



XVC-HEVC Encoder User's Guide

Version 2.2

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Table of Contents

1	INTRODUCTION	8
1.1	Testing environment	8
1.2	Additional Support	8
1.3	Definitions	9
2	INSTALLING THE SYSTEM	10
2.1	Unpacking the Encoder Hardware	10
2.2	Installing the XVC Management Tool	10
3	USING THE ENCODER HARDWARE	11
3.1	Buttons	12
3.2	Connectors	12
3.3	LEDs	13
4	CONFIGURING THE ENCODER	14
4.1	Getting Started	14
4.1.1	Assigning an IP Address	14
4.1.1.1	Assigning a Static IP Address	14
4.1.1.2	Assigning a DHCP-Allocated IP Address	15
4.1.2	Accessing the Encoder	16
4.1.3	Work Area	18
4.2	Video Input	19
4.3	Channel Settings	20
4.3.1	Video Bitrate Settings	23
4.3.2	Streaming Modes	24
4.3.2.1	TS-UDP Streaming	24
4.3.2.2	RTP Streaming	25
4.3.2.3	RTSP Streaming	25
4.3.2.4	SRT streaming	26
4.4	System Settings	27
4.4.1	System Settings Main Page	29
4.4.2	Time & Date	30
4.4.3	Network Configuration	31
4.4.4	User Management	33
4.4.5	Firmware Upgrade	33
4.4.6	Licensed Features	36
4.5	System Status	38
4.6	About	38
4.6.1	XVTEC Legal Page	40
4.6.2	Open Source Software	41
4.6.3	Certifications	42
4.7	Reboot	42

5	BOOTING, TROUBLESHOOTING AND RECOVERY	44
5.1	Booting the Encoder	44
5.1.1	Static IP Address	44
5.1.2	DHCP-Allocated IP Address	44
5.2	Overheating	45
5.3	Restoring System Defaults	46
5.4	System Recovery	46
5.4.1	Recovery Using Image on USB Memory Stick	47
5.4.2	Recovery Using Image on Network	48
5.5	Resetting the User Name and Password	50
APPENDIX A	SYSTEM SPECIFICATIONS	52

List of Figures

Figure 1: Encoder Front Panel.....	11
Figure 2: Rear Panel of Encoder.....	11
Figure 3: LED Panel.....	13
Figure 4: List of XVTEC Devices Discovered	15
Figure 5: Setting the Encoder IP Address.....	15
Figure 6: List of XVTEC Devices Discovered	16
Figure 7: Requesting Dynamic Allocation of an IP Address	16
Figure 8: Entering the IP Address in the Browser Address Bar	16
Figure 9: Enter User Name and Password	17
Figure 10: Configuration System Page Layout	17
Figure 11: Video Input Page.....	19
Figure 12: Channel Settings Page.....	20
Figure 13: TS-UDP Streaming Fields.....	24
Figure 14: RTP Streaming Fields.....	25
Figure 15: RTSP Streaming Fields.....	25
Figure 16: System Settings Menu	28
Figure 17: Systems Settings Main Page	29
Figure 18: Time & Date Page	30
Figure 19: Network Configuration Page.....	31
Figure 20: User Management Page.....	33
Figure 21: Firmware Upgrade Page	34
Figure 22: Selecting the Image File	35
Figure 23: Upgrade Status Field	35
Figure 24: Upgrade LED Indicators.....	36
Figure 25: Upgrade Completed LED Indicators.....	36
Figure 26: Licensed Features Page.....	37
Figure 27: Enabled Features	37
Figure 28: System Status Page	38
Figure 29: About Page.....	39
Figure 30: Legal Page	40
Figure 31: OSS Page	41
Figure 32: Certifications Page	42
Figure 33: Reboot Confirmation	42
Figure 34: Encoder Rebooting.....	43
Figure 35: End of Boot Sequence with Successful IP Allocation	44
Figure 36: Attempting to Retrieve Network Parameters from DHCP Server.....	44
Figure 37: Encoder Failed to Retrieve IP Address from DHCP Server	45
Figure 38: Release SW Button to Begin Restoring Defaults.....	46
Figure 39: System Defaults Successfully Restored.....	46

Figure 40: Release SW Button to Begin System Recovery 47

Figure 41: Recovery LED Indicators..... 47

Figure 42: End of Recovery Process 47

Figure 43: Recovery Page..... 49

Figure 44: Selecting the Image File 49

Figure 45: Upgrade Status Field 50

Figure 46: Recovery LED Indicators..... 50

Figure 47: Resetting the User/Password 51

List of Tables

Table 1: Contact Us	8
Table 2: Definitions	9
Table 3: Items Shipped in the Encoder Package	10
Table 4: Buttons	12
Table 5: Front Panel Connectors.....	12
Table 6: Rear Panel Connectors	12
Table 7: LEDs	13
Table 8: Main Menu Entries.....	17
Table 9: Control Types	18
Table 10: Video Input Field Descriptions	19
Table 11: Channel Settings Field Descriptions	21
Table 12: Valid Minimum/Maximum Bitrates	23
Table 13: Recommended Bitrates in Normal Encoding Latency Modes.....	23
Table 14: Recommended Bitrates in Low Encoding Latency Modes	23
Table 15: TS-UDP Streaming Field Descriptions.....	24
Table 16: RTP Streaming Field Descriptions	25
Table 17: RTSP Streaming Field Descriptions.....	26
Table 18: System Settings Menu Entries.....	28
Table 19: Systems Settings Field Descriptions	29
Table 20: Time & Date Field Descriptions.....	30
Table 21: Network Configuration Field Descriptions	32
Table 22: User Management Field Descriptions.....	33
Table 23: Firmware Upgrade Field Descriptions.....	34
Table 24: System Status Field Descriptions	38
Table 25: Overheating Conditions	45

1 Introduction

The XVC-HEVC Encoder delivers superior video quality, enabling users to stream broadcast quality UHD video with up to 50% bandwidth savings compared to H.264. The XVC-HEVC Encoder provides best-in-class HEVC video quality of up to 4:2:2 10-bit and sets new industry standards for bit rate and latency.

1.1 Testing environment

It is recommended to use a strong PC to decode a 4Kp60 HEVC stream, especially when selecting a 4:2:2, 10bits, IBBB profile. A strong graphics card can reduce CPU load substantially assuming the player knows to take advantage of it.

Unsmooth video, packet losses, glitches in audio and video are some of the symptoms of a low performance PC

Release Information

- Version 2.2

1.2 Additional Support

You can contact us for more information and assistance as follows:

Table 1: Contact Us

Email
Support: support@xvtec.com

1.3 Definitions

Table 2: Definitions

Term	Definition
AAC_LC	Advanced Audio Coding – Low Complexity Profile
HEVC	High-Efficiency Video Coding, a video compression standard whose guidelines are presented in ITU-T Recommendation H.265
Pixel depth	The number of bits used to represent the color (or a color component) of a single pixel. Typical pixel depths are 8 (for 24-bit color) and 10 for (30-bit color).
Color space	A numerical model representation of colors, usually over 3 axes, for example, RGB or YCbCr.
Frame rate	The frequency (rate) at which consecutive images (frames) appear on a display, expressed in frames per second (fps).
GOP	Group of Pictures
Bit rate	The number of bits transmitted or processed in a given period of time, expressed in bits per second (bps).
IDR	Instantaneous Decoder Refresh. An IDR frame is a specialized I-frame that clears the reference buffer so that no future frame can reference frames processed before the IDR frame.
TS-UDP	Transport Stream over UDP
RTP	Real Time Protocol
RTSP	Real Time Streaming Protocol
SRT	Secure Reliable Transport streaming protocol optimized for streaming across unpredictable networks
MAC	Media Access Control. A MAC address is a unique identifier assigned to network interfaces that supports communications at the data link layer (Ethernet) of a network segment (LAN).
IP	Internet Protocol. An IP address is a numerical identifier assigned to a computing device or node in a TCP/IP network. The address is used to locate and identify the node in communications with other nodes on the network.
APIPA	Automatic Private IP Addressing. Used to automatically assign an IP address when no DHCP server is available.
DNS	Domain Name Server. DNS is a naming system used to translate domain names into numerical IP addresses that are used to locate and identify computer services.
Unicast	A one-to-one association between a sender and destination: each destination address uniquely identifies a single receiver endpoint.
Multicast	A one-to-many-of-many or many-to-many-of-many association; datagrams are routed simultaneously in a single transmission to many recipients. It differs from broadcast in that the destination address designates a subset, and not necessarily all, of the accessible nodes.

2 Installing the System

2.1 Unpacking the Encoder Hardware

The items listed below are shipped in the encoder package. When opening the package, make sure that all of the items are found. If any item is missing, please contact your XVTEC representative.

Table 3: Items Shipped in the Encoder Package

Items Shipped in the XVC-HEVC Encoder Package
XVC-HEVC encoder
Universal desktop power supply
Four rubber feet pads
Quick installation guide
EULA
Warranty statement

2.2 Installing the XVC Management Tool

The XVC Management Tool is a Windows application used to perform discovery and to configure the network settings of the encoder.

To install the XVC Management Tool:

1. Download the XVC Management Tool from the XVTEC site at discovery setup tool from the Downloads page: <http://www.xvtec.com/support/downloads/>
2. Run the installation file that you just downloaded and follow the instructions as presented in the installation wizard.
3. Before executing the tool that you installed, disable Windows Firewall to enable discovery of the network.

3 Using the Encoder Hardware

This chapter contains information on the interfaces on the front and rear panels of the encoder unit:

- [Buttons](#)
- [Connectors](#)
- [LEDs](#)

The front panel of the encoder appears as depicted in the figure below:

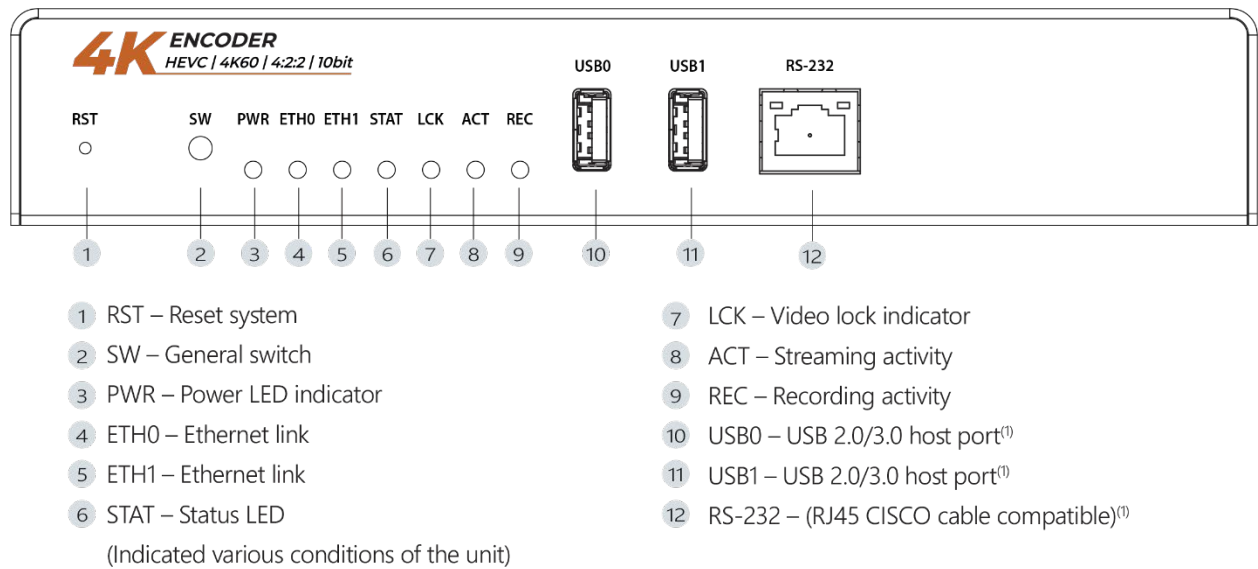


Figure 1: Encoder Front Panel

The rear panel of the encoder appears as depicted in the figure below:

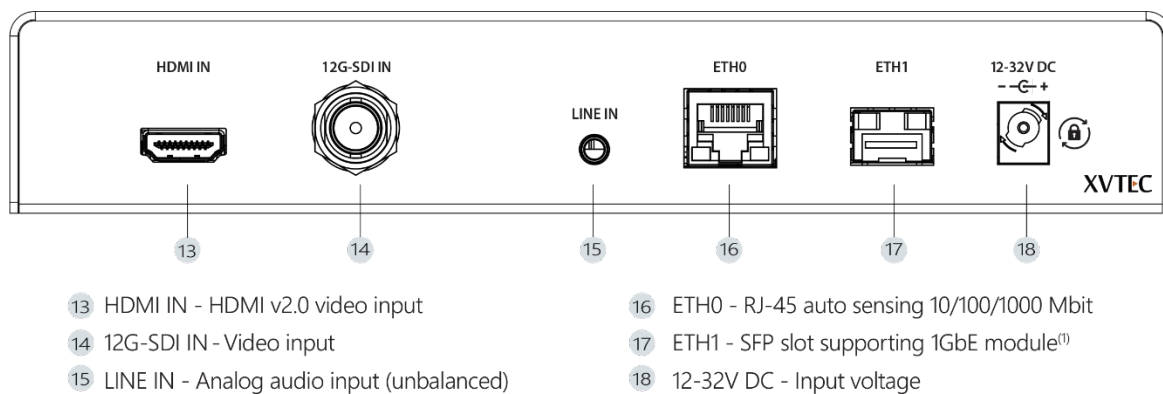


Figure 2: Rear Panel of Encoder

3.1 Buttons

The table below describes the buttons on the front panel of the encoder unit, and their use.

Table 4: Buttons

Label	Connection
RST	Internal button used to reset the system in recovery scenarios only. A pin is required in order to push the button from outside the unit. Two reset levels are supported: <ul style="list-style-type: none"> • Soft reset. Press for 1 second to reset the unit. • Hard reset. Press for 10 seconds to shut down and restart the unit.
SW	Multi-purpose switch used in factory reset and recovery scenarios.

3.2 Connectors

Table 5 and Table 6 below list the connectors on the front and rear panels of the encoder unit, and their use.

Table 5: Front Panel Connectors

Label	Connection
USB0	USB 2.0/3.0 host port 0
USB1	USB 2.0/3.0 host port 1
RS232	RS232 Serial port with RJ45 connector

Table 6: Rear Panel Connectors

Label	Connector
HDMI In	HDMI v2.0 video input connector
SDI In	12G-SDI input – coaxial connector
Line In	Unbalanced analog audio input
Eth0	Ethernet port 0 – RJ45 connector, 10/100/1000 Mbps Half/Full Duplex Auto-Negotiation
Eth1	Ethernet port 1 – SFP slot supporting a 1 GbE module
12-32V DC	12-32V input power

3.3 LEDs

The LED panel, as shown in the figure below, appears on the front panel of the encoder unit.



Figure 3: LED Panel

The table below describes the use of the LEDs appearing on the LED panel.

Table 7: LEDs

LED	Indication
PWR	On/Off indicator. <ul style="list-style-type: none"> Green: Unit is powered on.
ETH0	Ethernet link indicator for Ethernet port 0. <ul style="list-style-type: none"> Green: Ethernet link established.
ETH1	Ethernet link indicator for Ethernet port 1. [future use] <ul style="list-style-type: none"> Green: Ethernet link established.
STAT	Multi-purpose system status indicator. For further information, refer to the following sections: <ul style="list-style-type: none"> Boot Sequence – with static IP address Boot Sequence – with DHCP-allocated IP address Overheating Restoring System Defaults System Recovery
LCK	Video lock indicator. When the XVC-HEVC encoder detects a supported video standard the LED will be lit as follows: <ul style="list-style-type: none"> Red: Standard definition Orange: High definition Green: 4K
ACT	Streaming activity indicator. <ul style="list-style-type: none"> Blinking Green: Streaming is active.
REC	Recording activity indicator (in future release).

NOTE

The **STAT**, **LCK**, **ACT**, and **REC** LEDs are used in parallel to indicate process-specific states during the boot sequence and recovery operations.

4 Configuring the Encoder

XVTEC provides two tools for configuration of the XVC-HEVC encoder:

- **The XVTEC Management Tool**, a Windows application used to perform discovery and to configure the network settings of the encoder.
- **The web-based Configuration System**, which is used to configure the XVC-HEVC's settings using a standard web browser. The browsers supported are:
 - **Google Chrome**
 - Mozilla Firefox
 - Microsoft Edge

4.1 Getting Started

The following sections provide guidelines for your first use of the XVC-HEVC Encoder System.

4.1.1 Assigning an IP Address

In order to communicate with the encoder, a valid IP address must be assigned to the encoder using the XVTEC Management Tool, using one of two options:

- Using a [static IP address](#)
- Using a [DHCP-allocated IP address](#)

NOTE

The initial, factory-set IP address of the XVC-HEVC is in the APIPA range (169.254.x.x). Every encoder is assigned a different APIPA IP address, based on its MAC address.

4.1.1.1 Assigning a Static IP Address

To assign a static IP address to the encoder:

1. Execute the XVTEC Management Tool. The application discovers the XVTEC devices in your network, and displays them in a list, as shown in the figure below.

NOTE

To enable discovery of the devices, you may need to disable the Windows Firewall before executing the XVTEC Management Tool.

Device	Device Name	IP Method	IP Address	Subnet Mask	Default Gateway	MAC Address	State	Fw version	Bitrate	Video Input
encoder	xvchevc_CBD...	static	192 . 168 . 19 . 100	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:34:00:00:47	online	v1.1.5(8.1)		
encoder	xvchevc_CBD...	static	192 . 168 . 217 . 230	255 . 255 . 255 . 0	192 . 168 . 217 . 254	c0:d8:34:00:00:07	online	v1.1.5_01(8.1)		
encoder	xvchevc_CBD...	static	192 . 168 . 217 . 245	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:34:00:00:37	online	v1.1.5_01(8.1)		
encoder	xvchevc_CBD...	static	192 . 168 . 217 . 235	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:1e:00:00:03	online	v1.1.5(8.1)		
encoder	xvchevc_000...	static	192 . 168 . 217 . 211	255 . 255 . 255 . 0	192 . 168 . 217 . 253	00:01:02:77:78:7b	online	v1.1.2(8.1)		
encoder	xvchevc_CBD...	static	192 . 168 . 217 . 237	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:34:00:00:51	online	v1.1.5(8.1)		

Figure 4: List of XVTEC Devices Discovered

- Find the row in the table associated with your encoder. Right-click on the row, and select **Set IP**. The Set Device IP dialog box appears, as shown in the figure below.

Figure 5: Setting the Encoder IP Address

- Make sure that the IP Method selected is "Static".
- Enter the encoder's **IP Address**, **Subnet Mask**, and **Default Gateway** settings. Click **Apply** to save the new settings.

4.1.1.2 Assigning a DHCP-Allocated IP Address

To assign a DHCP-allocated IP address to the encoder:

- Execute the XVTEC Management Tool. The application discovers the XVTEC devices in your network, and displays them in a list, as shown in the figure below.

NOTE

To enable discovery of the devices, you may need to disable the Windows Firewall before executing the XVTEC Management Tool.

Device	Device Name	IP	IP Address	Subnet Mask	Default Gateway	MAC Address	State	FW version	Bitrate	Video Input
encoder	xvchevc_C0D834000051	dhcp	192 . 168 . 217 . 41	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:34:00:00:51	online	v1.1.8(8.1)		
encoder	xvchevc_C0D834000041	static	192 . 168 . 10 . 241	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:34:00:00:41	online	v1.1.8(8.1)		
encoder	xvchevc_C0D834000007	static	192 . 168 . 10 . 230	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:34:00:00:07	online	v1.1.8(8.1)		
encoder	xvchevc_C0D81E000021	static	192 . 168 . 217 . 199	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:1e:00:00:21	online	v1.1.8(8.1)		
encoder	xvchevc_C0D834000035	static	192 . 168 . 217 . 244	255 . 255 . 255 . 0	192 . 168 . 217 . 254	c0:d8:34:00:00:35	online	1432(8.1)		
encoder	xvchevc_C0D81E000003	static	192 . 168 . 10 . 235	255 . 255 . 0 . 0	192 . 168 . 217 . 254	c0:d8:1e:00:00:03	online	v1.1.8(8.1)		

Figure 6: List of XVTEC Devices Discovered

- Find the row in the table associated with your encoder. Right-click on the row and select **Set IP**. The Set Device IP dialog box appears, as shown in the figure below.

Figure 7: Requesting Dynamic Allocation of an IP Address

- Select "DHCP" from the IP Method drop-down list, and click **Apply**. The encoder attempts to retrieve network settings from a DHCP server. During the allocation process, the LEDs on the encoder front panel will respond as described in section 5.1.2. Following retrieval of network settings, the new settings will appear on the main window of the XVTEC Management Tool, as shown in Figure 6 above.

4.1.2 Accessing the Encoder

To access and configure the XVC-HEVC using the web-based user interface, enter the IP address of the encoder unit in the address bar of the browser, as shown in the figure below:

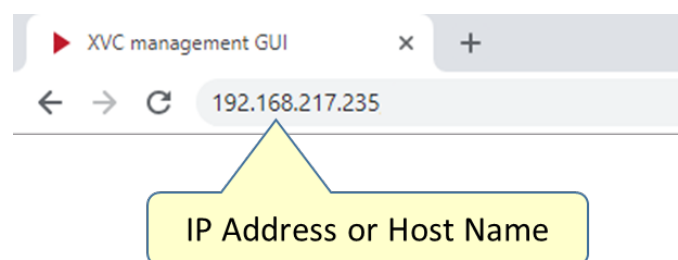


Figure 8: Entering the IP Address in the Browser Address Bar

Sign in by entering your user name and password in the dialog box displayed by your browser. A sample dialog box appears in the figure below. The default credentials are:

- **Username:** admin
- **Password:** admin

Sign in
 http://192.168.217.230
 Your connection to this site is not private

Username

Password

Figure 9: Enter User Name and Password

The main page of the Configuration System appears in the browser window. The page includes a main menu and a work area, as shown in the figure below:

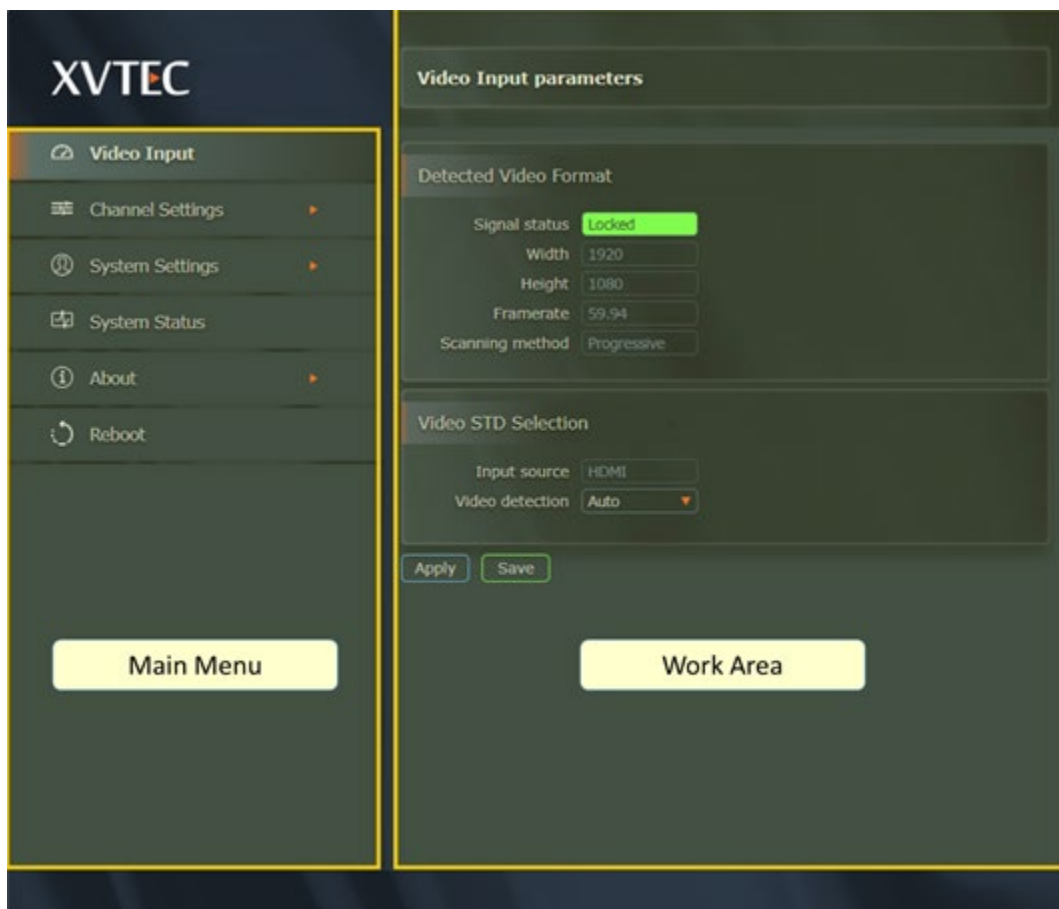


Figure 10: Configuration System Page Layout

The Main Menu provides the following capabilities, which are described in detail in the following sections:

Table 8: Main Menu Entries


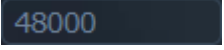


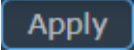
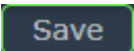
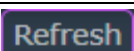
Entry	Description
Video Input	Provides access to video input format and settings.

Channel Settings	Used to configure audio and video encoding parameters.
System Settings	Used to perform administrative operations and configure network settings.
System Status	Displays system-related data.
About	Provides information on technical support, licensing, and system certifications.
Reboot	Restarts the encoder.

4.1.3 Work Area

This section contains guidelines for using the controls in the work area of the Configuration System, as described in the table below.

Table 9: Control Types

Field Type	Example	Description
Field Types		
Read/Write		Fields whose values can be modified – values appear in a bright color.
Read-Only		Fields whose values <i>cannot</i> be modified – values appear in a dark color.
Check Box		Used to enable or disable a function.
List Box		Click on the field to open a list box containing alternative values.
Button Types		
Apply		Click to apply changes made on the page to the current session only. Upon system reboot, the changes are not saved.
Save		Click to apply changes made on the page to the current session and to save them permanently to Flash memory.
Refresh		Click to restore the fields on the page to the values that were set during the last Apply or Save operation.

4.2 Video Input

Select **Video Input** on the main menu to display the Video Input page, as shown in the figure below.

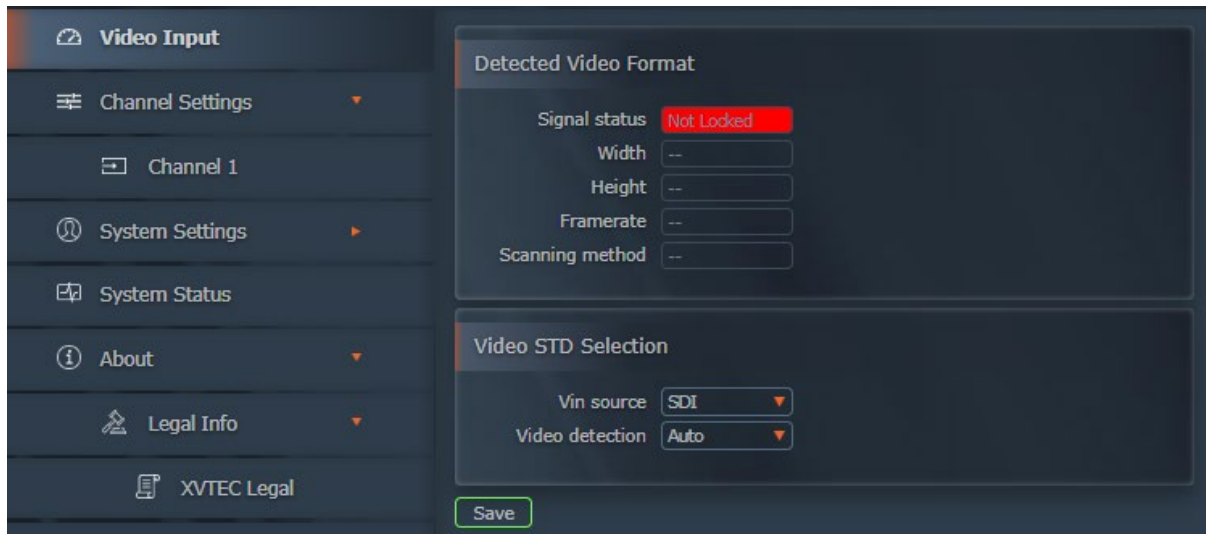


Figure 11: Video Input Page

The fields appearing on the page are described in the table below.

Table 10: Video Input Field Descriptions

Field	Description
Detected Video Format	
Signal status	Indicates if the encoder has detected a supported video standard: <ul style="list-style-type: none"> If detected, the message Locked appears on a green background If not detected, the message Not Locked appears on a red background.
Width	The width of the image in pixels
Height	The height of the image in pixels
Frame rate	The image frame rate, in frames per second (fps)
Scanning method	The scanning method used to display a video frame: <ul style="list-style-type: none"> Interlaced. Scanning method in which even-numbered and odd-numbered lines are captured alternately. Progressive. Scanning method in which the entire image is captured at every frame.
Video Standard Selection	
Input source	Video input source: <ul style="list-style-type: none"> HDMI (High-Definition Multimedia Interface). Supports version 2.0 of the HDMI digital video interface. 12G-SDI (Serial Digital Interface). Digital video over coaxial cables, using BNC connectors.
Video Detection	The method used to detect the video input source: <ul style="list-style-type: none"> Auto. Only automatic detection by the encoder is supported.

4.3 Channel Settings

The Channel Settings tab is used to configure the following parameters:

- Video encoding parameters
- Audio encoding parameters
- Streaming parameters

Select **Channel Settings** and the relevant channel number on the main menu to display the Channel Settings page, as shown in the figure below.

The screenshot displays the Channel Settings page for Channel 1. The left sidebar contains navigation options: Video Input, Channel Settings (selected), Channel 1, System Settings, System Status, About, Legal Info, XVTEC Legal, OSS, Certifications, and Reboot. The main content area is divided into three sections:

- Video Encoder Settings:**
 - Video enable:
 - Encoding res: Follow Input
 - Pixel depth: 10 Bit/pixel
 - Color format: 4:2:2
 - Rate control: CBR
 - Bitrate: 18182 (kb)
 - Frame rate: Full
 - Intra frame interval: 64
 - GOP structure: IPPP
 - Encoding latency: Low
- Audio Encoder Settings:**
 - Audio source: HDMI/SDI
 - Audio enable:
 - Detected sample rate: 0 (Hz)
 - Bit rate: 80000 (bps)
 - Coding: AAC_LC
- Streaming Settings:**
 - Streaming mode: TS-UDP
 - TS-UDP destination IP: 192.168.10.31
 - TS-UDP destination port: 35000
 - Traffic control:
 - TS-UDP stream URL: udp://@192.168.10.31:35000
 - Copy button

At the bottom of the settings area are three buttons: Apply, Save, and Refresh.

Figure 12: Channel Settings Page

The fields appearing on the page are described in the table below.

Table 11: Channel Settings Field Descriptions

Field	Description
Video Encoder Settings	
Video enable	If checked, the selected video channel is enabled for compression and transmission.
Encoding res	The resolution of the encoded video: <ul style="list-style-type: none"> Only Follow input is supported. The video input resolution is preserved.
Pixel depth	The number of bits used to specify each color component (Y, Cb, Cr) of a pixel: <ul style="list-style-type: none"> 8 Bit/pixel – Each component is represented using 8 bits 10 Bit/pixel – Each component is represented using 10 bits
Color format	The chroma subsampling scheme used to compress video transmissions. <ul style="list-style-type: none"> 4:2:0 – The video is compressed using 4:2:0 color space (normal quality) 4:2:2 – The video is compressed using 4:2:2 color space (high quality)
Rate control	The algorithm used by the encoder to maintain the target encoder bit rate. <ul style="list-style-type: none"> CBR (Constant Bit Rate). In CBR, the encoder encodes the video at a constant bit rate. Capped VBR (Capped Variable Bit Rate). CVBR encodes the video at a variable bit rate, allocating more bits for complex scenes. Typically, both schemes generate similar bit rates, but CVBR encoding has more bit rate fluctuations.
Bitrate/Average bitrate	Average video output bitrate. A higher average bitrate yields a better-quality video. Click to view a list of valid video bitrates.
Frame rate	The ratio of the target (output) frame rate to the input frame rate: <ul style="list-style-type: none"> Full (All frames are encoded) 1/2 (Every second frame is encoded) 1/4 (Every 4th frame is encoded) 1/8 (Every 8th frame is encoded) Note: <ul style="list-style-type: none"> For interlaced video standards (such as 1080i50/60), only the “Full” frame rate is supported.
Intra frame interval	The interval (in number of frames) upon which the encoder will produce an I/IDR (Intra/Instantaneous Decodable Refresh) Frame. When setting this field to 32, for example, the encoder generates an I/IDR frame every 32 frames. <p>The interval selected depends on the application and network conditions. For low bitrate transmissions, the interval value should be high – allowing the encoder to reduce traffic volume by sending more P (Predictive) frames.</p> <ul style="list-style-type: none"> Minimum value: 32 frames Maximum value: 228 frames Recommended values: 32 or 64 Note: The final value will adjusted automatically by the encoder.
GOP structure	The Group of Pictures (GOP) structure used: <ul style="list-style-type: none"> IBBBB without re-ordering of frames (similar to IPPP) IBBBB (for interlace M=4 for progressive M=8) The structure determines whether an I-frame is followed by P-frames (Predictive coded picture) or B-frames (Bi-predictive coded picture).

Encoding latency	Controls the level of latency introduced by the encoder. <ul style="list-style-type: none"> • Normal: Approximately 1000 ms • Low: Approximately 50 ms
Audio Encoder Settings	
Audio source	The interface used to input audio signals into the encoder: <ul style="list-style-type: none"> • HDMI High-Definition Multimedia Interface. • SDI Serial Digital Interface (supported in future release). • LINE IN The 3.5 mm analog audio input interface.
Audio enable	If checked, audio input is encoded.
Detected sample rate	The detected audio sampling rate used. Note: Only 48 KHz is supported.
Bit rate	The audio bit rate used by the encoder, in bits per second (bps). Valid values are between 64,000 and 256,000 bps. Default is 80,000 bps.
Coding	The audio compression method: <ul style="list-style-type: none"> • Only AAC-LC compression is supported.
Streaming Settings	
Streaming mode	The streaming mode selected. The following modes are supported: <ul style="list-style-type: none"> • TS-UDP - Transport Stream over UDP. • RTP - Real-Time Protocol over UDP. • RTSP - Real-Time Streaming Protocol. • SRT - Secure Reliable Transport streaming protocol Details on configuring the individual streaming modes are found in the following section.

4.3.1 Video Bitrate Settings

Table 12 below summarizes the minimum and maximum bitrates supported by the XVC-HEVC Encoder for major video standards.

- The *minimum bitrate* value depends on the video input standard. In addition, the minimum bit rate scales proportionally with the frame rate selected. For example, if the minimum bitrate for 2160p60 is 2812 Kbps, then the minimum bitrate for 2160p30 (a 50% reduction in frame rate) will be 1406 Kbps (a 50% reduction in bitrate).
- The *maximum bitrate* is always 80,000 Kbps.

Table 12: Valid Minimum/Maximum Bitrates

Video Standard	Minimum Bitrate (Kbps)	Maximum Bitrate (Kbps)
480i29.97 (NTSC)	500	80000
576i25 (PAL)	500	80000
480p60	500	80000
576p50	500	80000
720p60	312	80000
1080i60	351	80000
1080p60	703	80000
2160p60	2812	80000
4K(DCI)p60	3000	80000

Table 13 and Table 14 below list recommended video bitrate values for different video standards in normal and low encoding latency modes.

Table 13: Recommended Bitrates in Normal Encoding Latency Modes

Video Resolution	Video Quality (kbps)		
	High	Medium	Low
3840x2160@60p	80,000	16,000	8,000
1920x1080@60p	32,000	4,000	2,000
720x480@60p	8,000	1,000	500

Table 14: Recommended Bitrates in Low Encoding Latency Modes

Video Resolution	Video Quality (kbps)		
	High	Medium	Low
3840x2160@60p	80,000	60,000	32,000
1920x1080@60p	32,000	20,000	8,000
720x480@60p	8,000	8,000	2,000

4.3.2 Streaming Modes

The XVC-HEVC Encoder supports the following streaming modes:

- [TS-UDP](#) - Transport Stream over UDP.
- [RTP](#) - Real-Time Protocol over UDP.
- [RTSP](#) - Real-Time Streaming Protocol.
- SRT - Secure Reliable Transport streaming protocol

4.3.2.1 TS-UDP Streaming

The following fields appear in the Streaming Settings section when you choose TS-UDP streaming.

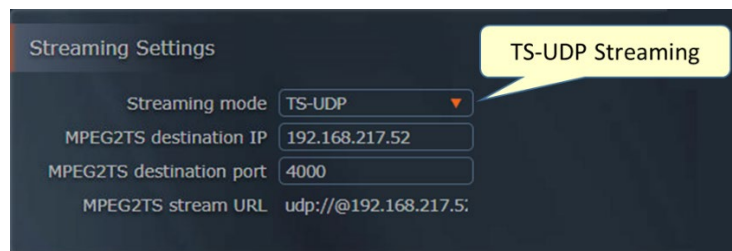


Figure 13: TS-UDP Streaming Fields

The fields appearing in this section are described in the table below.

Table 15: TS-UDP Streaming Field Descriptions

Field	Description
TS-UDP Streaming Settings	
TS-UDP destination IP	The destination IP address of the TS-UDP stream. Note: TS-UDP supports unicast and multicast transmissions. To perform a multicast transmission, use a multicast-dedicated IP address.
TS-UDP destination port	The destination port number of the TS-UDP stream.
TS-UDP stream URL	This address is generated automatically by the encoder and should be copied to the video decoder / player.

NOTE

The IPv4 multicast IP address range is between 224.0.0.0 and 239.255.255.255. Contact your system administrator for the specific address to use.

4.3.2.2 RTP Streaming

The following fields appear in the Streaming Settings section when you choose RTP streaming.

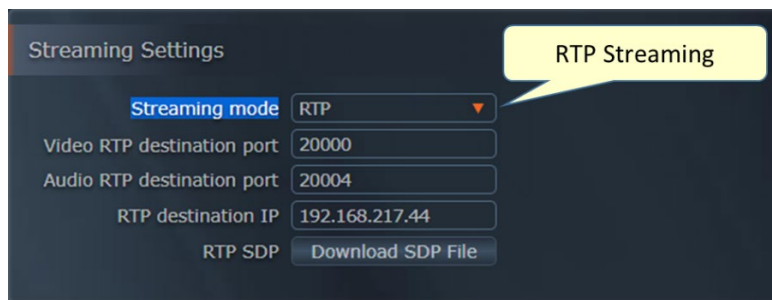


Figure 14: RTP Streaming Fields

The fields appearing in this section are described in the table below.

Table 16: RTP Streaming Field Descriptions

Field	Description
RTP Streaming Settings	
Video RTP destination port	The destination video UDP port of the RTP stream.
Audio RTP destination port	The destination audio UDP port of the RTP stream.
RTP destination IP	The destination IP address of the RTP stream. Note: RTP supports unicast and multicast transmission. To perform a multicast transmission, use a multicast-dedicated IP address.
RTP SDP	The SDP (Session Description Protocol) file is generated automatically by the encoder and contains information about the streaming parameters. The player should open this file to display the stream.

NOTE

The RTP specification recommends selecting an even RTP port number, and the next higher odd number for associated RTCP port. Note that XVC-HEVC does not send RTCP packets. Example RTP port selections:

* Video RTP destination port: 55000 (associated RTCP port number would be 55001)

* Audio RTP destination port: 55002 (associated RTCP port number would be 55003)

4.3.2.3 RTSP Streaming

RTSP supports streaming to a single client in unicast only. When a RTSP session is active, session requests from other clients will be refused. The following fields appear in the Streaming Settings section when you choose RTSP streaming.

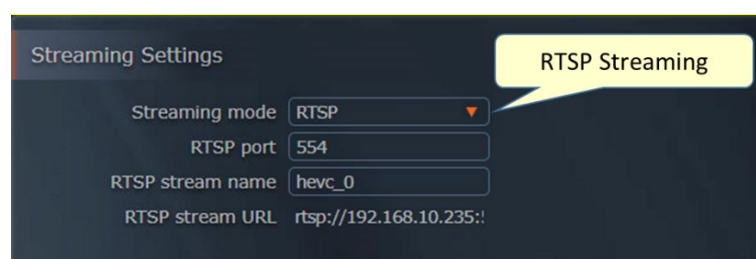


Figure 15: RTSP Streaming Fields

The fields appearing in this section are described in the table below.

Table 17: RTSP Streaming Field Descriptions

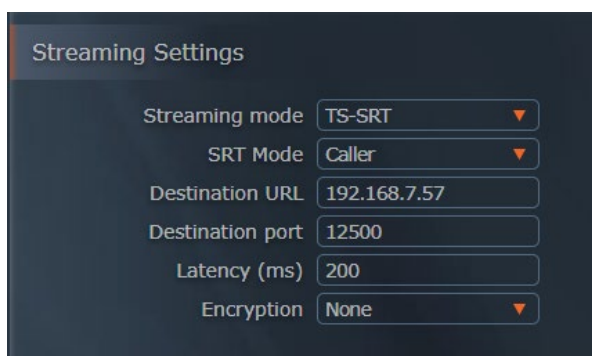
Field	Description
RTSP Streaming Settings	
RTSP port	The TCP port number of the RTSP session.
RTSP stream name	The name of the RTSP stream.
RTSP stream URL	The URL address is generated automatically by the encoder, and should be copied to the video decoder / player.

4.3.2.4 SRT streaming

Secure Reliable Transport is an open source video transport protocol developed originally by Haivision. SRT optimizes streaming performance across unpredictable networks, such as the Internet, by dynamically adapting to the real-time network conditions between transport endpoints. This helps minimize effects of jitter and bandwidth changes, while error-correction mechanisms help minimize packet loss. SRT supports end-to-end encryption with AES. When performing retransmissions, SRT only attempts to retransmit packets for a limited amount of time based on the latency as configured by the application.

Caller mode

Field	Description
SRT Streaming Settings	
Mode	Caller
Destination URL	Destination IP
Destination port	Destination port
Latency	20-2000ms, should be set to 3xRTT (Round Trip Time)
Encryption	None, AES128, AES192, AES256
Passphrase	If encryption is selected, enter a Passphrase



Listener mode

Field	Description
SRT Streaming Settings	
Mode	Listener
Listener port	The port that SRT will listen on
Latency	20-2000ms, should be set to 3xRTT (Round Trip Time)
Max Overhead Bandwidth	Valid range (5 – 100)% default 5%. Limits the overhead BW required for packet loss recovery
Encryption	None/AES128/AES192/AES256
Passphrase	If encryption is selected, enter a Passphrase
TS-SRT stream URL	Generated URL of final stream

Streaming Settings

Streaming mode: TS-SRT

SRT Mode: Listener

Listener port: 8118

Latency (ms): 20

Max Overhead B/W (%): 20

Encryption: AES-256

Passphrase:

TS-SRT stream URL: srt://@192.168.10.235:8118 Copy

Notes:

1. In **Listener** mode, the XVC-HEVC will wait for an incoming connection on the specified 'Listener port'.
2. In **Caller** mode, the XVC-HEVC will try to connect to the 'Destination URL'

4.4 System Settings

Select **System Settings** on the main menu to open the System Settings Menu, as shown in the figure below:

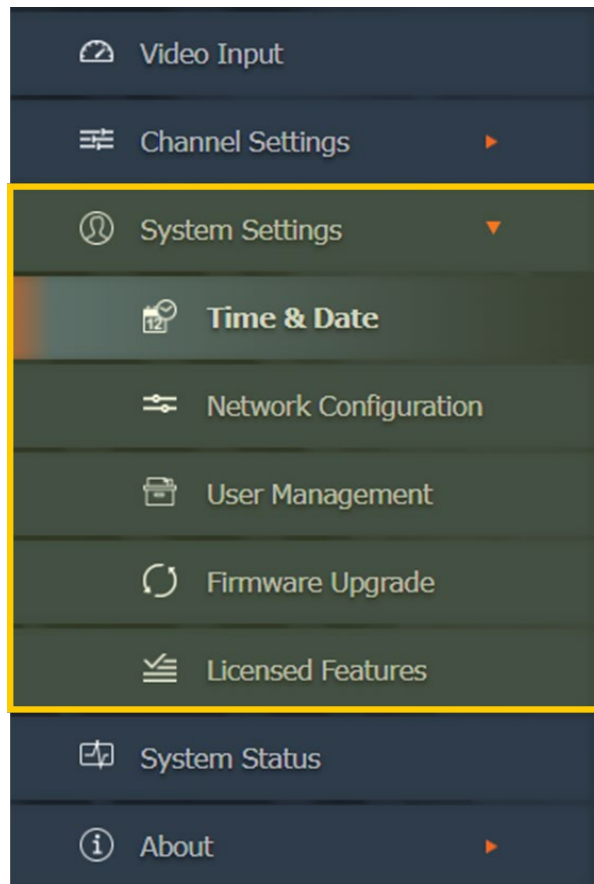


Figure 16: System Settings Menu

The Systems Settings menu provides the following capabilities, which are described in detail in the following sections:

Table 18: System Settings Menu Entries

Entry	Description
System Settings	Displays firmware version information.
Time & Date	Used to set the system time and date.
Network Configuration	Used to set the encoder's network parameters.
User Management	Used to authorize users to manage the encoder using the web interface.
Firmware Upgrade	Used to perform firmware upgrades.
Licensed1 Features	Displays a list of features that have been enabled for use with the encoder.

4.4.1 System Settings Main Page

The System Settings main page displays firmware version information. To access the page from the main menu, select **System Settings**. The System Settings main page appears as depicted in the figure below.

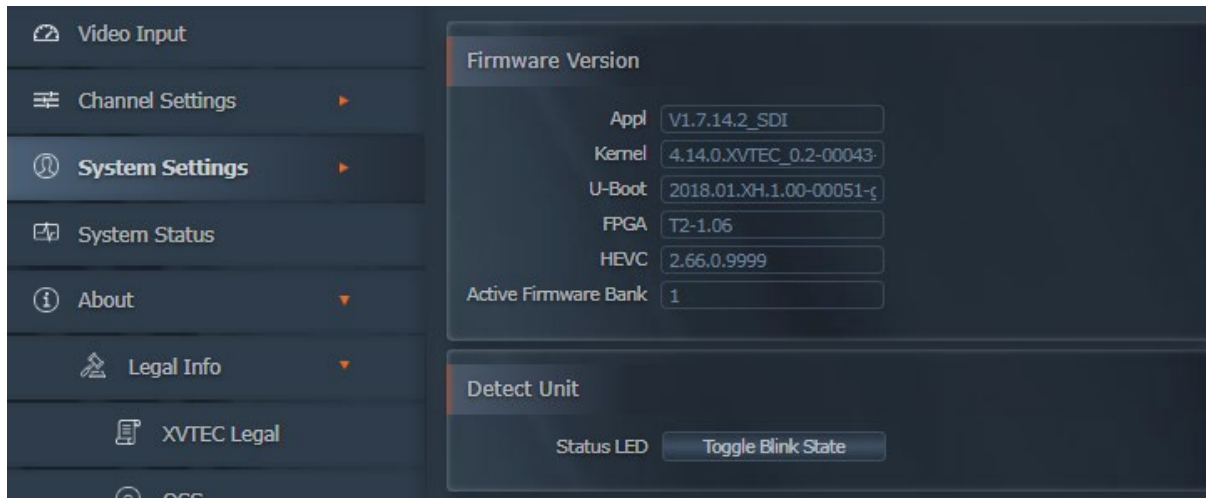


Figure 17: Systems Settings Main Page

The fields appearing on the page are described in the table below.

Table 19: Systems Settings Field Descriptions

Field	Description
Firmware Version	
Appl	The global firmware version
Kernel	Linux kernel version
U-Boot	U-boot version
FPGA	FPGA hardware version.
HEVC	HEVC firmware version
Active Firmware Bank	The number of the active bank (an area in the FLASH memory) from where all the software/firmware components are loaded
Detect Unit	
Status LED	Click on the button to toggle the STAT LED between <i>blinking</i> and <i>not blinking</i> . You can use this function to identify the encoder currently being managed.

4.4.2 Time & Date

The Time & Date page is used to set the system time and date – either manually, or automatically by an NTP server. To access the page from the main menu, select **System Settings >> Time & Date**. The Time & Date page appears as depicted in the figure below.

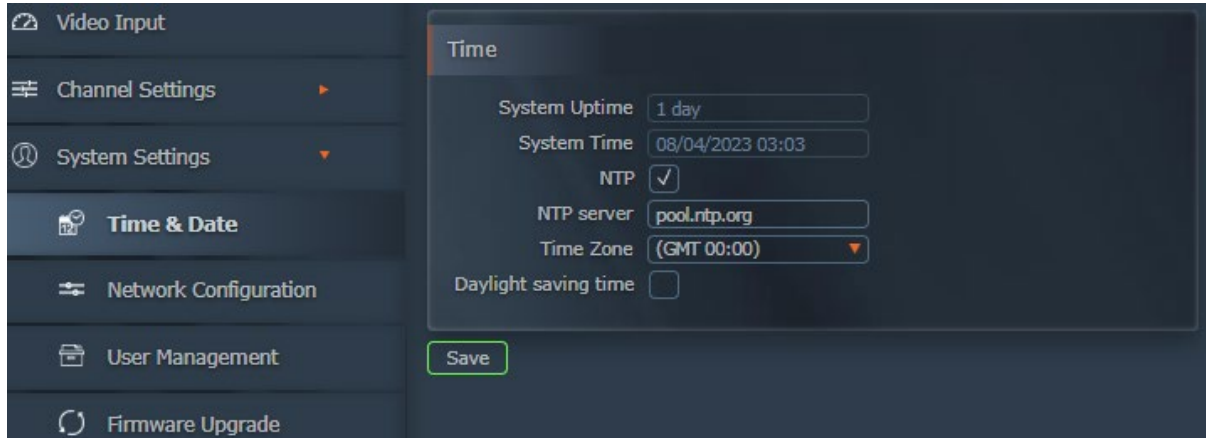


Figure 18: Time & Date Page

The fields appearing on the page are described in the table below.

Table 20: Time & Date Field Descriptions

Field	Description
Time	
System Uptime	The time elapsed since the last encoder reboot, in hh:mm format.
System Time	The current system date and time
NTP	If checked, the system date and time are synchronized with an NTP server.
NTP Server	The URL of the NTP server used.
Time Zone	The time zone in which the encoder operates. Select the appropriate time zone using the list box.
Daylight Saving Time	If checked, the system date and time are adjusted for daylight savings.

4.4.3 Network Configuration

The Network Configuration page is used to set the encoder's network parameters. To access the page from the main menu, select **System Settings >> Network Configuration**. The Network Configuration page appears as depicted in the figure below.

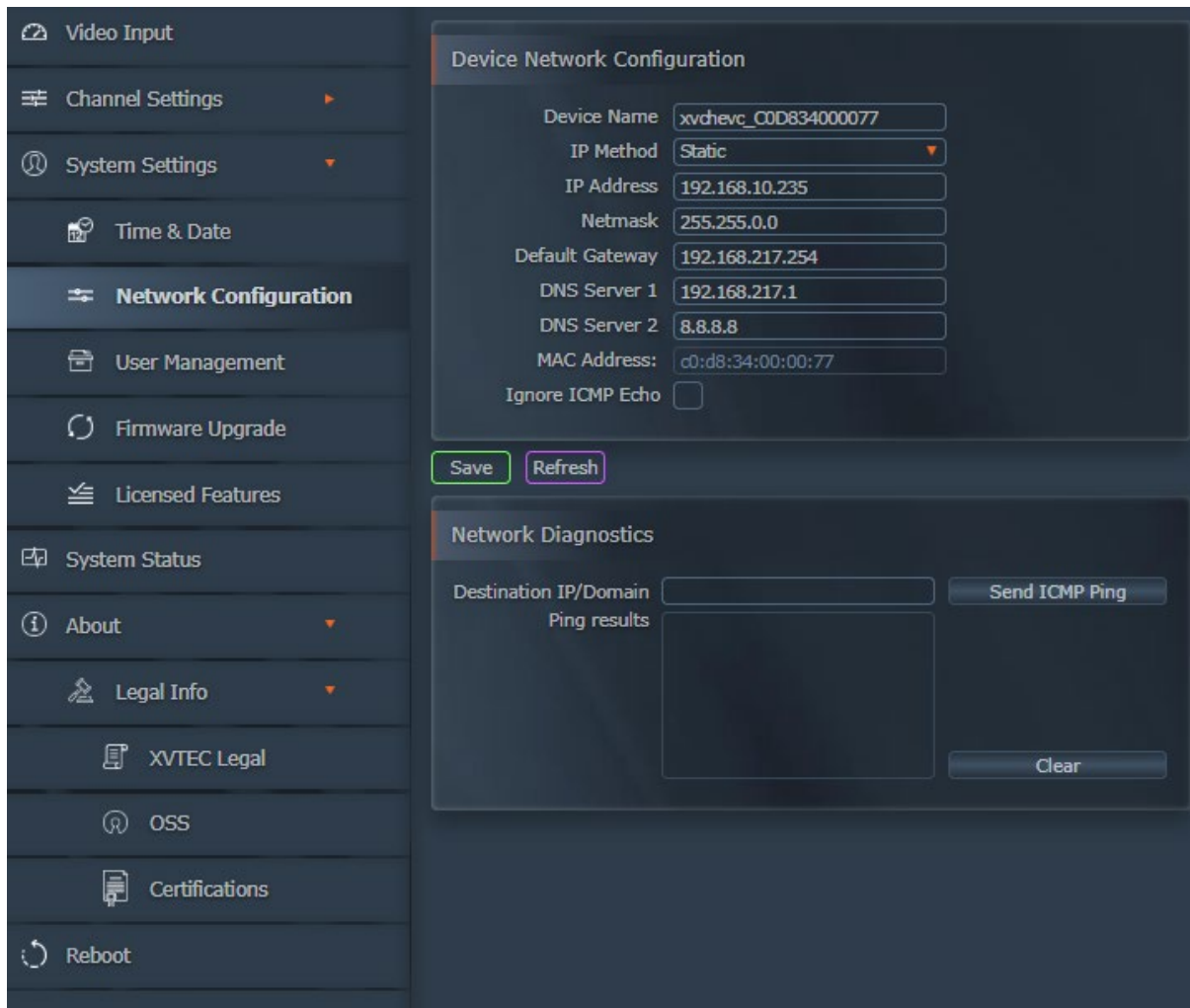


Figure 19: Network Configuration Page

The fields appearing on the page are described in the table below.

Table 21: Network Configuration Field Descriptions

Field	Description
Device Network Configuration	
Device Name	The encoder device name. The factory-supplied device name is generated by concatenating the prefix "xvchevc_" with the MAC address of the encoder.
IP Method	The method used to allocate an IP address for the encoder: <ul style="list-style-type: none"> • Static. The IP address is set manually. • DHCP. The IP address is allocated automatically using the DHCP (Dynamic Host Configuration Protocol). • Note: If a DHCP server is not up and running, the encoder will fail to receive network configurations. In this case, the encoder will attempt several times to send a DHCP request to the server. If no response is received, the encoder's IP address defaults to an APIPA address. The IP address of the encoder can be discovered using the XVC Management Tool
IP Address	The IP address of the encoder
Netmask	The subnetwork mask used by the network segment in which the encoder operates.
Default Gateway	The IP address of the default gateway that serves as the forwarding host (router) to other networks when no other route specification matches the destination IP Address.
DNS Server 1	The IP address or host name of the main DNS server accessed by the encoder.
DNS Server 2	The IP address or host name of the secondary DNS server accessed by the encoder.
MAC Address	The MAC address of the encoder.
Ignore ICMP Echo	If checked, the encoder ignores ICMP Echo (ping) requests. This feature can help prevent Denial of Service (DoS) attacks.
Network Diagnostics	
Destination IP/Domain	The IP address or domain name of the ping request destination. Click Send ICMP Ping to initiate the request.
Ping Results	Displays the results of the ping responses. Click Clear to erase the results.

4.4.4 User Management

The User Management page is used to authorize users to manage the encoder using the web interface. To access the page from the main menu, select **System Settings >> User Management**. The User Management page appears as depicted in the figure below.

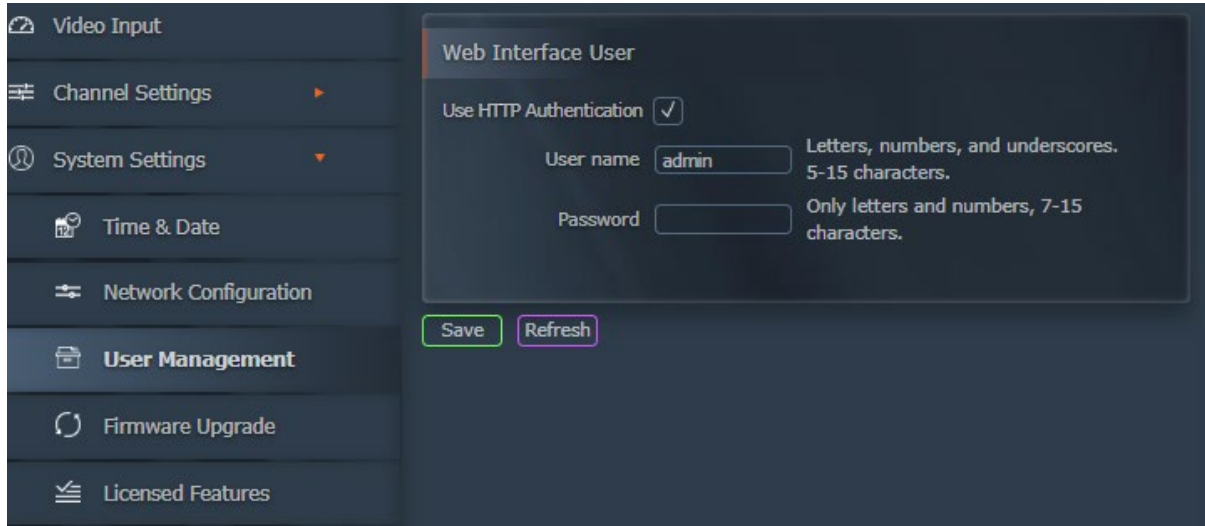


Figure 20: User Management Page

The fields appearing on the page are described in the table below.

Table 22: User Management Field Descriptions

Field	Description
Web Interface User	
Use HTTP Authentication	If checked, an HTTP Authorization request is required in order to authenticate the credentials of web-based client users.
User Name	Web-based client user name.
Password	Web-based client user's password.

NOTE

To [reset the user name and password](#), use the XVC Management Tool.

4.4.5 Firmware Upgrade

The Firmware Upgrade page is used to manage the firmware upgrade process. To access the page from the main menu, select **System Settings >> Firmware Upgrade**. The Firmware Upgrade page appears as depicted in the figure below.

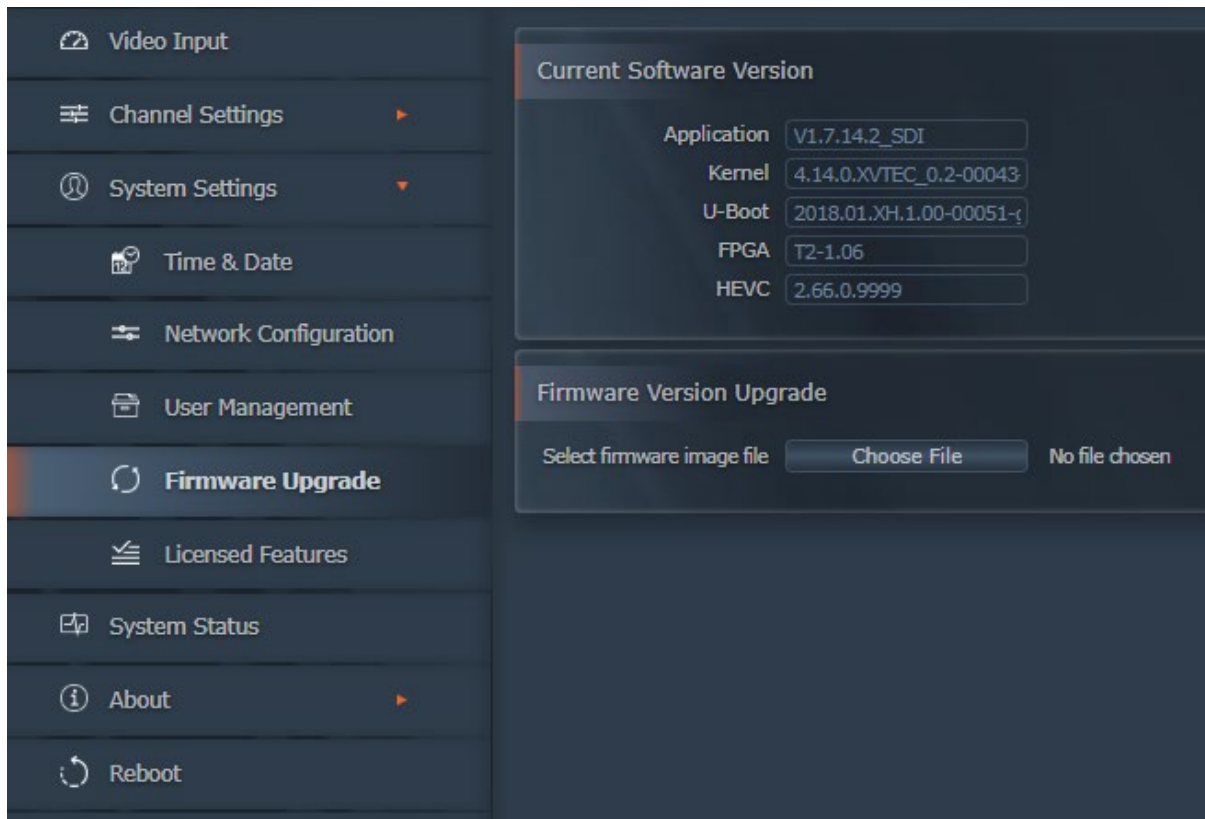


Figure 21: Firmware Upgrade Page

The fields appearing on the page are described in the table below.

Table 23: Firmware Upgrade Field Descriptions

Field	Description
Current Software Version	
Application	The global firmware version
Kernel	Linux kernel version
U-Boot	U-boot version
FPGA	FPGA hardware version
HEVC	HEVC firmware version
Firmware Version Upgrade	
Select Firmware Image File	The image file to be uploaded into Flash memory. Click Choose File to select an image file for upload.

In order to upgrade the encoder firmware, upload the firmware image file supplied by XVTEC.

To upgrade the encoder firmware:

1. Click on the **Choose File** button. An Open dialog box appears, as shown in the figure below.

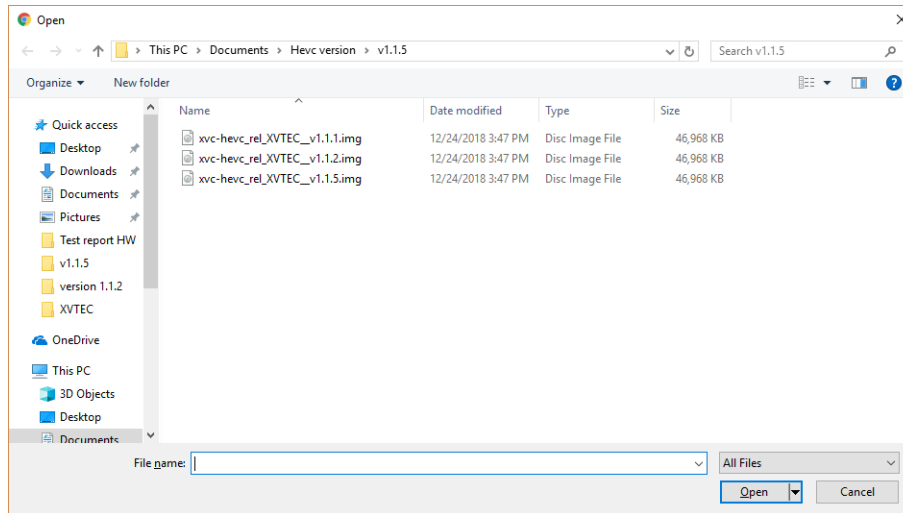


Figure 22: Selecting the Image File

2. Navigate the system and select the image file to be uploaded. Click **Open**. The name of the license file selected appears next to the **Choose File** button.
3. Click **Upload** to upload the image file to the encoder. A series of progress messages will appear in a new field – **Update Status** – that appears on the page, as shown in Figure 23 below:
 - "Loading"
 - "Saving"
 - "Validation"
 - "Rebooting." At this point, there will be a loss of connectivity with the encoder. Connectivity will be restored following the successful completion of the boot process.

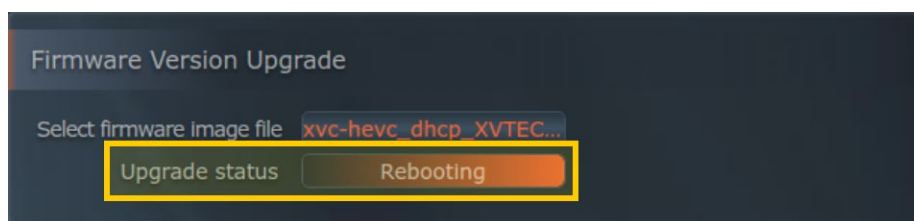


Figure 23: Upgrade Status Field

Following reboot, the upgrade process may continue for several minutes, as multiple hardware components are updated. During the process the **STAT** LED appears in blinking green, as shown in the figure below:



Figure 24: Upgrade LED Indicators

Following successful completion of the upgrade, the **STAT** LED appears in green, as shown in the figure below:



Figure 25: Upgrade Completed LED Indicators

4.4.6 Licensed Features

The Licensed Features page displays a list of features that have been enabled for use with the encoder. To access the page from the main menu, select **System Settings >> Licensed Features**. The Licensed Features page appears as depicted in the figure below.

NOTE

In a future release, you will be able to use this page to enable additional features.

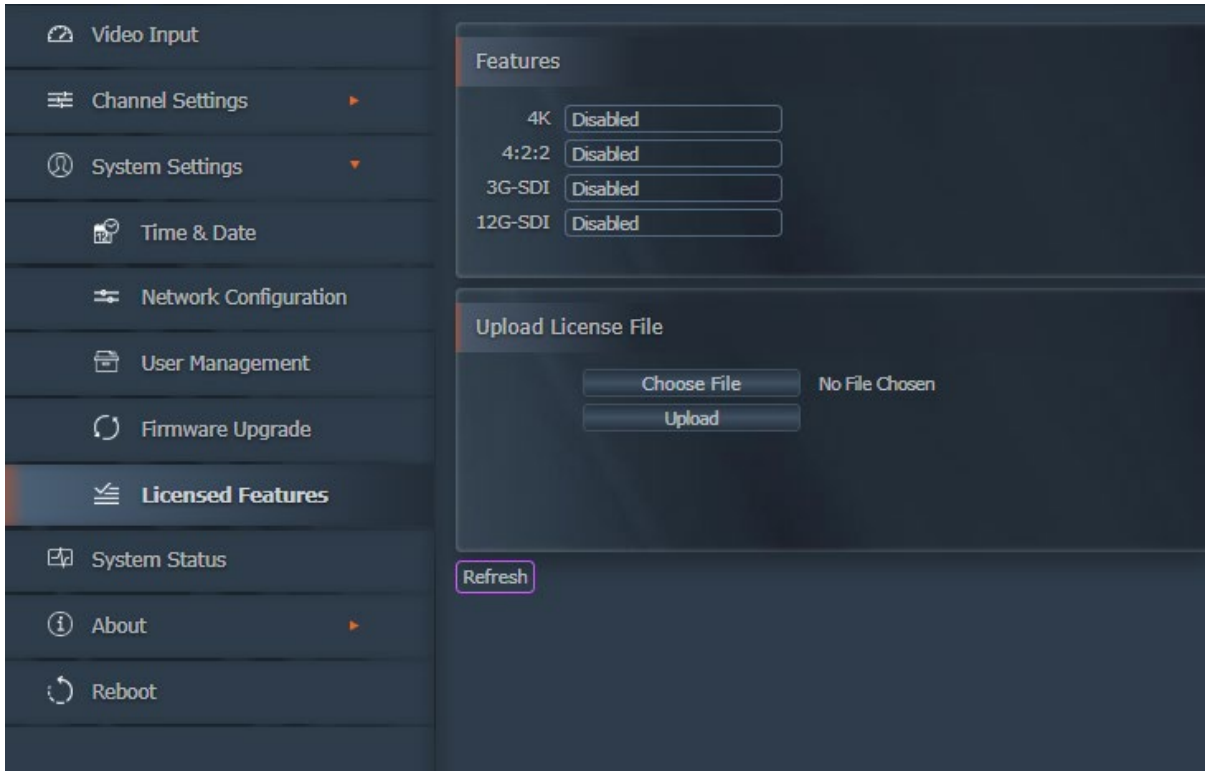


Figure 26: Licensed Features Page

The Enabled Features section displays a list of features that have been enabled for use with the encoder.

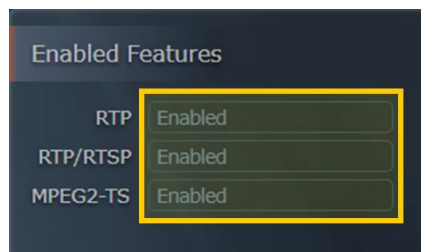


Figure 27: Enabled Features

4.5 System Status

Select **System Status** on the main menu to display the System Status page, as shown in the figure below.

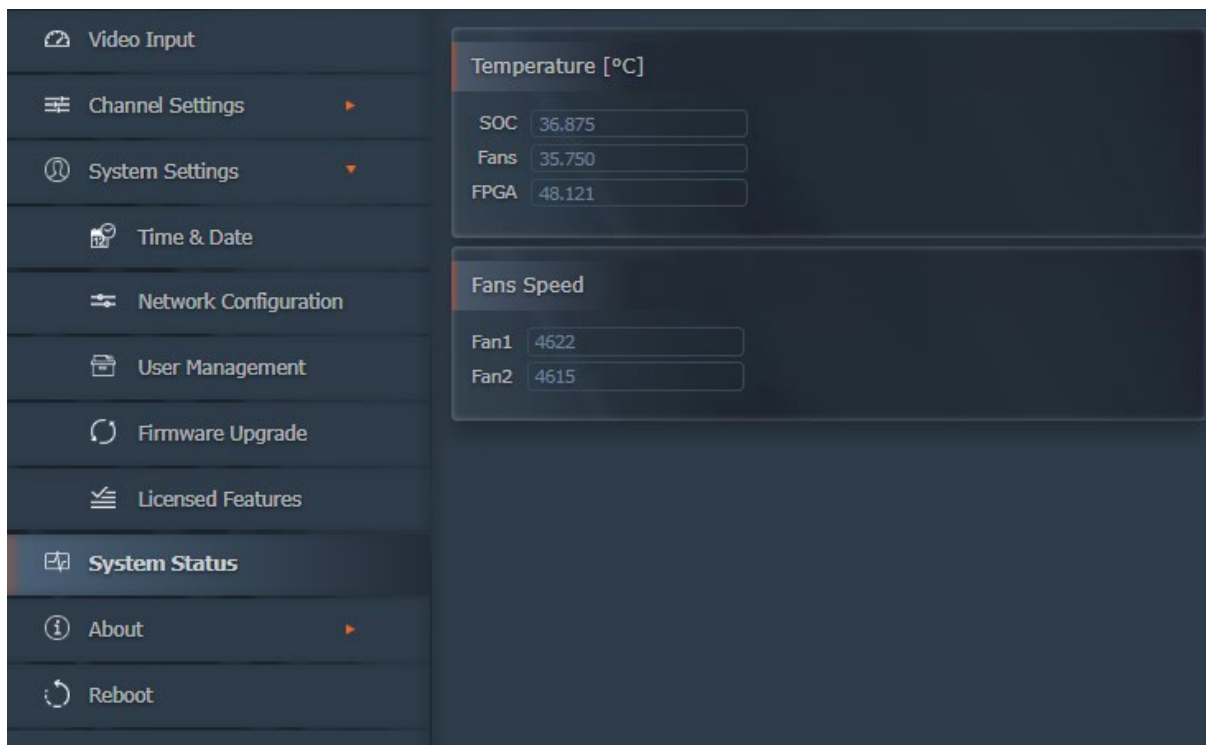


Figure 28: System Status Page

The fields appearing on the page are described in the table below.

Table 24: System Status Field Descriptions

Field	Description	
Temperature [°C]		
SOC	The temperature as measured at the video processor system-on-chip.	
Fans	The temperature as measured near the fans.	
FPGA	The temperature as measured at the FPGA	
Fans Speed		
Fan1	The speed of fan #1, in RPM.	At least 500 RPM is required for normal operation. Note: If both the Fan1 and Fan2 fields display a value of "45", the fans are <i>not operational</i> .
Fan2	The speed of fan #2, in RPM.	

4.6 About

Select **About** on the main menu to display the About page, as shown in the figure below.

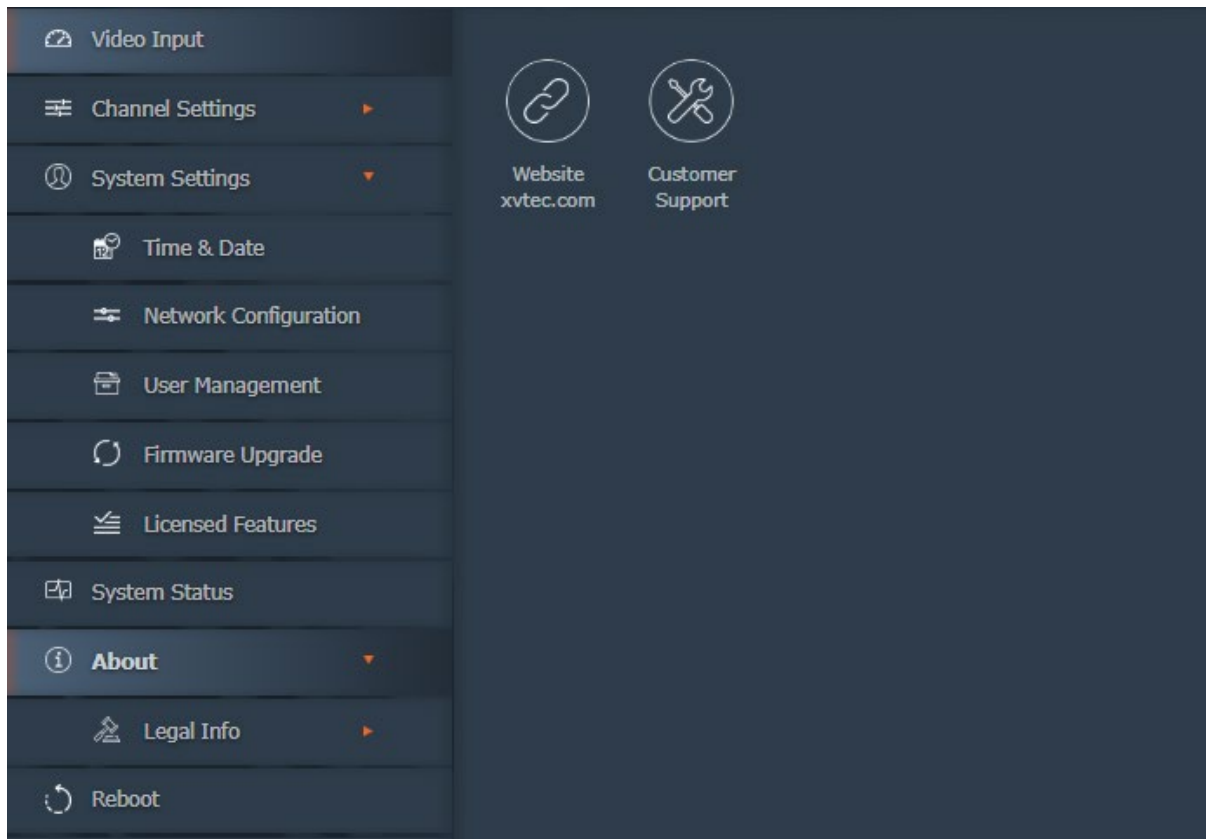


Figure 29: About Page

The About page provides access to the following resources:

- The XVTEC website at xvtec.com
- Customer support – the XVTEC website Downloads page

4.6.1 XVTEC Legal Page

The XVTEC Legal page presents the End User License Agreement and warranty information. To access the page from the main menu, select **About >> Legal Info >> XVTEC Legal**. The page appears as depicted in the figure below.

The screenshot shows a dark-themed user interface. On the left is a vertical navigation menu with the following items: Video Input, Channel Settings, System Settings, Time & Date, Network Configuration, User Management, Firmware Upgrade, Licensed Features, System Status, About, Legal Info, **XVTEC Legal** (highlighted), OSS, Certifications, and Reboot. The main content area on the right contains the following text:

IMPORTANT: YOU SHOULD CAREFULLY READ THESE TERMS AND CONDITIONS BEFORE ACCESSING, COPYING, DOWNLOADING, STUDYING, ANALYZING AND/OR USING (COLLECTIVELY, "USE") THE PRODUCT (AS DEFINED BELOW) IN ANY WAY WHATSOEVER. USING THE PRODUCT WILL MEAN THAT YOU HAVE READ THIS AGREEMENT, UNDERSTOOD ITS TERMS AND CONDITIONS, AND UNCONDITIONALLY AGREED TO BE BOUND BY ALL THE TERMS AND CONDITIONS SET FORTH IN THIS AGREEMENT. IF YOU DO NOT AGREE TO THE TERMS AND CONDITIONS OF THIS AGREEMENT YOU MAY NOT USE THE PRODUCT. IF YOU ARE ENTERING INTO THIS AGREEMENT ON BEHALF OF A COMPANY OR OTHER LEGAL ENTITY, YOU REPRESENT THAT YOU HAVE THE AUTHORITY TO BIND SUCH ENTITY TO THE TERMS AND CONDITIONS OF THIS AGREEMENT. IF YOU DO NOT AGREE TO THE TERMS AND CONDITIONS OF THIS AGREEMENT, YOU MAY NOT USE THE PRODUCT.

THIS IS A LICENSE AGREEMENT FOR THE USE OF THE FIRMWARE AND OTHER SOFTWARE EMBEDDED IN THE PRODUCT SOLELY AS PART OF THE PRODUCT AND IT IS NOT AN AGREEMENT FOR SALE OF THE SOFTWARE OR ANY INTELLECTUAL PROPERTY THEREIN.

END USER LICENSE AGREEMENT

This End User License Agreement ("Agreement") is a legal agreement between you (either an individual or a single entity) "Licensee", or "You" and XVTEC Ltd. ("Licensor") for software owned by XVTEC and/or its subsidiaries and/or licensed to XVTEC in connection with the Product by their respective third party suppliers and licensors which includes computer software and may include associated data, materials or documentation in connection with your use of the Product (as defined below) in which such software is embedded ("Software").

This Agreement sets forth the terms and conditions that govern the license granted to you to use the Software as part of the Product.

1. DEFINITIONS

In this Agreement the following terms shall have the meanings given below:

1.1 "Product" means XVC-HEVC/X500E UHD HEVC Video Encoder.

1.2 "Purpose" means use of the Software solely with the Product and as embedded in the Product.

2. GRANT OF LICENSE

2.1 The Licensor hereby grants solely to Licensee, as an end user, a personal, limited, terminable, non-transferable, non-assignable, non-sublicensable and non-exclusive license to use one copy of the Software on and together with the Product and you may not use or make the Software available over any other product or device (the "Purpose"), all subject to the terms and conditions set forth in this Agreement, and subject to Licensee's compliance (and continued compliance) with these terms and conditions.

2.2 Certain items of the Software may be subject to open source licenses or to rights of third parties. The provisions of open source license or third parties' licenses may override some of the terms of this Agreement.

2.3 Licensee shall inform Licensor upon becoming aware of any breach of this Agreement, and

Figure 30: Legal Page

4.6.2 Open Source Software

The OSS (Open Source Software) page provides access to a list of OSS packages integrated into the encoder system, together with licensing information. To access the page from the main menu, select **About >> Legal Info >> OSS**. The page appears as depicted in the figure below.

Package	Ver	License	URL
Kernel	4.14	GNU GPLv2	https://www.kernel.org
U-Boot	2018.01	GNU GPLv2+	https://www.denx.de/wiki/U-Boot/
ffmpeg	2.5.11	GNU LGPLv2.1+ GNU GPLv2	https://www.ffmpeg.org
Alsa-lib	1.1.5	GNU LGPLv2.1	https://www.alsa-project.org/main/index.php/...
libconfig	1.4.9	GNU LGPLv2.1	https://hyperrealm.github.io/libconfig/
thttpd	2.25b	Proprietary (2 clauses BSD like) - Free	http://www.acme.com/software/thttpd/
Bootstrap	4.1.3	MIT	https://getbootstrap.com/
qdecoder	12.0.4	Proprietary (2 clauses BSD like) - Free	http://www.qdecoder.org http://wolkymkim.github.io/qdecoder/
busybox	1.24.1	GNU GPLv2	https://busybox.net/
tcpdump	4.9.2	BSD	http://www.tcpdump.org/
libpcap	1.8.1	BSD	http://www.tcpdump.org/
monit	5.25.2	GNU AGPLv3	https://mmonit.com/monit/
libcurl	7.60.0	MIT/X	https://curl.haxx.se/
parted	3.2	GNU LGPLv3+	https://www.gnu.org/software/parted/

Figure 31: OSS Page

4.6.3 Certifications

The Certifications page displays a series of symbols representing certifications granted to the encoder system. To access the page from the main menu, select **About >> Legal Info >> Certifications**. The page appears as depicted in the figure below.

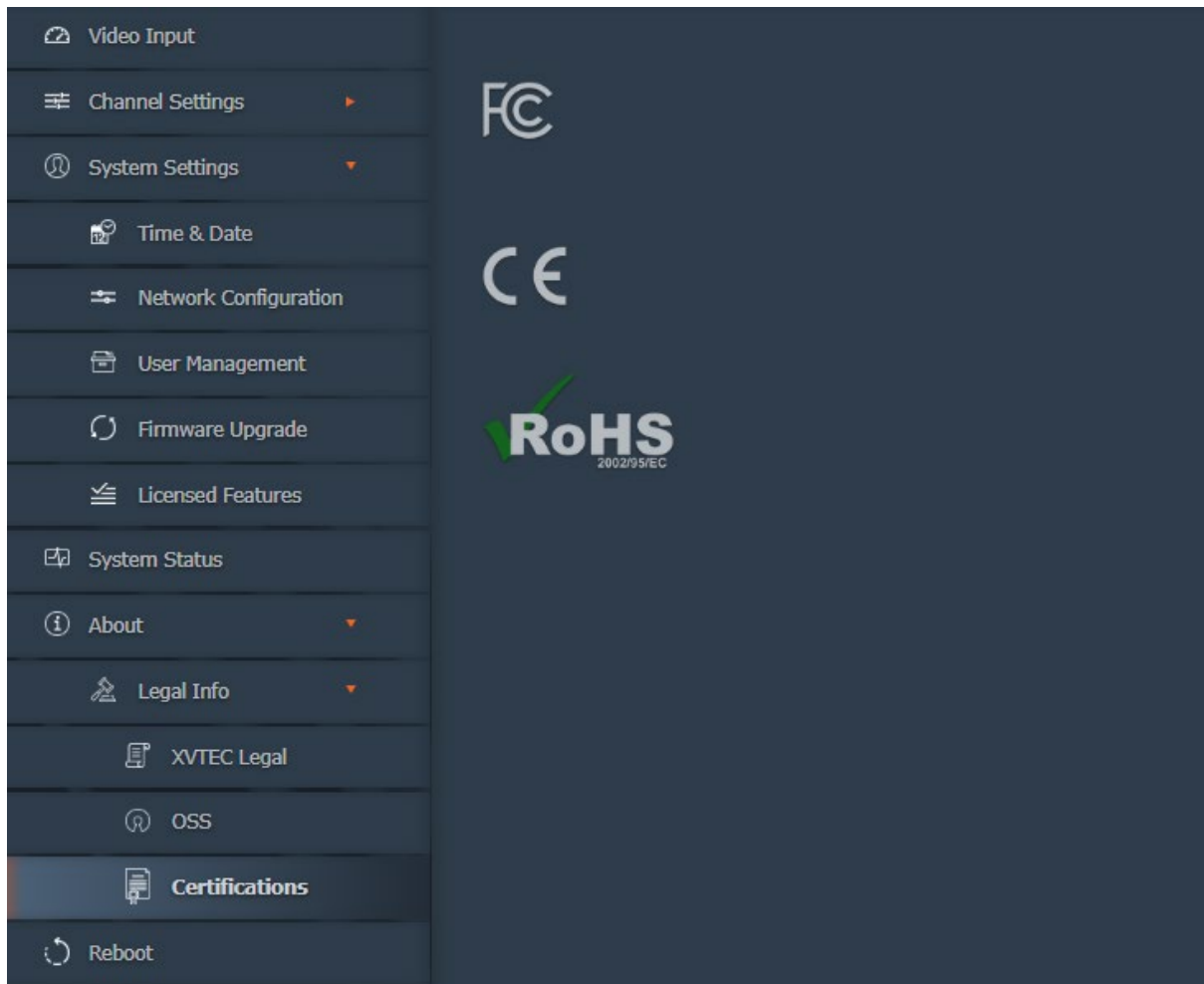


Figure 32: Certifications Page

4.7 Reboot

Select **Reboot** on the main menu to shut down and restart the encoder. The following decision box appears, requesting that you confirm the Reboot command.

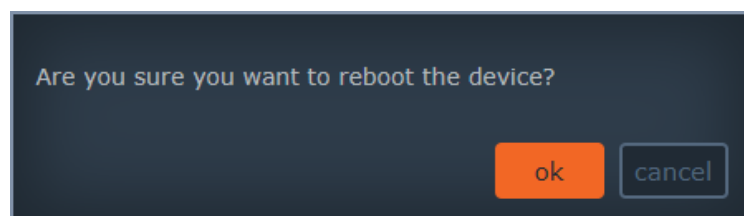


Figure 33: Reboot Confirmation

Click **OK** to confirm the reboot. The following message box appears, informing you that the reboot process has begun.

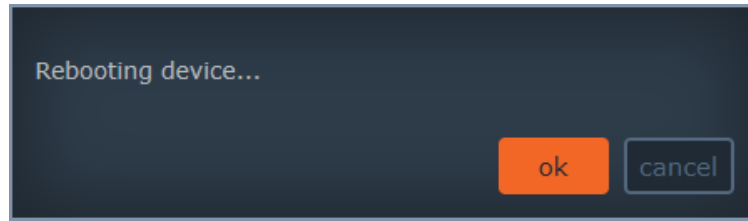


Figure 34: Encoder Rebooting

For more information on the reboot process, see the [Boot Sequence](#) section.

5 Booting, Troubleshooting and Recovery

This chapter provides details on reboot, troubleshooting and recovery operations.

5.1 Booting the Encoder

To boot the encoder system, perform one of the following operations:

- Select **Reboot** on the main menu (see the [Reboot](#) section).
- Press the **SW** button on the front panel of the encoder.
- Disconnect and then reconnect the input power connector.

During the booting process the LEDs on the front panel of the encoder are lit or blink in according to the current system state. The following sections describe the LED behavior when booting in Static and DHCP mode:

- Booting with a [static IP address](#)
- Booting with a [DHCP-allocated IP address](#)

5.1.1 Static IP Address

Following a system boot using a static IP address, the following LED behavior is observed:

1. The **STAT**, **LCK**, **ACT**, and **REC** LEDs are lit in orange, one after another.
2. The **STAT**, **LCK**, **ACT**, and **REC** LEDs turn red for several seconds.
3. The encoder loads the manually-configured IP address, and the **STAT** LED appears in green, as shown in the figure below:



Figure 35: End of Boot Sequence with Successful IP Allocation

5.1.2 DHCP-Allocated IP Address

Following a system boot using a DHCP-allocated IP address, the following LED behavior is observed:

1. The **STAT**, **LCK**, **ACT**, and **REC** LEDs are lit in orange, one after another.
2. The **STAT**, **LCK**, **ACT**, and **REC** LEDs turn red for several seconds.
3. The encoder attempts to retrieve network parameters from a DHCP server. The **STAT** LED blinks in orange, as shown in the figure below:



Figure 36: Attempting to Retrieve Network Parameters from DHCP Server

4. If the DHCP server responds and successfully allocates an IP address to the encoder, the **STAT** LED turns green, as shown in Figure 35 above, ending the boot sequence.
5. While waiting for the DHCP server response, the **STAT** LED blinks in orange for up to one minute, as shown in Figure 36 above. After one minute, the connection attempts cease, an APIPA IP address is allocated, and the **STAT** LED appears in orange, as shown in Figure 37 below.



Figure 37: Encoder Failed to Retrieve IP Address from DHCP Server

6. To resume the connection attempts between the encoder and the DHCP server, remove the LAN cable's RJ-45 connector from **ETH0/ETH1 port**, and re-insert it. The encoder re-initiates the DHCP process, and the **STAT** LED blinks in orange for up to one minute, as described in step 5.

5.2 Overheating

The **STAT** LED serves as an indicator of system overheating. The following table provides guidelines for handling the system in an overheating scenario.

NOTE

The **STAT** LED is used for multiple types of indications in a variety of processes. Note that *overheating and fan malfunction alarms have the highest priority, and always override all other indications.*

Table 25: Overheating Conditions

Status	STAT LED Behavior	Encoder Behavior
Normal temperature	Green	Normal
Fan failure	Red	Fan failures: <ul style="list-style-type: none"> • Fans not detected by the software • Fans operate under the minimum required speed: 500 RPM.
Critical temperature	Red, slow blink	System is reset after 60 seconds. Upon reset, only basic infrastructure and functionality are enabled – CPU, memories, peripherals, and communications. Full operation resumes upon return to Normal status.
Emergency	Red, fast blink	System is powered off after 30 seconds. Recovery required disconnection and reconnection of input power connector

5.3 Restoring System Defaults

Perform the following operations if you need to restore the factory system defaults.

NOTE

The factory-set IP address of the encoder unit is in the segment 169.x.x.x. The x.x.x is derived from the MAC address. Encoder parameters are set default, streaming mode is set to TS-UDP

To discover the unit please download XVTEC's **management tool**

To restore system defaults:

1. Disconnect the input power connector to power down the unit.
2. Reconnect the input power while pressing and holding down the **SW** button (long press). Continue pressing and pay attention to the behavior of the **STAT** LED:
3. After approximately 10 seconds, the **STAT**, **LCK**, **ACT**, and **REC** LEDs blink in orange, as shown in Figure 38 below. At this point, release the **SW** button to begin restoring the system defaults.



Figure 38: Release SW Button to Begin Restoring Defaults

4. Wait while the unit restores the system defaults. At the end of the process, the **STAT** LED should appear in green, as shown in Figure 39 below.



Figure 39: System Defaults Successfully Restored

5.4 System Recovery

NOTE

System recovery mode should be entered only when:

1. Units stops functioning correctly
 2. The web interface is unresponsive
-

In the event of firmware malfunction (Unit is not responding or no access to the unit), perform a **system recovery** to restore normal operation. You can upload an image using one of two methods:

- [From a USB memory stick](#) stick inserted into one of the USB ports of the encoder unit.
- [From the network](#), using the encoder's configuration web user interface.

5.4.1 Recovery Using Image on USB Memory Stick

1. Disconnect the input power connector to power down the unit.
2. Create a directory, “/firmware/upgrade/” in the USB memory stick. The directories should be created in the root folder
3. Copy the desired recover image file to the “/firmware/upgrade/” (**the image file must be named *xvc-hevc.img***).
4. Insert the USB memory stick with the recovery image into one of the USB ports of the encoder unit.

NOTE

* The partition containing the image should be formatted using the EXT4 or FAT32 (and **not** NTFS) file systems.

* During the recovery process, the second USB interface should remain *unconnected*.

5. Reconnect the input power while pressing and holding down the SW button for approximately 20 seconds. Pay attention to the behavior of the **STAT** LED:
 - After approximately 10 seconds, the **STAT**, **LCK**, **ACT**, and **REC** LEDs blink in orange.
 - After approximately 20 seconds, the **STAT**, **LCK**, **ACT**, and **REC** LEDs appear in orange (without blinking), as shown in Figure 40 below. At this point, release the **SW** button to start the system recovery.



Figure 40: Release SW Button to Begin System Recovery

6. Wait while the unit performs a series of recovery operations. During the recovery process, the **STAT** LED appears in blinking green, while the **LCK**, **ACT**, and **REC** LEDs appear in orange, as shown in Figure 42 below:



Figure 41: Recovery LED Indicators

Following a successful recovery, the encoder unit reboots. At the end of the boot sequence, the **STAT** LED should appear in green, as shown in Figure 42 below.



Figure 42: End of Recovery Process

5.4.2 Recovery Using Image on Network

To perform system recovery with an image on the network:

1. Disconnect the input power connector to power down the unit.
2. Reconnect the input power while pressing and holding down the SW button for approximately 20 seconds. Pay attention to the behavior of the **STAT** LED:
 - After approximately 10 seconds, the **STAT** LED appears in blinking orange.
 - After approximately 20 seconds, the **STAT** LED appears in orange (without blinking), as shown in Figure 40 above. At this point, release the **SW** button to start the system recovery.

The recovery process automatically configures the encoder's network settings as follows:

- IP address: 192.168.1.100
- Subnet mask: 255.255.255.0

The system boots using the new network settings.

NOTE

The host's (your PC's) IP address must be set to the same IP domain as the encoder in order to access the encoder. For example, you can set the PC's IP address to: 192.168.1.101

3. Enter the IP address of the encoder unit in the address bar of your browser to display the Recovery page, as shown in the figure below:

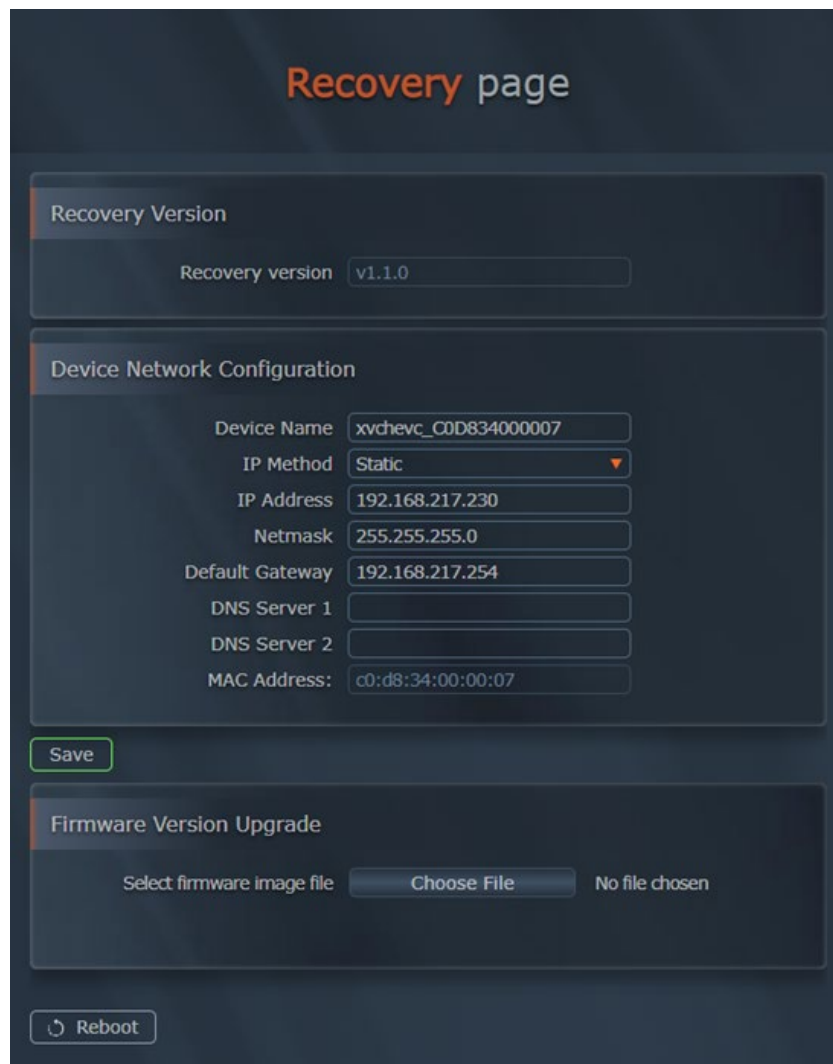


Figure 43: Recovery Page

4. Set the **IP Address** and **Netmask** as required (optional).
5. Click on the **Choose File** button. An Open dialog box appears, as shown in the figure below.

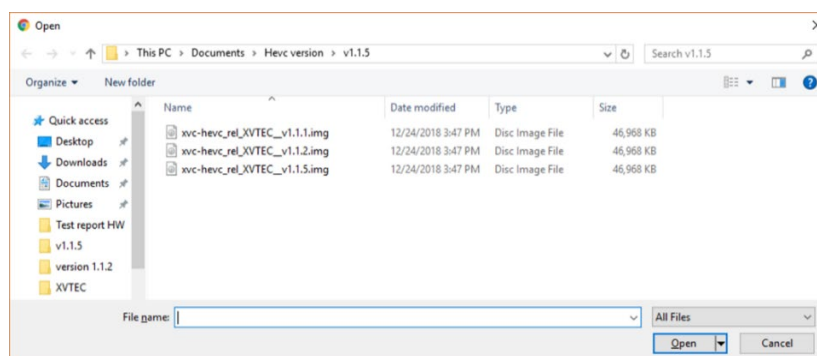


Figure 44: Selecting the Image File

6. Navigate the system and select the image file to be uploaded. Click **Open**. The name of the license file selected appears next to the **Choose File** button.
7. Click **Upload** to upload the image file to the encoder. A series of progress messages will appear in a new field – **Update Status** – that appears on the page, as shown in Figure 45 below:
 - “Loading”
 - “Saving”
 - “Validation”
 - “Rebooting.” At this point, there will be a loss of connectivity with the encoder. Connectivity will be restored following the successful completion of the boot process.

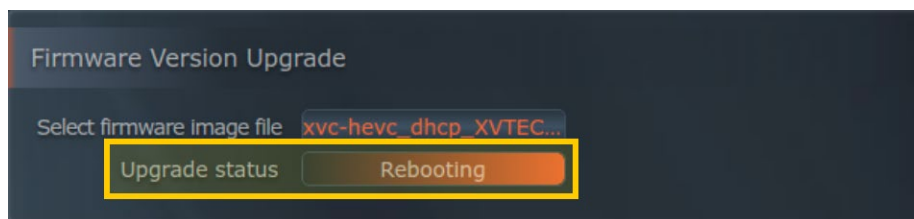


Figure 45: Upgrade Status Field

Following reboot, the recovery process may continue for several minutes, as multiple hardware components are updated. During the recovery process, the **STAT** LED appears in blinking green, while the **LCK**, **ACT**, and **REC** LEDs appear in orange, as shown in Figure 46 below:



Figure 46: Recovery LED Indicators

Following a successful recovery, the encoder unit reboots. At the end of the boot sequence, the **STAT** LED should appear in green, as shown in Figure 42 above.

8. [Access the encoder from your browser](#) using the newly configured IP address.

NOTE

You may need to clear cookies and site data from you browser before executing this step.

5.5 Resetting the User Name and Password

You can reset the user name and password used to access the web-based user interface using the XVC Management Tool.

To assign a static IP address to the encoder:

1. Execute the XVTEC Management Tool. The application discovers the XVTEC devices in your network, and displays them in a list, as shown in the figure below.

NOTE

To enable discovery of the devices, you may need to disable the Windows Firewall before executing the XVTEC Management Tool.

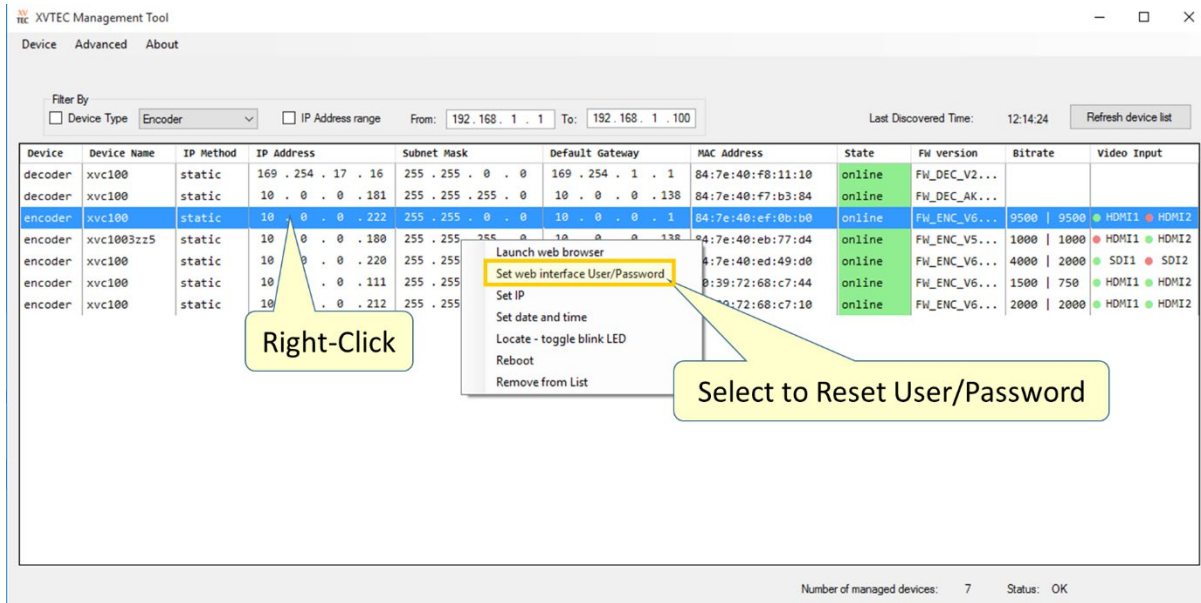


Figure 47: Resetting the User/Password

- Find the row in the table associated with your encoder. Right-click on the row, and select **Set web interface User/Password**.
- In the dialog box that appears, enter a new user name and password, and click **Apply**.

Appendix A System Specifications

Video	
Video Input	<ul style="list-style-type: none"> - HDMI Type A connector, HDMI v2.0a (Non HDCP) - 12G-SDI, BNC connector: <ul style="list-style-type: none"> SD-SDI : C-259M S HD-SDI : 292M S 3G-SDI : SMPTE 424M (Level A only), SMPTE 425M 6G-SDI : SMPTE 2081-1 12G-SDI: SMPTE 2082-1
Input Resolution	<ul style="list-style-type: none"> 4K: 4096x2160p[23.97, 24, 25, 29.97, 30, 50, 59.94, 60] Hz UHD: 3840x2160p[23.97, 24, 25, 29.97, 30, 50, 59.94, 60] Hz FHD: 1920x1080p[23.97, 24, 25, 29.97, 30, 50, 59.94, 60] Hz HD: 1280x720p[50, 59.94, 60] Hz, 1920x1080i[25, 29.97, 30] Hz SD: 720x576p50* Hz, 720x576i25 Hz, 720x480p59.94* Hz, 720x480i29.97 Hz (*) – Not supported in SDI
Output Streams	Up to 4Kp60 HEVC over IP
Video Compression	HEVC/H.265 ISO/IEC 23008-2 HEVC (H.265) Main 10 4:2:2, up-to level 5.1, high tier
Codec features	Configurable GOP size, FPS, BPS I/P/B frames support 4:2:0 and 4:2:2 color space 10/8 pixel depth Supports progressive and field based interlaced coding Rate control: CBR and capped VBR Bitrates: from 500 Kbps to 80 Mbps Frame rate: full, half, quarter, one eighth of the input frame rate
Encoding Performance	Up to 4Kp60 4:2:2 10 bit HEVC stream
Audio	
Audio Input	HDMI embedded audio OR SDI embedded audio OR Analog audio unbalanced (PL stereo connector)
Audio Sample Format	Single stereo channel audio at Fs = 48KHz, 16bit per/sample
Audio Compression	MPEG-2 AAC-LC (ISO/IEC 13818-7), configurable bitrate 64-256Kbps
Latency	
Latency Modes	Low latency mode: < 50 ms (Encoding latency at 4Kp60 20 Mbps with 1GbE I/F) Normal mode latency: up to 2000 ms depending on GOP structure
Interfaces	
Ethernet	Eth: RJ45, Ethernet 10/100/1000 Base-T, auto-neg, auto-sense, half/full duplex
Streaming Protocols	TS-UDP: Transport Stream over UDP (Unicast/Multicast) RTP: Real-Time Protocol over UDP (Unicast/Multicast) RTSP: Real-Time Streaming Protocol (Unicast, single client) SRT (TS): Caller/Listener mode

Other Protocols	HTTP, IGMP V1/V2, DHCP client
Other Interfaces	2 x USB 2.0/3.0 host ports RS-232 (RJ45 Cisco cable compatible) LED indicators (Power on, Ethernet link, Status, Video lock, Streaming, Recording) Tactile switches
Encoder Management	Web-based Interface via browser REST API Remote firmware upgrade via browser or REST API Hardware button for resetting factory defaults
Physical/Environmental	
Dimensions (LxWxH)	214 x 155 x 37 mm
Weight	730 grams
Operational Temperature	0°C to 50°C
Operational Humidity	Up to 90%, non-condensing
Input Voltage	12-32V DC, Max 35W
Power Consumption	Typical: 18-20W (varies according to use case)
Regulatory Compliance	FCC part 15 class A, CE HDMI sink certification, test specification

END OF DOCUMENT