **SCROLL TO END:** Jump to the end of the log stored in the browser buffer **AUTO UPDATE:** Enable the Web UI to automatically refresh your view of the log
The following should only be done if requested by Streambox Support: **DOWNLOAD LOG FILE:** Download the most recent log file **DOWNLOAD LOG SNIP:** Download a previous, snipped-and-compressed log file.

6 Decoder Web Administration

The Streambox Decoder is also equipped with a web management feature. This allows easy control from any computer with network access to the unit. The web interface allows dynamic updates of the web interface so that information is updated without having to refresh the page. The web interface can be accessed by connecting to the IP address of the Streambox ACT-L5 Decoder using a web browser.

6.1 Login Page

When first connecting to the web interface of the Streambox ACT-L5 Encoder or Decoder you are prompted for the Username and Password. This username and password is specific to the web interface and is not shared by the console. The password is case-sensitive. The default credentials are:
Username: **administrator** Password: **demo**

Figure 13 Decoder Web UI Login Page

6.2 Title Bar

The title bar contains the Streambox logo, product information, and important information about the Streambox stream.

Figure 14 Decoder Web UI Title/Status Bar

6.3 Info Page

Figure 15 Decoder Web UI Info Page

Statistics

The statistics section shows information about the incoming ACT-L5 stream. If there is no incoming ACT- L3/L5 stream, the statistics will show zero or “N/A”.
Bitrate: the current data rate of the incoming ACT-L5 stream as viewed by the Decoder. This value may be slightly different from the bitrate that is set on the ACT-L5 Encoder that is sending the stream.
Buffer: the current size of the Decoder’s receive buffer. This value will vary based on the bitrate, VBR buffer size, and jitter used.
Lost Frames: the total number of frames that have been lost due to packet loss.
Recovered Packets: the number of packets that have been recovered using forward error correction.

Metadata

Metadata can be used to further identify an incoming stream. Metadata is entered on the Encoder software under the Metadata menu and is transferred to the Decoder inside the ACT-L5 Stream.

Title (formerly Slug): a name given to the video stream **Location:** the location from where the live video feed is sent (or any descriptive text entered by the user) **Connectivity:** the type of connection used to transport the ACT-L5 Stream **Reporter:** the name of the user operating the Streambox ACT-L5 Encoder (or any descriptive text entered by the user) **Producer**: the name of the producer (or any descriptive text entered by the user)
GPS Latitude: the latitude of the Streambox ACT-L5 Encoder (supported by some mobile Streambox units) **GPS Longitude:** the longitude of the Streambox ACT-L5 Encoder (supported by some mobile Streambox units)

Decoder Info

The Decoder info section displays specific information about the Decoder software and the decoded ACT- L3/L5 stream overall.
Video: the captured resolution of the ACT-L5 stream currently being received by the Decoder.
Decoder IP: the current local IP address of the Decoder
Frame Rate: the current video standard of the Decoder video output. This video standard will change to NTSC (59.97) or PAL (50), or 720p (23.98) based on the format of the ACT-L5 stream it receives.
Color Profile: the color profile to be captured by the ACT-L5 Encoder
FEC: the forward error correction used on the incoming ACT-L5 stream
Shuffle: the forward error correction shuffle setting on the incoming ACT-L5 stream
Latency: the current latency of the incoming ACT-L5 stream
Audio: the audio codec and channel setting of the incoming ACT-L5 stream
Jitter: the jitter setting set on the Decoder
Jitter2: the secondary jitter setting on the Decoder
Port: The UDP port number on which the ACT-L5 stream is received
Field Order: Applying to interlaced video, this field indicates the first field that's being processed: UP for Upper First (odd-numbered lines), for example.
Codec: The codec of the incoming video, ACT-L3 or ACT-L5
Dolby Vision: Indicates whether Dolby Vision audio metadata is being received in the stream.
Preview: The preview window displays a low-framerate representation of the incoming video stream. With these buttons, you can select the frequency with which the picture will be updated. *Spot* will load a single frame about every 30 seconds, while *Low*, *Med,* and *High* will load frames at different speeds, respectively; it will not be a real time picture, however, and if bandwidth limitations affect the preview, it will load fewer frames. Furthermore, this compressed image will not have the full quality of the stream being sent.

Annotation: The Annotation feature allows users to draw on an overlay of the current image in order to indicate areas and directions to other viewers of the Annotations who are also viewing the Decoder Preview. Click Annotate to pop up the Annotation window. In the example below, a tablet user was able to draw and write on a frame of the video.

The Annotation window allows the user to change the view between SD or HD (which are the available quality settings for the picture, even if the video has higher resolution), and set the expected framerate. Like the regular preview, the Decoder will do its best to meet that demand. The user can also save the image or set the drawings to appear on the Decoder's video stream output.

Clear: Clears all annotation
SD / HD: Sets the resolution of the video image in the Annotation screen.
FPS: Sets the intended Frames Per Second rate of the video.
Save: Save the image locally
List: See a list of saved images, and download to the local machine using this button.
Burn-In: When enabled, the annotation drawings will be visible on the decoder's SDI/HDMI video output in addition to being seen in the browser.

Interface Info

The Interface Info section shows statistics about the individual network adapters used by the Decoder including its IP address.

6.4 Network Page

The network page allows access to the network settings on the Streambox ACT-L5 Decoder. Network settings affect how the Decoder handles the network data stream.

Figure 17 Decoder Web UI Network Page

Network Settings

IP Mode: selects the IP mode in which the Decoder interface is set to listen. Options are "IP" and "IP Multicast".
IP mode sets the Decoder to receive a Unicast ACT-L5 stream. (default) IP Multicast mode sets the Decoder to receive a multicast ACT-L5 stream.[3] (rare)

[3] The use of IP Multicast can be useful where a stream needs to be shared within a closed network; e.g., multiroom lectures or sermons. The Multicast mode must be used within a single network. A Streambox Encoder must be set up for multicasting with matching settings; IP and Port. The IP address must be in the range reserved for multicast use: 224.0.0.1 to 239.255.255.255. The Streambox Decoder/Media Players must also be set to connect to that multicast IP.

Auto Jitter: When enabled, Auto-Jitter will spend a period of time defined by the Timeout (in seconds), increasing the Jitter settings as needed by the connection. During the Auto-Jitter period, an on-screen overlay will appear, indicating the time remaining and the metadata. This overlay indicates that the stream is still adjusting its jitter settings, which results in skips during the stream.
NOTE: Auto-Jitter feature should only be used for non-LDMP wireless streams.
Jitter: sets the number of packets to use in the primary jitter buffer. The primary jitter buffer on the receiver (Decoder) is used to compensate for packets received out-of-order due to network congestion
Jitter 2: sets the number of packets to use in the secondary jitter buffer. The secondary jitter buffer is used to buffer packets that arrive out of time sequence, or packets arriving in bursts.
Port: sets the IP port that the Decoder will listen for the incoming ACT-L5 stream

Pull Stream

This section allows users of Streambox Cloud and Streambox Enterprise Server to pull streams from those servers by matching the metadata of the stream being sent to the Server. This requires credentials for the server and knowledge of the metadata, or else a Session ID.
IPv4: Set the IP (version 4) address of the Server from which the stream is to be pulled.
Port: Network port, usually 1770, to which the stream will connect.
Login & **Password:** Credentials to log in to the Server.
Group/DRM: The Group (also called DRM) found in the metadata of the stream being pulled from the Server.
Reporter: Should match the Reporter or Contributor metadata of the stream. Once data has been entered, use a button to start pulling the stream:
Exec Pull-Mode Executes the pull mode and requests a specific stream, based on Reporter name and DRM, from the server. When Pull Mode is enabled, it's indicated in the status bar, upper right.
Set to Normal Mode: returns the unit to its normal Listen mode, where it awaits an incoming stream.

Port Selector

The Decoder is set to listen for its ACT-L5 network stream on UDP port 1770. However if the Encoder and network is set up for transport on another UDP port, the Decoder must be set to listen for the stream on that port.
The port settings page allows the user to change the port on which the Decoder listens. To change the port, click **Edit**, then enter an alternate port number. Click **Set** to enable the changes.

6.5 Output Page

General Settings

Audio Channels: Sets the number of audio channels to output.

- 6 Channels mode should be used for 1, 2, 4, or 6 audio channels.
- 8 Channels mode should be used for 8 audio channels

Standby Video: sets the Decoder to display the standby video image (“colorbars image”) when the Decoder receives no incoming data. The default value is “ON”, If this setting is off, the screen will show a freeze-frame of the last video frame processed.

Standby Delay: This is the amount of time in seconds that the Decoder will display a freeze-frame of the last video frame processed before switching to the Standby Video image, if enabled. This delay allows time for the Encoder to resume the stream without interrupting the video with the standby image.

Latency Control: sets the Decoder to control decoding latency. The default, and recommended, value is “ON”

Show Audio: sets the Decoder to overlay audio meters on the output video signal. The default value is “OFF”.

Show Timer: sets the Decoder to overlay decode timing and display data on the output video signal. The default value is “OFF”.

Video Settings

SDI Output: selects the output configuration; depending on hardware, Chroma supports 3G, 6G, and 12G SDI connections. Depending on the video resolution, up to a single 12G connection, 2x 6G connections, or 4x 3G connections may be utilized to channel the output to the output monitor.

SDI Bit Depth: Sets the Bit Depth (8-bit, 10-bit, or 12-bit) of the color of the output.

Force RGB Output: Enable this to force the output to RGB even if the incoming stream was sent with a different color gamut.

Output HDR metadata over HDMI: Enables the HDR Metadata over HDMI

Genlock Settings

Genlock: Enable two modes of genlock, Reference or Input 1, or disable genlock with the Free Run setting.

Dolby Settings

DolbyVision Output: Enables DolbyVision metadata in Tunneling or CMU modes.

6.6 Accounts Page

This page shows user accounts for Web UI users.

User Accounts

Use the **Add User** button to add additional users. There are 3 types of users:

- Administrator: All-access. Next to each user, there are buttons to Edit or Delete users.
- Operator: Can access all features and make changes, but cannot create or delete users.

Operators can edit their own accounts to change their passwords.

- Guest: Can view all status and settings but cannot make changes.

Security

Enable login data autocompleting: Check the box for the Login form to auto-complete usernames based on the initial entry by the user.

Require password change after 30 days: Check the box to require monthly password changes. Applies to all users, unless the below box is checked as well.

Expire non-admin password after 90 days: Check the box to require quarterly password changes on non- admin users.

6.7 Encryption Page

Figure 20 Web UI Encryption Page Streambox Chroma offers the optional feature Stream Encryption, using 128, 192, or 256-bit AES encryption.

This page allows you to start the Activation process (if you've paid for an activation key) and, following activation, enter a Decryption Key. This key is not given by Streambox, but rather is the shared-secret phrase that sender and receiver must use. Use letters and numbers.

If Decryption is successful, the status line in the upper right will indicate that success with **ENCRYPTED**:

Figure 21 Decoder Web UI Encryption Success

If the stream is Encrypted, but the Decryption Key entered by the decoder user is not a match, the status line will report **Bad Decryption Key**:

Figure 22 Decoder Web UI Encryption Failure

NOTE: If the Encoder stream is not encrypted, there is no need to clear out the Decryption Key.

6.8 System Page

The system page allows system functions to be performed on the unit and it displays the serial number, version and firmware. Here you can also switch between ACT-L3 and ACT-L5 codecs.
Codec: The current codec is highlighted green, and also indicated by the Version number, which will begin with a 3 for ACT-L3, and 5 for ACT-L5. Encoder and decoder must match codecs in order for a successful stream.
Restart Decoder: restarts the Decoder software application; it takes only a fraction of a second but will interrupt a stream.
Switch to Encoder: Stop the Decoder software and switch modes to Encoder mode.
Advanced Mode: Open the Legacy web UI which has additional settings and diagnostics
Features: Open the Features page to view current activations or add additional features.

6.09 Log

The log page is where the user can preview and download the Decoder application log. This tool is used to assist in troubleshooting possible issues.
Refresh: Update the current display manually with the most recent lines of the log
Scroll to End: Jump to the end of the log stored in the browser buffer
Auto Enable: Enable the Web UI to automatically refresh your view of the log
The following should only be done if requested by Streambox Support:
Download Log File: Download the most recent log file
Download Log Snip: Download a previous, snipped-and-compressed log file selected from an alphabetical list that pops up.

7 Advanced Settings

The Advanced Mode button can be found in the System tab of both the Encoder or Decoder web UI. Advanced Mode is a legacy user interface that contains a number of items that are useful to Chroma users. In general, it should only be accessed during system setup, such as to change the IP address, during troubleshooting, or when directed to by Support.
The below URLs, starting with /avenir/ should be appended the IP address or hostname of the Chroma. For example: **/avenir/settings.php** should be understood to mean http://10.9.8.7/avenir/settings.php (using sample IP address 10.9.8.7).

7.1 Set IP address

Navigate to the Network Settings by selecting the **Network button on the Home page -> LAN1 [or LAN2]** or directly by appending the following URL's to the base IP address (see example above) **/avenir/settings_network.php /avenir/settings_lan1.php /avenir/settings_lan2.php**
Here, you can set a static IP address, subnet mask, and default gateway, or switch Chroma to DHCP mode.

7.2 Live Stream Status Display (Encoder Mode only)

Navigate to the Stream Status by selecting the **Streaming link in the upper right** or directly by appending the following URL to the base IP address (see example above) **/avenir/stream.php**

The network and video signal settings are displayed on the screen for your reference. Each network adapter in use will have a status line displayed on the Streaming screen.
Network adapter identifier, according to the Linux system of identifying network adaptors; **eth** for Ethernet (LAN), **WLAN** for Wi-Fi, and **PPP** for a USB WWAN adapter. Following that is the Encoder IP address, the bitrate currently being transmitted, and the number of bytes sent so far. Next is the CWND, the current Congestion Window for this adapter, the status of the adapter (Online when the adapter is in use, Offline if the adapter is not responding or the latency is too high) and finally RTT, the measured round-trip time or latency of the connection.

After the individual network adapter properties, the overall status of the stream is displayed. The first item is the transmission bitrate setting in kilobits per second (Kbps). Bitrate is the main factor for quality of the transmission, higher being better. Following that is the Encoder Buffer, which elsewhere may be referred to as Encoder Latency or VBR, and is measured in seconds (s). This represents the built-in delay added by the Encoder software to improve the compression of the ACT-L3 video before sending the video frames.
"Dropped" indicates dropped Encoder frames; it should remain zero or fixed after stream startup in most cases. If this number starts climbing, then the video-encoding software could be malfunctioning. If the Prefer Quality Over Framerate feature is being used, this may be increasing due to low-quality frames being dropped.

NOTE: Sometimes a few frames are dropped at the start of a video capture, but as long as the number is not increasing, there is nothing to be concerned about.

Following dropped frames is the Decoder IP, which is the address at which the Streambox Decoder or Streambox Media Player is receiving the live stream. The second status line contains some technical diagnostic information, including a summary of Encoder switch settings, a summary of LDMP settings, and ending with a measurement of latency from Encoder to Decoder, measured in milliseconds.
In the center of the screen you have a timer measuring the duration of your live stream, and a large button to stop the stream.
In the upper left corner of the screen, next to the Network adapter, is the instantaneous bitrate of the live stream. This number should be near the intended bitrate, but it may fluctuate.

7.3 Reboot and Shutdown

Navigate to System Settings by selecting **Settings -> System** or directly by appending the following URL's to the base IP address (see example above) **/avenir/settings_system.php** A user can command a software reboot or a hardware shutdown from this page. Select **Reboot Avenir** to start the reboot. **/avenir/settings_system2.php** To Power off, select **Settings -> System -> Others** Select **Power Off** to shut down the Chroma hardware. You will be prompted for confirmation.

7.4 Toggle Remote Configuration

Navigate to System Settings by selecting **Settings -> System -> Remote Config** **/avenir/settings_ra.php** or directly by appending the following URL's to the base IP address (see example above) By default, this remote connection (via SSH) allows the Chroma to use an available network connection to connect to the Streambox Remote Configuration Server. This enables both the online remote control page at **http://avenir.streambox.com/remote** to permit users to log in to their Chromas, but also allows Streambox Support to remotely configure, update, and troubleshoot the Chroma unit, as needed.
Auto Reconnect commands the Chroma unit to always attempt to connect. If disabled, the unit will require a manual press of the
Connect button to connect to the server.
Roundrobin commands the Chroma unit to try a different available network connection if disconnected from one.
By default, both Auto Reconnect and Roundrobin are enabled, but may be disabled for greater security.

7.5 Software Update

Navigate to System Settings by selecting **Settings -> System -> Update Software** or directly by appending the following URL's to the base IP address (see example above)
/avenir/settings_update.php This screen allows the internet-connected user to download new firmware releases from a remote server, and read the release notes.
The latest free public release is 1.2.2.Public at time of writing. Additional releases, Chroma.2023 and Chroma.2024 are manual updates and require a support contract.

7.6 Toggle Stream on Boot

Navigate to System Settings by selecting **Settings -> System -> Others -> Strm on boot** or directly by appending the following URL's to the base IP address (see example above)
/avenir/settings_encautostart.php This setting allows the user to enable or disable the option to have Chroma start streaming automatically when booting up. Enable this if the unit is used in a permanent or unattended backhaul workflow. Disable this if the Chroma is streaming to the Cloud, or used only for discrete streams.

7.7 Quad / Duo Input/Output Mode (Chroma 4K Only)

Navigate to System Settings by selecting **Settings -> System -> Others -> SDI OUT** or directly by appending the following URL's to the base IP address (see example above)
/avenir/settings_sdiout.php This setting applies only to 4K Chromas with the 8K Pro hardware installed (see the Features page in the Encoder or Decoder UI to view hardware specs)
Set **Quad Mode** to allow 4x 3G-SDI Input or Output. Also known as Half Duplex Mode.
Set **Duo Mode** to use 2x 6G-SDI or single 12G Input with simultaneous 2x 6G-SDI Output or single 12G, for monitoring. Also known as Full Duplex Mode. Set Single (for 12G) or Dual (for 2x 6G) mode in the Encoder/Decoder Config

7.8 WebUI Password

Navigate to System Settings by selecting **Settings -> System -> Others -> webUI pwd** or directly by appending the following URL's to the base IP address (see example above)
/avenir/settings_webuipwd.php
With the Firmware Update v1.1.1, this setting will allow the admin user to enable and set a password on the Advanced Web UI.

7.9 Dolby Audio Settings

Navigate to System Settings by selecting **Settings -> System -> Others -> DOLBY** or directly by appending the following URL's to the base IP address (see example above) **/avenir/settings_dolby.php** Enable and set up Dolby Audio Settings (not supported on all hardware)

7.10 Set Metadata

Navigate to **Metadata** or directly by appending the following URL's to the base IP address (see example above) **/avenir/settings_metadata.php** Set the metadata, all in one place. It should not be necessary to use this page since all settings are accessible in the Encoder web UI.

7.11 About

Navigate to **About** from the Home page or directly by appending the following URL's to the base IP address (see example above) **/avenir/systeminfo.php** This screen shows the versions of some internal packages. Information on this screen may be requested by Support.

8 First Time Set up

Initial Connections

Connect to LAN (Internet) connection

Chroma is equipped with 2 Gigabit Ethernet ports. Net1 (left port, when facing the back) is set to use DHCP; Net2 (right port) is pre-configured as a static IP: 10.0.4.10/24. A Decoder-only Chroma model is configured as 10.0.4.11/24

Power

Plug into the AC outlet; Chroma supports VAC 110-240, and draws up to 160W.

Video Monitor Connections

For a Chroma in Encoder mode: connect video source to center SDI connector (#2, or #3 for 4K model)
Decoder mode: connect output monitor to right SDI connector (#3, or #5 for 4K model)

Consult Appendix for the full pinout of your Chroma model.

Terminal Access

You may optionally connect a USB Keyboard, Mouse, and an HDMI Monitor to access and control the Chroma directly. Most operation of the Chroma can be done from a web browser, but this minimal access may be useful for setup.
If prompted for a login, enter username: **sb** and password: **streambox**
Once logged in, open a web browser (Chromium Browser is available) and open **http://localhost**

Determine the assigned IP Address

Us the front LCD Menus to locate the IP address.

Logging in to the Web Interface

Using a web browser, either in the Chroma's terminal, or on a different workstation or mobile device that can connect to the Chroma over the local network, connect to the IP address of the Chroma.
Example: **http://10.0.4.10**

Streambox Chroma has a web interface for each mode supported by the Chroma Encoder and Decoder. When you first connect to the web interface, the mode in operation on the machine you're accessing will be highlighted in blue, while the other will show as offline. Click the blue icon next to the active mode, and log in: Username: **administrator** Password: **demo**

Select Mode and Codec

Start your setup with the System Tab. This tab is where you can select whether you'll be sending or receiving a stream, by selecting "Switch to Encoder" or "Switch to Decoder" if the unit is not yet in your desired mode. Furthermore, you can select whether that stream should be ACT-L3 or ACT-L5:

- ACT-L3 supports 4:2:0 and 4:2:2 chroma subsampling, 8-bit and dithered 10-bit color depth, and Rec.709 color space.
- ACT-L5 (recommended) additionally supports 4:4:4 chroma subsampling, 12-bit depth, and additional color spaces.

Whichever you select must also be selected on the other Streambox units involved in the stream. Streambox Servers, such as Enterprise and Cloud Servers, support both codecs, but Encoder and Decoder must be set to use the same codec.
In the picture to the right, the Chroma is set in Encoder mode (as shown by the title bar, and indicated by the buttons), and in ACT-L5 mode. The software version number also indicates ACT-L5 by virtue of the fact that it starts with a 5.

Setting the IP address

There are 2 ways to set the IP address on Chroma: Using the Front Control Panel (FCP) or using the Advanced Web Interface. The latter requires web access, either through the terminal or another computer.

Using Advanced Web UI: This will work for you if you can get the unit online with a temporarily-assigned IP address, such as an APIPA address (generated without DHCP – always starts with 169.254) or using a DHCP address (requested from a DHCP server). Not sure of the IP address? Check the previous section to find the IP.

1. Open web browser to http://[IP Address]/avenir
2. Go to Network.
3. Click on LAN1 (or LAN2 for the other connection) next to “Configuration.”
4. Set the IP, Subnet Mask, and Default Gateway.
5. Click Apply. You may lose your connection to the Streambox because you’ve changed the IP address.

Using LCD FCP: Use the arrow keys to navigate through the menu, starting with the down arrow key which opens the menus.

Find the IP Address:

1. Go to NETWORK and hit Enter.
2. Go to NET ADAPTERS and hit Enter.
3. Select Net Adapter 1 for the leftmost network connection, or Net Adapter 2 for the rightmost
4. connection, and hit Enter. It should display “MODE”
5. Press the Down button once, and the unit will now display the IP address.
    a. If it has an address that’s not 127.0.0.1 (meaning the localhost, and so the unit doesn’t have an IP assigned), then you may be able to move on to using the web method below. Addresses starting with 169.254 are self-generated random addresses, and you can use another computer with a similar address to connect via web to the Streambox.

Set the IP Address:

1. Follow the 4 steps above to get to the displayed IP address.
2. Press Enter to begin editing the IP. Use the up and down arrow keys to set the number, including any leading zeros. Note that the interface will not allow, even temporarily, for you to make a number which is higher than 255 for each of the 4 numbers (octets) separated by periods.
3. To save the address, press enter all the way through the number; the address saves when you push enter on the final digit.

4. Press the Down arrow after saving the IP to get to the Subnet Mask, labelled MSK. Edit this in the same fashion. Again, you cannot make it display a number greater than 255 in each octet.
5. After saving the MSK value, press the Down arrow again to set the Default Gateway, which is the address the Streambox will use to reach outside the network. Edit and Save this value as above.
6. Press Down again, and you should see either SET STATIC or CHANGE STATIC, depending on whether there's already a static value saved. Click Enter on this to save all of your changes to the static settings.

The job is complete. Following this process, the software will restart itself, which forces the software to acknowledge the new IP settings.

Sending Live Streams (Point-to-Point) (1770/UDP) Streambox Encoders and Decoders can send live streams over private or public IP networks. The Decoder's IP address is fed into the Encoder's settings so it knows where to send the stream; the Decoder's replies and acknowledgements are sent back to the Encoder (LDMP protocol). If one-way connection is required, UDP only mode is supported with decreased functionality, such as adaptive bitrate or dynamic packet loss recovery. FEC is supported in UDP and LDMP network modes, but often unnecessary in LDMP mode.

Local Network Streaming When streaming over a local network, we recommend that both Encoder and Decoder have static or DHCP reserved addresses. It's more critical that the Decoder have a fixed address, and of course both machines must either be in the same subnet, or be visible to the other unit's subnet.

Streaming over the Internet When streaming over the public Internet, Encoders and Decoders are not required to have their own Public IP addresses. They should still have static internal IP addresses, however, and it will be necessary during the stream setup to know the external IP address of the Decoder's network.

A Firewall at any receiving location (Decoder/Enterprise Server/Media Player) should be set with a port forward (a.k.a. port filter) so that all traffic received from the internet that's been sent to port 1770 UDP must be forwarded to the private IP of the Decoder. This setting must allow both incoming and outgoing traffic. Alternatively, Network Address Translation (NAT) may be used so that a Decoder may reliably be contacted through a public IP address.

***For example**:* A Decoder has a static private IP address of 192.168.10.10. In the firewall settings, the user (or IT person) must set port-forwarding in the firewall so all UDP packets sent from Any address on the internet to Port 1770 on the firewall will be forwarded to 192.168.10.10 on port 1770. In this example IT person can also restrict source address for security reasons. Source port number can be restricted if Encoder is not behind a firewall.

Sending Live Streams via Streambox Cloud or Enterprise Server (1770/UDP and others)

Whether you're using Streambox Cloud, our online stream-management platform, or Streambox Enterprise Server, you set the Server IP address as the Target Receiver (aka Target Decoder) in the Encoder's settings. Both types of servers require that the Encoder metadata is enabled and configured for use; particularly the "Group" (also called "DRM") code must match the Group of whichever users are accessing the server.

Streambox Cloud Server IP Addresses

Name	Public IP Address	Session Initial	Location
Live**US**.streambox.com	52.25.129.48	$A	USA (Oregon)
Live**USEast**.streambox.co	54.83.19.155	$B	USA (Northern Virginia)
Live**Post**.streambox.com	52.8.239.106	$P	USA (California)
Live**DE**.streambox.com	54.93.179.19	$E	Europe (Frankfurt)
Live**EU**.streambox.com	54.247.100.52	$F	Europe (Ireland)
Live**JP**.streambox.com	52.69.71.156	$G	Asia Pacific (Tokyo)

Streambox Cloud is multi-tenant service; each Decoder setting for the Cloud can be configured for specific "destination" port number, with default port UDP 1770 . Streambox Cloud will use random source port number when routing stream to remote Decoder, so *the firewall rule should not restrict traffic based on source port number, but can restrict traffic based on destination port number and Source IP.*

Network Ports

Video streams -- from Encoder to Decoder/Media Player: Port: UDP 1770 Direction: Inbound and outbound for LDMP, inbound for UDP only ***Required for live streams***
HTTP -- For the server web interface. *Files* played/streams to Decoders/Media Players are also transferred through this port.
Port: **TCP 80**
Direction: **Inbound and outbound** ***Required for local web control of rackmounts***
Authentication -- Web user authentication. Port: TCP 80 and 443 Direction: inbound. ***TCP 443 is required for HTTPS authentication***
Remote Connections - Used for remote updates and remote configuration via SSH (Avenir, HD/2K/4K Rackmounts) Port: TCP 22 (SSH), 80, 443 Direction: Inbound and outbound SSH Connections go to and come from this IP addresses: 184.106.189.99 *Optional*

Customizing the Standby Video Image The standby image can be customized using basic graphics editing software.
Create a 24-bit BMP file with 1920x1080 pixels resolution, for your Standby video image. This image will be scaled as needed to other resolutions.
Name the file as “” for HD. All 3 of those resolutions, plus their fractional resolutions, will show a version of this splash screen.
Save the files and transfer them to the /Streambox folder and contact Streambox Support to assist you with uploading the files to their appropriate location.

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