

USER MANUAL

VS-2002-ENC, VS-2004-ENC

H.264 HDMI OVER IP ENCODERS

24/7 TECHNICAL SUPPORT AT 1.877.877.2269 OR VISIT BLACKBOX.COM



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SAFETY INSTRUCTIONS

INSTRUCTIONS PERTAINING TO A RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS

Important Safety Instructions. Save these instructions.

WARNING: When using electronic products, basic precautions should always be followed, including:

- ◆ Keep these instructions.
- ◆ Heed all warnings.
- ◆ Follow all instructions.
- ◆ Do not use this apparatus near water.
- ◆ Clean only with a dry cloth.
- ◆ Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
- ◆ Do not install or place this product near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- ◆ Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- ◆ The power cord must be accessible to allow for the removal of the power from the unit.
- ◆ Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- ◆ Unplug this apparatus during lightning storms or when unused for long periods of time.
- ◆ Only use attachments/accessories specified by the manufacturer.
- ◆ Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as if the power supply cord or plug is damaged, liquid has been spilled on or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

WARNING: To reduce the risk of fire or electric shock, do not place this apparatus in a position where it is exposed to dripping or splashing liquids, rain, moisture, or excessively high humidity. Do not place objects containing liquid near the unit because they might spill onto the apparatus.



CHAPTER 1: SPECIFICATIONS

TABLE 1-1. H.264 HDMI OVER IP ENCODERS SPECIFICATIONS

SPECIFICATION	DESCRIPTION
Video Input	2 or 4 x HDMI Type A, 19-pin, female
Input Signal	0.5 to 1.2 Vp-p
Input DDC Signal	5 Vp-p (TTL)
Video Output	(1) LAN (PoE), 10/100/1000BASE-T
Output Type	H.264/MPEG-4 AVC, HLS (Low/High data rate)
Video Encoding Bit Rate	1 Mbps to 10 Mbps (configurable)
Input/Output Resolutions	720 x 480i/p at 60 Hz, 1280 x 720i/p at 60 Hz, 1920 x 1080i/p at 60 Hz, 720 x 576i/p at 50 Hz, 1920 x 1080i/p at 50 Hz, 1280 x 720p at 30 Hz, 1920 x 1080p at 25 Hz, 1920 x 1080p at 24 Hz
Audio Input	(2) or (4) HDMI Type A, 19-pin, female, (4) 3.5-mm mini-jack (analog audio)
Audio Sampling Rate	48 kHz
Audio Input	(2) or (4) HDMI Type A, 19-pin, female, (4) 3.5-mm mini-jack (analog audio)
Audio Compression Format	AC3, MP2, AAC
Operating Temperature	+32° F to +113° F (0° C to +45° C)
Operating Humidity	10 to 90% (non-condensing)
Storage Temperature	-4 °F to +140 °F (-20 °C to +70 °C)
Storage Humidity	10 to 90% (non-condensing)
Power Input	12 VDC/1 A
Power Consumption	12 W (max.)
Dimensions	4.41" H x 7.09" W x 1.34" D (11.2 x 18 x 3.4 cm)

The table below details the maximum transmission distance between either directly connected encoder/decoder units or between the encoder/decoder and a network switch.

TABLE 1-2. MAXIMUM TRANSMISSION DISTANCE

CABLE	DISTANCE
Category 5	330 ft. (100 m)
Category 5e	330 ft. (100 m)
Category 6 UTP	330 ft. (100 m)
Category 6 STP	330 ft. (100 m)
Category 6A UTP	330 ft. (100 m)
Category 7	330 ft. (100 m)

CHAPTER 2: OVERVIEW

2.1 INTRODUCTION

The VS-2002-ENC or VS-2004-ENC is a 2- or 4-port live streaming media encoder that interfaces with HDMI signals for delivering media over IP networks. The VS-2002-ENC or VS-2004-ENC can be used with the VS-2001-DEC Decoder to deliver an A/V signal over a LAN or WAN.

The Encoder also works with a third-party decoder such as a set-top box, VLC, or Kodi media player on PCs to provide complete end-to-end streaming systems. It features two or four HDMI inputs and one Ethernet output for simplified integration into AV systems.

2.2 FEATURES

- ◆ Has two or four standard HDMI 1.4 inputs.
- ◆ Supports resolutions from common Standard Definition, through all resolutions including 1080p60, up to and including 1920 x 1200 at 60 Hz.
- ◆ Uses standards-based high-profile H.264/MPEG-4 AVC video compression in real time.
- ◆ Features adjustable video bandwidth targets from 1 Mbps through 10 Mbps.
- ◆ Offers assignable Program Number and Channel Name inserted in an encoded stream.
- ◆ Output resolution can track input resolution, or be fixed at a static size.
- ◆ Supports audio input as a component of HDMI input.
- ◆ Operates at LPCM, AC3, MPEG1 Layer 2.
- ◆ Supports analog audio and/or composite video for closed captions. CC requires use of a compatible composite cable.
- ◆ Output has one standard 10/100/1000BASE-T Ethernet port.
- ◆ Common communications protocols/methods supported include TCP/IP, ARP, DHCP, ICMP (ping), IGMP, HTTP, RTP, UDP, RTMP, and HLS.
- ◆ Output stream can be set to RTP, UDP, using either unicast or multicast addressing; or to RTMP or HLS unicast.
- ◆ Supports up to four simultaneous HLS sessions per video input.
- ◆ UDP/RTP video stream can be decoded by any number of Ethernet attached receiving devices, including PC/Mac, VLC, IP set-top box, IPSTB-enabled television, or custom appliance.
- ◆ Outputs audio in MP2, AC3 or AAC format.
- ◆ Manage the unit via a User Interface Web GUI browser.
- ◆ Supports Power-over-Ethernet (PoE), allowing for VS-2002-ENC or VS-2004-ENC to be powered by an appropriate switch or power injector.
- ◆ Upgrade the software through the User Interface web management application.



CHAPTER 2: OVERVIEW

2.3 WHAT'S INCLUDED

Your package should include the following items. If anything is missing or damaged, contact Black Box Technical Support at 877-877-2269 or info@blackbox.com.

- ◆ (1) 2- or 4-Port H.264 HDMI over IP Encoder (VS-2002-ENC or VS-2004-ENC)
- ◆ (1) 12-VDC power adapter

2.4 HARDWARE DESCRIPTION

2.4.1 FRONT PANEL

Figure 2-1 shows the front panel of the encoder. Table 2-1 describes its components.

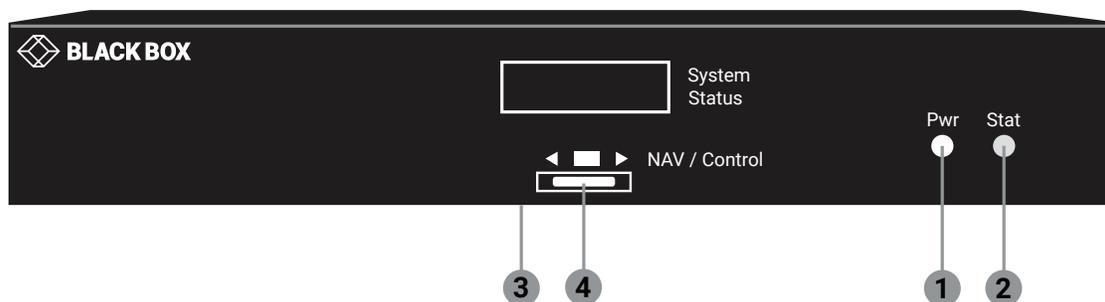


FIGURE 2-1. ENCODER FRONT PANEL

TABLE 2-1. FRONT-PANEL COMPONENTS

NUMBER IN FIGURE 2-1	COMPONENT	DESCRIPTION
1	Power LED	This LED indicator glows bright blue when the encoder is powered.
2	Status LED	The LED glows bright blue when the system boot process is complete and the encoder unit is functioning normally.
3	LED Panel	This LED panel shows IP address for config and management.
4	NAV/Control	This button/wheel is used to select different RESET options.

CHAPTER 2: OVERVIEW

2.4.2 BACK PANEL

Figure 2-2 shows the back panel of the encoder. Table 2-2 describes its components.

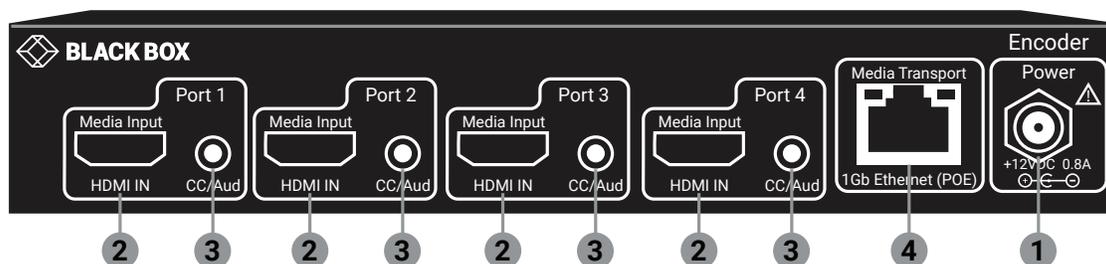


FIGURE 2-2. ENCODER BACK PANEL

TABLE 2-2. BACK-PANEL COMPONENTS

NUMBER IN FIGURE 2-2	COMPONENT	DESCRIPTION
1	Power LED	Connect the included 12-VDC power supply to this power receptacle.
2	HDMI In (1–4)	Connect an HDMI cable from this port to the HD video source.
3	Analog Audio/CC Input (1–4)	Connect an analog audio or closed caption source (requires a break-out cable).
4	Transport/PoE	Connect an Ethernet cable from this port to a smart switch on the Local Area Network (LAN).

CHAPTER 3: INSTALLATION

3.1 BASIC CONNECTIONS

1. Connect an HDMI cable from one of the HDMI In ports on the encoder to an HD video source.
2. Connect an Ethernet cable from the Transport connector on the rear panel of the encoder to a LAN or directly to the PC.
3. Connect the included 12-VDC power supply to the Power connector on the rear panel of the encoder (if you are not using PoE).

3.2 CONNECTING TO THE VS-2002-ENC OR VS-2004-ENC

1. By default, each encoder uses a DHCP IP address if a DHCP server is found on the network. Otherwise, the encoder will assign itself a link-local address. To connect to the unit, and depending upon your network setup, you might need to adjust the IP settings of the computer so that it can connect to the encoder.

NOTE: The IP address of the encoder is shown on the LED panel on the unit.

2. Once the computer is reconfigured, launch a browser, and enter the IP address of encoder in the address bar to display the encoder's User Interface.

See Logging In (Section 4.2) for more information on logging in to the User Interface.

See Network Configuration (Section 4.3) for details on setting a static IP address.

3.3 TYPICAL APPLICATION

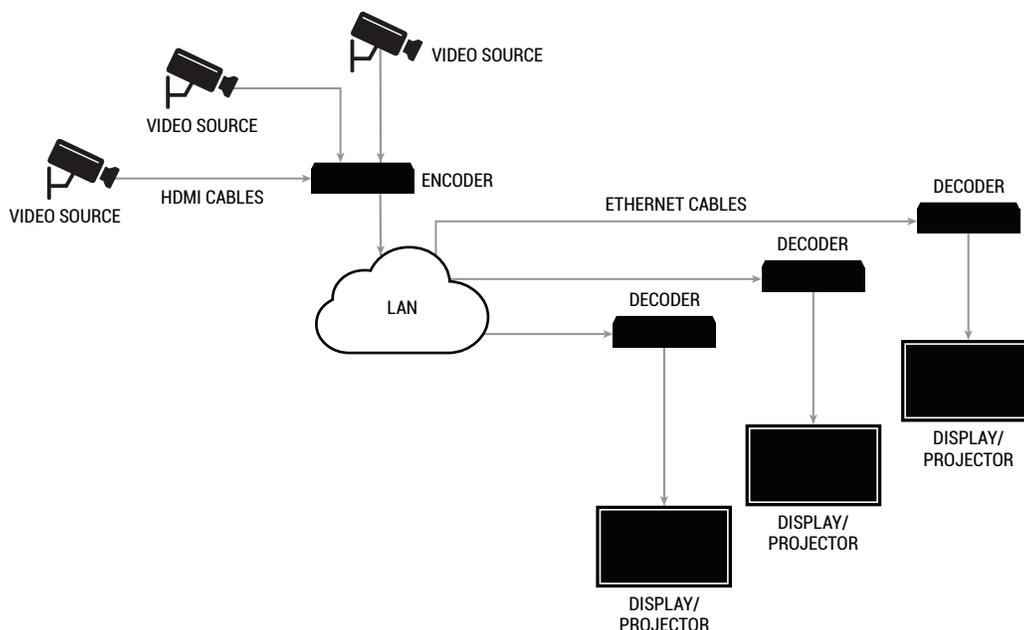


FIGURE 3-1. SAMPLE APPLICATION DIAGRAM

CHAPTER 4: BASIC OPERATION

4.1 USER INTERFACE

The encoder features the web user interface. The User Interface allows you to control and manage all features of the encoder. To access the User Interface, open a web browser and enter the IP address of the encoder into the address bar. We recommend using Firefox or Chrome browsers.

4.2 LOGGING IN

1. Make sure that the computer used to access the User Interface and the encoder are on the same network. If a network is not being used, the encoder can be directly connected to the computer. In both cases, the encoder and the computer must be on the same subnet.
2. Launch the web browser and enter the IP address of the encoder in the address bar. (The IP address is on the LED display of encoder.)
3. The User Interface will be displayed with the password dialog.



Log In

Enter your user name and password for this system:

User Name:

Password:

Log In

FIGURE 4-1. LOGIN SCREEN

4. Enter the password. The default password is admin and is case-sensitive.
5. Click the Login button.

CHAPTER 4: BASIC OPERATION

4.3 NETWORK CONFIGURATION

1. Login to the User Interface on the web. See the previous page for more information.
2. Click the Network tab and then select either AV Port 1 and 2 or AV Port 3 and 4.

NOTE: The VS-2002-ENC encoder only uses AV Ports 1 and 2.

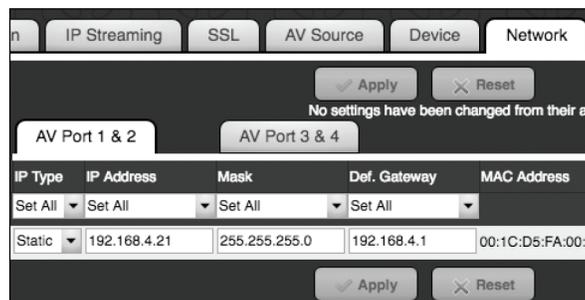


FIGURE 4-2.

3. The current network settings will be displayed.
4. Click the drop-down list, under IP Type, to select the desired network mode.

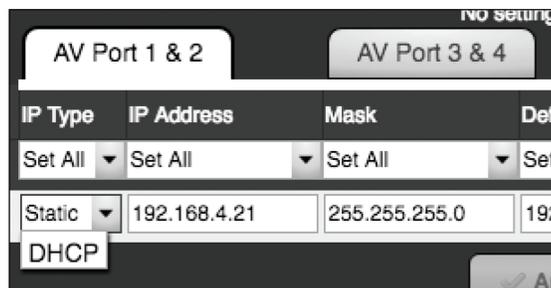


FIGURE 4-3.

The default setting for IPType is DHCP.

NOTE: The VS-2004-ENC has two independent IP address while the VS-2002-ENC has only one IP address. There is an IP address for AV ports 1 and 2 and a different IP address for AV ports 3 and 4. Both addresses should be set using this procedure.

NOTE: Once the encoder is properly configured, click the "lightbulb" icon at any time to physically identify the encoder on the network. This will cause the Status LED indicator on the front panel to flash rapidly for about 10 seconds.

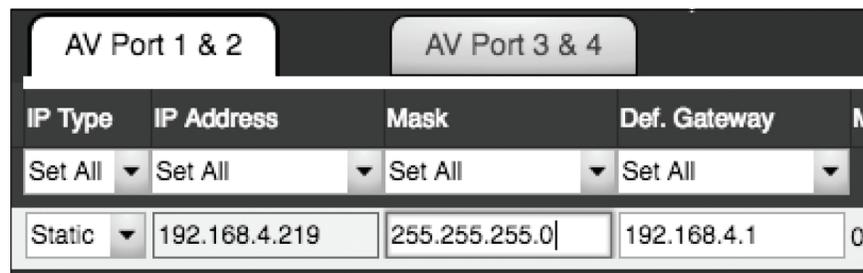
5. Locate the IP Type field: If this field is set to DHCP, then all network parameters are assigned automatically, providing there is a DHCP server connected to the network.

If the IP Type is set to Static, then follow steps 6 to 9.

6. Enter the IP address in the IP Address field. When a value is changed to valid address, the box will highlight in green.

NOTE: This is the Primary IP address for the VS-2002-ENC or VS-2004-ENC.

CHAPTER 4: BASIC OPERATION

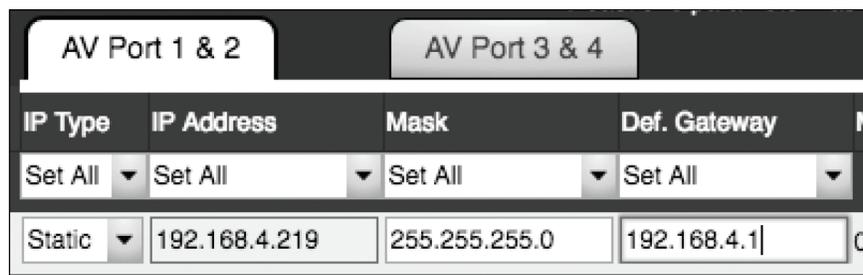


The screenshot shows the configuration page for AV Port 1 & 2. At the top, there are two tabs: "AV Port 1 & 2" (selected) and "AV Port 3 & 4". Below the tabs is a table with the following columns: "IP Type", "IP Address", "Mask", "Def. Gateway", and "M". The first row has dropdown menus for "Set All" in each column. The second row has text input fields with the following values: "Static" (dropdown), "192.168.4.219", "255.255.255.0", "192.168.4.1", and "0".

IP Type	IP Address	Mask	Def. Gateway	M
Set All	Set All	Set All	Set All	
Static	192.168.4.219	255.255.255.0	192.168.4.1	0

FIGURE 4-4.

7. Enter the subnet mask in the Mask field.
8. Enter the gateway address in the Gateway field.



The screenshot shows the configuration page for AV Port 1 & 2. At the top, there are two tabs: "AV Port 1 & 2" (selected) and "AV Port 3 & 4". Below the tabs is a table with the following columns: "IP Type", "IP Address", "Mask", "Def. Gateway", and "M". The first row has dropdown menus for "Set All" in each column. The second row has text input fields with the following values: "Static" (dropdown), "192.168.4.219", "255.255.255.0", "192.168.4.1", and "0".

IP Type	IP Address	Mask	Def. Gateway	M
Set All	Set All	Set All	Set All	
Static	192.168.4.219	255.255.255.0	192.168.4.1	0

FIGURE 4-5.

9. Repeat the procedure for AV Port 3 and 4 (VS-2004-ENC only). Click the Apply button to commit the changes. To discard recent changes, click the Reset button.

NOTE: You must reboot the unit for these changes to take effect.

CHAPTER 4: BASIC OPERATION

4.4 IP STREAM CONFIGURATION (UDP, RTP, AND RTMP)

The encoder can be configured to output either unicast or multicast IP streams using UDP or RTP protocols. It can unicast using the RTMP protocol.

1. Login to the User Interface. See Logging In for more information.
2. Click the IP Streaming tab.

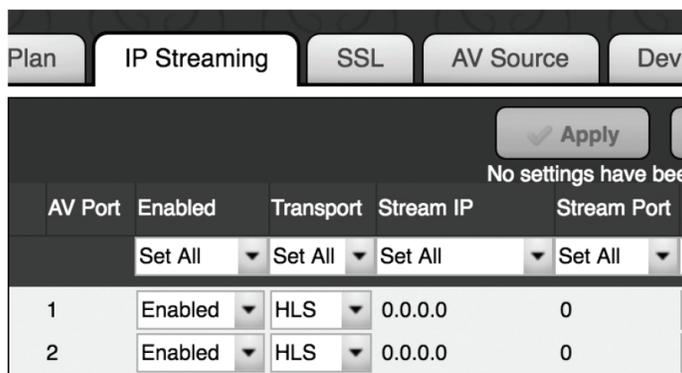


FIGURE 4-6.

3. To enable IP streaming, be sure that the Enabled drop-down box is set to Enabled. The default setting is Disabled.

NOTE: Each of the four streams (AV ports) can be enabled or disabled independently.

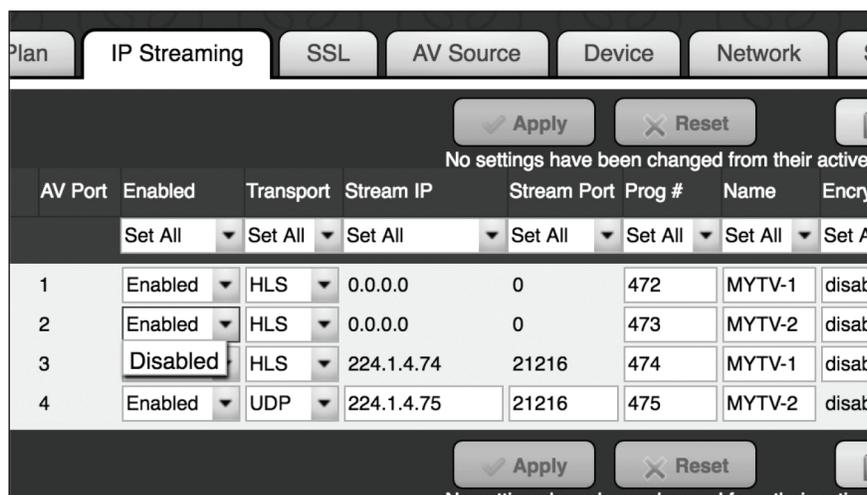


FIGURE 4-7.

4. Select UDP, RTP, or RTMP for the stream type from the Transport drop-down list.

NOTE: The HLS configuration is covered in the next section.)

CHAPTER 4: BASIC OPERATION

Port	Enabled	Transport	Stream IP	Stream
	Set All	Set All	Set All	Set
1	Enabled	HLS	0.0.0.0	0
2	Enabled	HLS	0.0.0.0	0
3	Enabled	HLS	0.0.0.0	0
4	Enabled	HLS	0.0.0.0	0

UDP
RTP
UDP+HLS
RTP+HLS
RTMP

No settings

FIGURE 4-8.

5. Enter the destination IP address in the Stream IP field. If you enter a valid IP multicast address (range 224.0.0.0 to 239.255.255.255), any endpoint registered with that multicast receives the stream. If you enter a valid IP unicast address, only that specific address receives the IP stream.

NOTE: The 224.0.0.x range is used for protocol discovery and is flooded to every port. Because these addresses are reserved and may not be constrained by IGMP snooping, we recommend against using them. If unicast, only the specifically addressed endpoint will receive the stream.

AV Port	Enabled	Transport	Stream IP	Stream Port
	Set All	Set All	Set All	Set All
1	Enabled	HLS	0.0.0.0	0
2	Enabled	HLS	0.0.0.0	0
3	Enabled	UDP	224.1.4.7	21216
4	Enabled	RTP	224.1.4.76	21216

FIGURE 4-9.

6. Enter the port number in the Stream Port field. The supported port range is 1025 to 65534. The destination IP port must not conflict with other IP protocols. If necessary, contact the system administrator for assistance.
7. Click the Apply button to save the changes or click the Reset button to discard any changes.

CHAPTER 4: BASIC OPERATION

TABLE 4-1.

TS TYPE	DESCRIPTION
UDP	Uses less overhead; lacks packet acknowledgement or error correction
RTP	Protocol built on top of UDP; delivers real-time multimedia and detects out-of-sequence packets
RTMP	Protocol commonly used by Content Delivery Networks such as Wowza

8. Move to the Channel Plan tab.



FIGURE 4-10.

9. Enter a Program number for each stream in the Prog # field.

10. Enter a description of the content in the Name field. Often, the viewing client will display the short channel name when tuning to different streams. The short name cannot be more than 7 characters long. Letters, numbers, and spaces are permitted.

11. Enter a description of the content in the Long Name field. The long name cannot be more than 32 characters long. Letters, numbers, and spaces are permitted.

Prog #	Name	Long Name	Rating
Set All	Set All	Set All	Set All
1	MYTV-1	HD Video Ov	TV-G
2	MYTV-2	HD Video Ov	TV-G
3	MYTV-3	HD Video Ov	TV-G
4	MYTV-4	HD Video Ov	TV-G

FIGURE 4-11.

12. Click the Rating drop-down list to select the desired Rating. The following ratings are supported: TV-G, TV-Y, TV-PG, TV-14, TV-MA, TV-MA-LSV.

This sets an audience rating for all entries in the program guide. This can be useful if some content should be excluded at some HDTVs. The values sent follow MPEG2 and CEA-766 specification, region 1 (USA), dimension 0 (TV-Rating).

NOTE: TV-MA-LSV is the most extreme content, with LSV short for "Language, Sex, Violence."

CHAPTER 4: BASIC OPERATION

13. Click the Apply button to save the changes or click the Reset button to discard any changes.

NOTE: UDP and RTP multicast streams can be viewed using many different decoders. One popular viewer/decoder for PCs is VLC. The link below provides a detailed example of how to use VLC to view a multicast stream.

<https://youtu.be/bslhfZJh3iA>

4.5 IP STREAM CONFIGURATION (HLS)

The encoder can be configured to output an on-demand HLS stream via HTTP/HTTPS.

1. Login to the User Interface. See Logging In for more information.
2. Click the IP Streaming tab.

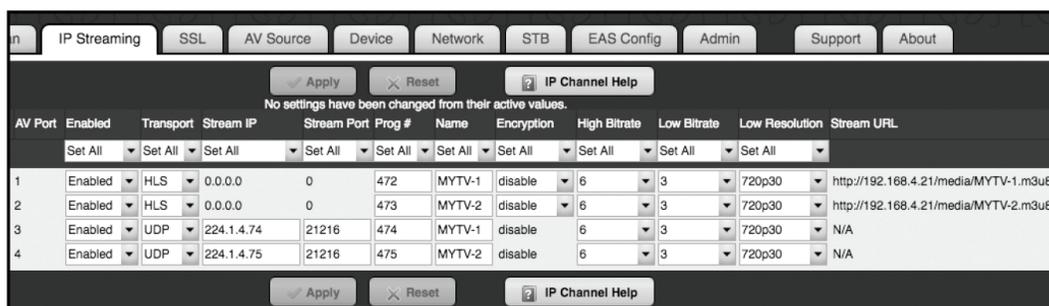


FIGURE 4-12.

3. To enable IP streaming, be sure that the Enabled drop-down box is set to Enabled. The default setting is Disabled.

NOTE: Each of the streams (AV ports) can be enabled or disabled independently.

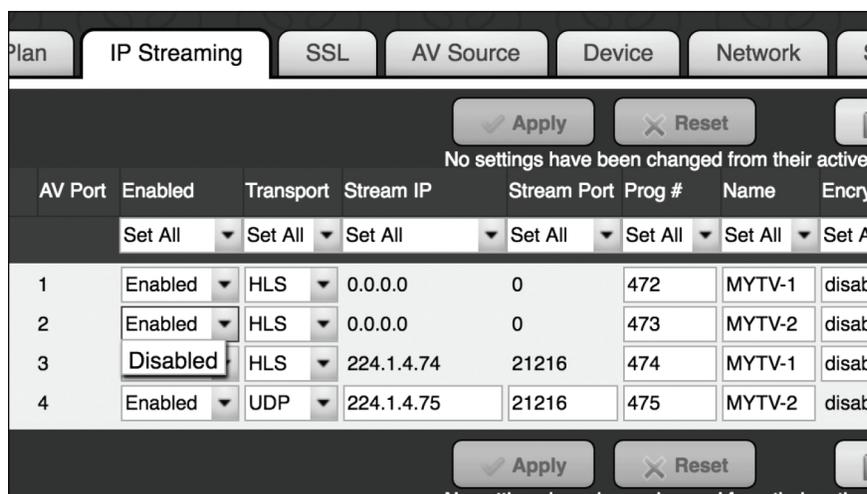


FIGURE 4-13.

CHAPTER 4: BASIC OPERATION

4. Select HLS for the stream type from the Transport drop-down list.

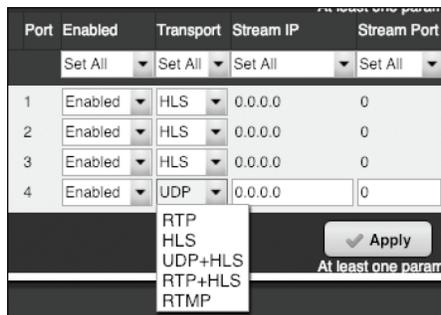


FIGURE 4-14.

5. Enter a Program number for each stream in the Prog # field.

Prog #	Name	Encryption	High Bitrate	Low Bitrate
Set All	Set All	Set All	Set All	Set All
472	MYTV-1	disable	6	3
473	MYTV-2	disable	6	3
474	MYTV-1	disable	6	3
475	MYTV-2	disable	6	3

FIGURE 4-15.

6. Enter a description of the content in the Name field. The name field cannot exceed 7 characters. Spaces are not allowed in the Name field because it is used as part of the address for HLS streaming.

7. Click the Apply button to save the changes or click the Reset button to discard any changes.

NOTE: Any input to the encoder can be configured to simultaneously output both a multicast and HLS stream. Select either "UDP+HLS" or "RTP+HLS" in step 4 above. Be sure to set the IP multicast address and port number as described on the previous pages.

CHAPTER 4: BASIC OPERATION

4.6 HLS STREAM VIEWING

To view an HLS stream, point a browser to the following address:

`http://<IP_ADDRESS>/media/<name>.m3u8`

Example:

`http://192.168.1.15/media/MYTV-1.m3u8`

You can also find the stream URL in the IP Streaming tab on the far right.

Low Resolution	Stream URL
Set All	
720p30	<code>http://192.168.4.21/media/MYTV-1.m3u8</code>
720p30	<code>http://192.168.4.21/media/MYTV-2.m3u8</code>
720p30	N/A
720p30	N/A

FIGURE 4-16.

NOTE: The browser used to view HLS streams must be enabled for Native HLS Playback. This may involve installing a plug-in to enable this functionality.

For example, Chrome® requires a free plug-in that can be downloaded and installed.

<https://chrome.google.com/webstore/detail/native-hls-playback/emnphkkblegpebimobpbekeedfgemhof>

NOTE: Chrome requires audio to be in MP2 format.

Firefox® requires a plug-in that can be downloaded and installed.

https://addons.mozilla.org/en-US/firefox/addon/native_hls_playback/?src=recommended

NOTE: Firefox requires audio to be in MP2 format.

Safari® does not require a Plug-In as HLS playback functionality is built in.

Edge does not require a Plug-In as HLS playback functionality is built in.

NOTE: Edge requires audio to be in AC3 format.

HLS Streams can be directly sent to a Wowza server. See the following Wowza link for additional details:

<https://www.wowza.com/docs/how-to-publish-and-play-a-live-stream-apple-hls>

CHAPTER 4: BASIC OPERATION

4.7 HLS STREAM LIMIT

The encoder can output up to four simultaneous HLS streams per HDMI input. Once this limit is reached, any additional devices attempting to access the HLS stream will receive the following message.

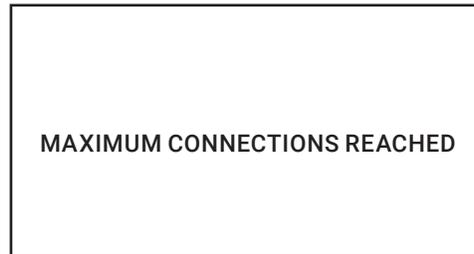


FIGURE 4-17.

CHAPTER 4: BASIC OPERATION

4.8 ADJUSTING VIDEO SETTINGS

The encoder employs Variable Bit Rate (VBR) encoding when transmitting IP streams. Specifying “High Bitrate,” “Low Bitrate,” and “Low Resolution” for video will define the limits of IP stream transmission, without overloading the network bandwidth.

1. Login to the User Interface. See Logging In for more information.
2. Click the IP Streaming tab.

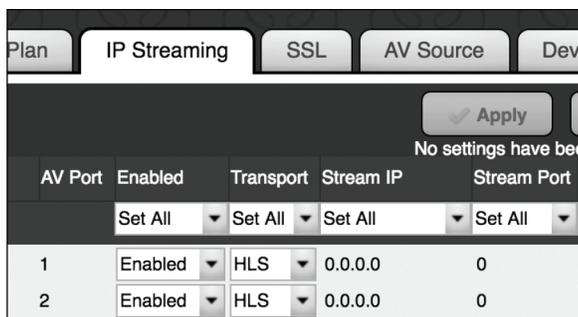


FIGURE 4-18.

3. For UDP and RTP streams, the High Bitrate setting is used.

NOTE: The Low Bitrate setting and Low Resolution are disabled in these modes.

Click the High Bitrate drop-down list to select a bitrate from 1 to 10 Mb/sec.

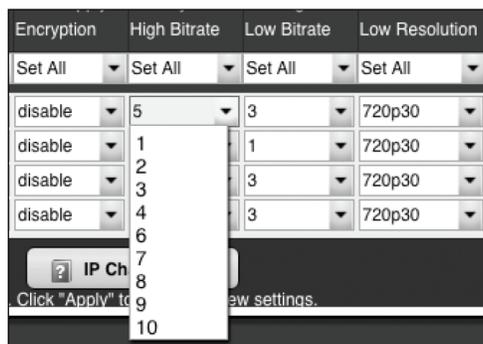


FIGURE 4-19.

When in HLS mode, the encoder will output both a High Bitrate stream and a Low Bitrate stream simultaneously using the target bitrates specified. The High Bitrate stream will always be output at the same resolution and frame rate as the original input. The Low Bitrate stream will output a reduced resolution stream. The resolution of this stream can be selected using the “Low Resolution” option.

Click the Low Resolution drop-down list and select the desired resolution of the Low Bitrate HLS stream.

CHAPTER 4: BASIC OPERATION

Encryption	High Bitrate	Low Bitrate	Low Resolution
Set All	Set All	Set All	Set All
disable	6	3	720p30
disable	6	3	720p30
disable	6	3	720p30
disable	6	3	720p30

FIGURE 4-20.

NOTE: To view an HLS stream, point a browser to the following address:

`http://<IP_ADDRESS>/media/<name>.m3u8`

Example:

`http://192.168.1.15/media/MYTV-1.m3u8`

This will show the best stream that the HLS player can handle, either the high or low bitrate.

NOTE: The HLS URLs are case sensitive.

You can manually select either the low or high bitrate steam in the following manner.

`http://<IP_ADDRESS>/media/<name><High>.m3u8` High Bitrate

`http://<IP_ADDRESS>/media/<name><Low>.m3u8` Low Bitrate

Example:

`http://192.168.1.15/media/MYTV-1High.m3u8`

Example:

`http://192.168.1.15/media/MYTV-1Low.m3u8`

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4.9 AV SOURCE SETTINGS

The encoder by default will provide HDCP handshaking to any connected source. This can cause undesired HDCP encrypted video to be sent to the encoder that will not be encoded. For example, an Apple laptop computer will automatically output HDCP compatible video if it detects the HDCP handshake.

The encoder can disable this HDCP handshake so that laptops will not automatically send HDCP encrypted output. To disable HDCP handshaking, the encoder can be put into Laptop mode.

1. Login to the User Interface. See Logging In for more information.
2. Click the AV Source tab.

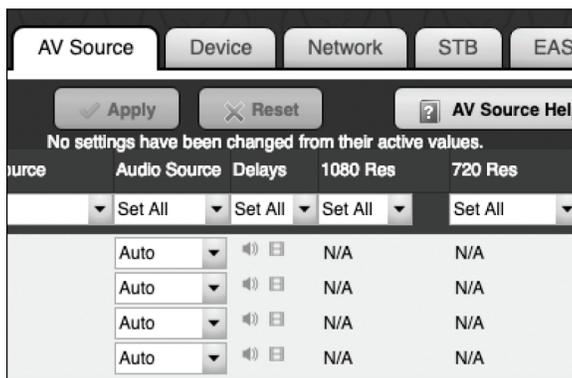


FIGURE 4-21.

3. Be sure that the Show Advanced Controls button is clicked in the lower left corner of the window.
4. Find the HDCP column to the right of the window and set the appropriate inputs to Laptop.

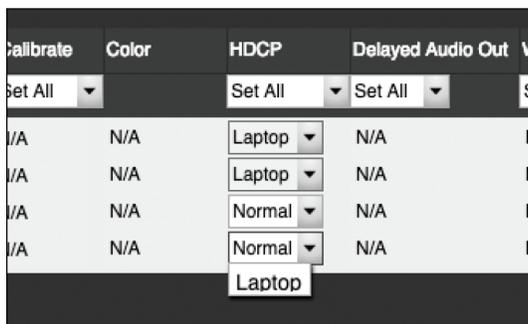


FIGURE 4-22.

5. Click the Apply button to save the settings.

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4.10 ADJUSTING AUDIO SETTINGS

The encoder supports either MP2, AC3, or AAC audio formats in the created stream. The default is MP2. You can change the desired audio format manually.

1. Login to the User Interface. See Logging In for more information.
2. Click the Device tab.

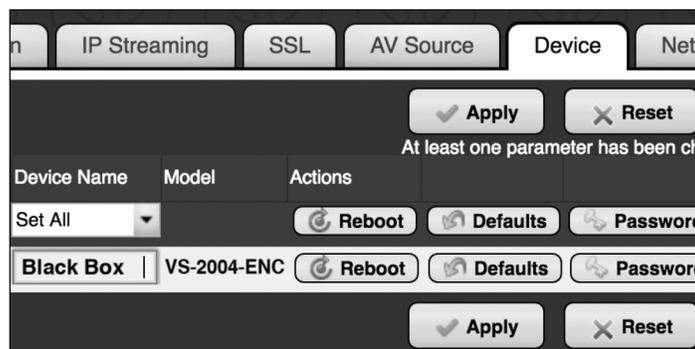


FIGURE 4-23.

3. In the lower left area of the screen, click on Show Advanced Controls.

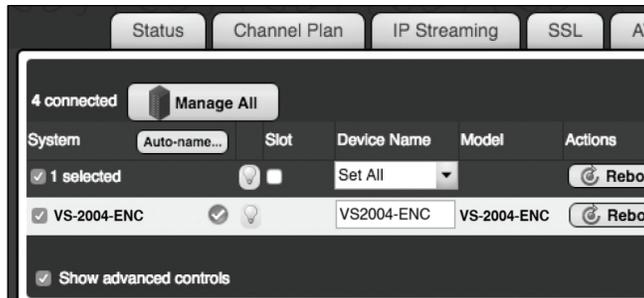


FIGURE 4-24.

4. To the right of the screen, you can now select the Digital Audio format desired. (MP2, AC3, or AAC) Be sure to save any changes and reboot the system.

NOTE: All four channels will be set to the same format.

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FIGURE 4-25.

4.11 HLS ENCRYPTION

When using the HLS functionality for IP streaming, you can enable secure connections for those streams by generating and uploading an SSL certificate via the User Interface. This certification will only be used for HLS video streaming. There is a multistep process to use HLS encryption as detailed next.

1. Log in to the User Interface. See Logging In for more information.
2. Click the IP Streaming tab.

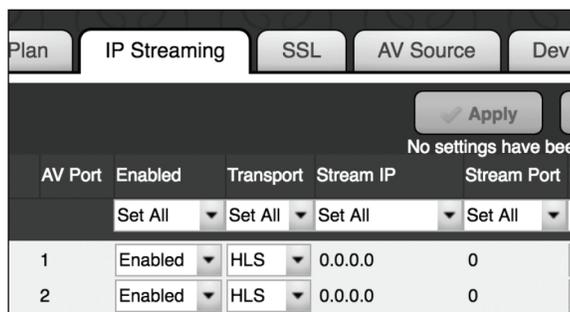


FIGURE 4-26.

3. Set the Transport method to HLS and enable Encryption. Be sure to apply any changes.

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Name	Encryption	High Bitrate	Low Bitrate	Low Resolution
Set All	Set All	Set All	Set All	Set All
MYTV-1	disable	6	3	720p30
MYTV-2	enable	6	3	720p30
MYTV-1	disable	6	3	720p30
MYTV-2	disable	6	3	720p30

FIGURE 4-27.

Once enable encryption is applied, you will be running in HLS mode and the actual video data being sent will be encrypted. However, the HTTP exchanges will still be in the clear (i.e. no encryption via https). That means that the encryption key and initialization vectors will be passed in the clear as well.

To protect the encryption key from being exposed, you have to configure the HTTP server for SSL. Go to the SSL tab and upload a security certificate and key exchange files, and enable SSL and define your domain that matches your security certificate (issued by a certificate issuing service – NOT by Black Box). These certificates are typically only valid for a period of time and then they expire and the user has to renew them. Failure to do so will result in https no longer working properly.

When requesting a security certificate you must enter some data. You can do this from the “SSL” tab in the User Interface:.

4. Click the SSL/RTMP tab

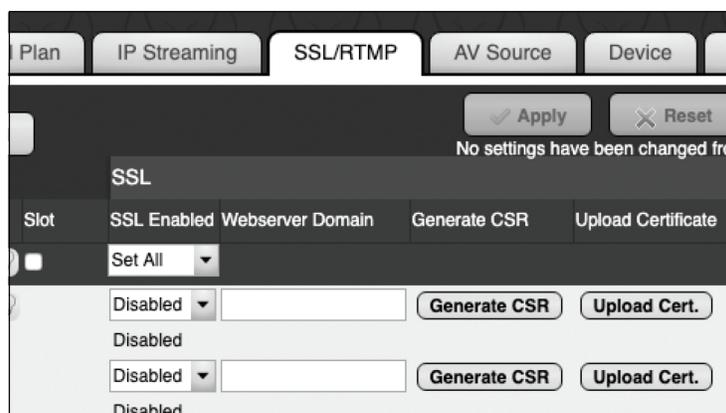


FIGURE 4-28.

5. Generate CSR (Certificate Signing Request). This will provide you with two files: The CSR and your Private key. Send your CSR file off to a signing authority and they will return via email a signed certificate file to you along with a certificate chain file.

IMPORTANT NOTE: Be sure to save the Private Key file, because you will need it when uploading the certificate. If you do not have the Private Key file, you will need to start the process over, including requesting the certificate from the signing authority again.

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Create CSR

Generate a Certificate Signing Request file

Generate a Certificate Signing Request (CSR) file that can be sent to a signing authority.

2-Letter Country Code:

State/Province:

City/Locality:

Company/Organization:

Domain:

FIGURE 4-29.

6. When you are sent the certificate from the certificate signing authority that you want to use, you need to go back to the “SSL” tab and upload it.

Import SSL certificate files

Select a PEM file

Choose a certificate file, key file, and optional chain file to upload. The slot must be restarted in order for the HTTP server to install it.

Select a Certificate .pem file:

Select a Private key file:

Select a Certificate Chain .pem file:

FIGURE 4-30.

7. Once you upload your certificate, private key file, and certificate chain files, select “Upload and Reboot Later” (you still have some work to do). You will be back at the SSL tab and you need to enable SSL and enter the domain that matches your certificate.

CHAPTER 4: BASIC OPERATION

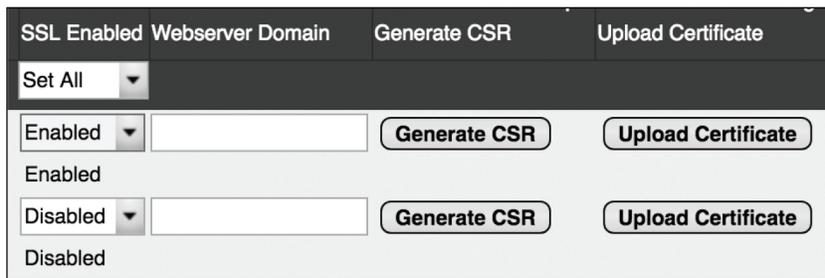


FIGURE 4-31.

Click Apply, then click “Apply and Reboot Now.”

4.12 STREAM RTMP TO A WOWZA SERVER

RTMP streams can be sent directly to a Wowza server for more widespread distribution of the AV signal.

1. Login to the User Interface. See Logging In for more information.
2. Select the SSL/RTMP tab.

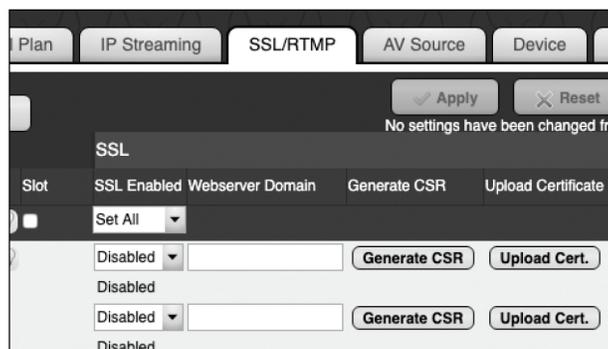


FIGURE 4-32.

The right side of the screen will have fields used for streaming to a Wowza server.

RTMP				
IP Address	Port	App. Name	Login ID	Password
Set All	Set All	Set All	Set All	Set All
0.0.0.0	0			
0.0.0.0	0			
0.0.0.0	0			
0.0.0.0	0			

FIGURE 4-33.

- The IP Address field is the IP Address of the Wowza Server that this stream should be sent to.
- The Port field is the Port number of the Wowza Server that this port is streaming to.
- The App. Name field is the Application Name configured on the Wowza Server that this stream is connected to.
- The Login ID field is the Login Name configured on the Wowza Server for this stream.

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- The Password field is the Password required for this stream to log into the Wowza Server.

NOTE: The Digital Audio output from the encoder must be set to AAC. Make this change in the Device Tab. Enter the configuration changes here first and then set the port(s) Transport Type to RTMP in the IP Streaming Tab.

HLS Streams can also be directly sent to a Wowza server. See the following Wowza link for additional details.

<https://www.wowza.com/docs/how-to-publish-and-play-a-live-stream-apple-hls>

4.13 DISPLAYING DEVICE INFORMATION

The Status page is automatically displayed after logging in to the User Interface. This page displays video and audio input/output information, firmware version, and status messages.

1. Log in to the User Interface. See Logging In for more information.
2. The Status tab will be selected automatically.

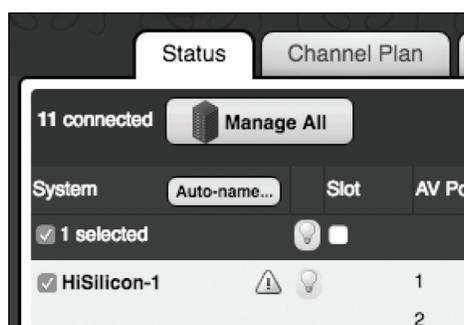


FIGURE 4-34.

The System field displays the name of the encoder. This name can be changed. See the next page for more information.

- Click the “lightbulb” icon to physically identify the encoder on the network. When this icon is clicked, the Status LED indicator on the front panel will flash rapidly for about 10 seconds.
- The Video field displays the video input and output resolution. In the illustration shown next, the input is 720p60 and the output is 720p60. Video input and output resolution cannot be changed. To change the video bitrate see Adjusting Audio and Video Settings.
- The Audio field displays the input audio type and the output audio type.

#	Video	Audio
HDMI	720p60 → 720p60	AUTO SPDIF-PCM → MP2
HDMI	720p60 → 720p60	AUTO SPDIF-PCM → MP2
HDMI	720p60 → 720p60	AUTO SPDIF-PCM → MP2
HDMI	1080p60 → 1080p60	AUTO SPDIF-PCM → MP2

FIGURE 4-35.

- The Model field displays the name of the model of the encoder.
- The Firmware field displays the current version of firmware.
- The Uptime field displays the time, in days and hours, since the unit was last rebooted.
- The Temp field displays the encoder unit’s internal temperature.

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- The Enet Average field displays current average output on the Ethernet port.

NOTE: This field can be helpful to determine if the HLS streaming level has been reached.

- The Messages field receives messages reported by the encoder during operation.

4.14 CHANGING THE DEVICE NAME

By default, the encoder is automatically assigned a name by combining the string “encoder” or “encoder2” and the MAC address of the encoder. This name can easily be changed to something more descriptive using the procedure below.

1. Log in to the User Interface. See User Interface for more information.
2. Click the Device tab.
3. Enter the desired name in the Device Name field.

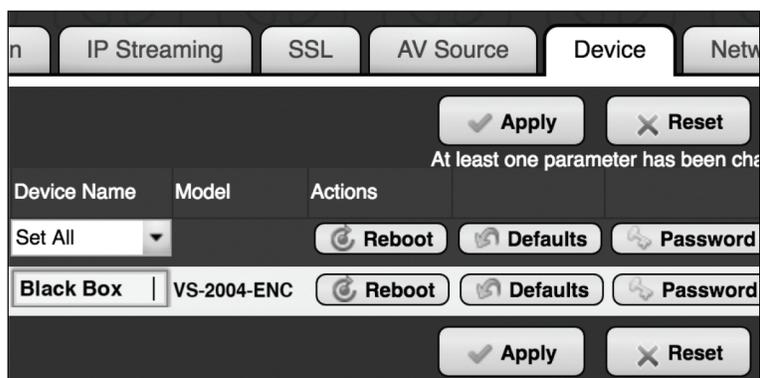


FIGURE 4-36.

4. Click the Apply button to save the changes or click the Reset button to cancel changes and revert to the previous settings.

4.15 RESETTING THE VS-2002-ENC OR VS-2004-ENC

The encoder can be reset to factory-default settings by clicking the Default button under the Device tab or by pressing the NAV/Control button on the unit. (See the next page for details.) When the encoder is reset to factory default settings, the IP address will be reset to will be set to DHCP mode.

4.15.1 USING THE USER INTERFACE

1. Log in to the User Interface. See User Interface for more information.
2. Click the Device tab.
3. Click the Default button, under Actions.

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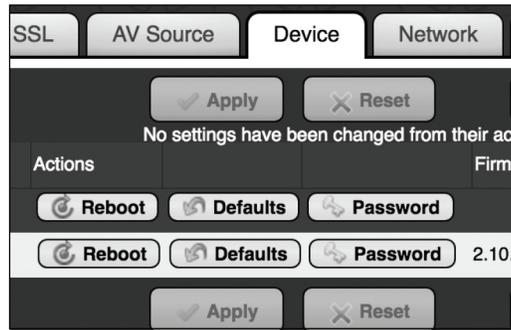


FIGURE 4-37.

4. The following dialog will be displayed, prompting to confirm the reset procedure.
5. Click the Reset button to reset the encoder to factory default settings. Click the Cancel button to return to the Device tab.

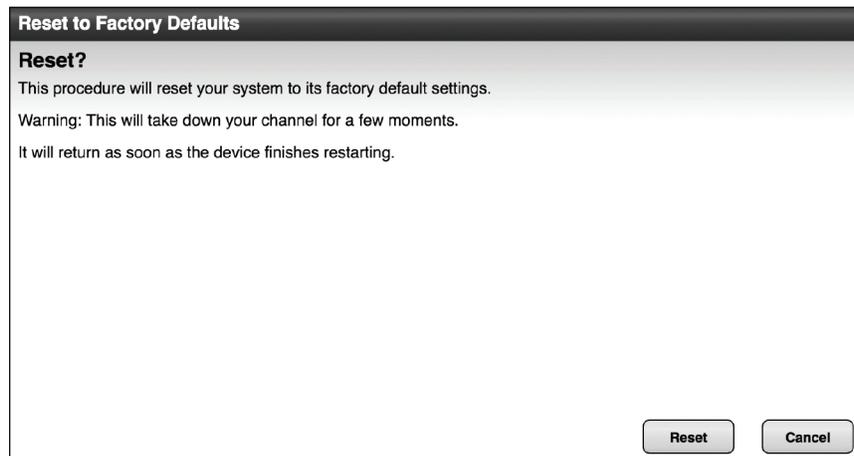


FIGURE 4-38.

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4.15.2 USING RESET BUTTON/WHEEL (NAV/CONTROL)

1. Locate the NAV/Control button on the front of the unit. This is both a button and wheel.



FIGURE 4-39.

2. Disconnect the power from the encoder. While applying power, rotate the dial to the left to reset the encoder to factory defaults. Rotate dial to the right to revert the encoder to the previously installed version of firmware. Be sure to hold the dial either right or left until the reboot begins.
3. The unit will reboot. After about 60 seconds, the unit will be ready for use.

4.16 REBOOTING THE VS-2002-ENC OR VS-2004-ENC

The encoder can be rebooted using the User Interface. All configuration settings are saved through reboots.

1. Log in to the User Interface. See Logging In for more information.
2. Click the Device tab.
3. Click the Reboot button, under Actions.

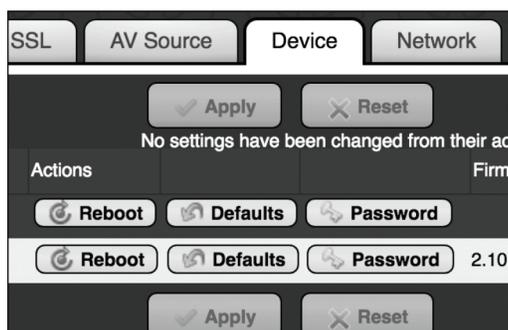


FIGURE 4-40.

4. Confirm the Reboot action to initiate the reboot.

CHAPTER 4: BASIC OPERATION

4.17 SETTING THE PASSWORD

The default login password for the User Interface is admin. This password can be changed using the following procedure. To recover a lost or forgotten password, see Recovering a Lost Password.

1. Log in to the User Interface. See Logging In for more information.
2. Click the Device tab.
3. Click the Password button, under Actions.

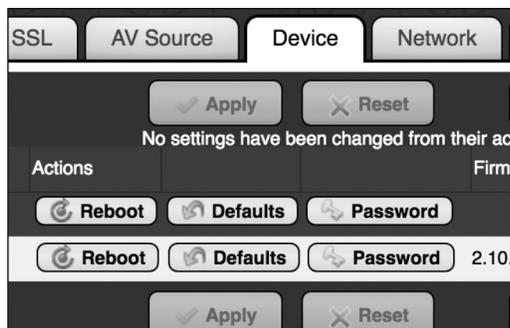


FIGURE 4-41.

4. Enter the new password in the top field, then retype the password in the bottom field. All passwords must be 4 to 16 characters in length and are restricted to alphanumeric (letters and numbers) characters.

A screenshot of a 'Change Password' wizard. The title is 'Change Password'. Below the title is the heading 'Enter New Password'. A message reads: 'This wizard will change your password on this device. Enter a new password below:'. There are two input fields: 'New Password:' and 'Repeat:'. At the bottom right, there are two buttons: 'Change' and 'Cancel'.

FIGURE 4-42.

5. Click the Change button to accept the changes. Click the Cancel button to return to the Device tab without any changes.

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4.18 RECOVERING A LOST PASSWORD

The encoder does not provide any built-in safeguards for lost or forgotten passwords.

The encoder must be reset to factory-default settings using the NAV/Control button on the front panel. Use the admin password to log in and then change the password under the Device tab.

1. Locate the NAV/Control button on the front of the unit. This is both a button and wheel.

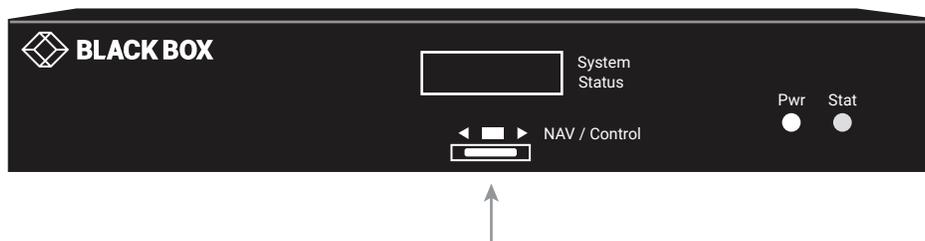


FIGURE 4-43.

2. Disconnect the power from the the encoder. While applying power, rotate the dial to the left to reset the encoder to factory defaults. Rotate dial to the right to revert the encoder to the previously installed version of firmware. Be sure to hold the dial either right or left until reboot begins.
3. The unit will reboot and after about 60 seconds, the unit will be ready for use.
4. Follow the steps under Setting the Password to complete the process.

NOTE: All IP streaming customization settings will be lost as a result of a factory reset.

4.19 UPDATING THE FIRMWARE

Firmware updates will be available when required. Contact Black Box Technical Support at 877-877-2269 or info@blackbox.com for more information.

1. Download the firmware to the desired location on your computer.
2. Log in to the User Interface. See Logging In for more information.
3. Click the Device tab.
4. Click the Update button, under Actions.



FIGURE 4-44.

5. The following dialog will be displayed. Click the Browse button to select the firmware file.

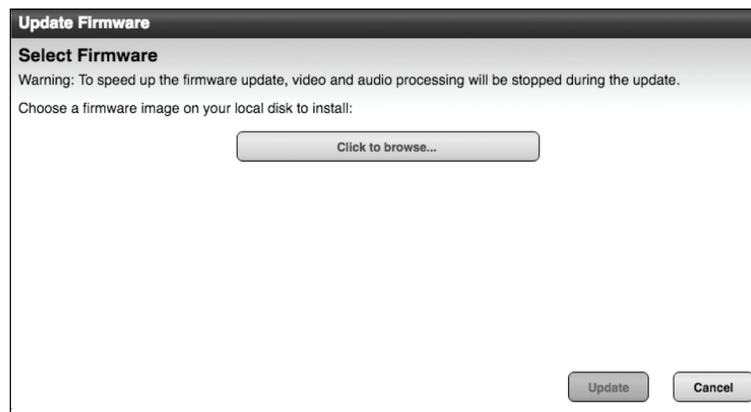


FIGURE 4-45.

6. Click the Update button to begin the firmware update process.
 7. Once the firmware has been applied, the encoder will automatically reboot.
 8. The firmware update process is now complete and the unit is ready for use.
- NPTE: Video will be lost during a firmware update but all configuration settings will be saved.

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4.20 STB TAB – DIRECTTV H.25 SET-TOP BOX CONTROL

The encoder has the ability to remotely control/manage DirecTV H.25 set-top boxes.

IMPORTANT: If you do not have a DirecTV H.25, do not make changes to any fields found in this tab.

1. Click on the STB tab.

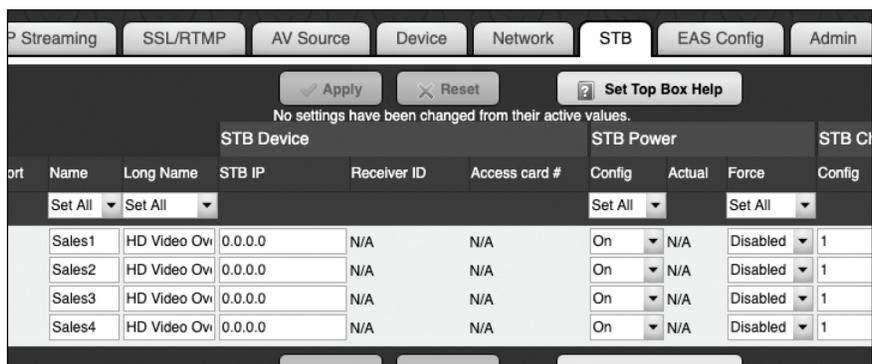


FIGURE 4-46.

2. Enter the IP address of the H.25 into the STB IP field. Once you have programmed the IP addresses of the connected set-top boxes through the boxes themselves and through User Interface, information from each managed unit, such as power status (on/off), current channel, and program information is pulled into the STB tab.

This information updates approximately every 5 to 10 seconds.

STB Power			STB Channel			STB Channel Names		
Config	Actual	Force	Config	Actual	Force	Link	Call Sign	Program Name
Set All		Set All			Set All	Set All		
On	N/A	Disabled	1	N/A	Disabled	Disabled	N/A	N/A
On	N/A	Disabled	1	N/A	Disabled	Disabled	N/A	N/A
On	N/A	Disabled	1	N/A	Disabled	Disabled	N/A	N/A
On	N/A	Disabled	1	N/A	Disabled	Disabled	N/A	N/A

FIGURE 4-47.

CHAPTER 4: BASIC OPERATION

STP power

In the STB Power section, you can power individual units on or off. The “on” or “off” text in the Actual field indicates the current state of the set top box for the specified input port (on the encoder unit).

In the STP power section:

1. Click in the Config field and choose on or off.
2. (optional) Click in the Force field to enable (or disable) the associated set top box to “force” the setting you specify. With Force enabled, the User Interface will query the box automatically and periodically and set the command to your configuration. For example, if the set top box is turned off, yet it’s configured in the User Interface as “on,” an enabled Force sends a command to set the power on to match the User Interface setting.
3. Click Apply to save.

The entire block of set top box units under management can be controlled simultaneously by clicking the Set All option at the top of the column.

STB Channel Number

In the STB Channel Number section, you can set the desired channel number to be sent to the set top box. The number in the Actual field indicates the current channel set to the STB for the specified input port (on the encoder unit).

To set STP channel numbers:

1. Click in the Config field and enter the desired channel number for the STB.
2. (optional) Click in the Force field to enable (or disable) the associated set top box to “force” the setting you specify. With Force enabled, User Interface will query the box automatically and periodically and set the command to your configuration. For example, if “242” appears in the Actual field, yet it’s configured in User Interface as “142,” an enabled Force sends a command to set the channel to 142 to match the User Interface setting.
3. Click Apply to save.

The currently active channel number the STB uses may vary from the configured value because of events at the STB (reconfiguration, STB firmware download, etc.). If “Force” is enabled, the condition corrects at the next automatic interval. If not in Force mode and there is a mismatch, the STB channel number can be manually reset to be corrected.

If the User Interface detects a mismatch between the configured channel and the actual active channel at the STB, a triangular warning flag will be displayed next to that value.

STB Channel Names

You can assign the Call Sign and Program Name to an encoder channel using the Link option in the STB Channel Names section. These fields populate automatically as do all the fields from an encoder unit when the set top box is assigned to it.

If you enable the Link function, the Call Sign (for example, CNBCHD) will be used for the encoder Channel Name field and Program Name (for example, Closing Bell) will be used for the Long Channel Name field. You cannot edit these fields when the Link option is enabled.

To link STB Channel Names with program information:

1. Click in the Link field and choose enabled or disabled.
2. Click Apply to save.

4.21 CONTACTING BLACK BOX TECHNICAL SUPPORT

Contact Black Box Technical Support at 877-877-2269 or info@blackbox.com.



CHAPTER 5: SWITCHES

5.1 RECOMMENDED SWITCHES

The following 1-Gbps switches are recommended for use with the encoder.

NOTE: This is not an all-inclusive list. There are many other switches available that will function with the encoder.

TABLE 5-1. RECOMMENDED SWITCHES

MANUFACTURER	MODEL NUMBER	NUMBER OF PORTS
Netgear	M4300-28G	(24) 1-Gbps ports, (4) 10-Gbps ports
Netgear	M4300-52G	(48) 1-Gbps ports, (4) 10-Gbps ports.
Netgear	M4300-28G-PoE+	(24) 1-Gbps ports, supports PoE+
Netgear	M4300-52G-PoE+	(48) 1-Gbps ports, supports PoE+
Netgear	S3300-28X	(24) 1-Gbps ports, (4) 10-Gbps ports
Netgear	S3300-52X	(48) 1-Gbps ports, (4) 10-Gbps ports
Netgear	S3300-28X-PoE+	(24) 1-Gbps ports, supports PoE+
Netgear	S3300-52X-PoE+	(48) 1-Gbps ports, supports PoE+
Netgear	GS728TP	(24) 1-Gbps ports, supports PoE+
Arista	7010T-48	(48) 1-Gbps ports, (4) 10-Gbps ports.
Luxul	XMS-7048P	(48) 1-Gbps ports, supports PoE+
Luxul	XMS-5248P	(48) 1-Gbps ports, supports PoE+
Luxul	XMS-2624P	(24) 1-Gbps ports, supports PoE+
Luxul	AMS-2624P	(24) 1-Gbps ports, supports PoE+
Luxul	AMS-4424P	(24) 1-Gbps ports, supports PoE+

5.2 SWITCH CONFIGURATION OPTIONS

Some switches will work directly out of the box with zero configuration required. Nearly all switches will provide the user some ability to customize the configuration. The list below includes various switch configuration options that Black Box has encountered. Look for these or similar options when configuring your switch.

1. Enable IGMP Snooping
 - a. Must be enabled
2. Enable IGMP Snooping on VLAN used by the encoder
 - a. Must be enabled when all ports default to VLAN1
3. Filter/drop unregistered multicast traffic
 - a. If not applied, the behavior of the switch will be to broadcast multicast packets if the switch has no known destination for that packet.
 - b. Must be enabled if found
4. Unregistered Multicast Flooding
 - a. Must be disabled if found

CHAPTER 5: SWITCHES

5. Filter Unregistered Multicast (different wording than number 4)
 - a. Must be enabled if found
6. Disable IGMP Query
7. Disable IGMP Query on VLAN used by the encoder
8. Validate IGMP IP Header
 - a. Must be disabled if found
9. Set IGMP Version to IGMP V2
 - a. Must be set if found
10. Enable FASTLEAVE on port X
 - a. Should be enabled, if found
11. Enable FASTLEAVE for VLAN used by encoder2/4
 - a. Should be enabled if found



APPENDIX A: FREQUENTLY ASKED QUESTIONS

A.1 NETWORK

Question: In a point-to-point environment, how should the encoder be configured?

Answer: First, on the networking front, be sure that both the encoder and the third-party decoder are set for static IP with addresses on the same subnet. Black Box recommends RTP for P2P installations. RTP has more timing and synchronization information built into the protocol.

Question: In a network environment, how best should the encoder be configured?

Answer: In a network environment, the encoder should be configured for UDP/RTP and multicast.

Question: How does channel beaconing work?

Answer: The channel beacon uses the 239.13.1.19 multicast address. The encoder uses this address to publish its channels across the network. In a single layer 2 network, this should always work. In a routed layer 3 network, this multicast address needs to be added to the router's forwarding table explicitly. By default, routers will not forward this address. The actual command to do this varies by router.

Question: What is included in the beacon signal?

Answer: The beacon includes the multicast group, port, and source IP address.

Question: What other network protocols are required to support the encoder/third-party decoder?

Answer: For an installation of more than a couple of encoder sources, the layer 2 Ethernet switch needs to be a smart switch that supports IGMP and multicast traffic management and varies by vendor.

Question: Should every encoder stream in the system be configured with a different multicast address? (UDP and RTP streaming)

Answer: Each encoder stream needs to be configured for a different multicast address for proper stream bandwidth management. Network switches filter based on the IP multicast address only. If multiple encoder streams are configured with the same multicast address with different ports, all the packets with that multicast address will be forwarded to any decoders tuned to any one of those channels. This will overwhelm the Ethernet processing on the decoder and cause video artefacts.

Question: What is the range of multicast addresses that can be used by the encoder?

Answer: The full range of multicast addresses is from 224.0.0.0 to 239.255.255.255

Question: What is the maximum router hop limit or TTL of a multicast stream?

Answer: The maximum hop limit is 9. Therefore, the TTL = 10.

APPENDIX A: FREQUENTLY ASKED QUESTIONS

A.2 MISCELLANEOUS

Question: What is the maximum length of HDMI cable that can be used on the encoder before it starts to not detect the source?

Answer: This will depend on the quality of the HDMI cable. Black Box has verified functionality with HDMI cables up to 25 feet (7.62 meters) long.

Question: What is the recommended video bitrate setting for the encoder when streaming video to decoder devices?

Answer: The recommended video bitrate is 6 Mbit/sec. Settings higher than this may cause unacceptable video breakup with the decoder.

NOTE: Higher bitrates can be used when streaming to some other video decoders.

Question: Can the encoder strip out any HDCP encoding?

Answer: Contact Black Box Technical Support at 877-877-2269 or info@blackbox.com.



APPENDIX B: REGULATORY INFORMATION

B.1 FCC STATEMENT

This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.



APPENDIX B: REGULATORY INFORMATION

B.2 NOM STATEMENT

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.



APPENDIX C: DISCLAIMER/TRADEMARKS

C.1 DISCLAIMER

Black Box Corporation shall not be liable for damages of any kind, including, but not limited to, punitive, consequential or cost of cover damages, resulting from any errors in the product information or specifications set forth in this document and Black Box Corporation may revise this document at any time without notice.

C.2 TRADEMARKS USED IN THIS MANUAL

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