CUBE™

CAMERA-TOP

HD H.264 SYSTEM

REFERENCE GUIDE

Introduction

Thank you for purchasing Cube – the world's first camera-top streaming HD video solution. The Cube Encoder streams HD video over any IP network. Wireless-equipped Cubes can connect directly to laptops, Cube Decoders, or mobile devices, or join an existing wireless network to stream over a LAN or WAN. USB-equipped Cubes are also capable of streaming using select 4G capable modems. Cube features native integration with Livestream.com for turn-key live Internet streaming and content distribution. Use this reference to help get the most out of your Cube.

1. Three key steps to get started with your Cube:
   1. **Connect and power your device** (page 5)
   2. **Connect Cube to your network** (page 8)
   3. **Pick your streaming application** (page 10)

Support Resources

In addition to this Reference Guide, there are a number of resources available for more information on Cube's features and operation. Included in the box is a USB drive that includes the full user manual, training videos, and our TeraCentral app. For online information, see the following:

o   Support forum: http://forum.teradek.com - Contains tips, information, and all the latest available firmware and software updates.

o   Training videos: http://cube.teradek.com/training.html

....

If you are unable to find what you are looking for online, please contact Teradek's support staff:
E-mail: support@teradek.com | Phone: (888) 941-2111 ext. 2 (available M-F 9AM-6PM PST)

Disclaimer

This manual is intended for user information only. Every effort has been made to ensure that the contents within are accurate at the time of printing, and that updates are made in a timely manner. Teradek cannot be held responsible for inaccuracies, typographical errors, or out-of-date information contained within this manual.

Warning

Teradek Cube products contain no user serviceable parts. Disassembly, modification, or removal of any of the device's components may void your warranty. For up-to-date warranty terms, please visit http://store.teradek.com/pages/warranty-information .

Table of Contents

Connect and Power Your Device

1. Getting started:

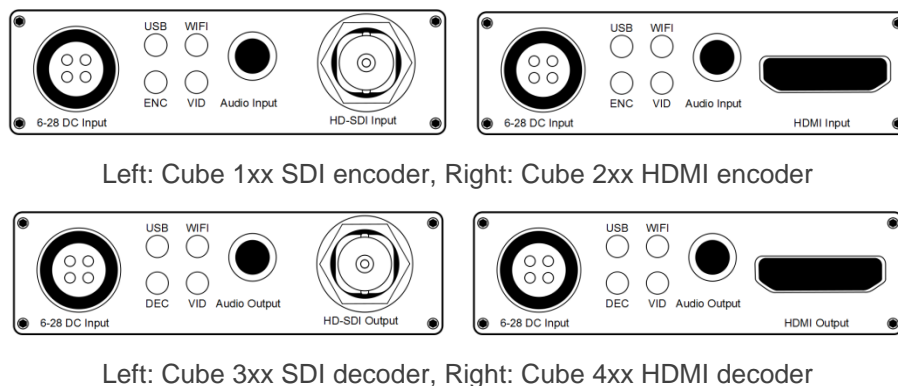   1. To power your Cube, connect the included AC adapter (or accessory power cable, sold separately) to Cube via the 4 pin LEMO connector marked '6-28 DC Input' (b). Cube begins to boot as soon as power is connected. NOTE: The ENC/DEC LED blinks to indicate Cube is booting. This process takes approximately 1 ½ minutes.
    2. Connect your video source to Cube via BNC cable (e) (SD/HD-SDI 1xx models, Composite 5xx models) or HDMI cable (2xx models).
    3. Attach the antenna (a) (if applicable) via the threaded RP-SMA connector.
    4. Use the included hot shoe mount and/or ¼" screw (f) to mount Cube to your camera, tripod mount, or other accessory mount, if desired.
    5. Once Cube has booted, verify that the 'ENC' and 'VID' LEDs are green, indicating video is successfully detected (c).

    For more information about Cube's physical connections and power options, please see the following sections.


2. Physical connections:

Left: Cube 1xx SDI encoder, Right: Cube 2xx HDMI encoder

Left: Cube 3xx SDI decoder, Right: Cube 4xx HDMI decoder
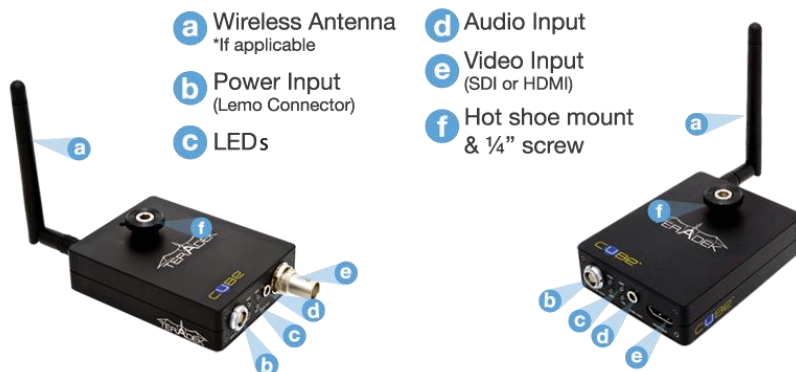
1. Audio/Video Input/Output:

   1.1. Video intput: SD/HD-SDI (Cube 1xx Series), HDMI (Cube 2xx Series), PAL/NTSC Composite (Cube 5xx Series)

   1.2. Video output: SD/HD-SDI (Cube 3xx Series), HDMI (Cube 4xx Series)

   1.3. Audio input: 2Ch. Embedded HDMI/SDI audio, Line in via 1/8" stereo TRS, Mic in via 1/8" stereo jack* (Cube 150 and 250 models only)

   1.4. Audio output: 2Ch. Embedded HDMI/SDI audio, Line out via 1/8" stereo TRS

2. Power:

Male 0B.304
LEMO on Cable

Female 0B.304
LEMO in Cube
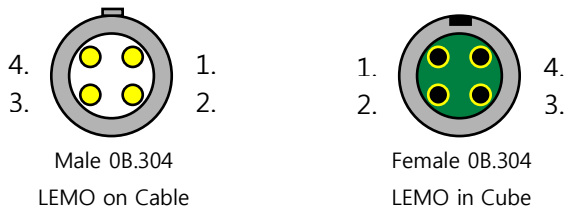
   2.1. LEMO pin configuration:

   1. DC +

   2. No Connect

   3. No Connect

   4. DC -

   2.2. Cube accepts 6-28 volts DC input via a 4 pin LEMO connector.

   2.3. An AC adapter is included with Cube. Teradek also offers a number of power accessory cables and battery plates to integrate with your existing power equipment. Accessories are available online at *http://store.teradek.com* or through your local Teradek dealer.

3. Ethernet, USB, antenna
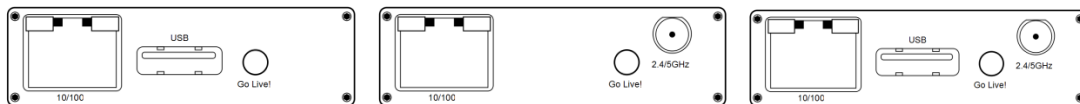
Left to right: Cube x00, x20, x50 back connections

   3.1. 10/100 Ethernet port – Use this for connecting to networks via Ethernet.

   3.2. USB port (if applicable) – Used for connecting to Wireless broadband USB modem.

   3.3. Go Live! Button – Used for various tasks including broadcast start and stop, pairing, and factory resets. Please See Description of Button and Standard LED (page 7) for more information.

   3.4. Antenna (if applicable) – RP-SMA connector used to attach antenna (included). NOTE: this is labeled 2.4/5GHz on both single and dual-band equipped Cubes.

3. <u>Description of Button and Standard LED Operation</u>
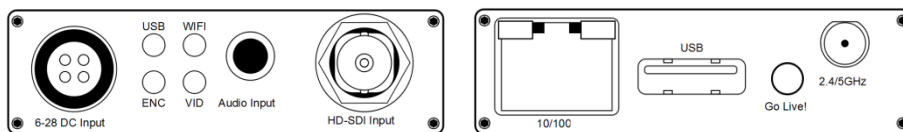
1. LED functions

   1.1. USB/PWR (model dependent):

      1.1.1. PWR – Green is on

      1.1.2. USB – USB modem status. *Off*, nothing connected. *Green*, USB modem connected. *Orange*, USB modem connection in progress. *Red*, USB modem connection failed

   1.2. WiFi

      1.2.1. Cube 100/200 – USB modem status (see above).

      1.2.2. Cube 120/150, 220/250, 320/350, 420/450 – Wireless status. *Off*, wireless disabled. *Red*, wireless disconnected. *Green*, wireless associated/connected.

   1.3. ENC/DEC – *Green*, encoding/decoding. *Orange*, no video detected. *Red*, codec is restarting or recording is in progress.

   1.4. VID – *Off*, no video sync. *Green*, video sync. *Orange*, resolution mismatch. *Red*, resolution not supported.

2. Button operation – Hold down the reset/'Go Live' button for the indicated times to use the following functions:

   2.1. 1-3 seconds (Livestream/RTSP Announce/RTMP mode only): Broadcast start or stop. ENC LED blinks green rapidly, and then indicates broadcast status. See **Stream Modes** (page 15) for more information.

   2.2. 1-4 seconds (Other stream modes), 7-9 seconds (Livestream, etc.): Pairing – ENC/DEC and WiFi LEDs blink green rapidly. See the Decoder section, page 14 for more information.

   2.3. 10-15 seconds: Network reset – WiFi LED cycles red, amber, green. Cube resets all network settings to their defaults and reboots.

   2.4. 20+ seconds: Full factory reset – ENC and WiFi LEDs cycle red, amber, green. Cube configuration is restored to factory defaults and the unit reboots.

   2.5. NOTE: when your stream type is set to 'Live Internet Streaming' or 'RTSP Announce,' the button operation changes as follows:

      2.5.1. 1-3 seconds: Broadcast start or stop. ENC LED blinks green rapidly, and then indicates broadcast status. See **Stream Modes** (page 15) for more information.

      2.5.2. 7-9 seconds: Pairing – see above.

Connect Cube to Your Network

Cube allows you to connect multiple ways. The simplest is to connect Cube to one other device (Ad Hoc mode), or you can add Cube to an existing network (Infrastructure mode). Find brief descriptions of these modes below.

- In Ad Hoc mode, Cube will create and advertise its own network name (SSID). Your computer, decoder, or mobile device connects directly to Cube, with no additional network equipment required.
- When using Infrastructure mode, Cube must be configured to join an existing wireless network, or connected to a network switch via Ethernet. Infrastructure mode allows Cube to communicate with all devices on your network, and is recommended for streaming to the Internet. Wireless range is typically improved when Cube is connected via a wireless access point.

1. Ad Hoc instructions

1.1. Connect video and power to your Cube Encoder (see **Connect and Power Your Device**, page 5).
1.2. On your computer, open your wireless networking utility.
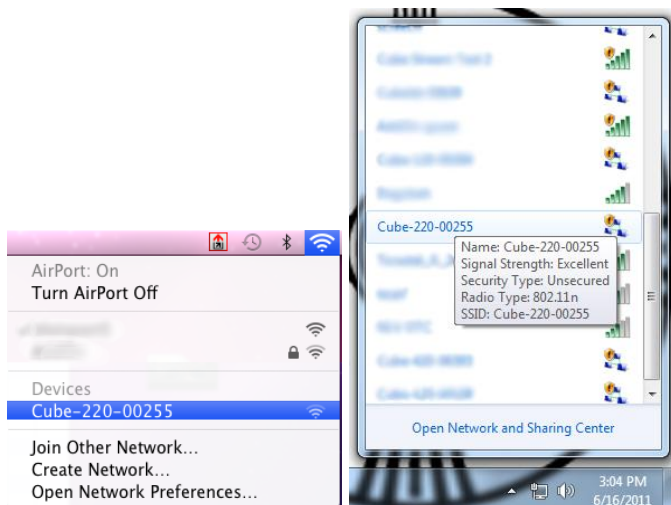
1.3. Choose your Cube from the list of WiFi devices in your area and connect to that network.

2. Infrastructure instructions

2.1. Connect video and power to your Cube Encoder (see **Connect and Power Your Device**, page 5).

2.2. Connect Cube to your computer via Ethernet.

2.3. Launch TeraCentral (included on the USB drive), and click the 'Configure Settings' button next to your Cube's listing. Your browser will open to Cube's setup wizard.
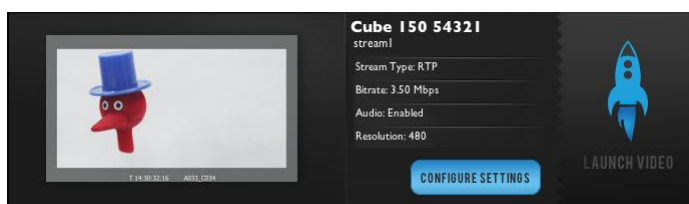
2.4. Click 'Next' and then 'Configure Wireless Interface.'

2.5. Select 'Infrastructure Mode,' wait for Cube to scan for available wireless networks, and select your access point's SSID.

2.6. Enter the network password, if applicable. Click OK.

2.7. Click 'Apply New Network Settings,' Cube will join your network.

2.8. Verify that the WiFi LED turns green after applying. You can now disconnect the Ethernet cable and connect your computer to the chosen wireless network.

**Connect to Cube using TeraCentral**
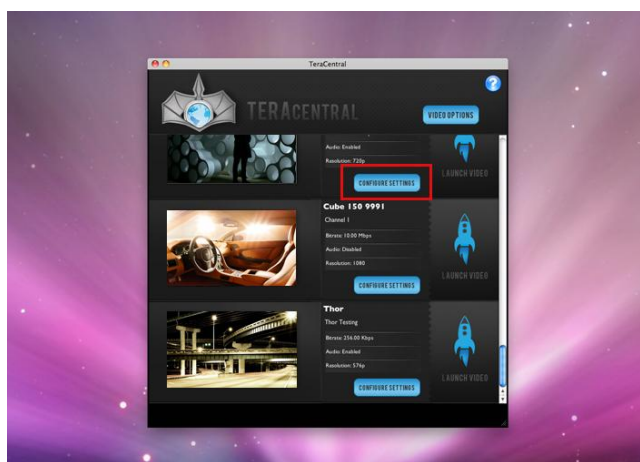
1. Launch TeraCentral from the included USB stick, or install TeraCentral on your computer and run the application.

2. In TeraCentral, click your video stream's Launch button. The video will begin playing in VLC. You can also launch Cube's menu system from TeraCentral by clicking the 'Configure settings' button next to your Cube's listing.

3. Refer to the following sections for other streaming applications.

Encoder – Pick Your Application

Cube can be used for a variety of different applications – local monitoring with a computer/decoder, local monitoring with iOS devices, or Internet streaming with Livestream. For information on other advanced or activatable features please refer to this guide's later sections. Cube's username is 'admin' and the default password is 'admin.' Changing your password is strongly recommended; see **System** (Page 26) for more information.
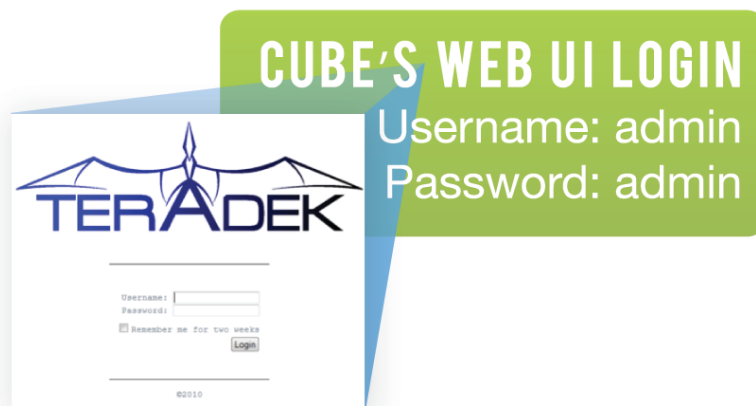
1. Local monitoring with computers and/or decoders

Cube's default streaming type is RTP. This is used by many widely available video players for network video streaming.

1.1. To view your video stream on a PC or Mac with TeraCentral installed, simply open TeraCentral and click the 'Launch Video' button. Refer to the **Encoder Controls** (page 18) section for

information about the controls you have over the video stream. If using a decoder, please skip to the **Decoder** section (page 14).

2. Local monitoring with iOS devices using TeraCentral

Cube can stream to iOS devices with a specially-configured stream called Quickview and Teradek's TeraCentral iPad app. You can download TeraCentral for iPad from the app store.

2.1. Open TeraCentral on your iPad. If the Quickview stream is enabled, you will see two stream listings from the Cube. Select 'Play' next to the Quickview listing. If you do not see the Quickview listing, follow the next steps to enable it.

2.2. To enable the Quickview stream, launch Cube's configuration page by Clicking "Configure Settings" in TeraCentral. If you have TeraCentral installed, you can use your iPad to launch Cube's configuration page.

2.3. If the wizard appears, click 'Next' until you see the Local Video Streaming options.

2.4. Choose your streaming interface and then select 'RTSP capable iOS app' for your decoder. Click 'Apply Settings.' Proceed to step 7.

2.5. If the login screen appears, log in to Cube's web UI and Navigate to 'Video Setup' -> 'Stream settings.'
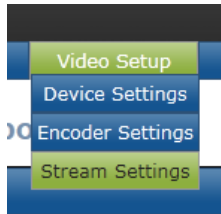
2.6. Click the 'Quickview Stream' tab, select 'Enabled' next to the 'Quickview Stream' option, and click 'Apply.'
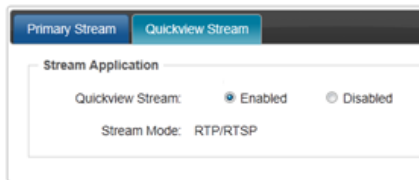
2.7. Open TeraCentral, and wait for the Quickview stream listing (highlighted blue) to appear. Launch the video by clicking the 'Play' button'.

3. Internet streaming using Livestream

Cube offers native integration with Livestream for live event broadcasts and turnkey remote content distribution. Depending on your needs, Livestream offers multiple free or paid membership options. A Livestream account is required to use this feature.

Livestream Configuration

3.1. To enable Live Internet streaming, first launch Cube's configuration page by Clicking "Configure Settings" in TeraCentral.

3.2. If the wizard appears, click 'Skip the Setup Wizard,' then log in to Cube's web UI. Navigate to 'Video Setup' -> 'Stream settings.'
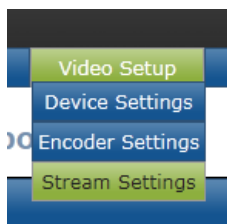
3.3. Under General / Type, select 'Live Internet Streaming.'

3.4. Enter your Livestream username, password, and channel short name. Click 'Verify Login' to check that Cube can contact Livestream and that your login information is valid. NOTE: the channel short name is case sensitive.

3.5. Check any options you would like to apply to your channel. Please refer to the **Stream Modes** section for more information on these options.

3.6. Click 'Apply.'

3.7. Once the settings have been applied, you can start or stop your broadcasts by clicking the 'Start/Stop Broadcast' button, or by holding the 'Go Live!' hardware button on Cube for approximately 1 second (ENC LED blinks to indicate when Cube is starting/stopping).

Decoder

If you purchased your decoder as a 'Cubelet' (paired with an encoder) there is no additional configuration required beyond ensuring that the two devices are on the same network (see **Connect Cube to Your Network**, page 7). Find instructions for setting your video output resolution and switching between streams below.

1. Changing output format
    1.1. Open your Cube decoder's web UI and log into the device.
    1.2. Navigate to 'Video Setup' -> 'Device Settings.'
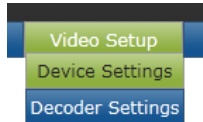
    1.3. Select your desired resolution under 'Video Output Format.'
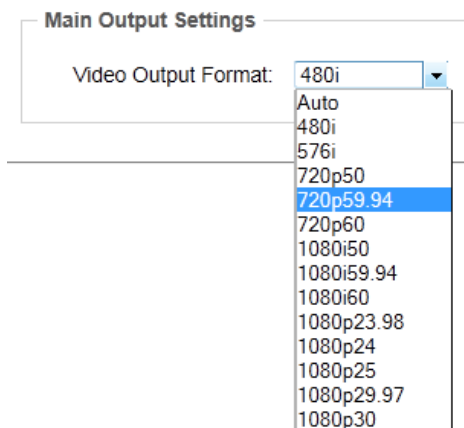
    1.4. Click 'Apply.'
2. Pairing

2.1. To pair two Cubes without using a computer, hold both devices' 'Go Live!' buttons until the ENC/DEC and WiFi LEDs blink green rapidly. NOTE: if set to 'Live Internet Streaming' mode, the encoder will attempt to start a broadcast before entering pairing mode.

2.2. After a short time, the decoder will restart and connect to the encoder.

3. Switching between available streams

3.1. Open your Cube decoder's web UI and log into the device.

3.2. Navigate to 'Video Setup' -> 'Decoder Settings.'

3.3. Choose a video stream from the list of 'Available Video Streams' and drag it to the 'Decoder Channel 1' box.

3.4. Click 'Apply.' So long as the chosen stream is valid and both Cubes are on the same network, the decoder will search for and connect to selected stream.

4. Manual configuration

4.1. Refer to the **Configuration pages** section, page 18, for information about manual decoder configuration.

Stream Modes

Depending on your video's ultimate destination, you can pick from a variety of different stream types. Cube's included stream types are described in this section. For information on the other activatable options, please refer to **Advanced and/or activatable applications**, page 30. All stream configuration is done via the web UI on the 'Video Setup'->'Stream Settings' page.
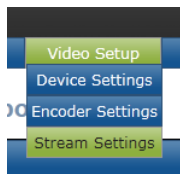
1. RTP/RTSP

1.1.

1.2. RTP is Cube's default streaming mode. Use this for local streaming to computers and Cube decoders. The URL for a standard RTP stream is *rtsp://xxx.xxx.xxx.xxx/stream1*, where the x's are your Cube's IP address or link-local hostname.

1.3. RTP Port and Max clients – Use these fields to configure the port Cube accepts RTP requests on and how many simultaneous clients are allowed. The default port is 554 and the default maximum number of clients is 10.

1.4. Authentication – Enable this to protect your stream by requiring a username and password for access. When enabled, some video players (VLC) will prompt for the username and password if the default stream name is used (see above). Alternately, the username and password can be added to the stream URL as follows – *rtsp://username:password@xxx.xxx.xxx.xxx/stream1*.

1.5. HTTP Tunneling – Some networks may require packaging video as HTTP traffic for transmission. If so, enable 'Tunnel RTSP & RTP over HTTP'. You may need to configure your video player to work with HTTP Tunneling (in VLC, the option is available under Input/Codecs->Demuxers->RTP/RTSP in the preferences).

2. Secondary Quickview Stream
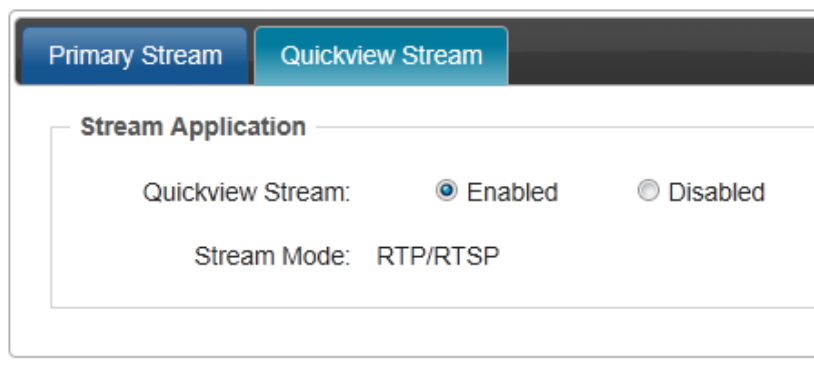
2.1.

2.2. When enabled, the Quickview stream can be used for low latency streaming to iOS devices. As the Quickview stream requires less bandwidth (1 Mbps) than a typical HD stream, it can also be used to enable streaming to a greater number of devices.

2.3. When enabled, the Quickview stream's URL is as follows: *rtsp://xxx.xxx.xxx.xxx/quickview*, where the x's are your Cube's IP address or link-local hostname. Use this URL with your video stream player (VLC, TeraCentral for iPad, OPlayerHD, etc.).

2.4. Audio is currently disabled in the Quickview stream.

3. HTTP Live

3.1.

3.2. HTTP Live streaming allows native streaming to iOS devices using the built in Safari browser. While this mode does support audio and HD video, there is a large amount of latency (~10 seconds or more) due to the stream type. For low latency streaming to iOS devices, please refer to the Secondary Quickview Stream instructions above or **Encoder – Pick Your Application** (page 12).

3.3. To open an HTTP Live stream in Safari on iOS, you can click the ▶ icon next to the stream URL (found on both the Dashboard and Stream Settings page), or paste the stream URL: *http://xxx.xxx.xxx.xxx/httplive/stream.m3u8 (*Mac users can also open this stream in Quicktime X).

3.4. Transport Stream over RTP – Enabling this allows Cube to stream an RTP stream while in HTTP Live mode. This allows you to stream HTTP Live to iOS devices while using the RTP stream on other devices. NOTE: When enabled, this RTP stream is not compatible with Cube decoders.

4.   Live Internet Streaming

4.1. The Live Internet streaming option is used for streaming directly to Livestream.com. For basic configuration instructions, please refer to the Livestream section of **Encoder – Pick Your Application** (page 12).

4.1.1.Account and Configuration options:

Encoder Controls

In addition to configuring your stream type, Cube allows you to control various characteristics of the network video stream. These include bitrate, frame rate, video scaling, and more. All of these settings can be found under 'Video Setup' -> 'Encoder Settings.' Use this page to adjust the video stream to best suit your streaming environment.

1. Options (in order of display):

    1.1. Title Text: Enter your desired title text here. Check 'Show Title' to display the title text on your video stream. If the title text is enabled, you can also display Cube's system time by checking 'Show Time Code.' The title text is also used as your channel name, and is displayed wherever you see a Cube stream advertisement. The default name is 'Channel 1.'

    1.2. Video Bitrate: Allows you to select different bitrates or manually enter your stream's target bitrate (in bits per second). Lower bitrates require less bandwidth and may allow for a more stable stream. Higher bitrates offer better video quality, but require more network bandwidth.

    1.3. Audio Bitrate: Similar to above video bitrate setting. Use this to adjust the audio bitrate, if applicable.

    1.4. Output Resolution: Adjust Cube's streaming resolution. If your network conditions have bandwidth restrictions or if you are streaming to mobile devices or the Internet, you can scale Cube's video to a smaller size to maintain video quality. You can also adjust the video stream's frame rate here.

    1.5. Key Frame Interval: Adjusts the number of frames between full picture refreshes. Increasing this value allows for better video quality at a given bitrate as the full image is not transmitted as often. Decreasing the value may lower the overall image quality, but will allow for quicker recovery of the stream if data is lost during transmission.

    1.6. Compression Profile: High profile encoding typically gives the best image quality at a given bit rate and is ideal for most applications. Main and baseline profiles utilize slightly different features, and may be required by certain decoder clients (e.g. mobile devices, set top boxes, etc.).

    1.7. Latency Options – Caching value: This value can be left at its default (300 ms) in most cases. By decreasing the value, you can reduce overall latency, but video quality and stability may suffer if the value is set too low. By increasing the value, you can increase the stream stability. Increase this value if your video stream stability is affected by a poor or challenging network environment. Recommended values are 300ms when Intra-refresh (see below) is disabled, 75 ms when enabled.

    1.8. Intra Refresh Mode: This mode allows for the lowest possible latency when streaming between Cube encoders and decoders. It also allows the above caching value to be set lower without affecting the stream stability. This mode is not currently compatible with available software decoders (e.g. VLC, Quicktime, etc.).

    1.9. Rate Control Settings: For most applications, Rate Control Settings can be left at their default values (Mode – Auto, Static Scene Detection – Disabled, and Complexity Detection – Enabled). Adjusting the rate control settings manually gives more control over the streaming bandwidth,

and may improve performance in challenging or restricted network environments.

1.9.1.Rate Control Mode: Select 'Auto' or 'Manual.' Additional options are present when set to 'Manual' mode.

1.9.2.Static Scene Detection: Enabling this prevents bitrate spikes during static-to-dynamic scene transitions. Disabling static scene detection improves video quality in mostly static scenes.

1.9.3.Complexity Detection: Enabling this allows the encoder to adapt more quickly to very complex content and scene changes.

1.9.4.QP: Setting the Minimum and Maximum QP values allows you to limit bandwidth by restricting the compression level range of a stream. Lower numbers correspond to less compression (higher quality). Valid range is 0 to 51.

1.9.5.Strict CBR: When strict CBR is enabled the stream bitrate is held at the configured bitrate. Extra data is added to the stream to 'pad' the bitrate if it would otherwise drop below the configured value and the bitrate is not allowed to exceed the configured value.

1.9.6.Maximum Bitrate: Sets a hard limit for the maximum bitrate. In normal operation, the actual bitrate varies above and below the configured value. If your network environment has a strict upper limit on bandwidth, set the Maximum Bitrate to prevent Cube's stream from ever exceeding that value.

1.10. Deinterlacer (Not pictured): The deinterlacer converts interlaced video input signals into progressive before streaming. This improves the appearance of interlaced video, particularly when video is scaled down from the original input resolution.

1.11. Adaptive Frame rate (Not pictured): Enabling adaptive frame rate allows Cube to dynamically adjust the frame rate up or down to maintain the target bitrate. This is useful when streaming at low bitrates, as Cube will use the highest possible frame rate without exceeding the target bitrate.
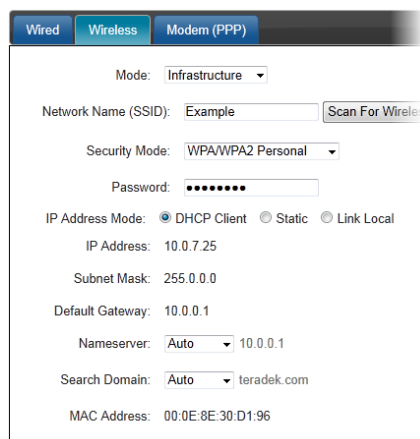
Network Settings

Cube's network configuration and services options can be found in Cube's web UI under the 'Network' menu item.

1. <u>Network Configuration</u>
    1.1. The network configuration page contains all of the necessary options to control Cube's wired, wireless, and USB network interfaces.

    1.2. Global settings – The global settings displays the currently used gateway and nameserver values, current domain, and allows you to set Cube's hostname. The default hostname for cube is *cube-xxx-yyyyy*, where *xxx* is Cube's model number and *yyyyy* is the last five digits of the serial number.
    1.3. Wired and Wireless Settings
        1.3.1. IP address mode: Depending on the selected wireless interface, you can choose from a number of IP address modes, detailed below.
            1.3.1.1.   DHCP Server (wireless only, encoder only) – When in Ad Hoc mode, Cube can act as a DHCP server. Cube will use the IP address 172.16.1.1 and assign other devices addresses in the 172.16.x.x range. In this mode, Cube can also be reached by navigating your browser to *http://mycube.teradek.com*.
            1.3.1.2.   Dynamic (DHCP) (wired) / DHCP Client (wireless) – In this mode, Cube requests an IP address from the DHCP server. This setting is used when connecting to existing networks. If Cube does not receive an IP address, it will assign a link local IP address.
            1.3.1.3.   Static – In this mode, you provide network settings for Cube. For local network streaming, Cube requires (as a minimum) an IP address and subnet mask. For Internet or wide area streaming, a gateway and nameserver may be required.

1.3.1.4. Link Local (wireless only) – Cube does not request an IP address via DHCP, and instead assigns itself a link local IP address.

1.3.2. Nameserver and Search domain: When using DHCP, the DHCP typically assigns the nameserver and search domain values, but you can set them manually if desired. If the IP address mode is set to 'Static', these values must be configured manually.

1.4. Wireless configuration

1.4.1. Mode: Please see **Connect Cube to Your Network** (page 8) for a brief description of the available wireless modes.

1.4.2. Network Name (SSID): This field allows you to specify your Ad Hoc network name, or enter an existing SSID for Cube to connect to. Use the 'Scan for Wireless Networks' button to select from a list of available wireless networks. Note that Cube will only scan for networks with the same wireless mode (see previous). To connect to your existing network, make sure 'Infrastructure' is selected before scanning. If your network SSID is not visible, you can manually enter the SSID and security settings without scanning for networks.

1.4.3. Security mode and password (Infrastructure mode): When connecting to an Infrastructure network, select the security type that corresponds to your network. The password entered should match your wireless network's password.

1.4.4. Channel (Ad Hoc mode): specify the wireless channel you would like to use. Channels 1 to 11 are in the 2.4GHz range. For dual band models, channels 36 and higher are all in the 5GHz range. Note: For Ad Hoc networks, the channel used depends on what order devices connect, and may not always match the channel configured on Cube.

1.5. USB modem

1.5.1. Preset: The preset drop-down menu contains a list of currently supported modems. If your modem is not in the list, you may be able to configure the modem using the 'Custom' option. Please refer to the FAQ section of http:/forum.teradek.com for a list of currently supported modems.

1.5.2. Nameserver: If your USB modem is connected, this field should show Cube's currently configured nameserver. The nameserver is configured automatically when a USB modem is connected.

1.5.3. USB modem status can be seen on Cube's Dashboard (see page 23). Additionally, the 'USB' LED indicates the modem status.

2. Network Services

2.1. Zero Configuration friendly name: The friendly name is used by TeraCentral, Bonjour, and other service discovery clients to identify Cube. Bonjour is enabled by default, but can be disabled if you do not want Cube to be easily discovered on your network. The default friendly name for cube is *Cube xxx yyyyy*, where *xxx* is Cube's model number and *yyyyy* is the last five digits of

the serial number. The friendly name must only contain alphanumeric characters, and can be up to 40 characters long.

2.2. SSL/TLS Encryption: Enables or disables encryption using a self-signed certificate. Note: if encryption is enabled, 'https://' (not 'http://') must be used to access Cube's web UI. Cube will not redirect users if 'http://' is entered.

2.3. Dynamic DNS: Cube can utilize DDNS services for remote network discovery. This feature requires an account with one of the supported DDNS service providers.

Configuration pages

1. Dashboard

1.1. Cube's dashboard is the first page you'll see after logging on to Cube. The dashboard contains at-a-glance information about your video and network status, and features some commonly used configuration options.
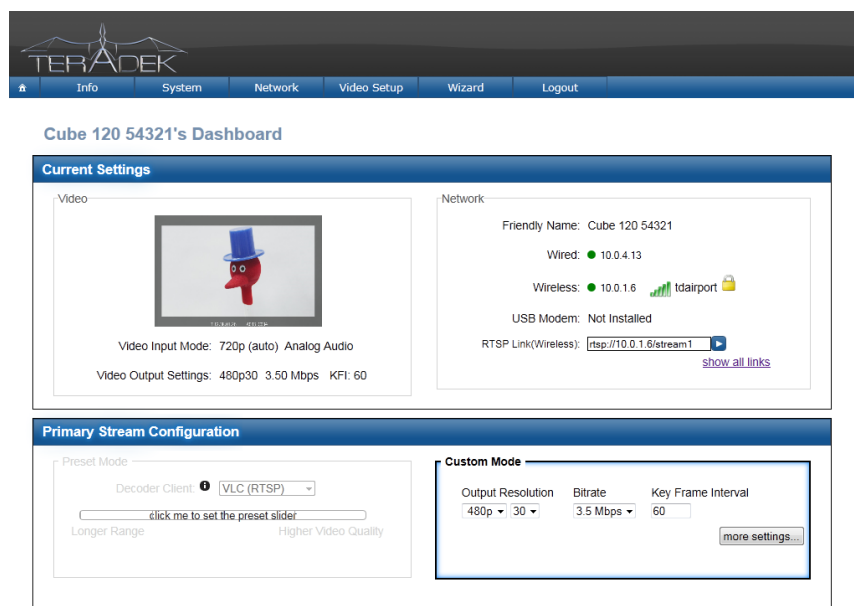

1.2. Current Settings – Displays a video snapshot image, detected format information, network, and stream information. Each one of the above links to the appropriate configuration page. Current stream URLs are displayed beneath the network status and can be used to launch video streams. To download a shortcut to the stream, click the ▶ icon. This will download a '.vlc' file that you can launch without opening your browser. The file is valid as long as network and stream settings are not modified.

1.3. Primary Stream Configuration – Use this section to make quick adjustments to Cube's primary video stream. You can select from multiple settings presets or individually adjust Cube's output

(streaming) resolution, frame rate, bitrate, and Key Frame Interval. For more information on these options, please refer to the **Encoder Controls** section (page 18).

2. <u>Video Setup</u>

    2.1. The Video Setup pages allow you to control options for your video input or output (Device Settings), options for the encoded video (Encoder Settings, see Encoder Controls, page 16), and the stream type (Stream Settings, see Stream Types, page 14).

    2.2. Device Settings – The Device Settings page contains options related to Cube's audio and video input and output.
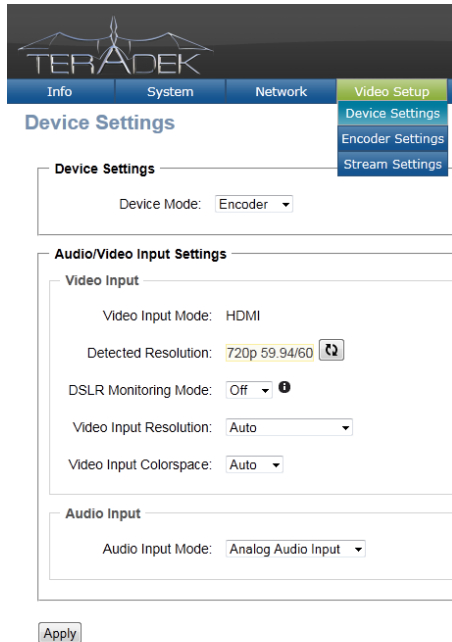

    2.2.1. Video Input Resolution: select the resolution provided by your video source. It can be set to Auto (default) in most situations. Change this if Cube does not recognize the input resolution or if you are using a non-standard input. NOTE (HDMI only): RED One users should manually select 'RED One (720p).'

    2.2.2. Audio Input mode: select audio input. Choices are disabled, embedded audio input, or analog audio via 1/8" stereo jack. Cube 150 and 250 models have additional level and volume control options when set to analog input.

    2.2.3. DSLR Monitoring Mode (HDMI only): Enable this to avoid signal drops when using Cameras that switch video resolution when starting/stopping recordings. Currently valid only for certain Canon DSLR cameras. Enabling this option requires a reboot.

    2.2.4. Video Output Format (Decoder only): Select video output resolution. If set to 'Auto,' Cube will attempt to determine its output resolutions based on the video stream it connects to. If not set to 'Auto,' the output format can be set independent of the decoded video format.

    2.3. Decoder settings

2.3.1. Basic Operation -- The Decoder Settings page contains two main panels, an available streams panel, and a cameo panel displaying information about the currently configured stream.
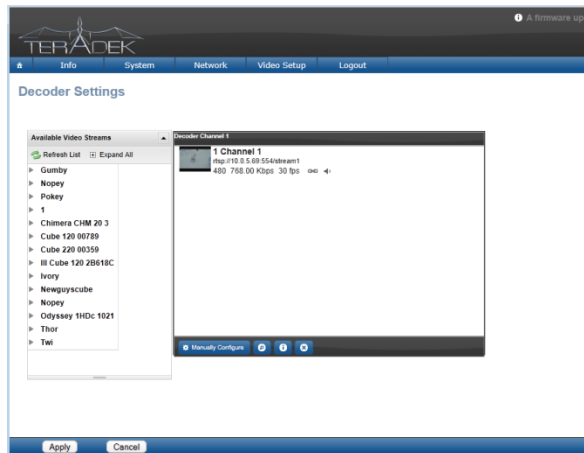
2.3.1.1.   Selecting a video stream – To choose a stream to decode, select your Cube from the list of available streams to expand the listing. Pick your desired stream (if multiple streams are available) and drag it into the Channel 1 panel.
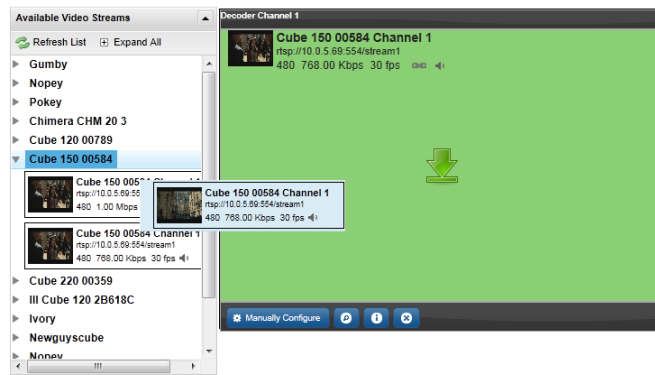
After you have dragged the stream across, click 'Apply.' The decoder will search for the stream, restart, and begin decoding. Once a stream has been selected, the decoder will search for the encoder whenever it is restarted. NOTE: HTTP Live streams are not compatible with the Cube decoder. The decoder Channel 1 panel will highlight red and you will not be able to apply the stream. Supported stream types are RTP/RTSP and transport stream.

2.3.1.2.   Removing a video stream – To stop the decoder and prevent it from searching for a video stream, click the [×] button, and then click 'Apply.'

2.3.1.3.   Previewing a stream – Click the [⊘] button to preview the video stream in your browser. This preview requires the VLC plugin, and may not work in all browsers.

2.3.1.4.   Stream info – Additional stream information can be seen by clicking the [ⓘ] button.

2.3.2. Advanced/Manual Configuration – If your network restricts Cube's service advertisements or if streaming over a WAN or the Internet, manual configuration of the Cube decoder may be necessary. The manual configuration panel also contains options for adjusting Cube's latency settings. Note that after manually configuring your decoder settings and clicking 'Set,' you will still need to click 'Apply' for the configuration to take effect.

2.3.3. Stream Type: RTP

2.3.3.1. Stream Protocol: Select UDP or TCP. Default is UDP. UDP streaming requires less network overhead but does not guarantee that video data will arrive intact. TCP streaming ensures data will arrive at its destination, but requires more network overhead and may impact performance and delay when bandwidth is limited.

2.3.3.2. Host IP Address: Your encoder's IP address.

2.3.3.3. Port: Default is 554, this should not be modified.

2.3.3.4. Stream Name: Choose 'Stream1' for the main stream or 'quickview' if enabled (see **Stream Modes**, page 15).

2.3.3.5. Audio Channel Mode: Choose Stereo or Mono, depending on the encoder's audio input.

2.3.3.6. Audio Sample Rate: Choose 48kHz if audio is enabled on the decoder, choose 'No Audio' otherwise.

2.3.3.7. Latency Options – Caching: Set this equal to or greater than the encoder's caching value. Default is 300ms. See **Encoder Controls** (page 18) for more information.

2.3.3.8. Intra Refresh: Set this to 'Enabled' if your encoder is using Intra Refresh mode.

3. System

3.1. Licenses – Cube supports a variety of features that are activatable on a per-device basis. More details regarding activatable features and license keys can be found in **Advanced and/or**

activatable applications, page 30.

3.1.1. Adding licenses – To add a license, paste your 40 digit license string into the 'Add a New License Key' field and click 'Add Key.' If the license is added successfully, you should see the description and license key displayed in the licenses table. If you see a message saying 'Invalid License,' verify that there the full license has been posted and there are no extra spaces following the string. After adding a license, Cube must be rebooted before the new feature can be used. Click 'Reboot Now' to reboot the Cube.

3.1.2. Importing and exporting license files – You can export a list of currently installed licenses by clicking 'Export All Licenses to File.' After doing so, this list can be imported by clicking 'Import a License File,' browsing for the file in the field at the bottom of the page, and clicking 'Import.' You will need to reboot after importing the license file. Note: Licenses and license files are specific to individual devices. License files are only valid for the Cube they are exported from.

3.2. User settings – The user settings page allows you to change your password and import, export, or reset Cube's settings.

3.2.1. Password – To change your password from the default value 'admin,' enter your desired password in the 'New Password' field and click 'Change Password.' Passwords are case sensitive and may contain alphanumeric (a to z, 0 to 9) and special characters (@, #, etc.).

3.2.2. Import Settings – To import a saved configuration, click 'Browse' or 'Choose File' (dependent on your web browser), select a previously generated Cube settings file, and click 'Import.' Leave 'Preserve network settings' checked if you want to preserve Cube's current network configuration, or uncheck the box if you want to completely overwrite the configuration. This feature is useful when configuring multiple Cubes at once. See below for instructions on generating the settings file.

3.2.3. Export Settings – To export Cube's current configuration, simply click the 'Export' button. You will be prompted to download a file ending in '.hdf.' This file can be used by other Cubes to copy the configuration, see above. In addition to generating a snapshot of Cube's configuration, the export settings feature can also be used for troubleshooting – to include system status information in the exported file, check the box next to 'Include System Information' before clicking 'Export.'

3.2.4. Factory Reset Settings – To restore Cube to its original settings, click the 'Reset to Factory Settings' button, and then confirm the reset by clicking 'Yes.' You can preserve Cube's

network settings by leaving the 'Preserve network settings' box checked. If you are unable to access the configuration pages, Cube can also be reset by holding the 'Go Live!' button on the back of Cube; see **Button Operation**, page 7, for more information.

3.3. System Time – The System time page allows you to set Cube's system time. Cube's system time can be set manually (Reference mode: Manual), or using NTP (Network Time Protocol). If NTP is selected, a valid NTP server must be present for the system time to update. The NTP server can be selected in the 'Server Address' field. If Cube has an internet connection a public NTP server (such as the default, pool.ntp.org) can be used.

3.4. Firmware Upgrade – Cube's firmware is upgradeable, and updates including new features and improvements can be found at Teradek's Cube forum, located at http://www.teradek.com/firmware.html.

    3.4.1. Firmware upgrade files – The downloadable upgrade file is in a '.zip' format. This file contains both the firmware image binary '.bin' and current release notes in PDF format.

    3.4.2. If Cube is connected to the internet it will periodically check for updates. When an update is available, a message is displayed in the top right corner of the web UI.

         ⓘ A firmware update is available.

    Clicking the message will open a prompt to walk you through the upgrade process.

    3.4.3. To upgrade manually, download and extract the firmware image files. Next, navigate to the Firmware Upgrade page and click 'Browse'/'Choose File' and select the '.bin' firmware image. Click upgrade. Status messages are displayed as the firmware upgrade processes, and Cube will reboot at the end.

    3.4.4. If the firmware upgrade fails at any point prior to rebooting the Cube, refresh the page and try again.

4. Info
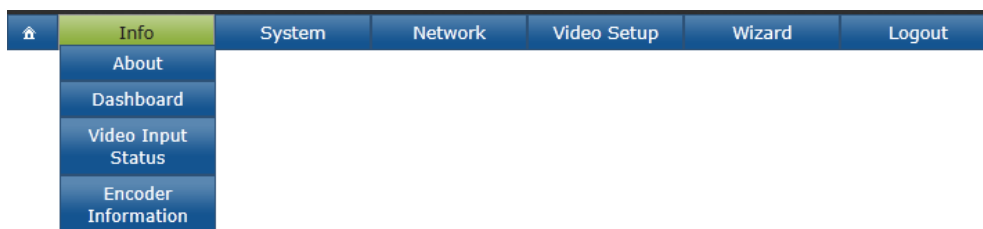
4.1.

4.2. About – Clicking the 'About' link pops up a small window that contains information about your device, including the product, firmware, and hardware versions.

4.3. Dashboard – Click this link to return to Cube's dashboard. You can also click the Teradek logo at the top left of the window or the home icon (🏠).

4.4. Video Input Status – This page displays information about the currently detected video input.

4.5. Encoder/Decoder Information – This page displays information about the current state of the encoder or decoder, including the current frame rate and bitrate. The page also contains a button to restart the encoder or decoder without rebooting the unit.

Advanced and/or activatable applications

The following options offer additional functionality over Cube's default feature set. Licenses for some features are available by request at no charge (RTMP, RTSP announce, RTP push). Licenses for the other features can be purchased through Teradek or your local reseller. For instructions on installing licenses, please refer to the Licenses section, page 26.

1. RTMP

1.1.
1.2. RTMP streaming allows you to stream to your own custom server or CDN. Configuration for RTMP requires a destination server URL and a stream name, and allows Cube to push video content directly to the destination. The RTMP license is provided by request, free of charge.
1.3. Configuration:
    1.3.1. Enter the server URL. Depending on where you are streaming to (local server or CDN), this will look something like rtmp://server.address:1935/live. This will vary by platform, so check with them to get the proper address. Often the server URL is found with FMLE instructions or buried in a downloadable XML file.
    1.3.2. Enter the stream name. This varies by platform, but should be found somewhere near the server URL.
    1.3.3. Select enabled or disabled for auto-start broadcast. If enabled, Cube will attempt to start a broadcast whenever it starts up.
    1.3.4. Click 'Apply.' You can start/stop the stream by clicking the buttons on the Stream Settings page or by holding the 'Go Live!' button on Cube for ~1 second.
2. RTSP announce

2.1.

2.2. RTSP Announce streaming allows Cube to start and stop broadcasts to a remote streaming server (such as Wowza). The RTSP announce license is provided by request, free of charge.

2.3. Configuration: Enter the host name or IP address of your server in the 'Host Name' field. Enter the host port configured on your server in the 'Host Port' field (default is 1935). In the 'File' field, enter the name of your application and desired stream name. The file will vary based on your chosen server. For example, if streaming to a Wowza server with an application 'live' and a desired stream name 'stream1,' 'live/stream1' should be entered in the 'File' field.

2.4. Using RTSP announce: Once your stream has been configured, start and stop broadcasting to your server by clicking the 'Start'/'Stop' button on the Stream Settings page, or press and release the 'Go Live!' button. The 'ENC' LED blinks rapidly when starting or stopping a broadcast.

2.5. User name and password are configurable for streaming servers that require authentication.

3. RTP push
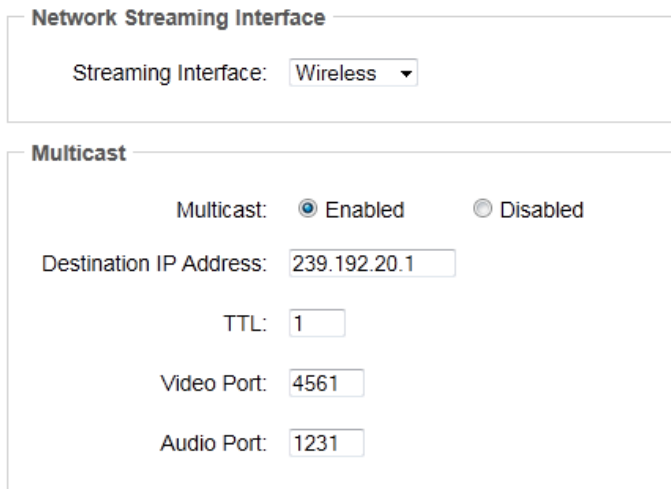
3.1.

3.2. RTP Push streaming allows you to direct video to a server or client and generates an '.sdp' file containing the stream description. SDP files can be stored on a streaming server, or opened by video players like VLC. The RTP Push license is provided by request, free of charge.

3.3. Configuration: To configure RTP push, select 'Enabled,' then specify your desired IP address and port. Click 'Apply' to save your configuration and generate the SDP file.

3.4. Using RTP Push: After applying your configuration, a link to the SDP file will be displayed towards the bottom of the Stream Settings page. To open the stream, either copy the URL and open it using your video player software, or right click the ▶ and save the file. The saved file can be opened directly, or added to your streaming server's content directory.
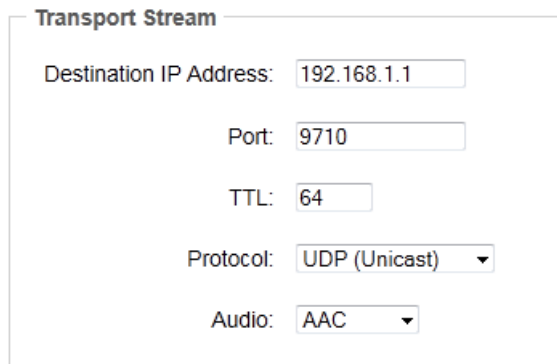
4. UDP multicast

4.1.

4.2. UDP multicast allows Cube to send multicast streams over RTP/RTSP. Compared to unicast streaming, where each client connection requires Cube to send additional data, multicast streaming relies on compatible networking equipment to intelligently duplicate the video streams. The multicast license can be purchased through Teradek's online store, http://store.teradek.com. The license is available individually, and is also included with the MPEG Transport Stream license.

4.3. Configuration: To Configure Cube for multicast, Select RTP for the stream type on the Video Setup -> Stream Settings page. Below that, select 'Enabled' for Multicast. Enter a destination IP address if desired, or leave at the default value (239.192.20.1). Set the TTL value equal to or greater than the number of network segments the video is to traverse, or leave at 1 for local network streaming. Set the Video and Audio ports, if desired, or leave at their default values. Lastly, be sure to select the network interface you are using to stream over in the 'Network Streaming Interface' field. Click 'Apply.'

4.4. IMPORTANT: Notes regarding multicast use: After applying your settings, your video stream can be opened in the same manner as a standard RTP stream. The multicast IP address does not need to be entered to open the video stream. For example, if a Cube has the IP address 192.168.1.100 and is set to multicast using 239.192.20.1, you would use the URL *rtsp://192.168.1.100/stream1* to open the video stream.

4.5. Additional considerations: Many capable network switches do not have multicast enabled by default. An improperly configured switch will cause the multicast stream to look like a broadcast,

and may adversely affect network conditions. Please refer to your network device documentation when using multicast.

5. Transport stream

5.1.

5.2. In transport stream mode, Cube sends video to a specified unicast or multicast address. The MPEG transport stream protocol is used in many broadcast applications and is also supported by many IPTV set top boxes. The transport stream license can be purchased online at http://store.teradek.com .

5.3. Configuration: To enable transport stream, select 'Transport Stream' for the stream type on the Stream Settings page. Choose your streaming protocol (see below). Enter your destination IP address and port. Select your audio codec (AAC or MPEG2). Click 'Apply.'

5.4. Protocol options: TCP is recommended when streaming over the internet or a WAN. For streaming over a local network, UDP can be used to avoid the additional network overhead of TCP. On a local network, use 'UDP (Unicast)' if streaming to a single decoder, or 'UDP (Multicast)' when streaming to multiple decoders over a multicast-capable network.

5.5. Using transport stream: If your transport stream is being sent to a computer, a program such as VLC can open the stream by opening the URL listed on the Stream Settings page. For example, if streaming to a computer with IP address 192.168.1.100 over port 9710, enter *udp://@192.168.1.100:9710* in VLC's 'Open Network' dialogue. For multicast streams, simply replace the unicast IP address with the multicast IP address. Please refer to following section for instructions on configuring your decoder to work with transport stream.

5.5.1.Decoder Configuration

5.5.2.Select 'Manually Configure' on the Video Setup ->Decoder Settings page (see page 24).

5.5.3.Stream Protocol: Select UDP or TCP. This value should match the value configured on your encoder. UDP streaming requires less network overhead but does not guarantee that video data will arrive intact on lossy networks. TCP streaming ensures data will arrive at its destination, but requires more network overhead and may impact performance when bandwidth is limited.

5.5.4.Port: Select the port configured on the encoder. Default is 9710.

5.5.5.Audio Channel Mode: Choose Stereo or Mono, depending on the encoder's audio input.

5.5.6.Audio Sample Rate: Choose 48kHz if audio is enabled on the decoder, choose 'No Audio' otherwise.

5.5.7.Audio Codec: Select the same value configured on the encoder, either AAC or MPEG2.

5.5.8. Latency Options – Caching: Set this equal to or greater than the encoder's caching value. Default is 300ms. See **Encoder Controls** (page 18) for more information.

5.5.9. Intra Refresh: Set this to 'Enabled' if your encoder is using Intra Refresh mode.

5.5.10. Jitter Buffer: The jitter buffer, when enabled, improves stream quality when network conditions are inconsistent (e.g. when streaming over the internet). The jitter buffer is a configurable buffer that stores video temporarily before playing it, providing better video stability at the cost of latency. For best results, set the 'Jitter Mode' option to 'Fixed Delay,' and then configure the buffer length in milliseconds.

6. Proxy Recording

6.1. Proxy recording is an activatable feature that allows Cube to generate video files on a remote server (via NFS) using start/stop information present on your camera's SDI output. For information on installing the proxy recording license, please refer to section 3.1 Licenses (page 26). Please note that Proxy Recording is *not* supported on HDMI Cubes.

6.2. Recording types

6.2.1. RED Camera Controlled – Cube reads start, stop, timecode, and file name information from RED One or Epic HD-SDI output. Files generated have the same file name as those recorded on the camera (e.g. the proxy file generated along with clip A008_C001_0211PV.RDC would have the file name A008_C001_0211PV.MP4)

6.2.2. Arri Alexa Controlled – Cube reads start, stop, and timecode information from ARRI Alexa HD-SDI output. Note that the camera must have 'SDI Remote' enabled on the SDI monitor output.

6.2.3. Record Run – For cameras with timecode output set to 'record run' mode, Cube detects starts and stops based on the timecode start and stop. Frame delay (the number of frames with different timecode required before Cube starts generating a file) is configurable in this mode, as some cameras change or increment timecode without recording (for example, switching into and out of playback mode on the camera).

6.2.4. Manual – Files are started and stopped using buttons on the Recording page of Cube's web UI. The manual start and stop buttons are also available in the other recording modes.

6.3. Configuring NFS

6.3.1. Mac OS X

6.3.1.1.   OS X users can set up NFS using our TeraCentral app. Open TeraCentral, click the 'Tools' option on the menu bar, and select NFS Server Setup. This opens up the Server Setup window.
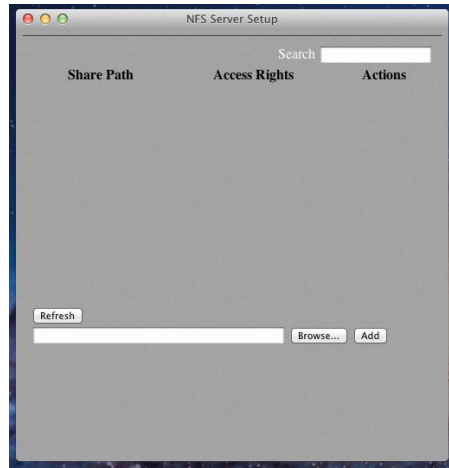
6.3.1.2.

6.3.1.3.　　Click 'Browse' and select the folder you want to share for recording. Click 'Open,' and then 'Add.' You may be prompted to enter an administrator password.

6.3.1.4.　　After the share is created, an entry will appear in the setup menu. Your NFS share is configured. Clicking 'Copy Path to Clipboard' will copy your NFS share location so that it can be entered on Cube.

6.3.2. Windows

6.3.2.1.　　An NFS server can be enabled with a number of third party NFS tools (nfsAxe, HaneWin NFS, etc.). Please refer to your chosen software's documentation for set up instructions.

6.4. Configuring Cube

6.4.1.Log in to Cube's web UI and go to the Recording page under Video Setup. Change the 'Recording Mode' setting from 'Disabled' to 'Camera Controlled' and click 'Apply.'

6.4.2.

6.4.3. Mounting your NFS share

    6.4.3.1.   Click 'Mount Network Volume' under the 'Volume Management' field. A window appears for you to enter your NFS share information.

    6.4.3.2.

    6.4.3.3.   Enter your NFS Server computer's IP Address (found under your Network Preferences), and paste the NFS share path that you configured previously. Click mount.

    6.4.3.4.   If the share is successfully mounted, the dialog window will disappear and you will see information about the current Volume displayed in the 'Volume Management' field.

6.4.4. Recording options

    6.4.4.1.   Record Mode – Select 'RED Camera,' 'Record Run,' or 'Manual' mode. Please refer to the beginning of this section (page 35) for more information.

    6.4.4.2.   File Options – RED Camera Mode

6.4.4.2.1.

6.4.4.2.2.   Recording Format – Choose your preferred format (MOV, MP4, MKV, H4V)

6.4.4.2.3.   Recording Destination – Choose none (place files directly in the mounted directory), 'Sort by Magazine' (places files into a folder named for the current magazine, e.g. 'A001'), or 'Sort by Date' (places files into a folder named with the current month and day, e.g. '0704' for July 4th).

6.4.4.2.4.   Embedded Timecode – Enable to add a timecode track to recorded files.

6.4.4.2.5.   Append Timecode – Adds the start timecode to the end of each file name.

6.4.4.2.6.   Clip Name Burn in – Recorded clips will display the clip name in the upper left corner of the video.

6.4.4.3.   File Options – Other Modes

6.4.4.3.1.

6.4.4.3.2.   Recording Format – Choose your preferred format (MOV, MP4, MKV, H4V)

6.4.4.3.3.   Filename Format – Specify the filename for your recordings. The filename can contain various information, added by putting the following strings into the filename; $TC (clip start timecode), $PN (product name), $MA (MAC address), $SN (serial number). You can mix those options with other plain text filenames. Files with the same file name string will not be overwritten, successive files will be denoted with '_1,' '_2,' etc. at the end of the file name.

6.4.4.3.4.   Embedded Timecode – Enable to add a timecode track to recorded files.

Troubleshooting

1. Power/Connection Issues

SYMPTOM	CAUSE	REMEDY
Cube will not power on.	Power cable may be connected incorrectly. External battery may be discharged.	-Remove video cable. Verify power cable or battery plates are connected and cables are not damaged. -Check battery charge.
VID LED stays off, ENC LED cycles orange to red	No video input is detected.	Verify that your source is connected to Cube. Check cables for damage. On some cameras, video output must be enabled on the camera.
VID LED stays orange	Resolution mismatch.	Change Cube's input format to match your source (See Video Setup, page 24). Alternately, set the input format to 'Auto.'

2. Audio/Video Streaming

SYMPTOM	CAUSE	REMEDY
Cannot open video stream	Cube may not be encoding. Stream URL may be incorrect.	Verify that Cube is encoding (ENC LED is green). If ENC LED is red, but VID is green, wait for encoder to start. Verify stream URL is correct. Stream URL is available to copy on the Dashboard page (see page 23).
Video stream is breaking up, freezing.	Bitrate/resolution is set too high for the network's available bandwidth.	Lower the bit rate and or resolution to avoid lost/late video data. See Encoder Controls, page 18.
VLC video latency is more than a second.	VLC's buffer (by default) is set to 1.2 seconds.	Reduce the buffer size. See http://forum.teradek.com under the *Tutorials* section for instructions.
Video to iPad has more than a ten second delay.	HTTP Live mode is enabled.	Enable the Quickview stream and use a third party video player. See page 11.
My video stream does not have audio.	Audio is disabled or Quickview stream is being used.	Enable audio (embedded or analog) on the Device Settings page (see page 24). NOTE: audio is not currently supported for Quickview stream.

3. Networking/ Web UI

SYMPTOM	CAUSE	REMEDY
Cannot Connect to Cube (Ad Hoc mode).	May be disconnected from network, network settings may be incorrect.	-Verify you are connected to Cube's wireless network (see Ad Hoc instructions, page 8). Check that Cube Wifi LED is green. -Verify your computer is set to DHCP or has an IP address in the 172.16.x.x

		range.
Cannot Connect to Cube (Infrastructure mode).	May be disconnected from network, network settings may be incorrect.	-If Wifi LED stays red, connect ethernet to Cube, access web UI and double check that infrastructure SSID, password, and security type are correct (see **Network Settings**, page 20).
Cube is visible in TeraCentral/ Bonjour, but the webpage will not open.	Advertisement may be taking a long time to update, network settings may be incorrect.	Close and reopen TeraCentral and/or your web browser. -In Ad Hoc mode, you can attempt to connect to the encoder by navigating to http://mycube.teradek.com or http://172.16.1.1 -Ensure your Computer's network connection is set to DHCP in Ad Hoc mode.
Cannot log in to Web UI	Password may be changed.	Default login information for Cube: Login: admin Password: admin If the password has been changed, perform a full factory reset (see page 7).

4. Live Internet Streaming

SYMPTOM	CAUSE	REMEDY
Cannot verify login	Incorrect account information, no Internet connection.	Verify your Livestream account information is entered correctly Verify your network's internet connection. Check Cube's Network Configuration page for valid gateway and name server values.
Cannot start broadcast	No internet connection. Cube encoder may not be started.	Verify Cube's internet connection (see above). Verify ENC LED is green and solid. (See page 39 if the LED does not turn green).
Broadcast starts, channel shows 'LIVE,' but only a black screen is shown	Bit rate is too high for available bandwidth.	Lower the bit rate and or resolution to avoid lost/late video data. See Encoder Controls, page 18.
Video drops out, freezes	Bit rate is too high for available bandwidth.	Lower the bit rate and or resolution to avoid lost/late video data. See Encoder Controls, page 18.